



Ecosystem Engineers, Ecodikes, Rich Revetments, Harbours opportunities

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Soft solutions

Hybrid hard-soft mix

Hard solutions



*more space, more BwN,
more flexible, cost-effective (?)*



*less space, more BfN,
less flexible, extra investment*



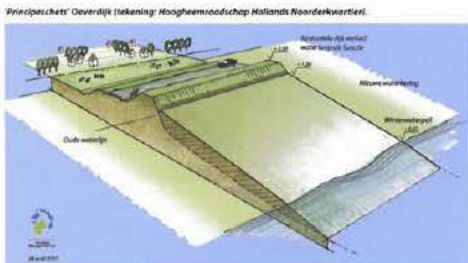
Wadden Sea - IJsselmeer



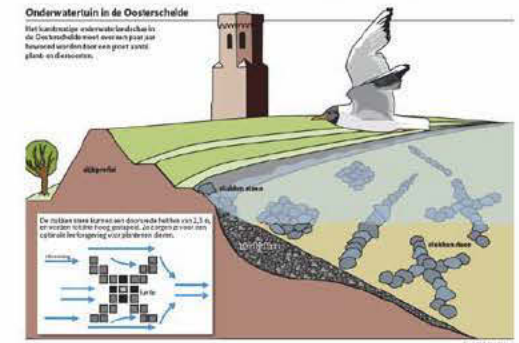
Oyster reefs
Eastern Scheldt



Rich 'Levees'
Eastern Scheldt



RfR Noordwaard

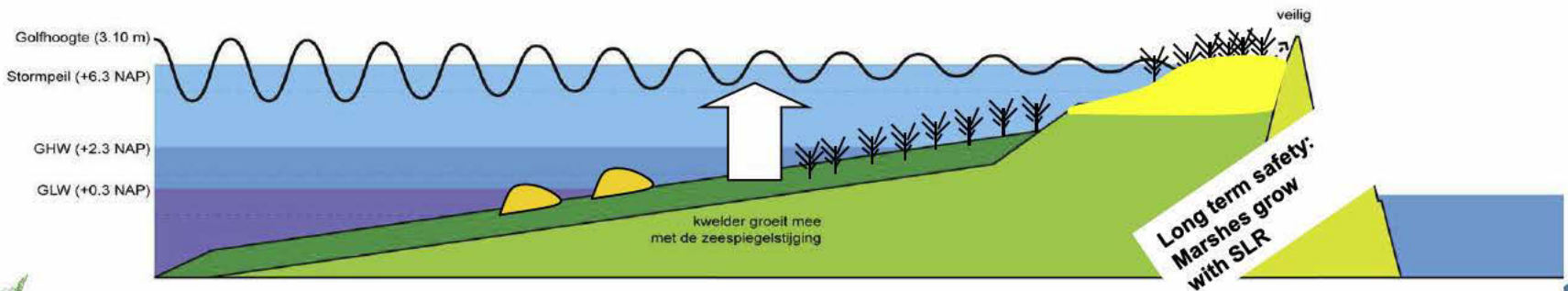
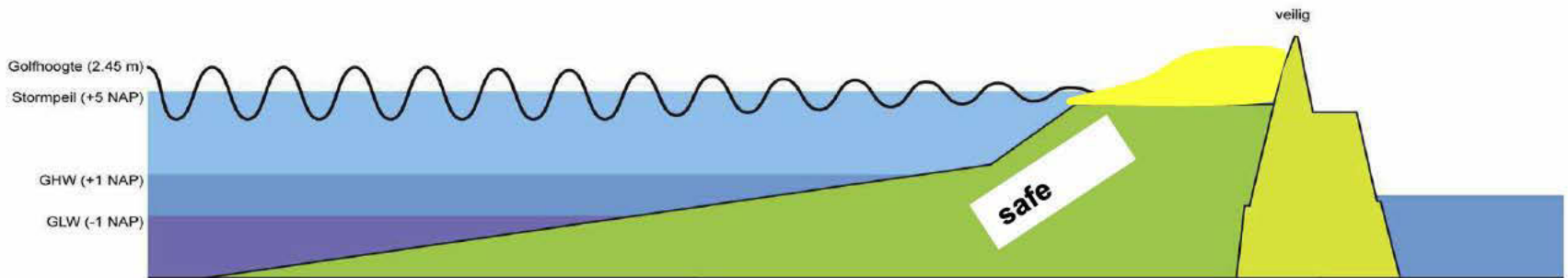
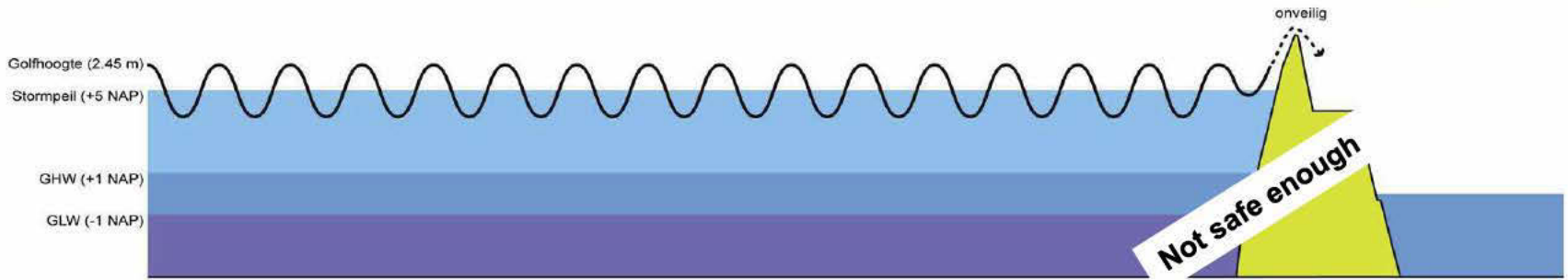


Onderwateruin in de Oosterschelde

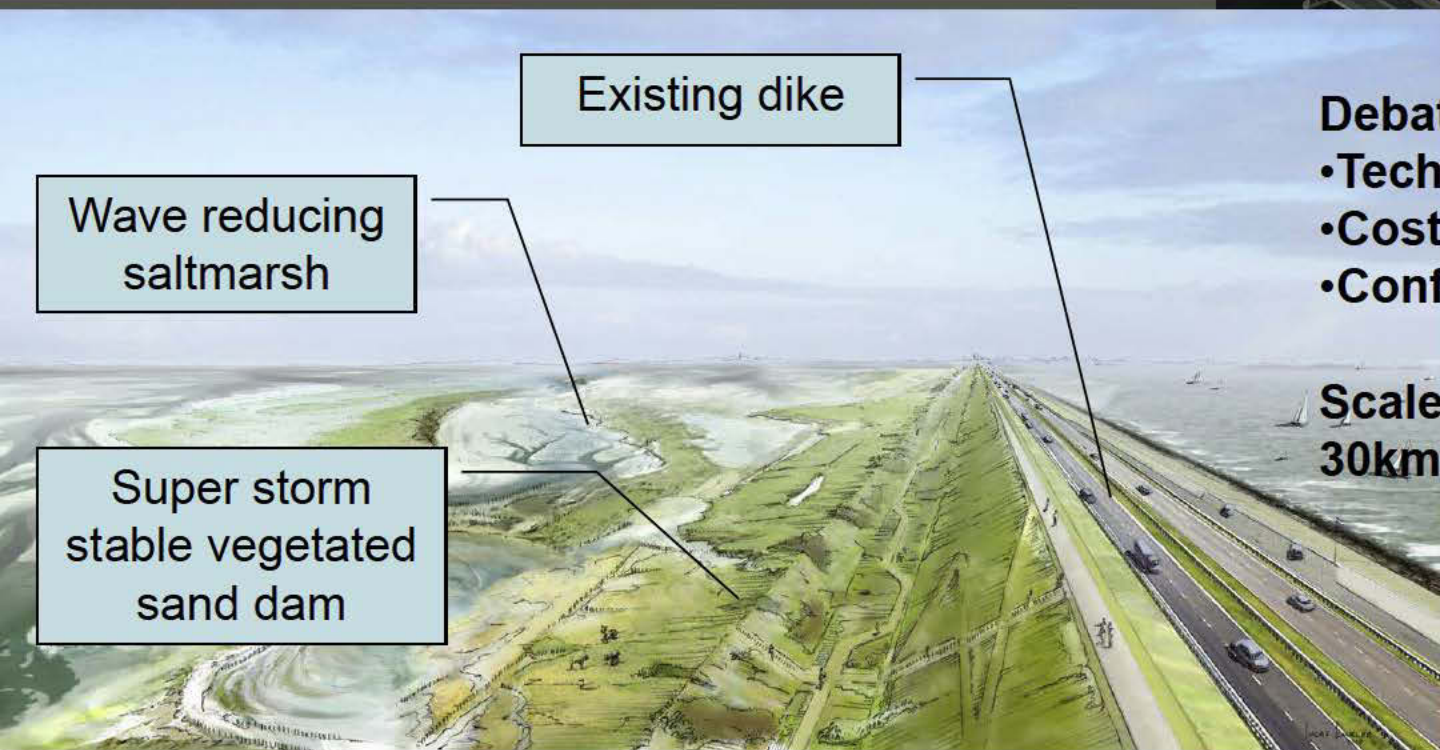
Het landbouw- en natuurlandschap in de Oosterschelde moet over een paar jaar functioneel worden met een groot aantal plank- en oestersloten.

De natuur moet kunnen aan de voorwaarde van 2,3 m en worden toegevoegd aan de oosterschelde met een groot aantal plank- en oestersloten.

Building with Nature : reefs, salt marshes, soft and hard



Wadden Sea Soft Safe DiKE: saltmarsh/sand dam/dike



Existing dike

Wave reducing saltmarsh

Super storm stable vegetated sand dam

Debate:
• Technical feasibility
• Cost-benefit
• Conflict with Natura 2000

**Scale 500m wide
30km long**

Saltmarsh grows with sea level and maintains stability and safety
Flexible, low tech, low maintenance cost, longshore connectivity

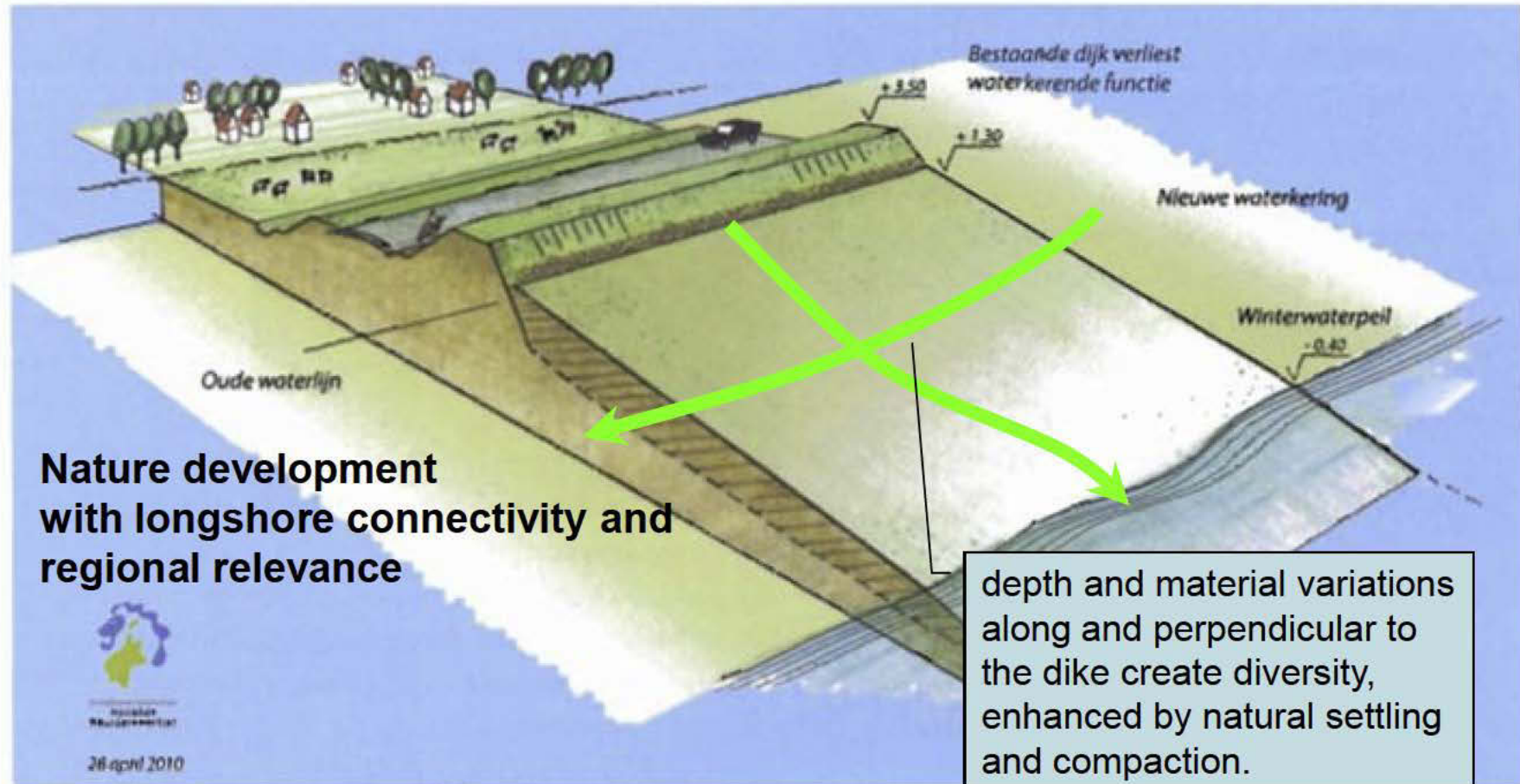
Lake IJsselmeer

Wadden Sea

Afsluitdijk

2010, HHNK, RWS-WD, Deltares, Haskoning: 'bankdike', soft safe green flexible dike along IJsselmeer

'Principeschets' Oeverdijk (tekening: Hoogheemraadschap Hollands Noorderkwartier).



Nature development with longshore connectivity and regional relevance

depth and material variations along and perpendicular to the dike create diversity, enhanced by natural settling and compaction.

50m wide, many km, large wave reduction, high nature value, along lake shore

2010, EcoShape: foreshore protection with reef. Large-scale oyster reef experiment (2x 200m x 20m)



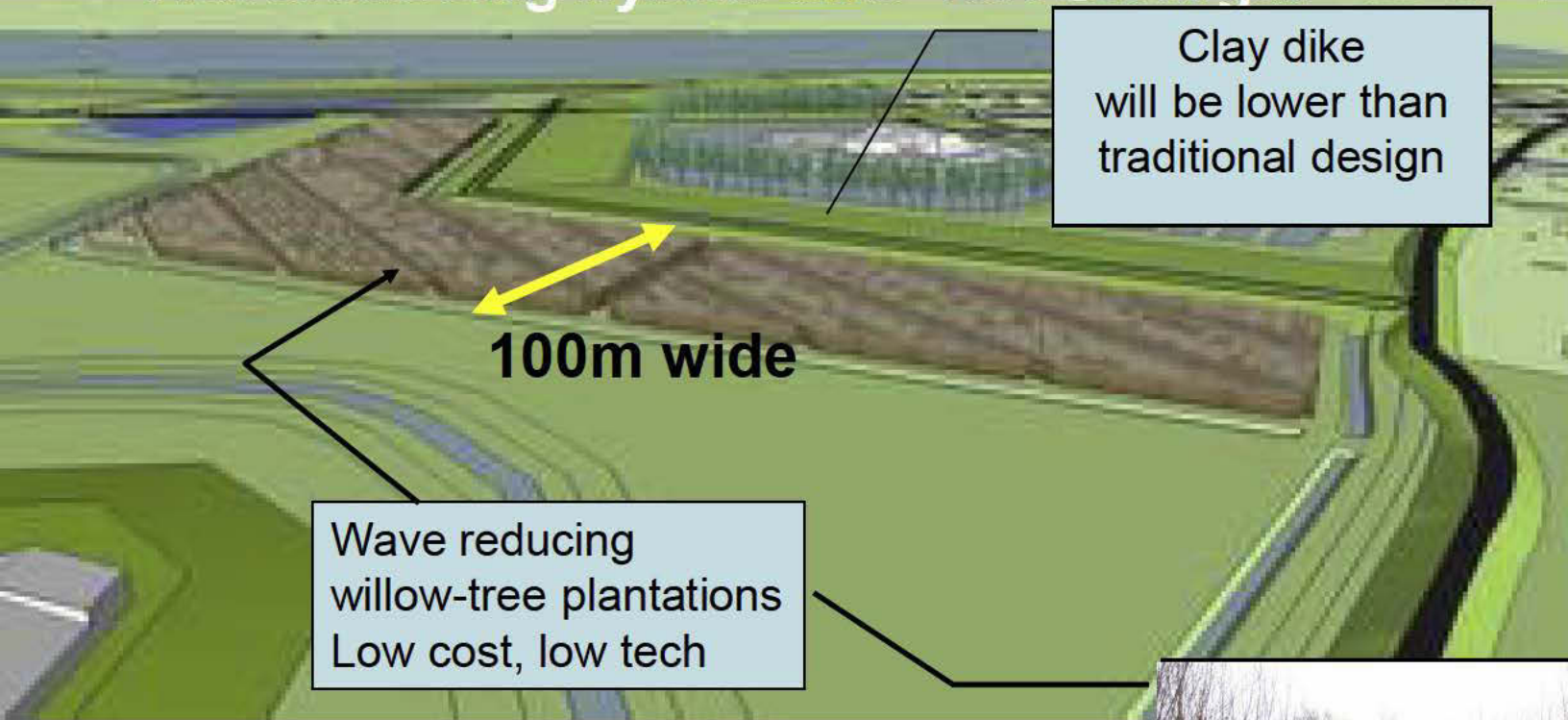
Reduce erosion of intertidal areas in Eastern Scheldt estuary due to storm surge barrier.



EcoShape

building with nature

2009 RfR programme Noordwaard Wavereducing hybrid dike 'fort Steurgat'



Clay dike
will be lower than
traditional design

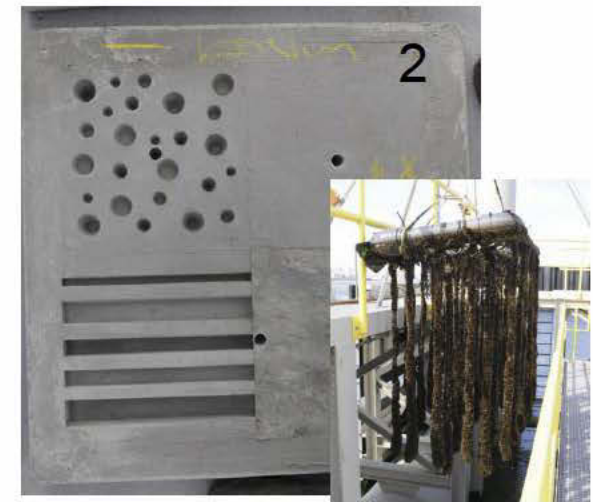
100m wide

Wave reducing
willow-tree plantations
Low cost, low tech



2007-2010 Rich Revetment pilots

1. IJmuiden
2. Haven van Rotterdam
3. Oosterschelde
4. Westerschelde



Application: underwater forest harbors

