Interreg
EUROPEAN UNION
2 Seas Mers Zeeën
Polder2C's
European Regional Development Fund

Literature study on dike closure strategies

Photo: Mischa Keijser

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Adaptation to climate change

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Literature study on dike closure strategies

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INTERREG Polder2C's project

The INTERREG Polder2C's is an international research project within the framework of the updated Sigmaplan for the river Schelde. The Hedwige-Prosperpolder will be transformed into tidal nature. Depoldering of Hedwige-Prosperpolder offers a unique testing ground, the Living Lab Hedwige-Prosperpolder, for flood defence and emergency response experts. In this environment current and innovative techniques, processes, methods and products can be tested for practical validation. Thirteen project partners, led by the Dutch Foundation of Applied Water Research (STOWA) and the Flemish Department of Mobility and Public Works (DMOW, Flanders Hydraulics Research), are working together. Together, they aim to improve the 2 Seas regions' capacity to adapt to the challenges caused by climate change.

Flood Defence

The rising sea level is a serious threat to the countries in 2 Seas region. How strong are our current flood defences? What is the impact of environmental elements such as the weather, the presence of vegetation or man-made objects on our flood defences? To answer these questions numerous destructive field tests are carried out in the Living Lab to validate flood defence practices. The project entails in situ testing, guidance on levee maintenance and validation of flood defence infrastructure.

Emergency Response

We aim to improve emergency response by developing the right tools for inspection of water defences, risk evaluation and solutions for flooding. If our water defences do not operate as designed, we must take the right measures to prevent flooding of valuable areas. The Hedwige-Prosperpolder Living Lab offers unique possibilities to exercise emergency management in the event of calamities under controlled but realistic circumstances. Activities that are part of the programme are levee surveillance and monitoring, emergency response exercises, breach initiation and the large European exercise.

Knowledge Infrastructure

We aim to develop a knowledge infrastructure through which existing and new to be developed knowledge will become available and accessible. A necessary success factor for any initiative to improve knowledge is to have its outcomes integrated in practices of a wider community. Knowledge Infrastructure focuses therefore on the consolidation of knowledge acquired in the Living Lab with a variety of activities. Accessibility of data in a user-friendly manner, educational activities in the field and incorporation of knowledge in educational curricula are considered key elements.

Field Station

How can we make sure that both experts in the field and the local public benefit from our project and the learnings about climate change, flood resilience, emergency response and the unique environment of the Hedwige-Prosperpolder? An important and unique way of reaching this goal is realising a Field Station at the project site. It will be used during and after the project for educational purposes, research and as a special meeting place for exclusive occasions.

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1 Scope of dike closure strategies

A dike can fail under different circumstances and via different failure mechanisms. The effect in the end will be a breach in the dike structure allowing water to flow into the hinterland.
To prevent drowning of large areas, with people living there, valuable agriculture grounds, vital infrastructure etc., it is very important to close a breach as fast as possible.
As part of the Polder2C's project we did a short survey on experiences or best practices on closing breaches

1.1 Survey on dike closure strategies

We did our survey by:

1 information out of the International Levee Handbook
2 discuss it with our observer United States Army Corps of Engineers together with Environment Agency, Rijkswaterstaat and some Regional Water Authorities
3 consult Deltares report "Snelle reparatietechnieken voor dijkbressen" (in Dutch; 1204477-016-VEB-0001, 2011)

Further, we learned from the Breach Defender experiment of the Dutch Army of Defence. Unfortunately, we were not able to experiment in the Hedwige-Prosperpolder with deliberately breaching the levee PFAS discussion did not allow us to let water flow from the river Schelde into the polder at that moment.

1.2 Conclusions

At the start of the developing of a breach it is possible to close the breach with the breach defender. Even better as a sort of prevention measure for a susceptible location in the section, for example a lower crest or places with trails from animals.
The problem when closing a developing breach is, that the rim of the breach is very soft and prone to erosion and sliding, when a breach defender is pressured against the rim of the breach. This is also a risk by using other techniques for locking, because of accessibility of the rims for material, equipment and workers.

If the breach is complete and there is still a hydraulic head difference between the water level outside the dike and inside the polder, experts consider it impossible or at least very dangerous to close the breach. Because of higher flowrates through a smaller glow cross-section as a result of the partial closure of the breach. Also personal safety of staff, executing the measure, is at risk because you can't het to close to the edges of the breach without the risk the gap will widen at that same moment.

There are however examples that it was successful. For example in the Netherlands in 1953 a barge was put in front of a starting breach. De opening itself was filled up with sandbags. But on the other hand during Huricana Cathrina in New Orleans barges where the cause of some breaches. Also some success were with big bags but only if it is possible to placed carefully in front of the breach

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and not dropped.(lesson learned in Whainfleet UK). Also at the Elbe (Germany) barges were used under marginal water level differences).

But it is considered more as ultimate attempt that can, as well would lead to failure or worsening of the situation.

Most experts advise to wait until the inner and our water levels have levelled, so no water will flow through the breach. When no hydraulic head difference remains, there are good examples for dike closure described in chapter 6 of the International Levee Handbook.

1.3 Recommendations

Because of the importance of closing breaches to protect the hinterland it is necessary to develop an effective closing strategy that can be executed without endangering the staff doing this.
This is a good subject for future collaboration.

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