Rijkswaterstaat
Ministry of Infrastructure and the Environment

Sediment management in the Dutch River Rhine

An integrated approach for navigation, safety against flooding and ecology

Pol Hakstege

Rijkswaterstaat

SedNet November 6 2013 Lisbon

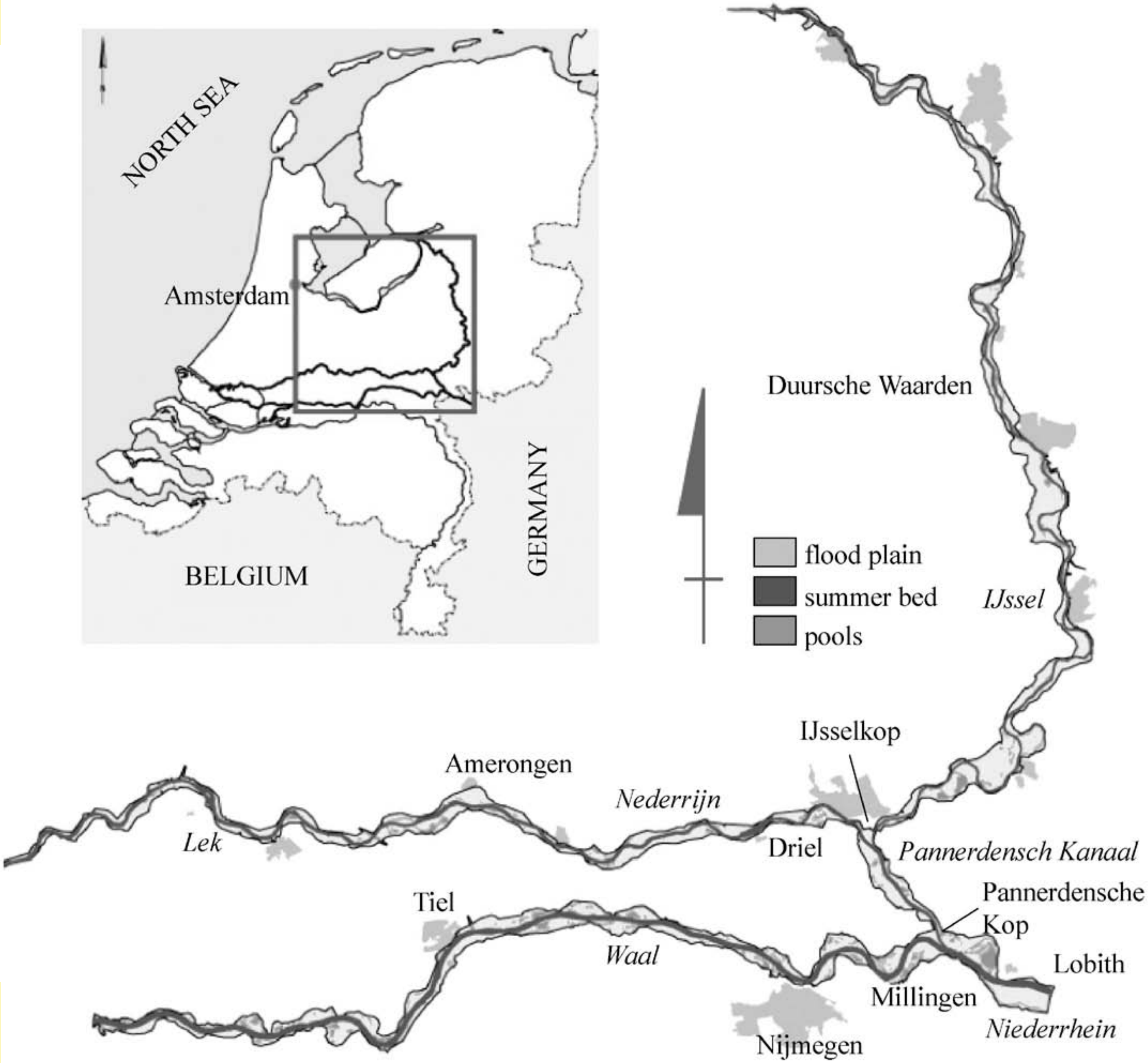
Outline

- Introduction
- Case study Dutch River Rhine
- Adverse effects from measures
- Dredging practices and strategies
- Options for more efficient sediment management
- How to do more with less

Key message

- How to do more.....sustainable sediment management with fewer......adverse effects for
  - Navigation
  - Flood risks
  - Ecology

Case Study Waal branch Dutch River Rhine



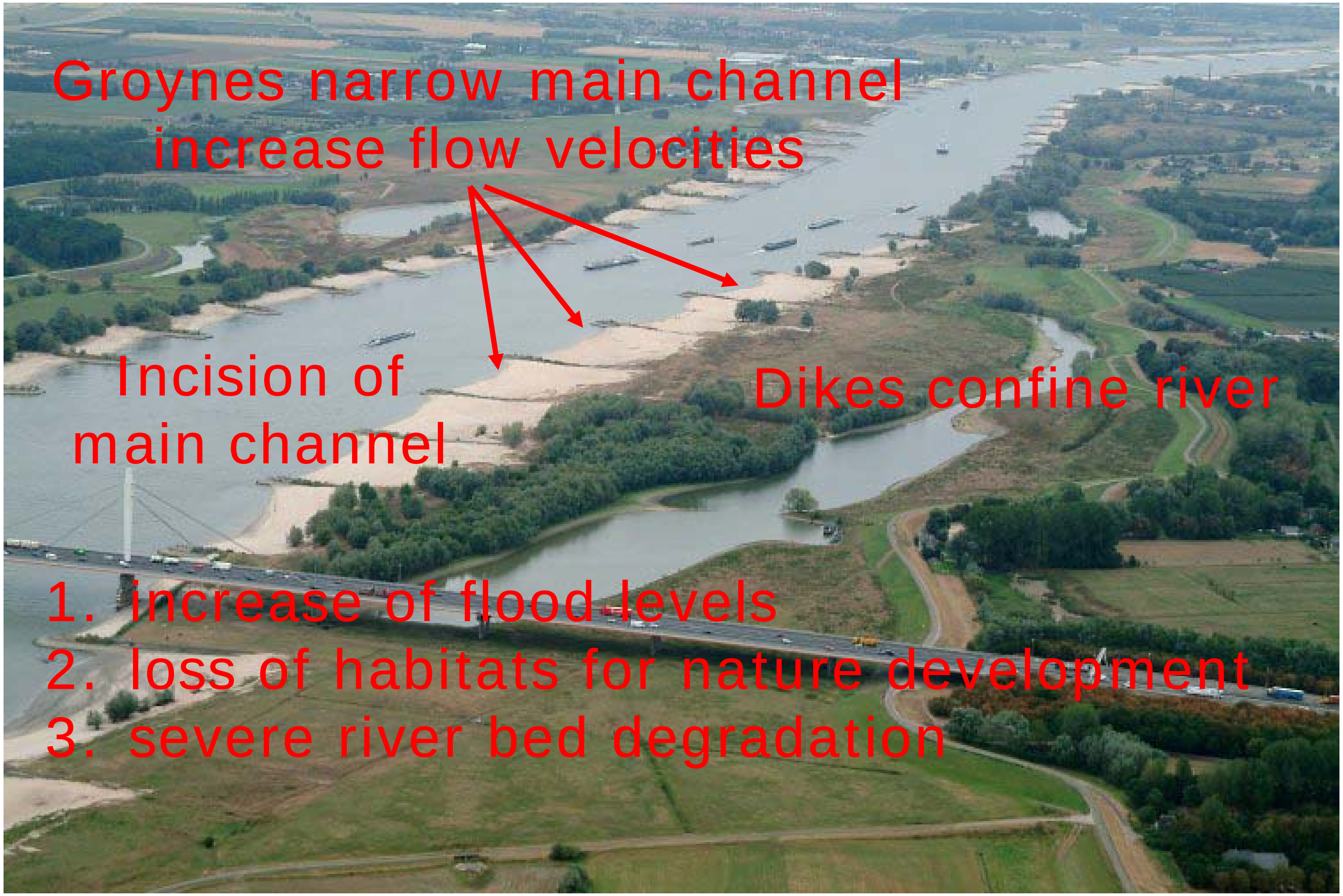
Multiple functions

Ecosystem Services

- Safe discharge
- Navigation
- Water quality (WFD)
- Nature (floodplains N2000)
- Other: recreation, agriculture, urban development

Conflicting demands

Regulated Rivers adverse effects



Near floodings, evacuations 1993 and 1995
Climate change: more extreme discharges

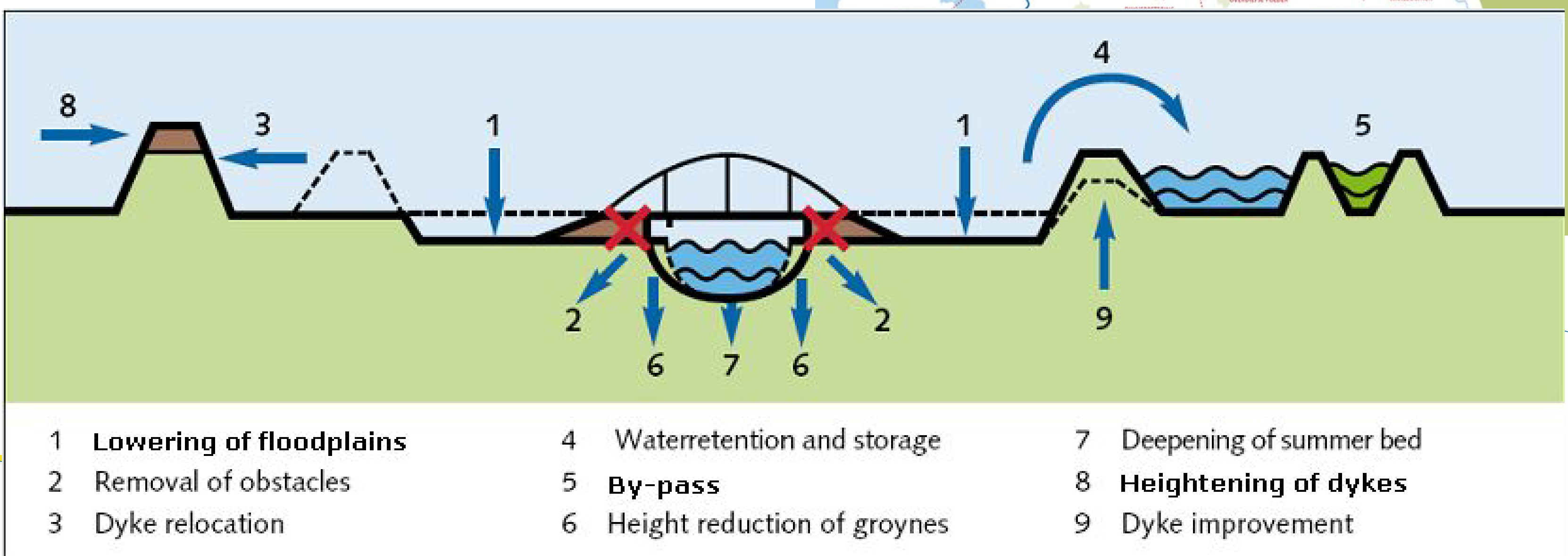
ruimte voor de rivier

Room for the River Programme

Two aims:

- Safer Dutch river areas by 2015. Reduce high water levels by making space for water
- Second objective: enhancement overall spatial quality

Some 30 measures in execution

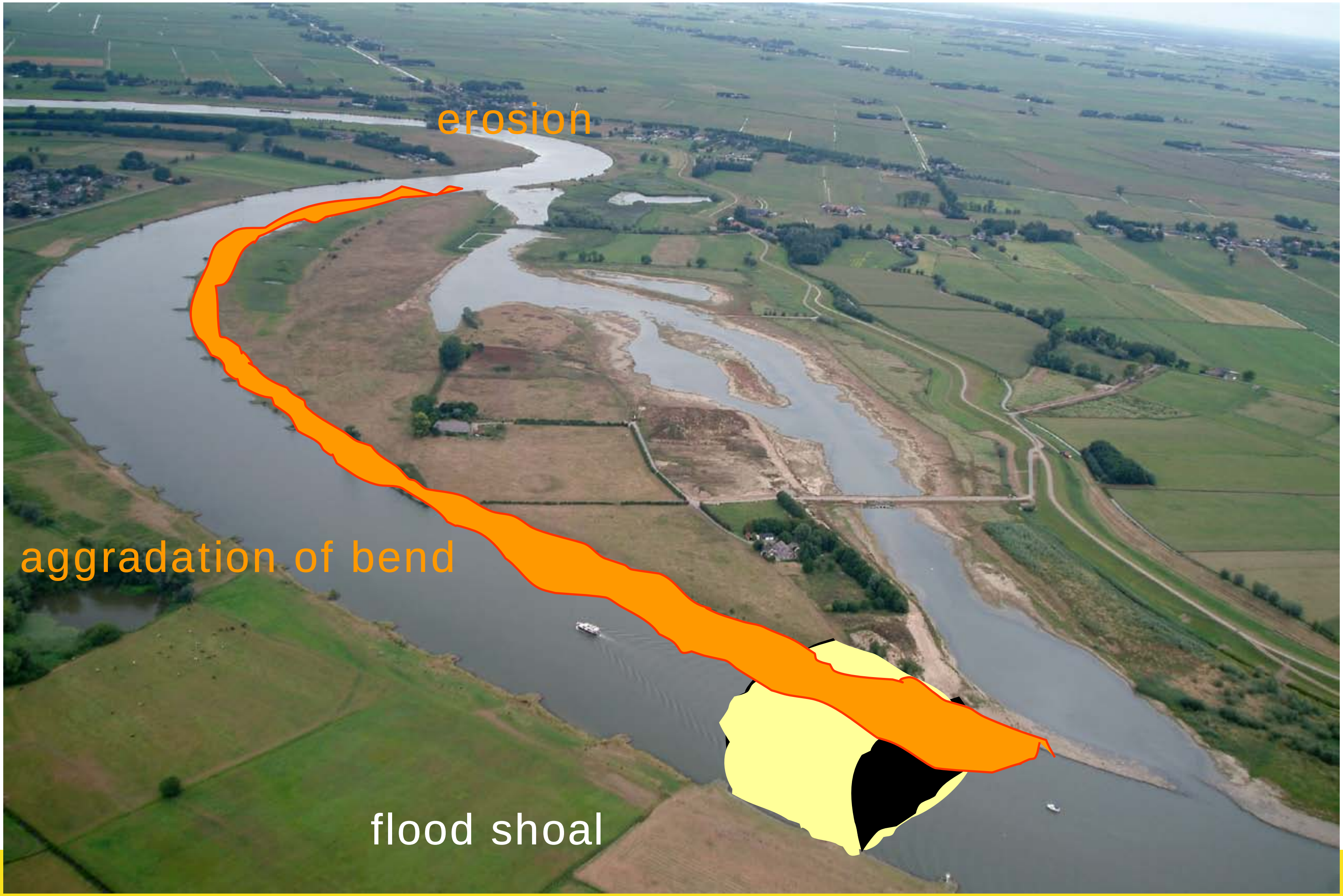


European Water Framework Directive (2015 and 2027)

- Objectives for chemical and ecological water quality
- Measures comprise different types of measures for cleaner water and to improve conditions for fish, macro fauna, algae and water plants
- Examples are construction of ecological river banks, secondary channels and lowering of floodplains to improve and create habitats.

Ecological riverbank

Morphological effects of measures
Example secondary channel



River bed degradation

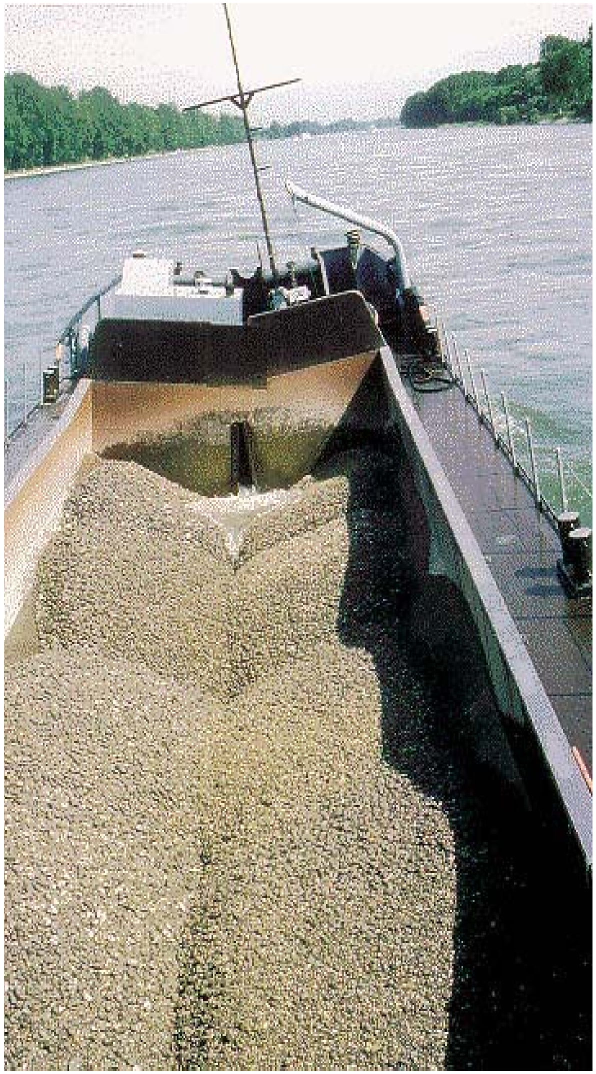
Causes

- Regulation:
  - narrowing and steepening of river bed
  - higher flow velocities and erosion

- Shortage of sediment:
  - embankments of floodplains
  - extraction of sand
  - little input from upstream

Consequences:

  - erosion river bed 1-3 cm/yr
  - resistant layers form barriers for navigation
  - problems access to locks, harbour facilities
  - cables and pipelines



Dredging for maintenance of fairway

- In the past 50-100.000 m^3/yr.
- Sand was extracted to be used for construction.
- From 2005 lowering min. depth of fairway (2.5 to 2.8 m).
- Morphological response. Increase in dredging 300-800.000 m^3/yr.

Dredging pilots 1998-2002

Present dredging practice TSHD + plough

- Profile dredging after high water levels
- Maintenance of fairway during the year
- Relocation of dredged material

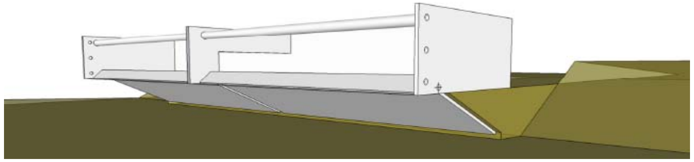

Dredging for maintenance
may hinder navigation

Options for more efficient sediment management

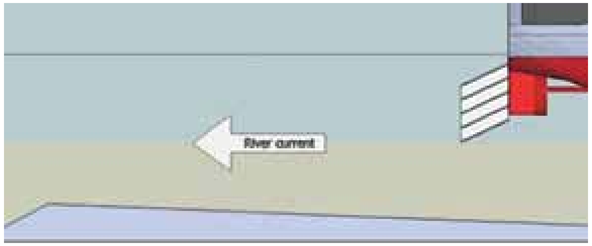
- Dredging contract based on performance criteria

- More efficient dredging
  - optimizing suction installation of TSHD with existing knowledge: 10 % gain in efficiency
  - water injection dredging

- Improvement of plough



- Hydraulically:
  - erosion by downwards deflected propellor wash
  - erosion by deep navigating barges



- Additional structural measures to reduce sedimentation

Pilot Longitudinal dams: multifunctional solution

Challenges

- Conflicting demands and unwanted effects from measures for flood risk management, ecology and navigation
- Increase of morphological effects (measures for Delta programme + 2nd phase WFD)
- More extreme discharges (climate change)
- Further degradation of river bed (action needed)

How to do more ...sustainable sediment management with fewer….adverse effects

- Integrated approach balancing interests also on the long term
- Safe and (cost) efficient maintenance (LCA)
- Multifunctional structural measures e.g. longitudinal dams
- More efficient dredging less hindrance for navigation
- Understanding of the system is essential (hydraulics-morphology-ecology)

Thank you for your attention!

Questions?