

Boris NOVAKOVIĆ\*, Snežana ČAĐO\*, Aleksandra ĐURKOVIĆ\*, Vanja MARKOVIĆ\*\*, Milica DOMANOVIĆ\*, Aleksandar TRAJKOVIĆ\*, Anđelina RADOJEVIĆ\*\*\*, Milenka BOŽANIĆ\*\*\* and Ivana ŽIVIĆ\*\*\*

\* The Serbian Environmental Protection Agency, Ministry of Environmental Protection, Belgrade, Serbia, boris.novakovic@sepa.gov.rs

\*\* University of Belgrade, Institute for Biological Research "Siniša Stanković", Belgrade, Serbia, vanjam@ibiss.bg.ac.rs

\*\*\* University of Belgrade-Faculty of Biology, Belgrade, Serbia, ivanas@bio.bg.ac.rs



## Introduction

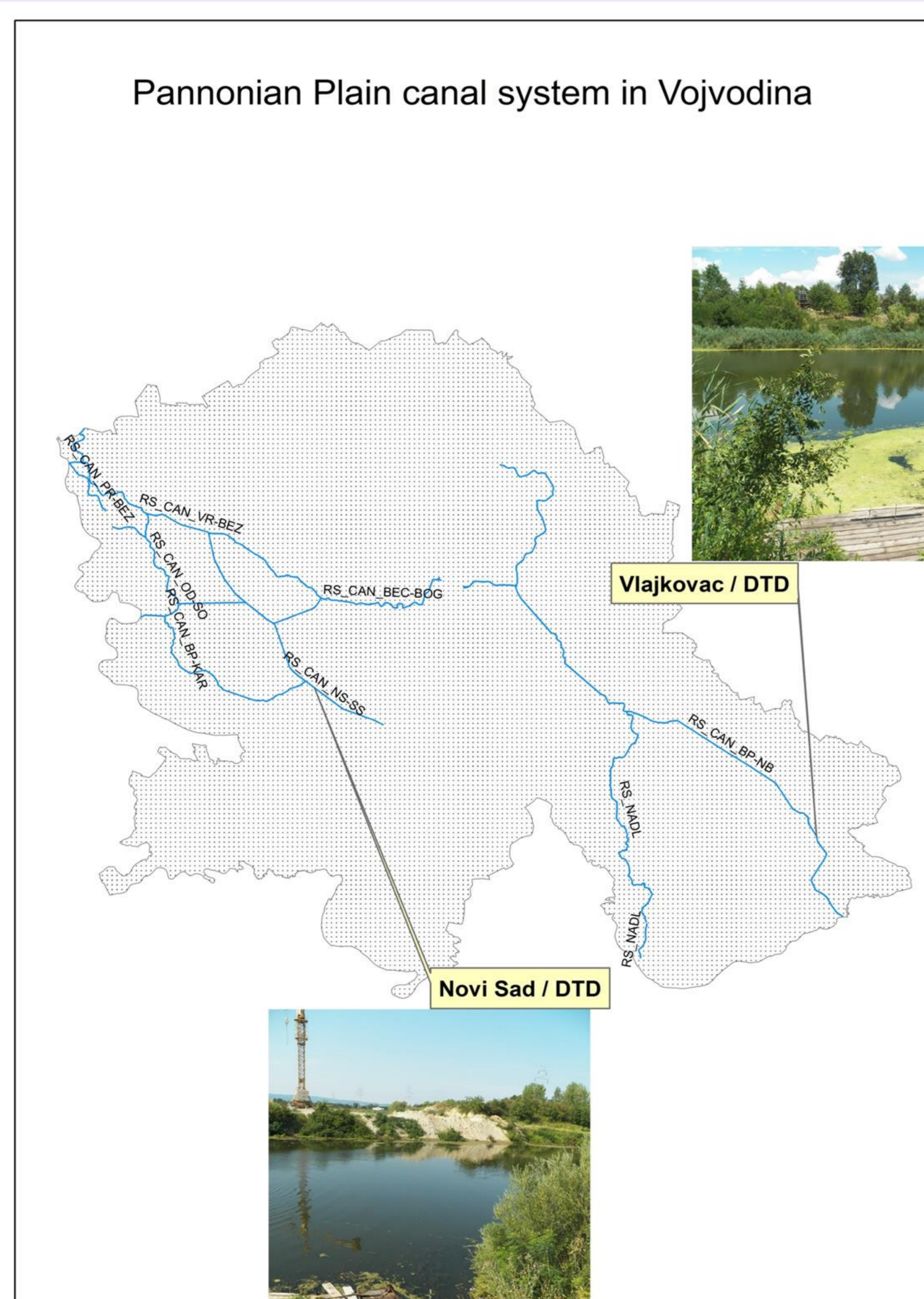
The Serbian Environmental Protection Agency (SEPA) provided a survey of ecological potential and chemical status assessment of the Pannonian Plain canal system in the territory of Vojvodina during 2012, 2013 and 2014. The sampling was carried out at total of 12 sampling sites. According to the national typology all investigated canals are classified as the artificial water body type.

The aim of the study is a comparison between the assessment of ecological potential and chemical status of the Pannonian Plain canal system as well as to provide more precise the degree of anthropogenic pressures on these water bodies.

## Material and Methods

For ecological potential assessment the biological quality elements (BQE) (phytoplankton, phytobenthos and aquatic macroinvertebrates) along with physico-chemical quality elements (PCQE) (pH, Dissolved Oxygen, BOD<sub>5</sub>, TOC, NH<sub>4</sub>-N, NO<sub>3</sub>-N, PO<sub>4</sub>-P, Total Phosphorus and Cl<sup>-</sup>; specific polluting substances-other substances) were used. The assessment of ecological potential and chemical status was done according to the national regulations. Data on investigated sampling sites are provided in the following table and map.

Waterbody code	Canal	Sampling site
RS_CAN_BAJ	DTD Baja-Bezdan	Bački Breg
RS_CAN_VR-BEZ	DTD Vrbas-Bezdan	Sombor
RS_CAN_KOS-MS	DTD Kosančić-Mali Stapar	Ruski Krstur
RS_CAN_BP-KAR	DTD Bački Petrovac-Karavukovo	Bač
RS_CAN_BEC-BOG	DTD Bečej-Bogojevo	Bačko Gradište
RS_CAN_OD-SO	DTD Odžaci-Sombor	Doroslovo
RS_CAN_NS-SS	DTD Novi Sad-Savino Selo	Novi Sad
RS_CAN_KIK	DTD Kikinda Canal	Novo Miloševo
RS_CAN_BP-NB	DTD Banatska Palanka-Novi Bečej	Melenci
		Vlajkovac
		Kajtasovo
RS_NADL	Nadel	Starčevo



## Results and Discussion

Based on the selected parameters the majority of investigated water bodies was characterised by moderate ecological potential (Class III). In 2012/2013 poor ecological potential (Class IV) was assessed at 3 sampling sites: the Sombor/DTD Vrbas-Bezdan, the Novi Sad/DTD Novi Sad-Savino Selo and the Starčevo/Nadel, while bad ecological potential (Class V) was assessed at the Bačko Gradište/DTD Bečej-Bogojevo sampling site. In 2014 poor ecological potential (Class IV) was determined at 2 sampling sites: the Sombor/DTD Vrbas-Bezdan and the Srpski Miletić/DTD Bečej-Bogojevo.

Chemical status was assessed related to limit values of priority and priority hazardous substances according to the national regulations. In cases when each of the limit values had not been exceeded the chemical status could be regarded as „achievement of good status“. The most of investigated water bodies did not achieve a good chemical status. The main cause of bad chemical status at all sampling sites was increased concentration of Dissolved Nickel.

### Ecological potential assessment in 2012/2013

Canal	Sampling site	Biological Quality Elements (BQE)					Ecological potential assessment	Confidence level
		Phytoplankton	Phytobenthos	Aquatic macroinvertebrates	Physico-chemical Quality Elements (PCQE)	Specific polluting substances		
DTD Vrbas-Bezdan	Sombor	III	III	III	III	III	high	
DTD Bački Petrovac-Karavukovo	Bač	III	III	III	III	III	high	
DTD Bečej-Bogojevo	Bačko Gradište	III	III	III	III	III	high	
DTD Novi Sad-Savino selo	Novi Sad	III	III	III	III	III	high	
DTD Kikinda Canal	Novo Miloševo	III	III	III	III	III	medium	
DTD Banatska Palanka-Novi Bečej	Melenci	III	III	III	III	III	high	
DTD Banatska Palanka-Novi Bečej	Vlajkovac	III	III	III	III	III	medium	
Nadel	Starčevo	III	III	III	III	III	medium	
DTD Baja-Bezdan	Bački Breg	III	III	III	III	III	high	

### Ecological potential assessment in 2014

Canal	Sampling site	Biological Quality Elements (BQE)					Ecological potential assessment	Confidence level
		Phytoplankton	Phytobenthos	Aquatic macroinvertebrates	Physico-chemical Quality Elements (PCQE)	Specific polluting substances		
DTD Kosančić-Mali Stapar	Ruski Krstur	III	III	III	III	III	medium	
DTD Vrbas-Bezdan	Sombor	III	III	III	III	III	medium	
DTD Bački Petrovac-Karavukovo	Bač	III	III	III	III	III	medium	
DTD Bečej-Bogojevo	Bačko Gradište	III	III	III	III	III	medium	
DTD Bečej-Bogojevo	Srpski Miletić	III	III	III	III	III	medium	
DTD Odžaci-Sombor	Doroslovo	III	III	III	III	III	medium	
DTD Novi Sad-Savino selo	Novi Sad	III	III	III	III	III	medium	
DTD Kikinda Canal	Novo Miloševo	III	III	III	III	III	high	
DTD Banatska Palanka-Novi Bečej	Melenci	III	III	III	III	III	high	
DTD Banatska Palanka-Novi Bečej	Kajtasovo	III	III	III	III	III	medium	
DTD Baja-Bezdan	Bački Breg	III	III	III	III	III	high	

### Chemical status assessment in 2012/2013

Canal	Sampling site	Chemical status assessment	Cause of bad chemical status	Sampling frequency per year	Mean annual concentration	Max. measured concentration	Confidence level
DTD Vrbas-Bezdan	Sombor	III	Dissolved Nickel	6	4.3	-	medium
DTD Bački Petrovac-Karavukovo	Bač	III	-	-	-	-	medium
DTD Bečej-Bogojevo	Bačko Gradište	III	Dissolved Nickel	6	10.1	-	medium
DTD Novi Sad-Savino selo	Novi Sad	III	Dissolved Nickel	6	4.3	-	medium
DTD Kikinda Canal	Novo Miloševo	III	-	-	-	-	medium
DTD Banatska Palanka-Novi Bečej	Melenci	III	Dissolved Nickel	6	4.1	-	medium
DTD Banatska Palanka-Novi Bečej	Vlajkovac	III	Dissolved Nickel	6	5.3	-	medium
Nadel	Starčevo	III	-	-	-	-	medium
DTD Baja-Bezdan	Bački Breg	III	Dissolved Nickel	11	14.0	86.2	medium

### Chemical status assessment in 2014

Canal	Sampling site	Chemical status assessment	Cause of bad chemical status	Sampling frequency per year	Mean annual concentration	Max. measured concentration	Confidence level
DTD Kosančić-Mali Stapar	Ruski Krstur	III	Dissolved Nickel	9	8.58	-	medium
DTD Vrbas-Bezdan	Sombor	III	-	-	-	-	medium
DTD Bački Petrovac-Karavukovo	Bač	III	Dissolved Nickel	6	15.88	-	medium
DTD Bečej-Bogojevo	Bačko Gradište	III	Dissolved Nickel	6	16.15	48.5	medium
DTD Bečej-Bogojevo	Srpski Miletić	III	Dissolved Nickel	8	16.54	56.9	medium
DTD Odžaci-Sombor	Doroslovo	III	Dissolved Nickel	9	4.42	-	medium
DTD Novi Sad-Savino selo	Novi Sad	III	Dissolved Nickel	8	9.20	-	medium
DTD Kikinda Canal	Novo Miloševo	III	Dissolved Nickel	6	19.05	69.2	medium
DTD Banatska Palanka-Novi Bečej	Melenci	III	Dissolved Nickel	6	8.27	-	medium
DTD Banatska Palanka-Novi Bečej	Kajtasovo	III	Dissolved Nickel	9	12.67	36.6	medium
DTD Baja-Bezdan	Bački Breg	III	Dissolved Nickel	10	5.47	-	medium

## Conclusion

- It is important to note the influences of heavy rain and flood wave on water quality of the canals during 2014 in Serbia.
- According to national legislation, the reliability level of this assessment is high or medium depending on included quality elements as well as the frequency of biological monitoring and monitoring of indicative physico-chemical parameters.
- For this ecological potential assessment the parameters of those quality elements that are most sensitive to different anthropogenic impacts (eutrophication, nutrient enrichment and organic pollution) were used.
- Our experience showed that phytoplankton as BQE is the most important indicator in ecological potential assessment of artificial water bodies (canals).
- Some stretches of the canals could act as isolated lentic ecosystems (low water flow, low variability of physico-chemical parameters and homogenous water conditions).