

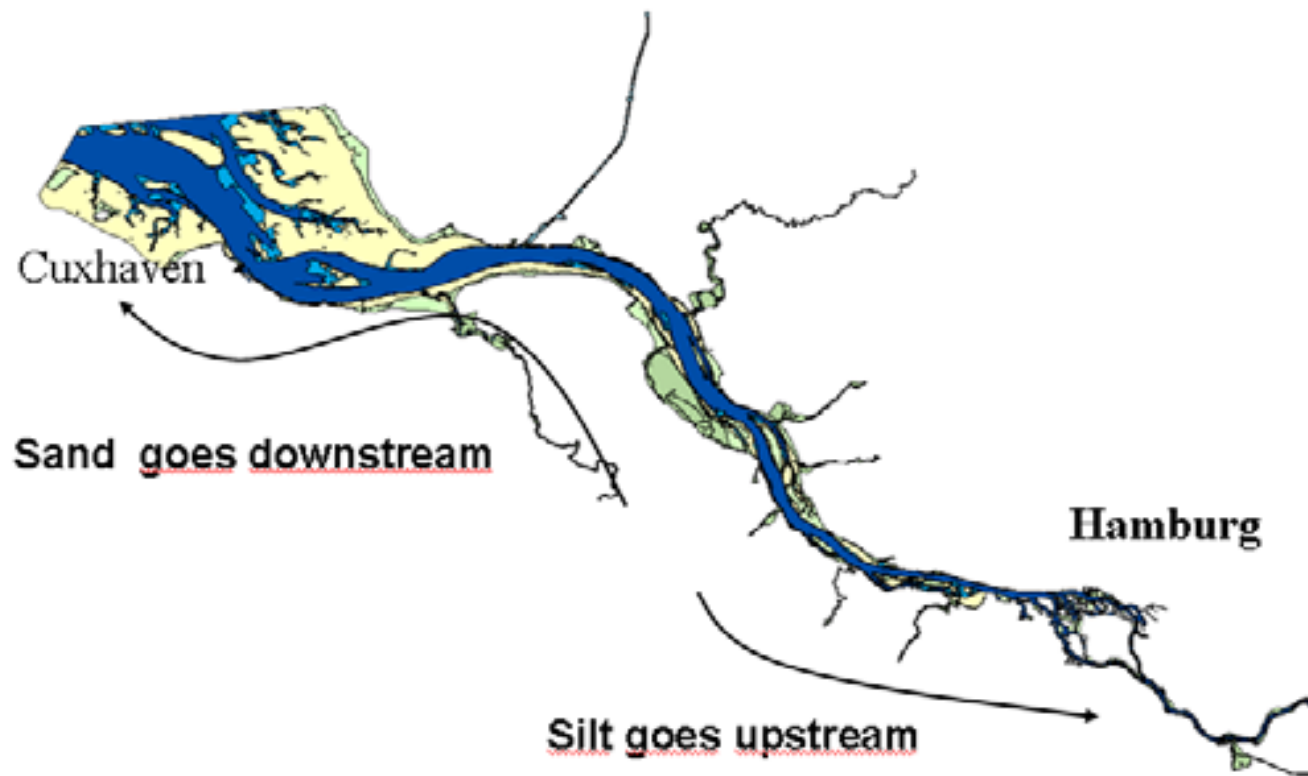
Wir machen Schifffahrt möglich.



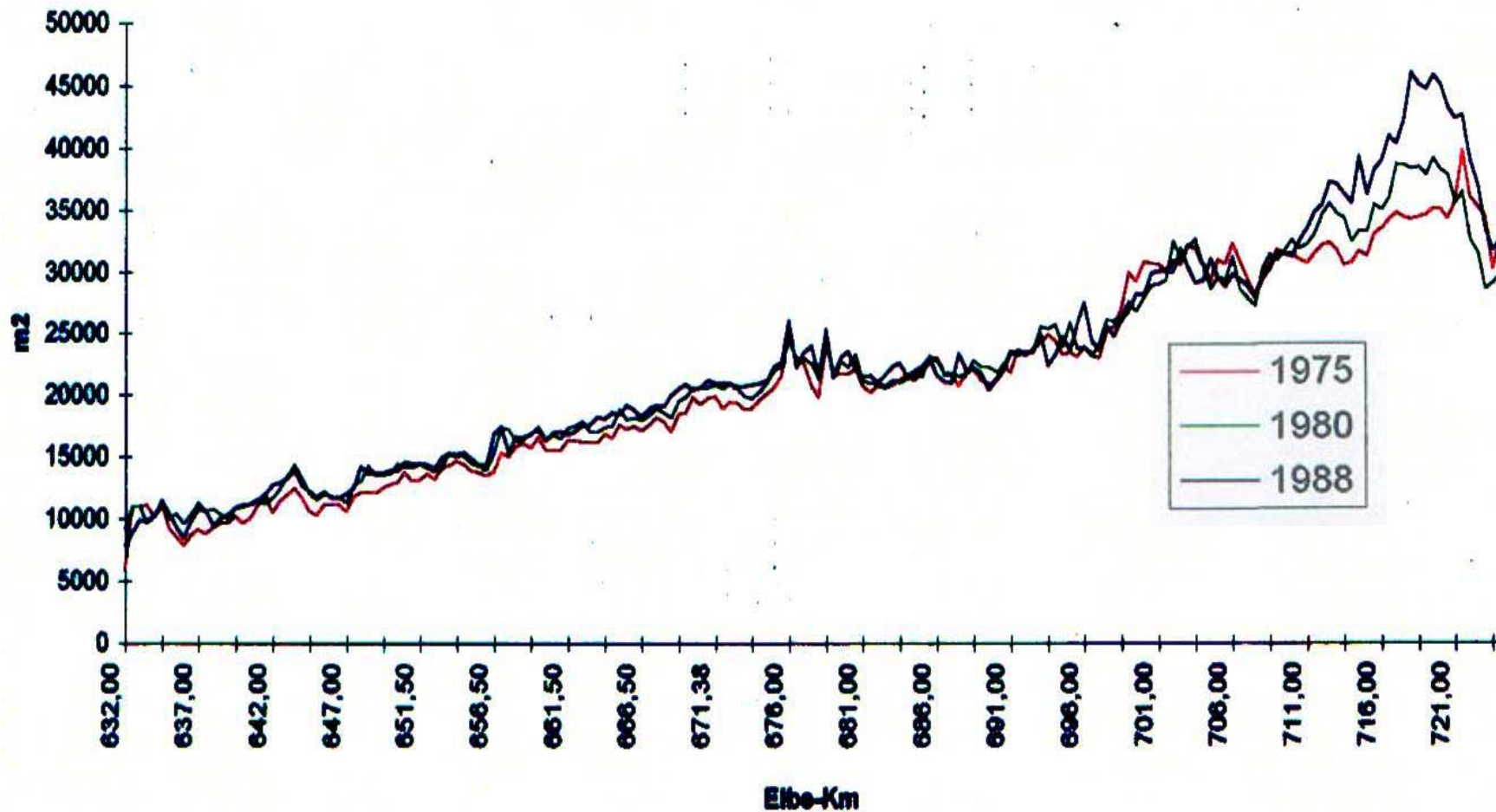
**Sediments in a changing Environment**  
**Ecological implications of dredging and relocation**  
**in the Elbe estuary**  
Günther Eichweber, WSD-Nord



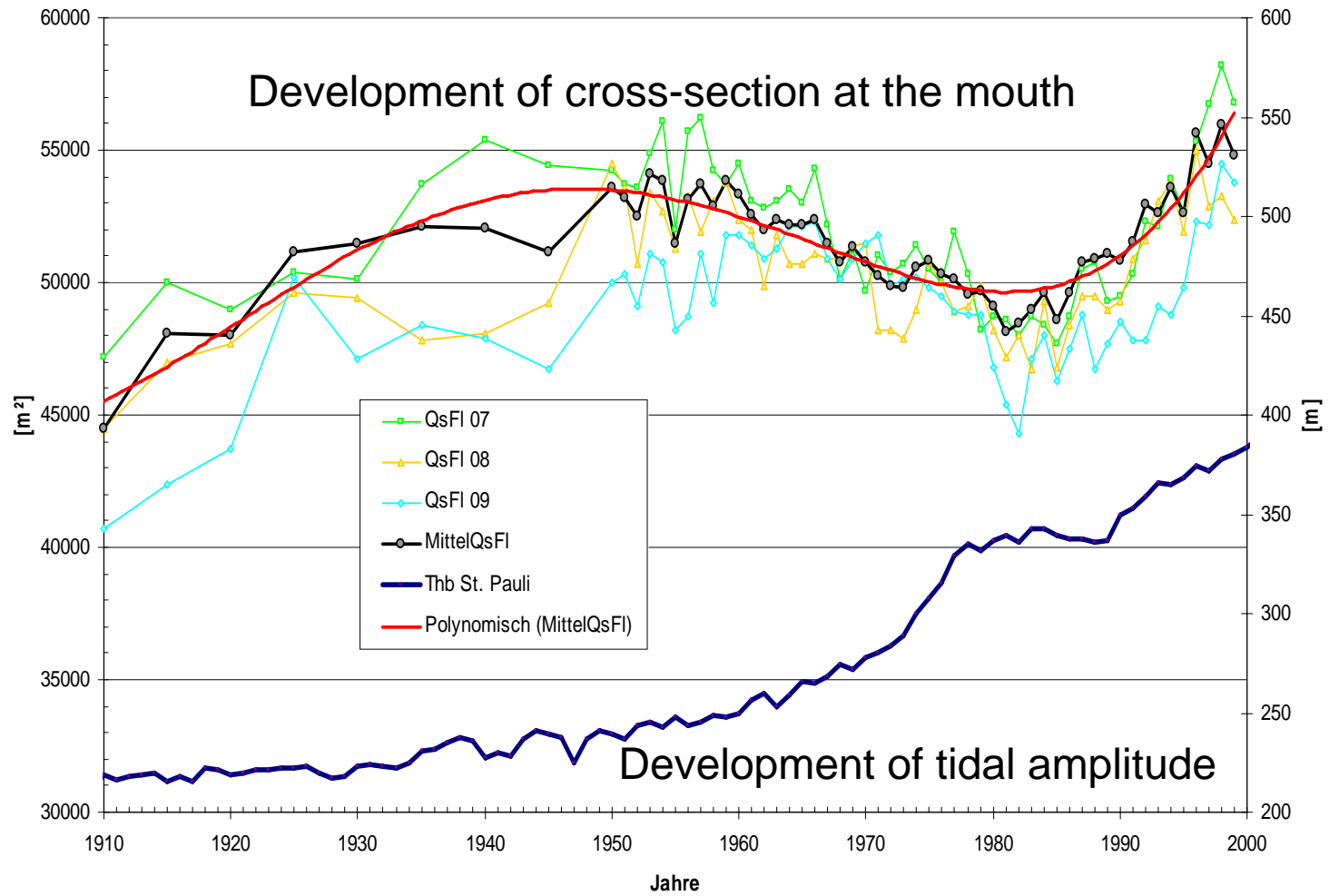
Basic problem: sediment budget out of equilibrium



### Effects: Increasing width of river bed

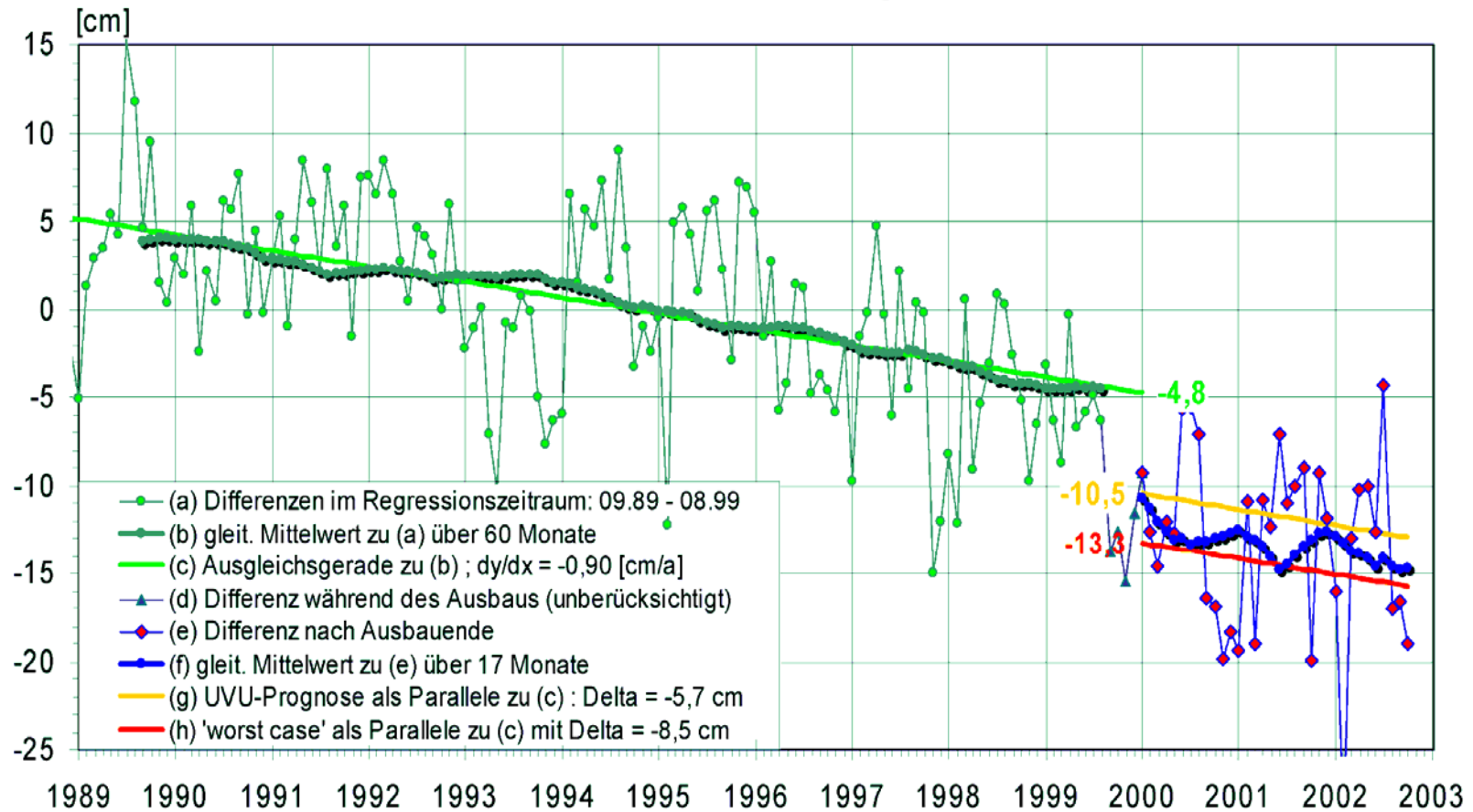


### Effects: Increasing tidal amplitude



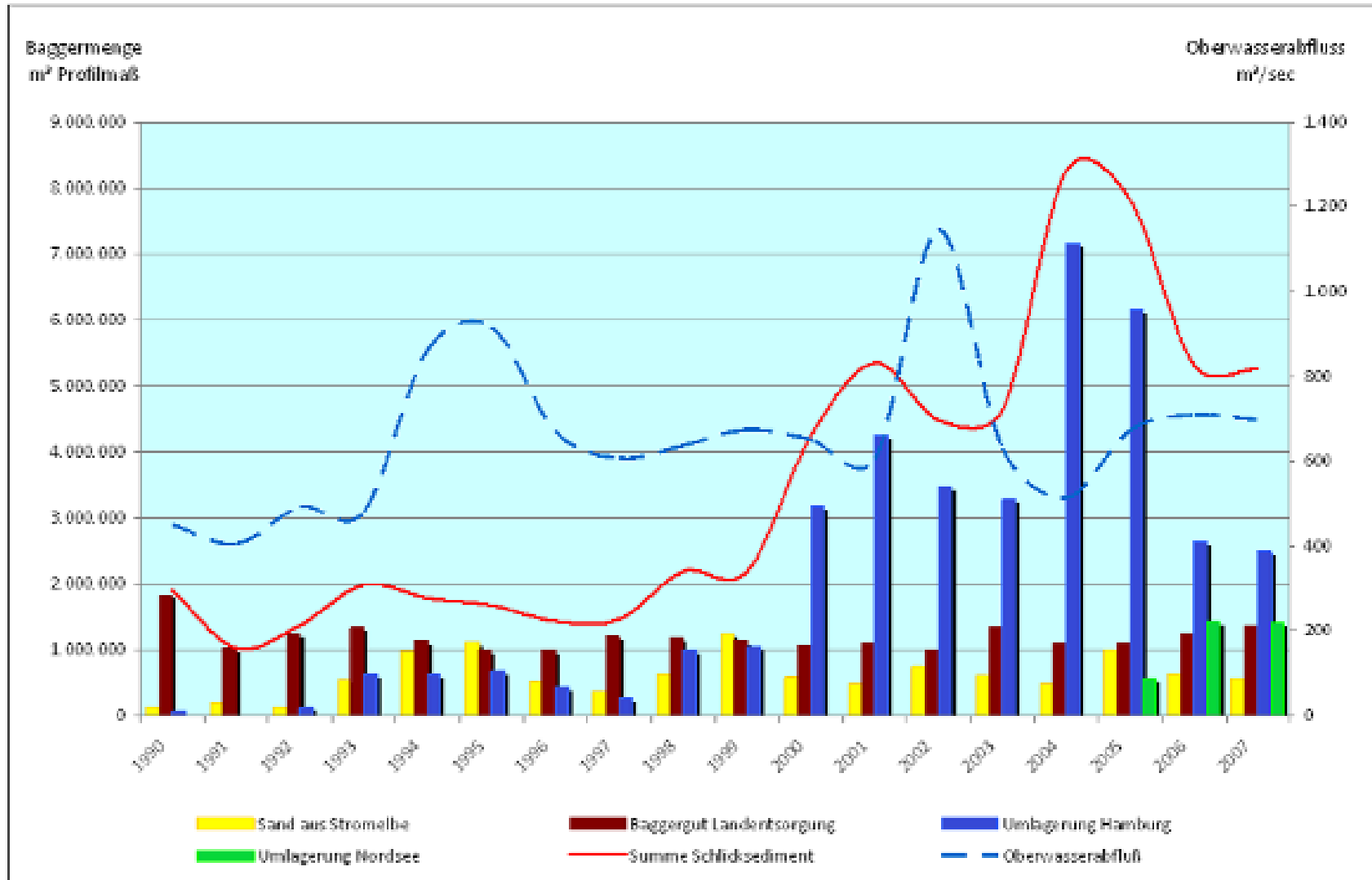


## Effects: Increasing tidal amplitude

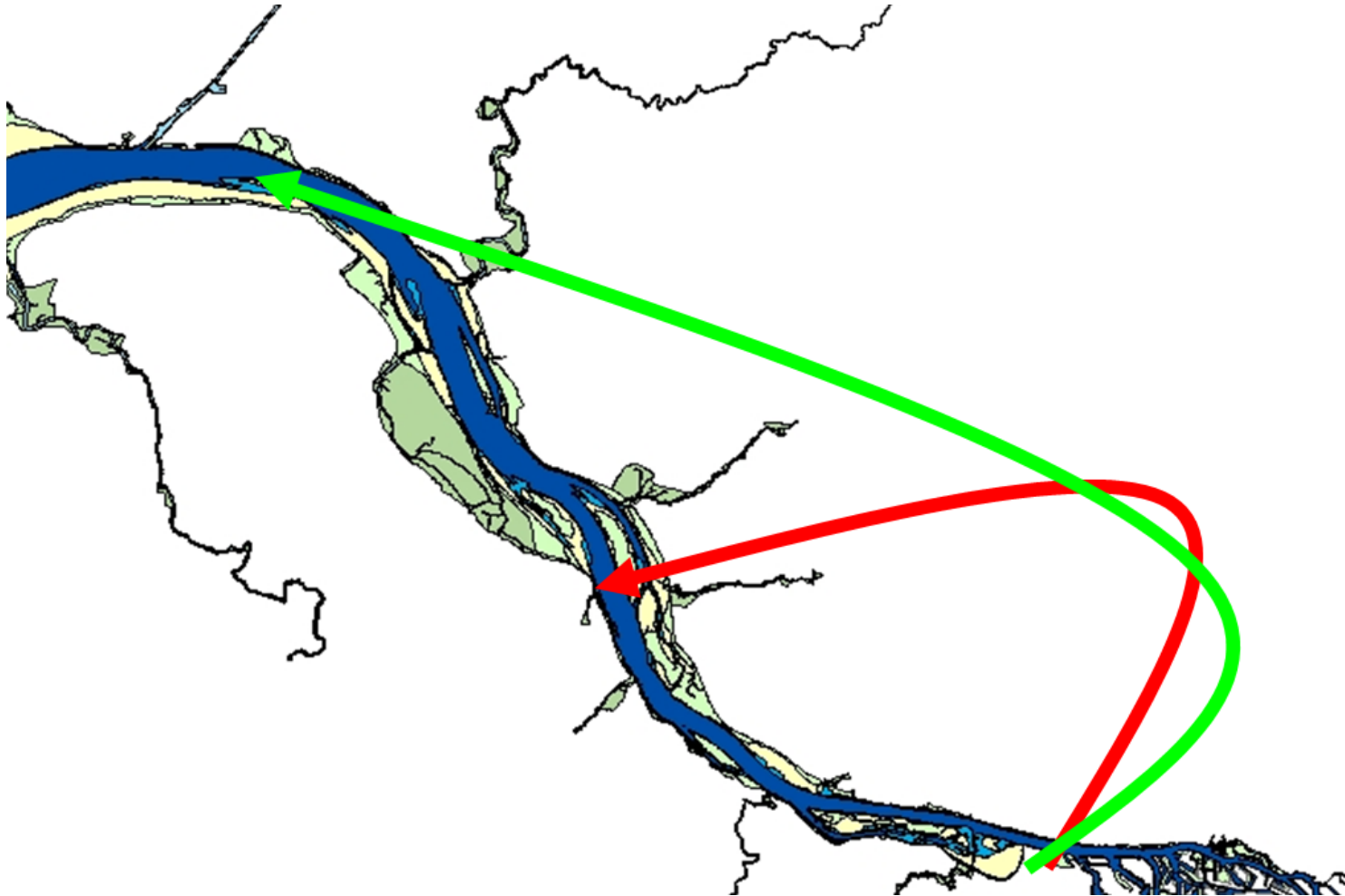


Continuously decreasing low water levels

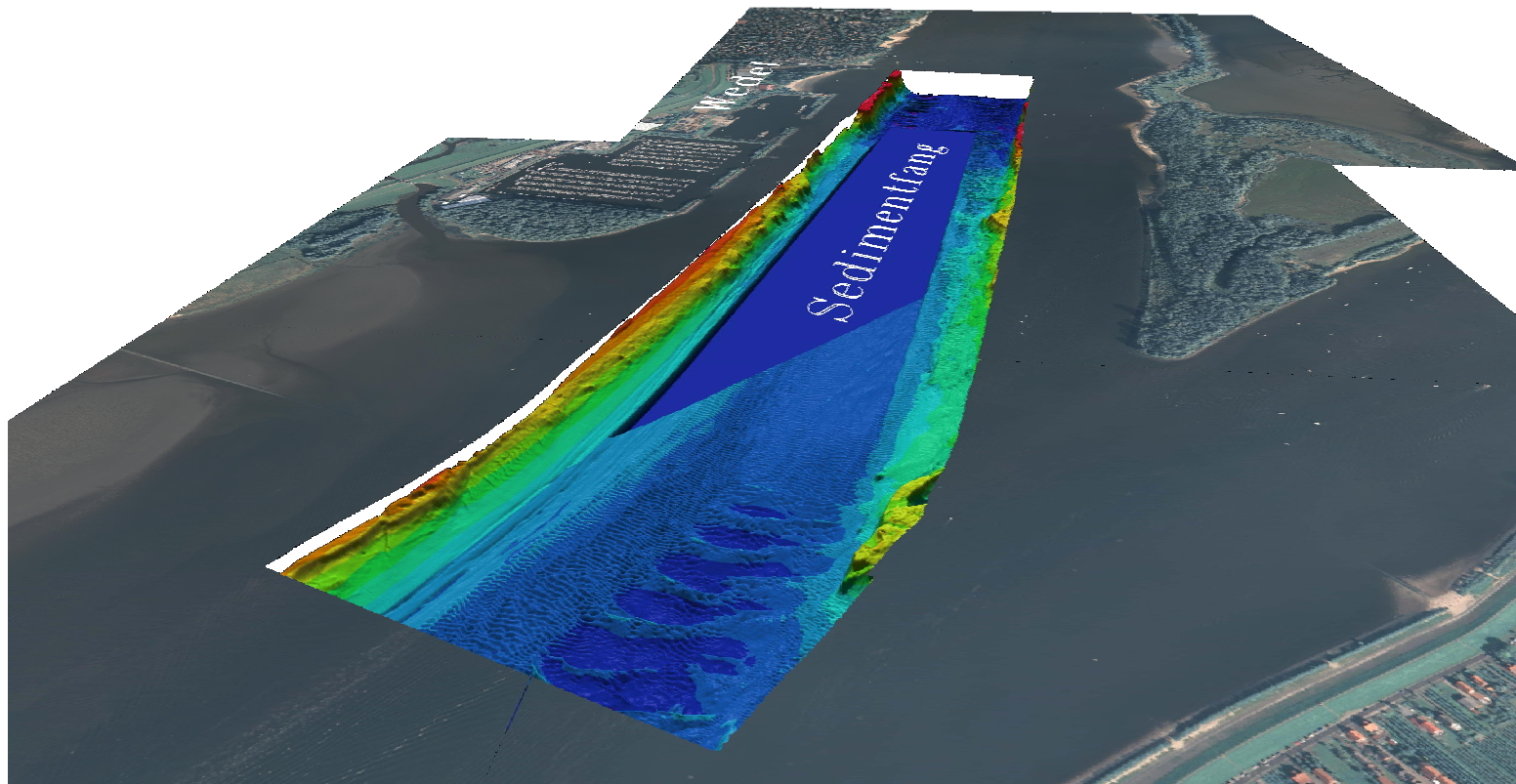
## Effects: escalating cycle of fines by short-range relocation



## Changing the relocation strategy: wide-range relocation of fines



## Changing the relocation strategy: construction of a sediment trap to prevent marine material from intrusion into harbour





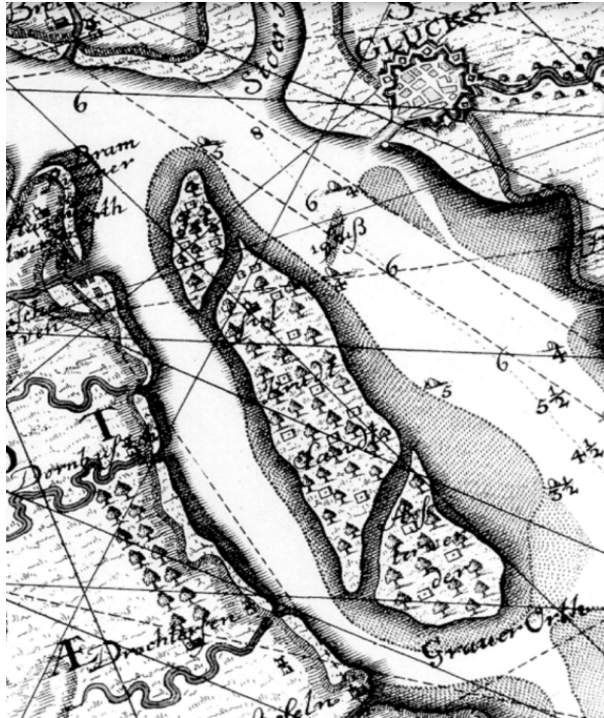
Wir machen Schifffahrt möglich.

# Valuable branches of the Elbe estuary





## Wischhafen - attenuation of a branch

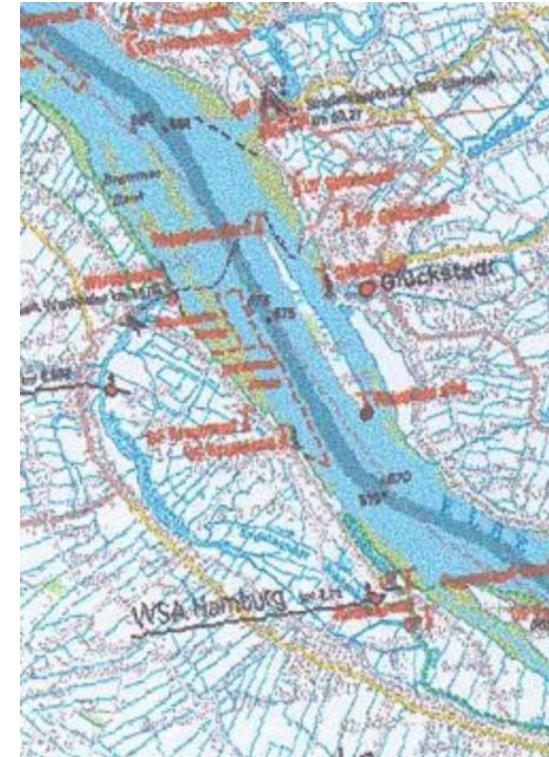


1721



1812

200 years ago – still  
500 m wide and 10 m deep



today



## Wischhafen - attenuation of a branch



Wischhafen Süderelbe today

Wir machen Schifffahrt möglich.



## Cutting off tributaries



Mouth of Stör 1972

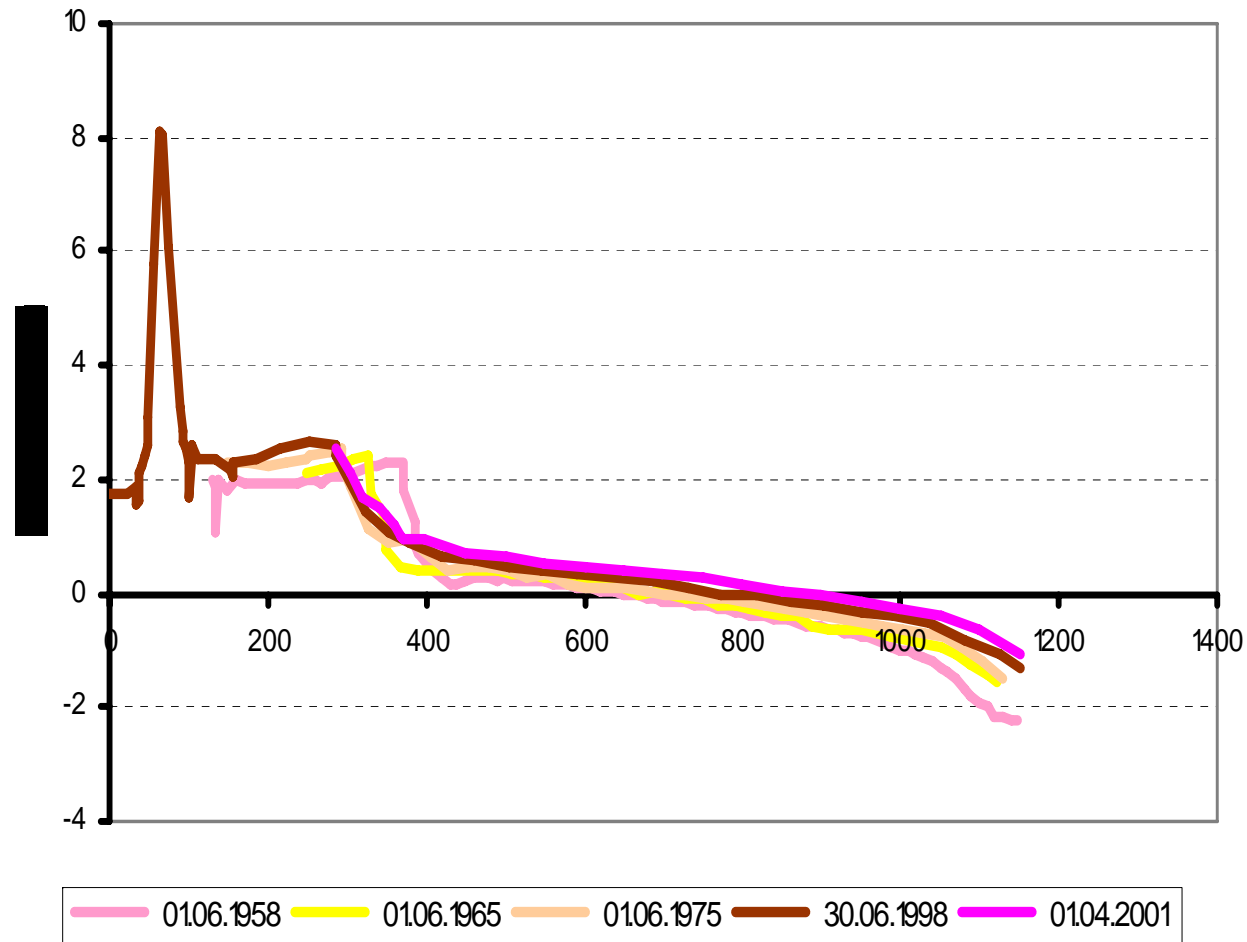


## Cutting off tributaries



Mouth of Stör today

Effects: Siltation on flood plains reaches values of 60 cm in 30 ys by reduction of floodplains



Developing relocation strategies means assessment and integration of many criteria

Criteria by economy:

- size and cost of dredger
- economy of work schedule
- relocation distance
- sediment reflux

## Criteria by ecology:

- toxicants, sinks of toxicants
- effect on oxygen content
- effect on benthic organisms
- fish and spawn
- siltation on mud flats
- sediment accumulation by cycles



Sediment management means:  
the current and accurate solution of ever changing goal  
conflicts

Minimizing the emission of toxicants

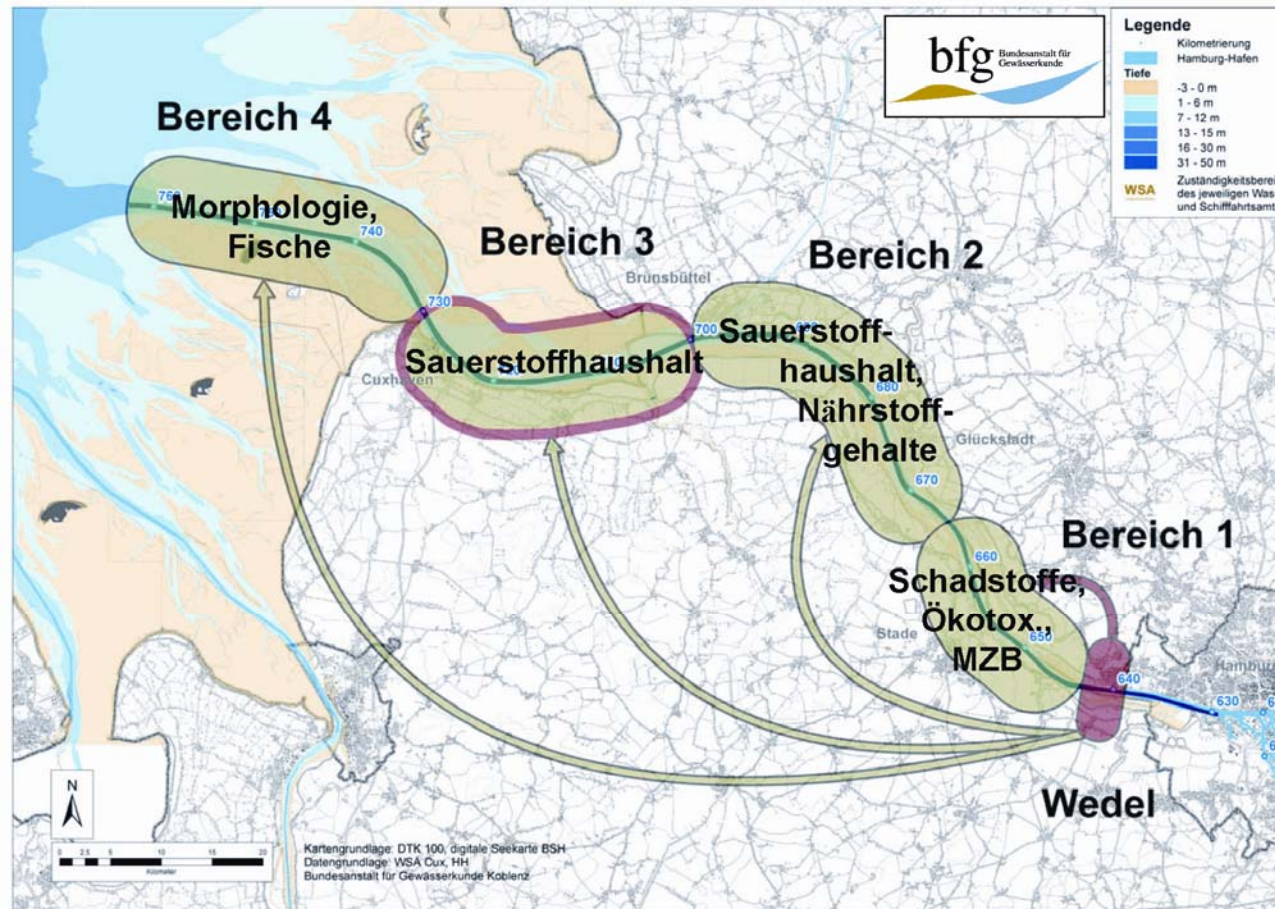
locally – overall

In the estuary – in the North sea

Minimizing the impact on fish and benthic organisms

In the marine section – in the freshwater section

## Solving goal conflicts: evaluation of long-term impacts for different relocation szenarios



Sediment management means the current and accurate solution of goal conflicts

among regulations like

London-, OSPAR-Convention  
Water Framework Directive  
Natura 2000-Directive  
Marine Strategy Framework Directive

Sediment management means the current and accurate solution of ever changing goal conflicts

all of these have to be integrated in a management concept, but...

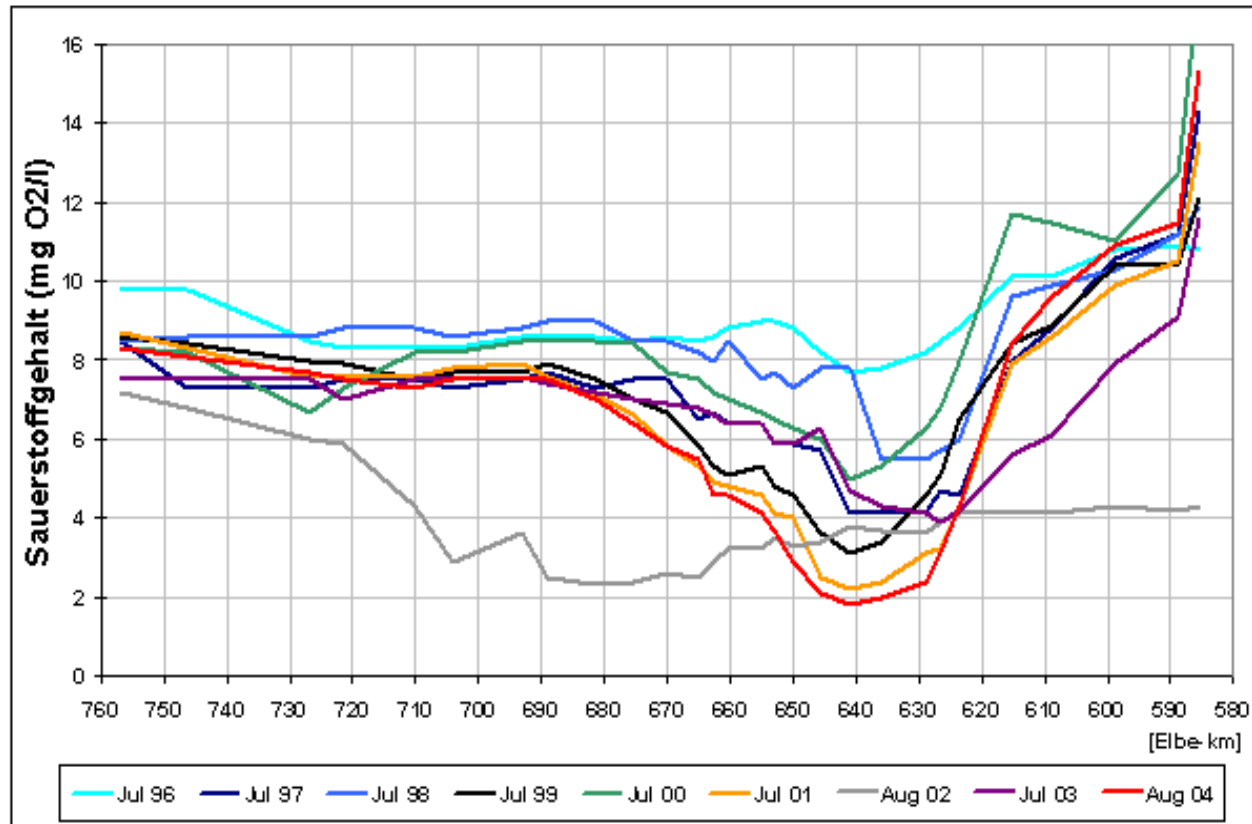
goal conflicts are not always insoluble:  
Optimization by engineering criteria and by ecological criteria may lead to similar concepts for relocation

- Reducing reflux for economic reasons
- Stabilizing sediment budget for engineering reasons
- Reducing siltation of shallow areas
- Promoting high oxygen values

are to be followed by the same strategy of long range relocation!



## Sediment management means the current and accurate solution of goal conflicts



Oxygene levels show critical minima at Wedel in summer

For the implementation of river maintenance in the integrated management plan of the Natura 2000 Directive the following procedure is defined:

- specific monitoring of endangered species (red herring)
- monitoring of maintenance related parameters like toxicants, siltation, sinks of toxicants
- evaluation of maintenance effects important to Natura 2000 goals
- optimization of strategy of dredging and relocation by monitoring results

In order to solve goal conflicts, basic understanding and assessment of ecological effects is needed to prioritize criteria of

- effects of morphology
- effects of deposition
- effects of overall water quality
- local effects of toxicants
- wide range long term effects of toxicants

Wir machen Schifffahrt möglich.



Thank You for Your attention!