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The Interreg IVB
North Sea Region
Programme



Current deflection wall ,Köhlfleet‘

Measure analysis 03
in the framework of the Interreg IVB project TIDE

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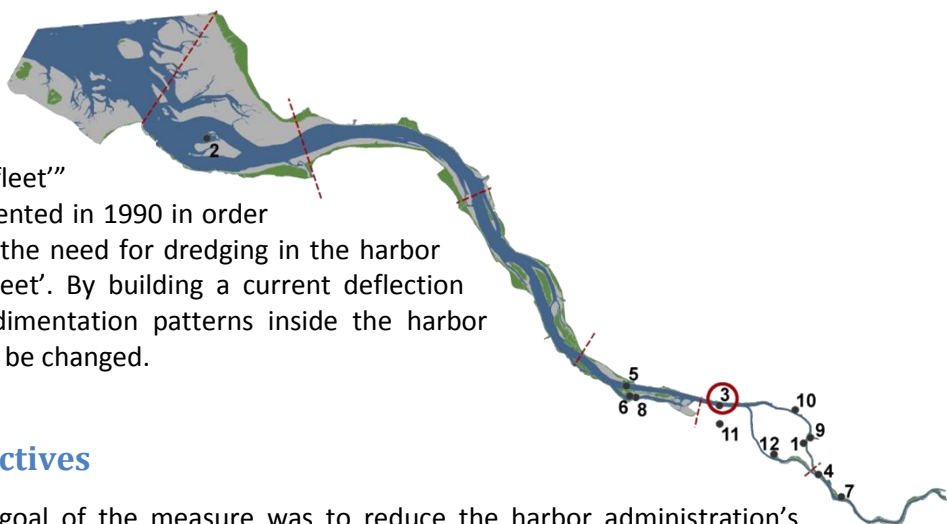


Part 1: Measure description

measure category	hydrology, morphology
estuary	Elbe
salinity zone	freshwater
pressure	gross change in morphology and hydrographic regime
status	Implemented in 1990
river km	630
country/location	Germany, Köhlfleet in the west of the Port of Hamburg
responsible authority	Hamburg Port Authority

1.1 Introduction

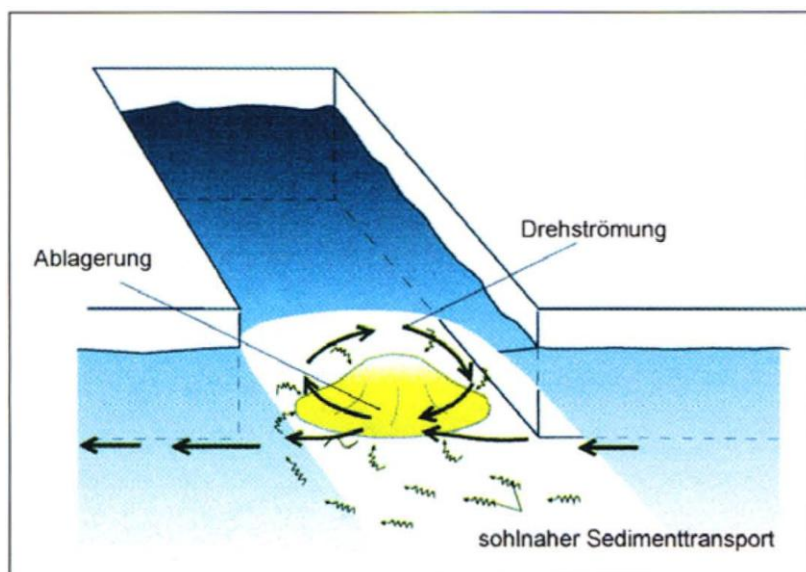
The measure “Current deflection wall ‘Köhlfleet’” was implemented in 1990 in order to decrease the need for dredging in the harbor basin ‘Köhlfleet’. By building a current deflection wall the sedimentation patterns inside the harbor basin should be changed.



1.2 Objectives

The overall goal of the measure was to reduce the harbor administration’s efforts and costs for maintenance dredging of the deposited sediment. The target of the measure was to reduce sedimentation in the harbor basin which was caused by an eddy flow (‘teacup-effect’) at the entrance of the basin.

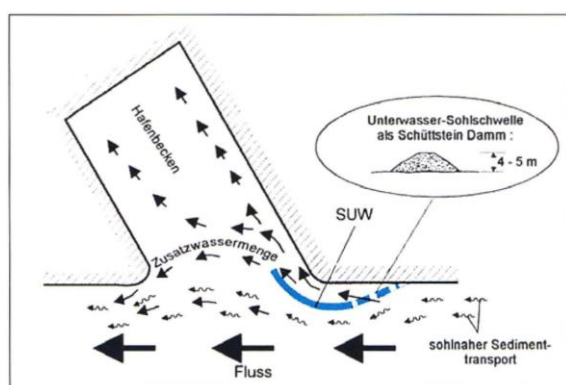
1.3 Background and side conditions



The Port of Hamburg has to fight against sedimentation within the harbor basins already for a long time. The reason for the sedimentation in the entrance of the basins is the so called 'teacup-effect', an eddy flow which leads to a deposition process in the entrance of the harbor (Fig. 1).

Figure 1: 'Teacup effect' in the entrance of the harbor basin

This process is enhanced by the tides: During flood tide large amounts of water flow into the harbor basin. However the low ebb tide energy has a stopping effect on the eddy flow. In order to assure sufficient water depth for shipping, dredging is unpreventable. The costs for dredging and deposition are very high, especially if the sediment is heavily contaminated as it was in the 1980ies.



Model tests, conducted at the Franzius-Institute of the University of Hannover, demonstrated that a current deflection wall in the entrance of the harbor prevented the eddy flow and the related sedimentation (Fig. 2).

Figure 2: Current deflection wall preventing the eddy flow

1.4 Measure

In 1990 a current deflection wall was built in the entrance of the harbor basin 'Köhlfleet', once it was optimized by using the model. The current deflection wall led to the filling of the harbor basin with water during high tide, without the occurrence of an eddy flow and the related 'teacup effect'. The first wooden construction was substituted in 1994 by a concrete construction. After a storm surge damage it was deconstructed. Approximately 1.5 mill. € were invested.

The area was already added to the Natura 2000 area 'Hamburger Unterelbe' and the nature protection area 'Norderelbe'. Estimated costs for the measure are > 50 mill € due to the huge



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amount of heavy contaminated soil that has to be removed and treated in a special way. A period of three years is expected for the construction time.

In order to introduce the tidal influenced landscape to a wide-ranging public, a 'tidal park' is planned. The aim of the concept is to introduce basic tidal specific phenomena to the public. The complexity of the tidal dynamics and estuarine functioning will be shown within the landscape and not only by informative posters, in order to allow individual experience of the landscape. Objects, textures, vegetation and buildings will be used to present all aspects of the tides.

1.5 Expected effect

From 1991 – 1996 the sedimentation rate in the harbor basin was monitored and compared to the sedimentation rate that took place before the wall was built. The measure was considered to be successful: per year 50% less sedimentation occurred in the entrance of the basin. At the end of the basin no reduction of sedimentation could be observed and no additional sedimentation in the neighbor basins took place.

The measure resulted in less effort and therefore a cost reduction for the harbor administration, i.e. for maintenance dredging and disposal of contaminated sediments. Further, reliable water depths made planning and disposition easier for local companies.



Part 2: Execution of the main effectiveness criteria

2.1 Effectiveness according to development targets of measure

Definition of development targets:

- Reduction of sedimentation at the gateway of the harbor basin 'Köhlfleet', which was caused by an eddy flow.

Achievement of development targets:

- The sedimentation rate at the entrance of the harbor basin decreased by approximately 50% after implementation. At the end of the basin no reduction occurred. Furthermore no increase in sedimentation took place in the neighborhood basins.

2.2 Impact on ecosystem services

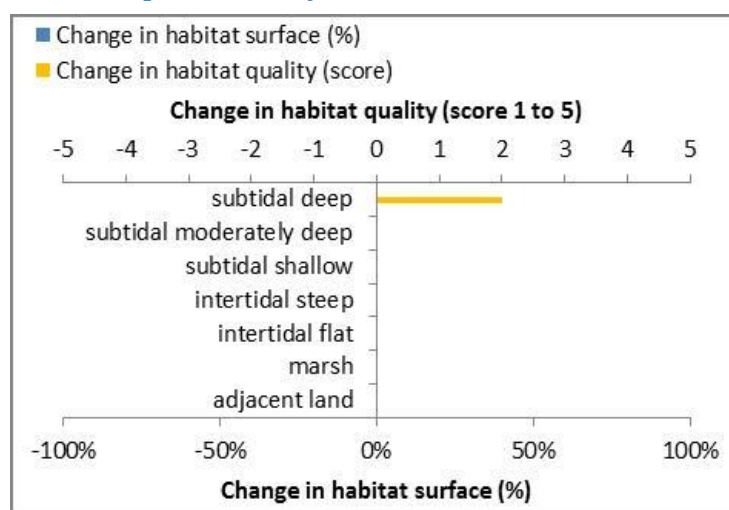


Figure 3: Ecosystem services analysis for Current deflection wall 'Köhlfleet': Indication of habitat surface and quality change, i.e. situation before versus after measure implementation.

- From the ES assessment it is concluded that this measure generates overall a slightly positive expected impact for several ES, mainly for:
 - o "biodiversity"
 - o Cultural services
 - o Some regulating services: Erosion and sedimentation regulation (by water bodies); Water quality regulation: transport of pollutants and excess nutrients; Water quantity regulation: transportation) and some provisioning services (Water for industrial use; Water for navigation)
- The expected impact for the two development targets ("Erosion and sedimentation regulation by water bodies" and "Water for navigation") is slightly positive.
- The expected impact for the different beneficiary groups is limited, with a slightly positive expected impact for indirect and future use and for local and region use.

Table 1: Ecosystem services analysis for Current deflection wall 'Köhlfleet': (1) expected impact on ES supply in the measure site and (2) expected impact on different beneficiaries as a consequence of the measure.

Current deflection wall 'Köhlfleet'		
Cat.	Ecosystem Service	Score
S	"Biodiversity"	1
R1	Erosion and sedimentation regulation by water bodies	1
R2	Water quality regulation: reduction of excess loads coming from the catchment	0
R3	Water quality regulation: transport of pollutants and excess nutrients	1
R4	Water quantity regulation: drainage of river water	0
R5	Erosion and sedimentation regulation by biological mediation	0
R6	Water quantity regulation: transportation	0
R7	Water quantity regulation: landscape maintenance	0
R8	Climate regulation: Carbon sequestration and burial	0
R9	Water quantity regulation: dissipation of tidal and river energy	0
R10	Regulation extreme events or disturbance: Wave reduction	0
R11	Regulation extreme events or disturbance: Water current reduction	0
R12	Regulation extreme events or disturbance: Flood water storage	0
P1	Water for industrial use	1
P2	Water for navigation	1
P3	Food: Animals	0
C1	Aesthetic information	1
C2	Inspiration for culture, art and design	1
C3	Information for cognitive development	1
C4	Opportunities for recreation & tourism	1

Beneficiaries:	
Direct users	0
Indirect users	1
Future users	1
Local users	1
Regional users	1
Global users	0

Legend: expected impact*	
3	very positive
2	positive
1	slightly positive
0	neutral
-1	slightly negative
-2	negative
-3	very negative

X Targeted ES

*: Indicative screening based on ES-supply surveys and estimated impact of measures on habitat quality and quantity. Quantitative socio-economic conclusions require local supply and demand data to complement this assessment.

The screening of the ecosystem services (ESS) that were effected by the measure 'Current deflection wall' showed no clear results. Some ESS will be influenced positively, and also the targeted ESS will slightly be effected. This outcome made clear that the screening of the effects on the ESS is not applicable on every type of measure executed in the TIDE project

2.3 Degree of synergistic effects and conflicts according the uses

-/-



Part 3: Additional evaluation criteria in view of EU environmental law

3.1 Degree of synergistic effects and conflicts according WFD aims

Table 2: Effect of the measure concerning the main pressures in the estuarine freshwater zone

Indicator Group	Code	Main pressures freshwater zone Elbe	Effect?					Description: Aim of the measure current deflection wall
			--	-	0	+	++	
S.I.	-	Habitat loss and degradation during the last about 100 years: Subtidal			0			
S.I.	1.1	Habitat loss and degradation during the last about 100 years: Intertidal			0			
S.I.	1.4/ 1.5	Gross change in morphology/hydrographic regime during the last about 100 years			0			
S.I.	3.1/3.2	Decrease of water and sediment chemical quality			0			
D.I.	2.3	Discharge of nutrients or harmful substances			0			
D.I.	1.3	Land claim during the last about 100 years			0			
D.I.	2.6	Capital dredging			0			

S.I. = state indicator; D.I. = driver indicator

The aim and the effects of the measure ‘current deflection wall’ have neither positive and nor negative effect on the main pressures of the freshwater zone of the Elbe estuary.

3.2 Degree of synergistic effects and conflicts according NATURA 2000 aims

Table 3: Effect of the measure concerning the main conservation objectives in the operational area 2

Operational area (zone)	Natura 2000 conservation objectives	Effect of Measure on conservation objectives			Description
		Positive	No effect	Negative	
2					
2	Prevention of further increase and/or reduction of tidal range (energy)		+		
2	Conservation and development of primarily floodplain/alluvial forest (*91E0)		+		
2	Conservation and improvement of alluvial meadows of river valleys (6440) and lowland and hay meadows (6510)		+		
2	Conservation of the primarily 'Elbe Water Dropwort' (<i>Oenanthe conioides</i>) with species specific dynamic, development of further habitats to improve the habitat network		+		
2	Conservation and development of spawn and growth habitats for asp, ensuring the habitat potential for the twaite shad		+		
2	Conservation and development of the transition functionality between the Middle Elbe and the Estuary downstream for migratory fish species of Annex II BHD		+		

The management targets concerning the BHD are not affected by the measure current deflection wall.

Part 4: Crux of the matter

The construction of a new current deflection wall within the harbor is planned by the HPA. In a side selection study two main criteria for the construction were identified: The wall should not alter the navigation conditions at the harbor basin entrances and has to be constructed in a way that they are on one hand strong enough to resist the pounding of the waves and on the other hand constructed as simple and therefore cheap as it can be.

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References

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