



The influence of impurities on the surface water of the Upper Biebrza Basin

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ABSTRACT

The paper "The influence of impurities on the surface water of the Upper Biebrza Basin" presents description of areas, environmental elements and the description of the potential pollution sources in Upper Biebrza Basin. The article presents a short description of the municipalities, located in the immediate vicinity of the Biebrza River. They are: Lipsk, Sztabin and Nowy Dwor. The Biebrza Valley is an area of great natural significance, mainly due to its largest wetlands in Central and Western Europe. Their well-being depends mainly on the hydrologic conditions. Biebrza National Park and the area of the Upper Biebrza Basin, have been reported by Poland to the the Ramsar Convention, NATURA 2000, BirdLife International classification. Therefore, water, as a basic element of shaping the whole Biebrza Valley habitat is also protection subject, including constant monitoring of water quality. The aim of the article was to characterize the Upper Biebrza Basin which covers the area between the Sztabin Village and the Polish border with Belarus.

Keywords: Upper Biebrza Basin, impurities, surface water

1. INTRODUCTION

Economic and agricultural progresses bring a lot of changes, not only for humans but also for animals and plants. Human activity can improve the necessary conditions for the development of flora and fauna, by providing new areas to create habitats thereby causing the environment degradation. The agriculture and its intensity, made radical changes in the

environment. Agricultural economy largely depends on the water. The economy is strongly conducted to peat soil. There is a specific relationship, exceptional accuracy, which also takes place in the Upper Biebrza Basin. Water doesn't provide only a plant growth, but it stirs to life the entire natural ecosystems. Areas of peat bog, marshy meadows, forests and swamp forests are not only the areas with specific productivity. It is also often the areas with vast, often unique natural value. Intensive economic and agricultural development in the areas of Biebrza National Park, began to result in deteriorating environmental conditions. Increasing decline of some species from the world of plants and animals have forced the Council of the European Union to develop a specialized program to protect valuable and the threatened extinction of fauna and flora in Europe. Biebrza Marshes are considered to be one of the most important in Poland and in Central Europe refuge to the wetland birds. Wetland of Biebrza National Park was inscribed on the list of the Ramsar Convention in 1995 as an extremely valuable. This list has international significance. Thus arose also the security program NATURA 2000 in Europe. In Poland it came into force with the signing of the Treaty of Athens on 16th April 2003 and paved legal way for its accession to the European Union. Biebrza National Park and the area of the Upper Biebrza Basin, have been reported by Poland to the NATURA 2000 program in April 2004 and approved by the European Commission in November 2007. Biebrza Valley was also considered a bird refuge by BirdLife International classification [1]. Therefore, water, as a basic element of shaping Biebrza Valley habitat is also protection subject, including constant monitoring of water quality. Despite the fact that the area is considered to be clean, it registers the presence of impurities of foreign origin. Studies indicate that water of Biebrza River periodically carry many natural or anthropogenic compounds. It is believed that the main factor responsible for the deterioration of the Biebrza River water quality compounds are washed out of the adjacent areas of peat, especially during their desiccation. It should also take into account the role of surface runoff, which leads pollution from farmland. Considerable importance for Biebrza water quality has also pollutant inputs from point sources [2-5]. Area of Upper Biebrza Basin is 95% privately owned. Each of the owners practiced economic and farming on land on their own. This led to changes not only in the flora and fauna of the general area, but also to changes in the composition of surface water [6]. The aim of the article was to characterize the Upper Biebrza Basin which covers the area between the Sztabin Village and the Polish border with Belarus. The characteristics included potential sources of pollution on the protected area. The article is to draw attention to the potential hazards of the area.

2. CHARACTERISTICS OF THE UPPER BIEBRZA BASIN

The area of the Upper Biebrza Basin is located on the grounds of Biebrza National Park (BNP) formed 9th September 1993. It is the largest national park and one of the largest in Europe. The main aim of BNP is to protect the extensive peatlands of Biebrza Valley, as well as a small portion of Sokolka Hills. Park lagging partly also includes Bialystok Upland, Kolnenska Upland and the Upper Narew Valley. The Biebrza River with the largest peatlands in Poland called Biebrzanskie Wetlands are the most valuable qualities of the BNP. A large number of unique elements of fauna and flora and comprehensive natural processes resulted in the placing of the BNP on the list of the Ramsar Convention in 1995 and in 2004 to a nature conservation program Natura 2000 [1,7,8].

Biebrza River is located in the Biebrza National Park. It is located near the eastern Polish border, a few kilometers south from Nowy Dwor and east of Dabrowa Bialostocka. Biebrza is one of the main tributaries of the Narew River. The length of the watercourse is 164 km, and the total catchment area is 7062 km². Its depth ranges from half a meter to several meters, while the width of the riverbed varies from a few meters in the upper part to dozen meters in the lower part [9].

Biebrza is a typical lowland river with many meanders and oxbow lakes. It has numerous tributaries, and also has a small ability to drain water from the area. This is due to uneven construction of the basin and the constrictions. Asymmetrical construction of the basin manifests itself in varying amounts tributaries. The right bank, constitute the major part, which consist mainly rivers flowing from the Mazury Lake District: Wissa, Klimaszewnica, Dybla, Jegrznia, Elk and its tributaries, Kopytówka, Netta with the Augustow Canal, Lebedzianka and Niedźwiedzica. Left basin bank is much poorer in its composed of Kosodka, Biebla, Krzeczowka, Brzosowka, Krzemienna, Sidra and Nurka [9,10]. In Biebrza Calley there are two main narrowing's, which divide it into three parts called basins. The first one is the stretch between Krasny Bor and Sztabin, where is the end of the northern basin. The next section, which is the central basin, begins nearby Sztabin and ends around Osowiec the second narrowing where the south basin has origin [9].

North Basin also called as the Upper Biebrza Basin is a valley with high edges, an average width of several kilometers, length of 30 km and elongated shape. Stretch of Biebrza river from the Polish border with Belarus to the Lipsk, extends toward the southeast-northwest direction and borders with Augustowska Plain and mineral islands: Kepa Jastrzebowska, Sztabińska and Lipskie Hills. Then, from Krasnybor river flows latitudinal and changes its course in the area of Czarniewo, from northeast to southwest, which borders with Suchowolsko-Janowska Upland and Sokolskie Hills. This region is used for agriculture and for animals breeding and grazing [9,11].

Around Czarniewo and Rutkowszczyzna occurs significant extension of the valley which creates a central basin. The upper border is determined by Sztabińska Kepa and borders of Elk Lakeland. At the bottom borders on the constriction around the Osowiec along the eastern extremities of Kolno Upland. From the south the area borders with Bialystok Upland. This area is characterized by a wide space constituting a flat wetland area [9,11].

Near the Bialystok-Elk highway, south of Osowiec extends south Basin. It includes a part of the Biebrza River from the estuary of the Rudzki Channel to the estuary of the Narew River. This Basin is characterized by numerous bogs and the side branches with old river beds, has a curved course and numerous forms of meanders [9,12].

The hydrographic relations of Biebrza River Basin in the last 150 years underwent to numerous and progressive changes, mostly due to the engineering activities. These changes followed the hydrographic relations with different intensity and frequency. Based on the regulation of riverbeds, construction of artificial watercourses (shipping canals and drainage) and the order of the river network. Current hydrographic network is the most similar to natural in the Upper Biebrza Basin. The tributaries in here are Lebedzianka River with Jastrzebianka River, Kamienna River, Kropiwna River, Sidra River, Niedzwiedzica River and Nurka River. Besides tributaries, border regions are marked by old drainage ditches, whose task was to drain water from the peaty meadows. a number of changes were followed in the middle of the Biebrza Basin for years which can include, eg. constructions of canals and intensive irrigation works. Currently tributaries in this area are Jegrznia River and Channels:

Rudzki, Kapicki and Leg. Lower Basin also has been changed drastically. Mainly as a result of drainage, the right-bank tributaries in this section are Klimaszewnica River and Wissa River, a left-bank Kosódka River. Apart from these tributaries to the Biebrza considered several smaller trenches [11-13].

Biebrza Basin is filled by surface water as well as quaternary underground water at various intermoraine aquifers. Groundwater remains in equilibrium. The glacial deposits of sand and gravel constitutes the reservoirs of different shape and size. The surrounding valley upland aquifer is characterized by the free movement and depth to 1m. Biebrza Basin is filled with the first level of the groundwater, which makes its a water reservoir, built mainly of peat, madow mules, sand and gravel. In the central Biebrza Basin water level depends on underground resources. Through numerous land reclamations and the construction of canals, flow of surface water is restricted. South Biebrza Basin has an ensured steady flow due to the vast area of flowing surface water. Predominance on the tributaries of outflows decides about strong dampness of areas, which results in the uniqueness of the soil and plant cover [14].

It is an area of high importance for the environment, mainly due to Biebrza Valley, but also because of a section Augustów Primeval Forest. The catchment area includes two protected areas Natura 2000:

- the Habitats Directive (Special Area of Conservation of Habitats-SAC):
 - Augustów Primeval Forest- SPA (Code: PLB200005)
 - Augustów Refuge- SPA (Code: PLH200005)
- the Birds Directive (Special Protection Area for Birds- SPA):
 - The Biebrza Valley-SPA (Code: PLB200002)
 - The Biebrza Valley-SAC (Code: PLH200001).

The state of the ecosystem, especially that which was created in the Biebrza Valley depends largely on the water conditions. Despite earlier land reclamation meandering river bed of the Biebrza with numerous oxbow lakes in various stages of overgrowing maintains its natural character. The natural character the river is changed by the annual flooding's usually caused by spring thaw. In this area recharge with groundwater is dominant , which leads to large peatland areas undergoing active peat formation processes. The Biebrza Valley is known for its large variety of wetland habitats (among 13 types of habitats enlisted in Annex 1 of the Habitats Directive). Well-developed vertical and horizontal ecological zonation expresses the natural character of the valley [15].

On 9 September 1993 was founded the Biebrza National Park in order to protect these precious areas. It is the largest National Park in Poland, and it covers over 59 thousand hectares. Almost the whole Biebrza Valley is protected. The Biebrza Valley is divided into three sections called basins: Lower, Middle and Upper Basin. The protected area which maintained their natural character, especially Wetlands. That is why the boundaries of the Park are very irregular [12]. BirdLife International declared this area as a bird refuge of world value. On 27th October 1995 Biebrza Valley was put on the Ramsar Convention list of habitats. The Biebrza National Park pays great attention to the protection of hydrogenic soil. In the upper basin area within the Park, it covers an area of 5289 ha.

The type and condition of wetland ecosystems in this area depends to a large on hydrological fed. A soligenous supply occurs in the section of the valley from the Niedźwiedzica to Sztabin,, which is than overlapped by fluvial supply mainly in the area from

the Kamienna confluence to Sztabin. The section from the Niedźwiedzica confluence to Sztabin is highly hydrated. It is caused by the Biebrza frequent occurrence to floods. The river is not regulated in this section, it slightly descends, and in the summer vast plant communities occur, which dam the water up [16].

3. THE STATE OF THE AQUATIC ENVIRONMENT

The general definition of the status of surface water is determined on the basis of the ecological and chemical status. The general condition of water is equal to the worst class of these two parameters. For example, if the water body achieve good ecological status, but does not achieve good chemical status, the status of the water body should be classified as a state than good [17].

The Single Part of Surface Water (Surface Water Bodies) is a term covering both the stagnant water reservoirs, streams and coastal portions of sea water and underground water, which is the basic unit of water management in accordance with Polish Water Law, according to the EU Water Framework Directive of 23 October 2000 [18,19,20].

In Poland, the method of assessing the state of water quality is the classification of surface water status, which takes place in classes I to V, where:

- I. - water with high ecological status,
- II. - water with good ecological status,
- III. - water moderate ecological status
- IV. - water with poor ecological status
- V. - water with poor ecological status [21].

In Poland, the regulation of issues related to the protection of the aquatic environment is adjusted by law in accordance with EU Water Framework Directive, namely the Water Law of 18 July 2001 and the Regulation of the Minister of the Environment of 22 October 2014 formed under the basic of Water Law [18-22].

Based on the report on the state of the environment Podlasie province prepared in 2013 by the Regional Inspectorate for Environmental Protection in Białystok an assessment of the status and ecological potential of water bodies for rivers surveyed in 2011-2012. After analyzing the results of the report specifies that the ecological status of the Biebrza River and its river basins is temperate and at the source, in the Valley of the Upper Biebrza, is good. Chemical status of the river Biebrza was described as good. However, the state of water bodies has been identified as bad. Groundwater chemical status in 2012 in the Upper Basin of the Biebrza was defined as good (class I-III) [21].

4. POTENTIAL POLLUTION SOURCES OF SURFACE WATER IN THE UPPER BIEBRZA BASIN

Pollution of water is known as adverse changes in physical, chemical and bacteriological properties, which may be natural or anthropogenic. Impurities of natural origin are mainly related to the withering away of aquatic organisms like animals and plants, as also chemicals leaching from rocks and soils. Effects of anthropogenic pollutants are usually due

to excessive amounts of inorganic, organic and radioactive substances, as also heat to the water caused by:

- improper use of natural fertilizers,
- abuse of pesticides and fertilizers,
- leaky sumps,
- improperly secured substrates in landfills,
- improper adjustment riverbeds, desludging and inadequate water management,
- inadequately protected fuel stations and warehouses,
- atmospheric pollutants.
- communication routes with high intensity,
- the impact of badly treated industrial wastewater [23].

Pollution of water is divided due to:

- origin:
 - › autochthonous, ones that come from impurity contained in the surface water and groundwater - e.g. salinity, pollution iron compounds,
 - › allochthonous, which are related to human activity - e.g. from wastewater, runoff from agriculture, municipal waste landfills.

Antropogenic pollution also can be divided into a:

- biological (bacteria, viruses, fungi, algae),
- chemical products (oils, gasoline, grease, oil, fertilizers, pesticides, acids, alkalis).
- sustainability pollution criterion:
 - › degradable - containing organic substances, potentially toxic, but which are chemical changes to simple inorganic compounds with the participation of bacteria (domestic sewage),
 - › irreducible - containing substances not undergoing chemical change more and not attacked by microorganisms (salts of heavy metals),
 - › durable - containing substances biodegradable slightly and remain in the environment unchanged form for a long period (pesticides, phenols, petroleum distillates
- the hazard degree:
 - › directly damaging - phenols (gas plants, coke plants) hydrocyanic acid (gas companies), sulfuric acid and sulfate, acid rain (plant fertilizers, pulp mills, factories, synthetic fibers),
 - › indirectly damaging - such that practices to minimize the amount of oxygen in the water below the level necessary to sustain the aquatic organisms.
- source:
 - › point sources - wastewater discharged in an organized manner sewage systems, mainly from industrial plants and from urban areas,
 - › pollution of surface or area - pollution flushed precipitation from urbanized areas that do not have sewage systems and agricultural and forest areas,
 - › pollution sources of linear or band - pollution from transport, generated by transport and washed away from the surface of the road or peat bogs, and from oil and gas pipelines, sewers, sedimentary [2,20,24].

4. 1. THE IMPACT OF PEATLANDS ON THE QUALITY OF SURFACE WATER

Peat soil mainly consist of organic substances thus is rich in carbon. Continued dewatering of peat bogs in the Biebrza Valley causes the decrease of the peat bogs surface, what causes mineralization of organic matter, whereupon nitrogen compounds are released. This process may cause pollution of surface water. Supported by an established scientific fact is a high concentration of nitrogen in the surface layer of drained peat bogs. The topsoil (0-20cm) concludes 5-20 t / ha of nitrogen in organic compounds [20].

It is assumed that the nitrogen is released along with the mineralization of organic matter in the Biebrza Valley may amount 30-500 kg / ha. This form of nitrogen is important from the point of view of water infiltration and possible contamination. However, there are also studies which does not confirm this thesis. The studies do not indicate the expected dependence between the quality of the water in the flowing stream through the bog and peatland drainage intensity. Mineral nitrogen compounds are readily soluble in water, so they can be readily leached from the soil [25].

Circulation of chemicals in the nature depends mainly on the hydrogeological conditions and the direction and flow rate of water. Therefore, it is necessary to support the analysis of surface water phenomena by the knowledge about the filtration. Mioduszewski, Slesicka and Querner research (2004) allow concluding that in the Biebrza Valley there was no permanent pollution of surface water with nitrogen. It is only transported from groundwater to surface in the spring, during the wash layer root. In this form of nitrogen is not a danger to the quality of surface water.

4. 2. THE IMPACT OF SPRING THAW ON SURFACE WATER POLLUTION

The annual spring thaw contribute to the bottling of water in areas adjacent to the Biebrza, thus surface water mix with the dirt located on them. To avoid this it should begin the construction of small uncomplicated damming ditches and canals. This treatment would extend the persistence of spring water in the valley. In addition, it must be ensured the correct methods of operation of drainage systems. This can be done by equipping these objects in dams to prevent the excessive lowering of the groundwater, by early closing of valves in the spring.

4. 3. FLOODS

Due to the huge area of the Upper Biebrza Basin, which includes villages and towns, there is a serious risk of pollution of the river during floods covering floodplains. To reduce flow of anthropogenic origin pollution it must be restored the natural development of river floodplain. This will allow restore of the natural wetlands capacity and floodplains to receive water and flood mitigation. It also should pay attention to the use by humans of the floodplain for possible threats. Aim of these actions should prevent the construction of artificial edges, embankments, reservoirs. It also should include the emergence of any building and technical facilities which could be an obstacle to the freedom and natural run-off water of the river.

4. 4. POINT-SOURCES OF POLLUTION

The danger of point-sources pollution are effluents from landfills or wastewater discharged from the wastewater treatment plant. The most significant source of pollution are uncontrolled discharges of rural buildings to the drainage network, which leads them directly into the water of Biebrza River [2].

4. 5. LEAD OF IMPURITIES INTO THE SURFACE WATER IN THE LIPSK MUNICIPALITY

Lipsk is a urban and rural municipality. Is situated in the south - eastern part of the district Augustów, in the area of North Podlasie Lowland, within the limits of Biebrza Valley. Adjacent to the Polish-Belarusian border and municipalities Sztabin, Dąbrowa Białostocka, Nowy Dwór, Augustów and Płaska. The seat of the municipality is Lipsk which is located on the Biebrza. The municipality is surrounded by moraines: Rogożyńskie and Jałowskie, whereas the remaining area is covered by a flat and wavy benthic moraine, around which are located the hills. The municipality is covered by flat plains of peat bog. Location makes the region is very interesting for tourists. The municipality is located at a distance of 85 km from Białystok and 67 km from Suwalki.

Area of the municipality has 18421 hectares. In this is located 28 villages, divided into 763 farms with an average size of the total area of 16.70 ha. Although not very favorable conditions it is a typically agricultural the municipality, it is grown mainly potatoes, tobacco, corn and strawberries, also breeding cattle and pigs [26].

Water supply system, sewage and wastewater treatment

In the municipality tap water has 97% of the city dweller and 13% of the municipality. The other residents acquire water from local water supplies, which are dug wells. Water from these wells often does not comply standards for drinking water and its resources are limited and do not meet the economic and existentially-social needs. Water supply station in Lipsk has a capacity of 685 m³ / d. Part of the municipality which has a water supply system includes a 19.7 km water supply. While the water supply systems are located in Lipsk, Krasne and Skieblewo. Sewage system in the commune is located in Lipsk and has a length of 9km. While house drain leading to residential buildings constitute 186km [8]. In areas not covered by the sewage system waste water are accumulated in collecting devices. and transported to the wastewater treatment plant in Lipsk, or subjected to treatment by a domestic sewage treatment plants. This is a mechanical-biological treatment of type BIOBLOK PS 400 with a multiphase activated sludge a designed capacity of 400m³ / d and an actual 250m³ / d. Wastewater treatment plant guarantees the removal of organic substances and suspensions. reduction of the content of nutrients such as nitrogen and phosphorus also Occurs in the sewage treatment plant. A receiver wastewater is a Biebrza River [27].

The storm sewer in the municipality is 4 km long. This network is not equipped with a device for pre-treatment of rainwater and meltwater [8]. The direct discharge of untreated sewage and excessive fertilization of agricultural land are the main hazard to surface water. Due to a sewage treatment plant in Lipsk, in the area adjacent to the town there is no risk of direct discharge of untreated sewage. However, there is a direct and indirect risk of pollution of surface water. Water supply system is only expanded in several villages in the

municipality. This causes a lot of small sewage treatment plants in these villages. With the increase of the number of sewage treatment plants increases the risk of pollution of groundwater and then to surface water. All waterworks of farms have septic tanks and some sewage treatment plants. No inspection of quality and quantity of discharged waste water, tightness of tanks and functionality of sewage treatment plants, are causing potential danger of the lead of pollutants into water [14].

4. 6. LEAD OF IMPURITIES INTO THE SURFACE WATER IN THE SZTABIN MUNICIPALITY

Sztabin is a municipality located in the district of Augustow in Podlaskie. Is adjacent to the municipalities: Lipsk, Płaska, Augustów, Bargłów Kościelny, Goniądz and Jaświły. The seat of the municipality is the city Sztabin which is situated on the Biebrza.. Character of the municipality is a typical agricultural despite of poor quality classes of land Land is not suitable for agricultural development and designated for meadows and pastures. Sztabin municipality is located in the region of Augustow Plain. Land relief is closely linked to the Valley of the Biebrza River, as well as its right tributaries: Lebedzianką, Jastrzębianką, Olszanecką, also Kanałem Augustowskim, there are flat plains of peat bogs. The area of the municipality is 361.80 km², in this is 1,083 farms with an average size of the total area 17,70 ha. The municipality is also more than 14,500 hectares of forest [28].

Water supply system, sewage and wastewater treatment

Water supply in the municipality followed by the central water supply systems. A significant part of the population is supplied with additional water from dug wells. Well water often does not meet the standards drinking water and its resources do not cater to full economic and existentially-social needs. Water supply system in Sztabin and around in 2001 had 158,1 km. Connections to residential buildings accounted for 999 km. In the municipality is located one modern mechanical-biological sewage treatment plant type Bioblok 200 with chemical precipitation of phosphorus, a designed capacity of 200 m³ / d, while the actual 100 m³ / d. It guarantees removal of organic substances, suspensions and reduction of biogenic compounds means nitrogen and phosphorus. Receiver wastewater is a Biebrza River. Sewage system has a length of 7 km. While sewerage connections leading to residential buildings has a length of 193 km. Domestic sewage in rural municipalities are collected in cesspools, or they are subjected to treatment in a domestic wastewater treatment plants. Rain drain system is not very well developed. The length of this network is 1.5 km. In addition, there is no pre-treatment devices for rainwater and meltwater. The most hazardous to surface water are the settlement units, as well as production facilities and service, with access to water and at the same time located in areas without sewerage system. In those cases, the wastewater is collected in cesspools of different tightness. When the containers are leaking and occurs directly sewage passage into the groundwater and surface [28].

4. 7. LEAD OF IMPURITIES INTO THE SURFACE WATER IN THE NOWY DWÓR MUNICIPALITY

Nowy Dwór is a municipality located in the eastern part of the region of Podlasie in Sokółka County. From the north, is adjacent to the municipality of Lipsk, the west with the

municipality of Dabrowa Bialostocka. With the municipality of Sidra and Kuźnica Białostocka from the south and to the east it borders with Belarus. The municipality is located partly in the buffer zone of Biebrza National Park. The seat of the municipality is Nowy Dwor located on the Biebrza. Municipality of Nowy Dwor by the division of physical-geographical Polish is located in the region of North Plains - Podlasie, acting by the north - eastern part of mesoregion Hills Sokółka. Nowy Dwor is a rural municipality, and its character is agriculture despite the relatively poor soils. The area of the municipality is 121.13 km², this is the 694 farms with total area of which amounts to 11012 ha. In the municipality is also more than 1,712 hectares of forest [7].

Water supply system, sewage and wastewater treatment

Water supply system in the city of Nowy Dwor in 2004 had a length of 21,1km. To the the water supply system consists of four hydrophores: Rogacze, Nowy Dwór, Choruzówce, Dubaśno. In the municipality Nowy Dwor is located one modern mechanical-biological treatment plant with activated sludge and sequencing biological reactor. The design capacity shall be 150 m³ / day. The capacity of the sewage treatment plant provides the current demand for sewage. Open sewage system in the municipality has a length of 11 km. Sewerage connections leading to residential buildings have a length of 145 km [7].

Nowy Dwor municipality has a well-developed network of water and sewerage supply systems. Only part of the population has no regular access to the network. In the municipality operates a sewage treatment plant, which minimizes the risk of contamination of surface water or groundwater. However, in the farms, which have not installed sewerage system, wastewater is collected in cesspools of varying tightness. Wastewater can be also pre-treated by domestic wastewater treatment plants, with varying effectiveness. It is a potential risk of introduction of pollutants into groundwater, which may result in pollution of surface water [14].

5. CONCLUSIONS AND RECOMMENDATIONS

The aim of the article was to identify a potential number of factors affecting the state of the environment area of the Upper Biebrza Basin. In order to assess the state of water quality it should be analyzed the results of tests in accordance with the Regulation of the Minister of Environment of 22 October 2014 (Dz.U. 2014 poz. 1482). It is advisable to extend the scope of research on the rate of TOC and biological elements, it would allow more accurate assessment of the content of organic substances in surface water and accurate classification of surface water in the Upper Basin of Biebrza. Thus a clear indicator of surface water pollution from sources presented in paper is significant number of fecal origin micro-organisms. This have to be based on the level where can be specified the source of pollution of ecosystems and assess the degree of risk in the event of their use. Risk for Biebrza River and dependent on its water habitats, is constantly connected with the inflow of domestic sewage. In general, contamination of anthropogenic origin is leded not only by local treatment, but also by uncontrolled discharges of wastewater from rural buildings. Without laboratory research it is difficult to say what is the impact of peat lands and spring thaw on surface water in the Upper Biebrza Basin. To prevent the contamination of the Biebrza River it should be ensured that the local water and sewage management, including the expansion of the sewage network in

rural areas and modernization of existing plant. It is necessary to ensure the constant monitoring of buildings located in the vicinity of the marshes and water of drainage networks. This will enable the exact location of sources of pollution and thus protect the Biebrza River.

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