The concept of creating a new water management system in the region

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Abstract. The article gives the reason for the formation of Lake Aydarkul, according to which Lake Aydarkul began to form, starting from the catastrophically high year of 1969 - as a result of the discharge of 21 cubic kilometers of Syrdarya waters from the Shardara reservoir. The area of the lake system reached 2000 km², salinity of water – 2 – 4 g/l. In the next decade, there was a drop in the water level in the lakes and deterioration in its quality. By 1978, the depth decreased from 25 to 20 meters, and salinity increased to 7-8 g/l. An analysis of the available materials devoted to this problem showed that the water surface of Aydar and Tuzkan lakes extends from west to east for more than 180 kilometers, and the adjacent chain of Arnasay lakes stretches from north to south for more than 70 kilometers. The reason for the salinity of Aydarkul was indicated - before the commissioning of the Shardara reservoir, salt lakes were located on the site of the lakes, and only in the Tuzkan Basin fed by the Kly River was a shallow salt lake. The problem can be solved by transporting an additional volume of water to the lower reaches of the Amudarya, which will improve the ecological situation in the Aral Sea region, provide, over time, the formation of fresh lakes and create a water management system Syrdarya - Aydarkul - Zarafshan - dead lakes - Amudarya. This system can serve the broad development of fisheries, and also contribute to the opening of new agricultural areas of the republic, while creating several hundred new jobs. A method is recommended for solving an important national economic task of the industry. It is proposed that for the formation of the water system Syrdarya – Aydarkul - Zarafshan - "dead lakes" – Amudarya – Priaralye, it is necessary to design and build the main canal with several sections of a length of about 250 km, each of which communicates with the lake of the above system, will provide gravity communication of three large rivers of the Aral Sea basin. It is proposed to design the main canal with improved lining, which will provide high efficiency, which, in turn, will reduce the filtration coefficient and contribute to an increase in water intake for the needs of the national economy, expansion of irrigated areas and the development of fisheries in the region, and improvement of the ecological situation in the Aral Sea region.

1. Introduction

In recent years, against the backdrop of global changes, there has been a redistribution of water resources in Central Asia. These include changes in the Aral Sea and in the Arnasay lake system, which is the second lake in Uzbekistan after the Aral Sea. Solving the problem arising from the above changes is an important urgent task for the government of Uzbekistan. Given the importance of solving the problem of the Arnasay lake system, it was accepted as an object of study of this work. Judging by the foregoing, the water management system of the region faces an urgent task of the proper management of the water resources of the Aral Sea River Basin to suspend this trend in the
system. An analysis of the available materials devoted to this problem showed that the water surface of Aidar and Tuzkan lakes extends from west to east for more than 180 kilometers, and the adjacent chain of Arnasay lakes stretches from north to south for more than 70 kilometers. Earlier, before the commissioning of the Chardara reservoir, salt lakes were located on the site of the lakes, and only in the Tuzkan Basin, fed by the Kly River, was a shallow salt lake (figure 1).

![Figure 1. Layout of Aydarkul Lake](image)

Basically, Lake Aydarkul began to form, starting with the catastrophically high-water year of 1969 - as a result of the discharge of 21 cubic kilometers of Syrdarya water from the Chardara reservoir. The area of the lake system reached 2000 km², salinity of water – 2 – 4 g/l. In the next decade, there was a drop in water levels in lakes and deterioration in its quality. By 1978, the depth decreased from 25 to 20 meters, and salinity increased to 7-8 g/l [1, 2]. According to the idea, the discharged water flow into Aydarkul through the Arnasay system should be delivered to the Aral Sea through the Syrdarya river. Reducing the flow of the Syrdarya River naturally continues to worsen the ecological situation in the Aral Sea region. The dynamics of changes in salinity are shown in the following graph.

![Figure 2. Dynamics of changes in mineralization of water](image)

Currently, many measures are being taken that can ensure the improvement of favorable conditions for the life of the flora and fauna of water bodies. To carry out these tasks, a dam and a water outlet were constructed, and a feed channel was built. A gradual increase in the flow of collector-drainage inflow
contributed to a rise in the water level by two meters. Discharges from the Chardara reservoir continue, affecting the dynamics of the hydrological regime of these lakes (see table 2).

| Years | Months | April | May     | Only     |
|-------|--------|-------|---------|----------|
| I     | January | 932.7 | 260.3   | 2132.8   |
| II    |         | 939.8 |         | 302.4    |
| III   |         |       | 408.6   | 813.7    |
| IV    |         | 228.4 | 585.3   | 180.6    |
| V     |         |       |         | 589.2    |
| VI    |         | 263.5 |         | 813.7    |
| VII   |         | 511.9 | 153.4   | 1473.3   |

Table 1. Information on water discharge to Aydarkul in recent years

To solve this problem, many government decisions and international problems have been sent [3–9]. Despite the efforts made to correct the situation, the problem has not yet been resolved. To solve the problem, it is necessary to develop a concept aimed at implementing the project in this direction, which is the main goal of this work.

2. Methods

The analysis of the available materials devoted to this problem and their generalization, as well as the development of a concept for solving this problem of the region is the main research method.

3. Results and Discussion

The results of the study of extensive material devoted to the problems of Aydarkul and Tuzkan showed that in recent years there has been a rise in the level that has led to the destruction of the dam and spillway between Aydar and Tuzkan, the destruction of the road bridge across the East Arnasay lakes, flooding of wells, roads, fishing mills. There is a gradual resumption of free wind exchange in this territory.

According to the data of G. Glazyrin [3] and the Ministry of Water Economy of the Republic of Uzbekistan [9], as a result of uncoordinated water discharges, 118 thousand hectares of equipped pastures were flooded, and a real threat to the yield of adjacent irrigated territories of the Jizzakh and Syrdarya regions appeared. With increasing water levels, coastal thickets of hygrophilous vegetation and algae remained underwater, which reduced the ability to self-clean and undermined the food supply of herbivorous fish species, and the number of wild animals decreased [10–15]. Ultimately, in these lakes, there is a real threat to the destruction of various species of flora and fauna. This fact requires the creation of a specific concept, the meaning of which is as follows: to transfer part of the Syrdarya water flow through the Arnasay-Aydarkul system, to the so-called final point of the Zarafshan river flow, and from there, by communicating this lake with the Amudarya, there will be a real possibility of the formation of the Syrdarya water system - Aydarkul - Zarafshan - “dead lakes” – Amudarya – Aral Sea region. This water management system creates an excellent option for solving a set of tasks, including tasks to improve the water quality of several lakes at the same time, including Aydarkul and Tuzkan [16-20].

The new water management system will include several “dead lakes” in the territory of the Bukhara and Navoi regions. The advantage of this concept is the fact that in addition to discharging an additional volume of water (about 100-150 m³/s) in the Aral Sea through the territory of Uzbekistan, it will be possible to develop the territory for irrigation along the projected channel and develop fisheries
in the flowing Aydarkul and several lakes communicating with the new trunk channel of the above system. Possible channel paths are shown in figure 3.
4. Conclusions

In conclusion, it should be noted that the developed concept, if successfully implemented, can solve the problem of transporting an additional volume of water to the lower reaches of the Amudarya, which will improve the ecological situation in the Aral Sea region, will ensure, over time, the formation of fresh lakes and create the Syrdarya-Aydarkul water management system - Zarafshan - Dead Lakes - Amudarya. This system can serve the broad development of fisheries, and also contribute to the opening of new agricultural areas of the republic, while creating several hundred new jobs. All of the above can solve the important national economic task of the industry.

Based on the foregoing, a reasonable concept can be stated that the formation of the water system of the Syrdarya – Aydarkul – Zarafshan — “dead lakes” — Amudarya – Priaralye — requires the design and construction of the main canal with several sections about 250 km long, each of which communicates with the lake the above system, will provide by gravity the communication of three large rivers of the Aral Sea basin. Also, the designed main canal will have a concrete lining with an improved scheme (another scheme can be used), which will provide high efficiency, which, in turn, will reduce the filtration coefficient and contribute to an increase in water intake for the needs of the national economy, expansion of irrigated areas and the development of fish economy in the region, and improving the ecological situation of the Aral Sea region.
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