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WATER SUPPLY AND WASTEWATER DISPOSAL FACILITIES IN THE KHARKIV REGION: CURRENT STATUS AND PROMISING DESIGN SOLUTIONS

Abstract. *The state of water resources in the Kharkiv region and the state of critical infrastructure facilities that provide water supply and treatment for both industrial enterprises and domestic consumers were analysed. Threats caused by the Russian Federation's military aggression against Ukraine were identified, along with measures to minimise them and eliminate their consequences.*

Keywords: *water supply and wastewater construction, Kharkiv region, promising design solutions.*

The Kharkiv region is located on the watershed of two river basins: the Don (Siverskyi Donets) and the Dnieper.

There are 867 rivers flowing through the territory of Kharkiv Oblast, with a total length of 6,405 km, one of which is a large river – the Siverskyi Donets, with a length of 1,053 km (375 km within the oblast).

There are 3,418 surface water bodies in the region: 57 reservoirs, 3,102 ponds, 249 lakes, and 10 quarries.

The water resources of the Kharkiv region are formed both by atmospheric precipitation and by external inflows from the territories of the Russian Federation. The region has an extremely low water supply – 1.8% of the total water resources of Ukraine.

An analysis of the sanitary and ecological state of the waters of the Siverskyi Donets River basin in the region, conducted on the basis of hydrochemical, chemical and microbiological data provided by specialised state institutions for 2018-2024, showed that the maximum permissible concentrations of integral pollution indicators, water acidity and, in some cases, insufficient dissolved oxygen content in the water. A major problem is the pollution of surface waters with complex organic compounds of anthropogenic origin. Excessive concentrations of heavy metals are often observed in bottom sediments.

Russian military aggression also had a significant impact on the ecological state of water bodies in the region. According to the State Environmental Inspection in the Kharkiv region, the amount of damage

and losses to the environment caused by the Russian Federation's aggression against Ukraine as of 01.01.2025 amounts to 11.4 billion euros, including 1.25 million euros to water resources.

The situation in the Kharkiv region is particularly dangerous due to the constant threat of damage to a large number of industrial enterprises, which could cause water pollution. The Udy, Lopan and Kharkiv rivers are at particular risk.

One of the most serious environmental incidents of 2024 was a fire at the oil depot of HNB-Reserv LLC in Kharkiv. The strikes damaged tanks containing fuel and lubricants, leading to the leakage of more than 3,000 cubic metres of petroleum products, a large-scale fire and environmental pollution.

The maximum permissible concentrations of petroleum products in the Nemyshlya River were exceeded by 260 times, in the Kharkiv River by 820 times, in the Lopan River by 2 times, and in the Siverskyi Donets River by 3.7 times.

As a result, one of the problematic issues in the region is the deterioration of water quality in the region's main waterway, the Siverskyi Donets River, which is periodically observed by the laboratories of the Siverskyi Donets Basin Water Resources Administration and the Kharkiv Regional Centre for Hydrometeorology.

The greatest negative impact on the aquatic environment in the region is caused by the discharge of organic substances in the return (waste) waters of municipal enterprises.

The total design capacity of the region's treatment facilities is approximately 470.0 million m³.

The actual discharge of wastewater into surface water bodies in 2024 amounted to 195.0 million m³ of wastewater (in 2020 – 312.2 million m³). Of this amount, 3.9 million m³ was polluted, 74.6 million m³ was within regulatory limits, and 116.5 million m³ was treated at treatment facilities.

At the same time, treatment facilities ensure the removal of no more than 70% of organic substances from wastewater. In addition, treatment facilities designed in the 1960s are not designed to treat wastewater from phosphates, as they simply did not exist at that time.

In the course of exercising its powers to control the state of water resources in the region, the regional military administration has established the following facts the absence of environmental impact assessment conclusions at municipal enterprises operating treatment facilities; technical projects for the placement of networks, structures and equipment for the collection, transportation and treatment of wastewater; technological regulations in the field of wastewater disposal.

In 2024, according to the Regional Water Resources Office of the State Water Resources Agency of Ukraine, there were 75 sewage treatment plants registered, the wastewater from which was discharged into surface water bodies. Of these, 15 treatment plants were not operating due to hostilities, 24 treatment

plants were operating satisfactorily, and 36 treatment plants (60% of operating plants) did not provide regulatory treatment. In particular, municipal enterprises in the cities of Berestyn, Izium, Chuhuiv, Zlatopil, and the settlements of Dokuchaievsk and Pyatihirsk, whose discharge accounted for 56.4% of the total volume of polluted wastewater.

Following Ukraine's signing of the Association Agreement with the EU in 2014, measures have been taken in the region to implement the EU Water Framework Directive, introducing integrated water resource management based on the basin principle of water resource management.

The State Agency of Water Resources of Ukraine, in cooperation with the regional military administration, has developed management plans for the Don and Dnipro river basins – a strategic document for achieving good ecological status of the region's waters, the development of which began in 2018, completed in 2023 and approved by the Order of the Cabinet of Ministers of Ukraine No. 1077-r of 01.11.2024.

However, during the hostilities of 2022-2024, the treatment facilities in some settlements of the region, the reconstruction of which is provided for in the Plan, were damaged or completely destroyed, in particular in the city of Vovchansk and the territorial communities of the Kupiansk and Kharkiv districts, and access to them is currently unavailable.

In order to restore water resources in the Kharkiv region, a series of studies need to be carried out to determine the necessary measures, which should form the basis of the Programme for the restoration, protection and use of the waters of the Siverskyi Donets River basin in the Kharkiv region, the development of which has been proposed by the Research Institute 'Ukrainian Research Institute of Environmental Problems' of the Ministry of Environmental Protection and Natural Resources of Ukraine.

The overall objective of the Programme is to normalise the condition of water bodies and aquatic ecosystems in the Siverskyi Donets River basin in the Kharkiv region and to create conditions for their further sustainable functioning in order to ensure the human right to an environment that is safe for life and health.

The means for achieving the main goal of the Programme is to improve the water protection system of the Siverskyi Donets River basin within the Kharkiv region based on the requirements of Resolution No. 758 of the Cabinet of Ministers of Ukraine dated 19 September 2018 'On Approval of the Procedure for State Monitoring of Water' and EU Directive 2000/60 of 23 October 2000 on ensuring the quality of surface waters and improving public information on the state of water bodies.

The programme is designed to ensure uninterrupted water supply to the population, industry and agriculture, the possibility of full use of water bodies for fisheries activities, as well as to protect the population from environmental emergencies. The

estimated cost of research, design work and programme activities is approximately €3.5 million.

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Water supply and wastewater disposal facilities in the Kharkiv region: current status and promising design solutions.

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