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TERRITORIAL ASPECTS OF WATER POLLUTION IN ZARAFSHAN REGION

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Abstract

The article examines the regional aspects of the state and pollution of water resources in the Zarafshan region, including groundwater and surface water. The level of water pollution is clearly shown by region and different indicators.

Key words: Zarafshan Region, Zarafshan River, Amu-Bukhara Canal, Collector-drainage Water, Water Pollution Index, Permissible Boundary Value, Biological Oxygen Requirements.

Introduction. Water is a key resource for human life, production and economic activities and economic development of the country in the arid climate, especially in the Zarafshan region of the region. In the last 20-30 years, the region's population has been suffering from the shortage of water and its socio-economic consequences. The irrational use of water resources, its size and its qualitative decline, present various problems. These include water shortages for irrigation purposes, land degradation, and land degradation near the Zarafshan River. As a result, unfavorable water resources have been created in the Zarafshan Valley, which is densely populated and has large irrigated land.

The social and economic development of Uzbekistan and how stable and favorable the state of the environment depends on the availability and quality of water resources. That is why the use of transboundary water resources is of particular importance in our country. Zarafshan is also a transboundary river, originating in Tajikistan. The total volume of water supplied by the river to Uzbekistan is 4888.3 million m3. 83.7% of water is used for direct irrigation; 797.8 million m^3 is used for industrial, utilities, technical and other needs [17].

One of the serious problems of the Zarafshan region is the scarcity and pollution of water resources. Rivers, canals, reservoirs and even groundwater are all exposed to anthropogenic impact. Since the 1960 s, water shortages in the valley, especially in the downstream of the river, have increased dramatically due to large-scale agricultural land development, extensive industrial development, the creation of collector-drainage systems and the increased use of river water for irrigation. This in turn led to a decline in water quality in the river basin, the development of land degradation, and the deterioration of environmental and sanitary-epidemiological conditions.

The most important water resources for the region's economy come from the Zarafshan River, and the Amu - Bukhara canal. Here, the Amu-Bukhara canal provides almost all of its water to the Bukhara region, and a small portion to the Navoi region. Samarkand and Navoi regions get all the water from the Zarafshan River. In addition, the importance of groundwater in this region, especially in the Samarkand region, is significant. The level and performance of these regions varies under the influence of various factors.

Methods. The statistical analysis and processing of data, mathematical analysis on the digitization of environmental pollution data, comparisons on characteristics of the regions, questionnaire methods used in the research.

Results and discussion. Irrigated lands in the Bukhara region make up only 8% of the total area (2721 km2) and the farm uses an average of 4 km^3 of water per year. However, this figure is constantly changing. For example, in 2016-2017 the annual water, consumption did not reach 3800 million m^3, and in 2018 it was more than 4.4 km^3. This is due to the fact that the Amu Darya water flow fluctuates over the years. Few of the received water (160 million m^3) is used for industry, the majority (96%) for irrigation. About 145 million m3 of industrial water is accounted for utilities, the rest are fisheries, and only a small part is the energy sector [12].

In terms of water use, Samarkand region ranks second in the region. Irrigated lands are 22.6% of the total area, and an average of 3 km^3 of water per year is used on the farm. Here, the lowest level was in 2016 (2,855 million m^3), the highest was in 2018 (3666 million m3). Most of the regional water (95 - 96%) is used for agriculture, including irrigation, 150 million m^3 of water for industry, utilities, fisheries and other areas.

Navoi region is the largest in the region, but lags behind water consumption. It accounts for about 2.5 km^3 of water per year. Changes in water supply indicators are negligible. This is because most of the water is used for industry. Because the industry always requires the same amount of water. In general, Navoi is the third region in the country for industrial water consumption, accounting for almost 40 % of total water intake. 81 % of industrial water is used in the energy sector.

Protection of water resources from pollution, improvement of surface and ground water quality is one of the main objectives of public policy in the water sector. In the middle and lower reaches of the main rivers there is a high level of mineralization and pollution. This poses a serious threat to the health of the population and the sustainability of its habitat.

Water flows outside the region begin with the

mountains, which are saturated with environmentally friendly mountain water and create a gradient of favorable environmental conditions from the beginning. There are virtually no sources of water pollution in the mountain areas, and all physical and chemical parameters of water - natural composition, changes in peripheral structure - are retained naturally according to the orography features and profile of the landscape. The qualitative composition of river waters in the areas where watercourses are formed varies with the discharge of rocks from the rivers and the waste generated by human activities. The flow chart by potential pollution sources is presented in the table below.

Table 1

The main sources of water pollution

Names of the river and its sources of pollution	Risk level			Type of pollution
	For health	To the ecology	To the economy	
Zarafshan, Mining industry of Tajikistan, wastewater of Samarkand and Navoi, KDS emissions	4	4	4	Nitrogen group, metals, mineralization of excess
Local pollution of ground water in Navoi region and other regions	4	3	4	Wide range of groundwater pollution index

Risk: 1-no, 2-minimal, 3-moderate, 4-strong, 5-very strong

Source: State Committee for Nature Protection of the Republic of Uzbekistan

In Uzbekistan, water pollution index (WPI) is used for integrated water quality assessment. This index is calculated as the arithmetic mean of six hydrochemical parameters - dissolved oxygen content, biological oxygen demand (BOD) and four pollutants with the highest concentrations of maximum permissible limit (HCMPL). The classification of surface water quality used in Uzbekistan on the basis of WPI includes 7 quality groups (Table 2).

Water pollution caused by anthropogenic impacts can be classified as follows:

pollution as a result of agricultural activity;

industrial pollution;

sources of domestic pollution in urban and rural areas;

Surface water monitoring and analysis of available data shows that the majority of water bodies in the region are classified as moderately polluted (Table 3), according to the WPI classification.

A small number of water bodies belong to the II category. Some open-water reservoirs in the city of Samarkand are more polluted (Table 4). In recent years, water quality stability has been observed in the Zarafshan Basin [Data from the State Committee for Nature Protection of the Republic of Uzbekistan. T. 2018.].

For the area of the Zarafshan River near the Ravat-Khoja Dam, which borders the Republic of Tajikistan, the WPI values did not change significantly (from 0.81 to 0.98) during the period under review. The amount of heavy metals varies from 0.1 to 2.0 RECH, the mineralization does not exceed 0.3 g / l. The wastewater and agricultural wastewater from industrial enterprises in Uzbekistan, Samarkand, Kattakurgan, Navoi. This condition results in a decrease in river water quality below Samarkand, where nitrite concentrations are within HCMPL (2,3-6,0), with copper concentrations exceeding HCMPL (2,1-3,6). WII values in this area correspond to the category

Table 2

Criteria for Surface Water Pollution Index

Classification of water quality	Definition	Amount SWP
I	Very clean	less than or equal to 0.3
II	Pure	0.3 to 1.0
III	Moderate pollution ranged	from 1.0 to 2.5
IV	Contaminated	2.5 to 4.0
V	Not pure	4.0 to 6.0
VI	Extremely polluted	6,0 to 10,0
VII	Very polluted	More than 10.0

Source: Data of the State Committee for Nature Protection of the Republic of Uzbekistan.

Table 3

Dynamics of change of index of water pollution index by Zarafshon basin

№	Name of the checkpoint	Water pollution index		
		2016 y. (category)	2017 y. (category)	2018 y. (category)
1	Rohat Hodja (bottom of dam)	0,85 (II)	0,81 (II)	0,98 (II)
2	(Karadarya branch), below the Tagigulyan collector, Samarkand	1,23 (III)	1,43 (III)	1,08 (III)
3	Zarafshan, below Navoi	1,23 (III)	1,43 (III)	1,08 (III)

Source: Uzhydromet data.

Table 4

The most polluted water body

Name of water object	Classification of water pollution index			Pollutant content
	2016 y.	2017 y.	2018 y.	
Siob Channel - Samarkand	1,93 III	3,66 IV	3,39 IV	Nitrites - 3,7-12,4; Copper - 2,3-4,3; Phenols - 5,0

Source: Data of the State Committee of the Republic of Uzbekistan on ecology and nature protection

of moderately polluted waters. During the period under review, water quality in the lower part of the river below Navoi was within the limits of III class of moderately polluted waters, where nitrite content was 2.5-3.5, copper - 2.2-4.3, MPE - 1. It has been observed that the index of 1-1,7 increased to HCMPL and its mineralization increased to 1,3-1,5 HCMPL [Schultz V., Mashrapov A. Hydrography of Central Asia. - T.: Economics, 1963.].

In areas where large industrial facilities are located, there is a local deterioration of water quality in open water reservoirs. Thus, the most contaminated water flow (Siab canal) shows a significant increase in copper, NO2, NH4, KBE5, and phenol from HCMPL, and the water pollution index corresponds to categories IV and B of WPI.

is discharged to the natural lowlands outside the provinces.

Groundwater is also important in the region's economy. They are included in the state program of their protection. In general, the state of groundwater (contamination) varies by region.

Underground deposits in the Bukhara region have lost practically no value for drinking water, with mineralization (1.63,5 g/l), total hardness (13,830.2 g/l), sulfates (6441639 mg / l). l) does not meet the state drinking water standards. The above indicators are typical for infiltration types of water intake facilities located in the Bukhara and Karakul deposits.

In Navoi, mining, processing and chemical industries, industrial waste storage facilities, and treatment facilities

Table 5

Wastewater disposal in 2016 - 2019 (mln м³/year)

№	Name of administrative regions	Normalized wastewater discharge volume				Polluted waste water volume			
		2016	2017	2018	2019	2016	2017	2018	2019
1	Bukhara	33,9	33,9	33,91	33,91	0,136	0,138	0,135	0,135
2	Navoi	663,8	644,8	634,3	634,3	4,426	4,897	4,6	4,6
3	Samarkand	63,8	20,62	21,33	21,33	3,56	2,8	2,67	2,67
Area by region		761,5	699,32	689,54	689,54	8,122	7,835	7,405	7,405
Total throughout the country		1618,9	1566,1	1569,0	1569,029	128,5	108,2	107,2	107,4

Source: Data of the State Committee of the Republic of Uzbekistan on ecology and nature protection

Significant changes in the quality of water resources occur under anthropogenic impacts. The main source of contamination is irrigated agriculture, where large amounts of collector drainage water are generated. Industrial and public utilities also contribute to water pollution. Between 46 and 51 percent of the collector drainage water is discharged into rivers, and 3 percent is used for irrigation. About 50% of the drainage water

in urban and residential areas are major sources of groundwater contamination in the region. According to the monitoring, in 2019 there was a partial improvement in the quality of groundwater at the Bukhara and West Kashkadarya fields compared to 2016-2017. At the same time, the quality of groundwater in the Zarafshan River valley has stabilized, with the increase in sulfate levels in the western part of the river compared to 2017 (up to

16922774 mg / l). Industrial wastewater treatment plants are located. Wells within the boundaries of the Navoi Industrial Zone show increased mineralization of water, increased overall hardness, and higher concentrations of sulfate, calcium, magnesium and ammonia.

Conclusions. During the reviewed period, it was noted that the quality of water at the underground drainage areas, grouped by mineralization level and the general hardness characteristics, was deteriorated during the period under review. Drinking water from Pahtachi, Madjar, Kattachorkent, Karnob water sources does not meet state standards. A number of other groundwater intake sites are also inoperable due to non-compliance with established standards. Well-pumping wells are still not equipped with steering pipes, which results in contamination of groundwater. Such cases can be found in the Bulungur, Nurabad, Jombay, Kattakurgan districts of the region, which are potential sources of groundwater contamination. Often specialized organizations and water consumers perform voluntary drilling wells and groundwater extraction without proper consent. The sources of pollution are, as a rule, industrial and agricultural facilities. About 100 pollutants in the area discharge their wastewater into local treatment networks. It was noted that wastewater from domestic and industrial enterprises in Payarik, Narpay, Pakhtachi districts and Kattakurgan was discharged into open ponds without proper treatment. The State Committee for Nature Protection of the Republic of Uzbekistan regularly monitors the sources of water pollution. According to the monitoring results, significant steps are required to improve the efficiency of many treatment facilities. Most of the industrial water pollution industries in the region account for industrial enterprises in Navoi and Samarkand regions. The share of industrial enterprises that have a negative impact on water quality (including the toxicity of discharged substances) is less than 20% of the total. However, they cause local sources of pollution and are the main source of contamination of ponds with heavy metals and other toxic substances.

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