Funded by
the European Union

Report on Quality of Surface Water in the Four River Basins of Kosovo - Areas Signaled by the Community

Promoting Universal
Access to **Clean Water**

Let's do it Peja!

DISCLAIMER

This publication was developed as part of the project "Promoting Universal Access to Clean Water", funded by the European Union, Office in Kosovo and implemented by Let's Do It Peja. Views, opinions and recommendations expressed in this publication are those of the author and do not represent necessarily those of the European Union Office in Kosovo.

REPORT

“SURFACE WATER QUALITY IN THE FOUR RIVER BASINS OF KOSOVO – AREAS SIGNALED BY THE COMMUNITY”

OCTOBER 2023

TABLE OF CONTENT

LIST OF FIGURES

LISTA E TABELAVE

ABBREVIATIONS

MESPI	Ministry of Environment, Spatial Planning and Infrastructure
KEPA	Kosovo Environmental Protection Agency
RBDA	River Basin Region Authority
HMIK	Hydro-Meteorological Institute of Kosovo
NIPH	National Institute for Public Health of Kosovo
ICW	Interministerial Council for Water
EU	European Union
EC	European Commission
WFD	Water Framework Directive
AI	Administrative Instruction

1. INTRODUCTION

The topographic water colleting area of Kosovo is 11,645 km^2, while only the existing accumulations are 569,690.00 m^2.[1]

In terms of hydrography, Kosovo is divided into 4 river basins:
- Drini i Bardhë,
- Ibri,
- Morava e Binçës, and
- Lepenci.

The nine rivers with the largest flows during the year are found in the Drini i Bardhë Basin in the Dukagjin Plain.

Kosovo's rivers flow into three maritime basins: the Black Sea, the Adriatic Sea and the Aegean Sea. The main rivers that belong to the basins of:

- Black Sea are: Ibri, Sitnica with branches Llapi and Drenica, and Morava e Binça.
- Adriatic Sea: Drini i Bardhë with its branches: Lumëbardhi of Peja, Lumëbardhi of Deçani, Lumëbardhi of Prizren, River of Klina, Ereniku, Mirusha, Toplluha and Plava.
- Aegean Sea: receives the flow of river Lepenci with the main branch Nerodime.

Drini i Bardhë has the longest length in kilometers within the territory of Kosovo with 122 km, while Lumëbardhi of Prizren is the smallest with 31 km^2.

Table 1. *River basins in Kosovo*[3]

Basin	Area km^2
Basin of Drini i Bardhë	4622 km^2
Basin of Ibri	4009 km^2
Basin of Morava e Binca	1564 km^2
Basin of Lepenc	0.685 km^2

Kosovo has established legal and institutional infrastructure for monitoring the quality of surface waters, which are further elaborated in this report. The main responsible institution for monitoring river waters in the territory of the Republic of Kosovo is the Ministry of Environment, Spatial Planning and Infrastructure, more precisely the Hydro-Meteorological Institute of Kosovo (HMIK). The quality of these rivers is determined on the basis of physical-chemical analysis and heavy metals which are defined and determined on a legal basis.

[1]https://siu.rks-gov.net/Hydrography/SurfaceWaters
[2]Brief summary of the water resources of the Republic of Kosovo - ARPL
[3] https://ammk-rks.net/assets/cms/uploads/files/Dokumente%202022/Raporti%20per%20gjendjen%20e%20lumenjeve%202022%20(alb).pdf

This report was developed as part of the project "Promoting Access to Clean Water", which is funded by the European Union Office in Kosovo and implemented by Let's Do It Peja.

This report is the first of its kind, and the monitoring of the water quality of the same rivers will continue through next year – 2024 as well, which results will be published through the report. The methodology of the report has also been approved by HMIK as conforming to Administrative Instruction AI 16/2017[4].

Legal and Institutional Framework [5]

The legal framework that directly regulates the quality of surface water and water services, as well as issues related to water resources and water services, the main documents are developed, which are also in compliance with the European Water Directives.

The National Water Strategy of Kosovo 2017-2036 is the main planning document in the field of water developed based on the Law of Water for a period of 20 years. The objective of this document is to provide sustainable and integrated development of the water sector by meeting the needs for: water supply, water for food production, irrigation and agriculture, industry, energy production, fishing, tourism, sports and recreation.[6]

There are laws that are directly related to the quality of surface water, as follows:

- Law No. 04/L-147 on Water, approved in 2013, is the main legal instrument that regulates water management and water rights. This law integrates most of the standards and principles from the DKU into the legal system of Kosovo, regulating the water policy.
- Law No. 06/L-035 on Hydro-meteorological Activity – It is another important law in the field of water which determines the way of conducting hydro-meteorological activities, the early warning system, expertise, products and services offered by these activities, to support with information the local and central institutions and the public as well as the international and regional institutions.
- Law No. 02/L-78 for Public Health – This law, among other documents, defines the Institutions responsible for the implementation of health policies, it also defines the tasks of the National Institute of Public Health of Kosovo (NIPHK) on

[4] https://gzk.rks-gov.net/ActDetail.aspx?ActID=15797

[5] AMMK – GJENDJA E UJËRAVE NË KOSOVË 2020 https://www.ammk-rks.net/assets/cms/uploads/files/Dokumente/Shqip_WEB_uji.pdf

[6] https://puacw.ldipeja.org/ëp-content/uploads/2023/04/Permbledhje-Monitorimi-Strategjise-Ujerave_FINAL_ALB.pdf

monitoring the quality of drinking water.

- Law No. 05/L-042 on Regulation of Water Services - is an important Law that aims to regulate the activities of water supply service providers, polluted water and wholesale water suppliers and the establishment of the Regulatory Authority for Water Services (RAW).
- Law No. 02/L-9 on Irrigation of Agricultural Lands - This Law regulates the organization and administration of irrigation and drainage of agricultural land in Kosovo, the competencies and allocation of responsibilities of irrigation and reclamation entities, the establishment and registration of irrigation companies, water users' associations for irrigation, federations, their organization, irrigation tariffs, the governance of associations, and other issues related to irrigation and drainage.

In the framework of the obligations deriving from the Law on Water and the Law on Public Health, the following administrative instructions have been developed and signed, which are classified as secondary legislation:

- Administrative Instruction MESPI No. 02/2022 "Conditions, methods, parameters and limiting values of the discharge of polluted water into the public sewage network and into the water body";
- Administrative Instruction MESPI No. 26/2013 on "Determining the method of identification and the form of legitimation of the water inspectorate";
- Administrative Instruction MESPI No. 12/2013 for "Water information system";
- Administrative Instruction QRK No. 10/2021 for "Quality of water used for human consumption";
- Administrative Instruction MESPI No. 15/2017 for " Criteria of determining the sanitary protection zones for water resources";
- Administrative Instruction MESPI No. 19/2015 on "Protection from harmful waters actions";
- Administrative Instruction QRK No. 02/2021 for the "Structure of water payments";
- Administrative Instruction MESPI No. 16/2017 "Classification of surface water bodies";
- Administrative Instruction MESPI No. 17/2017 "Calcification of underground water bodies";
- Administrative Instruction MESPI No. 11/2016 "On the determination, manner and procedures for the protection of erosive areas"
- Administrative Instruction MESPI No. 04/2016 for "Conditions, Criteria and Procedures for the Protection of the Water Flow Coasts and Accumulations";
- Regulation MESPI No. 02/2016 for "Method of determining acceptable ecological flow"
- Administrative Instruction MESPI No. 05/2016 for "Regulation of the Status of Water Resources";
- Administrative Instruction MESPI No. 09/2016 for "Organizational structure and additional tasks of the River Basin Region Authority";

- Administrative Instruction MESPI No. 03/2018 for "Water Permit Procedures"
- Administrative Instruction MH No. 05/2011 for "Prevention and Control of Hospital Infections"

In addition to the legal infrastructure, Kosovo has developed the administrative infrastructure as well, which consists of government bodies, divided into three administrative levels, as shown in the following table:

Table 2. *Division of government bodies according to administrative levels*

CENTRAL	REGIONAL	LOCAL
• Ministries • Agencies • National institutes	• Regional drinking water companies (state-owned) • Irrigation companies (state)	• Municipalities • Local public water providers

Other government stakeholders related to water management, including their quality, are:

- Interministerial Water Council (IWC),
- Ministry of Agriculture, Forestry and Rural Development (MAFRD),
- Ministry of Industry, Entrepreneurship and Trade (MIET),
- Ministry of Local Government Administration (MLGA),
- Ministry of Finance, Labor and Transfers (MFLT),
- Ministry of Foreign Affairs and Diaspora (MFAD),
- Ministry of Health/National Institute of Public Health in Kosovo (MH/NIPHK),
- Ministry of Internal Affairs (MIA),
- Ministry of Economy and Energy (MEE)
- Ministry of Education, Science, Technology and Innovation (MESTI),
- Water Services Regulatory Authority (WAR),
- Association of Water Supply and Sewerage Companies of Kosovo (SHUKOS), and
- Regional Water Companies (RWC).

Water quality – drinking water aspect

The monitoring of drinking water quality in Kosovo is conducted in accordance to Administrative Instruction 10/2021 on "The Quality of Water for Human Consumption". Article 3 paragraph 2.6 of this AI 10/2021 has defined that the health authority, under this legislation, refers to the Water Center within the National Institute for Public Health.

This AI determines that the health authority has an obligation to ensure that the water used for human consumption must be healthy and clean and meet the quality requirements according to this AI (Article 5 of AI 10/2021).

Water quality – Surface water

Based on the Law on Waters of Kosovo No. 04/L-147 – the Hydro-meteorological Institute of Kosovo (HMIK) has the main responsibilities for monitoring the quantity and quality of surface, groundwater and reservoirs.
HMIK is also responsible for the implementation of the Monitoring Program which is developed by the Ministry and approved by the Government for a period of forty (40) years with the possibility of revision, supplementation and modification based on the monitoring data.

According to the annual report on the state of the environment in 2021 published by KEPA, **the quality of surface water in our country continues to be affected by pollution.**

Water pollution comes from various sources and factors, but mainly, our rivers are polluted due to contamination resulting from urban and industrial wastewater discharges, uncontrolled dumping of waste into rivers, the use of pesticides and fertilizers in agriculture, the degradation of riverbeds due to the extraction of inert materials, as well as illegal construction.

According to this report, in 2021, the monitoring of surface water quality was conducted at 54 monitoring points in rivers, revealing the presence of organic pollutants in the river waters at all monitored locations but to varying degrees.

Kosovo still does not have regular monitoring of the water quality of lakes and groundwater, but some steps have been taken within various projects to improve monitoring, the achievements will be published in follow-up reports.

Kosovo does not even have biological monitoring of surface waters and the wastewater treatment system is not fully developed, although there was progress in this field during 2021. However, the treatment still remains at a low level, with only 11% of the all wastewater being treated. Donor support for the integrated management of water resources during 2021 has been one of the positive developments in this sector, creating a basis for further research and improvements.[7]

[7] AMMK – Raport vjetor për gjendjen e mjedisit, 2021
https://www.ammk-rks.net/assets/cms/uploads/files/Raporti%20i%20mjedisit%202021.pdf

2. METODOLOGY

The monitoring of the water quality of the rivers Drini i Bardhë, Lumbardh of Prizren, Ereniku, Ibri, Sitnica, Nerodime and Mirusha of Gjilan for the year 2023 was carried out through two phases divided into periods: the spring period in May and the autumn period during October.

The monitoring locations have been determined by the implementation team of the "Promoting Universal Access to Clean Water" project, where it was decided to collect samples at 8 locations along the flow of these rivers.

The methods used to determine locations are mainly cost-effective format methods through community invitations communicated directly and through Project and Organization's communication channels such as Facebook and email.

Various communities active in environmental and water issues have been invited to signal locations with water pollution. After receiving the reported cases, the addressed locations were analyzed and out of 34 of them, 8 locations were selected, specifically those not covered by state-level monitoring. The selection of these locations was made to ensure monitoring and comparison of data and comprehensive coverage of Kosovo's territory.

The sampling for on-site analysis was conducted during the month of May for the spring period and in September 2023 for the autumn period. Field parameter measurements were carried out during the field sampling, while the rest of the analysis was performed in the laboratory accredited by the Kosovo Accreditation Directorate (KAD) for the analysis of surface waters.

The methodology of carrying out sampling and determining physico-chemical parameters has been approved by HMIK and is in accordance with AI 16/2017 MESP.

In this report, the water quality is reflected through chemical parameters:

- Dissolved Oxygen (DO)
- Biochemical Oxygen Demand (BOD_5)
- Chemical Oxygen Demand (COD)
- Total Organic Carbon (TOC)
- Total Nitrogen (N_{tot})
- Total Phosphorus (P_{tot})

The physical field parameters determined at the sampling locations are:

- Air Temperature (T_A)
- Water temperature (T_W)
- pH value
- Saturation of water with Oxygen
- Electrical Conductivity (EC)
- Total Dissolved Solids (TDS)

All the determined parameters were analyzed according to the relevant standard methods, which are used by the contracted laboratory for conducting this activity and are also in accordance with the guidelines in Administrative Instruction 16/2017 of MESPI. The table below lists all the determined parameters and the respective standard method applied.

Table 3. *The parameters analyzed in the field and in the laboratory and the standard methods according to which those parameters were determined*

No.	PARAMETERS	SYMBOL	UNIT	STANDARD METHODS
Physical parameters				
1	Sampling	--	--	ISO 5667-3 and 6
2	Air temperature	T_A	^{0}C	*Weather app.*
3	Water temperature	T_W	^{0}C	*DIN 38404-C4*
4	Turbidity	TUR	NTU	*ISO 7027:1999*
5	Electrical Conductivity	EC	µScm-1	*ISO 7888:1985*
6	Dissolved substances in water	MTT	mg/L	*ISO 7888:1985*
7	Hydrogen ion concentration	pH	0-14	*ISO 10523:2008*
8	Dissolved oxygen	O_2	mg/L	*ISO 5814:2012*
9	Oxygen saturation	sat. O_2	%	*ISO 5814:2012*
10	Total Suspended Matter	TDS	mg/l	*EN 872*
Chemical parameters				
11	Chemical Oxygen Demand-UV	COD	mg/L	*ISO 5815-ISO 6060:1989*
12	Biochemical Oxygen Demand-UV	BOD_5	mg/L	*EN 1899*
13	Total Organic Carbon	TOC	mg/L	*APHA 5310*
14	Phosphate ion	PO_4^{3-}	mg/L	*ISO 6878*
15	Phosphorus Phosphate ions	$P-PO_4$	mg/L	*ISO 6878*
16	Total Phosphorus	P_{tot}	mg/L	*ISO 6878*
17	Ammonium ion	NH_4^+	mg/L	*ISO 7150-1*
18	Nitrate ion	NO_3^-	mg/L	*DIN 38405 D9*
19	Nitrite ion	NO_2^-	mg/L	*DIN EN 26 777*
20	Sulfate ion	SO_4^{2-}	mg/L	*APHA 4500-SO42-E*
21	Total Nitrogen	N_{tot}	mg/L	*ISO 11905-1*

This monitoring serves to reflect the quality of surface water from rural and urban areas of some settlements in Kosovo.

3. Description of monitoring locations and the selection methodology

The selection of the locations has been carried out based on the signals delegated by affected communities in various forms of river pollution. Different communities were invited to signal locations with water pollution. The locations were analyzed and out of 34 reported cases, 8 locations were selected, specifically those not covered by state-level monitoring, with the aim of having monitoring and data comparison and comprehensive coverage of Kosovo's territory.

The primary criterion for the selection of locations was that the monitoring sites should be located in the 4 main river basins in the country. While the second criterion was to select monitoring sites that are not included in the water quality monitoring network, the verification of which locations was carried out in consultation with the official website of HMIK, where the Surface water quality monitoring network is published.

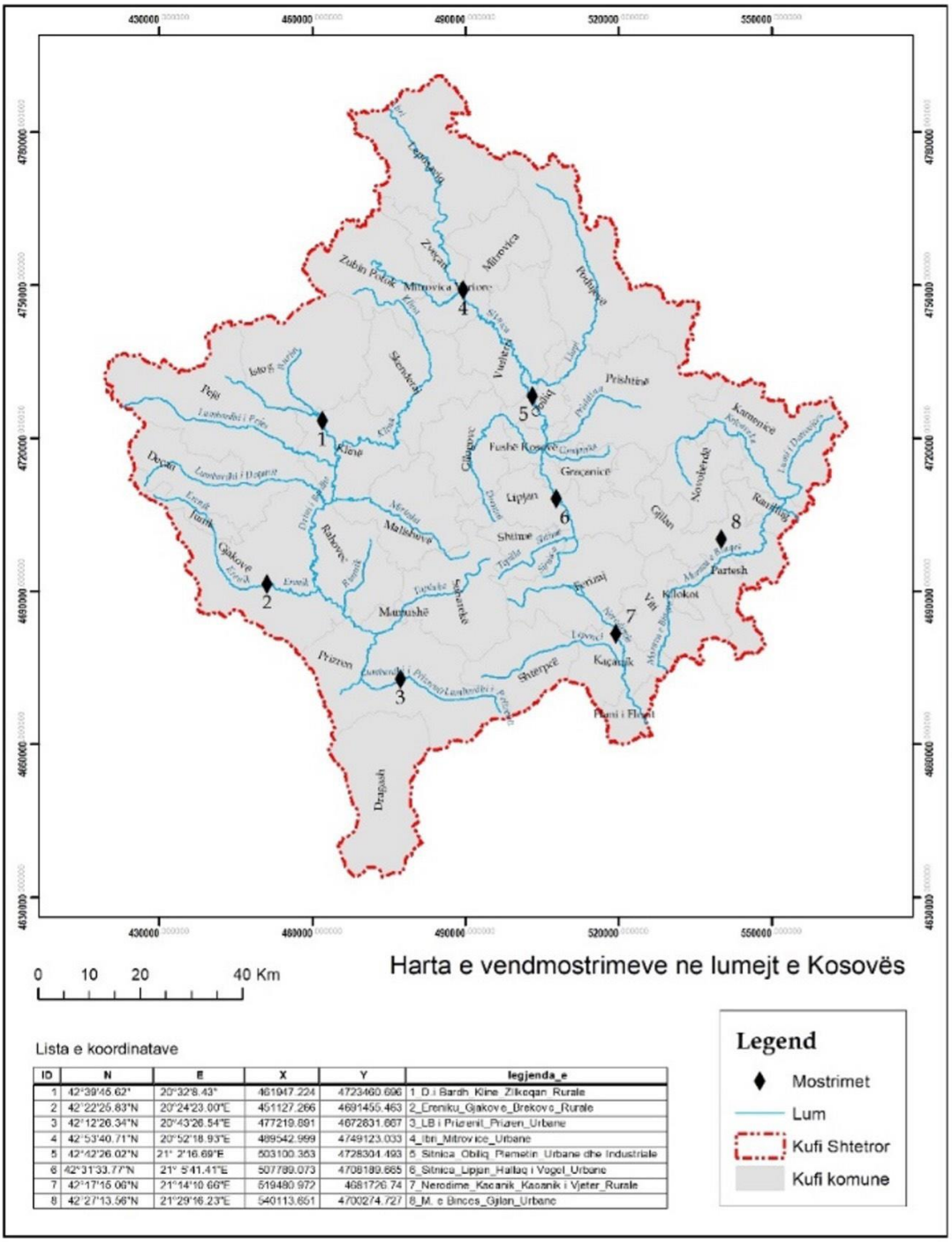
1. River Drini i Bardhë: it was monitored in the village of Zllakoqan, in the Municipality of Klina, and it represents a rural area which is also influenced by the urban area of the city of Istog, but also by various agricultural activities.
2. Erenik River: it was monitored in the village of Brekoc in Gjakova, which represents the waters of the city and Junik as well as some villages in the municipality of Gjakova as well as the areas planted with agricultural crops.
3. Lumbardhi of Prizren: sampling was carried out at the bridge at the exit of the city, which represents a part of the city's own urban waters, especially on the left side of the river, as well as the discharged waters of all settlements and other activities such as gastronomy and agronomy along the road to Prevalla.
4. Iber River: in the city of Mitrovica, the sampling site it is located half a kilometer before the river Sitnica joins, however, almost all discharges from the city of Mitrovica occur just a few tens of meters before the sampling site.
5. Sitnica River: near the village of Lumadh, is a location after the village of Lumadh where the Sitnica river joins the Llap river. The pollution is caused by the entire region through which the Llap River flows, as well as the pollution coming from the Drenica River, the Graqanka River, the Prishtevka River, as far as the industry, worth mentioning are: Kosovo Energy Corporation (KEK), producer products milk and meat, colors, etc.
6. Sitnica River: in the village of Hallaq near the city of Lipjan, which contains all the discharges of the residents of the city of Lipjan as well as the city of Shtime and other villages along the entire flow of the Sitnica river up to the sampling.
7. Nerodime River: in the village of Kaçanik i Vjetër, this location is located between the towns of Ferizaj and Kaçanik. In this sampling site, there are discharges of urban and rural waters, as well as runoff from agricultural land surfaces.
8. Mirusha River: in the city of Gjilan, it is a river with a very small natural water flow, but the water volume is significantly increased by the discharge of urban

waters from a large part of the city. The overall water flow volume increases several times due to the discharged waters.

Table 4. Data of geographic positions and altitude above sea level monitoring

Monitoring location	River	Latitude N	Longitude E	Altitude (m)
Zllakuqan (Klina)	Drini i Bardhë	42°39'45.62"	20°32'8.43"	394
Brekoc (Gjakova)	Erenik	42°22'25.83"	20°24'23.00"	347
Prizren (City)	Lumbardhi of Prizren	42°12'26.34"	20°43'26.54"	391
Mitrovica (City)	Ibri	42°53'40.71"	20°52'18.93"	501
Lumadh (Obiliq)	Sitnica	42°42'26.02"	21° 2'16.69"	528
Hallaq (Lipjan)	Sitnica	42°31'33.77"	21° 5'41.41"	545
Old Kacanik (Kaçanik)	Nerodime	42°17'15.06"	21°14'10.66"	520
Gjilan (City)	Mirusha	42°27'13.56"	21°29'16.23"	498

Geographical coordinates of the sampling locations



ID	N	E	X	Y	legjenda_e
1	42°39'46.62"	20°32'8.43"	461947.224	4723460.696	1_D.i Bardh_Kline_Zllkeqan_Rurale
2	42°22'25.83"N	20°24'23.00"E	451127.266	4691455.463	2_Ereniku_Gjakove_Brekovc_Rurale
3	42°12'26.34"N	20°43'26.54"E	477219.891	4672631.667	3_LB i Prizreni_Prizren_Urbane
4	42°53'40.71"N	20°52'18.93"E	489542.999	4749123.033	4_Ibri_Mitrovice_Urbane
5	42°42'26.02"N	21° 2'16.69"E	503100.353	4728304.493	5_Sitnica_Obiliq_Plemetin_Urbane dhe Industriale
6	42°31'33.77"N	21° 5'41.41"E	507789.073	4708189.665	6_Sitnica_Lipjan_Hallaq i Vogel_Urbane
7	42°17'15.06"N	21°14'10.66"E	519480.972	4681726.74	7_Nerodime_Kacanik_Kacanik i Vjeter_Rurale
8	42°27'13.56"N	21°29'16.23"E	540113.651	4700274.727	8_M. e Binces_Gjilan_Urbane

Figure 1. *Monitoring locations shown on the map of Kosovo*

Geographic map of Kosovo with the quality monitoring locations by HMIK

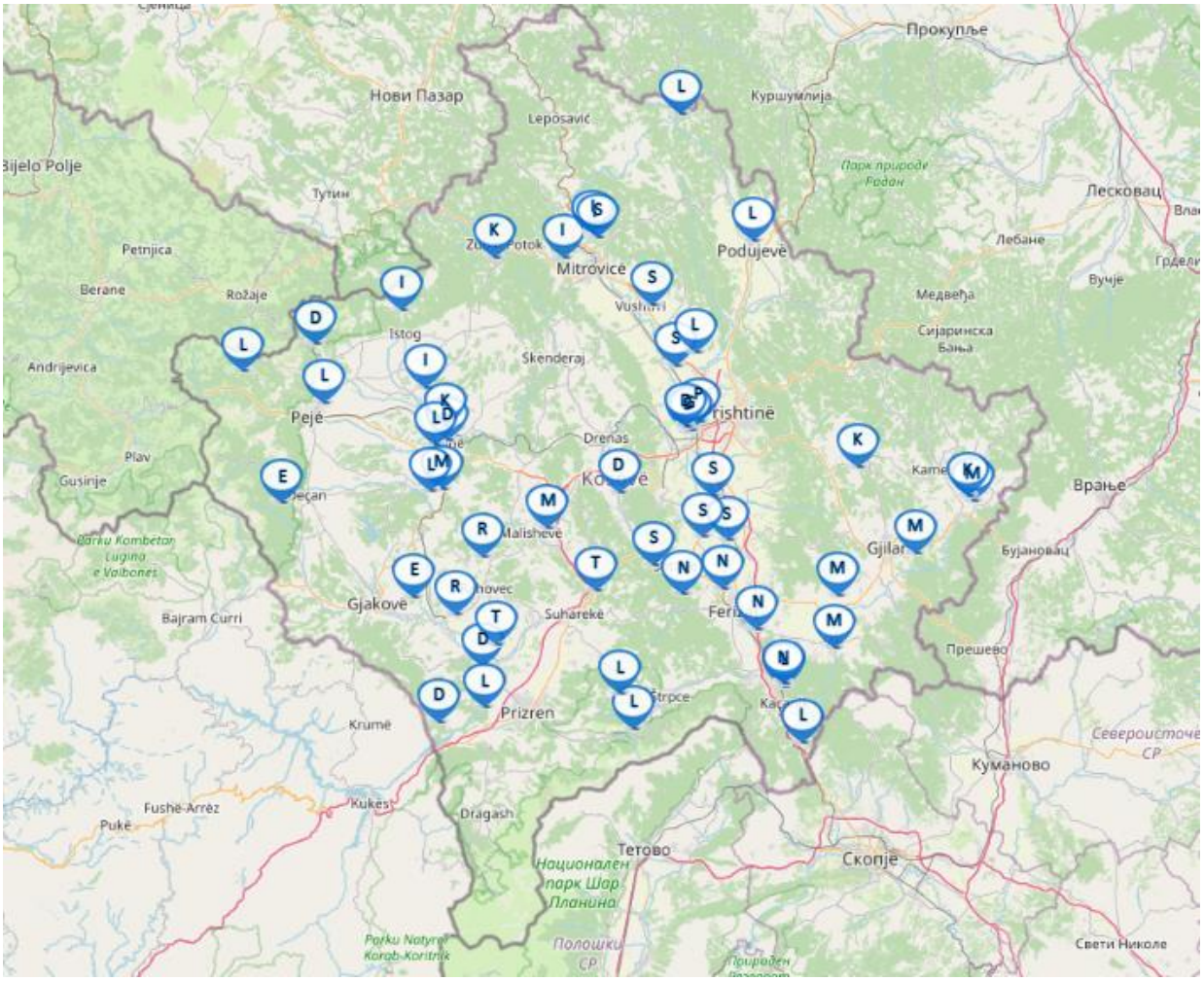


Figure 2. *HMIK surface water quality monitoring network – map with monitoring locations*[8]

[8] https://ihmk-rks.net/?page=1,22

4. RESULTS FROM THE MEASUREMENTS

4.1. Field activities

For the measurement of field parameters were used the portable devices such as:
- *The Hach Lange sensION 156 Multiparameter Device of the HACH company,* for determination of: Wt – percentage of oxygen, EC – electrical conductivity, TDS – Total Dissolved Solids. The device was pre-calibrated with a standard solution of 1413 µS/cm according to the manufacturer's instructions.
- *METER – portable – pH & mV & temperature measurement of ISOLAB manufacturer* was used to determine the pH value. The device was calibrated with buffer values of 10.01 and 7.00 according to the manufacturer's instructions.
- The amount of dissolved oxygen and water saturation with oxygen was determined by the device *Portable Dissolved Oxygen Meter w ith Extended Range in Water-Resistant Casing HI9143 of the manufacturer HANNA Instruments*, calibrated according to the manufacturer's instructions.

The air temperature at the time of sampling was recorded according to the Weather Forecast application.

Figure 3. *Pictures captured during measurements of parameters in the field*

The measurements were carried-out with these devices and three probes through which the following parameters were measured:

- Air Temperature (T_A)
- Water temperature (T_U)
- pH value
- Amount of dissolved oxygen (DO)
- Saturation of water with Oxygen
- Electrical conductivity (EC)
- Total Dissolved Solids (TDS)

The measured values are recorded in the field protocol.

The values determined during field measurements at the sampling locations are listed in following table, divided by river basins, initially with geographic and temporal data, and the physical parameters.

Table 5. Data of the parameters determined in the field during the measurements in the first phase: Spring

Parameters	Unit	Basin of Drini i Bardhë			Basin of Ibri			Basin of Morava	Basin of Lepencit
		Erenik Gjakova (Brekoc)	Drini i Bardhë Klinë	Lumbardhi of Prizren Prizren	Ibri Mitrovica (City)	Sitnica Obiliq (Lumadh)	Sitnica Lipjan (Hallaq)	Mirusha Gjilan (City)	Nerodime Kaçanik (Old Kaçanik)
Date of sampling	d.m.v	06.05.23	06.05.23	06.05.23	09.05.23	09.05.23	09.05.23	09.05.23	09.05.23
Sampling time	hh:mm	12:50	11:10	14:10	8:20	16:30	9:32	11:35	10:34
Air temperature	^{0}C	20	19	22	17.5	19.5	12	13	11
Water temperature	^{0}C	14.7	11	13.6	9.8	14.1	13.3	18.1	11.2
Electrical Conductivity	µS/cm	202	291	213	330	630	535	909	414
Total Dissolved Solids	mg/L	96.1	140	101.5	160	310	257	444	197.7
pH value	0-14	7.9	7.6	7.7	8.92	7.72	7.34	7.8	7.3
Dissolved Oxygen	mg/L	6.3	7.6	5.44	10.6	2.52	1.68	1.08	4.17
Oxygen Saturation	%	78	96.6	68.4	96	30.3	20.6	13.4	47.2
Turbidity	NTU	7.9	5.8	9.6	10.4	17.3	36.3	14.7	21.6

Table 6. Data of the parameters determined in the field during the measurements in the second phase: Autumn

Parameters	Unit	Basin of Drini i Bardhë			Basin of Ibri			Basin of Morava	Basin of Lepencit
		Erenik Gjakova (Brekoc)	Drini i Bardhë Klinë (Zllakuqan)	Lumbardhi of Prizren Prizren	Ibri Mitrovica (City)	Sitnica Obiliq (Lumadh)	Sitnica Lipjan (Hallaq)	Mirusha Gjilan (City)	Nerodime Kaçanik (Old Kaçanik)
Date of sampling	d.m.v	30.09.23	30.09.23	30.09.23	01.10.23	01.10.23	01.10.23	01.10.23	01.10.23
Sampling time	hh:mm	13:20	12:00	14:40	9:00	9:45	10:45	13:40	12:06
Air temperature	0C	25	22	22	19	18	19	18	17
Water temperature	0C	18.6	16.8	17	14.9	16.6	16.6	22	18
Electrical Conductivity	µS/cm	359	442	360	380	823	913	1133	762
Total Dissolved Solids	mg/L	179	220	180	190	412	456	558	380
pH value	0-14	8.32	7.95	7.63	7.42	7.45	7.5	7.62	7.19
Dissolved Oxygen	mg/L	8.4	7.14	4.15	7.2	2.18	0.88	0.3	0.56
Oxygen Saturation	%	113	88.7	58.4	73	26.9	11.9	3.4	5.9
Turbidity	NTU	1.31	1.74	7.5	9.01	11.8	25.5	9.31	13.2

4.2. Chemical parameters determined in laboratories

After the sampling of river waters at the sampling locations, chemical parameter analyzes were carried out in the laboratory according to the procedures of the standard methods described above in Table 2.

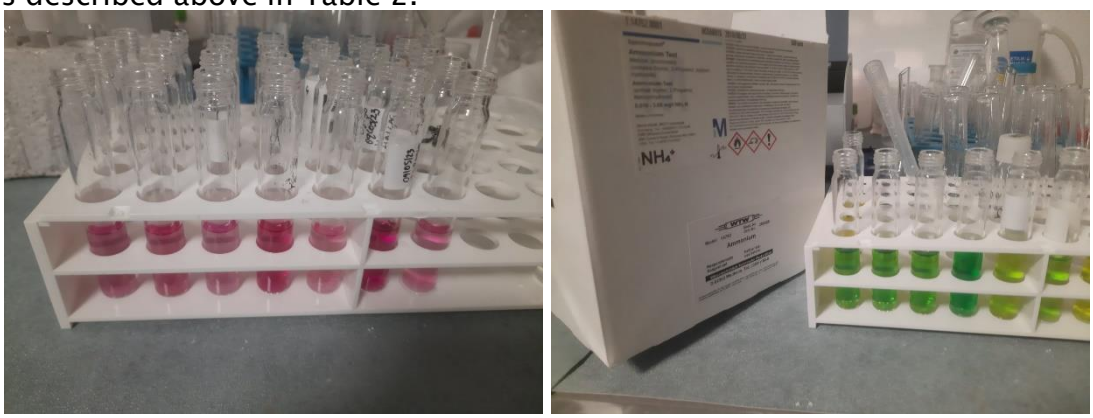


Figure 4. *Pictures during laboratory determination of chemical parameters*

Table 7. *Data of the parameters determined in the laboratory during the measurements in the first phase: Spring*

Parameters	Unit	Basin of Drini i Bardhë			Basin of Ibri			Basin of Morava	Basin of Lepencit
		Erenik Gjakova (Brekoc)	Drini i Bardhë Klinë (Zllakuqan)	Lumbardhi of Prizren Prizren (City)	Ibri Mitrovica (City)	Sitnica Obiliq (Lumadh)	Sitnica Lipjan (Hallaq)	Mirusha Gjilan (City)	Nerodime Kaçanik (Old Kaçanik)
Total Suspended Solids	mg/L	5.5	16.2	82	138	44.5	25.4	41.5	33.6
Chemical Oxygen Demand (COD)	mg/L	6.80	20.80	102.00	40.00	65.50	39.40	87.60	43.50
Biochemical Oxygen Demand (BOD5)	mg/L	4	12.3	62.6	28	38.3	20.7	53.6	28.5
Total Organic Carbon	mg/L	1.9	6.9	39.4	17	21.6	12.5	29.1	13.8
Ammonium ions	mg/L	0.007	0.016	0.314	0.67	0.572	0.545	1.19	0.55
Ammonium ion nitrogen	mg/L	0.005	0.012	0.244	0.521	0.445	0.424	0.926	0.428
Nitrate ions	mg/L	1.5	3.5	1.2	1.6	7	5.3	5.7	5.8
Nitrite ions	mg/L	0.051	0.087	0.136	0.12	0.623	0.708	1.343	0.453
Inorganic Nitrogen	mg/L	0.36	0.83	0.56	0.92	2.22	1.84	2.62	1.88
Organic Nitrogen	mg/L	0.14	0.41	2.07	1.88	1.26	0.68	1.77	0.94
Total Nitrogen	mg/L	0.5	1.24	2.62	2.8	3.48	2.52	4.39	2.82
Phosphate Ions	mg/L	0.021	0.235	0.286	0.6	0.869	0.475	4.172	2.758
Phosphorus of Orthophosphate Ions	mg/L	0.007	0.077	0.093	0.196	0.283	0.155	1.36	0.899
Total Phosphorus	mg/L	0.12	0.42	1.85	1.32	1.36	0.73	2.86	1.7
Chloride Ions	mg/L	1.4	2	5.5	11..5	17.8	20.2	59.6	12.4
Sulfate Ions	mg/L	2.3	2.9	23.8	23	97.5	69.4	10.5	36.2

Table 8. *Data of the parameters determined in the laboratory during the measurements in the second phase: Autumn*

Parameters	Unit	Basin of Drini i Bardhë			Basin of Ibri			Basin of Morava	Basin of Lepencit
		Erenik Gjakova (Brekoc)	Drini i Bardhë Klinë (Zllakuqan)	Lumbardhi of Prizren Prizren (City)	Ibri Mitrovica (City)	Sitnica Obiliq (Lumadh)	Sitnica Lipjan (Hallaq)	Mirusha Gjilan (City)	Nerodime Kaçanik (Old Kaçanik)
Total Suspended Solids	mg/L	6.4	9.9	192	7	16	142	73.5	51
Chemical Oxygen Demand (COD)	mg/L	8.90	14.20	236.00	26.00	46.00	176.00	192.00	102.00
Biochemical Oxygen Demand (BOD5)	mg/L	4.9	6.6	102.5	16.8	22.4	69.9	115	43
Total Organic Carbon	mg/L	2.3	4.2	67.2	12	14.6	47.8	60.4	29.8
Ammonium ions	mg/L	0.04	0.027	1.266	1.28	1.005	1.334	0.683	0.796
Ammonium ion nitrogen	mg/L	0.031	0.021	0.985	0.996	0.782	1.038	0.531	0.62
Nitrate ions	mg/L	1.7	6.8	1.2	2.2	4.8	1	0.1	0.1
Nitrite ions	mg/L	0.39	0.108	0.53	0.29	0.269	0.801	1.748	0.38
Inorganic Nitrogen	mg/L	0.53	1.59	1.42	1.58	1.95	1.51	0.57	0.76
Organic Nitrogen	mg/L	0.29	0.47	7.79	0.86	1.52	5.81	6.34	3.37
Total Nitrogen	mg/L	0.83	2.06	9.21	2.44	3.47	7.32	6.9	4.12
Phosphate Ions	mg/L	0.082	0.106	0.49	0.502	1.74	4.35	1.54	2.87
Phosphorus of Orthophosphate Ions	mg/L	0.027	0.035	0.16	0.164	0.567	1.418	0.502	0.94
Total Phosphorus	mg/L	0.28	0.43	6.77	0.89	1.86	6.35	5.88	3.79
Chloride Ions	mg/L	7.1	7.3	17	23	46.2	53.3	39.6	40.5
Sulfate Ions	mg/L	29.9	18.4	28.9	28.1	126	84.6	18.7	64.1

5. DISCUSSION OF RESULTS

5.1. Field measurements

5.1.1. Water temperature (T_w)

As shown in the diagram below, we see that the Water Temperature (T_w), depending on the period of sampling and the time of sampling, in the first phase in the month of May, it ranged from 9.8°C to 18.1°C, whereas in the second phase, in October, they were higher, from 14.9°C to 22.0°C. In both cases, River Mirusha in Gjilan had a higher temperature, given that the sampling location was at the exit of the city and that the amount of water in that stream is mainly from wastewater discharges.

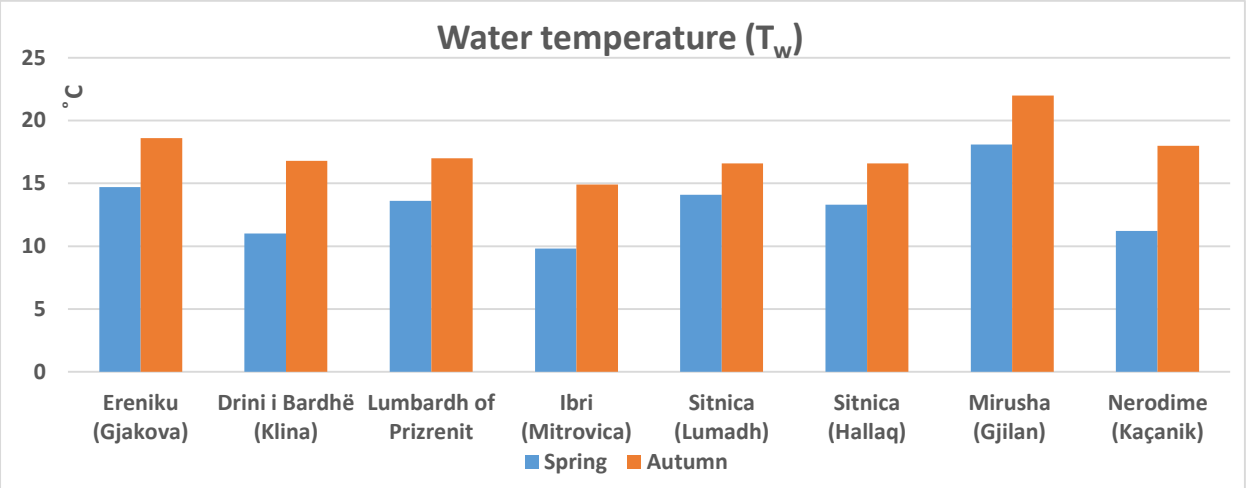


Figure 5. Diagram with water temperature data (Tw)

5.1.2. pH value

As usual, the pH value was above 7, which means that the waters had an alkaline medium in all cases, both periods: in spring and in autumn. The measured pH values were between 7.34 and 8.92 in spring, while in autumn they were between 7.42 and 8.32. *According to AI 16/2017 MESP, the maximum pH value for surface waters is required to be **between 7.0 and 9.0**.*

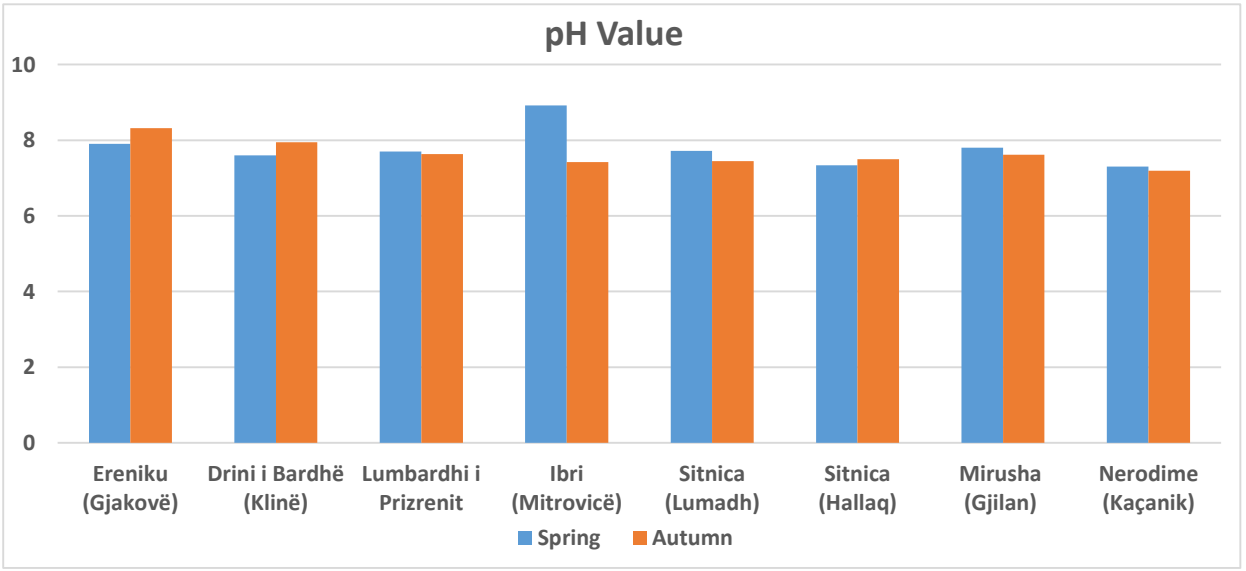


Figure 6. Chart with pH value data

5.1.3. Dissolved Oxygen (DO)

Dissolved oxygen (DO) in the spring phase has resulted in higher values, as a result of lower temperatures and higher volume of water in river flows. The measured values are between 1.08 and 10.6 mg/L O2 in the spring, while in the autumn phase they are significantly lower from 0.00 in the Mirusha river in Gjilan, as a result of the extremely high level of discharged pollution which has affected the expenditure of the entire amount of oxygen. While the highest value was recorded 8.32 mg/L O_2 in the Erenik River in Brekoc of Gjakova as a result of the fact that the water was not exposed to high pollution. On the other hand, in the river Sitnica, Mirushë, Lumbardh of Prizren and Nerodime, the amount of oxygen is lower than the reference value determined in *AI 16/2017 MESPI, where the value is required to be >7.0 mg/L NTU.*

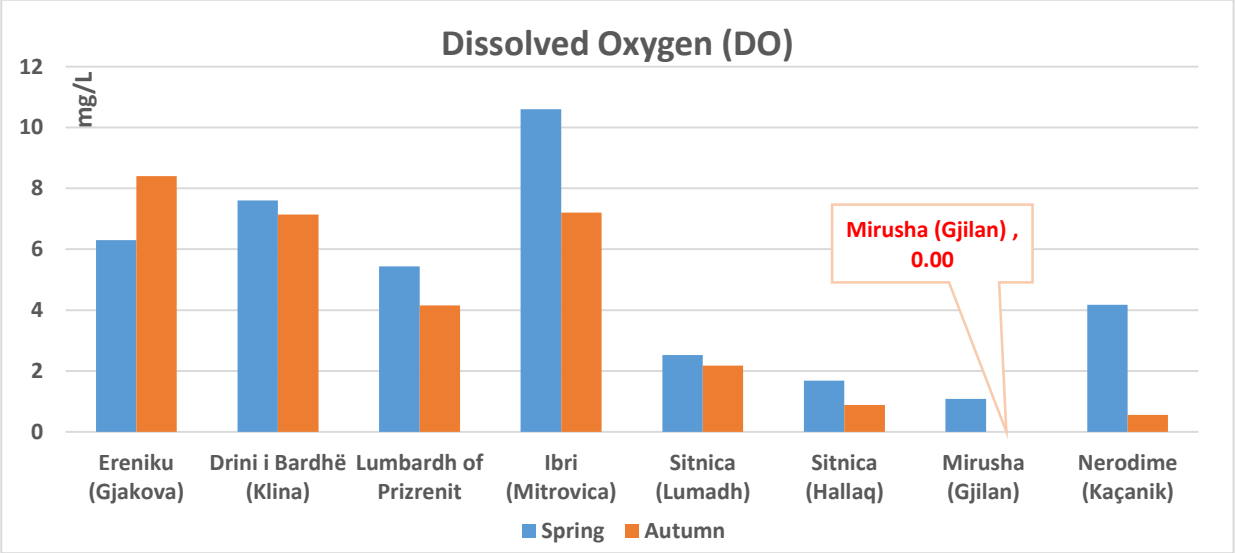


Figure 7. *Chart with Dissolved Oxygen (DO) value data*

5.1.4. Turbidity (NTU)

In the spring phase, it resulted between values of 5.8 NTU in the river Drini i Bardhë in Zllakoqan and the highest with 36.3 NTU in the Sitnica river in the village of Hallaq, very close to the city of Lipjan, where all sanitary water is discharged before the location where the sample was taken for analysis.

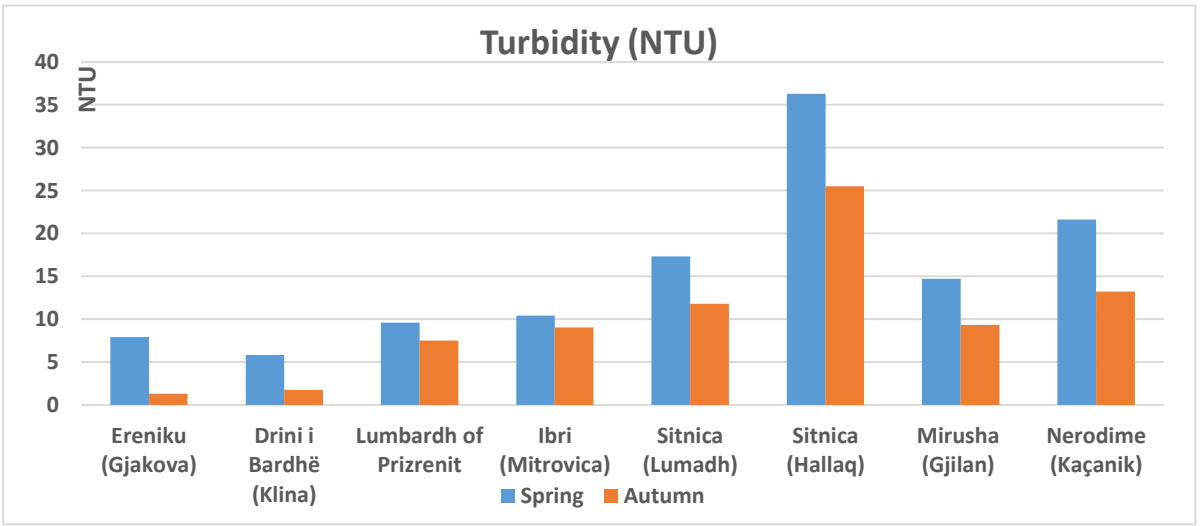


Figure 8. *Chart with Turbidity (NTU) value data*

5.1.5. Electrical conductivity - EC

The electrical conductivity in the spring phase had lower results, this is due to the fact that the amount of rainfall which was quite frequent during this period has affected the mitigation of the amount of pollution and consequently also affected the reduction of electrical conductivity values, as can be seen in the following figure.

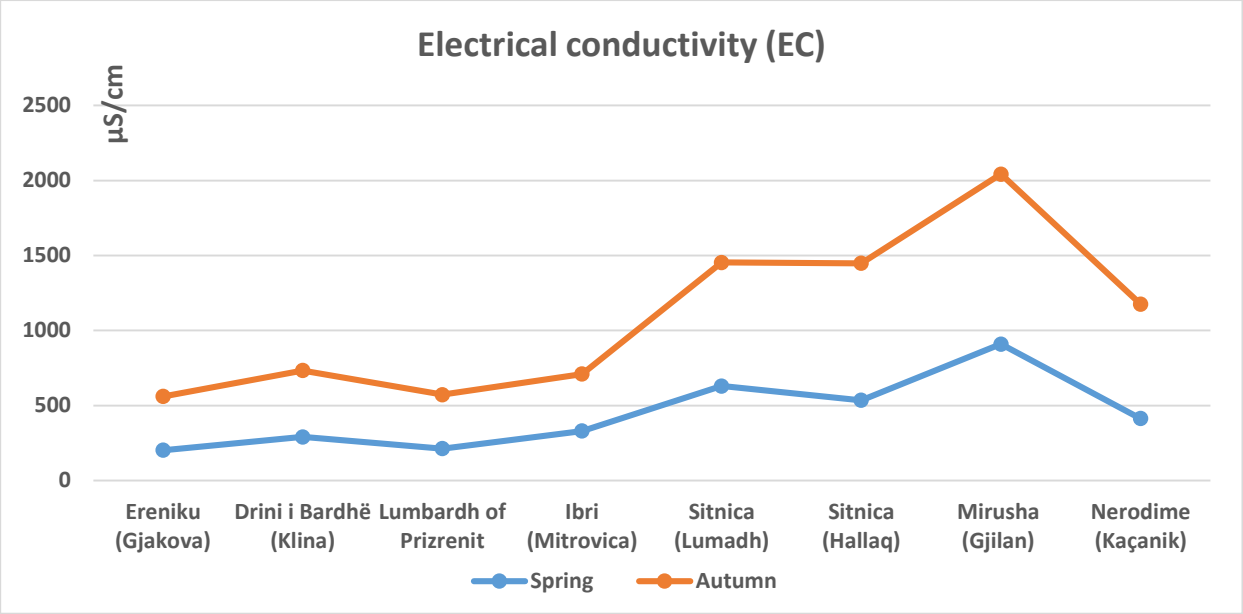


Figure 9. Chart with Electrical Conductivity (EC) value data

5.2. Parameters analyzed in the laboratory

5.2.1. Total Suspended Solids – TSS

TSS refers to the concentration of solid particles that are suspended in water but are not dissolved. As can be seen from the diagram, Lumbardhi of Prizren has resulted with the highest values of TSS, in both periods. The values measured in this river for spring monitoring are 82 mg/L and for autumn 192 mg/L.

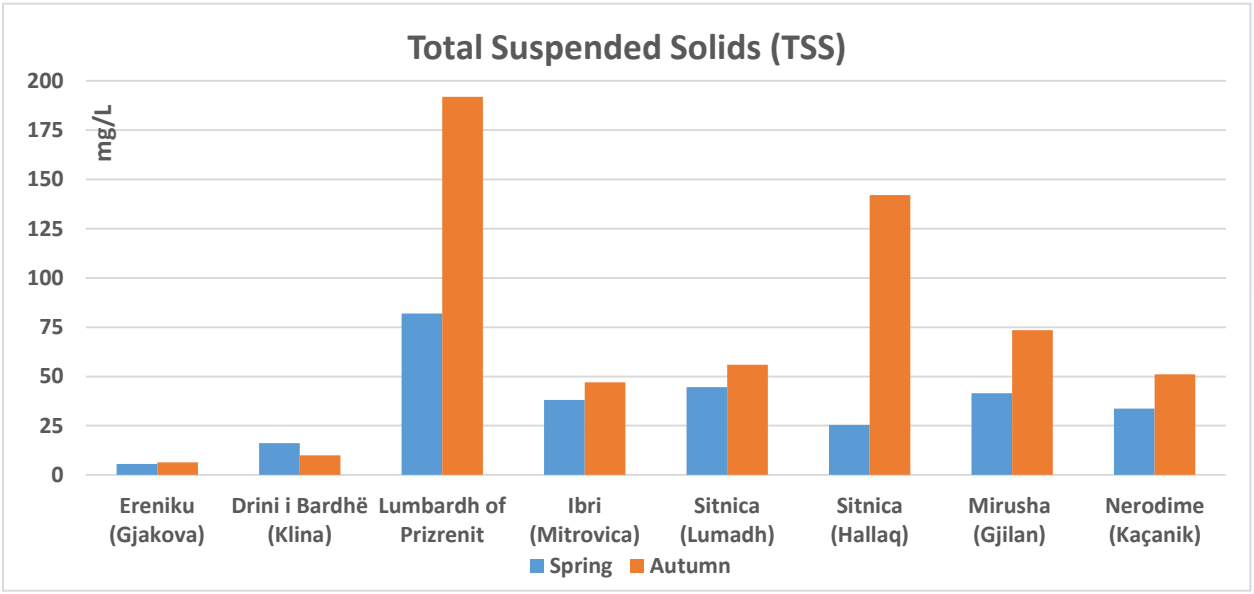


Figure 10. Chart with Total Suspended Solids (TSS) data

5.2.2. Chemical Oxygen Demand – COD

One of the key parameters that refers to water pollution from sanitary and industrial water discharges is Chemical Oxygen Demand (COD), whose values were quite close in the water samples monitored in both phases. The COD value in the river Lumbardhi of Prizren was 102 mg/L in spring and 236 mg/L in autumn, while in the river Mirusha in Gjilan the values of 87.6ml/L COD were recorded in spring and 192 mg/L in autumn.
*With AI 16/2017 MESP maximum value permitted for COD is **12 mg/L**.*

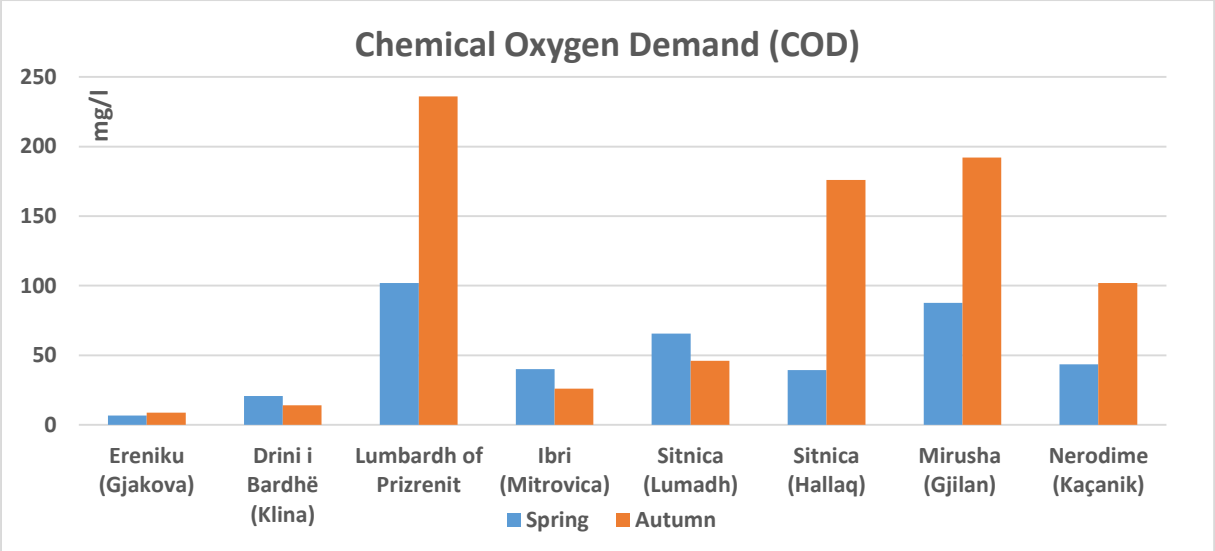


***Figure 11.** Chart with Chemical Oxygen Demand (COD) data*

5.2.3. Biochemical Oxygen Demand - BOD_5

Biochemical oxygen demand (BOD) represents the amount of oxygen required for the biotic decomposition of organic substances present in water under specific conditions and within specified time periods. As per the COD, for the BOD as well, the highest values are recorded at the river Lumbardhi of Prizren, with 62.6 mg/L in the spring and 102.5 mg/L in the autumn phase. Then we have the river Mirusha in Gjilan with BOD_5 at the level of 53.6 mg/L during spring and115 mg/L in autumn season.
*In AI 16/2017 MESP, the maximum value allowed for BOD_5 is **8.0 mg/L**.*

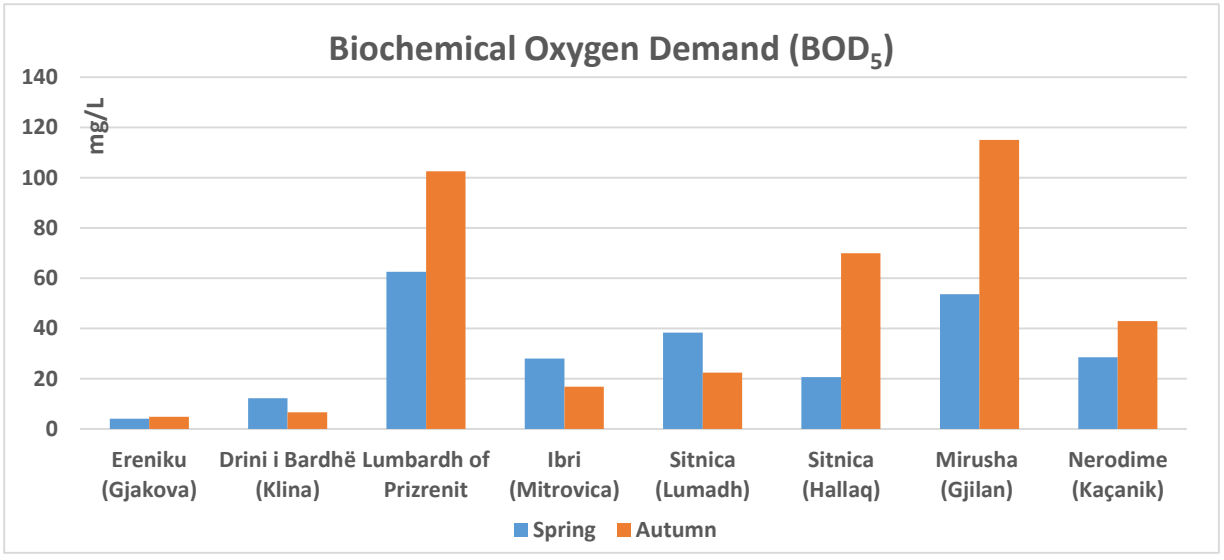


***Figure 12.** Diagram with Biochemical Oxygen Demand (BOD_5) data*

5.2.4. Total Organic Carbon – TOC

The TOC (Total Organic Carbon) is also an integral part of organic matter, which, like the previous two parameters, is present in significant quantities in most of the samples taken from the monitored rivers as part of this project. The amount of TOC in the River Lumbardhi of Prizren in spring was 39.4, while in autumn it was 67.2 mg/L TOC.

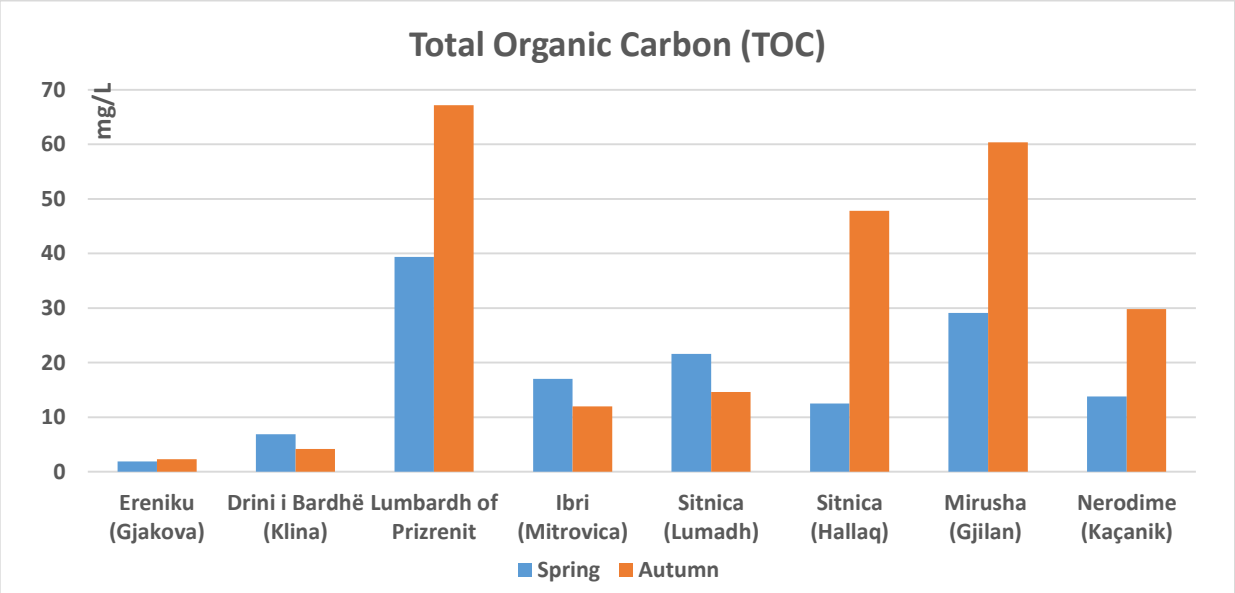


Figure 13. Chart with Total Organic Carbon (TOC) data

5.2.5. Ammonium Ions Nitrogen - $N\text{-}NH_4^+$

Has been present in all samples, but the highest amount was in River Mirusha of Gjilan in the spring phase, while in the autumn phase there was a high amount in Lumbardhi of Prizren, in Ibër and in the two samples of Sitnica.

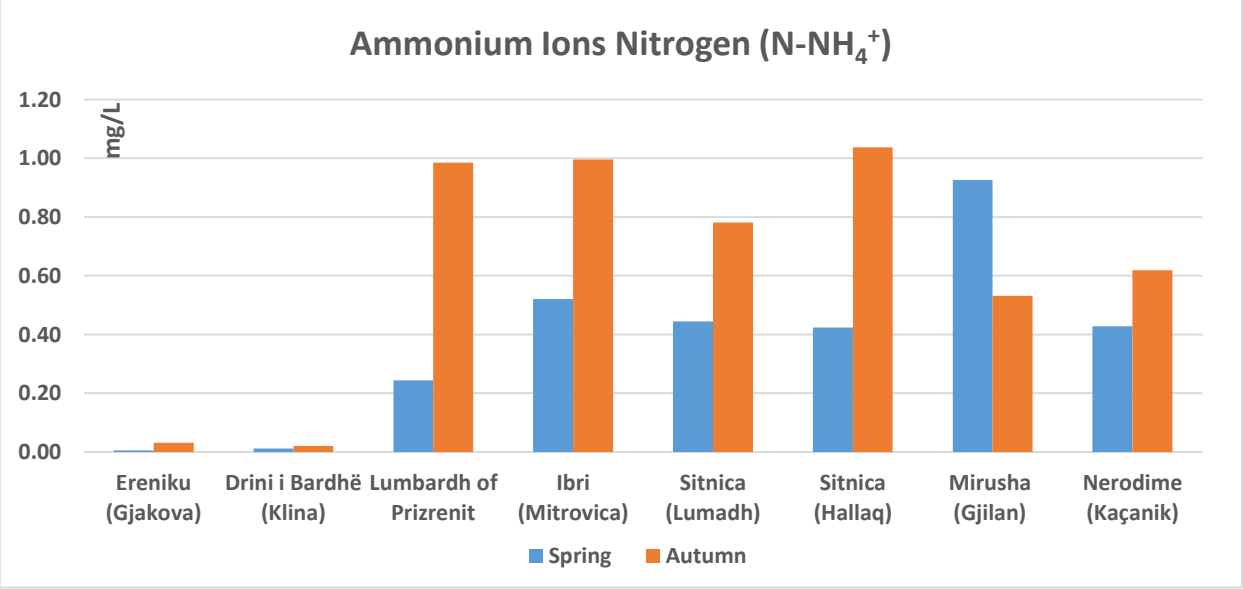


Figure 14. Diagram with Ammonium Ions Nitrogen ($N\text{-}NH_4^+$)

According to AI 16/2017 MESP, the maximum allowed value for $N\text{-}NH_4^+$ is ***0.7 mg/L***

.

5.2.6. Nitrates - NO_3^-

Nitrate levels in the autumn season were highest in the Drini i Bardhë River, at 6.8 mg/L, while in the spring season, they were higher in the Sitnica River at the sampling location in the village of Lumadh, measuring 7.0 mg/L. The presence of nitrates in river waters also results from the use of inorganic fertilizers in agricultural land.

According to AI 16/2017 MESP, the maximum allowed value for nitrate ions is ***5.0 mg/L NO_3^-.***

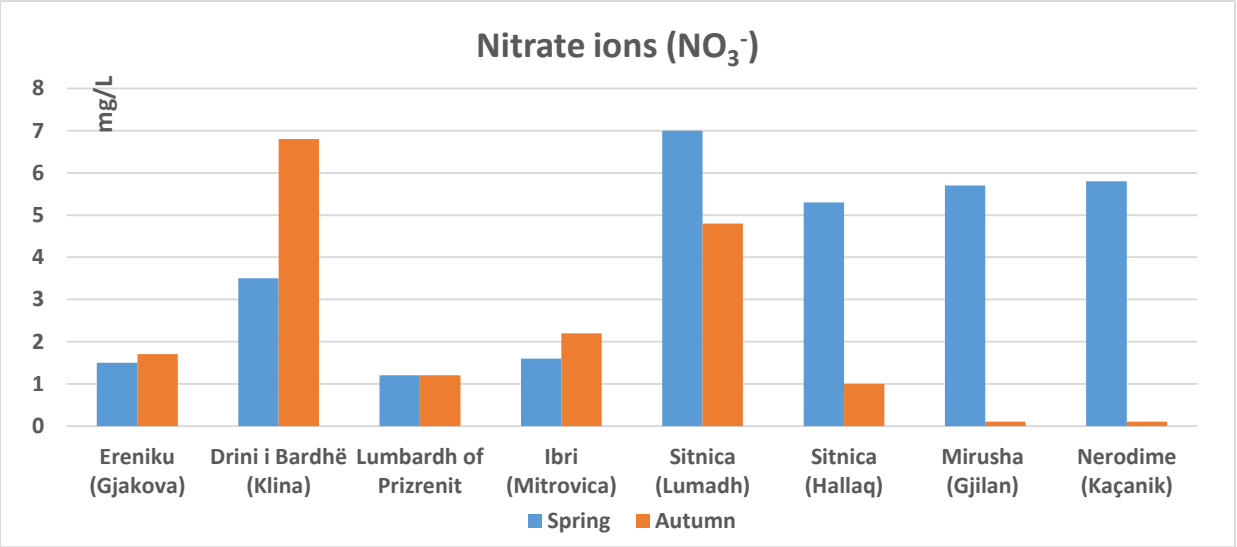


Figure 15. *Nitrate ions data diagram (NO_3^-)*

5.2.7. Nitrites - NO_2^-

The presence of nitrites during the two monitoring periods resulted in higher values in the River Mirusha in Gjilan, with a concentration of 1.34 mg/L in spring and 1.74 mg/L in autumn. It is worth noting that nitrite levels were also present in all other samples.

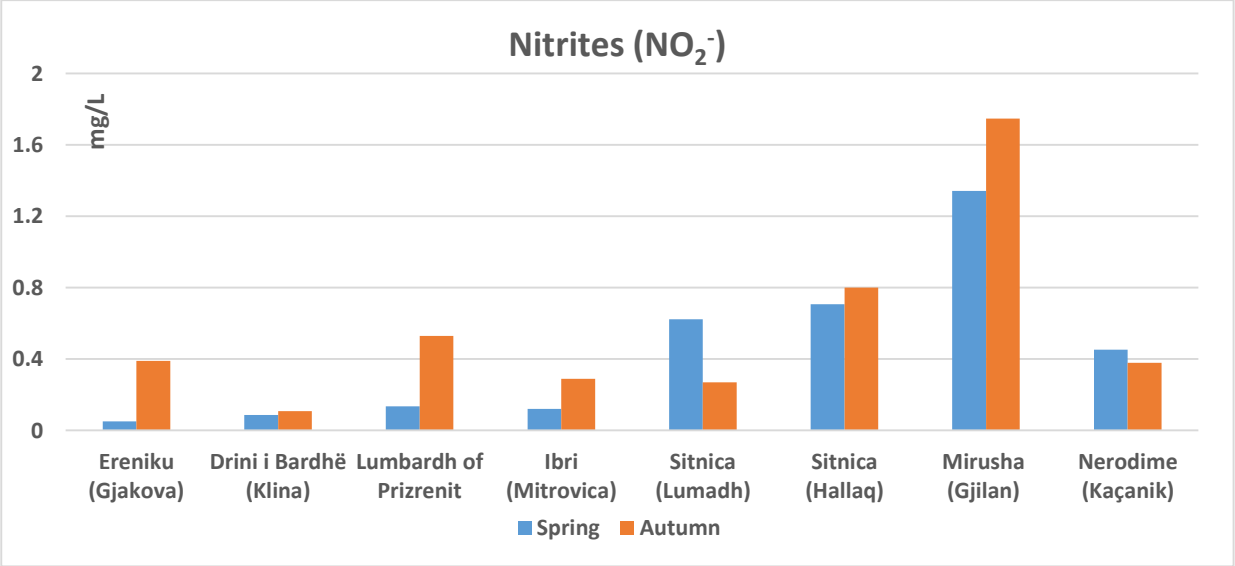


Figure 16. *Nitrite ions (NO_2^-) data diagram*

5.2.8. Phosphorus of Orthophosphates - $P\text{-}PO_4^{3-}$

The presence of orthophosphates was in significant quantities especially in the Sitnica river in the two sampling locations, in particular in the sample taken in the village of Hallaq in the autumn season with 1.42 mg/L P-PO4. However, in the spring monitoring, the highest values of orthophosphate were presented in the Mirusha River, with 1.36 mg/L.

*In AI 16/2017 MESP, the maximum allowed value is **0.2 mg/L** $P\text{-}PO_4^{3-}$.*

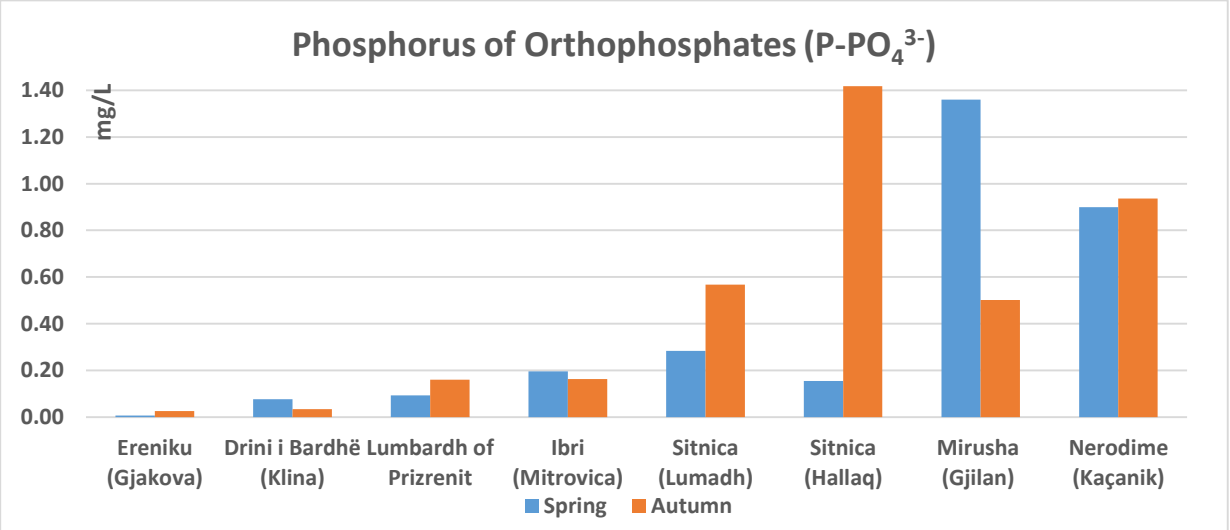


Figure 17. *Diagram with the data of Phosphorus in Orthophosphates ($P\text{-}PO_4^{3-}$)*

5.2.9. Total Nitrogen – N_{tot}

The highest values of Total Nitrogen were in the autumn season in the Prizren Lumbardhi River, with a concentration of 9.21 mg/L. It was followed by the Mirusha River in Gjilan with 7.42 mg/L and the Sitnica River in Hallaq with 7.32 mg/L N_{tot}.

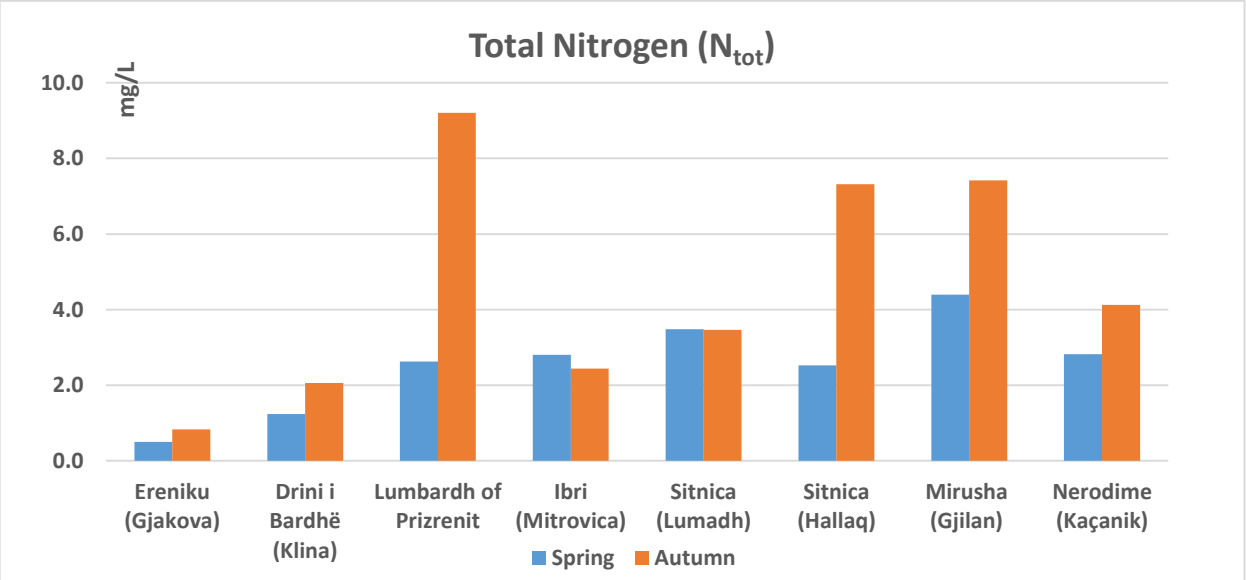


Figure 18. *Diagram with the data of Total Nitrogen (N_{tot})*

*According to AI 16/2017 MESP, maximum value permitted for Total Nitrogen is **10 mg/L.***

5.2.10. Total Phosphorus - P_{tot}

It indicates nutrient pollution and helps determine the potential for eutrophication. In the analyzed samples from the autumn season, it was found that the presence of total phosphorus was quite pronounced, especially in the Prizren Lumbardhi River, as well as in the Sitnica River in Hallaq and the Mirusha River in Gjilan.

In AI 16/2017 MESP, maximum level approved for this parameter is ***0.4 mg/L P_{tot}.***

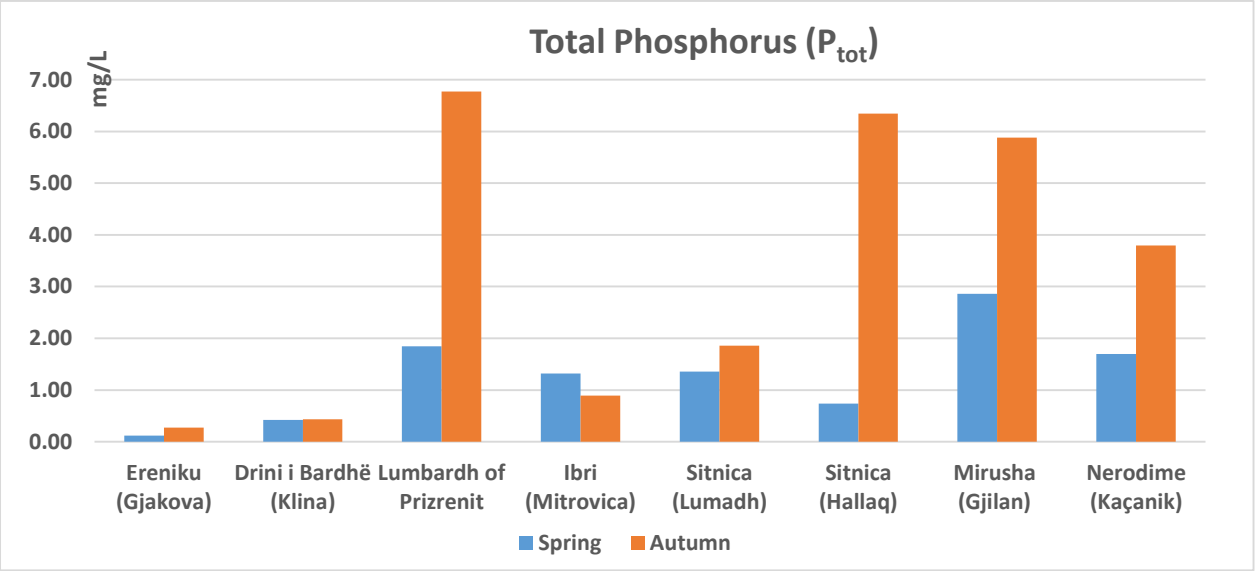


Figure 19. *Diagram with the data of Total Phosphorus (P_{tot})*

5.2.11. Chlorides - Cl^-

The presence of chlorides is common, and their quantity mainly depends on wastewater discharges and those from gastronomy establishments.

Especially in the autumn season, significantly higher quantities were recorded compared to the spring season, except in Mirusha river in Gjilan, where in the spring monitoring higher quantities of these ions have been recorded.

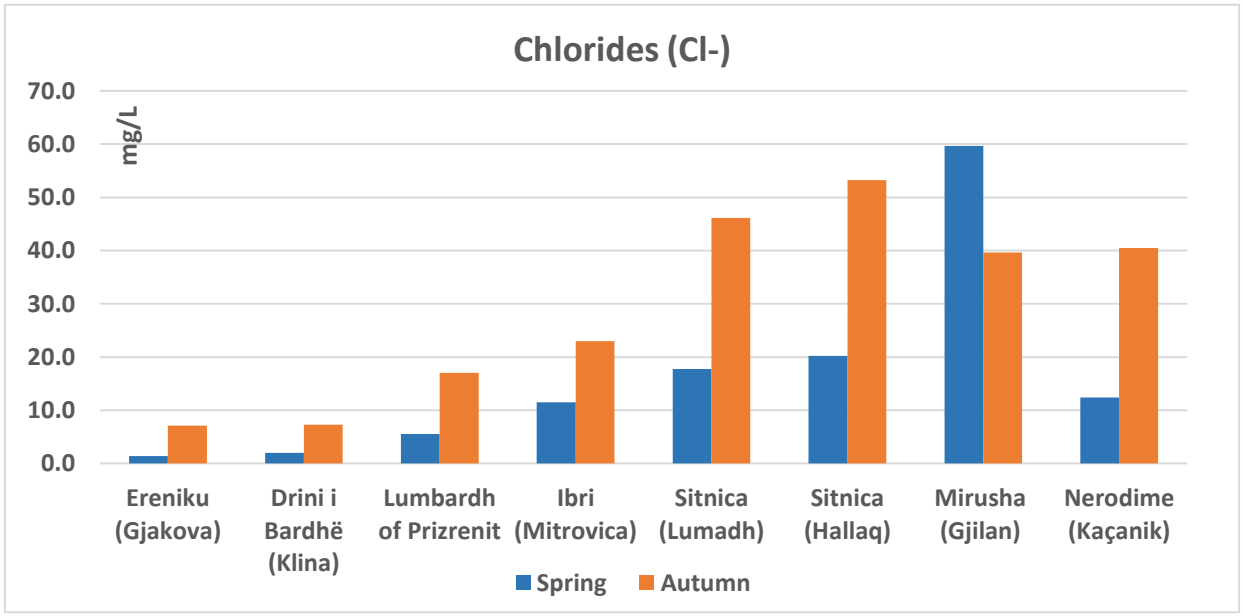


Figure 20. *Chart with data of Chlorides (Cl^-)*

5.2.12. Sulfates – SO_4^{2-}

The highest quantity of sulfates was found in the Sitnica River at the Lumadh monitoring location. This high amount of sulfates is a result of the influence of the Graqanka and Drenica rivers, as well as the wastewater discharges from the coal mines in Obiliq – KEK.

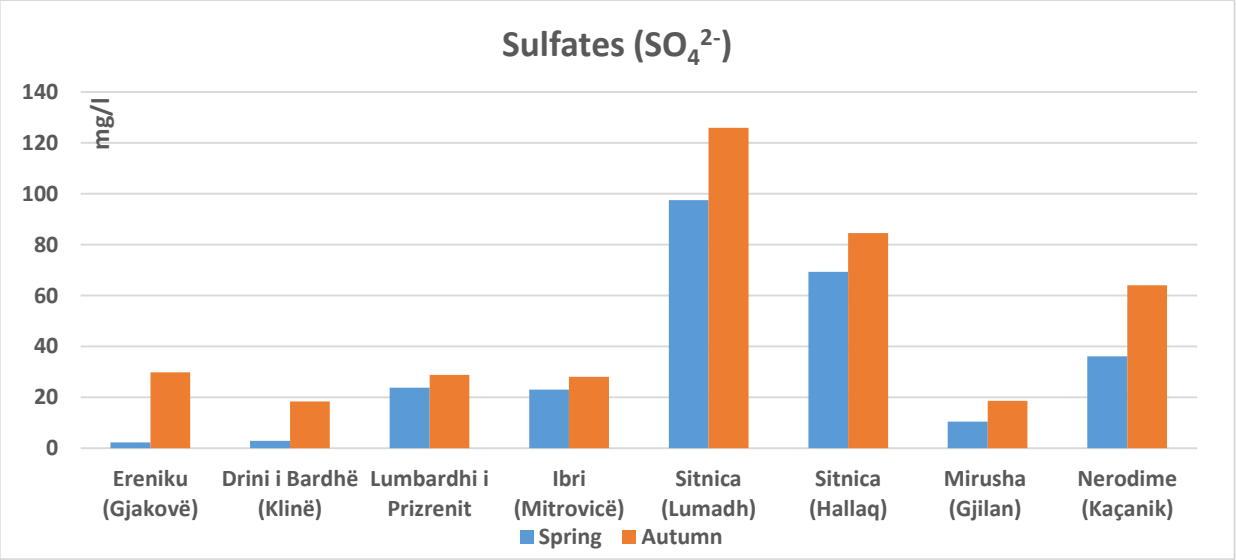


***Figure 21**. Diagram with the data of Sulfates (SO_4^{2-})*

6. CLASIFICATION OF SURFACE WATER BODIES

The classification of surface water bodies is done based on the existing national legislation. It has been done by comparing the field and laboratory measurements with the maximum allowable values specified in Administrative Instruction 16/2017 of the MESPI[9]. In our case, the comparison should be made with ***the T2 type of waters***, which includes ***small, medium, and large lowland rivers***, which category corresponding to the types of rivers monitored within this project.

Table 9. *Values according to Administrative Instruction No. 16/2017 MESP1 for the classification of surface water bodies*

No.	TYPE*	T 2 - Lowland small, medium and large rivers		
	Status	**H**	**G**	**M**
1	***pH***	7.0-8.6	<7.0 >9.0	<7.0 >9.0
2	***Dissolved Oxygen***	>7.0	7.0 – 6.0	6.0 – 5.0
3	***BOD5***	<4.0	4.0 – 6.0	6.0 – 8.0
4	***COD***	<4.0	4.0 – 7.0	7.0 – 12.0
5	***Nitrogen of ions Ammonia NH_4-N***	<0.10	0.10 – 0.25	0.25 – 0.70
6	***Nitrites***	<1.00	1.00 – 2.00	2.00 – 5.00
7	***Total Nitrogen - N_{total}***	<1.5	1.5 – 3.0	3.0 – 10.0
8	***Phosphorus of orthophosphate PO_4-P***	<0.05	0.05 – 0.10	0.10 – 0.20
9	***Total Phosphorus – P_{tot}***	<0.10	0.10 – 0.20	0.20 - 0.40

The classification of river waters based on the results of the first phase – spring and the second phase – autumn, according to Administrative Instruction 16/2017, results in a **moderate status**, and in some cases, it falls outside this status due to the values of parameters exceeding the reference values according to Administrative Instruction 16/2017.

[9] https://gzk.rks-gov.net/ActDetail.aspx?ActID=15797

7. CONCLUSIONS

For easier reading, the tables with spring and autumn measurements and evaluated according to the values determined in AI 16/2017 are presented:

high	good	moderate	poor

Table 10. *Evaluation of the chemical parameters analyzed according to the maximum values allowed with AI 16/2017: Spring*

River	pH value	Dissolved Oxygen	Chemical Oxygen Demand (COD)	Biochemical Oxygen Demand (BOD)	Ammonium ion nitrogen	Nitrate ions	Total Nitrogen	Phosphorus of Orthophosphate Ions	Total Phosphorus
	0-14	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Referent Values: L M Md	7.0-8.6 <7.0>9.0 <7.0>9.0	>7.0 7.0-6.0 6.0-5.0	<4.0 4.0-7.0 7.0-12.0	<4.0 4.0-6.0 6.0-8.0	<0.10 0.10-0.25 0.25-0.70	<1.00 1.00-2.00 2.00-5.00	<1.5 1.5-3.0 3.0-10.0	<0.05 0.05-0.10 0.10-0.20	<0.10 0.10-0.20 0.20-0.40
Erenik Gjakova (Brekoc)	7.9	6.3	6.8	4	0.005	1.5	0.5	0.007	0.12
Drini i Bardhë Klinë (Zllakuqan)	7.6	7.6	20.80	12.3	0.012	3.5	1.24	0.077	0.42
Lumbardhi of Prizren Prizren (City)	7.7	5.44	102.00	62.6	0.244	1.2	2.62	0.093	1.85
Ibri Mitrovica (City)	8.92	10.6	40.00	28	0.521	1.6	2.8	0.196	1.32
Sitnica Obiliq (Lumadh)	7.72	2.52	65.50	38.3	0.445	7	3.48	0.283	1.36
Sitnica Lipjan (Hallaq)	7.34	1.68	39.40	20.7	0.424	5.3	2.52	0.155	0.73
Mirusha Gjilan (City)	7.8	1.08	87.60	53.6	0.926	5.7	4.39	1.36	2.86
Nerodime Kaçanik (Old Kaçanik)	7.3	4.17	43.50	28.5	0.428	5.8	2.82	0.899	1.7

Table 11. *Evaluation of the chemical parameters analyzed according to the maximum values allowed with AI 16/2017: Autumn*

River	pH value	Dissolved Oxygen	Chemical Oxygen Demand (COD)	Biochemical Oxygen Demand (BOD)	Ammonium ion nitrogen	Nitrate ions	Total Nitrogen	Phosphorus of Orthophosphate Ions	Total Phosphorus
	0-14	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
Referent Values: L M Md	7.0-8.6 <7.0>9.0 <7.0>9.0	>7.0 7.0-6.0 6.0-5.0	<4.0 4.0-7.0 7.0-12.0	<4.0 4.0-6.0 6.0-8.0	<0.10 0.10-0.25 0.25-0.70	<1.00 1.00-2.00 2.00-5.00	<1.5 1.5-3.0 3.0-10.0	<0.05 0.05-0.10 0.10-0.20	<0.10 0.10-0.20 0.20-0.40
Erenik Gjakova (Brekoc)	8.32	8.4	8.9	4.9	0.031	1.7	0.83	0.027	0.28
Drini i Bardhë Klinë (Zllakuqan)	7.95	7.14	14.20	6.6	0.021	6.8	2.06	0.035	0.43
Lumbardhi of Prizren Prizren (City)	7.63	4.15	236.00	102.5	0.985	1.2	9.21	0.16	6.77
Ibri Mitrovica (City)	7.42	7.2	26.00	16.8	0.996	2.2	2.44	0.164	0.89
Sitnica Obiliq (Lumadh)	7.45	2.18	46.00	22.4	0.782	4.8	3.47	0.567	1.86
Sitnica Lipjan (Hallaq)	7.5	0.88	176.00	69.9	1.038	1	7.32	1.418	6.35
Mirusha Gjilan (City)	7.62	0.3	192.00	115	0.531	0.1	6.9	0.502	5.88
Nerodime Kaçanik (Old Kaçanik)	7.19	0.56	102.00	43	0.62	0.1	4.12	0.94	3.79

The values of most parameters in all samples are such that, according to Administrative Instruction 16/2017, they classify the waters with **moderate status**, and in many cases, **exceeding the quality of this status**, implying that the pollution of surface waters is persistent.

- Based on the amount of *Dissolved Oxygen*, it appears that the river samples: Lumbardhi of Prizren, Sitnica in Lumadh and in Hallaq, Mirusha and Nerodime **have exceeded** even the poorest classification status of the water body that of Moderate status.

- *Chemical and Biochemical Oxygen Demand* have high levels in almost all water samples, exceeding the **Moderate classification** of waters with Moderate status. The exception in this case is with the Erenik River, which has shown a moderate status in these two parameters.

- *Phosphorus of orthophosphate ions* **exceeded** this status in the 2 monitoring locations of Sitnica River, then of Mirusha River and Nerodime**.**

- The chemical status for *Total Phosphorus* was of **Moderate status** as well, but in 4 samples this status was exceeded, specifically in the rivers: Lumbardhi of Prizren, Sitnica in Hallaq-monitoring location, Mirusha and Nerodime.

- The recorded values for *Total Nitrogen* rank these waters mainly in the **Moderate status**.

- *Nitrates* in some cases are ranked in the status even exceeding the moderate status, as in the case of River Drini I Bardhë in the fall and Sitnica in Lumadh in the spring, while in other cases the water quality was **in the Moderate Good status**.

- *Ammonium ion nitrogen* in samples of the autumn season in four of the rivers, namely in Lumbardhi of Prizren, Ibër and Sitnica in both locations, where their waters **exceed the Moderate status** while the other four rivers such as Ereniku, Drini i Bardhë belong to **the high status**, as per River Mirusha and Nerodime they belong to the **Moderate status**. In the spring monitoring, all have resulted in **High Good Moderate status**, and only the Mirusha river had a status that exceeded the Moderate status, which means that this river continuously contains high amounts of nitrogen and ammonium ions.

From the data of this report on water quality monitoring in the rivers' flow selected for monitoring, it shows that measures should be taken as soon as possible to stop urban, rural, industrial wastewater discharges. Additionally, increased care should be taken in the use of chemical products and chemical fertilizers in agricultural activities.

8. RECOMMENDATIONS

Based on the findings of the report, the following recommendations were made:

- **Higher inspection by the inspectorate** at municipal and central level are needed, increasing the number of water inspectors across municipalities and ministries and consequently increasing regular joint inspections to prevent pollution and ensure that operators operate in accordance with environmental standards.

- **Provide opportunities for consultation and technical advice** with the purpose to provide assistance to farms and operating businesses in implementing sustainable practices in waste treatment and water management.

- **Raising awareness and engaging the community** through training and informational meetings about their impact on water quality and how they can help reduce pollution through simple actions.

- **Create comprehensive real-time monitoring** for all rivers, where all citizens have the opportunity to be informed about the quality of surface water throughout the country. This monitoring should include testing for chemical and biological contamination parameters.

- **Increasing the number of water treatment** stations across the country enabling surface water to remain clean.

- **Improving information on water quality monitoring data** – Data should be accessible to the public through dedicated websites and periodic reports.

- **Improving policies** at the local level to improve water quality control policies and regulations.

- **Awareness activities,** especially in schools, including environmental topics and sustainable practices in school curricula to educate new generations on the importance of water quality and environmental protection.

REFERENCES

1. Brief summary of the water resources of the Republic of Kosovo, RBDA- https://siu.rks-gov.net/Pdf/P%C3%ABrmbledhja_tabelare_p%C3%ABrshkruese.pdf

2. Report - THE IMPACT OF SAND AND GRAVEL USERS ON THE ENVIRONMENTAL STATE OF RIVERS, Pristina 2022 https://ammk-rks.net/assets/cms/uploads/files/Dokumente%202022/Raporti%20per%20gjendjen%20e%20lumenjeve%202022%20(alb).pdf

3. REVIEW OF NATIONAL WATER STRATEGY 2023-2027 AND ACTION PLAN 2023-2025 https://gzk.rks-gov.net/ActDetail.aspx?ActID=78647

4. Annual report on the state of the environment, 2021 https://www.ammk-rks.net/assets/cms/uploads/files/Raporti%20i%20mjedisit%202021.pdf

5. KEPA - WATER STATE IN KOSOVO 2020 https://www.ammk-rks.net/assets/cms/uploads/files/Dokumente/Shqip_WEB_uji.pdf

6. Administrative Instruction 16/2017 https://gzk.rks-gov.net/ActDetail.aspx?ActID=15797

Funded by
the European Union

This publication was developed as part of the project
"Promotion of universal access to clean water",
financed by the Office of the European Union in Kosovo
and implemented by Let's Do It Peja.

Let's Do It Peja
Address: Shtëpia e Kulturës, kati III,
30000 Pejë, Kosovë
Email: letsdoitpeja@gmail.com
Tel: +383 49 124 548
www.puacw.ldip.com

Promoting Universal
Access to **Clean Water**

OCTOBER 2023