UNSTABLE BED AND BANKS OF THE DANUBE RIVER AT THE "APATIN" SECTOR
THREAT TO LOCAL COMMUNITIES, PROTECTED AREAS, AND WATER TRANSPORT ALONG THE DANUBE CORRIDOR

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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

- Serious erosion of left bank
- River flow divided in 2 parts
- Deepening of the river bed - depths up to 13m
- Endangered right bank
- Sharp river bend (possible ice jamming)

Locations:
- 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
ROAD TO SOLUTION

STABILISATION AND IMPROVEMENT OF THE DANUBE RIVER BED NEAR APATIN

STUDY AND DESIGN

COORDINATION WITH CROATIA

COORDINATION WITH HUNGARY

FEASIBILITY STUDY (including EIA)

REVIEW OF POSSIBLE SOLUTIONS AND EFFECTS

REVIEW OF POSSIBLE SOLUTIONS AND EFFECTS

CONCEPTUAL DESIGN

COST ESTIMATE

DETAILED DESIGN

AGREEMENT ON FINANCING AND WORK EXECUTION

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)

- 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

\[ Q_{en} = 840 \text{ m}^3/\text{s} \]
\[ Q_{av} = 1700 \text{ m}^3/\text{s} \]
\[ Q_{fb} = 3760 \text{ m}^3/\text{s} \]

water depth
HYDRAULIC MODELING

$Q_{\text{fb}} = 3760 \text{ m}^3/\text{s}$

$Q_{\text{en}} = 840 \text{ m}^3/\text{s}$

$Q_{\text{av}} = 1700 \text{ m}^3/\text{s}$
Fairway dimensions according to recommendations of the Danube commission:
• $R_{\text{min}} = 1000$ m
• $b = 180$ m
DREDGING - km1406.0 to km1402.4
- b=200m, b=300m, b=400m
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