

IPOP project: Multifunctional Climate Robust Flood Defences

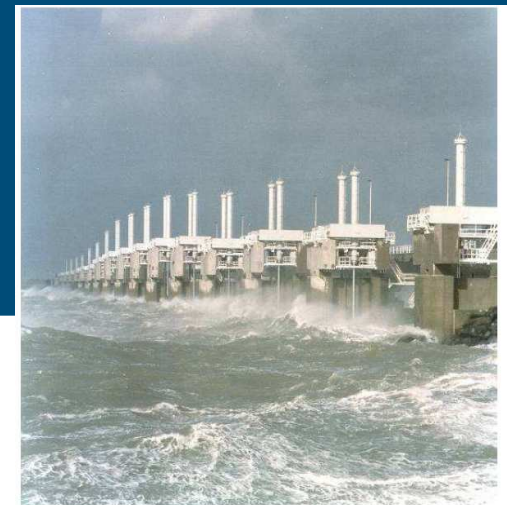
Jantsje M. van Loon-Steensma (ESG)



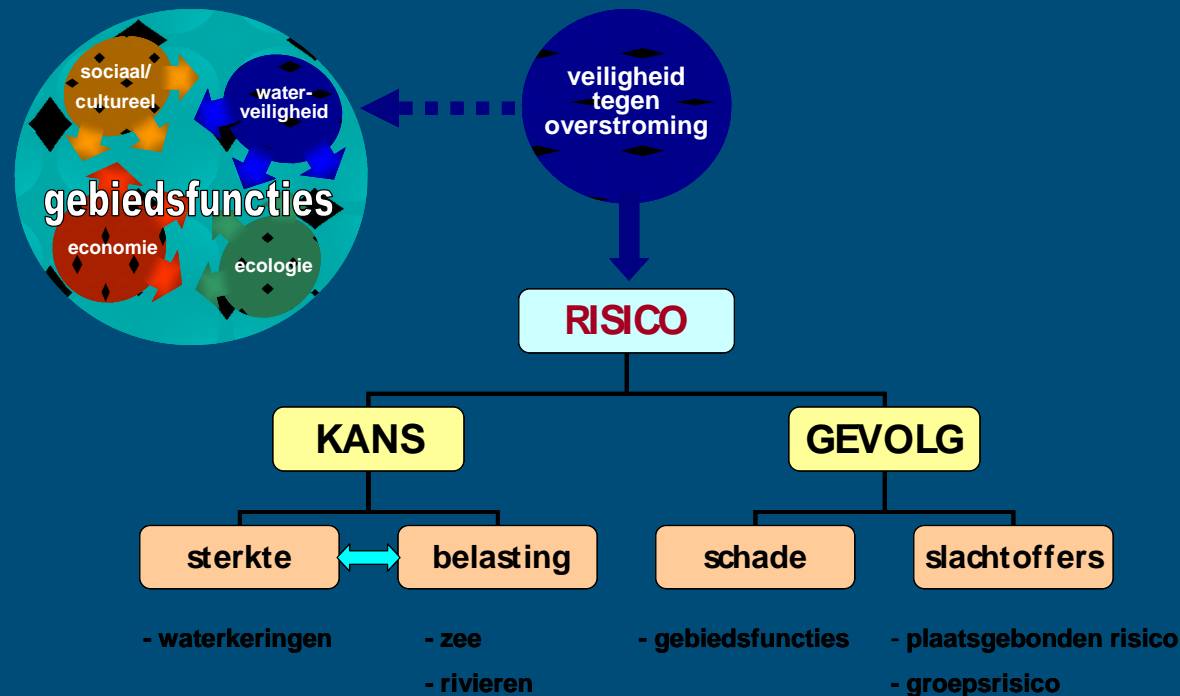
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The Netherlands: Protected by Dikes, Dunes and Retaining structures

- 330 km dikes along the North and Waddensea
- 250 km dunes
- 1400 km river dikes
- 770 km dikes along lakes and estuaries
- Retaining constructions



Risk = probability of flooding X consequences



Source: H. Schelfhout, Deltares (2008)

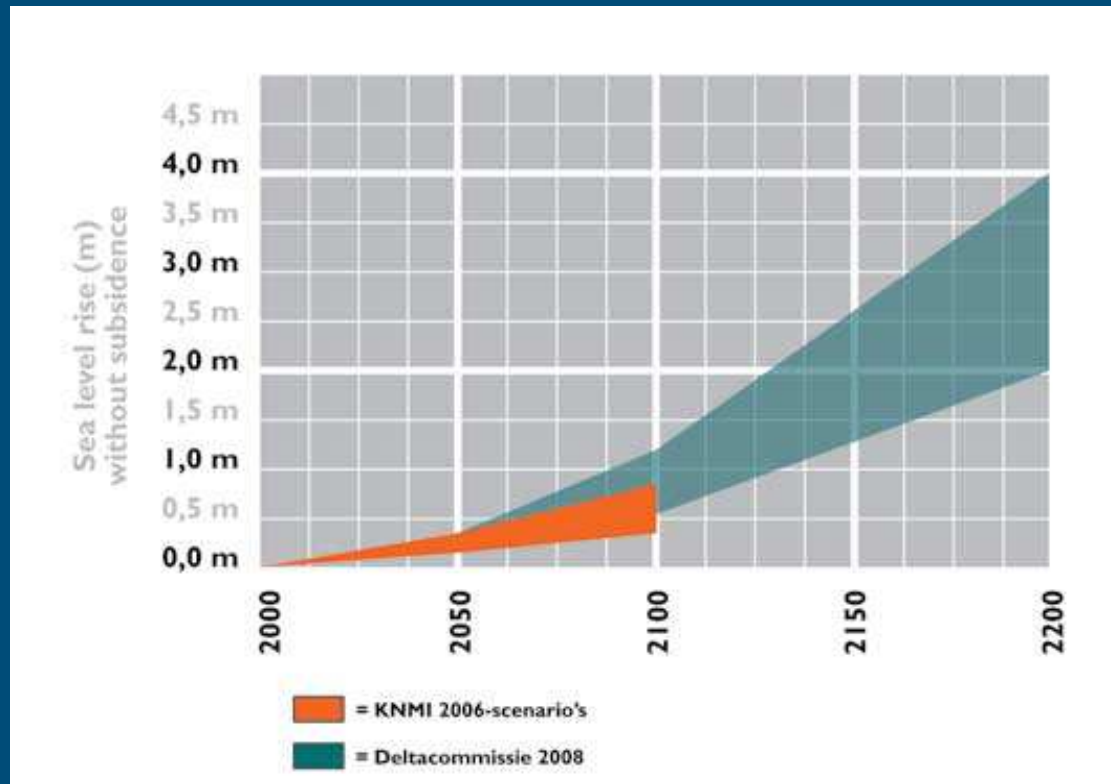


New Challenges for Flood Protection

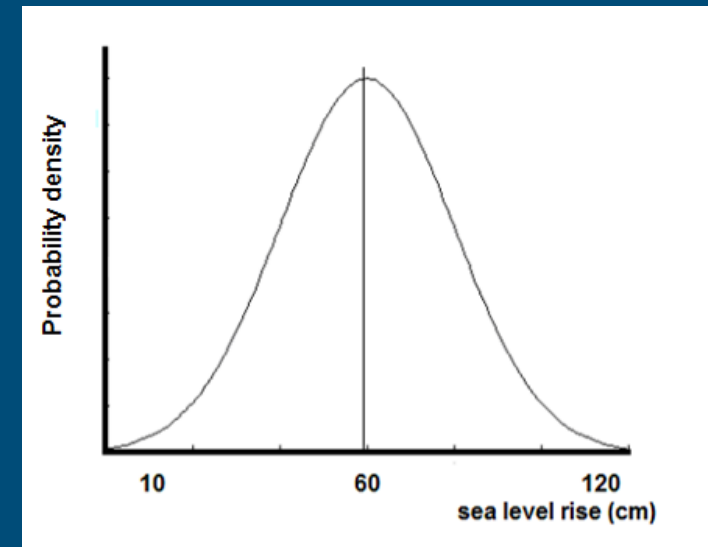
- Climate Change
 - Sea-level rise
 - Extreme summer rain
 - Extreme river discharges
 - Draughts
 - Strength and direction of Storms?
- Developments in economy
- Developments in demography
- New scientific insights



Sea level rise



Source: 2nd Deltacommittee (2008)



Source: N. Marinova (2009)



Climate Change and uncertainty Storm Surges

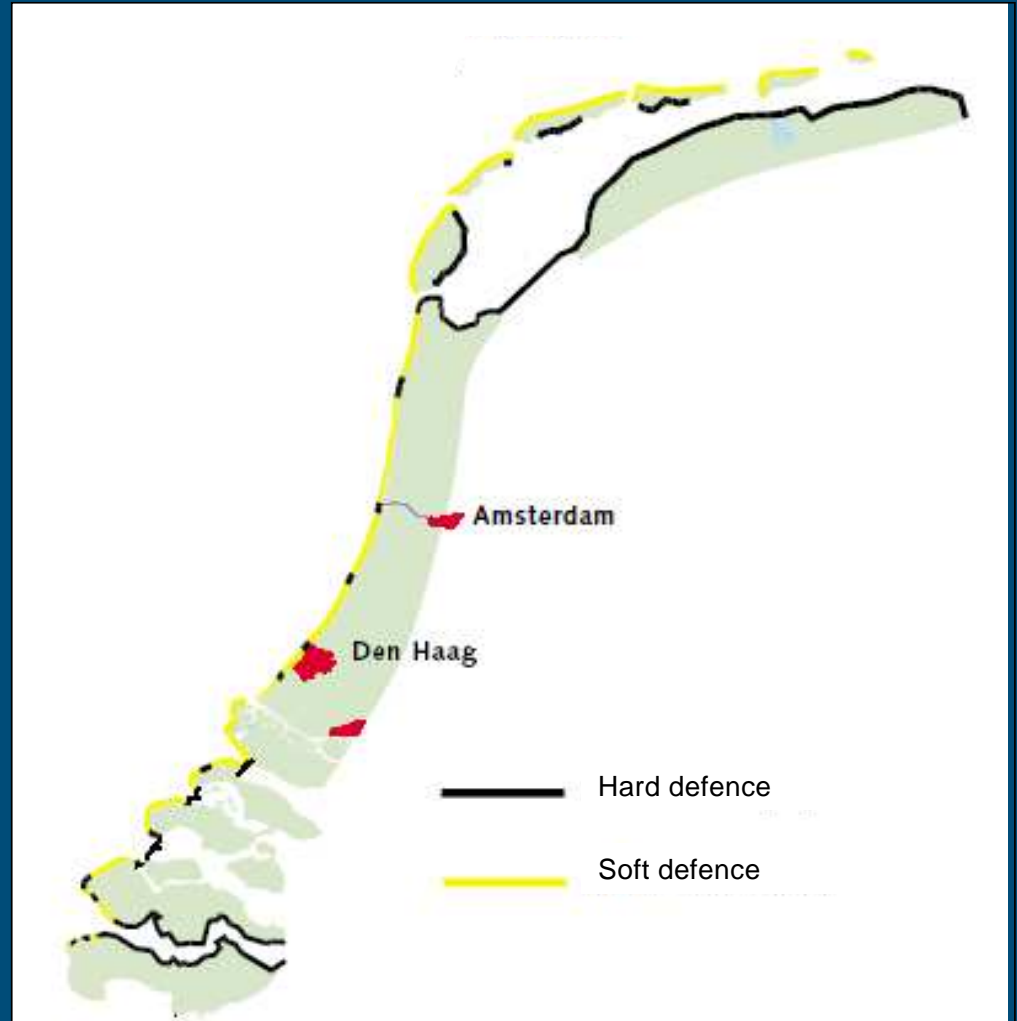
- Severity of storm surges?
- Wind direction?



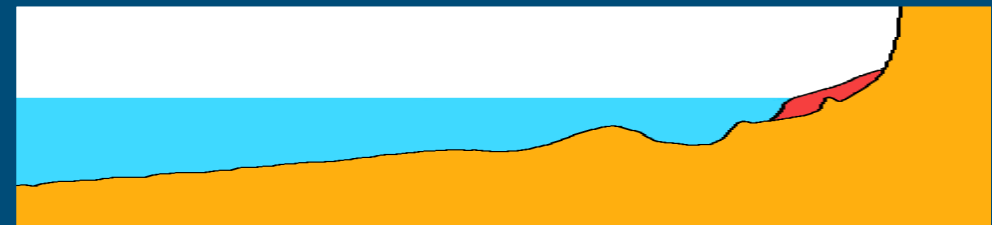
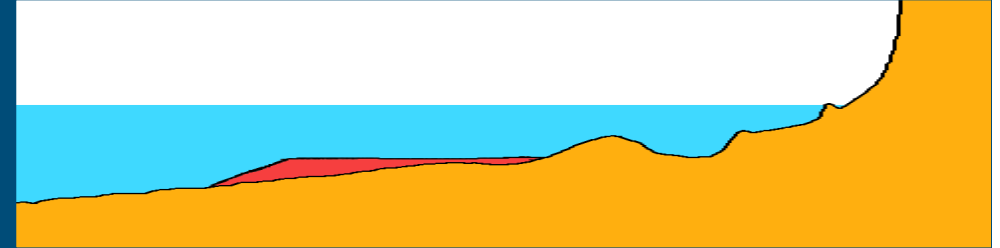
- Force of Waves?
- Duration?



New Coastal Policy in 1990: maintain the shore line at the 1990 position



Sand Nourishment



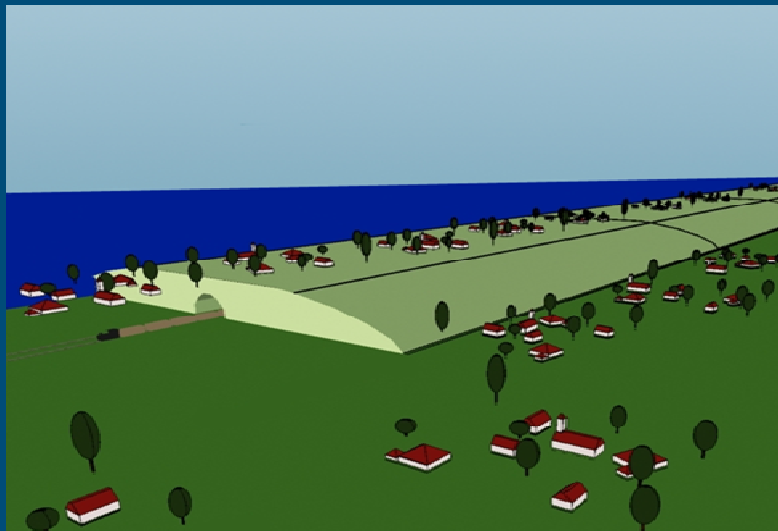
Programs and Projects on water safety

- HoogWater Beschermingsprogramma
- Maaswerken
- PKB Ruimte voor de Rivier (Spatial Planning Key Decisions 'Room for the River')
- Zwakke Schakels aan de kust
- Quick scan to investigate which adjustments are required to make the Dutch dikes unbreachable
- 2nd Delta Committee
- Deltaprogramme

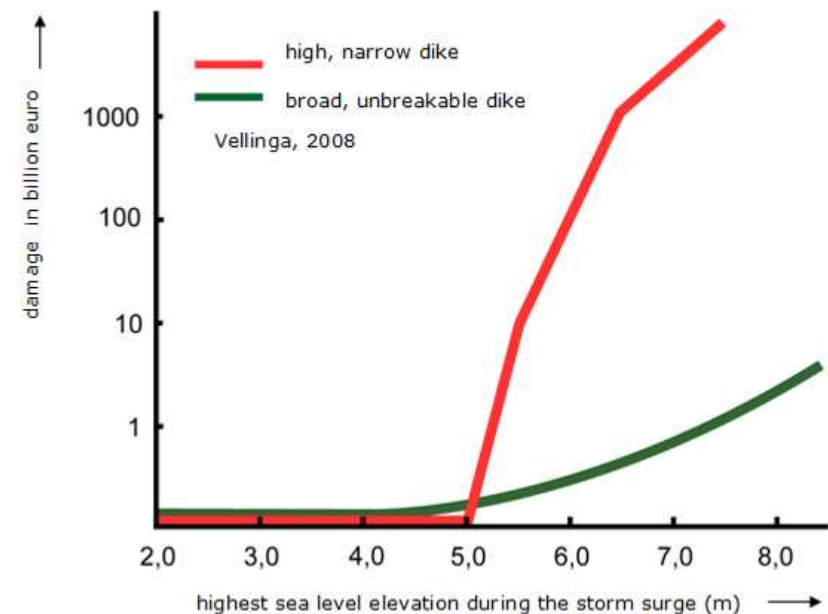


Why don't we reduce the risk by making robust climate proof protection infrastructure?

- Dikes that don't collapse when overflowing with high water
- Can cope with uncertainties in expected sea level rise and river discharges
- Don't fail due to draught stress

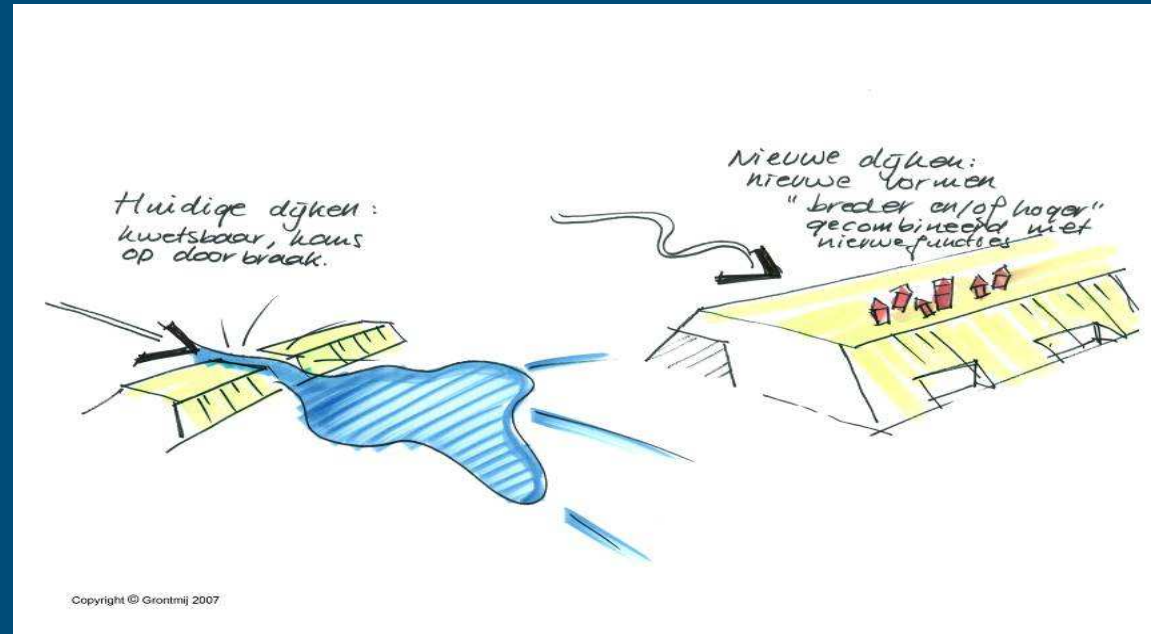


Source: P. Vellinga (2008)



Combining a broad range of functions

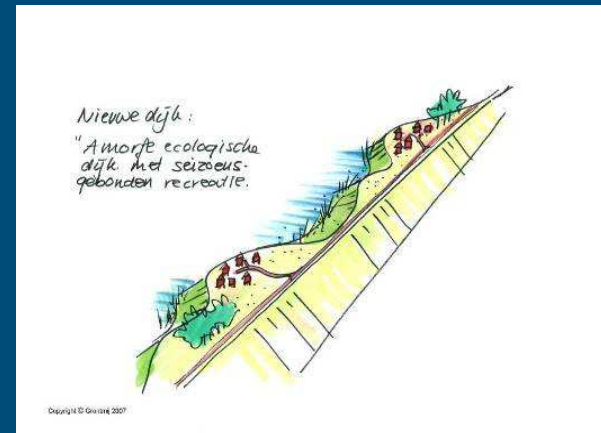
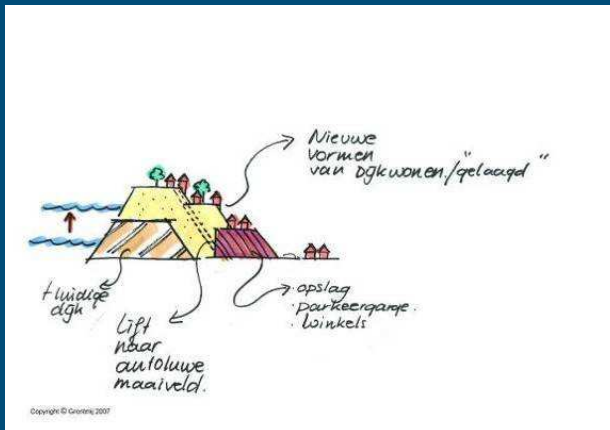
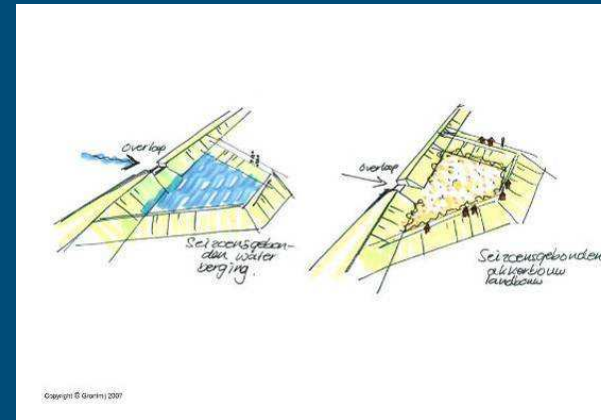
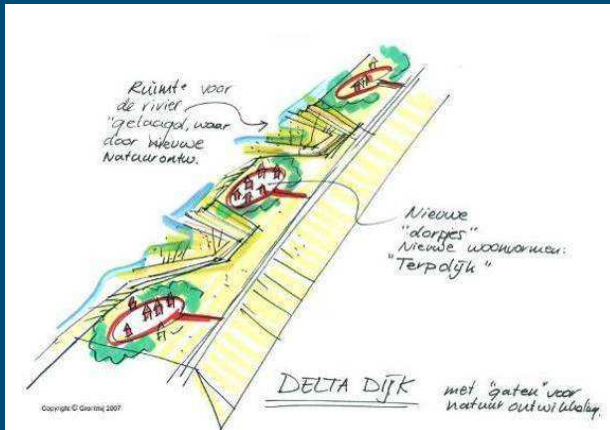
- Safety
- Nature
- Agriculture
- Reservoir
- Transport
- Recreation
- Cultural History
- Urban Planning
- Energy-infrastructure



Source: Grontmij (2007)



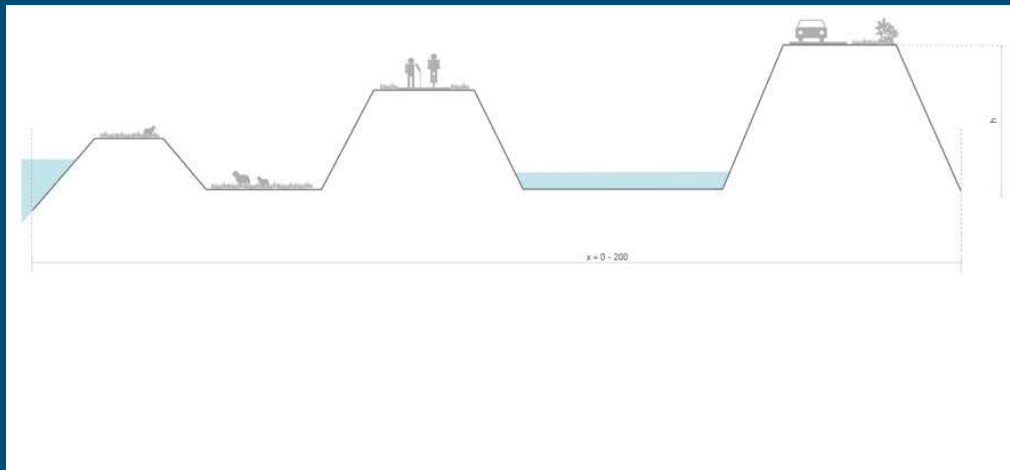
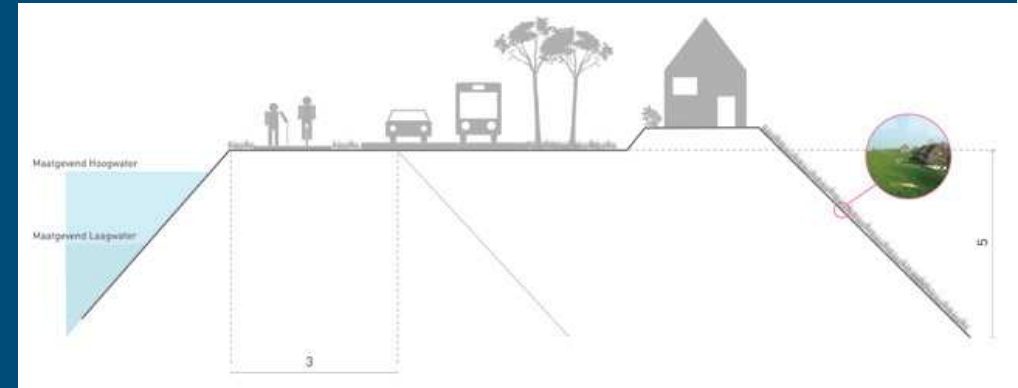
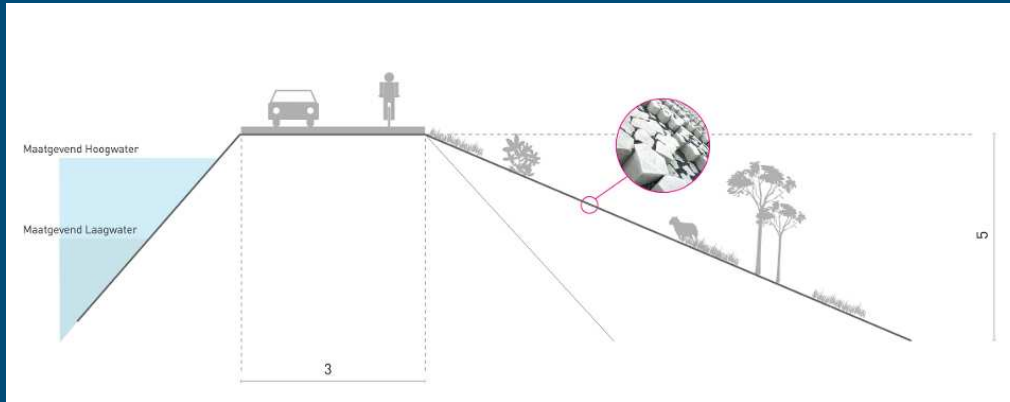
Forms of Robust, Climate Proof and Multifunctional Dikes



Source: Grontmij (2007)



Klimaatdijk



Source: Ministerie V&W (2008)



Examples of existing broad (super) dikes



Overstroombare superbrede dijk in Japan



Brede dijk langs Wantij in Dordrecht met ook functie voor recreatie en natuur.



Unbreachable dike



current dikes can be made unbreachable with relatively moderate means, with total costs for converting the dikes along the coast, estuaries and large rivers being estimated at $6.5 \cdot 10^9$ euro (Silva & van Velsen, 2008)



Robust, Climate Proof Flood Defences

- Robust Dikes are sufficient strong due:
 - to their width
 - to their height
 - to their internal structure
 - a double or triple dike
- But how wide, how high and by what kind of structure on each specific area?
- And how to plan these new dikes in our densely build up and populated country?
- How to use natural processes in the flood defense zone?



Aim: Project Multifunctional Robust Flood Defences

Procedures for decision-making about robust multifunctional defences

Aim: to develop fundamental knowledge for the location-specific design of **robust and multifunctional flood defense zones** which fit in their environment and use the opportunities that this environment offers for flood defence. A location-specific design will be the result of a decision process with multiple stakeholders, which may use several decision support instruments.



Focus

The focus will be on:

- agricultural (e.g. saline agriculture and biomass production for energy)
- nature functions (via ecosystem services and nature conservation)
- natural processes (in particular salt marshes and sand dikes).

Information about landscape (e.g. quality, cultural-historical or recreation), urban (housing and recreation) and transport functions from other research will be used where appropriate.



Activities and Results so far:

- Quick Scan (with other researchers) of available knowledge and experiences with robust dikes Hartog, M., van Loon-Steensma, J.M., Schelfhout, H., Slim P.A. and Zantinge A.(2009) Klimaatdijk; een verkenning. *Kennis voor Klimaat*, www.kennisvoorklimaat.nl
- Paper about adaptation to climate change Vellinga, P., Marinova, N., Loon-Steensma van, J.M., 2009b. Adaptation to Climate Change: A Framework for Analysis with Examples from the Netherlands. *Built Environment (Special Issue Climate Change, Flood Risk and Spatial Planning)*, vol. 35(4), p452-470
- 2 project proposals (Knowlegde for Climate and Waddenfonds)
- Interviews with stakeholders of dike reinforcementprogrammes



Foreseen activities:

- Possibilities combining saline agriculture in the coastal zone with flood protection functions
- Possibilities and constraints of sand dikes on the Wadden islands
- The possible role of mudflats and salt marshes in water safety (climate buffers)



Climate Buffers: can nature areas and natural processes be utilized for flood protection?

- How to stimulate the natural processes whereby sedimentation of mud or sand in such a way that it enhances the dimension or stability of dams and dikes?
- How are these natural processes influenced by climate change?
- What are bottlenecks for the realisation of climate buffers
- How do climate buffers react on extreme events?



Questions or Suggestion?

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