

# Research of deformation processes of Amu-Bukhara canal and increase of water permeability

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**Abstract.** The use of spurs and dams in the moderation of water flow, the correct direction of water supply, flow and protection of coastal areas from leaching, increase the strength of the current repair work. phase execution. The hydraulic parameters of the riverbed in the lower reaches of the Amudarya, in particular, the average depth of the river and the width of the riverbed are determined by the abundance of water in the river. calculated calculations were obtained by analyzing by obtaining links to water consumption in the years. Recommendations and calculation methods for the prevention, protection of floods in the river during floods, increasing the strength of hydraulic structures are recommended. This includes the construction of riverbeds and shore protection in the river areas, the creation of safe conditions in the settlements along the river and the prevention of floods in arable lands, as well as the improvement of river capacity and hydraulic engineering in the river. to ensure the safe and efficient operation of facilities and to be used in solving other engineering tasks.

## 1 Introduction

To date, more than 60 water intake facilities and reservoirs have been built in Central Asia to ensure efficient use of water resources in the Amudarya. change in hydrological regime) leads to a sharp change. As a result, various types of deformation processes occur in the riverbed and in the catchment area. Such situations cause various difficulties in obtaining water from the Amudarya to the ABMC. In order to study these negative conditions, a study was conducted and statistical analysis of data from the areas of water intake from the Amudarya to the Amu-Bukhara canal, picket 110 + 00 and picket 28 + 00 [1–3].

## 2 Materials and methods

Time-dependent graphs of water consumption and flow rate were developed for the study. Analyzes were performed based on these graphs. According to the results of the analysis, in the years of high water consumption in the river (2019th year) there was a decrease in the amount of runoff in the water flow compared to the years of low water. Only in the spring (April and May) was there a sharp increase in the amount of runoff in relation to water consumption. This was explained by the increase in turbidity in the river as a result of floods and mudslides in the spring [4].

The time (months) graph of water consumption and runoff in the figures shows that water runoff and runoff are symmetrical over time in autumn and winter, and the rise of the riverbed is normal in such periods. will

continue to rise. Conversely, with the increase in water consumption in the spring, there is a sharp increase in the amount of runoff relative to the water flow. This requires the use of additional mechanisms (dredgers) in the river basin [5].

The graphs show that in summer, water consumption increases sharply and, conversely, the amount of effluents in the water flow decreases relative to water consumption. During these periods, burials in the river are less frequent, and the old ditches of the river can be opened with the help of mechanisms [6].

In years of low water levels, the river has undergone dramatic changes, with rivers escaping from the headwaters of the ABMC. As a result, it is difficult to get the planned amount of water to the head of the canal.

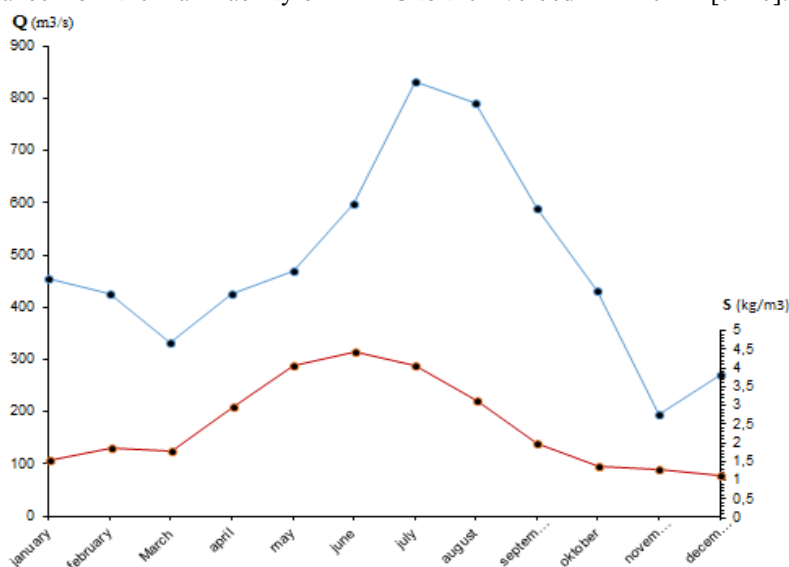
**Table 1.** Amu-Bukhara machine canal on the section Amu-Darya Picket110 + 00 in 2019 with an average permeability of 1 m<sup>3</sup> of water

Months	Water consumption	Loyalty
January	456,2	0,447258
February	426	0,502595
March	331,7	0,354322
April	424,5	0,756247
May	470	1,033483
June	598,4	1,906323
July	831,4	2,498191
August	790,1	1,582965
Septem	591	0,925861
Oktober	430,8	0,400816
November	195,7	0,130258
December	270,2	0,195301

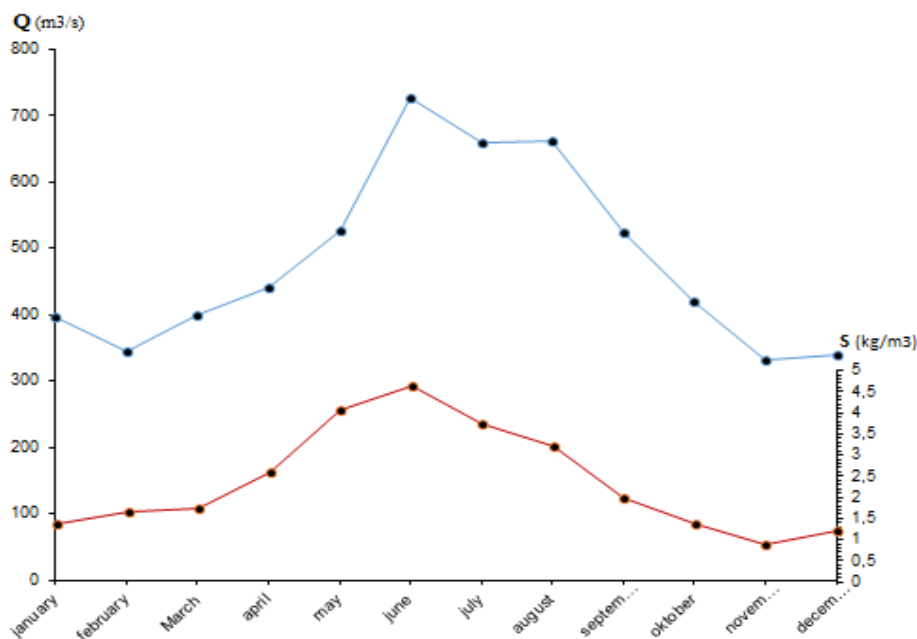
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It should be noted that according to the project, the distance from the main facility of ABMC to the riverbed

was 3–3.5 km, but to date this distance has exceeded 10 km [7–10].



**Fig. 1.** Time chart of water consumption and flow rate at ABMC Picket 28 + 00 (2019<sup>th</sup> year)



**Fig. 2.** Time dependence of water consumption and flow rate at ABMC Picket 28 + 00 (2020<sup>th</sup> year)

**Table 2.** Amu-Bukhara machine canal on the section Amu-Darya Picket 110 + 00 in 2020 with an average permeability of 1 m<sup>3</sup> of water

Months	Water consumption	Loyalty
January	456,2	0,447258
February	426	0,502595
March	331,7	0,354322
April	424,5	0,756247
May	470	1,033483
June	598,4	1,906323
July	831,4	2,498191
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The large amount of turbidity that enters the head of the ABMC causes the channel bottom to rise in the guide channel, adversely affecting the operation of the cleaning mechanisms. As a result, there are problems in delivering the planned amount of water to the pumping station.

The main source of water for the headwaters of the Amudarya River ABMC is the variability of the river flow, the process of changing the direction of the river, either to the left or to the right. As a result, it will be difficult to deliver the planned amount of water to the head of the ABMC. As a result, it is planned to carry out land reclamation works on the riverbed with the help of dredgers and mechanisms to supply water to the main water intake facility. In particular, it was recommended to deepen and clean the riverbed (in months of low

water). It is recommended to deepen the shallows of the riverbed and clean it with dredgers [11, 12]. The results of scientific research show that the bottom of the Amudarya River and its water level are rising from year to year. As a result, large amounts of turbid sediments enter the headwaters of the ABMC and the guide channel, the bottom of the guide channel also rises, and the water permeability of the channel decreases. We will not be able to deliver the planned amount of water to the first pumping station if the bottom of the canal is not cleaned in time. In the main part of the intake facilities (right bank (Picket-110 + 00 and Picket-28 + 00) the water of the canal in the lower basin (Picket) due to the sedimentation of turbid sediments due to the decrease in the velocity of water flowing into the canal there are cases when the planned amount of water is negatively affected by the decrease in capacity (width) [13].

### 3 Results and discussion

Faults in the referral channel and measures to eliminate them in a timely manner, if implemented in practice, will eliminate all the difficulties and achieve a positive result.

Until the summer of this year, the flow of water in the Amudarya River gradually shifted from the right bank to the left bank, making it difficult to deliver the planned amount of water to ABMC's main water intake facility. As a result, during the summer months (October-March), it became difficult to supply sufficient water to reservoirs through water supply networks [14].

During the low water months, dredgers set up and managed the riverbed, delivering the planned amount of water to the head of the ABMC. The condition of the water flow in the Amudarya will require additional work on the river due to the movement of the river. If this work is not done in time and is not put into practice, it will have a negative impact on the flow of water from the river to the ABMC, the water will increase in many months, the water flow rate in the river will increase as a result of rising water levels. As a result, dredgers operating on the river should be immediately diverted from the river to the canal-canal improvement works. The routing channel needs to be adjusted to the design defaults. If the canal is cleared of muddy sediments and adjusted, the water flow in the canal will be improved and the planned water capacity will be achieved [15].

In October, the Amudarya River shifted from the left bank to the right bank. The main river flowed to the left bank and flowed to the water intake facility from the right bank, which had a positive impact on the water intake. In order to maintain this situation, it is recommended to carry out dredging works in the riverbed by managing and adjusting the flowing water.

The following measures will be taken to stabilize the water supply in the main part of the ABMC in the Amudarya River and in the water bodies using the river.

Changes in the stability of the water flow, excessive flow of all kinds of sediments, and turbidity in the river bed and in the areas of water intake structures have a proportionally negative effect.

The excessive flow of turbidity in the main part of the ABMC will disturb the large volume of clean water, and its discharge under high pressure, washing, will seriously affect the technical condition of the water receiving structures. While the amount of water consumed by ABMC from Amudarya is 10–15% in wet years, this figure is 40% in lean years.

As a result of these conditions, as well as the abundance of turbidity and sedimentation, the underwater level in the head of the ABMC is rising from 0.6 to 0.8 m. As a result, drastic changes occur in the river bed. On the other hand, in the process of cleaning, repairing and using the canals that receive and direct water from the river, various wastes and turbidity affect the bottom of the river bed and changes in water flow. Such situations cause problems in the implementation of the water flow management of the river bed, which stretches over long distances [16].

As a result of irregular deformation of the water in the river bed, the flow of water in the river bed causes a decrease in the speed of movement of the water volume to a certain extent.

These circumstances show that the hydraulic direction of the water in the head of the ABMC, especially the flow rate (V) is very important and affects the bottom and width of the riverbed.

Traverse dams are located outside the river bed or partially in the bed at a certain angle to the flow. These dams are built mainly using local construction materials. The dry part of the dam outside the river bed is built by using bulldozers and excavators or by transporting the soil from another place by road transport. The part inside the river bed is built using gyromechanization [17].

On both banks of the river, the embankment structures can be located at different angles in the plan. In this case, it is necessary to make efficient use of the river flow in a certain middle part of the riverbed, stable and strong rocks and stony parts. In particular, it is desirable to make full use of existing pre-built coastal defense structures.

### 4 Conclusions

Clearance of a certain amount of turbidity at the water intake points of water intake facilities in the ABMC area by means of “dredge” mechanisms on the basis of cross-section. Regular monitoring of water intake points at the head of water facilities, taking into account the volume of underwater turbidity, and the establishment of appropriate measures.

Current repairs to increase the durability of the use of spurs and dams in the normalization of the processes of the river, the correct direction of water supply, flow and protection of coastal areas from leaching. ensuring phased implementation. Strengthening of soil laboratories for the study of soil levels, its chemical and mechanical levels, structural properties in the laboratory by scientific sampling of samples from the level of runoff, turbid, sandy soils.

Carrying out treatment works at the main part of ABMC and water intake facilities on the basis of developed and approved design, work plans.

The following recommendations are made for the implementation of measures to improve the water carrying capacity of the river, diverting channel and culvert by adjusting the flow of water when receiving water from the Amudarya to the Amu-Bukhara car canal:

In order to improve the condition of the Amudarya receiving water into the Amu-Bukhara canal, it is necessary to determine, design and build the construction points of the river bed straightening structures (banks, spurs, troavers dams) on the left bank of the river. For this, it is necessary to organize scientific projects to study the morphology of the riverbed.

In order to provide sufficient water in the headwaters of the Amu-Bukhara machine channel, after studying the condition of the channel, if deformation (burial) is observed in the area of the channel, first of all, these sections should be cleaned with the help of mechanisms (underground shells) to the depth of the channel specified in the project.

After determining the actual condition of the diverting channel, first of all, it is necessary to carry out measures to clean the areas of the channel from muddy sediments that hinder the water flow.

Based on the condition of the Amudarya river, it should be said that the water level of the river and the bottom of the channel have risen in recent years. Due to this, the water level in the head of the canal is higher than in previous years. It is necessary to study the condition of the channel with the condition of the river.

At the points of water intake from the Amudarya basin, it is necessary to clear the submersible (bottom) level of a certain amount of sediment from turbidity with the help of ground projectile mechanisms based on longitudinal and cross sections, and in the summer season to open the old basin (prokops) and start project water intake directions (position).

In the period of low water, the river bed and the main water intake areas of ABMC in the ranges from PK-110+00 to PK-28+00 and the corresponding intervals of the left bank of these areas are clearly studied and the necessary measures are taken to ensure their operation in the areas. should be strengthened.

In order to improve the performance of the ABMC, it is necessary to fully implement measures to fight against cloudy discharges.

Based on the current situation, actual measures are being implemented to ensure the planned amount of water from the Amudarya river to the Amu-Bukhara machine channel in the autumn-winter months through the main water intake facility and the diversion channel. As a result, in the autumn-winter months of this year, the planned amount of water is delivered to the first pumping station from the river and the main and diverting channel of ABMC. The main factors for achieving such indicators are the cleaning of the sediments in the river and the diversion channel, the improvement of the hydraulic condition of the water flow by correcting the conditions of the river and the channel has a positive result. In addition, sudden changes

in the Amudarya River have been happening for the last few years and are causing negative consequences. As a result, it is becoming difficult to get water to the main part of ABMC in some years and months when there is little water. As a result of this, due to the change in the river's course, in October and November, practical work is being carried out in the river by adjusting the flow of the river, using the factors that ensure the sediments and turbidity are washed away with the help of the water flow in the river itself.

In October-November of the current year, it is necessary to constantly monitor the changes in the water level and the amount of water in the river due to the hydrological condition. It is necessary to predict the changes of more complicated river bed processes in advance, to quickly straighten the river bed, improve the flow activity and maintain the depth of the water flow flowing through the main catchment of ABMC. A more positive result will be achieved only if the above-mentioned activities are well organized in practice.

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