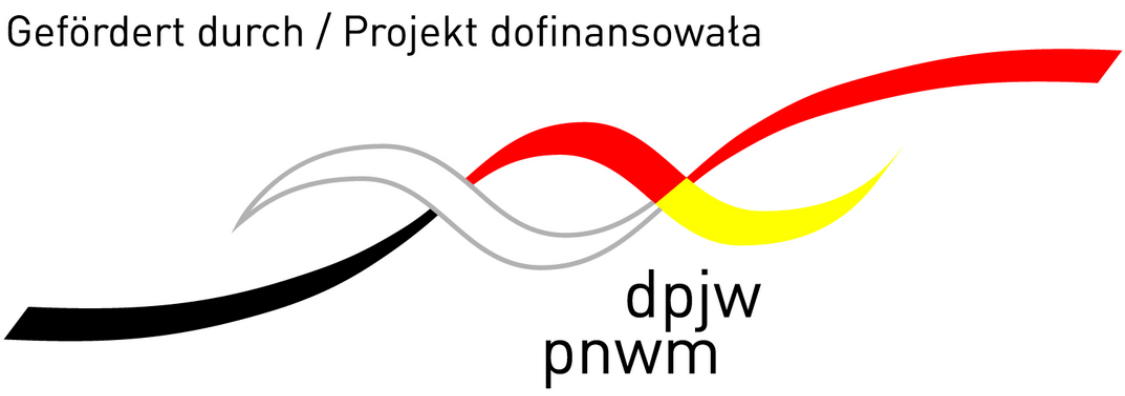
MINT project

Research protocol

German-Polish exchange



Research team members: Kamila Matuk (1st grade),

Emma Roszkowska (1st grade), Daria Łukjańczuk (2nd grade)

Supervisors: Marzena Smolewska, Tomasz Grzegorz Buczkowicz, Anetta Pogrebniak, Artur Kuźmicz

City: Bialystok, Poland

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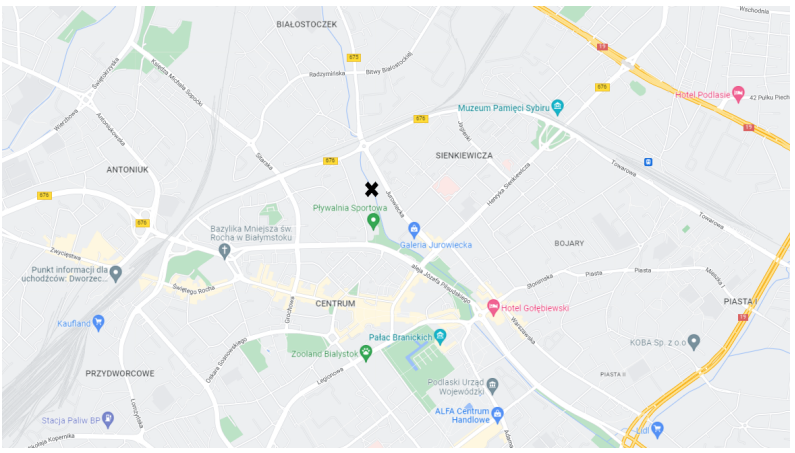
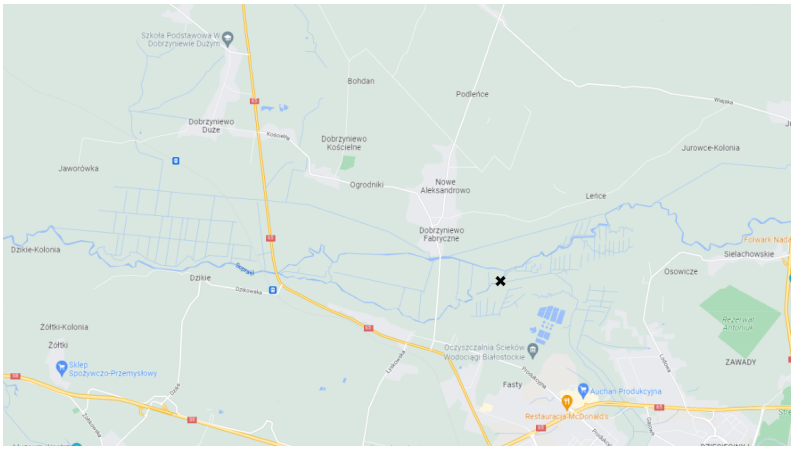
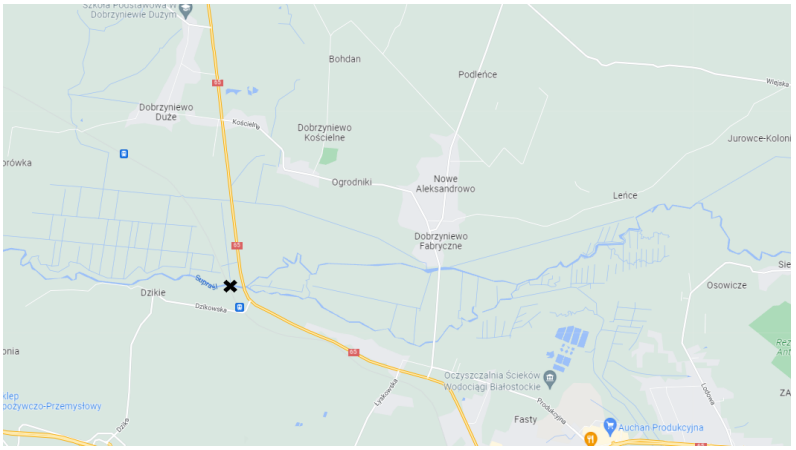
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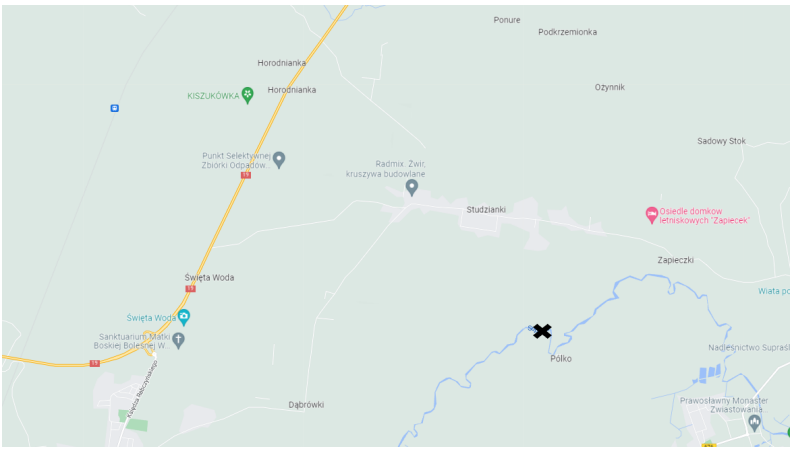
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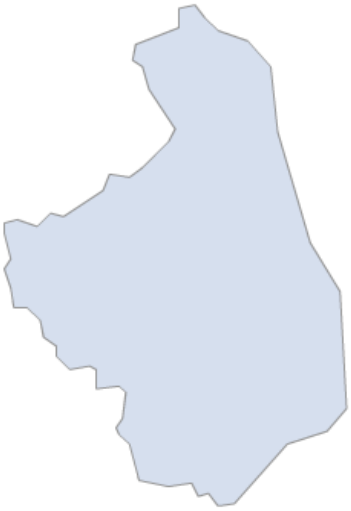
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Sampling locations

Lp.	Location	Map
1.	The White River near Jurowiecka mall	
2.	River Biała behind the sewage treatment plant	
3	The Supraśl River in the place where the Biała River flows into it just behind the sewage treatment plant	

4.	River Supraśl near Studzianki	
5.	The Biebrza River in the Biebrza National Park	

In order to have the most reliable results showing the influence of the environment on the heavy metal content in water, we decided to test water from 5 different locations. We chose these locations because of their remoteness from each other and the various effects of the environment and surroundings on the samples tested.



Heavy metal content in water

Equipment and reagents

Equipment:

- atomic absorption spectrometer
- X-ray fluorescence spectrometer
- vartex
- hotplate
- 50 ml volumetric flasks
- funnels
- test tubes
- volumetric pipette (100-1000 microlitres, 20-200 microlitres, 2-20 microlitres)
- conical flask
- ashless paper laboratory filter
- quartz slides, 5 cm diameter
- 1.5 millilitre eppendorf tubes

Reagents:

- standard solutions of the elements tested
- demineralised water

Background of the experiment

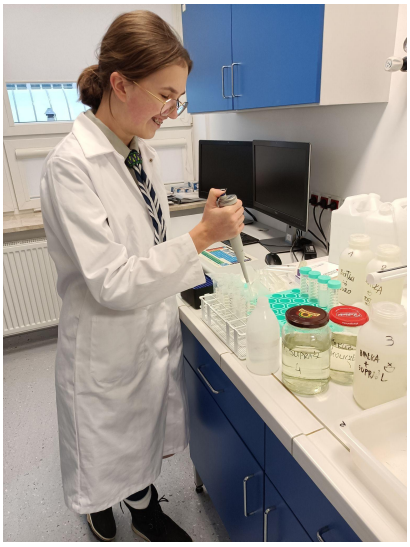
Examination with an atomic absorption spectrometer:

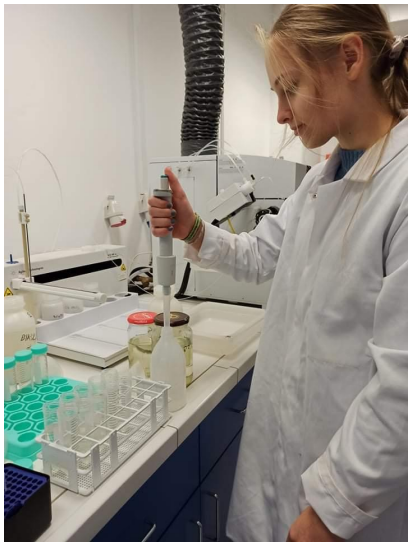


In order to determine the composition of chemical elements, water samples were acidified and analysed using flame atomic absorption spectrometry (FAAS). Using this method, elements such as:

- magnesium
- iron
- aluminium
- calcium
- potassium
- sodium

The quantitative determination of analytes requires the use of standard solutions of known concentration. For this purpose, standard solutions of individual elements of concentration from 0.5-5 milligrams per liter (and for iron from 0.05-1) were prepared in 5 50-ml volumetric flasks. For each element, under appropriate analytical conditions (identical to those for realistic samples), a calibration curve of the dependence of absorbance on concentration was made. Based on the obtained equations, the content of particular analytes (metals) was calculated.







Examination by X-ray fluorescence spectrometer:

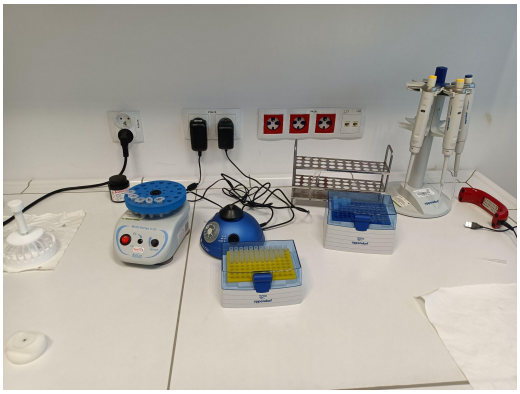
Due to the low levels of trace elements in the samples, they could not be determined by the method described above. We decided to determine these analytes using an X-ray fluorescence spectrometer. Thanks to the analytical capabilities of the apparatus, the following were determined:

• phosphorus • sulphur • titanium • chromium • manganese • nickel • iron	• copper • zinc • arsenic • cadmium • lead • sodium • potassium

In addition, we obtained results of macroelement content, which was treated as a comparative method to the one used (AAS).

The results obtained from both methods overlapped.

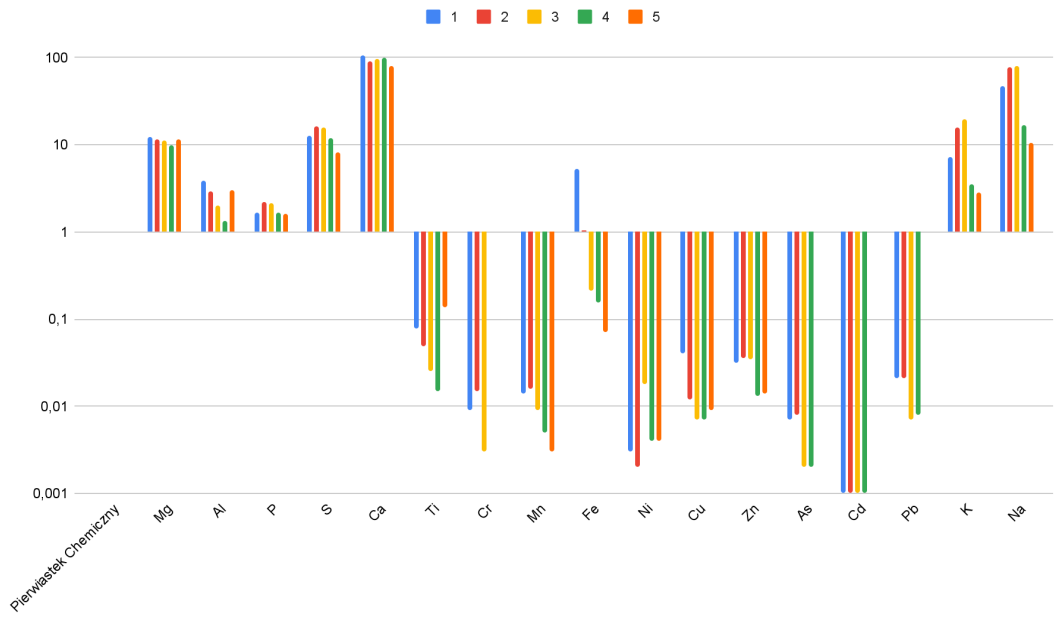




Results

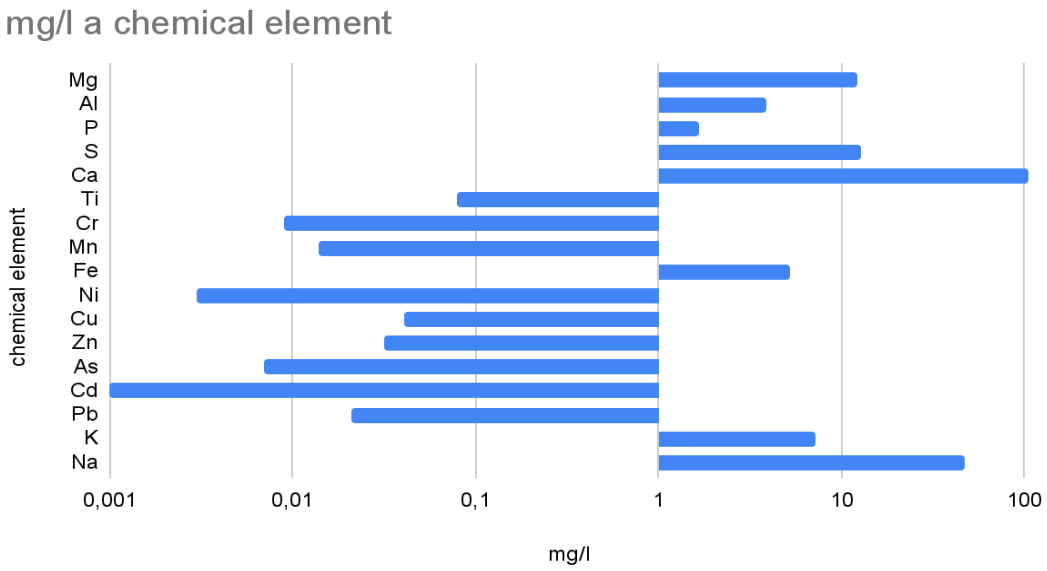
Number of sample	1.	2.	3.	4.	5.
Chemical element	mg/l	mg/l	mg/l	mg/l	mg/l
Mg	12,306	11,484	11,042	9,895	11,564
Al	3,859	2,918	1,986	1,329	3,054
P	1,650	2,237	2,123	1,684	1,626
S	12,698	16,499	15,949	11,875	8,209
Ca	105,790	91,221	96,380	99,471	81,105
Ti	0,079	0,049	0,025	0,015	0,135
Cr	0,009	0,015	0,003	-	-
Mn	0,014	0,016	0,009	0,005	0,003
Fe	5,245	1,043	0,211	0,156	0,070
Ni	0,003	0,002	0,018	0,004	0,004
Cu	0,041	0,012	0,007	0,007	0,009
Zn	0,032	0,036	0,035	0,013	0,014
As	0,007	0,008	0,002	0,002	-
Cd	0,001	0,001	0,001	0,001	-
Pb	0,021	0,021	0,007	0,008	-
K	7,234	15,96	19,844	3,5197	2,7894
Na	46,46	76,518	79,856	16,69	10,366

Comparison of samples from all locations:



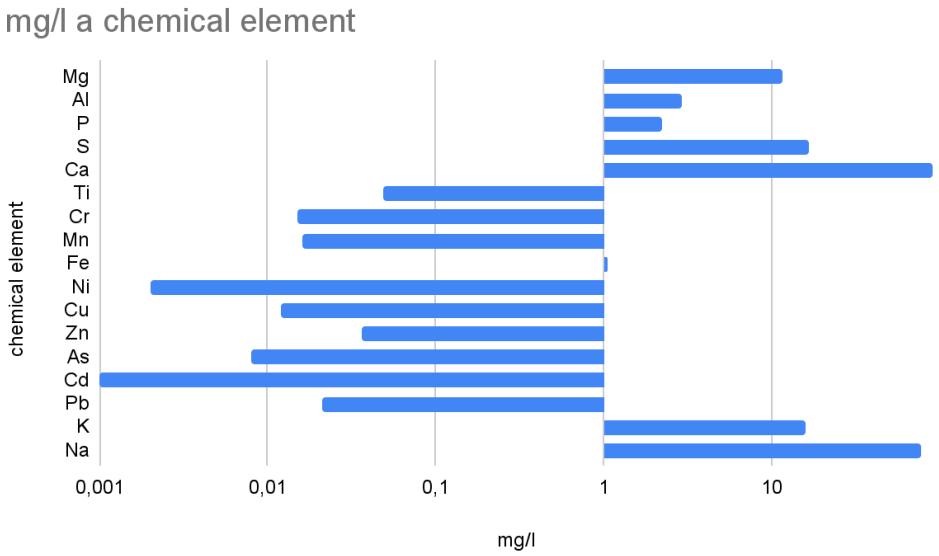
Sample 1:

(White River near Jurowiecka mall)



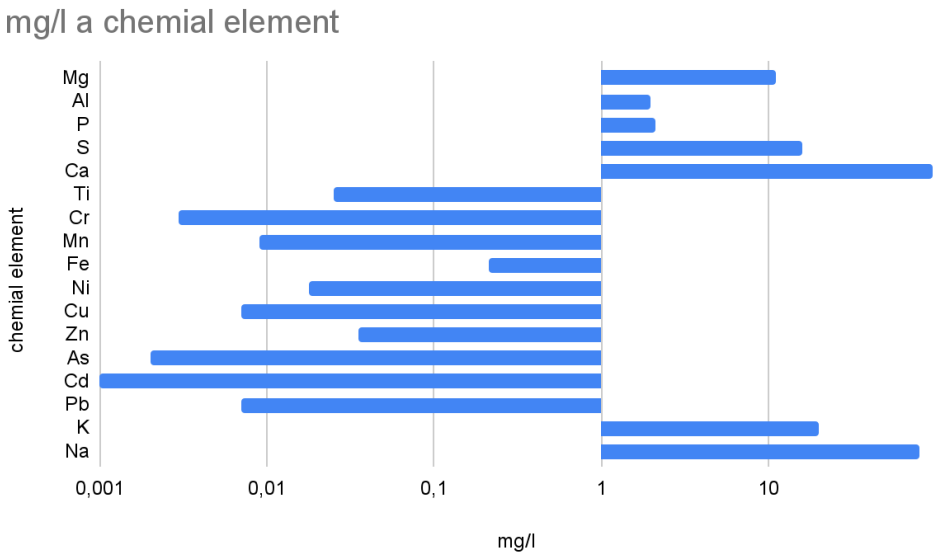
Sample 2:

(White River downstream of sewage treatment plant)



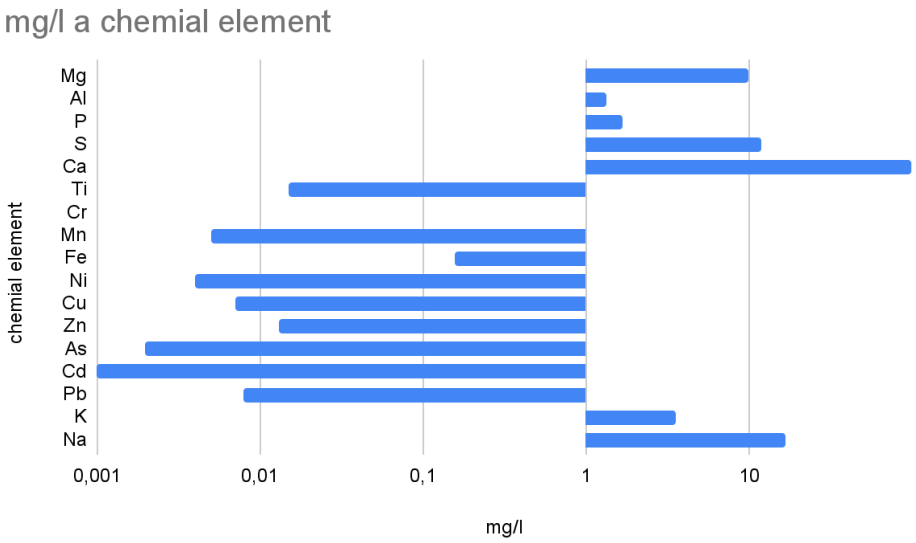
Sample 3:

(Supraśl River at the point where the Biała flows into it just after the treatment plant)

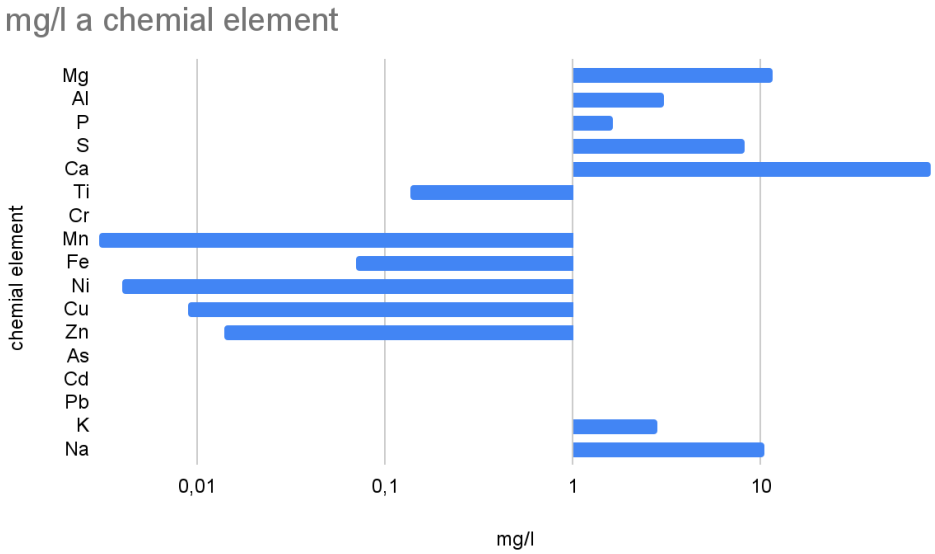


Sample 4:

(Supraśl River near Studzianki)



Sample 5:
(The Biebrza River in the Biebrza National Park)



Conclusions

Findings of the individual elements

Magnesium (Mg)

Among the samples tested, the sample taken from the Biała River near Jurowiecka Gallery had the highest magnesium content. The parameters of all the samples tested are within the correct parametric value of magnesium for drinking water.

Aluminium (Al)

Among the samples tested, the sample taken from the River Biała at Jurowiecka Gallery had the highest aluminum content. The aluminum content of this sample exceeded the parametric value for aluminum in drinking water by more than 15 times. This is probably due to metal particles deposited in the water from a nearby street with heavy traffic.

Phosphorus (P)

Of the samples tested, the sample taken from the Biała River downstream of the sewage treatment plant had the highest phosphorus content. This is probably due to pollution from industrial effluents.

Calcium (Ca)

Of the samples tested, the highest calcium content was found in the sample collected from the River Biała downstream of Jurowiecka Gallery. The parameters of all the samples tested are within the correct parametric value of calcium for drinking water.

Chromium (Cr)

Among the samples tested, samples taken from the River Biała downstream of the sewage treatment plant had the highest chromium content. This is probably due to

leakage of chromium from pipes from a nearby treatment plant into the river. Despite this, the level

the maximum permissible value for chromium in drinking water is not exceeded and does not pose a risk to human health.

Manganese (Mn)

Among the samples tested, the highest manganese content was found in samples collected from the Biała River near Jurowiecka Gallery and from the Biała River behind the sewage treatment plant. However, the values do not exceed the permissible amount of manganese in drinking water and are not dangerous to humans.

Iron (Fe)

Among the samples tested, the sample taken from the River Biała near Jurowiecka Gallery had the highest iron content. It exceeds more than 25 times the parametric value for iron in drinking water. This may be caused by a road nearby from which, due to heavy traffic, metal particles detach and settle in the river waters.

Nickel (Ni)

Among the samples tested, the highest nickel content was found in the sample taken from the Supraśl River at the junction with the Biała River. However, it does not exceed the maximum permissible value for nickel in drinking water and is not a threat to human health, although it may cause a slight allergic reaction in some people.

Arsenic (As)

Among the samples tested, the highest arsenic content was found in samples taken from the Biała River near Jurowiecka Gallery and from the Biała River behind the sewage treatment plant. However, their values do not exceed the permissible amount of arsenic in drinking water and are not dangerous for humans.

Cadmium (Cd)

Among the samples tested, all had similar cadmium contents. They do not exceed the permissible amount of cadmium in drinking water and are not hazardous to humans.

Lead (Pb)

Among the samples tested, samples taken from the River Biala at Jurowiecka Gallery and from the River Biala behind the sewage treatment plant had the highest lead content. In the case of the second sample it may be due to the proximity of the sewage treatment plant, as lead may get into the water due to corrosion of lead pipes and tanks covered with paint containing such compounds. In both samples the permissible amount of lead in drinking water is exceeded, making it unfit for consumption.