

Dike Solutions **Broad Green Dike**



A Broad Green Dike (BGD) is a gradually sloping dike with grass covering. The construction of a BGD requires a lot of clay. Only then is the dike able to absorb wave energy, without affecting the turf or underlying clay layer.

Because of the large amount of clay needed, experiments have been developed to win clay locally. This can be clay made of mud from a fresh water pond or channel or mud from the sea. The experiment also considers the use of solid clay from the present tidal marsh. It is expected that a dike reinforcement in the form of a BGD that has been made from locally produced clay, is cheaper than a traditional reinforcement with asphalt cover. A green dike (grass) also fits better in the landscape and better fits the nature reserve values. The experiment is aimed at gaining insight into:

- composition and suitability of locally produced clay as a building material for sea dikes;
- clay ripening processes and strategies;
- opportunities to strengthen dikes with locally extracted clay in a sustainable and safe way;
- management processes with stakeholders needed to build a BGD;
- steps and any necessary adjustments in the legal-planological framework to make a BGD possible;
- possibilities to win clay in the Natura 2000 area of the Ems-Dollart estuary;
- possibilities to produce clay from mud on the tidal marsh in a sustainable way for future reinforcements (clay engine);
- possibilities to store mud in the Natura 2000 area Ems-Dollart in a mud depot to ripen to clay;
- possibilities to realize a BGD in Natura-2000 Ems-Dollart area;
- difference in management and maintenance for a BGD and for a traditional dike with asphalt coverings;
- financial business case, in which costs and benefits are compared to a traditional dike reinforcement;
- suitable locations in the Netherlands for the construction of a BGD in combination with sustainable (local) extraction of clay.

Research

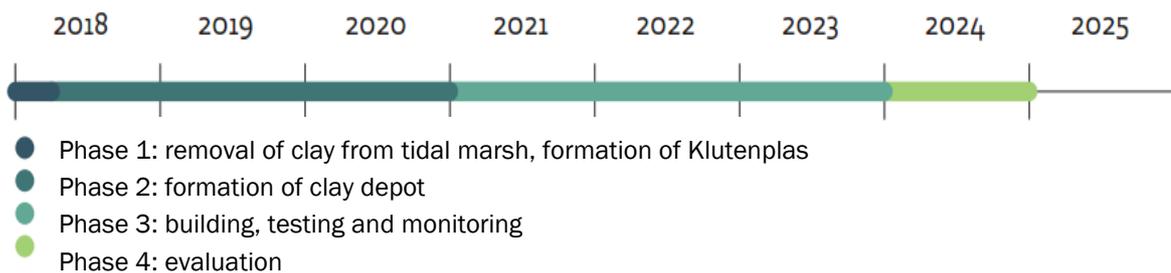
1 Can a BGD be constructed of locally produced clay? More specifically: (a) clay from the tidal marsh in front of the dike; (b) clay produced of (brackish) mud from an inner natural polder (Breebaart); (c) clay produced of (salt) dredging mud originating from the seaport of Delfzijl.

- 2 Can mud from the Ems-Dollart be matured and converted into suitable clay and what is the most optimal clay maturation strategy for this?
- 3 Can clay be extracted and matured from the salt marshes within the Ems-Dollart?
- 4 Can a BGD be built in Natura 2000 area of the Ems-Dollart?
- 5 Can a BGD be achieved cheaper and faster than a traditional reinforcement, considering the guiding preconditions and principles, including working in the Eems-Dollart?
- 6 Which characteristics and preconditions a location must meet to be suitable for realization of a BGD?

Approach

Waterboard Hunze en Aa's directs the research on the BGD. Within this study, the pilot "Kleirijperij" is carried out, in which different methods of maturing mud to clay are examined. This pilot is carried out by multiple parties. In 2021 Hunze en Aa's will build one kilometer of dike following the BGD concept for research purposes. The dike will be tested and monitored for three years.

Planning



- Phase 1, spring 2018 (finished): Digging clay from tidal marshes to construct a depot (left of dike on top photo) and to form the Klutenplas (to the far left on top photo).
- Phase 2, summer 2018 to 2021 (in progress): the construction of the clay depot (finished), in which the mud from the Breebaart polder is matured in different ways into clay.
- Phase 3, 2021 to 2024: Laying, testing and monitoring 1 km Of Brede Groene Dijk.
- Phase 4 2024: Evaluation.

Results

Phase 1 has been completed: digging out clay from the tidal marsh to construct the clay depot, in combination with the construction of the Klutenplas. As early as spring of 2018, the island in the Klutenplas was used by many Avocets as a breeding ground. In preparation for the breeding season of 2019, the island has been made suitable for breeding, by making the soil bare again. The excavated clay proved suitable for the construction of the clay depot. In 2019 the depot became partly filled with mud from polder Breebaart (Phase 2).

Stakeholders

Waterboard Hunze en Aa's, POV Waddenzeedijken, Eems-Dollard 2050, Province of Groningen, Groningen Seaports, Het Groninger Landschap, Ecoshape, Waddenfonds, Rijkswaterstaat, Maatschappij Onverdeelde Munnikeveen, E.H. Huisman.

Literature

POV Waddenzeedijken, 2019: Factsheet Brede Groene Dijk.

Van Loon J.M., Schelfhout H.A., van Hattum T., Smale A. & I Gözüberk, 2014: Innovatieve dijken als strategie voor een veilig en aantrekkelijk Waddengebied. Samenvatting van het Deltaprogramma Waddengebied onderzoek naar innovatieve dijken 43 pp.