14th Follow-up Meeting of the Joint Statement on Guiding Principles for the Development of Inland Navigation and Environmental Protection in the Danube River Basin

Border Section Croatia-Serbia

CEF Study "Preparing FAIRway 2 works in the Rhine Danube Corridor"

Zagreb, September 13.-14. 2023





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Co-financed by the Connecting Europe Facility of the European Union



Croatian-Serbian common Danube section







01/10/2020



Monitoring of hydrological, hydraulic, & morphological characteristics

 \rightarrow focus on navigational parameters and bottlenecks

30/09/2024



Catalogue of biodiversity components

 \rightarrow focus on enviro characteristics for the ichthyofauna, ornithofauna, river bottom types (benthos) and floodplain habitats

OBJECTIVES

- Set up an inventory of **navigational** & **environmental** characteristics of the HR/RS common Danube section (rkm 1433,1 - 1295,5)
- Use collected data ...
 - for navigation purposes to identify possible variants for future infrastructure related measures
 - to support the environmental authorities in the definition of the conservation objectives of the River **Basin Management Plans in Croatia**





July 2021 – April 2022



... Tender preparation + tendering procedure...



2nd Tender

publication July 2022



January 2023















Implementation plan for monitoring activities

1. MONITORING OF PARAMETERS IMPORTANT FOR WATERWAY MAINTENANCE

- 1.1 Inventorisation of river regulation infrastructure
- 1.2 Riverbed measurement of cross-sections of Danube river
- 1.3 Monitoring and analysis of flow, velocity and sediment transport
- 1.4 Piezometer installation
- 2. BIODIVERSITY INVENTORY
- 2.1 Fish inventory (monitoring)
- 2.2 Habitat inventory
- 2.3 Bird fauna inventory
- 2.4 River benthic habitats survey















- Inventorisation of river regulation infrastructure
 - Field work of inventorisation and assessment of existing river regulation infrastructure on both sides of the Danube
 - Estimate of around 85 existing objects on the right bank; 90 objects on the left bank
 - Assessment of the current state and identification of extent of damages (where applicable)
- Current status (09/2023):
 - Inventorisation to commence in Q4 of 2023 (to allow lower water levels and more visibility of the structures)







Riverbed measurement of cross-sections of Danube river

- Field work of hydrographic riverbed measurements of cross-sections
- Overall length of ~ 140 rkm; 1374 control profiles (equidistance of 100 m); 2 sets of measurements (yearly)

Current status (09/2023):

 First set of measurements conducted in 05-07/2023; data analysis underway









- Monitoring and analysis of flow, velocity and sediment transport
 - 3 sets of measurement campaign (lower, medium and higher water leves) on 3 locations
 - Locations: Batina/Vukovar/Ilok for flow and velocity measurements; Batina/Drava confluence/Ilok for sediment transport

Current status (09/2023):

- Measurement campaign for higher and medium water levels conducted
- Laboratory/numeri cal analysis underway







- Piezometer installation
 - Piezometer installation adjacent to Danube (<100 m), 15m of depth for continous monitoring of water levels and temperature
 - Locations: Batina, Vukovar and Ilok

- Current status (09/2023):
 - Installed piezometers







- Fish fauna inventory (monitoring)
 - Electric fishing, electrified benthic frame trawl, sonar monitoring of winter habitats
 - 17 critical sections



- Electric fishing conducted on all 17 critical sections (43 transects of 500 meters)
- 24 fish species and more than 4500 individual fish detected







Habitat inventory

• In 17 critical sections along the project scope

Current status (09/2023):

- Methodology of field work prepared
- Preliminary habitat maps prepared for 17 critical sections
- field works have started, after awaiting the period of low water levels stabilisation







• Bird fauna inventory

- In 17 critical sections along the project scope
- Wintering and migrating birds; raptors; nesting birds; steep shore colonies
- Current status (09/2023):
 - Protocol for inventorisation prepared
 - Field works ongoing – 7/17 monthly monitoring cycles completed









River benthic habitats survey

 In 17 critical sections along the project scope, individual 250m length of survey

Current status (09/2023):

- Methodology of field work prepared
- Field works are completed (sampling of macrozoobenthos on 17 critical sections conducted between June and July)







- Establishment of a Geoinformation system (GIS)
 - To be established as a central point for all monitored data

Current status (09/2023):

- Technical requirements agreed upon
- WebGIS development and server setup are in progress
- GIS database continously updated with incoming monitoring data





Thank you for your attention!

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Hydraulic and morphological modelling of the common SRB-HRV stretch of the Danube River



General concept for hydraulic and morphological modelling of the common Serbian-Croatian stretch of the Danube River

agreed during the series of
Stakeholders' Forum activities in 2021







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Why is modelling important for us?



Key reasons:

- Hydraulic models can help predict the depth and width of the river
- Morphological models can simulate sediment transport and deposition processes
- Morphological models can help assess the stability of riverbanks
- Hydraulic models can simulate flow velocity and turbulence
- Hydraulic models can help predict flood events and their potential impacts on river navigation
- Hydraulic and morphological models can help us understand and predict climate change impacts
- Hydraulic and morphological modeling is essential for designing and maintaining navigation infrastructure





Modelling Components with time frame estimates



- ID hydraulic model for the entire Serbian and Croatian common Danube stretch (3-4 months)
- Redefinition and prioritization of navigational bottlenecks (1-2 months)
- Definition of parameters for the multi-criteria analysis (1-2 months)
- Definition of alternative solutions for prioritized sectors and 2D hydrodynamic and morphological modelling (3-4 months)
- Development of the integrated study on alternative solutions and definition of next steps for future investments (last 6 months).

Starting in October 2023, the modeling procedure is expected to last a total of 12 months.

Currently, a tendering procedure is being held in Serbia to select the most qualified candidate for the execution of this contract.

In the meantime, all relevant data that will be used for modeling are collected via the monitoring process.



Multi-criteria analysis (MCA)



Decision-making process used to evaluate and prioritize multiple options based on a set of criteria.

Main steps	
Define the problem	Clearly state the problem or decision that needs to be made and identify the objectives or goals to be achieved
Identify options	List all possible options that can address the problem or achieve the objectives
Establish criteria	Determine the criteria or factors that will be used to evaluate and compare the options
Assign weights to criteria	Assign a weight to each criterion to represent its relative importance in the decision-making process
Evaluate options	Assess each option against the criteria and assign a score or rating based on its performance
Calculate weighted scores	Multiply the scores for each option by the corresponding weights of the criteria and sum them up to obtain a weighted score for each option
Rank options	Rank the options based on their weighted scores, with the highest score indicating the best option
Make a decision	Based on the ranking and the sensitivity analysis, select the option that best meets the objectives and preferences of the decision-maker

By considering various factors and their trade-offs, MCA enables more informed and transparent decision-making.



Multi-criteria analysis (MCA) on critical sector "Bogojevo"









Options defined prior to the execution of the 2D modelling

Option 1	Construct a side channel closure bund at km 1,365.5, dredging at km 1,363.5 and 1,362	
Option 2	Dredging	
Option 3	Sills and reconstruction of bank protection	
Option 4	Similar to option 1, but chevrons at right bank upstream of km 1,365.8 instead of closure bund	

The presented alternatives were evaluated and screened based on three criteria: *effectiveness, environmental impact and cost,* in order to determine which options would be subject to 2D modeling.

Screening of the options

Based on the information presented the options have been listed in Table 12.2. From the evaluation and screening of the options it is decided to further investigate and model the option 1 and 4.

Table 12.2.	Sector #09	- Screening of options

Option	Effectiveness	Environment	Cost
1	+		0
2	-	0	0
3	-	+	-
4	0	+	0

Extracted from 2013 FEASIBILITY STUDY – Preparation of Documentation for River Training and Dredging Works on Selected Locations along the Danube River in Serbia

Delegation of the European Union to the Republic of Serbia EuropeAid/129691/C/SER/RS



Stakeholders Forum (Integrated Planning)

- Multidisciplinary body bringing together interests of navigation, environmental protection and nature conservation, industry and archaeology
- Principles: voluntary membership, free of charge, mutual acknowledgment and respect for various standpoints of the forum members, and transparency of the work

Members: ICPDR, Croatian Institute for Environmental and Nature (Ministry of Economy and Sustainable Development, Institute for Nature Protection of the Vojvodina Province (Serbia), Danube Commission, Aqua et Archaeologica (Serbia), Association for Nature and Environment Protection Green Osijek (Croatia), Sport Fishing Association Vukovar (Croatia), Bird Protection and Study Society of Serbia, Public Institution "Kopacki Rit Nature Park", World Wide Fund for Nature Adria and World Wide Fund Austria

Observers: International Sava River Basin Commission, Environmental Agency Austria, Austrian UNESCO MAB Committee, Ministry agriculture, forestry and water management - Republic Waters Directorate (Serbia), Water Insitute Josip Juraj Strossmayer- Zagreb (Croatia), Croatian Waters (Croatia)





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