CHAPTER ONE: SYNTHESIS AND VISION

1 INTRODUCTION

1.1 METHODOLOGICAL BACKGROUND FOR STRUCTURAL PLANNING

The methodology described in this chapter is borrowed from the methodology used for spatial structural planning “on land” in Flanders. In structural planning space is seen as an area of structural unity, in which structural decisions need to be balanced against each other. In contrast with so-called ‘end situation’ planning, structural planning does not aim to identify and allocate every single piece of space in detail. Therefore, the structural plan is rather a global and strategic vision of the desired spatial development of a particular area. It aims to be a framework for sustainable spatial content and is represented by structural maps rather than the final planning maps (known in Dutch as ‘eindbestemmingsplannen’), which set out the zones in which different types of uses may take place.

Structural planning tries to detect inter-connected units or ‘structures’ and structural elements, and formulate these into a strategic vision that is relevant within the scope and scale of the studied area. The resulting structure plans intend to make provision for existing issues and problems, as well as potential opportunities. Another difference to ‘end-situation’ planning is that structural planning involves continuous refinement and adaptation in order to react to societal changes. The motto is ‘flexibility’ since the concept of ‘space’ involves constant evolution.

1.2 SITUATING THE BELGIAN PART OF THE NORTH SEA (BPNS)

The North Sea is situated between Norway, Sweden, Denmark, Germany, the Netherlands, Belgium, France and the UK (OSPAR 2000). It is connected with the Atlantic Ocean, the Channel and the Baltic Sea. The North Sea takes up less than 1/500 of the total seawater mass on earth. In this context it is little more than a shallow, small puddle (Map III.1.1a).

Heavily populated and industrialized countries surround the North Sea. In most of its coastal areas, coastal tourism and recreation are well developed. Also the Belgian coastline attracts intense tourism. A variety of activities takes place on the North Sea that all intervene on one of the busiest shipping routes in the world. The delimitation of the continental shelves of the North Sea coastal states is the result of agreements made in the 60s and 70s. The delimitation of the BPNS with its neighbours France, UK and the Netherlands dates back to 1990, 1991 and 1996 respectively.

The BPNS has a maximum width of about 66 kms and extends about 87 km from the coast. Its surface is comparable with an average Belgian province (about 3600 km²). It only consists of a small proportion of the entire North Sea (merely 0.5%). Shallow waters characterise that part of the North Sea that faces the Belgian coast (average of 20 metres and a maximum of 35 metres). This contrasts with depths of about 200 meters when nearing the Atlantic Ocean. One of the typical characteristics is a complex system of sand banks almost parallel with the coastline, some of which are exposed during low tide.

This report focuses on the BPNS. Relations with neighbouring countries are identified where needed or possible. Maps are used to guide the reader through the planning process. They all use a basic outline
map on which the BPNS contours and those of the northern part of the Province of West-Flanders are indicated. White dots indicate the coastal towns of Nieuwpoort, Ostend and Zeebrugge and the city of Bruges. Additionally, the groynes at the port of Zeebrugge are indicated on each map.

1.3 BRIDGING THE GAP BETWEEN SCIENCE AND STRUCTURAL PLANNING

This chapter tries to build a bridge between the scientific information and maps - as outlined in the previous chapters of this report – and the need for a structural plan for the BPNS. It addresses issues that are typical for marine planning in a general context as well as issues that need to be addressed within the specific context of the BPNS. Both general and specific issues pertaining to the BPNS, and addressed through structural planning under this Chapter, indicate that the BPNS is:

- part of a vaster mass of marine water interconnected by currents, flows and tides (Map III.1.1b)
- composed of a three dimensional structure including space in both horizontal and vertical direction going from seabed to water column and to air (Figure III.1.1a)
- occupied by an extensive array of jurisdictional zones, infrastructure, and uses (Maps III.1.1c-d)

A number of maps have been created in order to bridge the gap between the scientific text under previous chapters and the discussion of structural plans under this Chapter. These include in sequential order:

- GIS maps, which are geographically accurate, to scale, and show the exact location of existing uses and their impacts. For example, whereas the GIS maps show the location of fisheries;
- Overview maps, which are not geographical accurate or to scale, but illustrate specifically chosen information in a more practical way for planners. For example, the overview maps show the relationship between the numbers of fishing vessels leaving each port and the fisheries that they are fishing;
- Synthesis maps, which are based on the overview maps and give a summary of all the activities and uses found within the BPNS;
- Vision maps (or planning maps), which are based upon both the overview and synthesis maps and provide possible scenarios for the management and use of the various resources found within the BPNS. In effect the vision maps are structural planning maps insofar as they match the description of structural plans discussed above in section 1.1 of this Chapter.

2 SYNTHESIS: EXISTING SPATIAL STRUCTURE IN THE BPNS

2.1 THE SUB-AREAS OF THE BPNS

The BPNS consists of five characteristic sub-areas. The identity of each one of them is characterized by the interplay between the different physical elements in the area, such as relief, depth, structure of sand banks and its relationship with the land (Maps III.1.2.1a-e). These conditions in turn impact on the use of the sub-area. The five sub-areas are:

- The deeper sea: this is the sub-area that is furthest away from the land, characterised by its depth and therefore by a water column that is less influenced by the underlying seabed than in the other sub-areas;
The Flemish banks and Hinder banks: this sub-area consists of two sand bank systems that are almost completely oriented in a north-south axis;

The Zeeland banks: this sub-area is very comparable with the previous but its axis is more parallel to the coastline. The sand banks are also less shallow. The variation of banks and channels within these two sub-areas strongly influences the use. Differences are therefore local and depend on the conditions of certain sand banks e.g. the composition of its sediment will impact on the extraction possibilities;

The mouth of the Westerscheldt: this sub-area only covers a small part of the BPNS. It is mainly characterized by the fact that it covers a river mouth. The river mouth contributes to siltation, input of pollutants from land, and the mixture of freshwater and seawater. Those aspects are, however, mainly important in the Dutch part of the North Sea, which is a delta area formed by the Scheldt-Rhine-Meuse mouth;

The coastal area: this sub-area links up with the coastal landside. It is a shallow area in which uses and activities are mainly connected with land activities, tidal aspects and shallow waters.

2.2 THE DYNAMICS OF THE BPNS

The BPNS – though being very small – is intensively used. Its dynamics – both natural as well as human – are very strong in this part of the North Sea (Maps III.1.2.2a-h). Dynamics are another way to subdivide the BPNS into zones (Map III.1.2.2i).

The transit zone: dynamics in this zone mainly consist of shipping movements both on an international and national level, and the use of traffic separation schemes. This part of the North Sea is the busiest shipping area in the world;

The dredging zone: being an extension of the transit zone, dynamics in this zone are even more intense than those in the transit zone. Permanent dredging activity needs to be carried out to fight the shallowness of the area and constant sedimentation build up from the Scheldt mouth and the groynes at the port of Zeebrugge. This dredging zone covers the direct access routes to the ports of Ostend, Zeebrugge and Antwerp;

The activity zone: this zone accommodates a rapidly increasing use of mobile and fixed activities. Almost all current uses and infrastructure within the BPNS are situated here. Different natural resources are exploited, including such things as wind energy, sand extraction, fisheries ... etc. Those areas closest to the coast face the heaviest exploitation due to their short distance to coastal ports;

The coastal zone: the ports, coastal towns and the beach all impact on the activities that take place within the 3 nautical mile zone, which runs along the coast. It is consequently the most intensely used area of the BPNS. This is not only limited to economic and recreational activities, but also includes a high degree of natural and ecological activities, such as continuous coastal erosion.

2.3 THE NATURAL VALUES IN THE BPNS

Physical elements such as wind, water and sand reign at sea, in contrast to the ways in which human development has curbed the force of the elements on land. To this extent the physical elements have safeguarded the natural values of biodiversity and seascape. However, these natural values have increasingly come under pressure because of the intensified use of the coast and the sea. The natural values of the BPNS are diverse, but they are also dependent on specific communities and/or populations (Maps III.1.2.3a-d). Although biodiversity is enormous and widely spread throughout the BPNS, certain
core areas can be identified as being of higher natural value than others. Two areas identified within the GAUFRE project include (Map III.1.2.3e):

- A strip about 10 kms wide and more or less parallel with the coastline. This strip is divided into a marine and terrestrial part. The marine strip is widest in the western part. This part contains the most valuable coastal sand banks with large and rich benthic communities and their connected flora and fauna. The marine strip is less wide in the eastern part as a consequence of the high level of dynamics around the port of Zeebrugge. The most valuable area on this side is therefore situated on land. These are the internationally well-known bird areas of the polders, such as the Zwin and the hinterland of Zeebrugge. This coastal stretch also coincides with the wide strip being used as a migratory route for birds to and from northern and southern Europe.

- Perpendicular to the coastal strip, several faunal movements interconnect the landward with the seaward side of the coastal area. These patterns are mainly important for birds searching for feeding grounds during migration to and from the British Isles, and fish migrating between the shallow coastal banks and the deeper sea.

More natural values also occur deeper at sea but these are less well known and are mainly connected with specific local habitats, such as wrecks (Map III.1.2.3f).

The natural values of the BPNS are intrinsically linked to existing and potential threats from pollution and disturbance generated by infrastructure and other types of uses (Maps III.1.2.3g-j)

2.4 THE INFRASTRUCTURE IN THE BPNS

The BPNS has two types of fixed infrastructural systems. These can be characterised as exposed infrastructure and submerged infrastructure.

Exposed infrastructure consists of the port infrastructure (e.g. jetties and groynes) of Zeebrugge, coastal defense in general, survey and monitoring infrastructure, and the future wind turbine park on the Thorntonbank (Maps III.1.2.4a-d).

Submerged infrastructure is located on the seabed and mainly includes cables and pipelines (Map III.1.2.4e). Although the layout of this type of infrastructure can appear chaotic, a certain structure can be identified in the shape of ‘bundles’ (Map III.1.2.4f):

- Perpendicular to the coastal strip: two bundles leave the groyne of the port of Zeebrugge. Each one of them consists of a communication cable running parallel with a gas pipeline. A second bundle leaves from Ostend. Three cables run parallel in this bundle. Additionally many cables leave the area of De Panne-Koksijde-Oostduinkerke. The distance between these cables is larger and some of them are no longer in use.

- Parallel to the coastal strip: several communication cables have been installed parallel to the Norfra-gas pipeline.

On the landward side, the entire coastal strip can be identified as one stretched infrastructural lane. Different infrastructure (cables, coastal defense, construction, roads ... etc) is bundled parallel to the coastline. Accordingly, access routes are perpendicular to the coastline. No connections are made along the coast for energy network infrastructure (gas and high voltage), and there are only dead-end or passing connections towards the sea. Nevertheless, some dead-end cables are meant to be connected to the sea cables of future wind turbine parks.
2.5 THE STRUCTURE OF THE COASTAL STRIP

The coastal strip itself consists of a landward and seaward side. Both sides impact each other. Although the sea has an impact on the total length of the coastal strip, this strip can still be divided into a number of structurally distinct categories. These categories are mainly based on different physical characteristics, types of use and mechanisms for defense against the sea. Specifically these categories include (Map III.1.2.5a):

- The concrete coast: this type occurs in the area between Knokke and Heist and between Ostend and Nieuwpoort. The coastline is characterized by concrete structures such as dykes, high levels of construction, high pressure and completely depressed natural sea dynamics towards the land. An exception is the Zwin in Knokke;
- The port of Zeebrugge: this is an industrial landscape in which the link with the sea is purely based on shipping and port activities. The groynes are meant to protect incoming vessels against currents;
- The narrow dunes: the area between Blankenberge and Bredene has less hard infrastructure than the above categories. Although part of the coast is still comprised of dunes, natural dynamics between the sea and the dunes is limited. Furthermore, the dunes that are present are very narrow and immediately turn into a polder landscape or coastal forest;
- The broad dunes: the area between Nieuwpoort and De Panne contains a broad dune belt. Although intensive construction has heavily impacted on the dune belt, natural dynamics are still present. A recent example of natural dynamics are the artificially introduced breakthroughs from the sea to the dunes (sea inlets or the so-called 'slufter');
- The polders: these occur behind the coastal strip.

3 DEVELOPMENTS AND TRENDS

Besides current uses and the existing spatial structures within the BPNS, important trends can also be identified in the natural and societal development of the area. These trends illustrate the challenges that a future North Sea policy would have to face and are therefore guidelines in formulating a spatial vision for the BPNS. The most important trends are:

- Climate change: The effects of future climate changes will heavily impact on densely populated coastal areas, such as those along the North Sea. The pressure on those areas from the water, as a consequence of the greenhouse effect will only increase in the years to come. Sea level rise for the North Sea is estimated to be between 20cm and 110cm (Van Ypersele and Marbaix 2004). But the climate will also change due to changes in the North-Atlantic Gulfstream. The consequent increase in the risk of inundation, coastal erosion, siltation … etc needs to be anticipated. All these effects will have a tremendous impact on the use of the North Sea, its coastal strip and existing ecosystems.
- (Over) exploitation of fish stocks: Coastal seas such as the North Sea are very productive areas. They deliver about 80% of the fish catch and about 20% of the biological production in the world. Additionally, the demand for fish as a source of nutrition is constantly increasing. As a consequence, a large part of the most important fishing grounds is being overexploited. This of course raises questions about the sustainability of exploiting natural resources.
- Pollution and degradation: The quality of the marine environment is under a lot of pressure. The intense use and proximity to industrialised areas make the North Sea one of the most polluted areas in the world. Current and historical pollutants are a constant threat to the North Sea’s natural ecosystem. It is necessary to develop a system to protect the North Sea’s ecological and
physical assets. This protection is necessary not only to ensure preservation of the sea’s natural value but also its importance as a productive and stocking area.

- Under-utilisation of diverse natural resources: The North Sea has an enormous potential, but only part of its natural resources are really being used. There are many additional resources that are under-utilised or which might be applied to further uses. It is presently thought that additional applications can be found in the pharmacology, biotechnology and the chemical industries. It is believed that the demand for electricity will increase from 22170 MW in 2001 to around 35500 MW in 2030. Although the North Sea is presently restricted to gas and oil exploitation, new forms of energy exploitation are becoming likely. New areas where energy may be increasingly exploited in the future include tidal power, sea currents and wind energy.

- Increased spatial claims: While the demands for space on land increase, the amount of land available to meet that demand is decreasing. This has resulted in the wide areas of space at sea being increasingly sought after as an alternative location for uses and activities that previously took place on land. At the same time activities that have been traditionally based at sea are placing increasing demands on sea space. Although marine space appears unlimited, it is not, and it will soon be challenged by the same demands as those that are faced on land.

4 SPATIAL VISION FOR THE BELGIAN PART OF THE NORTH SEA (BPNS)

4.1 THE NEED FOR A SPATIAL VISION

The surface of the BPNS is approximately 3600 km², which is approximately 1/9 of the surface of Belgium itself. The BPNS gives the impression of being immense with an enormous potential for new uses. Nevertheless, the current demand for space shows that the BPNS already has a high exploitation rate. The current need for space at sea is larger than generally thought. The sum of all demand for space at sea is around 2.6 times larger than the available space (if space allocations are based on current legislation and if this space would actually be used) (Figure III.1.4.1a). Apparently, some activities do not occupy all their legally allocated space (both in time and space) and some activities or infrastructures can be perfectly combined without spatial or temporal conflicts (e.g. cables and pipelines versus shipping).

Nevertheless, future requirements for space will continue to increase. The increasing requirement for space within the BPNS, as a result of current and future plans, in turn increases pressure on current uses and existing (natural) systems. It is important to note that the need for space changes in two directions. The fixed activities (such as wind energy, cables and pipelines, coastal defense, port structures, aquaculture and land extension) are gaining importance in comparison with the mobile uses. The mobile uses (such as fisheries, shipping, air transport, military use, water recreation, sand and gravel extraction and dredging activities) do not increase their spatial occupation, but rather intensify their action in the zones they already occupy.

Space within the BPNS is limited and in most cases the use of space for one type of use restricts possibilities for other types of uses. In simple terms, there is not enough space within the BPNS to accommodate all the claims for space. Accordingly, structuring and planning is required for the BPNS and choices will have to be made about space allocation. The BPNS cannot just be seen as an extension of the land. The sea has a unique and typical structure and dynamics. It is not a ‘waste’ space for activities that can no longer take place on land. Therefore, each activity needs to be examined in terms of whether it can be performed more effectively on land or in an alternative form.
4.2 FOUR STEPS TOWARDS A SPATIAL POLICY OF THE NORTH SEA

The GAUFRE project goes beyond mapping the current uses of the North Sea. Rather, the aim of the project is to produce plans and maps that enable policy makers and users to envisage different ways in which the BPNS might be spatially managed in the future. Based on this approach GAUFRE has formulated a 4 step approach that policy makers might utilise in order to prepare and implement a spatial plan for the BPNS.

Step 1. Determination of the core values of the North Sea

Identification of the core values that determine each use within the North Sea (i.e. ecological, economic and social well-being).

Step 2. Development of various scenarios for the BPNS

Placing different emphasis on the core values to identify new scenarios under which the BPNS might be managed and formulate a vision, spatial strategies and preferential areas of use within specific scenarios.

Step 3. Drawing of the structure plan for the BPNS

Formulation of a single vision based on the different scenarios under one structure plan. This vision would form the foundation for the future management of the BPNS.

Step 4. The transnational approach

A structure plan for the BPNS could set an example within the international policy context. Ultimately, a combination of national structure plans may result in a structure plan for the whole North Sea.

The last two steps indicate how various visions based on different scenarios can be implemented in policy. The realization of these two steps is considered a government task. Therefore, these two steps will not be discussed in this report.

4.2.1 Step 1. The core values of the North Sea

The core values of the North Sea determine each use within the coastal and marine area (Figure III.1.4.2a). The three core values are: the value of well being, ecological and landscape value, and economic value.

- **Well-Being**
  The North Sea is an area for recreation. In particular, the coast is a place to relax, take holidays and get a breath of fresh air. Consumers of the sea view it as a large, empty space in contrast with the density of the land. The social value of the Belgian part of the North Sea is caused by its potential for consumption: the sea offers space, consumer goods and entertainment.

- **Ecology and Landscape**
  The second core value emanates from the combination of the ecological and the landscape value. In Belgium, the North Sea is a scarce ‘landscape’ with a large ecological importance. The North Sea has a highly diverse natural wealth formed through an ecological network of benthos, fish, marine mammals and birds. Moreover, its natural wealth covers the entire ecosystem through the combination and inter-relation of topography, currents, wind ... etc. Examples include such things as sand banks, dunes, tidal areas and more specific habitats on hard coastal structures. Furthermore this value concerns the landscape with its free horizon and the ‘heritage’ of this landscape, such as ship wrecks.
**Economic Value**

The BPNS is a very wealthy area, with resources and conditions that are unavailable on land. The maximum extraction of these resources, or making use of these specific conditions provide a surplus value. For example: transforming wind into valuable energy, the extraction of sand and gravel, the capture of fish and the development of aquaculture. In addition, the North Sea has an important role as transport area. The North Sea is still one of the most extensive shipping areas in the world.

In addition to the three core values the GAUFRE project identified three general principles that have an influence upon the management of the BPNS. These include the precautionary principle, sustainable management and sustainability, and finally security.

The ‘precautionary principle’ is based on international agreements, such as the OSPAR Convention 1992 (for the protection of the Marine environment of the North East Atlantic). This basically provides that ‘preventive measures are to be taken when there are reasonable grounds for concern that substances or energy introduced, directly or indirectly, into the marine environment may bring about hazards to human health, harm living resources and marine ecosystems, damage amenities or interfere with other legitimate uses of the sea, even when there is no conclusive evidence of a causal relationship between the inputs and the effects. This principle is a core principle in the Belgian law for protection of the marine environment (1999).

The principle of ‘sustainability’ is based on the Bruntland Report (1987) which defines ‘sustainable development’ as: ‘development which meets the needs of the present without compromising the ability of future generations to meet their own needs’. This principle has been translated in the Belgian law for protection of the marine environment (1999) as the principle of sustainable management of sea areas.

The Spatial Structure Plan Flanders (Ministry of the Flemish Community 1997) provides for sustainability as the guiding principle for land management. Analysis of the existing spatial structure of the North Sea revealed that uses on the BPNS are highly connected with the contiguous land parts. This means that sustainability must be implemented in the North Sea in the same way that it is implemented on land, so that the adverse effects of land use are not simply transferred to the sea. Stated more strongly, activities that are no longer welcome on land cannot simply be relocated to the sea.

The principle of ‘security’ can be interpreted as meaning such things as: the protection of land against floods and the power of the sea; the protection of nature values against pollution, disruptions and destruction; the protection of shipping against disaster and collision and the protection of the territory against invaders (e.g. military, coast guard, etc.).

4.2.2 Step 2: Development of scenarios for the BPNS

In this chapter six scenarios are developed for the future of the BPNS (Figures III.1.4.2b-c). These scenarios are based on the core values specified in the chapter above.

Three of the scenarios strongly focus on one of the core values. The other three scenarios are based on crossovers between two of the core values. Schematically, the six scenarios are respectively presented on the six angles of a hexagon. Each scenario has been elaborated to produce relatively extreme and conflicting results. These extreme scenarios provide an opportunity to consider a larger and less obvious picture. They reveal new possibilities and are designed to encourage the development of a policy that not only reflects present trends, but also anticipates future movements within the North Sea environment. It is not the intention of this project to provide the ultimate spatial structure plan for the BPNS (step 3). A spatial structure plan for the BPNS should rather try to balance the core values, and would therefore be situated at the centre of the hexagon.
Each ‘use’ of the North Sea (nature, cables and pipelines, coastal defense, wind energy, aquaculture, fishery, shipping, military, tourism and recreation, sand and gravel extraction, dredging and dumping) is considered under each of these six scenarios in terms of its development potential. These are presented in an array of 11 maps for each scenario. These maps represent zones of varying suitability towards a certain use for a specific scenario.

4.2.2.1 General ‘decision rules’ for the scenarios

There are a few ‘fixed principles’, which are applicable for each scenario. These are shortly explained below (Map III.1.4.2a).

- Shipping
  Shipping is regulated by international agreements and therefore in terms of planning is regarded as inflexible. Other uses that potentially conflict with shipping need to take shipping as a dominant use into account. This is mainly for safety reasons. Therefore, in the case of conflict, other uses are secondary. Shipping routes not regulated by international agreements (< 80 meters of length) have more potential to be fine-tuned with respect to other uses.

- Dredging and dumping
  Shipping routes and port channels require dredging. Dumping of dredged material has to take place as close as possible to the dredging zones (economic considerations). The main flow of the BPNS has a south-western/north-eastern direction. Accordingly, the dumping sites have to be located eastwards of the dredging zones.

- Sand and gravel extraction
  In principle, sand and gravel extraction are allowed and permitted anywhere within the BPNS with the exception of the main shipping routes. Additional factors in the allocation of sites for extraction of sand and gravel are the quality of the sediment (grain size: the sand must not be too fine, which excludes sand in the coastal zone) and the distance to the coast (economic considerations).

- Fisheries
  In principle, fisheries are allowed anywhere in the BPNS, although a 3 miles zone is reserved for fishing vessels with a gross tonnage of less than 70 GT. Determining factors in fisheries are the cost-effective distance between the fishing ground and the ports of call (related to the specific fleet segments) and its relationship with shipping (fisheries are of secondary importance to shipping, as is the case for other uses).

- Nature conservation
  It is preferable that the most valuable zones are protected. This study departs from the hypothesis, for which the basis is outlined in the analytical section, that the shallow coastal waters have the largest natural value or potential.

- Cables and pipelines
  In general, new cables and pipelines tend to be bundled with existing ones if possible. The most suitable bundles are those that leave Zeebrugge and Ostend. Several cables and pipelines already have connecting points in coastal towns and the terrestrial infrastructure is well developed in these areas. The bundle that leaves the western part of the coast is less suitable because the cables are more spread out (some of them are not even used) and the terrestrial infrastructure is less developed. The most suitable approach for new cables and pipelines that cross the BPNS parallel to the coastline is to bundle them with existing infrastructure on the level of the Bergues Bank in the direction of the Bligh Bank – Thornton Bank. Bundling with existing solitary cables is also possible but is less advisable. Priority is given to the existing large bundles.
Wind turbine parks
Wind turbines are in principle allowed anywhere on the BPNS, with the exception of internationally recognized shipping lanes and the war ammunition dumping site called the ‘Paardemarkt’. Their location is very much dictated by economic considerations (such as proximity to the coastline) and issues in terms of profit (as many turbines as possible on sites with optimal wind speeds: considering the present technology, this will be between 5 and 35 kms from the coastline).

Aquaculture
Aquaculture can in principle be located in any marine space, except in internationally recognized shipping lanes. Economic considerations play a role with issues such as distance from the coastline influencing location. Aquaculture requires areas that have few disturbances and should avoid highly dynamic zones. It is possible to allocate aquaculture and wind turbine parks to the same area. This approach is followed in most of the scenarios.

Military use
This use is not frequently carried out and has a low impact. So in principle, this use will be allowed to take place anywhere in the BPNS. Moreover, it is a flexible use that can interact with many other uses within the BPNS. Again, however, its use should be in accordance with major shipping activities.

Tourism and recreation
Tourism and recreation are (depending on the kind of recreation) rather neutral in terms of their interaction with other uses or activities. Therefore they can be located on any site within the BPNS.

Coastal defense
Coastal defense can in principle be located anywhere within the BPNS. There are types of defense that can be located in deeper parts of the sea. New coastal defense structures should be in accordance with other uses, in particular with tourism or recreation. They should also ideally act as an extension of existing soft and hard coastal defense structures.

The description of the following scenarios provides a rough sketch of some (rather extreme) future possibilities for the BPNS. These scenarios are intended to be specific aids to assist and inspire thought about the preparation and implementation of a spatial structure plan for the BPNS. The ideas go further than ‘the obvious’ in order to challenge future planning decisions. Nevertheless, the methodology that was used in this research can also be used to assist decision makers to make spatial planning decisions.

4.2.2.2 Scenario 1: The Relaxed Sea (Figure III.1.4.2d; Maps III.1.4.2b-e)

Theme
In this scenario, attention is mainly given to the issue of consumer ‘welfare’ in the North Sea. The welfare of the consumers, being the tourist, the recreationist, and also the consumer of fish and shellfish, pharmaceutical and beauty products... etc, is central in this scenario. The Relaxed Sea, therefore, is mainly experienced from a landward point of view. The North Sea exists of two parts: the coastal zone and the deeper sea. The Relaxed Sea overlaps the coastal zone and can therefore be reduced to a narrow strip of about 70 kms along the coastline in which the consumers can meet their various demands.

The Belgian coast is one of the most densely developed coastlines of the world. All major activities are situated within a narrow strip of about 5 kms wide that covers both the concrete strip as well as the shallow coastal waters.

In this scenario, the North Sea stands for sunbathing and sports on the beach, strolling along dykes, swimming, sailing and surfing, enjoying the scenery with an icecream or delicious seafood. In short, it aims at refilling the welfare battery. The structure and the use of the BPNS in this scenario therefore are meant to maintain, protect and further develop this narrow space for recreation and consumption.
pursues. The infrastructure of the hinterland is arranged entirely to assist access to the coastal strip, whereas mainly hard coastal defense structures are used to keep the sea under control, either on land or in sea. Each area within the coastal zone develops into a sub-zone with its own profile. The area deeper at sea and therefore further away from the coast seems to be of less importance here. In fact, it does not form part of the Relaxed Sea whatsoever. This space, being an area that is seen as separate from coast and land, is mainly used for activities that are not suitable on land, on the condition that they do not disturb the relaxing activities as discussed above.

Spatial concepts

Concentration and intensification of activities in the coastal strip

Since the coastal strip is most important in this scenario, several activities are concentrated within the coastal strip. Both the terrestrial and marine side are of significance.

Coastal strip as network of complementary activities

Tourism and recreation are not the only ‘welfare’ related activities that take place within the coastal strip. Other suitable ‘welfare’ related activities include such things as marine development that can be undertaken on land, for instance certain types of aquaculture. These new types of activities that are related to the sea will in turn contribute towards enhancing the identity of the coastal area. This in turn should lead to a coastal network of complementary ‘nodes’.

Activities that hinder tourism and recreation deeper at sea

Activities that might hinder the welfare of the ‘consumer of the coastal strip’ are avoided as much as possible in this scenario. The degree of impact on the consumer (both tourist as well as inhabitant) will largely depend on the distance of an activity from the coast.

The potential for marine development on land within the Relaxed Sea scenario

An extended and long term view of this scenario could eventually give way to the cultivation of marine organisms in closed production systems (fish, shellfish, salty vegetables, algae, sponges or corals) on land. This could possibly lead to a new development of the coastal area in the future. Though the development of aquaculture on land might seem far off, Luiten (2004) defends its future potential by stating several advantages.

4.2.2.3 Scenario 2: The Playful Sea (Figure III.1.4.2e; Maps III.1.4.2f-i)

Theme

The North Sea provides many opportunities for different kinds of tourism and recreational activities. The Playful Sea places emphasis on exploring and exploiting the opportunities that are available to ‘experience’ the sea. Current recreational development is mainly linked with the beach, as is discussed in the scenario for the Relaxed Sea. This scenario, however, goes beyond the beach and attempts to zone the entire sea for recreational purposes. The BPNS turns into a space entirely devoted to recreational activities where recreationists can take advantage of a range of environments including the dynamic dune environment with sea inlets (known in Dutch as ‘slufters’) and marshes; coastal islands with opportunities for sport in the tidal zone and for wind recreation; valuable wrecks as nature hotspots for divers and historians; cruises and excursions at sea ... etc. Spatially the term ‘seascaping’ is central in this scenario: the sea therefore is seen as one big attractive landscape that can give shape or that is given shape. Thus, diversity of the marine landscape as well as the recreational response to that landscape is
intensified. Increasing the significance of the North Sea as a tourist attraction will of course lead to high levels of development along the coastal strip. This will need to be managed within the framework of landscape values.

**Spatial concepts**

**The entire North Sea as a space for recreational experience**

The recreational potential of the sea is no longer restricted to the coastal strip alone. An extension of the recreational possibilities will see recreation activities spread and evolve into the deeper waters of the North Sea.

**Visualise the landscape of the sea**

The sea is a dynamic environment. Its landscape diversity is much more varied than that of the fixed coastline and the open horizon. The development of new structures at sea may have the effect of revealing the hidden patterns of the underlying topography. For example, the construction of wind turbines may serve to denote the existence of sand banks.

**The potential for coastal islands within the Playful Sea scenario**

Coastal islands render a particular coastal profile. Extending the fixed coastline with a range of coastal islands (comparable with the Dutch Waddenzee islands) would add to the tourism potential of the coastal strip. Different sub-areas of the coast could be given a renewed identity by constructing a variety of different islands ranging from shallow sand banks to surfing reefs and holiday islands. The islands could also have a function in coastal defense.

4.2.2.4 Scenario 3: The Natural Sea (Figure III.1.4.2f; Maps III.1.4.2j-m)

**Theme**

This scenario envisages maintaining the North Sea as a natural reserve. The sea is a much more wild and rough environment than the natural environment on land. It is one of the only remaining natural landscapes that are intact in Western Europe today. Clear-cut differences can be observed between the natural environment on land and the natural environment at sea. These differences can be broadly defined under the following headings: the sea’s dynamics, the open landscape and the coast. These three categories are crucial in the Natural Sea scenario.

Preservation of the sea’s natural dynamics could lead to the delimitation of large parts of the BPNS, where every form of use and consumption is banned or restricted and where natural values in their broadest sense are given priority. These become places of absolute wilderness.

The vast open landscape and clear horizon are images that typify the natural landscape of the North Sea. Here restrictions are imposed by leaving the horizon vacant.

On the border of land and sea lies the coast. Here, the sea meets the land and vice versa. At present this transitional environment is rigidly controlled to ensure that the land is protected from the dynamics and wilderness of the sea. Under this scenario, natural solutions would need to be devised to defend the land against the sea, in order to leave the sea as free as possible to follow its natural processes.
Spatial concepts

Protection of the natural wealth

In this scenario attention is focused on safeguarding and strengthening the natural resources of the North Sea. Protection of the most valuable areas is also essential. Limitations would be imposed in 'marine protected areas', on different types of uses. Some activities would be prohibited in the MPAs. It is generally accepted that the shallow coastal zone (western coastal banks and 'Vlakte van de Raan') would be suitable for such protection. The protected areas would be extended to land in order to protect beaches, dunes and coastal polders.

Moving activities to deeper sea areas

Protecting the shallow coastal zone implies that activities that were prohibited from taking place in these zones need to be relocated to other areas where they cause less nuisance to the ecosystem. This would lead to many activities being moved to deeper sea areas.

Reducing (the intensity of) activities that are harmful to nature — banning activities whose impact on nature is too large

In some cases, relocating activities will not be sufficient to protect the natural value of the North Sea. Some activities will have to be reduced or transformed (e.g. transformation of the trawling fishery into more ecologically sound alternatives), and other functions will have to be banned completely because their impact on the ecosystem in the BPNS is too large (e.g. wind turbine parks, as fixed installations that form an atypical rock-like habitat in the BPNS).

The potential for marine protected areas within the Natural Sea scenario

Attention in this scenario is focused on safeguarding and strengthening the natural resources of the North Sea. Protection of the most valuable areas is also essential to ensure that natural resources are safeguarded and strengthened for future generations. 'Marine protected areas', would impose limitations on some types of uses while other activities would be prohibited altogether within the MPAs.

4.2.2.5 Scenario 4: The Mobile Sea (Figure III.1.4.2g; Maps III.1.4.2n-q)

Theme

In this scenario the use of the BPNS starts from the combined action of economic and ecological processes and the connected dynamics of the North Sea. 'Dynamics' means the constantly changing intensity, quantity and movement of natural elements including (amongst other things): the movement of sand and sediments, the transition between fresh and saltwater, water currents, wind directions, the spread of nutrients and biodiversity of the North Sea. Dynamics also refers to temporal factors including: the periodicity of low and high tide, changes from day to night and the passage of the seasons.

Contrary to the Natural Sea scenario, the use and consumption of natural resources is possible under this scenario, provided that such use and consumption is controlled. In this manner the North Sea is treated as a storage room of resources where economy and ecology go hand in hand. Every use and exploitation is flexible or mobile, based on the natural dynamics of the sea. The emphasis in this scenario is on mobile structures that can follow the sea's dynamics. Immobile structures are therefore limited and in some cases even prohibited.
Spatial concepts

Concentrate alternating activities on sandbanks

In this scenario, activities are preferably located on sandbanks. This is because sandbanks provide a highly dynamic system that is capable of quickly regenerating following intervention. As many suitable sandbanks need to be found as possible to ensure a sustainable rotation system. Working with rotation systems prevents one specific location from becoming exhausted (which was the case with sand and gravel extraction at the ‘Kwinte Bank’) and causing long-term adverse effects on the ecosystem. Furthermore, using rotation systems protects the environment during vulnerable periods.

Mobile energy platforms

The emphasis in this scenario is put (as much as possible) on mobile activities that can follow the sea’s dynamics. For immobile structures, such as wind turbine parks, mobile alternatives will need to be sought.

Coastal currents can provide natural dredging of harbours and shipping lanes

It is necessary that as many natural alternatives as possible are sought to present activities. For instance, the force of the sea could be used and controlled to undertake natural dredging in some locations. Lessons can be learned from port construction. In Ostend the ‘Spuikom’ was built to enable natural dredging of the port. However, this never succeeded because the ‘curve current’ of the Spuikom was constructed using incorrect dimensions. In addition judicious breaks in the groynes of the port of Zeebrugge would contribute to a natural dredging of the port channel.

The potential for rotation systems for sustainable management of the natural resources of the sea within the scenario of the Mobile Sea

In this scenario, one needs to look for as many rotation systems as possible. Rotation systems are already being used in the BPNS for sand and gravel extraction, but this could be expanded to other activities in the North Sea, like fishery, military use, tourism and recreation.

4.2.2.6 Scenario 5: the Rich Sea (Figure III.1.4.2h; Maps III.1.4.2r-u)

Theme

The North Sea is rich in natural resources, living and non-living. In this scenario economic development is the most important objective, and the sea is considered as a production space where many more resources can be exploited than at present. Accordingly, the maximisation of exploitation is the priority in this scenario. The different uses of the sea’s wealth should be geared to complement one another in order to maximise the return on exploitation. If necessary, conflicting uses that do not contribute to the economic exploitation of the BPNS must yield in favour of exploitation, or even disappear. In the Rich Sea scenario, many criteria must be considered in order to spatially plan for different activities. Firstly, the suitability of the local marine environment needs to be considered. Secondly, new methods and structures must be applied to optimise exploitation. Economic criteria are decisive, and include such things as the distance to the ports, the exploitation techniques and the intensity of the exploitation.

Spatial concepts

Concentration of economic activities in a core zone

In this scenario it is very important to use the economic potential of the North Sea as efficiently as possible. Each different economic activity must take place in the best location, considering the distance to
the ports and the physical qualities of the location. Since we can assume that the range of exploitation activities will increase, a rather large area is reserved for these economic activities. Economic criteria (distance to the coast, substrate, intensity of activities) favour locations in the southern and central parts of the BPNS.

**Concessions in the economically most suitable locations**

The most important economic activities in this scenario (fishing, sand and gravel extraction and wind turbine parks) are geared to one another as closely as possible. The aim is that they will be allocated to a specific location in which the physical conditions, combined with the distance to the coast, are optimal. To avoid mutual conflicts, a system of (temporal and spatial) concessions will be used. An additional advantage of the concession system is that each user has responsibility for the location of his activity. Users effectively become the 'managers' or 'wardens' of their concession zone and must take care of that zone in order not to overexploit the available wealth.

**Natural and ‘sheltered’ zones act as storage rooms**

‘Natural’ zones (zones with few or no activities) and wind turbine parks have additional uses as storage rooms for fishing and aquaculture. Aquaculture can easily be combined with wind turbine parks, and wind turbine parks and natural areas can serve as shelter for fish (fishing and other ‘interfering’ activities are not possible in and around nature zones and wind turbine parks). In this way the use of these areas is maximised by rendering extra advantages to fisheries.

**The potential for concession zones for fishing within the Rich Sea scenario**

An extended and long term view of this scenario could eventually give way to the idea of concession zones for beam trawler fisheries (Luiten 2004). These ‘fishing fields’ are believed to provide self-organising ecosystems in which an optimal turnover would lead to a maximum harvest. This confirms nothing more than an ongoing pattern in the current fisheries. Surveys indicate that fishermen tend to return to the same favourite fishing spots instead of using the entire sea.

Eventually these fields could be managed by the concession holders without having to deal with strict European rules and quota. It would be up to them to decide what fishing intensity would be most sustainable for the catch in that area in the long run.

The banning of fishing for other areas would eventually lead to other economic uses taking over and therefore stimulating the economic turnover of the Belgian part of the North Sea.

**4.2.2.7 Scenario 6: the Sailing Sea (Figure III.1.4.2i; Maps III.1.4.2v-y)**

**Theme**

In the Sailing Sea scenario the North Sea becomes a place of both social and economic importance. The BPNS is seen as more than just an area for exploitation, from which as many resources as possible should be extracted. It is also a place where social needs should be addressed. In this scenario a lot of attention is given to immobile structures that have a social value, such as communication infrastructure, hard coastal defense, wind turbine parks that deliver sustainable energy and even (in the long run) the development of port activities at sea. A project such as the airport island near the Dutch coast is a good example. Unlike the Relaxed Sea scenario the focus in this scenario lies on the deeper sea, as opposed to the coastal area.

The BPNS is a place of transit in this scenario. Attention is given to new means of transport. On the one hand, this means larger ships on the international shipping lanes, maybe in combination with port
activities at sea. On the other hand, more flexible and small-scale coastal navigation between the different coastal ports (short sea shipping in a hub system) could be developed.

**Spatial concepts**

**Development of a differentiated transport network**

Mobility issues are very important in an area that belongs to one of the busiest sea-routes of the world. To increase the efficiency a strongly differentiated transport network should be developed. This network will consist of mobility nodes and transfer points, short sea shipping, tourist routes, economic routes, etc.

**Concentration of other economic activities**

Other economic activities would be located where they cause minimal disturbance to fast transport to other ports. The area in the central and eastern part of the BPNS currently has minimal transport movements and is therefore most suitable for the concentration of other activities.

**The potential of the development of an (air)port island within the Sailing Sea scenario**

It is possible to develop a combined airport and port island at the ‘exit’ of the international shipping lane to the ports of Zeebrugge, Gent and Antwerp. This island could provide relief to the current ports on land and for people that live near cargo airports (Ostend, Zaventem). The development of such an island would save a lot of time for large cargo vessels. The cargo could be transported from the island to the surrounding ports by short sea shipping. In extension the island could also serve other ports in the whole southern part of the North Sea (including the port of London, Rotterdam ... etc).

This system would enable Belgium to be further developed as a logistic centre. In this respect the (air)port would be an example of the spatial ‘hub-and-spoke’-principle as applied at sea.

**4.2.3 Step 3 and 4: the making of the spatial structure plan and trans-national issues**

It is clear that marine spatial planning must include an integrated vision of all the uses within the North Sea. It is not possible to plan with just one user in mind. The combined actions of uses as they relate to other uses, and as they relate to the environment, should also be taken into account. A sectoral approach or strict zoning is not suitable for managing the sea’s dynamic system. To have a sustainable North Sea, we need the integration and participation of many different parties in the policy making process. The sea cannot be seen as separate from the coastal area (on land). As discussed above, this approach would place a structural plan for the North Sea somewhere in the middle of the hexagon representing the above scenarios. In other words, there should be a consideration and weighing of the different values of well-being, ecology and landscape, and economy.

The aim of a vision should be to provide a sufficiently flexible framework for the further sustainable development of the Belgian part of the North Sea. Eventually, the resulting ‘structure plan’ should be translated into international policy (step 4). The North Sea is a very dynamic system that cannot be delineated by the territorial borders of the BPNS. The sea and sea organisms do not care about territorial boundaries, neither does pollution or waste. Accordingly, a good policy should take an international approach in which the specific issues of the BPNS are considered in the context of the whole North Sea, and perhaps even beyond. Finally, activities should be geared to complement one another on an international scale and international agreements should be established to ensure that this occurs.
5 REFERENCES


