

CLIMATE RESPONSIVE RESEARCH BY DESIGN - THE OPPORTUNITIES OF THE 'VLAKTE VAN DE RAAN' WITHIN THE COASTAL AREA OF FLANDERS

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Raised interest for planning at sea

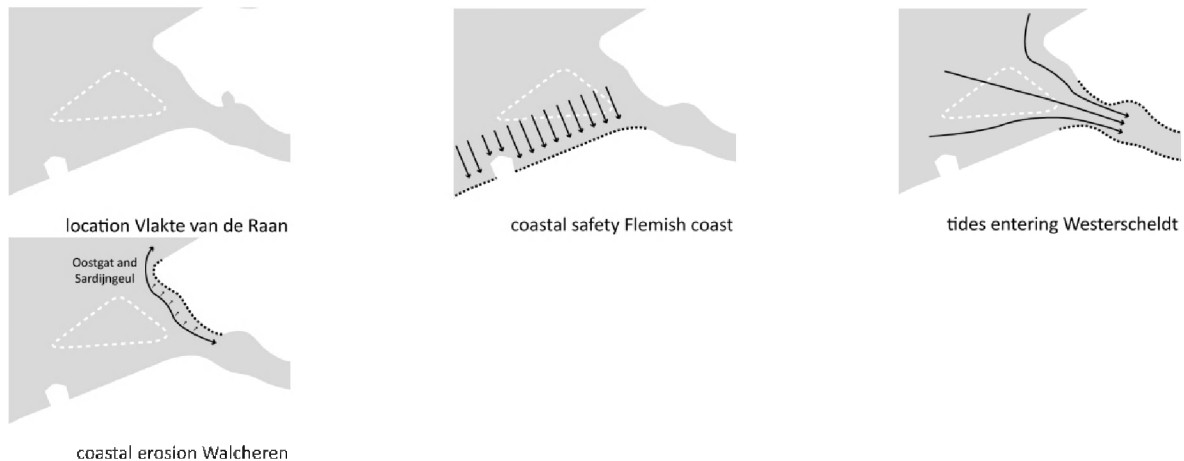
The sea recently attracts special attention in light of adaptation to global warming and socio-economic development. Among other problems, the climate change and the affiliated sea-level rise cause increased coastal erosion and larger extreme waves. As a result existing coastal defenses are getting outdated. The offshore *advance the line* strategy consists of measures to increase the robustness (IPCC CZMS, 1990; Klein and Tol, 1997). In Belgium this strategy has gotten picked up by private participants who developed the master plan Flemish Bays (THV Vlaamse Baaien, 2010). This master plan proposes to raise existing sandbanks and to construct islands in front of the current coastline.

In addition, the sea is claimed by different sectors, e.g. fishery, mining and shipping. The European Commission promotes a coordinated approach of these activities by means of marine spatial planning (European commission Maritime Affairs and Fisheries, 2011). In Belgium, this integrated approach has been explored in several projects; Gaufre and the future commons (Geldof et al., 2011; Maes, 2005).

Climate related challenges and socio-economic developments at sea do not only attract the attention of (spatial) planners. The *Flemish Bays* master plan opened up a broad debate on planning at sea. Whether or not the proposed islands are feasible and favorable calls for technical research and general discussion to grow common vision. This research explores the opportunities new islands can offer to enhance both climate adaptation and development at sea. By means of research by design on the Vlakte van de Raan (a shallow zone in the Westerscheldt estuary where various climate-related problems and socio-economic developments occur in a confined space) different projects are integrated into one coherent project.

Climate change related challenges and socio-economic developments at the Vlakte van de Raan

Near the Vlakte van de Raan different problems, related to climate change, take place. Morphological changes of the Vlakte van de Raan could resolve each of these problems. Firstly, to remediate coastal defense, which will be outdated now or in the future by raising sea-levels, the *advance the line* strategy can be applied. Transforming the Vlakte van de Raan into an island, an action that is not part of the master plan Flemish Bays, could help protect seaside resorts Heist, Duinbergen, Knokke and Cadzand. Whether such islands actually provide protection is debatable (Reyns et al., 2010), yet the idea will be examined within the master plan Flanders Coastal Safety (Afdeling Kust, 2011).



Secondly, the Westerscheldt estuary is vulnerable to climate change as it is exposed to potential storm surges. Historical land reclamation and dredging to maintain the accessibility of the port of Antwerp have resulted in a deep and narrow estuary. As a result the tide is pushed more and more upstream. In 1976, after a big flood, the Sigma-plan was developed to protect land and ecosystems from increasing tide. All actions in light of the Sigma-plan are concentrated inland, e.g. dyke reinforcement, creation of controlled reduced tide (CRT) and flood controlled areas (FCA). Besides these actions within the estuary, measurements could be taken to reduce the tide at the entree of the Westerscheldt estuary. Alternative strategies to lower the tidal inlet, e.g. linear transverse structures and artificial island, are being explored within the TIDE-project (www.tideelbe.de). Similar barriers for the Westerscheldt estuary could be situated near the Vlakte van de Raan.

Coastal erosion is intrinsic to coastal systems and responds to climate change in complex way. At Walcheren, near the Vlakte van de Raan, erosion occurs as a result of a shifting Oostgat gully. This gully, one of the two entries to the Westerscheldt harbors, is gradually shifting landward creating a very steep coast (Israel, 2001; Provincie Zeeland, 2006). Safety is now obtained by repeated beach and dune nourishments, but structural measures, e.g. the creation of a new gully, could guarantee the necessary protection for a long-term.

Besides climate-related problems, different socio-economic developments near the Vlakte van de Raan are currently being explored, planned or implemented. Large vessels can only access the port of Antwerp by fixed lanes where enough draught is guaranteed at high tide. The length of these lanes limits the period of entry. At present, most ships that call at Antwerp leave the international east-west traffic route near Westerhinder, navigate through the Belgian Part of the North Sea (BPNS) and use the Oostgat (1) and Wielingen (2) gully to enter the Westerscheldt estuary. However, within the Agency for Maritime and Coastal Services (AMCS) an alternative is being explored (interview Chantal Martens 2012, engineer within AMCS). Deepening the Geul van de Walvisstaart (3) creates a new and shorter sea lane. This reorganization of shipping in the Westerscheldt estuary would improve the accessibility of the port of Antwerp, the second largest harbor within Europe and renders both existing lanes unnecessary.

Inland navigation connects the various ports of the Westerscheldt estuary with an exception of the port of Zeebrugge. Because of wave conditions and currents near the Vlakte van de Raan only reinforced vessels with a raised bow may sail up the coast to Zeebrugge. This mode of transportation, called estuary shipping, now accounts for 4,5 percent of the further inland transport (Port Zeebrugge, 2011). An ambitious project near the Vlakte van de Raan could create favourable wave conditions and currents, which would make the route along the coastline to the port of Zeebrugge accessible for inland vessels. This would also be an alternative for current plans to widen the Schipdonk

channel, a proposal to open the port to inland navigation that bumps into a lot of local protest.



In addition, scenarios to improve the accessibility of the port of Zeebrugge are examined within the policy plan *Flanders in Action, Pact 2020* (Vlaamse Overheid, 2011). At the moment entering vessels are hampered by lateral currents. Most scenarios to improve the accessibility foresee the extension of the existing breakwaters. Such obstacles, however, interfere with the natural transport of sand along the coastline. In the past such extensions have caused sediment deposition at Zeebrugge and Heist (De Moor, 2006). Further sediment deposition could endanger tourism at the local seaside resorts.

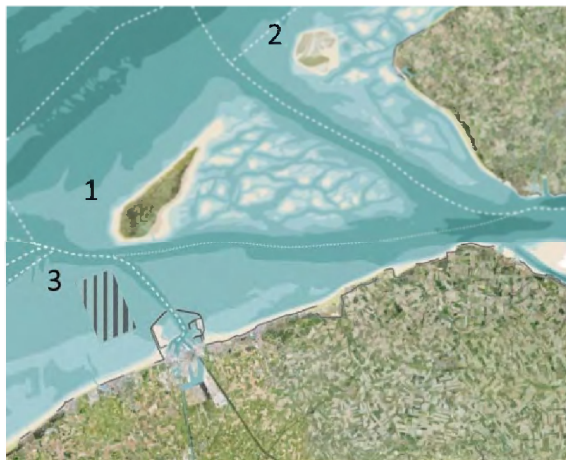
Besides these projects in favour of port and shipping activities near the Vlake van de Raan, a nature conservation zone is actually being planned at the highest area of the shoal. While the Belgian part is used as a dumping site for dredged material (S2, S3, R4), the Dutch part has been registered as Natura 2000 site (Bleker, 2010). Both policies seem to conflict but might actually be closely connected. Research points out that increased biodiversity near the Belgian-Dutch border could be due to increasing availability of fines due to disposal activities. However, further research is needed to confirm this hypothesis (Van Lancker et al., 2012).

Research by design as a tool for an integrated project at sea

The reorientation of shipping lanes is a base for the CcASPAR proposal. A new gully, a deepened Geul van de Walvisstaart, creates a shorter link between the international east-west traffic route and the ports within the Westerscheldt estuary. As a result, the gullies Oostgat and Sardijngeul are no longer needed and structural measures to remediate coastal erosion near Walcheren can be put through. An intervention at the Vlake van de Raan, reshaping the shoal and its surroundings, could create favorable conditions near the coastline which would render estuary shipping by reinforced inland vessels unnecessary. Such development would stimulate inland traffic via the Westerscheldt estuary and the project to enlarge the Schipdonk channel would no longer be needed.

At the moment, a natural deepening occurs at the gully Geul van de Walvisstaart (Peters, 2006). However, to create such a new gully some dredging will be unavoidable. In the CcASPAR proposal the dredging is organized as efficiently as possible. To avoid time-consuming (and therefore expensive) journeys to dumping sites, the dredged materials is disposed near the new sea lanes. As a big amount of sediment needs to be dredged, this intervention creates an opportunity to raise the shoal and to construct new islands. To maintain the gully continuous dredging is needed. This frequent dredging offers the necessary sediments to nourish the beaches and dunes of the new island(s).

This research by design proposes to construct three new islands, each one with its own typology and fulfilling different needs. Together they narrow down the Westerscheldt estuary, dissipate tidal energy and prevent storm surges upstream.



The biggest island (1) is situated near current dumping sites S2, S3 and R4. This island is permanent and can accommodate housing and tourism, as proposed in the master plan Flemish Bays. The island is situated way into the sea, so not to disturb the current open panorama at nearby seaside resorts. Furthermore, this island will be a barrier in the lateral transport of sediment along the coastline. Because there is a high rate of suspended matter at the Vlakte van de Raan (Van Lancker et al., 2012), one can expect that the rest of the Vlakte van de Raan will naturally silt up. Such deposition would create a composition

of gullies and ridges, an interesting environment for nature rehabilitation.

Overview of CcASPAR the proposal

A second island (2) is situated in the Dutch part of the Vlakte van de Raan, near Walcheren. In contrast to the previous one, this island is not suitable for permanent activities. It is rather an offshore Sand Motor, like the one recently constructed near Ter Heijde, that replaces current nourishment near Walcheren and the entire western coast of Zeeland.

Finally, this research rejects prolonging the breakwaters of the port of Zeebrugge and proposes to build a floating construction or one on pilotis (3). Such intervention should slow down the current along the coastline in order to improve navigation conditions at the port of Zeebrugge. It is important that the construction does, however, guarantee some longitudinal current, otherwise regional sedimentation is unavoidable.

Within the CcASPAR project design, was used as a tool to create a coherent scenario. The design is not really a definite proposal that should make or break but rather a tool to build towards a common project. As such, the proposal is a test case for research by design as new tool for planning at sea and reveals the potentials of an integrated approach.

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