



ASSESSMENT OF FORECAST PARAMETERS OF THE AVERAGE LONG-TERM WATER FLOW FORMED IN LARGE COLLECTORS

Ravshan Aminaddinovich Mamutov
Researcher, Scientific Research
Institute of Irrigation and Water Problems

Abstract

The assessment of forecast parameters of the average long-term water flow formed in collector–drainage networks, as well as the quantitative parameters of water resources accumulated in main collectors, and the improvement of hydraulic methods for discharging certain portions of these waters into irrigation canals, are among the urgent scientific and technical challenges.

This article presents the results of assessing the quantitative parameters of water resources accumulated in the Daryalyk Main Collector in the Khorezm region, as well as the forecast parameters of the average long-term water flow formed in the Divankul Collector.

Keywords: Collector–drainage networks, water mineralization, water discharge, flow, hydrological post, forecast parameters of water flow, empirical curve.

Introduction

The Daryalyk Main Collector is formed by drainage and groundwater from the Khonka, Urgench, Yangibazar, Gurlan, and Bagat districts of the Khorezm region. Its parameters are presented in Table 1.



Table 1.

The system of river						
Region Name	Collector Name	Years of construction	Length km	Discharge M3/s	Width m	Depth m
Gurlan District	Divankul Collector	1957	40,3	72	72	2,5
Yangibazar District	Atashev Collector	1957	30,3	30	25	3
Urgench District	Atashev Collector	1976	22,1	8	15	2,2
Khonka District	Tossoqa Right Bank Collector	1974	20,2	3	14	2
Bagat District	Right Tossoqa Collector	1970	8,5	1,6	18	2,5

For the Daryalyk Main Collector, the average annual water discharge from inter-farm drainage channels amounts to **16.74 million m³**. The annual water flow totals **531.68 million m³**. The mineralization of the water is **2.31 g/L** [1]. The average long-term water discharge and mineralization of the collector are shown in **Figures 1 and 2**, respectively.

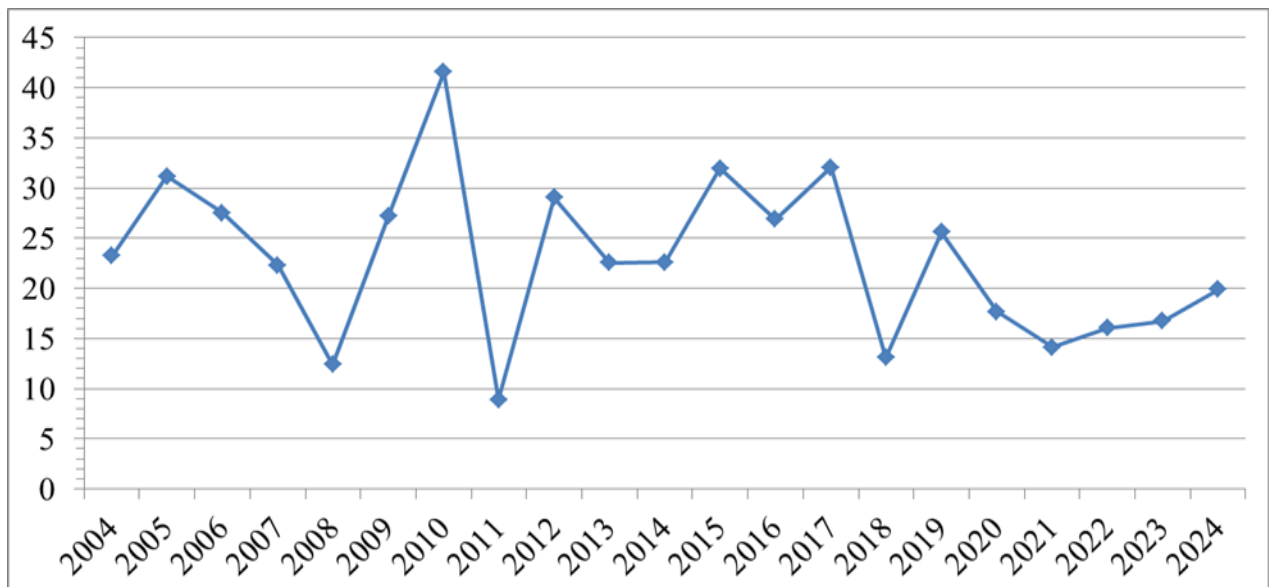


Figure 1. Dynamics of water discharge at the “Gurlan–Divankul” hydrological post of the Daryalyk Main Collector

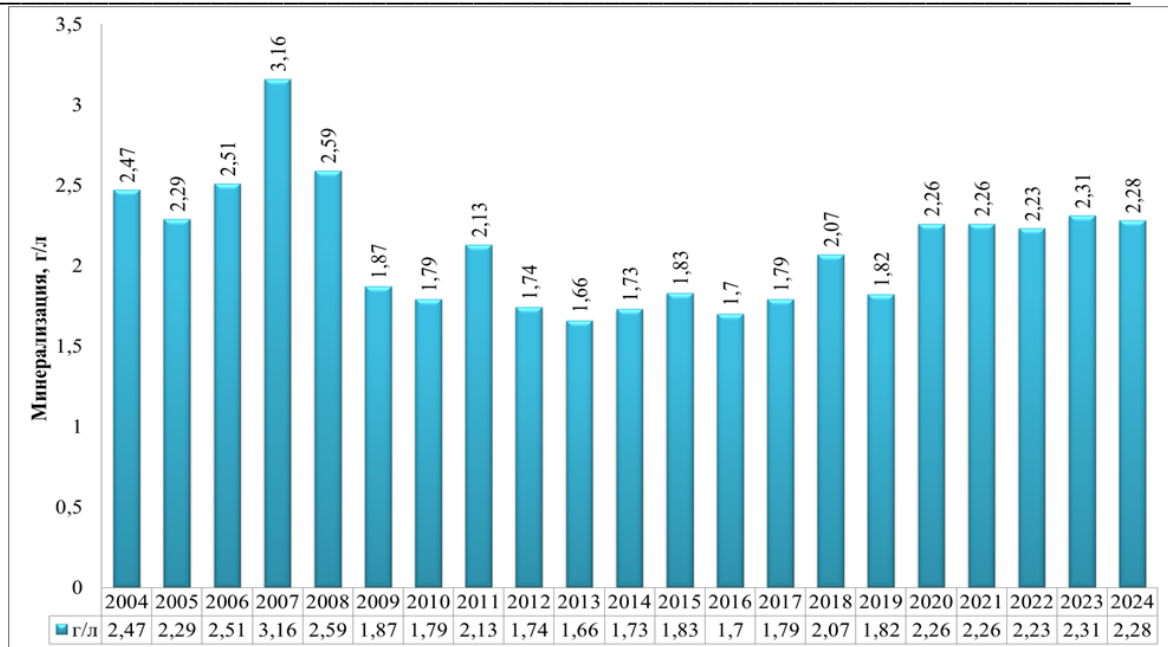


Figure 2. Dynamics of water mineralization at the “**Gurlan–Divankul**” hydrological post of the Daryalyk Main Collector

Based on the analysis of the graphs presented in Figures 1 and 2, during the low-water years of the Amu Darya River—**2008, 2011, and 2018**—the average long-term water discharge and mineralization in the Daryalyk Collector were, respectively: **12.4 m³/s and 2.6 g/L in 2008, 8.91 m³/s and 2.13 g/L in 2011, and 13.1 m³/s and 2.1 g/L in 2018**. Thus, an increase in mineralization was observed in the collector in relation to changes in water discharge [2,3].

At the same time, the average long-term forecast parameters of the water flow formed from the Divankul Collector and flowing into the Daryalyk Collector were calculated based on long-term water discharge data obtained from the “**Gurlan–Divankul**” hydrological post of the Divankul Collector.

Based on hydrometric data, the parameters of the probability distribution function and the reliability (exceedance probability) curve of the annual water flow were constructed.

According to the research methodology, at the first stage, the forecast parameters of the distribution of the average annual water discharge were determined. These forecast parameters are presented in **Table 2**.



Table 2

m	Year	Average per year Q, m ₃ /sec	k=Q _i /Q ₀	(k-1)	(k-1) ²	(k-1) ³	p=m- 0,4/n+0,4*100
1	2011	41,54	1,808	0,808	0,652	0,527	2,80
2	2008	32,05	1,395	0,395	0,156	0,061	7,48
3	2018	31,98	1,392	0,392	0,153	0,060	12,15
4	2021	31,16	1,356	0,356	0,127	0,045	16,82
5	2022	29,06	1,265	0,265	0,070	0,019	21,50
6	2023	27,50	1,197	0,197	0,039	0,008	26,17
7	2020	27,19	1,183	0,183	0,034	0,006	30,84
8	2024	26,86	1,169	0,169	0,029	0,005	35,51
9	2007	25,61	1,114	0,114	0,013	0,001	40,19
10	2013	23,25	1,012	0,012	0,000	0,000	44,86
11	2014	22,58	0,983	-0,017	0,000	0,000	49,53
12	2004	22,57	0,982	-0,018	0,000	0,000	54,21
13	2019	22,30	0,970	-0,030	0,001	0,000	58,88
14	2016	19,90	0,866	-0,134	0,018	-0,002	63,55
15	2009	17,66	0,768	-0,232	0,054	-0,012	68,22
16	2006	16,74	0,728	-0,272	0,074	-0,020	72,90
17	2012	16,03	0,698	-0,302	0,091	-0,028	77,57
18	2005	14,14	0,615	-0,385	0,148	-0,057	82,24
19	2015	13,10	0,570	-0,430	0,185	-0,079	86,92
20	2017	12,41	0,540	-0,460	0,212	-0,097	91,59
21	2010	8,91	0,388	-0,612	0,375	-0,230	96,26
	S	482,54	21,00	0,00	2,43	0,21	
	Average	22,98	1,00	0,00	0,12	0,01	
	High	41,54	1,81	0,81	0,65	0,53	
	Low	8,91	0,39	-0,61	0,37	-0,23	

At the second stage, the empirical curve of the average long-term exceedance probability of water discharge in the Divankul Collector was constructed (Figure 3).

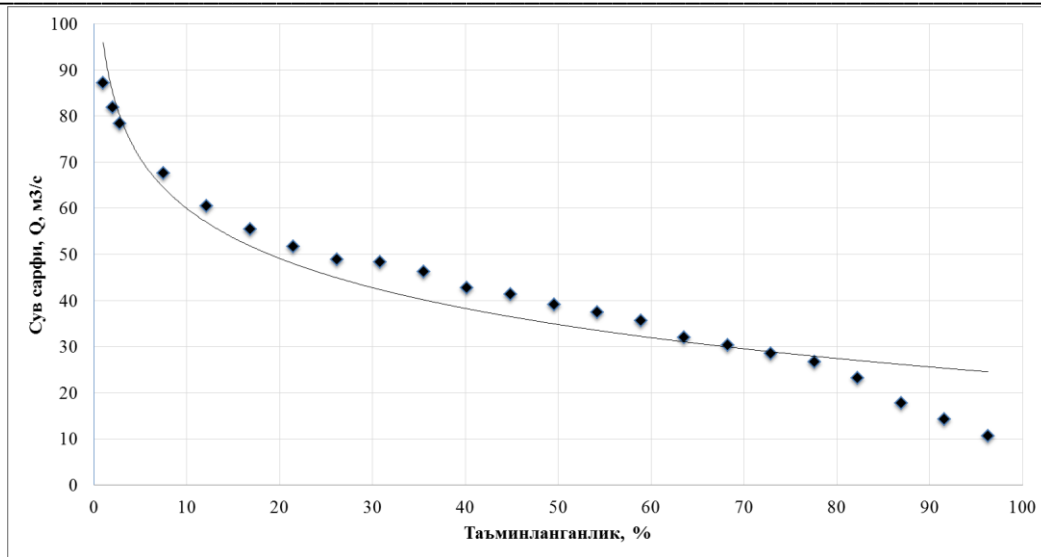


Figure 3. Empirical curve of the average long-term exceedance probability of water discharge.

At the third stage, the parameters of water resource formation in the collector were assessed for water supply (exceedance probability) levels of **1%, 5%, 10%, 50%, 75%, and 96%**. According to the assessment results, at the “**Gurlan–Divankul**” hydrological post of the Daryalyk Collector, located near the border of the Republic of Turkmenistan, the water discharge at **50%, 75%, and 96%** exceedance probabilities amounts to **39.2 m³/s, 28.8 m³/s, and 10.7 m³/s**, respectively (Table 3).

Table 3

Exceedance probability, %	1	5	10	50	75	96
Water discharge, m³/s	87,2	70,3	61,9	39,2	28,8	10,7

Conclusion

During the low-water years of the Amu Darya River—2008, 2011, and 2018—the average long-term water discharge and mineralization in the Daryalyk Collector were, respectively: 12.4 m³/s and 2.6 g/L in 2008, 8.91 m³/s and 2.13 g/L in 2011, and 13.1 m³/s and 2.1 g/L in 2018. Thus, an increase in water



mineralization is observed in the collector depending on changes in water discharge.

The parameters of water resource formation in the Divankul Collector were assessed for different exceedance probabilities of 1%, 5%, 10%, 50%, 75%, and 96%. According to the assessment results, at the “Gurlan–Divankul” hydrological post, the water discharge at 50%, 75%, and 96% exceedance probabilities amounts to 39.2 m³/s, 28.8 m³/s, and 10.7 m³/s, respectively.

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