Graduation Thesis
Maintaining the waterfront in Vlissingen

Re-stitching the relationship between water and the urban fabric

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The great painter Edvard Munch paints landscapes in their most expressive way. One of his best and most famous examples is “The Scream”, shown here. Depicted is the emotional crisis of a human being within an overwhelming nature. Eggum (1984) even goes so far as to state that this piece of art has been widely interpreted as a representation of the universal anxiety of modern man. Somehow a lot of people have come to mix up the profound appearance of the landscape with the figure in front, assigning the scream to the figure. Of course, here it is not the figure screaming but the landscape and in such a way that it becomes too much for the figure, thus giving it its characteristic pose of unbearable incomprehension. In the words of Munch himself:

“I was walking down the road with two friends when the sun set; suddenly, the sky turned as red as blood. I stopped and leaned against the fence, feeling unspeakably tired. Tongues of fire and blood stretched over the bluish black fjord. My friends went on walking, while I lagged behind, shivering with fear. Then I heard the enormous, infinite scream of nature” (Faerna, 1995, p. 17).

During the first two months of my graduation year I increasingly became aware of nature screaming at us. In particular the rising sea roared in my Dutchman’s ears, at times making me feel like the figure in Munch’s “The Scream”. I imagined myself standing at the Delta works in Munch’s pose overlooking the screaming North Sea.

However, that is not what I’m here for at the Faculty of Urbanism, Technological University of Delft. I see it as my task to come up with new ideas and inspirations to tackle the water challenges Dutch cities face. My personal aim therefore is to make sure that by the end of my graduation year I won’t have to feel like the figure in “The Scream” anymore.

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I Research Setup
1 Introducing the Problem

1.1 Future challenges of the Dutch coast line

The most popular way of depicting the water challenges facing the Netherlands is by stating that the water comes from four directions (figure 1). These four water challenges are the rise in sea level, increasing river discharges, increasing precipitation in winter season and a relative increase of ground water level due to soil subsidence (Deltares, 2007; Delta-commissie, 2008). This graduation project focuses on the challenge of sea level rise and its influence on coastal defences within urban environments.

Ever since the formation of the Dutch lowlands, the North Sea coastline has been under pressure. The approximately 350 km long Dutch coast along the North Sea has always been a dynamic coast that moves back and forth from the shoreline due to processes of erosion and accretion of sand. Now, with 16.7 million people living in the Netherlands - of which almost two third of the country’s territory is below sea-level - in a welfare society driven by important economic drivers close to sea such as Schiphol airport, Rotterdam harbour and the greenhouse area Westland and a substantial number of urban areas it is vital to keep the coastline in place. However, it seems probable that in the future it will be much harder to sustain the coast line. Scientific measuring has shown an average of 20 cm sea level rise per century during the past 150 years (Deltaprogramma Kust, 2011). Given an increase in greenhouse gas emission scientists foresee a temperature rise on a global level (Ruddiman 2008; IPCC 2007). Based on these predictions, the royal Dutch maritime institute KNMI has presented models of sea level rise occurring near the North Sea coast. Around 2050 the sea level rise is estimated to be between 15-35 cm higher than the current level, whereas in 2100 a rise of 35-85 cm has been predicted (KNMI, 2006). The specially appointed Delta committee has even defined scenarios in which the sea level rise by 2100 would be more than one metre compared to now (Deltacommissie, 2008). This is not quite tantamount to a 20 cm level rise per 100 years (figure 2).

In the process of keeping the base coast line as defined in 1991 by national government intact, different phases can be discerned. From mini supplementations along the entire coast a shift occurred towards mega supplementations on a couple of strategic points (Van den Broek, 2005). A new development in this process is the so-called ‘sand engine’, a large mega supplementation in a strategic point which over time supplements the coast to its north, thus decreasing the frequency of supplementa-
tions necessary (Zandmotor, 2011). This new type has been referred to as a type of dynamic coastal protection, since it interferes much less with natural processes and makes use of natural dynamics. A new era in the coastal defence tradition in the Netherlands seems to be initiated with this dynamic coastal protection (Ministry of Transport, Public Works and Water Management, 2000).

As solution to the coast line problematic, the Ministry of Transport, Public Works and Water Management defined three possible solutions in the Third Coastal Memorandum of 2000. First, the coast line defence is kept in place and heightened using sand suppletions (Ministry of Transport, Public Works and Water Management, 2000). Second option is to go with the natural movement of the coast line which is landward as a consequence of the sea level rise (ibid.). Larger dune areas are the result, not necessarily with a higher dune crest but preferably so. Third option is to move counter to the natural dynamics and generate sand buffers seaward. Possible options are sand buffers following a natural shape, under water dams, islands in front of the coast or mega suppletions supported by hard constructions (ibid.).
1.2 The challenge of urban waterfronts

The place where the rising sea level, coastal defence and urban environment confront each other is the urban waterfront. Spatial density and spatial quality are of profound importance in these places and have serious influence on the type of coastal protection that is and can be used.

When looking back at the history of waterfront redevelopment a number of phases can be discerned in the morphogenetic relationship between city and port, as described by Hoyle et al. (1988). These changes directly affect the waterfront and are particularly driven by technological advances in shipping and cargo handling facilities, the world-wide economic restructuring processes and the competition among cities in an increasingly global hierarchy (Schubert, 2011).

Moreover, as Vallega (1993) shows, the approach adopted by Hoyle et al. (1988) investigates two interrelated processes: “On the one hand, an economic and social process arising from the evolution of port-city relationships in terms of conflict and co-operation; on the other hand, a spatial process consisting of the expanding/retracting of the port from the waterfront and the expanding phases of the waterfront” (Vallega, 1993, p. 24). From this analysis, five stages emerged (Hoyle et al., 1988) (see figure 5):

1. The primitive cityport in which strong linkages between city and port were in place, referred to by Vallega (1993) as the mercantile stage: the government has absolute control over foreign trade.
2. The expanding cityport in which the port extends beyond the spatial domain of the city, referred to by Vallega (1993) as the paleo-industrial stage: the earliest industrialisation.
3. The modern industrial cityport, blossoming in the 1950s and spreading in the 1960s, is characterized by the emergence of coastal industrial areas and the containerisation of many short- and deep-see routes. This stage in which the container and oil refining are introduced on a global scale is referred to as the neo-industrial economy by Vigarié (1981).
4. The retreat from the waterfront, which started in the late 1960s and accumulated in the 1970s. During this shift, the neo-industrial stage entered a crisis making way for the soon to be post-industrial stage (Vallega, 1993).
5. The redevelopment of the waterfront, a process which is underway from the 1970s and is induced by the enlargement of port spaces while simultaneously renewing its original core. This process spread out when the post-industrial stage entered its take-off phase (ibid.).

This last redevelopment process in waterfronts has continued since the nineties until now, even though distinctions can be made. Schubert (2011, p. 74) identifies “a general shift from small-scale and project-oriented approaches to a regional perspective
of waterfront transformation since the turn of the millennium”. Marshall (2001) shows that the period after the millennium is marked by spatial and social shifts from industrialization towards knowledge-based economies and post-industrial society.

Although containers still dominate the port trade, computerization has led to advanced port logistics which combined with trans-shipment of goods in containers has rationalized handling activities as well as the spatial relocation of functions formerly linked to the harbour (Witthöft, 2000). This leads to increasing changes in the interaction between city and port, showing new forms of land-use activities and building stock (Schubert, 2011).

This recent transition has been termed a change “from ships to chips” by Schubert (2001, p. 131), indicating “a transformation of waterfronts from an era in which the movement of goods and cargo by water was central to one in which globalized information processing economies play an increasingly important role in determining spatial patterns of activities (Schubert, 2011, p. 74).

The famous triptych by Manuel Castells on “The Information Age” is a testimony to this notion, in particular his concept of the “space of flows”, a space which has emerged parallel to the geographical and morphological spaces, in which terminals, transfers and transport determine space within their own networks (Castells, 1996-1998).

So, in addition to the model shown in figure 5, it can be said that phase five has extended on to the year 2000, turning into phase six of information and communications technology revolution driven by technological advances such as the world wide web (ibid.).

In conclusion to the historical overview of waterfront redevelopment, it can be stated that in the late seventies an upheaval began leading to a genuine urban revolution of generalised waterfront redevelopment projects (Bruttomesso, 1993). The most important principle in that process seemed to be the city’s rediscovery of its waterfront, “the ‘re-stitching’ of the relationship between the water and the urban fabric” (Bruttomesso, 1993, p. 10).

A relationship which historically had been very intense, with a lot of public activity going on next to the water and cities blossoming on the basis of their accessibility to waterways, both regional and global (by the early eighteenth century, the difference in wealth between Paris and London could be traced back to the accessibility to sea and overseas products, with Paris being some 270 kilometres from the French coast line) (Steel, 2009).

Later on came the split, leading to a differentiation of roles between city and port. Amsterdam is a perfect example of this divide when, at the end of the nineteenth century, the construction of the new railway station on the old port site barred forever the view of the IJ (Bruttomesso, 1993).

With the introduction of containers, oil refineries, computerization and associated scale enlargement of port areas, came the period of waterfront zone revitalization: the aforementioned urban revolution of generalised waterfront redevelopment projects.

It is essential to note that currently still a lot of waterfront redevelopment processes are underway (cf. Desfor et al., 2011) and that the port increasingly has dissociated itself from the city engaging in a global network and space of flows of its own. This continuous dislocation of the harbour vis-à-vis the city urges waterfront redevelopment.

Typical examples in practice can be found in the Dutch cities Rotterdam and Amsterdam. In the Rotterdam case the harbour area is expanded seaward with the second Maasvlakte, allowing redevelopment of the inner city ports, the so-called “Stadshavens” in Dutch (Port of Rotterdam, 2011). In Amsterdam the Zaan-IJ bank will be redeveloped creating a multifunctional supply of industrial areas (Palmbout, 2010).
1.3 Vlissingen: a specific case

Reviewing the solutions posed in paragraph one on how to keep the coast line intact given sea level rise, the problem of Vlissingen becomes more apparent. In the second half of the twentieth century the city developed its boulevards as part of a process of re-discovering the potentials of its south oriented beach (Hooimeijer et al., 2005). These boulevards together form a track of two kilometres long uniting urban developments, public space and the seawall defence. However, due to the fact that the city has 'climbed over' its water defences, solution one (heightening the existing seawall) proves problematic, since this would destroy the two kilometres of unique south oriented boulevards and alter the relationship between city, beach and sea. (There is some leeway in this operation since buildings on the boulevard have been constructed with an extra high first floor, thus allowing to raise the ground floor together with the

Fig. 6 Depths of the Westerschelde along Vlissingen (Map by author, 2011)
seawall construction (Ministry of Transport, Public Works and Water Management and VROM, 2007). At the same time it proves even more problematic in light of solution two, which is extending the seawall landward. This would mean that a whole part of the city centre of Vlissingen would have to be demolished and rebuilt, an unthinkable solution.

Lastly there is option three, actually an option more suitable for urban environments so close to the coastline in general: extending the seawall into the sea. Now the importance of the proximity of the deep shipping channel in this matter becomes clear, as much as the notion that the hard seawall construction intensifies erosion of the seabed. For if sand would be supplemented in front of the existing seawall it not only suffers from increasing erosion (the channel wall will only grow steeper as a consequence, whereby the impact of waves through the channel intensifies, eroding the wall at a much faster pace) but it might also interfere with the depth of the shipping channel. Already the shipping channel of the Westerschelde is too shallow or too narrow on a number of points in its track for large ships heading for Antwerp, with Vlissingen currently not being one of them.

These intriguing conditions of the waterfront of Vlissingen stem forth from its unique location within the Rhine-Meuse-Scheldt delta. Following the origin of the Rhine from Graubünden in the mountains of Switzerland as Alps Rhine through the Lake Constance (German: Bodensee), through 120,000 square kilometres of its catchment area in Germany all the way to the Dutch low lands gives an impression of the large river system the delta is part of. A 7,000 kilometre long river system that traverses seven countries and flows to the North Sea in the Netherlands, where it is located at the confluence of the Rhine-Meuse-Scheldt rivers (Garza & Thomas, 2011).
But there is more to the story of Vlissingen’s unique location than the fact that it is located near the estuary of the Rhine-Meuse-Scheldt delta into the North Sea. For within the estuaries of this tidal delta system it occupies a unique position as well. In order to pinpoint the cause for this fact, a specific major flood needs to be recalled.

In the night of 31 January to 1 February 1953 a major flood occurs in the delta estuary caused by a deadly combination of springtide and a Southwestern storm. According to Van der Ham (2003) administrative mismanagement and bureaucracy were the main factors why nothing was done with the reports created by a special flood commission led by Johan van Veen, indicating that most of the dikes in Zeeland were at least one meter too low and many of them in poor condition. Since 1937 the engineer Van Veen (author of the inspiring book on water management in the Netherlands: Dredge, drain, reclaim. The art of a nation (1984)) had issued several warnings about the condition of the dikes. ‘His’ flood commission concluded in 1946 that water levels of 4 metres above N.A.P. (so-called ‘superfloods’) were possible and that if they would occur all dikes in the Southwestern Netherlands would prove insufficient (Historici, 2012). Their advice was to study the closure of the sea inlets. Since this meant an enormous
operation, the reigning opinion was that the Delta plan should be constructed progressively (ibid.). The Botlek, Brielse Maas (both in 1950) and Braakman (1952) were dammed as a consequence of this advice and at the end of January 1953 the document “De afsluitingsplannen der Tussenwateren” (The closure plans of the sea inlets) was published. But measurements with the same scale and impact as the Afsluitdijk of 1932 had not been undertaken in the delta estuary, when the major flood of 1953 struck.

An immediate consequence of the 1953 flood was the realisation that a progressive, gradual construction of delta dams would be too slow. A delta committee was installed (in which Van Veen would also participate) to work out the earlier ideas into a coherent, safe and durable Delta Plan. In 1959 the Delta Act was approved in order to streamline the construction of the Delta Works. Starting in the sixties and continuing unto the 1987 realisation of the Philipsdam, this tremendous operation proved successful in a number of ways (Deltawerken, 2012):

1. Shortening of the total length of seawall defences with 700 kilometres
2. Improving the water management by means of the compartmentation of the water flows.
3. Improving the mobility of the Zealandish isles which had been relatively isolated until then
4. Improving inland shipping infrastructure, especially in the east of the delta area between Rotterdam and Antwerp.

Because of the economic interests of the major ports of Antwerp and Rotterdam the Westerschelde and the Nieuwe Waterweg were kept ‘open’, although later the Maeslantkering (1997) was constructed to...
be able to close off the Nieuwe Waterweg in times of major floods. It is precisely this agreement which has given Vlissingen its unique location since it is the only city in the Netherlands which lies so close next to a truly open connection to the sea and in such proximity to the main course of the water through the deepest channel of the Westerschelde.

1.4 Waterfront assignments Vlissingen

Next to the technical problems associated with sea-level rise and the seawall defence in relation to the unique position of Vlissingen, the waterfront has to deal with specific spatial problems as well. Looking down from the city scale two important assignments come up:

1. the attachment of the off-centre located station with the city centre.
2. the undefined space taken up by the former Spuikom area behind Boulevard Bankert in-between inner city and dune area and in-between the city and its beach waterfront.

These assignments stem directly from the historical development of these sites in relation to planning attitudes and even dreams and ideals of what they and the city as a whole could have become.

The second waterfront assignment has been addressed by the municipality, resulting in a Masterplan for the area in-between the station and the inner city. Although it can be argued whether this plan is truly successful in relinking the station to the inner city and providing the (inner) city with a better entrance, it nonetheless shows potential for the redevelopment of this area. For the relinking/redevelopment of the Spuikom area multiple ideas and plans have been drawn up - for instance by urban designer Ashok Bhalotra and architect Cees Dam - but these met ample resistance from the local population who saw their quiet green and empty space being turned into high density areas full of commercial and housing developments (PCZ, 2010). Urban plans which show understanding of this place in terms of its historical and actual sense of place are needed.
Het hele gebied ademt de sfeer van historie en scheepsbouw. Vooral rond het dok is er een maritieme sfeer, alleen al door de aanwezigheid van de behouden hijskraan, de oude schepen en de bewaarde oude gebouwen. De sfeer komt ook terug in het materiaalgebruik voor de inrichting van de openbare ruimte (de sfeer van bolders, staal, stelconplaten, rails). De stoer vormgegeven openbare ruimte blijft te allen tijde openbaar, dat wil zeggen vrij toegankelijk.

De Plaatwerkerij, de Machinefabriek en de Timmerfabriek worden naadloos opgenomen in de nieuwe inrichting. Er is ruimte voor winkels, café’s en restaurants op de begane grond van de woon- en werkgebouwen. In het plandeel Kaden worden drie publieke parkeergarages gerealiseerd.

De nieuwbouw op de kop van het dok is ambitieus en opvallend. De kop van het dok moet zowel de kwaliteit van het winkelgebied versterken en voldoende aantrekkingskracht hebben om (internationale) bezoekers te trekken.

Van zuid naar noord zijn de volgende deelgebieden (plandeel) te onderscheiden:

Binnenstad (zuidzijde dok), Kaden, Blauwe Dorp en Bolwerk. In de volgende pagina’s worden deze deelgebieden in iets meer detail gekarakteriseerd.

Verder zijn in toelichtende afbeeldingen de toekomstige bebouwingstructuren aangegeven. Op sommige plaatsen is in de nieuw getekende structuren ook de bestaande te behouden bebouwing opgenomen.

4.2 Karakterisieken deelgebieden, beeldkwaliteit en kwaliteit openbare ruimte
1.5 Spatial Problems Vlissingen

Apart from the assignments described earlier which relate directly to climate change and associated sealevel rise and waterfront connectivity, spatial problems on the scale of Vlissingen are taken into account as well. Since this Thesis is carried out in the field of Urbanism such an approach is vital if not unavoidable. Although this project started out with a fascination which leans more towards the Civil Engineering and Water Management fields, analysis of the urban context will be the essential basis of the research and design phase. Based on the findings of these spatial problems accompanied by the seawall defence and waterfront connectivity issues an adequate test site can be selected for further research and design. The findings presented here are elaborated upon in further detail in Chapter 2 Research.

1.5.1 Landscape structure

Research into the landscape structures of the city (water and green) shows a number of potential connections within the city layout. The green analysis shows a clear green belt surrounding the city structure which was built until the end of the eighties, and bordering the newer neighbourhoods. The historical clear connection between inner city and dune area (see also next paragraph) has diminished. Moreover, the green boulevard part of the Boulevard de Ruyter together with the Bellamypark on top of the former and filled up Merchant’s port are the only isolated green spaces within the city center. Connecting these to the dune area and to the green belt along the waterways would prove a significant betterment of the green structure of Vlissingen.

As for the water network, it is remarkable that the only connection used for water recreation is the canal through Walcheren, straight through to the Veerse Meer. Historically, that is before the digging of this canal, Walcheren has always relied on its water network for transport and the system of small canals is still to found throughout Walcheren today. This provides fruitful starting points for an expansion of the water recreation along these smaller canals. While the Westerschelde, Walcheren canal
and Veerse Meer are very suitable for larger (sailing) ships, the smaller water network is very interesting for smaller boats, for citizens to re-experience the port city that Vlissingen used to be.

1.5.2 Connection Vlissingen - dune area

Historically there used to be a clear connection between the inner city and the dune area, with two main axes leading directly from the historical heart of Vlissingen towards Vlissingen seaside resort, with a unique south side beach. Nowadays the beach has extended onto the boulevards of Vlissingen whereas the dune area actually has moved further away from the city centre. (Of course, not in a literal way: the city has gobbled up more of the dune area, with the construction of boulevard buildings and detached housing where dunes used to be.) Whereas the closer proximity of the beach to the inner city can be perceived as an enhanced spatial quality, the disconnection of the dune area is a development which should be countered by generating a green and ‘slow’ connection from the city center towards this area.

1.5.3 Waterfront permeability

The waterfront permeability in Vlissingen has decreased following the construction of side-by-side high-rise boulevard buildings in combination with the barrier of the Spuikom road. Moreover, the street behind the boulevard buildings is crammed with parked cars, thus deteriorating spatial quality of the area directly behind the boulevards. The parking surfaces in the Spuikom area behind the boulevards add up to this deterioration.

1.5.4 Morphology

Morphologically speaking, the city seems to suffer from a particular fragmentation. Whereas it may come as no surprise that certain neighbourhoods in the city have been constructed earlier and in different typology from others, the connection between these different neighbourhoods falters since a lot of these neighbourhoods are oriented inward. The boulevard buildings are predominantly oriented towards the sea and, as said, decrease waterfront permeability.
1.6 Synthesis of problematic: Spuikom area

The area where all the aforementioned problems come together is the drainage basin the Spuikom, an area which used to be a symbol of the maritime character of Vlissingen.

To demonstrate the difference in character between this place a century ago and now, please take a look at figures 21, 22 and 23 respectively. The first, taken from a tourist folder around 1910, shows a beautiful sequence from west to east of the seaside resort, the drainage area with surrounding buildings and the ancient city with the ports running through it. The seaside resort and the city centre are connected by only one major axis, which serves as its umbilical cord: the Badhuisstraat (bath house street), running from the water tower along the drainage basin towards the inner city along its harbours. The Spuikom has not been encompassed fully yet, but it is integrated in the city layout and it feels like one space. If the reader now looks at the image taken in 2004, with the zoom-in from one of the large boulevard buildings taken two years later, an entirely different picture is to be seen. The drainage basin has been filled up leaving an ambiguous water form in the middle of an open green field.

The Badhuisstraat still is an important axis but the relationship from this street towards the boulevard has changed dramatically. Not only are the high boulevard buildings and the seawall shielding the houses from a view towards the sea, but look at the line of trees obscuring the backs of the buildings along the Badhuisstraat. There is a main road running through the area (the Spuikomweg) but curiously enough it too runs parallel to the boulevard. Why is there no perpendicular connector between city and boulevard? And what to think of the parking places on a level higher than the road? Do they serve as the entrance zone for people coming to Vlissingen to enjoy the boulevard with its south side beach?
I cannot keep from showing a sequence of four pictures which to me demonstrate the essential problem of the lack of linkage between city and boulevard through the Spuikom area. These pictures have been taken over a distance of some thirty metres from the square in front of the city hall crossing the Badhuisstraat towards the Spuikom. The first two look back and forth from the beginning of this small trip showing a clear line of sight and path, the last two looking back and forth whence the Badhuisstraat has been crossed.

In summary, the principled problems which are discerned concerning the Spuikom area are:

1. The Spuikom area is an ‘empty’ green field with an isolated ambiguous water form and surfaces of parking whereas it should serve as an important entrance zone for people coming to Vlissingen to enjoy the boulevards and south oriented beach. Several historical landscape structures are surrounding the Spuikom area but not continuing into the area [landscape structure].

2. Taking into account the predicted sealevel rise the primary seawall which is located behind the boulevard buildings, bordering the Spuikom area, needs to be re-enforced. This has an impact on the connectivity and spatial character of the whole area [seawall defence].

3. The historical clear link between city centre and seaside resort has lost is clarity. Recreating a green link between inner city and dune area would help signify this relationship and improve the structure of Vlissingen’s waterfront [connection Vlissingen - dune area].

4. The parallel structure of access roads obstructs perpendicular lines connecting the city to its boulevard. Several structural lines running in this direction are already there but they are all cut off by the Badhuisstraat [waterfront permeability].

5. The buildings encompassing the Spuikom area are turned away from it rather than facing it. This greatly diminishes the spatial quality of the area and generates a space which is unseen and not part of active public life [morphology].
Fig. 27 Bird’s eye drawing Spuikom (Map by author, 2012)
2 Aims of the Project

The general aim of this project is to contribute to solutions posed for the future water challenges in the Netherlands, in particular in a coastal urban waterfront environment, Vlissingen. More specifically, the aim is to enhance the spatial quality of the urban waterfront of Vlissingen, in particular the Spuikom area which used to be a symbol of the connection of Vlissingen with water but has degenerated into an undefined left-over space, an intermediate zone disconnecting city from boulevard, an inactive part of public life and a poor entrance for people visiting Vlissingen to enjoy its fascinating relationship with the water around it.

Based on the fascination with the water assignment for Vlissingen’s waterfront combined with the spatial problems of the city the specific site the Spuikom area was chosen. This site will be the subject of further research and design. Following the earlier described city problematic and the waterfront assignment the design goal for this site is:

To re-attach the Spuikom area to the spatial structure(s) of Vlissingen whilst simultaneously providing a safe and durable urban waterfront.

The problems which have been identified are related to the landscape structure of Vlissingen, its seawall defence, the connection between city and dune area, the permeability of its waterfront and the reigning fragmentation in the city. The design needs to provide a solution to this problem field.

3 Research Questions

3.1 Main Research Question
How can the Spuikom area be re-attached to the structure of Vlissingen and be adapted to the future climate challenge of sealevel rise in such a way that it enhances the spatial quality of the urban waterfront and the link between this place and the surrounding cityscape?

3.2 Sub Research Questions

The sub research questions are derived from the elements of the main research question. They deal with the five problems summarized in paragraph 1.6.

1. How does the water defence structure in Vlissingen function?
2. What are the future water problems in general and specifically in Vlissingen?
3. What are generic solutions to deal with the water problematic? What solutions have been thought up for the specific context of Vlissingen?
4. What successful spatial principles have been adopted in adaptive waterfront design?
5. What characterises the spatial quality of the urban waterfront of Vlissingen? What are the positive and negative properties, treads and opportunities?
6. What starting points does the city of Vlissingen offer for the re-linkage of the city to its waterfront?
7. What principles have been adopted in practice on re-linking a city to its waterfront which are applicable and might prove successful in Vlissingen?
4 Relevance

4.1 Academic Relevance

Sea level rise is one of the aspects of the debate about climate change, a debate in which scientists are far from unanimous. However, an important difference is that sea level rise is accepted as such, meaning that the majority of scientists agree that this process is occurring (cf. Ruddiman 2008). The most important question that remains is at what rate the sea is rising and to which level. This has led to all kinds of scenario studies, for instance also by the Deltacommissie (2008) and the KNMI (2006) here in the Netherlands. The Dutch government also advocates a policy in which a safe delta is vital, for instance in its Randstad Urgent document. In any case they underline the importance of looking for innovative new ways of dealing with the rising sea-level to provide safety for the Dutch.

Academic research has also been conducted into types of water defences which can be integrated into the urban realm (Van Veelen et al., 2010). These are theoretical models which have not yet been tested extensively in practice and the research by design phase of this graduation project could contribute here as well.

4.2 Societal Relevance

The field relevance can be especially highlighted by mentioning the recent exhibition of the Museum of Metropolitan Art in New York titled “Rising currents: Projects for New York’s Waterfront” (MOMA, 2011). Increasingly, people are becoming aware that especially at urban waterfronts where city and water come together so closely solutions are needed to cope with future challenges. New York is most certainly not the only example, multiple cities worldwide are going to have to face the incline in water level rise. Flexible solutions are a must.

Apart from the water problematic, the spatial problems and in particular the lost link between urban structure and the water are of profound importance and can be highlighted by mentioning projects in the Netherlands in which historical water structures are brought back and surface water is expanded: Amsterdam canals and Utrecht Catharijne canal.

5 Methodology

5.1 Research design

“Architects, including the seriously gifted, construct their ideas, even if these are keys to utterly new insights, out of raw material that in one way or another had already to be present in their minds. Nothing, after all, can be born of nothing” (Hertzberger, 2002, p. 389).

This research is designed along three main lines: Site Specific Analysis, the Theoretical Framework and the Empirical Framework. The reasoning for this subdivide is as follows: first the specific problems for Vlissingen need to be known based on finding out how the city works. Also, the analysis needs to present starting points how solutions for the problems found can ‘land’ in the context of Vlissingen. Then the theoretical framework will provide principled, generic solutions on how to deal with such problems, based on the wider theoretical knowledge about these problems – in particular the water and the spatial problematic. Lastly, case studies serve as inspiration and examples how to re-connect city and waterfront, based on multiple approaches which seem applicable in Vlissingen too.

Apart from answering the sub research questions and
therefore finding an answer to the question how the seawall defence of Vlissingen should be adapted, this project will have a strong Research by Design approach. Thus, the findings will be tested into a specific design in the Spuikom area in Vlissingen.

5.2 Site Specific Analysis

The first part of the research focuses on the specific context of Vlissingen. (Clarification: I do not mean first part in a temporal sense, since parts of the theoretical framework had been carried out before to know what needed to be researched in Vlissingen, such as the general water problematic facing the Netherlands.) The set of research methods which will be used in this analysis consists of:

1. Official Data Research, that is the analysis of planning documents, historical overviews, demographic statistics, water plans and the like.

2. Literature Research, that is the analysis of literature directly related to the case of Vlissingen. For instance, literature on how to sustain hard water-repellent structures in view of the water challenges to come has some data about Vlissingen as well (cf. Deltares, 2011).

3. Interviews, which will be conducted with experts from the municipality of Vlissingen on the site specific context. For instance, an interview was held with Wim Crusio, of the spatial development department of the city on the spatial problem of the Spuikom area and the challenge for the urban waterfront.

4. Site Observations, which will be necessary in order to get a better grip on the spatial dimension of the assignment. For instance, photos taken can provide a better understanding of notions such as ‘poor spatial quality’ to outsiders.

5. Mapping, actually the most important method used in this analysis part. In order to understand the city it is vital to draw its most important features in an easy-to-understand way. Moreover, the ethical principle of transparency which this graduation project tries to adopt (see paragraph 6.2) demands this clear representation of findings.

In fear of repeating myself, here too there is no temporal order assigned to the different methods, often they are complementing and informing each other and progressing together. For instance, based on an historical overview of the growth of the city the criteria for selecting specific neighbourhoods for morphological mapping were established: typologies built in the same period following the same planning logic reflected in the same physical layout within the city.

Although not every component of the site specific analysis will incorporate each method as much as the others, all components should be informed by the four different methods in order to get an adequate idea of what is relevant. So, even though mapping is often the most important outcome of the analysis, its justification lies not only in the mapping itself, but in the other methods as well providing a full argumentation why precisely this has been mapped.

5.3 Theoretical Framework

The primary goal of the theoretical framework is to establish generic theoretical knowledge on how to deal with both the water problematic and the spatial problematic. For that reason, it has been closely linked to the problematic of the urban waterfront of Vlissingen, as described in chapter 1. So, although it is generic knowledge on principled solutions the basis for looking at this knowledge lies in the specific
context of Vlissingen. Generic knowledge is meant to provide inspiration and information for specific assignments. Here the primary method is Literature Research.

Generic knowledge on how water defence structures can be integrated into the urban fabric has been researched on the basis of a review paper (see Theoretical Framework). Generic knowledge on principles of composition how to deal with fragmented urban open space have been investigated on the basis of the work of Beune & Thus (1990).

The outcome of these two analyses will be summarized into two toolboxes: a water toolbox containing types of multifunctional integrated water defences in urban areas and a spatial toolbox containing types of composition methods to reconnect and re-introduce meaning to fragmented urban open space.

Apart from this toolbox analysis, the theoretical framework consists out of the general theoretical basis for the entire graduation project: climate change, water level rise, problematic of the urban waterfront and so on. Next to Literature Research, Official Data Research will provide an important input as well. Mapping and Site Observation are of lesser importance here, although the synthesis of theoretical findings into a map might prove a representative way of presenting the outcome of analysis.

5.4 Empirical Framework

Three case studies have been selected based on two main criteria: first, the aim of the design intervention was to improve the connection between an urban area and its waterfront (general criterion) and second, the design adopts a specific rationale which could be adopted in Vlissingen too based on the problems defined earlier in the thesis plan (case specific criterion). This last definition is exemplified below. Mapping and Official Data Research are the methods used here, sometimes supplemented by Site Observation.

The first case study, Hamburg HafenCity Am Sandtorkai waterfront, incorporates flood-resilient buildings in order not to have to build dikes in between the city and its waterfront. It therefore adopts the rationale of integrated flood defence in waterfront buildings to maintain the relationship between urban area and its waterfront by not having to raise dikes next to the waterfront. Moreover, these buildings are not only orientated on the waterfront but are also facing the city. This approach could work very well in the case of the boulevard buildings in Vlissingen, which now tend to neglect the city behind them (identified as problem in paragraph 1.6).

Second case study is the plan by HKB stedenbouwkundigen for revitalisation of the city centre of Alphen aan den Rijn (cf. HKB, 2005; Municipality Alpen aan den Rijn, 2007). Based on their historical analysis of the development of the city along the river and figure ground drawings of the current city centre they discovered that from its initial location near the river the city continued to develop away from the water, forgetting about its historical roots. The main water axis needs to be incorporated into the public space axes. By adopting the principle completion to deal with this fragmented urban open space (one of the principles researched in the theoretical framework and part of the spatial toolbox) and even adding a bridge over the river they adopt the rationale of enhancing the structural lines perpendicular to the main axis of the river. A problem, which has been identified in the case of the Spuikom area too (see again paragraph 1.6).

The third case study is the master plan for Lochem by RG&P (cf. RG&P, 2009). Here, the waterfront redesign entails the demolition of an industrial terrain which is situated in-between the city and the
river. The rationale which is adopted here, is to use existing structural lines with high spatial quality (the ‘durable spatial hull of Lochem’ as mentioned by RG&P (2009)) to redesign the area, extending these lines from the city centre on to the waterfront. The wish to continue structural lines with high spatial quality have been identified in the Spuikom area as well (in paragraph 1.6).

Based on the standard work by Yin (2003) on how to conduct case study research five components are of paramount importance in these analyses and they will be discussed per case study:
1 A study’s questions
2 Its propositions
3 Its units of analysis
4 Logic linking data to propositions
5 Criteria for interpreting the findings

Hamburg HafenCity Am Sandtorkai
1 Main question: how can an integrated multifunctional flood-resilient building be used to increase flood-resilience whereas at the same time maintaining or even enhancing the relationship between city and waterfront?
2 Proposition: by adapting buildings to occasional flooding the urban space can be kept at the same level as the waterfront, without having to raise dikes in-between, thus hampering the physical as well as mental connection.
3 Units of analysis: building blocks along the waterfront and the public space surrounding them.
4 Linking data to propositions: relating the structural flood-resilience measures taken to the lack of need for dikes in the urban area.
5 Criteria for interpreting findings: proving that the structural flood-resilience measures prohibit the use of dikes but still work to keep the buildings intact.

Alphen aan den Rijn city centre
Problem: How to redesign and reconnect a fragmented urban space based on existing structures?
1 Main question: how can perpendicular axes to a central axis be spatially enhanced so as to make them feel part of a system of axial relationships, rather than being located in the proximity of a main axis?
2 Proposition: by enclosure and spatial demarcation of the perpendicular axes akin to those of the main axis the whole will feel like one system of integrated and connected spaces.
3 Units of analysis: the public spaces in the city centre
4 Linking data to propositions: relating the intervention to the situation before, exemplified in figure ground drawings.
5 Criteria for interpreting findings: on the basis of the figure ground drawings assumptions are made about the effectiveness of the method. These will be checked against the reassessment of the master plan by the municipality in 2007 (cf. Municipality of Aplhen aan den Rijn, 2007).

Lochem Master plan
1 Main question: how can existing structural lines be extended into a design that re-links a city to its waterfront? What kind of principles can be used for this?
2 Proposition: by identifying structural lines with high spatial quality and extending them onto the waterfront through the redesigned area, both connectivity as well as spatial quality of the intermediate zone are enhanced.
3 Units of analysis: the different structural lines brought back to seven principles
4 Linking data to propositions: relating the extended structural lines to the increased connectivity and spatial quality.
5 Criteria for interpreting findings: on the basis of the design steps taken, showing the combined effects of each principle.

Fig. 30 Empirical Framework (image by author, 2012)
5.5 Answering the sub research questions

Linking the three main lines of research to the sub research questions gives a clearer view how this research was designed. Therefore here the sub research questions are repeated, complemented with their primary analytical methods (often, all the methods are used but some clearly form the main analysis) and the research line they belong to.

Below the sub research questions have been repeated, complemented by an extended description of the methodology used to answer these.

1 How does the water defence structure in Vlissingen function?
- Historical analysis of the urban growth of Vlissingen in relation to its water defence structure and pinpointing critical developments over time.
- Mapping of the location of the water defence structure, both in plan drawing as in section in order to understand the specifics of the water defence structure.
- Official Data Research into the more technical specifics of this defence system.

2 What are the specific future water problems in Vlissingen?
- Literature study into climate changes and its protagonist sea level rise, narrowing down to the case of Vlissingen.
- Using the maps drawn for research question one in order to visualize what happens if the water level rises and especially where the problems exactly occur.
- Interviews with experts on the case of Vlissingen: Crusio from the department of spatial development on the spatial problematic and the water management of the city and prof. dr. ir. Stive, Department Head for Hydraulic Engineering and former Senior Specialist Coastal and Estuarine Management on the coastal situation.

3 What are the specific future water problems in Vlissingen?
- Literature Research into the methods that have been adopted in the last decades, especially notable are Deltacommissie, 2008; Ministry of Transport, Public Works and Water Management, 2000 and Dijkzeul & De Hoog, 2010.
- Literature Research solutions more specific for Vlissingen, notable here are Deltares, 2011; Witteveen+Bos, 2006 and Lazar, 2011.
- In interviews with experts mentioned earlier this topic will also be raised, particularly with in mind to test the suitability of these methods according to the expert and on what he/she bases that finding.

4 What successful spatial principles have been adopted in adaptive waterfront design?
- Literature Research accumulating in a review paper on integrated water defence structures in urban areas.
- Comparative Case Study of adaptive waterfront design in Hamburg HafenCity.

5 What characterises the spatial quality of the urban waterfront of Vlissingen? What are the positive and negative properties, trends and opportunities?

- Mapping of actively used public space, typologies of green space, water structures, the underlying landscape and morphological analysis of the Spuikom and boulevards, based on the analysis of maps, site observation and official data research.

6 What starting points does the city of Vlissingen offer for the re-linkage of the city to its waterfront?

- Mapping of actively used public space, typologies of green space, water structures, the underlying landscape and morphological analysis of the city, based on the analysis of maps, site observation and official data research.

7 What principles have been adopted in practice on re-linking a city to its waterfront which are applicable and might prove successful in Vlissingen?

- Comparative Case Studies of waterfront redesigns in Lochem and Alphen aan den Rijn, focusing on their respective design rationale of extending structural lines with high spatial quality and establishing a pattern of axial relationships.

8 What principles of composition can be discerned in redesigning fragmented urban open space which is not well integrated into the overall urban structure?
- Literature Research into composition principles based on the work of Beune & Thus (1990).
6 Possible Ethical Problems

6.1 Trained Incapacity

“Give a small boy a hammer, and he will find that everything he encounters needs pounding. It comes as no particular surprise to discover that a scientist formulates problems in a way which requires for their solution just those techniques in which he himself is especially trained... The price of training is always a certain ‘trained incapacity’” (Kaplan, 1964, pp. 28-29).

This intriguing notion was raised by Kaplan and I don’t think many people can escape from it. For my graduation project it stresses the need to be equipped with an entire toolbox instead of just one hammer, to use Kaplan’s expression. By delving into the possible methods of coastal defence and knowing their advantages and disadvantages a serious choice can be made as to what tool is most effective in the case of Vlissingen.

Still, of course, Kaplan’s notion applies. My design solution will be based especially on the skills of an urban designer and urban planner and it will prove difficult to fully grasp civil engineering skills to tackle the problem.

6.2 Majority versus Minority

One of the most confronting notions from the lecture of Koller (2011), presented in view of this course, I find the following:

“The largest number of happy people always comes at the extent of a smaller number of people. How can we morally justify that?” (Koller, 2011)

This is a fundamental notion to the disciplines of urban planning and urban design. It has been a central part of the work of David Harvey, as can be seen for instance in the next quotation:

“Surplus absorption through urban transformation has an even darker aspect. It has entailed repeated bouts of urban restructuring through ‘creative destruction’, which nearly always has a class dimension since it is the poor, the underprivileged and those marginalized from political power that suffer first and foremost from this process. Violence is required to build the new urban world on the wreckage of the old” (Harvey, 2008, p. 33).

In proving his point Harvey describes how this has become apparent within the system of Capitalism, in restructuring Paris under Haussman, in notions already made as early as the nineteenth century by Engels and especially in the specific case of park building in New York city as performed by Robert Moses who judged and approved his own proposals and tore down large parts of the Bronx (Harvey, 2008). Recently, we have been witnessing protest actions very much according to these notions, contesting our capitalistic system (figure 7).

To resolve the moral problematic posed here, Koller (2011) presented two possible way outs: participationism and procedural justice (transparency). My aim for this project will be to develop it transparently so that everybody will be able to review my steps taken and my considerations/conclusions accumulating into the final design.
II Research
1 Underlying Landscape

1.1 Introduction

This part of the Site Specific Analysis deals with the underlying landscape and has a strong geomorphological nature. The landscape analysis narrows down from an overview of processes which played an important role in the formation of the Netherlands to an overview of the tumultuous interplay between sea and land in the Southwestern Delta to the most important landscape formations on Walcheren.

1.2 The formation of the Netherlands

In the Holocene formation process of the Netherlands a couple of important moments can be traced which mark the evolution of the landscape (see figures 2-5). In the year 3300 BC the transgressive phase of the coastal dune area came to an end, allowing barrier beaches to form just east of the present coast line (Berendsen, 2005). The slowing sea level rise (what precisely caused this process remains unknown) made coastal progradation possible, even though sealevel continued to rise (ibid.). Apparently, rates of deposition were greater than the rate of sea level rise, with the protruding northwestern coast of 3300 BC probably being an important source of sand (ibid.). The resulting wide barrier beaches protected the land against marine ingressions. From approximately 2000 BC to 1000 BC river inundations and precipitation led to large-scale peat formation in the swamy

Fig. 1 Overlay of the tumultuous interplay between sea and land - mapping thirteen important stages of flooding in the Southwestern Delta (map by author, 2011)
The Emsdelta and his Dollard estuary are situated at the end of the river Ems. As part of the Wadden Sea, this delta area is important for a lot of European birds and other flora and fauna.

Cities around this delta are founded around 600 B.C., although these cities did not grow rapidly until the industrialisation of the 20th century.

The shipwright Meyer in Papenburg dominates the landscape and waterfront of the Ems till the Dollard. To keep the shipyard in the region, the German government decided to broaden the riverbank and build a dam upstream. This dam can raise the water level of the Ems by 50 cm to let big ships pass through (Meyer Werft, 2011).

Passing through the peat lands of lower Saxony, the river Ems widens his path by the small rivers coming from the former peat lands. The peat in these regions are almost dug away for energy supply till the 20th century. Nowadays, the land is nowadays a scenic landscape which can be found everywhere in Lower Saxony.

Deep in the Teutoburger Wald hills the river begins and finds his path to the lands of lower Saxony. As an important part of the former German Empire and later as independent states, the culture founded at the spring of the river spreaded out over a big part of Europe. Nowadays, the old urban riverfronts of this region can be found in a lot of European regions.

![Fig. 2-5 Holocene palaeogeographic development of the Netherlands. (Maps by author, 2011; based on Berendsen, 2005)](image-url)
area behind the dunes (ibid.). This formation process lasted until the year 0, decreasing gradually (ibid.).

Around the period 500 AD to 700 AD erosion of the coast increased once again, whereas the main drainage of the Rhine shifted in southwestern direction (Berendsen, 2005). During the last two millennia, differentiated coastal development can be seen, as a result of the diminution of sand sources available for progradation (sedimentation from ebb tidal deltas and rivers) and locally different current and wave patterns (ibid.).

1.3 Sea versus land in the Southwestern Delta

In the Southwestern Delta a particular tumultuous process of coastal development has occurred. Here, the battle between sea and land reached its culmination in a substantial number of floodings, during the entire two thousand year period.

The situation in the year 600 BC shows the result of the coastline progradation in the Southwestern Delta caused by the diminishing sea level rise, as mentioned in paragraph two. The coastline is almost one continuous line up to the Meuse estuary apart from the exception of the current Oosterschelde estuary (POSAD, 2009).

Over the next centuries the character of the Southwestern Delta changes dramatically caused by an advancing sea, accumulating into the situation as shown in the year 800 AD. Walcheren and the largest part of the rest of current Zealand has become an intertidal landscape with continuous flooding, flanked by beach barriers unable to protect the hinterland. The area is intersected by channels and the con-

Fig. 6-12 Different stages in the battle between sea and water in the Southwestern Delta (Maps by author, 2011; based on POSAD, 2009)
tours of the present islands begin to show (POSAD, 2009). Sedimentation occurs on the higher grounds, whereas the channels continue to deepen (ibid.).

This sedimentation process continues in the course of the next centuries, leading to the situation of 1300 AD in which several islands have been formed, helped by the process of diking which started around 1000 AD (Van Mourik, 2008). From that moment on, the influence of man increases in the form of further diking of dry land and the later reclamations of ‘new land’ (POSAD, 2009).

The period 1000 AD to 1500 AD has been termed the Defensive Phase in the phd dissertation of Hooimeijer (2011) since it is in this period that cities all throughout the Netherlands begin to set up defences against the obtrusive sea, especially in the form of dikes. It is also called defensive, because of the reigning attitude versus the water: a mighty enemy which need to be kept out, but with an undeveloped instrumentarium to do so. It is the beginning of the Dutch way of dealing with the water and concepts such as water management are still centuries away.

The same applies to the Southwestern Delta, the earliest soil dikes prove no match for the strong sea current there. After 1300 AD several major floods alter the relationship between land and sea drastically: the St. Elisabeths floods (1404, 1421 and 1424), the St. Felix flood (1530) and the All Hallows flood (1570) (POSAD, 2009). This process of changing sea and land configuration continues right up to the seventeenth century.

Human influence in this configuration increases from the second half of the seventeenth century, when a more manipulative attitude regarding the threatening sea starts to develop (Hooimeijer, 2011). Islands are moulded into larger wholes, giving the Southwestern delta its final shape (POSAD, 2009). The Great Flood of 1953 AD however, demonstrates the potence of the still unmerciful sea if the seawall defence succumbs to the water pressure (ibid.).

![Fig. 13-18 Different stages in the battle between sea and water in the Southwestern Delta (Maps by author, 2011; based on POSAD, 2009)](image_url)
1.4 Conclusion: the four landscapes of Walcheren

The above geomorphological story can be summarized into a conceptualisation of the four dominant landscape phases of Walcheren (as depicted on the left of this page).

The first dominant landscape structure of Walcheren is characterized by intertidal zones of land which are continuously flooded by the sea, a situation which dates back to the year 800 AD. There are no settlements to be found yet and Walcheren is part of a system of uninhabited swampy islands.

From 1000 AD to 1300 AD the process of diking has led to the situation depicted in figure 20 where a large part of Walcheren consists of dry land. The dominant landscape structure is made up of creek ridges, channels silted up with sandy material after the transition from a wet tidal landscape to a dehydrated cultural landscape (Van Mourik, 2008). The creek ridges rise to a level of one metre above NAP whereas the surrounding grounds are partly excavated and lowered to one metre below NAP (ibid.). This process of elevation inversion is described more detailed in paragraph six. Apart from the diked area still large intertidal zones exist.

The unique pattern of creek ridges is largely destroyed as a consequence of the land reparcelling projects in the twentieth century. Whereas older parcellation structures still followed the creek lines, the new allotments - which were configured as a consequence of the restructuring process of Walcheren after the Second World War - ignore most of those (Van Mourik, 2008). The image of figure 21 depicts the parcellation structures around 1950 AD. Although a completely new pattern emerged, there are still some creek ridges left and they are visible on the height map of Walcheren.

The final image shows the dominant pattern today: besides the polder lines still clearly visible, cities and their networks of infrastructure have emerged as essential parts of the landscape structure of Walcheren. Only when elevation is taken into consideration as well, leftovers from the creek ridge pattern appear (figure 23).
1.5 Landscape and Occupation

The maps in figures 24 and 25 show the emerging pattern of landscape and occupation in the beginning of the process of settlement and the current situation.

The first settlements of Walcheren were almost exclusively realized on higher grounds, either on the beach barriers or on the creek ridges. The first road networks followed these higher creek ridges, and a multitude of lines can be found in the same situation today.

1.6 Creek Ridges and Pool Grounds

In order to understand why the creek ridges form the higher grounds, the development of the ground layers in sections is shown in figure 26. The creek ridges are the former channels which from the fourth to the eight century silted up with sandy material (Beenhakker, 2003). A process which continued long afterwards, thus creating an inversion of elevation: the creek ridges rose compared to the surrounding pool grounds.

These pool grounds are the original peat grounds, covered with clay in the same intertidal period (Beenhakker, 2003). The dried up peat subsided, a process which was stimulated by the heavy clay layer on top (ibid.).

In the Middle Ages peat excavation became a common resource for the production of salt and fuel. In order to reach the peat layer, the people from Walcheren had to first dig out the top clay bed. After the peat was excavated, the clay was mixed again with the underlying layer of old sea clay, a remnant of the situation 3000 BC (ibid.).
2 Historical Landscape Structure Analysis Vlissingen

2.1 Historical landscape structure analysis Vlissingen

The cape town Vlissingen has a historically strong connection to the sea, a relationship which can be found in the DNA of the city today. Indeed, in 2010 the municipality conducted a research combined with several workshops with inhabitants and local organizations and companies into the DNA of the city, concluding that the maritime character is essential to the city (Municipality of Vlissingen, 2010). In order to better understand this historical connection, the research presented below shows a historical overview of the evolution of the city of Vlissingen, as it was shaped by its hydraulic structure. The different time frames under analysis have for this reason been selected on the basis of their hydraulic layout, influencing the city structure. (In order to provide a sensible comparison of the different stages in Vlissingen’s evolution, the maps are all shown at the end of this paragraph one after the other. The story presented here will refer to the different time stages shown in the maps.)

Originally, the village of Vlissingen was located far more inland than it is today. A charter of 1247 indicates that in this year this humble fisherman’s village contained as facilities a church, a rectory and a guest house/hospital for travellers on their way to Flanders (Van Grol, 1931). The location had everything to do with the untameable sea: further inland the fishing boats could seek their refuge from the raging water. Dike construction had just emerged as a new type, but the first clay dikes were not much of a defence against the sea. Therefore floods occurred frequently, changing the figure-ground shape of sea and land continuously. In the map of 1294 the different lines of dikes are shown that were constructed in these centuries, since older ones were destroyed by intrusion of the sea.

Following the three St. Elisabeth floods (1404, 1421, 1424) one more major flood in 1439 washed away the main seawall defence together with the sleeper dike, making the construction of a new dike necessary over one kilometre back from the earlier seawall, thus relocating the city to where it still can be found today (Hooimeijer et al., 2005). The strategic location of the city next to very deep waters made it the ideal base for fishery, trade, marine and cape sailing (ibid.). It is this strategic benefit that fed the persistence to keep the city where it was, despite the harsh conditions of the sea flowing through such a deep channel nearby.

This large relocation process of the sea wall and the harbours and in fact the entire city itself, was made possible due to the effectiveness of the new pillar dike (Forbes, 1997). This new type, which contrary to the earlier clay dikes did a good job in terms of keeping the water out, meant that Vlissingen was able to allow the water inside its urban domain. In other cities such as for instance the dam cities Amsterdam and Rotterdam already in the eleventh century water was let into the urban domain and the dam became a prominent place within the city (Hooimeijer, 2011). What these developments signify is that during the eleventh to thirteenth centuries Dutch cities begin to exploit their relationship with the water. Van Dam (2010) has termed this amphibious culture, with water being the dominant infrastructure throughout the Netherlands and people living in close relationship to the water.

The period between the year 1000 AD and the beginning of the fourteenth century is referred to as ‘The great reclamation’ by Van der Ham (2002), a period in which the agricultural acreage expanded
dramatically. The reclamations were carried out through means of the digging of ditches that drained into peat currents or rivers (leading to typical feather or fan allotments), or, when the reclamation area was located too far from natural water flows, by digging out a separate drainage channel (ibid.). Silting up of rivers and subsidence of peat soil increased water logging, making dams and sluices necessary from the twelfth century onwards (ibid.).

The turn from defensive to offensive water state is marked by offensive diking with the purpose of land winning, helped by the introduction of the windmill at the end of the fifteenth century (Van der Ham, 2002; Hooimeijer, 2011). Especially in the Southwestern delta this offensive land winning takes place, following a specific procedure based on the clay and sandy deposits of the sea.

After the establishment of the first dike ring around 1200 AD population increased and new land was necessary to house the growing population (Beenhakker, 2003). The large creek channels which still existed in between the islands had to drain much less water since the polders were not flooded on a daily basis anymore (ibid.). Since flow velocity decreased, the sedimentation of sand and clay increased. Two scenarios were possible: either the islands grew on the edges because of sedimentation along the dikes, or the shallow grounds in the middle of wide streams grew to become new islands (ibid.). Typically, in Dutch two different words exist for these processes of land accretion due to sedimentation – aanwas and opwas respectively. Diking of aanwas grounds occurred by seaward construction of a new dike parallel to the old one, with connections on both sides. With increased sedimentation of the creek channel, this process could continue until a very small stream remained. In this way an artificial landscape was created of small, long narrow polders and parallel dikes in close proximity to each other with small transversal dikes. Such a landscape can be found in West-Zeeuwsch-Vlaanderen in between Zuidzande and Nieuwvliet.

The opwas grounds were also diked when the sedimentation process had advanced to the point that sand plates had a considerable height and salt marshes had arisen around the plates. Often after diking of the opwas grounds the ‘new land’ continued to grow based on the aanwas process allowing the diking of new small and long polders (ibid.). A typical landscape shaped by opwas diking is found in Heinkenszand at Walcheren.

Eventually the remaining creek channels would become so small that they could be dammed, which for the first time occurred with the Zwake between Beveland and Borsele in 1445 (Beenhakker, 2003). This was for that time a tremendous effort since one had only shovel and wheelbarrow to work against the tides. Later on, in particular between the seventeenth and nineteenth century, this method of offensive diking (diking of aanwas, diking of opwas and subsequently damming the diminishing creek channel in-between) was employed on a large scale resulting in many hundreds of hectares of new land (ibid.).

In 1550, the physical layout of the relocated city heart of Vlissingen was determined by its maritime character, with a very principled set-up. Central in the city three ports (Achterhaven, Koopmanshaven and Voorhaven - Backport, Merchantport and Frontport) were situated, with a sluice system protecting them from the tidal differences (ibid.). The ports were linked to the Molenwater (Mill
water) outside the city walls, which was used to flush the harbours (clearing out sedimentation deposits) and which kept the water level of the ports constant. Following the road along this Molenwater leads one back to ‘old Vlissingen’, with houses and church indicating the former location of this village. Perpendicular to the water axis the most important public buildings of that time can be found: to the left the city hall and prisoners’ tower and the St. Jacobus-church to the right. The prisoners’ tower served as the western of four city gates: to the north and next to the Molenwater the Middelburg Gate; to the east the Blue Gate; and to the south the Keizersbolwerk which is the only one left today.

The fact that Vlissingen is located near the deep channel gave it a large competitive advantage over other harbour cities in the Netherlands, for its harbour accessibility did not depend on high tide. Its strategic position hadn’t escaped the attention of the Spaniards, by 1568 in war with the rebellious seventeen provinces of the Netherlands that did not accept Spanish rule. Despite this geographical unity (and that of the later Republic) the cities still mainly needed to fight for themselves, without a coherent national defence system (Hooimeijer, 2011). Vlissingen proves very capable of this task as it is the first city to liberate itself without assistance from the Spanish aggressor at April 6th 1572 (Van Grol, 1931). A feat of arms which enhanced the image of the inhabitants of Vlissingen as rough seamen (ibid.).

In later years, the city developed its harbours with the construction of the Dokhaven in 1610, a project which for that time was unheard of in terms of its size and the fact that the whole port was dug out (Hooimeijer et al., 2005). This new connection to the Westerschelde followed the lay-out of a planned moat by the Spanish, scared away in 1572. The name Dokhaven refers to the many dry docks which were constructed along this new port. Due to the many conflicts with the English the Dokhaven was primarily used as military port (ibid.).

The development of the hydraulically and warfare technologically driven urbanism of Vlissingen peaked in Napoleonic times (Hooimeijer et al., 2005). After the English attack in 1809 the fortification walls were expanded through means of the construction of a broadened moat and an extra ring of fortifications around the city, thus turning the city more and more into an autonomic war machine (ibid.). Moreover, a new city hall was constructed along the Dokhaven, which led to the relocation of the centre towards the east.

With the fortification law of 1874 and the construction of the defence line of Amsterdam and the new Dutch water defence line (apart from seven other areas in the Netherlands which would also defend themselves based on inundation of the surrounding land), many cities were able to dismantle their fortifications (Forten Info, 2012). The changing way of warfare determined the end of the city of Vlissingen as important war harbour (Hooimeijer et al., 2005). In search for new functionality, the city seemed an ideal place to become a transhipment port for global trade. The uniqueness within the Dutch delta of the position of the city near a deep shipping canal, the realisation of a railway connection to Rotterdam and Antwerp and the construction of the canal through Walcheren gave rise to expectations that Vlissingen would become the biggest seaport of Europe (ibid.). By the end of the nineteenth century this gave rise to a large harbour development to the northeast of the city, on the ruins of the old fortifications. The train station was also constructed in this eastern part of the city, based on the promise of enormous port expansion (ibid.). Meanwhile, the unique south side beach of the city was discovered as a touristic forte, leading to the development of a seaside resort west of the city (ibid.).

Vlissingen never came to be the harbour hub it hoped to become. With the better hinterland connection of Rotterdam and Antwerp and especially the construction of the New Waterway in 1872 providing Rotterdam with unlimited access to the North Sea, Vlissingen was soon overtaken in the race for seaport dominance (Loyen et al., 2002). The city is left with the heritage of its twentieth century ambition: many inner city buildings were demolished and replaced by large assembly halls, the station is
curiously located in the port area, detached from the city centre and the drainage basin which flushed the city’s harbours for centuries has now become an empty flat space infected by parking spaces, with adjacent buildings turned away from it.

The first two problems have received attention and led to a waterfront redevelopment of the Dokhaven area, clearing away the assembly halls from the city centre and re-stitching the station to the rest of the city. The third problem which is the connection of the city with its boulevards and the sea through the Spuikom (drainage basin) still needs to be encountered...

Following pages:
Fig. 9-14 Evolution of the urban layout of Vlissingen driven by its hydraulic structure (Maps by author, 2012; based on Gemeentearchief Vlissingen, 2012)
NB the streets Korte Zelke and Lange Zelke are continuously shown as reference points since they always have been part of Vlissingen.
2.2 Conclusion water structure

A larger contrast between Vlissingens current city structure and that of four and a half centuries back is nigh impossible. In figure fifteen and sixteen a schematization of this difference is shown. Visualized by the drawing at the cover of this graduation thesis, Vlissingen was a proud sea city in 1550, living off its unique location next to open sea.

Vlissingen has lost its embodiment as proud sea city and turned into a generic coastal city. High-rise boulevard buildings along a unique south-oriented boulevard and beach, an industrial harbour area with station and an inner city in which all the traces of Vlissingen’s history seem to have been tried to erase.

On the scale of Walcheren the ancient network of barge canals has been overtaken by the dug-out Walcheren canal leading all the way from the Dokhaven through Middelburg to the Veerse Meer. The barge canals have turned into drainage ditches. It is a pity that this water structure is not simultaneously used for recreation, providing smaller boats with ample recreation possibilities. This development is also visible on the scale of Vlissingen itself, where the deterioration of the Spuikom area is painstakingly visible: from mill water to flushing basin to retention area to the undefined left-over space of today. Not only has this area lost its water function but with it also the spatial quality has vanished: the specific spatial quality of a large open and flat area in the city of considerable size.

From this analysis two direct assignments follow: re-stitching the relationship between water and urban fabric and re-activating the water network and Spuikom as important link in this network.
2.3 Conclusion green structure Vlissingen

Looking at the development of the green structure in Vlissingen important moments are the expansion of the dune area due to allied bombing in the Second World War of the Nolledijk and the creation of a green belt along the Sloeweg. Unique is the green boulevard Oranjedijk with a grass slope behind the seawall. With these three developments immediately the assignment is encountered: to integrate them into a green network, through the inner city area. Important connections to make are the connection between dune area and inner city through the Spuikom and the connection of the Green Belt to the inner city via the Walcheren canal.
Fig. 14 Potential green connections in Vlissingen (Map by author, 2012)

Fig. 58 Green Space analysis on city scale (Map by author, 2012)
3 Connection Vlissingen - dune area

In figures 1-2 the historical development of the city of Vlissingen along the main waterfront axes has been sketched and abstracted, to pinpoint another problem field. When comparing the city structure of 1900 and before with that of today there are a couple of notable differences:

1. The clear water lines running through the inner city ports towards the large flushing basin connected to the smaller basin which can be flushed with seawater and the canal are gone.
2. The beach has grown towards the city centre, until the beginning of Boulevard de Ruyter.
3. The dune area has partly been swallowed up by boulevard buildings and detached housing, now starting behind the Nollehoofd groyne.
4. The two main axes Badhuisstraat and Boulevard have grown into lengthy infrastructural lines, whereas the Spuikomweg crosses through the former.

Fig. 1 Historical structure Vlissingen 1900 (Map by author, 2012)

Fig. 2 Current city structure (Map by author, 2012)

Fig. 3 Northwestern dune area Vlissingen (Beeldarchief Rijkswaterstaat, 2010)
flushing basin and follows the port connections of old.

Combined this means that the former clear structure of Vlissingen city centre - flushing basin Spuikom - dune area with beach (Vlissingen seaside resort) has dissolved. Whereas the lengthening of the beach can be considered as an enhancement of the waterfront of Vlissingen, the removal of the port structures so typical of Vlissingen and the ‘moving away’ of the dune area actually diminish its attractivity. Therefore the connection of the inner city with the dune area is an important assignment in Vlissingen, in combination with the redevelopment of the Spuikom area. Figures XX-YY show a sequence of pictures of the current condition of the road behind the boulevard buildings which connects the inner city to the dune area. Enhancing the spatial quality of this connector, especially for slow traffic, is the assignment.

In figure XUXY design intentions are shown based on the landscape analysis, the analysis presented here and the waterfront permeability analysis.
Several seaside cities and towns in the Netherlands seem so suffer from a particular lack of waterfront permeability due to the construction of highrise boulevard buildings, which block off the rest of the city from its waterfront (cf. Dijkzeul & De Hoog, 2010; Warmerdam, 2011). Notable examples are Zandvoort, Scheveningen and Vlissingen, the city under investigation. As an example of the opposite the case of Brighton in the UK is intriguing, in which the boulevard is actually taken up in the grid structure of adjacent building blocks, thus allowing all the streets to connect to it. Also several park areas connect up all the way to the shore. Although Brighton is quite an extreme example, it does give a sense of an integrated and actively used waterfront. Also in Brighton

Fig. 18 Demarcation line between low-rise (east) and high-rise Boulevard Bankert (Map by author, 2012)

Fig. 18 Boulevard buildings bordering Vlissingen (Map by author, 2012)

Fig. 18 Boulevard buildings bordering Vlissingen (Map by author, 2012)
there are far little high-rise buildings which do not fence off the seafront from the rest of the city. The character of the boulevard in Vlissingen is different from that in Brighton particularly in that respect. Just as in Zandvoort and Scheveningen the area where high-rise buildings are located is the most troublesome in terms of permeability. In Vlissingen the highrise buildings are constructed along Boulevard Bankert behind which the Spuikom area can be found. Interestingly, right in the middle of this boulevard lies a clear demarcation line between the low-rise buildings (three to four stories high) eastward towards the city centre and the high-rise buildings towards Boulevard Evertsen and the dune area behind. This location might prove a succesful point to break up the linear ‘wall’ of boulevard buildings and create buildings at an intermediate level of building height, thus linking the low and high-rise to the eye.

Fig. 18 Boulevard buildings bordering Zandvoort (Map by author, 2012)

Fig. 18 Boulevard buildings bordering Scheveningen (Map by author, 2012)

Fig. 18 Boulevard buildings bordering Brighton (Map by author, 2012)

Fig. 19 Intermediate level boulevard buildings (Map by author, 2012)

Fig. 19 Profile of the boulevard in Brighton UK (Google Streetview, 2012)
5 Seawall defence

Fig. 65 The foreshore of Boulevard de Ruyter (Image by author, 2011)

Fig. 66 Quiet residential character of Boulevard de Ruyter (Image by author, 2011)

Fig. 67 The foreshore of Boulevard Bankert (Image by author, 2011)

Fig. 68 High-rise buildings dominate the spatial character of Boulevard Bankert (Image by author, 2011)

Fig. 69 The foreshore of Boulevard Evertsen (Image by author, 2011)

Fig. 70 The wider spatial character of Boulevard Evertsen (Image by author, 2011)
5.1 The seawall defence of Vlissingen

In figure 60 the location of the primary seawall defence of Vlissingen is depicted, showing an interesting deviation of path from the boulevard de Ruyter in the south corner to the boulevards Bankert and Evertsen north. Whereas the boulevard de Ruyter is part of the primary seawall defence, boulevards Bankert and Evertsen are not. There the seawall continues between two building blocks and extends behind the boulevard buildings (see images to the right). This differentiation is very important in redesigning the connection through the Spuikom area to the boulevard since a primary seawall defence needs to be incorporated in such a design.

Apart from this distinction the three boulevards differ more from each other (see also sections and pictures on next and previous pages). In the map of figure 61 already a specific difference is noticeable which is the nature of the foreshore of the boulevards. The hard seawall defence of Boulevard de Ruyter is made up of boulders and asphalt with no visible sandy bed, since the channel runs closest to the coast here. The character of the boulevard space is very quiet with the sole programme of apartment buildings. Boulevard Bankert is characterized by the same foreshore as de Ruyter, but with the difference that here the channel is further away and its walls are less steep, thus creating a beach foreshore. Here, the high-rise boulevard buildings can be found, giving this boulevard a total different feel. At Boulevard Evertsen there is no asphalt and there are no boulders. The sandy bed is quite wide here due to the extending Nollehoofd, thus creating a collection point for sedimentation in the corner. Here, the beach really begins. Housing is lower and located slightly more backward, giving the boulevard a ‘wider feel’.
Fig. 64 Sections of the three different boulevards (Map by author, 2011)
5.2 Beyond principled solutions: innovative ways of dealing with the water problematic

One of the concepts put forth in the Third Coastal Memorandum is the relocation of shipping channels based on the supplementation of the channel nearest to the coast with sand from the more seaward located bank (Ministry of Transport, Public Works and Water Management, 2000). This sand is ideally adapted to the conditions of the shipping channel, since it is already part of it (Stive, 2011). The only difficulty lying in this operation is the fact that interference in natural flood- and ebb-streams are carried out, a system which is very difficult to command (ibid.).

However, experiments have already been carried out with channel wall supplementation in the channel Oostgat near Zoutelande (approximately ten kilometres northwest from Vlissingen) with promising results (Lazar, 2011). Sedimentation also occurs in the Sardijngeul, the shipping channel along Vlissingen, making occasional dredging of the channel necessary to keep the channel deep enough for the large sea ships heading for the port of Antwerp (ibid.). Channel wall supplementation making use of this layer of sediment seems quite achievable (ibid.). In the short term this method would lead to a decreased slope of the shipping channel, thus diminishing the eroding impact of waves and to an extended sand bank in front of the city, thus decreasing the incoming amount of energy of waves (ibid.). Both results enhance the coastal safety of the city in a very short amount of time.

On the longer run, the channel wall supplementation might prove capable to feed the coastal foundation in a dynamical way, akin to the sand engine described in paragraph 1.1 (Lazar, 2011). Thus, this new type of sand supplementation in which the shipping channel is relocated further off-shore proves very interesting to diminish effects of the rising sea level in a relatively short time span.

Fig. 15 Conceptual drawings of the channel wall supplementation
(Maps by author, 2011)
Apart from innovations in ‘soft defence’, research has also been conducted into new types of ‘hard defence’, that is integrated water defences within urban areas. This is very relevant for the De Ruyterboulevard in Vlissingen which serves as primary seawall defence and has no substantial soft defence lying in front of it. The traditional way of adapting a hard seawall defence is simply ‘lifting it up’ with buildings having to follow, a method for instance advocated in the Pilot Waterfronts Walcheren (ARCADIS, 2009). The difficulty of this way of dealing with the problem is the sequentiality of the climate scenarios and the lifespan of the built environment. Sea level rise, the accompanied increase in wave energy and an increase in storm activity are expected, but nobody knows how fast and to what degree they will develop (the reader is referred back to paragraph 1.1 for an overview of the estimations). So, if you build a hard seawall defence, how do you determine its dimensions and how can you incorporate a safety margin? Moreover, what about the buildings situated next to the boulevards in Vlissingen right now which have not been built with an extra high first floor and are therefore unable to ‘grow with’ the boulevard? Demolish them all and build new ones?

In order to cope with this problematic research is conducted in types of buildings which are flood-resilient and can cope with occasional flooding. Since the primary seawall defence in Vlissingen lies behind the Boulevards Bankert and Evertsen, it is interesting to find out if new buildings constructed here could be flood-resilient with occasional flooding of these two boulevards.

Current floodproof measures of Vlissingen... (Crusio, 2011)

... lead to cosmetic interference in the boulevard profile (Crusio, 2011)
5.3 Flood risk maps of Walcheren

The images on the left show what happens if dike ring 29 succumbs to sea water pressure. This directly shows the weak links in the coastal defence system of Walcheren. Clearly visible is the weak point of the Nolle Westduin which as part of the Weak Links project has been heightened already in 2011. The polder around Rithem east of Vlissingen proves a very weak link too.

In the second stage where relative flooding amounts to 0.8 to 2 metres the boulevards come into view, thus highlighting the importance of their assignment.

The leftover pattern of creek ridges comes back in these maps, reaffirming the historical legacy of this interesting landscape feature.

On the next page the sections of the boulevards are presented again, supplemented by the estimations of the sealevel rise scenarios, showing the need for adaptation of the seawall defence of Vlissingen.

Fig. 71-82 Flood risk maps of Walcheren with underlay of height map. Different stages are:
0. base situation
1. relative flooding 2 to 5 m
2. relative flooding 0.8 - 2 m
3. relative flooding 0.5 - 0.8 m
4. relative flooding 0.2 - 0.5 m
5. relative flooding < 0.2 m
(Interprovinciaal Overleg, 2012; AHN, 2012)
Sections of existing boulevards with sealevel rise scenarios projected into them (Map by author, 2011)
6 Morphology

6.1 Introduction

The morphology chapter of the city of Vlissingen deals with the grammar of the urban tissue and explains the difference in typological sense between different neighbourhoods. Five specific types have been worked out, showing the interrelationship between location, main structure, allotment, building typology, density and the transition between public and private domain. These five have been selected on base of their relationship and spatial proximity to the Spuikom area, the prime design location (see Thesis Plan [paragraph 1.5]).

In figure 27, a simplified version of the morphology analysis is shown. Since the Spuikom area (shown in hatching) is located in-between the types Boulevard Buildings, Historical City Center, 19th/20th Century Ring, Garden City and Green Belt these are the specific types under investigation. Goal is to establish what the morphological context of the Spuikom area is, in order to be able to base the redesign of this area on its surrounding cityscape.

Within these areas examplaric houses are chosen in order to apprehend the morphological character. These are not necessarily houses directly adjacent to the Spuikom area, since it is about the essential of the whole denoted area.

The methodology which is adopted in analysing the morphological types is based on Meyer et al., 2008, in particular chapter three which deals with the specifics of this type of analysis. There is one important deviation in methodology: the main structure there has been drawn as a general neighbourhood structure, whereas here more specifically buildings sharing the same morphological character have been drawn as being part of one structure.

Figure 28 depicts the morphological analysis on the scale of the city of Vlissingen in which the locations of the different types have been pinpointed. In the key, a short description has been given of the main characteristics of these types. Further elaboration is presented in the remaining of the chapter based on the numbering indicated in this map.
Fig. 28 Morphological Analysis of the discussed types in this chapter (Map by author, 2012)
6.2 Type 1: City Center

This is the oldest part of the city of Vlissingen and it has seen many reconstruction phases. Here, the oldest buildings of Vlissingen can be found such as the St. Jacobschurch and the Prisoners Tower. Some of the houses in the area date back to the seventeenth century with typical gables in the facade. In the morphological research, a specific type of buildings has been selected which is representative for this old part of the city and gives a clear insight into the morphological structure.

Allotment and building

The allotments of the inner city buildings are generally small, often only five metres wide, with the buildings situated directly along the walkways. Wider parcels can be found as well in this area, but except from corner solutions they never exceed seven metres. Parcels are not very deep, but they do encompass private back gardens. Buildings are situated in rows, within a closed structural pattern. The stepped gable is characteristic for the facade, as well as the large window panes (see figure 33).

Density

The density indexes show a considerably low Open Space Ratio, even when compared to other inner city areas (cf. Meyer et al., 2008). The canal ring in Amsterdam for instance has an OSR of 0.27, although the open space of the canals helps this figure up (ibid.). For an average of 2.5 layers the FSI or pressure of the built environment is also quite high, with 4.28 the aforementioned canal ring in Amsterdam has a FSI of 1.98 (ibid.). This type is therefore quite dense.
Transition between public and private domain

The transition between public and private domain is quite rigid: the facades of the buildings serve as the barrier between public space and private space (see figure 32). There are no houses with semi-private porches, the doors are directly situated onto the walkway.

The private backgarden is enclosed by the building block and therefore fenced off from and literally out of sight from the public domain.
6.3 Type 2: Garden City

This type is constructed following the principles of the garden city ideas, but on a neighbourhood scale integrated into the urban fabric - as happened a lot in the Netherlands from the 1920s to the 1940s. The buildings are located near the old barge canal in the geometric center of the city of Vlissingen.

Allotment and building

The allotments of the garden city buildings are just as small as those of the inner city, only five metres wide, but with even shallower parcels. The front of the buildings is situated directly along the walkways. Buildings are situated in rows, within a closed structural pattern. The bay window is characteristic for the facade, as well as the curvature of the roof (see figure 38).

Density

The density indexes show a slightly lower pressure of the built environment on the area, compared to the inner city type. Especially the Open Space Ratio has gone up, helped by the wider street profile of main road flanked by parking spaces. Although this type is quite dense in its layout on the allotment, the open space outside these allotments is significantly larger than the small inner city alley ways.

Fig. 34 Structure type 2 (Map by author, 2012)

Fig. 35 Allotment type 2 (Map by author, 2012)

Fig. 36 Density indexes and spacemate graph (Diagram by author, 2012; based on Meyer et al., 2008)
Transition between public and private domain

The transition between public and private domain is quite rigid and comparable to that of the inner city type: the facades of the buildings serve as the barrier between public space and private space (see figure 37). There are no houses with semi-private porches, the doors are directly situated onto the walkway.

The private backgarden is enclosed by the building block and therefore fenced off from and literally out of sight from the public domain.
6.4 Type 3: 19th/20th Century Ring

This type is constructed as a ring encompassing the old city center, with houses built both in the nineteenth century (especially the blocks near the Spuikom area and inner city) and some housing from the twentieth century (more to the northeast). The neighbourhood structure is very ‘block’ like with a couple of main streets (such as the Badhuisstraat) and smaller residential streets.

Allotment and building

The allotments are generally six metres wide here and particular types to be found here are the upstairs-downstairs houses, in which two houses are combined in one such an allotment. The front of the buildings is situated directly along the walkways, after which parking places with trees at intervals are located. Buildings are situated in linear rows, although not always in the shape of the block. The detailed brickwork is characteristic for the facade, as well as the curvature of the roof and the balconies (see figure 38).

Density

The density indexes show a considerably lower pressure of the built environment on the area, compared to the earlier discussed types. The Open Space Ratio almost equals one, which means that the pressure of the built environment is in perfect volumetric balance with the open space of the neighbourhood. This type is less dense than previous ones due to the larger open space outside the allotments.
Transition between public and private domain

In this type too, the front door serves as the barrier between public space and private space. The street profile is more generous than previous types and consists of a main road flanked by parking spaces with trees at intervals, apart from a wider walkway.

The private backgarden is fenced off in a different way from previous example. Behind these gardens a small back alley can be found which is almost completely out of sight from the Spuikom area due to a considerable thick line of trees. No cars are allowed in this back alley.
6.5 Type 4: Park Ring

This type is constructed as a ring encompassing the previous types, with houses built at the beginning of the second half of the twentieth century, although some villas were already constructed in the first half. The neighbourhood structure is very suburban like with separated compositions of two buildings along smaller residential streets.

**Allotment and building**

The allotments are considerably wider here than in previous types with the front portion not completely covered by the buildings, which span 6.5 metres per house. These houses are configured two-by-two, with individual back and front gardens. Groups of two buildings are separated by private driveways. The front of the buildings is therefore not situated directly along the walkways, but with a private garden in-between. Buildings are situated in linear groups, following the street pattern. The large simple lines in the facade area characteristic for this type, with modern window proportions compared to the traditional large window panes of previous types (see figure 38).

**Density**

The density indexes show a low pressure of the built environment on the area, primarily as a result of the large parcels. The Open Space Ratio is more than one, which means that the built environment takes up less volume than the open space of the neighbourhood. This type is the least dense of the investigated types.

![Fig. 44 Structure type 4 (Map by author, 2012)](image)

![Fig. 45 Allotment type 4 (Map by author, 2012)](image)

![Fig. 46 Density indexes and spacemate graph (Diagram by author, 2012; based on Meyer et al., 2008)](image)
Transition between public and private domain

In this type, the front garden serves as the barrier between public space and private space. The back gardens are also considerable in size and behind them a small back alley is situated. Directly behind this alley way runs the canal bordered by lines of trees. These trees are very representative for the neighbourhood character with houses situated in green spaces, thus giving this type its name Park Ring.
6.6 Type 5: Boulevard Buildings

This type is constructed as a ring bordering the boulevards, constructed in the second half of the twentieth century. The neighbourhood structure is very linear with rows of alternating high and low ‘highrise buildings’ (as in compared to the rest of Vlissingen, not to Manhattan), with towers up to 60 and even 85 metres, the smaller ones being twelve to fifteen metres tall.

Allotment and building

The allotments of this type are the footprints of the buildings themselves, which area situated in the public spaces of the boulevard and the back road of the buildings. The buildings form large continuous rows of linearity, with little breaks in the pattern. The type investigated here is the new Sardijntoren, which serves as inspiration for the other boulevard buildings, since this building has not one particular front, but is oriented to all round (see figure 53). In this sense, the type under investigation is not very typical for the whole area, but serves more as inspiration for the rest of the boulevard buildings.

Density

The density indexes show a huge pressure of the built environment on the area, primarily as a result of tall 85 metre tower. The Open Space Ratio however, is still larger than that of the inner city type, as a consequence of the wide boulevard. This type is clearly the most dense of the investigated types.

Fig. 51 Density indexes and spacetmate graph (Diagram by author, 2012; based on Meyer et al., 2008)
2.21 Transition between public and private domain

In this type, the transition between public and private domain is situated within the building, since the first floor of the lower part of the building consists of services such as a grand cafe adjacent to the main entrance. The all round orientation of the building is inspirational and should serve as example to the rest of the boulevard buildings, with their clear linear facing predominantly the sea and traffic space within the building oriented towards the Spuikom area.
7 Infrastructure

7.1 Contents

This chapter is concerned with the means to get to the boulevard of Vlissingen. In figure 55 analysis is presented showing the contrast between the ring structure of road networks entering the city from the east versus the difficult parallel pattern of roads in the vicinity of the boulevard. Whereas the Badhuisstraat is well integrated into the ring structure and even the boulevard can be reached following the ring of the President Rooseveltlaan, the road structure in the Spuikom area is a mess.

Apart from this network analysis the most important entrance ways of the city towards its waterfronts have been investigated in a spatial manner, by drawing the plan area of the road and an accompanying section. The idea is to get to know how the lines look that converge towards the Spuikom area so as to be able to deal with these in a redesign of this area. Different from previous chapters, this spatial infrastructure analysis is image-based, the drawings should contain all spatial information relevant.

All drawings in the remainder of this chapter are produced by the author (2011) and the different infrastructure lines will only be accompanied by their name, since continuously plan drawing, section and streetview are presented. All streetviews are sourced: (Google, 2011).
7.2 President Rooseveltlaan
7.3 Burgemeester van Woelderenlaan
7.4 Koudekerkseweg
7.5 Paul Krugerstraat
7.6 Glacisstraat

7.7 Aagje Dekenstraat
7.8 Coosje Buskenstraat

7.9 Badhuisstraat
8 Vlissingen compared to the rest of the coast

On this and the next two pages research into the larger context of Vlissingen is presented, which was conducted early on in the graduation process to get an idea of the difference between Vlissingen and other seaside towns. By positioning Vlissingen within the context of the Netherlands and Belgium and relating it to surrounding harbour areas and seaside resorts a better understanding of the city in relation to similar locations is achieved.

Fig. 87 Seaport transfers compared between the Netherlands and Belgium (Map by author, 2011; based on ABN AMRO, 2009; ING, 2010)
Fig. 88 Supplementation of Walcheren and the rest of the coast compared (Map by author, 2011; based on KNMI, 2010)
Fig. 89 Comparison of seaside resorts in the Netherlands (Map by author, 2011; based on Dijkzeul & De Hoog, 2010)
Toolboxes and Empirical Framework
1 Water toolbox

1.1 Multifunctional water defences in urban areas

The water toolbox consists out of integrated multifunctional water defences in urban areas, of which the review paper was the main basis.

The integration of functions is of paramount importance in securing the sustainability of a flood defence type in an urban area, given climate change and the lifespan of the built environment. Although endless technical variations of the dike as type are imaginable (cf. Salagnac, 2007), there are three basic principles from a flood-resilient perspective (Van Veelen et al., 2010):

1. Soil dike: the sloping dike is made of soil and if necessary is supported by additional banks on either the landside or the riverside.
2. Soil dike with hard construction: the dike is partly made up of soil and partly of a hard construction such as a vertical screen replacing the supporting banks.
3. Hard construction: the dike is made up of a hard construction which can be very compact.

Based on these principles Van Veelen et al. (2010) describe six typologies of successful incorporated dikes (see illustration 2): the L-construction, U-construction, retaining wall, climate dike, breakwater barrier and dike park. These are successfully incorporable due to their ability to be integrated into the built environment.

Many variations on these themes have been thought up, such as for instance the Japanese superdike (De Graaf & Hooimeijer, 2008), the dike-in-boulevard which will be executed in Scheveningen, the Netherlands (ARCADIS & ALKYON, 2008), the tidal terrace levee (ARCADIS, 2009) and a stepped dike (Municipality of Rotterdam, 2009) to name a few. Since this paper deals with existing waterfronts, types of flood defence based on concepts like artificial reefs or islands in front of the coast are not part of this toolbox, for inspiration the reader is referred to Dijkzeul and De Hoog (2005). What is quintessential in all these concepts is the integration of flood-resilient measurements with the spatial domain, either by integrating flood defence in a building or by combining a large robust dike with added sellable terrain.

In order to understand the spatial implications of these solutions, the different types are elaborated, following Van Veelen et al. (2010). The most compact type of multifunctional flood defence is the L-construction, although this construction is very hard and abrupt causing a considerable physical barrier (ibid.). To further integration of this water-repellent structure public space could be constructed on top of this element, whereas directly behind it space is
available for private developments.
The same goes for the U-construction, which has the additional benefit compared to the L-construction that a parking function can be integrated within the water-repellent structure (ibid.).
The retaining wall serves as a space saving alternative to the traditional dike in that half of the dike is replaced by this structure. Integration with urban development is possible by integrating the structure into buildings.

These three hard structures all have the disadvantage that they are very inflexible (ibid.). Given the uncertainty in climate scenarios on what the actual increase in water level will be, this means that structures need to be oversized to keep open the option of heightening in the future.

The other three typologies are more spacious in design. The climate dike in particular is an oversized dike which adopts a more strict safety standard than the Delta Committee (2008) prescribes, since this inflexible robust solution is meant to last (Van Veenlen et al., 2010). The concept basically is that urban development and dike slide over each other, making this solution highly integral. Although its footprint is large, it functions much less as a barrier than the earlier described typologies.

The breakwater barrier is actually not a ‘full’ dike typology but rather deals with one important aspect of dikes (ibid.): energy diminishment of incoming waves. Interesting is its multifunctional character combined with the decreased barrier function and its suitability to be combined with other dike types (ibid.). An important example of this type is the mangrove forest, which is advocated by Tri et al. (1998) as a natural resource management to mitigate climate impacts, as can be found in Vietnam.

The third more spacious dike is the park dike, since almost exclusively it is believed that trees should not be integrated in a dike in order not to hamper its constructional base (Van Veenlen et al., 2010). The simple concept is the heightening of a traditional dike in order to acquire sufficient soil for tree root development, without interfering with the construction of the dike. Spatially, this type introduces a whole new conception of a dike slope, since all throughout the Netherlands for instance dike slopes are generally unplanted (Bobbink, 2009).

Another important aspect when dealing with the threat of flooding in urban areas is how to make existing buildings flood-resilient. In that respect, the article by Manojlović and Pasveer (2007) is very interesting. They describe flood mitigation strategies for existing buildings based on two concepts: dryproofing, in which buildings are actually kept dry, and wetproofing, in which part of the building is flooded but is adapted to that. The methods described by them might prove a useful supplement to earlier described multifunctional flood defence types, where redevelopment is not (immediately) wanted.

Stalenberg and Vrijling (2006) promote the idea of the adaptable flood defence, describing its two most important features. Apart from the multifunctional use of the flood defence which was already described above they add the concept of adaptability. Specifically, they describe a building of which the foundation has been constructed in such a way that it not only is flood-resilient but also strong enough to expand the number of floors of the building later on (ibid.). This adaptability is incorporated in the above examples as well, either in the form of an oversized dike or a hard water-repellent structure with added foundation to be expanded later on.

Apart from these principles, the water toolbox contains specific information about the consequences of the climate scenarios for the case of Vlissingen: what exactly does Vlissingen and its seawall defence need to deal with?

Furthermore, these water threads based on different safety standards are drawn in section over the current seawall defence: thus showing the impact of the consequences.

In the second overview of sections, these threads have been coped with, making use of principles of multifunctional integrated water defence types. The
use of these types is now very literal and in later elaborations of the design intentions these need to be better translate into a context-specific design. Moreover, the dimensions of the climate dike have been determined following Van Veelen et al. (2010) into overdimensioning so as to be extra safe since this is an option build to last. However, the enormous length drawn is necessary to combat the threads of piping underneath the dike, which is less relevant in the case of Vlissingen since here the hard boulevard construction and the soft sandy seabed provide an extra basis against this process.

Integration of these principles with the other intervention methods (learned from the Spatial Toolbox and the Empirical Toolbox and based on the Site Specific Analysis) is still necessary.
Fig. 9 Section with integrated water defence types literally drawn into the area (Maps by author, 2011)
2 Spatial Toolbox

2.1 Contents

The spatial toolbox was developed in order to be able to rationalize the redesign of the Spuikom area along different design principles. Therefore, the work by Beune & Thus (1990) forms the contents of the toolbox, since they analysed design principles dealing with the assignment of fragmented urban open space.

In figure 10 the basis model of Beune & Thus (1990) is presented, with their representations of the principles in figures 11 to 20. Below descriptions of the first two principles are given, the other eight have analogous descriptions of their methodology.

There are two possible ways to make use of this toolbox. The first is just plain trying out of the principles on the design location in order to play with the figure ground configuration (an example can be found in figures 21 and 22) and acquire new ideas. For the integration with other design methods, such as the Water Toolbox or the Empirical Framework this will prove problematic. Therefore, the second method might be more interesting: to find out the pros and cons of each principle and to consciously adopt a certain principle based on a specific design question.

Principle 1: Completion

“Frayed, incomplete edges are completed, connected by means of one single architectural device” (Beune & Thus, 1990, p. 156).
“The result is an enclosed space with a clear geometric main form” (ibid.).
“The new dominant form bears little relationship to existing patterns” (ibid.).

Principle 2: Dissection

“The existing complex space is dissected into a number of geometric forms” (Beune & Thus, 1990, p. 157).
“The new enclosure appears to be adapted to the existing form and street alignment” (ibid.).
“Volumes are completed, free-standing objects are either absorbed into surrounding volumes or are given a prominent place” (ibid.).
Fig. 11-20 The ten principles represented on the basis model (Beune & Thus, 1990)

Fig. 21 Fragmented urban open space on design location Vlissingen, Spuikom are (Map by author, 2012)

Fig. 22 Principle 1: Completion on design location Vlissingen, Spuikom are (Map by author, 2012)
3 Hamburg HafenCity

3.1 Introduction

The case study of Hamburg HafenCity is conducted specifically with the boulevard buildings in Vlissingen in mind. It focuses firstly on the way flood-resilience measures have been resolved within the buildings on the Sandtorkai. Secondly, the relationship between these waterfront buildings is investigated to serve as inspiration for the relationship between the boulevards in front of the buildings and the Spuikom area behind in Vlissingen.

3.2 Flood-resilience and the wish for spatial integration of the waterfront

There was a specific wish for the Hamburg HafenCity development not to build dikes in-between the urban areas which were going to be redeveloped, in order to keep the spatial continuity towards the waterfront – to secure the ‘leap across the Elbe’ (Hafencity Hamburg GmbH, 2011). Rather, a type of flood adaptability was sought after, safeguarding the developments from increase in Elbe fluctuations whereas simultaneously providing spatial quality and attachment of neighbourhoods to the waterfront.

The interesting result is an area in which flooding can occur and buildings have been adapted to that occurrence. As can be seen in the section shown to the right, the buildings have a very specific vertical zoning. The first floor of the building which is at street level starts at the top of the parking deck below (Reed, 2010). The residential or commercial units start one storey above this level, appearing over two storeys over the water promenade (ibid.). From the first floor downwards two storeys of parking are constructed with flood gates.
3.3 Relation to public space

The relationship of the buildings with the surrounding public space is very well designed. The buildings do not have a unilateral focus on the waterfront, but are oriented to all four directions. The broad two-by-two street layout is thus not left as an infrastructural evil but embraced as a public street, part of active public life.

During flooding large parts of the public space at Sandtorkai disappear beneath the water, see the images to the right. The layout of public space and water space has been carried out in such a way that active public life is provoked.

3.4 Lessons learned

The Hamburg HafenCity case study has generated three important lessons:
1. By adapting buildings to occasional flooding public space can remain on the same level, furthering integration.
2. All around orientation of the waterfront buildings helps in creating an active waterfront.
3. Breaking the line of boulevard buildings in Vlissingen would help the integration of the waterfront as public space.

Fig. 26 Quay underneath the buildings (Reed, 2010)

Fig. 27-30 Public space during flooding (top: Reed, 2010; middle & below: Bruns-Berentelg, 2008)

Fig. 31 The transition between public and private space (map by author, 2012)

Fig. 32 Architectural diversity per building (Bruns-Berentelg, 2008)

Fig. 33 Turned away buildings in Vlissingen (Map by author, 2012)

Fig. 34 The layout of public space and water space: active waterfronts (Bruns-Berentelg, 2008)
4 Alphen aan den Rijn

4.1 Introduction

Given the dominance of the parallel main axes the boulevard and the Badhuisstraat in Vlissingen, a case study has been carried out into a project which deals with the specific problematic of a dominant axis functioning as a barrier: Alphen aan den Rijn.

4.2 Historical development: the city turns away from its main artery

Research carried out by HKB stedenbouwkundigen (2005) into the historical development of Alphen aan den Rijn shows that ever since the city first formed along the river banks, it continued to grow away from this dominant axis. Not only in terms of expansion (this is actually quite logical, for where else could the city expand) but specifically also in the morphological layout and the orientation of public space. Although networks of public spaces grew on both sides of the river, the river itself as public space was until 2005 never incorporated (ibid.).

Figure 37 shows more clearly the developed networks on both sides of the river without fully integrating this central element.
4.3 The proposal

Based on the morphological analysis of the city showing how it in the course of time turned away from its main axis, the translation to proposal was quite logical and straightforward: re-embrace the river axis. In order to do so, the most important east-west axes were taken up and supplemented by a bridge, a public square and a better integration of surrounding buildings (HKB, 2005).

4.4 Lessons learned

The most important lessons learned from this case study are:

1. A sound morphological analysis provides a good basis for a redesign of fragmented urban space.
2. Axial cross relationships can be strengthened by embracing the axis through means of buildings surrounding it, new public space of new (infrastructure) connections.

In Vlissingen the problem is almost similar, albeit here two dominant axes are discernable: the boulevard and the Badhuisstraat, ignoring and turned away from the Spuikom area in-between. Reconnecting the lines through this area is an interesting solution to this problem, in which the methodology of HKB stedenbouwkundigen is most certainly useful.
5 Lochem

5.1 Introduction

The masterplan by Rijn Geurtsen & partners (2009) is all about the continuation of important structural lines. That is the main reason why this case study was chosen. It is furthermore characterized by its wish to re-integrate the waterfront which it historically encompassed, a connection which was lost over the last decennia.

5.2 ‘Durable spatial hull’ as main starting point

In order to be able to continue structural lines, first an inventarisation needs to be made of such lines and more specifically which of these are viable to extend onto the waterfront. Therefore RG&P (2009) drew the ‘durable spatial hull’ of Lochem, that is, those structural lines which have a particular historical and spatial quality and which are suitable and wanted for extension.

5.3 Extending the hull

Based on this structural layer, reference points were taken up and extended unto the waterfront. In particular the water structure and the road networks were taken up to give form to the extensions of the hull. In the impression shown below, these structures have been highlighted, thus pointing out the original inspiration for the waterfront redevelopment.
5.4 Lessons learned

The most important lessons learned from this case study are:
1. defining a ‘durable spatial hull’ proves a very insightful analytical tool, directing the design.
2. Landscape and infrastructure features are important reconnecting tools, continuing lines which are a central part of the city.

In Vlissingen the ‘durable spatial hull’ around the Spuikom is characterized by landscape lines, infrastructure lanes and public spaces.
III Design
1 Design Strategy

1.1 Introduction

In this chapter the intentions underlying the design are elaborated upon. Following a short reiteration of the earlier mentioned problematic and the design goal which needs to be achieved in the Spuikom area, a stepwise explanation is presented of the key elements of the design. After that different details of the design are presented.

1.2 Re-stitching the Spuikom area

The proposed new connectivity of the Spuikom area stems for an important part from its historical origin. Although history alone cannot be an argument to bring something back, it does signify a certain sense of place, a *genius loci*. Since the Spuikom has always been an empty flat and significantly large open water body bordering the city centre, it is connected to the spatial sense of a wide open flat space.

Based on the analysis of the city fragmentation and the statement that the water should be the unifying connector once again in Vlissingen (following the original situation) the Spuikom is the essential link between the canals of Walcheren and the inner city ports of Vlissingen. Given its historical sense of place the water is brought back into the shape of a flat water body. Although the function as flushing basin is gone, the water can now be used for recreational purposes as well as for water retention, dealing with the problem of increased and more unexpected precipitation.

Apart from this sense of place five spatial problems have been identified for the city of Vlissingen which come together in the Spuikom area. The assignments linked to these are:

1. Strengthening the seawall defence in view of future sealevel rise
2. Re-linking the water and green structure, in particular connections between the green belt of Vlissingen and its inner city and the re-activation of the small canals of Walcheren.
3. Improving the spatial quality of the connection between inner city and the dune area.
4. Increasing waterfront permeability.
5. Countering city fragmentation in building morphology.

The research is below schematized into the problem of Vlissingen as a whole and what aim and strategy have been developed to counter these. Based on this scheme, the same can be done for the Spuikom area itself, schematizing the way the urban fabric should be re-stitched to the water. After that the design build-up is presented in different steps.

1.3 Design problem, strategy and aim

The problem of Vlissingen as a whole is the fact that it has developed from a unique proud seaside town into a generic coastal city which is very fragmented. To counter this fragmentation the design strategy makes use of the historical heritage of Vlissingen and aims to re-link the urban fabric to the water. Water will be the connecting element in the fragmented city of today. Following from the statement of its fragmentation, two major waterfront assignments have been identified: Spuikom and the station...
area. Following the analysis these two areas should be re-attached to the city structure and be connected through means of the water. Based on the sense of space that has always characterized the Spuikom area, the redesign area takes up the water connection and re-introduces a Spuikom water body although now with the function of recreation and retention rather than that of flushing basin. The different spaces surrounding the Spuikom area (see also figure 1) need to be re-stitched to this new water element. In that sense the borders of the new water form are at the centre of design.
1.4 Stepwise explanation of design interventions

In the next figures the build-up of the design is presented in simple line drawings to make clear how the different assignments have been incorporated and worked out in the design. The author is aware that there comes a certain danger with this way of presenting, namely that the different assignments have been taken up one after another and that the outcome of the design is a sum of its parts rather than a holistic answer to the problems posed. For clarity’s sake however, this is a useful method to pinpoint the key elements that in particular deal with one of the problems described.

The first steps undertaken are the clearing away of existing border lines such as the Spuikom road, the ambiguous water form in the middle and the blocking tree lines. Parking surfaces are removed and will be integrated into the dike (more about that later). Then the initial concept for the area is projected upon the site: the historical layout of the Spuikom flushing basin along with the port axis in the city centre. This has been done in a direct way, without attention for existing structures. The idea behind this approach is that following the solving of the other design issues the water form will automatically change along with these developments. See figures three to eight.

Fig. 8 Vlissingen by the end of the 16th century (Canon Vlissingen, 2012)
Fig. 9 Bird’s eye drawing Design Spuikers (Map by author, 2012)
Fig. 10 Aerial image Design area Spukorn (Googlemaps, 2012)

Fig. 11 Simplification of aerial map into design location (Map by author, 2012)
Fig. 12 Further simplification into line drawing design area (Map by author, 2012)

Fig. 13 Step 1: Delete boundaries (Map by author, 2012)
Fig. 14 Cleared out design area (Map by author, 2012)

Fig. 15 Re-introducing the flushing basin and water connections (Map by author, 2012)
Based on the analysis into integrated seawall defences (see water toolbox), a specific integrated solution was developed for the case of Boulevard Bankert. Since the existing profile of the boulevard of Vlissingen has been identified as a quality as well as the fact that the shipping channel is so close to the shore - providing unique views of large container ships sailing close to shore - the design seeks not to change this quality. Whereas the current Vlissingen floodproof model involves cosmetic changes and deterioration of the unique profile of the boulevard, the design seeks to leave the profile as it is. This can only be done by creating floodproof boulevard buildings along the waterfront, akin to the buildings in Hamburg Hafencity. But then the problem of heightening the primary seawall defence has not yet been addressed. Here the problem of the parking surfaces in the Spuikom area now prove valuable input for seeking an integrated solution. Since the redevelopment of this area is a huge operation the seawall defence should be strengthened based on a wider time horizon. Therefore the basis of this defence is a climate dike, a dike sufficiently wide and strong enough to last at least 200 years. Because of the sewards buffer zone of boulevard and flood-proof boulevard buildings, this climate dike can be integrated with parking without inflicting too much constructional damage to its core. Figure 9 shows the combined elements that make up the future seawall defence of Vlissingen.

If the climate dike is meant to last 200 years its height needs to be updated to 14.0 metres above NAP (see the water toolbox for a detailed section with scenarios). This means that in order to create an acceptable slope, the water body needs to be shortened. The former connection to the sea is also superfluous, since the ports will be flushed automatically, without the use of the Spuikom as flushing basin.

In the next step the problematic of the connection between inner city and dune area is under focus, for which the key design element is the dune park. Since the flushing function of the Spuikom area won’t be needed, the small Spuikom to the west is superfluous as well. Here the demand for a connection towards the dune area leads to a parklike setting in which the dune landscape has been abstracted into ‘grass dunes’. Provided with tree groups this undulating grass landscape provides an ideal relax and wander terrain with multiple paths running through the grass dune landscape. A theatre is designed here as well to make the park more livelier and add to the cultural demand of the city of Vlissingen. This theatre makes use of the slope lines following the construction of the seawall defence and is oriented towards the landmarks the Watertower (+35m) and the city hall. Since parking is integrated into the seawall defence, the spatial quality of the road behind the boulevard buildings, bordering the Spuikom area increases significantly. Provided with a tree lane this road is to become an attractive connector between city and dune area.

Combining the waterfront permeability problem with the morphology analysis identifying fragmentation as problem, in figures 19 and 20 the key design interventions to counter these are shown: creating an extra connection to the boulevard and ‘finishing’ the building blocks along the Badhuisstraat, in order to make them face the park as well. Part of the boulevard buildings is adapted as well into an intermediate building height level, following the analysis presented under Water Permeability.

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Fig. 16 The proposed integrated seawall defence (Map by author, 2012)
Fig. 17 Introducing the climate dike (Map by author, 2012)

Fig. 18 Connecting city centre to dune area (Map by author, 2012)
Fig. 21 Integrating the water form into the city structure (Map by author, 2012)

Fig. 22 Total design intervention (Map by author, 2012)
2 Design Outcome
2.1 Profiling the water

Although the intervention of bringing back the water into the city of Vlissingen seems quite blunt in that it forces water onto existing structures in a large area, a closer look reveals that it is not that difficult. In the current city layout the former water structure can still be perceived based on the profiling. Only now it has become scar tissue: former ports have dissolved into a park area, parking places, an oversized entrance zone to the shopping area and the undefined left-over space of the Spuikom area itself. The only true new profiles pop up in the Spuikom area where a connection is made between the city hall square and the new boulevard square through means of a bridge and the extended dune area with undulating dunelike surfaces.
Fig. 25 Section dune area

Fig. 26 Section bridge
2.2 Planting

Since the project location is under direct influence of sea wind, planting needs be able to withstand not only strong winds but in particular the salt that comes with sea wind. Apart from this crucial demand, trees have been selected following their shape and park tree aesthetics. The trees used will be briefly discussed below.

2.2.1 Populus tremula

Characteristic for this tree are its rustling leaves, even when there is not too much wind. The tree crown of the tree is oval shaped and is highly wind resistant. For that matter these trees make up the lane along the 14m dike.

2.2.2 Populus x canescens

A crossing between P. alba and P. tremula which grows very fast into a tree with a loose but tight crown. Common in parks and along canals, also often planted as solitair (Van den Berk, 2012).

2.2.3 Fraxinus excelsior ‘Eureka’

This fastgrowing tree develops a wide cone shaped crown and grows as tall as 20 metres and 15 metres wide. ‘Eureka’ is particularly succesful along wide lanes and in green strips (ibid.).

2.2.4 Ulmus ‘Clusius’

This upright Ulmus species grows in the shape of a column first, only to grow into an oval shape later on. Ulmus species are in general very well capable of withstanding the salty seawind, but a common problem is the elm disease. This kind has a high resistance to this disease, making it suitable to plant and even mixture with other Ulmi.
2.2.5 Ulmus ‘Lobel’

This Ulmus is a crossing of multiple Ulmi: U. glabra ‘Exoniensis’, U. hollandica ‘Bea Schwarz’ and U. wallichiana (ibid.). Forms a straight upright growing tree, with outstanding lateral branches. Although these trees grow to become 15-18 metres tall they are only 4 to 5 metres wide, making them ideal for appliance close to urban fabric.

2.2.6 Ulmus ‘Columella’

An elm specifically bred for the purpose of elm disease resistancy, with a typical leave structure often twisted, rotated and crimped (ibid.). Because of its very small growth this Ulmus is very suitable as lane- or streettree.

2.3 City intervention

On the next page the intervention of bringing back the water in the inner city and Spuikom area is shown. This map clearly demonstrates the design goal of re-stitching the urban fabric to the water. Since this intervention was based on the premise of re-activating the smaller water network of Walcheren, it might prove valuable for other cities in Walcheren too, which used to lie close to the sea but over time have lost this connection and at a certain time also filled in their ports and water surfaces. Notable examples of this are Goes and Middelburg. In the last city the beautiful inner canal structure has been preserved and this could prove a good starting point to link this city up to the wider network.
3 Design methods

3.1 Introduction

In this part a couple of design methods are shown, which in particular helped in the process of designing.

3.2 Use of 3D

When a new primary seawall defence at 14 metres height is introduced in an area in-between a boulevard at 8 metres and the rest of the nearby city at 2 metres it becomes apparent that it is vital to grasp this difference in level in a fruitful way. The only way to understand the situation was to design with elevation lines and test that in a 3d model. This model subsequently formed the base for the placing of certain elements in the design such as the theatre and trees.

3.3 Reference studies

Another important design method closely related to research is the study of references. For this project in particular the reference parks Valkenberg in Breda and Beatrixpark in Utrecht were fruitful sources of inspiration to get an idea what spatial character can be realized within a park and what dimensions come with a specific type of character (for instance, park Valkenberg has curvy fast main path lines with subsequent wandering routes with quite an amount of trees whereas Beatrixpark has a lot of open space and one direct route cutting through and multiple pathways not per se linked to that route).
3.4 Wave pattern analysis

Large square

Padrão dos Descobrimentos Ussabon
Copacabana Rio de Janeiro

Stadtüleplein Vilsingen

La Rambla Barcelona (estudio OCA)

La Rambla Barcelona

Enlarged x4

Enlarged x8

Design

1 2.5
Scale Comparison Spuikom

Beatrixpark, Utrecht

Park Valkenberg, Breda

Museumplein, Amsterdam

Vondelpark, Amsterdam

Jardins du Château de Versailles, Versailles

Giardino di Boboli, Firenze
4 Conclusion

The goal of this graduation project was to re-stitch the urban fabric to the water in the location of Vlissingen. Water is proposed to be the connecting element in the fragmented generic coastal town Vlissingen has become, because Vlissingen used to have a very strong, clear and unique relationship with the water in and around it. It can once again be the unifying element that separates Vlissingen from other seaside towns. The specific design location the Spuikom was chosen for the fact that it’s one of the two missing links in the fragmented city of Vlissingen - apart from the station area - in which all spatial fragmentation problems which occur on the scale of Vlissingen also apply. Based on the strategy of bringing back the water, the area is further developed following the surrounding elements dune area, seaside boulevard, city hall and 19th century city and the historical inner city. By re-attaching these different areas to the new water body it is believed that the fragmentation on city level will decrease.
5 Recommendations

5.1 The integrated seawall defence

The proposed integrated seawall defence should be tested or more extensively researched by someone who really knows how these constructions work, i.e. a civil engineer. Although interviews with civil engineering experts have taken place and the concept is rooted in research into these structures by others, it still entails a new design. One crucial aspect of the seawall defence is its dimensions. In Vlissingen it proved necessary (based on the time span of 200 years for an integrated climate dike which needs to be floodproof for so long because of the developments it is integrated with) to heighten the existing seawall up to 14 metres. Thereby, the barrier between city and boulevard only increased and the design needed to take this into account very well and try to bridge this large gap in elevation. Further research should delve more deeply into this elevation matter, which is quite a problem for these locations and to which as a separate problem I have not really found an answer, other than to use the difference in elevation to create a parklike landscape and bridge it literally by means of a bridge.

5.2 Re-stitching the relationship between water and the urban fabric

The most important aspect of the design has been the reconnection and re-enactment of water in the city of Vlissingen. In the current urban fabric the dimensions of the former water bodies can still be found, albeit they are now scar tissue in the structure of the city. Based on the sections it was considerably easy to re-introduce the water into the city. This method helps against the future climate challenge of more, more unpredictable and heavier rainfall since the total amount of surface water is increased, thereby being capable of more retention. Of course this is method is far from new and is being adopted throughout the Netherlands, for instance in Amsterdam with its Unesco canals. This only strengthens the argument to investigate this method in cities which have to deal with increasing precipitation and suffer from water floods. To my mind the city of Rotterdam would provide an ideal location to look into historical canal structures and what has become of them today in order to bring these structures back and drive back the dominance of the car. Another example is the revitalization project for the station area in Utrecht, in which the Catherijnecanal will be restored, replacing the infrastructure duplication of the road above.
6 Reflection

6.1 Introduction

In this chapter a reflection is presented upon the graduation process and a number of aspects of the design.

6.2 The relationship between research and design

The aim of this graduation project is to find solutions for re-stitching the relationship between water and the urban fabric while keeping in account the future climate challenges. In that sense the lessons learned here in the case of Vlissingen need to be able to provide input for similar problems elsewhere. Observations have already been made throughout this thesis on the applicability of solutions found here for assignments elsewhere, for instance: the waterfront permeability problem seems (at least for Dutch and Belgian coastal cities) to be a generic problem when high-rise buildings are involved; research into the integrated seawall defence might provide food for thought elsewhere, in particular the combination of different seawall methods and the creation of parking space within the dike; bringing back historical canal structures and enlarging the total amount of surface waters is in fact a solution which is already applied on a large scale, for instance with the Amsterdam canals and the Catharijne canal in Utrecht.

Apart from findings in this project which can be implemented in other assignments with a similar problem field, the relationship between research and design needs to be encountered on the basis of this project alone as well: have the problems identified through means of research been solved in the design? I think that the most urgent problems have been addressed in a good way, whereas a couple of identified spatial problems were not fully integrated into the design. To my defence, I can say that the prime target of the design was to counter the most important problematic of Vlissingen: the loss of the relationship between its urban fabric and the water which is an essential part of its being. But take for instance the waterfront permeability problem: in essence, the waterfront permeability decreases when implementing a further barrier between the city and the boulevard (the water body the Spuikom). Of course a new connection was designed here in the shape of a bridge, but it shows that some problems were deemed more important than others, based on the design outcome. Although I am still in support of this fact, it serves as an interesting critique and stimulates me to be aware of the fact that some aspects of the research got favoured over other aspects and received more and better attention in the design.

6.3 The relationship between studio theme and this case

With delta interventions being the studio theme, Vlissingen located in the only delta area left in the Netherlands of which the whole coastal area used to be one giant deltaic area, this case serves as a paramount example of the studio theme. It combines the water safety issue with urban (re-)development and as such is a direct outcome of the line of reasoning of the studio. Apart from the water problematic specific spatial problems have been identified and studied on the level of the whole city, down to the selected test site for further research and design. This approach seems natural to me in view of the fact that it was carried out in the field of Urbanism.

6.4 The relationship between the methodological line of approach of the studio and the method chosen in this graduation project

An important part of this graduation project lies in the understanding of the actual water threats, both in general as well as specifically for Vlissingen. In that sense this project links up closely to the approach of the studio as well. A striking difference is the area under investigation which has been worked out into a design. Surveying the work of other group members I found out that a vast majority of them focus on the dike c.q. primary seawall defence and the area
in front of it, that is the area between sea and dike or boulevard. Here the focus lies with an area behind the primary seawall defence, making possible a connection between city and waterfront through this area. In that sense, this project seems to focus more on a particular urban problem field, whereas other projects are more concerned with water management and civil engineering.

6.5 The relationship between the project and the wider social context

The focus of this project always lay with the city of Vlissingen and its inhabitants: the aim was to improve the conditions and urban structure of the city itself and not just create a more attractive seafront for visiting tourists. In that sense the wider social context is the fact that you do not look towards this location with a profit view full of exploitation possibilities but try to make the area better for the city itself.

6.6 Graduation process

To be honest, this graduation year was quite an arduous task. Partly this has to do with the fact that I have not often enough experienced the design process - in particular the anxiety that comes with it when not knowing what to do or where to start. Because I acquired my Master in Urban Planning in Utrecht previously (2004), I was accepted in the Master of Urbanism at the TU Delft provided that I followed a transition year of the Bachelor in Architecture. Although I passed this year without a doubt and acquired the necessary technical skills along the way, in retrospect I can state without a doubt that the lack of experience in design process took me tremendous effort.

Partly I saw this coming and therefore I made an extensive analysis of the design location following the reasoning: if I know everything about the place, surely I will know what is needed and what the design should look like. Although in part this is true - since the analysis has helped a great deal in getting to the final story as it lies before you now - the relationship between research and design proved difficult and time consuming. Not until late did I fully comprehend the way in which the analysis should inform my design. Earlier design attempts were basically nothing more than a collection of multiple little assignments, without a clear concept and without specific design guidelines. Only by taking the time to take some distance from the hard work and reviewing the analysis did the importance of water in the city of Vlissingen emerged as a central theme, for which the design of the Spuikom area could be used as a test site for the spatial problems identified in Vlissingen while simultaneously re-stitching the urban fabric to the water.

Colophon

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