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THE ASSESSMENT OF TRANSBOUNDARY IMPACT OF THE NAVIGATION ROUTE REOPENING IN THE UKRAINIAN PART OF THE DANUBE DELTA

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INTRODUCTION

The beginning of navigation through the Chilia and Bystre arms dates back to the 1830s, though the most intensively this waterway had been used in the middle of the 20th century. The navigation charts of 1956 included the Bystre waterway as one of the main options for freight shipping. At that time its capacity to transport cargoes of minerals, building material and oil totalled 6 mln. tons. It practically equalled the then capacity of the Sulina Canal (6.123 mln tons).In 1958-1992, the Bystre waterway had been reserved for the Soviet Navy, though till the early 1990s on some occasions merchant vessels used it.

Since 1958 the navigable waterway through the Prorva Branch had become the main channel for cargo transportation in the Ukrainian part of the Danube Delta.

Upon breakaway of the Soviet Union the regular dredging works in the Bystre mouth stopped, and soon it became non-operational. In 1994, the same happened to the Prorva Channel.

The decision on the reopening of the deep-water navigation route in the Kilia and Bystre Branches was made on the basis of comprehensive comparative assessment of over 10 design options (four of them are described in Annex 1).

The Working Design for the 1st phase of the navigation route reopening project (Phase 1), which comprised the implementation of dredging activity in the sandbar section of the Bystre Branch, the clearance of sand reefs in the river section between Izmailsky Chatal and Vilkove, and the construction of (a part of) retaining sea dam, was duly reviewed and approved, and its implementation is currently near to be completed according to the design parameters provided in Annex 2.

Further development of the deep-water navigation route (Phase 2) involves the final adjustment of its elements and parameters in line with existing international standards, and the provision of protective hydraulic facilities designed to ensure its stable operation (Annex 3). The scope of works for the Phase 2 will be clarified and refined on the basis of the design review and environmental monitoring data.

1. THE IMPACT OF DREDGING ACTIVITY ON THE DISTRIBUTION OF RIVER FLOW BETWEEN THE KILIA AND TULCEA BRANCHES

1.1. The Quantitative Assessment of Impact Factors

The results of mathematical modelling of flow distribution between the Danube Delta branches, conducted at the Faculty of Geography of the Moscow State University by

a team led by Dr. Prof. V.N. Mikhailov, show that the increase in flow discharge rates in the sandbar section after the completion of a 9 m deep sandbar cutting will be up to 1-2 m^3/s, i.e. by 0.2%. The deepening of rifts along the whole course of the deep-water navigation route would result in the increase of flow discharge in the Kilia branch by 24 m^3/s (0.8% of the Danube flow) in the low-water period [1]. This finding was confirmed by the hydrological monitoring, carried out since the commencement of project activity.

The analysis of historical measurement data on flow discharge rates in the Danube Delta branches shows that the proportion of river flow carried through the Kilia Branch has decreased by 4.2% over the last 10-15 years, while the flow carried through the Tulcea Branch has increased by the same margin. According to the results of modelling exercise, this can be mainly attributed to the large-scale channel-straightening activity conducted by the Romanian party in the St. Georghe Branch. It is forecast that the washout process triggered by the channel-straightening activity in the St. Georghe Branch would result in a further increase of flow discharge in the Tulcea Branch by 40 m^3/s (Annex 4).

From the above, it can be concluded the Tulcea Branch will continue to receive larger proportion of river flow in the future, after the reopening of the deep-water navigation route in the Ukrainian part of the Danube Delta.

1.2. Mitigation Measures

The potential for gradual riverbed washout in the Bystre Branch cannot be excluded, leading to a more significant redistribution of river flow to the benefit of the Bystre Branch. To prevent this process, the Project Phase 2 involves the construction of a flow-guide dam on the left bank of the Starostambulsky branch where it splits to form the Bystre branch (Annex 5). The main purpose of this flow-guide dam is to provide a pathway for bottom sediments carried with river flow and to keep them away from the navigation route lying along the Bystre branch, and stabilize the hydraulic section of river branch after the construction of seaward access canal across the sandbar.

Conclusions

The dredging activity involved in the reopening of navigation route in the Ukrainian part of the Danube Delta will not alter existing flow distribution trend with the Tulcea Branch receiving a larger proportion of river flow. It will only slow down the flow diversion process, leading to a greater stability of the hydrological regime of the Danube Delta. **There is no significant transboundary impact on the river hydrology from the Project Phase 1. Any future increase in scale and magnitude of such impact is highly unlikely.**

2. THE IMPACT ON WATER QUALITY AND REPRODUCTION OF FISH STOCKS

2.1. The Quantification of Impacts on Water Quality and Reproduction of Fish Stocks

The potential transboundary impact on water quality and reproduction of fish stocks may be associated with the handling of bottom sediments (including their excavation as part of dredging activity, storage on the riparian storage sites, spoil islands, and offshore dredging spoils site), and hydroengineering construction operations.

In assessing these operations, the following factors of impact can be identified: a) the formation of turbid cloud, or plume, in the areas subject to impact of these activities, which, coupled with the deterioration of water quality, may result in a decrease in productivity and partial loss of aquatic organisms that provide a food basis for fish stocks; b) nearly complete loss of benthic organisms, representing an important food reserve for fish stocks, in the locations of dredging operations, hydroengineering construction activities and dredging spoils storage sites; c) partial loss of spawning grounds for valuable and commercial fish species; d) death of young fish individuals that happen to enter the dredge working area and/or the plume of turbid water, d) the alteration of migration routes for migratory fish.

The design data pertaining to the scope of sediment movement operations, hydroengineering construction activities and affected area of riverbed are shown in Annex 2 (Tables 2 and 3). Of the total projected volume of dredging spoils (3.66 million m^3), 1.73 million m^3 will be placed at the riparian storage site on the left bank of Kilia Arm, and 1.93 million m^3 will be delivered to the offshore dumpsite for dredging spoils.

The site selected for offshore dumping of dredging spoils is located at the distance of 8 km from the coast, at the depth of over 20 m. This provision excludes the possibility of dragging the stored spoils into the general sediment flow aligned along the coastline, and prevents the contaminated water plume from entering the coastal zone. The selected site for offshore spoils storage does not represent a valuable habitat for benthic communities, the potential for danger to bottom benthos is therefore weakened. The dumpsite lies within the intensive sediment deposition zone, especially during floods, therefore the sediments transported with river flow will provide additional, and reliable, cover for dredging spoils. Therefore, the contamination of water and soil in the location of offshore dumpsite for dredging spoils should be considered as a local and short-term impact. The monitoring data provide no indication of transboundary impact of dumping activity on water quality (Annex 6).

The area of riverbed where bottom communities may be affected by dredging activity is about 113 ha, or 1.5% of the total bottom face, which would not cause any

significant impact on the reproduction of fish stocks. The area of affected seabed is the same.

The mathematical modelling tools were used to examine the spreading of turbid water plume associated with dredging operations. The modelling results produced for the channel section of navigation route show that the average increase in background concentrations of suspended solids in the Kilia Branch downstream of dredging activity location will be about 0,4 mg/dm^3, and the most contaminated part of river flow, where the increase in concentrations of suspended solids will be about 10-25 mg/dm^3, will never get near the right bank of the Kilia Branch. For the Danube, where mean annual concentration of suspended solids in water is about 180 mg/dm^3, such margin of increase is not considered as significant. Consequently, it can be concluded that the elevation in concentrations of soluble substances in river water will be marginal, which is confirmed by monitoring data.

The deterioration of water quality will be largely limited to the sandbar section, as suspended solids carried by the plume of turbid water are dispersed and deposited (Annex 7), and the concentrations of soluble pollutants decrease as a result of water mixing and self-purification. Both design estimates and monitoring data indicate that **there is no transboundary impact on the marine water quality and littoral fauna**.

While the region of these **impacts on the reproduction conditions for fish stocks** can be potentially big due to fish migration, its magnitude **is forecast to be not significant in the transboundary context.** Firstly, the area of affected fish habitats will be relatively small, especially where the spawning and growth of fish species representing commercial fishing targets for the Romanian party is involved. Secondly, this disturbance is temporary in nature due to a relatively high restoration potential of aquatic life habitats in the locations of dredging operations.

The assessment of impact associated with the retaining dam to the north of the seaward access channel to the depth of 7 m, especially on the migration of sturgeons to their spawning areas, indicates that such impact will be virtually absent, as adult individuals usually travel at depths larger than 10 m [2]. Moreover, this dam does not represent a barrier for fishes migrating to the south at smaller depths. Given that the angle between the dam and coastline is about 45° (and the distance from the remote end of the dam to the Ptichiya Spit is 1.2 km), fish shoals will move around the outward face of the dam.

The changes in hydromorphological and hydrological regime in the mouth section of the Bystre Branch may cause certain alterations in migration patterns, with some part of fish stocks choosing to use other branches of the Danube Delta to travel to their spawning areas. However, this will not cause changes in reproduction conditions for fish in the Danube Basin as a whole.

2.2. Mitigation Measures Designed to Reduce the Impact on Water Quality and Reproduction of Fish Stocks

The design provides for a suite of measures designed to prevent the adverse impact of the deep-water navigation route on water quality and biota. Special focus was placed upon the minimisation of potential impacts on the protected species, both fish and bird (Annex 5).

In particular, the dredging activity is planned to be confined to high-water periods, and be suspended during the periods of nesting, spawning and migration of young fish.

The proceeds of the financial compensation for damage incurred to fish stocks, planned under the project, will be used for financing the cost of measures on restoring the natural water regime of the DBR area, disturbed by previous economic developments (including those undertaken by Romania), and improving the conditions for fish stock reproduction in the Ukrainian part of the Black Sea Basin.

Conclusions

There is no indication of any transboundary impact on water quality and littoral fauna, while the impact on the reproduction conditions for fish stocks is considered to be not significant, subject to the proper implementation of mitigation measures proposed by Ukraine.

SUMMARY

There is no significant transboundary impact on the river hydrology from the Project Phase 1. Any future increase in scale and magnitude of such impact is highly unlikely.

There is no indication of any transboundary impact on water quality and littoral fauna, while the impact on the reproduction conditions for fish stocks is considered to be not significant, subject to the proper implementation of mitigation measures proposed by Ukraine.

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ANNEXES