



TIDAL ELBE CONCEPT

## Kreetzand Tidal Shallow Water Area

Securing the seaward access to the port in a sustainable way

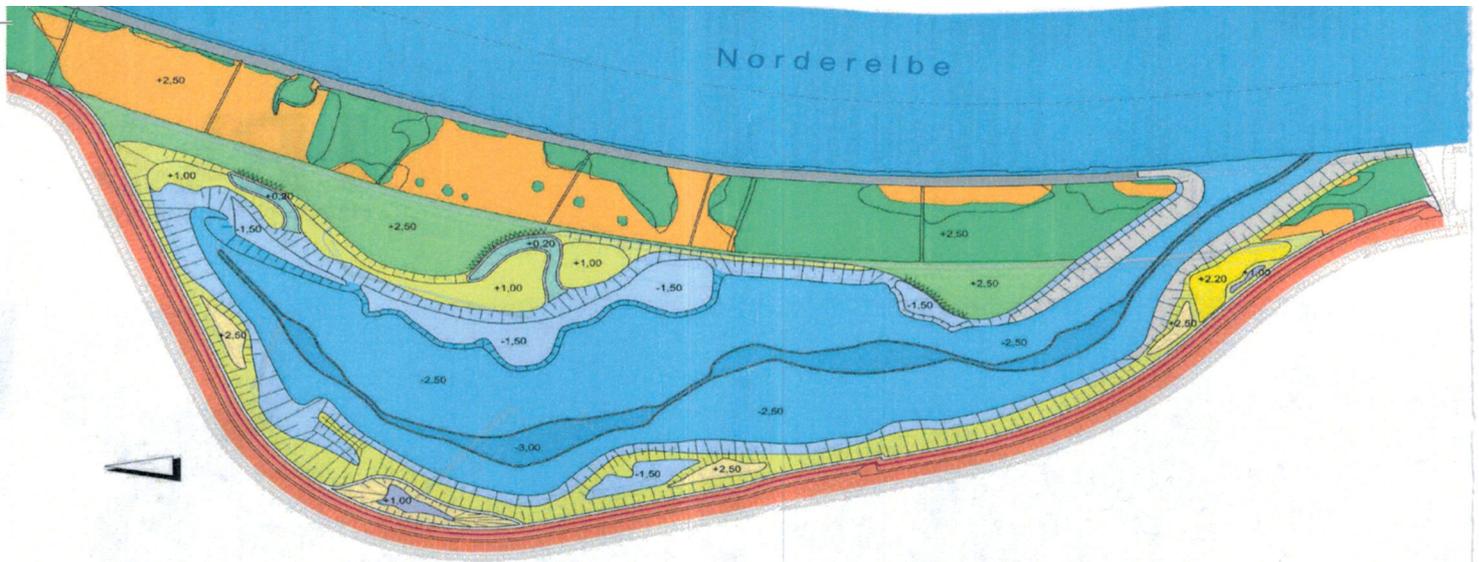


Fig. 1: Plan of design



Fig. 2: Spadenlander Busch/ Kreesand



Fig. 3: Kreesand dyke foreland before construction began



Fig. 4: Water dropwort

### The Tidal Elbe

The Tidal Elbe is the tide-influenced part of the Elbe, from the weir in Geesthacht to its mouth at the North Sea. A unique, extensively protected habitat, the Tidal Elbe is also the seaward access to the Port of Hamburg, the region's economic driver. Since dyke construction began about 1000 years ago, man has changed the Tidal Elbe significantly, so that today only about three per cent of the original Elbmarsch is periodically influenced by the tide. The expansion towards a globally significant sea waterway has additionally shaped the Tidal Elbe. Man's influence and natural developments have caused a significant change in the hydrological situation (currents, tidal range). The incoming tide is significantly stronger than the ebb tide these days, which is why sediments are increasingly transported upstream from the North Sea towards Hamburg. There, they have to be dredged to ensure that large vessels can reach the Port of Hamburg unhindered. As part of the water-depth maintenance, approximately three to six billion cubic metres of Elbe sediment are handled every year.

### Secure the seaward access

It is the goal of the Tidal Elbe concept of the Hamburg Port Authority (HPA) and the Federal Waterways and Shipping Administration to secure unrestricted access to the Port of Hamburg in the long run. The sustainable approach serves the economy and nature as well as the people in the region. In addition, the consequences of climate change are taken into consideration.

### This is based on a three-pillar approach:

1. Measures in the entrance area to dampen the tidal energy.
2. Creation of tidal shallow water areas between Glückstadt and Geesthacht.

3. Optimisation of sediment management by taking the whole Elbe system into account.

Thus the vital artery of the Hamburg metropolitan region can be developed in a way that sustains its valuable ecological and economic functions also in the future.

### Pilot Project Kreesand

With the creation of a tidal shallow water area in the region of a former flushing field Spadenlander Busch / Kreesand, the HPA kicked off the implementation of the second concept pillar (fig.1). Thus the Kreesand pilot project leads the way for the Tidal Elbe development. In addition to the positive influence of hydraulic conditions, the transport of sediment and the creation of a valuable tidal habitat, the plan also involves the gathering insights that will contribute to the planning of additional areas along the Tidal Elbe. Furthermore, public awareness and knowledge of the complexities of the Tidal Elbe system will be increased.

The project area belongs to the Hamburg-Mitte district, and is located on the eastern side of the Elbe's Wilhelmsburg Island (fig. 2). The former flushing field has been filled up with sand and silt material from maintenance dredging of the River Elbe in the middle of the last century. In 1999, while raising the level of the dykes, the Kreesand Hauptdeich was relocated. In 2004 the old dyke line was removed by the authority in charge. The resulting outer dyke area covers about 47ha, but is not currently part of the daily tidal processes (fig. 3). Here, a new shallow water area of 30 ha will be subject to the periodic tidal flow conditions and assume an important role within the Auenlandschaft Upper Tidal Elbe nature conservation area.

The HPA conducted extensive examinations and computer modelling during the development of possible design variations. In the end, the HPA identified a one-sided connection of the area to the Norderelbe as the best possible combination of hydraulic efficiency and nature conservation. The measure was approved on 24 April, 2012, as part of the plan-approval procedure under the Water Resources Act.

#### Construction Measure

The creation of the shallow water area requires the removal of approximately two billion cubic metres of soil materials, of which one quarter is contaminated and therefore has to be disposed of professionally. The goal is to utilise as much suitable material as possible in other construction measures. The expansion will take place in sections, moving from south to north, and will begin with dry activities on land, then continue in ground water influenced layers up to a maximum depth of 2.50 m to 3.00 m below the tidal datum. Afterwards, the opening to the Norderelbe will be established and a fine profiling of the various low-water zones and shore areas will be carried out in accordance with the nature conservation implementation plan. From this initial state, the various habitats at different elevations can develop their own natural processes.

The construction began in June 2012 with the reinforcement of the dyke crossing (fig. 6) in order to ensure that the volume of traffic across the dyke could be handled safely. As of September 2012, the compensation measures for flora and fauna were implemented, such as the installation of bat boxes and the creation of amphibian waters.

Site development activities began at the end of November 2012. Mowing and clearing work, and the investigation of unexploded ordinance were carried out. Construction roads were created (fig. 7) and excavation work began on the site (fig. 8). Excavation work continued throughout the first half of 2013. A flood-safe staging area for future soil declaration was established as well as site infrastructure (fig. 9).

In the course of 2014, a barge berth was built in the northern part of the area (fig. 11) to ensure that the majority of the soil could be transported to other construction sites by water as of 2015. From November 2014, the natural soils influenced by ground water in the southern construction field were excavated (fig. 12). The first 9 ha of the new shallow water area were completed and connected to the Upper Tidal Elbe by the end of 2015. Completion of the project will

depend on the utilisation of the removed soil, and - based on current knowledge - is estimated to take place by the end of 2019.

#### Synergies between the Tidal Elbe, nature conservation and other concerns

Upon completion, the area will develop into a valuable habitat, which will be protected within the network of the Auenlandschaft Upper Tidal Elbe nature conservation area. The 30 ha shallow water area will serve as a retreat for a variety of fish such as asp or salmon. The shore areas offer optimal conditions for the establishment of the globally unique water dropwort (*coenanthe conioides*, fig. 4). For this reason, the project also serves to ensure the coherence of the Natura 2000 network for the planned deepening of the Lower and Outer Elbe fairway. In addition, Kreeetsand allowed the HPA to implement an important aspect of the integrated management plan for the Elbe estuary (Natura 2000), which was completed in 2011, thus making an important contribution to the ecological upgrading of the Elbe estuary.

The Tidal Elbe concept was fully discussed at city, regional and even European level already. Moreover, the Kreeetsand project included residents, associations and administrations from the very earliest stages of planning. This is how a project came to life that takes the aspects of creative and landscape quality as well as nature conservation and recreational value into account and experiences high acceptance and recognition.

In fact, the project was included in the International Construction Exhibition (IBA) held in Hamburg, and received the renowned 'Working with Nature Award' which is only presented every four years by PIANC, one of the oldest global technical and scientific associations for waterborne transport infrastructure. An exhibition exploring the complex relationships and special features of the project can be seen in the 'Dyke Booth' pavilion at the southern end of Kreeetsand (fig. 5).



Fig. 5: Outside view of 'Dyke Booth' information pavilion



Fig. 6: Reinforced dyke crossing



Fig. 7: Creation of construction road



Fig. 8: First work for the construction of the tidal opening



Fig. 9: Staging area (January 2015)



Fig. 10: Status of construction work (spring 2015)



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#### Technical Data

Size of project area:	47ha
Newly created shallow water area:	30ha
Newly created tidal volume:	1bn m <sup>3</sup>
Height former flushing field:	approx. 5.5m above tidal datum
Excavation volume:	2bn m <sup>3</sup>
Future water depth:	up to 3m below tidal datum

#### Dates

<b>May 2008</b>	Start of planning stage
<b>June 2010</b>	Application process for planning approval
<b>April 2012</b>	Plan approval decision
<b>June 2012</b>	Beginning of preparatory measures
<b>November 2012</b>	Start of main activities in the area
<b>End of 2015</b>	Estimated completion of the southern section (approx. 9ha)



Fig. 11: Construction of the temporary barge berth



Fig. 12: Excavation of natural soil