UNSTABLE BED AND BANKS OF THE DANUBE RIVER AT THE "APATIN"SECTOR

THREAT TO LOCAL COMMUNITIES, PROTECTED AREAD, AND WATER TRANSPORT ALONG THE DANUBE CORRIDOR

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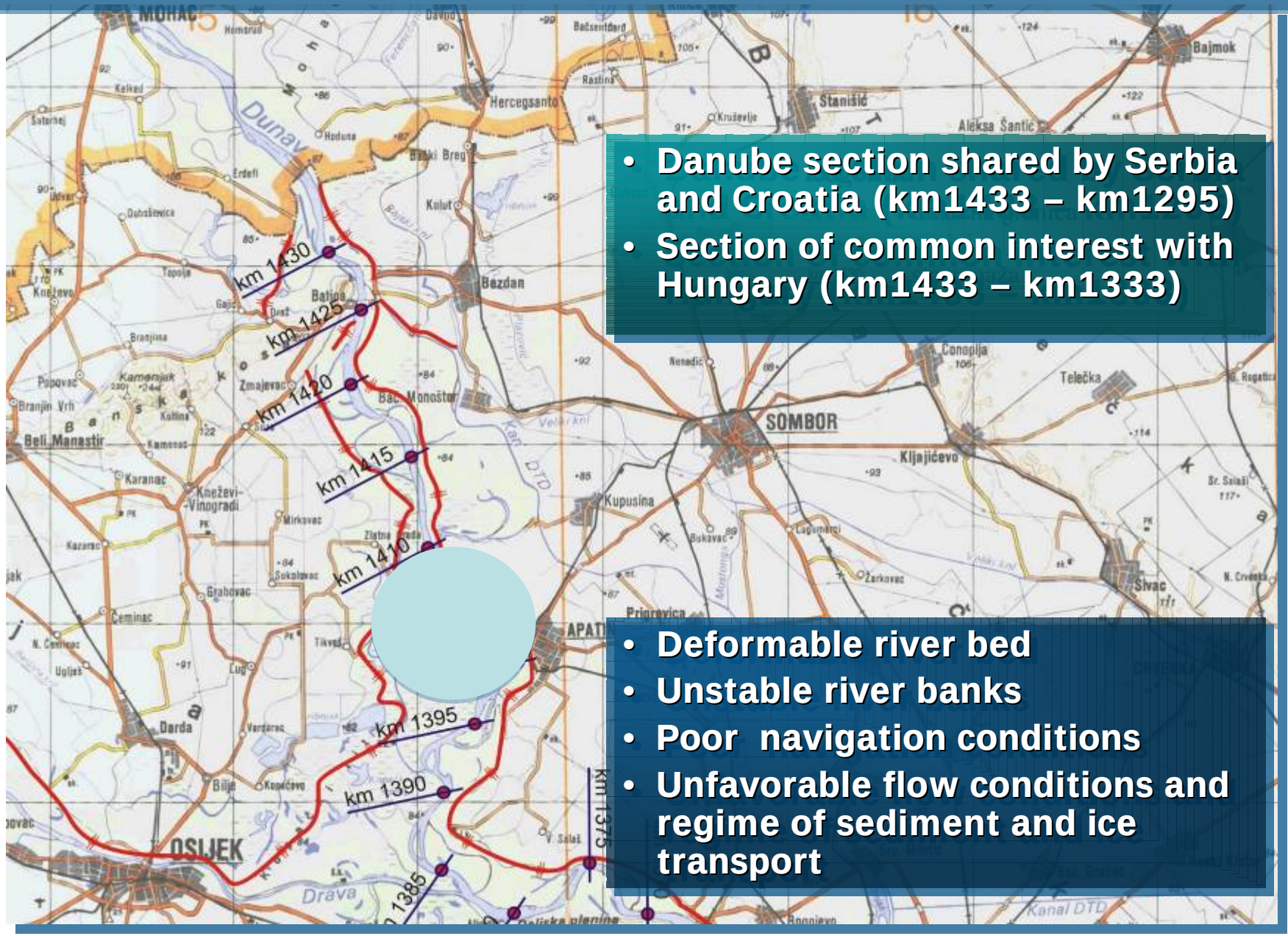
Institute for Development of Water Resources "Jaroslav Cerni" - Belgrade

Joint Statement on Inland Navigation and Environmental Sustainability in the Danube River Basin, II workshop, Bucharest, June 25-26, 2007

SECTOR APATIN

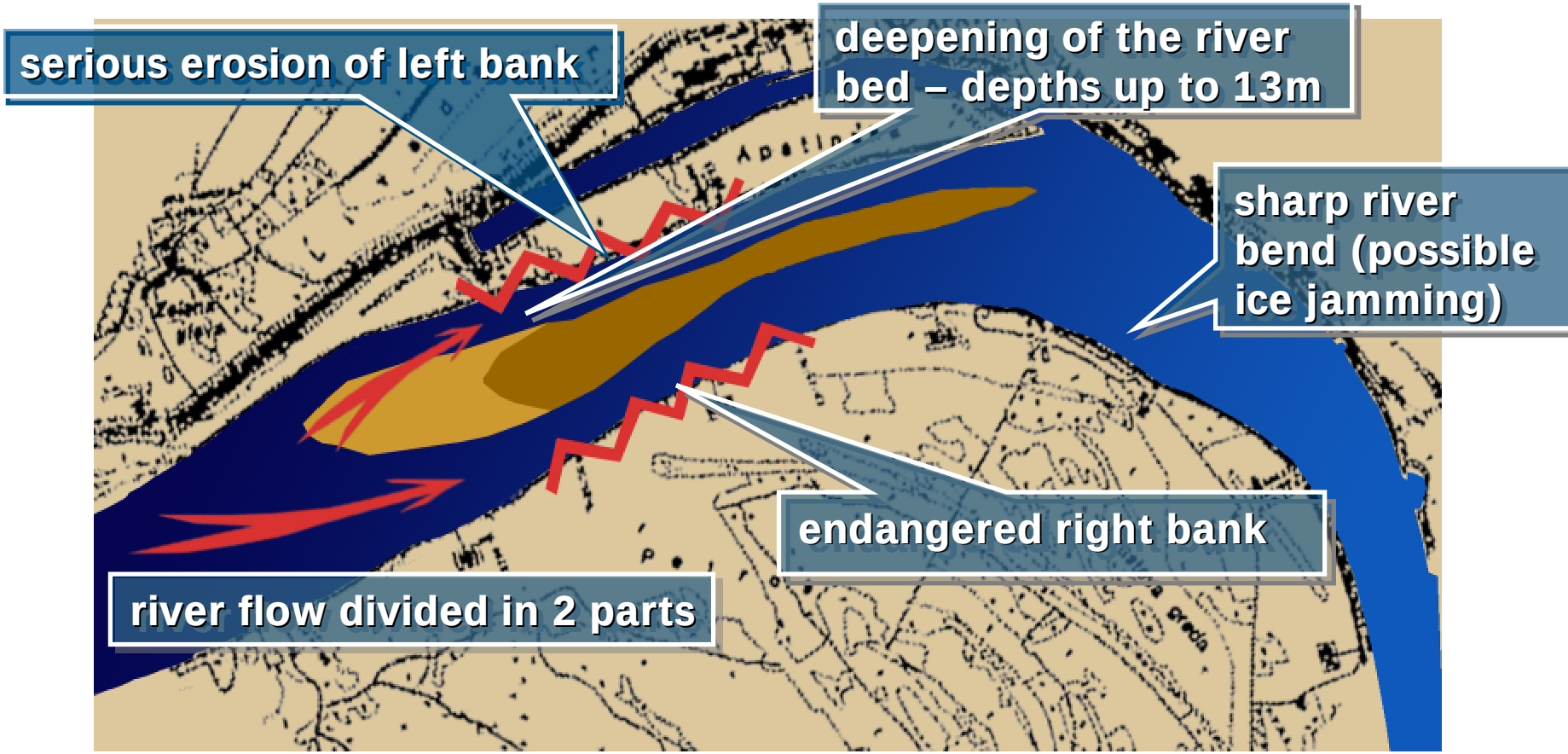


- Danube section shared by Serbia and Croatia (km1433 – km1295)
- Section of common interest with Hungary (km1433 – km1333)

- Deformable river bed
- Unstable river banks
- Poor navigation conditions
- Unfavorable flow conditions and regime of sediment and ice transport

RIVER BED DEVELOPMENT DURING FLOOD 2002

SERBIA



CROATIA

LOCAL BANK PROTECTION

Right bank (Croatia) – protection of Kopacki rit area of 17,700 ha (protected by the Ramsar Convention and featuring the Special Zoological Reservation)

Left bank (Serbia) – protection of Apatin city, including international ship winter shelter, harbor, shipyard, custom center, and city beach

NAVIGATION CONDITIONS

ROAD TO SOLUTION

STABILISATION AND IMPROVEMENT OF THE DANUBE RIVER BED NEAR APATIN

STUDY AND DESIGN

- FEASIBILITY STUDY (including EIA)
- CONCEPTUAL DESIGN
- DETAILED DESIGN

COORDINATION WITH CROATIA

- REVIEW OF POSSIBLE SOLUTIONS AND EFFECTS
- COST ESTIMATE
- AGREEMENT ON FINANSING AND WORK EXECUTION

COORDINATION WITH HUNGARY

- REVIEW OF POSSIBLE SOLUTIONS AND EFFECTS

NEW BILATERAL COMMISSION

EXISTING BILATERAL COMMISSION

FEASIBILITY STUDY 2004-2006

Ministry for capital investments – IWT Department

Inland waterways maintenance and development agency PLOVPUT

Civil engineering faculty - Belgrade

Ministry for agriculture, forestry and water resources management – Directorate for water

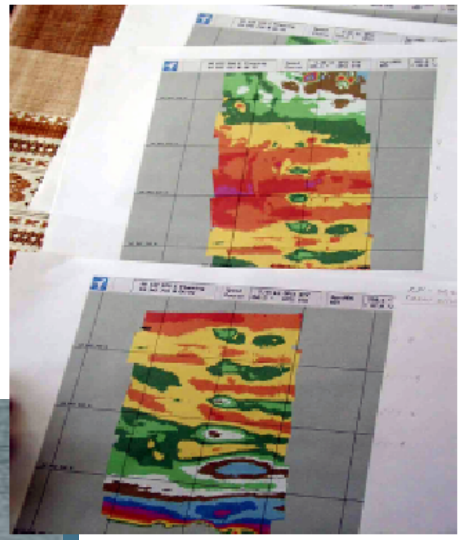
Institute Jaroslav Cerni

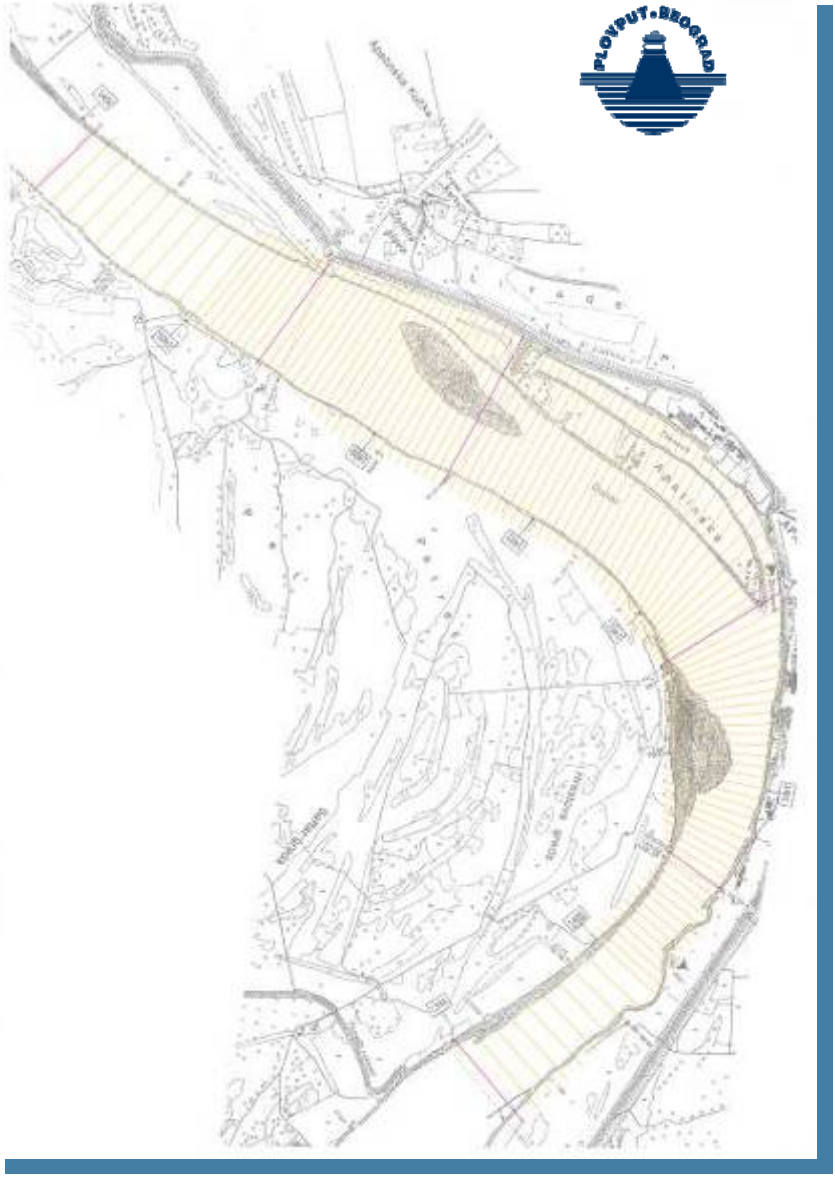
1. Field investigations – detailed survey of river morphology, 2 series of flow and sediment transport measurements (December 2004 and May 2005)
2. Hydraulic study - 1D (HEC-RAS) and 2D models (finite elements)
3. Preliminary design

Feasibility study

Environmental impact assessment

FIELD INVESTIGATIONS



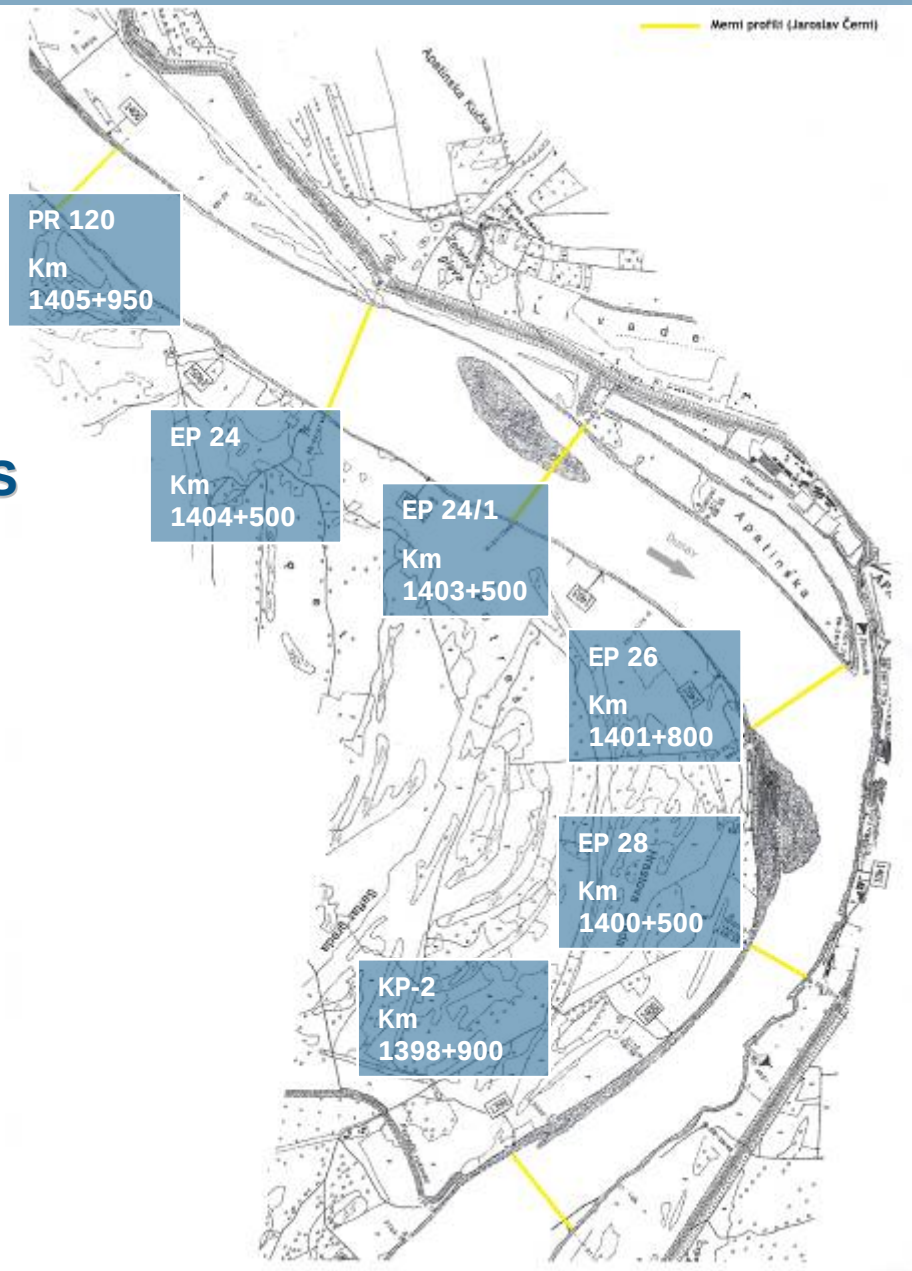


RIVERBED SURVEY - km 1399 do km 1406

120 cross sections (km 1400 do km 1405 at 50 m distance and 100 m upstream/downstream)

FIELD INVESTIGATIONS

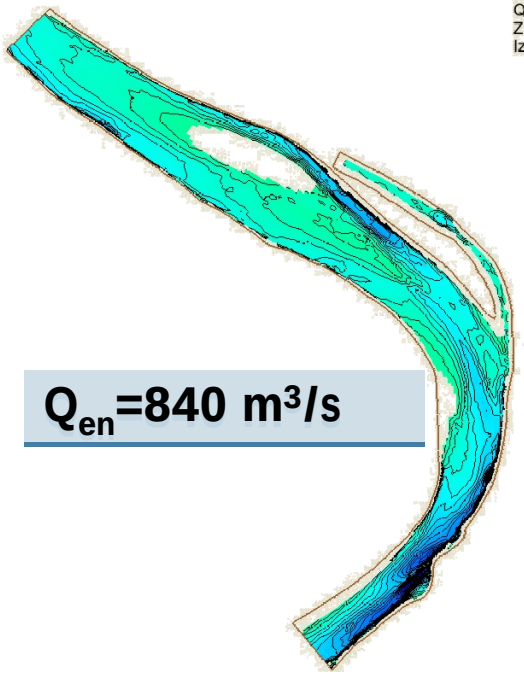
2 SERIES OF FLOW AND SEDIMENT MEASUREMENTS AT 6 CROSS SECTIONS



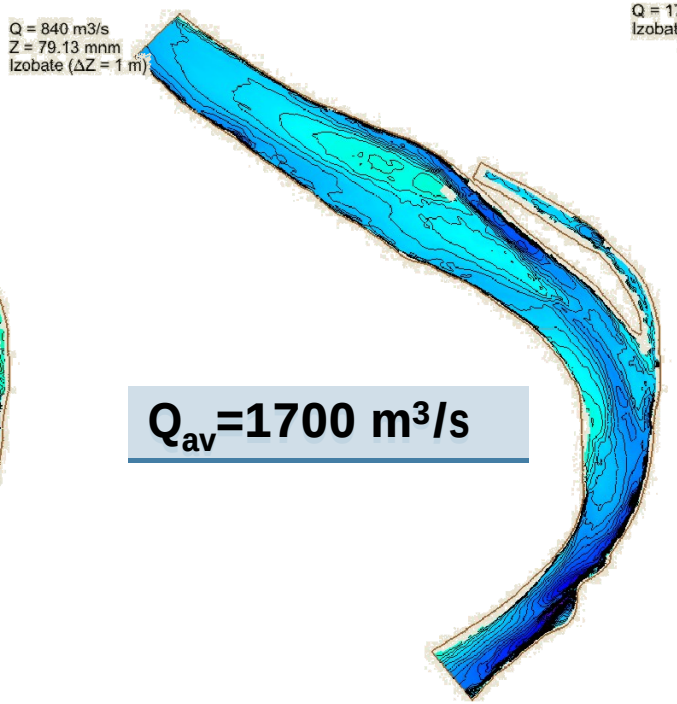
HYDRAULIC MODELING

1D HEC-RAS model

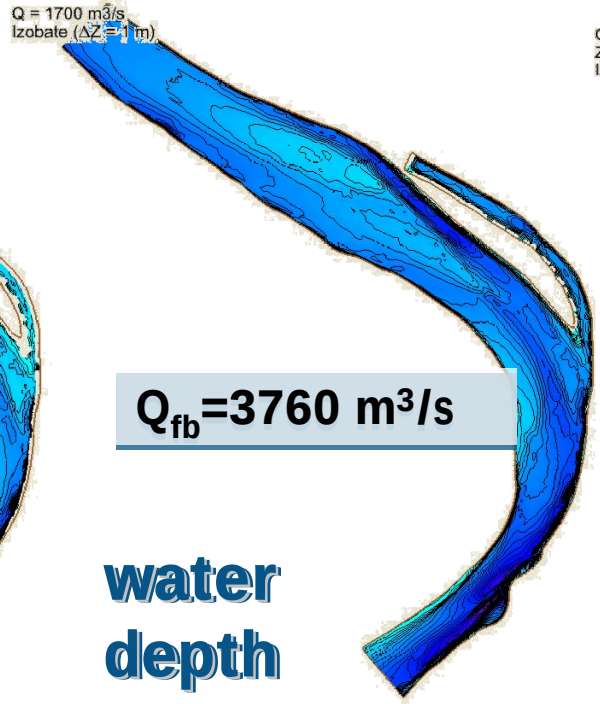
2D model
RMA2 (final elements)



Q_{en}=840 m³/s



Q_{av}=1700 m³/s



Q_{fb}=3760 m³/s

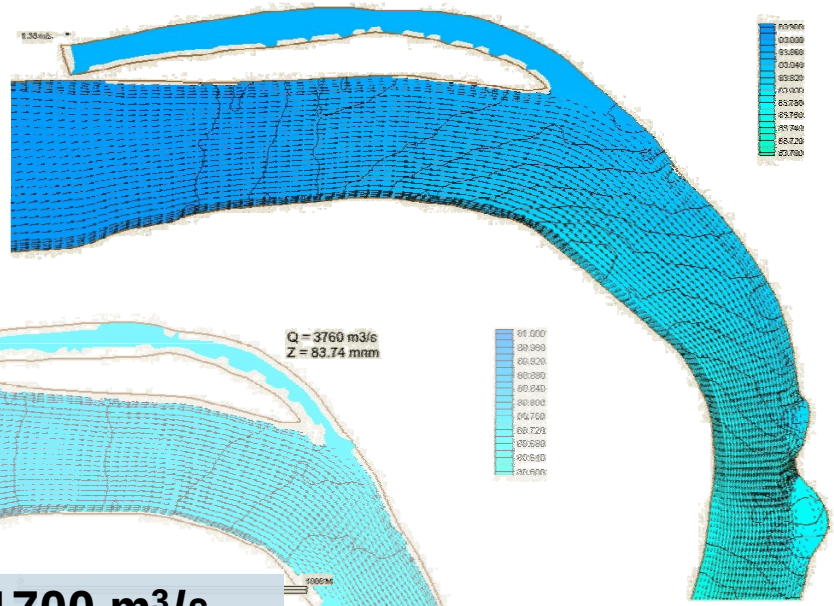
water depth

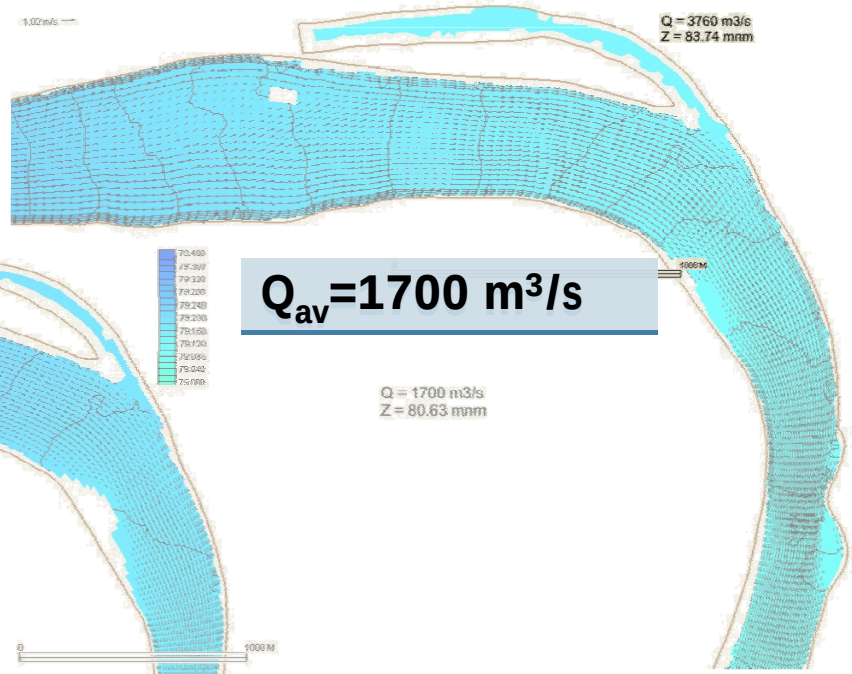
- model calibration (data from the 1st field campaign)
- model verification (data from the 2nd field campaign)
- simulation – present state + riverbed with designed river engineering structures

HYDRAULIC MODELING

Q_{fb}=3760 m³/s

flow field





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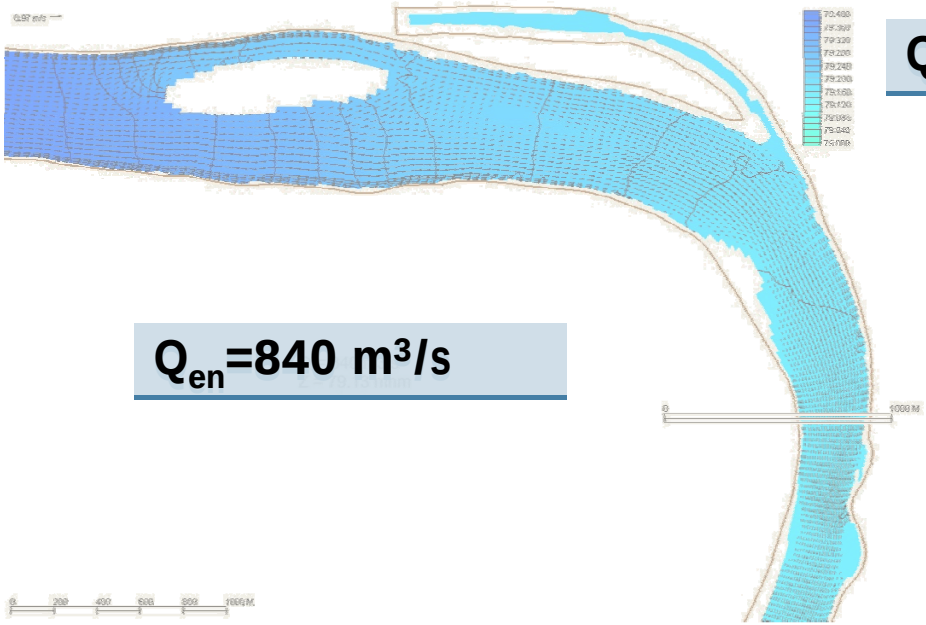

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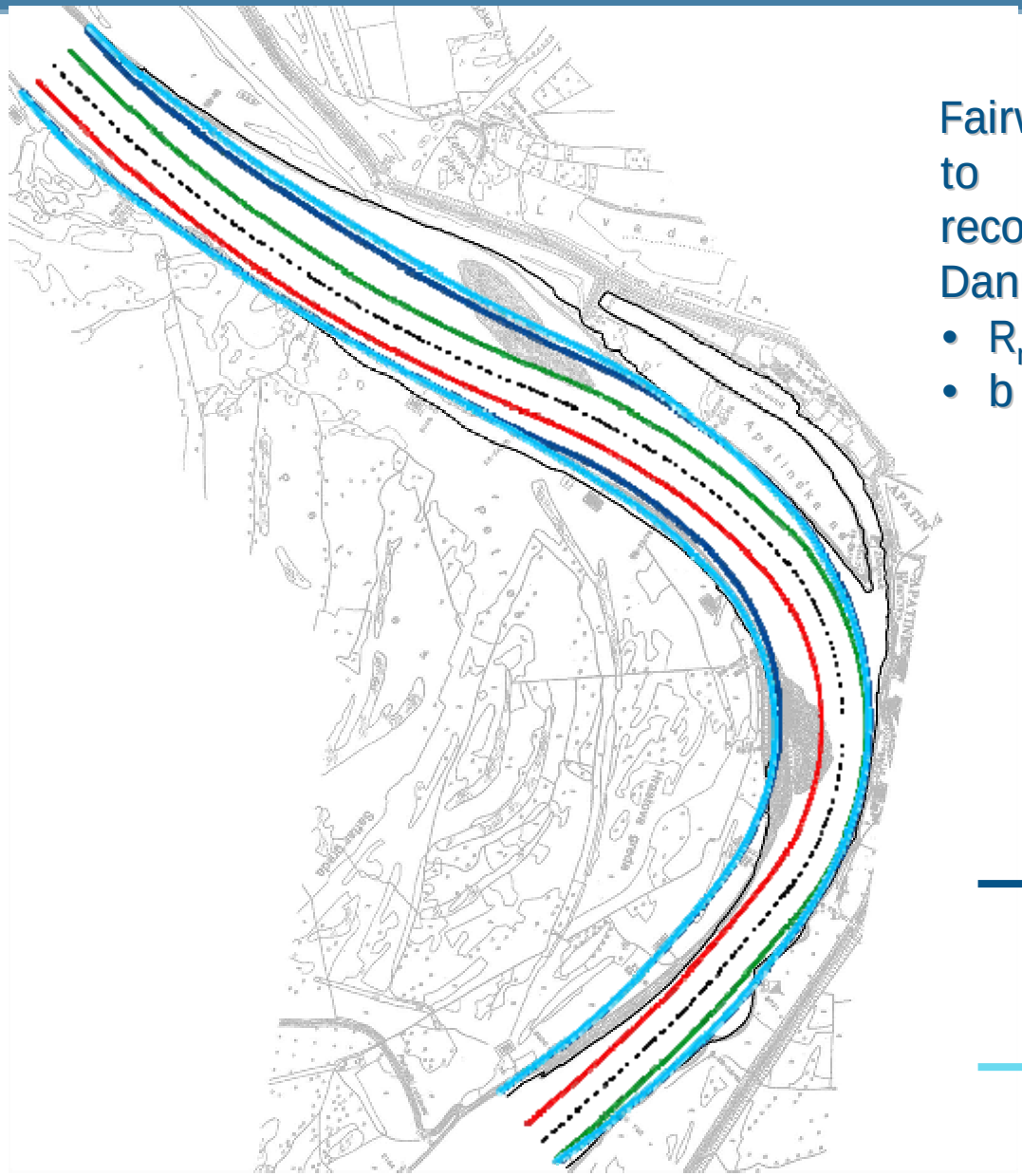
PRELIMINARY DESIGN



Fairway dimensions according to recommendations of the Danube commission:

- R_{min}=1000 m
- b = 180 m

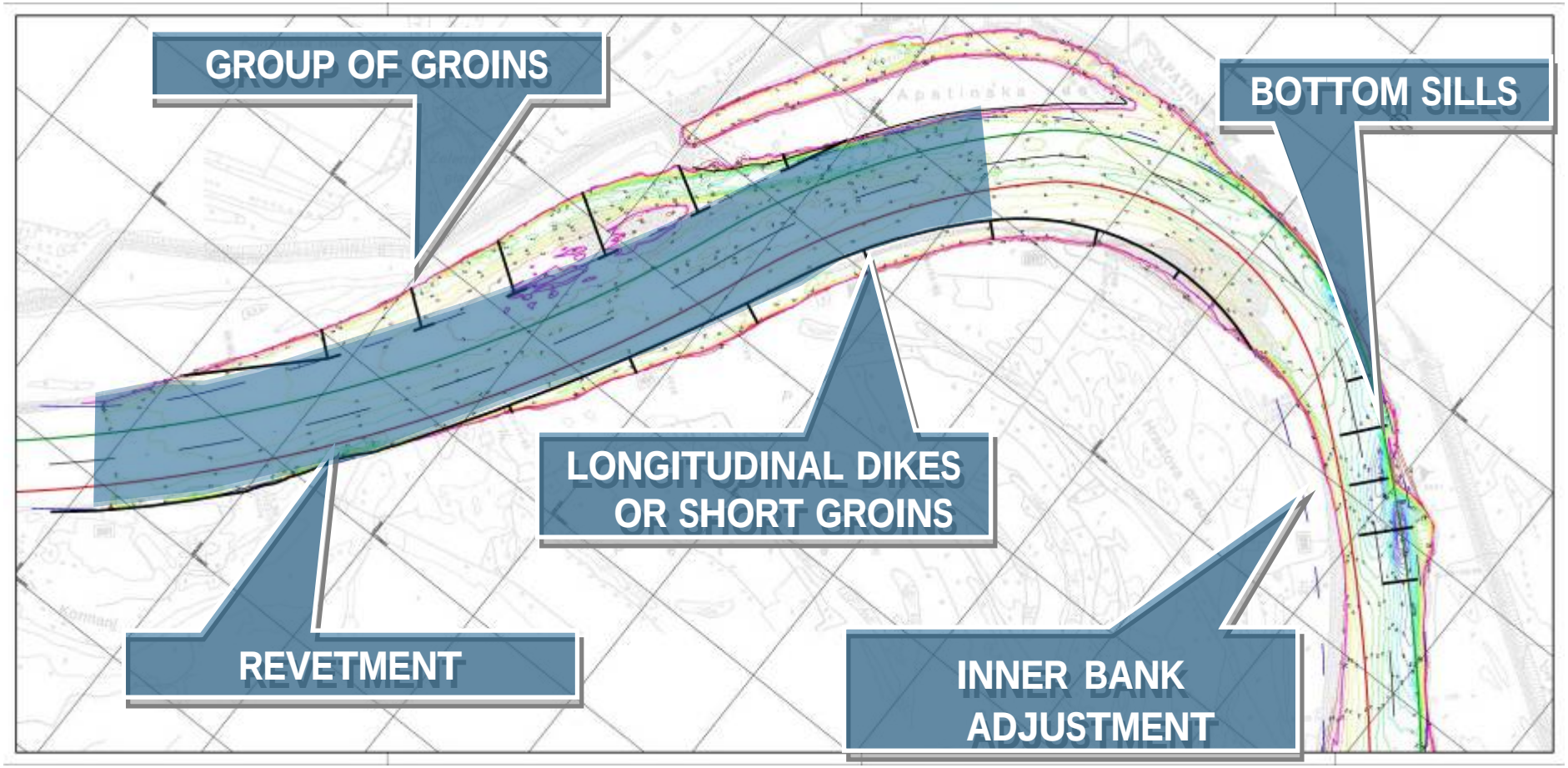
Alternative 1: B=400m

Alternative 2: B =400-500m

PRELIMINARY DESIGN

DREDGING - km1406.0 to km1402.4

- b=200m, b=300m, b= 400m



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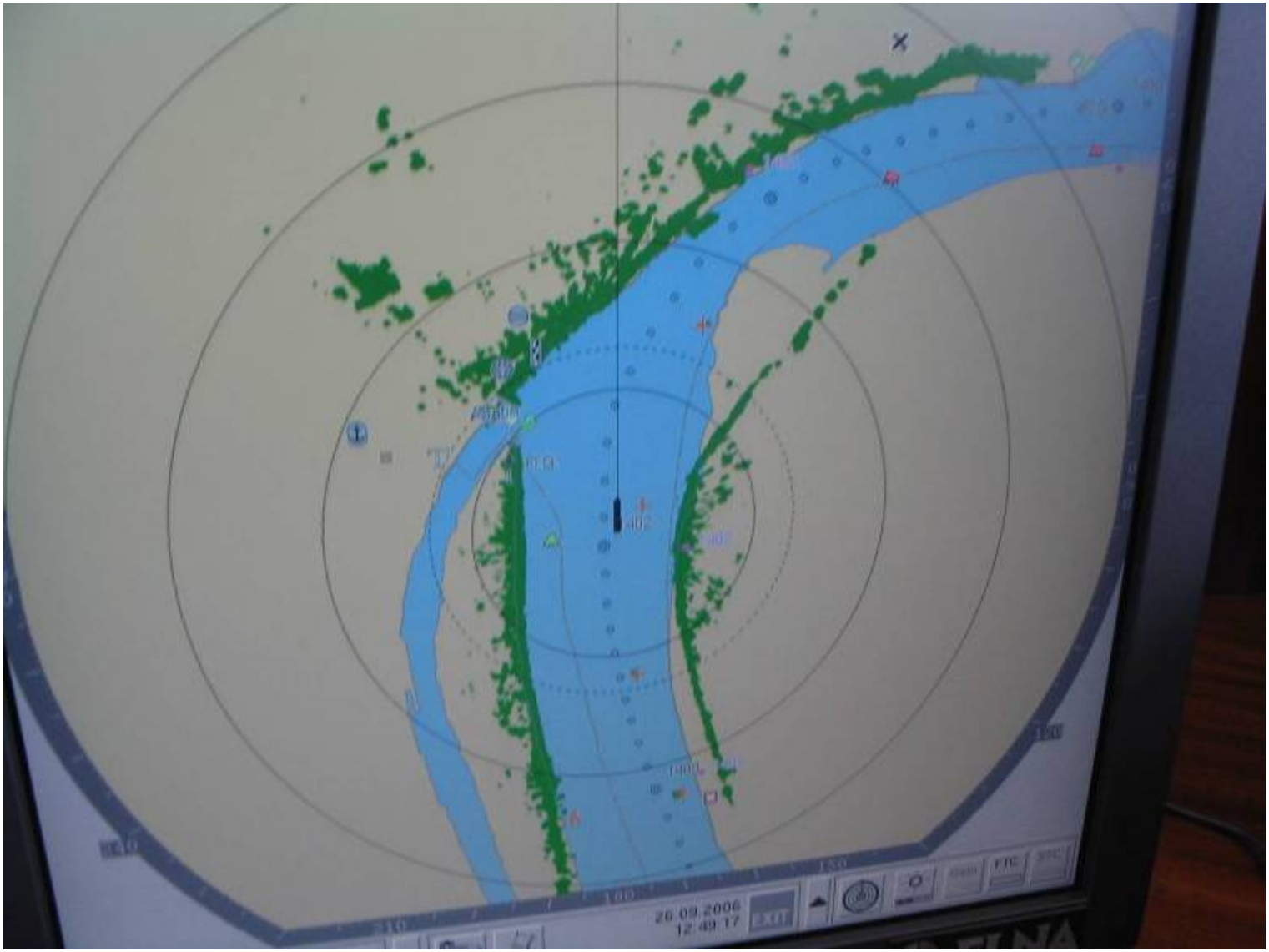
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