



INTERMEDIATE ENVIRONMENTAL MONITORING REPORT DURING WORKS n° 4

FUTOG – SUMMARY OF RESULTS

Introduction

The main objective of this environmental report during works is to address the base values of the main parameters identified during the elaborations of the EMRbW. These values were established during the Inception Phase and will serve as the base for evaluation of effects of river training and dredging works to the environment.

According to the ToR, one Monitoring report must be prepared every 3 months from the start of the construction works at each critical sector till the end of works (at critical sectors on which dredging activities are performed) and until the start of the Defects Notification Period (for critical sectors on which river training structures have been constructed), identifying all changes in environmental parameters compared to the base values identified in the Environmental Monitoring Report Before Works, also arguing the reasons for these changes, as well as their long-term impact to the integrity of the affected areas.

Works have begun in Futog on August 21st and they have not been finished by the end of August, so this report is necessary in order to identify the current status of environment after three months (Twelve months from the beginning of the works in this sector).

The Environmental Monitoring Report n° 4 covers the following fields:

- Hydromorphology
- Sediment and water quality
- Waste
- Biology
 - Phytoplankton
 - Macrozoobenthos
 - Vegetation (*Limosella aquatica*)
 - Birds (*Charadrius dubius* and *Riparia riparia*)
 - Fish (*Acipenser ruthenus*)
- Development of vegetation and riparian areas
- Protected Areas and Ecological Networks

The table below shows the works to be carried out in the critical sector Futog and their exact location according to the Final Design:

N°	Name of critical sector	Type of works	Chainage from	to
	Futog	Dredging	1266+400	1265+000
		Detached groyne	1263+350	
		Chevron	1262+700	

The report shows the status of environment once completed twelve months of works, according to ToR statements.



Description of work site

Construction works are being performed on two locations within the subsector Futog 2, on the right side of the Danube River – construction of detached groyne and chevron, while dredging works on subsector Futog 1 are not started in this moment.

The construction Works have been finalized up to the profiling of the body” at location that is positioned upstream (position 1 at Figure 1), while the construction of chevron is performed from the ship “Nova Sava” at the downstream position (position 4 at Figure 1). A distance between these construction sites is about 400 m.

Construction works were started at the upstream location, and just after approximately one month they were started at the downstream location.

Floating barge with construction material (position 2 at Figure 1) is used as a temporary storage for solid material like steel armature (reinforcement bar) and new rolls of geotextile are into the foil Floating office (position 3 at Figure 1)

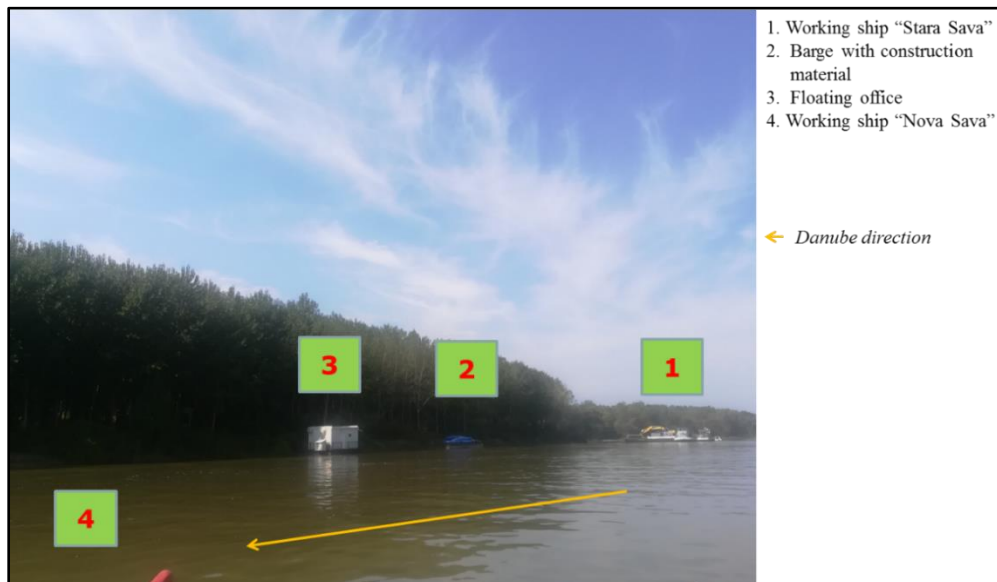


Figure 1 Display of construction sites and auxiliary objects within the Futog critical sector (Futog 2 subsector)



Figure 2 Display of construction sites and working ships "Stara Sava" (left) and "Nova Sava" (right) – upstream view



Status of the works after 9 months (August 2018 to May 2019)

The construction Works in the sector 19 (Futog) are not completed. The table below shows the current status of each planned activity per structure.

Sector 19 (Futog)	Detached groyne 19.1	Chevron 19.2
Geotextile	Completed	Completed
Base layer (phase I)	Completed	Completed
Base layer (phase II)	Completed	Completed
Profiling the base layer	Completed	Completed
Construction of the body	Completed	Completed
Profiling the body	Not finished	Not finished

Project context

River stretch Futog is located upstream from Novi Sad, second most populated town in Serbia. Its position is between gauging stations Novi Sad and Backa Palanka.



Futog stretch is most dynamic sector on Danube in Serbia. Intensive dynamics is the consequence of straight and wide section long about 7 km. Such characteristics are contributing the flow circumfluence, what generates current slowdown and bed load deposition, and consequently intensify morphological changes. Hydrology is the most influential factor on morphological development, but there are many local sub-factors, which are changing course of morphological development as well. Riverbank erosion, sandbars, training structures and dredging are just some of them.

Hydromorphology

As it was asserted in inception report, sandbars on Futog stretch are arranged alternately along the stretch. There are three groups of sandbars, whereof the most obstructive sandbars are located in the central part of stretch. Sandbars along the right riverbank are not so influential on navigation regime.

Morphological analysis will start with upstream sandbank (km 1267+250 to km1266+250). At this location, sandbank is along the right river bank and it doesn't affect navigation conditions. Position and shape of sandbar are pretty stable and unchanged.

In comparison with previous report, it could be noticed that depths along the left riverbank are permanently increasing, so the scour depth is now almost 2m bigger than in 2018 (max depth in 2018 was 6.5m and now 8.5m).



Central part of Futog stretch is most critical. On this part of the river, hydro-morphological changes are most intensive, sand bank transformations are fastest and moving volumes are biggest. Equally, on this stretch is determined intensive uncontrolled artificial impact which may cause riverbed destabilization.

In accordance with previous claim, central part of the Futog stretch continue to change its morphology. Sandbar, which is located directly across from "Karin Komerc" depot is slightly decreased and cut in the middle in comparison with previous bathymetry. Its appearance indicating that cut is actually caused by dredging. Downstream of this location (km 1265 to km 1263.750) sandbar, which was most significant cause of navigational problems is literally flattened. In area, which was covered with thick layer of sand, now we have flat river bottom with average depth of 3.5m (reference level: LNL) with traces of former sand deposits on km1264.400. In this area surface of the river bottom is flattened with small ripples. It is very hard to determine cause of such development, but some indications are pointing out on dredging, like vicinity of depot of one of major dredging companies in Serbia. One of consequences is scour in immediate vicinity of left riverbank (km1264.200). This scour was enlarged and deepened in a last five months with maximum depth 6.5m (reference level: LNL)

Such morphological development has positive impact on navigation and navigational fairway.

Transformation of sand deposit, located across the detached groyne is continuing equally. Physically, sandbar loses significant volume of sand and available width for navigation has been increased from 220m on 250m (measured from construction to 2.5m isobath). This transformation was happened in a low water levels season. Process of energy transformation, described in previous report, continues permanently to erode sand deposit and to widen channel available for navigation. This process is additionally accelerated with morphodynamic in upstream part of the stretch.

Downstream of chevron, water flow changed its direction and penetrated through the flattened sand deposits. Consequence of this penetration was new sandbar which remained in the middle of the water flow. At the very beginning, new sandbar was visible, but it was hard to determine future trend. Now, after two bathymetric surveys and after high and low water seasons, it could be ascertained that sand deposit will continue to growth and it will appear on Futog stretch as obstacle for navigation.

In general, effects of newly constructed training works are positive. Negative effects are minimal or almost unperceivable. River depths in vicinity of constructions are increased, but within limits of normal morphological dynamic. In recent future, expectation is that intensive erosion in vicinity of construction slow down and to stabilize river bed

As it was emphasized several times before, Futog stretch is one of the most dynamic stretches on the Danube in Serbia. Such conditions imposed frequent shifting of fairway boundaries and adjustment to the new morphology. Present navigation conditions, which are consequence of implemented training works and riverbed dynamic are much favorable than conditions in a previous reports. Width of navigation fairway has been reduced on 120m, referring on 2.5m water depth during the corresponding Low Navigation Level.

Sill generated by the sandbars on km1266.700 to 1265.200 has been spilled out and this part of observed stretch is not critical anymore. Sandbars along the left river bank from km1265 to km1263.5 are removed or suppressed towards left riverbank what improves navigation conditions and extends available widths for navigation fairway.

Executed works and newly established morphodynamics had negative consequence on most downstream part of Futog stretch. Between km1262.250 to km1262.050 new sandbar started to grow, its volume and shape are affecting navigation conditions so its development should be monitored.



Water quality monitoring

Detailed Monitoring plan for both water and sediment quality was created in accordance with monitoring plan from the Inception Report but also in accordance with currently valid dynamic plan and prediction that working period are going to be longer than it was planned.

Regular water quality monitoring is performed every third month (four times per year), while additional monitoring is performed more frequently. During additional monitoring campaigns parameters like temperature, TSS and mineral oil are being determined. Extra monitoring of these parameters is not predicted within the Inception Report for the locations where the construction is performed, only where dredging and sediment disposal is performed. However, the SEM team concluded that additional monitoring could be useful for screening the situation during works execution in Futog, especially because that is the first sector where construction works are performed within this Project.

Until now, five regular monitoring campaigns were carried out, one at the beginning of September (07/09/2018), second in the middle of November (23/11/2018) and third in the middle of February (19/02/2019), fourth in the middle of May (13/05/2019) and fifth at the end of August (29/08/2019).

During all campaigns, sampling was performed at the position located about 100 m downstream from the works. In the second, third and four regular campaigns sample was taken downstream the last construction site. Sampling and further analyses were performed by accredited laboratory Anahem from Belgrade.

In the meantime, 13 water samples in four campaigns were taken for additional screening analyses. Samples were taken upstream and downstream of the construction sites in 22/10/2018 (just for the detached groyne), 30/10/2018 (both for detached groyne and chevron) and 19/02/2019 (upstream from the detached groyne and downstream from the chevron). And 14/03/2019 (both for detached groyne and downstream for chevron).

Sediment monitoring

Until now five sampling campaigns were carried out, in the same time as water samples were taken at the beginning of September and in the middle of November and in middle of February, May and August 2019 at the same positions.

Additional sampling and testing of sediment quality during the construction works is not proposed with the Inception Report, only for the dredging and sediment disposal activities.

Review of water and sediment quality results during forth campaign

Results obtained during the **fifth regular sampling campaign** carried out on 29/08/2019 show that quality of the Danube River at location Futog, downstream from the work construction site predominantly corresponds to the quality of water class I, except for parameters ammonium ion, nitrites and BOD, which correspond to quality water of the II class. Water of the taken sample belongs to the class I for intestinal enterococci, class II for the total coliform, class III for the coliform bacteria of fecal origin and in the class IV for aerobic heterotrophs.



During additional sampling and analyses of water from the Futog, during 22/10/2018, 30/10/2018, 19/02/2019, 14/03/2019 and 29/08/2019, quality of parameters temperature, suspended matters and mineral oils of all 13 samples corresponds to the class I of water quality.



SAMPLING POINTS AND OBJECTS AT THE SITE	RESULTS OF WATER QUALITY IN DIFFERENT CAMPAIGNS																			
	22/10/2018				30/10/2018				19/02/2019				14/03/2019				29/08/2019			
	temperature (°C) / suspended matters (mg/l) / mineral oils (mg/l)																			
Sampling point 1	15	10	<0.1	14	2	<0.1	4.8	4	<0.1	7	10	<0.1	X							
DETACHED GROUYNE																				
Sampling point 2	15	6	<0.1	14	6	<0.1	X				7	12	<0.1	24.8	12	<0.1				
CHEVRONE																				
Sampling point 3	X			14	<2	<0.1	X													
Sampling point 4	X			14	8	<0.1	4.7	20	<0.1	7	8	<0.1	24.8	12	<0.1					
LEGEND:																				
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I CLASS	II CLASS	III CLASS	IV CLASS	V CLASS																

Results of the sediment quality obtained during regular monitoring campaigns performed on 07/09/2018, 23/10/2018, 19/02/2019, 13/05/2019 and 29/08/2019 show that all parameters values are below target values and most of them are not even detected.

Waste

During this period regular inspections have been carried out with the purpose of detecting uncontrolled discharges of waste or pollution incidents. The monitoring have been done by visual inspection of vessels and water analysis.

Conclusions show that all the established preventive measures are been followed by WKSC, so that during this period there has been no incident related to discharges or waste

Phytoplankton

This is typical phytoplankton community structure for this season, characterized by low primary production. Community structure was uniform along depth gradient and among localities

Macrozoobenthos

The water level is decreased and several dozens of big mussels (genus *Anodonta*) remained on the bank. Mussel population was represented by four genera and four species. Three individuals of Swollen river mussel (*Unio tumidus*) has been recorded in sediment (dimensions 3 x 7 cm to 5 x 9 cm). Eastern Asiatic freshwater clam (*Anodonta woodiana*) has been represented with around 30 individuals in sediment, around 2 m from the water line (dimensions mostly were 8 x 10 cm and 9 x 12 cm). *Corbicula fluminea* (several individuals) has been recorded around 100 m downstream of chevron. One individual of *Dreissena polymorpha*.

General conclusion is that mussels on the bank and in the sediment are not endangered by ongoing works on sector Futog duo to long distance between work machinery and mussel habitats in the river. The only factor that can endanger these populations is low water level, as it was this summer and first part of the autumn.

Sector	<i>Unio</i> sp.	Other species
Sector 19 Futog	<i>Unio tumidus</i>	<i>Anodonta woodiana</i> <i>Corbicula fluminea</i> <i>Dreissena polymorpha</i>



Birds

Bird population was not numerous in quantitative sense and were represented by several individuals of Great cormorant (*Phalacrocorax carbo*), which was standing on the edge of groyne and on the sand bar, one individual of Great egret (*Ardea alba*), which was also on the groyne and several individuals of Grey heron (*Ardea cinerea*), Mallard (*Anas platyrhynchos*) and European herring gull (*Larus argentatus*).

Not any individual of migratory birds *Charadrius dubius* and *Riparia riparia* has been found.

Sector	<i>Charadrius dubius</i>	<i>Riparia riparia</i>	Other species
Sector 19 - Futog	--	--	<i>Phalacrocorax carbo</i> <i>Anas platyrhynchos</i> <i>Ardea alba</i> <i>Ardea cinerea</i> <i>Larus argentatus</i>

Fishes

Six species with 16 individuals have been recorded.

Sector	<i>Acipenser ruthenus</i>	Other species
Sector 19 – Futog	Two individuals	<i>Silurus glanis</i> (5 individuals) <i>Abramis brama</i> (4 individuals) <i>Barbus barbus</i> (2 individuals) <i>Ballerus sapa</i> (1 individual) <i>Blicca bjoerkna</i> (1 individual)

Macrovegetation

Macrovegetation is characterized by presence of different “floors” in its habitat, White Willow (*Salix alba*), which is very good adapted on the semiaquatic conditions in its habitat. Maple (*Acer* sp.) and American Ash (*Fraxinus americana*) are present by some individuals. One of frequent present species in floor of shrubs is False indigo bush (*Amorpha fruticosa*). Lower and ground floor is represented by herbaceous plants. European dewberry (*Rubus caesius*), as perennial plant, is present in the lower floor. Ground floor is characterized by frequent presence of some perennial such as genus *Galium*. Annual plant *Stellaria media* will grow up in the spring period.

Sector	Species: <i>Limosella aquatica</i>	Other species
Sector 19 Futog	--	<i>Populus euroamericana</i> <i>Salix alba</i> <i>Quercus</i> sp. <i>Tilia</i> sp. <i>Fraxinus americana</i> <i>Amorpha fruticosa</i>



		<p><i>Rubus caesius</i> <i>Aristolochia clematitis</i> <i>Vitis</i> sp. <i>Ranunculus sceleratus</i> <i>Viburnum acerifolium</i> <i>Ulmus</i> sp. <i>Epilobium</i> sp. <i>Cyperus eragrostis</i> <i>Chenopodium ficifolium</i> <i>Morus rubra</i> <i>Lycopus europaeus</i> <i>Bidens bipinnata</i> <i>Stellaria media</i> <i>Rubus phoenicolasius</i> <i>Acer negundo</i> <i>Urtica dioica</i></p>
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Plants

Not any individual of species *Limosella aquatica* and *Lindernia palustris* have been found.

Sector	Species: <i>Limosella aquatica</i> Species: <i>Lindernia palustris</i>
Sector 19 Futog	No results

Development of vegetation

Herbaceous plants are represented by species from families Urticaceae, Lamiaceae, Papaveraceae, Rosaceae and Poaceae.

Riparian areas

Vegetation shows regularly seasonal and spatial development by floors. Birds are occurred by several common genera and species for these types of habitat. Invertebrate animals are represented by Snails, Mussels and Insects (families *Papilionidae*, *Staphyllinidae*, *Formicidae*, *Cerambycidae*, *Pentatomidae* and *Sphexidae*). Amphibians are represented by Marsh frog (*Pelophylax ridibundus*). Vegetation and animals are not endangered in no way, except variable water level which influences on mussels.

.Sector	Species
Sector 19 Futog	<p>Anura – <i>Pelophylax ridibundus</i> Gastropoda - <i>Helix pomatia</i> Insecta – <i>Papilio machaon</i>, <i>Ocypus olens</i>, <i>Formica rufa</i>, <i>Cerambyx cerdo</i>, <i>Pentatoma rufipes</i>, <i>Sphex</i> sp.</p>

Protected areas

The selected quarry is located inside the National Park Fruška Gora. The EIA concluded that any impact could be expected in the National Park due to the fact that the quarry is currently active for some other uses. Some visuals inspections have been carried out during the full period of



activity in order to verify the accomplishment of the preventive measures defined in the EIA Report, as well as the preventive measures proposed in the EMRbW and the Environmental Plan presented by the WKSC. During this period, negative effect over the National Park of "Fruška Gora" due to the activities of this project have not been observed.

Ecological network

According to Regulation on ecological network ("Official Gazete RS" No. 102/2010), one area (as part of ecological network), relatively close to work zone, is mentioned as ecological corridor of international importance in the Republic of Serbia. This is Monument of nature "Marsh forest on Mačkov sandbank" in the Beočin municipality. Area of protected zone is 4 ha and Danube bank length in protected zone is 0.5 km. Previous and ongoing activities on the critical sector Futog does not show negative effect on the mentioned area.

Summary of results

After field surveys during November, February, March, July, August, October and November 2018 and February, May and August 2019 the following target species have been found **in sector Futog**:

Sector	Macrozoobenthos (<i>Unio sp</i>)	Fishes (<i>Acipenser ruthenus</i>)	Plants (<i>Limosella aquatica</i>)	Plants (<i>Lindernia palustris</i>)	Birds <i>Riparia riparia</i>	Birds <i>Charadrius dubius</i>
Nov 2017	-	-	-	≈10 individuals	-	-
Feb 2018	-	-	-	-	-	-
March 2018	-	-	-	-	-	-
July 2018	-	-	-	-	-	-
Aug 2018	-	-	-	-	-	-
Oct 2018	1	-	-	-	-	-
Nov 2018	--	-	-	-	-	-
Feb 2019	1	-	-	-	-	-
May 2019	1	-	-	-	-	-
August 2019	1	-	-	-	-	-
October 2019	-	2 individuals	-	-	-	-

Summary of main impacts in the sector during this period

In this sector is defined the construction of some river training structures and dredging works. These activities include dredging in the central part of the river between km 1266 and km 1265 of approx. 157,456.90 m³ sediment and the construction of a detached downstream facing groyne at km 1263.35 and a chevron at km 1262.8-1262.7 both located along the right bank.

During this fourth period, activities have been interrupted most of the time due to high water level. The monitoring activities during this period has been focused on determination of the potential effects on biological parameters and water and sediment parameters, as well as the effects on the hydromorphology.



Several monitoring has been executed during these months, the last of them after completion of the fourth period of three months since the beginning of works in Futog. The obtained results have been compared with data included in Environmental Monitoring Report before Works and with data included in Intermediate Report during works n° 1 to 3.

Regarding water and sediments, after this period it is possible to conclude that there are no significant effect over these parameters. The obtained results during field surveys in August are significantly similar to the previous ones. This can be interpreted as the works are not affecting the quality of water and sediments in the vicinity of critical sector of Futog.

From the point of view of biology, the results show that the nature is not been affected by the works, which confirm the conclusion obtained after previous twelve months.

Bearing in mind that works are being executed from the water, the riparian vegetation existing in the river banks are not suffering any impact except a little dust deposited on leaves. This impact cannot be avoided because mainly depends on wind direction. However, it is not significant and the general status of riparian habitat remains in good conditions.

None of individuals of protected species of plants have been affected during these months and wildlife seems not to be impressed by the presence of machinery and workers. Protected species of birds have not been detected in Futog in any of the field surveys.

Finally, although five individuals of *Unio tumidus* have been found in water sediments, the place is located near 100 m downstream the work site.

Protective and corrective measures

The following mitigation measures have been carried out during these months to reduce or to avoid the described adverse impacts resulting from the proposed project activities:

- Confirm the absence of the river mussel (*Unio* sp.) in the vicinity of the working area.
- Perform monitoring of spills and suspended concentration during the execution of the works. If exceedance of the critical concentration is observed the work intensity is to be reduced;
- Monitor the incidence of works over the vegetation surrounding the working area
- Monitor the variations, if any, of wildlife population around the working areas, focused on the main species mentioned in the EIA.

Conclusions & Recommendations

Works being executed currently in critical sector of Futog (one chevron and one groyne) are following the methods and recommendations regarding environment protection included in EIA report and official decision. Additionally, WKSC is accomplished the environmental measures included in the tender specifications and taking into consideration conclusions of Inception Report. The environmental monitoring begun at the same moment that the works and has been considered one of the most important elements of the project. Thank to this, the measures implemented by WKSC and the continuous monitoring are avoiding negative effects over the nature.

The main recommendation is to continue with the strong and continuous monitoring until the end of works in this sector. If any negative effect would appear, the environmental team should be immediately advised in order to take the most adequate corrective measures.