TIDE
Tidal River Development

Project part-financed by the European Union (European Regional Development Fund)

The Interreg IVB North Sea Region Programme

‘Compensation channel Hahnöfer Nebenelbe’

Measure analysis 06
in the framework of the Interreg IVB project TIDE

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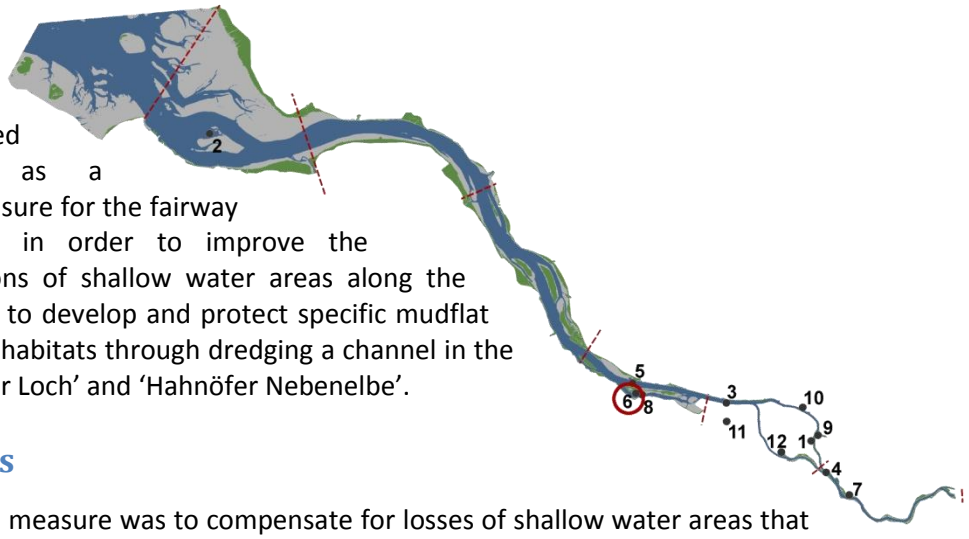
Part 1: Measure description

measure category	hydrology, morphology
estuary	Elbe
salinity zone	freshwater
pressure	gross change in morphology and hydrographic regime
status	Implemented in 2008
river km	640
country/location	Germany, near Hahnöfer Sand and the Mühlenberger Loch
responsible authority	Federal waterways and shipping administration (WSA HH)

1.1 Introduction



The measure "Hahnöfer Nebenelbe/A+E Rinne" was carried out in 2003 as a compensation measure for the fairway deepening (1999) in order to improve the ecological conditions of shallow water areas along the river. The aim was to develop and protect specific mudflat and shallow water habitats through dredging a channel in the area 'Mühlenberger Loch' and 'Hahnöfer Nebenelbe'.

1.2 Objectives

The purpose of the measure was to compensate for losses of shallow water areas that occurred in relation to the deepening of the fairway in 1999. The long-term conservation and establishment of shallow water areas and mudflats should be implemented by creating a flow-through channel from the anabranch 'Hahnöfer Nebenelbe' into the bay 'Mühlenberger Loch'. The channel of approx. 7 km length starting at 'Hafen Hahnöfer Sand' and ending in the west of the 'Neß-Leitdamm' should increase the flow-through of the anabranch. Furthermore the area should be stabilized and further sedimentation and potential separation of the 'Mühlenberger Loch' should be prevented. The whole area is of great importance for several ecological functions. It is very valuable for the oxygen budget of the Elbe estuary, serves as a spawning area for fish and creates tidal volume. A stable tidal creek system should therefore be established.

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1.3 Background and side conditions

The measure was realized in 2003 by the Federal Administration of Waterways and Navigation (WSA Hamburg) and Hamburg Port Authority (HPA) as a compensation measure according to national legislation (BNatSchG, LNatSchG, NNatG und HmbNatSchG). For the permission of the deepening of the fairway in 1999 a formal plan approval procedure including an EAS and a so called 'Landschaftspflegerischer Begleitplan (LPB)' was necessary which described the necessary compensation measures. In 2002 a change in the course of the channel (i.e. the so called 'Ausgleichs- und Ersatzrinne', 'A+E Rinne') was approved in order to fulfill the requirements related to the extension of the Airbus company which is located close by.

1.4 Measure

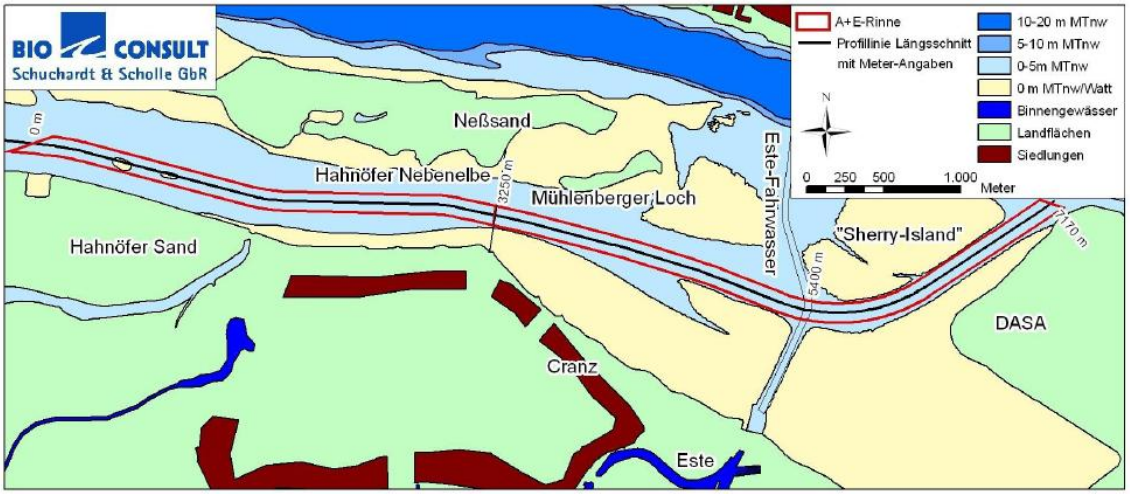

Figure 1: Area map of 'Hahnöfer Nebenelbe' and 'Mühlenberger Loch'

In order to build the channel 1.3 mill m³ sediment were dredged in an area of 68 ha. The channel was approximately 125 m wide with a depth of 2.3 m below mean low spring tide. In the 'Mühlenberger Loch' the channel had to be excavated through the entire area (Fig. 1). In the area of the 'Hahnöfer Nebenelbe' the planned depth was almost existent. The dredging was finished in June 2003. The total cost of the measure accounted for 5,2 mill €.

1.5 Expected effect

Monitoring results showed that several years later the planned compensation and development goals within the area 'Hahnöfer Nebenelbe/Mühlenberger Loch' such as conservation and establishment of shallow water areas, were only partly achieved, i.e. the channel silted up in its eastern end (see Fig. 2). Therefore further investigations by the Federal Waterways Engineering and Research Institute (BAW) were set up which should deliver a proposal for the optimization of the function of the channel. The results of the hydrodynamic modeling did not lead to any good solution

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i.e. to regain the missing 18 ha shallow water area. Furthermore a stable morphological state without any additional dredging could not be achieved.

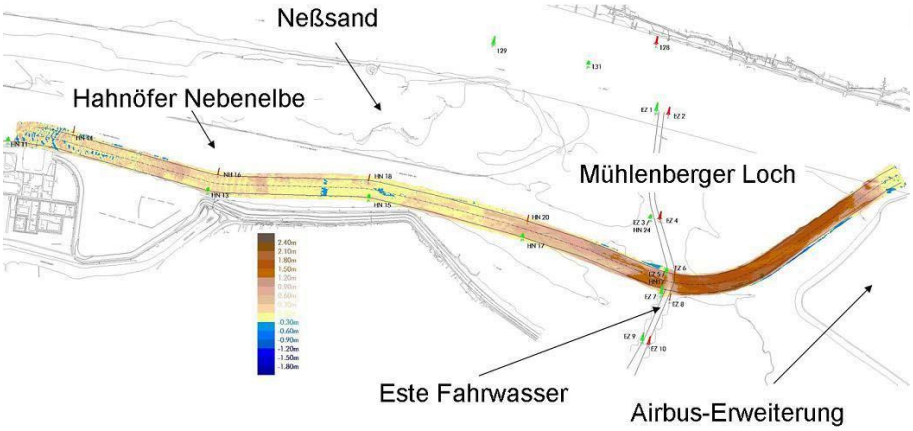

Figure 2: Position and design of the 'A+E Rinne', the different colors show the sedimentation tendencies after two years

In 2012 HPA decided to restore the eastern end of the ‘A+E-Rinne’ in order to fulfill the compensation needs by regaining the lost shallow water area.

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Part 2: Execution of the main effectiveness criteria

2.1 Effectiveness according to development targets of measure

Definition of development targets

- Creation of 68ha shallow water area inside the so-called ´A+E-Rinne´ as spawning area for fish and resting area for birds.
- Long-term conservation and establishment of shallow water areas with adjacent mudflats.

Achievement of development targets

- Not all development targets could be achieved by this compensation measure. The 68ha of shallow water area were established but a long-term stabilization could not be achieved. Due to strong sedimentation processes in the eastern part of the channel on 18 ha the development targets could not be achieved (view Fig. 2).

To regain the lost functions the eastern part of the channel was dredged again in 2012 leading to additional costs of 800.000 €.

2.2 Impact on ecosystem services

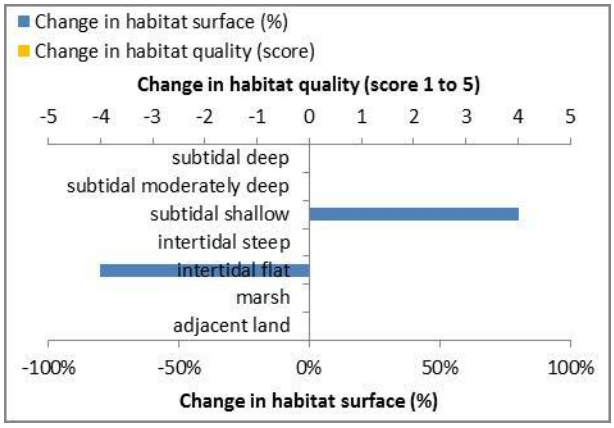

Figure 3: Ecosystem services analysis for Compensation channel 'Hahnöfer Nebenelbe': Indication of habitat surface and quality change, i.e. situation before versus after measure implementation.

- From the ES assessment it is concluded that this measure generates both a slightly negative and a slightly positive on various ES. This is the consequence of transforming one estuarine habitat type into another.
    - Slightly positive expected impact:
        - Water quality regulation: transport of pollutants and excess nutrients
        - Water quantity regulation: dissipation of tidal and river energy
        - Food: Animals
        - Opportunities for recreation & tourism
    - Slightly negative expected impact:

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- "Biodiversity"
- Erosion and sedimentation regulation by biological mediation
- Water quantity regulation: landscape maintenance
- Climate regulation: Carbon sequestration and burial
- Regulation extreme events or disturbance: Wave reduction
- Regulation extreme events or disturbance: Flood water storage
- Aesthetic information

- The expected impact on the development target ("Biodiversity") is slightly negative.
- The expected impact for the different beneficiary groups is overall neutral, but slightly positive for future use.

The expected impact for the different beneficiary groups is overall positive, with a positive to very positive expected impact for indirect and future use and for local and region use.

Table 1: Ecosystem services analysis for Compensation channel 'Hahnöfer Nebenelbe': (1) expected impact on ES supply in the measure site and (2) expected impact on different beneficiaries as a consequence of the measure.

Compensation channel 'Hahnöfer Nebenelbe'

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

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

X Targeted ES

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

*: 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 affected by the measure `Hahnöfer Nebenelbe` showed more negative than positive effects on the ESS that were generated by implementing this measure. This is caused by the transformation of mudflats, which already delivered a certain amount of ecosystem services, into shallow water area.

2.3 Degree of synergistic effects and conflicts according the uses

There is a strong conflict potential between the management target creation of shallow water area and the general idea of nature conservationist of leaving the nature unaltered.

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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 Hahnöfer Nebenelbe
			- -	-	0	+	+ +	
S.I.	-	Habitat loss and degradation during the last about 100 years: Subtidal					++	Building of new shallow water area, long-term stabilization of these areas
S.I.	1.1	Habitat loss and degradation during the last about 100 years: Intertidal				+		Stabilization of the adjacent mudflats
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 measure ‘Hahnöfer Nebenelbe’ is, conducted as a compensation measure, not assigned to the WFD. Nevertheless it covers two of the main pressures related to the WFD.

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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 3

Operational area (zone)	Natura 2000 conservation objectives	Effect of Measure on conservation objectives			Description
		Positive	No effect	Negative	
3	Improvement of the hydro morphological habitat conditions of the habitat type Estuaries, if possible conservation and improvement of estuary typical dynamics	+			
3	Conservation and development of tidal reeds, hydrophilous tall herb fringe communities (6430) and floodplain/alluvial forest (*91E0) esp. on islands.		+		
3	Conservation, reestablishment and development of meadows with vegetation typical for the Elbe region, like lowland hay meadows (6510) with respect to their avifaunistical function.		+		
3	Conservation and partly reestablishment of the primarily 'Elbe Water Dropwort' (*Oenanthe conioides*) populations with typical dynamics, esp. on the island of Neßsand and Hanskalbsand, as well as Hahnöfersand, development of additional habitats for the improvement of the habitat network.		+		
3	Conservation and reestablishment of the outstanding relevance of the functional zone for the reproduction of the twaite shad	+			
3	Conservation, partly reestablishment and development of the brooding function esp. for the species on extensive used meadows, large-scale reeds and grassland-ditch complexes of the marshes and the associated habitats.		+		
3	Conservation and development of the resting function esp. for Nordic goose and swans, as well as for waders (Limikolen) on the widespread, low disturbed grasslands.	+			
3	Conservation of the resting occurrence of ducks, gulls and sea swallows	+			

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Part 4: Crux of the matter

All options of the preliminary investigation showed that the measure had only a small positive effect on the current situation of the channel. Long periods of slack water and related increased sedimentation rates are the dominant phenomenon and will possibly lead to the siltation of the area. The analysis of the current velocities showed that the maximum velocity of the flood current in the eastern part of the channel decreased by 10 cm/s. Velocities of the ebb current remained unaltered, as well as the currents of the rest of the 'Hahnöfer Nebenelbe'. Analysis of the gauge data showed an increase of sedimentation of more than 2 m and no flow through during ebb tide in parts of the eastern channel 2-3 years after completion. Taking all insecurities into account it can be assumed, based on the modeling study that a partial aggregation will occur after 2-3 years within the channel after its rebuilding. Effects of single events like storm surges or high discharges have not been considered.

Concerning the morphological stability of the eastern part of the "Hahnöfer Nebenelbe" under today´s conditions it can be concluded that there is no indication of a change of the system that could lead to a sustainable state without maintenance. The competent authorities have to consider whether to dredge every 3 years or to leave the area untouched and accept a habitat change from shallow water area to a mudflat.

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