Dredged material management in the Elbe River and the Port of Hamburg - How it evolved in time

Dr. Henrich Röper
Agenda

01 Port of Hamburg & Dredging

02 First Dredged Material Management Concept

03 Beneficial Use

04 Working with Stakeholders
01

Port of Hamburg & Dredging
Dregding for the Port of Hamburg – A public mandate since 1548
Port of Hamburg – A brief history of dredging

First steam dredger in 1877

Land disposal in the 1960ies
Public worries and resulting protests in the 1980ies

→ Development of the first dredged material management concept
First Dredged Material Management Concept
Why do we need Separation into silt and sand fractions?

Cadmium

Copper

Lead
METHA – Treatment Plant for Dredged Material
Process – Sorting and Separation

Dredged Material → Cutter with pre-screening → Hydro cyclones (63 µm stage) → Upstream current classifier → Sand Dewatering screen → Spirals → Vacuum dewatering belt

Stock basin → Rotary screen (10 mm) → Hydro-cyclones (20 µm stage) → Fine sand

Coarse fraction → Sand
Main Components of the METHA Plant - Sorting and Separation

- Rotary Screen (10 mm)
- Hydrocyclones (20 µm)
- Hydrocyclones (63 µm)
- Upstream current classifier
- Spirals
Process – Dewatering

- Thickener
- Agitated stock tank
- Dewatering 1st stage Screen belt press
- Waste water Treatment
- Dewatering 2nd stage High pressure belt press
- Membrane chamber filter press
- Silt
Main Components of the METHA Plant - Dewatering

Membrane chamber filter press

Filter belt press

High pressure belt press
Disposal on Land

Francop 2014

Feldhöfe 2007
Unterhaltungsbaggermengen Tideelbe [Mio. m³]

WSA HH und Cux
HPA
Sediment Management Concept

**Sediment Management**

**Tidal Elbe**

**Improve Quality of Sediments**

- **Remediation**
  - *Identify and remediate at the source*
  - Effect: medium term

**Reduce Sediment Quantities**

- **Maintenance**
  - *Relocation strategy*
  - Effect: short term

- **River Engineering**
  - *Create more tidal volume and engineering measures*
  - Effect: medium term
Dredged Material Management

NORTH SEA DISPOSAL

RELOCATION HAMBURG
Dredged Material Management

- NORTH SEA DISPOSAL
- RELOCATION HAMBURG

BENEFICIAL USE
- Sand und Dichtungsbaustoff
- Keramische Produkte

DISPOSAL
- Francop
- Feldhöhe

TREATMENT
- METHA
- Entwässerungsfelder

CEDA - Central Dredging Association
Beneficial Use
Beneficial Use Today

(1) METHA-Material (silt)
   - Backfilling of harbour basins
   - Pellets: METHA-Material
     - since 2004 available
     - up to 10,000 m³ / Year
   - Dewatered METHA material is used as a mineral liner on landfills. Certified product that has the same physical characteristics as clay.

(2) METHA-Sand
   - Drainagelayer for gas and leachate water on landfills
Protection against erosion

- Direct use for construction purposes
- Non-contaminated sand only
- Quantities depend on the demand only – it’s very difficult to predict available capacities

Use of sand in Wittenberge
Beneficial use - Backfilling

Harbour Basin

Sand  Silt  Vertical Drainage  Mixed Sand and Silt
Dyke Construction

- Clay usually used in dyke construction → a natural resource
- Beneficial alternatives to land disposal are wanted
- METHA-Material is a product with constant properties → Can it be used in dyke construction?

Research and Development
1. Soil properties?
2. Hydraulic behaviour?
3. Contamination emission?
Testfeld 2
Klei über METHA-Material

Klei
1.37 g/cm³
$k_f = 6.3 \times 10^{-10}$ m/s

METHA-Material
0.96 g/cm³
$k_f = 1.7 \times 10^{-9}$ m/s
Research results

- METHA-Material tend to show fractures at a later stage, but forms larger cracks.
- Experience from construction with clay can not be transferred directly to METHA-Material.
  - What does it mean for the stability against collapse?
- Further improvements aiming at reduction of the crack generation are being investigated.
Technical Products

Brick production: METHA material as a substitute

- 30,000 t have been used in a professional production line, high effort, technically possible, not economic

Pellet production: Construction material, e.g. road construction
- METHA material
- Bulk material
- High energy demand in production
- No market
Natura 2000 PA, national PA

NP Waddensea
Working with Stakeholders
Implementing a new strategy

• Common economic and ecologically handling of sediments in the Elbe
• Involvement of stakeholders to bring in all relevant aspects not covered by the concept (yet)
• “Consultation” of environmental NGOs, business representatives, Ministries, communities, fishery and tourism organizations etc.

Sound concept for the future
Forum Tidal Elbe

Develop recommendation for the political-administrative level – consisting of a well documented report determining consesus and dissensus areas.

The overall character of the forum is a consultation. It is not a deciding body.
Keynote

**Strategic keynotes** at the beginning of the process

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Stakeholder involved

HPA/WSV
- Hamburg Port Authority
  - Claudia Flecken
  - Wolfgang Hurthenne
- Generaldirektion Wasserstraßen und Schifffahrt

Moderation IFOK
- Ralf Eggert

Umweltverbände
- NABU
- WWF
- BUND
- AG Naturschutz HH
- Rettet die Elbe e.V.

Landkreise/Kommunen
- Landkreis Stade
- Landkreis Cuxhaven
- Kreis Dithmarschen
- Kreis Nordfriesland
- Kreis Steinburg
- Städtetag S-H (Brunsbüttel)
- Gemeindetag S-H (Moorrege)
- Städtetag NI (Cuxhaven/Otterndorf)
- Städte- und Gemeindebund NI (Gemeinde Jork)

Initiativen
- Stiftung Lebensraum Elbe
- Maritime Landschaft Unterelbe

Wirtschaft
- IHK Nord
  - Unternehmensverband Hafen Hamburg e.V.
  - ver.di
  - Elbe Seaports

Boden/Landwirtschaft
- Wasser- und Bodenverband S-H
  - Wasserbandstag NDS
  - Wasserbandstag HH
  - Bauernverband SH

Ministerien
- S-H - MELUR
- NI - MUEK
- HH - BSU
- HH – BWVI

Segler/Sportboote
- Gruppe Nedderelv e.V.
- HH Segler-Verband
- Hamburger Motorboot Verband e.V.

Fischer
- IG Elbe-Weser-Fischer
- FV Friedrichskoog
- Dt. Fischereiverband
- Fischereischutzzversand S-H Nordsee

Angler
- Angelsport-Verband/ Landessportfischer
Our common objective...

- **Stabilising the sediment budget, reduction of dredging necessity**
  - River engineering measures
    - long-term effect
  - Optimized sediment management
    - short-term effect
  - Remediation
    - medium- to long-term effect

- Improvement of sediment quality
...and the following discussions

18 meetings a total of 45 presentations showing 39 different options and measures (sediment management / engineering) were discussed and assessed.
What worked well?

- Establishment common understanding
- Technical statements
- Room for discussion
- Need for further elaboration
- Recommendation for future work
How did the process influence the concept?

Sediment management
Tidal Elbe

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<th>Reduce sediment quantities</th>
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<td>New strategy – more flexible relocation based on sediment quality</td>
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<td>River Engineering</td>
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<td>Estuary Partnership – a new approach participation</td>
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Remediation Project ELSA

- Initiated by Hamburg for upstream remediation
- Financial contribution of measures in the catchment area through „ELSA“ (11 Mio. €)
- Identification of potential measures → Studies by consultants, local authorities

- Quality objectives: comply with environmental quality standards, allow relevant types of use, environmental safe relocation of dredged material
And the way ahead...

The group recommends the **foundation** of an **estuary partnership** in collaboration with the „Länder“.