Prologue: Inland-Seaport saves CO_2

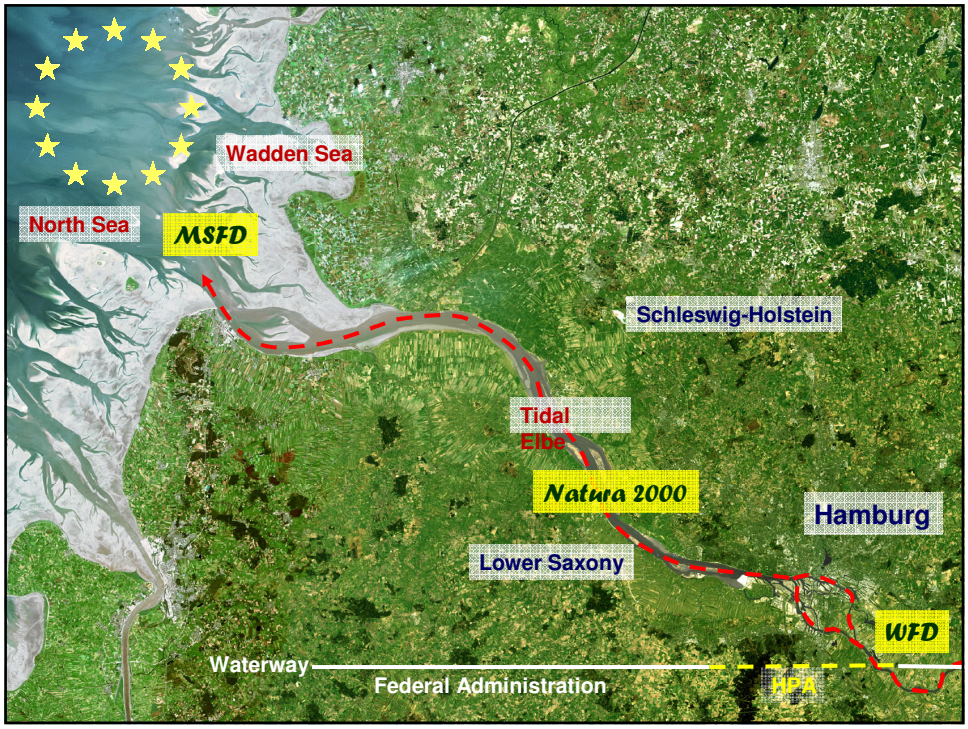
Hamburg Port Authority

	kg/TEU/km
Containership = 4800 TEU	0,113
Barge/Feeder = 400 TEU	0,477
Train = 80 TEU	0,673
Truck = 2 TEU	2,296

the system needs to be maintained

→ 130 km inland:
679 t CO_2 saved/Containervessel *!

* compared to trucks



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Challenges

- Increasing sediment transport, requiring more maintenance dredging and improved sediment management

Challenges

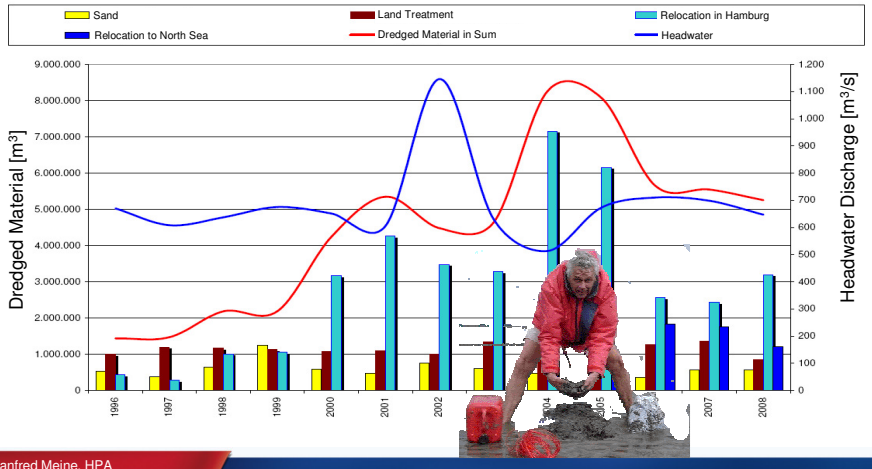
- Endangered estuarine ecosystem functions: flood regulation, coastal protection, water purification, plant and animal habitats

Challenges

- Increasingly challenging legal and global economic framework:
  - EU Directives (Birds and Habitat, Water Framework, Marine Strategy)
  - Economic prosperity demands port development and fairway provision
- Climate change
  - Sea level rise → changed hydraulics and hydromorphology
  - Storm surge protection

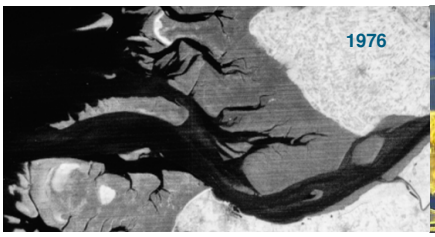
Fact: Increase in dredging amounts

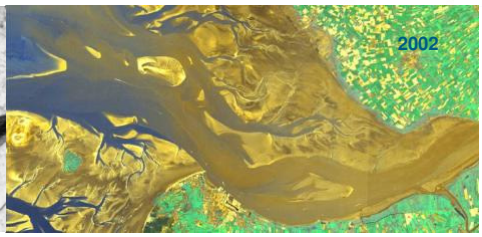
Development of Dredged Material within
the Port and the River Elbe in Hamburg
1996 - 2008



silting up of anabranches and shallow water areas

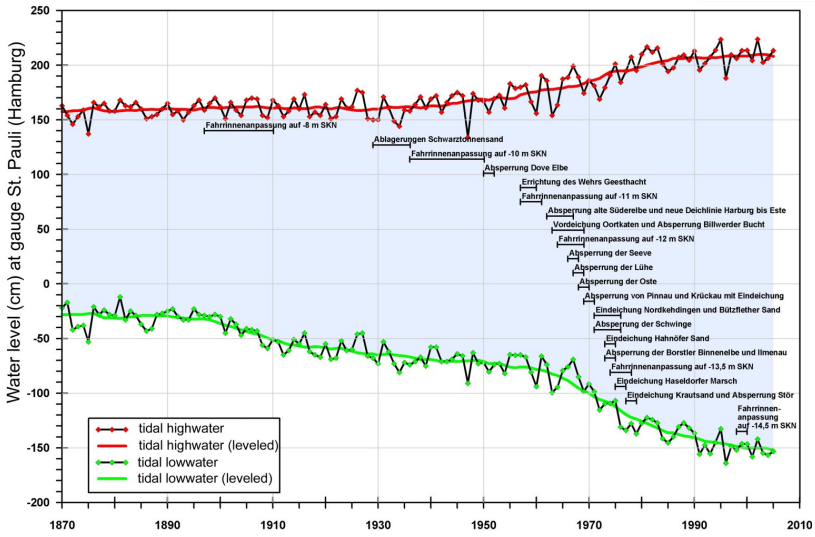
… effects caused by natural



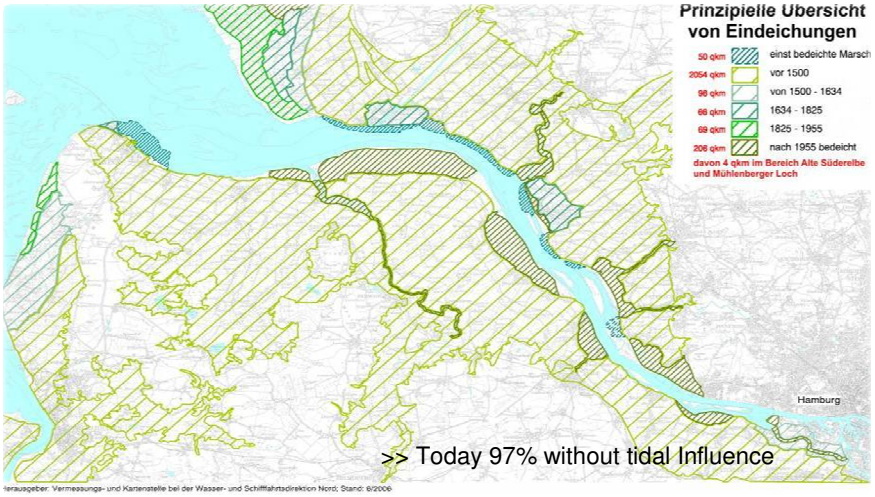


…and anthropogenic changes

Changing Estuary: Tidal Range and Measures

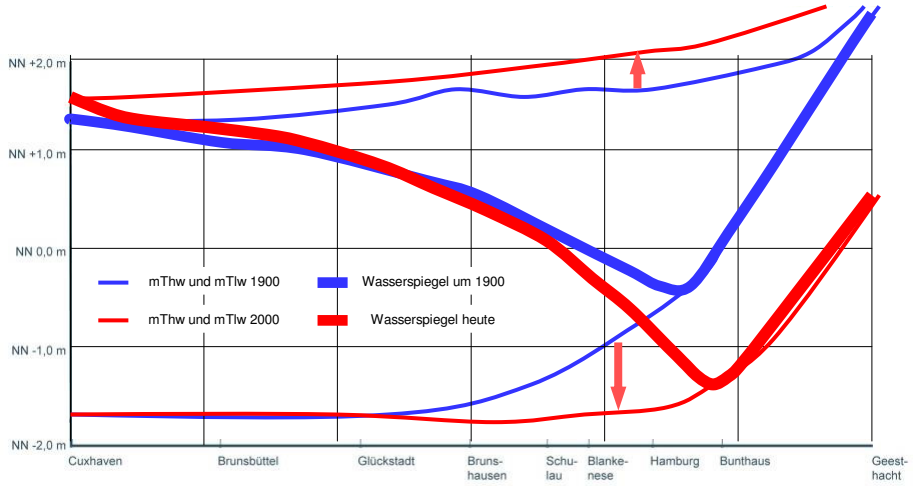


Changing Estuary: Land Reclamation and Dykes



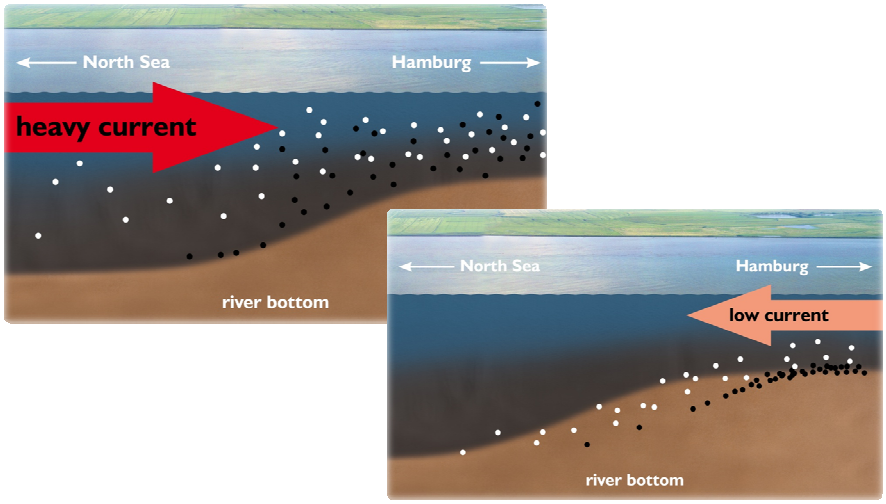
Changing Estuary: Water Level 1900 - 2000

Hamburg Port Authority

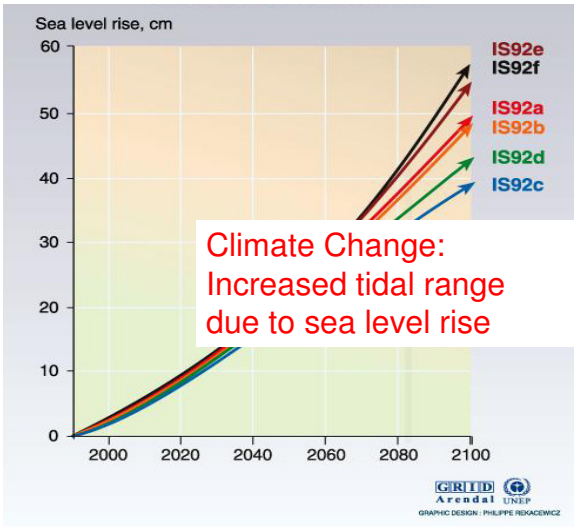


Changing Estuary: Tidal Pumping

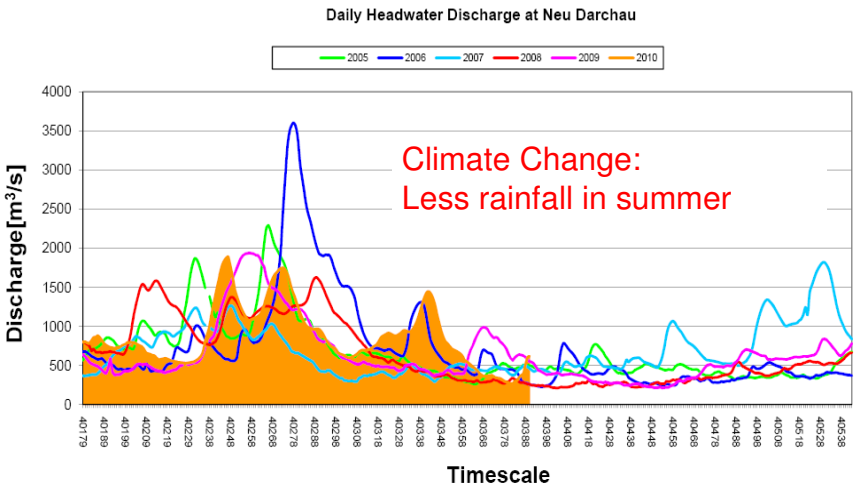
Hamburg Port Authority



Changing Estuary: Sea Level Rise Scenarios



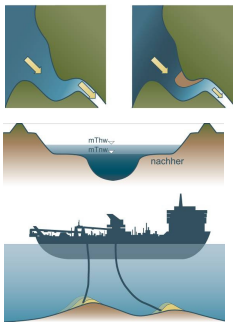
Changing Estuary: Headwater Discharge



Historical Contamination: Sediment Trap Port of Hamburg

Fixing the Estuary: The Tidal Elbe Concept

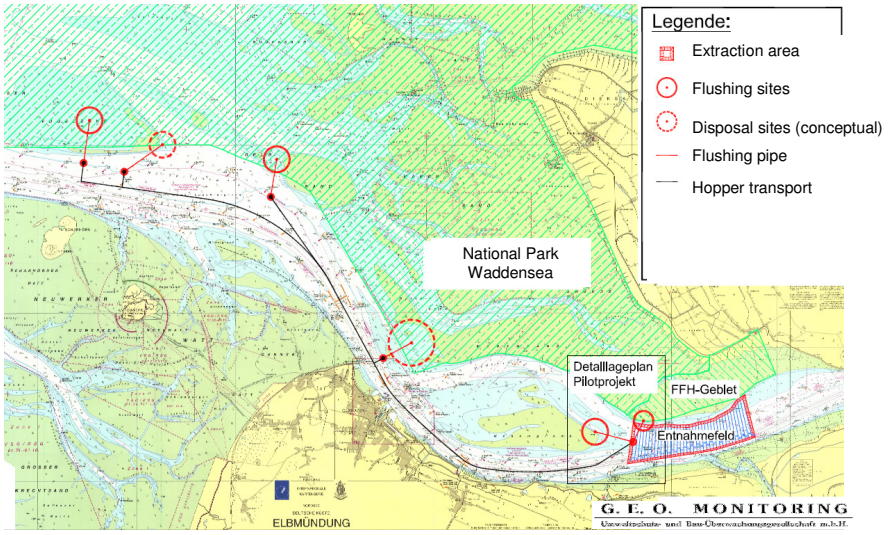
Three Cornerstones for a Future Action Plan:



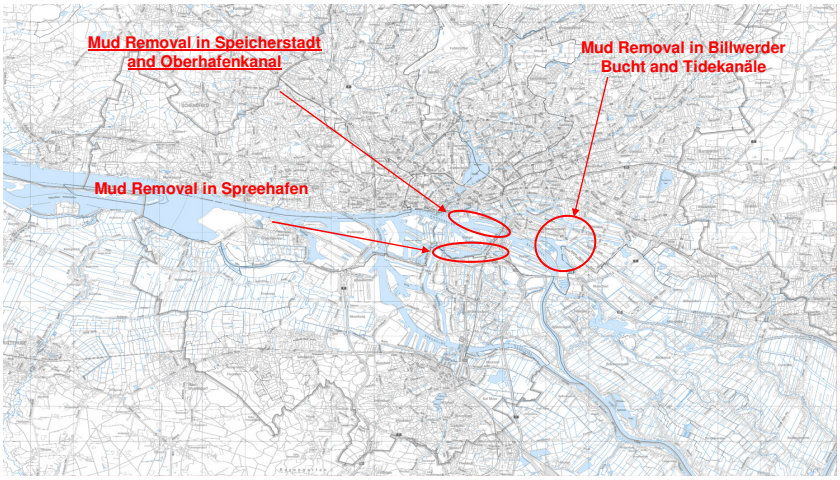
1. **Attenuation of the Tidal Energy through River Engineering in the Mouth of the Estuary,**
2. **More Room for the River (Tidal Volume) in the upper Part**
3. **Optimisation of the Sediment-management considering the whole System of the Elbe**

1) Taming the Tide: Sand Islands in the Mouth

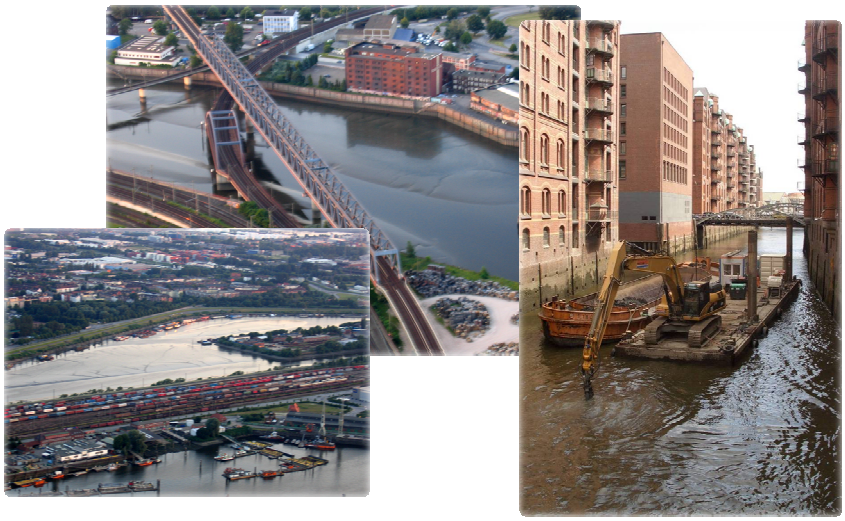
1) Taming the Tide: Feasibility Study – “Feeding” Sand Islands



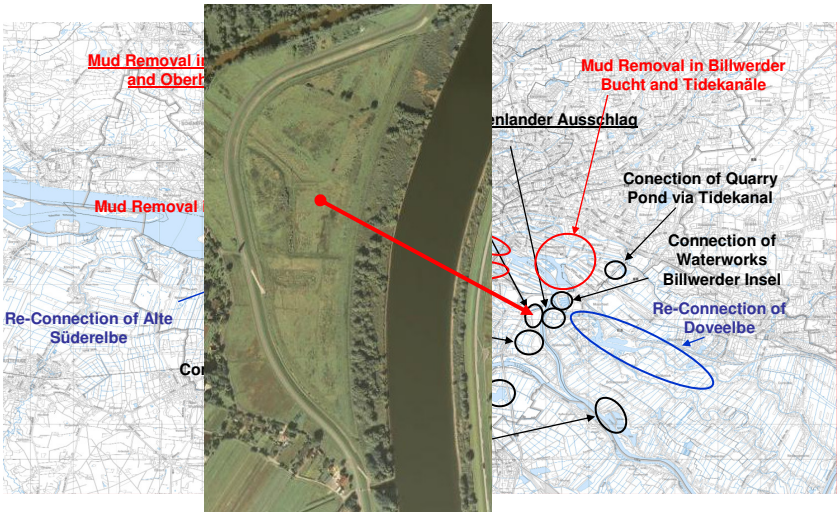
2) Tidal Volume: Scenarios for Hamburg



2) Tidal Volume: Cleaning up the Port



2) Tidal Volume: Scenarios for Hamburg



2) Tidal Volume: Pilot Project Spadenlander Busch

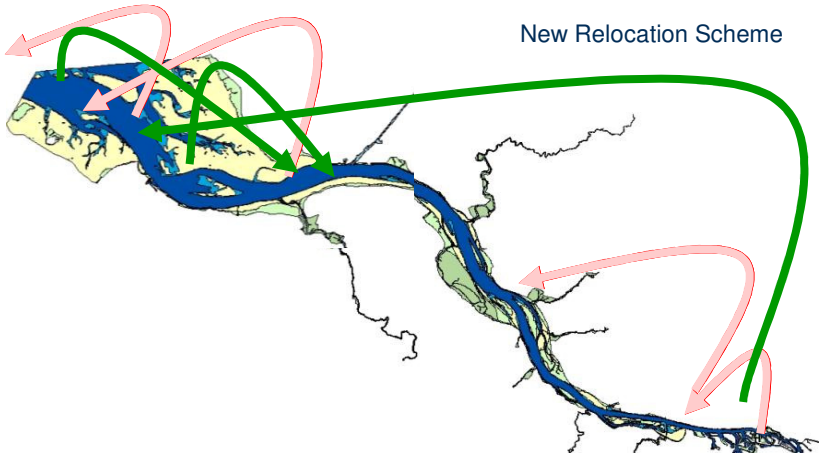
2) Tidal Volume: Pilot Project Spadenlander Busch

2) Tidal Volume: creating Tidal Landscapes

3) Sediment Management

Adapted Relocation Strategy

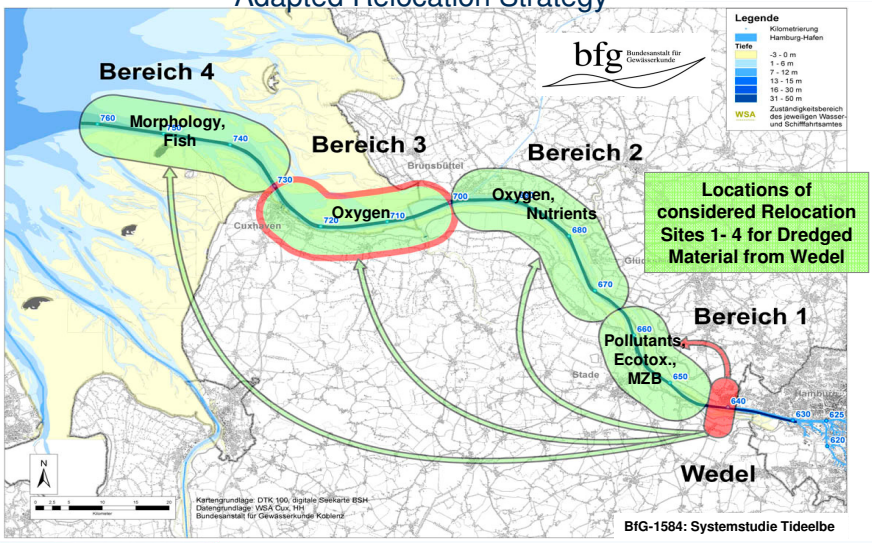
Hamburg Port Authority



3) Sediment Management

Adapted Relocation Strategy

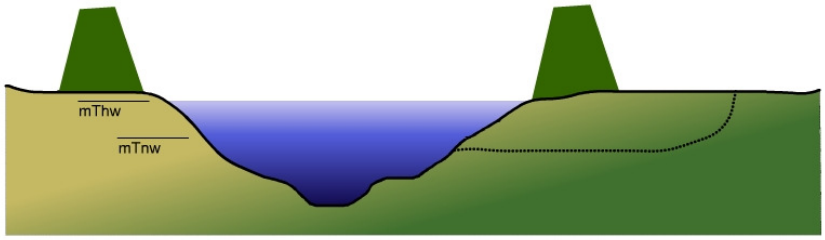
Hamburg Port Authority



Option for tidal wetlands: Storm surge relief polder

Hamburg Port Authority

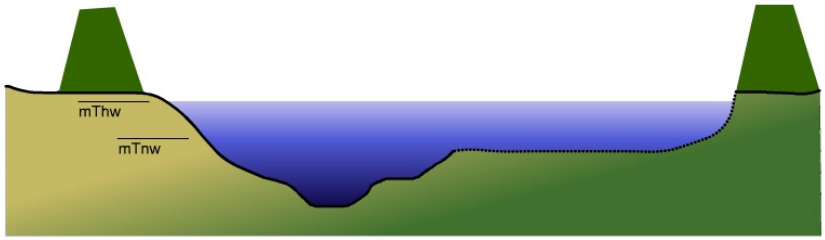
today: potential shallow water area



Option for tidal wetlands: Storm surge relief polders

Hamburg Port Authority

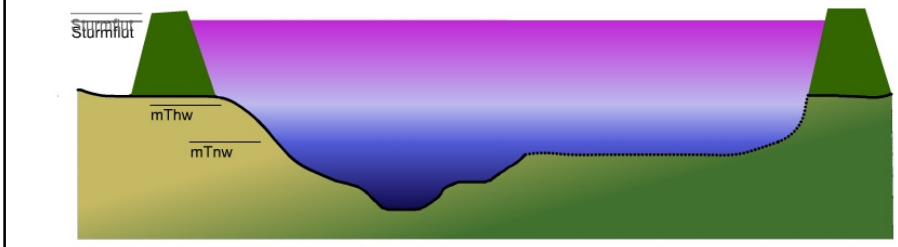
Future: tidal wetlands realised at mean high water



Option for tidal wetlands: Storm surge relief polders

Hamburg Port Authority

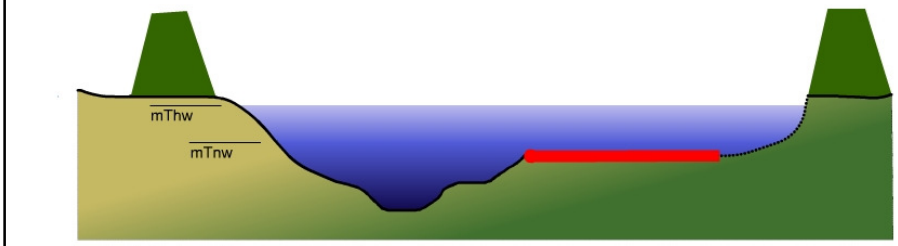
Future: tidal wetlands at severe storm surge



Option for tidal wetlands: Storm surge relief polders

Hamburg Port Authority

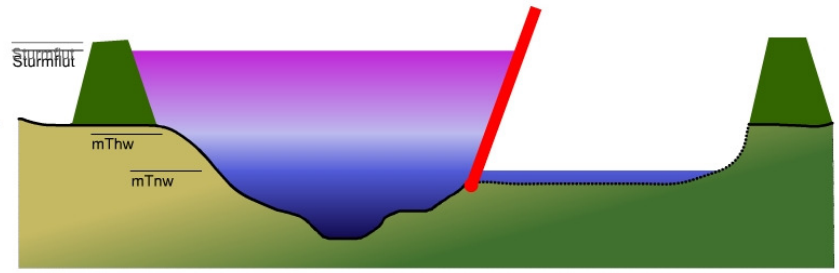
Future: tidal wetlands with polder hatch at mean high water



Option for tidal wetlands: Storm surge relief polders

Hamburg Port Authority

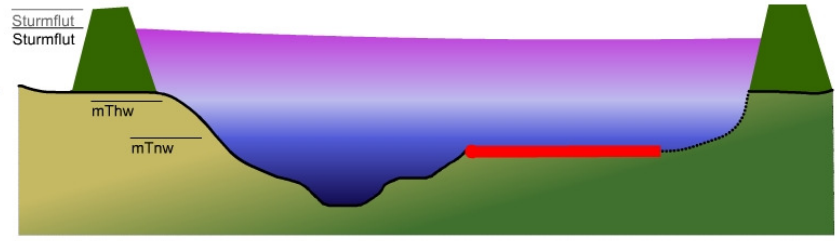
Future: tidal wetlands with polder hatch closed before crest of storm surge is reached



Option for tidal wetlands: Storm surge relief polders

Hamburg Port Authority

Future: tidal wetlands with lowered polderk hatch and reduced storm surge



Sea Level Rise: Future Scenarios for the Mouth

Hamburg Port Authority

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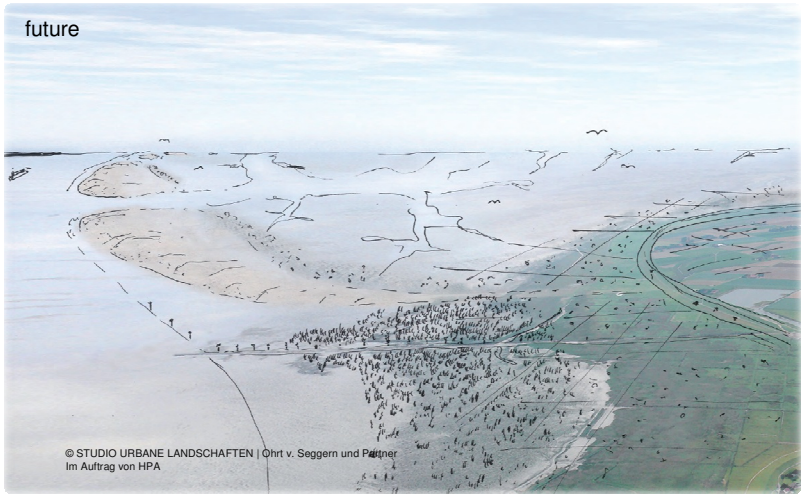
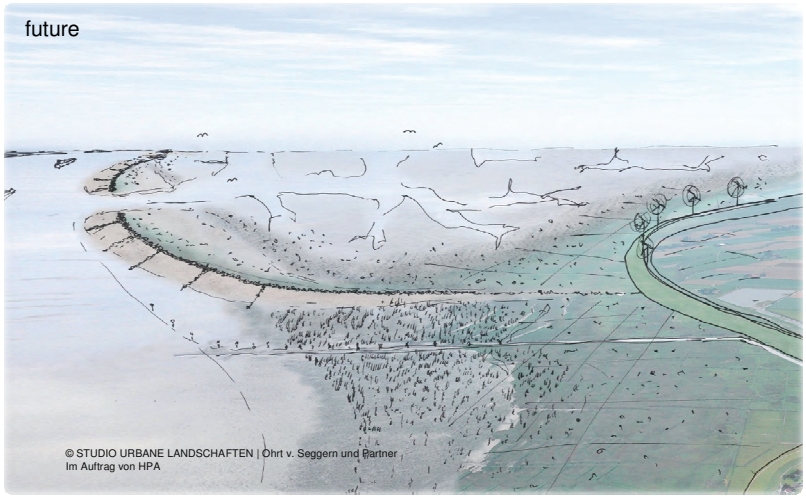
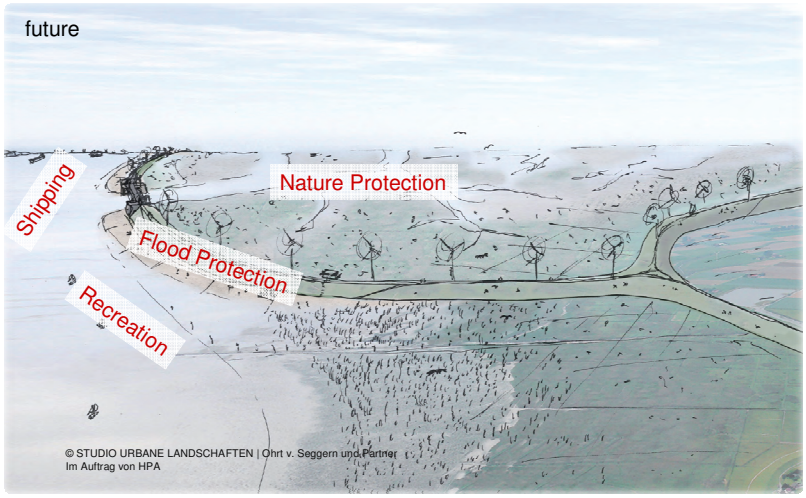
Sea Level Rise: Future Scenarios for the Mouth



Sea Level Rise: Future Scenarios for the Mouth



Sea Level Rise: Future Scenarios for the Mouth



Working Together: Integrated Management Plan

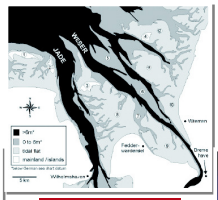
Working Together: Expert Exchange TIDE

TIDE
Tidal River Development

Four Estuaries...

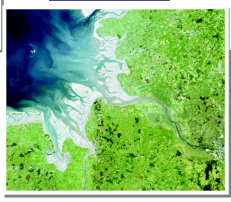
... One Project

Scheldt | NL,BE



Weser | DE

Elbe | DE



Humber | GB

TIDE Partners

Scheldt | NL,BE

Rijkswaterstaat
Flemish Authorities, Department of Mobility and Public Works
Antwerp Port Authority
University of Antwerp

Elbe | DE

Hamburg Port Authority (Lead Partner)
Lower Saxony Water Management, Coastal Defence and Nature Conservation Agency

Weser | DE

Lower Saxony Water Management, Coastal Defence and Nature Conservation Agency
Free Hanseatic City of Bremen
University of Bremen

Humber | GB

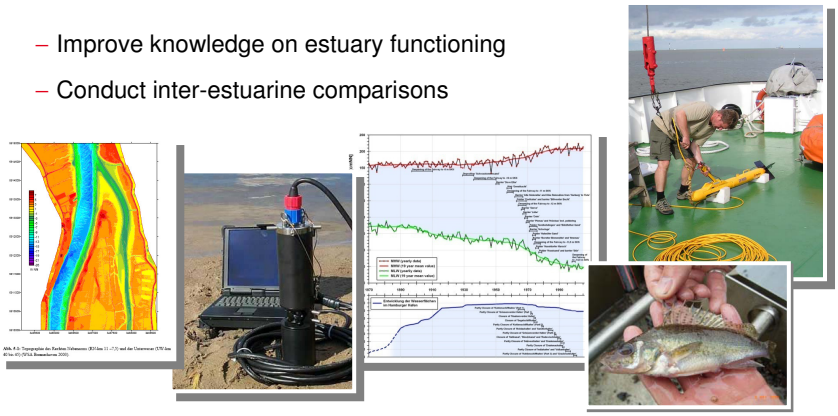
Institute of Estuarine & Coastal Studies, Hull
Environment Agency

TIDE Approach

- Account for ecological, economic and societal needs
- Interlink multiple processes, efforts & investments already taking place
- Use knowledge and solutions generated in previous projects (HARBASINS, SedNet, New!Delta)
- Link to existing management plans and EU Directives

TIDE Approach

- **SCIENCE:**
  - Improve knowledge on estuary functioning
  - Conduct inter-estuarine comparisons



TIDE Activities

- **GOVERNANCE:**
  - Improve effectiveness of policy mechanisms and instruments
  - Bring together diverse stakeholders
  - Realise integrated management and governance

TIDE Activities

- **MEASURES:**
  - Compare, assess and plan mitigation measures
  - Develop new mitigation solutions

TIDE Activities

- **INFORMATION:**
  - Raise awareness
  - Improve understanding and acceptance of necessary changes
- **TRANSNATIONAL:**
  - Develop jointly agreed work plans and methodologies
  - Continuous exchange among partners

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