

Windows in the dunes – the creation of sea inlets in the nature reserve de Westhoek in De Panne

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Abstract

The Flemish Nature Reserve 'De Westhoek' constitutes together with the French public domain 'La Dune du Perroquet' a transborder coastal dune area of 700ha, situated between De Panne (Belgium) and Bray-Dunes (France). From high-tide mark to polders, the range of dunes has a width of nearly 2km. In the 1950s heavy storms beat a breach through the foredunes of 'La Dune du Perroquet'. Consequently, the seawater could penetrate through the breach into a dune slack during high high tides. This phenomenon is called a 'sea inlet', or a 'slufter'. The seawater could also top over the foredunes of the Belgian 'Westhoek' in those days (during storm tides), but at the end of the 1970s a concrete dunefoot revetment was built in front of the foredunes to prevent further coastal erosion. Sea inlets in the dunes are a rare phenomenon along the sandy coasts of the southern North Sea. They usually harbour a highly specialised bird life and salt-tolerant flora. The management plan for the Nature Reserve 'De Westhoek' that was approved in 1996, includes the creation of sea inlets by locally removing the concrete dunefoot revetment. As the coastal protection policy of the Flemish Regional Authority has evolved to a more dynamic and risk-based approach, the Coastal Division decided to create two sea inlets. Projects that have an influence on the hydrological system of natural areas are however subject to an Environmental Impact Assessment, so that an EIA had to be drawn up for the creation of two sea inlets. After the approval of the EIA by the competent authority and the delivery of a building permit, the works were carried out between January 2004 and June 2004. The two new sea inlets' surface totals approximately 1ha. The deflation zones where the sea inlets were created consisted originally of sandy plains that were thickly strewn with debris from demolished blockhouses and had a scarce Marram-grass (*Ammophila arenaria*) vegetation. The creation of sea inlets should allow the development of the natural habitats of the annex I of the European Habitat-directive '1310 (15.11) Salicornia and other annuals colonising mud and sand' and '2110 (16.211) Embryonic shifting dunes', and also offer breeding opportunity to at least Kentish Plover (*Charadrius alexandrinus*) and Great Ringed Plover (*Charadrius hiaticula*). The results and effects of the sea inlets on the salinity of the groundwater is being meticulously monitored.

Keywords: Sea inlet; Slufter; Dynamic coastline; Risk-based coastal safety.

Introduction

The Flemish Nature Reserve 'De Westhoek' is the largest area of natural coastal dunes area along the Flemish coast. It is situated near the border with France. Together with the French public domain 'La Dune du Perroquet' it forms a transborder coastal dune reserve of 700ha. From high tide mark to polders, the range of dunes has a width of approximately 2km (*cf.* Fig. 1).

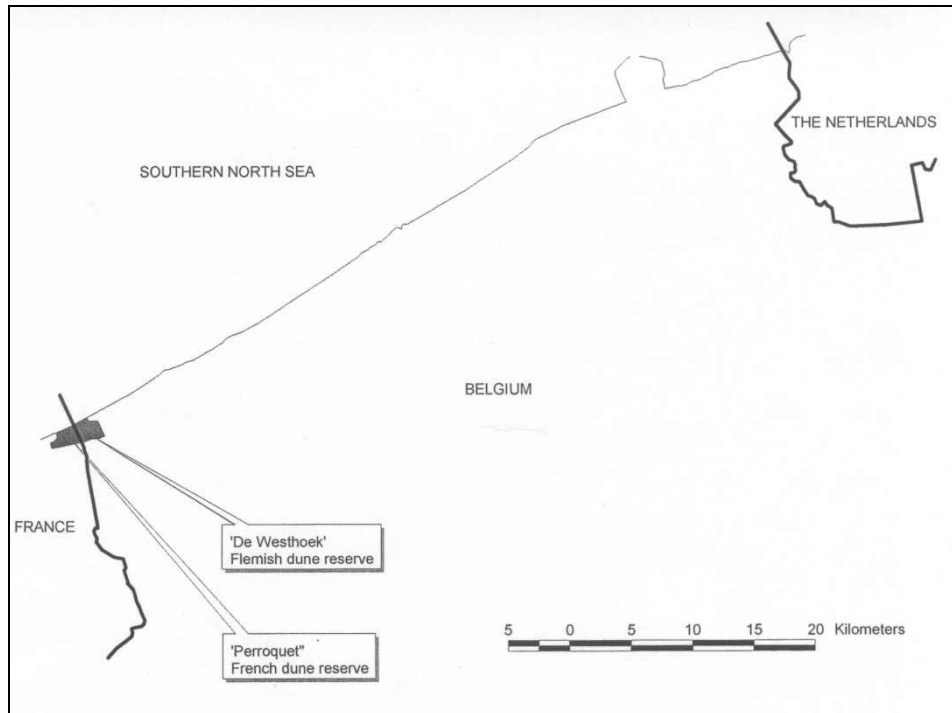


Fig. 1. Location.

In the 1950s heavy storms beat a breach through the foredunes of 'La Dune du Perroquet'. Consequently, during high high tides the seawater could penetrate through the breach into the lowlying areas behind the foredunes. This phenomenon is called a 'sea inlet', or a 'slufter'. A sea inlet has a limited lifespan. Eventually a sea inlet will close when natural accretion by sand that is transported from its surroundings by wind and water blocks its mouth. A closed sea inlet can reopen again by erosion during stormy weather. A sea inlet is a feature of a dynamic sandy coastline. Sea inlets in the dunes are a rare phenomenon along the sandy coasts of the southern North Sea. They usually harbour a highly specialised bird life and salt tolerant flora.

At the end of the 1970s a concrete dunefoot revetment was built in front of 'De Westhoek' dunes in order to prevent further coastal erosion of these dunes. Back then the

shoreline management in Belgium consisted very much of fixing the coastline wherever erosion was taking place. Meanwhile the coastal resort of De Panne was expanding. Dune areas were built up with apartment blocks and villas. These buildings further necessitated the protection against erosion of the dunes.

Development of the project

Nowadays, a quarter of a century later, the shoreline management of the Flemish Regional Authority has changed and it is now forbidden by law to build inside the dunes. The concept of fixing the coastline has been replaced by the concept of a dynamic coastline, meaning that the natural processes of sand transport along the coastline are being re-established wherever possible. According to these new shoreline management principles a project has been developed for the artificial creation of sea inlets in the dunes of the 'Westhoek'.

The project idea is presented by Figs. 2 and 3. Essentially the idea was to remove the first line of dunes and the dunefoot revetment at two locations, to build two bridges at those locations, and to remove sand from the sluffer areas and transport it to the second line of dunes.

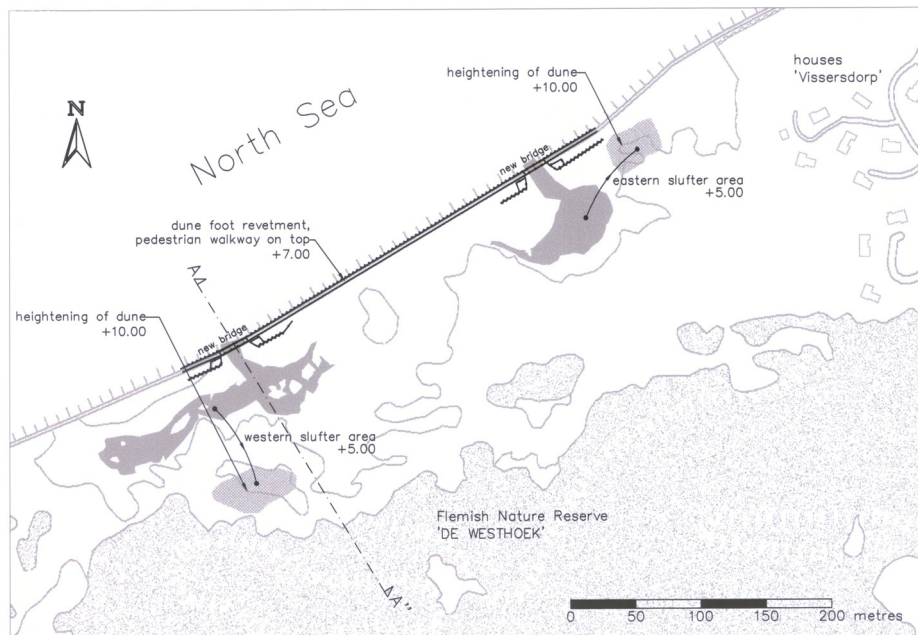


Fig. 2. Project idea - plan view.

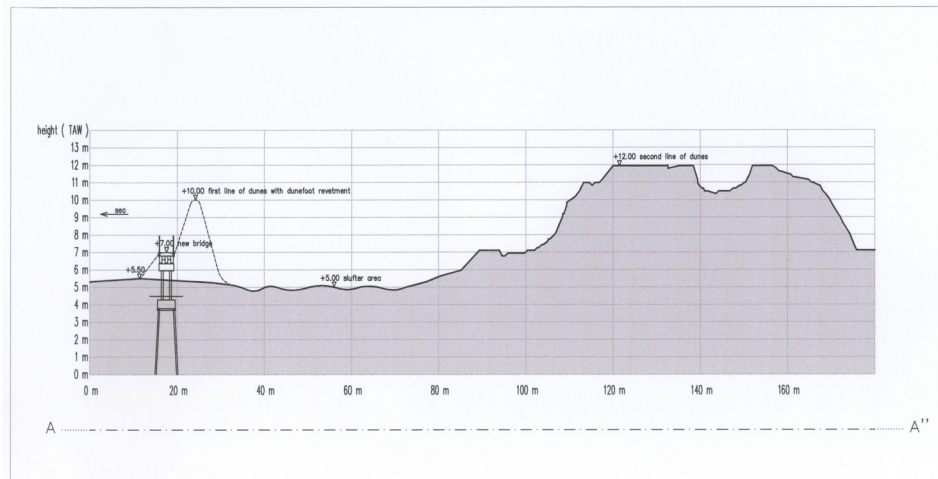


Fig. 3. Project idea – cross section.

Finding common goals

It has been very difficult to agree on common goals during the development of the project. Different stakeholders emphasised different view points. Many aspects had to be taken into consideration. The most important aspects were nature development, coastal safety, recreation, landscape conservation and protection of the fresh groundwater.

During the elaboration of the management plan for the Nature Reserve 'De Westhoek' between 1994-1996, the possibility of developing one or more sea inlets behind the frontdunes came into view. The feasibility of such a measure from the point of view of coastal protection was then thoroughly examined by a contracted coastal engineering consultant.

The management plan for the Nature Reserve 'De Westhoek', that was approved in 1996, suggested to create sea inlets by locally removing the concrete dune foot revetment. The creation of sea inlets allows the development of the natural habitats of the annex I of the European Habitat-directive '1310 (15.11) *Salicornia* and other annuals colonising mud and sand' and '2110 (16.211) Embryonic shifting dunes', and also offer breeding opportunity to at least Kentish Plover (*Charadrius alexandrinus*) and Great Ringed Plover (*Charadrius hiaticula*).

The coastal protection policy aims at minimising the possible damage by the sea during storm periods. The creation of sea inlets in the foredunes had to be combined with strengthening the dunes behind the sea inlets. Thus, the risk of storm damage for the local residents as well as for the hinterland does not increase.

On top of the dune foot revetment is a very popular path for walkers. It is part of the signposted footpaths across the 'Westhoek' dune reserve. Breaching the foredunes and

the dunefoot revetment had to be combined with the building of bridges over the mouths of the sea inlets. In that way the continuity of the walkways is preserved.

In the first concept, wooden arch bridges were proposed, but this concept turned out to be conflicting with the landscape protection regulations. Therefore a new concept of the bridges has been worked out in which the bridges have the least possible visual impact on the landscape.

A large layer of fresh groundwater exists underneath the 'Westhoek' dunes. Part of it is pumped up as drinking water. The creation of the sea inlets is not expected to cause major salinisation of this fresh water reserve.

Detailed design of the mouths of the sea inlets

The width and the height of the mouths of the sea inlets determine how much water can flow into the sea inlets. Larger mouths need more expensive bridges. Therefore the width of the mouths has been set at approximately 20m. To guarantee the stability of the bridges under stormy conditions erosion protection of the mouths was necessary. The top level of these stone revetments is situated at approximately the level of mean high water. On top of these stone revetments a layer of sand was placed with a thickness of ca. 1m, in order to establish sandy, dynamic mouths of the sea inlets. Because of the height of the mouths, well above mean high water level, flooding of the sea inlets can occur only occasionally, namely when water level setup caused by stormy weather is high enough (in combination with the amplitude of the astronomical tide).

Procedural issues

Projects that have an influence on the hydrological system of natural areas are subject to an Environmental Impact Assessment, so for the creation of two sea inlets an EIA had to be drawn up. After the approval of the EIA by the competent authority a procedure for getting a building permit had to be followed, which includes a public enquiry on the project.

Although these procedures are time-consuming they generated broad discussions about all aspects of the project. Finally this resulted in a public acceptance of the project.

Description of the works

The works were executed in the spring of 2004.

The works consisted of:

- lowering the bottom of two deflation zones behind the foredunes and partly the foredunes themselves to a level that is lower than the high tide level;
- strengthening the dunes that surround those lowered deflation zones to prevent the seawater from penetrating the dune area further than is considered desirable; this

reinforcement was carried out with the sand that was excavated from the deflation zones and the foredunes;

- removing the concrete dunefoot revetment at two locations over a distance of 20m and 15m respectively to allow the seawater to penetrate the deflation zones;
- building two bridges over the breaches in the dunefoot revetment to allow pedestrians to continue their walk uninterrupted.

The result is shown on Fig. 4 based on a photograph taken during a flooding of the western sluffer area from on top of the second line of dunes.



Fig. 4. View on the western sluffer area during flooding on 13 November 2004 (photograph by Thierry Delrue from De Haan).

Monitoring

Measurements of the morphological changes during the first months after completion of the works reveal that especially the mouths of the sea inlets are very dynamic. Wind blown sand accumulates in the mouths but is eroded again by the sea when flooding occurs. Also a thin layer of silt and mud has already formed a deposit in the sluffer areas' gullies, together with the deposition of organic debris such as seaweed at the floodmark.

A large number of borings with open pipe piezometers have been installed to monitor the evolution of the groundwater salinity in the immediate surroundings of the sluffer areas and also at a larger distance from the sluffer areas in the direction of the drinking water wells. Conductivity measurements in the boreholes (EM 39 technique) show that on 13

January 2005 salt water has infiltrated underground not farther than ca. 10m from the sluffer areas, and not deeper than ca. 10m beneath ground level.

Monitoring of the different environmental and natural characteristics will be continued in the coming years.

Conclusions and recommendations

Shoreline management projects must be executed according to the principles of Integrated Management of Coastal Areas. Multidisciplinary studies and consultation between the different competent administrations and other involved parties take a lot of time and effort, but they result in better projects.

The legally necessary procedures, such as EIAs and building permits, embed the broad social consultation on shoreline management projects. Nevertheless during the period before these procedures, when the project was still being outlined, ample consultation between the different competent administrations and other involved parties was also needed. With a view to prevent discussions from lasting endlessly, mediation by a neutral, authoritative coordinator is very useful.

Due to the complexity of shoreline management projects, there is an increasing need to pay extra attention to the project management. Many years pass between the preparation of the project and its realisation. Numerous organisations each give their input in the success of the project. A multidisciplinary team with representatives of all parties involved is needed to finally realise a successful project.

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