

# Muddy Waters and the Wadden Sea Harbours

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## EcoShape Building with Nature Programme Wadden Sea Harbours

### Building with Nature

A key characteristic that distinguishes a BwN design from other integral approaches is the proactive utilization and/or provision of ecosystem services as part of the engineering solution.



### Objectives

In the Wadden Sea Harbours programme four key concepts have been identified that are or will be tested in case studies:

- optimising dredging strategies;
- enhancing saltmarsh development;
- creating estuarine gradients;
- optimizing flow patterns.

### Pilot projects

#### Enhancing salt marsh development by a Mud Motor

Beneficial use of dredged sediments from Port of Harlingen by disposing the sediment closer to a salt marsh system is expected to:

- Reduce recirculation towards the harbour, saving costs;
- Promote the expansion of salt marshes, improving the ecosystem;
- Stabilize the foreshore of the sea defense, reducing maintenance.

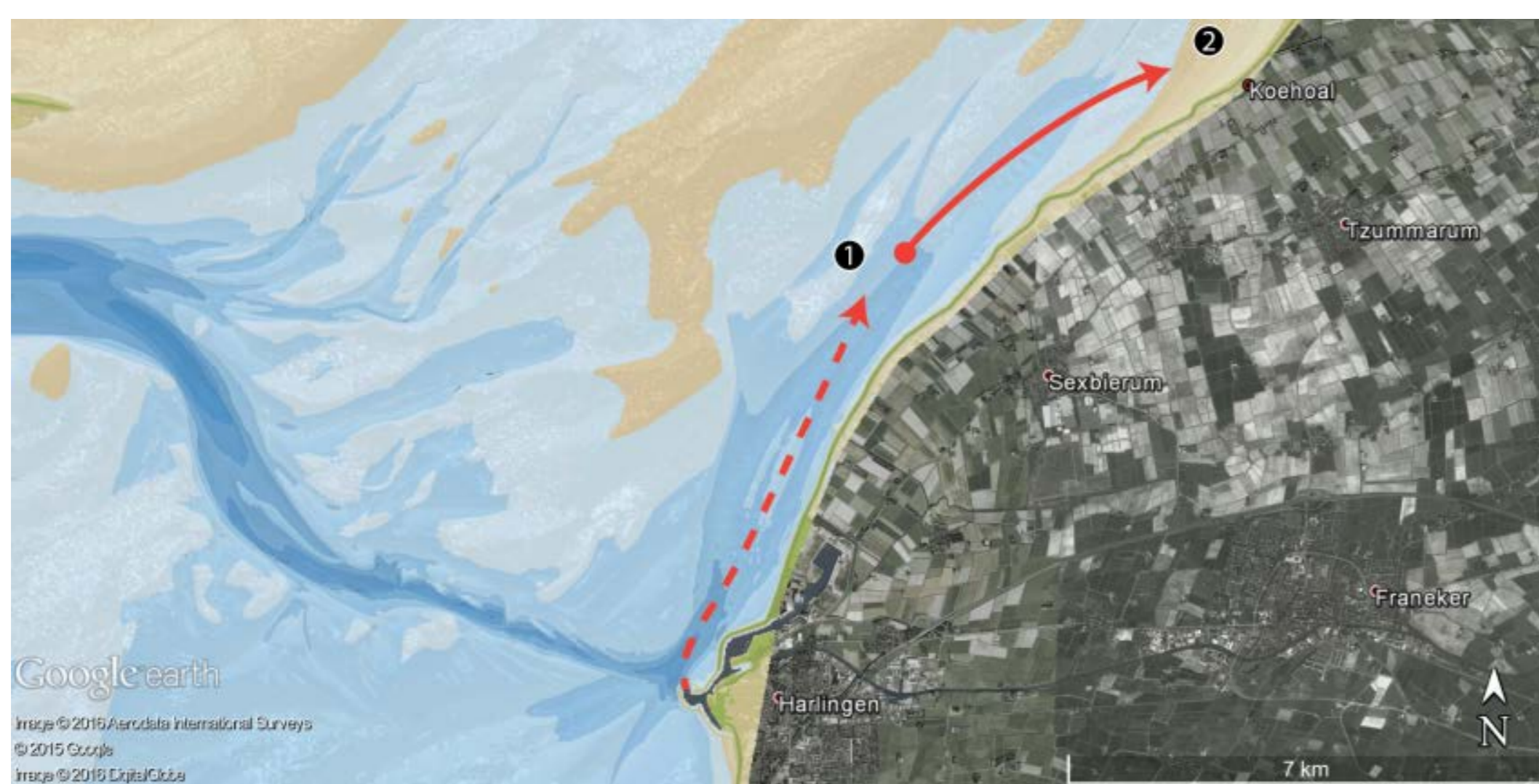


Figure 1. Overview of dredge site at Port of Harlingen, (1) Mud Motor disposal location and (2) saltmarsh development location.

#### Marconi Offshore Delfzijl

Both the environment and the economy in Delfzijl will be enhanced by:

- Improving flood safety;
- Improving the spatial quality by enhancing recreation and nature;
- Removing industrial chalk deposits, reviving the benthic ecosystem.

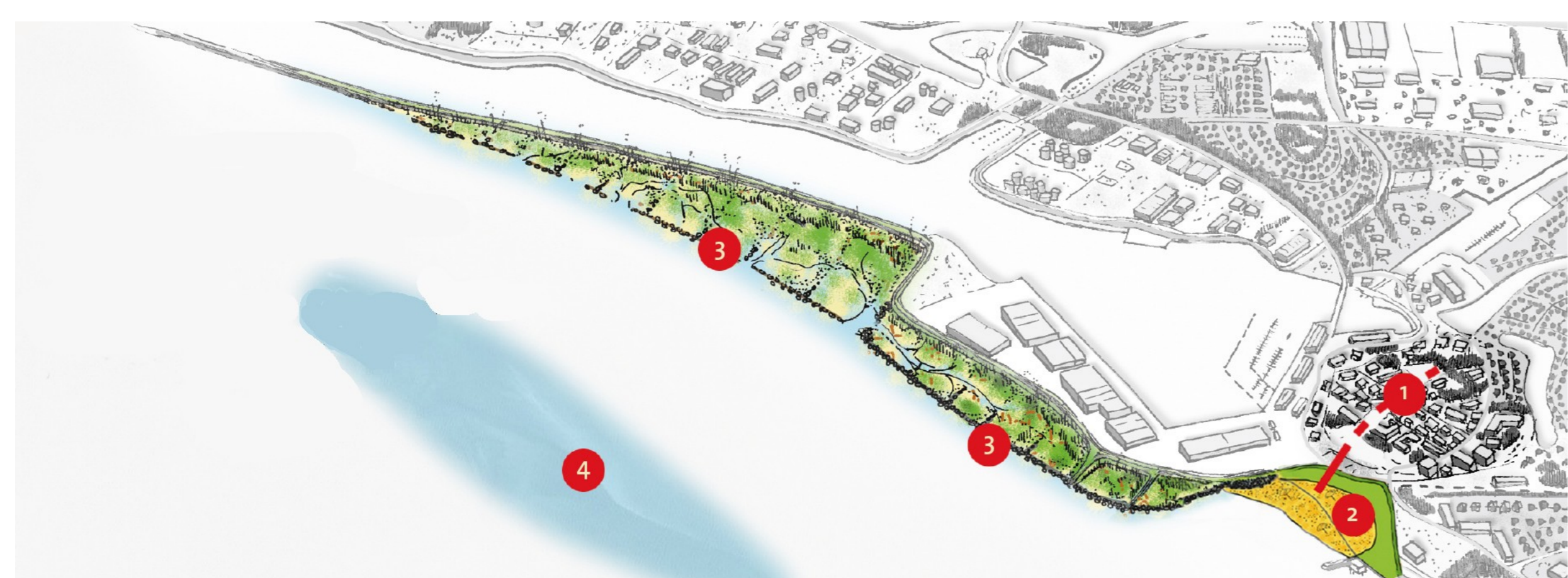


Figure 2. Overview of Port of Delfzijl project elements, (1) Delfzijl centre, (2) beach, (3) salt marsh and (4) removal of chalk deposits.

### Creating estuarine gradients

Part of the Marconi Offshore project is creating a new estuarine gradient outside Delfzijl harbour to:

- Reduce freshwater outflow and thereby reduce harbour siltation;
- Create freshwater wetlands and salt marshes, enhancing biodiversity;
- Provide for a migratory fish passage with brackish basin.



Figure 3. Proposed design of the freshwater outflow at Delfzijl including the development of an estuarine gradient with salt marshes, freshwater wetlands and fish passage.

### Port of Den Helder nature-inclusive development

An improved design of the harbour entrance would make it possible to create more room inside the harbour and to reduce the trapping efficiency of sediments. Relocating freshwater outflow will reduce siltation. These measures will be made nature-inclusive by:

- Optimizing flow patterns for nature development through changing the lay-out of the harbour entrance;
- Creating estuarine gradients and enhancing salt marsh development by relocating a freshwater discharge;
- Creating a fish migration estuarine gradient in a freshwater canal.



Figure 4. Project locations around the Port of Den Helder, (1) modification of entrance lay-out; (2) relocation of freshwater discharge and (3) fish migration estuarine gradient.

### Conclusions

Ports all over the world face the challenge of operating in or nearby valuable ecosystems. This is certainly true for the harbours along the Wadden Sea, a UNESCO World Heritage site. The need for harbour development and cost-reduction in maintenance dredging has led to the idea of using Building with Nature concepts. These concepts proactively use ecosystem services ("use the force") and provide for ecosystem services ("let it grow"). Four Building with Nature concepts have been introduced in the EcoShape Building Wadden Sea Harbours programme and are or will be tested for feasibility in global applications.