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Improving the Operation Conditions of Amu-Bukhara Machine Channel

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Abstract. The article focuses on the Amu-Bukhara machine channel, which supplies water to Bukhara region, and the existing problems in the process of using this channel. Water in the Amu-Bukhara channel The existing problems in obtaining water from the Amudarya without a dam are mentioned. Development of recommendations for improving the conditions of water intake in the Amu-Bukhara channel.

INTRODUCTION

Changes in water consumption and water levels for the conditions of the middle reaches of the Amudarya River, where the Amu-Bukhara machine channel (ABMCH) is located without a dam, Kerki sh.p. and Chordjuy t.y. studied based on water consumption measurement data performed at the bridge crossing. In addition to them, the field observations data of ISMITI river basin department, ABMCH channel operation service were used. Basically, data on average monthly and annual river water consumption from 1999 to 2019 were used [1-7].

Collection, processing and analysis and generalization of the hydrological regime of the Amuradya River; A full-scale and experimental study of the current state of the channel environment in the inlet channel of the ABMCH water intake channel.

An analysis of the measurement data for the period 2005-2018 shows that the largest annual water flows: 2005 y. - 60.04 km3; 2006 y. ¬66.69 km3; 2009 y. - 64.71 km3; 2011 y. - 62.88 km3; 2012 y. - 64.11 km3.

Correspondingly, the lowest average annual water consumption in these years was: 985 m3 / s in 2018; 885 m3 / s in 2011 [8-12].

METHODS

Let us now consider the water flow from the river to the inlet sections of the ABMCH. ABMCH b.k. The average monthly amounts of access to water intake channels were determined based on daily water consumption. For clarity, incoming water consumption was grouped by month, i.e., the range of change in water consumption was shown, e.g., in January of the 24th year. Calculations have shown that the amplitude of change in water consumption over months occurs over a large range. For example, in 24 years, the ratio of maximum water consumption to minimize water consumption was 3.3 times in January, 3.63 times in February, 6.8 times in March, 2.1 times in April, and 3.5 times in May.

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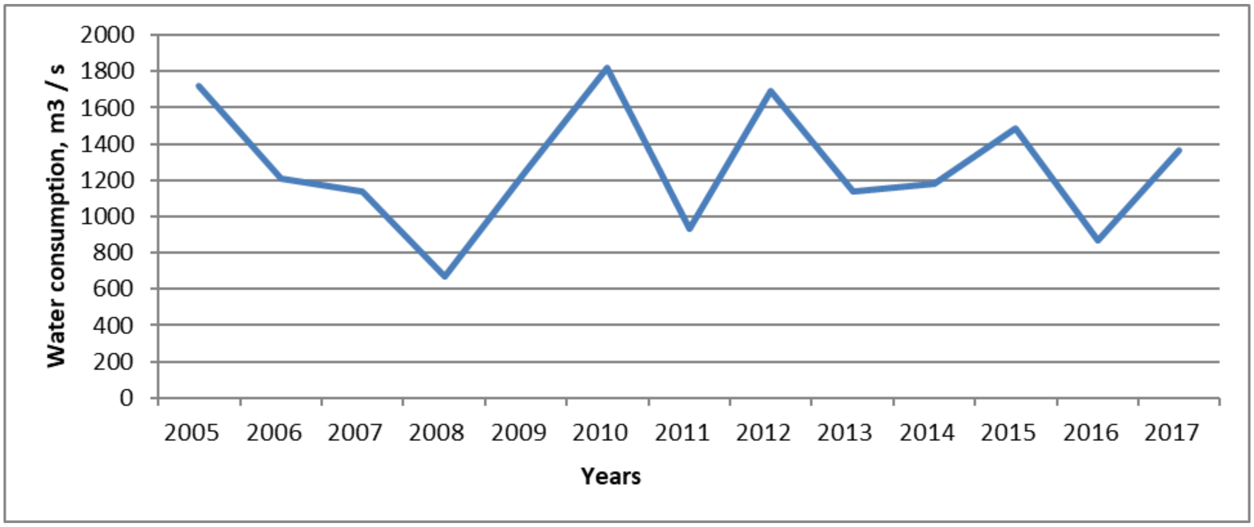

FIGURE 1. Water consumption of Kerki g.p of Amudarya. June - 2.0 times; in July - 1.6 times; in August - 2.3 times; the period of flood reduction in September - 2.5 times; in October - 3.2 times.

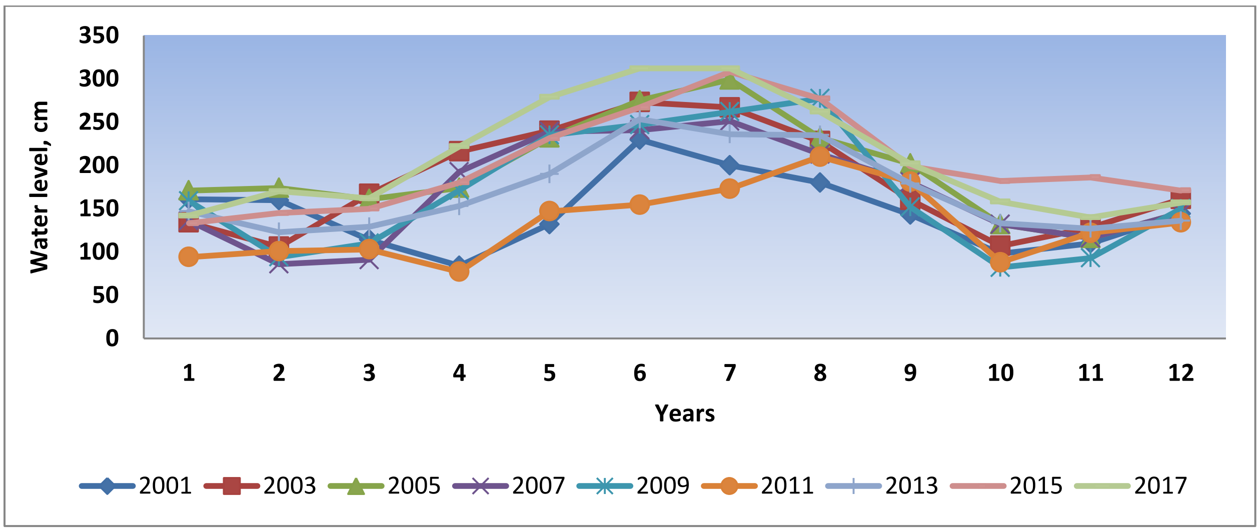

FIGURE 2. Changes in water levels entering the ABMCH

Such a sharp fluctuation of water consumption entering the ABMCH is due to the inflow rate, the cross-section is not adjusted, and the water consumption schedule for washing the fields from salt and wetting them before planting and irrigating various types of agricultural crops during the growing season.

Sudden fluctuations in water consumption during a month lead to very rapid difficulties in 2001-2017 when water supply through the channel № 1, excess water often flows back into the river through the channels №2, №3, 400 m3 / s. there have been cases of water consumption leaks. Thus, due to the non-adjustment of the inlet, the total water consumption during the flood reaches 800 m3 / s and more. Along with the water, a large amount of effluent enters the channel. For many years, the flow of water has been accompanied by high water levels, the best conditions for receiving water in the Amu-Bukhara channel, and there were no difficulties organising the water distribution yesterday. The most serious difficulties in water distribution occur during periods of water scarcity, especially in years of water scarcity**.**

Insignificant water consumption in a water shortage is accompanied by a low water level, which leads to a low level in front of the ABMCH main facility regulator. There were cases of the full opening of the adjusting valves so that the difference between the levels in the upper and lower bays is 0.2-0.3 m. it decreased to.

During the years of water scarcity, during the process of river re-formation, it was often observed that the stream lay on one of the banks, and the river left the point of water intake. As a result, it will be difficult to bring the planned water consumption to the main regulator of ABMCH and then to the first lift pump stations.

The deposition of a stream on one of the shores results in its washing away and removing much of the crop area from planting. To protect the shores from subsequent washing, often in the event of an emergency, shore protection work is carried out. In such cases, the washing depth of the protected shore is 18.0 - 20.0 m. In the absence of protective measures, the washing depth is 6.0 - 8.0 m. does not exceed. According to the observations of some authors, up to 25% of the shoreline of the Amudarya River is washed away at the same time.

The nature of the change in the level of the Amudarya River in the ABMCH was studied based on observations made near the Chorjoi bridge, 12 km below the water intake to the ABMCH.

Consideration of changes in the surface regime of the Amudarya River provides a more detailed description of its changes in the section of water inflow into the channel and in the upper reaches of the main structure of the ABMCH. To do this, the nature of the change in monthly average levels obtained based on the calculation of daily and every ten-day water levels was considered. Since the daily change in water levels was not typical for the non-adjustable regime of the river, it was decided to consider only their monthly values.

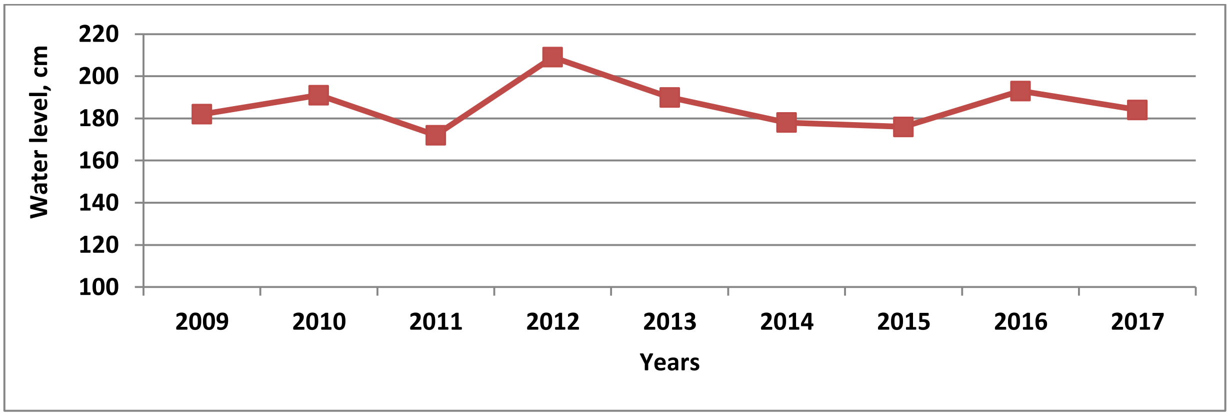

FIGURE 3. Changes in the water levels of the Chorjoi t.y.p of the Amudarya

As can be seen from the figure, during the period under review, the highest average monthly water levels were observed in the ABMCH region of the Amudarya, the lowest in 2011 and the highest in 2012. The amplitude of change in average monthly water levels during this period was 2.64 m.

Considering the nature of changes in the average monthly parameters of the water level in the Amudarya, it should be noted that the distribution of water in the intake of water without a dam to ABMCH occurs in large fluctuations of water levels.

The nature of changes in the level regime of the Amudarya River and ABMCH [8, 12, 14, 15]. Daily changes in water levels in the Amudarya River indicate that they alternate with sharp rises and falls. It is good to take water to ABMCH when the water level rises, and when the water level drops, the water intake conditions worsen as the flow leaves the water intake point.

There was some kind of winter, low water water rise associated with the discharge of water flows from the Nurek Reservoir to generate electricity for the needs of the national economy. The analysis of changes in daily water levels in the ABMCH region of the Amudarya River served to conduct some analysis in the upper reaches of the ABMCH, which is described below [15-19].

The main concern of the ABMCH maintenance service is the creation of continuous large water levels in front of the main structure adjuster. In front of the main building of ABMCH, high water levels are provided at the entrance, and №1 and №2 are provided for continuous cleaning along two channel lengths. About 20 dredgers of different types by type and capacity, the nature of the work of turbid cleaners is aimed at ensuring high water consumption and levels of the water regulator at the main facility of ABMCH. The maintenance service achieves this by properly organizing the cleaning work and placing the dredgers in the right place and time. To overcome the crisis in planned and limited water intake, it is necessary to consider a complete picture of changes in water levels over a sufficiently large period.

For this purpose, the nature of changes in the water level in the upper part of the main structure of ABMCH and water consumption in the lower part in 1995-2003 was studied. Average monthly water levels were determined by calculating daily and every ten-day values. The daily water levels are less typical for the upstream of the ABMCH main facility, so limiting them to their average monthly values was decided.

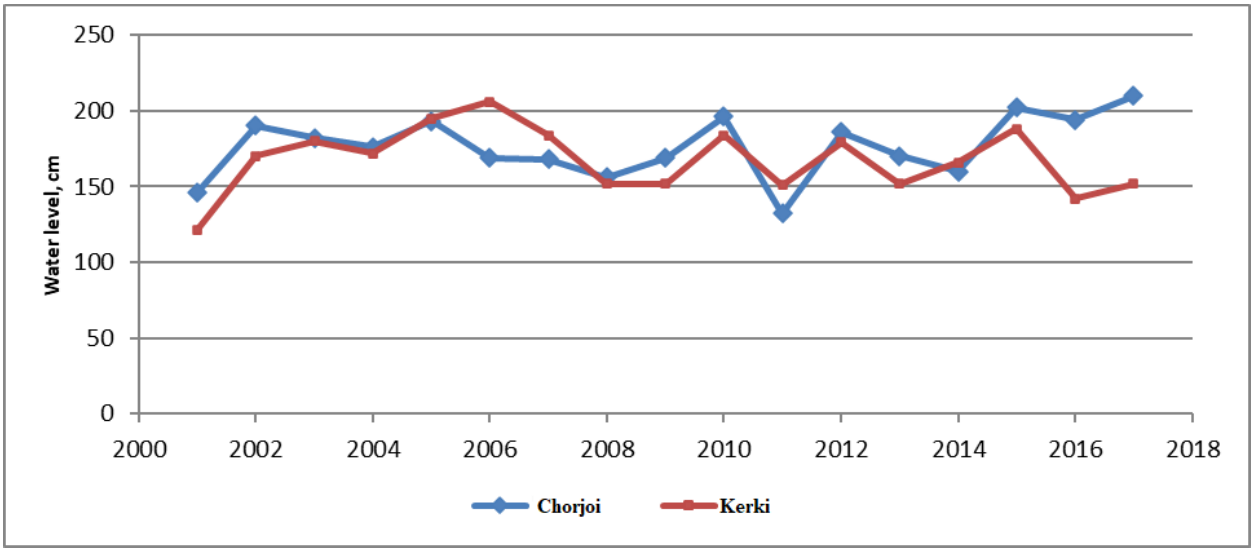

FIGURE 4. Changes in the water levels of the Kerki and Chorjoi t.y.p of the Amudarya

The change in average monthly water levels for 2001-2017 is shown in Figure 4. It can be concluded from this picture that the highest water levels in the upper reaches of the ABMCH main facility during the period from 2001 to 2017 were 192.99 m B.S. (2002), 192.69 m B.S. (2001), and in August 192.73 m B.S. (1998, 1999). The largest amplitudes of the level were 2.1 m (1998), 2.3 m (1999), and 2.4 m B.S. (2000).

It should be noted from the table that the size of the length of water intake channels (up to 10.0 km) allows achieving large heights of water in the upper reaches of the main structure of ABMCH at different water levels at the catchment point of the Amudarya River.

Now let us consider the nature of the distribution of average monthly water consumption in the lower part of the main facility of ABMCH in 1995-2009, which are shown in Figure 6. The average monthly water consumption was determined based on the calculation of daily and ten-day water consumption, which is transferred to the lower reaches of the ABMCH according to the data of channel services.

From 1995 to 2009, water consumption in the lower reaches of the ABMCH main facility decreased slightly in 2001 compared to other years due to water shortages. This is not due to the deterioration of water intake conditions but to the limited distribution of water consumption in the Amu-Bukhara channel.

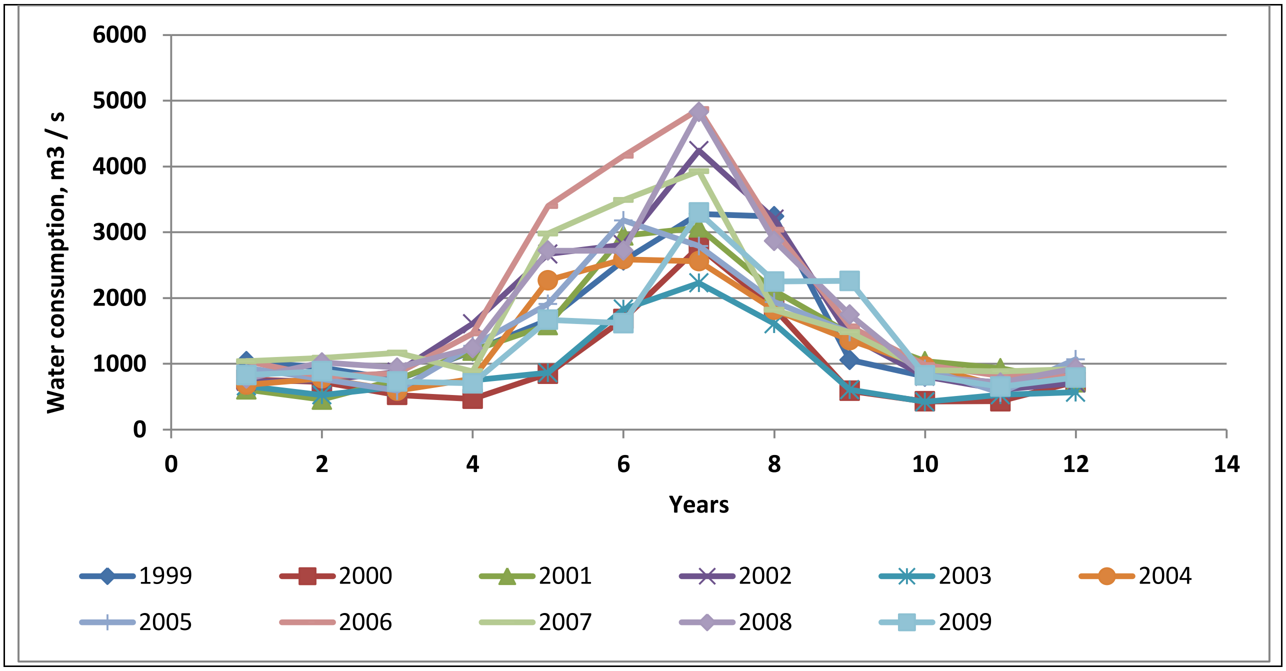

FIGURE 5. Monthly change of water level and water consumption at Kerki water metering station of Amudarya

The maximum flow of the Amudarya is 9060 m3 / s, Ilchik gp. da 6840 m3 / s Kerki g.p.da- 4830 m3 / s. The annual flow dynamics is 41.5 cu. km3 to 99.1 km3, with an average annual rate of 64 cu. km. The average flow rate in the Kerki area is 1460 m3 / s: 2570 m3 / s - the minimum flow rate is 422 m3 / s; The flow distribution is uneven, flowing 80% of the total flow during the period of water increase, and 20% of the total flow during the low water period. The amplitude of the annual water level varies from 2.2 to 3.05 m, and the maximum amplitude corresponds to the period when water is abundant. The hydrographic changes in this Kerki stratum of the Amudarya consist of sharply increasing peaks, which have a sharp periodicity of up to 16:17, with large and small peaks lasting 3: 4 days. Maximum expenditures and levels are usually observed in July of the year, and levels and expenditures decrease in August. The low water period mainly lasts from October to the end of March. In general, the level and consumption are stable, and in March-April, due to rainfall and rising temperatures, changes occur 2-3 times before the melting process 1, 2, 3, 4, 12, 15].

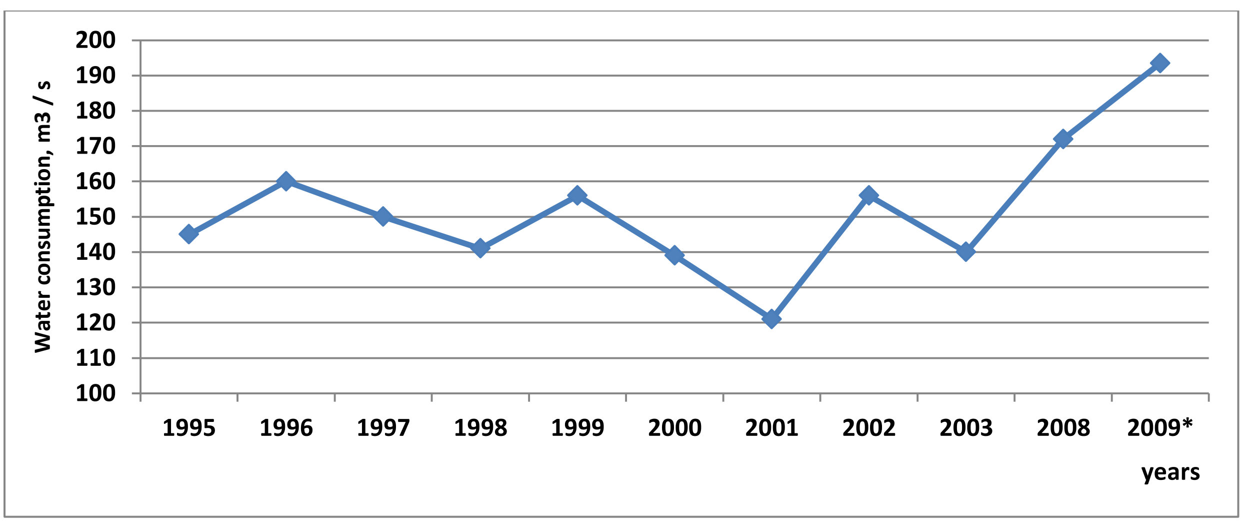

FIGURE 6. Graph of consumption change in the lower part of the main building of ABMCH

As can be seen from the graph, the increase in water falls in 2009. In some periods, for example, in 2008, a decrease in water consumption can be observed**.**

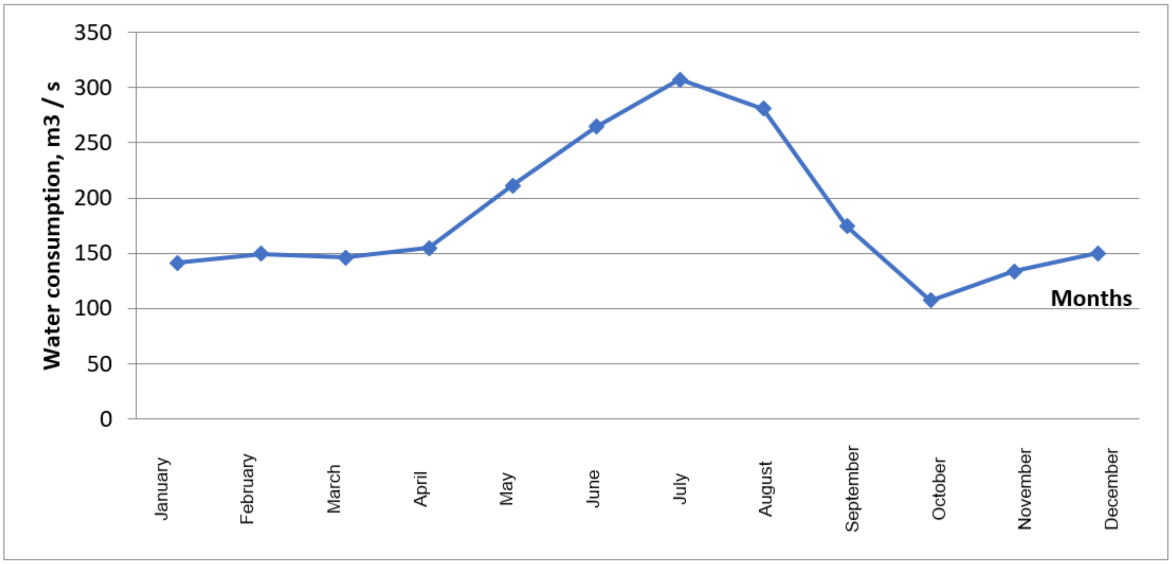

FIGURE 7. Water consumption through the main facility of ABMCH, 2018 y.

RESULTS AND DISCUSSION

The Kerki hydroelectric power station on the Amudarya River is characterized by a sharp rise in water flow and corresponding flow changes. Water levels and consumption were observed to fluctuate dramatically during the day and fluctuate between 35-35%. These analyzes showed that the abrupt change in the hydraulic regime of the water flow in the inlet area of the Amudarya ABMCH is characterized by fluctuations in the value of the depth and flow width.

The maximum values of water flow velocities are observed in areas where there are natural or artificial narrowing or deviations of the flow.

The characteristic feature is that the same consumption can have average speed, depth, width values of different values. For example, when the water consumption in the Amudarya is Q = 1000 $м^3$/s, the average velocity is 0.5-1.7 m / s, the depth is 1.1-1.4 m, and the depth is 180-1030 m. values may match.

The analysis of water intake in the perennial ABMCH showed an average volume of 2 km3 per year, including 1.64 km3 during the growing season and 0.76 km3 during the non-vegetation period. In the area of non-dam water intake, which is constantly controlled by dredgers, the required amount of water is directed to the ABMCH, which requires a very high operating cost. Also, the complexity of the nanos regime is that a large amount of nanos enters the water intake channel, causing the flow in its head section to sink as a result of the change in hydraulic mode and the channel water permeability decreases. To rectify this situation, the channel will be adjusted at the entrance to the channel, and the dredger sediment will be dumped in the lower reaches of the river, squeezing the river on the right side. As a result, the river will start to escape from the catchment. If ABMCH delivers water to AB-1 at a length of 20.4 km, large nanos will sink in the first km, and relatively small fractional nanos will sink in another 10 km. It is necessary to clean the channel from these nanos, update the fleet of submarines to maintain the good condition of the channel and maximize the throughput.

To reduce the access of nanos to the ABMCH inlet channel, the inlet area channel structure should be rehabilitated in such a way as to improve the flow circulation in the river, ensure that the stream with the main part of the nanos flows downstream from the water intake and the low nanoscale part of the relative flow enters the channel.

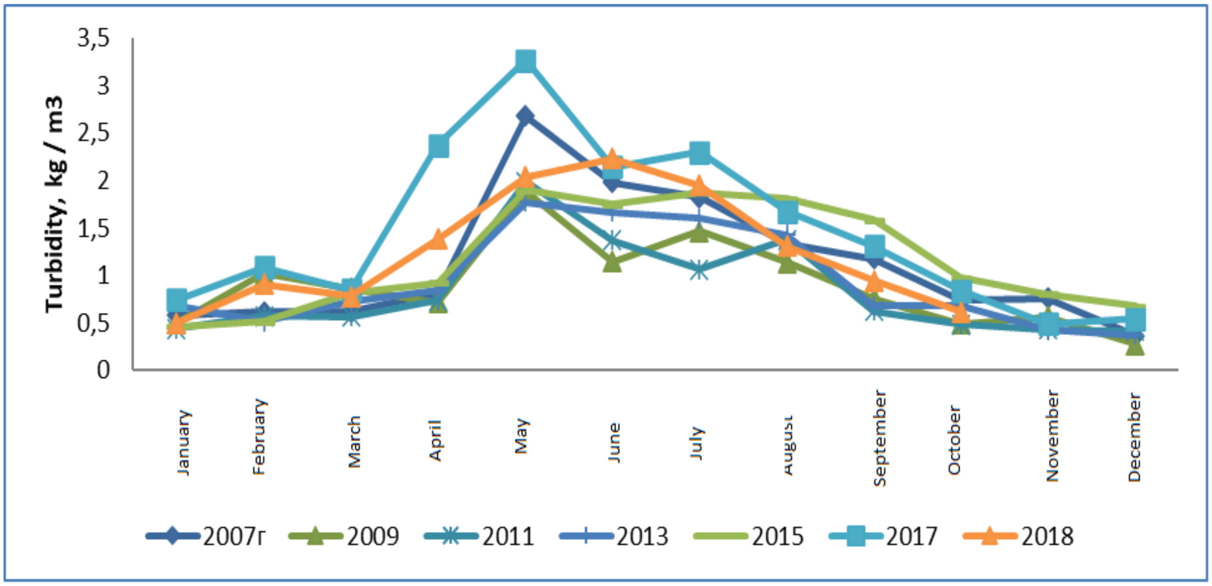

FIGURE 8. Change of turbidity entering the ABMCH

The turbidity of the water flow entering the ABMCH is on average 3.5 kg/m3. The average annual input volume of nanos is 8-12 million tons.

Based on the above properties, the flow in the water intake area to ABMCH rapidly changes the direction of the river and continues to complicate water intake [8-10].

As a result of many years of research, measures are being taken to improve water access to the ABMCH and ensure that the Amudarya River's fairway reaches the catchment area and reduces the number of nanos, mainly in the catchment area.

FIGURE 9. AB-2 n /st. view of the channel from the front

CONCLUSIONS

1. The hydraulic and hydrological characteristics of the Amudarya River were analyzed.
2. The operating mode of the Amu Bukhara machine channel AB-1, AB-2 pumping stations was studied, and the hydraulic characteristics of the water supply channel were determined.
3. The optimal parameters of the water supply channel were determined to reduce the inflow of turbid discharges from the pumping stations.

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