

An overtopping dyke to combat sea level rise, Ellewoutsdijk - NL

1. Policy Objective & Theme

- ADAPTATION TO RISK: Preventing and managing natural hazards and technological (human-made) hazards
- SUSTAINABLE USE OF RESOURCES: Preserving coastal environment (its functioning and integrity) to share space

2. Key Approaches

- Participation
- Ecosystems based approach
- Technical

3. Experiences that can be exchanged

Allowing dyke overtopping under design conditions as an innovative response to the threat of flooding from climate change. This manner of strengthening sea defences preserves safety without heightening a dyke and allows other, multifunctional uses in a coastal zone between an outer and an inner dyke. The protection against flooding is not a strict defence line but a wider protection zone. The example of Ellewoutsdijk also shows the importance of engaging the public from an early stage.

4. Overview of the case

Ellewoutsdijk is an example of an innovative defence mechanism against sea level rise and storms. It envisages a dual dyke system with a multi-functional, coastal defence zone between. The outer sea dyke can be severely overtopped but will not breach and overall safety is maintained by the whole defence system. The area between can be used as a multifunctional coastal zone with spatial adaptation for salt and brackish water systems, recreation, aquaculture and wet agriculture. Participation of all stakeholders is important for the acceptance of sea-water inundation.

5. Context and Objectives

a) Context

Ellewoutsdijk lies in SW Netherlands along the north shore of the Westerschelde estuary. It is bounded by a 6m high outer dyke with a 10.5m inner dyke built in 1980. The water level between the two dykes is regulated by a pumping system. A historical-cultural fort lies in the area (ca. 2 ha) between the two dykes.

This sea defence system was considered unsafe during severe storm conditions. Furthermore, due to expected sea level rise and storm predictions, wave heights would, with a chance of 1/4000 years, overtop the outer dyke so that the dyke would breach. The inner dyke (largely grass-covered clay) would not be strong enough to withstand the additional water force and the hinterland would be flooded.

b) Objectives

The objective was to look at different options of sea defences to determine which one would be most fitting to maintain the safety of the low-lying hinterland without losing the historical-cultural fort. By using a wide coastal defence zone, safety aspects can be linked to a positive spatial and environmental development.

6. Implementation of the ICZM Approach (i.e. management, tools, resources)

a) Management

The project bureau for all the dyke reinforcements with personnel from Rijkswaterstaat and the Water Board has drawn up detailed options to solve the problem. The work was conducted by the relevant central government ministry (Rijkswaterstaat or the Directorate-General Public Works and Water Management). The Municipality of Borsele under which the community of Ellewoutsdijk falls was involved as was the regional government (Province of Zeeland), the Water Board (Waterschap Zeeuwse Eilanden) and the National Heritage and Monuments Association (Vereniging Natuurmonumenten). The local community was kept informed from the outset.

b) ICZM tools

This is largely a technical solution to a problem. However, it can be realised at virtually any location where, nowadays, grassed coastal dykes are used as the primary coastal defence. Even when a wide coastal zone cannot be developed for spatial restrictions, overtopping is still an option but would require a separate drainage and pumping system. The space between a double dyke system can be used for recreation, Nature protection or restoration, aquaculture or saltwater agriculture.

A decision to simply raise the outer dyke was rejected since this would mean an increase in the dyke height by 4m. Raising a dyke means that it also has to be widened. There was not enough space to do this; on the landward side, the fort would have had to be destroyed and on the outer side the sea-bed is too steep and the water too deep.

Strengthening the inner dyke to protect the hinterland was also rejected as this would mean that the outer dyke would still be breached which would destroy the fort.

Therefore, it was decided to strengthen both sides of the outer dyke, without raising it. This means that it will absorb the force of the waves in a storm. Even though some water will overtop the dyke (once every 50 yrs raising the water level between the dykes by 10cm, and once every 100-200 yrs by 2m), this extra water would be pumped out. The dyke has been strengthened by open stone-asphalt covered with earth and grass.

7. Cost and resources

No costs are available.

8. Effectiveness (i.e. were the foreseen goals/objectives of the work reached?)

The objectives were all reached and the work completed in 2007. It is anticipated that the overtopping dyke will provide more safety against flooding than the single-line defences that largely exist now. The overtopping dyke will be virtually breach-free and a wide coastal zone will ensure flood water will be better contained.

9. Success and Fail factors

The main factor was involving the general public and stakeholders from the outset. For historical reasons, the Dutch have a fear of a shortage of clean, fresh water and inundation so any suggestion of allowing sea-water onto the land is generally greeted with mistrust and suspicion. This is particularly the case as the threat of sea-level rise and the increased chances of flooding due to climate change are well known.

The partners organized various information evenings and gatherings for the residents of Ellewoutsdijk about the solution chosen and the scheduling of the various activities involved. An exhibition in the fort provides information about the operation of the overtopping, resistant dyke. The access routes for supplying and removing materials were chosen in such a manner as to ensure that the residents of Ellewoutsdijk and the summer birds along the coastline would be disturbed as little as possible.

10. Unforeseen outcomes

None as far as completion of the sea defences were concerned. It is too early to know if there will be any long term effects; there have been none since the dyke system has been in place since the 1980's.

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13. Sources

- ComCoast flood risk management schemes Final Report (2007) Rijkswaterstaat, Netherlands.
- ComCoast Project Ellewoutsdijk (NL) (2007) Rijkswaterstaat, Netherlands.
- Dijkverbetering Ellewoutsdijkpolder Ontwerprnota (2005) ProjectBureau Zeeweringen (In Dutch)

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-  Comcoast - Flood_risk_managment_schemes (9.04 MB) 
 -  Comcoast project Ellewoutsdijk (1.93 MB) 
 -  Dijkverbetering Ellewoutsdijk Ontwerprnota (179.17 KB) 