

NO CALM BEFORE THE STORM

A landward coastal defence alternative in the Westland as guide for new spatial developments

Judit Bax

Graduation thesis Urbanism, Delft University of Technology

in cooperation with the Rijkswaterstaat
National Institute for Coastal and Marine
Management /RWS RIKZ.

June 2005



TUDelft

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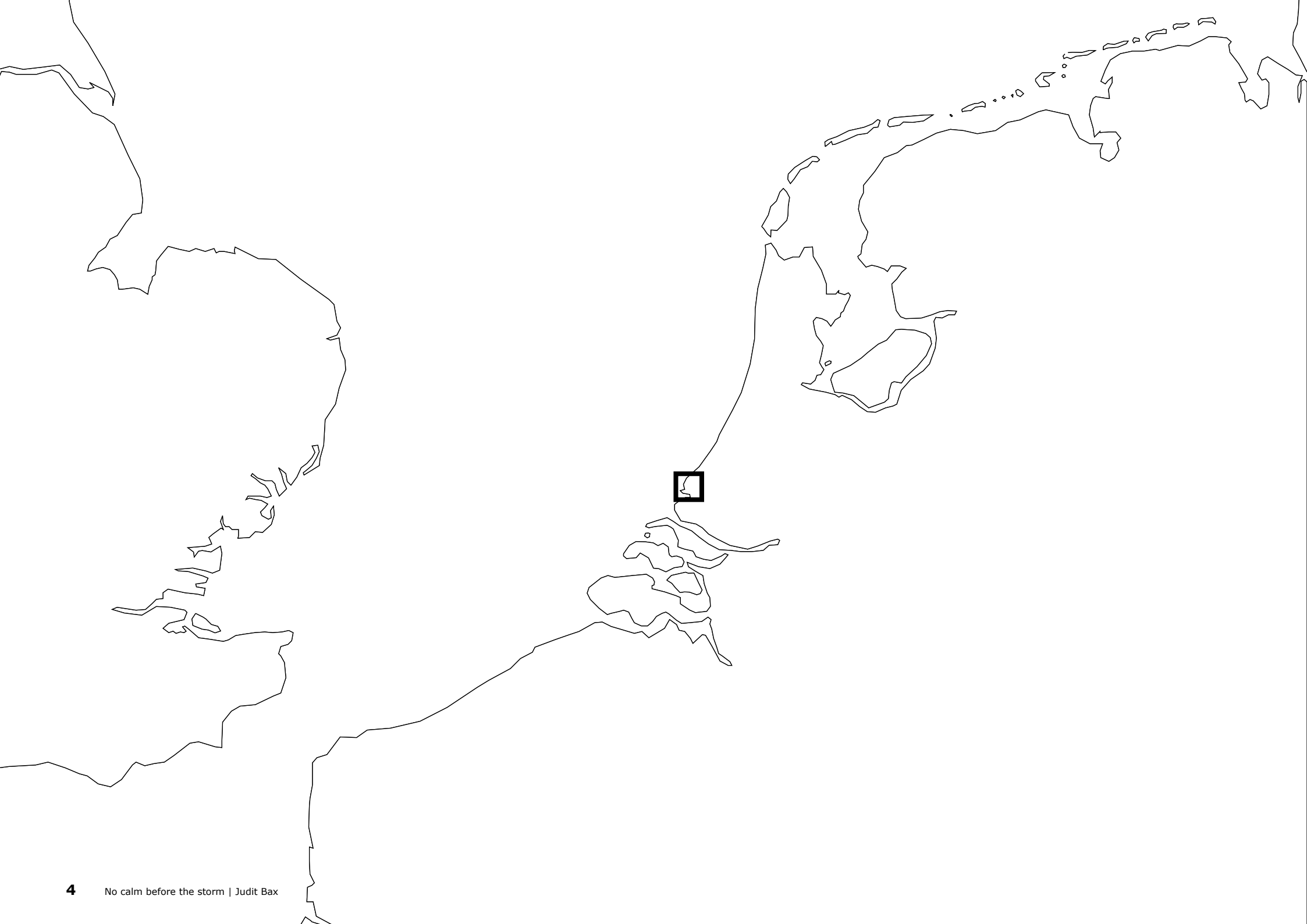
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Tussen wolken en aarde de tekens:
dit waren wij, zijn wij. Kijk maar,
wij graven land uit het water,
stapelen stenen tot torens,
onze blik laat geen ruimte met rust.
Aan de rafelige rand van ons blikveld
raakt het oog nog vluchtig verleden:
het scheve hek, de vergeten
wan in de graanschuur, het muntgeld
met het scheepswrak mee opgegraven,
de gebroken boog van de brug.
Wij zijn hier maar even, een onrust
die tast in de stilte naar taal,
een wet om angst te beheersen.
Lees maar. Wij hebben bestaan.

Between clouds and earth the signs:
this is who we were, who we are. Just look,
we dig land from the water,
stack stones to towers,
our view leaves no space alone.
At the frayed edge of our horizon,
the eye catches the past still briefly:
the leaning fence, the forgotten
winnow in the granary, the coins
dug up with the wrecked ship,
the broken arch of the bridge.
We are here for only a moment, a restlessness
that feels for language in silence,
a law to control fear.
Just read. We have existed.

Willem van Toorn, 1997

Preface

We are here for only a moment. But the interventions we make on this earth are often far-reaching over a wide time horizon. This fact, that I have become aware of during my graduation project, fascinates me as urbanist.

As a true lover of coast and sea it couldn't be odd that my thesis deals with this subject. I chose the graduation studio 'Delta Design' that has the Dutch lowlands as its study area. Starting from a relatively new point of view, the project could be implemented in WINN (Water als innovatiebron), the water innovation program of Rijkswaterstaat. Therefore this thesis has been done as an internship at the Rijkswaterstaat National Institute for Coastal and Marine Management. For me this was an excellent opportunity to link my project to practice, use the knowledge that is available overthere and experience the work environment of the institute.

Looking back to the start, my graduation project has gone quite rapidly. I realize, however, that I owe a lot of thanks to different people. Of course my supervisors at the TU Delft and RIKZ that were always willing to criticize my findings and help me further. All the other people I visit for advice concerning my project at the university and in practice. The fellow students at atelier 9Zuid which whom I shared life's joys and sorrows. And last but not least my dear and near family and friends that supported me during a confronting year.

Luctor et emergo! These words are characteristic for my experience of the graduation process. A lot of thinking went into things that now seem very simple. Finally, the result is here, in front of you.

Judit Bax
Delft, June 2005

Table of contents

Preface	6
Summary	8
1. Introduction to coastal defence	11
1.1 Motive	11
1.2 Problem definition	12
1.3 Approach	13
2. Natural dynamics and the Dutch lowlander	15
3. Coastal dynamics	21
3.1 Introduction	21
3.2 The sea as sand river	21
3.3 Coastal behavior in the Westland	23
3.4 Result: extensive damming system as a human answer on coastal dynamics	23
4. Atlas of reclamation and urban occupation Westland	25
4.1 Introduction	25
4.2 The rise of the Westland	25
4.3 Westland and its surroundings	39
4.4 Conclusions of atlas	45
5. Scenario's of a Westland with space for coastal dynamics	47
5.1 Introduction	47
5.2 Levels of the Westland	47
5.3 A disaster scenario	47
5.4 The sea breaks in again	49
5.5 Withdrawing land	51
5.6 Guardian, sleeper and dreamer	53
5.7 Consideration	55
5.8 Elaboration of guardian-sleeper-dreamer concept	57
6. Strategic meaning of guardian-sleeper-dreamer	59
6.1 Introduction	59
6.2 Strategic for the safety	59
6.3 Primary nature as part of the metropolis	61
6.4 Nature compensation	63
6.5 A linked dune park system for the south of Holland	67
6.6 A low-dynamic connection	71
6.7 A new orientation for the Westland on its coast	75
6.8 A multiple role for the guardian-sleeper-dreamer intervention throughout time	79
7. Conclusions and recommendations	81
7.1 Conclusions	81
7.2 Recommendations	83
Literature	85
APPENDIX A Levels of the Westland	87
APPENDIX B Dimensions of the sleeper and dreamer dune	89
APPENDIX C Statistics of the Westland	91

Summary

sea, coastal defence and man

The Dutch lowlands are famous for its man-made land. Although the lowlands developed by the influence of sea, wind and sand, today one will hardly experience the dynamics of these natural elements anymore. In the course of time Dutchmen have put the land more and more at the service of welfare and therefore dammed natural dynamics. Together with a rising sea level this makes the land vulnerable for a flood, nowadays.

In the Westland, a conflict between nature and man manifests obviously. The sea has eaten and still desires to eat space from the west of the coast. East, glasshouses extend very close to the coast. What has left is a very small coast strip which has been identified as one of the so called prior weak links in the Dutch coastal defence system. This means that the coast does not meet the safety demands anymore and therefore needs to be strengthened. The current policy is to maintain the coast as its 1990 position. Therefore, sand nourishment is carried out along several places of the Dutch coast. But these regular sand nourishments are not sufficient to solve the problem of the weak links and additional measures have to be taken. Three options are taken into consideration. The first possibility is to maintain the current coastline by strengthening the seaward dunes. Another option is seaward reclamation of new land from the sea. This generates space for new developments and can guarantee extra safety for the hinterland, but brings along an uncertain maintenance. A third alternative that can be considered is a landward solution. In this case, space is given to coastal dynamics and a natural balance can recover. The landward alternative is hardly considered, because it requires space in the already occupied and urbanized hinterland. In the Westland, however, the urban and industrial occupation of land have brought the area in an impasse. This thesis researches if a landward solution in the Westland – in which renewed space is given to natural dynamics – can reconcile an approach of the coastal defence problems with new spatial qualities for the hinterland. Central question is: *How can space for natural dynamics shape a sustainable coastal defence in the Westland that guides new spatial developments?*

a relation between nature and man

In the development of the relation between nature and man in Holland one can distinguish several layers that can be connected to the structure of the physical space. At first man followed nature. At the moment that man decided to control nature on a large scale, the relation to nature changed radically. Today man lives in fact in a second nature, separated from real nature. Giving renewed space for the dynamics of nature supposes the search for a new harmony with nature.

behaviour from the sea side (nature)

The Dutch coast can be considered as the bank of a sand river in which enormous amounts of sand are transported from south to north. In origin it is a dynamic system searching for balance. Nowadays this balance has been upset in the Westland by:

- a relatively rising sea level that naturally moves the coast into a landward direction;
- the spherical shape of the coast between Hoek van Holland and Scheveningen that is unstable;
- the construction of the Noorderdam at Hoek van Holland that diversifies the sea current, which causes a continuous erosion of the Westland coast.

Coastal erosion and the extraction of sand by man caused the natural dunes along the Westland coast largely to disappear, and thus the natural coastal defence. As a human answer on these coastal dynamics, an artificial system has been built.

behavior from the land side (man)	<p>A historical map analysis shows the development of the morphology of the Westland and the way man dealt with this natural foundation in its reclamation and urban occupation of the land in the course of time. Once the Westland was a dynamic nature area, westward bordered by dunes and southward bordered by a very wide Maas mouth. From this Maas mouth, tidal creeks broke into the land and flooded a large part of the hinterland everyday. In the course of time the Maas mouth silted up: a sedimentation process that was followed by man in its reclamation process. From the 9th century a continuous habitation started, at first following nature, living at the higher parts (dunes, river banks and creek back) in the land. As a reaction on a new flood disaster people started to dam nature. Since the 12th century they constructed dikes and canal systems to discharge the water. The Maas dike, finished in 1350, was the first closed dike track from the coastal dunes until the city of Rotterdam. A further cultivation of land destroyed much of the original relief in the Westland: the land had been made suitable for gardening by raising the clay soil and digging off the sand soil. With the rise of the gardening and the development of the glass city, the natural processes that once dominated the Westland have been taken over by a control of man, entirely.</p>
scenario's with space for natural dynamics	<p>To explore the consequences of giving space to the dynamics of nature in the Westland, in this thesis different scenario's have been developed and tested in the landscape of the Westland. A breakthrough at the most narrow point in the coastal defence will be able to flood a considerable part of the south of Holland as there are no large barriers present in the hinterland. This fact is used in the scenario 'The sea breaks in again' in which a tidal creek leaves sediment and creates a natural raise of land. 'Withdrawing land' defines an area behind the narrow coastal defence that can catch sea water. The 'guardian, sleeper and dreamer' is a natural concept, in which a second and third dune row behind the first dune - the guardian - together form a robust protection against the sea. In this thesis the guardian-sleeper-dreamer has been chosen for further elaboration.</p>
strategic meaning of guardian-sleeper-dreamer	<p>The coastal defence function gives the new proposed landscape a certain unassailable position and supposes a natural character. That doesn't mean that the new landscape is just a scenery: in the middle of an intensive urban and industrial landscape its public nature can play an active role. The different spatial meanings that are drawn in this research show this role. All of them connect the nature function of the intervention to a larger scale and in fact place the intervention in a range of spatial interventions and transformations that are historical, present, developing or planned in the future. This research does not make a statement about the exact direction of the spatial developments in the Westland. However, the different strategic roles of the guardian-sleeper-dreamer show the surplus value of the intervention not only for the Westland, but on a scale that is much larger than the Westland, as well. This enables the intervention to guide future spatial developments, anyhow.</p>
a sustainable solution for man and nature	<p>Once it was nature that shaped the land, but in the course of time it was man that controlled this nature and often acted perpendicular to the forces of nature. Nowadays, this makes an area like the Westland very vulnerable for floods. The discovery of the guardian-sleeper-dreamer – a second and third dune in the hinterland – is a concept that, in fact, moves <i>with</i> nature as landward solution for the coastal defence. Just because it intervenes in human structures that are not sustainable anymore in different respects, this solution derives its surplus value. It can fulfill more roles than just the damming one and contribute to a better spatial future for the Westland and its context. As a matter of fact, a new harmony between man and nature is found in the guardian-sleeper-dreamer intervention. This makes the intervention sustainable, in all respects.</p>



1. Introduction to coastal defence

1.1 Motive

**natural
dynamics
versus control
of man**

Holland – the Dutch lowlands – is famous for its man-made land. The most dense urbanized part of the country has been reclaimed from the sea and has more and more been put at the service of welfare in the course of time. Although the lowlands developed by the influence of sea, wind and sand, today one will hardly experience the dynamics of these natural elements any more. However, one of the places where one can experience these dynamics is De Kerf in the north of Holland. Dutchmen dug a groove through the first row of dunes in 1997 and allowed the North Sea to enter the valley behind now and then, with spring tide and a north wester storm. Here it is nature that shapes again. This is in glaring contrast to the Westland area in the south of Holland where a conflict between coastal dynamics and human interests manifests obviously. East of the coast the glasshouse gardening is an important economical pillar for the region, but has eaten and still desires to eat space, together with a growing desire of housing in the region. The North Sea has claimed land from the west side of the coast. What has left is a very small coastal strip which nowadays has been identified as one of the so called 'weak links' in the Dutch coastal defence system (figure 1.1).

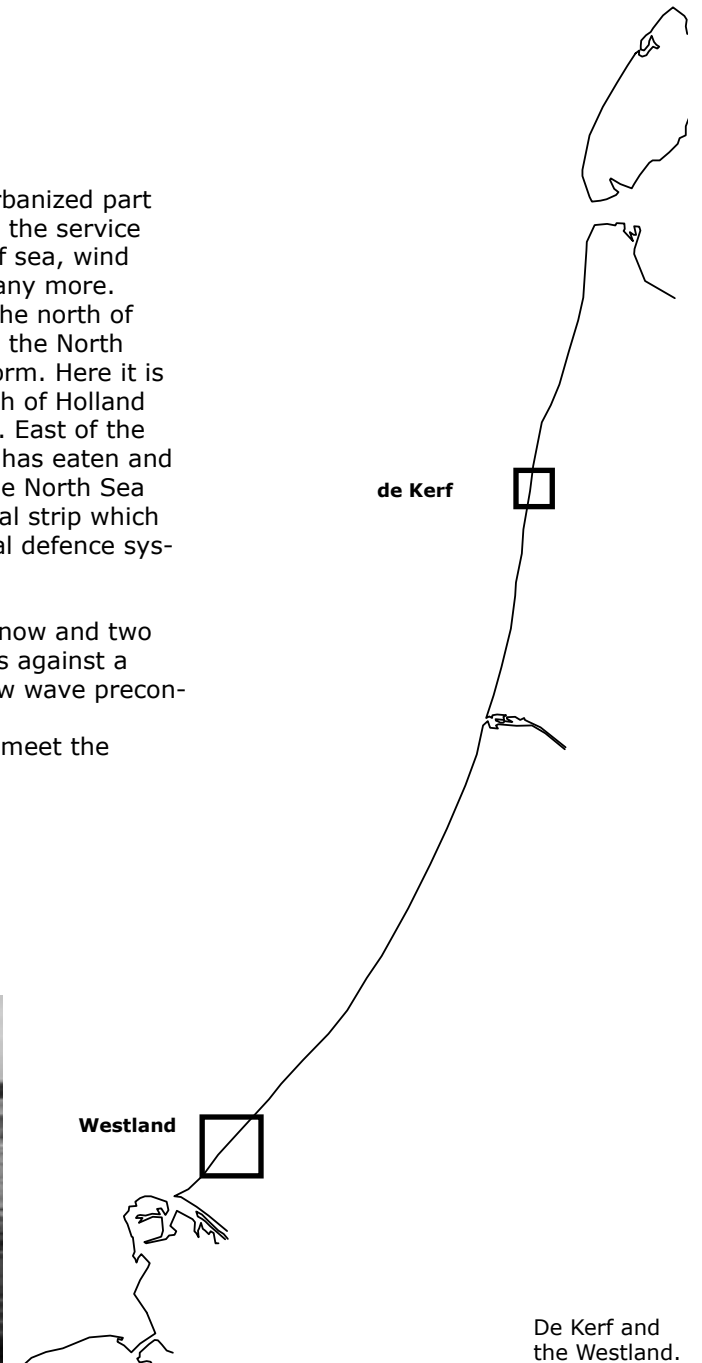
weak link

A weak link is 'a coast section that is expected to have to be strengthened between now and two hundred years (practically fifty years for the time being) to meet the safety demands against a flood of the hinterland in case of a rising sea level, a higher storm frequency and new wave preconditions'. (Bestuurlijk Overleg Kust, 2003 p6)
The coast section between Hoek van Holland and Kijkduin is a prior link: it does not meet the safety demands already and therefore has high priority in undertaking action.

left: The rise of new dunes in the Kerf.



right: The glasshouses in the Westland are approaching the coast very closely.



De Kerf and the Westland.

seaward,
maintaining,
landward

1.2 Problem definition

Expected changing conditions of the North Sea - a sea level rise and more frequent and stronger storms - require more space. Today's economy requires space as well. The current policy is to maintain the coast as its 1990 position. Therefore, sand nourishment is carried out along several places of the Dutch coast. But these regular sand nourishments are not sufficient to solve the problem of the weak links and additional measures have to be taken. Three options are taken into consideration. The first possibility is to maintain the current coastline by strengthening the seaward dunes. Another option is seaward reclamation of new land from the sea. This generates space for new developments and can guarantee extra safety for the hinterland, but brings along an uncertain maintenance. A third alternative that can be considered is a landward solution. In this case, space is given to coastal dynamics and a natural balance can recover. In the table below the three options to approach the coastal defence problem have been plotted:

	<i>concept</i>	<i>spatial examples</i>	<i>strengths</i>	<i>weaknesses</i>
SEAWARD	Constructing with nature	Holland Bolland; Plan Waterman	New land; Extra safety	Sand nourish- ments needed to sustain; Uncertain sustain- ability
MAINTAINING	Sand nourish- ments Hard defence	Scheveningen; Hondsbosche Zee- wering	Protection of de- veloped hinterland	Increasing vulner- ability
LANDWARD	Space for natural dynamics	De Kerf	More robust coastal defence; Recovery of nature	Loss of developed land

landward
alternative

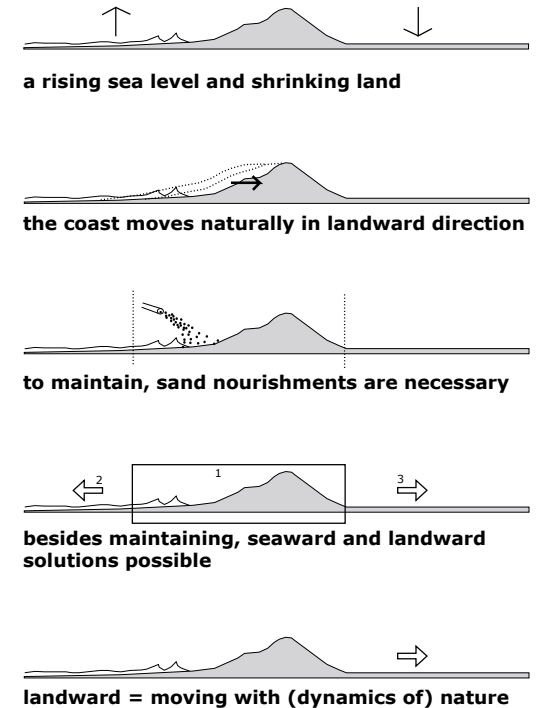
The landward alternative is hardly considered, because it requires space in the already occupied and urbanized hinterland. In the Westland, however, the urban and industrial occupation of land have brought the area in an impasse.

Objective

This thesis researches if a landward alternative – in which renewed space is given to natural dynamics – can reconcile an approach of the coastal defence problems with new spatial qualities for the hinterland. By that it aims to find a reasonable breakthrough in the impasse of pressure from man and sea on the coast.

Central question

How can space for natural dynamics shape a sustainable coastal defence in the Westland that guides new spatial developments?

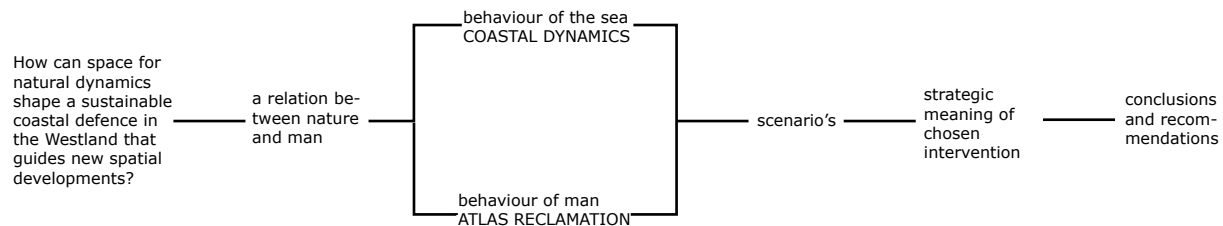


1.3 Approach

To specify the central question in this graduation thesis, the following sub questions are listed:

- What is the role of nature and its dynamics in the life of the Dutch lowlander?
- What are coastal dynamics?
- How did Dutchmen deal with these dynamics in their reclamation and urban occupation of land in the Westland?
- What new landscape can arise if space is given to coastal dynamics?
- What can be a strategic meaning of the chosen intervention for the Westland and its metropolitan context?

The working out of the first three questions form the theoretical framework of the graduation research and the last two questions stand for designing the intervention.



The research questions are elaborated in the five following chapters. Finally the outcome of this research and suggestions for further research will be treated in the conclusions and recommendations.

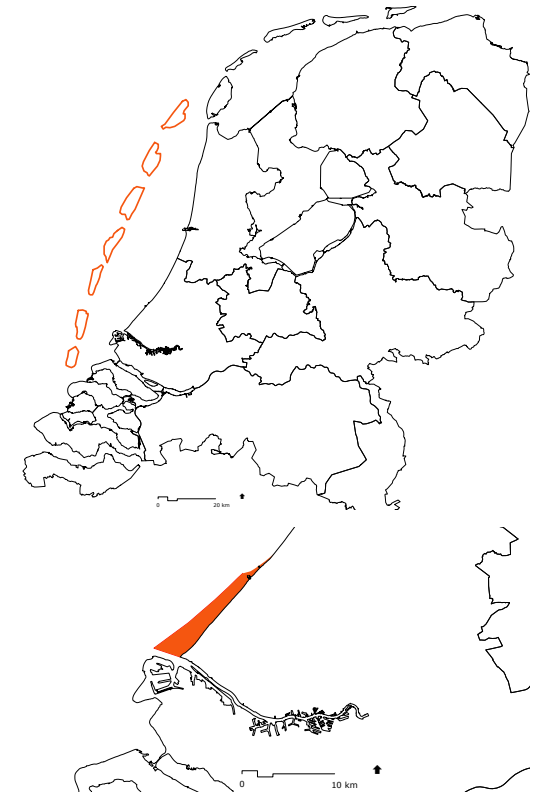


figure 1.2
seaward solutions

above: Plan Waterman, the reclamation of new land off the coast between Hoek van Holland and Scheveningen.

under: Holland Bolland, new islands off the coast of Holland.



2. Natural dynamics and the Dutch lowlander

'Now and then at spring tide and a northwester storm De Kerf runs full with sea water. This is the unchallenged peak. Driven by wind, the sea approaches closer and closer. The sand threshold decreases by beating waves. Then suddenly, the water dives into the valley and changes everything.'¹

GRAINS OF SAND THROUGH THE STREETS OF HOLLAND

Judit Bax

essay ar3u020 urban theory, TU Delft, May 2005

Introduction

Holland – the Dutch lowlands – is famous for its man-made land. Although the lowlands developed by the influence of sea, wind and sand, today one will hardly experience the dynamics of these natural elements any more.

It was De Kerf in the north of Holland that inspired me to my graduation thesis. In 1997 Dutchmen dug a groove through the first row of dunes. At spring tide and a northwester storm the valley behind is taken by the sea water. Every time I visit De Kerf I see a different landscape. Here it is nature that shapes and that fascinates me.

This observation formed the reason for my thesis in which I research the possibilities of dynamics of nature to design a more robust coastal defence that can be a carrier for a new urban vitality.

To place the intervention treated in my thesis in a history of transformations – spatial AND human – I want to explore the development between nature, its dynamics and the Dutch lowlander in time. Therefore I have set a question for this essay:

What is the role of nature and its dynamics in the life of the Dutch lowlander?

The current manifestation of the physical space of Holland on which so many millions of people live their life today, is the result of a constant responding of man to the foundation. In this foundation a deep history has been preserved. 'Only he who reads the tracks in the landscape, sees that we have existed'² was a headline in the NRC Handelsblad of last summer. But only he who discovers the meaning of these tracks, realizes the impact that forces of nature once had on this piece of the earth. In what we see today, much of the past remains hidden.

The Staelduinse bos as one of the rare visible tracks of the varied nature landscape the Westland once was.

History of a relation with nature

Jos Bazelmans names three factors as being crucial for the creation of the Dutch lowlands: 'the rising sea level after the latest ice age, the supply of sediment from sea and rivers and the influence of man.'³

The rough contours of the Dutch lowlands as they are present now at the North Sea developed in their physical form about 10.000 years ago, at the end of the last ice age (figure 4.1). The melting ice filled the dry land between England and western Europe with water: the North Sea. A rapid sea level rise moved the coast landward and the water entered the hinterland through old river valleys.

From 3000 BC onwards, the sea level rise was slowing down and the supply of sediment compensated this rise more or less. Sea and wind transported large amounts of sand to the coast on which a series of beach walls were shaped. These are now called the old dunes. Behind these dunes a 'wadden' environment developed and on the calm places peat grew on a large scale. Eventually, a rough peat wilderness extended from Flanders to Jutland in Denmark.

The behaviour of the sea had no logic through the years. This means that the land of Holland was liable to constant changes in its morphology and passability. It is likely that these fluctuations of the forces of the sea were the reason that habitation in the Dutch lowlands never was continuous for a long time.

A wandering existence

The oldest human tracks of nowadays Holland date from 9000 BC. But only from 3000 BC on the agriculture developed, which changed the ways of living.⁴ So the first people who entered the lowlands after the ice age probably had a wandering existence in which they explored the land for food and shelter. The influence of man on nature was very little, he looked for the best paths in this nature wilderness to ensure his survival.

Nature was also determining for a new way of living by man in the course of time. A tempering sea level rise allowed the development of agriculture and permanent settlements on higher places in the land.

Norman Crowe mentions this transition of man from a wanderer to a pioneer as a crucial change in the relation of man to nature. 'The transition from a nomadic hunter-gatherer society to one that resides more or less permanent structures located in settlements profoundly changed the way people think, especially about the natural world around them. The hunter-gatherer had accepted the natural world just as it was. [...] But once the wanderer had chosen to dwell in a fixed place on earth, once his shelter and settlement became permanent, his view of nature changed. Accordingly the settlement provided a distinct 'alternative nature', a 'second world within the world of nature' as Cicero called it.'⁵

In the Dutch lowlands however, I think a turning point in the relation with nature only came later in history. The pioneers, the first farmers, in fact followed the morphology of nature in their

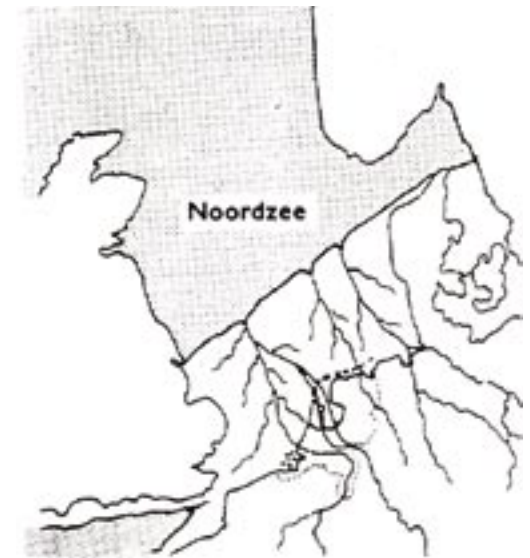


figure 4.1
The North Sea in the early Holocene
(about 10.000 years ago)

Oerlemans, H. (1992). Landschappen in Zuid-Holland. Den Haag, SDU-uitgeverij

settlements on higher parts of the lowlands: 'the "geesten" behind the dunes or on high and sandy "stroomruggen" along the large rivers'⁶. These settlements never formed the basis for a continuous habitation in the lowlands: on different moments the land became depopulated, often due to a growing aggression of the sea.

Large cultivation

The peat wilderness of the lowlands seemed not suitable for permanent habitation. In the centuries 900-1300 however 'the relation between man and peat changed radically, a process that probably has been supported by a climate that became drier'⁷. The lowlander started to cultivate the inhabitable land on a large scale into land suitable for agriculture. Hoppenbrouwers mentions the slowly growing population pressure as a reason to enter the peat.⁸ Man dug ditches - mostly perpendicular to natural watercourses - to start a discharge of water. I think this so called 'Grote Ontginning' (large cultivation) has been an important change in the relation of the Dutch lowlander to the dynamics of the natural foundation. It was a process with unforeseen effects that made the lowlander acting in a way that nature was excessively controlled.

The dehydration and treatment of the peat caused a continuous drop in the level of the land, see figure 4.2. This stopped the natural discharge of the water. The answer that the Dutch lowlander found on this problem was the construction of dikes, locks and mills. Would there have been another choice? Yes, leaving. But that was not the nature of the Dutch lowlander. He chose to control nature, a control that became more far-reaching in the course of time.

Urbanisation of Holland

Blockmans mentions two other problems as a result of this large cultivation: the profit of grain reduced due to a decreasing fertility of the soil and the resulting change of the self-supporting farmers to a mixed-farming caused a surplus of labour. These problems and the solutions Dutch lowlanders found for them were partly the basis for the urbanisation of the lowlands. 'The surplus of labours found new work in the "ambachten"; thanks to the production of export goods it was possible to buy and import the needed grain. Therefore, from the 13th century on the economy of Holland had increasingly been turned to foreign trade.'⁹

Together with a geographical position on the crossing of connection routes between surrounding flourishing regions (figure 4.3) and the position in a delta in which shipping already was an obvious activity, this transition to trade brought the Dutch lowlanders success and welfare, especially in the 17th - golden - century. A network of cities developed on strategic positions in the lowlands, and a growing part of the population moved to these settlements. The Dutch lowlander became an urban dweller.

According to Crowe the rise of the city is a new extreme in a relation to nature. 'The city is the ultimate expression of artifice, a second nature built as an alternative to living exclusively within the natural world. In perfecting this second nature, we have progressively separated ourselves from real nature.'¹⁰

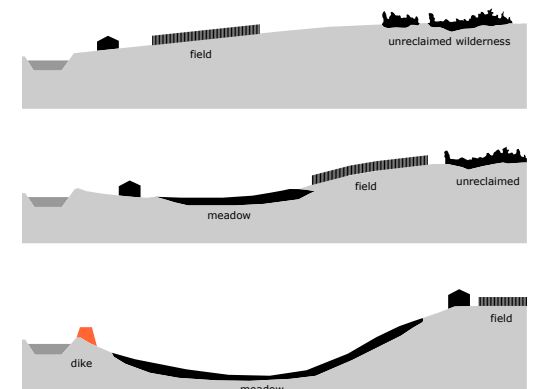


figure 4.2
Consequences of reclamation of peat

Ven, G.P. van de (1993). Leefbaar laagland. Geschiedenis van de waterbeheersing en landaanwinning in Nederland. Utrecht, Matrijs.

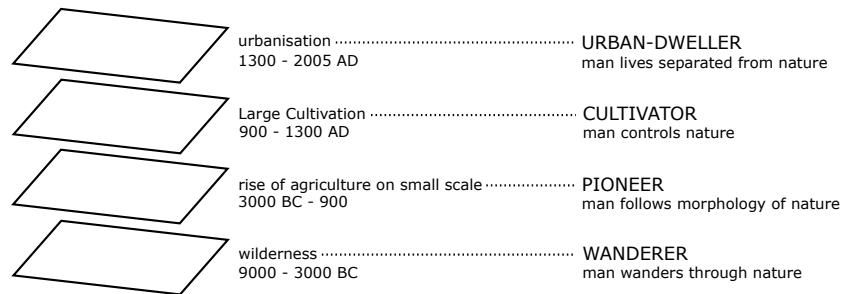


figure 4.3
European communications 11th until 13th century with a strategic position for Holland

Lopez, R. (1966). The birth of Europe. London, Dent.

Conclusion: from wanderer to cosmopolitan

Moving through a history of natural foundation and human intervention in the Dutch lowlands one can characterize the development of the relation between the Dutch lowlander and nature as follows:



A footstep in the future

'God created the world, but the Dutchmen created Holland'. This is a well-known French proverb that is revealing the way the Dutch lowlanders treated their piece of mother earth and also how it provides the lowlands a strong identity. The structures of the peat parcelling can be found back everywhere in the urbanized landscape of Holland: on the agriculture land, but in the layout of the cities as well. As a matter of fact this cultivation history is not only determining the physical space, but also characteristic for Dutch society. The maintenance of dikes and the regulating of drainage forced the lowlanders to cooperate, a cooperation that is often mentioned as the basis for the so called 'polder model'. Nijs explains this model as 'a society model in which interest contrasts and conflicts had not been fight out, but in which consultation, cooperation, mutual respect, agreement, and pragmatism should lead to a solution. This consensus culture, that originates in the polder boards, would be – both positively and negatively – characteristic for the society of Holland. On the one hand peace had been maintained, so trade could flourish and on the other hand the reaching of agreement would have led to governmental passivity and the abandoning of principalities.'¹¹

However, this development of the relation to nature did not only gain the Dutch lowlanders and their physical space an identity. It also formed the loss of what is a characteristic of Holland as well: the presence of dynamic natural elements that once shaped the landscape of Holland and constantly changed its morphology. The remainders of these elements still border and cross Holland but are restrained in their dynamics, nowadays.

Renewed space for the dynamics of nature can provide Dutch lowlander of today and tomorrow a new consciousness. A conscience that these dynamics are a fundamental part of his existence. This is a period in which welfare is not only determined by finance any more, but in which a general quality of life is important for the urban-dweller. The presence of places where he can experience

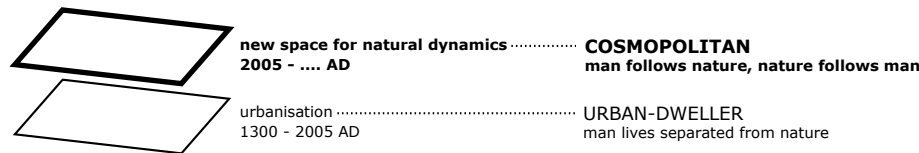


Cultivation pattern in city layout of Delft, 18th century.

Cruquis, N. en J. (1712). 't Hooge Heem-raedschap van Delflant. 1977 Alphen a/d Rijn, Canaletto.

nature in his near living-environment is one fundamental part of this quality. Personally I can enjoy nature everywhere, but there's only one place I will always return to: the coast, with its beach and dunes. This is the outstanding place where one can still experience the way natural elements shape the land. In the recent survey "The Netherlands can be so beautiful"¹², the dunes of Schoorl came out to be the highest valued as natural environment by its surrounding urban-dwellers.

After so many centuries of struggle against undesirable influences of nature I don't expect the Dutch lowlander to give up his reclaimed land. I only have to reflect on my self to know that man will always do whatever he can to ensure his survival. But a few steps back in time learns that man is able to live in a certain harmony with nature. In the cultivated and urbanized Holland of today this means that man has to search for a compromise between a world in which nature follows man and a world in which man follows nature. In this a lot of challenges are hidden for new exciting typologies of urbanization.

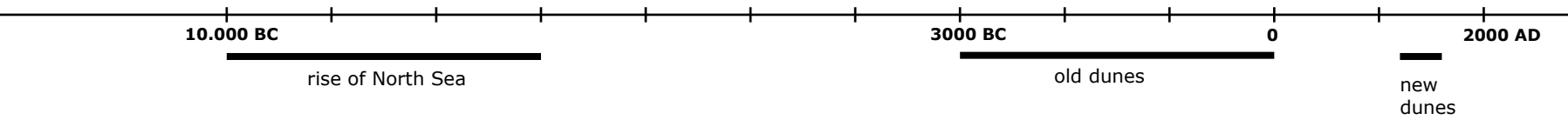


And what can I say about the urban-dweller of the future? Aaron Betsky calls the developments in society a transition to a 'nomadic world culture'.¹³ This is the culture of a cosmopolitan. A Dutch lowlander that is mobile in every way and who's choices are uncertain. With this a physical space fits, in which not everything has been controlled and fixed. So, neither has nature.

(Footnotes)

- 1 Words from the permanent exposition in 'Het Zandspoor', visitor centre of the Dutch Forestry Commission, Schoorl.
- 2 Vos, M. de (2004). Alleen wie de sporen in het landschap leest, ziet dat wij hebben bestaan. NRC Handelsblad, 3 juli 2004.
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figure 3.1
RISE OF THE DUTCH COAST



The development of the Dutch coast on a large time scale: the rise of the North Sea after the latest ice age, the forming of the old dunes until the beginning of our era and the forming of the new dunes in the middle ages.



The residual current in the North Sea that determines the direction of the sand transport. Along the Dutch coast this current moves from south to north.

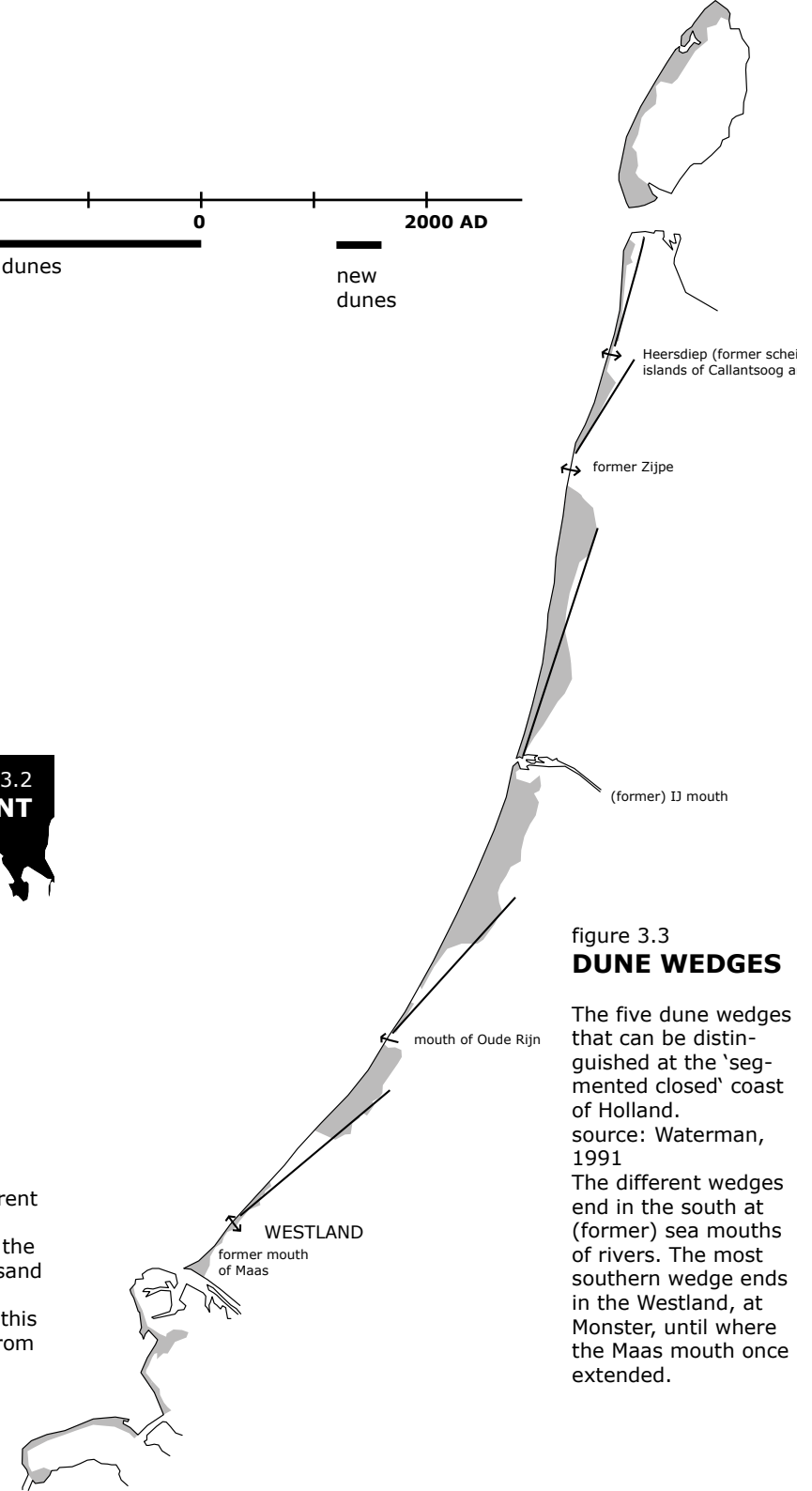


figure 3.3
DUNE WEDGES

The five dune wedges that can be distinguished at the 'segmented closed' coast of Holland.

source: Waterman, 1991

The different wedges end in the south at (former) sea mouths of rivers. The most southern wedge ends in the Westland, at Monster, until where the Maas mouth once extended.

3. Coastal dynamics

3.1 Introduction

The narrow coast at the Westland is the result of western (natural) and eastern (human) influences. To understand what is happening from the west at the coast of the Westland, this chapter treats what coastal dynamics are, how they formed the Dutch coast system and finally, what is going on in the coastal area of the Westland.

3.2 The sea as sand river

Bijnsdorp et al (2002, p7) describes the Dutch coast as the bank of a sand river 'in which on balance enormous amounts of sand are transported from south to north. In origin it is a dynamic system in which climate, waves, tidal flows and sea level rising cause non-stop changes, but also search for balance. Product of this permanent dynamics is a coastal landscape of shore, beach and dunes. The building material of this landscape is sand.'

tidal currents

The sea has different tidal currents. The flood tide current along the Dutch coast moves the water from south to north. The ebb tide current moves the other way around and transports the sea water from north to south. However, the flood tide current is stronger than the ebb tide current and together with a dominating south-west wind this means that on balance more water is transported from south to north. This is called the residual current. This current determines the direction of the sand transport along the coast (figure 3.2).

formation of a natural defence

Consequently, the wave movements actually moves the sand to the land. Close to the coast the sea becomes more shallow. The waves from the sea are curbed by the bottom and as a result of this, the waves 'break' and sand is detached from the sea bottom. Because of the breaking of the waves, a surf is created. The surf waves throw the sand on the beach during flood tide. When the sand dries up during ebb tide, the wind can move it further into the land and banks – beach walls – can develop. Salt loving plants hold the sand, as a result of which dunes can develop on top of the banks. Different dunes together can eventually form a closed dune row. This dune row can develop into a sea strip: a solid seawall which is high and damming during a storm flood.

Along the Dutch coast the first dunes were formed between 3000 BC and the year 0. Due to a rising sea level different beach walls developed gradually. These beach walls – that could become 10 meters high – are called the old dunes.

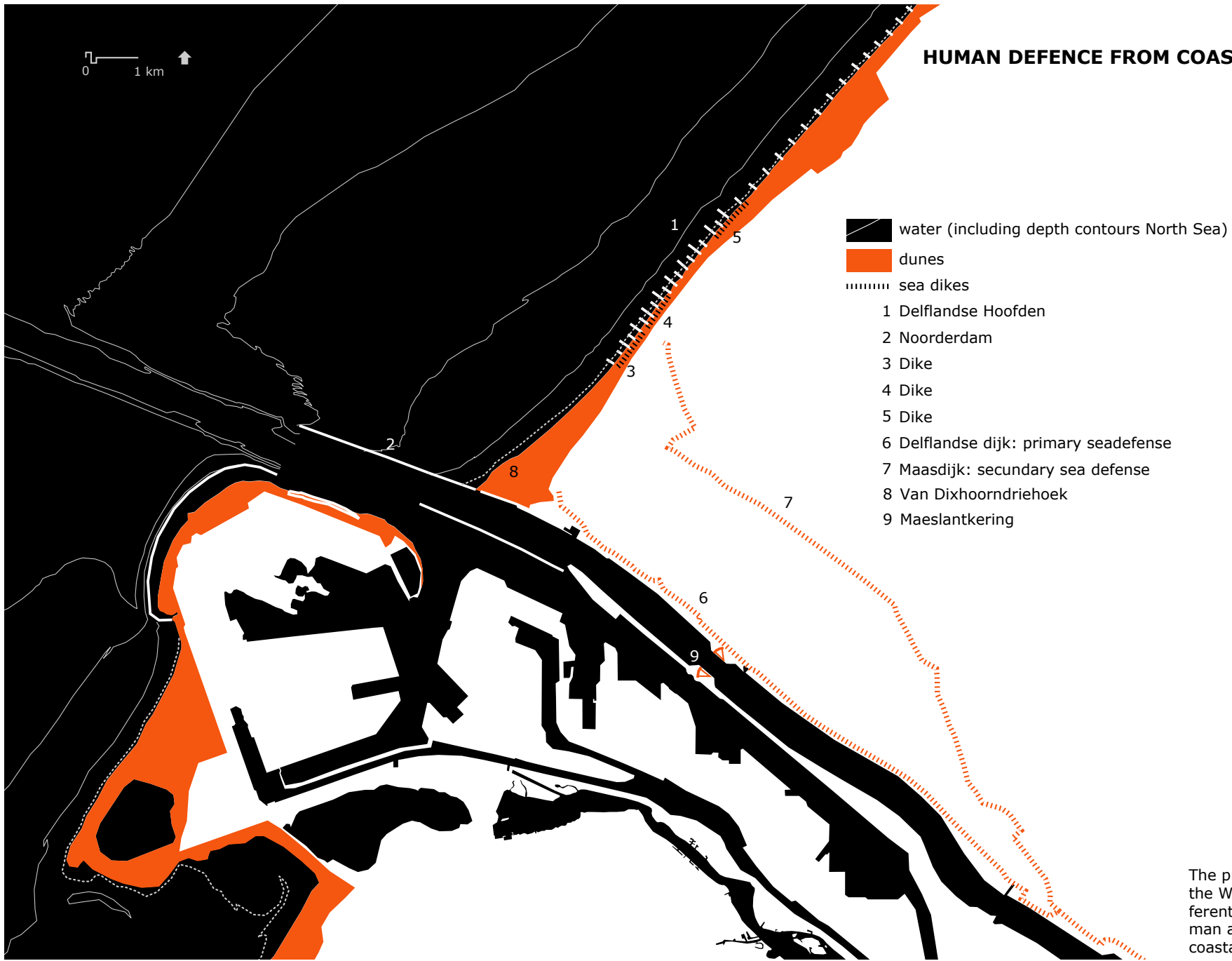
Due to a growing aggression of the sea that probably caused different storm floods about 500 BC the old dunes were partly or completely destroyed. For instance in the Westland area the beach walls have almost completely disappeared. As a result of the coast eroding, the free coming sand formed a new series of dunes over the old dunes between 1200 and 1600 AD. These dunes are called the new dunes and sometimes have become more than 50 metres high (figure 3.1). (www.deltawerken.com)

Sketches of the current dune dike and a beach crossing in the Westland.



figure 3.4

HUMAN DEFENCE FROM COASTAL DYNAMICS



The present situation of the Westland with the different elements built by man as an answer to the coastal dynamics.

3.3 Coastal behavior in the Westland

greater coastal system

According to Waterman (1991, p29) the Netherlands have three types of coast: a wadden coast from Rottumeroog until Texel, a segmented closed coast from Den Helder until Hoek van Holland and an estuary coast from Hoek van Holland until Cadzand. The segmented closed coast of which the Westland is part, consists of a series of 'dune wedges' with in between very small spots (figure 3.3). The most southern dune wedge runs from Wassenaar to Ter Heijde in the Westland where it reaches its smallest point. A thousand years ago, the Maas mouth extended until this spot and at that time Monster formed the south-west hook of Holland.

sea level rise

Since the middle ages large parts of the land have been fallen in respect to the North sea. As an answer on the relatively rising sea level (figure 3.5) the coastline has naturally moved in landward direction for centuries already.

spherical coast = unstable coast

Besides the rising sea level, Waterman (1991, p31) mentions the slight spherical coast arch between the north of Scheveningen and 's Gravenzande as being an unstable coast. This in contradiction to the coast between Wassenaar and The Hague that has behaved as a quit stabile dynamic balance coast during the last hundred years (figure 3.6).

diversion of sea current

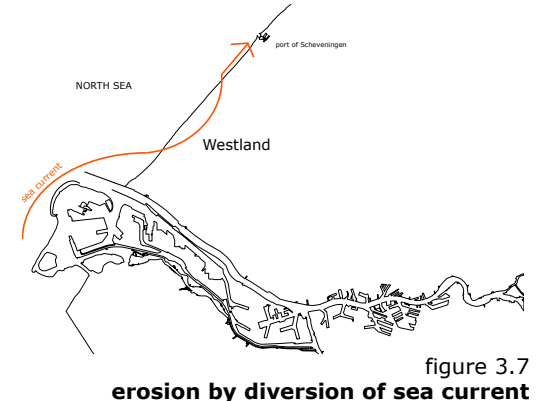
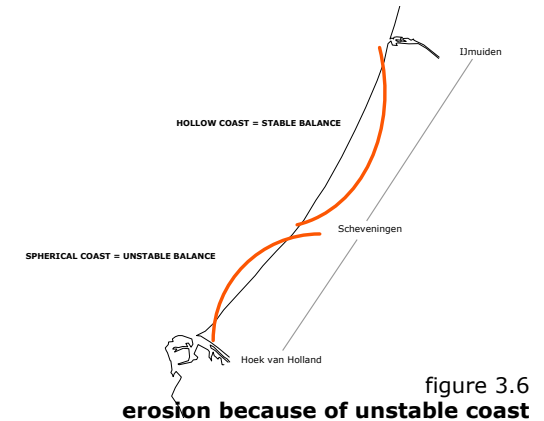
Last but not least the construction of the Noorderdam at Hoek van Holland – nowadays 4,7 km long – diversifies the sea current according to Svašek (1979, p17). The dam causes so called 'dead corners' at which the sea current takes hardly any sand. South of the dam sedimentation takes place as more sand has been left than has been taken by the sea current. North of the dam less sand is supplied than is discharged by the sea current; as a result the coast is eroding (figure 3.7).

Coastal erosion and the extraction of sand by man caused the natural dunes along the Westland coast largely to disappear, and thus the natural coastal defence. The coast of the Westland (with Ter Heijde as its most narrow spot) is one of the prior weak links in the Dutch coastal defence system, nowadays.

3.4 Result: extensive damming system as a human answer on coastal dynamics

The behavior of the sea and as a consequence the reaction of man on this behavior to ensure his survival, makes the current coast of the Westland looking as follows (figure 3.4):

- the dunes as a natural defence against the sea running until Ter Heijde;
- a dune dike from Ter Heijde until Hoek van Holland: a dune row strengthened by an underlying body of a dike;
- the Delflandse Hoofden, constructed in the 18th and 19th century to catch the sand;
- the Maas dike, part of the first continuous diking from the coast until Rotterdam, nowadays functioning as secondary sea dike along the Nieuwe Waterweg and Nieuwe Maas;
- the Delflandse dike, primary sea dike along the Nieuwe Waterweg and Nieuwe Maas;
- the Noorderdam, constructed in 1872 as pier of Hoek van Holland and extended after the second world war for the shipping over the Nieuwe Waterweg;
- the Van Dixhoorn Driehoek at Hoek van Holland, new dunes constructed in 1971, as a seaward strengthening of the coast;
- the Maeslantkering, finishing touch of the Deltawerken in 1997.





4. Atlas of reclamation and urban occupation Westland

4.1 Introduction

As a matter of fact coastal dynamics can either break or shape the land. In the Westland nowadays, one observes a coastal landscape that is almost completely maintained and controlled by human elements. Behind this coast the so called 'glass city' is situated, an intensive glass gardening area with in between different towns.

'When people settle somewhere they change the landscape overthere' (Roorda van Eysinga, 1988, p3). To understand the rise of the Westland, this chapter analyses how Dutchmen did deal with the coastal dynamics in their reclamation and urban occupation of land in this area. Therefore, a historical map analysis has been made. Subsequently, the Westland history has been placed in a larger context. Resulting conclusions can be found at the end of the chapter.

4.2 The rise of the Westland

The Westland is a region in the south of Holland, part of the polder board of Delfland. It probably owns its name to the western part of this board: the Westambachten. After the rise of the gardening the name Westland became synonymous with the gardening area that also consisted Loosduinen and Rijswijk. (www.westlandmuseum.nl)

Governmentally spoken the Westland is nowadays one municipality concerning the urban hearts of De Lier, 's-Gravenzande, Heenweg, Honselersdijk, Kwintsheul, Maasdijk, Monster, Naaldwijk, Poeldijk, Ter Heijde and Wateringen. In this thesis the Westland has been considered as a geographical unit and therefore Hoek van Holland (part of the municipality of Rotterdam) is taken in account as well.

Deepening the genesis of the Westland by Ridder (1979) and Roorda van Eysinga (1988) one could summarize the rise of this area chronologically in four phases:

1. large floods;
2. reclamation of land;
3. rise of gardening;
4. development of glass city.

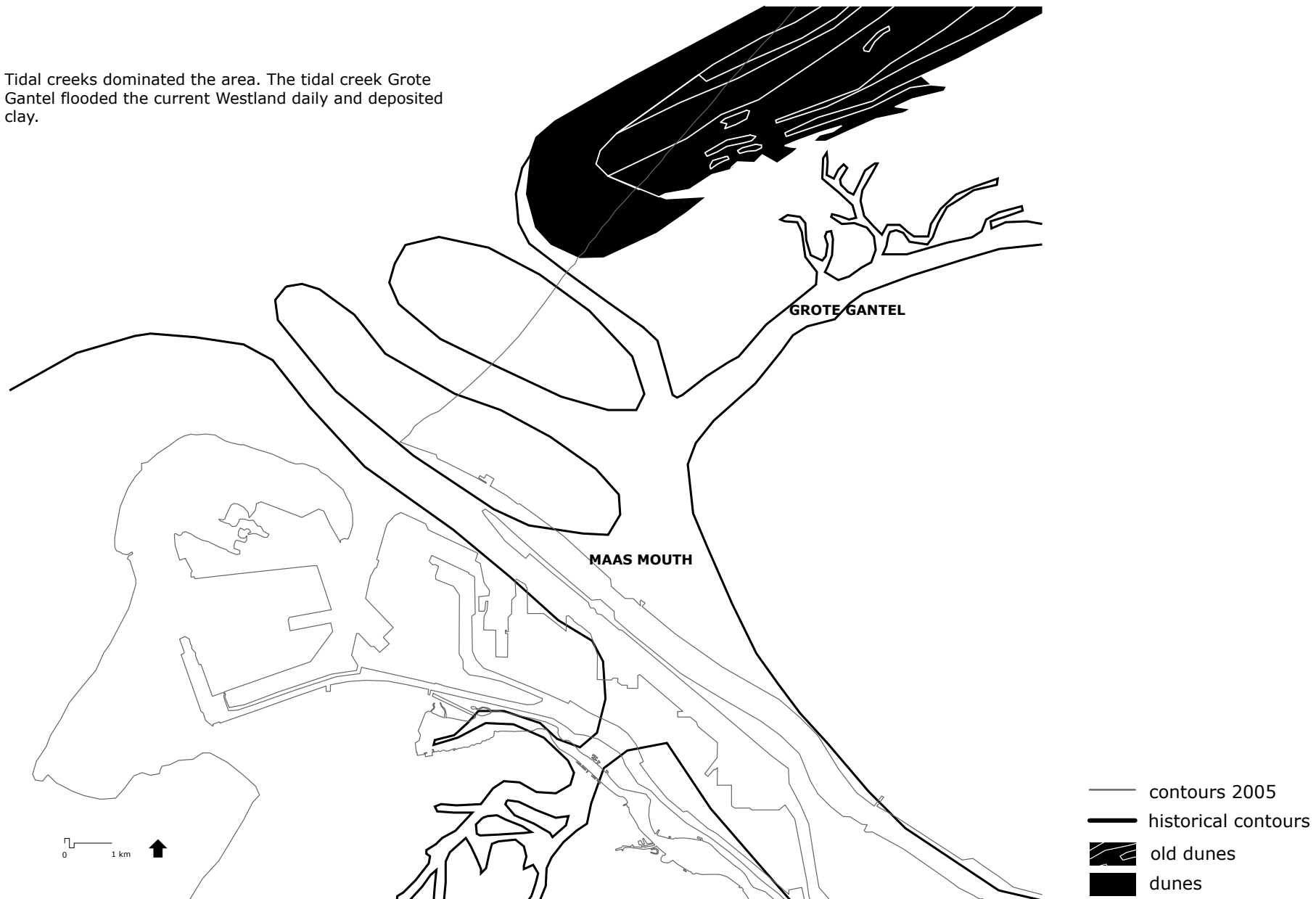
The series of maps on the next pages expresses the development of the Westland during these different phases, shows the morphology of the landscape and the way man reacted to nature.

Aerial view on the Westland from the plane. Right the southern city edge of the Hague, above the coast and North Sea, under one can distinguish the body of highway A4.

figure 4.1
200 AD

source: Provincie Zuid-Holland, 2004

Tidal creeks dominated the area. The tidal creek Grote Gantel flooded the current Westland daily and deposited clay.



large floods

Habitation in the Westland already took place before the roman age, thanks to dunes that developed on a beach wall that developed after the breaking of the Straits of Dover (figure 4.1). Due to a rise of the sea level the beach wall weakened. About 200 BC the beach wall collapsed at different spots and the sea water felt its way through the peat. Tidal creeks developed that meandered through the land. Dominant in the Westland was the creek Grote Gantel. About 350 AD new floods took place that made habitation in the area for the most part impossible.

reclamation of land

Towards the 9th century new habitation became possible in the area. The first inhabitants founded settlements on the higher parts of the land: behind the dunes (Monster, Naaldwijk and 's Gravenzande) or on dikes they constructed (Poeldijk, Honselerdijk, Wateringen and De Lier). In 1134 a storm flood broke the hook bank between Monster and Naaldwijk. New tidal creeks entered the hinterland, the Gantel got a new mouth. This has probably been the reason for the start of an intensive diking of the area (figure 4.2). The different creeks were successively damned, so they lost their connection with the sea (figure 4.3). For the most part they silted up in the course of time. In 1300 the polder board of Delfland was founded from a merger of the older boards Maasland and Zeven Ambachten. Sea dikes were already present in the Westland at that time. The polder board of Delfland showed a great diking activity of which the finishing of the Maas dike in 1350 was a special moment: a closed diking system from the dunes in the Westland until the city of Rotterdam had been born. A network of existing rivers and new constructed canals regulated the discharge of water. They still form the main 'boezem' of the Westland.

Due to a natural southward sedimentation of the Maas mouth, new land was reclaimed from the sea in this direction (figure 4.4 and figure 4.5). In the course of time the silting up of this river mouth was unfavorable for the port cities along the Maas, like Rotterdam. Therefore a new canal – the Nieuwe Waterweg – was cut out through the land and finished in 1868 (figure 4.6). At a small harbour at the end of this canal, used for the construction activities, Hoek van Holland was founded. Where the land silted up to the south, it was the sea especially in the 15th to 17th century that moved the coastline from the west more landward. The fishing village Ter Heijde was forced to move three times.

figure 4.2
1150 AD

source: Ven, 1993

A new large flood in 1300 formed the reason for the construction of dikes along creeks that arised during the flood.

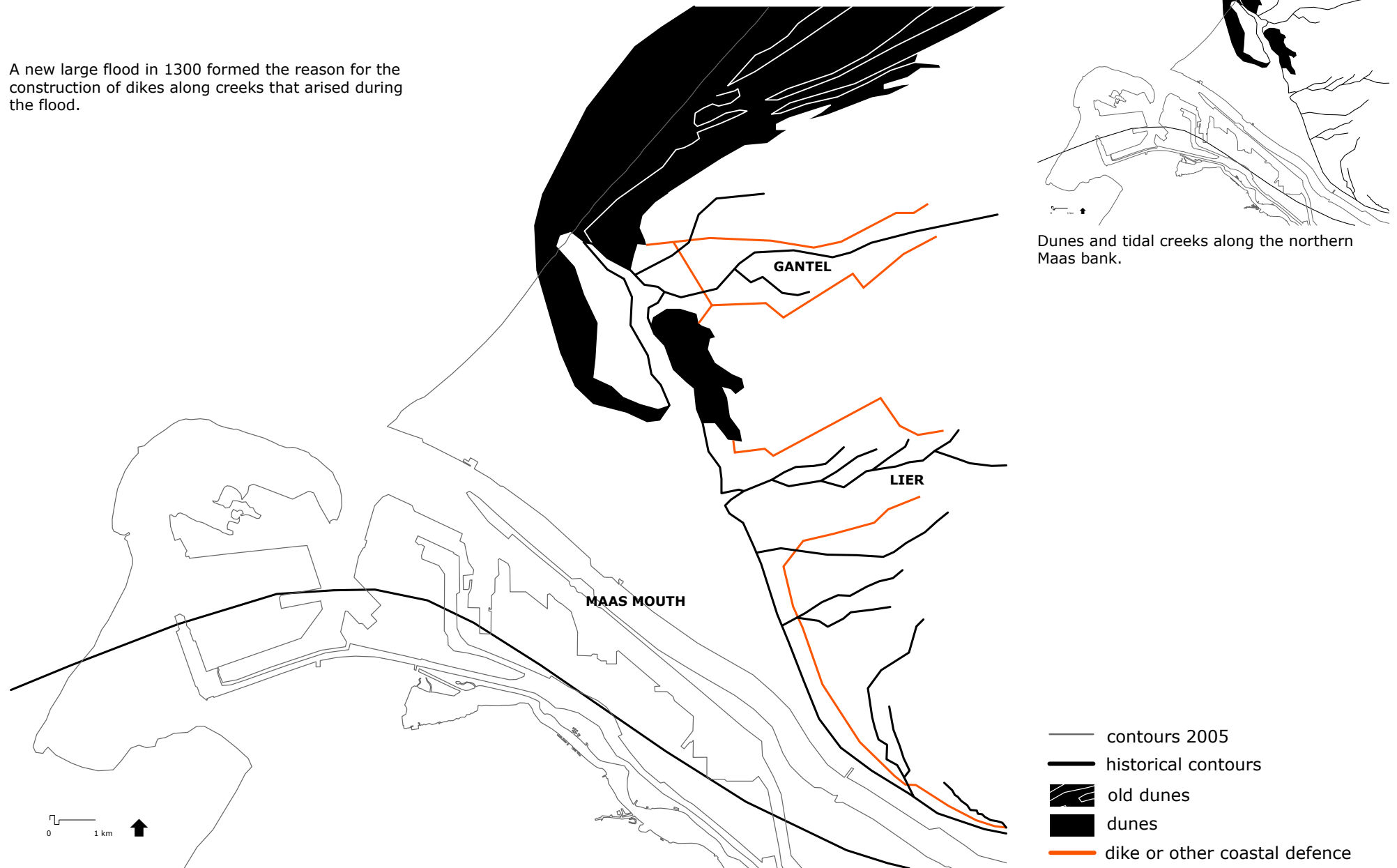


figure 4.3
1250 AD

source: Ven, 1993

Further diking disclosed the creeks from the Maas mouth and North Sea. On the higher parts of the land - the dunes and dikes - settlements were founded.

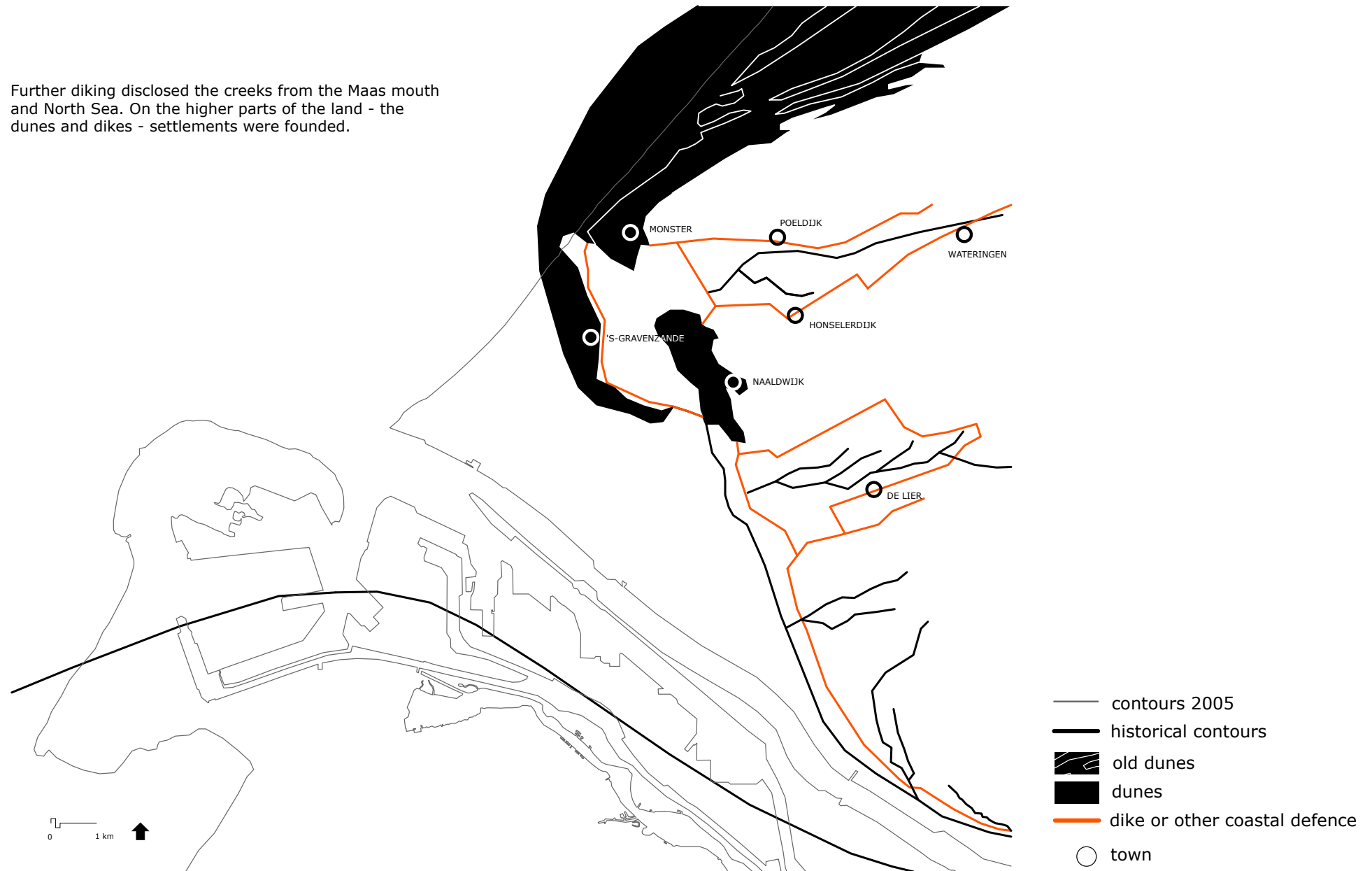
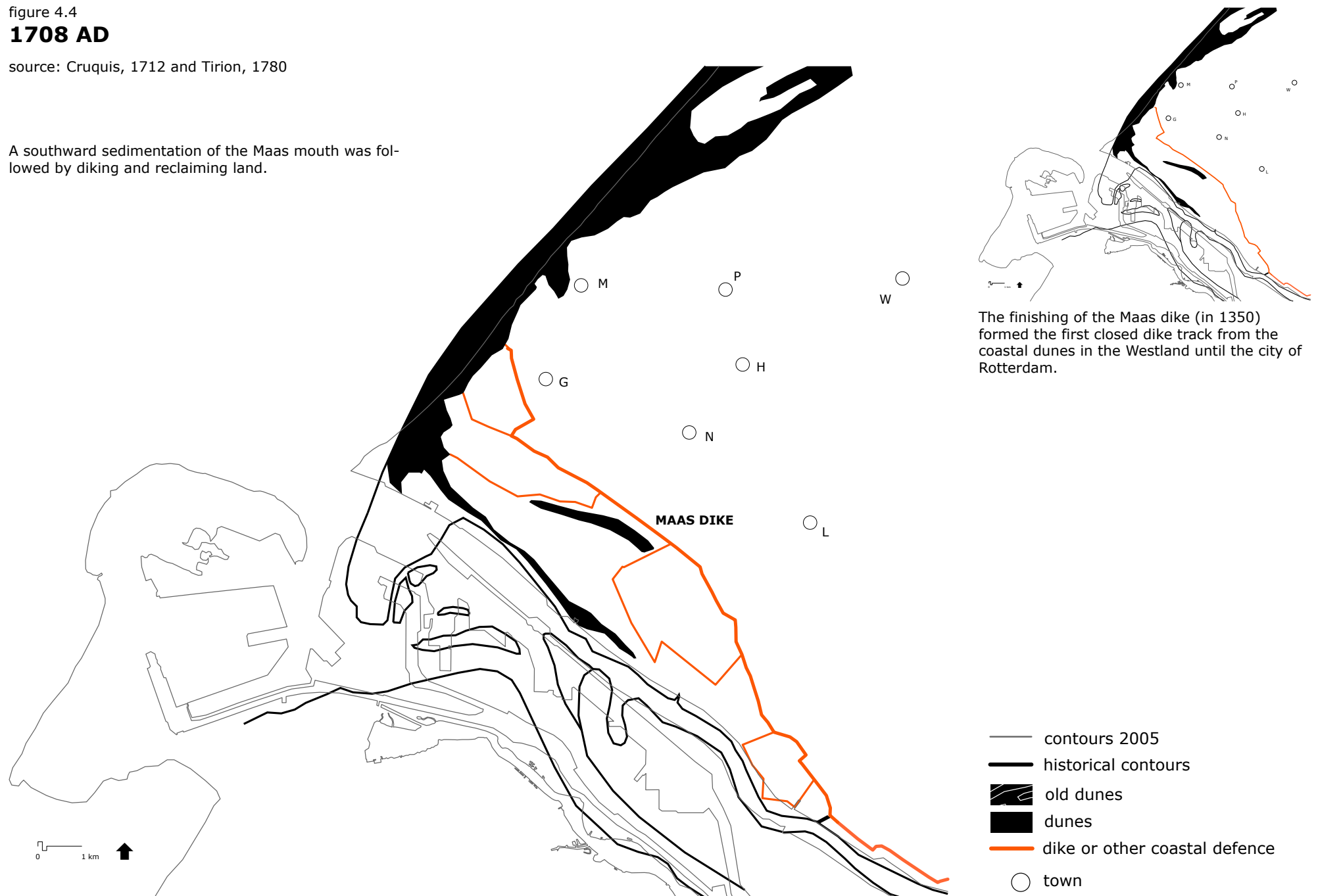


figure 4.4
1708 AD

source: Cruquis, 1712 and Tirion, 1780

A southward sedimentation of the Maas mouth was followed by diking and reclaiming land.



rise of gardening

In the middle ages agriculture and cattle breeding formed the main means of support in the Westland. From the 16th century on the gardening grew in the area at first at the monasteries, castles and later the country seats in the area. It is probably the geographical position of the Westland that formed an important reason for the development of the gardening: a position at the sea with its moderate climate, but more a position between the surrounding growing cities in which the question for gardening products increased and with which the connections (over water) were present. To make the land suitable for the gardening the clay soil was raised and the sand soil was dug off (to reach the groundwater).

In 1880 the Westland gardening came into a depression, mainly as a result of a large agricultural crisis in western Europa. This depression caused a larger feeling of solidarity in the Westland and the rise of the auction business: a new method of selling products. Furthermore new more efficient production methods were searched for and the first glasshouses developed.

figure 4.5

1850 AD

source: Linden, 1973

The Maas mouth had almost completely silted up; man followed with more dike tracks to the south. Parallel to the Maas several dunes developed in the course of time. Only the Staelduinen are still present in the Westland.

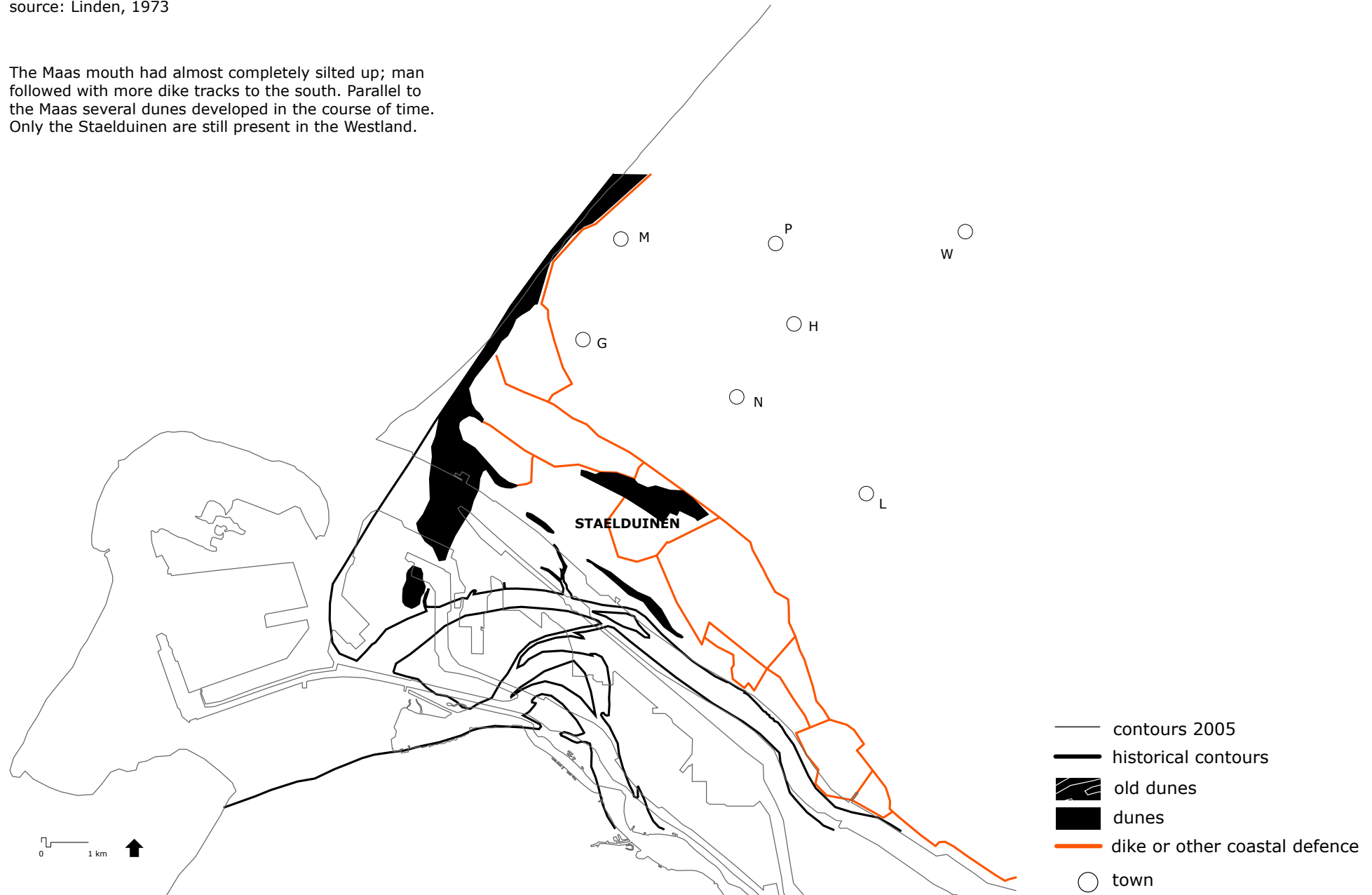


figure 4.6
1912 AD

source: Wieberdink, 1989

A growing gardening flourished in the area due to its geographical position near the sea and near booming surrounding cities. Initially, the water discharge system of canals was used to transport the goods. On crossings, the first auctions were founded in the course of time.

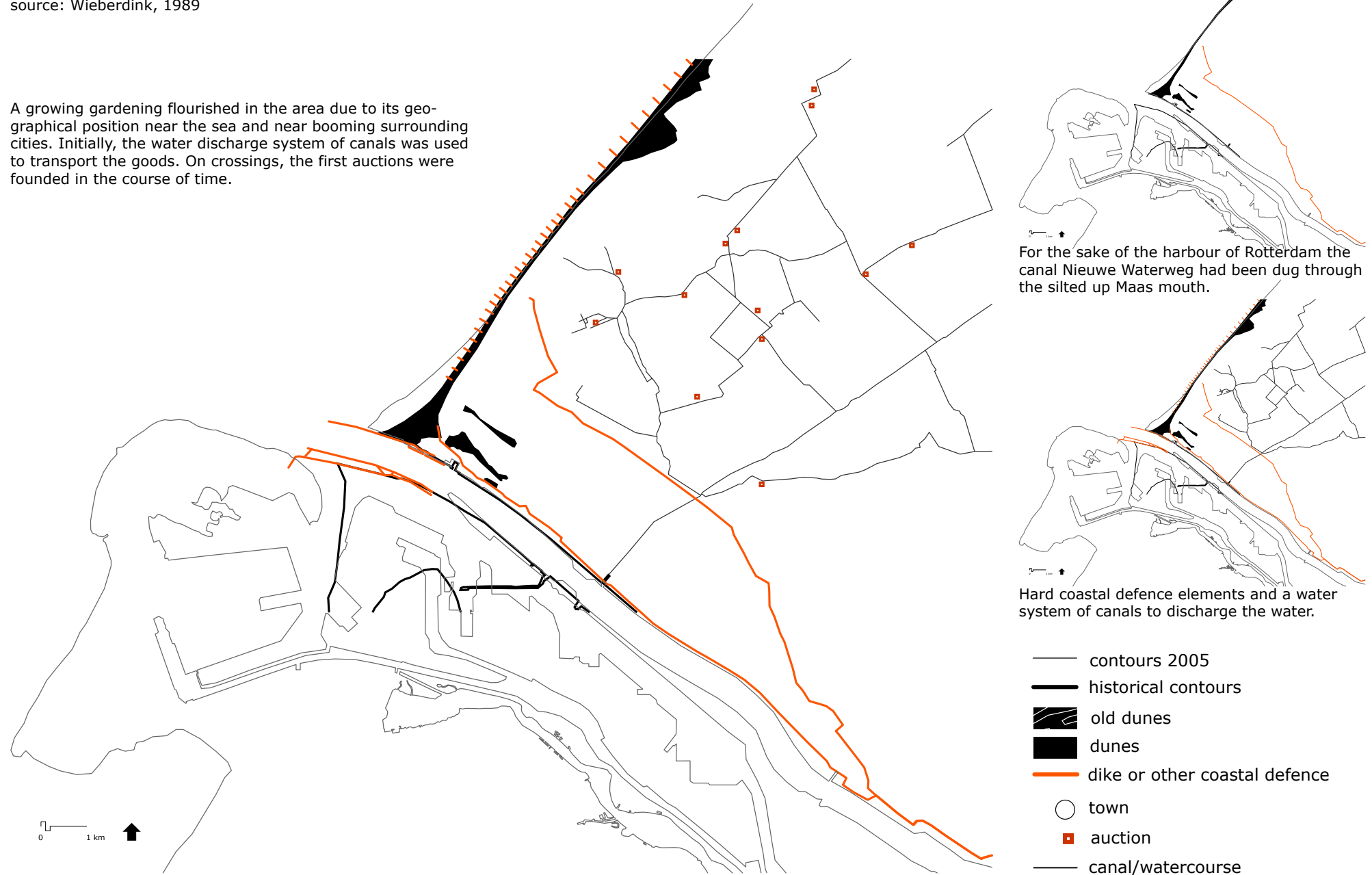


figure 4.7
2005 AD

source: Topografische Dienst, 2004 and Hoogheemraadschap van Delfland, 2003

The result of the reclamation process, nowadays. Most of the land has been impoldered.

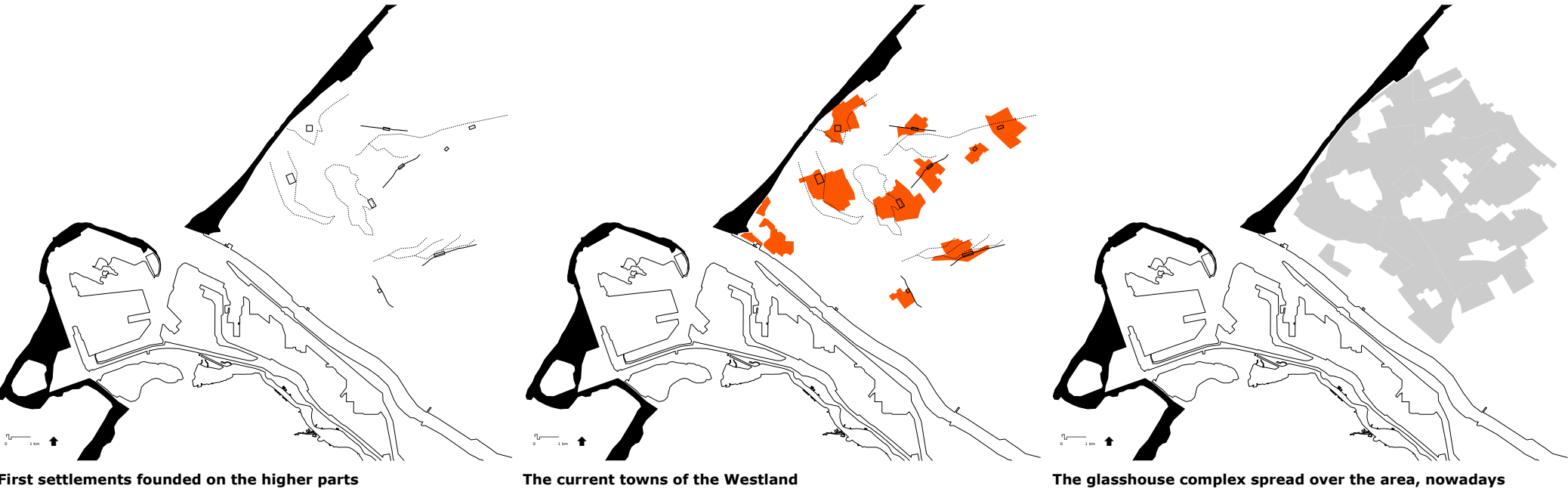


glass city

Until 1945 it was the production of grapes that was dominant and flourishing in the Westland. After the second world war there was a growing competition from the mediterranean sea and a transition to the production of tomatoes grew. Nowadays the area has a mix of vegetable and flower production. The eighties and nineties of the 20th century formed a period of large welfare for the Westland. A tomato crisis in 1995 showed on the other hand, that a certain economical monofunctionality makes an area vulnerable as well.

However, the glasshouses extended over a large part of the Westland during the past decennia with a far-reaching asphalt network to transport the goods to the auctions and further into Europe. A growing scale-enlarging can be observed in the transformation of this transport network (from canals to large N-roads), in the fusion of relatively small gardening companies to large glass companies and in the fusion of auctions. Currently only one auction has been left in the Westland: the flower auction Flora Holland in Naaldwijk. To survive a growing world competition, the Westland specializes more and more in high-quality goods, new efficient production methods and new forms of glasshouses.

figure 4.8
HUMAN COLONIZATION OF THE WESTLAND



The Westland has been transformed from a land that once was entirely controlled by nature to a land that has been fully put at the service of human welfare. The series of maps in figure 4.8 shows this transformation from the moment on that man inhabited continuously in the area. The exploitation of the land for human welfare faces the Westland nowadays with quite a dilemma: the glasshouse gardening is an important pillar of the economy for the region, but frustrates several other interests. This is expressed in the SWOT-analysis, below.



High scale infrastructure network, to efficiently transport the gardening goods



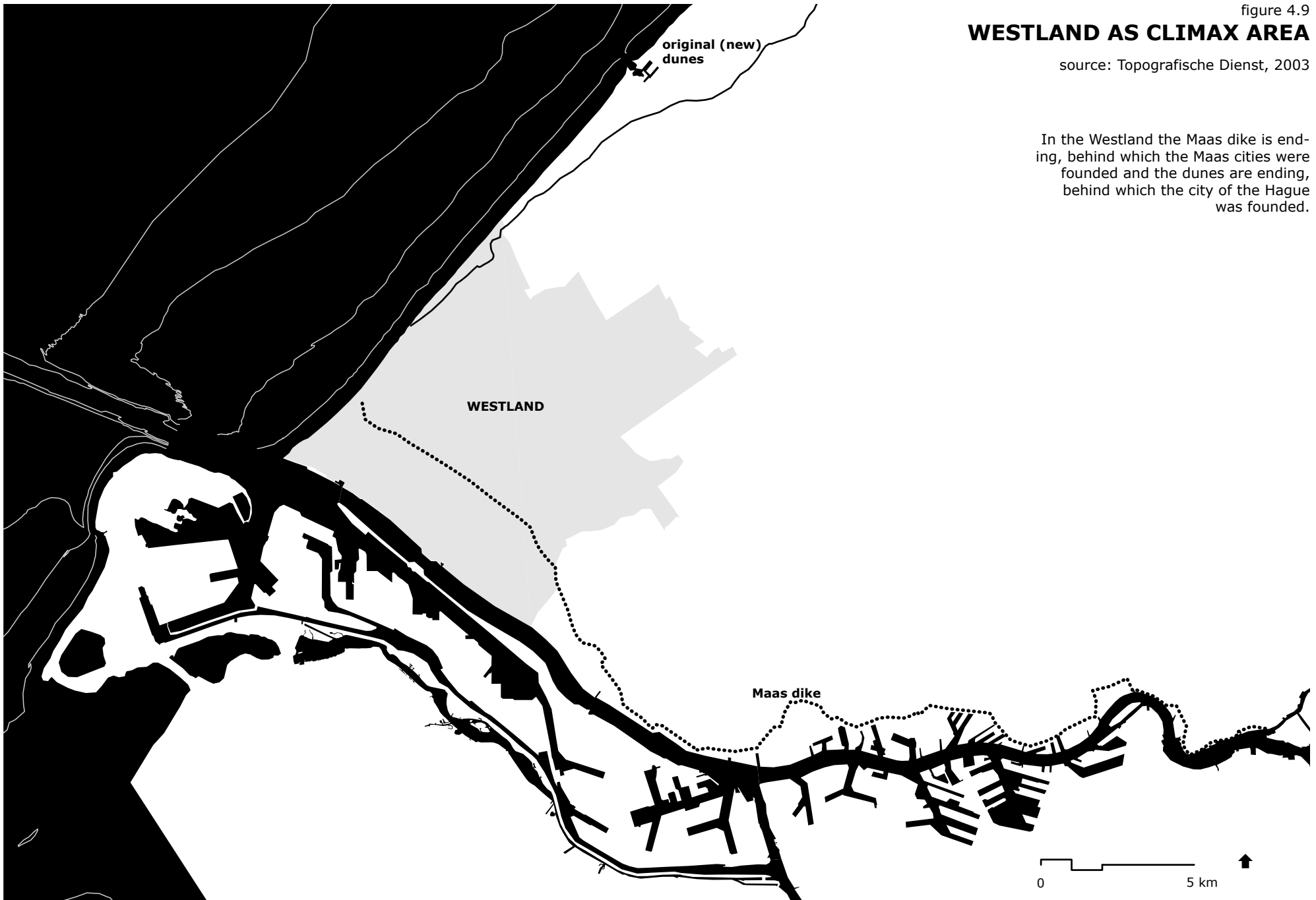
The city of Westland, 2005.

SWOT	OPPORTUNITIES	THREATS
STRENGTHS	<p>position between the Hague and Rotterdam</p> <p>nearness of the sea</p>	<p>glass gardening as economical pillar: overruling monofunctional</p> <p>position near expanding mainport Rotterdam</p>
WEAKNESSES	<p>1 community Westland: more cohesion between different urban hearts</p>	<p>under capacity infrastructure: not many opportunities for extension</p> <p>total lack of open space</p> <p>amount of paved surface: need for waterstorage</p> <p>pressure on coast: weak link</p>

figure 4.9
WESTLAND AS CLIMAX AREA

source: Topografische Dienst, 2003

In the Westland the Maas dike is ending, behind which the Maas cities were founded and the dunes are ending, behind which the city of the Hague was founded.



4.3 Westland and its surroundings

cohesion in natural foundation

The Westland occupies a special place, situated at the northern edge of the North Sea and the Maas mouth and therefore cannot be seen separated from the genesis of its surrounding area's. One could actually summarize the strong cohesion in the natural foundation of the Westland with its surroundings in two still present physical elements (figure 4.9):

1. the Maas dike ending at 's Gravenzande and
2. the dunes, ending in its natural form just above Monster.

Maas dike

The Maas dike forms the representation of a strong control of nature as it was the first closed dike track from the dunes in the Westland until the city of Rotterdam. Originally the area behind the dunes and north of the Maas mouth was a wadden environment. Tidal creeks – of which the Grote Gantel was the largest – entered at the Westland, flooded the area every day and deposited clay (figure 4.10). In the quiet environments, where the influence of sea and creeks was little, a marsh forest developed according to Palmboom (1990, p12). By the continuous dying of wood and leaves a thick peat layer developed that extended the largest part of the area between the Hague and Rotterdam. From this peat layer different peat streams flew in the direction of the large rivers and the sea (figure 4.11). During the cultivation and colonization of land, the peat streams were not sufficient to discharge the large amount of water from the peat, so from the hinterland on new canals were constructed (figure 4.12). Behind the damming of the peat streams and canals by the Maas dike different cities like Rotterdam, Schiedam, Vlaardingen and Maassluis, were founded. Along the constructed Delf – the current Schie – the city of Delft was founded (figure 4.13).

original dunes

The dunes as one can observe them now at the coast between Monster and Wassenaar are the so called new dunes blown over the old dunes in the middle ages. The old dunes – beach walls – developed between 3000 BC and 0, until far in the hinterland (figure 4.10). On these banks the cities of the Hague, Voorburg and Leidschendam were founded (figure 4.13).

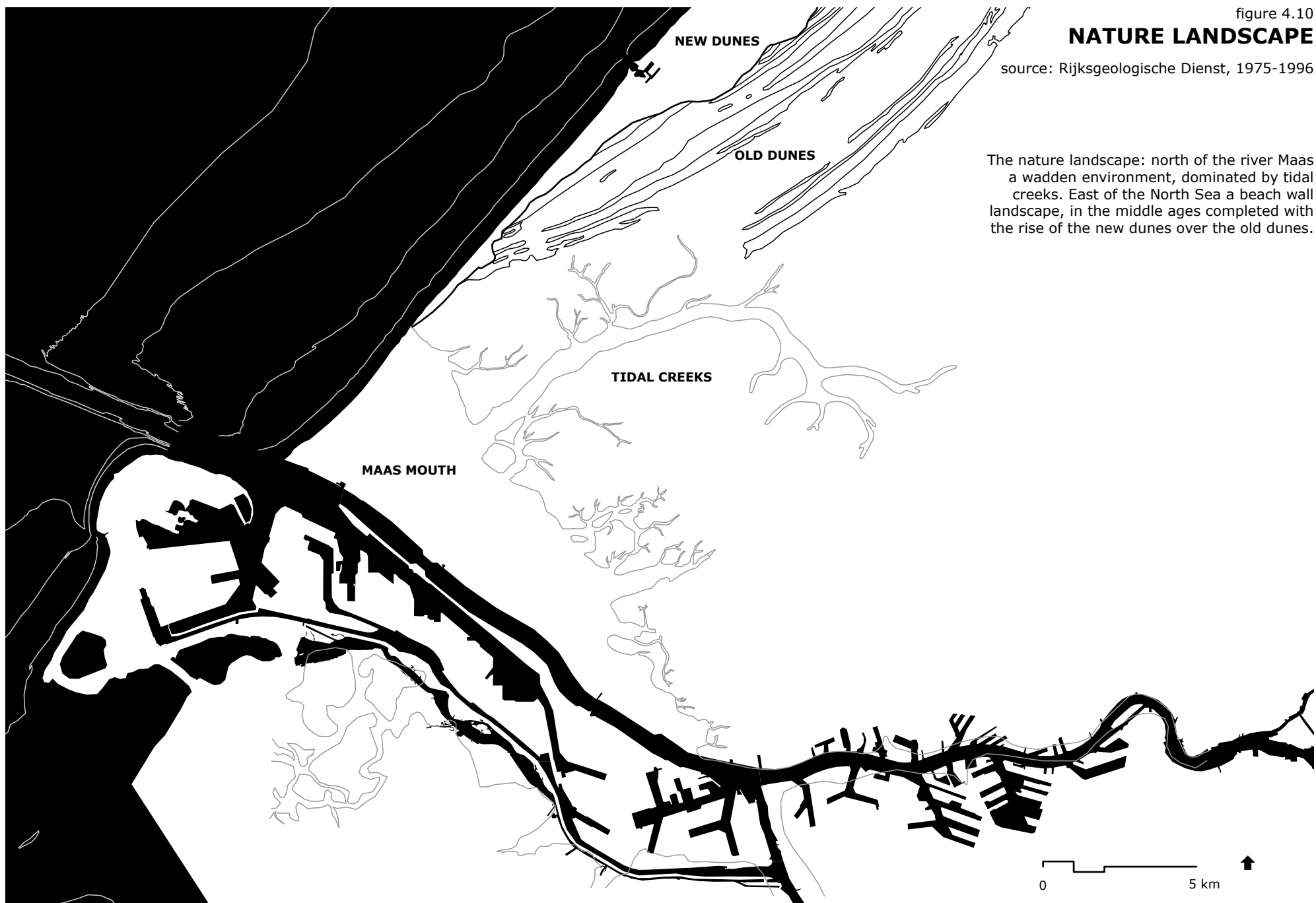


figure 4.11

NATURAL WATER DISCHARGE

source: Palmboom, 1990

Different creeks cut the clay and peat soil and discharged the water naturally.

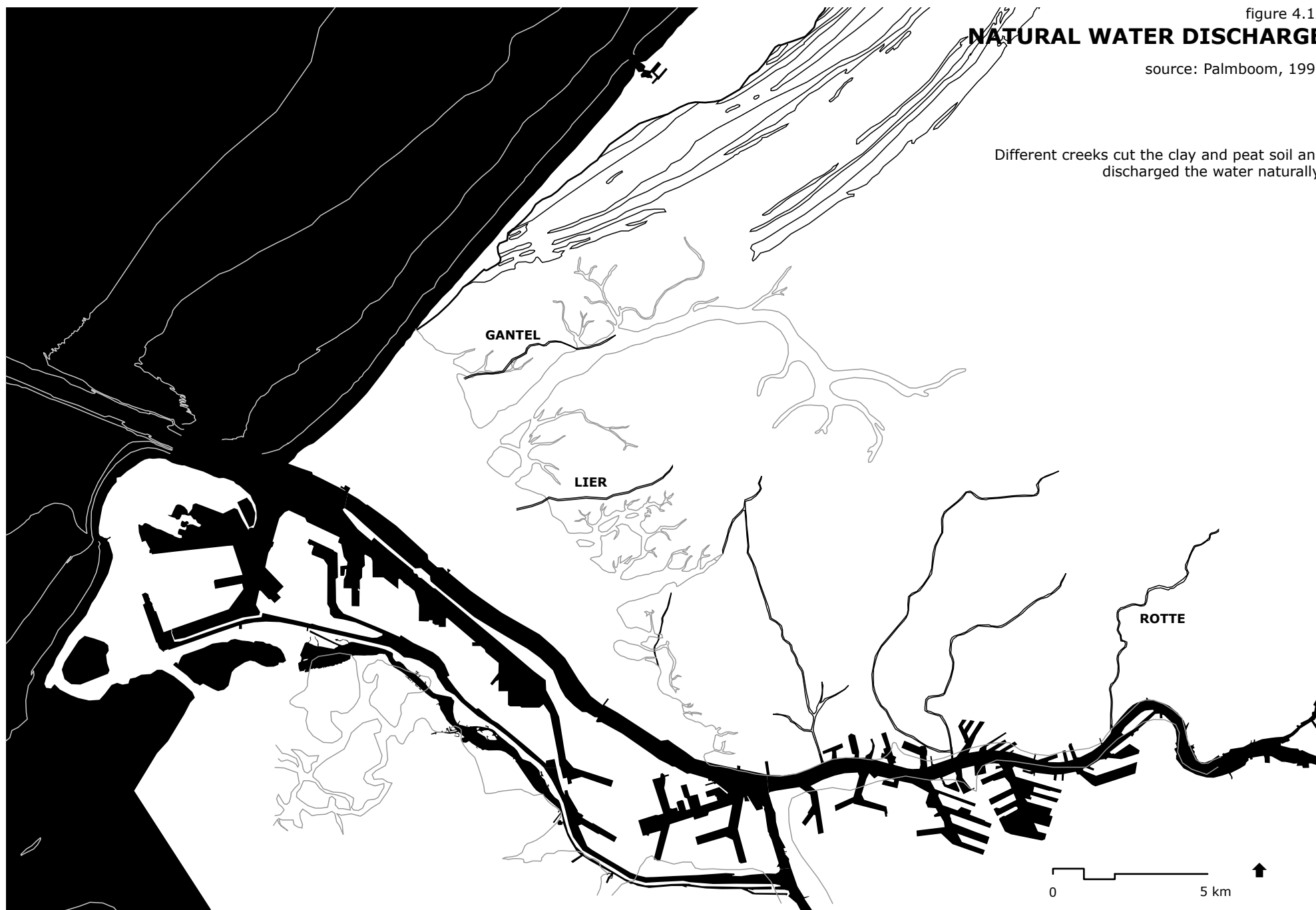


figure 4.12

HUMAN CONTROL SYSTEM

source: Palmboom, 1990
and Hoogheemraadschap Delfland, 2003

The construction of the Maas dike formed a closed dike track from the coastal dunes until Rotterdam. As the creeks appeared not to be able to discharge all water, a system of canals was dug, connected to the creeks and to the sea.

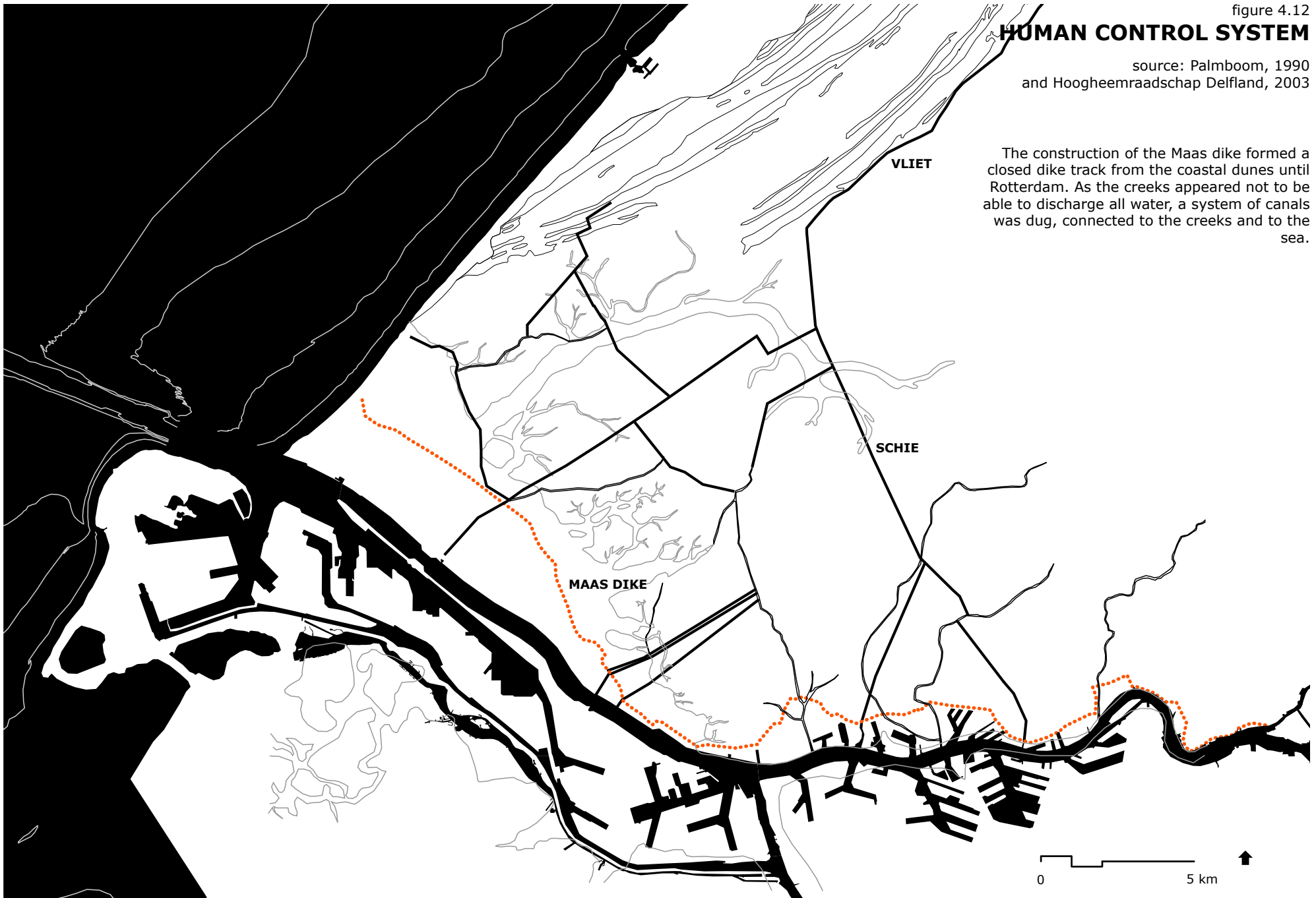


figure 4.13
FOUNDING OF CITIES

source: Palmboom, 1990

The cities in the region were founded and grew behind the barriers to the sea: the Maas dike and The Hague, Voorburg and Leidschendam on the beach walls, behind the new dunes.

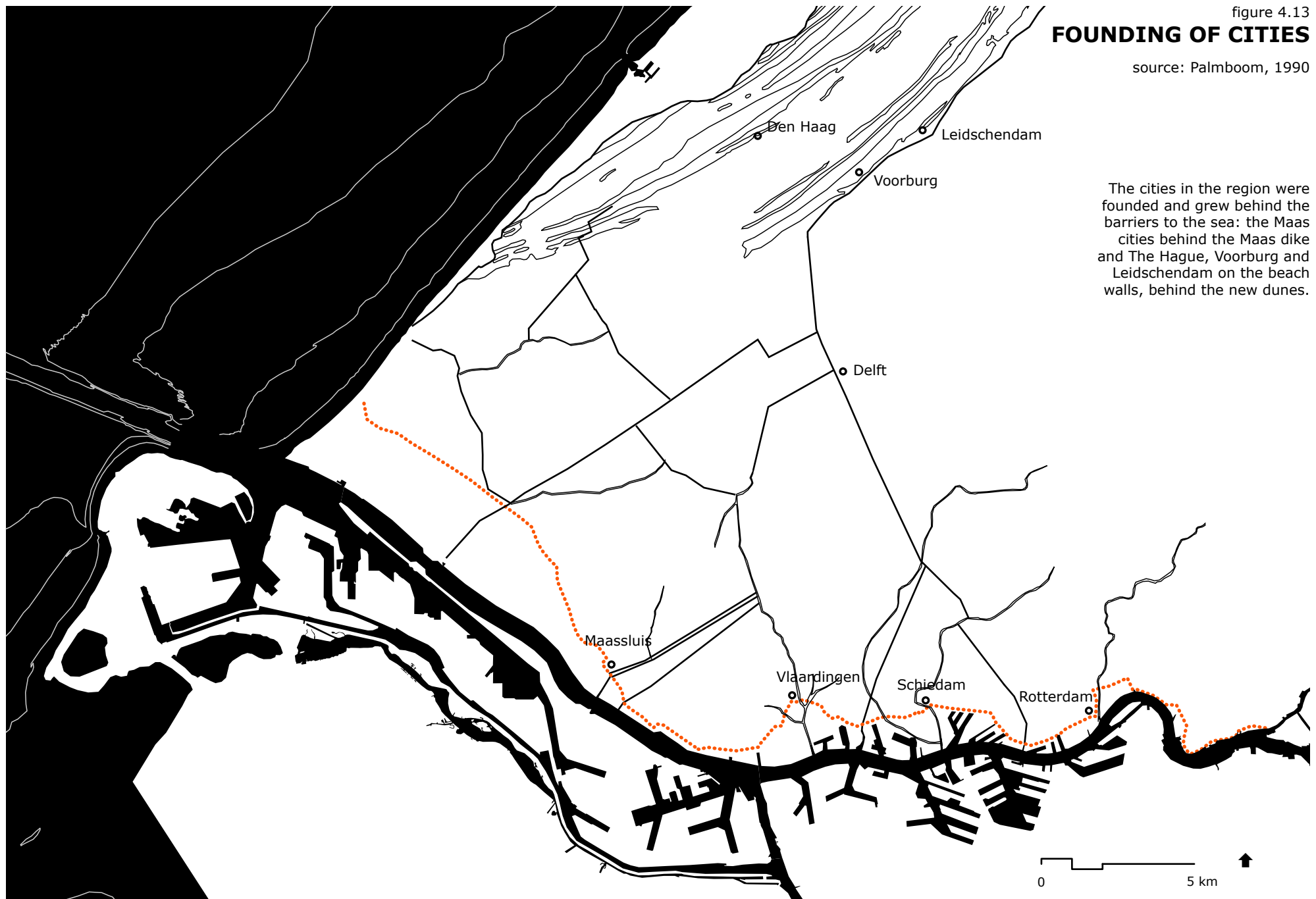


figure 4.14
NATURE LANDSCAPE, 200

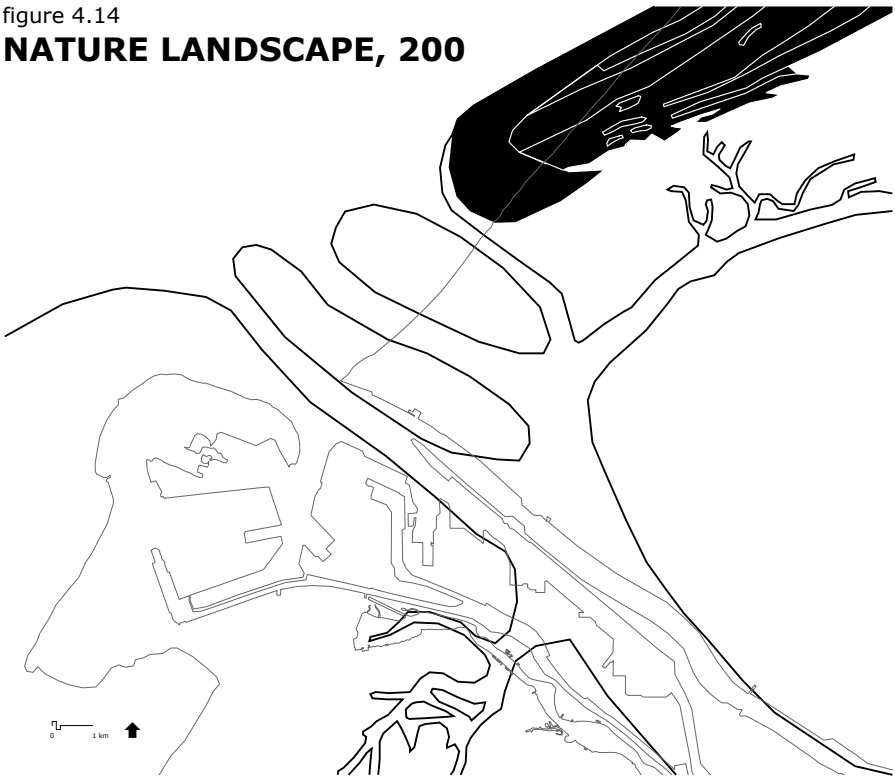
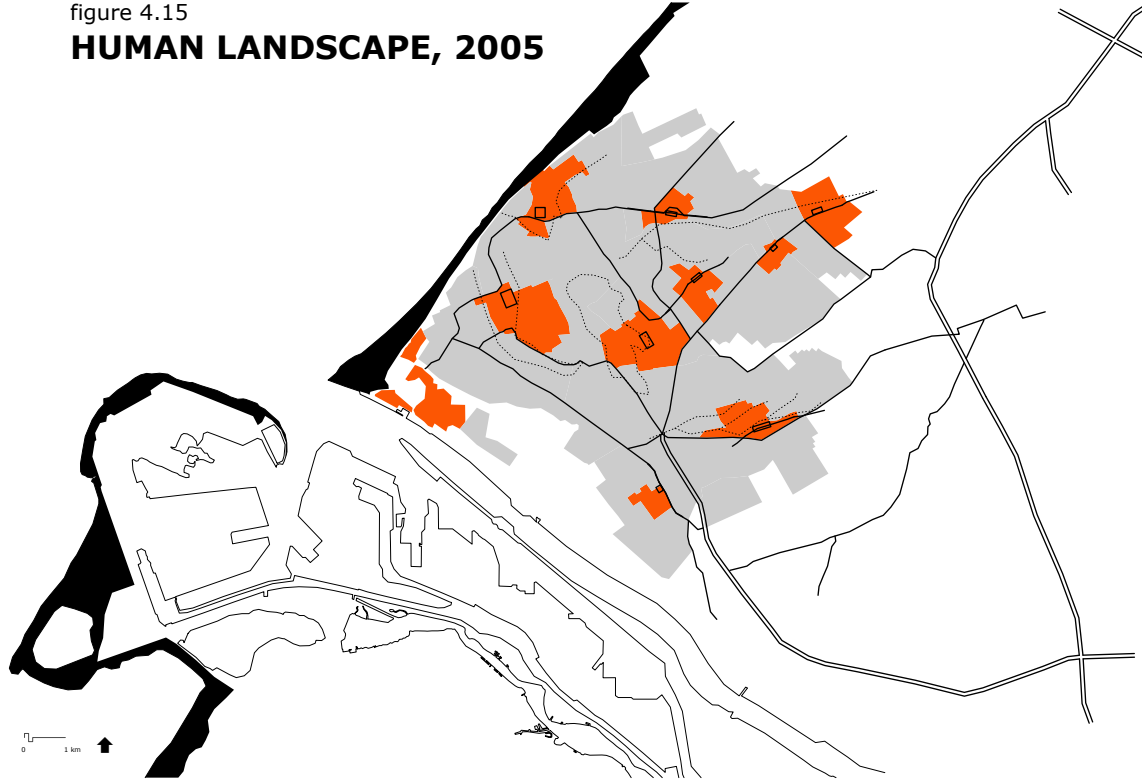


figure 4.15
HUMAN LANDSCAPE, 2005



4.4 Conclusions of atlas

The analysis above unravels the activities and motives of man in the Westland area and their relation to the movement and structure of the natural foundation. One can derive 1001 clues for new research and design assignments but in the frame of this thesis the following conclusions can be drawn:

man followed natural sedimentation

One can notice a continuous erosion from the west and a southward sedimentation of land, when looking to the development of the morphology of land through the centuries. Man followed this sedimentation process in its reclamation of land, however, most of the settlements in the Westland were founded on the old existing land.

original tracks have disappeared

Tracks of the original relief have almost disappeared from the area, because the land was made suitable for the gardening by the raising (opvaren) of clay soil and the digging off (afgeesten) of sand soil (figure 4.16). Exception is the Staelduinse Bos, one of the dunes formed in the silted up Maas mouth and still present in the area.

Westland climax area in genesis region

The Westland can be considered as a climax area in the genesis of its surrounding area's: here it was that tidal creeks entered the hinterland and the Maas mouth had its origin: natural elements that formed the motive for a continuous diking after which large cities start growing. Moreover, here it was that the beach wall landscape and new dunes ended, dunes that formed the basis and are characteristic for a large urbanisation north of the Westland

natural processes taken over by man

Generally one could say that natural processes have been taken over by man in the course of time. The start of a large cultivation process after a period of floods (figure 3.14) marks the turning point in this change and resulted in a wide system to dam and regulate the water. Over this system the gardening function developed to a glass city in which space has been put at the service of human welfare, entirely (figure 4.15).



figure 4.16 Loss of original relief
A map of the raised clay soil ('opgevoerde gronden') and dug off sand soil ('afgeeste gronden') for the favour of the gardening. At the dug off sand soil one can recognize the places of the former dunes in the area.

source: Heslinga et al, 1985

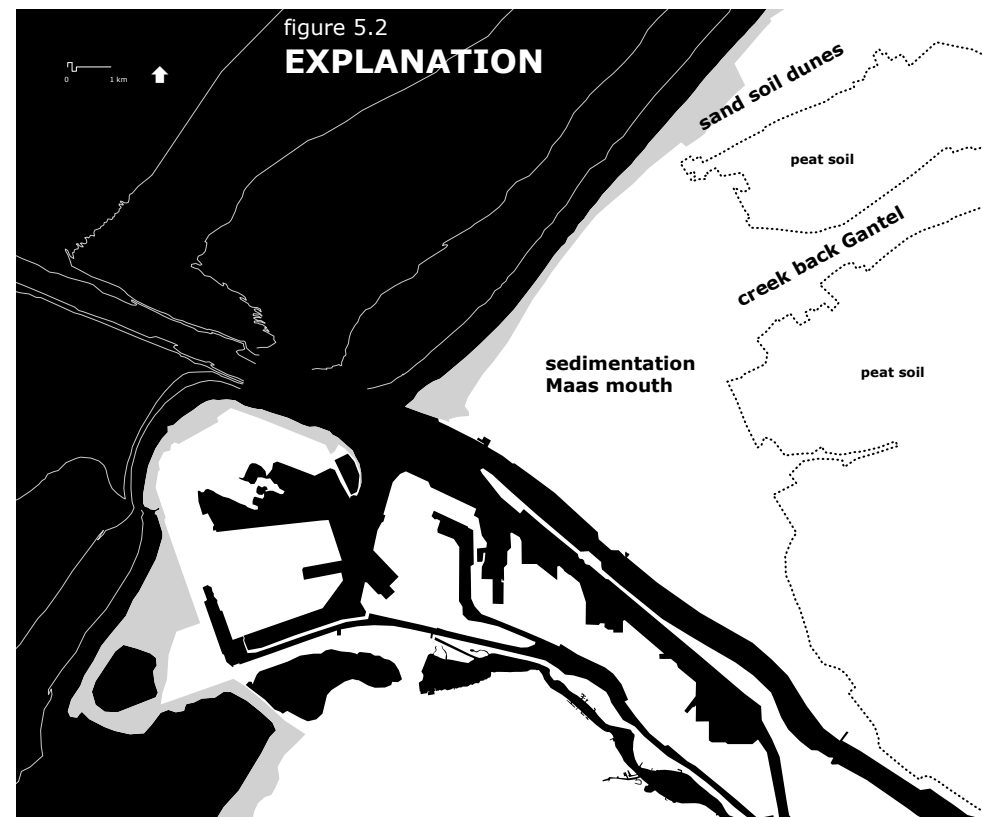
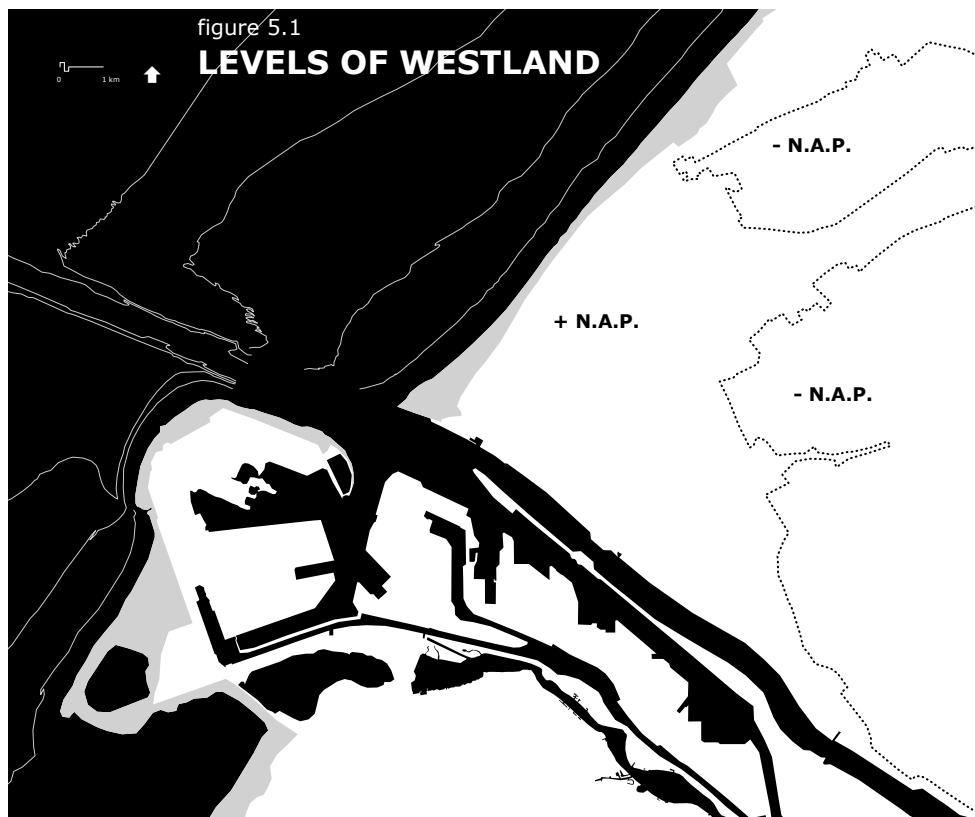
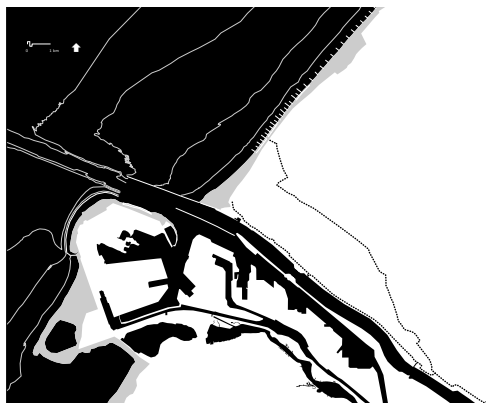
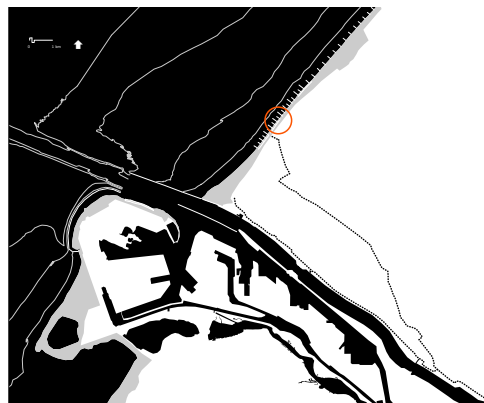


figure 5.3
A DISASTER SCENARIO

the existing coastal defence system



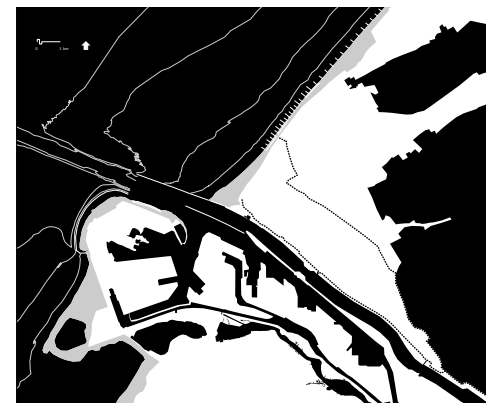
the probable place of a breakthrough



a breakthrough flooding the hinterland



withdrawing water from the higher parts



5. Scenario's of a Westland with space for coastal dynamics

5.1 Introduction

This thesis treats the possibilities of a landward solution for the coastal defence which suggests renewed access for the dynamics of nature. On the basis of these natural processes land and water once found themselves in a dynamic balance (Helmer et al, 1997). Besides being able to form a robust defence against the sea, new space for nature and its dynamics can probably intervene positively in the already occupied hinterland and open new perspectives for the present and future spatial assignments. To explore this hypothesis, different scenario's have been developed in which a certain amount of space is given to the coastal dynamics. These scenario's are tested in the Westland to map the reaction of the land and the possibilities it offers. On the basis of a consideration, one intervention is chosen for further elaboration.

5.2 Levels of the Westland

On the basis of data from the Actual Height model of the Netherlands (see Appendix A) the levels of the Westland are summarized in figure 5.1.

Conspicuous is the part next to the coast that is about 0 N.A.P. This can be explained from three things:

- the sedimentation of the Maas mouth;
- the presence of creek back Gantel;
- the sand soil of the dune landscape.

The area behind is considerably lower situated. This is the peat area that developed between the tidal creeks and shrank in the course of time due to a far-reaching drainage (figure 5.2).

5.3 A disaster scenario

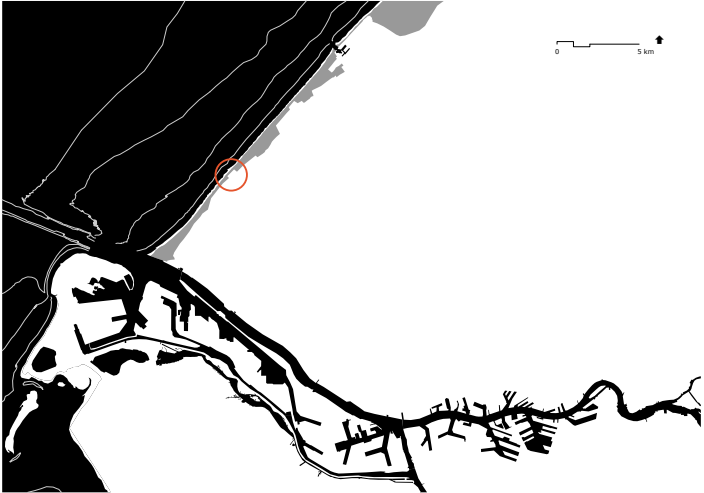
According to the level map, a breakthrough at the smallest coast part of the Westland could flood a considerable part of the south of Holland as there are no considerable barriers present in the hinterland (figure 5.3). The risk on a flood can be defined as:

risk = probability x effect

The chance on this flood is small (although it can still happen tomorrow), but the consequences that this flood will have - are enormous.

Looking in landward direction for a new relation between coast/sea and the developed hinterland different scenario's (possible futures) can be used to explore the answers of the natural foundation and the spatial consequences for the urbanized landscape.

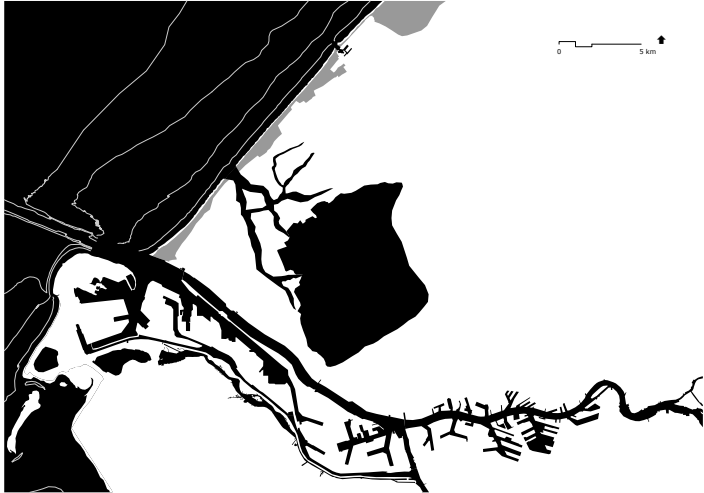
figure 5.4
THE SEA BREAKS IN AGAIN



the weakest link of the coast in the Westland

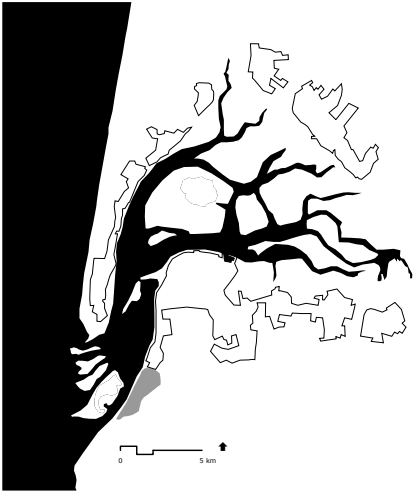


potential barriers in the hinterland to border a breakthrough



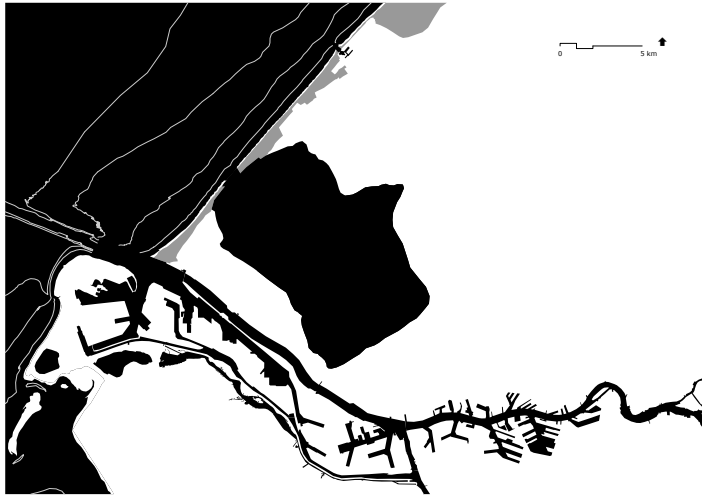
a breakthrough of the sea is looking for its way in the landscape

Arcachon at the Atlantic coast in France, an existing tidal creek. Scale comparison.

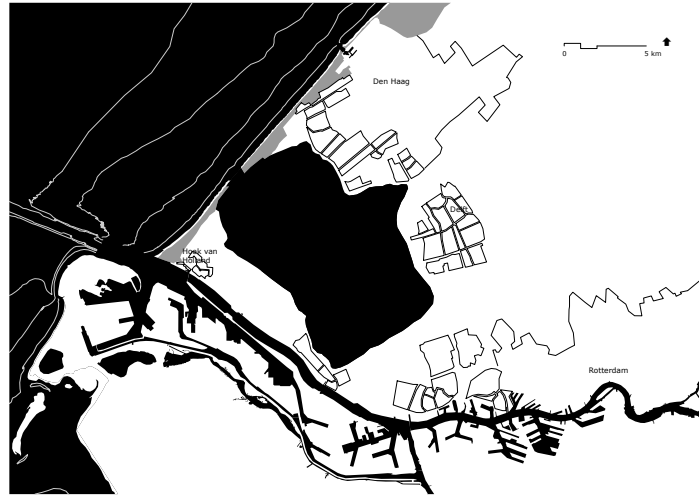


5.4 The sea breaks in again

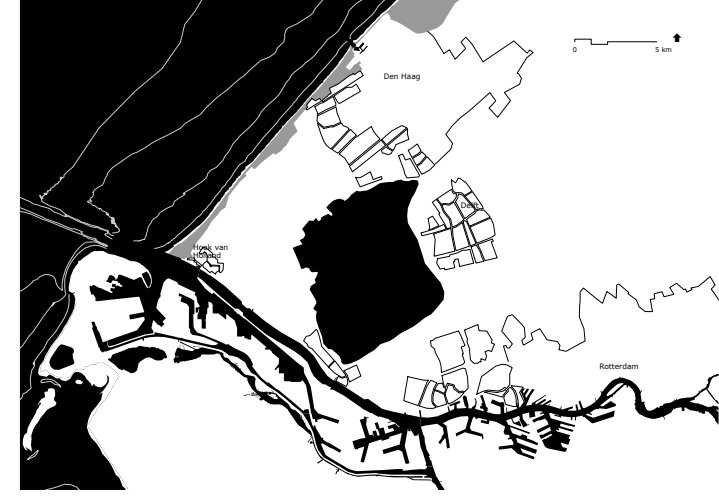
Two thousand years ago, the sea broke daily through the weakest part of the area and flooded the hinterland. After centuries of eroding, the sea appears to be very hungry to break through the small defence along the Westland coast, again. If we give access to this breakthrough, how will it change the existing landscape? Where are potential barriers to border the sea again. And how will the water subsequently look for its way through the existing land? See figure 5.4.



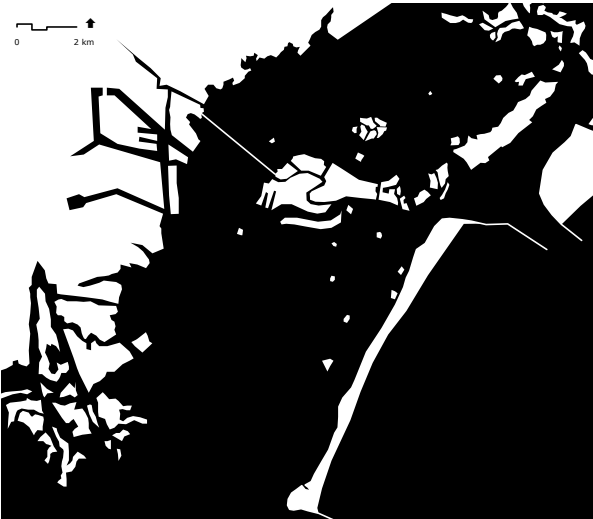
the flood tide covers the whole area



the breakthrough in regional urban context



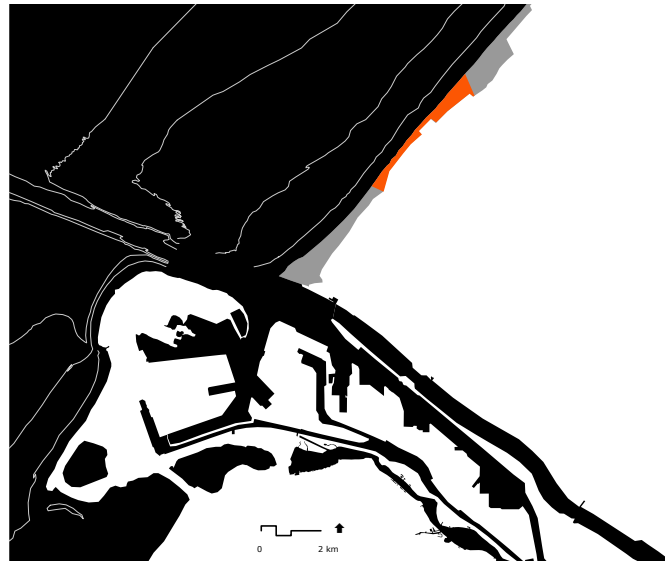
the land will silting up and a salt/brackish lake remains



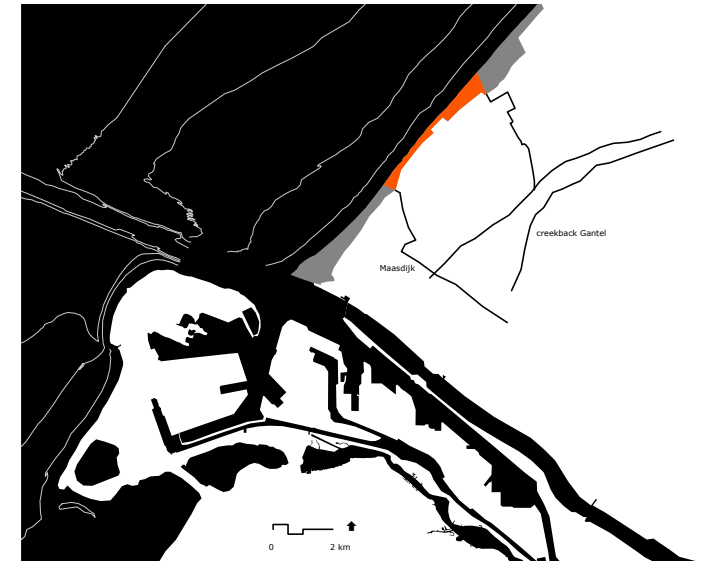
scale comparison with Venice, Italy. The city of Venice combines a necessary discharge of water with a canal network that functions as transport network and characterizes the city.



figure 5.5
WITHDRAWING LAND



the smallest part of the sea defence as part of wider system



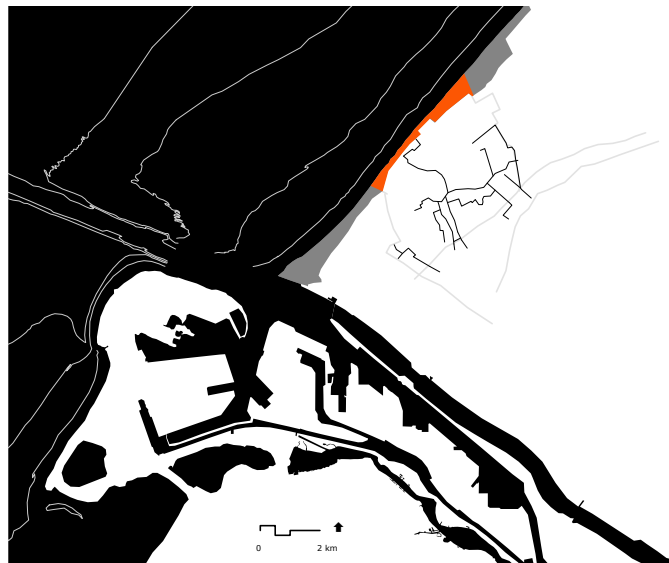
potential barriers in the hinterland as second part of the damming system

5.5 Withdrawing land

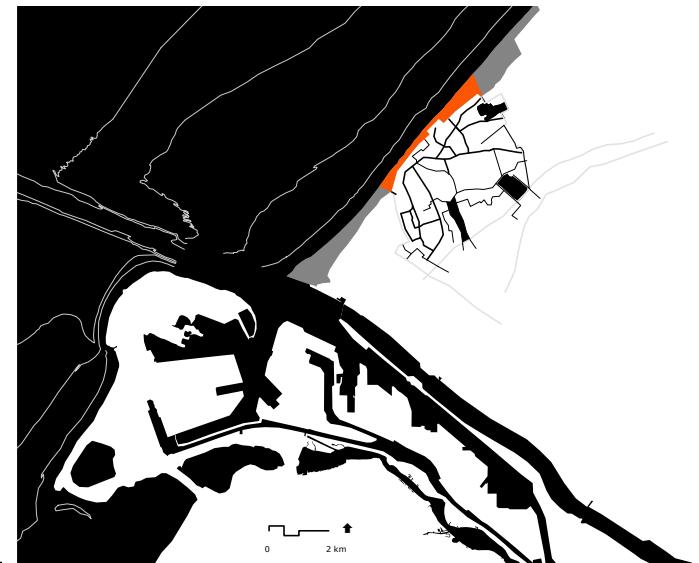
The coastal defence of the Westland needs to be strengthened in the near future to satisfy the safety standards. In stead of focussing on the reinforcement of the current dune dike, a new primary defence can be constructed in the hinterland and in between an area can be defined in which breaking waves over the old primary defence can be caught in an extended water system. In this way the water is turned width wise. See figure 5.5.



urban settlements



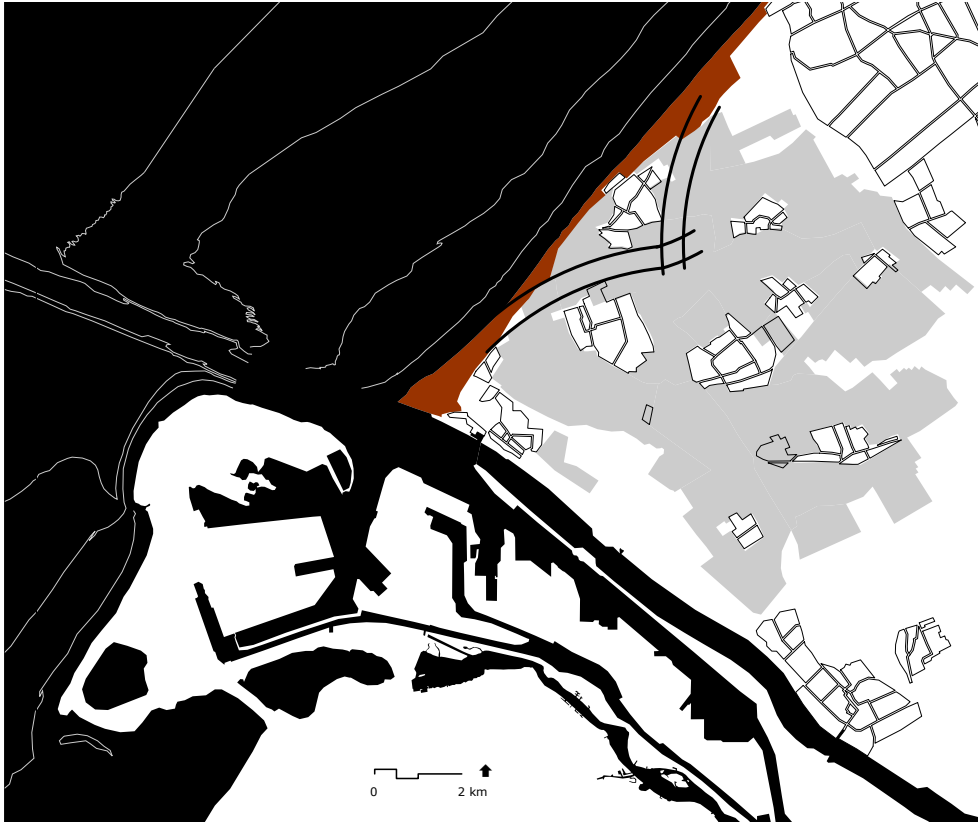
the current boezem water in the area...



...completed with new canals and lakes to catch the water

figure 5.6

GUARDIAN, SLEEPER AND DREAMER



searching space for the new dune rows



new dune landscape

5.6 Guardian, sleeper and dreamer

Dunes are a product of the combination of sand, wind and obstacles. In forming multiple rows behind each other, a natural and robust defence against the sea water develops. Through the centuries little has been left from this natural defence in the Westland. A small dune/dike protects the hinterland against the sea nowadays.

The guardian, sleeper and dreamer are dikes Dutchmen built in their reclamation of land from the sea, in which a new constructed dike took over the damming function of the older dike. From guardian, such a dike became sleeper and often dreamer in the course of time. As a matter of fact it is a concept derived from nature, as it are the dunes that developed in a similar way (figure 5.7). In the case of the Westland space is given for a robust sleeper and dreamer dune behind the primary coastal defence: the guardian. When a breakthrough of the sea through the current dune dike would occur, a second and third barrier will still stop the water and protect the intensive urbanized hinterland (figure 5.6). One simply needs a large amount of sand, wind and some human intervention.

typologie of the dunes at Schoorl: fixed innerdune edge, primary sea defence dunes planted with helm and in between a rougher area with more space for the dynamics of sand.

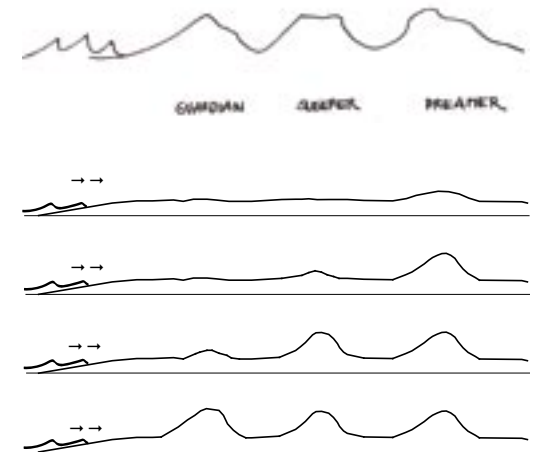


figure 5.7. The guardian, sleeper and dreamer as concept from nature: rise of the dunes.

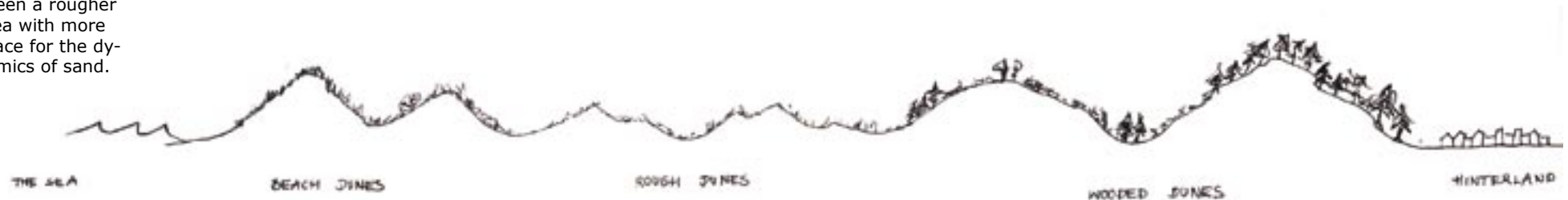
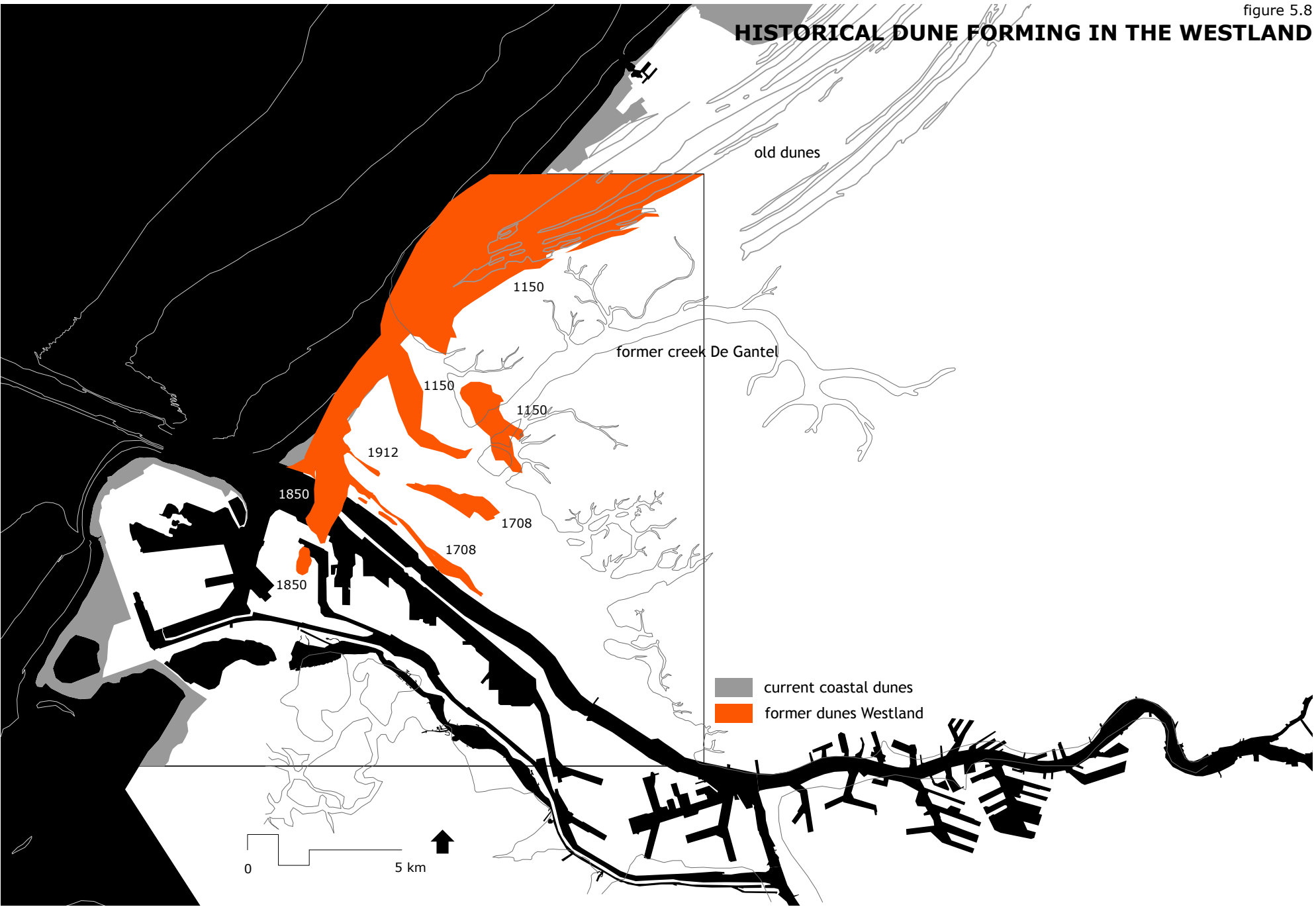


figure 5.8

HISTORICAL DUNE FORMING IN THE WESTLAND



5.7 Consideration

The three different scenario's are compared on the conditions, advantages and disadvantages for their implementation in the Westland, in the table below.

scenario's >	THE SEA BREAKS IN AGAIN	WITHDRAWING LAND	GUARDIAN-SLEEPER- DREAMER
<i>conditions</i>	<ul style="list-style-type: none"> - Limitation of the sea-water: 140 km new dike. - Abandoning of the current occupation of the Westland and Midden-Delfland. 	<ul style="list-style-type: none"> - A system to catch the salty water. - A new dike that substitutes the current dune-dike as primary defence. 	<ul style="list-style-type: none"> - Availability of suitable sand. - Presence of sand, wind and some human intervening. - Space for dune development.
<i>advantages</i>	<ul style="list-style-type: none"> - Recovery of natural balance. - Chance to a new beginning. - Repositioning of surrounding urban region. 	<ul style="list-style-type: none"> - Water network as a new quality for the towns. - New nature and ecology in the Westland. 	<ul style="list-style-type: none"> - Short term implementation possible. - Dry solution. - New natural landscape fitting in the coastal landscape southwards and northwards.
<i>disadvantages</i>	<ul style="list-style-type: none"> - An extensive disaster: loss of capital, salination. - New human control necessary: 141 km high new dike needed. - Long term implementation. 	<ul style="list-style-type: none"> - Brackish water, salination. - Loss of capital. - Reasonable amount of preparation needed. 	<ul style="list-style-type: none"> - Loss of capital. - Not only natural dynamics, but human component in shaping the landscape as well.
<i>impact</i>	XL	M	S

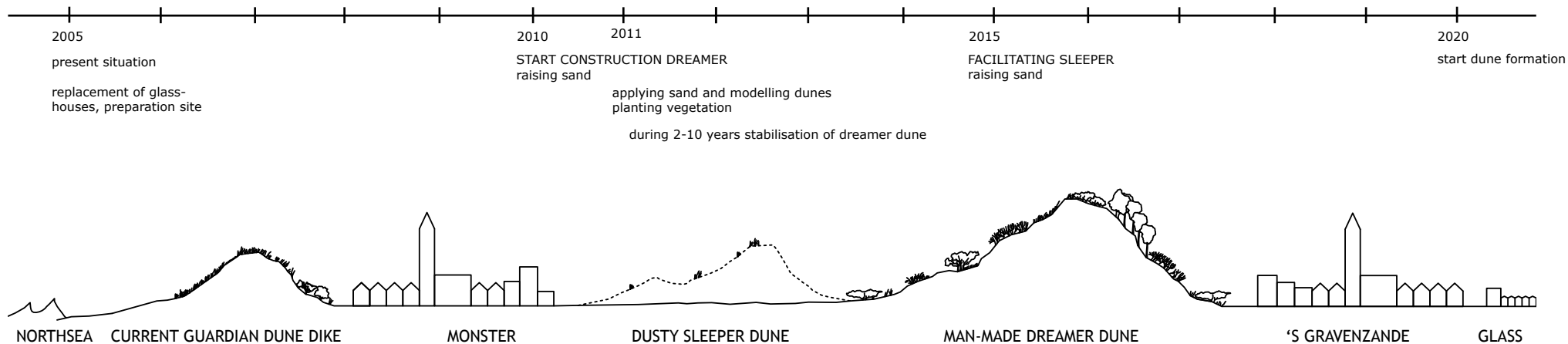
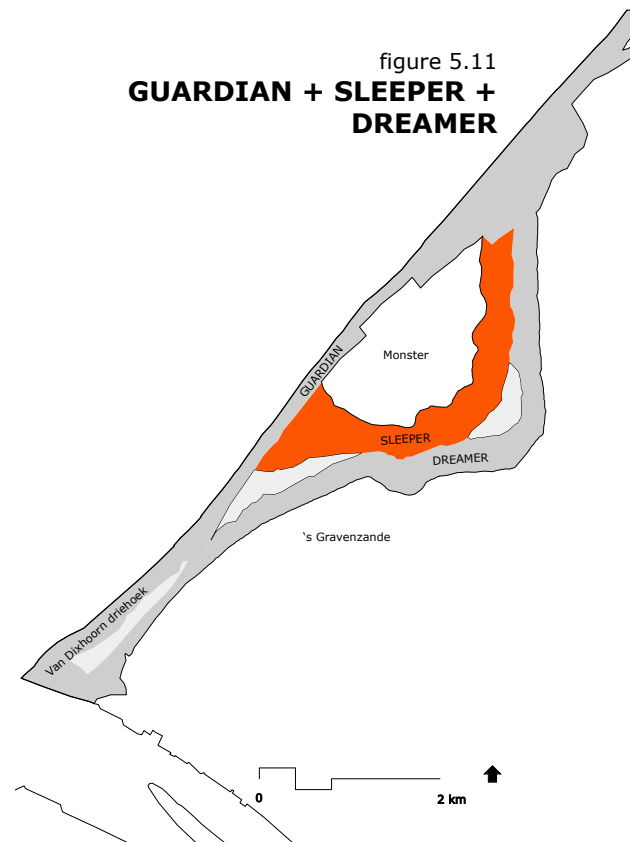
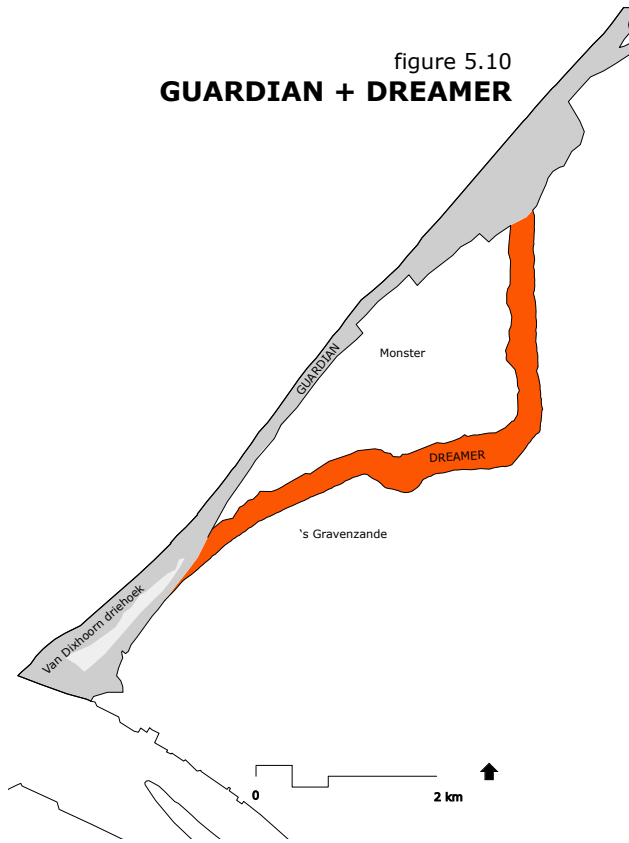
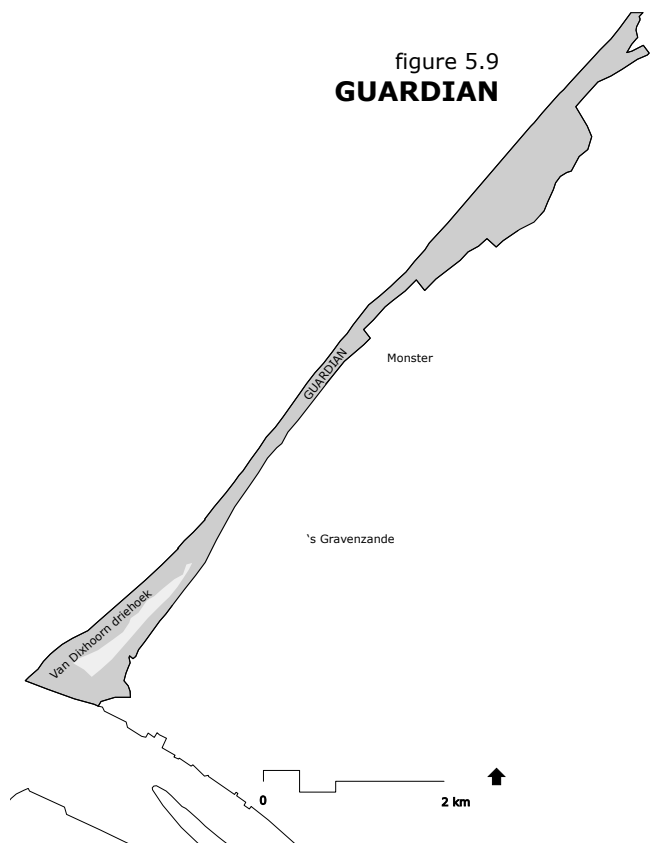
Considering the conditions, advantages and disadvantages, the guardian-sleeper-dreamer scenario is chosen for further elaboration:

- > it is a dry solution for the coastal defence, relatively little far-reaching concerning the damage of human capital;
- > it supposes an intervention that is in line with a history of dune forming in the Westland, see figure 5.8;
- > the concept supposes a comparatively simple implementation;
- > intuition tells that this scenario offers a range of opportunities.

figure 5.9
GUARDIAN

figure 5.10
GUARDIAN + DREAMER

figure 5.11
GUARDIAN + SLEEPER + DREAMER



5.8 Elaboration of guardian-sleeper-dreamer concept

There are different methods for the development of a dune area, in hierarchy of natural processes:

- entirely silting up of a dune area from the sea;
- development of a dune area from a beach plain;
- construction of a dune area by man.

(Löffler et al, 1999)

In the case of the Westland - see figure 5.9 - in which a second (sleeper) and third (dreamer) dune row have to be developed, the influence of the sea will not be present in the process of dune forming. This means that for the development of the new landscape the intervening of man is necessary.

man-made dreamer

To ensure the safety for the hinterland on the short term the third dune row – the dreamer – is made by man entirely, see figure 5.10. This means the introduction of relief (by a bulldozer), active management of hydrology and planting of vegetation. (Löffler et al, 1999)

Given the fact that the replacement of glasshouses and the preparation of the site needs to be planned in phases, 2010 is chosen as start, to give an indication of the process in time.

Because the intervening of man is distinguished and the period of the development of the dunes is relatively short, the new dunes will have a certain artificial character. To give the dunes a natural character, the morphology of existing inner dunes along the coast of Holland is used as reference in the design of the dreamer.

dusty sleeper dune

After the stabilization of the dreamer dune, between the new dreamer and present guardian, space is given to a 'dusty sleeper dune' (figure 5.11). In this case, man only shapes the conditions for the development of the dune: a thick sand layer is raised after which the wind takes care of the formation of relief. This is secondary dune formation: the development of dunes from an existing amount of sand. A lot of dunes along the coast of Holland have developed by secondary dune formation. (Löffler et al, 1999)

man-made versus natural formation

The Dutch dunes as they are present along the coast, nowadays, are originally formed by an interaction between man and nature dynamics. Sea waves and wind transported sand over the land, where it formed a hill on the spot of a (natural) barrier. This hill was often fixed with vegetation by man to protect the hinterland that was used for agriculture. This is why nowadays the border between the inner dune edges and the urban landscape is very sharp. In the design of the new dune landscape in this case the contrast between the man-made dreamer and moving sleeper symbolizes a new relation between man and natural dynamics: a search for a harmony in nature following man and man following nature.

In appendix B a motivation of the dimensions of the sleeper and dreamer dune can be found.



Sea buckthorn plays a key role in the rise of dunes behind a first dune row. It is able to colonize new pieces of land and to create conditions for the growth of other vegetation. It can survive in a soil with little nutrients, it loves the wind and grows above sand. Its roots can grow until 20 m wide.



Sand couch is a pioneer plant in the rise of dunes: it is a good sand catcher with its long roots, it survives silt circumstances and it has the property that it can be blown over by sand and grow above it again.

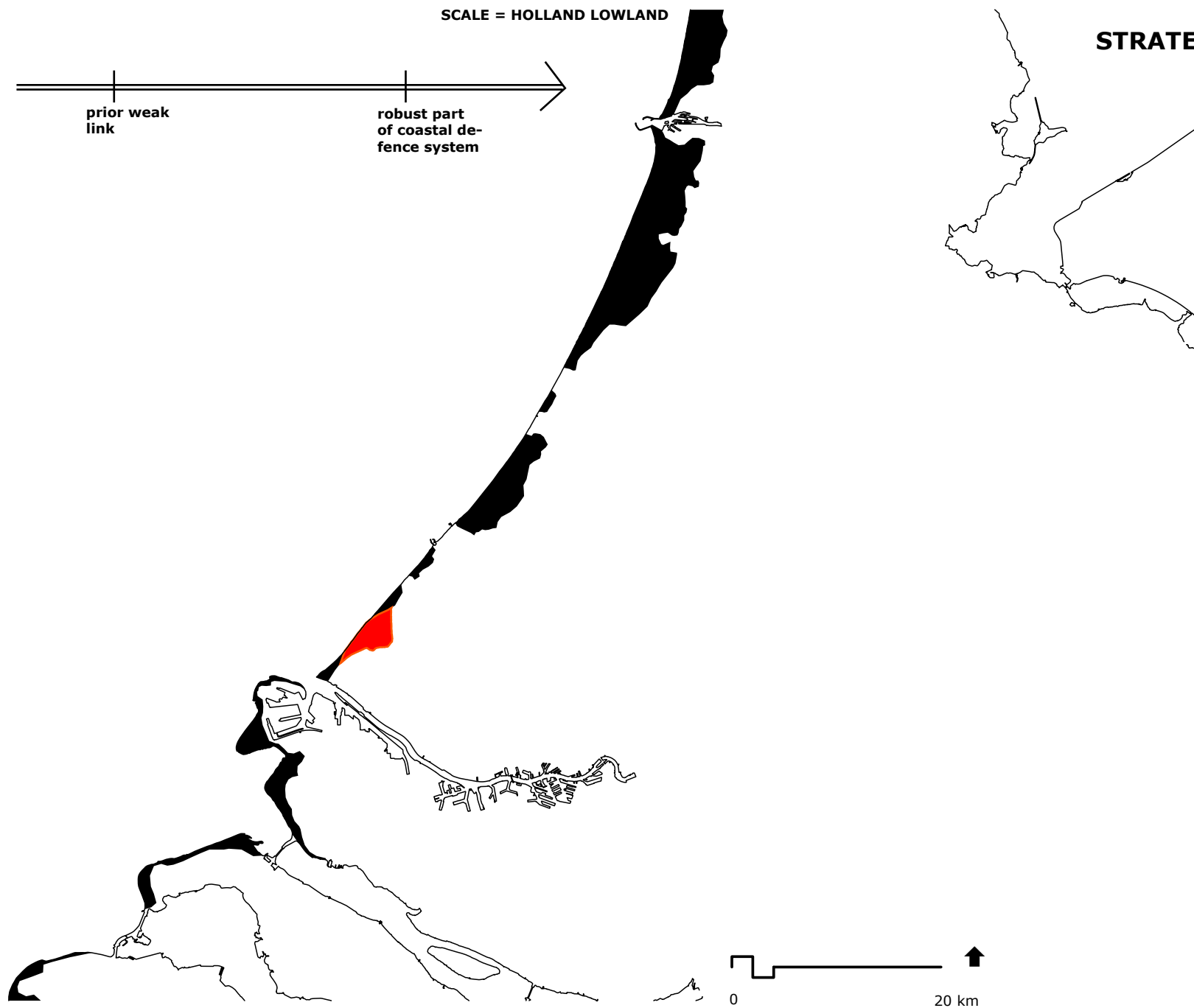


figure 6.1
STRATEGIC FOR THE SAFETY

The transition of the Westland coast from a weak link to a robust link in the Dutch coastal defence system.

6. Strategic meaning of guardian-sleeper-dreamer

6.1 Introduction

intervention in urban landscape

The implementation of a new sleeper and dreamer dune in the Westland will considerably intervene in the current urbanized landscape of the Westland. It assumes the replacement of a part of the glass housing in the area for a more robust coastal defence that will protect a large part of the hinterland against a flood. But exactly because the chosen concept intervenes in an already occupied and urbanized landscape it can and should have a strategic meaning for the spatial future of the area that uses its primary function – a coastal defence – as an opportunity for the spatial assignments that are present and justifies the radical changes it involves.

a strategic meaning throughout time and scale

The people that live on a site and the identity and function they give to that site are only short-living. However, the interventions men commit, are often far-reaching for a long period. So is the guardian-sleeper-dreamer intervention, as proposed in this thesis. The dunes will probably survive hundreds of years, so it is almost impossible to predict the future spatial role for them. But reasoning from the past and looking to present and near future spatial assignments there are a range of roles that this intervention can fulfill for the Westland and its metropolitan context throughout time and on different scale levels.

6.2 Strategic for the safety

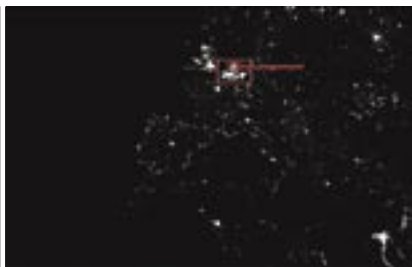
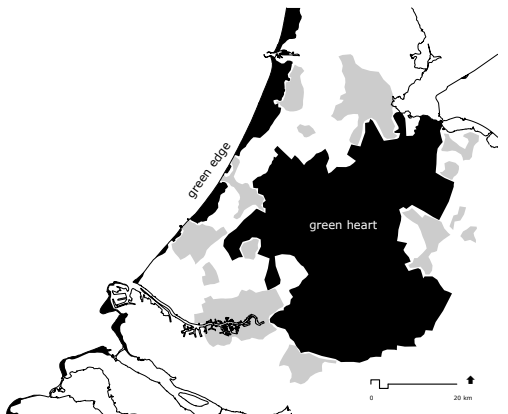
robust link

The guardian-sleeper-dreamer concept will change the coast of the Westland from a weak link to a robust part of the Dutch coastal defence (figure 6.1). If a breakthrough will happen, a second and third barrier will protect the hinterland against a disaster. As the sea moves naturally in landward direction, Monster - that is situated between the guardian and sleeper dune - will obtain a lower safety level in the course of time. This is a consequence that seems realistic for the future: not all places can be offered the same safety level. The position between the dunes and almost at sea offers Monster however a range of opportunities for its development in future.

figure 6.2

PRIMARY NATURE AS PART OF THE METROPOLIS

SCALE = HOLLAND IN MONDIAL
CONTEXT



6.3 Primary nature as part of the metropolis

According to Crowe the rise of the city was a new extreme in a relation to nature. 'The city is the ultimate expression of artifice, a second nature built as an alternative to living exclusively within the natural world. In perfecting this second nature, we have progressively separated ourselves from real nature.'

In the past decennium however, the scale enlarging on the one hand in which large urban agglomerations merge to metropolitan area's faced a new conscience of man for the values of nature and an ambition to integrate nature in the metropolitan assignment.

coastal dunes as green edge

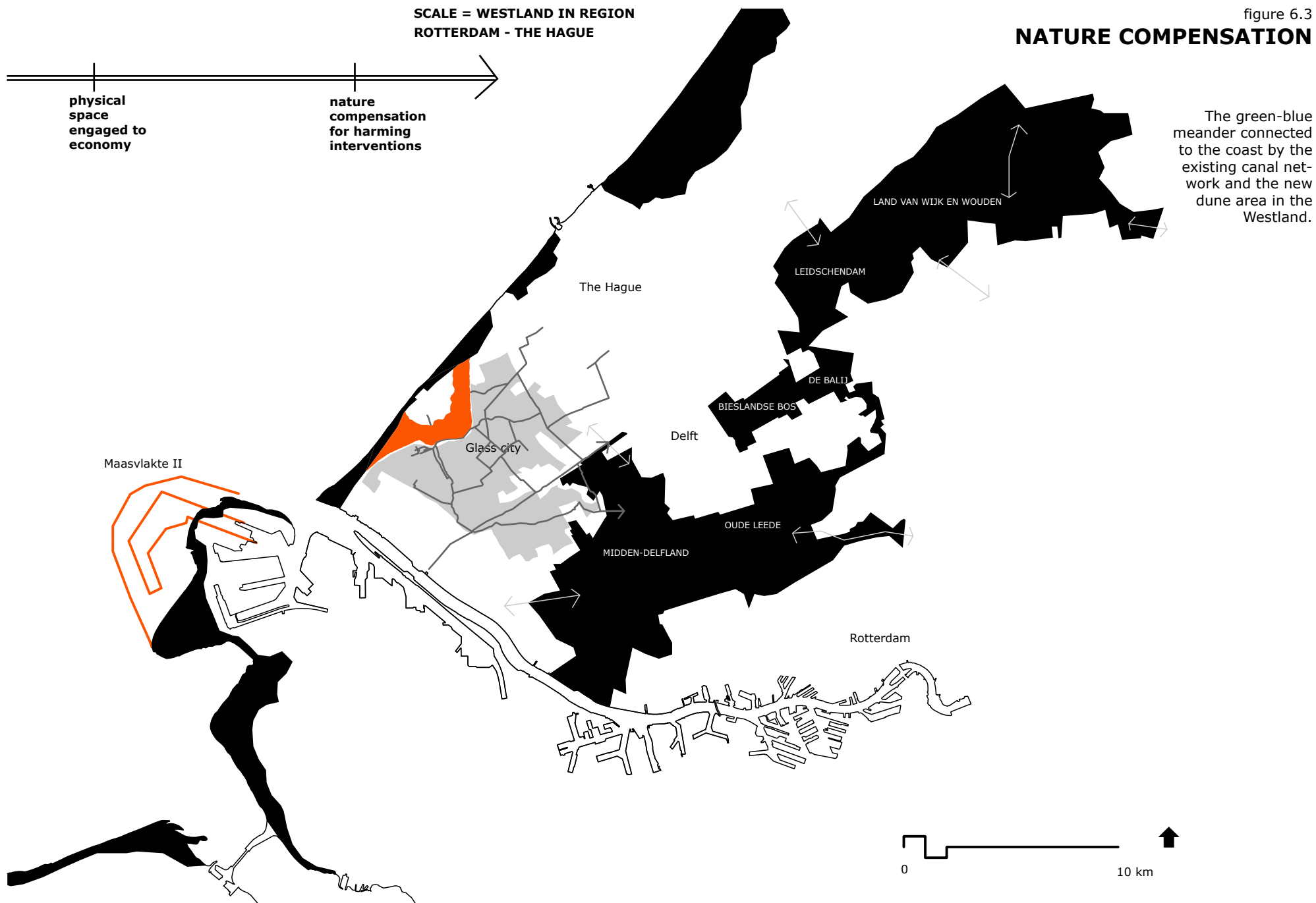
This is expressed in the Randstad/Delta metropolis, planning concepts for the strongly urbanized west of the Netherlands as economical, political and living heart. Different from other metropolises like London and Paris, the Randstad contains no central urban heart, but is a range of urban centres positioned among the so called 'green heart', protected as national landscape in the Nota Ruimte. This large, still quite open space, mainly represents cultural-historical values. At the west of the Randstad nature is present that owns its protected position to the safety function it fulfills: the dunes. One can consider these dunes as the 'green edge' of the Randstad with a natural experience that can be strongly determining for a living quality, see figure 6.2. In the north wing of the Randstad this is evident, in the south wing this quality is hardly present.

strengthening of living quality

The sleeper-dreamer intervention can be seized for a new living quality in the region Rotterdam-The Hague. If the glasshouse function slowly moves out of the Westland region – a process that is not unlikely as it is still happening – the new dune landscape can form a strong character full carrier of the transformation to a living area.



The four large cities of the so called 'Delta metropolis' positioned among the Green Heart and their individual nature areas: the IJ lake at Amsterdam, the Utrechtse Heuvelrug near Utrecht and... the dune coast for the cities of the Hague and Rotterdam.



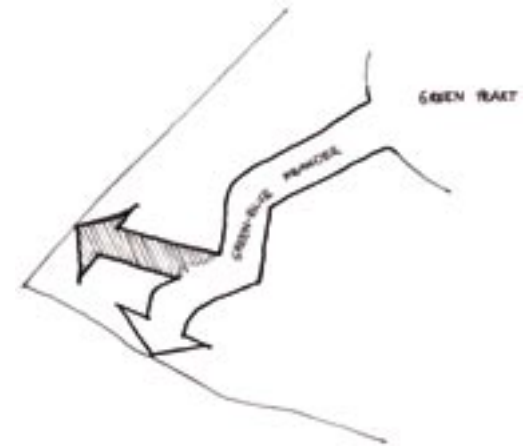
6.4 Nature compensation

The physical space of Holland is very clearly a landscape that has been put at the service of welfare in the past centuries. Interventions in space for the favour of the economy – large infrastructure, glasshouses, harbours – have almost always negative consequences for nature. Today, a so called quality of life cannot only be expressed in money anymore. Existing nature area's and new to be developed nature area's are being connected with each other to form both an ecological zone and a recreational network that cuts through the urban landscape. They form in fact a nature compensation for the intensive urbanized landscape that it surrounds.

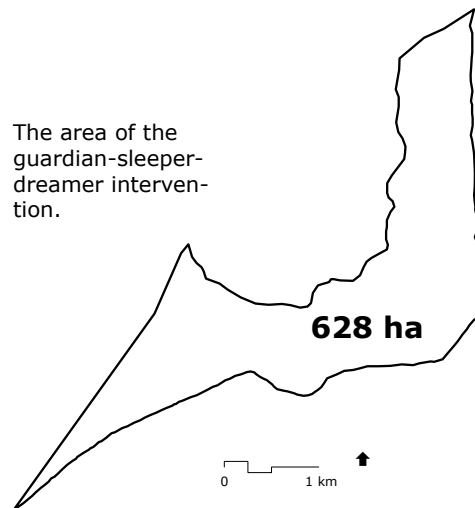
nature compensation

The so called 'Green-blue meander' is a series of 'green' and 'blue' area's that form a meander through the region Leiden-The Hague-Rotterdam and connect the Green Heart with the river Maas. The new dune area in the Westland together with the water network - the canals - in the area can form a second meander to the sea. This gives the Westland her own ecological and recreational network, connected to a larger scale nature structure. To make this network accessible for men, the dunes as well as the canals have to be made public.

Literally spoken, 'nature compensation' is a legal obligation that derives from the European rules. When an intervention is planned that destroys nature, a reasonable compensation of this loss has to be found and implemented in the near environment, nowadays. The guardian-sleeper-dreamer intervention can be a nature compensation for the reclamation of land in favour of Maasvlakte II. Besides, it can be a large part of the 750 ha 'new nature' that is planned in the near direction of Rotterdam as part of the Project Mainport development Rotterdam (www.portofrotterdam.com/maasvlakte2/).



An extra meander to the coast containing the water network of the Westland and the new dune area.

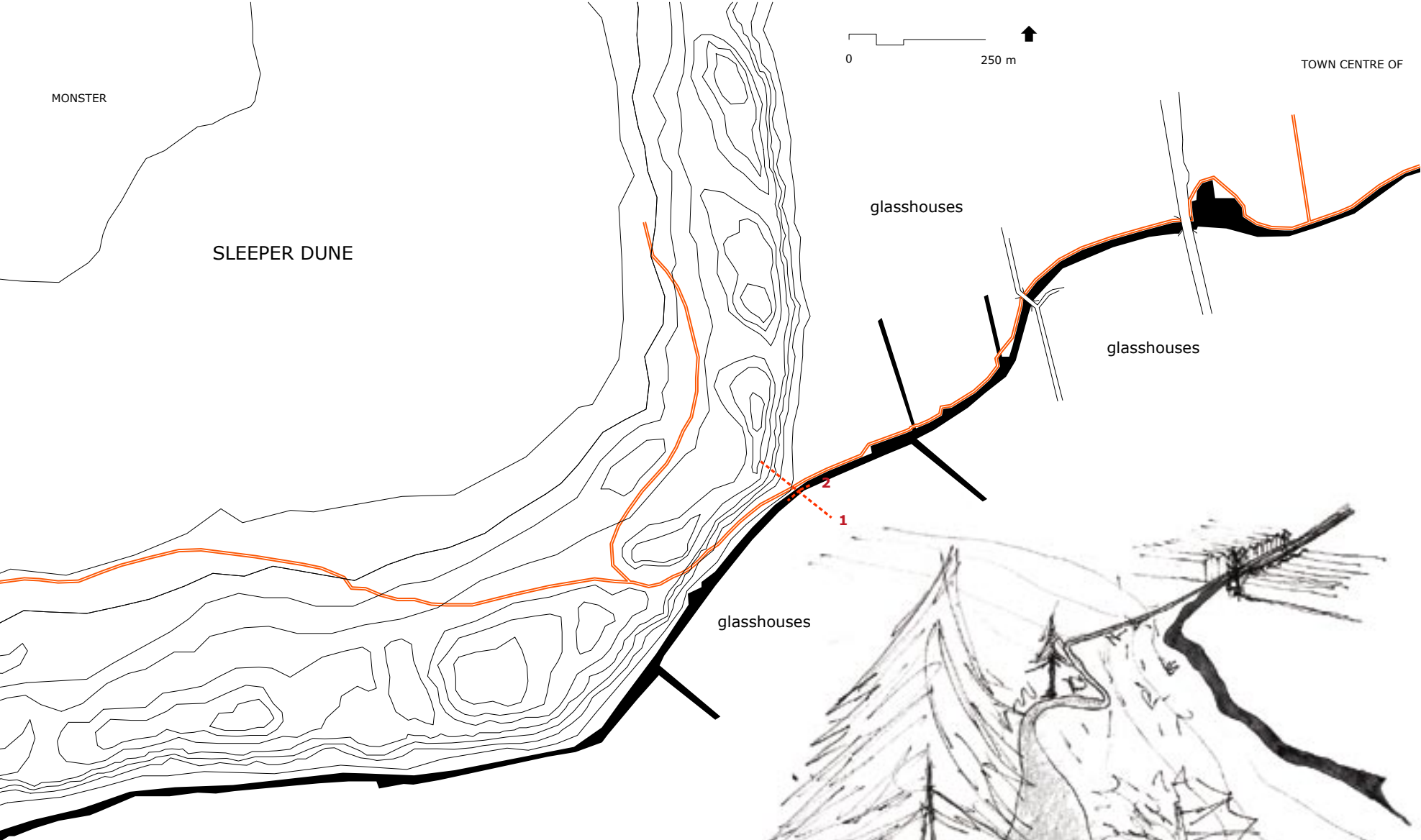


The area of the guardian-sleeper-dreamer intervention.

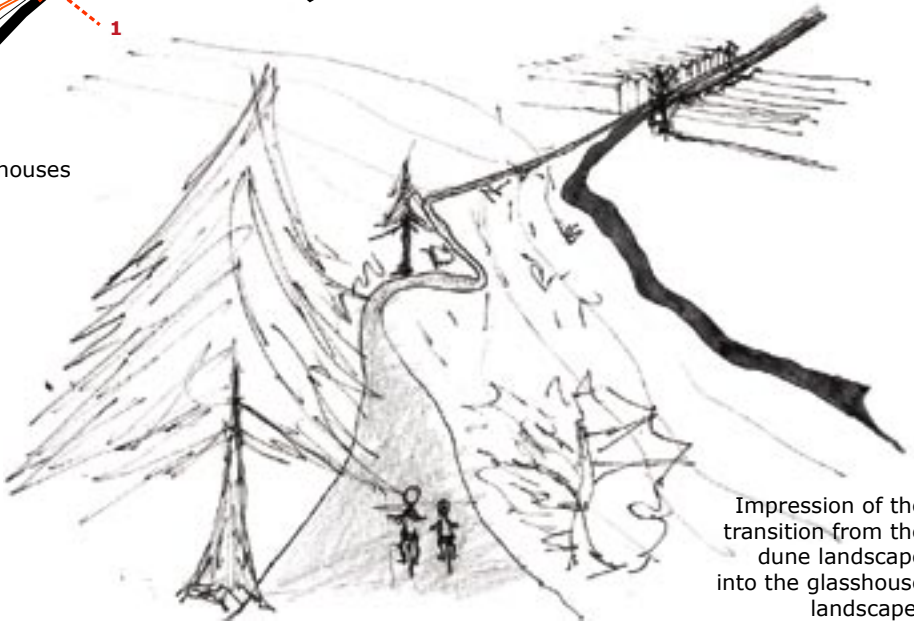
total area of Westland = 9059 ha
(see appendix C)

The intervention takes 6.96 % of the space of the Westland.

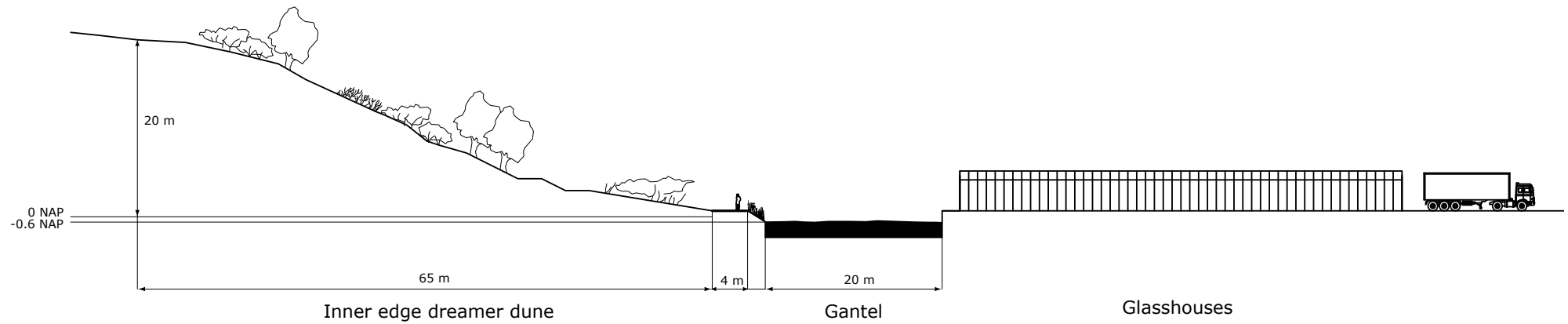
DUNES AS PART OF NATURAL RECREATIONAL NETWORK



The design of the new dunes, bordered by the river Gantel. The construction of a recreational road make the dunes and the bank of the river public and connects the new dunes with the existing canal network. In this way a recreational layer traverses the Westland, as new layer next to the high-scale gardening network layer.



Impression of the transition from the dune landscape into the glasshouse landscape.

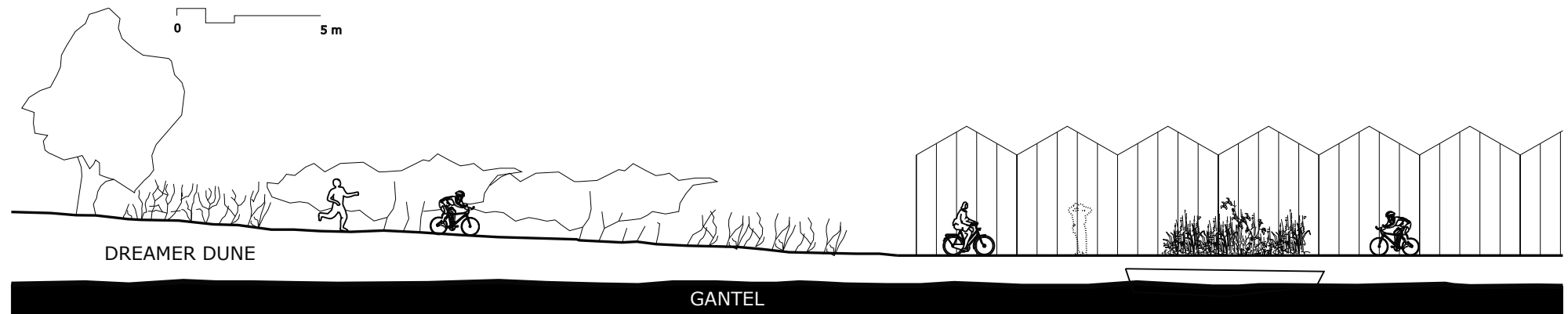


section 1 Typology of the relation dune - river - glasshouse

The glasshouses have their back orientated on the water and recreational network and their front to the high-scale transportation network.

section 1 Transition dune area - glasshouse area

The inner dune edge of the dreamer is quite steep and a public road therefore has to descend oblique over the height contours to reach the needed angle. This means that the path runs sometimes almost parallel to the dune. This will give a magnificent view over the glasshouse complex. As the glasshouses are lighted during the night, the recreational network has free lighting, which increases the safety.



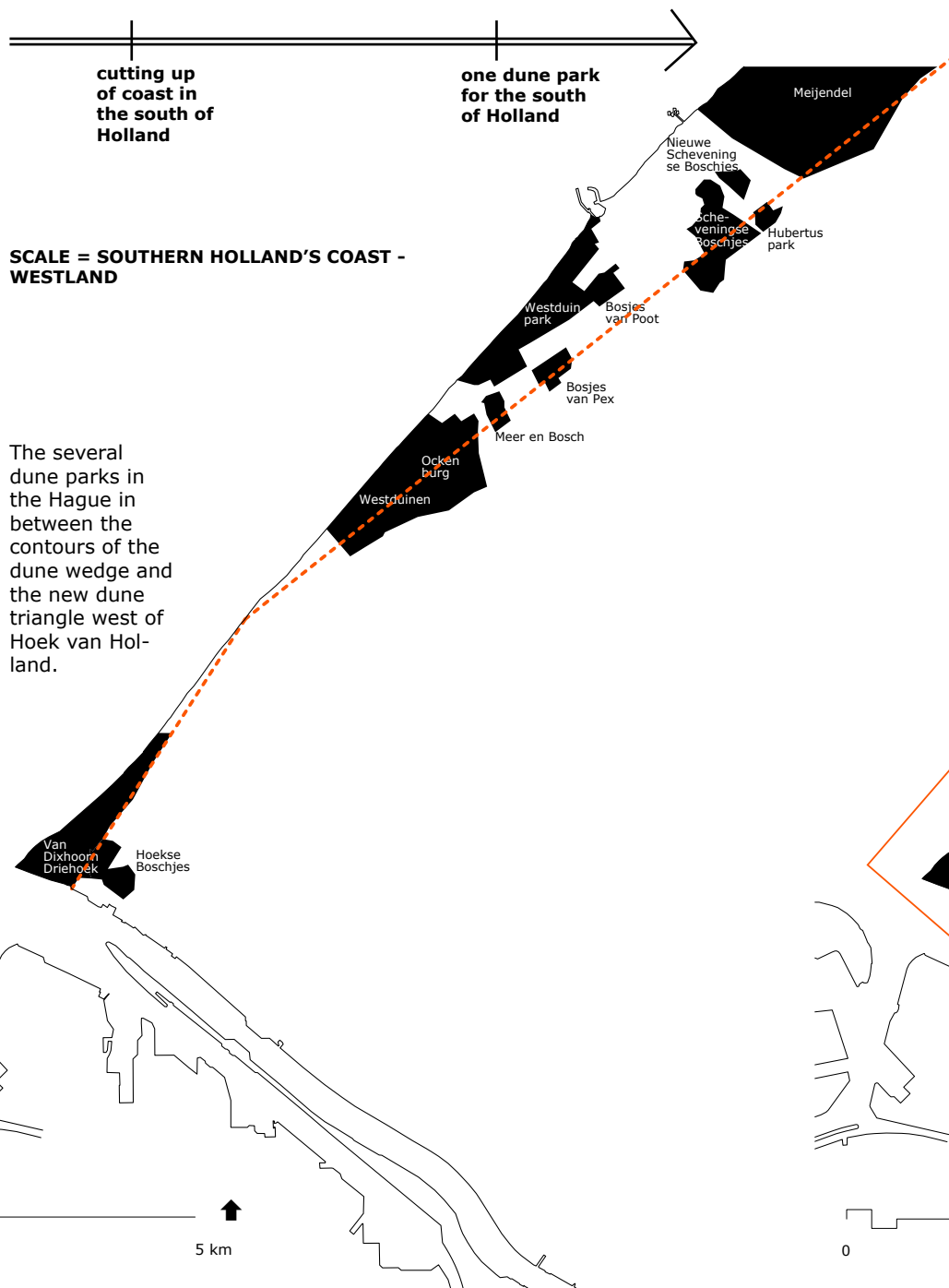
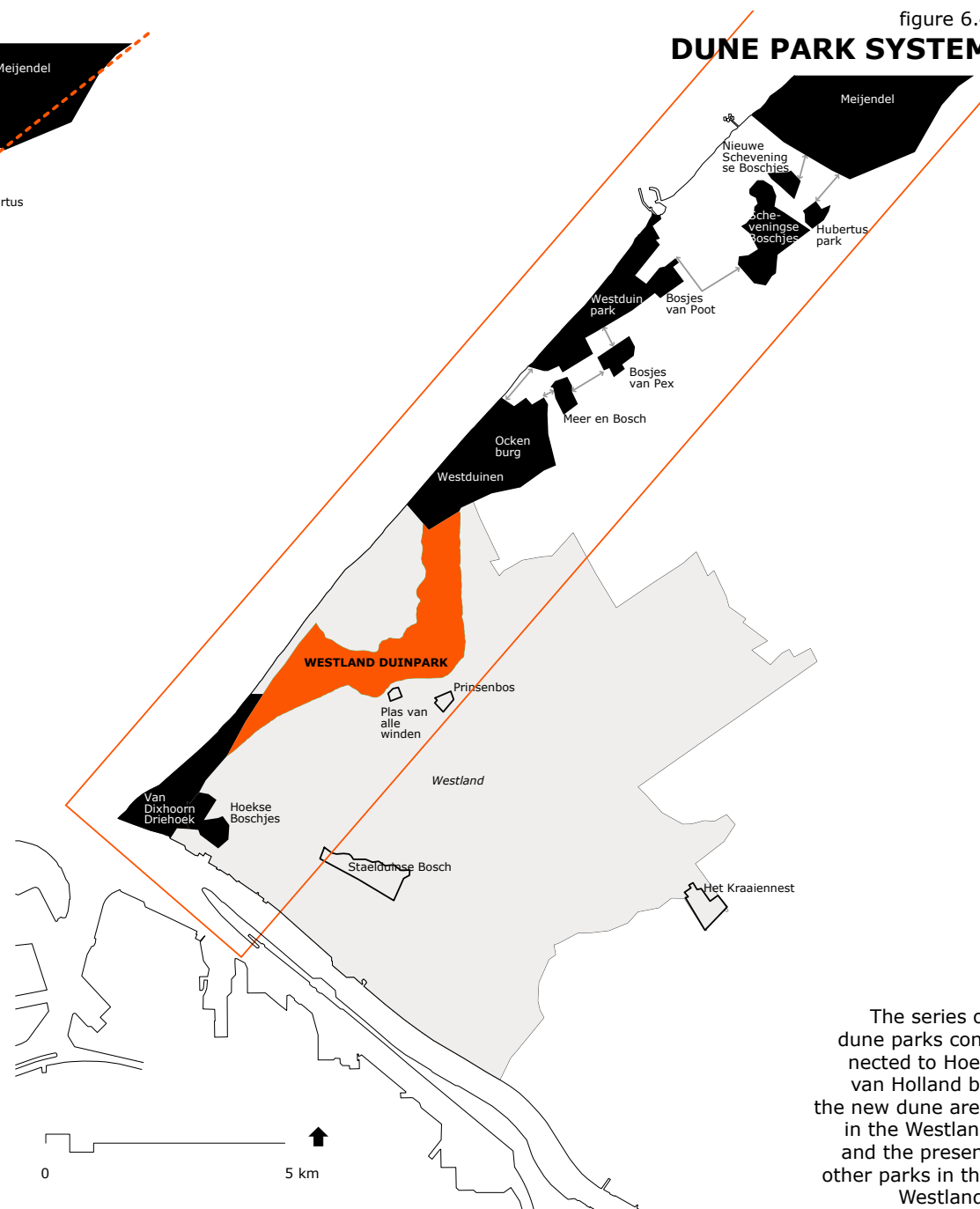


figure 6.4
DUNE PARK SYSTEM

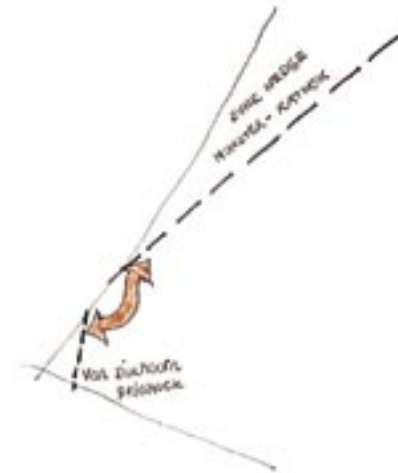


The series of dune parks connected to Hoek van Holland by the new dune area in the Westland and the present other parks in the Westland.

6.5 A linked dune park system for the south of Holland

Once the sea defence between Katwijk and Monster consisted of one closed dune system (see figure 3.3 'Dune wedges'). North of the Hague - in the Meijendel - the dunes of this system have been preserved. In the Hague itself, a large part of the former dune area has been dug of for the sake of the city and boulevards at sea have been built instead. But in between, the contours of the former dune wedge one will find a series of parks in the Hague that are remainders of the former dunes. These parks - like the Scheveningse Boschjes and Boschjes van Poot - still contain the relief of a dune and form visible tracks of a former coast landscape that left the city. South of the Westland, land that once belonged to the sea, the Van Dixhoorn Driehoek has been constructed as new dune area west of Hoek van Holland. The guardian-sleeper-dreamer intervention can link the series of 'dune parks' of the Hague with the 'dune park' of Hoek van Holland. Considering these dune area's and tracks of former dunes as one park system, a historical coast landscape can be articulated and supplied with a new coast landscape.

A park is a place where nature and man come together. It usually has been made suitable by man to stay and move through and in the meantime it is a place where flora and fauna can flourish. Parks are important for the city to give the urban-dweller some rest and contact with nature. On a higher scale, they play a role in the creation of livable surroundings. In the Westland - a city on itself - one will not find parks, except for the Staelduinse Bosch and a few small lakes. The new dune area as park will therefore fulfill an important function as new - accessible - green area.



The most southern dune wedge of Holland connected with the Van Dixhoorn Driehoek by the new proposed dune area.



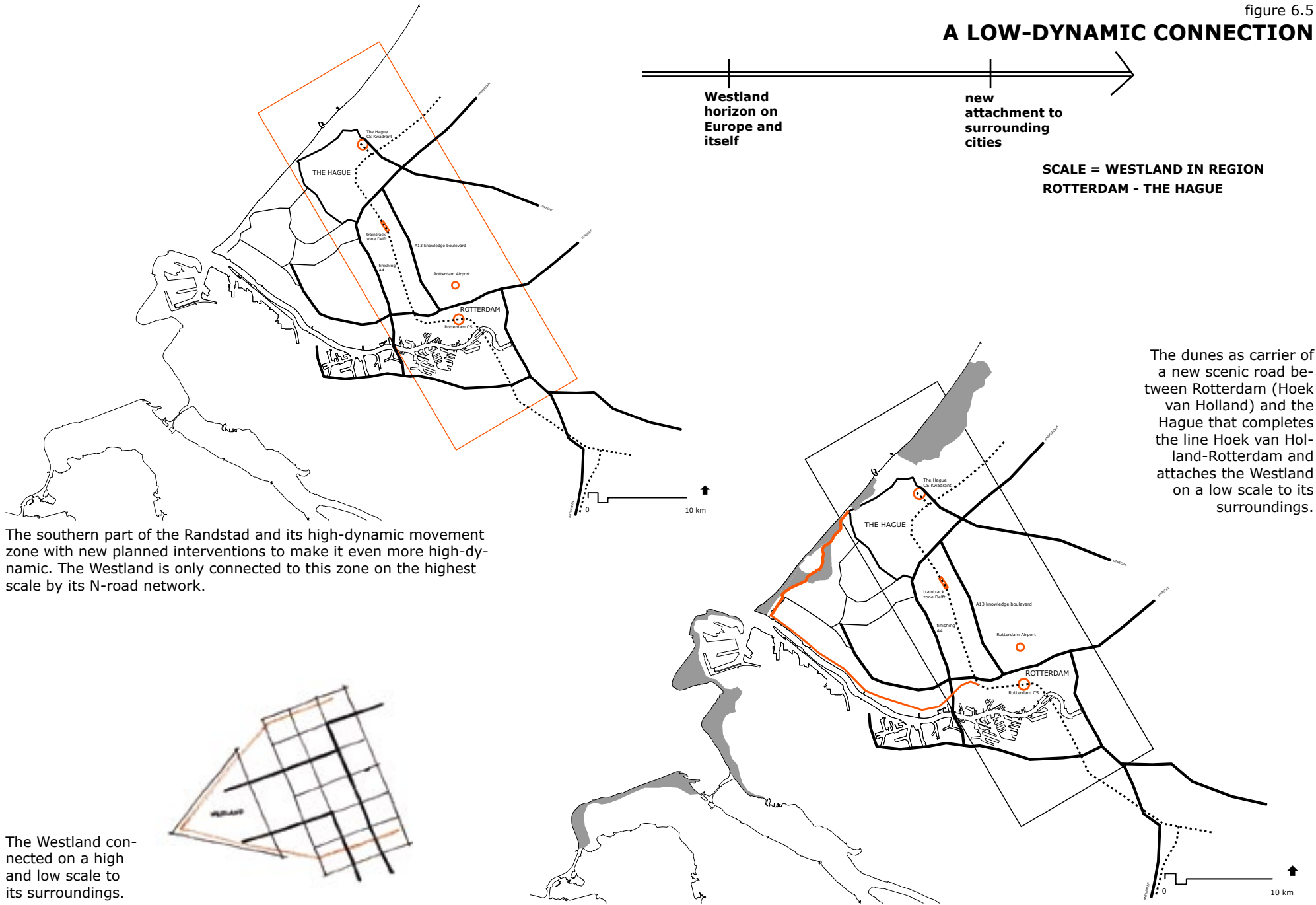
The Westduinpark,
between Schevenin-
gen and Kijkduin,
and the view it
offers on the city of
the Hague.



The Meijendel
dunes, north of the
Hague, and its
public function.

figure 6.5

A LOW-DYNAMIC CONNECTION



6.6 A low-dynamic connection

High-quality connections appear high on the current agenda to make it possible to move as fast as possible over the physical space. Examples of planned projects in the region Rotterdam-The Hague are the finishing of the A4, the transformation of the A13 to a city boulevard and the high speed train track. All these ambitions can be caught together in a high-dynamic area of which the Westland is not part. The N-road network of the Westland only connects this dynamic area and uses it for a fast transportation of goods. The N-road network is a symbol for Westland's horizon that extends in fact globally. This global scale overrules the area and disconnects the Westland from its surrounding urban context.

informal connection

The Westland has however a special geographic position between The Hague and the Maas cities. Together with the plans for an up-grading of the track Rotterdam-Hoek van Holland the new dunes can carry a new route that informally connects The Hague with Rotterdam, see figure 6.5. This gives the Westland a new accessibility that it can exploit for, for instance, touristic reasons.

Westland's global
scale: the glass
business.

1. glass house
production
2. cargo handling
3. transport
along glass-
houses
4. trading at auc-
tion
5. transport over
N-road
6. transport over
international road

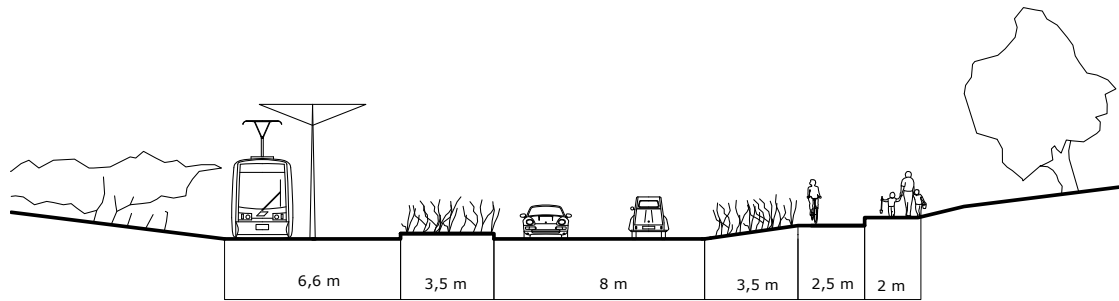


DUNES AS CARRIER OF A SCENIC ROAD



section of the new road crossing the sleeper and dreamer dune

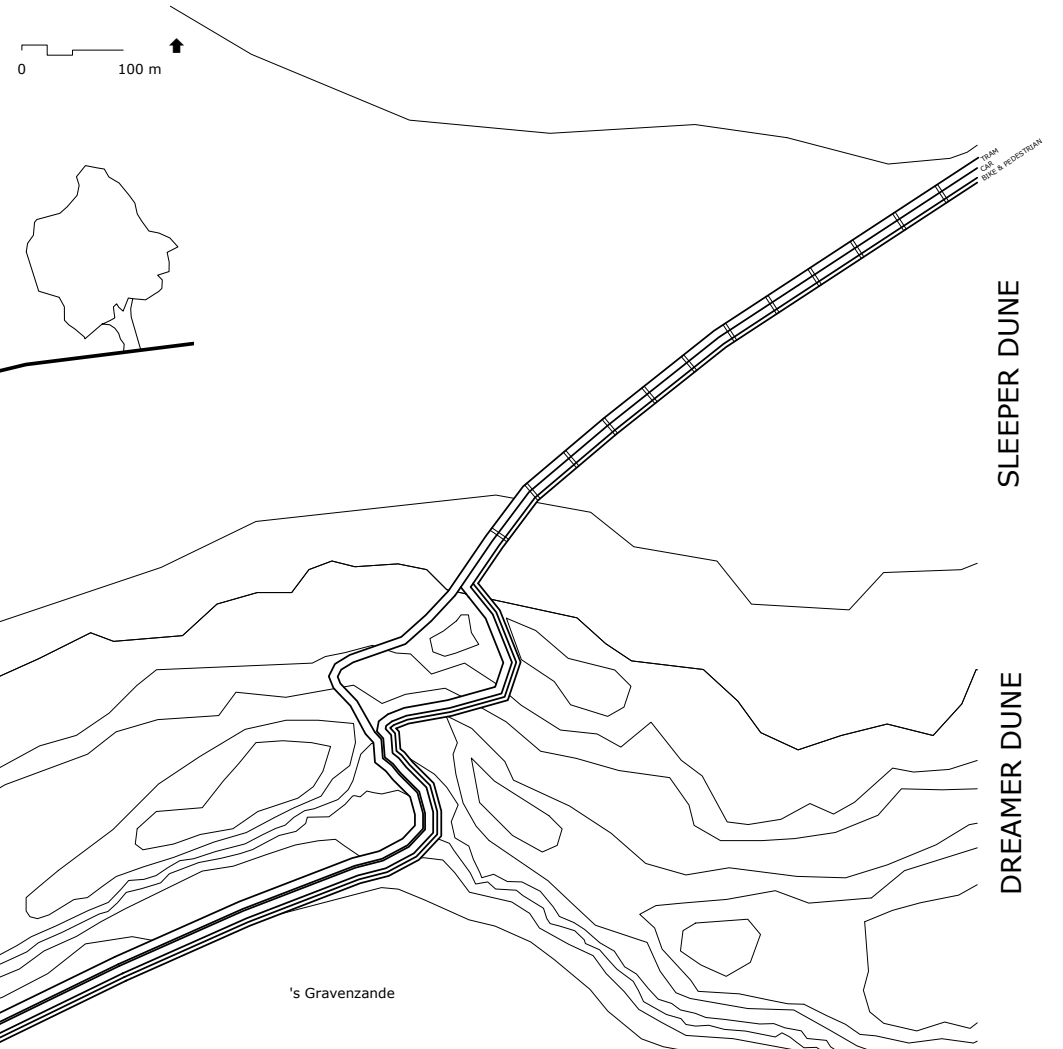
Typology of the relation road to dune landscape: at the dreamer dune, the road is cutting through the dune and passing at its lowest part (still far above storm flood level). Man is part of the nature landscape, here. At the sleeper, the road is placed on a viaduct to make sure that the sand can move. Man is lifted up from the nature landscape.

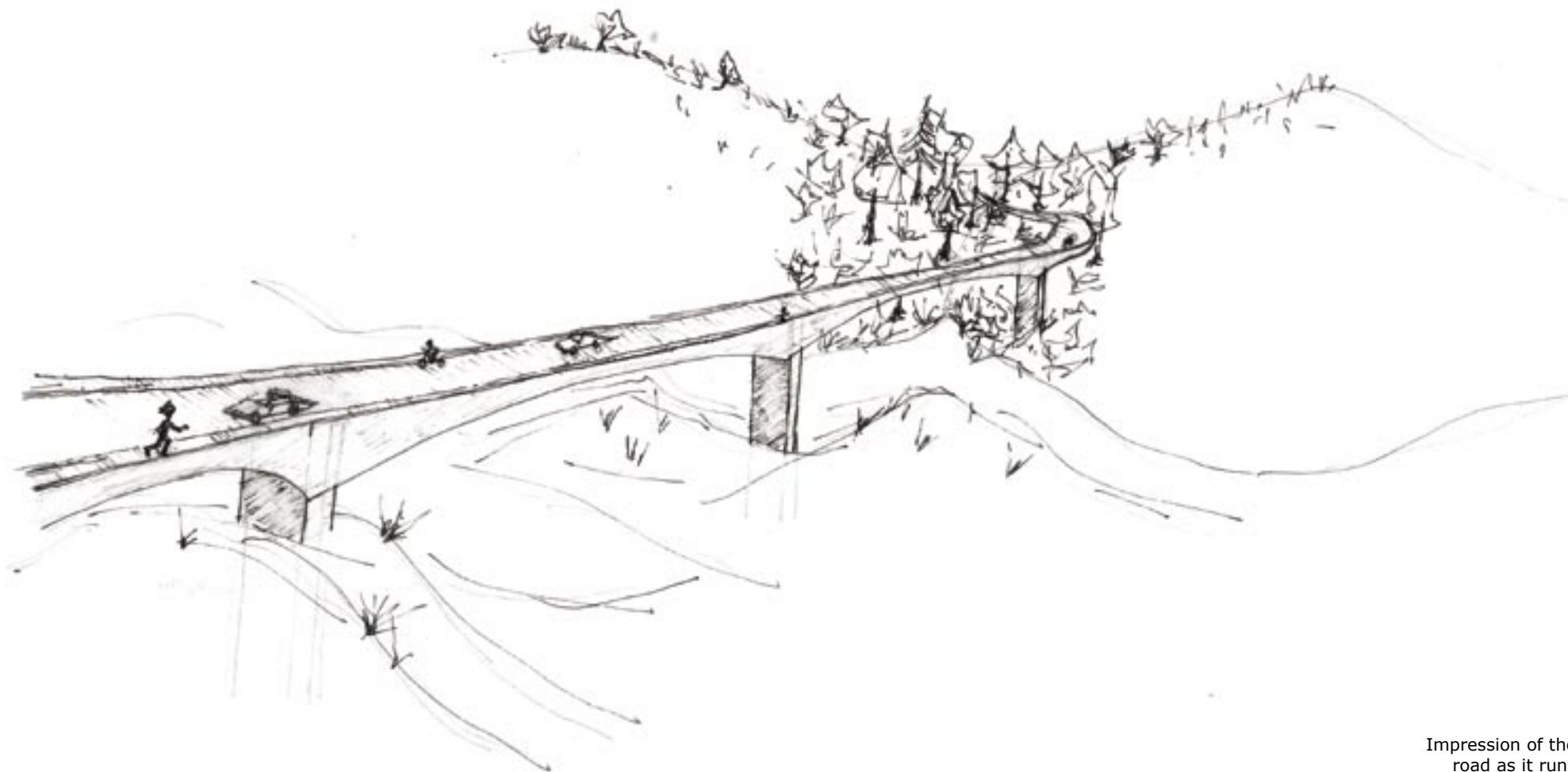


road profile at the dreamer dune

The scenic road carries a car route as well as a public transport route by tram. In this way the Westland area obtains a closed public transport line from Rotterdam to Hoek van Holland to Kijkduin. The bike and pedestrian route is separated from the road.

plan of the road crossing the dunes



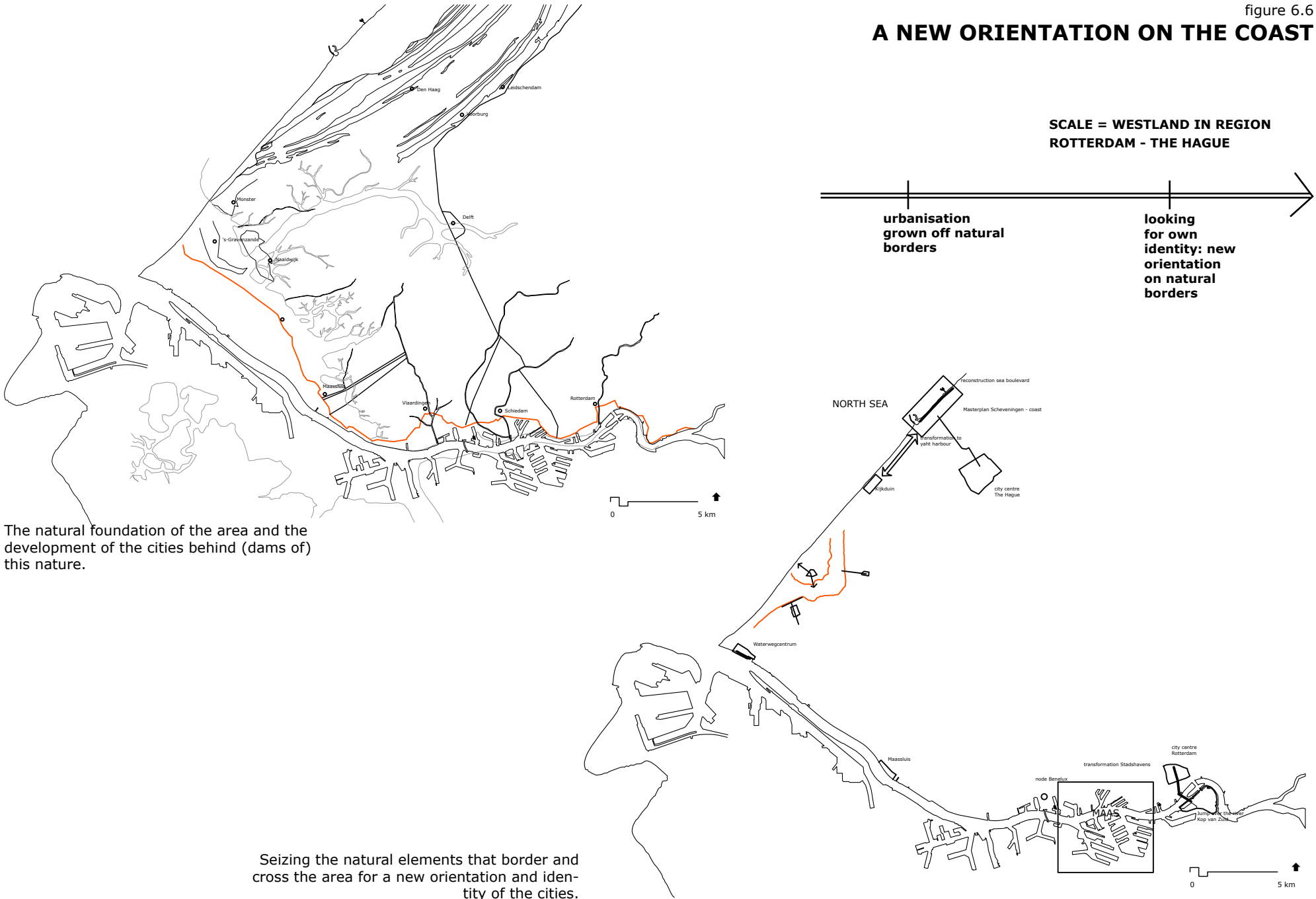


Impression of the
road as it runs
from the dreamer
dune and is lifted
up from the sleep-
er dune. Here,
without tram.

figure 6.6

A NEW ORIENTATION ON THE COAST

SCALE = WESTLAND IN REGION
ROTTERDAM - THE HAGUE



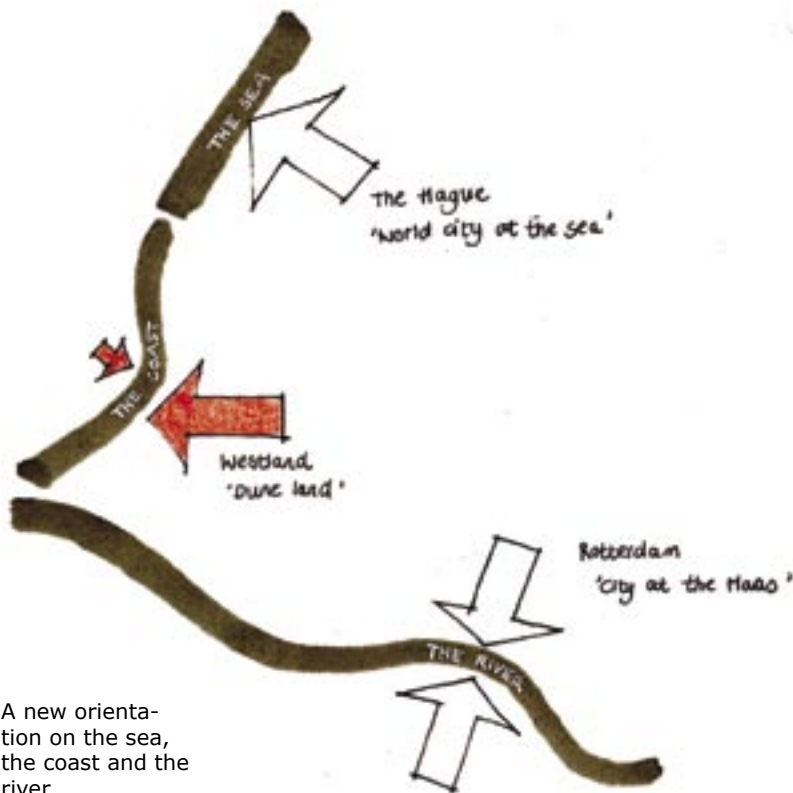
6.7 A new orientation for the Westland on its coast

The area which the Westland is part of, has developed by the grace of sea and Maas mouth. The cities in the area were originally founded behind the dams to control these natural elements. They grew with their back to what has left of the nature landscape.

**nature elements
as identity carrier**

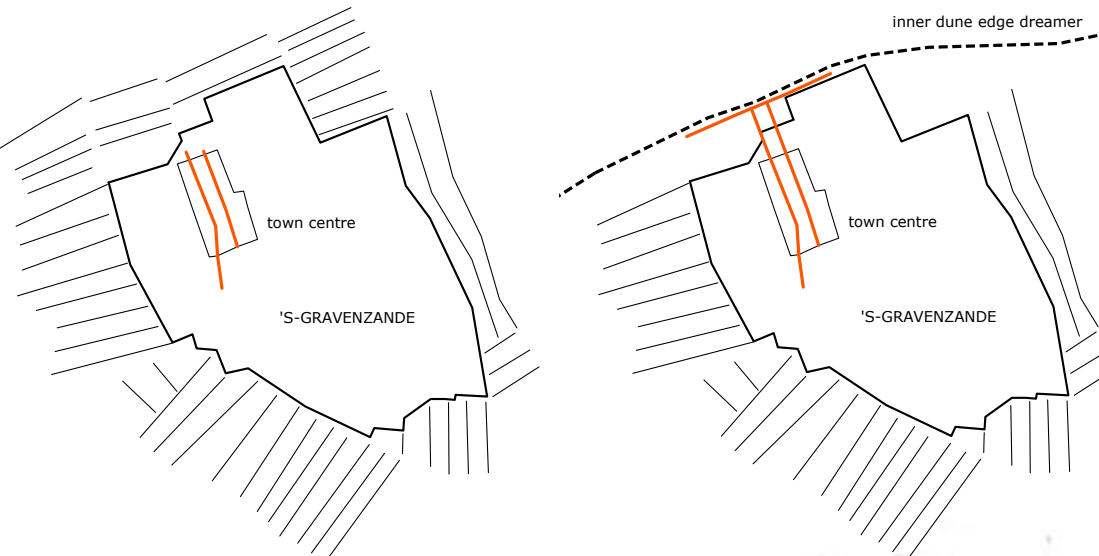
The Hague and Rotterdam are searching for a strong identity to connect their city to, already during a range of decennium. Both cities seize their natural elements now – the North Sea and the river Maas – for a new orientation of the city. The Hague as 'world city at sea' and Rotterdam as the 'Maas city'. Different interventions from the past, the present and planned in the future are witnesses of this process.

The Westland can seize the new dunes as a strong natural element to orientate on (figure 6.6). It can strengthen and renew its character as not only a glass city, but a diverse urban area with different towns very close to the sea and coast. Characteristics that are overruled by the glass business know can be expressed to the outside.



The Erasmus bridge in Rotterdam and the sea boulevard in Scheveningen, The Hague as icons of a new orientation to respectively the river and the sea.

DUNES AS NATURAL ELEMENT TO TURN TO



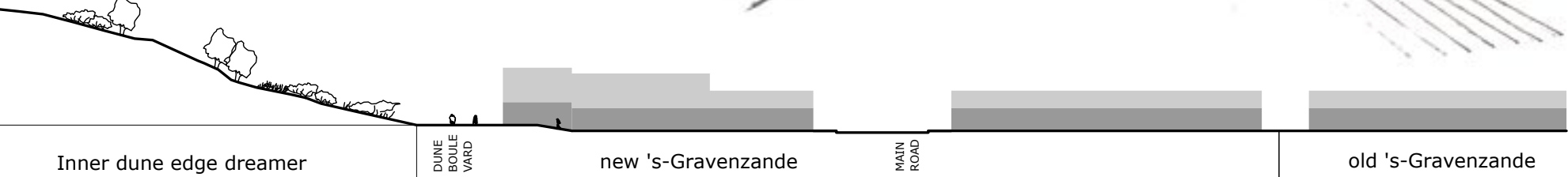
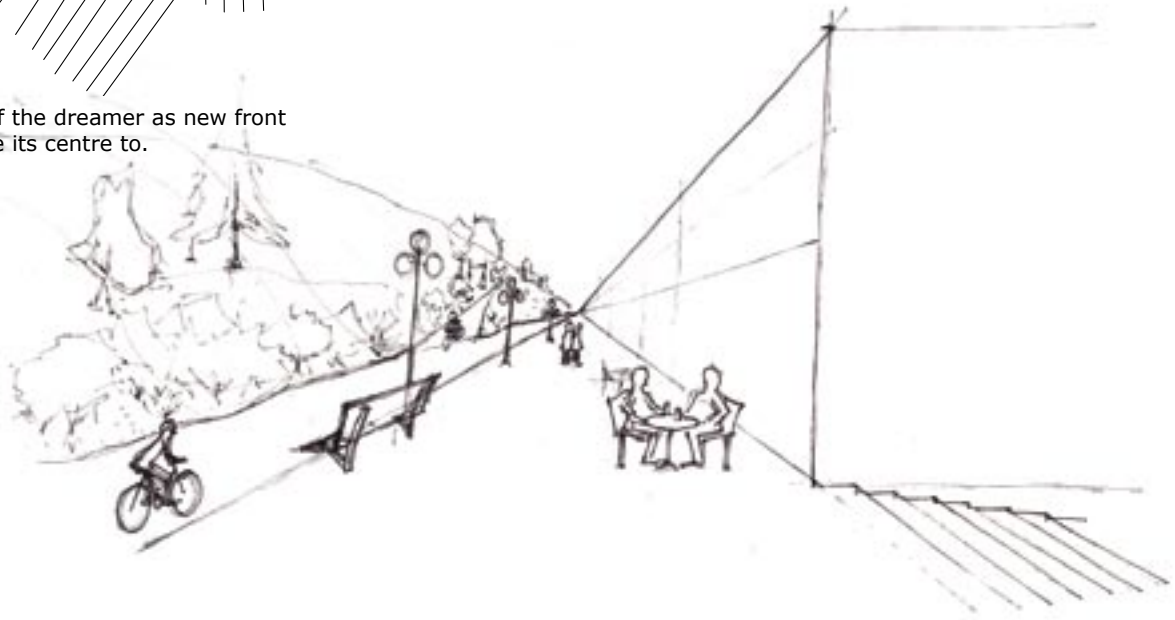
The city of 's-Gravanzande surrounded by glass-houses and therefore very introvert.

The inner dune edge of the dreamer as new front for the city to orientate its centre to.



The city moving its eye to the dune edge.

Impression of a public space bordering the dunes: a dune boulevard that connects the city centre functions to the dune edge.



THE PUBLIC FUNCTION OF A DUNE

intensifier of a quality of life

a sporting track



a long line along the coast



view point over the lowlands



guiding for urban structures



a place to study



pass to the sea

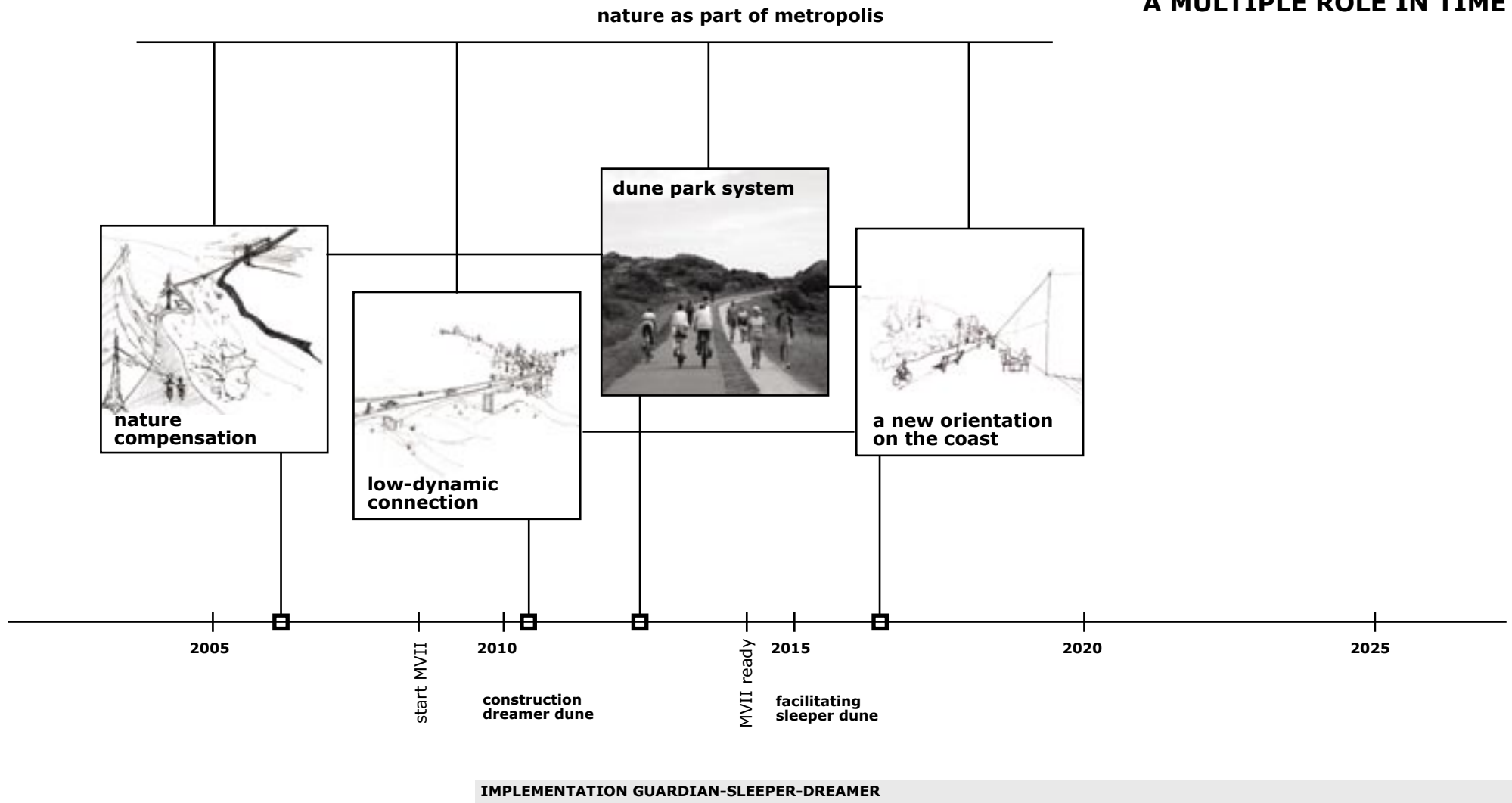


inspiration source for architecture



a place to find peace

A MULTIPLE ROLE IN TIME



6.8 A multiple role for the guardian-sleeper-dreamer intervention throughout time

public nature

The coastal defence function gives the new proposed landscape a certain unassailable position and supposes a natural character. That doesn't mean that the new landscape is just a scenery: in the middle of an intensive urban and industrial landscape its public nature can play an active role. The different spatial meanings that are drawn above show this role. All of them connect the nature function of the intervention to a larger scale and in fact place the intervention in a range of spatial interventions and transformations that are historical, present, developing or planned in the future.

surplus value throughout time and scale

All these possible roles for the new dune area should not be seen as different perspectives for the Westland. They show the surplus value of the intervention for the Westland but on a scale that is much larger than the Westland, as well. This justifies the integration of the guardian-sleeper-dreamer intervention in the future spatial planning for Holland only more.

Figure 6.7 shows the different roles for the dunes on a time scale:

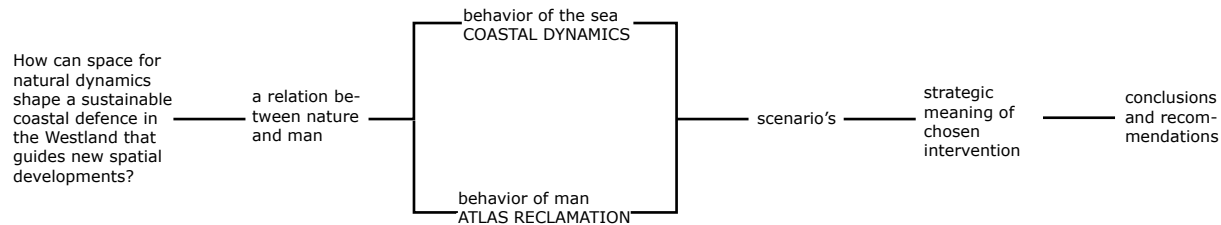
- Nature compensation can start very rapidly. The continuous renewing of the glass housing can be combined with the transformation of the main water - canal - network to an ecological and recreational network. It could even be considered to widen the canals to improve the water storage and discharge capacity in the Westland.
- The low-dynamic connection can be part of the construction of the dreamer dune. Also, because a new accessibility of the surroundings is necessary.
- After the construction of the dreamer dune a start can be made with the forming of a public recreational network through the dune that connects the dune parks of the Hague with Hoek van Holland. This network will finish the proposed western meander of the 'green-blue meander' as well.
- One of the probable future assignments for the Westland is to integrate a large question for housing from the Hague on its occupied land. A new orientation on the coast in the future - as the sleeper and dreamer dune have already found their place in the Westland - can guide this assignment.

Being able to guide a range of transformations, the guardian-sleeper-dreamer intervention can finally improve the quality of life on metropolitan scale.



7. Conclusions and recommendations

7.1 Conclusions



a sustainable solution for man and nature

Once it was nature that shaped the land, but in the course of time it was man that controlled this nature and often acted perpendicular to the forces of nature. Nowadays, this makes an area like the Westland very vulnerable for floods.

The discovery of the guardian-sleeper-dreamer – a second and third dune in the hinterland – is a concept that, in fact, moves with nature as landward solution for the coastal defence. Just because it intervenes in human structures that are not sustainable anymore in different respects, this solution derives its surplus value. It can fulfill more roles than just the damming one and contribute to a better spatial future for the Westland and its context. As a matter of fact, a new harmony between man and nature is found in the guardian-sleeper-dreamer intervention. This makes the intervention sustainable, in all respects.

strategic for the safety

The safety system Dutchmen built around them is stronger than ever nowadays: the chance on a flood is not large. The safety risk is however defined as risk = probability x effect. The consequences of a coast breakthrough in the Westland will be incalculable. The guardian-sleeper-dreamer concept minimizes these consequences. Besides, it offers the Westland coast a flexibility to future behavior of the sea. Vulnerability has been replaced by robustness.

It should be remarked that the village of Monster will be situated between the guardian and sleeper and therefore obtain another safety level than the hinterland behind the dreamer. This is a considerable future state, for several other places in Holland as well. Living in a high natural environment can have living with a lower safety level as consequence.

coastal defence as spatial assignment

By considering the coastal defence not just as a civil-engineering issue, but also as a physical fact that intervenes in space, it is able to catch problems of different disciplines.

a strategic role in spatial developments (read: human interventions)

The coastal defence function gives the new proposed landscape a certain unassailable position and supposes a natural character. That doesn't mean that the new landscape is just a scenery: in the middle of an intensive urban and industrial landscape its public nature can play an active role. The different spatial meanings that are drawn in this research show this role. All of them connect the nature function of the intervention to a larger scale and in fact place the intervention in a range of spatial interventions and transformations that are historical, present, developing or planned.

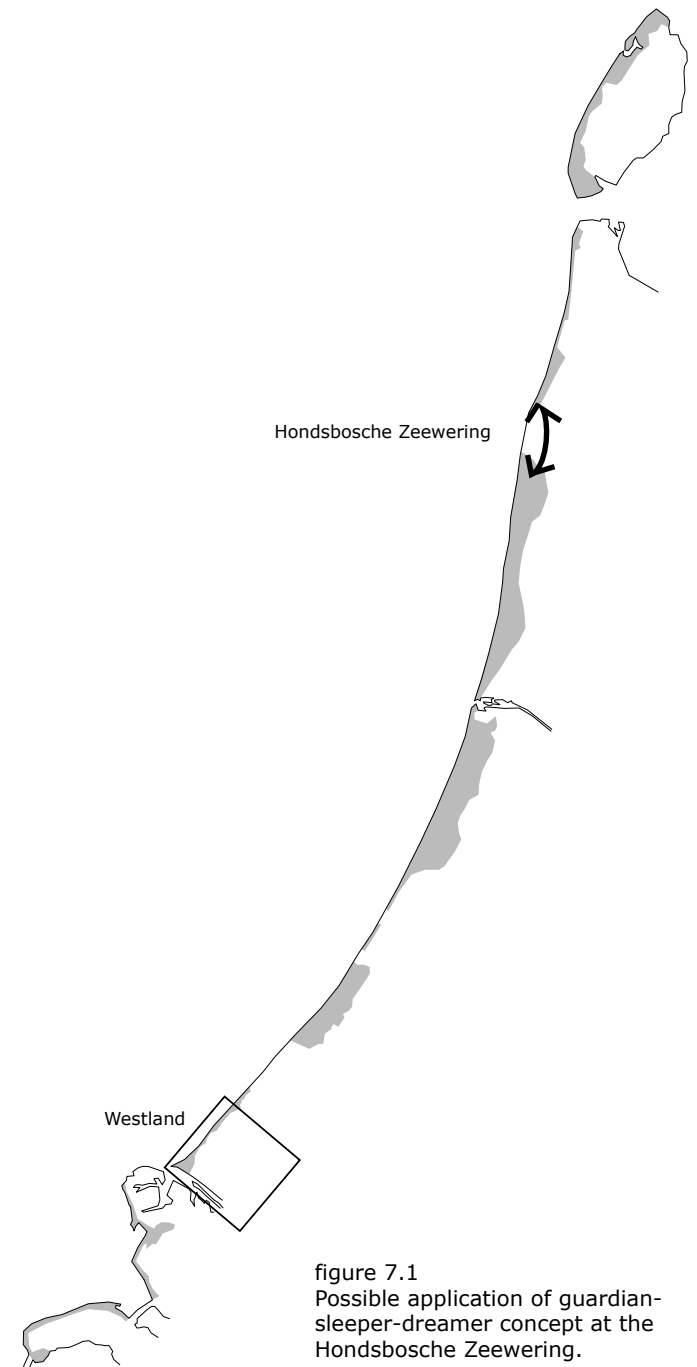


figure 7.1
Possible application of guardian-
sleeper-dreamer concept at the
Hondsbosche Zeewering.

in the future. This research does not make a statement about the exact direction of the spatial developments in the Westland. However, the different strategic roles of the guardian-sleeper-dreamer show the surplus value of the intervention not only for the Westland, but on a scale that is much larger than the Westland, as well. This enables the intervention to guide future spatial developments, anyhow.

nature is always feasible

The implementation of the guardian-sleeper-dreamer concept in the Westland supposes the replacement of a considerable amount of glasshouses and its attachments, glass that is part of a complex that forms an important economical pillar of the region. However, where glass is just a temporary function, the new dune landscape fulfills a long natural protection role for an extremely far time horizon. The only thing that is needed is a one-time investment: as it is nature, it maintains itself. Because of the sustainability of the concept, it is feasible from the start.

concept is general applicable

The guardian-sleeper-dreamer concept can be used at several other parts along the coast, for instance the Hondsbosche Zeewering (figure 7.1), another weak link in the Dutch coastal defence system. With a sleeper and dreamer dune row behind the primary sea dike, the dune area's south and north of the Zeewering can be connected. Also for several weak links in Zeeland the concept can be considered.

7.2 Recommendations

the new role for Monster

The implementation of the guardian-sleeper-dreamer concept supposes a new position for the village of Monster as: a. place with a lower safety level and; b. village between dunes and sea. It is worthwhile to investigate the opportunities of these two facts together, in which a flexibility to catch a eventual flood in the village is combined with exploiting its geographical position.

use of concept for other weak links

As the concept is generally applicable, a further study can be done to use the concept as solution for other weak links in the Dutch coastal defence system. Every weak link has its own context and the guardian-sleeper-dreamer will however obtain other meanings than in the Westland.

further detailing

The appearance of the proposed intervention and its relation to public space on a small scale shows its concrete consequences. Therefore it is worth wile to detail the different roles that are given to the intervention further.

study to requirements for strategic roles

For a future realization of the guardian-sleeper-dreamer concept it is interesting and necessary to study what is needed to implement the new strategic roles of the intervention. This might even open new perspectives for consideration of this landward alternative.



Signpost with directional arrows:

- Stad
- Centrum
- L.F.10 Noordzeeroute
- L.F.10 Noordzeeroute M
- Ter Heijde 3 Kijkduin 9
- Hoek v. Nederland M
- Monster 3 Den Haag 14

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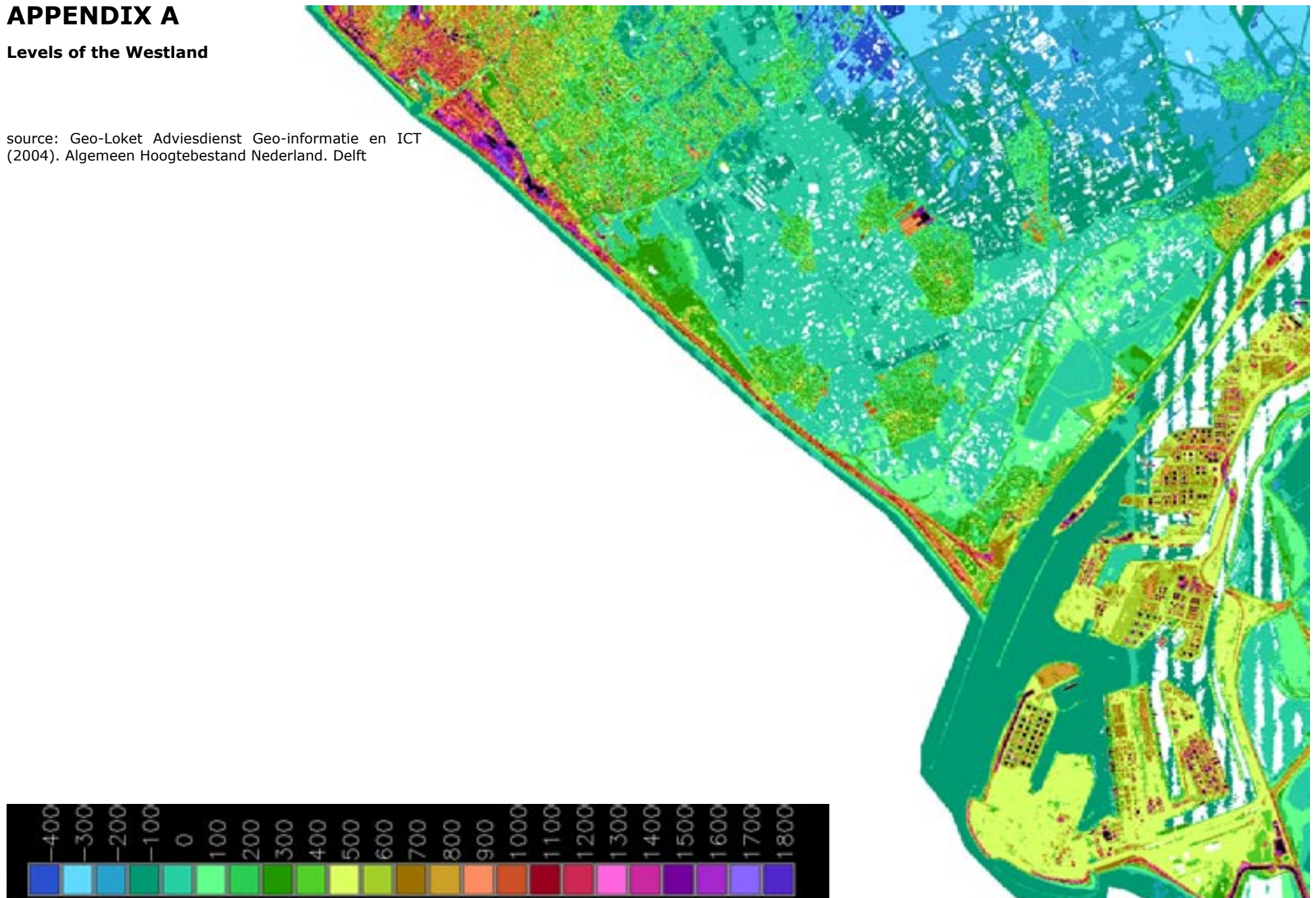
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APPENDIX A

Levels of the Westland

source: Geo-Loket Adviesdienst Geo-informatie en ICT
(2004). Algemeen Hoogtebestand Nederland. Delft

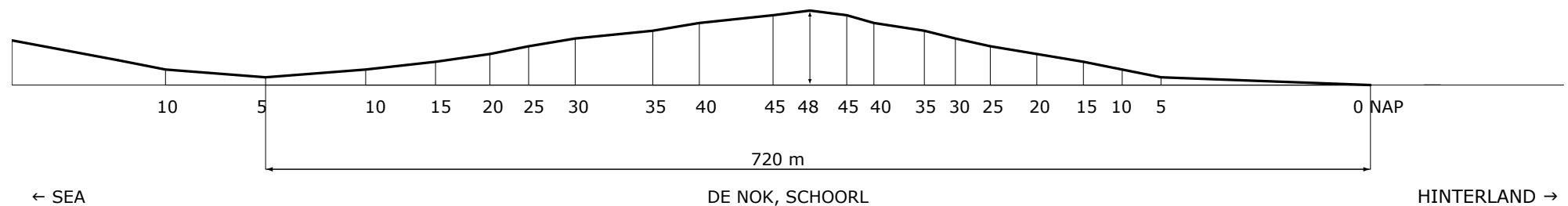


APPENDIX B

Dimensions of the sleeper and dreamer dune

De Nok, one of the highest dunes of the Netherlands in the inner dune edge between Bergen and Schoorl in the north of Holland, has been used as reference for the dimensions of the new dunes (figure B.1).

figure B.1
DIMENSIONS OF DE NOK



From this analysis on space has been searched for the sleeper and dreamer dune in the hinterland of the Westland in which the point of departure was: preservation of the towns and the going of glasshousing. A stroke of land of at least 700 m wide has been reserved for the intervention, see figure B.2. This is needed to give the dreamer dimensions, and the sleeper space, to form a robust (high) barrier in case of a flood.

Nowadays coastal defence is mostly about 10 m + N.A.P. The dreamer is at least 15 m + N.A.P. In a maximum scenario of the TAW Werkgroep Kust (p142) the sealevel will rise until +0,45 m +0,85 m, +1,70 m respectively in 2050, 2100 and 2200. This is however based on the policy and knowledge of today. The intervention has probably been constructed for 200 years or even longer. To make the dunes flexible in time the dimensions are therefore relatively exaggerated.

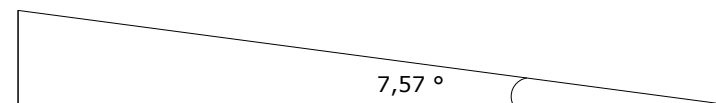
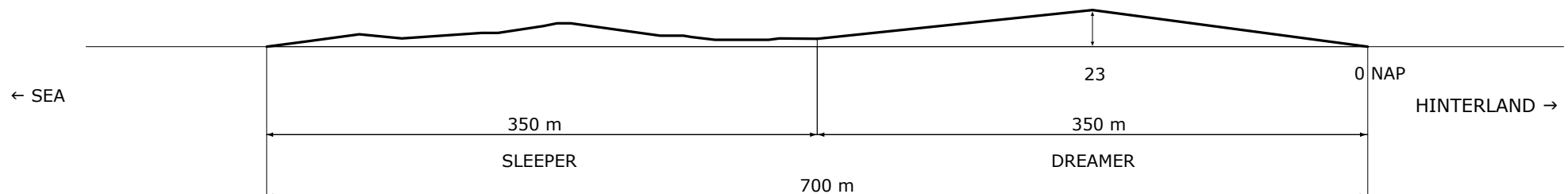


figure B.2
MINIMUM WIDTH OF DREAMER AND SLEEPER



APPENDIX C

Statistics of the Westland

<http://statline.cbs.nl>

gebaseerd op gegevens uit 2004



	NEDERLAND	ZUID-HOLLAND	WESTLAND	DEN HAAG	DELFT
inwoners	16.258.032	3.451.942	97.270	469.059	95.817
oppervlakte (ha)	4.152.795	340.338	9.059	9822	2408
oppervlakte land (ha)	3.378.337	281.810	7990	8268	2321
oppervlakte water (ha)	774.457	58.528	1068	1554	870
bevolkingsdichtheid (inw/km2)	481	1225	1217	5674	4129
km wegen	133.383	15.517	602	1072	297
woningen	6.809.581	1.499.698	37.622	228.240	42.867
woningdichtheid (won/km2)	202	532	471	2762	1848
bebouwde stad	9,4 %	17,6 %	18,2 % 65,4 % kas	57,8 %	48,1 %