ZANDMOTOR MONITORING

Rijkswaterstaat
Ministry of Infrastructure and the Environment

EcoShape

provincie ZUID HOLLAND

Kansen voor West G4P4

Investing in your future
Project co-financed by the European Union
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More information:
www.rws.nl/zandmotor
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The Sand Motor

Pilot project for natural coastal protection

Building with Nature

A low-lying country like the Netherlands must defend itself against the water. With climate change causing sea levels to rise, this need is becoming increasingly urgent. The natural coastline of the Netherlands, which is made up of sand and dunes, is the country's first line of protection against flooding from the sea. Efficient coastal management is needed to keep this coastline stable and strong. One method used by Rijkswaterstaat (the executive branch of the Dutch Ministry of Infrastructure and the Environment) involves pumping sand onto the beaches. However, more sustainable strategies are needed. That is where the Sand Motor comes in. It is a pilot project run by Rijkswaterstaat, the provincial authority of South Holland, research institutes and the private sector. It provides natural coastal maintenance while at the same time creating space where recreation and nature can thrive. The pilot project will find out whether this sustainable approach to coastal maintenance actually works.

A dynamic addition to the Netherlands coastline

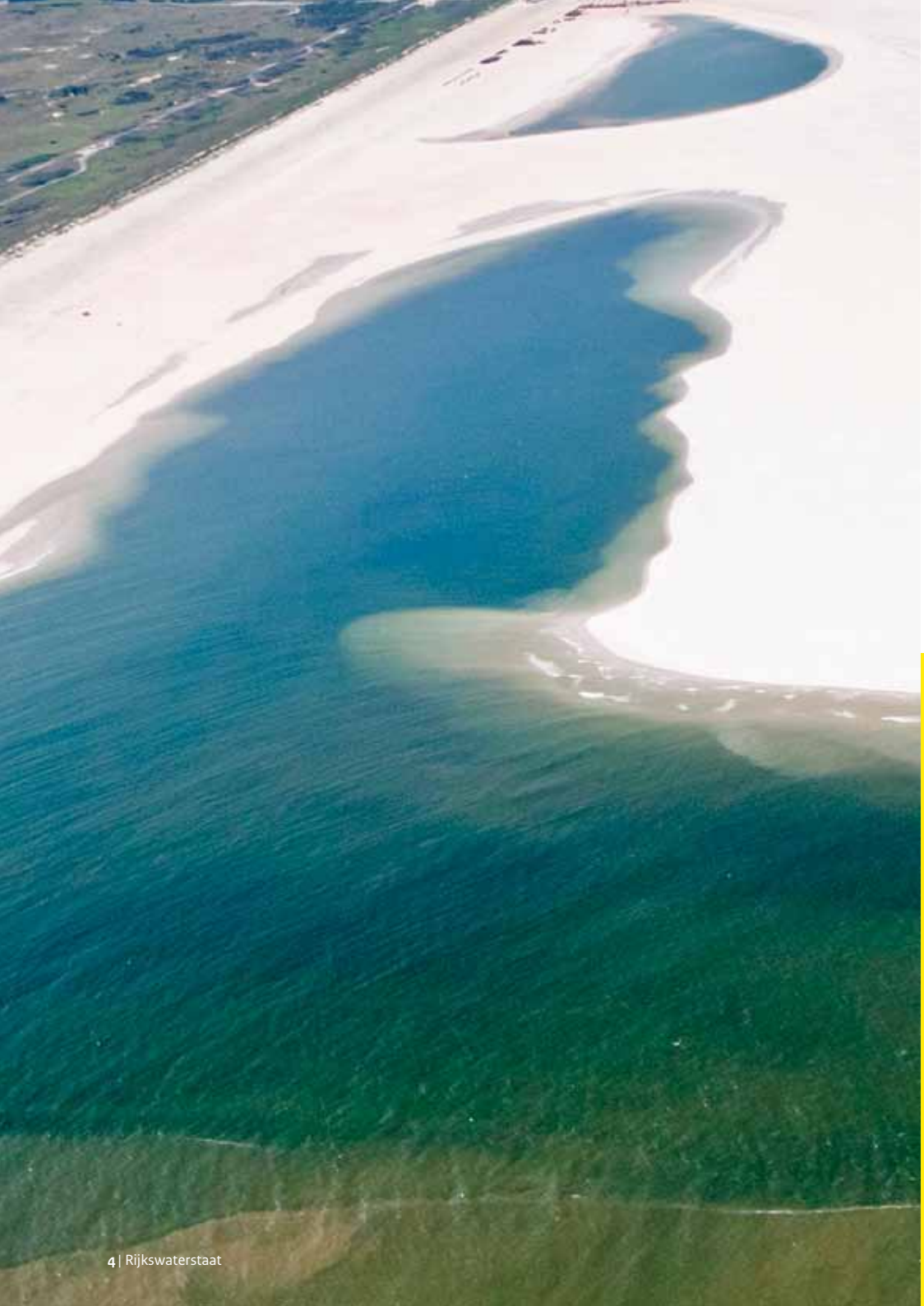
Since 2001, the Dutch coast to the south of The Hague has been the site of a huge deposit of 21.5 million cubic metres of sand. This is the Sand Motor. Natural elements such as wind, waves, tides and currents will be given free reign so that they spread the sand from this man-made peninsula along the South Holland coast, forming new beaches and dunes. Owing to the peninsula's hooked shape, the sand lies in the direction of the dominant current, giving the area a natural look comparable to an intertidal flat.
There is another benefit to depositing a large amount of sand in a single operation: the vulnerable seabed will not suffer repeated disruption because, if the Sand Motor works as expected, no further beach nourishment will be required on this stretch of coast for the next 20 years.

Sand Motor objectives

The Sand Motor serves a threefold purpose:

- the enhancement of coastal protection in the long term;
- natural and recreational development by widening beaches and dunes;
- knowledge development and innovation in the field of coastal management and reinforcement

From top to bottom: 5 July 2011, 13 October 2011, 30 March 2012 and 4 September 2012



Unique knowledge development project

The Sand Motor is a pilot project associated with a major, long-term knowledge development programme. Run by Rijkswaterstaat, this programme is an alliance with EcoShape, the provincial authority of South Holland, universities and research institutes.

Innovation in water management

If the Sand Motor fulfils expectations, the concept can be rolled out elsewhere in the Netherlands and the rest of the world. With the Sand Motor as its latest innovation, the Netherlands is once again setting the tone in water management.

Left: The Sand Motor on 11 July 2011

"Our country has a rich history when it comes to coastal management, and yet a pilot project the size of the Sand Motor is still truly unique. Particularly because it is so visible and tangible. I think the dynamics of it, for example, are a fantastic sight. Another thing that makes the Sand Motor so special is the range of interests involved: it will generate an enormous wave of knowledge and insights for science, and possibly a business case for the market, as well as a sustainable coastal management tool for the government. We are making that happen together."

Carola van Gelder, Rijkswaterstaat's monitoring and evaluation project manager

The eight cameras on the Argus Mast keep permanent track of how the Sand Motor is evolving

GPS Drifters are used to monitor the currents

"I never even dared to dream that the Sand Motor would be in place in such a short time – just under five years. How did we pull it off? All the parties saw benefits at their own levels that allowed them to move forward. And the Sand Motor combines engineering interventions in the coastal system that are all accepted by society. At Delft University of Technology, a team of masters and doctorate students will be observing the Sand Motor, with support from the Dutch government (the Topsector Water initiative) and the European Union, using state-of-the-art technology that was inconceivable only 20 years ago. A fantastic development."

Marcel Stive, Professor of Coastal Engineering at Delft University of Technology

Sand Motor Monitoring and Evaluation

Meteorology and hydrodynamics
- waves and currents
- wind and water level data
- bather safety
- bathing water quality

Groundwater
- groundwater development in Solleveld Natura 2000 area
- salt intrusion
- quality of bathing water in dune lake

Recreation
- survey of leisure experiences
- visitor counts

Nature/dunes
- sand dynamics of existing foredunes and inner dunes
- morphodynamics of dunes
- changes in dune height
- fine sand drift
- salt spray
- changes in the composition and structure of vegetation
- vegetation mapping in existing dunes
- dune ecology (taller plants, butterflies, sand lizard, breeding birds)

Beach and foreshore; morphology
- beach height
- seabed position in intertidal zone
- sediment composition
- short- & long-term morphological developments
- present coastline position
- morphological behaviour of shoals

Beach and foreshore; ecology
- benthos population on wet beach and in shallow coastal zone
- juvenile fish
- resting place for seals
- use of existing bird counts
- ecotope map

Research
Since 2011, the Dutch coast near The Hague has been the site of a huge deposit of 21.5 million cubic metres of sand: the Sand Motor. The Sand Motor is a pilot project for sustainable and natural coastal maintenance and also a space where nature and recreation can thrive. Wind, waves, tides and sea currents will gradually spread the sand from this man-made peninsula, predominantly northwards along the Delfland coast between Ter Heijde and Kijkduin. This is 'Building with Nature'. The Sand Motor project is accompanied by an extensive knowledge development programme. The first official results will be published in 2016.

Collaboration
Run by Rijkswaterstaat, this programme also is an alliance with of EcoShape, the provincial authority of South Holland, universities and research institutes.

Extensive monitoring

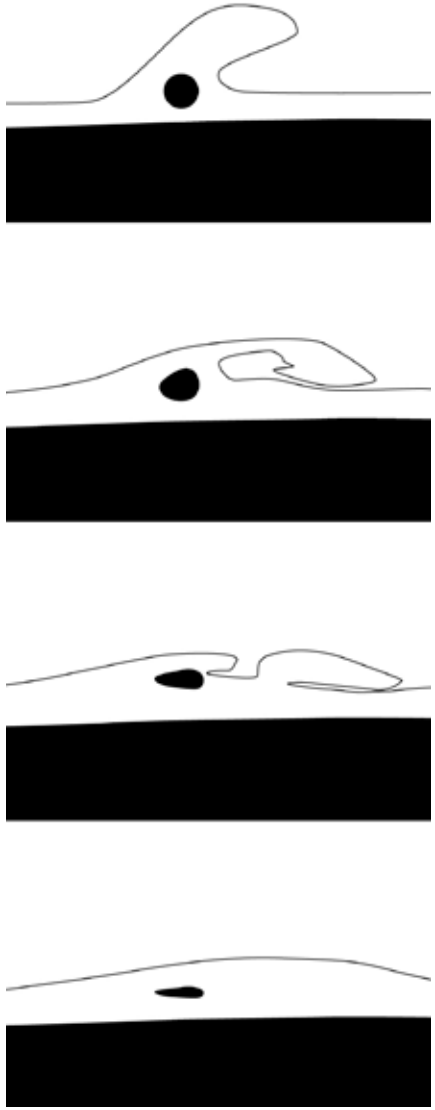
The actual creation of the Sand Motor was preceded by analyses of how it would develop in different respects. To monitor whether the Sand Motor is developing in accordance with these predictions, it is being monitored and mapped.

A range of research questions

A broad array of measurements and analyses are taking place for each research theme. For a complete overview of the Sand Motor Monitoring and Evaluation Plan, please visit www.rws.nl/zandmotor.

The research themes are:

- Hydrodynamics and morphology
- Foreshore and beach ecology
- Dune development
- Groundwater
- Recreational use
- Bather safety



The original forecast for the development of the Sand Motor

Young dunes

Building with Nature

"The Sand Motor is an enormous pioneering project that demonstrates that sustainable building with nature really is possible. It also shows that working together in the Golden Triangle of government, research institutes and the private sector does indeed represent added value and meet the challenging innovation targets set by the government in its efforts to foster innovation in top sectors. It's no longer just a good idea; it has been transformed now into a project with an ambitious focus. What is very important to us is that the new knowledge and experience will allow us to apply the Sand Motor concept in time in improved high-end solutions, both at home and abroad."

Stefan Aarninkhof, programme manager at EcoShape

Close collaboration

The Sand Motor is a major innovation project bringing together the government, research institutes and the private sector. They have joined forces to assess the feasibility of this new form of coastal maintenance based on building with nature.

This is a unique partnership. The parties are looking beyond their own backyards, taking each other's interests, and those of the end users, into account. A steering group made up of representatives from the universities involved, the provincial authority of South Holland, EcoShape and Rijkswaterstaat has been established to ensure the project runs smoothly.

Government authorities
The Ministry of Infrastructure and the Environment (working through Rijkswaterstaat) and the provincial authority of South Holland have jointly funded and executed the preparation and implementation of the project. The provincial authority is responsible for the day-to-day management of the Sand Motor, while Rijkswaterstaat will lead the monitoring and evaluation programme.

Universities and research institutes
New knowledge and insights will emerge from both fundamental and applied research. Researchers from Delft University of Technology, VU University Amsterdam, the University of Twente, Utrecht University, Wageningen University and the research institutes Deltares and Imares are all conducting research in their own fields.

Private sector
EcoShape is a consortium of private sector parties, government authorities, non-profit organisations and research institutes. The marine contractors Van Oord and Boskalis were behind the initiative for the consortium. They believe it is important for hydraulic engineering to become more sustainable where possible, and they are using the opportunity afforded by this project to expand their expertise in this field.

European Regional Development Fund
Knowledge development through the Sand Motor project is co-financed by the European Union's Regional Development Fund through the 'Kansen voor West programme' (a joint initiative for propelling the west of the Netherlands into the top five of Europe's metropolitan areas).

Seal and first vegetation

The Sand Motor is already a firm favourite with kitesurfers

Initial observations

Data are collected 24 hours a day, seven days a week. After just over a year, we now know that large amounts of sand are already on the move. Expectations are that most sand will be displaced in the early stages. There are also developments in other areas. The Sand Motor is well frequented by different bird species and seals, and the first plants are already growing. The Sand Motor is already a popular leisure destination: kitesurfing and walking are popular activities here. The first official monitoring results will become available in 2016, and the whole experiment will take approximately 20 years.

Development:

In 2012, 2 million cubic metres of sand started moving:

- 500,000 cubic metres spread along dunes and on the deep seabed (outside monitored area)
- 600,000 cubic metres on the Sand Motor itself
- 900,000 cubic metres spread in the monitored area

(data provided by Shore Monitoring and Deltares)

"The Sand Motor is a unique, innovative project. Building with Nature is still in its infancy and this pilot project will hopefully demonstrate that it works. Monitoring is key, for the province, its people and visitors. Information about how the Sand Motor is developing, and particularly about possible currents, is of course important for us as the province but also for people like lifesaving teams during the bathing season. I am extremely pleased that so many parties have embraced the Sand Motor that the scientific community is so hard at work, and that there is so much interest in the project."

Han Weber, member of the South Holland Provincial Executive