The ELBE River - a lifeline for Northern Germany

The sense of maintenance dredging on the ELBE - and the future requirements for its navigational Fairway
The ELBE River - a lifeline for Northern Germany

1. Tidal River ELBE

2. Maintenance dredging concept on the ELBE

3. Trading position of the harbour of Hamburg

4. The future deepening of the ELBE
Tidal river ELBE
Tidal river ELBE
Tidal river ELBE
Tidal river ELBE

North Sea

Cuxhaven

100 km

Hamburg
Tidal river ELBE

Administrative responsibilities
# Tidal river ELBE

Development of the fairway depth at the ELBE (related to MLW)

<table>
<thead>
<tr>
<th>Year</th>
<th>Depth (m)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1960</td>
<td>4.5</td>
</tr>
<tr>
<td>1980</td>
<td>5.0</td>
</tr>
<tr>
<td>1990</td>
<td>6.0</td>
</tr>
<tr>
<td>1914</td>
<td>9.0</td>
</tr>
<tr>
<td>1950</td>
<td>10.0</td>
</tr>
<tr>
<td>1962</td>
<td>11.0</td>
</tr>
<tr>
<td>1969</td>
<td>12.0</td>
</tr>
<tr>
<td>1978</td>
<td>13.5</td>
</tr>
<tr>
<td>1999</td>
<td>mind. 14.4</td>
</tr>
</tbody>
</table>

Fairway depth at the Elbe (related to MLW)
Tidal river ELBE
Current longitudinal profile

Mean low water level (MLW)

-15,20m -14,70m -14,40m maintained nominal depth

Cuxhaven Brunsbüttel Glückstadt Stadersand Wedel Seemannshöft

750 740 730 720 710 700 690 680 670 660 650 640 630 620
Tidal river ELBE
Morphological development 1998 - 2002
Tidal river ELBE

Morphodynamic processes - general description

- tidal pumping
- density currents (saltwater)
- meandering
- circulations in multiple channel system (ebb-flood channels)
- flooding and drying on intertidal areas
- tidal asymmetry
# The ELBE River - a lifeline for Northern Germany

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>1. Tidal River Elbe</strong></td>
<td></td>
</tr>
<tr>
<td><strong>2. Maintenance dredging concept on the ELBE</strong></td>
<td></td>
</tr>
<tr>
<td><strong>3. Trading position of the harbour of Hamburg</strong></td>
<td></td>
</tr>
<tr>
<td><strong>4. The future deepening of the ELBE</strong></td>
<td></td>
</tr>
</tbody>
</table>
Maintenance dredging concept on the ELBE

Total amount of dredging activities at the ELBE 1992 – 2006

WSA Cuxhaven
WSA Hamburg
Hamburg Port Authority

Last deepening 1999

Dredging Amount (Mm³/yr)

Years


Hamburg Port Authority
WSA Cuxhaven
WSA Hamburg

Maintenance dredging concept on the ELBE

Total amount of dredging activities at the ELBE 1992 – 2006

WSA Cuxhaven
WSA Hamburg
Hamburg Port Authority

Last deepening 1999

Dredging Amount (Mm³/yr)

Years


Hamburg Port Authority
WSA Cuxhaven
WSA Hamburg

Maintenance dredging concept on the ELBE

Total amount of dredging activities at the ELBE 1992 – 2006

WSA Cuxhaven
WSA Hamburg
Hamburg Port Authority

Last deepening 1999

Dredging Amount (Mm³/yr)

Years


Hamburg Port Authority
WSA Cuxhaven
WSA Hamburg

Maintenance dredging concept on the ELBE

Total amount of dredging activities at the ELBE 1992 – 2006

WSA Cuxhaven
WSA Hamburg
Hamburg Port Authority

Last deepening 1999

Dredging Amount (Mm³/yr)

Years


Hamburg Port Authority
WSA Cuxhaven
WSA Hamburg
Maintenance dredging concept on the ELBE

Annual and seasonal fluctuations of dredging volumes

Dredged quantities 2001 - 2006

- 2001
- 2002
- 2003
- 2004
- 2005
- 2006
- Average 2001 - 2006
Maintenance dredging concept on the ELBE

Average monthly dredged quantities 2001 - 2006
Maintenance dredging concept on the ELBE

Hopper dredgers on the ELBE during maintenance work volumes

TSHD „Atlantico Due“ (4.200 m³) and “Josef Möbius” (5.500 m³)

TSHD „Mellina“ (3.500 m³) and “Marieke” (5.600 m³)
Maintenance dredging concept on the ELBE

- Average dredged quantities '01-'06
- 5300 m³ TSHD (authority)
- 3.000 m³ - 4.000 m³ TSHD (contractor)
- > 4.000 m³ TSHD (contractor)

Average dredged quantities '01-'06:
- May: 455.000 m³
- Jun: 458.000 m³
- Jul: 460.000 m³
- Aug: 469.000 m³
- Sep: 479.000 m³
- Oct: 456.000 m³
- Nov: 470.000 m³
- Dec: 455.000 m³

Maintenance dredging concept on the ELBE

- Jan-Feb: 5300 m³ TSHD (authority)
- Mar-Apr: 3000 m³ - 4000 m³ TSHD (contractor)
- May-Aug: > 4000 m³ TSHD (contractor)

CEDA Dredging Days November, 7th 2007

Nikša Marušić
WSA Cuxhaven
Maintenance dredging concept on the ELBE

Pilot tests with water injection dredgers in order to optimize hopper planning

Hopperdredger and Jetplough on the ELBE
Maintenance dredging concept on the ELBE

New relocation areas under investigation on the Elbe

General view of the tidal Elbe showing the 3 observation areas
Maintenance dredging concept on the ELBE

Geographical representation of tidal currents in the ELBE

Blue = Ebb stream dominance  Red = flood stream dominance
# The ELBE River - a lifeline for Northern Germany

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Tidal River Elbe</td>
</tr>
<tr>
<td>2.</td>
<td>Maintenance dredging concept on the ELBE</td>
</tr>
<tr>
<td>3.</td>
<td>Trading position of the harbour of Hamburg</td>
</tr>
<tr>
<td>4.</td>
<td>The future deepening of the ELBE</td>
</tr>
</tbody>
</table>
Trading position of the harbour of Hamburg

Port of Hamburg - Germany's logistic hub

From 100 Containers in the Port of Hamburg are:

- Container from/to west. Europe (70% per rail) - 30
- Container from/to east. Europe (90% per feeder) - 30
- Container from/to Port of Hamburg (packing/unpacking) - 10
- 40% local rate

Trading position of the harbour of Hamburg
Trading position of the harbour of Hamburg

Real and forecast container handling volumes in Hamburg

Istverlauf


Planco1998 Potential

ISL 2003 Potenzial

UVHH 2000

OBC 2002 basis

ISL 2003 Basis

UVHH 2000

ISL 11.2004 Dynamisierung

Nikša Marušić

WSA Cuxhaven

CEDA Dredging Days November, 7th 2007
Trading position of the harbour of Hamburg
Hamburg–Antwerpen Range (Container handling)

1990 bis 2005 (TEU)

Groth in Hamburg:
Before 1999: + 5 % / a
After 1999: + 10 % / a

Quelle: HHM, HPA
Rotterdam
Hamburg
Antwerpen
Brem. Häfen

Before 1999: + 5 % / a
After 1999: + 10 % / a
Trading position of the harbour of Hamburg

Existing container vessels (split by draft)

Number of vessels 2001-2006, draft in saltwater

- **+ 73 %**
  - 2000: 156 vessels
  - 2006: 270 vessels

- **+ 33 %**
  - 13,0 bis <13,5: 93 vessels
  - 2000: 124 vessels

- **+ 139 %**
  - 13,5 bis <14,0: 64 vessels
  - 2000: 153 vessels

- **+ 205 %**
  - 14,0 bis <14,5: 77 vessels
  - 2000: 235 vessels

*Quelle: HPA*

**Nikša Marušić**

WSA Cuxhaven
Trading position of the harbour of Hamburg
Port of Hamburg - employer of the region

Jobs in Hamburg
133 000

Jobs around Hamburg
23 000

Jobs in the rest of Germany
101 000

Residence outside of Hamburg

Total: 257,000

Quelle: Planco, 2005
The ELBE River - a lifeline for Northern Germany

<p>| | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>1.</td>
<td>Tidal River Elbe</td>
</tr>
<tr>
<td>2.</td>
<td>Maintenance dredging concept on the Elbe</td>
</tr>
<tr>
<td>3.</td>
<td>Trading position of the harbour of Hamburg</td>
</tr>
<tr>
<td>4.</td>
<td>The future deepening of the Elbe</td>
</tr>
</tbody>
</table>
The future deepening of the ELBE

Development of vessel sizes

Baujahr ab 1980 (3. und 4. Generation)
Länge: bis 295,0 m  Breite: bis 32,2 m  Kapazität 3 000 bis 5 000 TEU
Tiefgang: bis 13,5 m*

Baujahr ab 1992
Länge: bis 318 m  Breite: bis 42 m  Kapazität rd. 6 000 TEU
Tiefgang: 13,5 bis 14,5 m*

Baujahr ab 1997
Länge: bis 350 m  Breite: bis 46 m  Kapazität rd. 9 000 TEU
Tiefgang: bis 14,5 m*

In Fahrt / in Bau
Länge: bis 400 m  Breite: bis 56 m  Kapazität über 12 000 TEU
Tiefgang: ca. 15,5 m*

* Bezogen auf Salzwasser.
The future deepening of the ELBE

Development goal (draft in saltwater)

Selected Design Vessel:
Container vessel Post-Panmax-Category:

B = 46 m  L = 350 m  T = 14,50 m

14,50 m depending of the tide (2 hours start window from HH)

13,50 m independently of the tide
The future deepening of the ELBE

Cross section of the next channel modification
# The future deepening of the ELBE

## Time frame (planning)

Application from the free Hanseatic city of Hamburg: 27.02.2002

<table>
<thead>
<tr>
<th></th>
<th>2004</th>
<th>2005</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>I</td>
<td>II</td>
<td>III</td>
<td>IV</td>
<td>I</td>
<td>II</td>
<td>III</td>
</tr>
<tr>
<td>Completion of the feasibility study</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Inclusion in the German Transport Network Plan (cabinet decision)</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technical Planning</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Environmental impact assessment</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Application for the Environmental and construction permit</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Public exhibition of the planning documents</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Final date for objections</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Discussion period</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Finalization of plan of action</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Licensing process</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deepening can start</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tender</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Start of Dredging Works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Completion of the deepening works</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Total number of objections: 5,500 !!!
The future deepening of the ELBE

Volume of dredged material:
38.5 Mio m³

32.7* Sand

Wasser- und Schifffahrtsverwaltung des Bundes

2.4 Sand

Freie und Hansestadt Hamburg

3.4 glacial till boulder clay stony material

* inkl. Warteplatz Brunsbüttel
The future deepening of the ELBE

The different relocation possibilities in the hydraulic engineering concept

- Underwater relocation area
- Beach replenishment
- Mud containment areas
- Relocation site
The future deepening of the ELBE

Hydraulic engineering concept: Overview of individual measures

Nikša Marušić
WSA Cuxhaven

CEDA Dredging Days November, 7th 2007
The future deepening of the ELBE

Reduction of the local cross-section by Underwater relocation areas

Medemrinne: 12.2 Mio m³

Neufelder Sand: 10 Mio. m³
The future deepening of the ELBE
Reduction of the local cross-section by Underwater relocation areas

Current situation
Future situation
The future deepening of the ELBE

Reduction of the local cross-section by Underwater relocation areas

Current situation

Future situation
The future deepening of the ELBE

Construction of Underwater relocation areas

Dredged material

Embankment

Geotextile containers
Thank you for your attention !!!