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The dissipation of water's kinetic energy in channel water conveyance tracts

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ABSTRACT: The high velocity of water flow in the channels' water conveyance tract leads to erosion of the riverbeds and changes in their technical parameters. As a result, this leads to a decrease in water flow in irrigation systems and causes water scarcity. Energy dissipators are being utilized in main canals to properly regulate water flow and reduce the excess kinetic energy of the water current. This article provides information on the parameters of energy dissipators used to reduce the kinetic energy of water in the water conveyance tract of the Dargom Main Canal, as well as explanations on dissipating the kinetic energy of the flow over short distances.

I. INTRODUCTION

In accordance with Decree №. PP-4486 of the President of the Republic of Uzbekistan dated October 19, 2019, measures are being systematically implemented to further enhance the water resource management system. In recent years, within the framework of comprehensive institutional reforms implemented in our country, measures have been taken to enhance the effectiveness of state management in the water sector and to improve the principles and system of water resource management [3]. Consistent efforts are being undertaken to improve the meliorative condition of irrigated lands, increase the efficiency of water resource utilization, enhance the accounting system for these resources, as well as strengthen the material and technical base of water management organizations [1,7]. At present, considerable attention is being devoted in our republic to improving the operational regimes of irrigation systems, reducing water losses while taking into account water scarcity, and implementing modern information technologies in this process [2]. The volume of water delivery and operation of irrigation canals create an opportunity for the rational use of water.

II. SIGNIFICANCE OF THE SYSTEM

The paper mainly focuses on how machine learning techniques in Data mining can be applied to predict the risk factors. The study of literature survey is presented in section III, the research objective and method IV, section V Analysis of the results and examples, VI discusses the Conclusion.

III. LITERATURE SURVEY

Many scientists are conducting scientific research on the issue of reducing the kinetic energy of water flow in canals. In particular: The appearance, dimensions, and placement conditions of energy dissipators designed to control water flow in canals, as well as hydraulic experimental studies, have been examined in the scientific research works of Carolina Yubing, John Southard, Kevin Rawal, M.D. Chertousov, I.I. Levi, A.N. Rakhmanov, N.P. Rozanov, A.A. Uginchus, N.T. Kaveshnikov, M.R. Ikramova, A.A. Yangiyev, B.M. Norkulov and others. As a result of intense erosion processes occurring in the Dargom Canal bed, the canal banks are collapsing, the channel is becoming silted, and consequently, its water-carrying capacity is decreasing [5]. This is leading to a gradual reduction in the canal's efficiency. Measures aimed at reducing the intensity of channel erosion and sedimentation through improving the technical parameters of the canal have been developed. Increasing the efficiency coefficient of the canal and reducing water losses remain urgent tasks [4,6].

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IV.THE RESEARCH OBJECTIVE AND METHOD

Water is drawn into the Dargom main canal through the Yangi Dargom canal from the Ravotkhoja hydroelectric complex, which is built on the Zeravshan River. The total length of the New Dargom and Dargom canals is 103.2 km (from PK0+00 to PK1032). The water intake section of the canal from the river is illustrated in Figure 1 below. Measurements were conducted on the channel between PK 160+00 and PK 235+50.

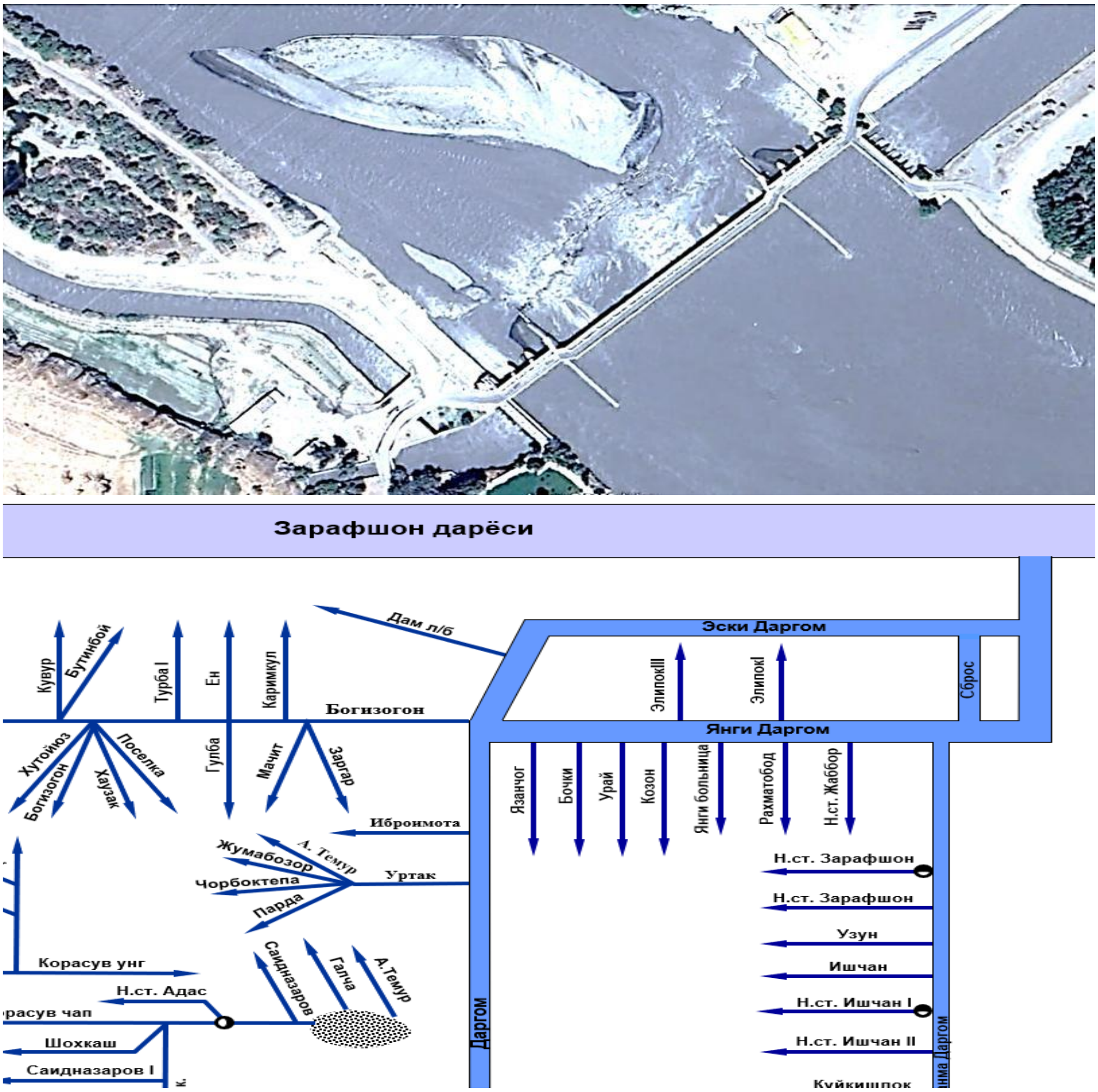

Figure 1. River water intake sections of the canal

The Dargom canal provides water to 67.5 thousand hectares of land in Samarkand region and 50 thousand hectares in Kashkadarya region. The total length of the New Dargom and Dargom canals is 103 km. The average water discharge is 180 m3/s. The annual flow volume amounts to 0.9-1.2 km3. The irrigated areas connected to the Darghom irrigation system comprise 123.3 thousand hectares. 815 million cubic meters of water is drawn from the Zarafshon River. Additionally, 27.5 million cubic meters of water is used from streams and springs, 6.16 million cubic meters from underground sources, and 56.46 million cubic meters from return waters. The water usage limit in the irrigation system is established based on the water availability level of the year. In years with low water availability, the limit amount is around 770 million cubic meters, while in water-abundant years, it is approximately 1200 million cubic meters.

V. ANALYSIS OF THE RESULTS AND EXAMPLES.

The process of studying the technical condition of the Darghom Main Canal revealed that the primary channel processes and bank erosion were occurring over a 5 km stretch between the Jumabozor Bridge and the Gulba Hydroelectric Power Station. In some places, bank erosion ranged from 1.5 to 3 meters, creating a hazardous situation for agricultural lands and other objects located near the riverbank zone. The technical data of the Dargom Main Canal was analyzed, and the eroded areas of the canal were studied. The hydrometric, morphological, and kinematic characteristics of the canal have been refined.

Figure 2. Bank erosion conditions of the Dargom canal

Figure 3. Instances of reducing the kinetic energy of water through the use of rapid flow structures in canal sections PK138+00 to PK153+00

Dissipation of flow energy. In the upper sections of the channels, a hydraulic jump phenomenon occurs due to the impact of the flow's energy. If a hydraulic jump process occurs, energy dissipation basins, rapid flow channels, or micro-cascades, and walls (barriers) are used to reduce the impact of water flow from the upper reach to the lower reach. Structures built to dissipate energy in the downstream area are called energy dissipators. In the compressed section of the waterway, up to the depth of the second jump, the flow velocity is relatively high. To ensure the safety of the waterway structure and considering economic efficiency, it is necessary to partially increase the potential energy by reducing the kinetic energy to a certain extent. Additionally, it is required to transition from a driven hydraulic jump to a submerged hydraulic jump for connecting the downstream and upstream water levels. Taking into account the high energy of the water flow and channel erosion in the Dargom main canal, several energy-dissipating structures are being implemented. The Aylanma Dargom Canal features 10 rapid cascades, while the Eski Dargom Canal has 24 rapid cascades, all designed

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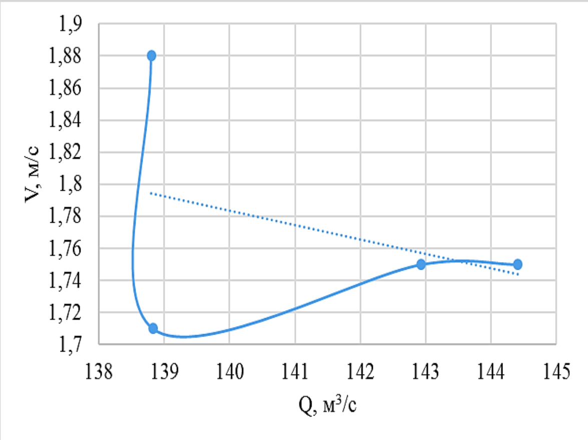
to dissipate the flow energy. As a result of field measurements, we obtained the following results. Measurement work was carried out on the section between the Jumabozor Bridge and Gulba Hydroelectric Power Station to monitor the eroded parts of the main canal's banks. The coastal erosion zones were studied and a topographic survey was conducted. The length of the washed section of the riverbed was marked with pickets, and measurement work was carried out. Measurements of the channel's cross-section were conducted at the picket line intersections.

Table 1. Results of the measurement work

№	PK	Water flow velocity: V, m/s	Water flow rate: Q, m^3/s
	160+00	0,72	18,27
2.	165+00	0,78	19,17
3.	191+00	**1,29**	18,01
4.	200+00	**1,31**	18,90
5.	230+50	0,66	19.04
6.	170+00	1,75	142,93
7.	175+00	1,88	138,8



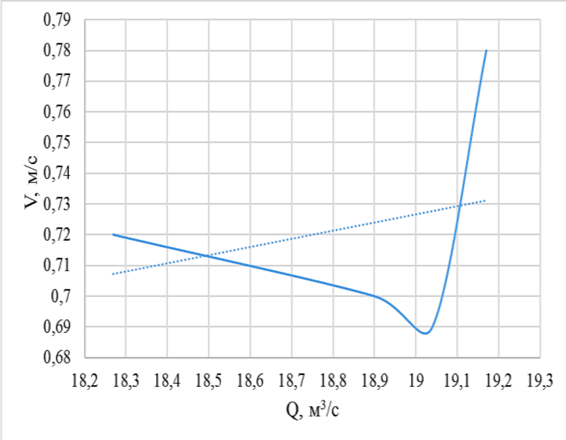


Figure 4. Graph of water flow rate and stream velocity measurement results.

From the measurement results, we can observe that even during periods of low water discharge in the canal, the water flow velocity maintains good movement. As a result, in the Dargom main canal, the water flow transitions from a laminar regime to a turbulent regime as the velocity of the water increases, leading to erosion of the coastal slopes. The following conditional formulas were developed to determine the static stability of the channel bed.

Water flow rate condition $U_2 > U > U_1$

Condition for water flow acceleration $\int_0^L \frac{\partial U^2}{\partial l} \partial l \approx 0$

Condition for Energy Loss $\frac{\partial}{\partial t} \int_0^L I_f \partial l \approx 0$

VI. CONCLUSION

A study of the technical condition of the Dargom Main Canal revealed that the primary channel processes and bank erosion were occurring along a 5 km stretch between the Jumabozor Bridge and the Gulba Hydroelectric Power Station. In some areas, coastal erosion ranged from 1.5 to 3 meters, creating a hazardous situation for agricultural lands and other objects located close to the shoreline zone.

The velocity intensity in the lower reaches of the canal does not remain excessively critical (high) over very long distances. Therefore, it is recommended to identify zones with high channel flow velocities and construct energy dissipation structures. The Dargom main canal serves to reduce energy demand alongside meeting the population's water needs by effectively utilizing the kinetic energy of the water flow through the additional construction and commissioning of micro-hydroelectric power stations in sections with high water flow rates.

REFERENCES

[1] Artkbayeva F., Nishanbayev Kh., Azimov S., Sharipov O., Pulatov S. Channel processes in the earthen bed of an irrigation canal. Web of Scholar. 6 (24), 2018.
[2] Babkin V.I., Norina A.B., Rosova V.L. A method for calculating annual runoff and its intra-annual distribution in the absence of hydrological observation data. In: Calculations of Water Resources and Water Balance. Proceedings of the Order of the Banner of Labor State Hydrological Institute, issue 338. Leningrad: Gidrometeoizdat, 1990, pg. no:13-35.
[3] 1. Bakiyev M., Altunin S., Tursunov T., Chariyev J. Channel Regulation. Textbook. Tashkent, 2008. Pp. 262
[4] 1. Vorobyev A.E., Ortsukhayeva Z.Sh., Alferova N.N. Formation of channel deformations in the lower reaches of the Terek River. Bulletin of Orenburg State University, 2015, №. 10 (185). pp. no: 337-340
[5] Lyapichev Yu.P. Methodology for analyzing and evaluating the risk of the accidents in hydraulic structures. Structural mechanics of engineering structures and structures. 2019. T. 15. № 4. pg. no: 327–336. http://dx.doi.org/10.22363/1815-5235-2019-15-4-327-336.
[6] Kosichenko Yu. M. Issues of safety and operational reliability of hydraulic structures for reclamation purposes. Environmental management. №3. 2008. pg. no: 67-71.
[7] Filippov E.G. Hydraulics of hydrometric structures for open flows. Gidrometeoizdat, 1990. 288 p.