



Framework for Coastal Development

Towards a safe, strong and attractive North Sea coast



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Foreword

The Framework for Coastal Development was signed on 9 March 2011 by Mr. Joop Atsma, State Secretary for Infrastructure and the Environment and Ms Rinske Krusinga, chair of the steering group of the sub-programme Coast. The Framework for Coastal Development was presented to parliament on budget day and definitively adopted.

This Framework for Coastal Development was arrived at with contributions from a range of parties. Preparation over the past year involved meetings with representatives of social parties, provincial meetings, designers, knowledge sessions and various other assessment gatherings.

The Framework for Coastal Development has several objectives. First and foremost the documents provide a framework for the issue of "coastal expansion". For parties seeking to prepare for coastal expansion the Framework for Coastal Development provides a number of relevant preconditions and criteria.

The Framework for Coastal Development also provides direction for provincial visions for the coast. Among other things it comprises a number of development principles which are offered to the regional parties for application in the provincial coastal visions and strategic agendas.

In particular the Framework for Coastal Development seeks to be a source of inspiration in thinking around preservation and development of functions on the coast, taking advantage of linkage between the coastal base and the adjacent hinterland and sea. Moreover, it is important to take account of conceivable developments around rising sea levels and spatial-economic developments on the coast and adjacent area, during the course of the 21st century. The Framework for Coastal Development offers a thinking pattern for this, but rather than being a blueprint it can be further refined and adjusted apace with practical experience.



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1 Introduction

1.1 Background and context

The North Sea coast is under pressure. Alongside tasking around safety the current sea level also presents a task in terms of spatial development for the coastal zone. This requires an integral vision on development of the coast.

Readings taken over the past 150 years show an average 20 cm per century rise in sea level. Increased levels of carbon-dioxide and other greenhouse gases in the atmosphere mean a further rise in average temperatures on earth. Scenarios from the Dutch meteorological service KNMI (KNMI, 2006) put the absolute increase in sea level on the Dutch coast at between 15 cm and 35 cm in around 2050. In around 2100 it will be between 35 cm and 85 cm higher than the current sea level. Moreover, a number of climate scenarios point to a slight increase in severe storms at sea which could impact on coastal safety. At the same time a possible flood would have a greater impact due to population growth and increases in economic capital behind the coast. And so, although there is no acute problem around coastal safety, this development does require a vision on coastal safety in the longer term. This is apparent from sources including the Safety tasks project (Rijkswaterstaat - Directorate-General for Public Works and Water Management - and the regional Water Boards). Moreover, in a densely populated country like the Netherlands optimal and multiple utilization of the coast makes good sense; indeed, society makes a constant stream of new demands around the coast.

Even given the absence of acute problems for coastal safety there are regular claims on space that need to be weighed up on the basis of a long-term safety vision (2100 onwards): this requires an integral, long-term development vision for the coast. This Framework helps enable meaningful plans leading to a sustainably safe, robust and attractive coast, while leaving space for development. This approach to planning specifically involves private parties seeking to jointly invest with the public sector in coastal development. The underlying thinking here is that smaller and larger investors alike will only be interested in projects for spatial quality, if coastal safety – also in the longer term – and regulation in the coastal region have been duly organized.

Delta Programme Coast's plan of approach started by announcing this Framework for Coastal Development as the first of the policy products to be delivered. The Framework for Coastal Development specifically relates to the base of the entire Dutch North Sea coast. At the same time the study exceeds this relatively limited base given the need for vision-building to include functions like accessibility, ecological systems or energy which have links to the coastal base: this applies to both wet and dry sides.

The coastal base “carries” the flood-defence function of dunes and dykes on the landward side and as such plays an important role in this area. It also supports the nature and leisure functions of the dune areas and coastal towns, including their harbours. Morphologic processes underway in the “wet” zone are significant for the formation of beaches and dunes. This framework will filter down into the other

two policy products announced in the plan of approach, i.e. the provincial coastal visions and the National Coastal Vision. At the same time the framework should not be taken as a blueprint. Sections of it can be adjusted in line with the provincial and national visions. The provincial visions are expected to be in line with the current national spatial policy.

The framework offers regional governments a handle in drafting provincial visions on the coast, or strategic agendas up to 2100¹.

The principles from the framework (para. 2.4) can also be used to assess the desirability of proposed developments around long-term coastal safety and serve the interests of better spatial quality for the coast. Hence, the framework and the coastal visions are in line with the established national spatial policy incorporated in the National Spatial Strategy white paper and the Randstad 2040 Structural Vision, as a further elaboration of the National Spatial Strategy where the entire North Sea coast has been given the status of National Spatial Main structure. Here, government indicates its objective of ensuring safety in the face of flooding by the sea while maintaining national and international spatial values with the specific, area-identity being a core quality. In the National Spatial Strategy government defines the coastal base in order to emphasize that the coast is a single dynamic system within which functions are mutually fine-tuned and cohesive control is a must. According to the Randstad 2040 Structural Vision “sea defences and interventions in water management are necessary to make the Randstad a climate-proof and safe delta. If done well there will be no reason to be cautious with investment in the Randstad. However, this does mean that the chances and constraints of water tasking will also impact regional organization” (Randstad 2040 Structural Vision).

To summarize this means that although current policy is the starting point, it will be reviewed and where need be adjusted in line with the long-term coastal vision. The framework assumes existing spread of authorizations and responsibilities between governmentals – both in terms

of safety and spatial planning: above all it is meant as an aid to cooperation between the various parties involved.

1.2 Objective and application of the Framework for Coastal Development

The objective of the Delta Programme’s sub-programme Coast (hereafter Delta Programme Coast) is to explore requirements for a future-proof coast that will (cost) effectively and sustainably defend the adjacent hinterland against flooding from the sea while ensuring scope for the preservation and development of functions on the coast. The Delta Programme Coast realizes this by optimal long-term linkage of coastal safety and spatial tasking. A broadly based coastal objective will provide direction for the policy strategies to be drafted on both long- and short-term activities towards a climate-proof and attractively configured coast. This demands interaction with other sub-programmes, notably the Wadden Region, Southwest Delta and Rhine Estuary-Drechtsteden, where these border the North Sea coast.

The time horizon of 2100 and beyond is a particular challenge here. With the provincial and national visions of the coast one will have to deal with uncertainties in various scenarios for climate change and spatial-economic developments (see paragraph 2.3). Several climate scenarios affect the pace of increase in sea level leading to a range of safety tasking for the coast. Spatial-economic scenarios will impact on pressure on space along the coast.

The Framework for Coastal Development should provide some grip here. To this end it has been decided to outline a number of building blocks for a National Coastal Vision (chapter 2). These building blocks comprise a number of principles for the translation of tasking around safety and spatial quality in terms of policy and implementation. In so doing the Framework seeks to offer a base for the set up of integral long-term visions on the coast and/or province-by-province strategic agendas, and hence a source of inspiration.

¹ Jointly with the regional parties every coastal province drafts an integral vision for the area, covering the coastal section of the province. Some provinces already have such a provincial coastal vision in place albeit with a shorter term than up to 2100. In addition these provinces will draft a strategic agenda which particularly focuses on issues in the longer term. Where the Framework for Coastal Development mentions a provincial coastal vision this can be taken to include the related strategic agenda.

The Framework applies to the entire coastal base. A shared system in drafting coastal visions would promote meshing of provincial visions. This system is set out in chapter 2. This approach also stimulates the provincial coastal visions to make a recognizable contribution to the National Coastal Vision and, eventually, to a provincial coastal vision within the framework of the MIRT and to choices within regional policy plans and the second National Water Plan (see figure 1). An investment agenda will be drafted based on the National Coastal Vision and the MIRT studies. This will feature MIRT and regional investment projects. However, differentials will be in place for the level of steering within this context.

The Framework for Coastal Development is the starting point for an iterative process. In administrative terms it requires detailing and implementation via the interactive principle of governance. Intensive cooperation is already underway. Input by regional partners is crucial for a broad-based, long-term vision on the development of an attractive, climate-proof coast. In this context the Framework for Coastal Development takes a development-oriented approach with innovation and knowledge development playing an important role.

Seaward coastal expansion is in a special development category. Chapter 2.6 and Appendix 1 set out the relevant room to manoeuvre and preconditions, as per the findings of recent studies.

To summarize, the Framework for Coastal Development comprises:

- agreements on the set-up of long-term coastal visions including definitions, coastal typology illustrating the most significant differences in the coast, and to-be-detailed scenarios for climate change and spatial-economic development;
- principles and intentions as building-blocks for sustainable coastal development (safety and spatial quality);
- preconditions and evaluation criteria for coastal expansion in provincial coastal visions and the National Coastal Vision.

2 Towards a National Coastal Vision

2.1 System

This chapter sets out the system for arriving at a National Coastal Vision. In this context long-term safety is the starting point and precondition for a robust and attractive coast in line with the substantive scope of the plan of approach for the Delta Programme Coast. The three intertwined tracks mentioned here form the building blocks for an integral vision on coastal development. The focus is on coastal safety (the first track): coastal reinforcement and spatial fitting-in of the measures required. Solutions for other long-term spatial issues can be dealt with in conjunction with this (the second track). The third track for which the Framework sets out potential and preconditions is coastal expansion – in terms of possible forms of coastal development.

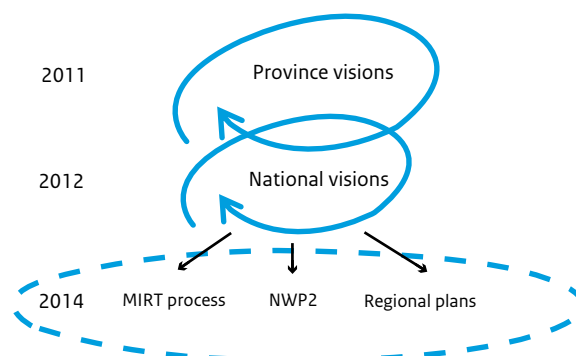
Input – partly clustered in provincial coastal visions - by the parties involved will help determine the National Coastal Vision in substantive terms. It is important that government and the regions take an unambiguous approach in drafting the coastal visions and so enable mutual meshing between the provincial coastal visions and the National Coastal Vision. Hence, the line of thought set out here not only targets impending National Coastal Vision but also provides a context for the detailing of long-term provincial coastal visions.

Figure 1 illustrates linkage between the policy products to be developed for coastal development. Chapter 3 of the plan of approach for sub-programme Coast incorporates planning and a phased approach for realization of these products.

The Framework provides building blocks to arrive at the provincial and national visions for coastal development. This is based on the following steps and elements:

- A coastal typology incorporating an image and a description of the current situation around the coast in terms of distinctive elements and types, as a basis for spatially differentiated coastal policy in the long-term.
- The delta scenarios comprising the most important autonomous developments up to 2100, notably around the degree of increase in sea level and climate change,

Figure 1 Flow chart for development and implementation of new coastal visions and coastal policy



and the nature of socio-economic development. These scenarios show the margins of uncertainties to be taken into account by long-term coastal policy.

- Analyses of watch-points for long-term safety and spatial quality up to and beyond 2100, resulting from the delta scenarios.
- A target for the Dutch coast (“dots on the horizon”). The regionally differentiated target for the Dutch coast to be fed by the other objectives from the provincial coastal visions (2040/2050 and 2100).
- Development principles for development and management of the coast vis-à-vis the preferred strategy. These principles can also be viewed as detailing of the general, basic values and starting points from the Delta Programme.
- A cyclical process to arrive at a preferred coastal strategy 2100 (figure 2) via a typology of the current coast, via delta scenarios and development strategies. This preferred strategy is then reversed to policy choices for the shorter (2040) and longer terms (2100). This process of cyclical thinking will be constantly fed with provincial visions, study findings and meshed with other sub-programmes during 2011 and 2012. Following an initial round the cyclical thinking process will penetrate further through the various stages of the project, as shown in figure 3.

A glossary is to be prepared for the delta programme to ensure unambiguous usage of the terminology above (and other terminology). This complements the list of abbreviations and terms from the plan of approach sub-programme Coast, Appendix 11.

The method used to formulate the visions is integral area development, i.e.:

- a balanced, climate-proof development of nature, economy, leisure, landscape and cultural history, living/home and accessibility in harmony with sustainable coastal safety;
- which comes about with active participation from relevant players from government, the business community and social organizations;
- and which is attuned and linked to adjacent developments in the area of the Dutch North Sea coast (North Sea, Wadden Sea, Southwest Delta, immediately inland from the coast, and the Belgian and German coasts).

2.2

Typology of the Dutch coast

Introduction typology

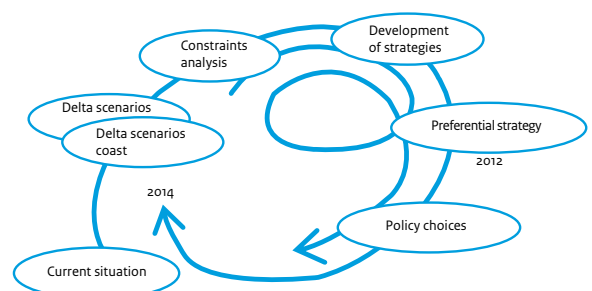
The coastal base covered by the Delta Programme and the Framework runs lengthwise for some 350 km from the Belgian to the German border, and across this coastline of the Amsterdam Ordnance Datum (NAP) – 20 m up to and including the inner dune edge on the landward side, and by dykes and smaller dunes up to the borderline with sea defences, including the spatial reserves for two hundred years of rising sea levels. The coastal base is a dynamic system with ancillary processes of erosion and sedimentation. Partly due to the narrowing of several inlets and the related need for sand there is considerable coastal erosion in the adjacent areas. Wave action is the main determining factor in shifting sand, indeed this is the case right along the coast. Shifting silt, alongside sand, is also an important factor. Sea water currents move the silt out of the rivers to the northeast - together with swirling silt from the coastal zone, in what is termed the “coastal river” which runs some 15 to 30 km out from the coast (Source: WL Delft, 2008: Eiland in zee).

Rising sea levels are nothing new along the coast of the North Sea. The past 100 years have seen the sea level rise some 20 cm compared with the NAP (Delta Committee, 2008). Moreover, according to the Delta Committee this century will see a just over 10 cm drop in the seabed along the coast due to tectonic shifts.

The Dutch coast forms part of a sandy coastal strip running from the tip of Jutland to Cap Gris Nez in France. The Dutch coast comprises:

- the Wadden coast fronting the islands and an intertidal area
- the Dutch coast with continuous dunes and
- the open Delta coast with closed or open inlets and estuaries.

Figure 2 The cyclical process of vision forming in provincial and national visions (of the current coastal situation via the delta scenarios and analysis of constraints towards strategies and policy choices).



Not only do these coastal areas differ in terms of physical characteristics but also in intensity and utilization of space. These differences trickle down into technical-economic potential and tasking around coastal development at provincial, regional and local scales. Moreover, the area covered by the study is bigger than the coastal base for which – at the end of the day – the strategy is being crafted.

Why typology?

In crafting integral coastal visions it is essential to take account of the spatial variation and cohesion in the coastal zone. In the first instance this involves linkage between the wet and dry issues. This linkage varies along the coast and primarily depends on the physical characteristics and predominant instances of lack of space. These aspects form the basis of coastal typology in this Framework. Moreover, account should also be taken of processes that are parallel with the coastline. Hence, to take an example, not only do the morphological effects of the piers at IJmuiden affect linkage in the cross section, but also the accretion and washing away along the coast. To this end the National Coastal Vision should make optimal use of monitoring data around the effects of engineering structures such as the piers on the Maasvlakte on morphology elsewhere along the coast. Developments along the Belgian coast must also be taken into account, as must differences and commonalities in economics and cultural characteristics and seaside resorts, when developing coastal visions.

The typology was introduced to reflect the fact that the coastal system is the unit from which issues are approached.

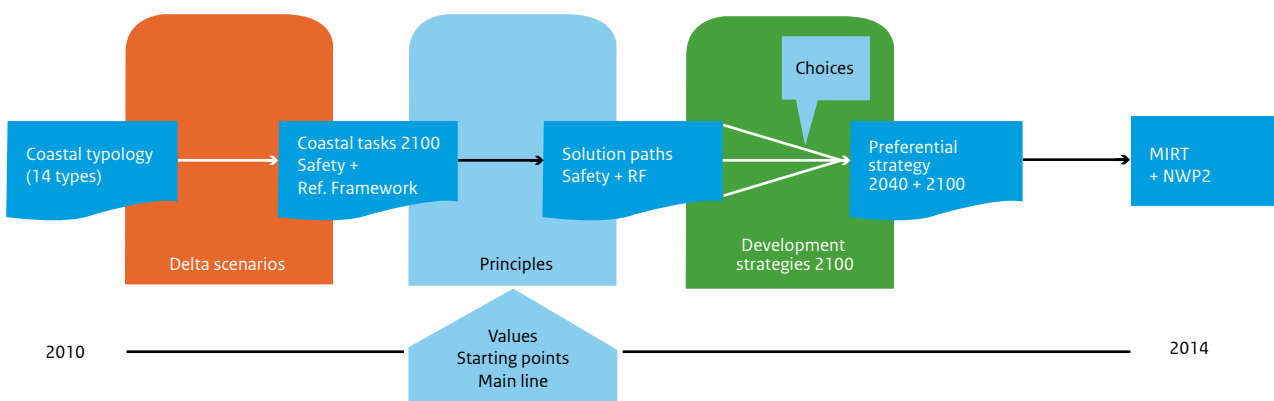
Using a generally applicable classification of the coast into coastal types helps position discussions and decision-making on local situations within a general context. Jointly recognizing and discussing the types with partners enables a systematic treatment of the coastal issues. In turn this gives rise to a common language for the coast.

At a later stage one or more generically applicable strategies will be set up as a means to realizing a safe, robust and beautiful coast and via which the coast can grow apace with sea level. The strategies will be drawn up in the provincial and national coastal visions and used to develop policy statements for the second National Water plan (among other things). Policy choices can be made – founded on the objectives for 2100 leading to short-term choices. The typology can be used to illustrate various strategies. Safety and spatial tasks are combined within the strategies, e.g.:

- options for future-proof coastal reinforcement;
- management and maintenance of wide beaches;
- effects on coastal towns and reserve sites.

The coast typology developed here gives a schematic overview of the various types of situation along the Dutch coast. Each type requires its own methodology or approach. Hence, pressure on space is much greater at “Seaside resorts” than in the most common (“Standard”) type with wide dunes and minimal building. As the National Coastal Vision approaches, the types will be further detailed, using provincial visions. The layered approach will be used in the further detailing of profiles.

Figure 3



Construction of the typology

Within the typology the Dutch coastal base is divided up into three zones at right angles to the coast:

1. Foreshore: the zone from -20 m to 0 m.
2. Transition sea - land: the zone (hard/soft) providing (partial) sea defence structures from the waterline to the edge of the sea (beach) up to and including the inner dune edge. This zone has not been further subdivided in order – as far as possible - to respect the natural uniformity of the coastal base formed by the sea.
3. Adjacent hinterland: the landward zone as from the inner dune edge or inner-side of the dyke (see figure 4).

Every zone has its own characteristics and predominant activity. Recreation as a form of co-activity occurs almost everywhere along the coast. Table 1 classifies the three zones above in terms of characteristics and predominant uses.

A combination of zones creates a coastal type. In theory and in line with the chart above this could be $3 \times 6 \times 3 = 54$.

In practice this can be brought back to 14 frequently occurring types as characterized in cross-sections below (also see Appendix 2).

Notes to coastal types

The various types of the Dutch coastal base with examples of the most common types are classified below. All types occur at various locations along the coast; 14 basic types are shown below. Appendix 2 gives a description per type, together with – among other things – possible future safety measures, for the meantime without giving any opinion or financial assessment. Figure 5 pictures the geographic location of the cross-section selected.

Dedicated tasks (safety and spatial quality) can be assigned per coastal type, whereby appropriate detailing can be outlined later in the integral area development. There may be further studies of these longer-term solution paths in preparation for the National Coastal Vision - and possibly also for the provincial coastal visions. These will mainly focus on opportunities for growing space with the sea level and multiple uses of sea-defences and links with the immediately adjacent hinterland.

Table 1 Classification of zones in terms of characteristics and predominant uses

Foreshore area	Transition sea – land ²		Adjacent hinterland
Shallow	Hard	Quay	Quay Agriculture
Deep (channel)		Dyke	Nature
Tidal		Engineering works (sea defence)	Built-on
	Soft	Wide dune > 250m	
		Narrow dune < 250m	
		Inlet	

² All soft transition zones include beaches. If so wished a differentiation can be made between wide and narrow beaches

Table 2 The 14 coastal types

Type	Foreshore	Transition sea-land		Adjacent hinterland	Coast length (km)	Expected complexity
Most common	Shallow	Wide dune		Agriculture	97	Low
Nature	Shallow			Nature	70	Low
Dutch	Shallow			Urban (coastal towns)	41	Low
Island tip	Deep			Agriculture	11	Low
Mud flats	Drying	Sea inlet		Agriculture	6	Low
Sea inlet	Shallow			Agriculture	4	Low
Seaside resort	Shallow	Built-on wide dune (sometimes partly hard)		Agriculture / urban	19	Very high
Channel	Deep	Narrow dune		Agriculture	32	Moderate
Narrow dune	Shallow			Agriculture	27	Moderate
Dune village	Shallow			Urban	9	Hoog
Engineering works	Shallow/deep	Hard	Dyke/dam	Deep water	16	Moderate
Dijkdorp	Deep			Urban	13	High
Dyke	Deep		Dyke	Agriculture/nature	12	High
Harbour	Deep			Urban/industry	8	Moderate
Total (inc. rounding-off margin)					365	

2.3 Delta scenarios: possible developments to be anticipated

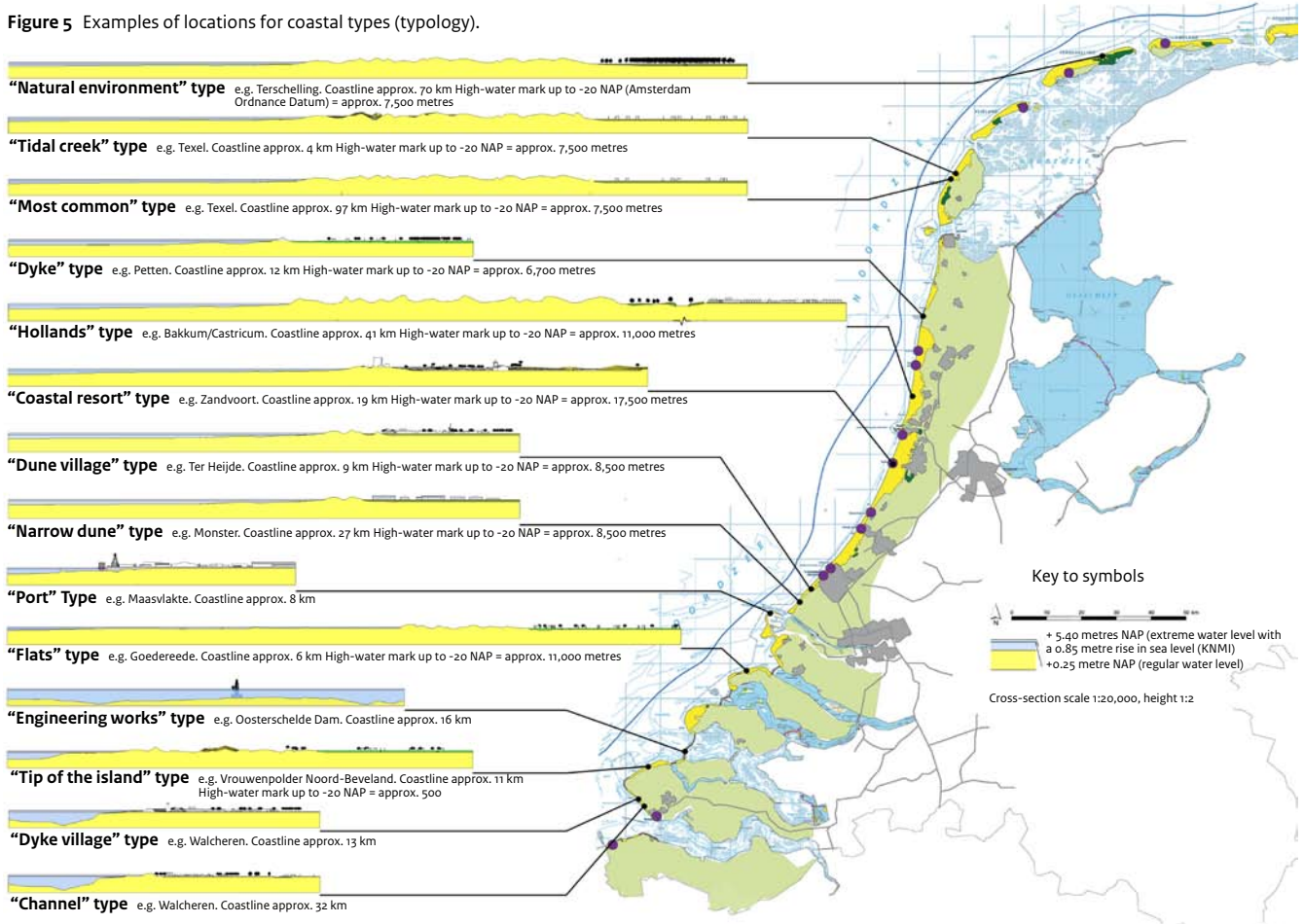
In developing targets for the coast it is important to examine how the future could look in order to be prepared for various situations. Scenarios are deployed to explore the playing field; the scenarios are about developments which are not easily influenced or are immune to influence. In this context we think in terms of delta scenarios that influence safety pressure on space in the coastal zone in the century to come. Scenarios provide a bandwidth of uncertainties that are incorporated when detailing the policy strategies.

Delta scenarios are developed to determine freshwater and flood risk management tasking within the context of the entire Delta Programme. The delta scenarios are also deployed to gain insights into the robustness and flexibility of measures. Whether or not the strategies are tenable with the various delta scenarios will become clear at such time as the strategies are elaborated.

The Delta Programme uses four delta scenarios covering the bandwidth of the climatological and socio-economic developments as per the Delta Programme. The most extreme situations are not included as by definition they require measures which cannot be easily justified. One example of this is the Veerman committee's 1.30 m rise in sea level in 2100. The delta scenarios yield data including the expected rise in sea level, developments in population, and economic development. These data which are based on the WLO (Prosperity and Quality of the living Environment) and official Dutch meteorological service (KNMI) scenarios enable calculation of measures from the Delta Programme, for various scenarios, using the Delta model. In turn, the Delta model yields the water management backing for preparation and implementation of the Delta Programme. There are no coastal models in the Delta model. For detailing of the delta scenarios see the draft delta scenarios³.

³ Delta scenarios: scenarios to analyze robustness of measures for freshwater supplies and flood risk management. (2011) Deltares. Brugman et al.

Figure 5 Examples of locations for coastal types (typology).



2.4 Principles for integral coastal development

A number of starting points are set out to ensure direction in the manner of development of a future-proof coast; they are formulated for use in arriving at visions and for planning, plan assessments and project preliminaries. The development principles spring from one main line, the main starting point for coastal policy in this century. The principles apply to integral tasking for the coast – meaning both safety and spatial tasking. The principles provide guidance and contribute to deliberate involvement of the various aspects of weighing pros and cons. It is not impossible that in given areas there may be a clash between development principles. Implementing the principles in practice may lead to further honing of the hierarchy and specific customization.

2.4.1 Main line for safety and spatial quality

The main line in protecting the Netherlands from the sea is and remains: “soft where possible, hard where necessary”, or, put another way: “move apace where possible, and resist where there’s no other option”. Sand and sand replenishment are central here. This outline also forms the main line for the current National Water Plan or target for the coast. The Delta Committee has reviewed and confirmed this main line. The soft option was deemed to be cheaper, easier for maintenance and above all, flexible. Rijkswaterstaat has calculated that enough sand could be obtained within the twelve-mile zone for one hundred years of replenishment, with no need for major coastal expansion. Sufficient sand can also be obtained for replenishment over the next several centuries, albeit costs will rise as the sources shift further out from the coast.

The National Water Plan has opted for a strategy of “where possible moving apace with natural processes but resisting where necessary, and exploiting opportunities around prosperity and welfare”, an adaptive approach and cooperation in- and outside water management.

Hence, looking at practical configuration and management for coastal development, the terms “move apace” and “resistance” translate as follows:

- move apace: dynamic coastal management (replenishment with natural sand distribution; grooves in the dunes; creeping islands); flexible use of space (e.g. non-complex, portable buildings; easily adaptable buildings); dynamic nature management (drifting dunes; types of nature objectives around dynamic ecosystems)
- resistance: pave, heighten, and reinforce the coast; protect existing functions in the coastal zone; maintain current position of islands
- combination of resistance and moving apace: e.g. sand replenishment for existing hard defence systems, seawater catchment dykes, the concept of “dyke in dune”.

An area-based approach will often enable chances to improve water management while working towards a stronger economy and living environment – with the lowest possible social costs.

2.4.2 Development principles

The main line set out above points the way for detailing tasks around safety and lack of space in plans and projects. The development principles a) to e) inclusive, shown below, illustrate the importance of future-proof coastal development over the next several centuries. They all relate to the main line for safety and spatial quality and are mostly derived from the underlying long-term objectives in current policy, which are expected to remain relevant over the next several centuries. The sections headed “current detailing” contain points from current policy and points which go further. Detailing may change during the course of the Delta Programme, apace with altered policy or insights.

The development principles from the Framework for Coastal Development can be seen as a further detailing of the overall, basic values (solidarity, flexibility and sustainability) and starting points (cohesion, consistency and transparency) from the Delta Programme for Delta Programme Coast. With this in mind see the chart of basic values and starting points in the plan of approach sub-programme Coast (p. 8).

A. The principle of growing apace

Defence systems and functions must be able to grow apace with rises in sea level and climate change, and with an optimal cost-benefit ratio.

This principle aims to anticipate possible developments whereby future generations have sufficient space to adjust in line with the then current related requirements and wishes. This principle links short-term decisions with long-term objectives and targets. The principle applies both to safety, spatial configuration and coastal management. This principle leads to a reduction in costs of coastal development – certainly in the long run. The principle also comprises the concept of “working with nature” (links with principle c).

This principle meshes with the concept of “adaptive delta management”. It is an example of moving apace and matches with sustainable safety with quality. In this context costs are taken to mean the costs of construction, management and maintenance.

Current detailing

Grow apace with sea levels in terms of height and strength of the defence system; this applies to both hard and soft; Maintaining the main line “Soft where possible, hard where necessary”, in that a soft coast is easier to adjust in line with the rise in sea level.

At least maintain the coastline as a basis for the defence system. At this stage this only applies to soft coastlines.

A study is also underway to define a standard for the foreshore of hard defence systems resembling the basic coastline.

To allow the volume of sand in the coastal base to grow apace with rises in sea level. This is important to maintain “growth apace” rather than being obliged to offer resistance.

Interface with current practice

For the natural - completely sandy - coast, having sea defences grow apace with the rise in sea level is an ongoing process. This involves the coast being maintained with regular additions of sand. However, growing apace is not a comprehensive option for sections of coast with hard elements, such as promenades, dykes and buildings. The solution identified for the promenade at Flushing is a source of Inspiration for new strategies. The sea defences are assessed every 6 - formerly 5 - years. A negative report on a given section can mean its inclusion in the Flood Protection Programme (HWBP) whereby the defence system is reinforced with a 50-year time-horizon. A forward view of all defence systems, and a longer time-horizon, are desirable for the Delta Programme.

Future perspectives

Maintaining the defence systems and the basic coastline are currently separate in terms of objectives, responsibilities and systems of checks. Increased linkage between the two processes could enhance efficiency, and looking further ahead will enable better planning for both safety measures and spatial developments.

Built-up areas must not be allowed to hinder the defence system from growing apace. Spatial constraints are now in place around the defence system. Ways to have spatial developments and safety working harmoniously – or possible spatial separations – will need to be examined. Also applicable here are principles for a flexible spatial detailing of functions and the meaningful spatial meshing of safety measures (see principle d2).

B. Basic safety

The functions along the coast must maintain a basic level of safety to survive and invest.

This principle aims to provide the necessary stability, safety and clarity whereby residents and business community are aware of factors they need to take into account. Safety forms an important part of security. At the same time it is quite conceivable that the level of basic safety may differ between coastal areas dependent on the economic and social interests in place. Providing basic safety is a joint task for all governments.

Current detailing

- Safety within the dykes is ensured preventatively in line with relevant standards.
- The multi-level approach is applied to safety in- and outside the dykes: prevention - spatial configuration - disaster relief.
- Preserving the basic coastline; not only does the basic coastline form the basis for safety within the dykes, but also for safety outside the dykes, and other functions including recreation and obtaining drinking water.
- Focus on safety levels around linked, built-up areas within coastal municipalities, outside the dykes, which have grown over the course of time. This is important both for residents and – for example – the leisure sector.
- In principle safety around new developments outside the dykes is for own risk and will also need to meet the other development principles.
- If necessary adjust safety policy for built-up areas outside the dykes in line with the results of the sub-programme Safety and fine-tune sub-programme New Urban Developments and Restructuring.
- As far as possible maintain conditions for agriculture and fisheries at equal levels and manage dynamics so that the sectors can adjust in good time.

Links with current practice

The basic coastline has been fully implemented. The policy for 13 coastal towns will be specified quite soon. Conditions for agriculture and fisheries will not be actively monitored but will be dealt with in MER studies.

Future perspectives

A more flexible detailing of the Basic coastline is conceivable without affecting its robustness. Consideration is being given to wider options for a customised approach to adapt sand distribution based on area-specific characteristics and interests.

The principle can also act as a means for coastal development if use is made of the natural elements of wind and water currents (“working with nature”). The process is highly suitable for phasing and zoning and hence supports the principle of growing space (a).

Current detailing

- Reinforcing robust ecosystems. Robust means that the nature in the systems can adapt to shifting circumstances and that the biodiversity – in the sense of the entirety of types – at least remains up to strength. Alongside quality this also requires sufficient scale and linkage between areas.
- Ensure basic condition for quality of the natural environment, e.g. water levels, required water quality, minimal nitrogen position.
- Dynamic dune management to have the dune mass grow apace with sea levels and ongoing rejuvenation of the landscape and biotopes with pioneer vegetation. Ways to realize this will include dusting and penetration of water and sediment via inlets.

C. Principle of a natural dynamic

Working for and with a natural dynamic.

This principle underlines the importance of the dynamic of natural systems both as objective - the intrinsic of natural quality the coast – and as means for coastal development.

Bio-diversity is a fundamental objective directly aimed at preserving the stability of life on earth. In this context natural quality means the entirety of flora and fauna with the required environmental conditions in a given area. Quality of the natural environment is valuable for the quality of the living environment, health, air-quality, recreation, employment, drinking water, the buffer function. Quality of the natural environment can also be expressed in economic terms (ten Brink et al., 2010). The actual flora and fauna form indicators for quality of the natural environment. Given the main line “moving apace where possible”, the detailing of the objectives for bio-diversity and quality of the natural environment will shift toward more dynamic ecosystems, with the proviso that neither quality of the natural environment nor biodiversity are diminished. However, the principle does subject the current policy around Natura 2000 to discussion in that it strongly focuses on maintaining existing, non-dynamic natural values.

Interface with current practice

Natura 2000: The European directives on Birds and Habitats have been implemented under the Dutch Nature Protection Act (1998). This formed the basis for dedicated protection zones – which cover most of the landward side of the coastal base. Although Natura 2000 is primarily a network of nature reserves it has also established area-based preservation objectives for species. However, realizing these objectives may be hindered by the migration or disappearance of species due to climate change and rises in sea level. It is not possible to specify which individual species will disappear or arrive as a consequence. However, for the meantime the objectives and measures will remain in place. Brussels does not attach any consequences to EU objectives which are not realized. In contrast, individual member states must do their best in countering climate-related damage to conservation objectives.

Future perspectives

This principle implies that in future some of Natura 2000's preservation objectives for the coastal area may require reformulation (also see Delta Programme 2011, p. 48). This is prompted by climate change whereby some species and colonies will deteriorate or disappear, or vice versa. In this context migration is an important factor for some species. Hence, cohesion in the coastal area is a precondition for quality of the natural environment and diversity in the dunes. To this end, it is quite conceivable that the Natura 2000 policy will eventually need to focus more on preservation and development of more dynamic, climate-proof nature objectives on the coast. This type of development would offer a better perspective for combining nature policy for the coast with long-term coastal safety policy that takes advantage of natural processes.

D. Spatial quality principle

Spatial quality involves a translation of the main line: "moving space if possible, resistance if necessary". In terms of spatial quality this has been detailed in three directions: specifying and monitoring core qualities, optimal slotting-in of safety measures, and developing new, future-proof qualities. The matrix "spatial quality", described in Appendix 1 of the plan of approach sub-programme Coast assists in applying this principle.

D1 Identifying and monitoring core qualities

Developing visions and drafting policy choices for coastal development must always start with identification of core qualities for the coastal area in question. Views on core qualities may alter with time but coastal policy is always first and foremost a matter of maintaining and where possible reinforcing the stated qualities.

Current detailing (coastal policy paper/NWP)

- Unimpeded view of the horizon from the high-water line to the sea.
- The current objective is to preserve the attractive structure of spreading dunes with valuable areas of nature and busy

coastal towns while meshing with economic developments.

- Preservation of the (historically rooted) identity of coastal landscapes and coastal towns.
- Preservation of landscape and cultural-historical values.

D2 Optimal slotting in of safety measures:

Secondly, the impact of a given safety measure on spatial quality needs to be limited or positive.

Current detailing

- The careful slotting-in of safety measures with existing use respected and continued as far as possible.
- Maximum possible limitation of negative impact, and where possible the promotion of any positive impact by the safety measure on spatial quality.
- Enhancement of the locality of the safety measures by synergy, such as spatial-economic enhancements and vitalizing coastal towns.
- Carrying out safety measures in a future-proof manner with sufficient scope to go on meeting safety standards in the event of rising sea levels, i.e. capacity to grow apace.

D3 Future-proof development of new qualities

In the area of spatial investment active advantage should be taken of expected climate change – such as temperature, precipitation, more frequent and heavier storms – and socio-economic developments.

Current detailing

- Coastal towns to be spatially/economically reinforced and restored to health, e.g. by specialization in terms of target groups and positioning closer to their own identity;
- Regulation and zoning of activities and enabling multiple use of space on the coast including the reserve zone, which in the long term will meet a range of coastal/social needs;
- In the area of coastal accessibility take advantage of possible increase in recreational use of the beach in line with potentially higher summer temperatures;
- Promote the coast as an excellent place to make a base by stressing its appeal.
- Reinforce the quality of the beaches in attracting tourism to the coast;
- Define "stay away" areas, i.e. where development is not wanted ("resistance where necessary", such as silent areas);
- Renovation of obsolescent mono-functional buildings in coastal towns into more flexible forms.

Interface with current practice

Monitoring core qualities (d1) is incorporated in the Coastal Guideline and the Draft Order in Council Space. Generally, this is taken into account. The ideas set out around fitting-in of safety measures (d2) are heeded here. See the weak links in particular. Levels of realization here depend on the availability of budgets for the safety measures.

Future perspective

The future-oriented development of new qualities (d3) has been the focus of a range of forward studies and should be reflected in the provincial coastal visions in particular. The challenge here is to specify desired developments to such an extent that the above mentioned specialization gives coastal areas and towns their own identities in concrete terms.

E. Financing principle

The costs of investing in safety up to the level of (updated) safety standards are borne by the party responsible for the flood defence system. Additional investment towards other social wishes and requirements – such as homes, employment, recreation, nature, landscape – are defrayed in line with the task principle.

That principle is derived from the direct-benefit principle on the basis that parties must contribute to the costs of provisions generated pro rata the benefits and fulfilment of social tasking. The overall amounts for construction, management and maintenance are included in weighing-up costs. Specific consideration is required for rules around funding of maintenance and relevant safety.

Starting-up integral projects is often problematic in that there is a lack of meshing between wishes and funding between the various interests. In such cases the parties involved will seek financing constructions to bridge the time gap. Adaptive delta management also demands adjustment of existing financing structures.

2.5 Strategies for future-proof integral coastal development

In order to start up desired developments towards a chosen target for the coast various types of coastal policy strategies will be detailed within the National Coastal Vision. These strategies are based on the main line and development principles for a future-proof coast, as described in the previous paragraph. The strategies will be reviewed in terms of future-proofing, on the basis of the delta scenarios (climate change and socio-economic developments).

Long-term tasking and safety and spatial quality for sections of the coast will need to be determined before it is possible to develop policy strategies and targets; this tasking is mentioned in provincial coastal visions, among other places. Often a number of strategies will be needed to realize objectives and targets. Choices for a preferential strategy per coastal type will focus on efficient linkage of short-term wishes for coastal development with long-term objectives for a sustainable, safe, robust and attractive coast (“adaptive delta management”).

Further detailing of targets and strategies is realized via:

- Design studios: how can the various sections of the coast, with their typical, differing cross-sections, develop?
- Scenario workshops: which images match with the various delta scenarios (constructed from combinations of KNMI scenarios for climate change and rising sea levels, and WLO-scenarios for spatial-economic development)?
- Studies into topics including future-proof hard sea defences and long-term replenishment strategies.
- Involvement and cooperation with the business community and social groupings.

2.6 Potential for coastal expansion

The Delta Committee (2008) defines coastal expansion as wide, permanent, seaward land reclamation aimed at reinforcing long-term safety and spatial quality. This differentiates coastal expansion from regular replenishment to maintain the level of the coastal base.

The desirability and feasibility of coastal expansion will depend on local and regional needs and circumstances. Hence, the provincial coastal visions were asked to determine the motivation and potential per coastal province and substantiate these so that they can be included in the National Coastal Vision. Arriving at an eventual national vision depends on comparable input from the provinces. The development principles for a future-proof coast – as set out in this chapter – also apply in full to plans for coastal expansion.

Based on the findings of the feasibility studies it is fair to say that realization of the functions at a coastal expansion location will generally be more costly than on existing land. It is quite possible that sufficient political and economic motivation for coastal expansion will only be forthcoming where there is major pressure on available space: if anywhere, this would be the Randstad. Legal and economic preconditions and criteria are important in substantiating the feasibility of coastal expansion, as set out in Appendix 1.

Certainly with the next 50 years in mind, coastal expansion will not be mandatory for coastal safety. It can create benefits for coastal safety where land reclamation enables limits on safety measures. A study could be conducted into how far investment in long-term safety via seawards coastal expansion might lead to relaxing or ending of the landward reserve areas for rising sea levels over a period of 200 years. To this end the contribution of coastal safety in a coastal expansion plan will need to be well substantiated.

In regard to land reclamation methods, unfettered, dynamic coastal expansion, stretching along much of the North Sea coast, matches best with the recommendations of the Delta Committee while, building on the existing coastal policy of dynamically maintaining the coastal base and coastline. Unfettered coastal expansion is also flexible, and replenishment can be temporarily reduced due to financial

or other reasons. The disadvantage is that this type of land reclamation involves a longer-term approach - in the region of 50 years – which is unfavourable for the cost-benefit ratio. Managed coastal expansion leads to faster and more focused results, albeit on a smaller scale.

2.7 Potential for greater flexibility around the reserve zone

Discussions around coastal expansion show that the provinces and municipalities seek greater flexibility around the spatial planning of built-up areas situated on the defence system or in the reserve zone for rises in sea level over a period of 200 years. The impact on the location and the coast as a whole need to be taken into consideration when determining potential for this in a given coastal location. For more specific detailing of a fresh approach to the present reserve zones regional and local governments have been asked to consider the innovative options for multifunctional use. The sub-programme Coast will take the initiative to seek greater clarification on this matter, for several locations. Linkage will be sought here with ongoing practical issues and other sub-programmes. The results of the sub-programme Safety are also important here.

3 Questions around the provincial coastal visions

3.1 Questions and issues around the formulation of provincial coastal visions

In formulating their coastal visions it is important that the national government and the provinces follow an unambiguous system. This promotes the good mutual tuning of the provincial coastal visions and a meaningful continuation within the joint National Coastal Vision. A number of questions have been formulated to this end. The concerns and questions have been sub-divided in four blocks, i.e. “integral coastal development”, “keeping the coast safe”, “(seawards) coastal expansion”, “the defence systems zone and the reserve zone”.

A. Questions and concerns around ‘integral coastal development’

With a view to an unambiguous system of formulation for coastal visions it is important to deal with a number of substantive questions and concerns in the provincial coastal visions. Meaningful process-agreements are important for the optimal fine-tuning of a broad social and administrative base. The questions and concerns below place the most important issues for provincial and coastal visions on the agenda. Where possible and relevant the question asks for the information to be divided up per type of coast (for typology see Appendix 2 of the Framework for Coastal Development).

Questions for provincial visions:

- What is the provincial objective or development perspective (in approx. 100 years) around a future-proof coast, per section of the coast and/or types of coast?
- What are the prognoses (structurally determined expectations) around space shortages on the coast (up to and after 2040)? How do regional and local parties view economic and ecological development of their area?
- When will additional measures of or shifts in coastal policy be required in response to extreme developments (in climate or spatial tasking, or otherwise)? In other words – what are the possible breakpoints in coastal policy?
- Which parts of the coast have shortfalls (in the areas of safety and spatial quality), now or in the future (if possible taking account of delta scenarios)? If possible detailed per coastal region or coastal type (based on the coastal typology from this Framework).
- Preferably this information should be set down in a constraints chart and/or a chart with policy shortcomings (per short or long term) for safety and spatial quality (e.g. target broad leisure beaches).
- Where are the chances for coastal expansion and/or coastal widening (sea- or landwards): physical, financial-economic, planological (existing or planned building of infrastructure) and what do these contribute to safety and spatial quality? Preferably this information should be charted.
- What are the options for future-proofing (i.e. against sea level rises) in hard coastal sections? Please split into coastal towns and sea dykes.

- Is an increased dynamic in the coastal zone (inc. dunes) possible and desirable with an eye to safety, spatial quality and nature development? Where yes and where not?
- What target do you foresee for Natura 2000 areas, partly in conjunction with safety and dynamic dune management?
- Where and when are the tasks and wishes for coastal development (e.g. restructuring; spatial reserve zone, marinas, developments in the wet sections of the coast) and, in that context, what can projects contribute to long-term coastal safety and spatial quality?
- Are there specific purposes, tasks or wishes for the wet section of the coast (e.g. sand flats or channels) to be taken into account in integral coastal policy?
- Which functions, in which form and to what degree does the province aim for per area – or vice versa – in the coastal zone? If possible show this in the form of predominant functions with linkage between sea, coast and adjacent hinterland.
- What is the province's policy on building outside the dykes, or does the province seek to develop such a policy?

Point of particular interest for the provinces:

- Apply development principles (2.4.2) in the provincial coastal visions and in projects for coastal development and expansion.
- Indicate how these principles work in practice. Where is customized work needed locally or regionally? Where do the principles occasionally clash?
- Indicate which regulatory constraints you encounter in seeking to realize your vision. What requests have been made/granted for adjustment of regulations?
- Detail the vision on integral coastal development in meaningful cooperation with the relevant authorities and social stakeholders.
- Ensure good, mutual fine-tuning between the provinces.

B. Issues around 'keeping the coast safe'

The ongoing project "Safety tasks" has a special focus on when, and at which location given safety problems can or will arise. Rijkswaterstaat and the regional water boards are working jointly on the project; findings based on ongoing studies and initial estimates from water managers around realizing and maintaining safety – for defence systems and coastal bases respectively – will be deployed in areas such as the provincial coastal visions. By definition the outcome of the project will be a developing

document given that availability of knowledge will increase apace and there will be ongoing changes in acceptance of risks and demands around the benefits. Even so, constraints and chances are being identified on the basis of the current document. To date urgent spatial-economic issues are generally more acute than urgent issues around safety. Ensuring that the Netherlands stays the world's safest delta requires continuous efforts in maintaining a safe coastline; this will avoid a future situation whereby costs rise far higher. Moreover, the social benefits of financial resources dedicated to the dunes, dykes and the coastal base will increase due to greater mutual cohesion and linkage with other functions. Innovations around methodology and instruments to improve cohesion and better anticipate the future will be most valuable, and this will work to that end.

C. Questions and concerns around 'seawards' coastal expansion'

Where regional parties see opportunities for coastal expansion it is important to examine feasibility. The following concerns relate to the provincial coastal visions

Legal

Realizing coastal expansion projects requires a large number of licences, permits and exemptions. The most important decision to be taken is establishment of the development plan. Above all the development plan must focus on nature protection, given the protected status of much of the Dutch coast, insofar as this falls under the Nature Protection Act and has Natura 2000 status. To this end it is essential for the project plan to show how the project will be shaped when implemented in such a manner that it meshes with a legally achievable development plan meeting the criteria of the 1998 Nature Protection Act. Legal advice on the subject of coastal expansion from the law firm of Pels Rijcken & Drooglever Fortuijn provides specific proposals (see paragraph 2.9 - 2.11 of the advice). The advice states that right from the start preliminaries for coastal expansion projects should deploy the full weight of measures that impact positively on Natura 2000's protection objectives.

Spatial/economic

The following concerns and questions derive from the spatial/economic perspective:

- Is there a space-shortfall for the envisaged functions on existing land in the coastal region? Put another way,

which shortfall does the province seek to solve with coastal expansion?

- How do developmental costs for the envisaged functions compare with those for existing land?
- Which public and private sector cost centres can contribute to financing the coastal expansion, what are the expected contributions per cost centre, and for which functions are the contributions destined?
- Can functions on the coastal expansion be combined (multiple use of space) and what would be the efficiency benefits? In this context deal specifically with possible synergetic effects on realization of safety objectives, which safety costs (without coastal expansion) would be avoided by coastal expansion?
- What is the cost-benefit ratio within the timeframe?
- Does coastal expansion with the envisaged functions mesh with the development principles including those for spatial quality (see chapter 2)? Are any possible negative environmental effects on new land less than for existing land?

Technical

A range of working approaches is available for coastal expansion depending on the type of coast and development time available. Specify whether the envisaged coastal expansion can be realized under the principle of unfettered dynamic coastal expansion or whether managed dynamic coastal expansion would be a better choice. Does coastal expansion need to be “suspended” on a number of hard elements?

D. Questions and concerns for the defence system and reserve zones

Discussions on coastal expansion have shown that the provinces and municipalities need greater flexibility around spatial planning in built-up areas on the defence system or in the reserve zone for rising sea levels over a period of 200 years.

In the case of some coastal towns current safety regulations are said to have enforced a shut-down.

In this regard, the provinces were asked the following questions:

- What options do you see to reinforce coastal defenses and/or have them grow apace with sea levels, with the present defence system and reserve zones?
- What consequences does this have for existing development and what solutions do you see to enable

this to proceed in harmony with the development of the coastal towns?

- What do you view as the current issues around the defence system and reserve zone? What options does the region (provinces, regional water boards, municipalities) have to solve this?
- What options do you see for seaward reinforcement of the coast at such time as there is sufficient scope for the spatial development of the coastal towns?
- What costs and benefits do you see (qualitative/quantitative) for the two solution paths (in the defence system and reserve zone/seawards)?
- What do you see as the overall effect on the coast of local approaches to solutions?
- If you see greater benefits from seawards development, do you see real chances to obtain these benefits and hence make a financial contribution to the seawards shift of the coastal defences? If so, how?

It should be noted that in the event of spatial adjustments to the defence systems and reserve zones the legal preconditions under C apply undiminished. The spatial-economic concerns under C are replaced by the above questions.

3.2

Linkage of the National Coastal Framework with the knowledge agenda and activities by Government and the Delta Programme

Parallel with the provincial visions the Delta Programme Coast will enable the process for the National Coastal Vision. Cooperation with regional partners will be vital here. Moreover, the Delta Programme Coast and the Government will work towards answers on such questions as:

- When and where do safety constraints arise and what is the safety task?
- What is the effect of new safety standards on the coast?
- Where do possible spatial constraints arise?
- Which openings would yield a new replenishment strategy?
- Where are the possibilities along the coastline as a whole for multifunctional use of defence systems?
- How can hard defences be made future-proof?

Appendices

Appendix 1

Coastal expansion

Coastal expansion as a specific strategy for coastal development

In this context coastal expansion is seen as one of the possible strategies for coastal development. This Framework for Coastal Development substantiates the Government's commitment in the National Water Plan (NWP) to conduct a feasibility study into possibilities for coastal expansion. The commissioning document for the Delta Programme Coast includes a separate sub-task for this: "Review the desirability and feasibility (both technically and in terms of finance, benefits and capacity) for a possible coastal expansion and examine where and to what degree coastal expansion would bring advantages or benefits." This chapter contains the review findings translated in terms of criteria and preconditions to be met by the coastal expansion.

What is coastal expansion?

The recommendations of the Veerman Committee (Delta Committee 2008) define coastal expansion as broad seawards land reclamation aimed at reinforcing long-term safety and spatial quality. The Provincial Water Plan includes the following on coastal expansion:

"In order to offer greater future scope for functions in the coastal area, the Delta Committee suggests that the coastline should be extended. Rather than local widening of the beach this involves a sandy seaward extension across large sections of the coast. This would make the coast safer in terms of robustness and resilience. There would be more chances for landscape development, more space for recreation and the coast would contribute more to the quality of the hinterland, such as the Randstad. During the planning period the Government will conduct further feasibility studies for such an expansion of the coast, which will weigh-up the pros and cons."

Deltares (2010) further details the description of coastal expansion as follows:

- carrying out additional sand replenishment over and above sand replenishment already underway to maintain the coastline and the sand volume in the coastal base,
- for a period of at least 50 years, whereby there is sufficient time for gradual coastal accretion,
- which results in a permanent strip of new land above the water line,
- 50 - 1,000 metres wide, seawards of the current coastline,
- directly linked to the current North Sea coast.

A working definition for the National Coastal Framework summarizes matters as follows: coastal expansion is a

substantial and robust, sand-based land reclamation which is linked to the existing coast, with the idea of maintaining this on a permanent basis. The starting point is that coastal expansion is robust in character, i.e. the coast can cope with extreme situations without additional measures being needed. Coastal expansion can also take the form of tidal inlets with a nature/buffer function.

In general it is so that while coastal expansion can provide safety it is not absolutely necessary for that purpose, at least not in the next 50 years. Safety can be sustainably maintained by having the coast grow vertically apace with the rise in sea level while maintaining the coastline at its present position. Hence, the NWP de-links coastal expansion from safety. Indeed, any possible coastal expansion needs to be largely argued and substantiated from the spatial-economic perspective. At the same time, coastal expansion will certainly make a positive contribution to the robustness and resilience of the coast, while there are potential synergetic benefits from safety and spatial tasking.

The Framework does not say anything about the total required and available investment scope for coastal expansion. However, it does contain a number of preconditions and concerns employed by the regional governments in drafting their coastal visions.

Preliminary studies

Three studies were carried out in preparation for the Framework. These were based on the concerns: legal regulation, economic feasibility and technical realization and examined the possibilities – but not the necessity of social/political will – for coastal expansion.

The results of these studies are shown, in brief, below.

1 Legal preconditions for coastal expansion (Pels Rijcken & Droogleever Fortuijn, 2010).

The European Bird and Habitat directives as implemented in the 1998 Dutch Nature Protection Act and the 2002 Flora and Fauna Act represent an important review framework to be negotiated before coastal expansion can be included in a development plan and/or decision based on the Water Act. Hence, almost all dune areas are designated as Natura 2000 areas, and large parts of the North Sea enjoy the same protected status. Where damage to the natural characteristics of an area cannot be ruled out, licensing of the project requires compliance with three cumulative conditions

(ADC criteria under the Nature Protection Act):

- a. there are no alternative solutions;
- b. there are pressing reasons involving major public interests;
- c. compensating measures must be taken.

As large-scale coastal expansion is not mandatory for safety (see the NWP) it will not be easy to pass the ADC criteria.

In particular it will be difficult to show that there are no possible alternative solutions (condition a). Given the preliminary study of technical aspects of coastal expansion (Deltares, 2010) it will be less difficult to show that coastal expansion contributes to long-term high-water protection (condition 2).

Even so, in seeking better chances for coastal expansion projects while avoiding the necessity of assessment based on ADC criteria, one could aim for an integral approach whereby such measures could be meaningfully included in the plan in such a way that there is no significant negative impact on Natura 2000.

In the event that a coastal expansion project is promoted, the solution can be sought in:

- spatial upscaling
- a slow change (whereby there is no noticeable impact on the biotope)
- positive (mitigating) measures
- a balance approach

One line of argument with slower coastal expansion is that there will be no noticeable change to the area but there will only be a gradual shift. The “balance approach” is now accepted with the proviso that positive measures must form a logical and integral part of the project. Random sections may not be attributed to a project in order to enable a positive assessment – as these would then count as compensatory measures. Compensatory measures can only be taken on where it can be clearly shown that the first two ADC conditions have been met.

2 Economic preconditions (Witteveen and Bos, 2010).

Functions around lack of space, such as nature, recreation or residential construction can be realized on both existing and reclaimed land. Indeed, the central question here is at what point, given a function subject to constraints of space, does one shift to land reclamation?

From the economic perspective the answer is: land reclamation is the obvious option where this is cheaper than realizing the function subject to constraints of space on existing land. Logically, realizing a given function subject to constraints of space on newly to be reclaimed land will only be cheaper than on existing land where:

- development costs of the function on new land are lower, and/or
- negative environmental impact on the new land is less.

However, from a spatial perspective the answer to the central question is: we move to land reclamation when there is no space available elsewhere to meet the need for space. In other words: there has to be a shortfall on the existing land, e.g. lack of nature, recreation or housing areas.

The study findings were as follows:

- In general cost of land reclamation is high compared with the costs of realizing functions on existing land.
- The most economic solution for the shortfall in recreational areas is inland. The greatest shortfall in recreational facilities is along the coast of South Holland, whereby recreational demand for coastal expansion is highest. This shortfall is limited in the Wadden Region and the Southwest Delta.
- In relative terms, realization of natural features on coastal expansion is most promising for the section of the coast of North and South Holland where urban development within the dykes is more problematic insofar as the seaside does not fall under Natura 2000.
- There will certainly be a shortfall in space for homes and businesses up to 2020, but the costs of coastal expansion are substantially higher than on the landward side. Given that large sections of the coastal zone pose constraints for the construction of housing or commercial sites – and the major shortage of housing on this part of the coast, the higher costs for coastal expansion locations can, to a degree, be justified.
- Wind-energy plant is now being shifted out to sea in view of the lack of space, albeit construction costs are far higher. The question is whether construction costs for a coastal expansion location would be in proportion to those at sea.
- No shortages are expected in supplies of drinking water and coastal expansion is not an obvious option to ensure supplies.

3 Technical possibilities for dynamic coastal expansion (Deltares, 2010).

The technical report shows no insurmountable technical problems around coastal expansion. Coastal expansion is most appropriate along the closed North and South Holland coast where gradual coastal growth is feasible in line with unfettered dynamic coastal expansion. This involves large-scale sand replenishment in the coastal strip for a period of 50 years whereby the distribution of the sand along the strip is left to the natural forces of wind and water. Coastal accretion, enabled by managed dynamic coastal expansion, can reinforce given sections of the coast. Meanwhile, seaward expansion of the coast via strategically-timed and -sited, large-scale sand replenishment for socially desirable developments and uses. This type of coastal expansion can use fewer hard provisions such as artificial reefs, sand hooks and sand dams.

Appendix 2

Typology of the Dutch coast

The various types occur along the coastline. The 14 basic types are shown below in cross-section, with notes. These notes set out possible future safety measures for each type, without evaluation or financial assessment. For some types there are specific questions for partners in the studies and provinces.

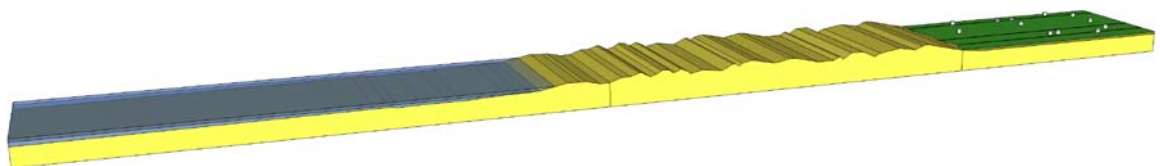
Main type 1 Coastal base with wide dunes

1 'Most common' type

Description This type comprises a wide, shallow foreshore (5-20 km wide, with the 10 m depth contour situated 5- 10 km from the flood line), a robust chain of dunes of at least 250 m and agricultural areas in the hinterland. Example: the Texel-Noordkaap coast.

Expectations In general safety can be ensured by having the foreshore of the dunes grow apace with the rise in sea

level. As this type of coast will probably comply with safety standards up to 2100 there will be little change here. The broad dune area hosts a range of ancillary functions including recreation, nature and water production. Dynamic dune management is also an option. Multiple use of space will be more intensive near urban areas and more fine-tuning will be required between functions (zoning).



2 Type 'Natural environment'

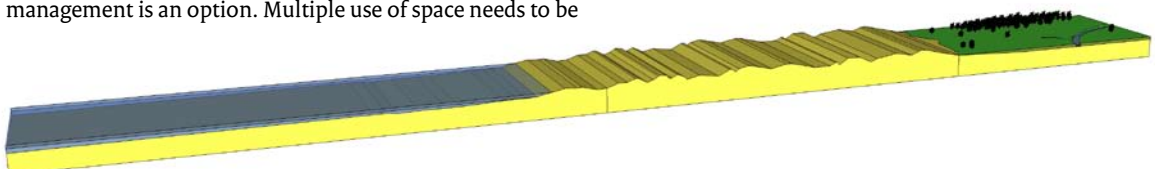
Description This type comprises a wide, shallow foreshore (1-20 km wide), a robust chain of dunes (at least 250 m), and a natural area as hinterland. Example: Boschplaat, Terschelling.

Expectations In general, safety can be guaranteed by having the foreshore and chain of dunes grow apace with rising sea levels. This type of coast will probably conform to safety standards until 2100, whereby there will be little change. The broad dune is home to various ancillary uses; recreation, nature and water collection. Dynamic dune management is an option. Multiple use of space needs to be

intensified near urban areas, and mutual fine-tuning of functions (zoning). This type of coast will probably conform with safety standards until 2100, whereby there will be little change.

Any impact – or lack of impact – on the natural areas will depend on legislation and financing.

Question Does coastal development on the sand flat side impact the (necessary) coastal development on the side of the North Sea?



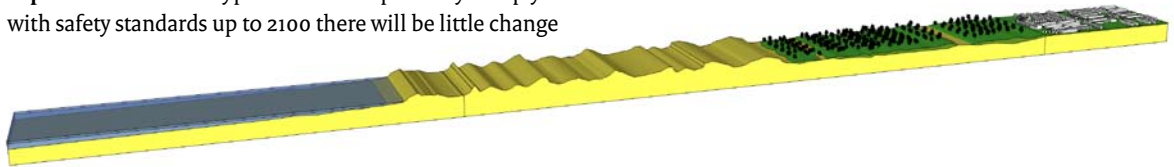
3 'Hollands' type

Description This type comprises a wide, shallow foreshore (1-20 km wide), a robust chain of dunes (at least 250 m) and an urban area for a hinterland, such as Castricum (North Holland) or Wassenaar (South Holland).

Question To what extent do the regional parties support dynamic dune management in the wide dunes?

Expectations As this type of coast will probably comply with safety standards up to 2100 there will be little change

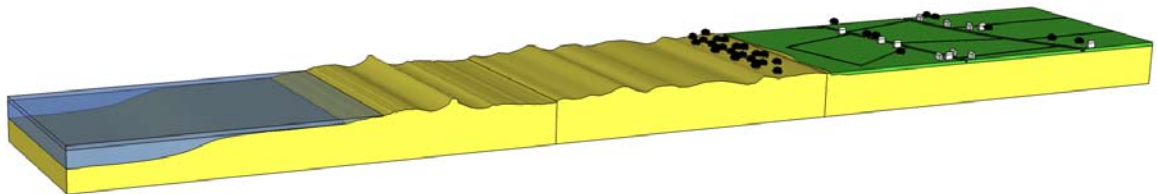
here. The broad dune area hosts a range of ancillary functions including recreation, nature and water production which will require mutual fine-tuning (zoning). There will also be increased pressure on space for (e.g.) development of seawall locations. The broad dune area hosts a range of ancillary functions including recreation, nature and water production. Dynamic dune management is also an option.



4 'Tip of the island' type

Description This type comprises a deep foreshore, wide dunes and an agricultural hinterland. Example: Westenschouwen, Schouwen.

Expectations This is a robust type although - depending on the situation - the foreshore can entail erosion. This will mainly involve transitional areas between wide and narrow dunes. Another watch point is the slotting-in of recreational provisions.

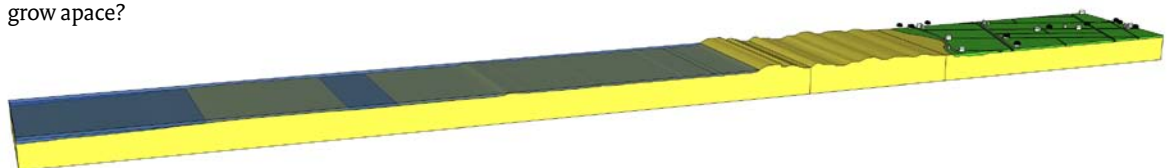


5 'Flats' type

Description this type comprises a shallow, low-tide, accreting foreshore, a wide dune and a mainly agricultural hinterland. Example: Brielse gat.

Question In how far are the flats stable and/or will they grow apace?

Expectations This type will be robust for the period up to 2100, with little change in safety terms. The question remains in how far the accreting foreshore can ensure safety⁴.

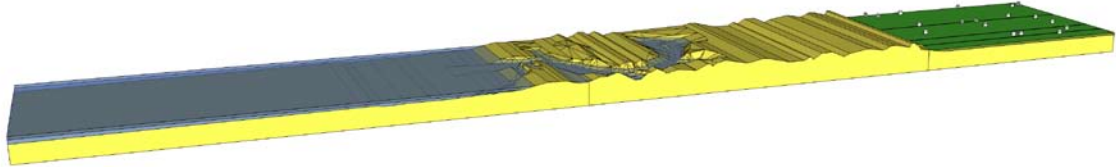


⁴ The sub-programme Southwest Delta further examines foreshore development.

6 'Tidal creek' type

Description This type comprises a shallow foreshore, an inlet penetrating into the wide chain of dunes, and a hinterland with agriculture. The inlet is surrounded by dunes, some with dykes ("t Zwin). Examples: Texel tidal gully de Kerf, "t Zwin.

Expectations Dit type ligt over het algemeen in een robuust duingebied en heeft vooral natuurwaarde (gradiënten, dynamiek). Het biedt perspectieven voor natuur, natuurrecreatie en dynamisch duinbeheer.



Main type II Coastal base with narrow dunes

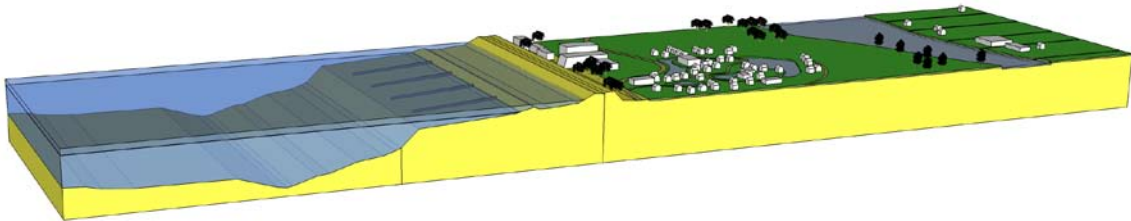
7 'Channel' type

Description This type comprises a deep foreshore, usually with a channel, a narrow (less than 250 m) reinforced set of dunes, and an agricultural area in the hinterland. Example: the southwest coast of Walcheren.

Expectations This type will need reinforcement due to the (natural) coastwards shift of the channel combined with rising sea levels. The most obvious solution is to widen the dune area on the landward side. This could be problematic for recreational facilities and dune villages (see the dune village type).

Alongside replenishment of the sides to stabilize the channel, the channel could also be shifted seawards. This would create more space for seaward dune reinforcement and other ancillary uses.

This investment needs to be weighed up from the social angle, given that several regions are currently undergoing a squeeze. Meanwhile, these regions often require a boost to employment in the recreation sector. The principles of uninterrupted construction and basic safety go hand in hand here.



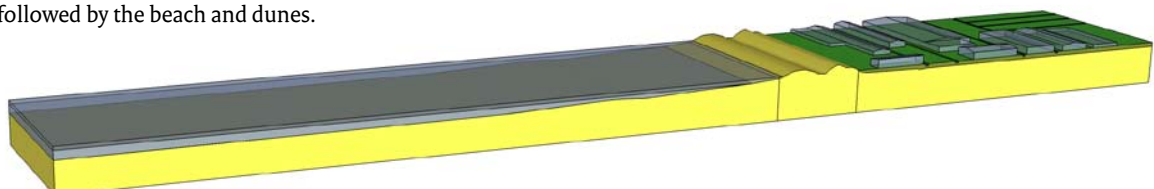
8 'Narrow dune' type

Description This type comprises a wide, shallow foreshore (between 1 and 20 km wide), a narrow chain of dunes (less than 250 m), and agricultural hinterlands. Example: Westland.

Expectations This type is unlikely to meet safety standards in the period leading up to 2100, whereby there is a (soft) safety task. Safety can be maintained having the foreshore and chain of dunes grow apace with rising sea levels. Options here include the sand motor whereby the coast continues gradual growth, starting on the foreshore followed by the beach and dunes.

Given intensive recreational use this development raises objections around aspects including swimmer-safety and management (continual management of the old seawall will be required until the end-stage has been reached).

In urban areas like the province of South Holland there is major demand for space on the narrow dunes. Recreation across the board is prevented by management and ecological features around the vulnerable dunes. Dune expansion could relax these constraints. The principle of natural dynamics offers chances to reinforce this type of coast.



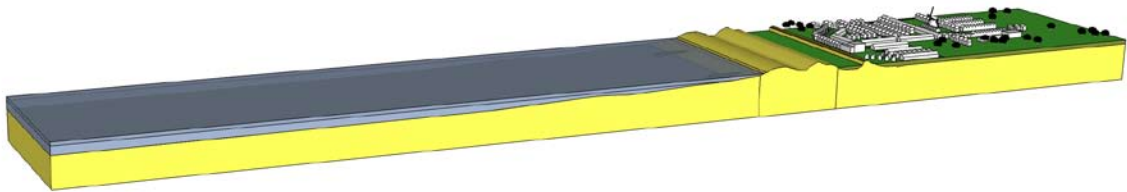
9 'Dune village' type

Description This type comprises a wide, shallow foreshore (between 1 and 20 km wide), a narrow chain of dunes (less than 250 m), and agricultural hinterlands. Example: Westland.

Expectations This type is unlikely to meet safety standards in the period leading up to 2100, whereby there is a (soft) safety task. Safety can be maintained having the foreshore and chain of dunes grow apace with rising sea levels.

Options here include the sand motor whereby the coast continues gradual growth, starting on the foreshore followed by the beach and dunes.

Question What options do the regional parties see for having the dyke grow apace with a soft, increasing dune mass, along with the rise in sea level?



Main type III

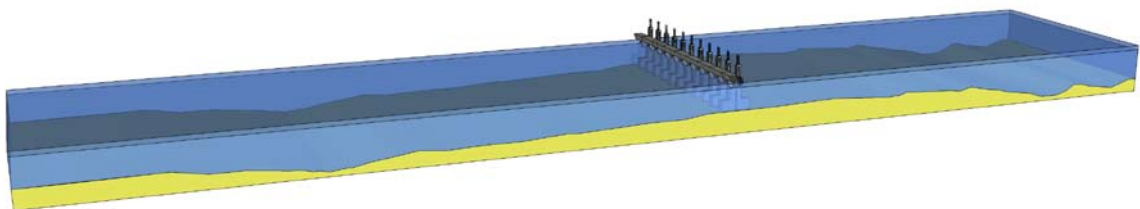
Coastal base with hard defence system

This covers the sub-types mentioned in the future-proof hard sea defence systems study (Deltares), namely: Sand dykes, Engineering works, Dams, Retired embankments, Sea dykes – both sea- and landwards, Hybrid sea defence systems, Dams reduced coastlines, Open dams, and Outer harbours.

10 'Engineering works' type

Description This type comprises a wide, shallow foreshore (1-20 km wide), a dyke or dam (with or without moveable sections), with water as hinterland⁵.

Expectations All engineering works will need to be checked for adjustments. Customized work will be needed for shipping and recreational boating. Several engineering works act as traffic arteries with the landward side used for recreation.



⁵ The ongoing study (2010-2012) entitled Future-proof hard sea defences, by Deltares, contains more information on hard sea defence systems.

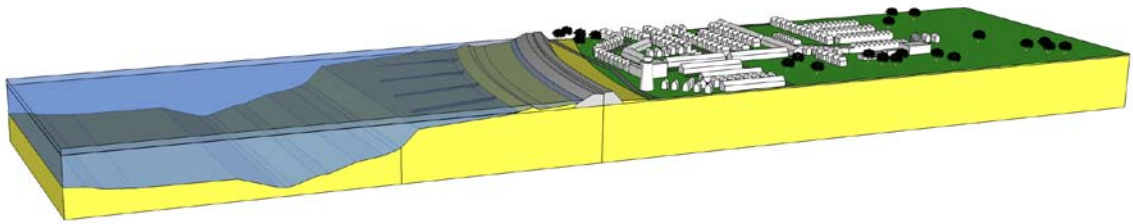
11 'Dyke village' type

Description This type combines a deep foreshore with a dyke and a built-up hinterland. Examples: Westkapelle and Walcheren.

Expectations Increasing the height of, or widening, the dyke is problematic in a built-up area. Alongside dyke-widening, consideration could be given to restructuring combined with increasing the height (climate dyke) or partially shifting urban development outside the dykes.

Sand-based solutions are another possibility, albeit demands on space will often make this problematic. A number of dyke villages (former fishing villages) are undergoing a "squeeze" and seek new sources of income, such as recreation.

Question What potential do the regional parties see to have the dune mass grow apace with the rise in sea level?



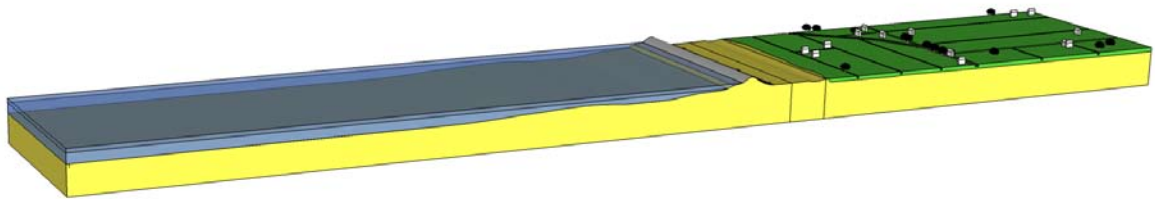
12 'Dyke' type

Description This type comprises a deep foreshore with a dyke fronting agricultural land or natural environment. Example: Hondsbossche seawall.

Expectations Sand-based solutions will also be investigated alongside traditional formulas for increasing the height and/or widening of the dyke. These narrow sea

defences are often bottlenecks for the natural environment and the combination of traffic and recreation demands good dyke profiling.

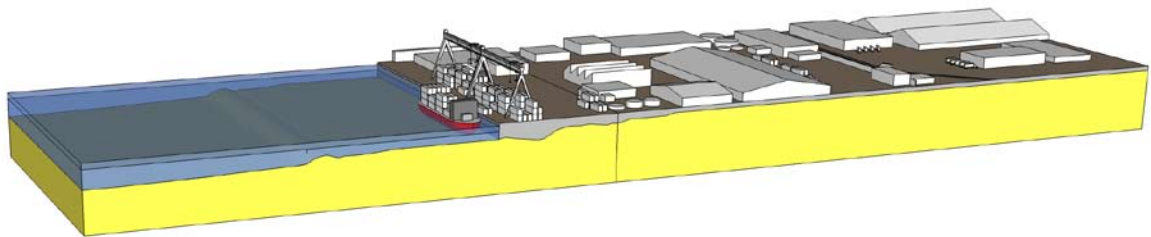
Question What options do the regional parties see for having the dyke grow apace with a soft, increasing dune mass, along with the rise in sea level?



13 'Port' Type

Description This type comprises a deep foreshore and a quayside with an urban/industrial hinterland. Example: Maasvlakte.

Expectations Increasing the height of the quay will require fine-tuning of development, whether or not combined with restructuring. For example, studies have been conducted for the Port of Flushing whereby urban development grows apace with a higher quay, e.g. via parking levels.



Main type iv

Coastal base with built-up sea defence zone

14 'Coastal resort' type

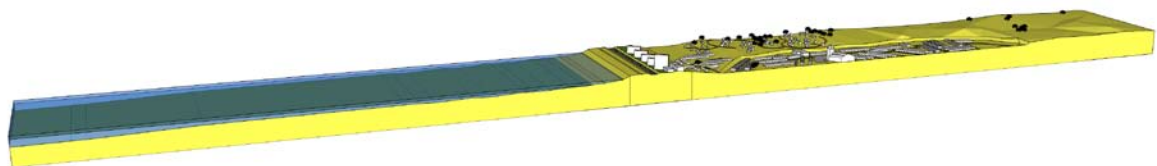
Description This type comprises a wide, shallow foreshore (1-20 km wide), a wide row of dunes extending more than 250 m, a built-up, soft or partly hard sea defence zone with part of the built-up area outside the dykes (in exit or reserve zone) and behind the dunes an urban or agricultural hinterland.

Some coastal towns have promenades with partially hard sea defences. This includes the sub-types listed in the Deltares study on hard sea defences, namely Hybrid sea defences and promenades.

Expectations At many coastal towns the building stock is post-war, obsolescent and privately owned (partly ground-leased) and needs restructuring. There is also pressure on space, as evidenced in accessibility and lack of parking. Many coastal towns face downward property investment due to obsolescent building stock and uncertainties around safety measures. A lock-down of sea defences and the reserve zone makes restructuring problematic. Hardening-up sea defences is a way of winning space, as is hard and soft

seaward reinforcement, albeit this demands high levels of investment. Current urban development outside the dykes – and its possible renewal – faces uncertainties around new standards, whereby it is unclear at which level building/restructuring can take place. The principle of basic safety is involved here. For the time being, spatial concepts for the non-permanent use of the sea defence (cf. also, beach cafés) offer few prospects for restructuring or economic impulses for coastal towns. In practice, there have been positive results around increasing the height of promenades at Scheveningen, Noordwijk and Flushing, whereby the safety aspect is combined with a quality boost for public areas. Hopefully this will lead to an improved investment climate whereby basic safety is ensured. The combined task of safety and spatial quality 2100 for coastal towns is complex.

Question What potential do the regional parties see to have the town grow apace with rises in sea level – with both soft and hard solutions?



⁵ Meer informatie over verharde weringen kan worden gevonden in het lopende onderzoek (2010 – 2012) 'Toekomstbestendige Verharde Zeeweringen' door Deltares.

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Delta programme

The Delta programme is a nationwide programme. The national government, provinces, municipalities and regional water boards work together with input from social organizations and the business community. The objective is to protect the Netherlands from flooding and to ensure adequate supplies of freshwater for generations ahead.

The Delta programme has nine sub-programmes:

- Safety
- Freshwater
- New urban developments and restructuring
- IJsselmeer region
- Rhine Estuary-Drechtsteden
- Southwest Delta
- Rivers
- Coast
- Wadden region

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