



Innovative river management – combining ecology, navigation and river engineering

BOKU - University of Natural Resources
and Applied Life Sciences, Vienna

Institute of Water Management, Hydrology and Hydraulic Engineering

H. HABERSACK



Outline

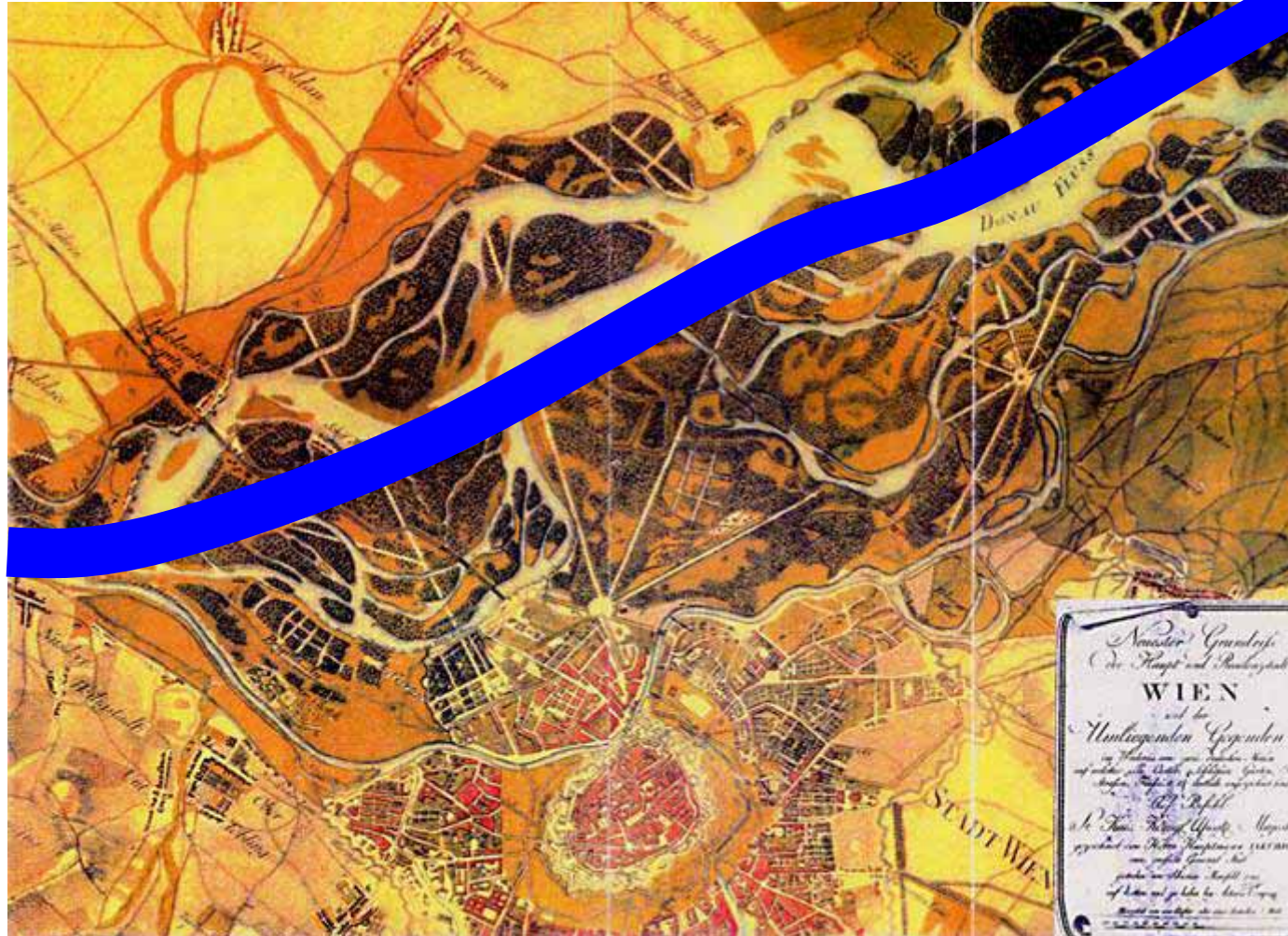
1. Introduction
2. Problems in the Danube river reach east of Vienna
3. Planning philosophy
4. The integrated Danube river project
5. Conclusions



Problems

- Steady river bed erosion (2 - 3.5 cm / year)
- Numerous critical spots (low water depth during low flow) for inland navigation
- Heavily regulated river in a National Park region (erosion of river bed and sedimentation of inundation area etc.)
- High maintenance costs (sediment insertion)
- Flood management

Historical and existing situation



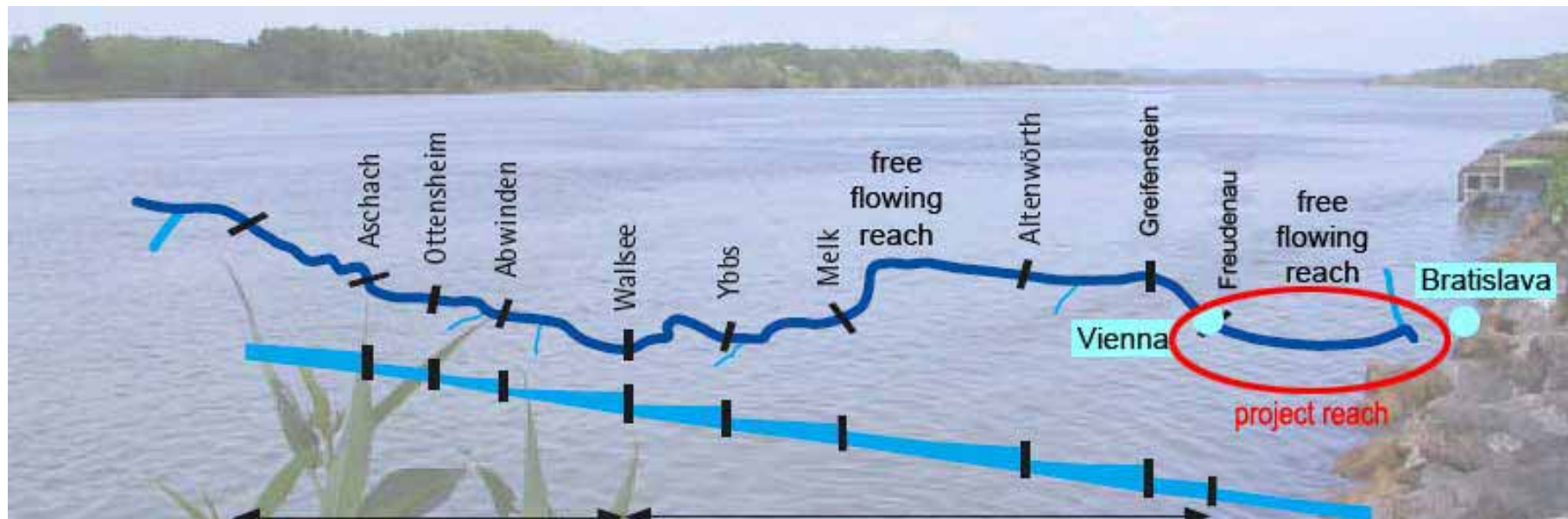
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Danube river
in the vicinity
of Vienna,
1790

Boundary conditions



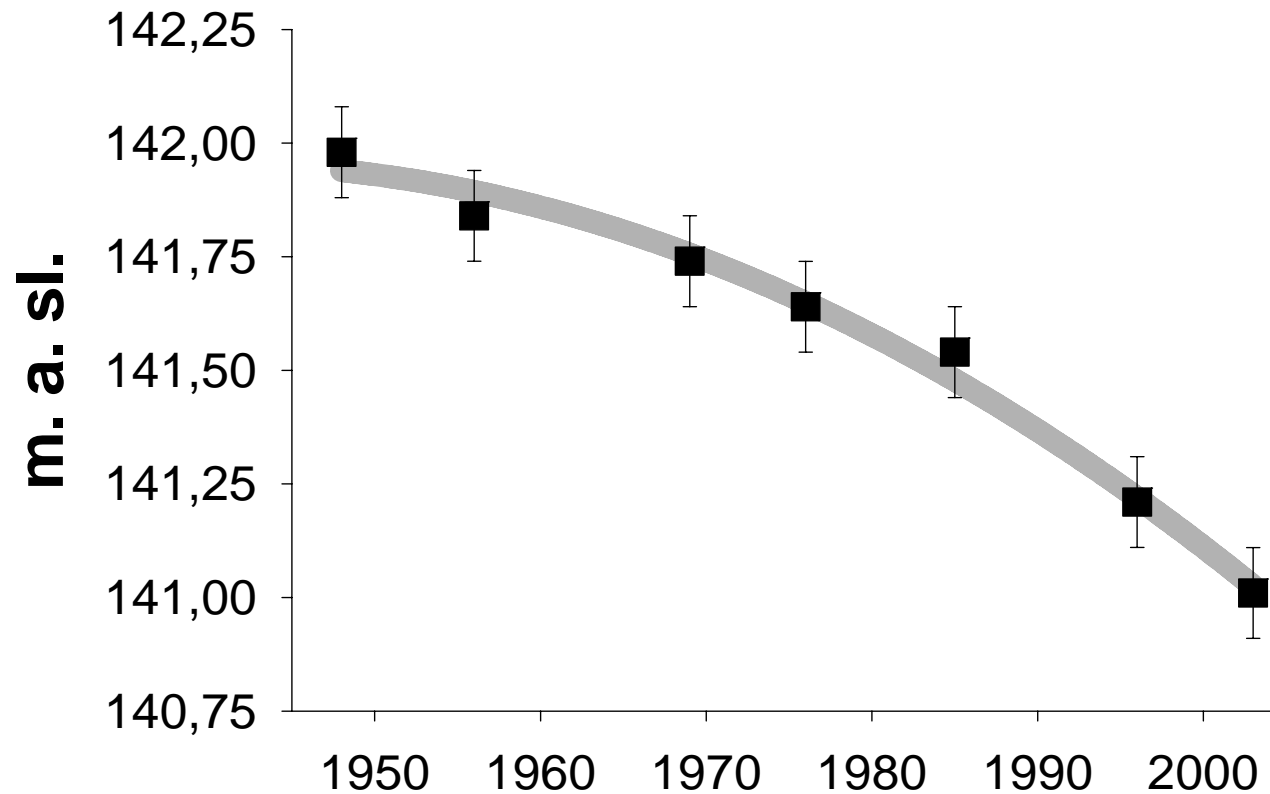
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Danube river bed degradation

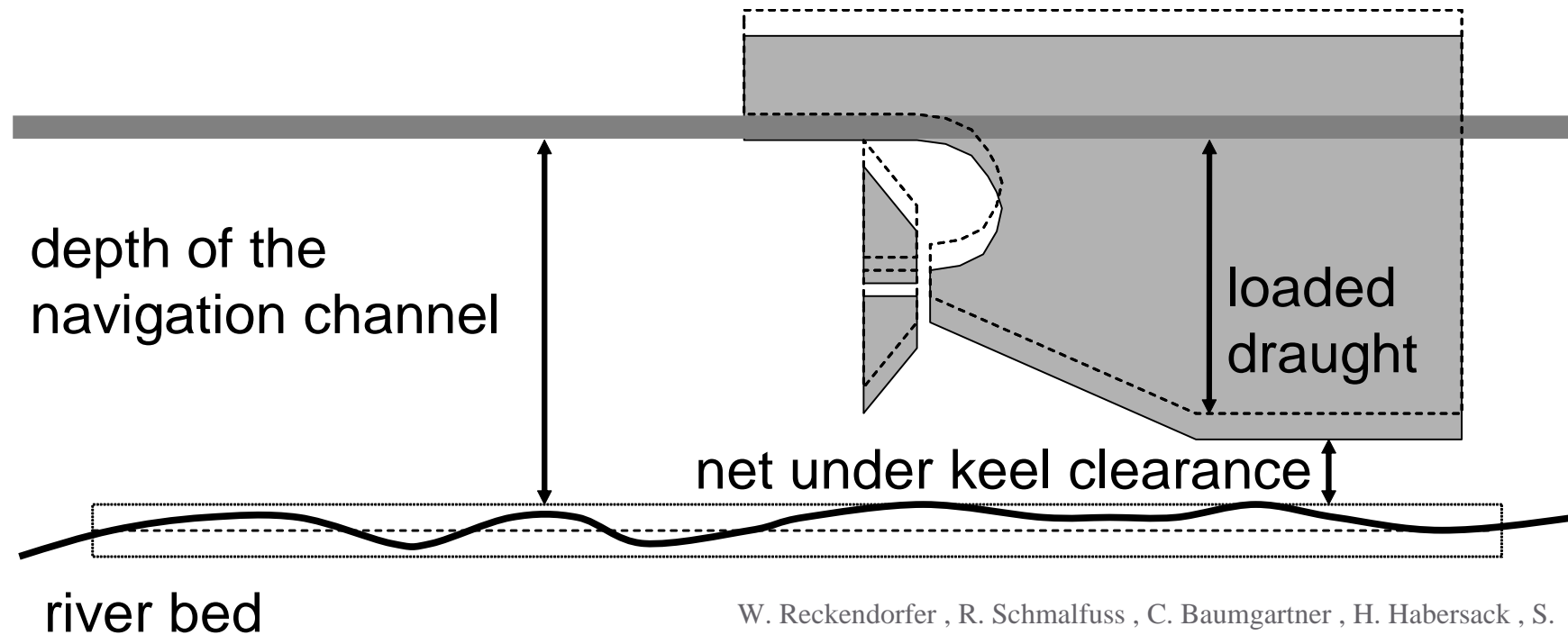
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Navigation problems



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Integrated River Engineering Project on the Danube East of Vienna

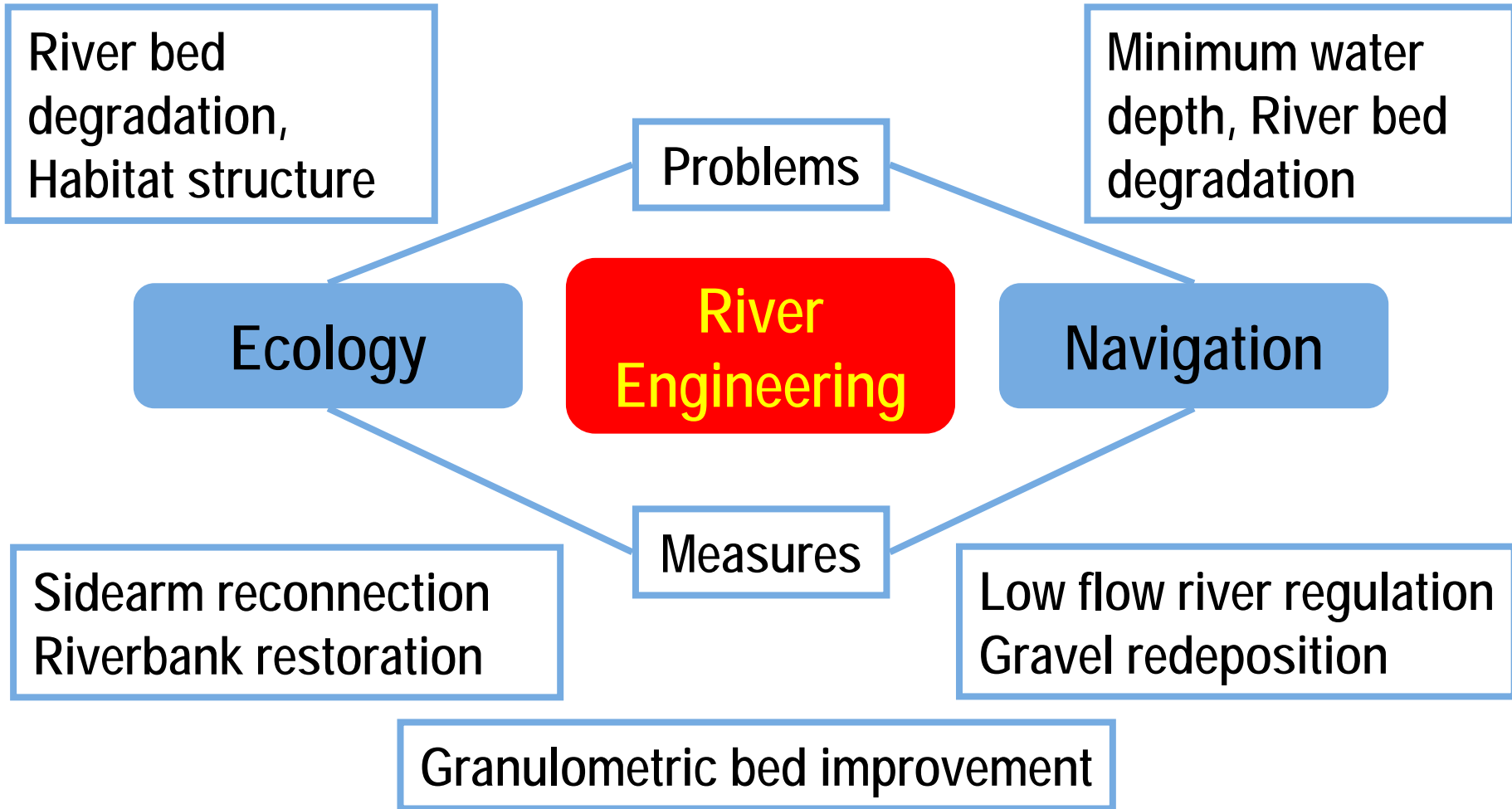
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Foto: Nationalpark
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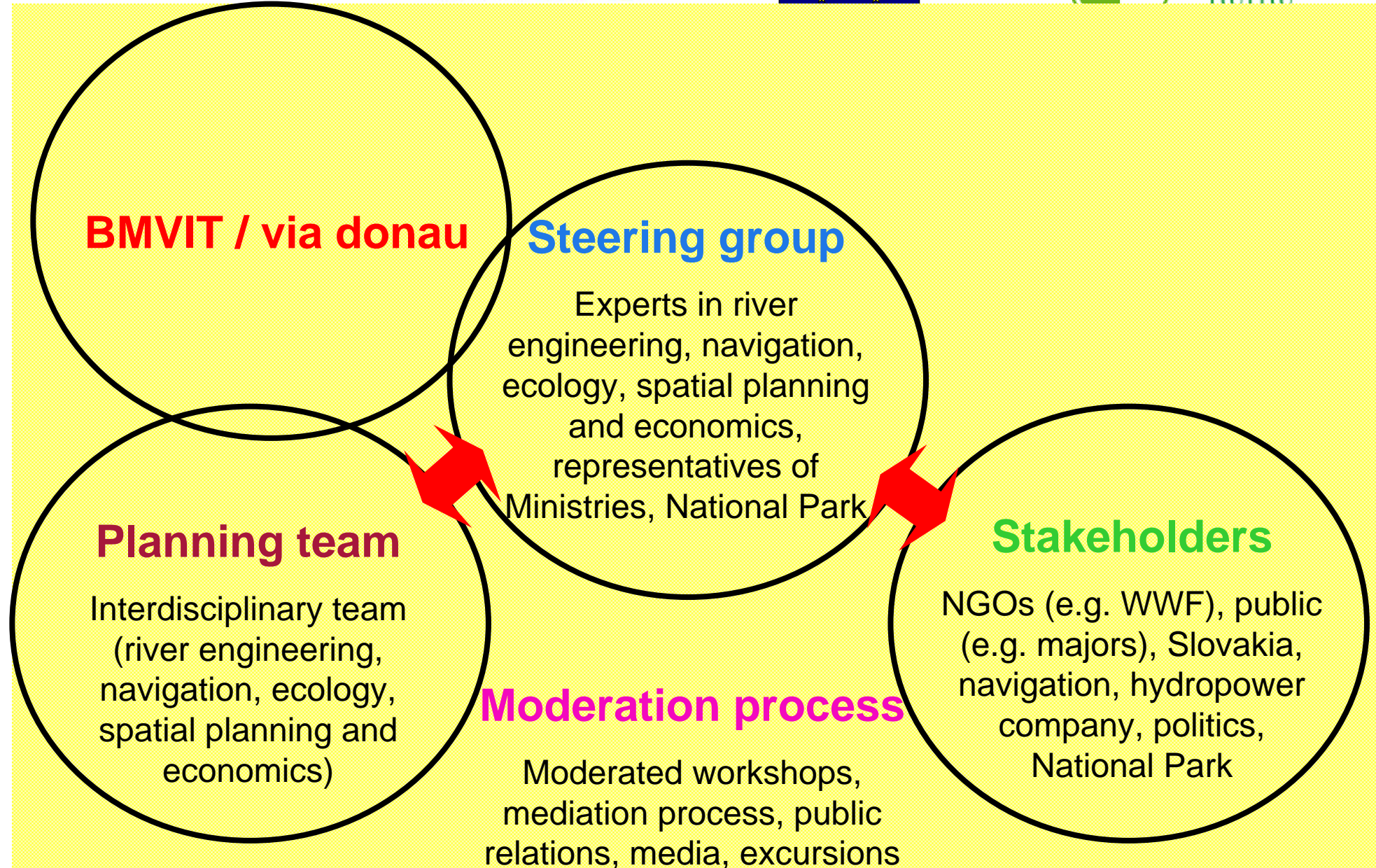
Problems/Measures





Main Objectives

- 1. Stop of further riverbed degradation by a *sustainable stabilisation* of the *mean bed level***
- 2. Improvement of *minimum water depth* for navigation**
- 3. Sustainable improvement of the *ecological status*, especially at shorelines and sidearms, based on necessities of the National Park**





Scenario comparison

	BED STABILISATION						
Depth	without	normal bedload			Granulometry		
25 dm	existing sit.	25			25		
27 dm		27A	27B	27C	27A	27B	27C
32 dm		32			32		



qualitative planning



detailed planning



Scenario comparison

Scenario	Normal bedload					Granulometric Bed Impr.				
	27A	27B	27C	32	25	27A	27B	27C	32	
NAVIGATION	Green	Green	Green	Green	Red	Red	Red	Red	Green	
ECOLOGY	Red	Red	Green	Red	Red	Green	Red	Red	Red	
RIVER ENGINEERING	Red	Red	Red	Red	Red	Red	Red	Red	Green	
SPATIAL PLANNING	Red	Green	Green	Green	Green	Green	Green	Green	Green	

**!!If no solution is found
 all parties will only loose!!**

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Planning principles

- application of the **granulometric bed improvement** for river bed stabilisation
- improvement of low water depth by **dredging** and **defined refilling of material** and construction of new and **modification** of existing **groins**
- implementation of **measures according to given morphological processes**
- **integrated design of regulation structures**, equally regarding hydraulic, morphological and ecological criteria



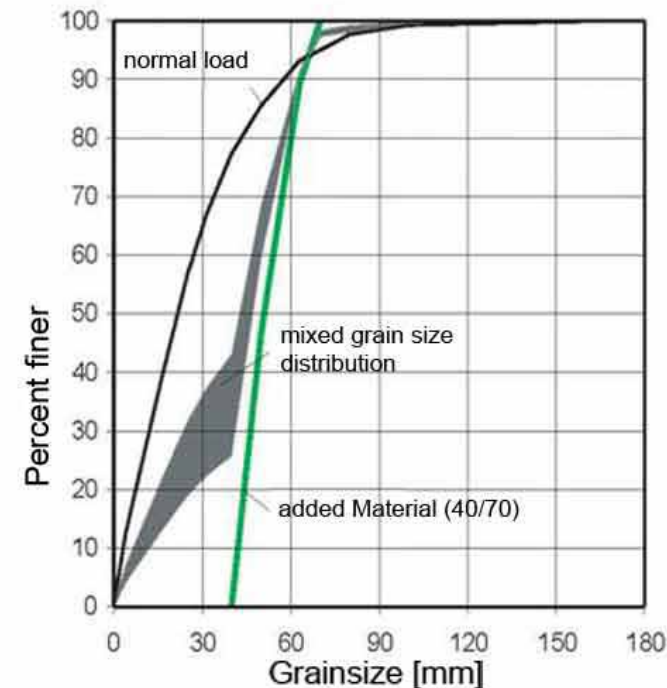
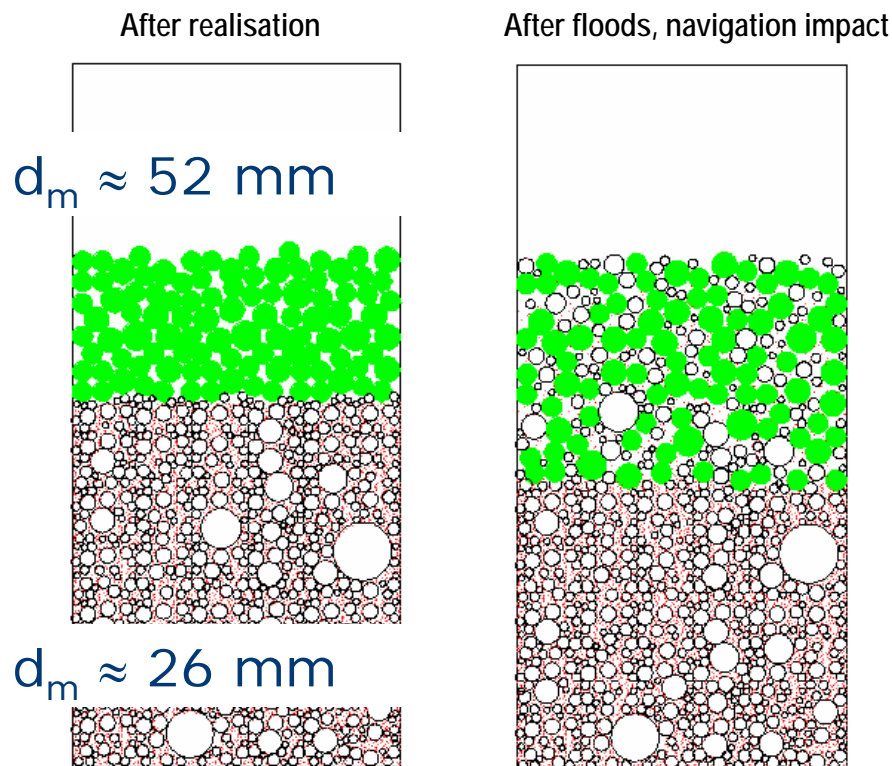
Planning principles

- **realisation of measures in an adaptive** form, focussing on pool reaches
- **definition of width and depth** specifically for the central part of the navigation channel and areas with granulometric bed improvement
- **optimisation** of the potential for **river bank restoration** and **side channel reconnection**
- keeping or if **possible reducing flood water levels**

Reduce riverbed erosion by adding larger gravel sizes (ca. 40 – 70 mm) within the natural grain size spectrum
 → **Granulometric Bed Improvement**



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Navigation: Low flow regulation

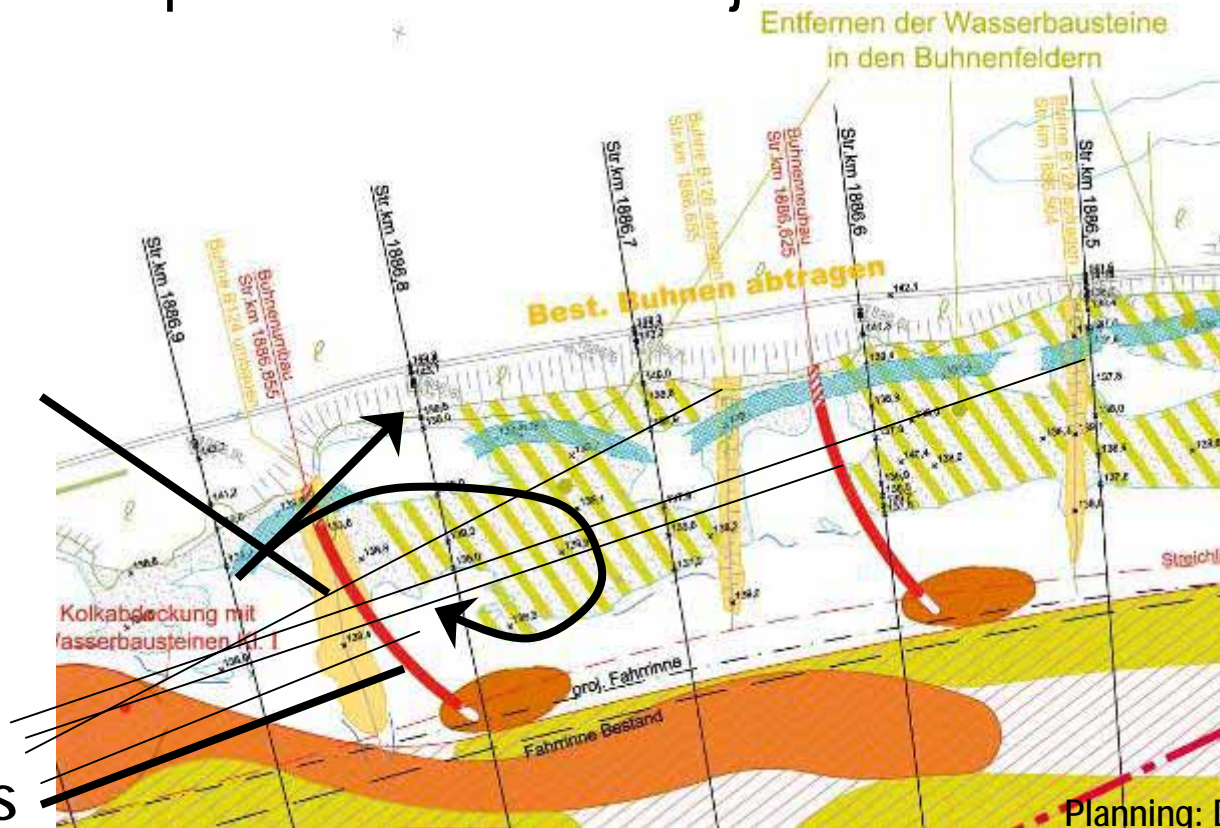




Improve navigation conditions, particularly during low flow periods, by raising water levels using modified groyne shapes and riverbed adjustments

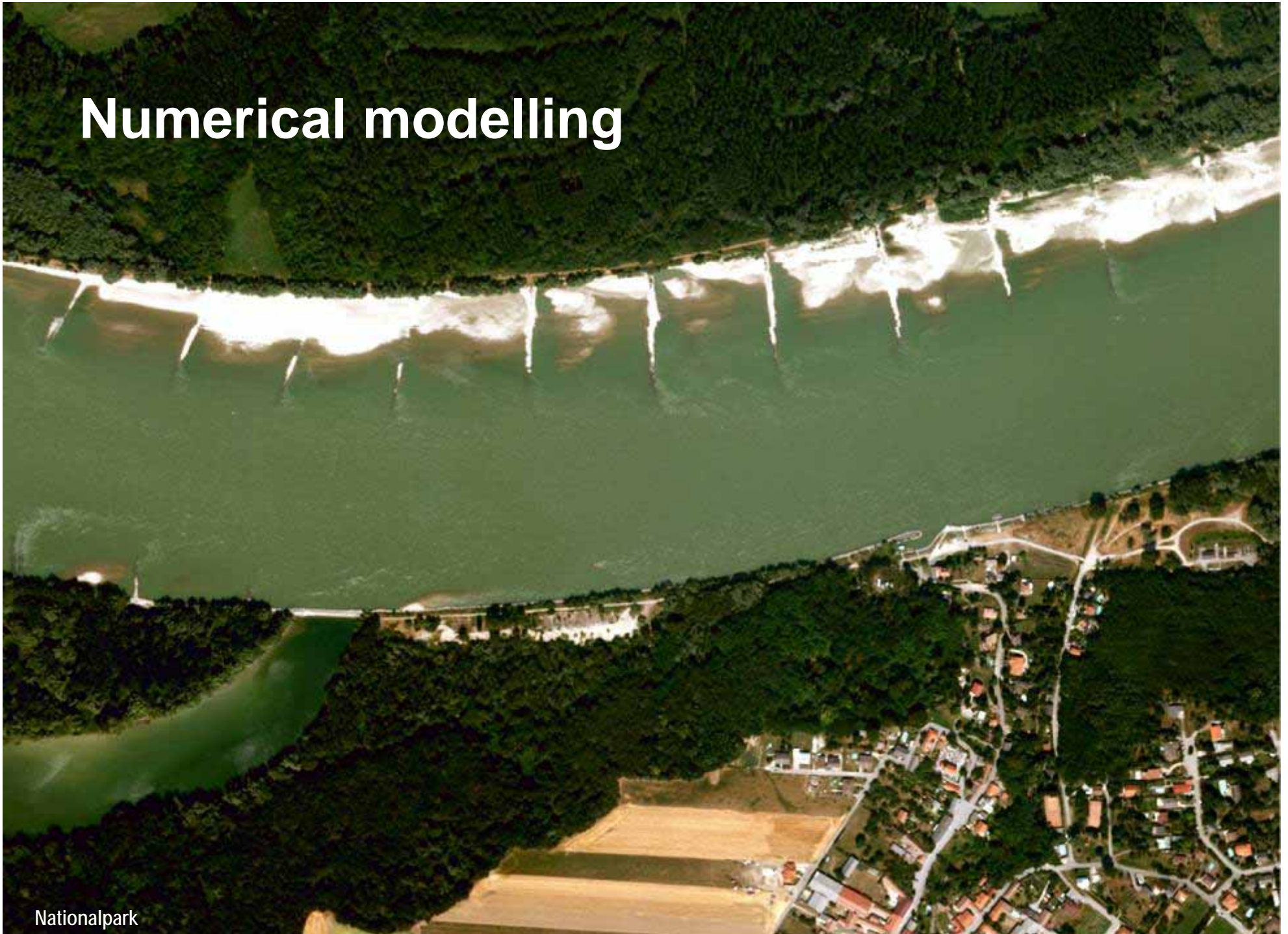
existing groynes

modified groynes

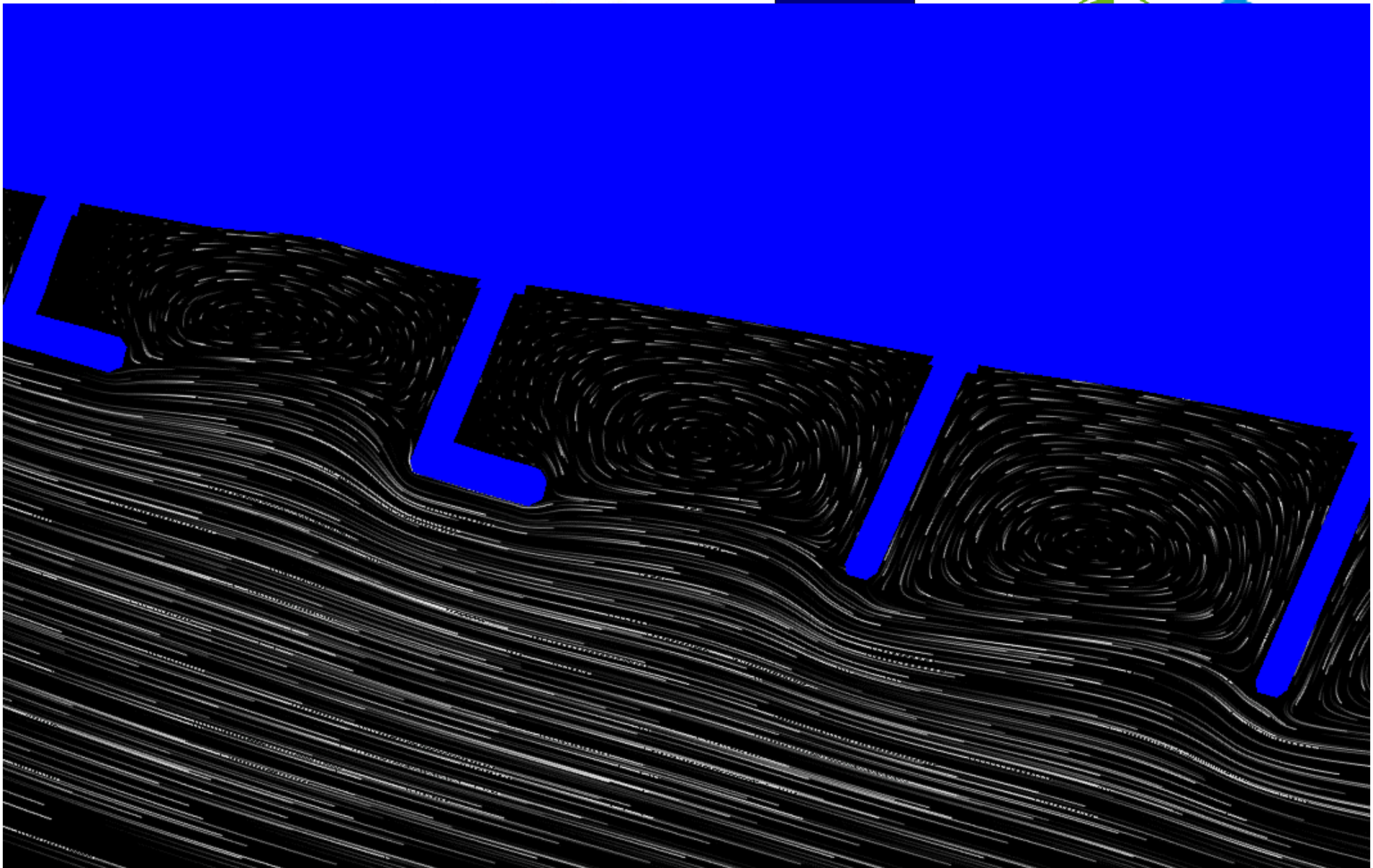


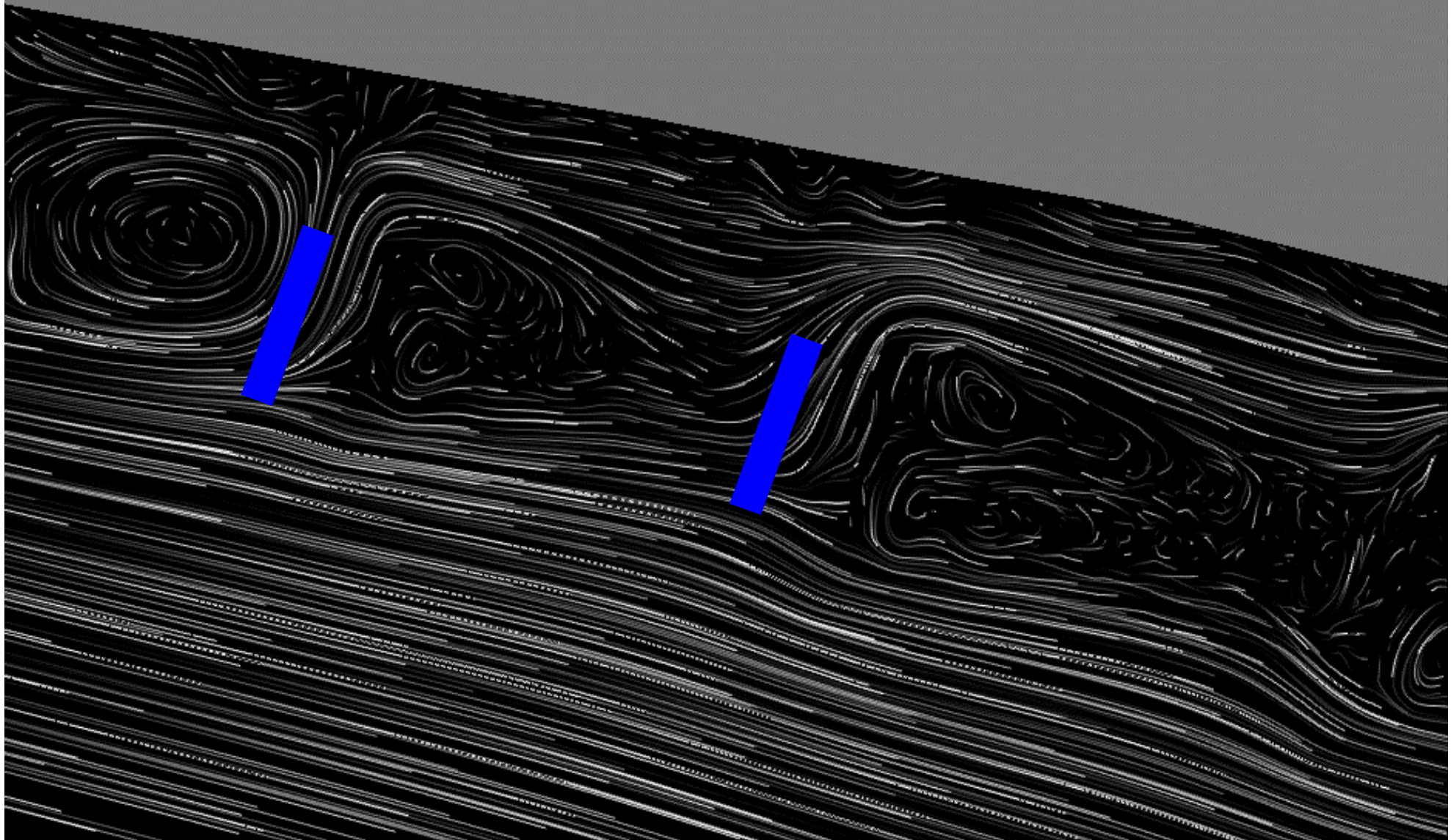
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Numerical modelling

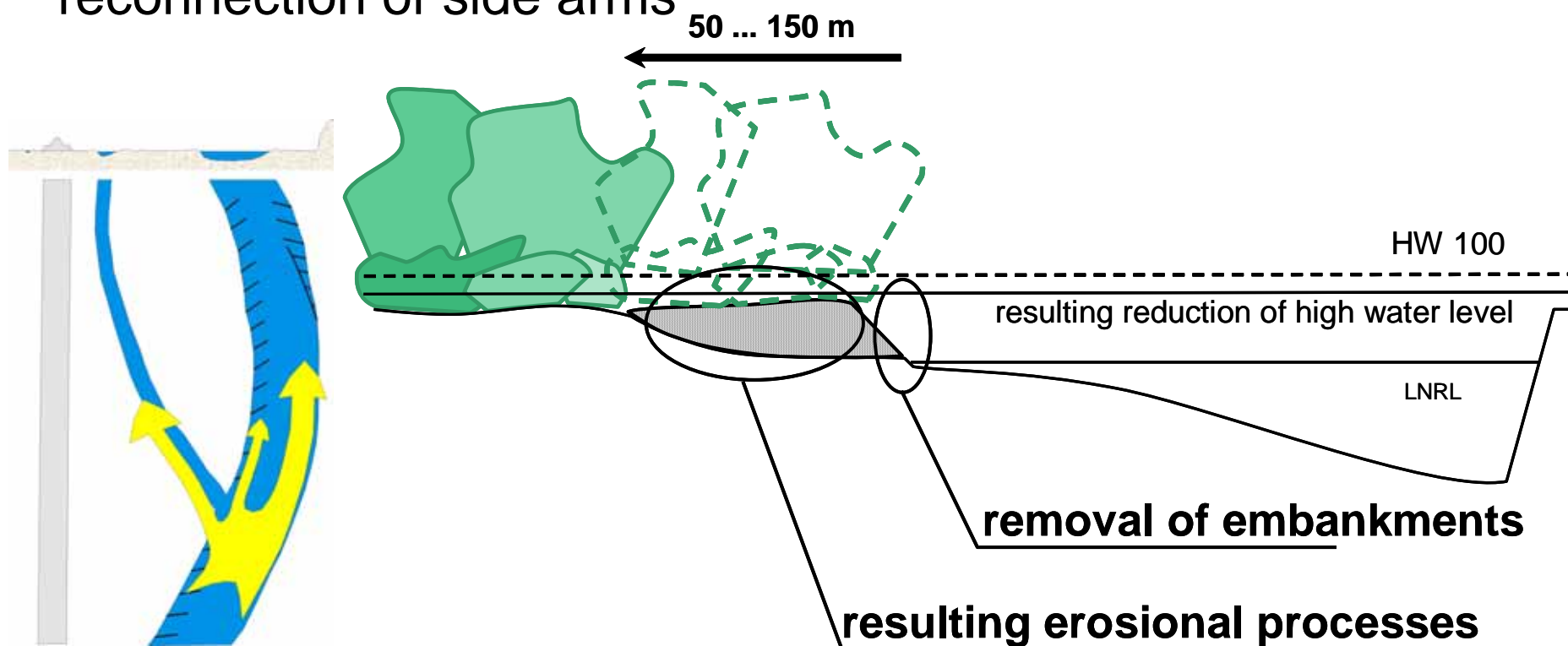


Nationalpark





Achieve improved ecological conditions by riparian restoration measures and the reconnection of side arms



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Innovative River



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Conclusions

- Integrated, interdisciplinary planning is necessary for reaching a common understanding – moderated process
- A central aim of the Integrated River Engineering Project on the Danube East of Vienna is minimizing bed degradation
- The granulometric bed improvement is a novel approach
- Improving navigation is reached via increasing water depth at low flows and gravel redeposition
- River restoration is mainly done by allowing side erosion, bank dynamics and reconnecting side channels
- A combined monitoring approach and common modelling strategies allow an evaluation of the success



Interdisciplinary steering group

**Common
Goals**

WIN - WIN

**Willingness
to find
compromise**

**Integrated and
interdisciplinary
planning**

**Public
participation**

**Support from
politics**

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