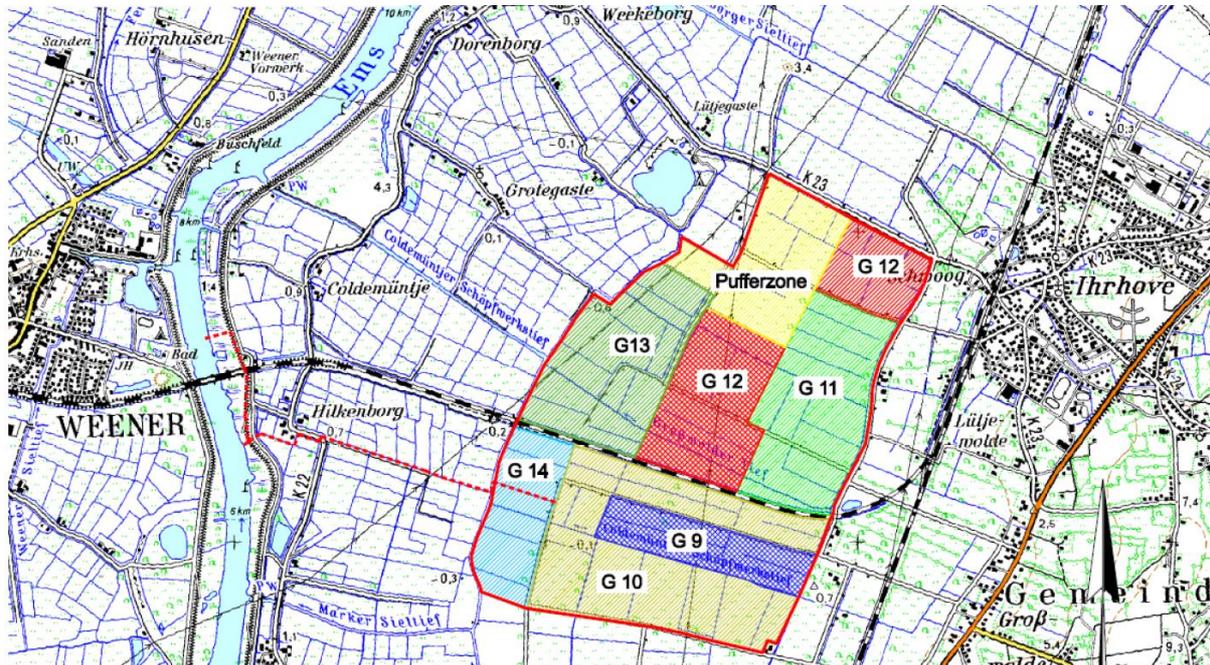


# Landward Solutions Ihrhove landfill



Dredging sludge taken from the Ems river is used near Ihrhove and Großwolde in the municipality of West-Overledingen to heighten and improve some 530 ha of agricultural land. Up to 1.5 million m<sup>3</sup> is annually stored. The benefits for the dredging operations of the Lower Ems river are that transport distances for the dredgers are reduced considerably, reducing the costs. Furthermore, the heightening of the land should facilitate water management in the area.

20.000 m<sup>3</sup> dredging sludge per ha can be deposited. At the start, an annual amount of up to 500.000 m<sup>3</sup> dredging sludge was deposited annually requiring an area of 15 - 20 ha. Later, these amounts were heightened to up to at maximum 1.5 million m<sup>3</sup>. As a result, some 500 ha of the 530 ha in total had already been covered with mud in the period 2006-2015, shortening the original project time considerably (2006-2031). Currently a placement of a second layer on top of the current layer is considered.

The sludge is transported by pipes over a total distance of some 5 km from the Ems. The profit of the landfill approach is that the transport time for the dredging boats will decrease considerably compared to the dumping of the sediments in the outer Ems reaches (lower Figure). The sludge dredged is mainly from the brackish water zone between Leer and Papenburg. As other landfill sites, such as clay mining pits, along this area are almost not available (anymore) the new approach offers a welcome alternative. Over the period 1996-2017 on average some 7.9 million m<sup>3</sup> was dredged from the lower Ems river including 2.5 million m<sup>3</sup> from the harbor at Emden. The costs vary from less than 5 million Euros to almost 18 million. Over the period 1996-2017 of the sludge thus dredged some 1.8 (1.5-2.0) million m<sup>3</sup> is annually stored of which 1.3 million m<sup>3</sup>/yr on land.

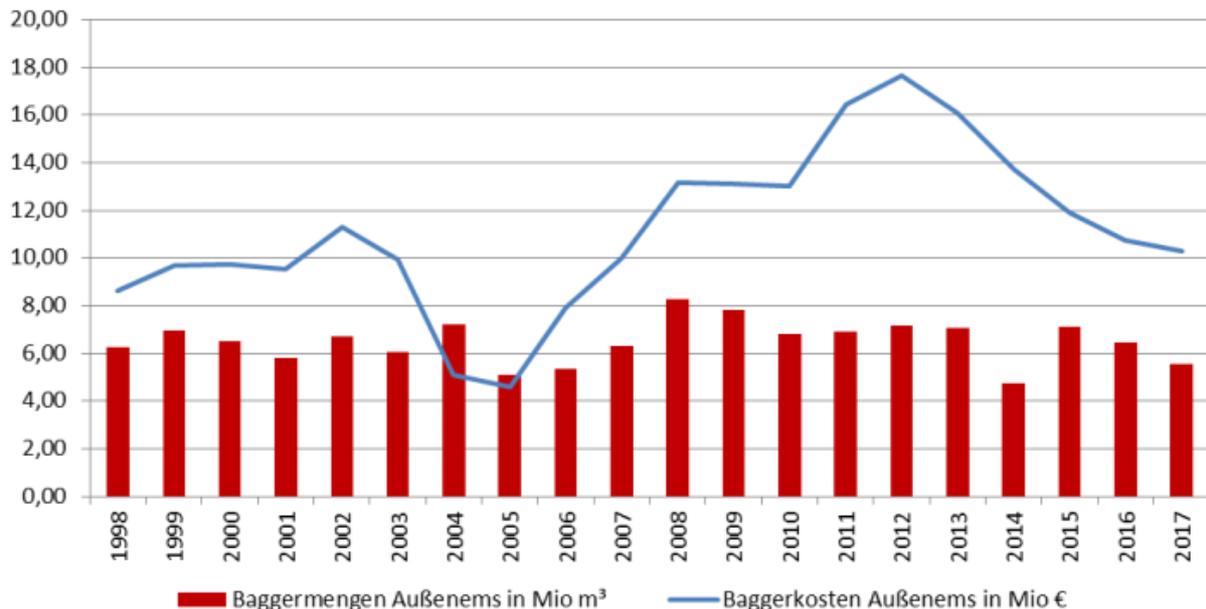
## Research

Without research such landfills are not possible. The following research is needed:

- An intensive coring and cone penetration testing are needed (every 50-100m) to establish an overview of the sedimentary built up (see below).
- Determination of the height of electric power poles.
- Assessment of archeological values
- Continuous control of the chemical composition of the dredged sediments, applying very strict quality standards.
- The landfill requires vegetation monitoring which is currently carried out by bureau Diekmann & Mosebach.



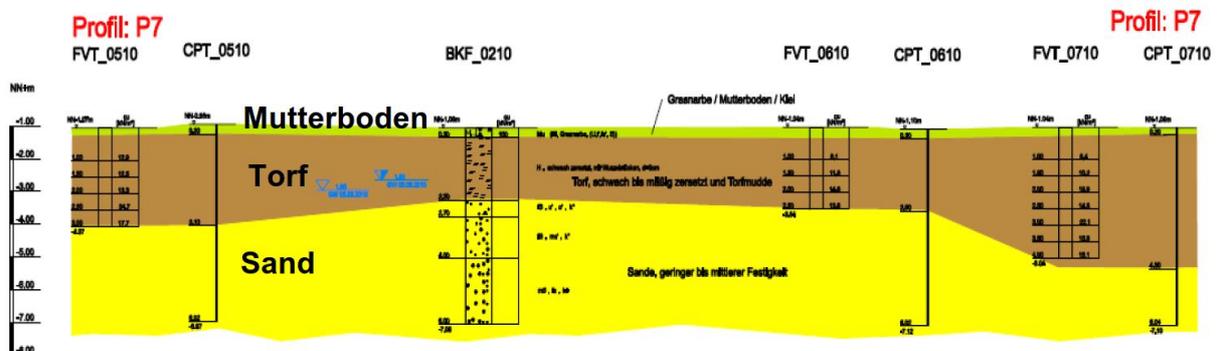
- Furthermore, ecological compensation areas have to be located outside the landfill areas.
- Water-related research for the affluent waters and ground waters (Bureau de Vries).



Dredging volumes and costs for the lower Ems (Meyer, 2018).

### Approach

The start of the project was in 2006, SW of Ihrhove when in total circa 30 ha were surrounded with a 4 km long dam which should retain the sludge. This is less trivial than it might look at first sight. The subsurface sediments on which the mud is deposited consist of a thick peat layer which is not very strong (see Figure cross-section). After establishment of the sedimentary built-up of the area, dikes would be built on the weak subsurface in such a manner that they are able to withstand the filling of the basins behind them.



Representative cross section of the area (F.P. Eißfeldt, 2011).

The layer deposited is some 2 m thick. The weight of the mud should not be too much as it compacts the underlying peats and will lead to subsidence. After 3 years of ripening only a 1m thick layer will remain. After the ripening, a period of 2 years is needed to cultivate the soil. From the start of the landfill works it takes 7 years before farming is possible again.

### Results

It turned out that the drainage of the newly established fields is not enough, leading to negative changes in plant species composition, slower nutrient release in spring and slower soil-ripening processes. The landowners press currently for subsurface drainage pipes.

### Lessons learned

As the dredging volumes of mud are large and the costs for dumping in the Ems estuary are high, landfill forms an appealing alternative. As a result, the landfill sites are filled up quickly and the need to find alternative landfill sites will remain high.

After landfill, the drainage of the land is problematic. Better development and measures are needed.

### Stakeholder processes

The Landkreis Leer is the overseer of the Wasser- und Bodenverband which was established in 2005. The organization consists of landowners and is the municipality of Westoverledingen. The Verband concentrates on the acceptance of mud of the Ems to improve the soil quality in Ihrhover/Großwolder Hammrich area. To that end several land owners and the Wasser- und Schifffahrtsamt Emden (WSA), have developed an appealing plan. After a considerable assessment of the applicability the plan was carried out in 2006. The Wasser- und Bodenverband also aims at a land consolidation process (Flurbereinigungsverfahren; ruilverkaveling) under the guidance the authority of Geoinformation, Landentwicklung und Liegenschaften (GLL, ehemals Amt für Agrarstruktur) Aurich also to help with the requirements, such as for example, to optimize the identification of compensation areas as required by Nature conservation laws. The intensive cooperation of the above-mentioned organizations made the project feasible.

### Discussion points

At the moment there seems to be a virtually unlimited supply of mud dredged from the estuary to be used for landfill. However, there might be some potential problems which might pose limits to the deposition of mud:

- 1) as shown by Vos (2015) for peats below the Dollard polders mud deposition puts a weight on the peats which may lead to considerable compaction. The question is therefore how thick can a mud layer become before it exerts too much pressure on the underlying peats.
- 2) a comparable problem might be the weakness of the peat. Is it possible that the clay might sink into the peat, thus leading to an irregular surface?
- 3) With an average total of some 1.8 million m<sup>3</sup> the annual deposition on land and near the waterway is considerable and comparable to the practices before the 1990-ies. Historical studies learn that the amount of mud annually available to the Ems is some 3-4 million m<sup>3</sup>. This seems to be an upper limit for the Ems estuary and river at large. The question is: are there limits to storage of mud dredged from the lower Ems river because the Ems estuary also needs a certain amount of mud?
- 4) The strong sedimentation of mud in the Ems tidal river makes dredging unavoidable. The dredging sludge is fresh to slightly brackish. At the same time, there is a need for improvement of the agricultural quality of the land and sustainable water management. This is reached via heightening in combination with reparcelling of the area and re-structuring water management in these new high lying lands. Given the above discussion points the question is whether the approach of massive and thick landfills is the right approach or that mud should be "smeared out" over a larger area, as envisaged in the (temporary) large-scale managed realignment plans, so that agriculture can diversify, peat subsidence will not be a risk and on the long run the area can grow with sea-level rise.

### Literature

De Boer R., 2006. Wasser- und Schifffahrtsverwaltung des Bundes, Wasser- und Schifffahrtsamt Emden. Presseinformation Nr. 6/06 Erstmalige Schlickeinspülung im Großwoldener und Ihrhover Hammrich.

Meyer H., 2016. Schlickproblematik an der Ems Erfahrungsaustausch zur Verarbeitung u. Verwertung von Schlick, powerpoint on Workshop 22.11.2016.

Meyer H., 2018. Landseitige Unterbringung von Baggergut der Unterems - „Überspülung, Entwässerung und Rekultivierung landwirtschaftlicher Grünlandflächen mit Feinsedimenten (Schlick)“ powerpoint Hamburg.

Planungsbüro Diekmann & Mosebach NY: Landkreis Leer Einfacher Bebauungsplan Nr. G 13; Überschlückungsgebiet V, Großwolde – Ihrhove; Begründung inklusive Anhang: Belange von Natur und Landschaft (Teil I) und Umweltbericht (Teil II)