



INTERMEDIATE ENVIRONMENTAL MONITORING REPORT DURING WORKS

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 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 November, so this report is necessary in order to identify the current status of environment after three months.

The Environmental Monitoring Report n° 1 covers the following fields:

- Hydromorphology
- Sediment and water quality
- 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 three months of works, according to ToR statements.

Description of work site

Futog is the only critical sector where works execution is in progress in this moment. 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.

Construction of detached groyne is performed from the ship “Stara Sava” 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 X). 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).

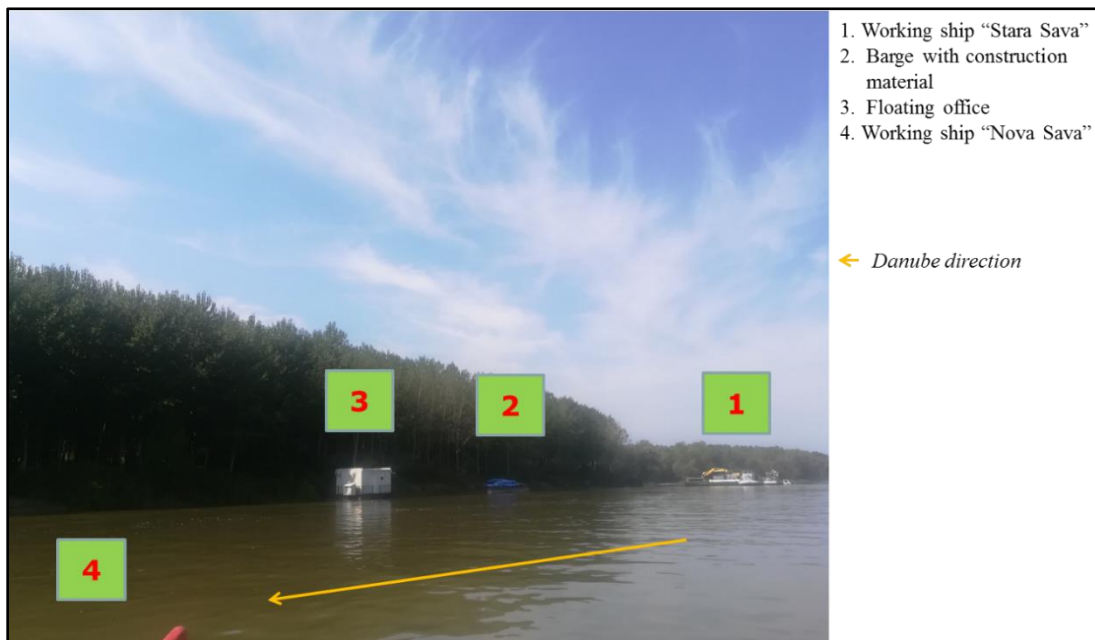


Figure 1 Display of construction sites and auxiliary objects within the Futog critical sector (Futog 2 subsector)



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



Status of the works after 3 months

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	In progress
Base layer (phase I)	Completed	In progress
Base layer (phase II)	Completed	Not started
Profiling the base layer	In progress (40% profiled)	Not started
Construction of the body	Not started	Not started

Project context

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

Hydro-technical works on Futog stretch are started at August 30th, 2018. Preparatory works, mobilisation of workers and equipment and geodetic survey, started several months earlier, so consideration of hydrological development will embrace this period.

In period of interest, water stages were low, moreover in some period extremely low like in August. There are some episodes when water level have been increased, but reach of these episodes were small and water stages remain between low and mid water levels during the all considered period.

In envisaged period, variation of discharges was between 2940 m³/s and 926 m³/s, what means that discharges were far below perennial average, particularly in August.

From morphological development point of view, stretch Futog could be analyzed as two connected stretches with different flow conditions. Downstream stretch 1264+800 to 1261+600, is regulated. Imposed width of river bed is statistically calculated and achieved by series of groyne on the right side and riverbank protection on the left side which constrains current and



theoretically provides stable conditions for river flow. Danube width on this cross-section, which is narrower part of stretch, is about 430m measured at the Low Navigation Level (LNL).

On the right shore, there are three groynes (G133 – official identification label). Fields between groynes are mostly filled with river sediment and covered with dense vegetation. On the opposite side (left riverbank) is laying down a riverbank with protection named (G136). Both constructions are designed and implemented as effort for enhancement of the navigation conditions. Also, existence and number of training works indicate that stretch under consideration already has problems with sedimentation and width of navigation waterway.

Present situation of riverbed state would be used as “0” stage, or starting stage for determination of morphological changes after training works and dredging execution. For this analysis there are three available layouts, captured in May and July (Plovput and SEMC).

At the first glance, it could be noticed that whole stretch contains significant amounts of sandbars arranged alternately along the stretch. They impose fairway alternation as well. The most critical parts, concerning fairway width and depth are thresholds generated on transition between sandbanks.

Comparison between upstream sandbanks, captured in May and July are showing certain transformation. Shape of sandbank is changed, it becomes thinner, shorter and overall volume of disposed sand is smaller. Front side of sandbank is partially washed away and left edge of sandbank approaching closer to the right riverbank which means that sandbank slowly diminishes.

Sandbar between km 1263.950 and km 1265.300 is the key obstacle on the observed stretch. This sandbar is dividing river current on two currents. Right current, where is navigational fairway, is deeper, and the deepest point is between the first groyne and green buoy on km 1264+800 (about 10m below LNL). Edge of sandbar, closer to the fairway have extremely steep side, which are forming wall and restrain further widening main river flow. In terms of transformation, it could be noticed that front side of sandbar is moved downstream and overall sandbar volume is diminished.

Bathimetric survey, executed in July is showing some artificial impact between km 1265 + 750 and km 1265 + 550 – left riverbank. Shape of river bed and depths indicates on dredging. Affected sandbank is divided on two smaller by scour caused by dredging. Its volume is definitely smaller than earlier, but ratio between dredging and natural spill away could not be appraised.

The third sandbank in a row, located along the left river bank has been affected by the smallest changes. Its front side is barely changed as consequence of transformation on the upstream stretch. Even these small changes are following the trend of removing sand from sand deposits and diminishing amounts of disposed material.

The greatest change is recorded on the sandbank located between km1262.300 to km1261.600. In considered period, given sandbank is completely transformed and majority of disposed material is removed from fairway towards right riverbank where it creates shallow water which does not affect fairway and main river flow.

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, two regular monitoring campaigns were carried out, one at the beginning of September (07/09/2018) and other in the middle of November (23/11/2018). During both campaigns, sampling was performed at the position located about 100 m downstream from the works. In the second regular campaign sample was taken downstream the last construction site (position 4 at Figure 1). Sampling and further analyses were performed by accredited laboratory Anahem from Belgrade.

In the meantime, 6 water samples in two 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) and 30/10/2018 (both for detached groyne and chevron). During the sampling campaign from 30/10/2018, additional sampling was performed immediately next to the ship "Nova Sava", downstream, with intention to be checked this location as potentially the most impacted.

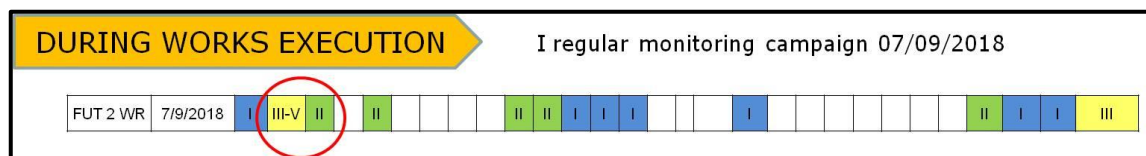
Sediment monitoring

Until now two 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, at the same positions.

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

Review of water and sediment quality results

Results obtained during the first regular sampling campaign carried out on 07/09/2018 show that quality of water sample was not quit different than quality of the samples analysed in previous campaigns, both within this Project (baseline) or official campaigns. It could be seen that concentration of suspended matters was a little bit higher and concentration of dissolved oxygen was a little bit lower, while microbiological parameters were better. Also, determined concentration of mercury corresponds to class V of water quality. Reason for this finding could not be defined but it is for sure that it is not come from the construction site because any potential source of mercury does not exist here. This finding could be fortuitously but in situation that it would be found in some further campaign during this Project, some authorities will be informed just that information about that be shared as interesting and important.

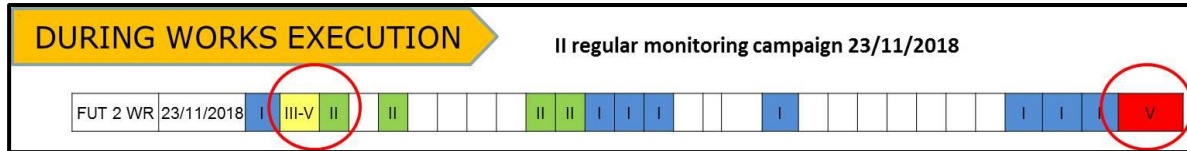


Results obtained during the second regular sampling campaign carried out on 23/11/2018 show that quality of water sample was very similar with earlier obtained results for this location. Majority of determined parameters have values that correspond to the class I of water quality, except parameters like dissolved oxygen, total phosphorus, orthophosphates, total nitrogen and BOD, which correspond to the class II of water quality. Concentration of suspended matters fits to class III, while concentration number of aerobic heterotrophs fits to class V of water quality.

Presence of aerobic heterotrophs in this quantity indicates an occurrence of the organic substances bacterial degradation, which means that fecal matters are in intensive contact with sampled river water. During sampling of the Danube River here, there were not identified other floating objects and ships in the area of works execution, except the working ships of the Contractor. This result



could be a sign of sanitary water discharging into the Danube River in the moment of sampling that could not be confirmed in this moment but could be monitor in the further days.



During additional sampling and analyses of water from the Futog 2, during 22/10/2018 and 30/10/2018, quality of parameters temperature, suspended matters and mineral oils of all 6 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		
	temperature (°C) / suspended matters (mg/l) / mineral oils (mg/l)					
Sampling point 1	15	10	<0.1	14	2	<0.1
DETACHED GROUYNE						
Sampling point 2	15	6	<0.1	14	6	<0.1
CHEVRONE						
Sampling point 3	x			14	<2	<0.1
Sampling point 4				14	8	<0.1
LEGEND:	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 and 23/10/2018 show that all parameters values are below target values and most of them are not even detected.

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

Populations of mussels in the work zone on the right bank belong to four genera. Representatives of genus *Unio* are very rare in this river stretch. Only one individual of *Unio tumidus* has been found in October in the shallow water on the right river bank. Several individuals of genus *Anodonta* have been found on the right bank, in the sand and shallow water. The most numerous mussel population on the right bank belongs to genus *Corbicula*. This genus has been found in the sand about 1.5 m in front of the water line, as well as in water to the visible border. Rough estimation number of individuals of this genus in the work zone, on the right bank, is several hundreds. This genus is dominant in numerous bearing in mind all mussel genera on the right bank. Also, several individuals of *Dreissena polymorpha* have been found in the sand. Strictly protected species *Unio crassus* have not been found in the work zone.



General conclusion is that mussels on the bank and in the sediment are not endangered by ongoing works on sector Futog due 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>Corbicula fluminea/fluminalis</i> <i>Anodonta woodiana</i> <i>Dreissena polymorpha</i> <i>Dreissena rostriformis bugensis</i>

Birds

One colony of around 20-30 individuals of European herring gull (*Larus argentatus*) is present on the sandy island closer to the left bank. Population of Mallard (*Anas platyrhynchos*) has been represented both by males and females (around 20 individuals), whereby males dominated in number. Several individuals of Great Cormorant (*Phalacrocorax carbo*) have been recorded in flight close to water and in the flock of around 15 individuals. These species wintering there.

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

Bird populations are not endangered by ongoing works due to long distance between bird colonies and location of work machinery. Not any nest of protected species has been found on the right river bank.

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

Fishes

Fishes have been monitored partially upstream and downstream from river training work sites because, as well as birds, they are mobile and can move from working area if they are disturbed. Fishes have been monitored around 200 m downstream of works

Sectors	<i>Acipenser ruthenus</i>	Other species
Sector 19 – Futog	-	<i>Abramis bjoerkna</i> <i>Rutilus rutilus</i> <i>Sander lucioperca</i>

Macrovegetation

Macrovegetation is characterized by presence of different “floors” in its habitat. Highest floor (woody plants) is dominated by Black Poplar (*Populus nigra*) and, in lesser extent, White Willow (*Salix alba*). Maple (*Acer sp*) and American Ash (*Fraxinus americana*) are present by some individuals. Floor of Shrubs are represented by False indigo bush (*Amorpha fruticosa*).

Lower and ground floor is represented by herbaceous plants. European dewberry (*Rubus caesius*) is present in the lower floor. Ground floor is characterized by frequent presence of some species of genus Galium (*G. molugo* and *G. aparine*, as well as *Stellaria media*).



Sector	Species: <i>Limosella aquatica</i>	Other species
Sector 19 Futog	--	<i>Populus nigra</i> <i>Salix alba</i> <i>Fraxinus americana</i> <i>Acer</i> sp. <i>Amorpha fruticosa</i> <i>Rubus caesius</i> <i>Gallium molugo</i> <i>Galium</i> sp./ <i>aparine</i> <i>Stellaria media</i>

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

Current work activities include work on the river and from the river and none of activities are taking place on and from the river bank and habitat. As a consequence, none of the negative impacts on the vegetation, habitats or land conditions have been occurred. Forest vegetation has regular life and space development. Basic humus layer is preserved, land conditions is favourable for small vertebrate and invertebrate organisms and there is enough humidity for some part of life cycles. Changed physical conditions, except variable water level, have not been registered. Conclusion: vegetation and habitats are not damaged or endangered due to above mentioned facts.

Riparian areas

Riparian areas, as transitional zone, have favourable conditions for semiaquatic and water-related vertebrate organisms (primarily frogs). In front of water line a sand zone is located with enough humidity and width for such organisms. Neighboring forest vegetation provides shadowness and other necessary conditions for some elements of life cycle. Riparian areas, habitats and forest vegetation are not damaged and endangered by ongoing works because all work activities are performed from the water and there are no work activities on the river bank. Water level was variable this summer and autumn, but this did not damage riparian area and their habitats.

Representatives of Frogs (order Anura) have been recorded by 7-10 individuals on the sand and in the shallow water. Recorded Anura belongs to Pond frogs (genus *Rana*) and Water frogs (genus *Pelophylax*). Other amphibian species have not been recorded.

Sector	Species
Sector 19 Futog	Ordo Anura; genera <i>Pelophylax</i> and <i>Rana</i>



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 visual inspections have been carried out during the first three months 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 Gazette 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 the following target species have been found **in sector Futog**:

Sector	Macrozoo benthos (<i>Unio</i> sp)	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	--	-	-	-	-	-

Summary of main impacts in the sector during this period

In this sector is defined the construction of some river training structures. 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 these three months activities have been focused on the construction of the groyne and the chevron. The monitoring activities during this period has been focused on determination of the potential effects on biological parameters and water and sediments parameter, due to the fact that the effects on the hydromorphology would be analyzed once the works will have been completed.

According to the data explained in precedent sections, several monitoring have been executed during this months, the last of them after complete three months since the beginig of works in



Futog. The obtained results have been compared with data included in Environmental Monitoring Report before Works.

Regarding water and sediments, after this first three months it is possible to conclude that there are no significant effect over these parameters. The obtained results during field surveys in October and November 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.

Data regarding mercury found in one sample of water, are not considerable and do not consequence of the works given that this substance is not currently used in any of the works activities.

From the point of view of biology, the results show that the nature is not been affected by the works.

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 one individual of *Unio turmidus* 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 that are been 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.