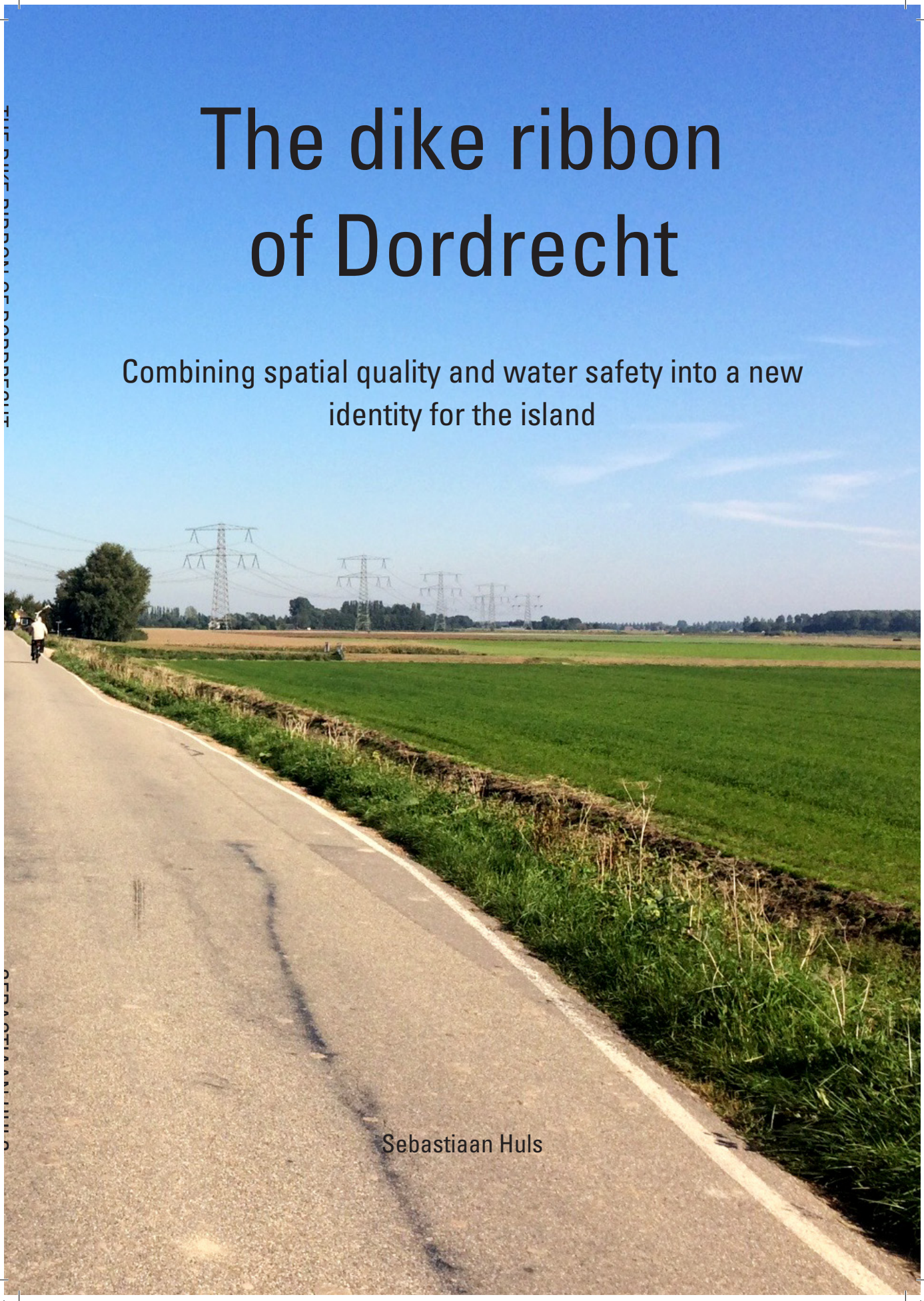
The dike ribbon of Dordrecht

Combining spatial quality and water safety into a new identity for the island



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THE DIKE RIBBON OF DORDRECHT
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Faculty of Architecture and the Built Environment
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Graduation Thesis

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Image 01 on the cover: picture of the Wieldrechtse Zeedijk close to Sterrenburg

Image 02. Painting called Polder (Edgar Fernhout, 1959)

Preface

This graduation thesis is the result of a year hard work in the Delta Interventions Studio of Urbanism. The road towards this dike was an intense and informative path in terms of exploring myself and the field of urbanism.

But it wouldn't have been made possible without the help of many people. Firstly I would like to thank my mentors, Han Meyer and Egbert Stolk. The 'dike ribbon of Dordrecht' is a project that has been realized thanks to the great expertise, the interesting tutor discussions and the support. I'm thankful to Han for his knowledge in everything concerning delta urbanism and the new ideas which arose from this and learning me how to look from a broader scope to a design. I would like to thank Egbert for guiding me through the graduation process in a smooth way and helping me understand to make the right choices in designing.

Furthermore I would like to thank Machiel van Dorst for being my mentor in the first half of my graduation year. The knowledge on the social part of my research was very fruitful for the outcome of my plan. A special thanks to Willem Hermans for helping me in the design process and the push to search for a more exciting shape. At last I couldn't have used all the knowledge without the help of the municipality of Dordrecht and especially the meetings of the MIRT-team.

Finally I want to thank Rosa for supporting me all year long and her dedicated involvement in my process. As well as my mum and dad, sister and brother and family who were always curious and had an unconditional trust in me.

Table of contents

0.1 Foreword

Personal motivation

As a child I lived on a hill in the east of the Netherlands. Although we lived on a hill our house was closely located to the river the Rhine. When I was young the river and the 'uiterwaarden' intrigued me in their behaviour with the summer and winter dike and constant dynamic flow of the water. This system resulted in the fact that I was able to ice skate on the river and enjoy the nature reserve of the 'Blauwe Kamer' in the summer. When it was a really warm day we went with the family to the beach. As soon as we arrived at the beach I started making my own sand castles, played with the tidal movement of the sea and I started building different dike rings to defend my own sand castle.

These two water systems fascinated me as a child but because we lived on a hill, I was never aware of the dangers that water brings along. My family always joked that we wouldn't be in danger if the Netherlands would flood. But since I am living in Delft my perspective concerning safety has changed. I am now living beneath NAP, the Dutch vertical water datum, and my safety is guaranteed by dike ring 14. In the western part of the Netherlands the 'makeability' of the polders, the canals and the river can be seen very well. The influence and presence of water in and around the cities is way more noticeable than where I grew up.

This combination of the presence of the water and the ability to feel the water fascinates me and it is the main motivation of this project. I think this special world we live in, the delta of the Netherlands, not only provides us with technical and design challenges but also the social interaction of the water with the people. It is therefore essential to create something extra for the inhabitants of Dordrecht. Without decades of experience a lot of people wouldn't be able to live where their homes are now located.

0.2 Introduction

This graduation project focusses on delta urbanism in the Netherlands and is therefore connected to the studio of Delta Interventions. Within the overall graduation lab Urban Transformations & Sustainability of the master of Urbanism at the TU Delft this specific studio concentrates on the relation of urbanism and an attractive living environment while having the constant danger of flooding and ecosystem destruction. The city of Dordrecht in the Southwest delta in the Netherlands serves as a case-study.

The city of Dordrecht and its municipality are since destructive floods in the past one of the most developed and state-of-the-art cities in the Netherlands concerning water safety and flood reduction. Within the graduation studio one of the topics was the island of Dordrecht and the current strategy for water safety. This project takes the policy from the municipality and current progress as the starting point.

After the construction of the Delta Works, the Dutch assumed they were safeguarded from floods coming from the sea. They thought a new decade had begun where the water, urban, agricultural and natural system could be regulated (Meyer & Nijhuis, 2014, p. 49). But the climate change, which became hot topic afterwards, wasn't taken into account properly. The threat of a rising sea level, higher river peaks, subsidence and salinization due to a changing climate gave a new perspective on the Dutch delta. This project takes this unknown future as an opportunity to plan with adaptivity in the delta combining water safety and spatial quality into a new identity for the island of Dordrecht.

Image 03. As a child defending our coastline

Image 04. The primary dike at the Dordtsche Kil

1
FRAMEWORK

1.1 Problem field

1.1.1 Trends

Before looking at the problem analysis it is relevant to take a look at the current shift in urban development in the Netherlands especially focused on the delta transitions. The following trends can be distinguished for this case.

There is a paradigm shift on how to develop in an urbanized delta (Meyer, Bregt, Dammers, & Edelenbos, 2014). There is more focus on nature and environment in terms of planning and design. Plans work together with nature and make more room for the water and environment instead of strengthening the dikes again (De Vriend & Van Koningsveld, 2012). Furthermore the number of inhabitants in the urbanized areas below NAP has grown which makes the issue of water safety very urgent. Due to the fertile land in the delta a lot of people are living in that specific area and the economy is dependent on the delta. The delta also provides perfect positions for countries to develop their harbour and to enlarge that specific economy. This results in a competition between the economy of the harbour and the economy of the agricultural areas.

There is a shift going on from centralized government to decentralized government (OntwerpDelta.NL, 2014). The Netherlands have made a gradual shift from their national policy to local policies with the municipalities. Responsibilities have been decentralized and are transferred to the lower scales. With the reorganization of the Ministry of Housing, Spatial Plan-

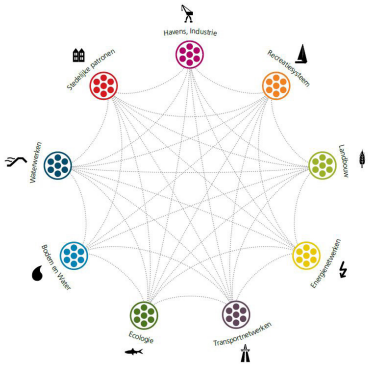


Image 05. Complex systems in the delta (Meyer, Bregt, Dammer, & Edelenbos, 2014) and image 06. citizen participation in EVA Lanxmeer (groenblauwenetwerken.com)

ning and Environment (the former Ministerie van VROM) the government is shifting its role of safeguarding spatial quality by writing policies for local initiatives, provinces and municipalities.

Inhabitants have more awareness of their surroundings in the built environment and more initiatives in citizen participation are started in neighbourhoods (Qu & Hasselaar, 2011). Opportunities like do-it-yourself houses, community spaces and bottom up approaches evidently show the increasing involvement of the citizens in urbanisation processes.

The effects of climate change for the future are uncertain which results in planning with different scenarios (Bleuzé & Pötz, 2012). Due to climate change the world will alter. However, it is uncertain to what extent it will change and what the effects will be. Four different scenarios have been developed by the KNMI, the Dutch national weather forecasting institute, that follow the same trend but in different intensities: moderate, moderate +, warm and warm +. Whereby the most probable scenarios will be the W/W+ with the highest temperature increase in 2050 compared to 1990 (Klein Tank & Lenderink, 2009).

So the trends in urban development in the delta in the Netherlands are a paradigm shift in delta urbanism, a shift from centralized to decentralized government, more citizen participation on neighbourhood level and effects of climate change on the urbanization.

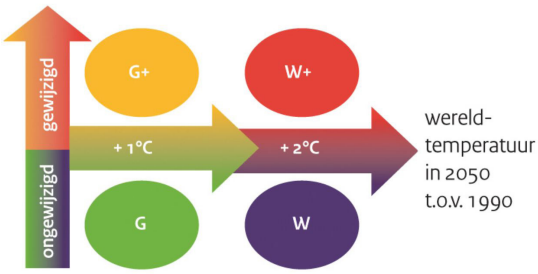
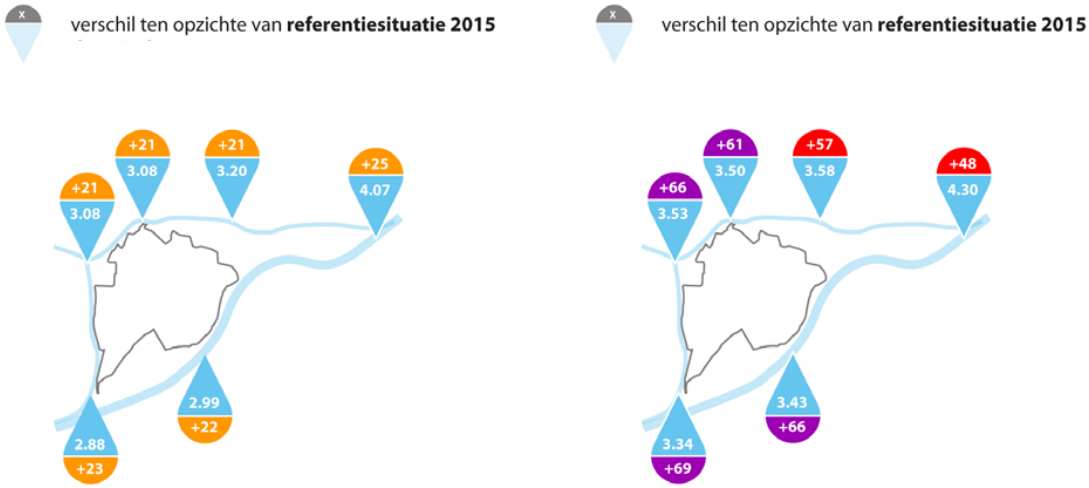


Image 07. The four climate scenarios (Klein Tank et al., 2009)

1.1.2 **Problem analysis**

The water management system in Dordrecht meets the regulations but needs adjustment according to the latest policies by 2050 and 2100 (Kelder & Gersonius, 2014). The island of Dordrecht is a crucial point in the Delta coping with the influence of the sea and of the water run off of the rivers. In a worst case scenario both levels will cause high water levels around the island with possibilities of dike failures. In order to prevent this the municipality, province, Rijkswaterstaat and other stakeholders are looking at what interventions have to be done at the water prevention system by 2050 and 2100 in order to guarantee the safety of the inhabitants of Dordrecht.

Apart from the technical issue of renewing the dikes the municipality is trying to combine this aspect with spatial quality. By the so called 'meekoppelkansen' the municipality of Dordrecht is looking for smart combinations by combining the strengthening of the dikes with spatial quality with-



Figuur 2.7 Effect klimaatscenario W+ op maatgevend hoogwater (MHW), links in 2050 en rechts in 2100

Image 08. Water levels in 2050 and 2100 in Dordrecht (Kelder & Gersonius, 2014)

in the multi-layer safety approach. Its aim is to combine all these different aspects within the limited financial means.

The identity of Dordrecht with its high historical and cultural value has difficulty in competing with other cities in the Randstad (Kelder & Gersonius, 2014). Due to the stagnation of urban growth, cities and regions start to compete with each other in order to attract new inhabitants and tourists and provide economic boosts. Although Dordrecht has a lot of value in terms of history and ecology, it has a lot of difficulty competing with other cities due to its location in the south of the Randstad.

In short the problem analysis consists of the technical water management dike issue, the incompetence of combining the civic works with spatial quality and the lack of identity on the whole island in which it can compete with the Randstad.

Image 09. Historical city centre Dordrecht (Kiwibirdproductions.com)

1.1.3 Problem statement

The problem statement consists of three interrelated elements.

Based on the problem analysis, one might say that the technical task for the water management combining with the design task for improving the spatial quality is currently not guaranteeing any prosperous future for the island. While the current struggle for the island to compete with the Randstad and at the same time trying to involve the inhabitants in the continuous discourse on the island doesn't contribute to this either. The water management, the spatial quality and the identity in relation the society are therefore primary issues that will be dealt with in this graduation project. These are topics that on the island of Dordrecht have priority to be researched and designed on in order to keep the island up and running for the coming decades.

Above mentioned paragraph reacts on the current assignment of the municipality to look at the water management issues for the island for the year 2050 and 2100. The dikes are not strong enough to cope with the water level rise due to climate change. The municipality of Dordrecht is looking for a new adaptive strategy for strengthening specific dikes instead of heightening the whole dike ring. This change of the engineering system can be combined by improving the spatial quality of certain dike segments. The spatial quality can contribute to the undefined identity the island now has in order to distinguish itself from the competing cities concerning urbanization and economy.

On a spatial level the problem statement is concerning the lost identity of the island. The island is too strong separated in two parts: the historical centre and the agricultural recreational landscape. The infrastructural flows between these qualities don't succeed in uniting the island. On neighbourhood level the island also has to deal with lack of connections with a lot of fragmented districts with their own typology. The urban growth of the island with railway and highway has cut off some neighbourhoods and therefore they have lost their connection to the broader picture of the island. A solution for this problem on both scale levels is crucial for a better functioning of the island.

1.2 Relevance

1.2.1 Academic relevance

The research group Delta Urbanism focusses on new ways of designing and planning in urbanised delta areas throughout the world. A diverse approach is in a changing water system is being considered by looking at urbanisation, ports, agriculture, environment, ecology, flood defence and fresh-water supply. Combining all these different aspects ask for complex and dynamic solutions towards a balanced and adaptive future.

In my graduation project the research will mainly focus on how the island of Dordrecht can adapt to future conditions influenced by possible climate scenarios and urbanization growth. This may result in a new identity for the city of Dordrecht adding a new spatial quality on the location where it has fought the water for several decades. The release of the new Delta programme and the publication of Integrated Planning and Design in the Delta it is relevant to form this policy into certain design principles and strategies (Meyer, Bregt, Dammer, & Edelenbos, 2014). It elaborates on years of research done on the changing transition in the delta area in the Netherlands.

In the case of Dordrecht it is relevant to consider the growth of the urbanization of the last couple of decades and the role of society in a water oriented city. The island of Dordrecht is since the St. Elizabeth flooding in 1421 struggling to retain its land again back on the water. First in order to establish a lot of agricultural land, but later on after the Second World War this land was redistributed for the urban area. With a stable population and a clear separation between urban, rural and natural land on the island the design solution is a complex issue. Considering the sea level rise in the coming years the dikes aren't able to defend themselves to the water. How will the island look like in 100 years with the growing influence of the rivers and sea? By researching the different issues mentioned in the topics of the research group Delta Urbanism I intend to find a solution for this complex matter and design for a flexible and adaptive future in order to improve the spatial quality in Dordrecht.

1.2.2 Social relevance

Instead of solely looking at the technical way of solving the design questions, this project is about getting input from the stakeholders and considering the social perspective in the realisation of water management project. People need to be aware of their safety and their possible dangers in the future. But it also is a lot more appealing when it actually tells a story of the island. Besides looking only forward to the possible threats of the climate change and its new water levels it is relevant to give the plan a recognizable aspect concerning the long history of the island. Next to the multi-layer safety approach of the municipality it is extremely important to consider the inhabitants while designing for a dynamic future. Therefore it is about making the right decisions in the design process for the city but also for the people.

Image 10. Man in his basement in Dordrecht after high water levels in 2013 (nrc.nl - Robin Utrecht)

1.3 Theoretical framework

The theoretical framework consists of two main theories: adaptivity in delta urbanism and identity & spatial quality.

1. Adaptivity in delta urbanism

The interference of human beings in the deltas all over the world is a large scale project we can learn from. If we look at challenges for the future it can be argued that the hard protection strategy is not the only way to go, the ability to work more with nature is more acceptable (Meyer, Bobbink, & Nijhuis, 2010, p. 41). Working with two different strategies needs different tactics in planning and design, looking at the adaptivity of a plan. The Southwest delta is a complex system with different subsystems like water safety, the ecosystem, the economic system and the spatial system. To make this adaptive it is necessary to deal with uncertainties in climate change and sea level rise, on the aspect of ecology and biodiversity and in the field of economy and urbanisation (Meyer et al., 2014, p. 15).

2. Identity & spatial quality

The term identity has been mentioned several times in the problem field chapter already. In order to be able to tackle this problem on the island it is explained in the context of spatial quality. Identity is a completely different landscape or setting you have never seen before. This setting of different elements makes it a unique place for the perceiver. The issue of spatial quality can be described as a combination of utility, perception and robustness (Ruimtemettoekomst, 2015). The overlap of both terms is the perception of the observer, in which will be taken a closer look at later on in the research.

1.4 Aim and research questions

1.4.1 Aim

To generate an adaptive design for the island of Dordrecht for the year 2100 in which the aspects of water management, climate change, spatial quality and identity through different scales are taken into account. In order to do so the aim is to understand the social and technical perspectives and combine them to answer the question of how to develop with an uncertain future.

In order to tackle the problems stated earlier it is relevant to come up with a solution for both the island and for a specific location. The strategy on island level will be able to tackle the larger scale issue regarding to the identity of the island and the relation between historic city centre, fragmented neighbourhoods and the Biesbosch. This strategy will make use of the historic narrative of the dikes of the island of Dordrecht. The aim of the study is to combine the use of these old dikes with the problem of the malfunctioning of the island as a whole.

The specific design on local scale will focus more on the role of adaptivity and integration in a design in a dynamic delta. It will therefore react on the unknown future by possibly planning different scenarios. Combining both the island and local scale aims for a design which tackles the problems of water management, climate change and at the same time adding spatial quality by involving society in terms of water safety.

1.4.2 Research questions

With the known problem field and the aim of the project the main research question is the following:

How can the water safety measures of dikes be combined with adding new spatial qualities, resulting in a more adaptive and integrated design proposal for the island of Dordrecht?

1. How can the dynamic delta and island from historical, technical and morphological perspective function as design guidelines towards unknown future demands?

2. How can the spatial quality and the identity of Dordrecht be improved given the current and future conditions of the Southwest delta of the Netherlands by the use of multifunctional flood defences?

1.5 Methodology

The methods used in the graduation project consist of three different parts which are related to each other. The first aspect is the dynamic delta research mainly focussing on desk analysis, the second aspect is the action research really going to the island and grasping the life of the island, and the third aspect is the design based research which happens along the process and is a playful sketching way of looking for the right shapes and functions by models and drawings. The dynamic delta research corresponds with the first sub-question, the action research with the second sub-question and the design based research is used as a method to test the research by design. As an outcome this will answer the main research question.

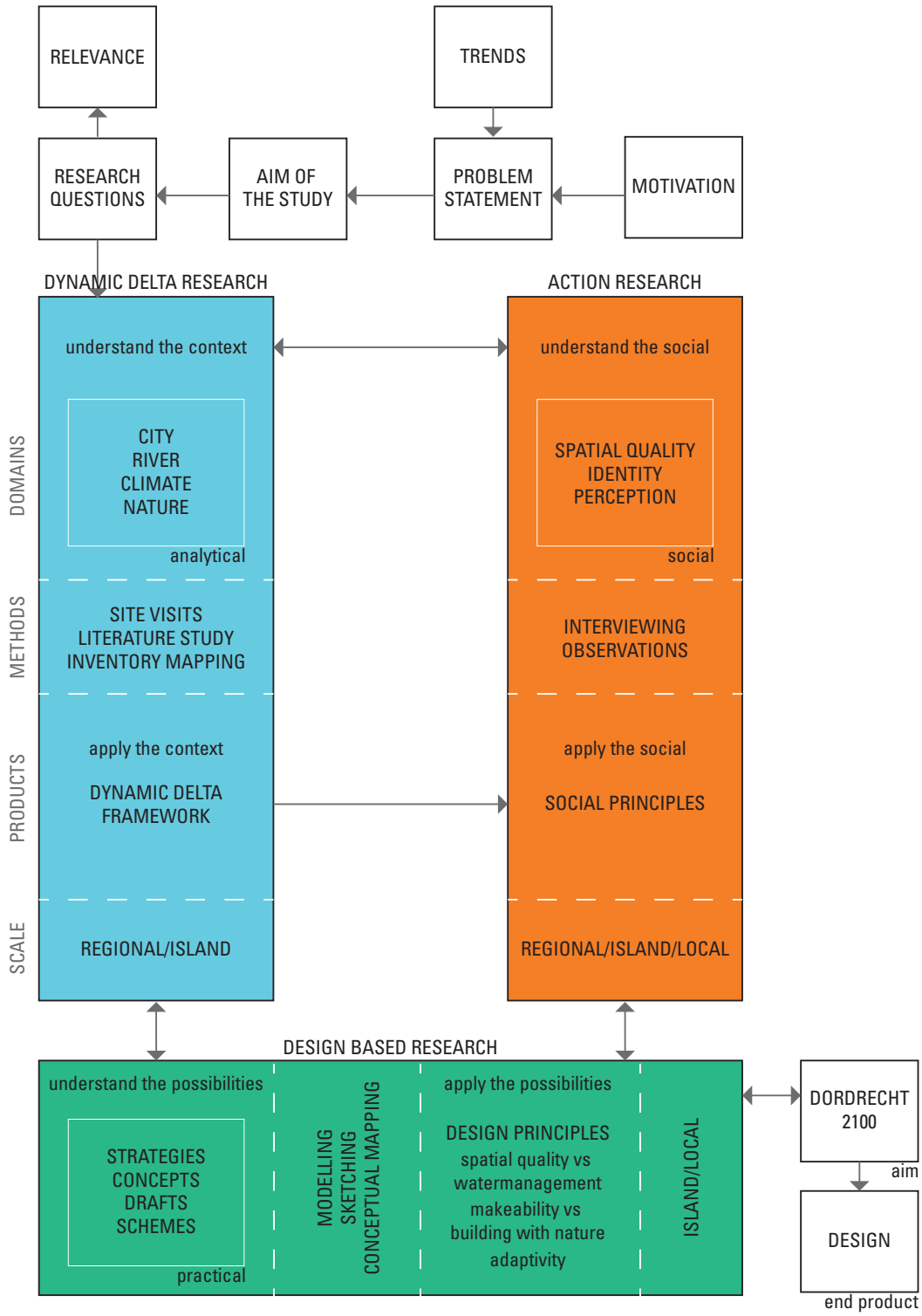


Image 11. Methodology scheme of the graduation project

Image 12. The Wieldrechtse Zeedijk hides the neighbourhood Sterrenburg

2
RESEARCH

2.1 Adaptivity in delta urbanism

The most densely populated areas in the Netherlands are located below sea level. This means that there is a constant task in protecting the land from the sea and the rivers. With the effects of climate change this protection on the longer term is even more important. The pace of the delta takes place in a different cycle compared to the planning, designing and policy cycle. The delta committee in the Netherlands makes every decision an adaptive one which can last longer and can be altered in the future. In this way the country is prepared for uncertainties in climate and society and it still has plenty of opportunities for future interventions (Deltacommissie, 2014, p. 12). The postponement of certain decisions to a later stage when all factors are sure is quite a difficult job in such a complex system as the delta. With a lot of unknown issues the ability to make a plan which can work with extreme scenarios requires insight in all the different subsystems of urban, nature, ecology, water safety, flood risks, economy, culture and society. The start of the adaptivity in delta urbanism all started with the shift from 'fighting against the water' to 'working with nature'. (Meyer,

Image 13. The Southwest delta near the coastline (Atlas van de Zuidwestelijke Delta, 2009)

Bobbink, & Nijhuis, 2010, p. xiii) By embracing the nature in the delta this was the start after the paradigm shift towards adaptivity in planning and designing in the delta.

The need in adaptive decision-making is essential for the Southwest delta since it has to deal with the effects of climate change in the sense of sea level rise, high discharge peaks from the rivers, salinization of the waterways and soil subsidence. Due to the unknown intensity of these effects it is hard to estimate the measurements which need to be taken, thus an adaptive plan needs to be realized in which different scenarios can be applied. To react to the effects of climate change river beds are widened along the Rhine, Meuse and Scheldt, plans for freshwater supply are generated, the coastline is being built up, the question is being raised if a closed coastline will protect us in case of high sea level rise and the accessibility of the ports of Rotterdam and Antwerp are being investigated in the future (Meyer et al., 2010, pp. 145-146). These issues are relating to the complex system of the delta and therefore require an adaptive approach. A closed coastline will has it effect in all the different subsystems and therefore already blocks some of the solutions in the adaptivity.

On the island of Dordrecht a completely different scale is being looked at when talking about adaptivity. It is concerned about the issues mentioned above but planning and designing involves a different way of thinking. The island of Dordrecht is doing this by the multi-layer safety approach. Whereby strengthening the dikes is the primary investment anymore but it also focusses more on crisis management before, during and after a flood. In this way the aim is there will be less casualties and economic damage to the city by investing in planning in water safety. The adaptivity of this approach is that they are aware of the ability of a flood and have the knowledge how to react on this disaster.

2.2 Identity and spatial quality

The city of Dordrecht is an old city with a lot of history in the city centre based on the former trade and wealth in the Middle Ages. Unfortunately as stated earlier in the problem field the identity of the city of Dordrecht is limited to this historical city centre and some other cultural values on the island. With a shifting economic world where the cities can't deal anymore with a continuation of growth, Dordrecht has to deal with a less intense growth compared to before. This results for example in the competition between cities and regions in means of attractiveness of the city (Kelder & Gersonius, 2014, p. 12).

The current trends in the cities therefore speak even more for an investment in the identity of the city of Dordrecht. The municipality also recognizes this by considering the rural southern part of the island as essential for the identity and recognisability of a place (Kelder & Gersonius, 2014, p. 12). Furthermore the vision for the city supports this by stating that the current trends like stabilized growth and urbanization ask for a greater significance of identity (Gemeente Dordrecht, 2013). But that raises the question what exactly identity is and how this can be used in order to make a city flourish again.

Image 14 and 15. The identity of the south on the left and the identity of the north on the right

Identity needs to be seen separate from the image. While the identity is an objective term created by the physical shape of the landscape, the image is the identity combined with a perception of the landscape (Montgomery, 1998, p. 100). When you probably ask a foreigner about the identity of Delft you will be told about the canals and the cute houses along them. But when you ask a student the same question probably the university and the city combined will be the composition of the identity of Delft. They therefore describe their image of the city and how they perceive the physical form of Delft and use it in their daily life. Besides the objectivity of the matter the importance of identity is that it separates the existence of what you see from what you already know. Or as Lynch (1960) describes "A workable image requires first the identification of an object, which implies its distinction from other things, its recognition as a separable entity." (p. 8). If we reflect this to the island of Dordrecht we can see that some cultural values of the southern part of the island can be found in similar places. The polder and the dikes can be found in other parts in the delta as well, but with the combination of the Biesbosch this makes it a unique combination which can be seen as a separable entity from the rest.

But with the presence of identity in the southern part of the island as well it isn't enough to make this a lively vibrant place which will attract people to visit. The presence of the uniqueness of this place will not be an extra identity for the island on its own as an addition on the historical centre. The spatial analysis of the island has shown the great promise of the qualities in the south and the analysis of the Zeedijk and Wieldrechtse Zeedijk resulted in the realization of the importance of this dike element as border between city and land and how it can function as a connector. How can these qualities and a new plan for this city border in fact lead to a new identity for the island? By realizing a route or a network along the dike to put this rural area with its nature on the map again won't be enough. The question rose how I could turn this in a lively place where people would visit now and then and would exactly be convinced of all the beauty of the island. There is in fact a lot more to do in Dordrecht besides only visiting the old city centre. The task is to actually make this dike into a so called 'place' where an urban design can contribute to this matter. Within the urban field many people like Cullen, Alexander, Lynch, Gehl and Jacobs have

discussed what a place should look like. In my case it is more important how to actually make this dike into a place in order to create the wanted identity for the island.

In order to create a certain place at the city border of Dordrecht it is necessary to add extra elements to the dike. As considered in the analysis the quality of the landscape is already present. This can be seen as the image by cognition, perception and information from an individual. In order to make the dike an attractive place to be the design should consider both the implementation of activity and form according to Montgomery. Activity hereby relates to the product of diversity and vitality. Form on the other hand considers scale, intensity, permeability and landmarks (Montgomery, 1998, pp. 97-103).

These three elements turn the definition of a place into an urban design with spatial quality. When translating this to the design proposal for the dike it can be stated that there is a lack of activity going on. The recreational routes and the Biesbosch don't offer enough vitality throughout the year. The form is slightly present in some cases since the rural area offers a lot of scale in its polders and views and the cultural historical elements are the landmarks in these views. But actual form in the sense of building blocks is missing to add upon the composition of place making. This consideration states that it is necessary to add diverse functions along the dike in order to create both activity and form in order to give create an attractive plan with spatial quality.

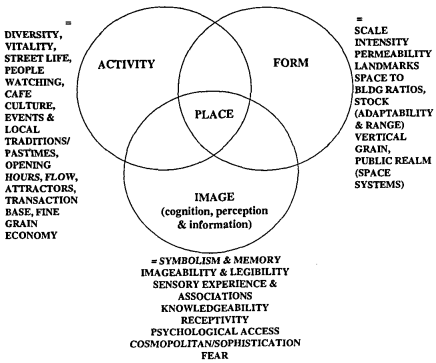


Image 16. Composition of the elements of place making (Montgomery, 1998, p. 98)

2.3 The history of fighting against and living with the water in the Netherlands

The Netherlands is a great example of how to live with the water and to constantly adapt to new ways of trying to extend the abilities of it. The past decades the ´makeability' of the Netherlands has been tested and we have reached a position at where we can ask ourselves if we haven't tried to control everything to much (Meyer et al., 2010). In this case when we want to control all the dynamic systems like the river, the nature, the climate change at some point we won't be able to compete anymore with the unpredictable flows. This asks for a completely different way of planning and designing for the future. Instead of just aiming for one direction and making a blue-print a more strategic scenario way of thinking is needed. Before it can be decided which way directs us to the best solution it is necessary to look at the historic approaches from the past. Looking at the shifts made in the past can help us to understand the future design task. The island of Dordrecht is used as an example to make this more tangible throughout different scales. By learning from the past new perspectives can be found for a more natural delta of the Netherlands, with less interference of human hand and back to where it all started.

2.3.1 Introduction

Around 50 percent of the world's most urbanized areas are located in deltas (UN-Habitat, 2006). Due to fertile grounds and ports establishments economies are dependent on the urbanized areas in the delta. But living in these areas isn't the easiest option. Throughout many years different countries throughout the world have been dealing with different natural disasters like the 'watersnoodramp' in the Netherlands in 1953, hurricane Katrina in New Orleans in 2005 and flooding by the tsunami in Japan in 2011 (Pleijster, Van der Veeken, & LOLA Landscape Architects, 2015). How did the human beings in the urbanized delta of Netherlands have been fighting against the water over the last decades? This paper will therefore focus on the history of the water management and land reclamation of the Netherlands since the first indication of early occupations. After the review of the large scale historic engineering works it is relevant to look at the smaller scale interventions on city level. By reviewing both scales the knowledge of the history can be used in order to have a broad view over the changes in the delta and a prediction if this progress can be continued.

In the end this prediction needs to be translated in a design task in order to be able to think of solutions for designing and planning in a dynamic delta for an unknown future.

2.3.2 History of water management in the Netherlands

The Netherlands has a rich history considering the shape of the country by the influence of the water from the sea and the river over the past centuries as can be seen in image 19 (Hocks, Hoekstra, & Stedenbouwkundig Ontwerpbureau POSAD, 2009, pp. 12-13). The coastline has constantly been changed by erosion and sedimentation and the rivers never hold on too long to their old position of flowing. Before the interference of the human being nature was able to live as wildly and as dynamic as possible. The first settlements in the Netherlands were actually build on building mounts in order to be able to live next to these extreme water conditions (Donkers, 2010). This way of living with the water was the first sign of water management in the Netherlands.
From the early settlements on people where protecting their land by making small levees next to the river, only a couple of decimetres higher than the high river levels during summer. These types of constructions still caused floods during some days but made it more liveable for the people to live next to the water and maintain their agricultural land. The occupation of the land and the use of this land for agricultural reasons had great influence in the natural shape of the Netherlands. The human interference in a lot of areas caused the land to subside and thus made the influence

the Netherlands

Southwest Delta

Image 17 and 18. Context of the location (adapted from Bing Maps)

of the tides of the sea land inwards bigger. It was therefore no surprise that the natural system of erosion and sedimentation had been affected by human hand which resulted in some major floods in the 12th and 13th century (Van de Ven, 1993, pp. 33-34).

These floods were reason for the Dutch to believe that their land had to be improved and stronger levees had to be built in order to prevent any further land loss. This resulted in the first dikes around Holland and therefore the first actual attempt of water management. The implementation of this new system of protection came along with a policy where regional water boards where responsible for the inspection and maintenance of a certain dike ring (Meyer et al., 2010, p. 25). The idea of living with the water was first by means of trial and error during the time of the first occupation. But the Netherlands showed for the first time improving on the research of the technology behind the dikes and how to protect its country from the water. The importance of its land and early settlements and therefore its

Image 19. Changing dynamics of the Southwest Delta (Atlas van de Zuidwestelijke Delta, 2009)

economy was around the middle ages of such high value floods and land loss would lead to a huge economic disaster in a city. This almost forced the people to gain more knowledge in learning how to keep the water out in the most effective way.

In the late Middle Ages the research resulted in even more knowledge for the water management system in the Netherlands. Mills were built in order to maintain the water levels in lower areas and to make these areas still appropriate to live in without having severe burden of the water now and then. The southern part of the Netherlands still had to deal with a lot of influence of the sea. The inlets of the estuary became bigger each time after a storm which resulted in a bigger flood or storm afterwards. The most disastrous one was the second Saint Elizabeth flood in 1421 which made a lot of land disappear as shown in image 20 (Van de Ven, 1993, p. 92). In other parts of the Netherlands they were able for the first time to regain some land on the water by making polders around the sediment areas.

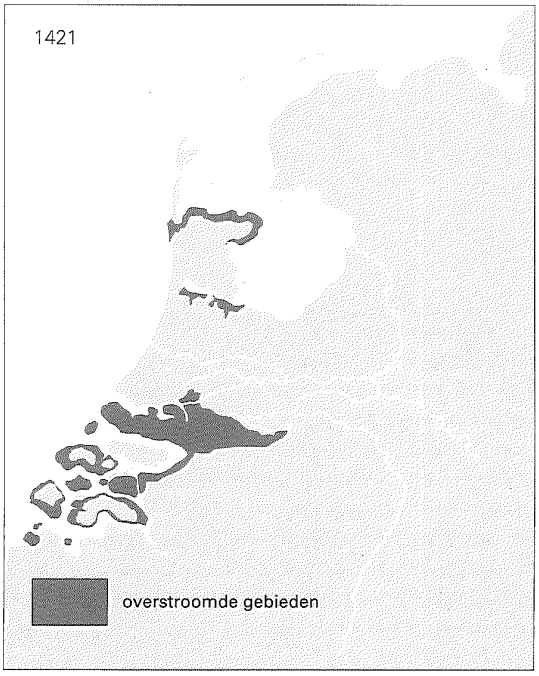


Image 20. Flooded areas during Saint Elizabeth flood 1421 (Van de Ven, 1993, p. 92)

Between the year 1600 and 1800 the Netherlands were trying to reclaim all the land that had for once been theirs. New drainage methods in lakes and reclaiming land by making polders took place all over the country. This new land made it possible for more farmers to establish their business and so the amount of agricultural land in the Netherlands grew rapidly. Furthermore the engineers applied a method whereby the system of the water flow of the Rhine and Waal was being regulated in such a way that the danger of river floods decreased (Van de Ven, 1993, p. 152). By these new ways of water management and a lot of new land the economy of the Netherlands was able to grow even more. It looks like the Dutch now slowly getting a firm grip on the water and were able to control the dynamic system as much as possible.

Large scale reclamations kept on going in the 19th and 20th century like the enormous project of the Haarlemmermeerpolder. Next to new lands during these ages the engineers were also busy with enabling the econ-

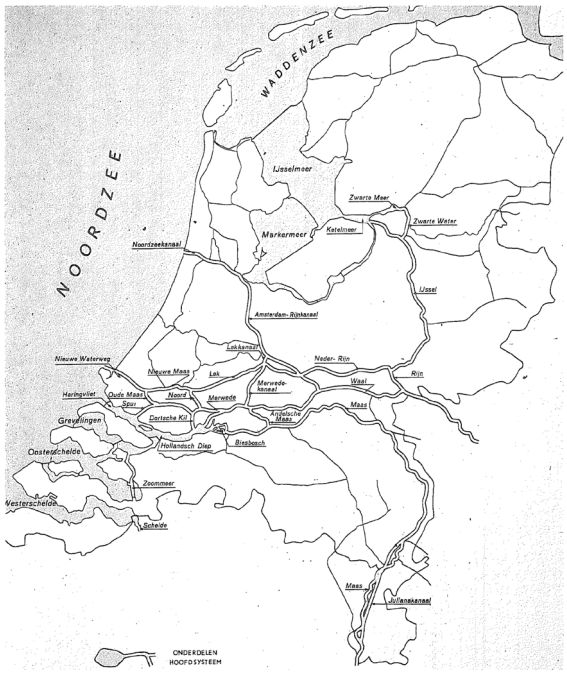


Image 21. Water system with Noordzeekanaal and Nieuwe Waterweg (Van de Ven, 1993, p. 170)

omy by digging new canals connecting cities within the country. Furthermore the Nieuwe Waterweg and the Noordzeekanaal were dug out in order to make the harbours of Rotterdam and Amsterdam navigable through all weather conditions and therefore improve the harbour economy of both cities as shown in image 21. Apart from this water management improvements in the Netherlands the biggest interventions were the Afsluitdijk in 1932 and the Delta Works which started construction in 1958 (Meyer et al., 2010, pp. 33-34). The policy which started the Delta Works was a result of the big ´watersnoodramp' in 1953 which caused huge floods all over the Southwest delta. Until that moment the Netherlands were quite experienced in keeping the water out and how to build the dikes, mills and drainage systems.

2.3.3 The island of Dordrecht

As we have seen the conditions in terms of water management change on the large scale it is relevant to look closer at Dordrecht, a city in the Southwest delta. In order to completely understand the impact of the changing role of water management it is necessary to look at the interventions on a smaller scale. For this case study the island of Dordrecht is being used since it is located on a position in the delta where it is influenced both by the changes tides of the sea and the water runoff from the rivers.

Dordrecht is one of the oldest cities in the Netherlands and has always been on a strategic position for doing trade. Its economy was until the end of the 16th century completely dependent on the passing ships towards Rotterdam and further land inwards following the Rhine and Meuse (De Bruijn & Middag, 2013). Their trading routes had to pass Dordrecht since that was the only navigable route for the cargo ships to take. The so called 'stapelrecht' obliged the ships to anchor at the harbour of Dordrecht to pay taxes to the city before being able to continue their journey. The city of Dordrecht was therefore able to make profit of the lack of knowledge in water management during the first urbanized ages in the delta.

The urban type of the Dutch delta city of Dordrecht can be determined as a typical 'dike town'. This type of urban form is referred to as a city with

a main street located on a dike with its settlements on top of it. This dike functioned as a strategic and safe place for the urbanization of the city (Meyer et al., 2010, p. 67). Along this main street called the 'Voorstraat' new urbanization was realized behind the dike safe against the danger of the water.

But apart from this great ability of the city of Dordrecht to fight against the water by making money out of the situation and build their typology of the city according to their location it also had to deal with great disasters in the past. The most disastrous event for the city was the earlier mentioned Saint Elizabethflood in 1421 which affected the whole of the Netherlands but especially Dordrecht. Before this major flood the city was part of a bigger mainland called the 'Groote Waard' where it was connected to the southern province of Brabant and to the eastern part to the towns of Woudrichem and Heusden (De Bruijn & Middag, 2013). This flood flushed away all the mainland of the 'Groote Waard' and only the historic

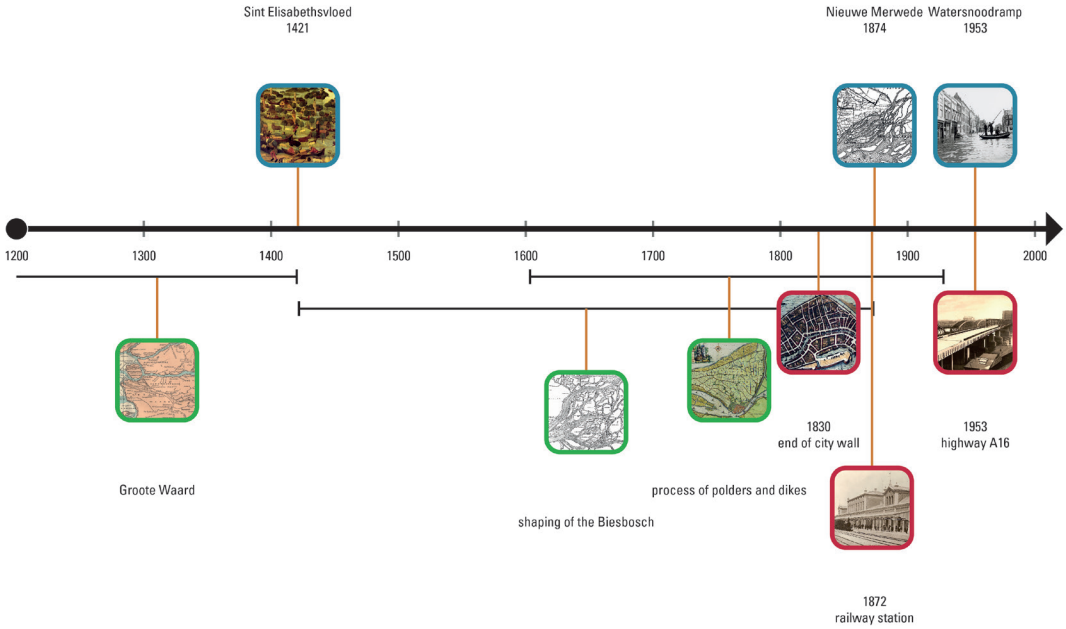


Image 22. Timeline of historical events on the island of Dordrecht

‘Voorstraat’ remained with a few higher laying urbanized areas adjacent to it. Whereas the people of Dordrecht only focussed on the safety of their inner city they didn’t have the knowledge yet back in these days to keep the whole hinterland safe from the danger of the water.

This flood was a turning point for the city of Dordrecht. It showed the urgency of better water management on that crucial location between the danger of having river and sea closely. The dynamics of the river resulted in sedimentation against the historic part of the city. It took till the beginning of the 17th century that the inhabitants were able to regain land back on the water. The newest sedimentation was being made into a polder and new land was claimed by the city. This was the start of an era where sedimentation was turned into new polders until the beginning of the 20th century. The disadvantage of this control of the water system was that it was taking over parts of the natural reserve the Biesbosch and the percentage of man-made land grew to a relative high amount. The river wasn’t able to flow naturally anymore and sedimentation made it hard for the ships to be able to navigate around the island all year long. This resulted in the making of the Nieuwe Merwede in the middle of the 19th century whereby this part was made navigable for every weather condition. Therefore the Biesbosch was even more limited and its area has been declined rapidly since the origin after the Saint Elizabethflood.

The engineers had the opportunity of learning within several decades how to regain a lot of land back on the water. Dordrecht is still famous for the old dikes showing the historic cultural layer in the past of the struggle between water and land. Although it was able to win new land on the water it was even in the 20th century not always sure of safety. In 1953 also Dordrecht suffered from the ‘watersnoodramp’ with several dike breaches around the island. So the knowledge of retaining land was there but the trial and error mind-set had to be used in order to improve the strength and quality of the dikes to keep the water outside. With the construction of the Delta Works also the island of Dordrecht remained the shape it still has today and hasn’t had any severe danger from sea or river. For the island of Dordrecht the nature is being controlled and the water management in the end has taken over the dynamics of the water.

2.3.4 A new type of delta

Looking at both the large and small scale water management solutions the historical research shows that the type of delta in the Netherlands has changed a lot since the first settlements occurred in the lowlands. The influence of the human being interrupted the natural system which was able to live freely until they had built their first settlements. When we look closer at how the delta did work through these ages we can distinguish different types. First of all the delta lived a harmonious life and had a dynamic relation with land and water until approximately the middle of the 19th century. Secondly this delta was being opened by the growing economy and by the urgency to make rivers, canals and ports navigable. This open delta lasted until the middle of the 20th century. At last the period until now this delta has been turned in a closed delta where interventions has led to a controlled system with to the shortened coastline (Meyer et al., 2014, pp. 61-90).

Having this closed delta nowadays makes the Dutch save against the water but it affects the ecology and nature by having such a tight grip on these dynamic systems. The Netherlands have reached a point where the man-made water management has nearly reached its maximum. The dikes are already engineered for extremely conditions and with the unknown scenarios of climate change in the future the aim is to strengthen and maximize the dikes even further. The specialists are already able to make dikes where only a predictable flood would occur once every 10.000 years (Kelder & Gersonius, 2014). The role of the engineer in the water management in the Netherlands has grown rapidly since the first signs of occupation occurred in the Netherlands. But with initiatives as 'building with nature' and policies like 'room for the river' in the late 20th century the direction of the closed delta has changed (Meyer et al., 2010, p. 35). By embracing this closed delta there isn't room for biodiversity and within the engineered water system and the influence of the climate change the delta wouldn't be able to resist the danger of the water for the coming decades. The fight against the water started when the first major floods took away a lot of land and caused casualties. From that time on the influence of water got declined and the impact of the human being grew enormously. We are

now at a crucial point whereby we can't foresee the future and forecast if this man-made delta will be able to resist the power of nature (Meyer et al., 2014, p. 93). Therefore it would be wise to adapt to the possibilities of the coming decades. This closed delta should be softly transferred back to a more harmonious relation between nature and land. As being described by Auke van der Woud people were used to the interferences of the power of water only 200 years ago, it was part of their lives (Van der Woud, 1987). There isn't any harm when land is flooded some now and then as long as society and urban form is able to adapt to it.

2.3.5 Translating towards planning and design

At last we have seen the transformation of the delta from a historic perspective and reached a position to implement a different approach for the future. It is extremely important to translate this vision to a certain strategy and design. As mentioned before the matter of planning and designing should concern a certain state of adaptivity and flexibility, whereby the faster urban layer can adapt to the slower unpredictable natural layer. This means that when at a certain point demographic growth within a city in the delta isn't meeting the predictions a plan will be able to adjust to a lower urbanization. Or that if the assumed water level in 2050 will be higher than precautionary measures have already been taken by designing the first floor waterproof. For the designer it is relevant to be able on the one hand to adapt to new changes in a future perspective but on the other hand not to narrow its scope by the limitations. The ability as a designer to reshape those new probable conditions into spatial quality is a demanding task when planning for an unpredictable future. The Dutch have proved themselves over the last centuries that they are able to fight the water, but now it is time to show that the can live with the water.

2.3.6 Conclusion

The research has shown that the Netherlands has tried for several years to control the natural delta. But the big flood in 1953 proved that the system wasn't the right approach for this specific delta anymore (Donkers, 2010). Since the artificial and closed delta with the Delta Works has been

established the limit has been reached with smaller floods in 1991 and 1993 (Donkers, 2010). Due to climate changes and influence of both river and sea at certain points in the delta the system of the artificial delta isn't fulfilling its needs anymore. After the 'room for the river' project a new approach where at certain points more natural water systems can be applied and where the river can go freely whenever it wants is the new way to go. A change in planning and designing is required in how to deal with the urbanization close to the rivers. It is also an opportunity to create new urban developments and typologies and to show the rest of the world how the Netherlands is again capable of adapting to the water, but then with a different more natural approach. Instead of only looking to the future it is a wise decision to look at the past and learn from the pitfalls made earlier in order to establish a better position concerning matters of the future. By looking at the rich history in water management in the Netherlands an intelligent lesson can be extracted: living with the water in a dynamic relation also has its charm and can be the solution for the unknown future.

Image 23. Picture of an old creek turned into a harbour

2.4 Policy and context

The position in which the island of Dordrecht is situated is part of the Southwest delta. Apart from the history of water management in the Netherlands with its paradigm shift from fighting against the water to living with the water there are some specific topics which lead to context of this project. To understand the broader story of the problems nowadays the context can be explained by the terms nature, city, water and policy.

2.4.1 Water

Centuries ago the land and the water lived in harmony together with no influence of humans. It was common that land was taken away by the water now and then and that sedimentation gave it back to the land another time or that floods would destroy the harvest. The Saint Elizabethflood in 1421 caused that almost all the land of Dordrecht was taken by the water. Only the old city center remained with the Voorstraat being an old dike and therefore can be considered as the first flood defence system of the city. After the disaster a process of land reclamation began with a big role for the dike surrounding new pieces of land, the polders. More and more control of the humans was being put on the water system and so the river on the south of Dordrecht was canalized to influence the high peaks and limit the floods during these peaks. Unfortunately all the steering wasn't enough to prevent the huge flood of 1953. This resulted in the implementation of the plan of the Delta Works whereby the influence from the sea was limited and future floods would be nearly impossible or at least controllable. After the creation of this huge water engineering project polders inland were given back to the water for extra water storage in an attempt to slowly shift towards living with the water.

2.4.2 Nature

The term nature works closely together with the impact of the water but it concentrates in this case more on the general sense of nature and its ecosystem. As said nature was able to flow and grow freely in the delta in the past, wildlife was generous and there was limited influence of human being on the ecosystem. The water peaks caused too many economic damage and losses which resulted in less influence of the nature in the

delta. The human interference in the delta actually changed a lot on the ecosystem, the water turned from salt or brackish to fresh which resulted in a lot of deaths in the fish population. Besides that the tidal nature complete vanished since the tides where so limited compared to before and a lot of species disappeared resulting in a low biodiversity. In fact there was no more space for nature in the modern delta. Luckily there was a change of mind-set which resulted in a series of nature development projects in the delta from the 1970s onwards. Nature reservation areas have been adapted in the policy and there is more attention to the ecosystem. Delta management projects focus more on the impact on the biodiversity and try to integrate this in their approach.

2.4.3 City

The city of Dordrecht is the oldest city of the former province of Holland. When visiting the old city center this can be immediately recognized by

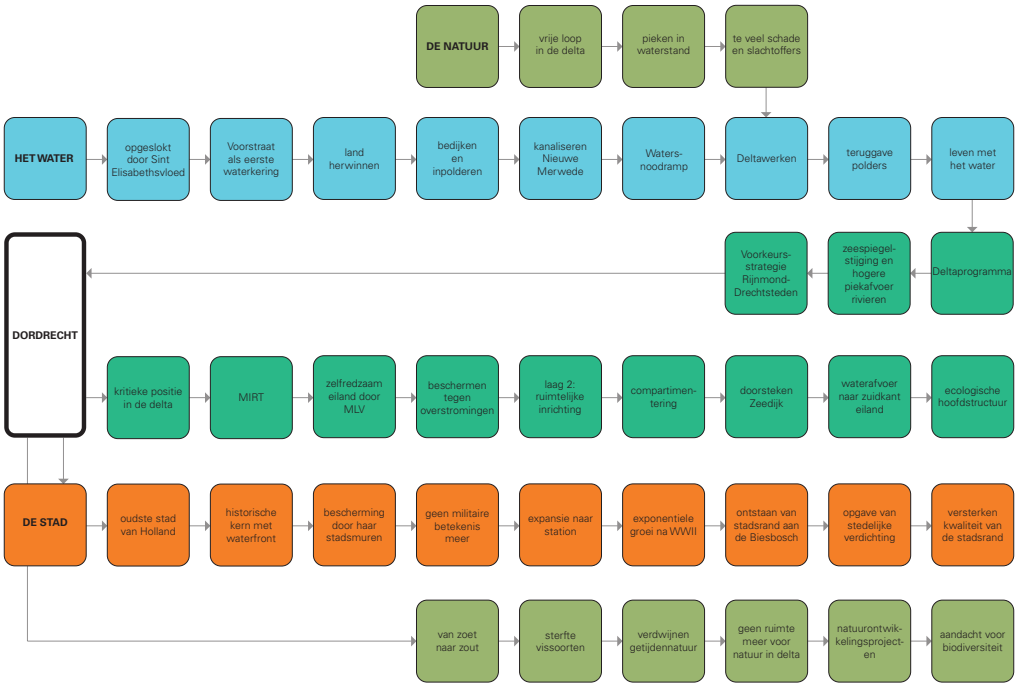


Image 24. Diagram of the relating elements in its context

the old warehouses along the canals and along the waterfront. It was protected in the past by its city walls due to its strategic position near the sea and navigability for the enemies. After it lost its military purpose the city walls were demolished and the city could finally expand beyond its former boundaries. With the realization of the railway station the direction where to grow was set clear and the urbanization took place. After the Second World War it witnessed a second exponential urbanization with wedges going out the city and neighbourhoods were realized rapidly on the island. This resulted in a strict city boundary in the middle of the island upon the entrance of the nature and recreational area the Biesbosch. Nowadays the city has to cope with a task for urban densification and to strengthen the spatial quality of the city border in the middle of the island.

2.4.4 **Policy**

The Delta Works were the first major decisions based on policy regarding

Image 25. Problems of water safety and fresh water (Deltacommissie, 2014, p. 15)

the water safety of the whole country. But also the aftermath of the realization resulted in a new decade of policy making with the introduction of the Delta Committee publishing the Delta Programme. This was related to how to continue after the construction of this massive civil work and how to cope with the climate change and its related issues on the water management of the Netherlands.

Within this Delta Programme several preference strategies for critical areas in the Netherlands have been identified where the strategy of Rijnmond-Drechtsteden is concerning the island of Dordrecht. It is a densely populated area close to the rivers and the sea where the economy is playing a huge role for the national level. When looking at the island of Dordrecht on the bigger scale it is on a critical position in the delta since it has to deal with both potential sea level rise and larger river peaks from the east. When both happen at the same time the water has no place to go and will put a lot of pressure on the dikes of Dordrecht with a possible

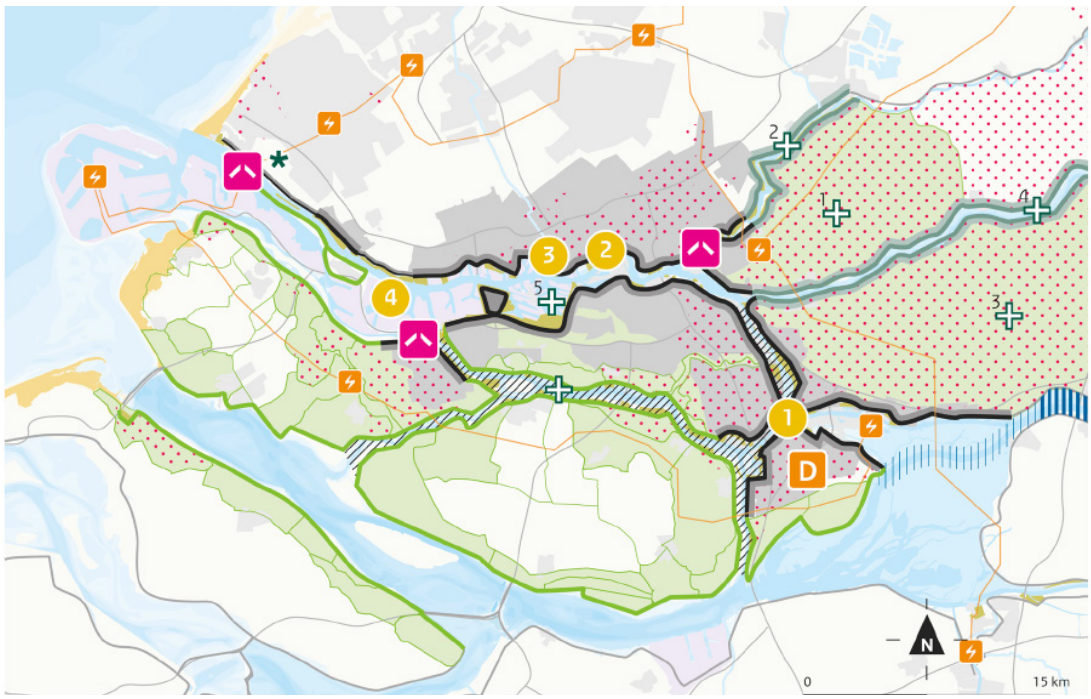


Image 26. Preference strategy Rijnmond-Drechtsteden (Deltacommissie, 2014, p. 64)

dike breach as outcome.

In the preference strategy the Delta Committee has seen this situation of Dordrecht as an exception to all the other precautions which are standardized for the region. Within this opportunity the municipality has set up a team to work on the so called MIRT, freely translated in multiannual plan infrastructure spatial quality and transport. Within this project they look for opportunities which are specific for the island and will result in a more resilient approach for the future. The main aim for the municipality is to create an independent island by means of the multi-layer safety approach. Where the first layer is based on prevention, the second layer on sustainable spatial quality and the third on disaster management. These actions will be taken in case of possible future floods on the island considering that actually not a single inhabitant has to leave the island without being in danger. The most interesting layer in terms of urbanism is the second layer focussing in the multi-layer safety approach on the regional dikes forming different safety compartments on the island. The most recent strategy in this is that a regional dike will be excavated so water can flow in case of a flood away from the city towards the outlet in the Biesbosch. Next to this measurement there is a positive side effect that it will generate an ecological main route from the Hollandse Biesbosch to the Sliedrechtse Biesbosch.

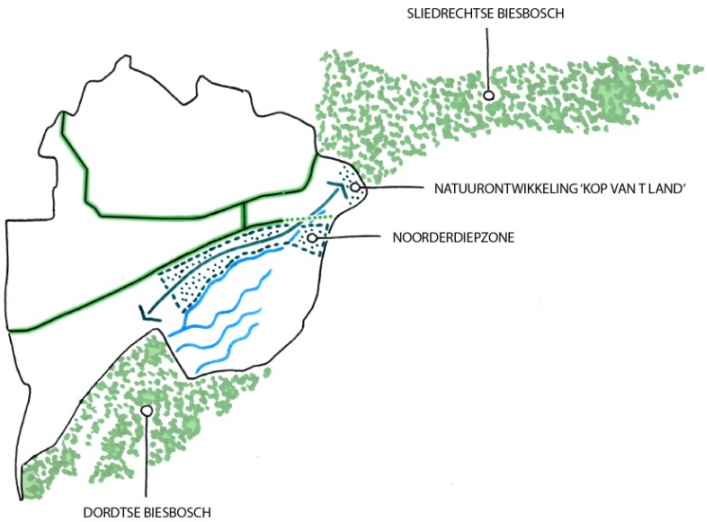


Image 27. Two advantages of the excavation of the most southern regional dike (De Urbanisten, 2015)

2.5 Dynamic systems research

2.5.1 Water safety

As said before the island of Dordrecht is in a critical position regarding the water safety. This means that the city being on an island has to deal with more complex measurements against high water levels. Therefore the island has its own primary water defence, the dike ring 22, which protects the land from being flooded. In terms of water safety a dike has to fulfil certain qualifications in order to be protective towards its hinterland. This flood probability for dike ring 22 is at the moment 1/2.000 per year (Kelder & Gersonius, 2014, p. 5).

In 2014 decisions for the water safety in the Netherlands have been made by the Delta Committee. In this new plan the dike ring of Dordrecht has to be strengthened even more in order to be able to fulfil the regulations in the coming years. This meant that the northern part of dike ring 22 needs to be strengthened to 1/10.000 per year and the southern part to 1/3.000

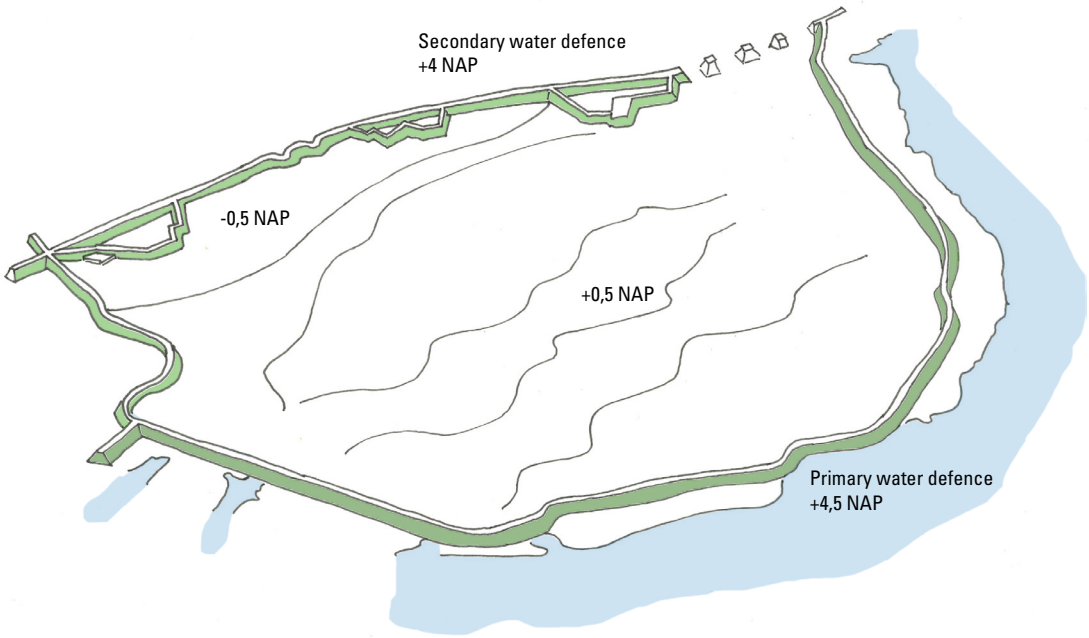


Image 28. The unflooded situation of Polder de Biesbosch

per year (MIRT-projectteam, 2015, pp. 3-4). As a response to these new adjustments the MIRT team has started to think of other possibilities besides this costly maintenance.

The problems of heightening the dikes even further is that if still a dike breach occurs a flood will result in a lot of casualties. Another problem is that the ancient dike in the north, the Voorstraat, has limited strengthening capacities so it's has to think of other ways of dealing with the water safety issue in the future. At last due to the forecasting of extreme weather conditions and the limited time to response it is not possible to evacuate people from the island to the mainland. These three reasons resulted in a new strategy concerning the water safety for the island.

The adapted strategy for the island consists of vertical evacuation whereby shelters need to be pointed out, inhabitants need to be aware of this method of evacuation and energy supply should be able to continue

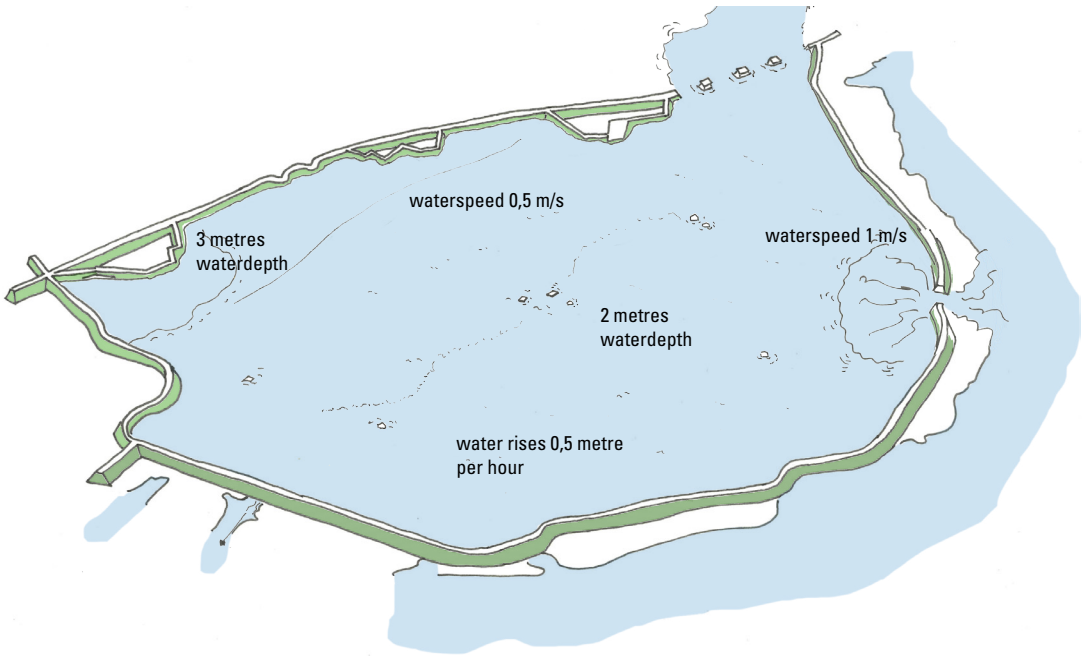


Image 29. The flooded situation of Polder de Biesbosch in case of a dike breach

whenever possible. The secondary dikes on the island, the compartment dikes, will play a big role in the new strategy because they will take care of a better dispersal of the water around the island and will protect the most valuable parts of the city. By choosing these compartments carefully it means that the qualifications of the primary dikes can be lowered into a 1/3.000 per year for the north side and a 1/1.000 per year for the south side. With the money saved the regional dikes can be strengthened to fulfil to the regulations of the water defence.

The compartments on the island will have a flood probability of 1/300 per year. And besides this the structure of the dikes will be adjusted from the way it is nowadays. An excavation will be made to create a natural flow of the water to the southern part of the island where there will be less damage and casualties. A critical remark for this strengthening of the dikes is that this is now only based on the height of the dikes and that it needs further investigation based on soil research (MIRT-projectteam, 2015, p. 32).

As a new proposal on the latest version of the MIRT in my opinion the compartment dike should be connected closer to the excavation so there is no wasted flooded land in case of a dike breach. If the compartment dike connecting the inner compartment ring with the outer compartment ring will be more to the east than the water hasn't got another option than directly flowing to the south.

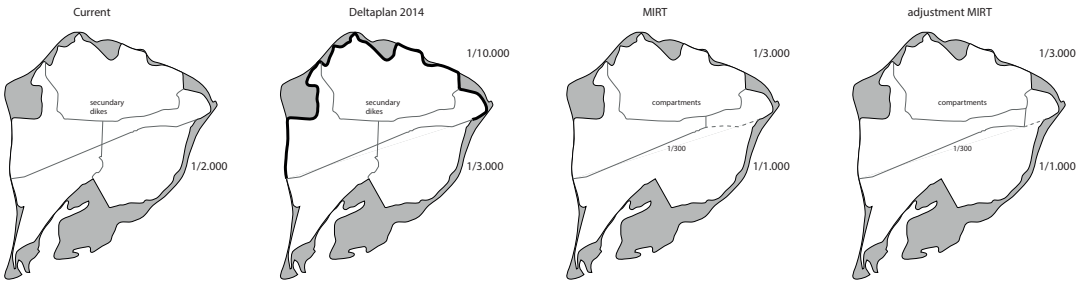


Image 30. The multiple plans concerning the water safety on the island

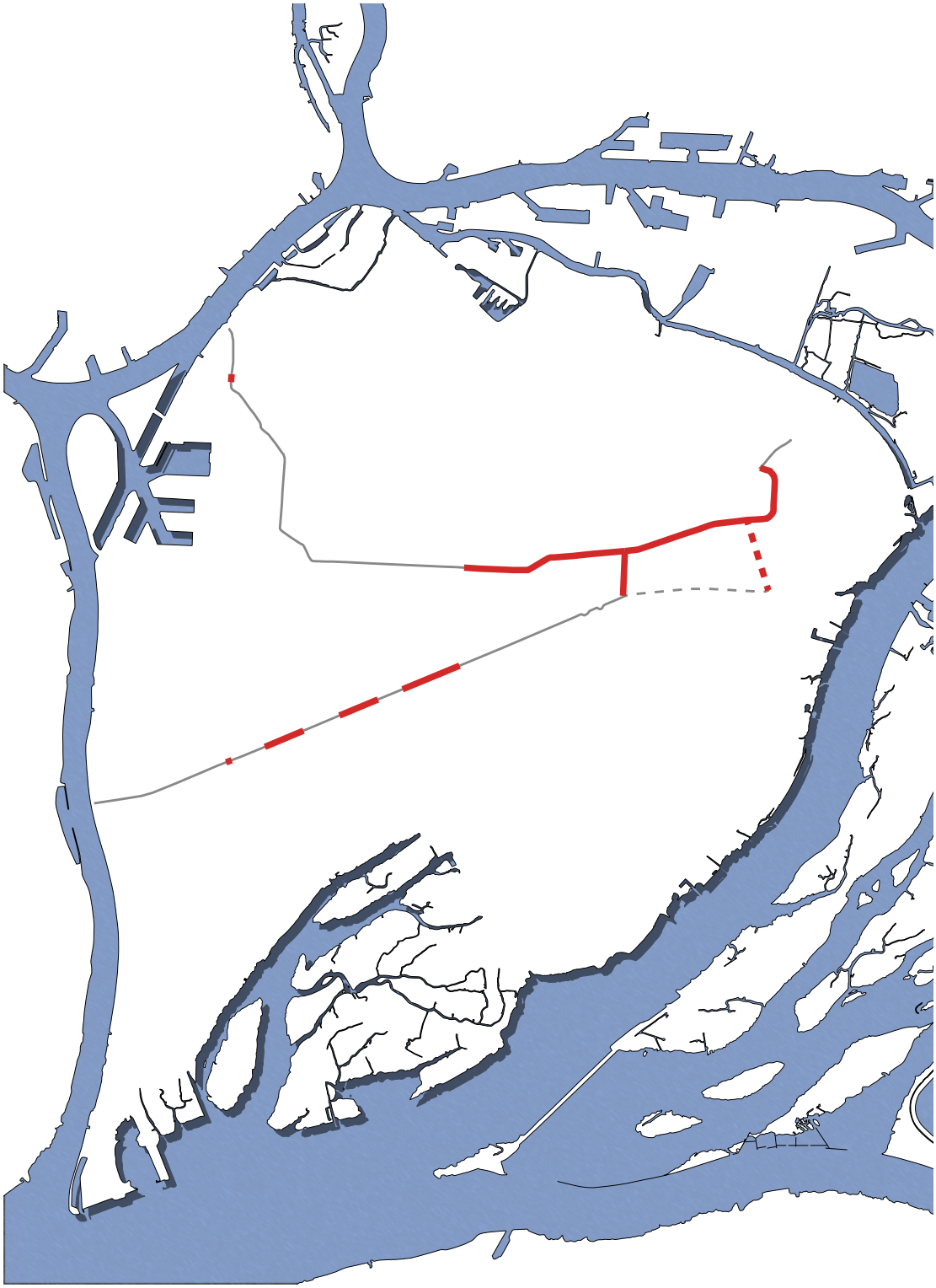
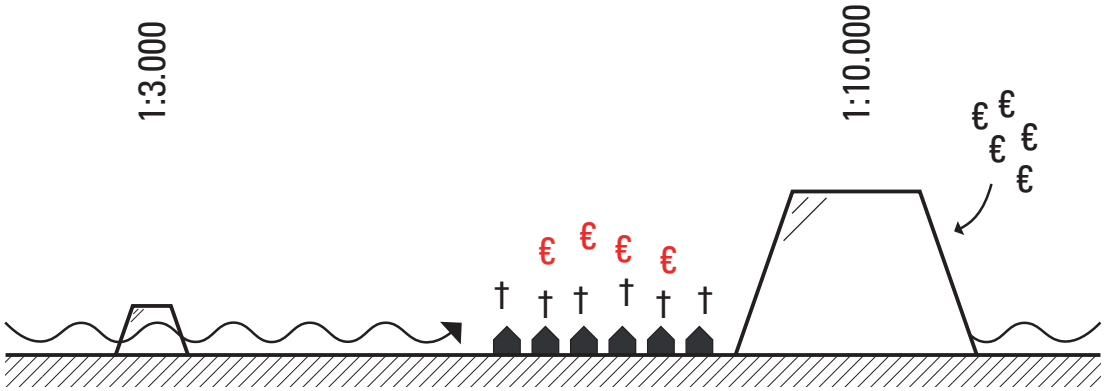


Image 31. Places where the compartment dike doesn't fulfil the height according to 1/300 regulation



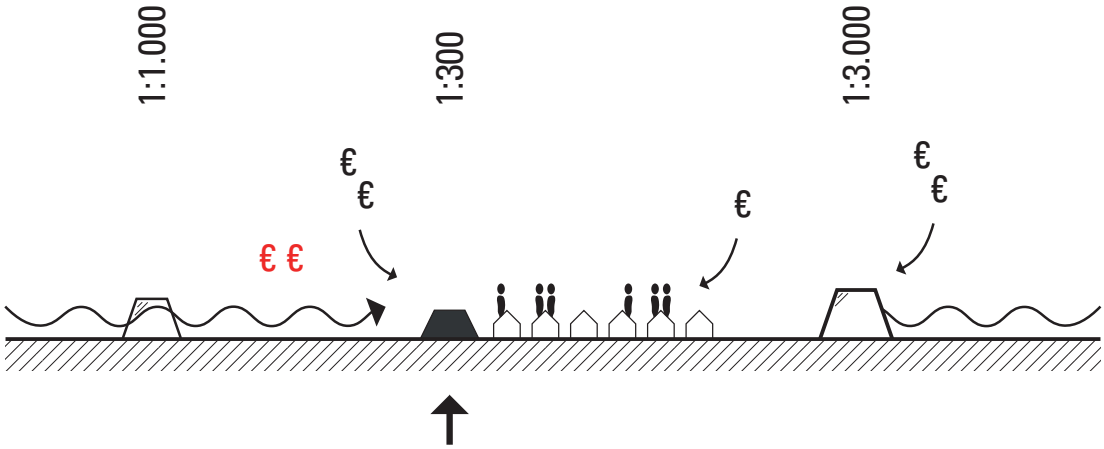


Image 32. Diagrams of the Deltaplan and the MIRT plan

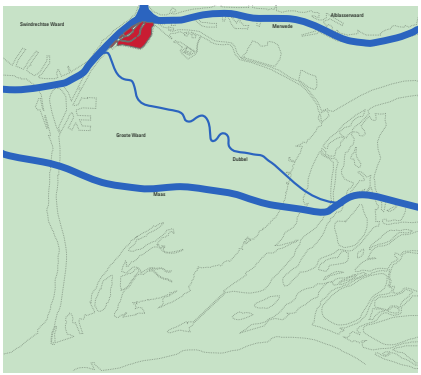
2.5.2 **Historical**

As a continuation on the theory paper I closely looked at the historical perspective of the island of Dordrecht. This part of the research is focussed on the growth of the city, its polders and the realization of the numerous neighbourhoods.

In order to be able to answer one of the subquestions the historical analysis is extremely relevant. In this way I am able to understand the context and the becoming of the island. Also the current status can be better defined with understanding of the past and if the influences which happened back in the days still have effect on the daily life of the inhabitants of Dordrecht. This analysis will be looked at from the first settlement of Dordrecht in the year 1200 wherefore the city is considered as one of the oldest of the Netherlands.

In the first maps of the island of Dordrecht the city centre is still surrounded by a lot of land and some smaller streams of the Oude Maasje, Merwede, Thure, Thuredrecht, Dubbel and Devel. The streams still went through the city and Dordrecht was already on a good position for navigation to other parts of the Netherlands and to reach the sea. The stream Thuredrecht is the original name of Dordrecht which also can find its origin in the meaning of shallow water.

In image 33 the smaller streams have disappeared and the size of the



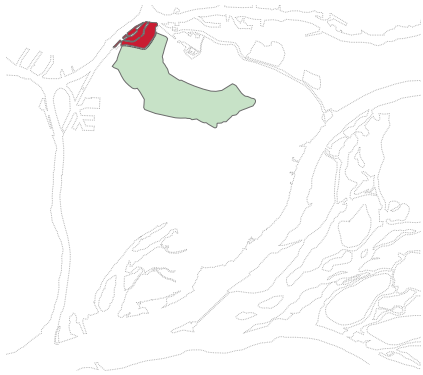


Image 33 and 34. The island before 1421 and in 1603

Maas and the Merwede have significantly grown. The city centre is now really oriented towards the north. The city still makes part of the bigger region Groote Waard. In 1421 the Saint Elizabeth flood washed away a lot of land.

With a lot of land flushed away and Dordrecht being an island was a completely different lifestyle for its inhabitants. The influence of the river and the sea caused sedimentation on the south side of the island. Where first the duck decoys were located in 1603 the first polder, the Oud Dubbeldamse polder, was being made as shown in image 34.

And so the process of sedimentation along the first polder continued. After less than fifteen years it was already time to reclaim more land for the second polder, the Noordpolder. Only a year after the Noordpolder was reclaim the Zuidpolder as seen in image 35 was constructed. The Zuidendijk made a long strip of new land along the oldest polder in 1617.

Half way the seventeenth century the Alloijzen- of Bovenpolder was reclaimed on the water. This polder is the location of the Kop van 't Land nowadays. For the first time settlements were established outside the city walls. It was illegal to actually live there so more public intended buildings like breweries and pubs found new ways of earning money without the strict regulations of the city and paying all the taxes.

In 1659 the Wieldrechtse- en Oostmijlpolder were created. With the com-

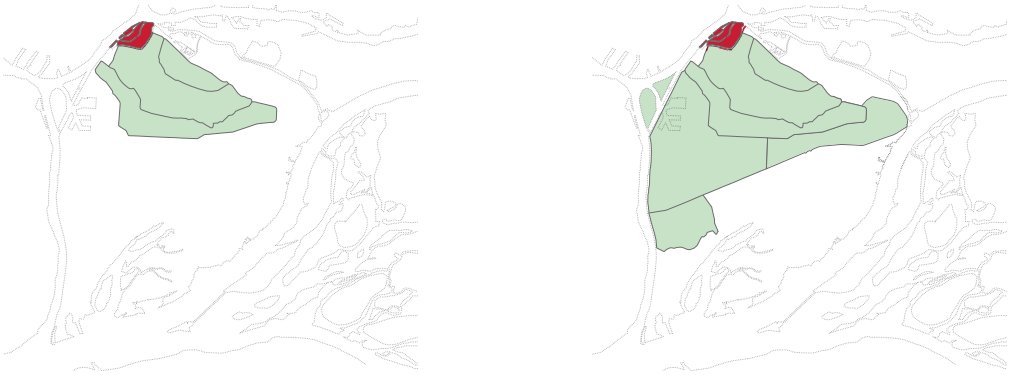


Image 35 and 36. The island in 1617 an in 1715

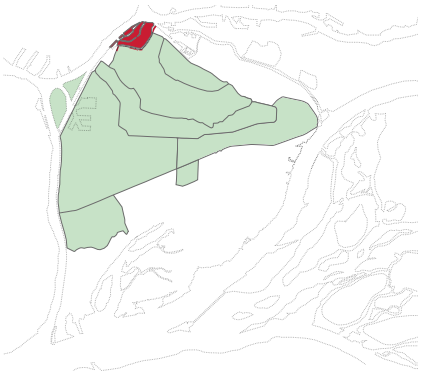
pletion of this polder the system of the seadike was finished. This seadike was stronger than the former dikes of the earlier polders. This was the reason of plans that the current shape of the island would be able to resist the water for the coming years and the amount of land would meet the needs of the inhabitants of Dordrecht.

It was only in 1715 that they occupied new land behind the seadike. The Oude Beerpolder was reclaimed on the western part of the island and to the south of the Wieldrechtse Zeedijk. This was the start of more new polders to grow behind the primary water defence.

The second smaller polder on the southern part of the island was the Hania's polder in 1758. The Schenkeldijk was extended by the Oude Veerweg in order to make this new polder. In only a few decades after the first land reclamation the engineers of Dordrecht were able to already regain a lot of land.

Within three years three new polders were reclaimed in the end of the eighteenth century. As shown in image 38 the Zuid Buitenpolder, the Noord Bovenpolder and the Oude stadspolder were constructed. The Zuid Buitenpolder was a logical implementation of a polder after the weird shape of the Hania's polder.

The Noord Bovenpolder is currently an outer dike polder whereby this northern dike has not been improved since the reclamation of this pol-



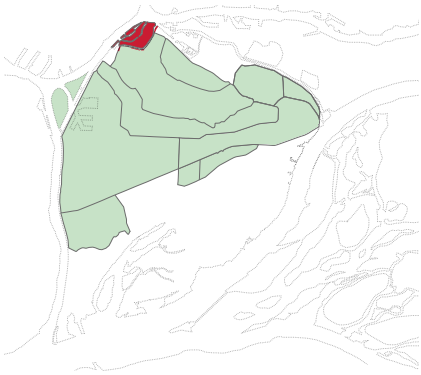


Image 37 and 38. The situation in 1758 and in 1780

der. The Oude Stadspolder is the polder where half of the neighbourhood Stadspolders is being located nowadays.

In 1788 the empty space between the Hania's polder en de Oude Beerpolder was filled by the Louisapolder. The rough southern line of the dike shows the influences of the sedimentation and the water tidal system opposite to the man-made former sea dike.

Since the Saint Elizabeth flood in 1421 the Biesbosch was able to grow freely with the influences of the water and the tidal differences were still around two metres back in those days. Although the Biesbosch accommodated a lot of quality for nature and biodiversity the influence of the land of Dordrecht grew with the making of the polders. Two extra polders in the south of the island confirmed this message. The Cannemandspolder and the Nieuwe Beerpolder were reclaimed which made the south side of the island nearly to its current shape.

In image 40 the industrial revolution also reached Dordrecht and the railway from north to south was realized. This resulted in more urbanization outside the historic city centre and new houses grew towards the railway station. The city of Dordrecht started to orientate itself more land inwards after all the land reclamation and the construction of the railway. The waterway on the south of the island wasn't navigable throughout the whole year due to the natural flows of the river and the influence of the Biesbosch. Plans for a structured river finally came to realization by con-

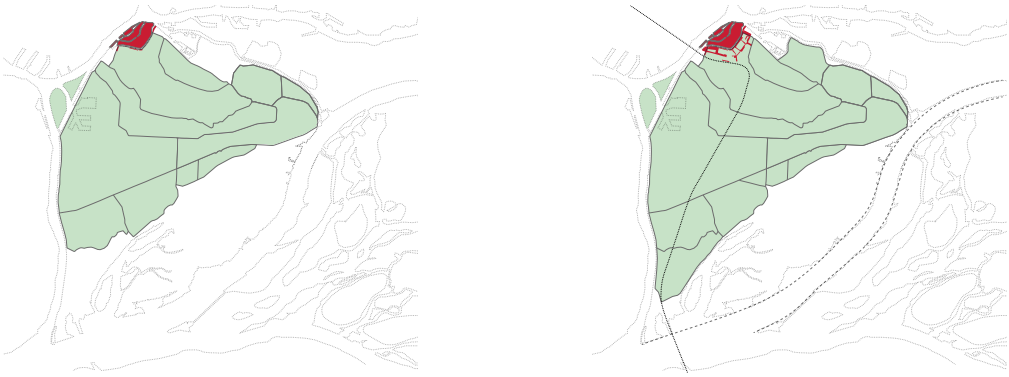


Image 39 and 40. The situation on the island in 1788 and 1881

struction of the Nieuwe Merwede.

The railway and the Nieuwe Merwede were the start of a century full of new implementations and a lot of changes on the island. And so in the beginning of the twentieth century the railway was extended to the Alblasserwaard. Furthermore the municipality put a lot of effort in heightening the outer dike area of the Staart so this piece of land was also suited for port, living and industry. The urbanization grew due to the removal of the city walls towards the railway station. For the first time the old polders are now being used for housing, along the old dikes the first settlements occur as shown in image 41.

In 1916 Dordrecht again constructed a new outerdike area on the north of the island and so Staart II was realized. This was the last controlled piece of land since the eastern side is more recreational and still part of the Hollandse Biesbosch.

In 1929 the most recent polder was reclaimed and the final shape of the island was achieved. This last polder minimized the present wildlife on the island of Dordrecht itself. The most of the nature reserve was by this action definitely shifted towards the east of the island.

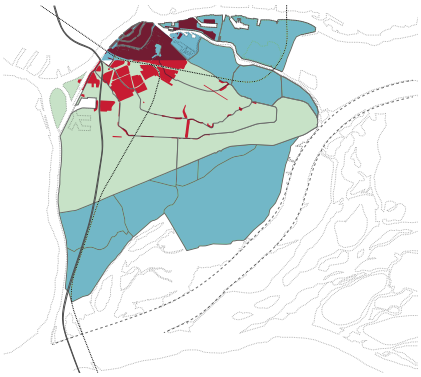
Shortly after the Second World War the first city expansion of the island made the first ring around the historic city centre. Two big neighbourhoods were realized and also new urbanization grew along the old dikes. As can

Image 41 and 42. The island in 1901 and 1929

be seen in image 43 the 'watersnoodramp' flooded quite a large percentage of the island. Due to several dike breaches the city centre was filled with water. On the southern part of the island the water only came till the old sea dike which still proved the function of this civil work and the ability to function as a secondary water defence. Also the former regional road from north to south was now replaced by the A16 highway splitting the first harbour from the rest of the city.

In 1980 the urbanization of the island had grown fast through the last couple of decades. The port inlets on the west of the island had been constructed to boost the economy of the city. The first signs of the second city ring can be seen new houses on Staart II, and growing towards the old sea dike.

In the last image 44 the most recent situation of the island is displayed. The port area in the west has hugely expanded along the rail- and highway. The second expansion of the city has been completed by establishing this second ring around the historic centre. The latest dikes of the most recent polders fulfil the function of the primary water defence and the Biesbosch has still some ability to flow freely near the island. In the end the urbanization in the last century grew immensely and the island can be divided in the urban north and the rural south. By this historical analysis and the construction of polders and dikes thorough research has been done on how the island has grown and why certain patterns are the way they are.



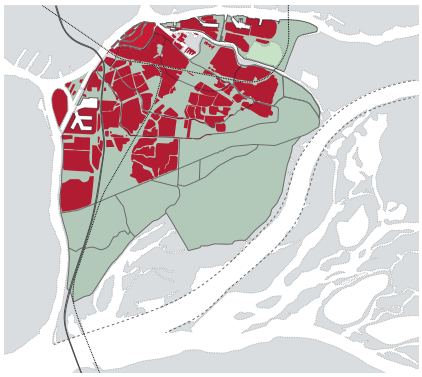


Image 43 and 44. The island of Dordrecht in 1953 and 2010

As a conclusion of this analysis the different polders can also be seen in the model with their height exaggerated. The polders show a diverse height difference due to the long history with sedimentation, floods and land reclamation.

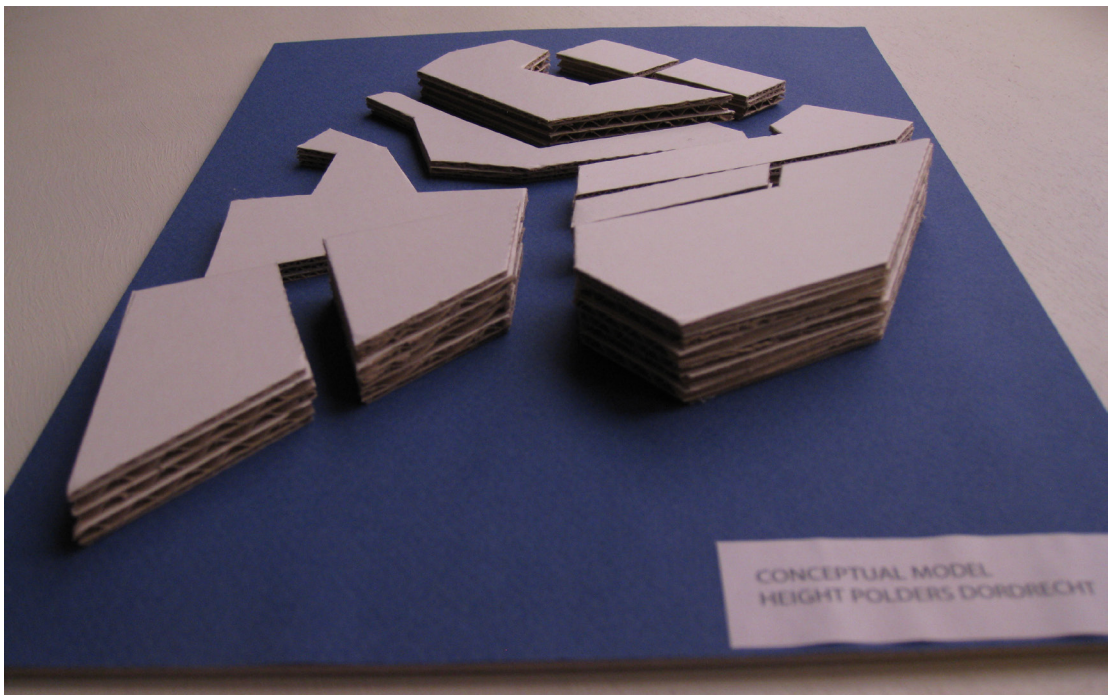


Image 45. Model of the heights of the polders

2.5.3 **Island**

As shown in the historical analysis in the previous chapter the rapid urbanization of the island resulted in a typical shape of the city. It all started with the expansion beyond the dam of the Voorstraat which was later turned into housing (Hooimeijer, Meyer, & Nienhuis, 2005). With the later city expansion this example was followed and now clear rings of urbanization are recognizable in the pattern of the city. While the business districts are strictly separated from the living areas by the highway and railroad.

It is clear from the map that the city grew from its historical center towards the land which was reclaimed in the south. It stopped growing until the agricultural landscape and the Dordtse Biesbosch.

When looking at the island several different qualities can be distinguished in the north and in the south. Obvious is the quality of the city centre near

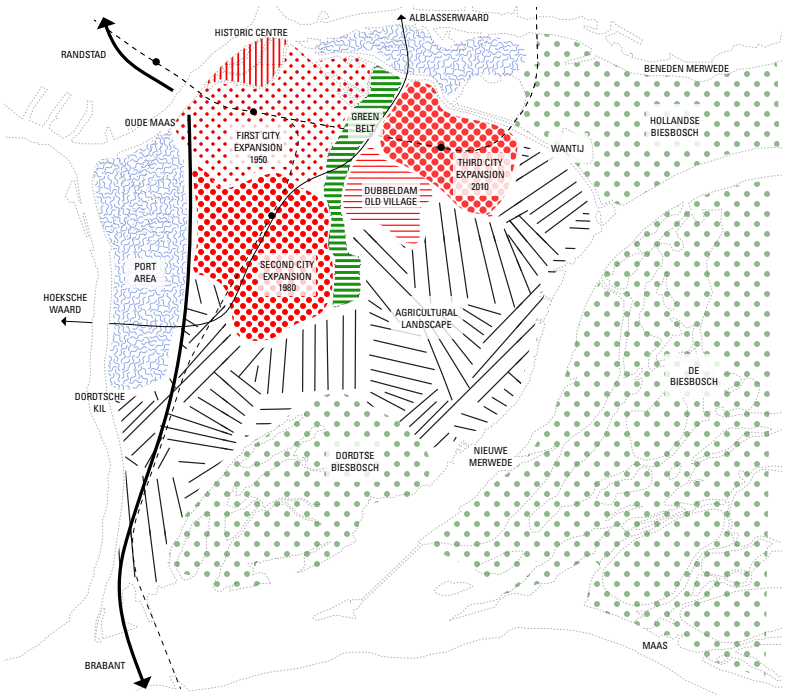


Image 46. Different living environments on the island

the waterfront, but also the first expansion after the demolishment of the city walls is still of good urban quality with a lot of green within the neighbourhoods. When looking at the southern part of the island the Biesbosch is located at the water with a lot of biodiversity and possibilities for recreation. Around this nature reserve area the polders are laid out in the open and the views are stretched and beautiful. Unfortunately in between the rapid urbanization after the Second World War caused a lack of identity in the middle of the island where mainly infrastructure is the most present in the landscape. The connection between the qualities in the north and in the south is therefore brutally disrupted.

Besides the qualities on the island the orientation of the island can also explain a little bit of the identity crisis and the mistakes made in the past. In the early years of the existence of Dordrecht the city was strictly oriented to the waterfront, the economy was based on it and the harbour was the main reason why Dordrecht could flourish in the Middle Ages. But

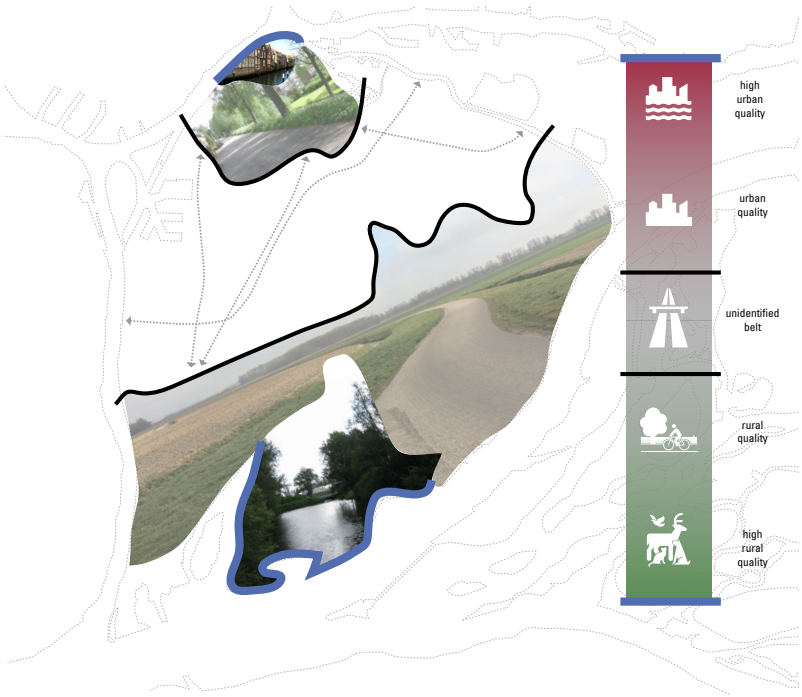


Image 47. The different qualities on the island of Dordrecht

with the establishment of the railway station the city turned its back a little towards the water in order to be able to grow towards the railway. Along the old dikes new establishment were realized and the face of the city became two folded. At last we can see that with the most recent constructions in the middle of the island both in terms of living and industry the face of the city is mostly turned inwards. The water is only recognizable at its waterfront and its former identity is lost.

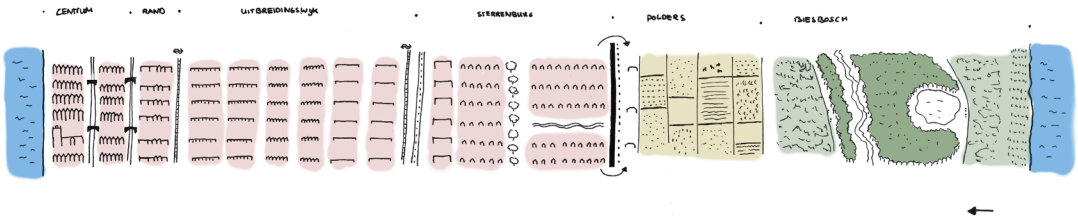
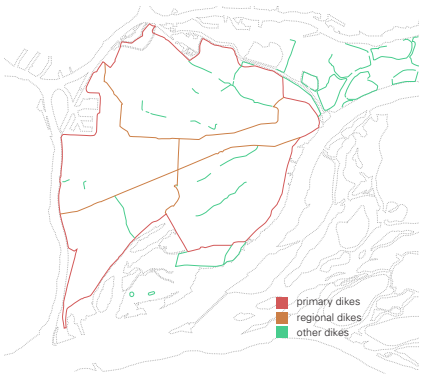


Image 48 and 49. The gradual shift on the island and the transition of the orientation of the city

2.5.4 **Dikes**

In the Netherlands thousands of kilometres of dikes are located with many of them being very ancient and forming the typical character of the landscape (Rijksdienst voor het Cultureel Erfgoed, 2013, p. 2). The dikes of Dordrecht are especially characterising its landscape due to the long history of fighting against the water described before. There are still a lot of former dike elements which no longer function as water defence but still show the old structure of the island. Or as Renes (2015) says "Dikes tell stories about their history" (p. 143). This separates the analysis with the historical perspective from the dikes with their narrative. And as it is considered as a storyline there are also different interpretations of the dikes in Dordrecht.

The heights of the dikes are also key elements for the different characters and how they are perceived in the landscape. The model shows how many dikes are actually situated on the island and that the profile in the middle of the island is very high which origins from the function of a former sea dike.



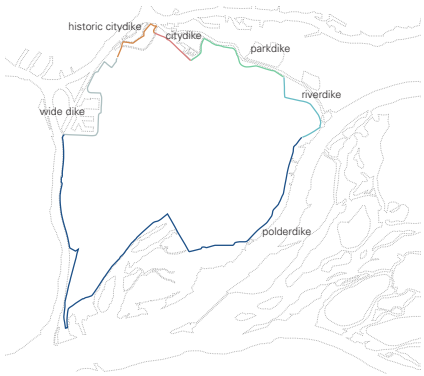
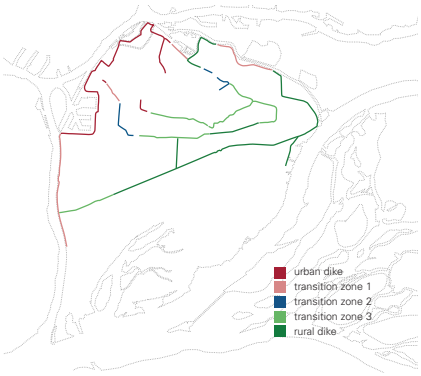


Image 50 and 51. Dike in terms of water safety (Dijken van Nederland, 2015) and spatial character (Kelder & Gersonius, 2015)

The heights of the dikes are also key elements for the different characters and how they are perceived in the landscape. The model shows how many dikes are actually situated on the island and that the profile in the middle of the island is very high which origins from the function of a former sea dike.



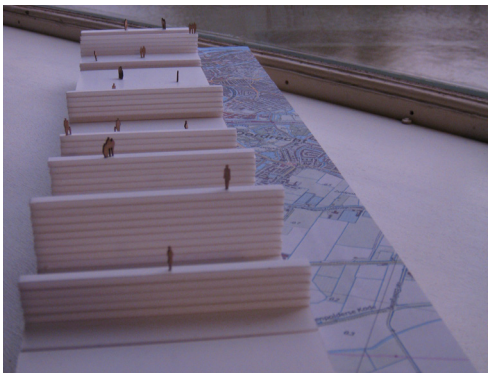


Image 52 and 53. Dikes in term of zoning plan (Gemeente Dordrecht, 2015) and the model showing the heights of the dikes

On the island eight different types of dike combinations can be distinguished based on the fact that a dike has actually two sides from where the city or land can grow to. This diversity in different dike typologies is only regarding the primary and secondary dike elements. Having this spectrum of options makes the narrative of the dike even more diverse.

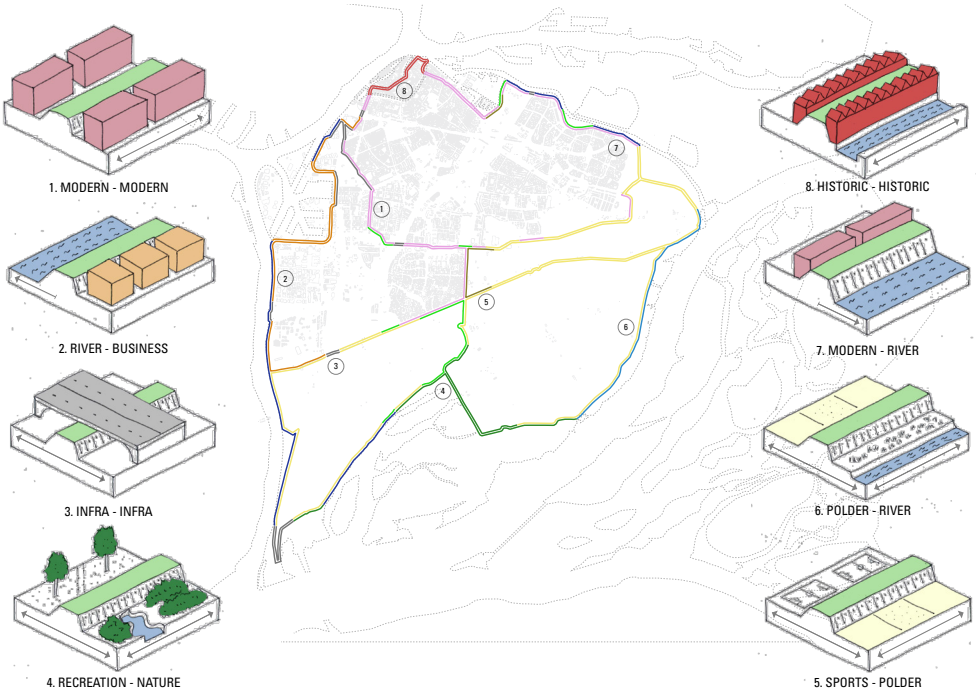


Image 54. The relation between the city and the dike

2.5.5 City borders

Next to these dikes forming a spatial typology in the landscape of the city they sometimes also form the border of the city. At a point where the urbanization has either stopped growing or is blocked by another spatial element. On the island of Dordrecht roughly seen four different city borders can be distinguished. The first one is the historical waterfront with the dike the Voorstraat as a backbone. The second one is the broad green border on the north east part of the island along the Wantijdijk. At the west side of the island the sea harbours are located forming the third city border. And finally in the middle of the island the urbanization has stopped against the dike Zeedijk and Wieldrechtse Zeedijk separating the city from its land. These four different borders have a completely different character but all contribute to the diversity of landscapes on the island. The question is however the southern border locating between city and land can function in the future. If it will be complimentary to the other borders or that it will be a new type of border while still maintaining the character of the island.

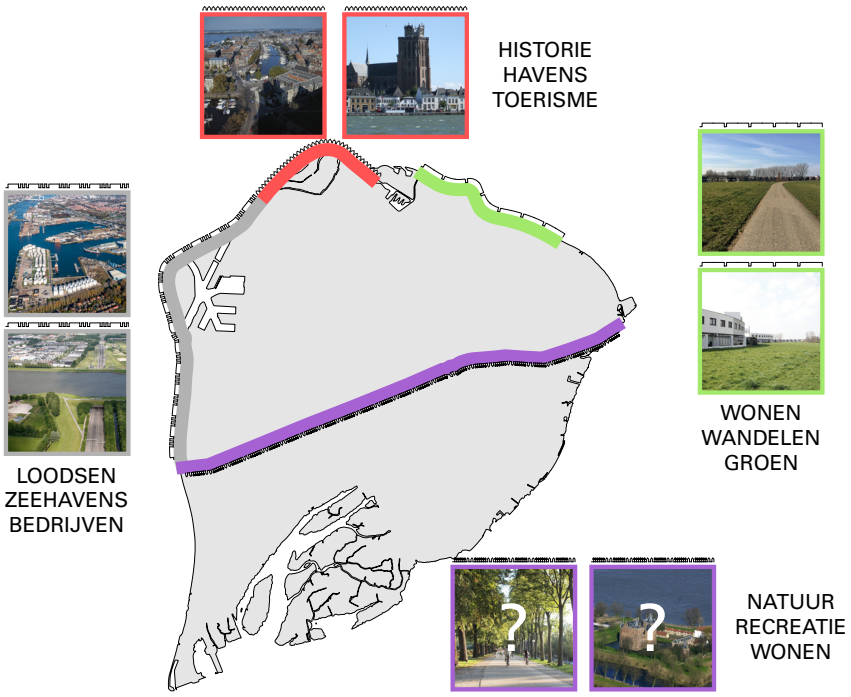


Image 55. The island of Dordrecht and the four different city borders

With the research I have zoomed in on this last city border and see how it can respond to the historical waterfront. The dike here functions as a clear separator between the urban settlements and the rural nature. This makes the city border a relevant and interesting topic to look at its role towards the future and how it can contribute to the whole island. This can be seen as the new front side of the island supported by the new route the orientation of the urbanization has chosen. It may be possible to suggest to go either visit the old front, near the centre, or to visit the new front, near the Biesbosch and in the delta.

The city border can be compared with a pantry, with the city being our home and the landscape being our garden (LOLA Landscape Architects, 2011, p. 11). It hasn't got a real quality while it is extremely useful but being positioned on a very conflicting space. As it can be seen in the image 57 the city abruptly stops at the border and there isn't a soft way of entering the landscape. This is a pity since there are a lot of opportunities to design this border in such a way that it connects the city more to the landscape. They are living next to each other without cooperating from each other's qualities.

The 'Stadsrandenatlas van de Zuidvleugel' discusses ten different types of borders. As a study to look at this specific case all the different types have been tested on the dike in order to look for new solutions which might be a bit out of the box. This gave an interesting perspective on the role of the dike and if it should have functions along the dike on the inside or outside.

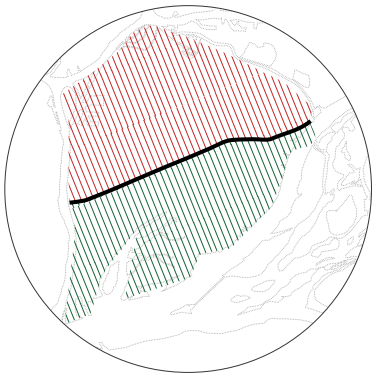


Image 56 and 57. The confrontantion between city and land on island level and on local level

2.5.6 Zeedijk and Wieldrechtse Zeedijk

In order to take a closer look at the Zeedijk and Wieldrechtse Zeedijk as a city border and what could actually be done in terms of designing it is necessary to analyse how this dike actually works. Is it necessary that this dike actually needs readjustments? Or can small interventions do the job for upgrading the city border and therefore revitalize the island? And if so, what can be the right places for new design plans so it goes accordingly to the structure of the dike and the island.

First of all the spatial analysis of the dike as a line shows the specific elements which make this dike unique. The dike has a length of nearly 10 kilometres and consists of almost a large straight line. The dike actually consists of two names called Zeedijk, the eastern part, and Wieldrechtse Zeedijk, the western part separated in the middle by a crossing. Apart from this straightness the biggest eye-catchers are two half circles which is followed by the route of the dike. These originate from a flood and caused a double breach in the dike. This was solved by making a half of a dike ring on the outer area of the dike in order to strengthen it to its former capacity. Other types of movement on the dike consist of three kinks of only a few degrees but enough to give a nice view when cycling on the dike. The last one is caused by a major infrastructure structure going north south which causes a small disruption in the pattern of the dike since the traffic from east to west has to go underneath the highway and turn a little around the railway track.

Image 58. View from the south towards the Zeedijk and Wieldrechtse Zeedijk

Apart from the movement along the dike caused by its position several sightlines can be seen as shown in image 59. The big neighbourhood of Sterrenburg shown earlier is put against the dike separated with a little bit of water. Next to this polders are located next to the dike and a big line of trees on the eastern part of the dike. A small village living on the dike can be distinguished in the west around the infrastructure hub and at last it can be seen that the endpoints of the dike are relatively open and the views are far.

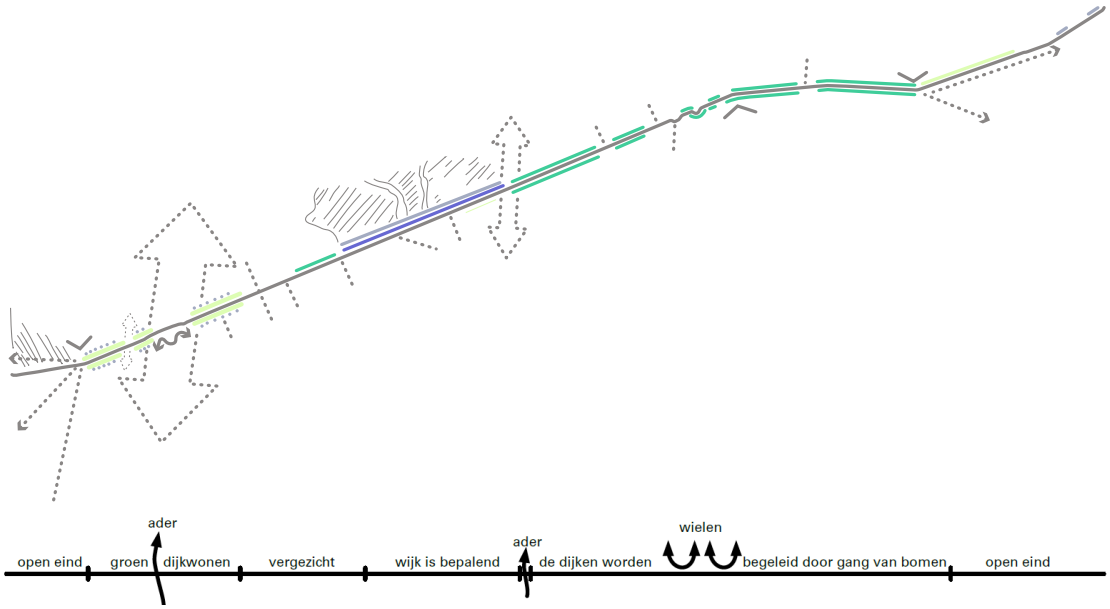


Image 59. The spatial analysis of the dike as a line

Surroundings

The character of the dike is somehow already described by the spatial analysis but it lacks the actual feeling and context. This identity of the dike and how the surroundings can be felt by the observer are therefore explained in image 60.

All the different elements and how the dike approaches its context is being described by what can be actually seen at a certain place. This results in an abstract way of looking at the dike as being open or closed towards its surroundings. As seen in the spatial analysis the big line of tall trees are typical to this dike. Therefore they are suggested as the hallway whereby the ceiling is covered with the leaves and you can see the surroundings throughout the trunks of the trees. The dike can also be completely open or closed on only one side.

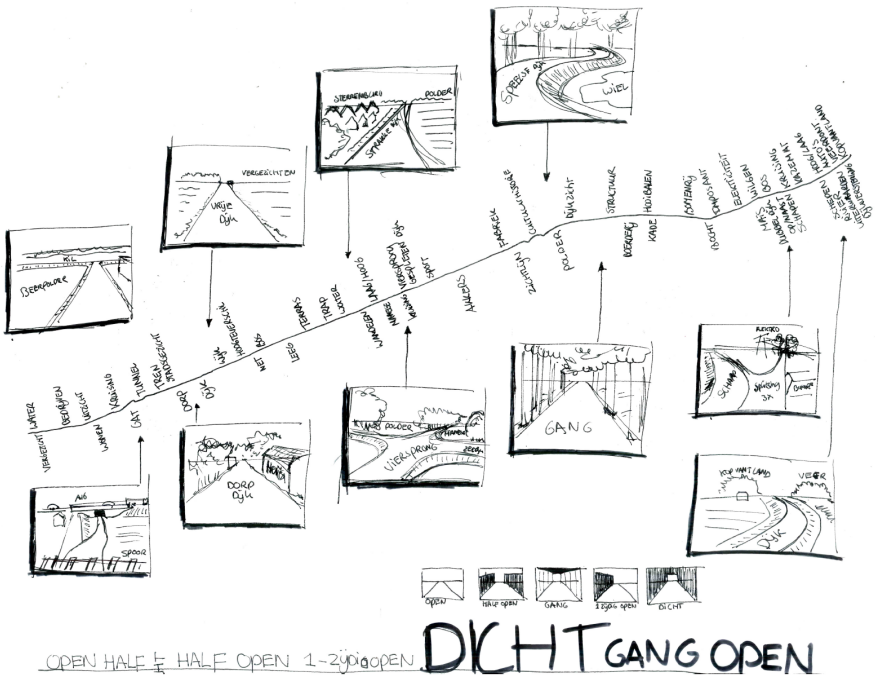


Image 60. The observations from how the dike is perceived

Sightlines and sections

This closed and open space towards the surroundings of the dike brings the research to the sightlines from the dike to the landscape. The hallway is hereby also clearly recognizable but in this case the sightlines are only when there is an actual open space in between the trees. At the point where Sterrenburg is closely located to the dike the sight to the north is very limited. How far your view can reach can actually be cluster in three parts. The wideness on the endpoints has been mentioned before and this is because of the lack of functions and the open polders. It is interesting to see that the long views are also merged between the railway and the Biesbosch. There is nearly an unlimited sight towards the south looking at the polder structure towards the primary dike and the trees popping out on the horizon of the recreational forest.

Besides the views along the dike at crucial points along the dike intersec-

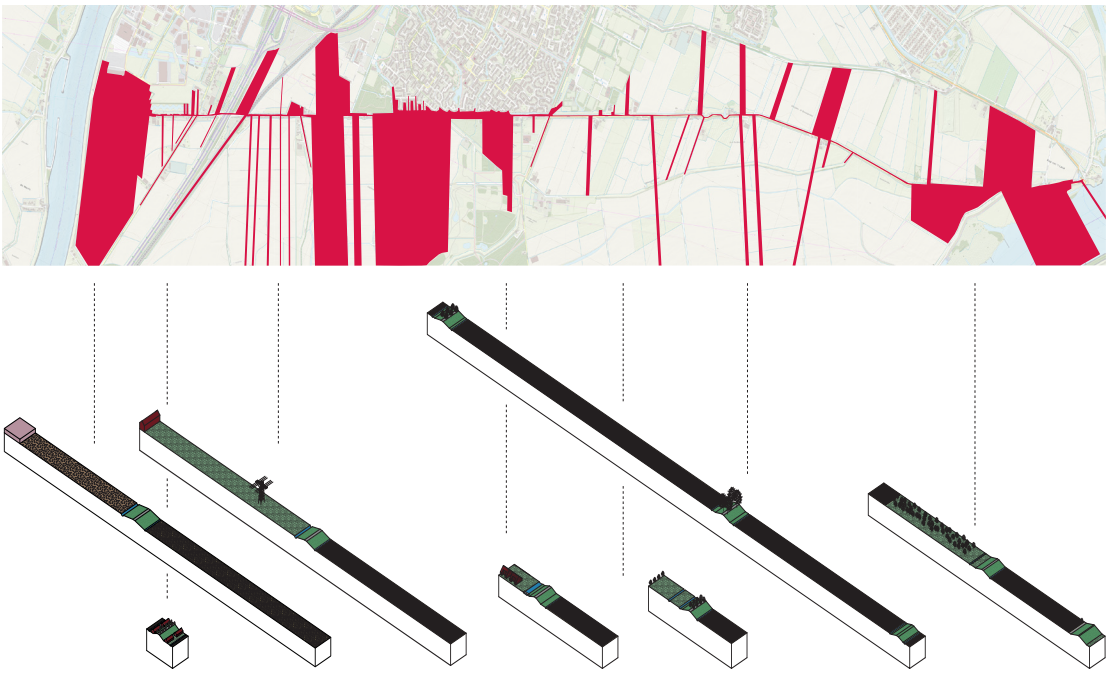


Image 61. The perpendicular sightlines with corresponding sections

tions have been drawn in order to look closer at the relation of the dike with its hinterland. From these isometric drawings it can be clearly seen how the dike responds to the polder, forest or buildings. It also displays the relation between other non-functional dikes located closely to the Zeedijk.

Nodes

The previous analysis was closely related to the structure of the dike in the east west direction. While there are some conflicting north south movement along the dike which are of great importance to know how the dike really functions. This series show how roads, other dikes or infrastructure is approaching the dike and how this junction looks like. Apart from the two main north south directions mentioned earlier the general movement will stay from east to west and vice versa.

Since the dike is only a regional dike in terms of water defence and therefore hasn't got an active role in the water protection it is interesting to see how this dike interacts with the primary dike along the Nieuwe Merwede

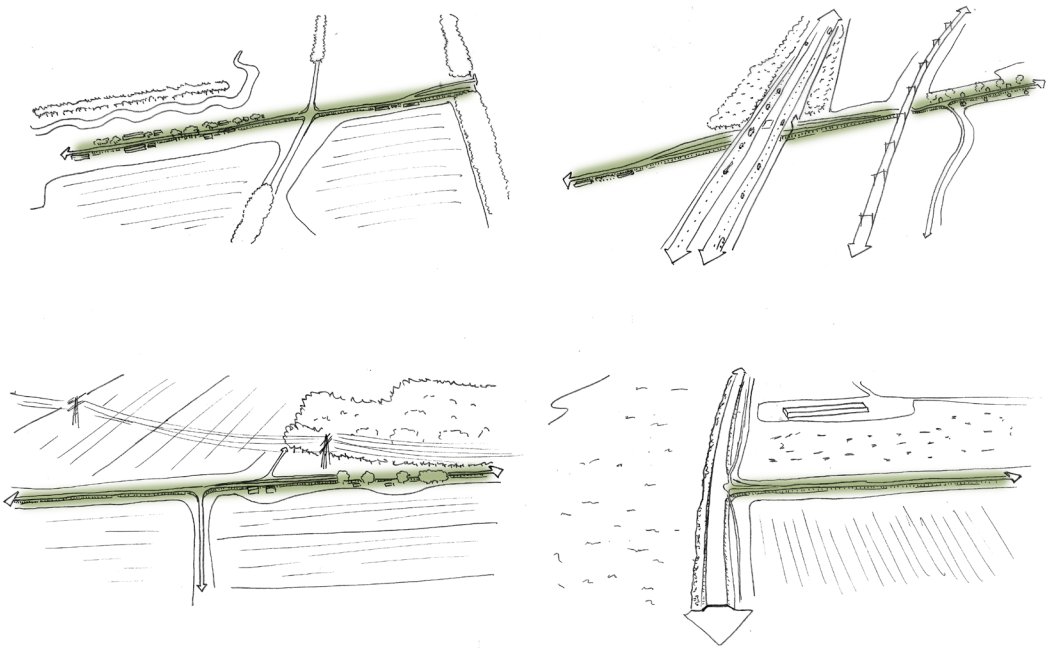


Image 62. Nodes crossing the dike; primary dike, railway, polder road and regional road

on the east and the Dordtse Kil on the west. On the west the main dike in the vertical direction is really dominating the Wieldrechtse Zeedijk with a broader broader profile. But on the eastern side the primary dike gently connects with the Zeedijk going towards Kop van 't Land.

Conclusion

Having all these qualities within the dike also creates a lot of possibilities for the design. It is therefore recommended to respect the spatial quality of the dike instead of going extremely against it. In image 64 it shows how this dike is situated on the island and how it positions itself compared to the other city borders.

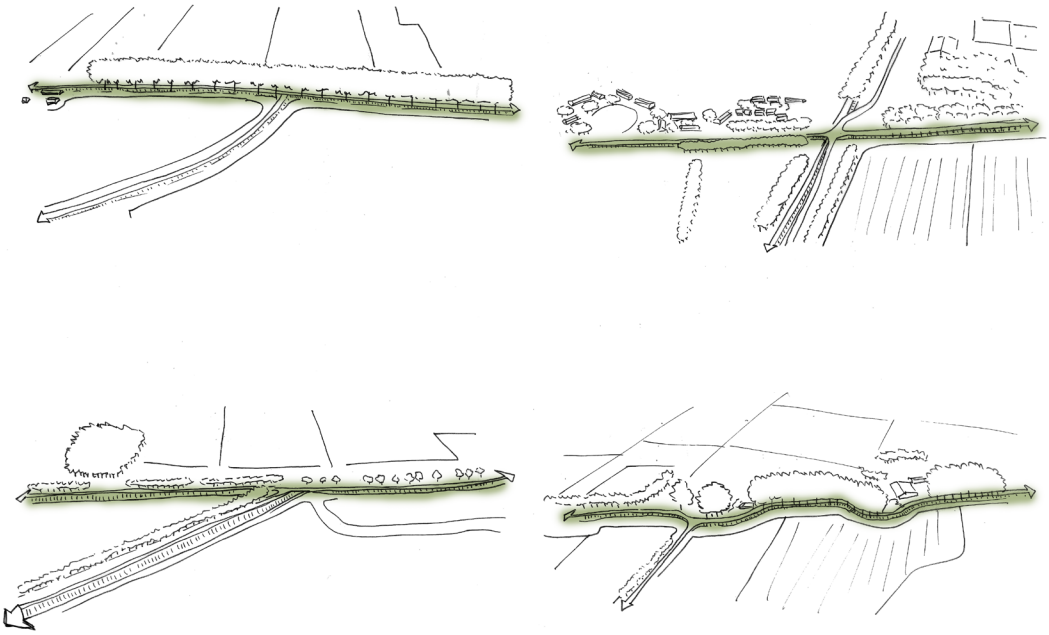


Image 63. Nodes crossing the dike; former dike, compartment dike, primary diek and agricultural road

Image 64. Perspective on how the dike relates to the bigger scale of the island

2.6 Action research

2.6.1 Introduction

As a part of my methodology it is important to fill the gap between water safety and spatial quality. With the action research the intention was to visit the site a lot and have a talk with people about the island and their knowledge on water safety. My position within the project having collaboration with the municipality made it also possible for the research to get the latest information about the MIRT and be able to talk with relevant stakeholders at meetings or workshops.

2.6.2 Site visits

The site visits often consisted of going to the island of Dordrecht and making a lot of pictures. This was done by bike, walking or by car to interpret the lifestyle on the island also by different modes of transport. The intention of these visits was to get an idea of the whole island and in the end have cycled on all the dikes that the island is rich of.

Next to the smaller site visits of one day I stayed for three days in Dordrecht in May in order to be able to identify myself more with the inhabitants. Therefore I also slept with the help of AirBnB at random people places in two different neighbourhoods to get an idea of how the city works during day and evening. During these days I interviewed people and tried to figure out how their knowledge was of the island, which specific locations they knew and how they were involved regarding the water management and the dike system on the island. Besides the street interviews I spoke with a police officer, the tourist information office, hostel employees, antiquarian and a bar keeper. In order to also get in contact with people who would be able to look at the island from a different perspective than a random passer-by. This information has been gathered in the form of several mindmaps which will be discussed later on. During my last site visit in October when looking closer at the dike I was also invited at a nice elderly couple's house to discuss the dike and the island of Dordrecht. This kind of information of people living there for more than 20 years is very valuable.

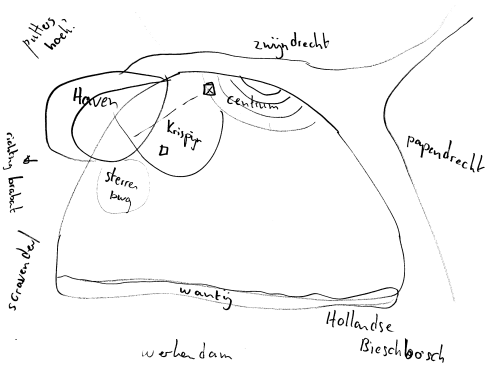
The reasons why I also visited the island quite often was because in the

early stage of the graduation project the involvement with the municipality was still high. I visited at least once a month a meeting or a workshop with the team of MIRT to discuss the latest results and proceedings. This gave me the newest information regarding the water safety and because of this personal contact I was able to test my ideas already in an early stage. Since the project team had to finish the MIRT publication before the summer the meetings have stopped since then. I have also visited an opening of an exhibition afterwards to show the inhabitants the influences of a flood on the island. And we also had a workshop with several parties bringing ideas to the table for the spatial quality combined with the water safety measurements in the multi-layer safety approach. The people involved in these gatherings were different stakeholders which gave a nice perspective of the reality of working a project. Next to the municipality Dordrecht having a water flood specialist and a policy employee spatial quality, the province of South Holland, the water board Hollandse Delta, Rijkswaterstaat, the Ministery of Infrastructure and Environment and consultant HKV were other actors involved in the meetings.

Image 65. Picture of the compartment dike in the city during one of the site visits

2.6.3 **Mindmaps**

As mentioned in the previous section the longer site visit was used to interview people. Therefore I asked them to draw a cognitive map of the island. Unfortunately the weather was really bad so the amount of maps drawn was less than expected. Although I could conclude that the knowledge of the island is really poor. It only remains to the basic knowledge of the historic city centre, the Biesbosch and probably the surroundings of their living environment. It made it obvious that the scale that people live in is very small and they are not easily attracted to the hinterland of the island.



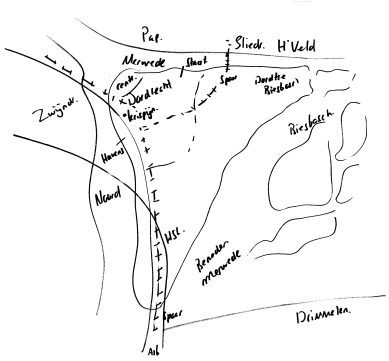


Image 66 and 67. Mindmaps drawn by a couple where I stayed one night

2.6.4 **Cultural history**

During my earlier site visits I noticed a lot of objects in the rural part of the island which meant something for the island but weren't highlighted very much. These were really interesting for me to see since I wanted to know more about their origin and the story behind. Unfortunately I could only guess where it came from but that it had to deal with the history of the island was for sure.

Later on in my research the aspect of cultural history came in the picture. Since I was closely working on the identity of a place and how the history also has influence in place making the term of cultural history was an interesting term to look closer into. As Feddes (1999) describes: "The space in which we live conceals a wealth of information concerning our cultural history and the manner in which our environment was created." (p. 6).

Image 68 and 69. Cultural historical objects in the landscape of the island of Dordrecht

The cultural history objects tell us something about the history of the landscape and how there has been lived on in the past. Due to the rich history of dikes, polders and dwelling mounds which were realized and also were demolished the landscape is full of signs of the dynamics of the Southwest delta (Landschapsbeheer Zuid-Holland, 2011, pp. 3-4). And these objects can be pointed out more in order to even enlarge the identity of the southern part of the island. Probably in the past the urbanized part of the island was also full of cultural history objects but these were removed due to the urbanization. In 1999 the policy document Belvedere stimulated municipalities to look carefully after their landscape and cultural history elements. This was taken a step further on the 1st of January 2012 by obliging the municipalities to take into account their cultural historical valuables (Rijksdienst voor het Cultureel Erfgoed, 2013, p. 1).

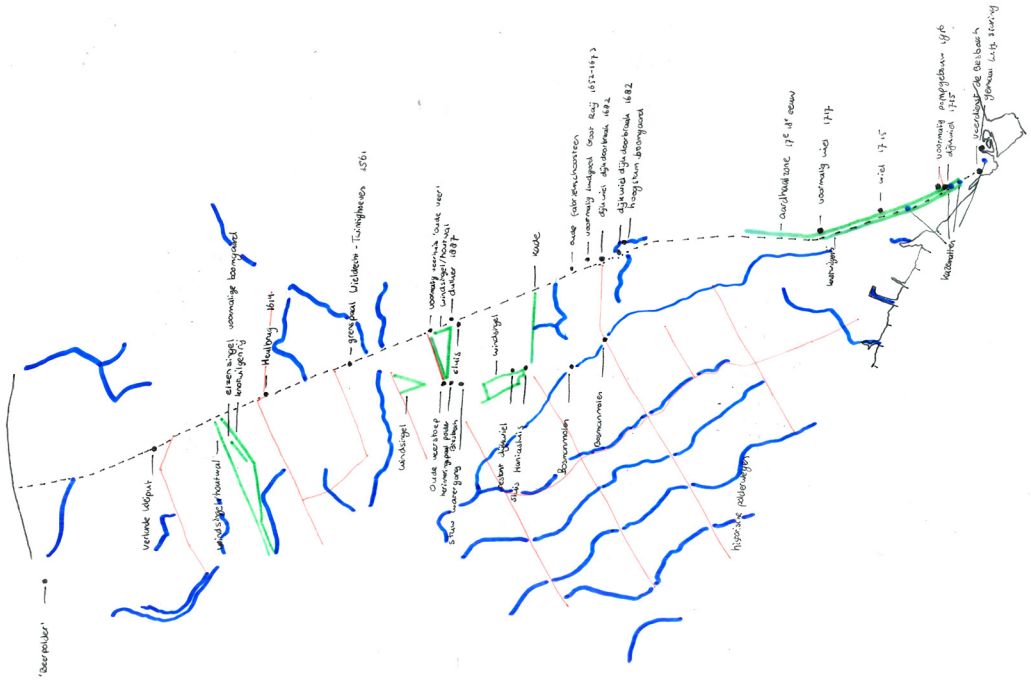


Image 70. All the cultural historical objects close to the dike

2.7 Design based research

2.7.1 In search of a program

The most interesting aspect of the design based research is how the process led to the final outcome. Until the P1 the design did not play any role, the only thing which was thought of in terms of design was what the possible outcome would be. At that moment I described this as an adaptive and integrated urban design. The possible location was chosen as the Kop van 't Land on the east side of the island.

Due to the research done in the different typologies of the dike and the city the idea arose of designing along different dike elements on the island towards P2. To give more attention to the dikes of Dordrecht and to let people understand more the underlying landscape of its city. Several conflicts between urban situations were chosen to make the dike work as a connector instead as a separator. At four different points this conflict was being solved by a new redesign for the dike. The situations were 'urban meets urban', urban meets nature', 'park meets nature' and a conflict between an outerdike and an innerdike area.

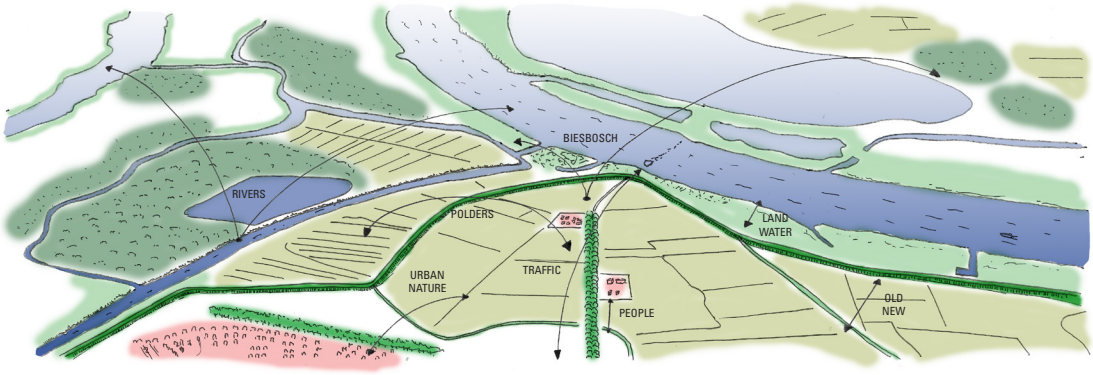


Image 71. Suggestion for the design in an early stage

At this point the importance of the dikes was feasible in the design. And the means to make people more aware of the water safety was the function of the dike. In which a new perspective would be used to pay more attention to the water system. At these four different points the design proposal consisted of a renewal of the dike in such a way that it wouldn't be possible for the inhabitants to notice the presence of the dike.

The role of the dike is extremely important which gave a direction towards the design. But what is necessary to give the design more body is a specific location which can also be related to bigger scales. In contrast to the historical city the dike in the middle of the island opens up towards the rural landscape. This dike can function as a new front side of the city as the opposite atmosphere of the northern waterfront.

After the choice of using the Zeedijk and Wieldrechtse Zeedijk as a tool for the design different elements could be combined. This dike can work

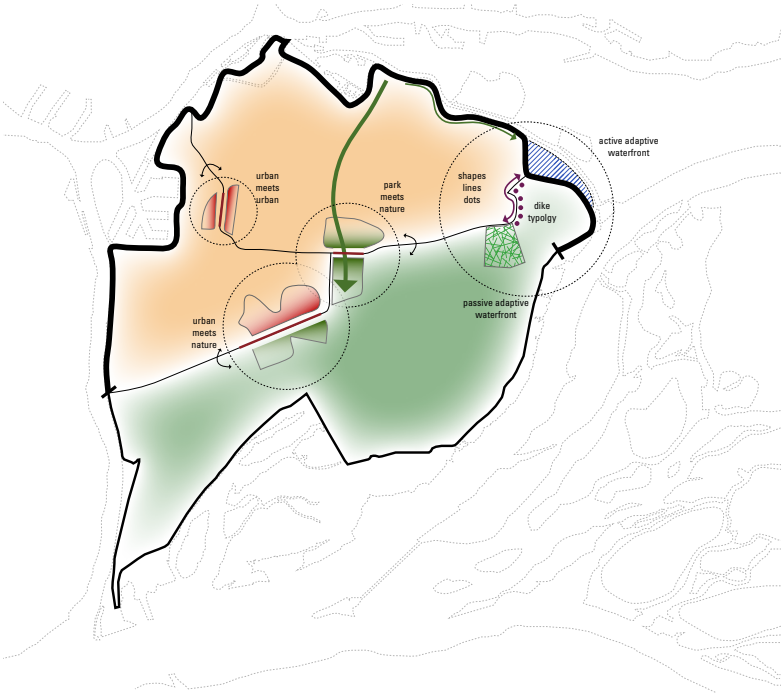


Image 72. Suggestion for a strategy in the middle of the process

in the new identity for the island and can show the quality of the delta to the inhabitants. On the other side it can combine the current qualities with the historical centre. As mentioned before this dike is also the city border of the island. With recognizing this as the border between urbanization and landscape a new process towards the design started. At this point the design research took place on experimenting with all the different types of city borders.

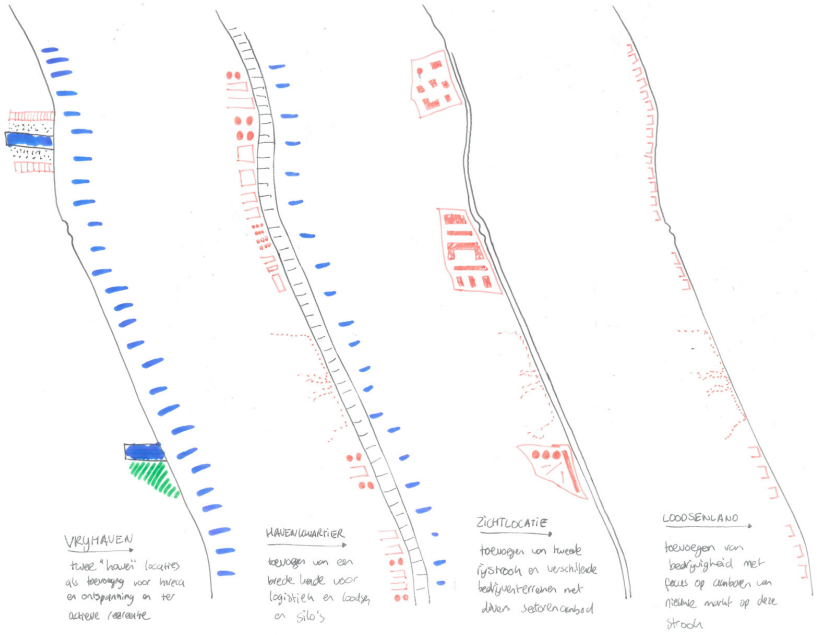


Image 73. Studies on how the dike can function as different city borders

2.7.2 **Experimenting with shapes**

The design experiments with the different types of functions along the dike caused a new question to rise. Next to the fact if it would be recreation or living along the dike the pattern of the dike and the shapes of the added elements are relevant for the spatial quality of the new dike. Whether an addition on both ends of the dike would do enough or that a big object in the middle would be better were questions I had to find out due to designing. A relevant question was if the shape should connect with the current landscape and lines or that it should oppose on purpose in order to create friction. A shape could also mean something recreational added to the dike whereby the type of intervention wouldn't be on such a large scale. It would relate more to the current structures and continue the current state of mind.

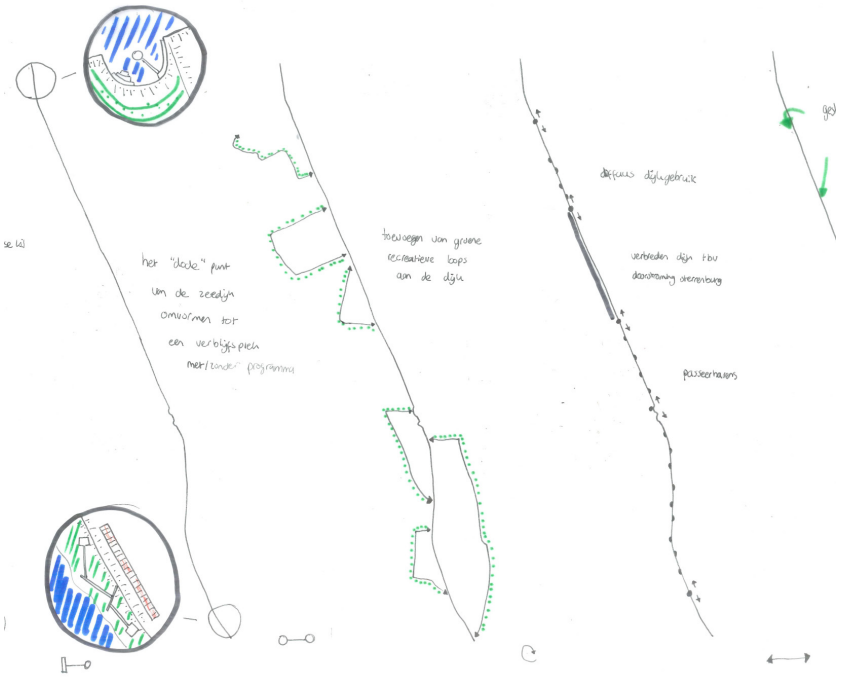


Image 74. Studies on how the dike can make use of different shapes

Having all these possibilities sorted out in such a way to test what could be done at maximum and minimum with the dike made it possible for this research to end with some concepts. The first one is related to the cultural historical creeks, the second one with the dike as a spine with different functions along the dike, the third one based on the current structure and the connection of city and landscape, the fourth one is a dike with experimental shapes connected by a green route and the last one is a concept whereby the dike has several landmarks and works as the in-between route from city to the Biesbosch.

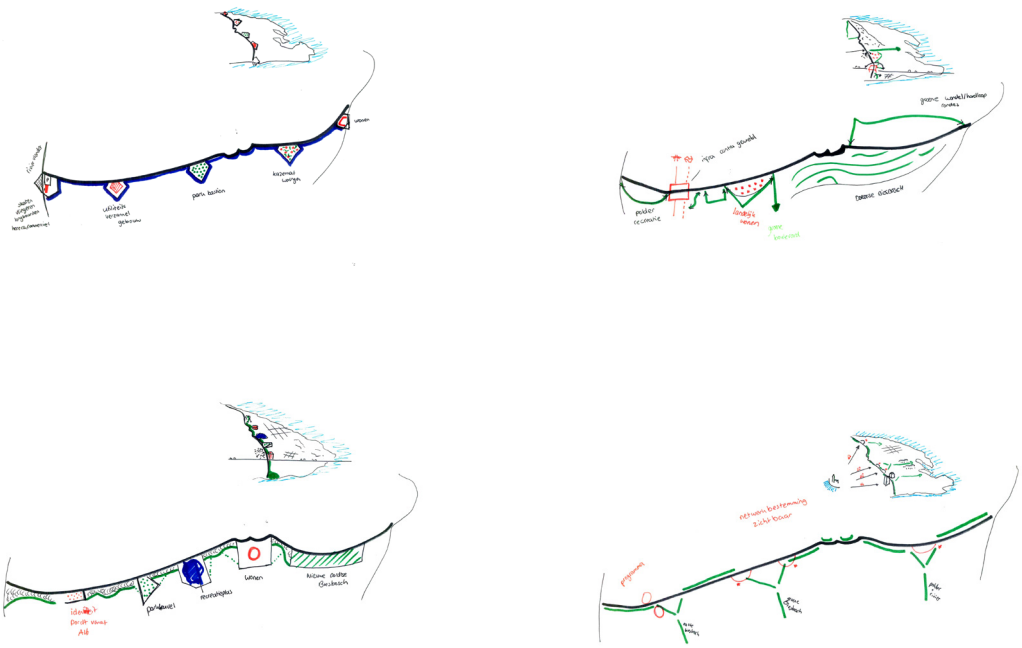


Image 75. The four different concepts of the dike

2.7.3 Seeing as

The idea of Goldschmidt (1991, pp. 131-132) of "seeing as and seeing that" is very applicable to this dike. As the dike also being a city border immediately the connection with the former city walls of Dordrecht were made. These had in the past a strict gradient between urban and nature and so it can be seen for this dike. With this reference the connection between the old and new front side of the city can be given a new shape and extra dimension in the design.

Having this idea of the city wall of Dordrecht was the start of a new relation of seeing as. The former city walls of Dordrecht only consisted of straight brick walls with 35 towers. There were plans in the past also to include fortifications on the land side but these were never realized (De Bruijn & Middag, 2013, p. 23). This plan made the next idea possible of having fortifications along the dike to protect is hinterland. As inspiration of what type of urban environment could be realized within such a fortification along the dike the cities of Willemstad, Woudrichem, Zaltbommel and Geertruidenberg were visited. So the idea for the design went from a dike to a city border to a city wall and to a fortification city. This is an interesting way of looking and sketching on a design and gives as Palmboom (1987, p. 41) noticed new urban problems which lead to new relevant questions.

Image 76. Picture of the fortification wall of Willemstad

2.7.4 Routing and sightlines

Having the fortification as a new design aspect from whereon I can give new shapes to the dike led to the deduction of what the main elements of a fortress are which are also interesting for the dike. The case study of the four cities showed that routing on the fortress walls is a major aspect, sightlines are very important, diversification in topography and the public space created at a bastion.

Besides this elements which can be seen in historic cities with fortification walls other issues are also important considering the shape of the bastions. It is all about perceiving the landscape with its cultural history elements and the delta. While the fortifications were designed to look at their enemy they have to be translated in the view towards the landscape. Each view should be unique and should be a painting on its own. It should embody the principle of the circuit walk whereby a stroll gives a scene where images are continently projected on the eye with the English landscape gardens as an example (Steenbergen & Reh, 2009, p. 321). Furthermore the dike itself is also a cultural history object but because of its straightness it is hard to see the actual beauty of it. By creating a place in the hinterland you also have the ability to look at the dike from a certain distance. In this way the dike will get a more prominent place in the landscape. At last it is very important that the addition along the dike also makes the users interested and curious and therefore distracts them from their normal route along the dike. This can be done by looking at the diagram of Kaplan (1987) where distraction from the dike can be reached by making a mystery. So the user needs to be involved, which means needs to go on the fortification to see the whole routing, and the information promises the user something because the end can't be seen.

	Understanding	Exploration
Immediate	**Coherence**	**Complexity**
Inferred, Predicted	**Legibility**	**Mystery**

Image 77. Framework for predictors of preference (Kaplan, 1987, p. 12)

2.7.5 From military defence to place to be

The next steps taken in the design based research were to make this military defence into a water defence. And on the other hand make this an interesting place for people to visit or to live next to. From a copy of the shape of the bastion and the fortification walls the idea of field of vision where directly translated into a binocular shape to perceive the landscape (Nijhuis, Van Lammeren, & Van der Hoeven, 2011, pp. 115-116). The fortification walls where positioned in the shape of half a circle made from the beliefs of the radial city and in order to lead the people from the dike. It also stands for an analogy of the 'dike wheels' which form the exception to the straight line of the dike.

Since this radial shape also gave some problems with the inner part of the bastion it was necessary to continue designing for new shapes. The shape of the half circle was also copied on the several locations which didn't make every place unique. The military defence wasn't recognizable anymore and it still missed uniqueness on every location. This brought the design experiments back to trying new shapes and having the routing as the main concept for this shape. It would therefore be a ribbon attached on the dike from where the landscape could be experienced. This new shape was with the principle of 'seeing as' seen as a mountain upside down.

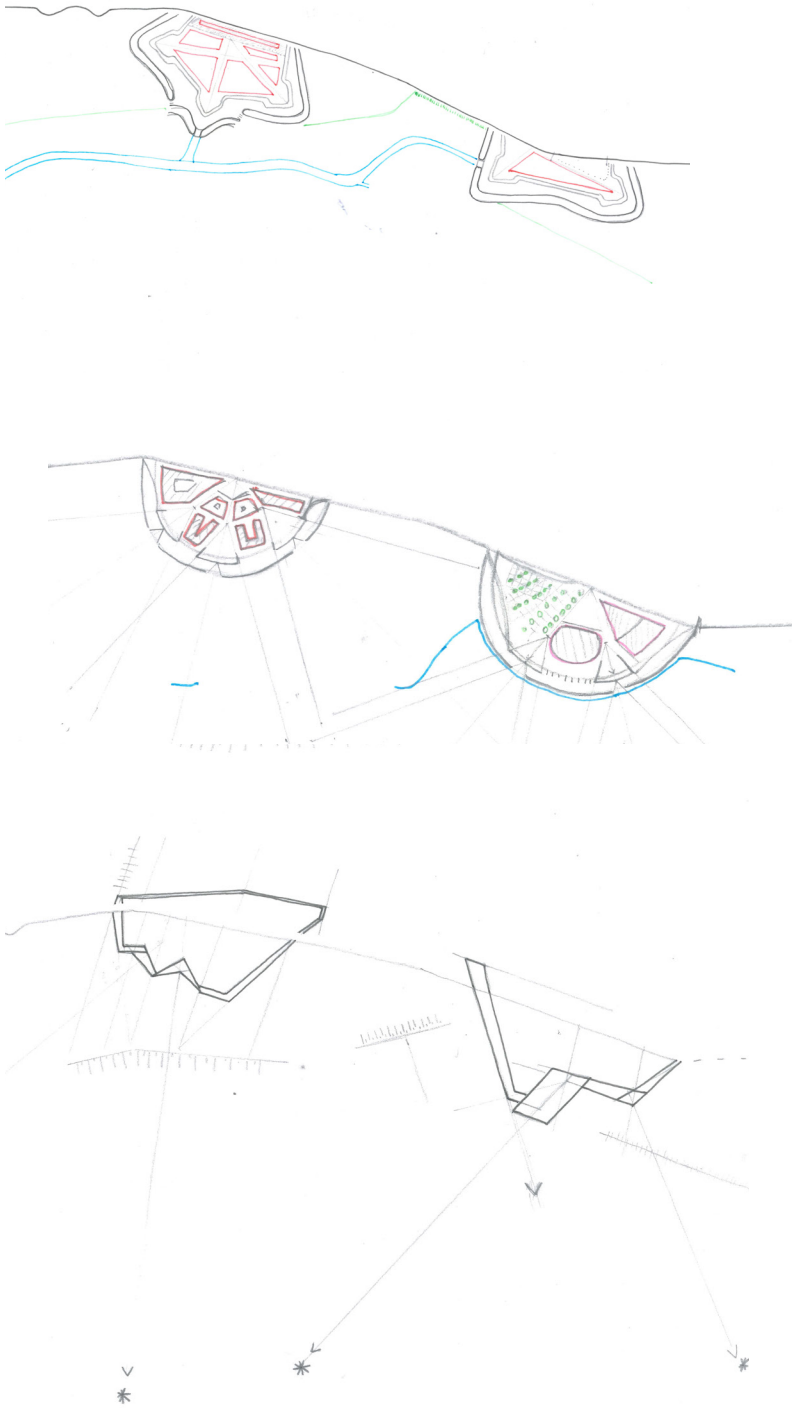


Image 78. The transition from the miliitairy defence to a place to be; from sharp to circular to ribbon

Since this radial shape also gave some problems with the inner part of the bastion it was necessary to continue designing for new shapes. The shape of the half circle was also copied on the several locations which didn't make every place unique. The military defence wasn't recognizable anymore and it still missed uniqueness on every location. This brought the design experiments back to trying new shapes and having the routing as the main concept for this shape. It would therefore be a ribbon attached on the dike from where the landscape could be experienced. This new shape was with the principle of 'seeing as' seen as a mountain upside down.

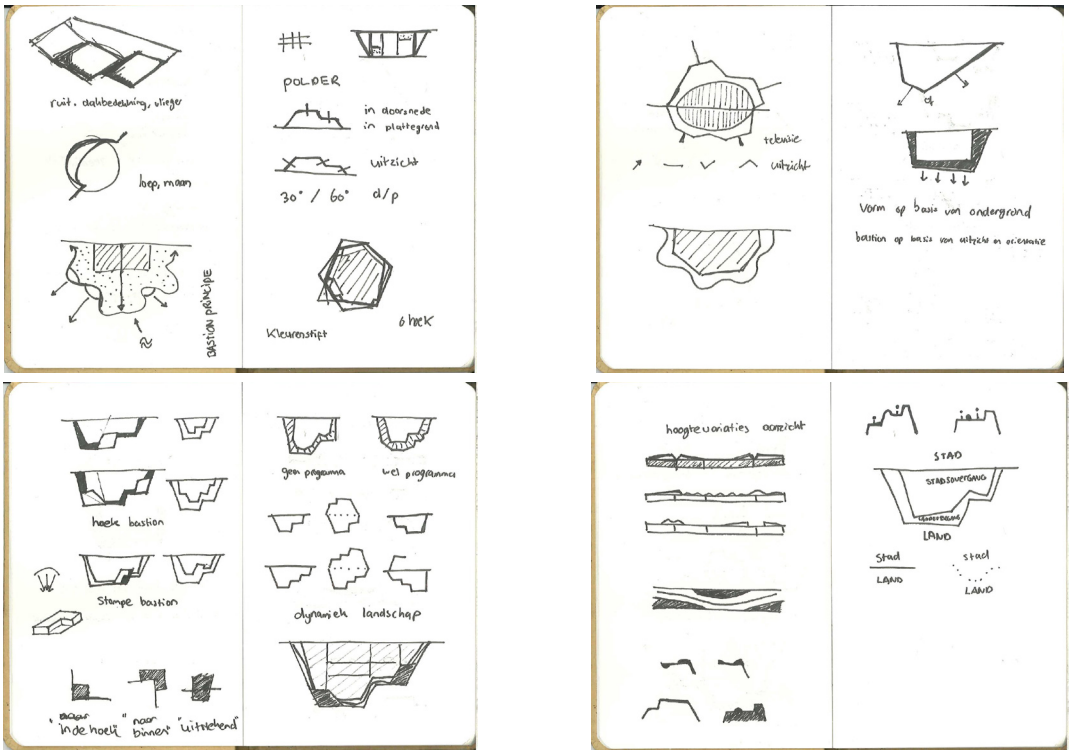


Image 79. Sketches from my sketchbook with the final designing of the ribbon concept

Concerning it being a route with paper ribbons I tried to experience if the drawn routing would give the required effect in small models. By bending the paper in different ways new routes and places were spontaneously created on the dike. Another advantage was that by this method the heights could be tested and bastions could be positioned higher above the dike in order to create besides the sightlines an extra aspect of this public space.

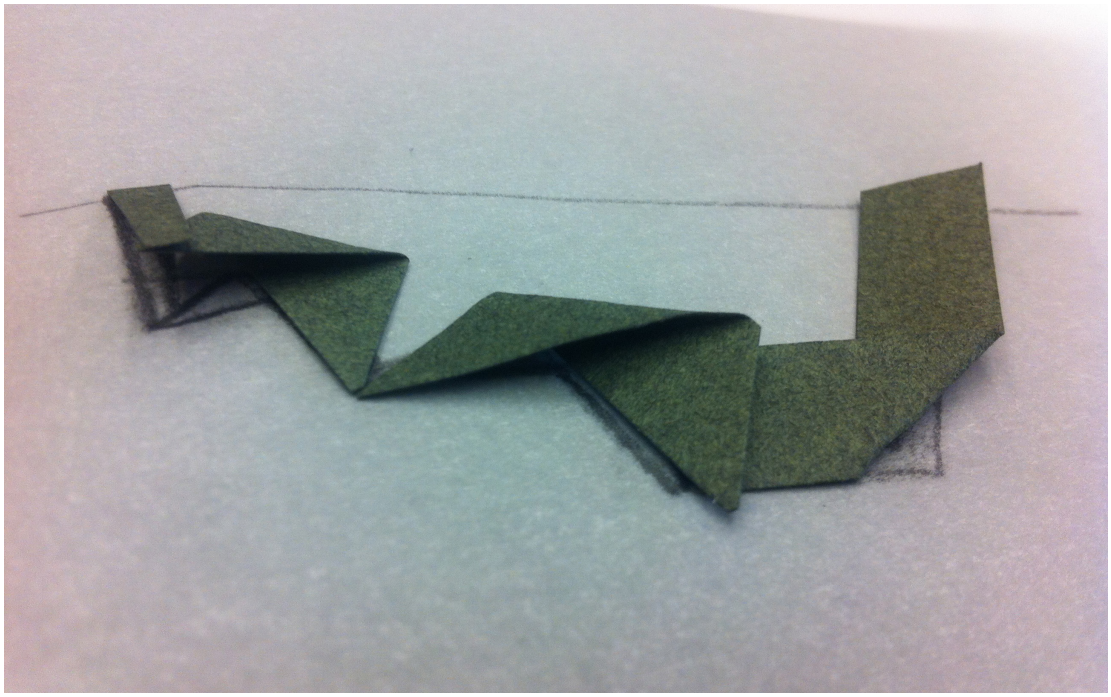


Image 80. Designing by using models and testing the shapes of the ribbon

Image 81. Picture of the dike on the 'dike wheel'

3
DESIGN

Image 82. The dike ribbon connecting city and nature

3.1 Vision

At the last stage of the graduation project the design for the island of Dordrecht is realized. The plan for the readjustment of the dike has effect on different scales in the delta region. The largest scale takes place in the Southwest Delta and is therefore more related to a vision of what this plan can contribute to on a larger scale. It is the start of a series of a nature reserve areas which can be connected by the new dike design. The dike design is focussed very much on the landscape perspective and the fact that people should make use of the qualities of the hinterland of the city. From the Biesbosch on this movement can be continued along Hollands Diep and Haringvliet having these nature reserve areas on the Hoeksche Waard and Goeree Overflakkee. Another dike typology can be realized between Numansdorp and Zuid-Beijerland in order to support this movement and to generate more places where people can live in a unique place while on the other hand the recreation network is getting a boost as well.

The same idea of redeveloping the dike in an open landscape can be adapted in IJsselmonde in between the suburbanized land of Barendrecht, Ridderkerk and Hendrik-Ido-Ambacht. In order to react on the urban density of this part towards Rotterdam a new more rural movement of the readjustment of the dike could be generated to create a better balance between city and nature.

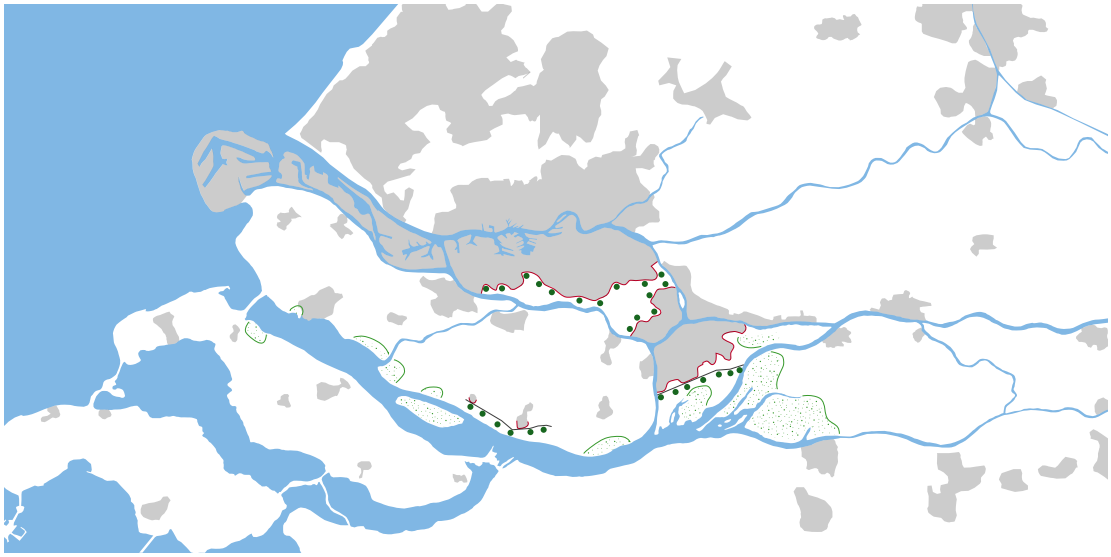


Image 83. The dike as a starting point towards other places in the southwest delta

3.2 Plan

3.2.1 Design of the plan

In the plan different elements along the dike have been added. A unity in all the elements is the connecting part with the dike as the spine. But also a uniqueness of each element based on the shape of the structures of the landscape, presence of dikes and ditches and the prominent aspect of sightlines is of great importance. This resulted in a more recreational bastion setting on both end of the dikes. This is where the dike actually meets the water and the rivers can be perceived in optima forma. So the main goal was that a new point of view would be enriched at the element of the dike, by different routes on a path through a polder a platform near the water will be reached were people can enjoy a 180 degrees view of the dynamic water system of the delta. For the other five bastions containing functions it should match with the current urban patterns but also needs to be in line with the spatial quality of the dike. Therefore one element is placed apart from the dike, another attached against Sterrenburg, the third one on the crossing in the middle of the island as a reaction on urban, sport and recreation. The two on the eastern side of the dike relate to the structure of the dike since they are both positioned in a curve of the dike. This means that while going west to east on the dike a completely different view will be perceived than the other way around. Next to this they

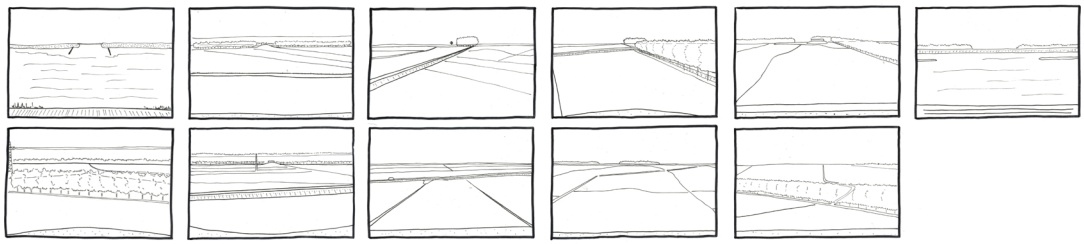


Image 84. The eleven different sightlines from the bastions towards the landscape; from west to east

both play with the possibility to cross the dike and make use of the polder situated on the northern part of the dike.

As concluded in the design based research the perception of the landscape is of great importance. Therefore the bastions have instead of a defensive sightline a panoramic sightline towards the polder landscape. Each bastion is next to this focused on a special object regarding the cultural history. The target for each view was to create a view as inspiring as a painting. References for this aspect were used by the idea of Metz & Van den Heuvel (2012) whereby pictures and paintings were used to look at the cultural historical value of the landscape.

Image 85. Picture of the perfect river in the landscape (Andreas Gursky, 1999)

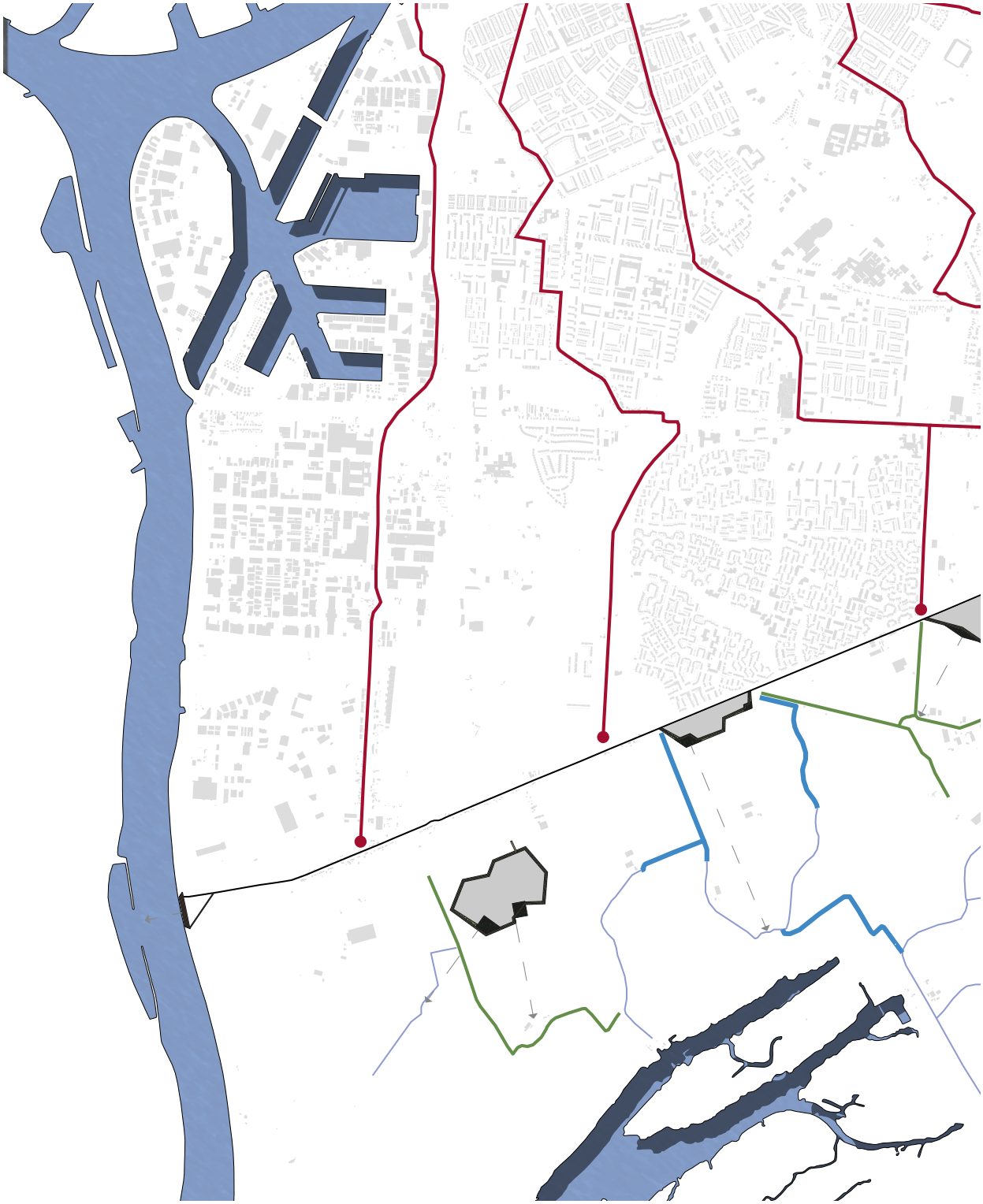
3.2.2 **Program of the plan**

For the interior in the dike ribbon the functions in each element are dependent on its position on the dike. In general the activities in the bastions are recreation, dwelling, leisure and small creative industry (art galleries and businesses).

A recreation bastion with the ability to use the stairs to go beyond the dike towards the water. With a path which leads from the dike towards the platform across the polder landscape. The sightline on the bastion is pointed at the Dordtse Kil and its traffic.

A bastion in the middle of the polder as a reaction to the art galleries in the historic centre. This bastion offers a 360 view of different landscape and thus a lot of creative inspiration. Possibilities to function as a utility building for short rent in the creative industry. Due to its location close to the high-

Image 86. The different functions of each bastion with corresponding sightlines



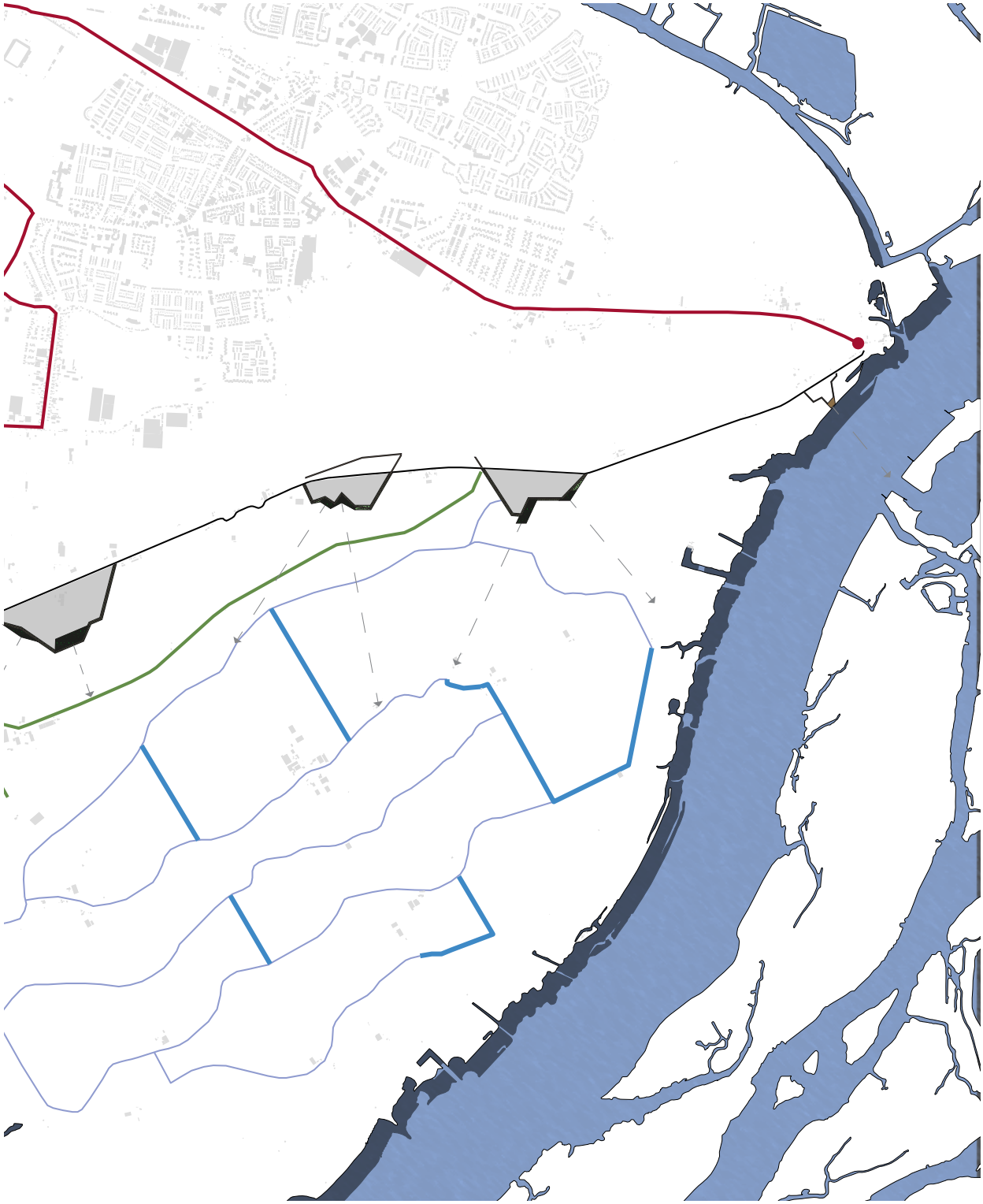


Image 87. Plan of the dike ribbon and bastions as a part of new recreation, water system and network

way and railway it has very good accessibility for this type of landscape to work in. The sightlines of the bastions focus on an old dwelling mound and a cultural historic creek.

The bastion linked to Sterrenburg offers a recreational purpose close to the Biesbosch with the possibility to create a function as a part of the nature reserve. The sightline is aimed at the remains of a former dike breach, a 'dike wheel'. The small pond still reminds us of this moment in the cultural history.

On the crossing in the middle of the island, looking diagonally at Sterrenburg, this bastion offers the possibility to realize dwellings. These dwellings can be realized for the middle class segment which has expected growth in the coming decades. The sightlines are another 'dike wheel', located next to a sluice, and one of the compartment dikes.

The other bastion ought to be for dwelling is located more in the open landscape targeting the higher class segment. With a low density character the bastion looks over the landscape with the highlights of an older windmill and a dwelling mound.

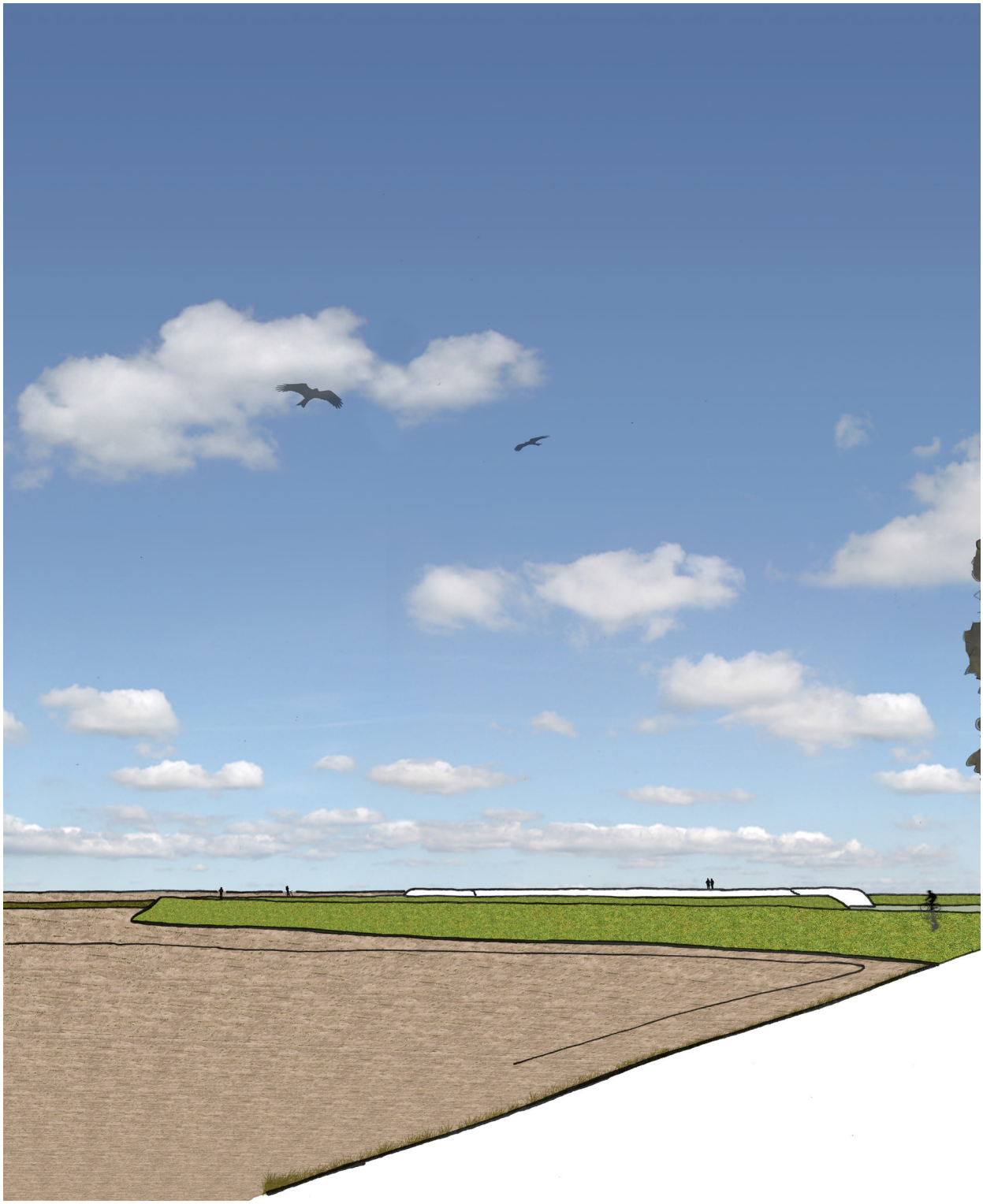
The most eastern bastion still containing functions is located the closest to the delta. The ideas of realizing a Delta Experience Centre in Dordrecht does perfectly match this position of the bastion with a view over the Biesbosch and the river. The sightlines are the primary dike protecting the land from the delta and a dwelling mound, the old analogy of this bastion.

At last the bastion near Kop van 't Land is a recreational bastion with two paths following a route to a platform in-between the trees. This platform is actually at the waterfront and this the closest way to perceive the delta landscape. The sightline is thus focused on this river and the Biesbosch on the other side.

3.3 Bastion

When zooming in on one of the bastions the routing and the sightlines can be looked at more in detail and how the dike acts as a ribbon in the landscape. As shown beneath we are closing upon a bastion for which we need to ascend slightly to enjoy the perfect view. Behind this the zig zag pattern of the dike appears at the horizon. It looks like a mystery since the end is not clear and the way you will be guided along the dike neither. By stepping in the landscape on the ribbon you also have the possibility to look back at the city and its border of the dike. By creating a distance from the dike the new perspective creates another way of looking at this border instead of only moving along it from west to east.

Image 88. Plan of the bastion in a landscape scenario



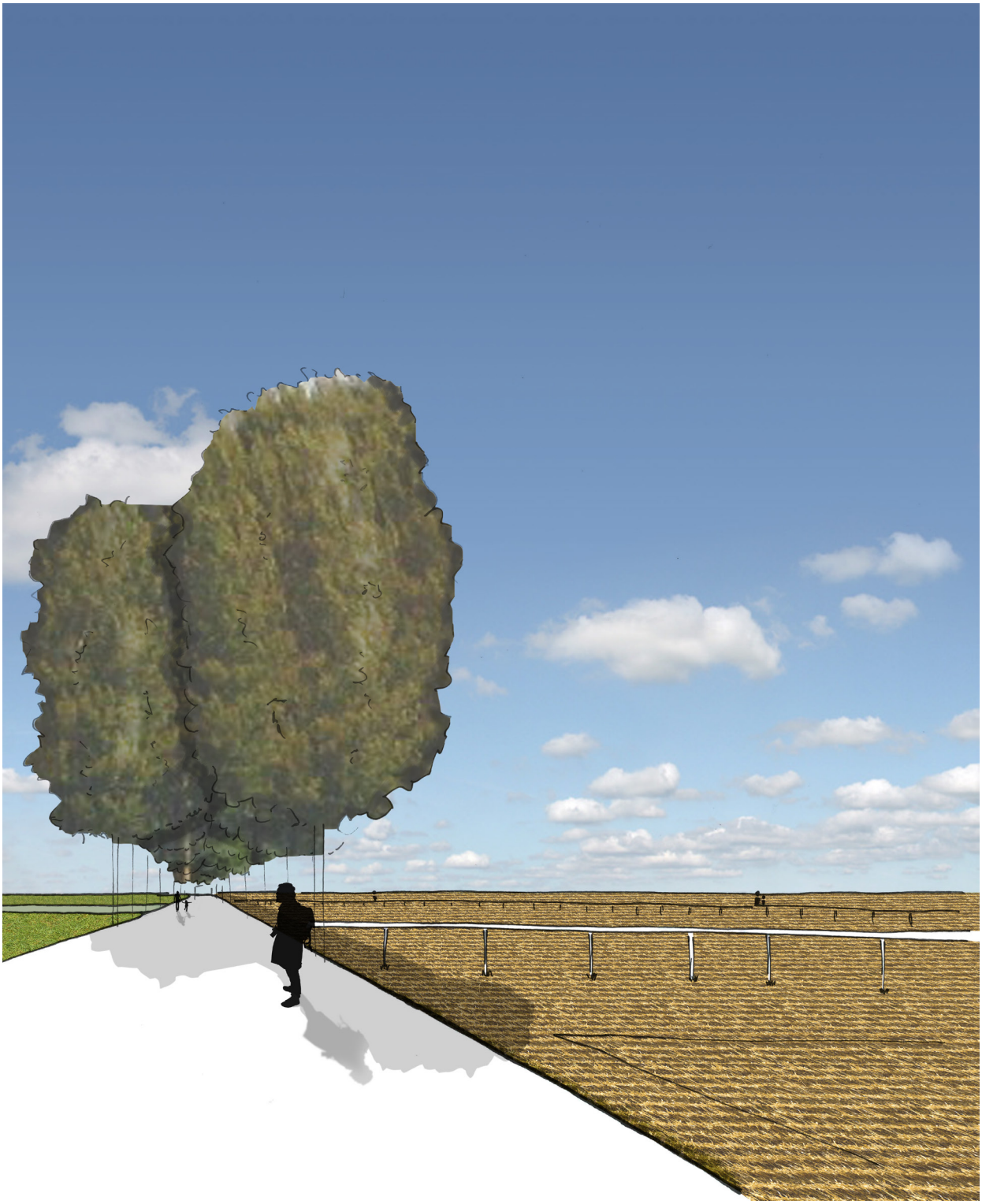


Image 89. Visualization of the bastion looking to the west from the Zeedijk

Image 90. Visualization of the dike ribbon looking towards the polder landscape of the south

Looking at the bird's eye perspective of this dike the height differences of the bastions can be seen more clearly. A bastion is highlighted by its higher position in topography compared to the regular routing. By shifting the routing from the top of the dike to the edges of the dike on some places the perception of the dike and the routing also differs. In the dike a mini polder is created were functions can be added. These functions must follow building rules regarding sightlines from the dike to the ribbon and the most crucial routes within the lower laying areas in order to increase the spatial quality of the ribbon.

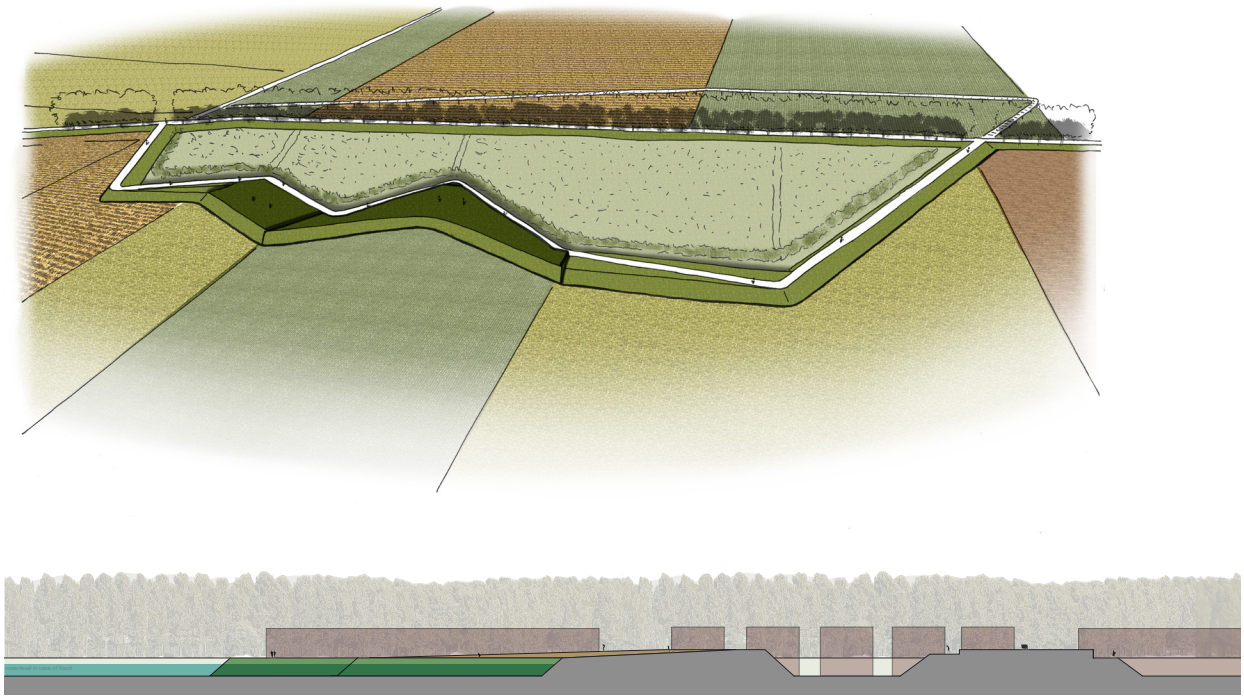


Image 91. Bird eye perspective of the dike ribbon with its bastions and the surrounding polders

Next to adding new spatial quality on a dike it also contributes to the multi-layer safety approach of the municipality. In the second layer it is part of the compartment dike with flood probability of 1/300 per year. As mentioned before they are not sure of what the current strength of the regional dike is. By realizing a dike in front of the old dike the costs of investigation will be avoided and the extra costs for maintenance on the old dike on places of historical buildings or landscape objects also can be avoided. Next to the costs these bastions can also function as shelters for the surroundings in case of evacuation. The dike can function as the escape route and for the bastions the flood probability can be assumed on 1/300.000 per year in case of a flood.

There isn't done enough research in the MIRT yet to say whether the strengthening of the compartment dike will be too complex. On the other hand the municipality and the province promote in their policy the protection and implementation of cultural historical qualities. It also has a lot of attention improving the spatial quality of the rural areas in relation to the water safety. Which means that the quality of the city border should be strengthened, the connection between city and nature needs to be improved and the preservation of the characteristic landscape structures in the south (MIRT-projectteam, 2015, p. 14).

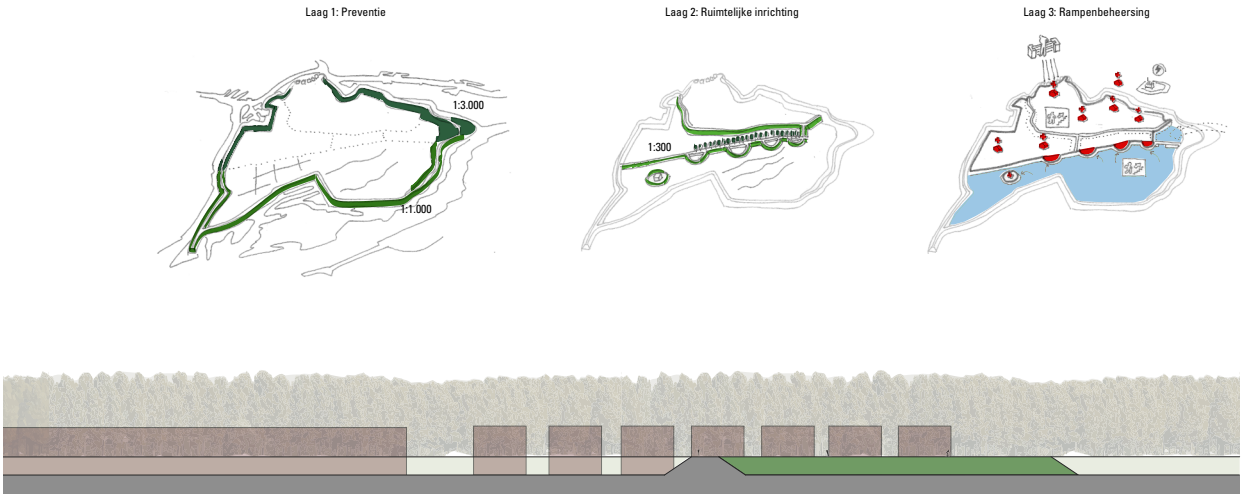


Image 92 and 93. Multi-layer safety approach with the dike ribbon and section with possible buildings

Eventually in the end the last scale of the design are the public spaces along the dike in the bastion. These spaces are focussed on the cultural historical objects in the surroundings and are therefore ideal for a moment of rest or enjoying a game of soccer with an amazing view. The public space is reachable by different ways and different heights. The end result of a certain view will always be a surprise till the last moment. For cyclists this will give a dynamic view along the path of the dike. The dike will function as a public domain with the inner part of the bastion being more private seperated by a green zone as a semi-public separator as an introduction to the promising view.

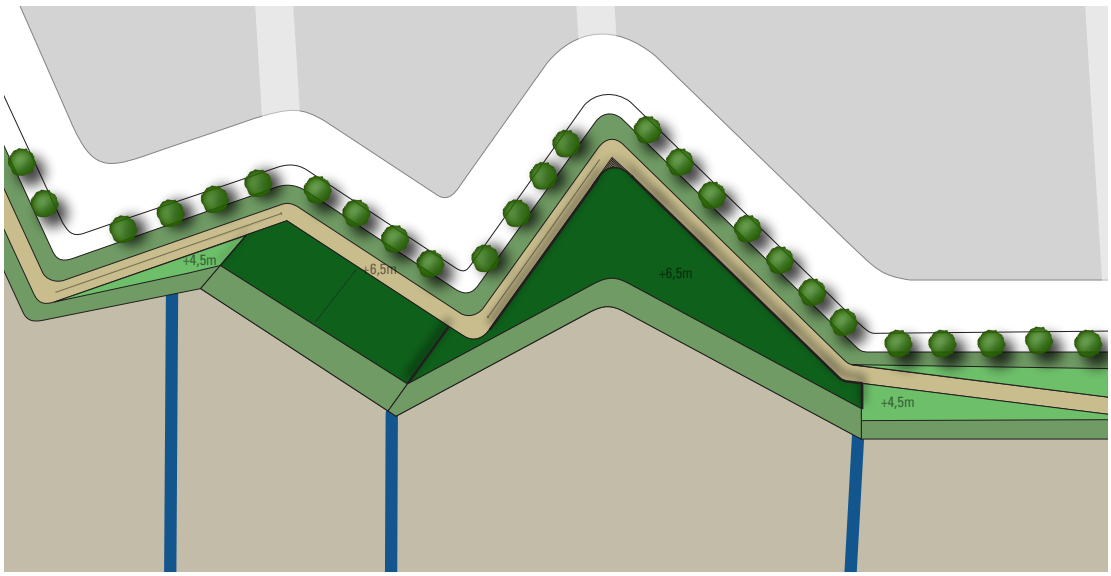


Image 94. Different height levels in the public spaces and the paths towards them

As can be seen in the sections underneath the shape of both the public spaces are different from each other. This is based on the type of view each public space has. The public space with the slope is facing towards a polder landscape following the line of an old dike and focussing on a polder mill in the far distance. This is translated in the design by an opened public space by using height difference and using the elevation as a kind of theatre towards the view. For the other public space the view is located to a former dwelling mound and as an analogy this section is therefore heavier and it's shape is more focussed to the specific point of the mound.

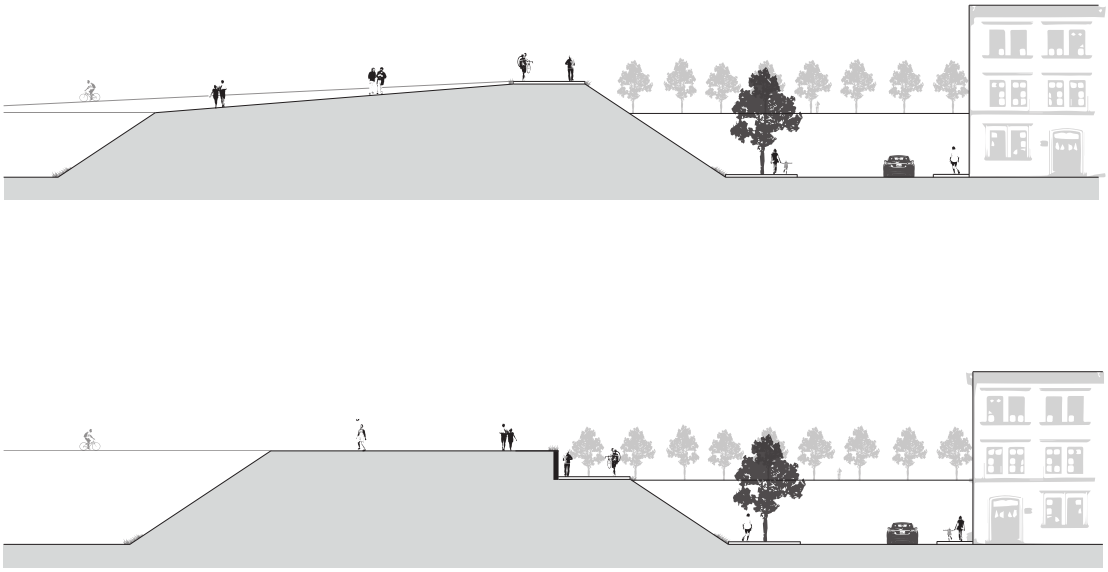


Image 95. Sections of both public spaces on the dike

Image 96. Visualization of the public spaces in the bastion

3.4 Scenarios

For the plan it is extremely relevant to look at different scenarios for the future. The adaptivity of the plan is very important since the effect of the climate change is unknown and also the plans on the larger scale in the Southwest Delta may affect the plan of implement this compartment dikes on the island. The plan therefore has to deal with different possibilities for the future.

Scenario 1: Stagnation of urban growth – possibility of a flood
The dike ribbon plan can be realized in steps whereby the ribbons can be used in the recreational network of the city whereby the landscape and the delta can be perceived in its purest form.

Scenario 2: Pilot of bastion settlements – possibility of a flood
The plan of the dike ribbon makes it possible for people to live in a unique place in the delta. A first bastion will be transformed into settlements according to the building regulations. The possibility of a flood as calculated by the Delta Committee is still applying.

Scenario 3: Bastions include functions – possibility of a flood
With the realization of the plan the functions of the plan match the rapid urban growth of the city of Dordrecht and in each bastion utilities and settlements will be built. In this case the city border will have a lively urban environment whereby there is a change of a flood according to the estimated possibilities.

Scenario 4: Urban growth – high effects from climate change
Due to high river discharge peaks and a high sea level rise the river can't be kept within the current borders of the dikes. The island has to provide in room for the river whereby the idea of living in or on a dwelling mound can be copied land inwards protecting current settlements and realizing new types of dwelling.

dike ribbon
recreation

realization bastion
need in unique living environment

urban growth
concept of bastions matches need

rapid urban growth
extension of the river on land

Image 97. The four different scenarios making the dike ribbon plan suitable in adaptivity

Image 98 and 99. Collages of the scenario with recreation and housing bastion

Images 100 and 101. Collages of the scenario with a pilot bastion and the dwelling mound

3.5 Phasing

Next to the different scenarios on the island level it is important to look at the scale of the bastion in terms of development. First of all the research has shown that a certain dike track is not the right heigth according to the regulations. This means that there is a perfect situation for the realization of a bastion and the water defence line will be shifted more south. The next step is that the new dike can be used as a new recreational zone and the development of nature inside the bastion has already started. But it is also possible that in the future with new investigations they find out that besides the bastion the dike is not fulfilling the regulations either. In this case there is an opportunity to extend the recreational network by broaden and thus strenghtening the dike. If one of the scenarios will occur where in the bastion development will be realized in a later phase some nature will be replaced occurding to the building rules which will be discussed in the next chapter. Having the zoning plan of the bastion in mind the development of the nature can be maintained in such a way that trees may grow freely in unbuilt areas and grasses will be planted in the areas which may be used for development in the future. Furthermore as can be seen in the last diagram the sightlines from the dike to the former dike are important according to the building principles and thus need to be taken care of in terms of nature development.

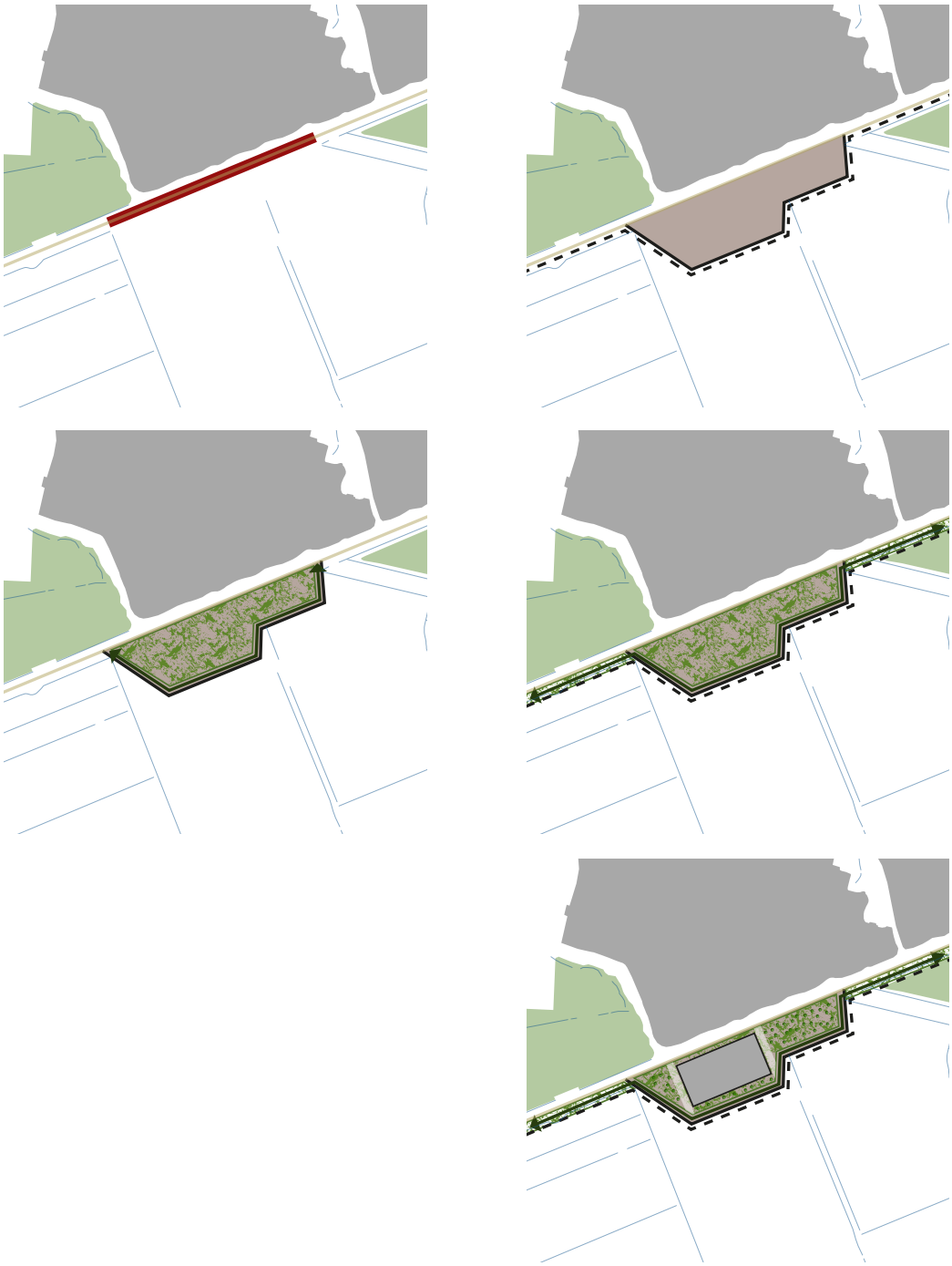


Image 102. Different stages of the development of a bastion

3.6 Principles

With the functions of the bastions already mentioned a lot of freedom remains in realizing different types of atmospheres within the dike ribbon. By setting some building regulations for the bastions containing functions the atmosphere can be steered and the perception of the landscape and the dike ribbon can be kept as designed. First of all the layers of the buildings have been set in order to control how the height above the dike ribbon connects with the landscape. Secondly the routing inside is important to generate sightlines from the Zeedijk to the dike ribbon. In this way the bastions can be visited by the routing along the ribbon or directly from the dike across the urbanized part. Thirdly it is very important that the zoning plans of the buildings are not situated against the slope of the dike ribbon. This is to maintain a certain distance between public and private as the dike ribbon also works as a recreational route.

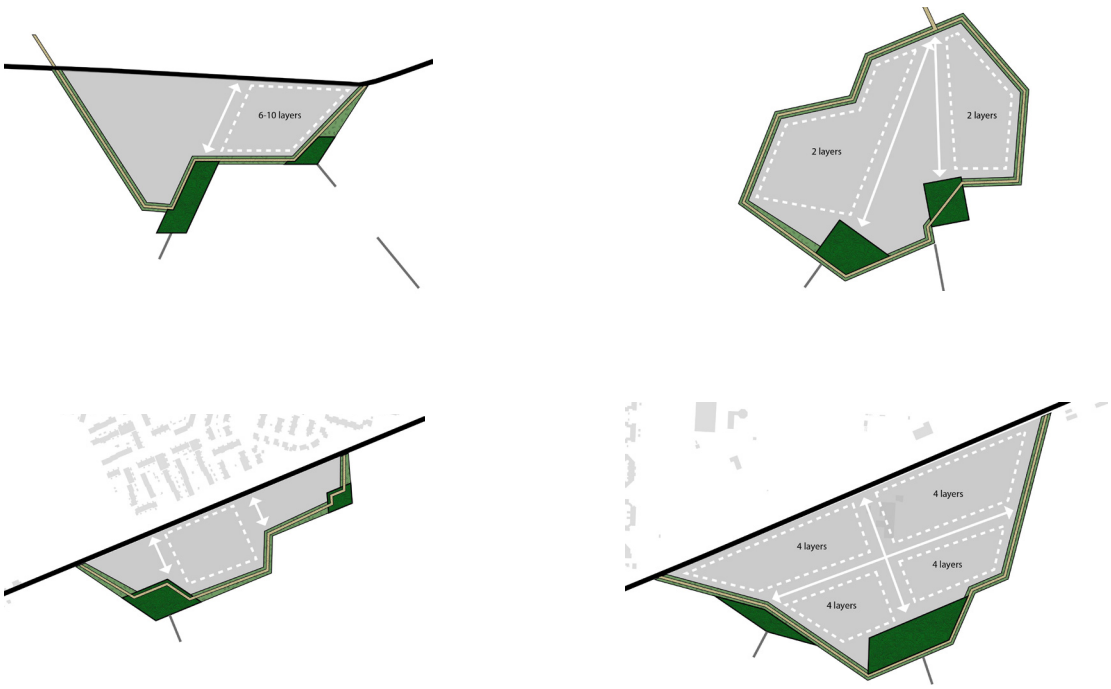
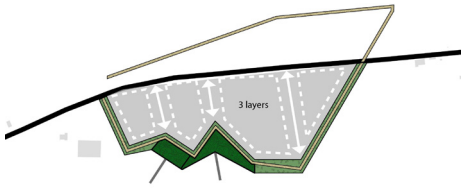


Image 103. The building regulations for four bastions with functions in the program

The building regulations of one bastion will be illustrated by the help of a bird's eye perspective. This three layer buildings are the maximum number of stories the buildings can have. Which already results in the fact that the buildings are higher than the dike. Three important sightlines from the dike to the dike ribbon are regulated and filled in by a road. A road is also the separator between the zoning plan and the dike itself. As an extra open space between the private and public part a green zone along the dike ribbon softens the barrier between buildings and recreation.



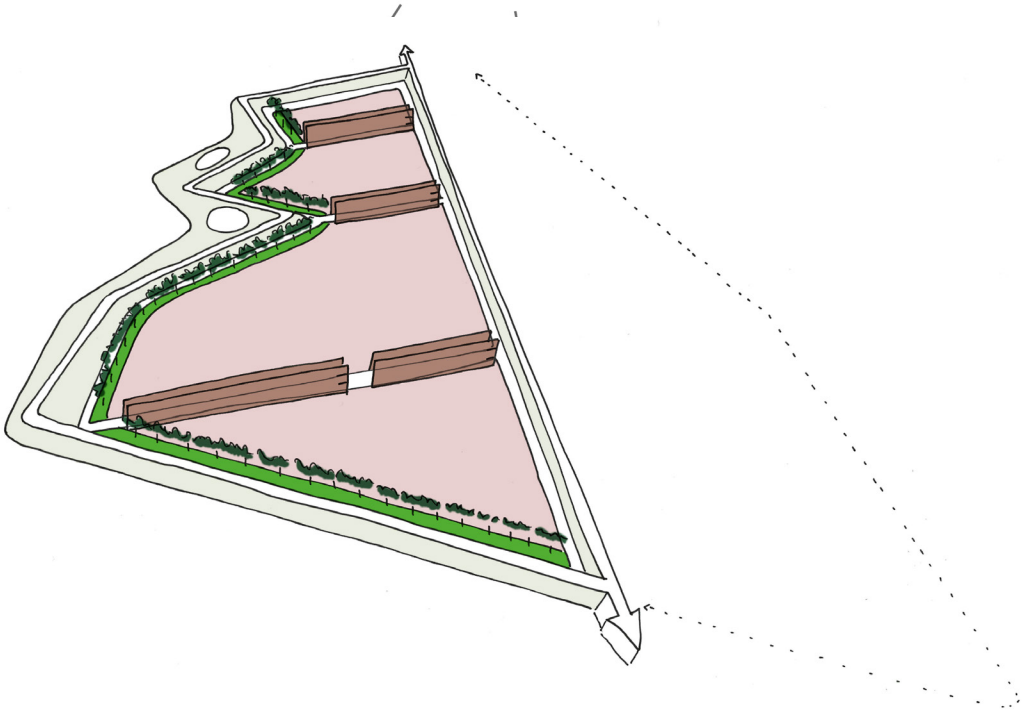
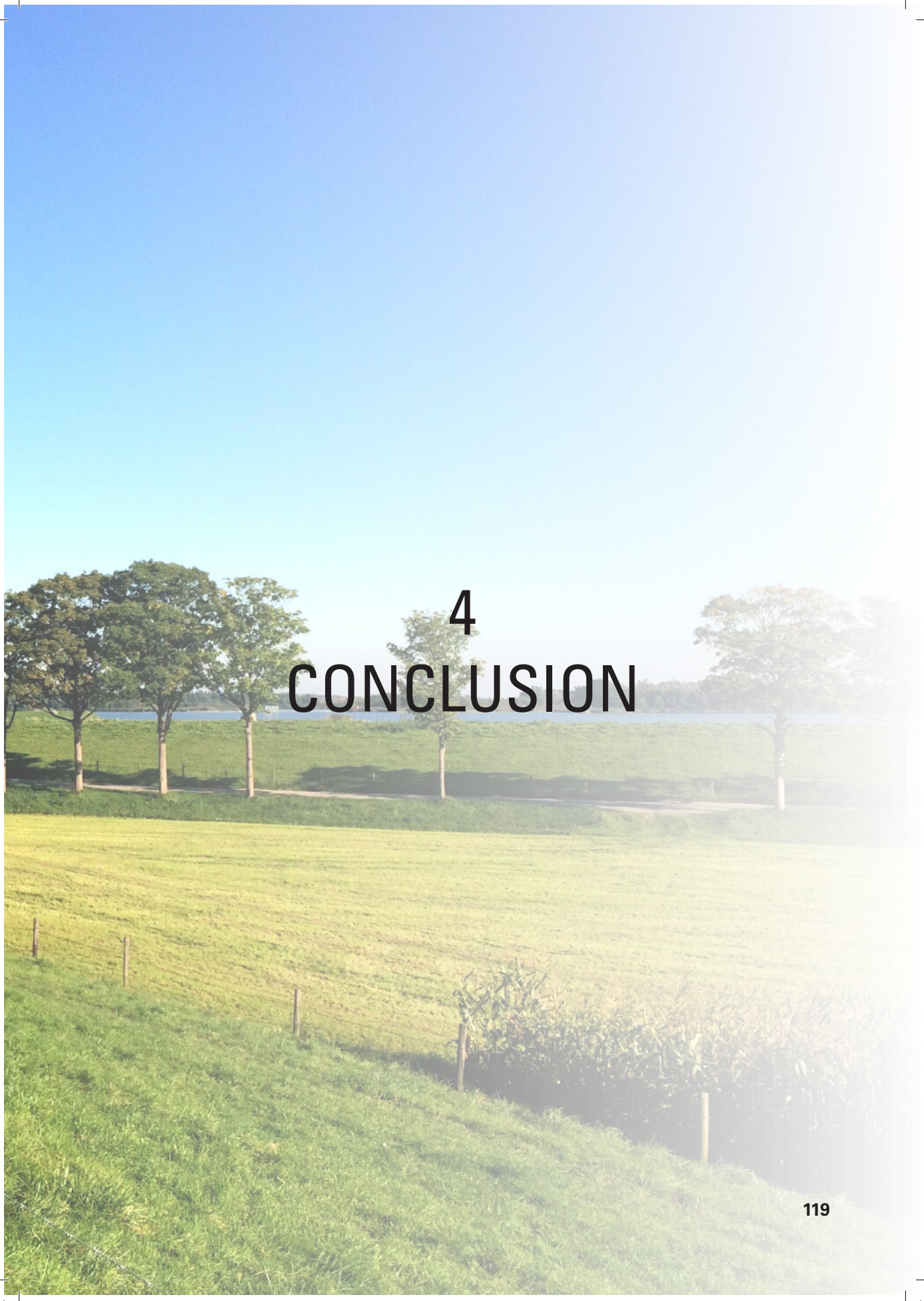


Image 104 and 105. Scheme of the regulation and visualization of important characteristics of the rules

Image 106. Zeedijk with the view on the Nieuw Merwede



4
CONCLUSION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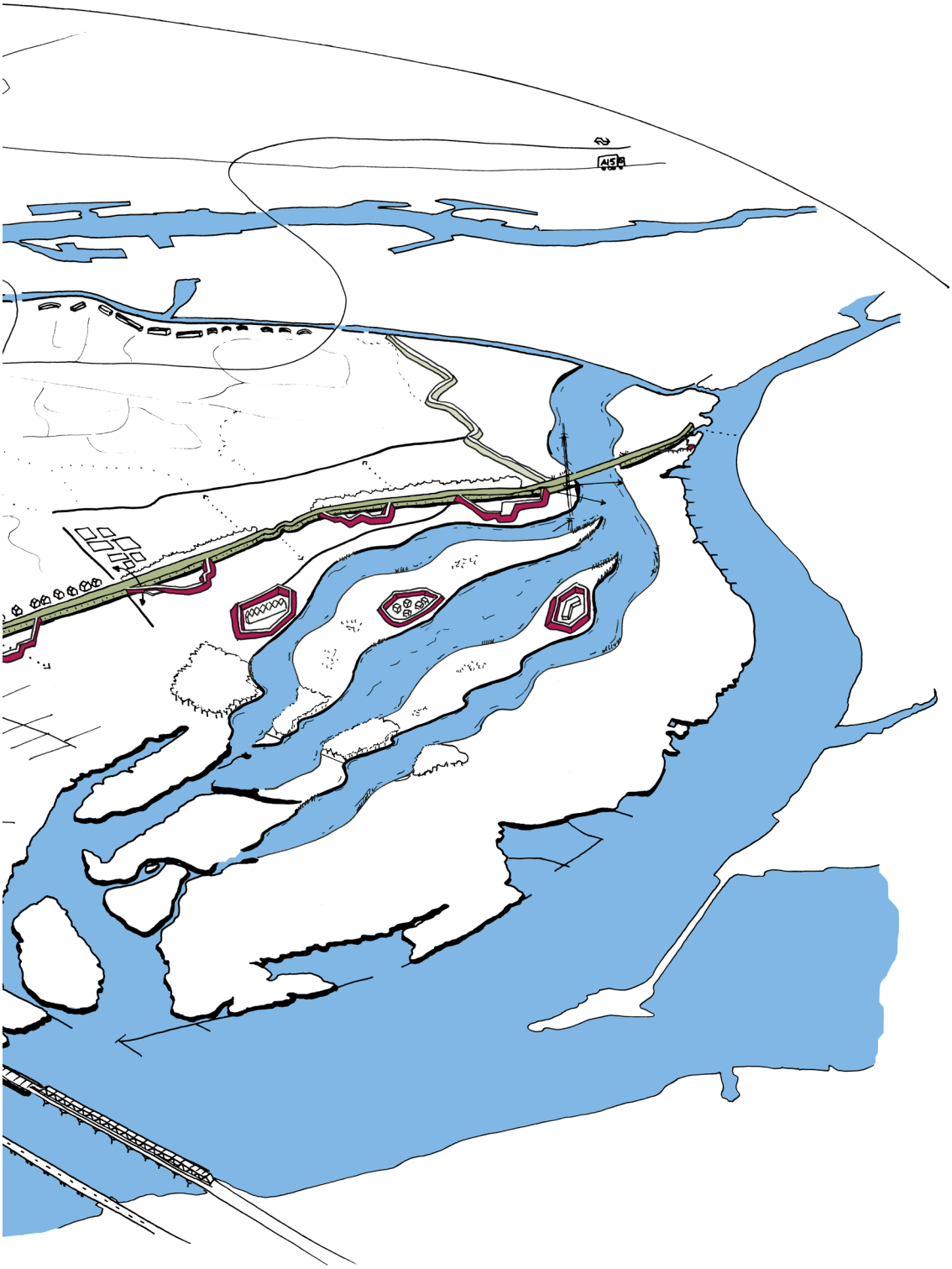

Image 107. Possible future with the dike ribbon and the bastions in a new type of landscape

4.1 Conclusion

The aim of the graduation project is: "To generate an adaptive design for the island of Dordrecht for the year 2100 in which the aspects of water management, climate change, spatial quality and identity through different scales are taken into account."

The plan of the redesign of the city border of the island of Dordrecht is related closely to the changing dynamics of the delta due to climate change. The plan provides an attractive landscape and urban diversity along a former seadike while connecting the land with the city with a softer transition. By generating a new dike system in front of the rejected compartment dike a new type of routing interacts with the landscape and its cultural history. The analogy of the former fortifications of the city can adjust to different climate and urban scenarios dealing with the complexity of unknown systems in the future.

The identity of the island will be renewed by combining the history of fighting against the water with the spatial quality a dike can offer. The plan amplifies the presence of the Biesbosch and thus the new role of landscape qualities in the perception to the inhabitants of Dordrecht. On the broader scale the dike ribbon plan is a start of a movement towards the Hollands Diep en Haringvliet whereby natural areas should be embraced. The typology can be reflected on several other places in the delta to improve the connection between city and land in order to strengthen the relationship between the delta and its spatial quality as can be seen on the previous spread.

4.2 Reflection

This graduation project had a bit of a different perspective in the second half year of the process. After the P2 I noticed that I had difficulties in combining the research with the design and that is was lacking a step in-between. This chapter elaborates more on this by explaining the relationship between the design and the research, how it is linked to the studio and the relation with the wider social context.

4.2.1 Research and design

Based on this realization after the P2 I had to carefully look at my methodology again. This was mainly consisting of the method design based research in order to continue with the design. Towards the P2 the dynamic delta and action research led directly to the design. Which is a solution to go from your research towards the design, but since I intended to make use of the design based research it felt like I missed some steps in-between. After the P2 most of the time was spent at the design based research in working on the design. As a result the design could be linked more with the research and the design choices could be verified by the research.

4.2.2 Delta Interventions

As the booklet of the Delta Interventions studio promote: "Due to a chang-

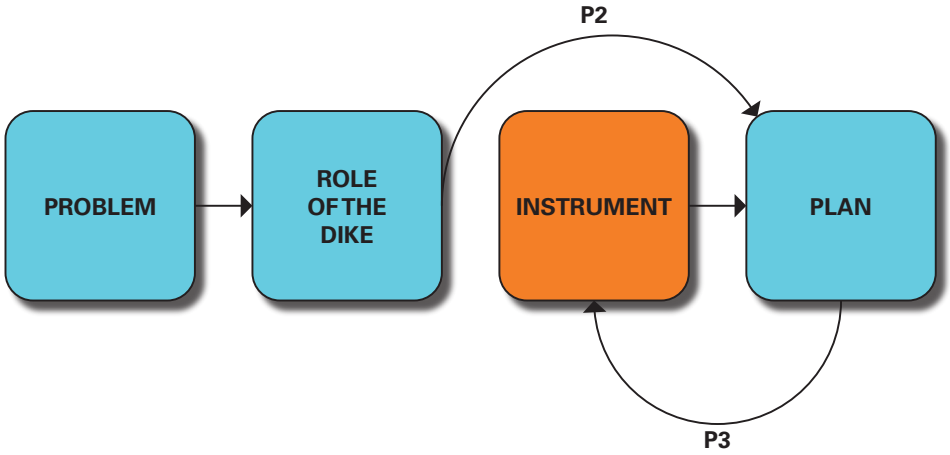

Image 108. Problem stated after the P2 regarding the missing element towards design

ing climate and new insights concerning sustainability, new interventions will be needed. In addition to safety and better water-systems, there is a need for stronger spatial identities and new cohesion between cities and their water-landscapes. Delta Interventions therefore is an inter-disciplinary studio which, on a wide variety of scales, deals with transformations in delta landscapes." (Delta Interventions Studio, 2015)

The graduation project mainly focussed on the role of climate change and its effect on the water safety. With this aspect it really looked into how to perceive the water-landscape by help of spatial quality. The other part of the theme of the studio relates to the variety of scales, which is a useful element within the project. Whether your location has a special object or that it can work on different scales and be implemented on more areas in the same delta makes your project even more valuable for the larger discourse on the water safety implement new interventions.

4.2.3 Methods

Besides the theme of the studio the methodical line of approach in Delta Interventions strongly focuses on the relationship between research and design. Within this drawings are a very important tool to communicate the key message of the analyses and designs. By using the design based research it pushed me into combining all the elements of my analysis in my design and vice versa. With the outcomes of this I was able to ask new questions on other scale which led to new investigations. This type of research and design wouldn't be able without the use of drawings to communicate with my mentors. I tried to experiment with a lot of different drawing techniques in order to look at the best ways to present the research and the design but especially the link between them.

4.2.4 The wider social context

Water safety is an issue that is being discussed a lot on the political and technical level but in the end it is all about the safety of the inhabitants. This project is therefore related to the social context of a broad scope with the climate change scenarios in the future and possible evacuations as a

result. Besides only concerning the inhabitants of Dordrecht, the strategies and interventions of this project can be used as a case-study in other deltas. It is a proposal how the city and the land can be shaped in such a way that it can be a spatial quality for the landscape while it can add a lot of qualities for the people. Furthermore it elaborates on the design of a city border with urban densification of cities this design still offers a place for people to live, recreate and enjoy the natural environment.

4.3 Contemplation

After a year of experience in the field of urbanism I have the ability to think about what I have done and what this can actually lead to in practice. For me a few thing throughout the project where very interesting to position myself in, this meant that it was hard for me to think of what I really stood for as a person and how I could translate that into my design. I will elaborate on three thoughts which are probably not finished thinking of. First of all this is about the rol of an urban designer. In a society where everything is changing pretty quickly the last decades how can I adapt to this and what role do I prefer to take? Secondly what is a plan or design these days and what have I actually designed in the end? Which of these is more appealing? At last I will share my thoughts on the field of delta urbanism since it is a recent approach to look at urban development in water related areas.

4.3.1 Urban designer

What is the role of an urban designer? In the times that there was still a massive demand in housing there weren't any questions about the role of the urban designer. It was just about making it possible to let as many people live in a such pleasant way as possible with the amount of money. But since the demand is lacking and buildings aren't popping out of the ground anymore it is time to function in a different matter. It is still about designing, in fact the design is a very powerful tool in convincing people. And I think in that part the new role is explained for the urban designer. It is more as a mediator between people and being able to visualize ideas, but also to convince people of things which they have seen before. Or even better convince them of a beauty they thought of being a burdon. In speaking a lot with inhabitants of Dordrecht last year I recognized that the knowledge of a laymen is based on there own perception and therefore the truth. But how nice is it when this perception can be interepreted as something different which can result in a new quality. The role of the urban designer is a complex but satisfactory one.

4.3.2 Designing

In the beginning of this year I was quite sure that I was going to make a design for 2100. Continuing my graduation I saw that a masterplan takes so many years to be realized that the question is if how much of your

original design is still implemented in the end. More or less the shift was made from design to plan which is related to different scenarios and phasing. With a lot of uncertainty in the realization of projects as designed a designer can prepare for future changes by making an adaptable plan. A design can have more value when it will be able to function in a growing and stagnated economy and it can even deal with extreme conditions. In the end my design can be better interpreted as a plan with some basic guidelines to adapt to different future possibilities. These guidelines are extremely relevant for the success of the plan in connecting different parts of the city and making a new identity along the city border. But it also shows that this aim can be reached by not making a blue print in order to be ready for any future.

4.3.3 Social delta urbanism

Delta urbanism focusses on highly densely populated areas all around the world. But in fact most of the times there is still chosen for a civic approach by working on the water system and combining this with housing or other types of buildings. What in my opinion is lacking is the real social involvement of the inhabitants of these flood risk areas. In fact a lot of peoples lives are at stake and they should be part of the design process. In a year I heard so much untruth about water safety from the inhabitants that I think that there is a great opportunity by making people more aware of water safety in a good way. By showing them the spatial quality of the delta instead of only warning for floods all the time. It is really important to try and highlight these issues from a positive point of view in order to create more awareness and therefore better risk reduction.

Actually these thoughts could be summarized by the beauty of things. As long as this is one of the means to live for we are all able to create a better place.

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This booklet is the result of the graduation project of the master Urbanism, TU Delft in the studio Delta Interventions. The dike ribbon of Dordrecht is a connecting element on the island of Dordrecht reuniting city and landscape.

Given the future threats concerning climate change new opportunities arise: integrating water safety with spatial quality. By designing dikes in this way a new identity for the island is generated with the abillity to excell in an adaptive delta.

THE DIKE RIBBON OF DORDRECHT

SEBASTIAAN TIOLS