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Study of the process of cultivation in soil fertile irrigation canals

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Abstract. The article focuses on increasing the efficiency of soil fertile irrigation canals. The useful coefficient of the channels depends on many factors (such as the type of soils constituting a canal, the water-carrying capacity of the canal, the hydraulic elements of the canal and the operational condition), their joint study will enable to define the actual beneficial coefficient of the channel. The article also analyzes the methods for filtering leading researchers for filtering processes in soil-leach irrigation canals and compared the computational methods presented in the regulatory documents and analyzed based on the results of the analysis. The article focuses on natural-field conditions in the study of soil-water dynamics and filtration processes in natural conditions in determining the coefficient of usefulness in soil-leach irrigation canals. At the same time, filtration processes are directly related to the change (increase or decrease) of the water level, which in some cases changes rapidly. The article has developed a graph of determination of the useful coefficient of value depending on the water level of the channel by measuring-monitoring of hydrotechnical, hydrogeological and hydrometric methods in various methods of filtration processes in soil-sprinkling irrigation canals. With the help of the developed graphs, the possibility of increasing the efficiency of the channel's useful coefficients in soil-leach irrigation canals has been identified. The recommendations developed within the article provide a good effect on the management of water resources in irrigation canals and water conservation in meeting the water demand of consumers.

1 Introduction

Today, irrigation canals are not only important for agriculture but also in many other sectors of the economy. Therefore, it is important to pay attention to the hydraulic efficiency of the channels. The hydraulic efficiency and operational reliability of the channels is primarily to ensure that they are in the design and operation mode of their selection of the transverse cutting and the hydraulic elements corresponding to them. he majority of researchers in this field and our hydraulic parameters are incompatible with the design indicators during the exploitation of our studies in our natural field conditions. Such changes do not provide channels with hydraulic efficiency and exploitation. As a result, the

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reduction of the water and the sloping capacity of the channels leads to a decrease in the efficiency of the filtration process and the declining efficiency of the canal channel.

Increase of efficiency of main canals of water management, reduction of their repair and exploitation costs is the main tasks of economic reforms in the country. Currently, ground channels are widespread in our country, causing considerable water loss due to filtration, which breaks the irrigation system performance and deteriorates soil reclamation. Therefore, the problem of exploitation of main and secondary canals requires detailed study of the filtration process in it.

2 Method

The filtration processes are mainly dependent on the type of soil that forms the channel, the channel hydraulic parameters and the change in the filtration consumption varies with them. The Tashkent trunk canal line consists of medium-sized limestone mixed loam, fine-gravel mixed gravel and sand-gravel. Determination of filtration depends primarily on the coefficient of filtration, depending on the type of soil and the various grits, depending on the thickness of the layer. In the investigated section of the Tashkent trunk channel, the coefficient of filtration, which is mainly of medium-sized fine gravelly soluble loam, is presented in CR and R (Construction rules and regulations) 2.06.03-97. [1-3].

In the first layer there is a midline particle with limestone, thickness $t_1 = 6.2$ m

In the second layer, the sand is covered with gravel, its thickness is $t_2 = 15.6$ m

Thus, the average filtration coefficient for the canal section PK 257 + 00 to PK 318 + 00 was 1.37 m^3/day.

We define filtration costs using the above mentioned formula for the detected filtration coefficient. Calculations are carried out in Table 1.

Table 1. Information on filtration expenditure

h, m	The results of filtration consumption, m3/sec					
	CR and R	A.A.Uginchus	N.N.Pavlovsky	Kozen	A.N.Kostyakov	V.V.Vedernikov
0,8	0,309	0,338	0,292	0,285	0,268	0,306
1,0	0,326	0,358	0,309	0,301	0,280	0,329
1,2	0,343	0,373	0,325	0,317	0,291	0,347
1,4	0,360	0,387	0,341	0,333	0,303	0,366
1,6	0,378	0,402	0,357	0,349	0,314	0,384
1,8	0,396	0,417	0,374	0,365	0,326	0,402
2,0	0,413	0,431	0,390	0,381	0,337	0,420
2,2	0,425	0,446	0,406	0,396	0,349	0,435
2,4	0,440	0,464	0,422	0,412	0,360	0,453
2,6	0,454	0,479	0,438	0,428	0,371	0,471
2,8	0,467	0,494	0,455	0,444	0,383	0,488
3	0,480	0,509	0,471	0,460	0,394	0,505
3,2	0,492	0,524	0,487	0,476	0,406	0,521
3,4	0,504	0,538	0,503	0,492	0,417	0,539

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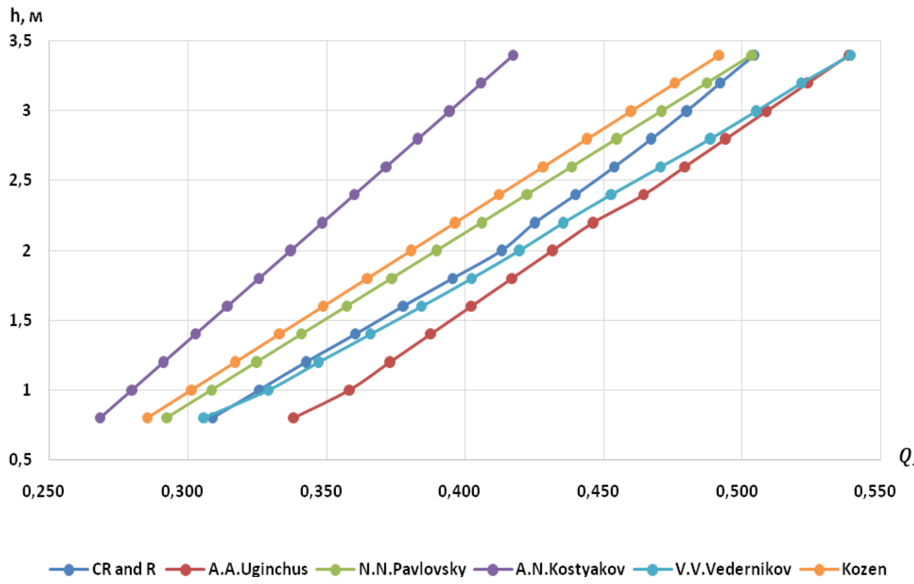

Fig. 1. Depending on the flow depth of the Tashkent trunk channel PK 257 + 00 filtration expenditure

As can be seen from Table 1, the filtering exposure identified by these empirical links corresponds to the design of the project. However, as a result of research conducted, the actual filtration consumption increased significantly. This, of course, is due to the change of the regime of groundwater in the region due to various cracks in the concrete sections of the canal and the rise of the water level due to depletion of the channel's design exploitative regime. Therefore, it is necessary to consider the filtration costs on channels based on the study of dynamics of groundwater movement on characteristic sections of the Tashkent trunk channel.

Natural field researches on filtration processes in the Fergana canal in which provided at the point of PK 2000 + 00 and PK 2100 + 00 channel with several ways show that this researches requires further improvement. [4-6].

Results of hydraulic, hydrometric and hydrogeological methods of analysis shows that value of discharge of filtration are not same in those three methods. Because it is a very complex matter to observe the filtration process, at the same time with calculation until 1 ppm. On can conclude that it will not be correct to accept it for kilometers.

Nowadays, there are many methods to calculate filtration, and most of them bring difficulties in field experiments. Nevertheless, the were provided filtration calculations for the part of the Greater Fergana channel from PK 2000 + 00 until PK 2100 + 00 with using above methods. [7-9].

Provided measurement discharge of water in PK 2000 + 00 and water discharge was measured in point 2, taking into account the velocity of the stream. As a result of the measurements, the water discharge in the first point was Q = 26.97 m^3/sec, and in the second point was Q = 22.16 m^3/sec, and the water discharge of secondary channels which takes water from this channel was q = 2.52 m^3/sec. So, the water lost of the Big Fergana channel from PK 2000 + 00 until PK 2100 + 00 is equal to formule:

$$S = Q_1 - (Q_2 + q_d) = 26.95 - (22.16 + 2.52) = 2.27 m^3 / \sec \tag{1}$$

Of course, the calculated water lost is not because of filtration additionally there where evaporation from water had. It depends on the accuracy of the measurements in all the water intake secondary channels. If we calculate the amount of evaporation from water surface based on the principles given in the literature, it equal to formule:

$$Q_{evop} = B * e * l = 19 * 15(\frac{mm}{day}) * 10000m = 7125\frac{m^3}{day} = 0.082\frac{m^3}{day} \quad (2)$$

there:

B - width of the channel according to water level; (m)

l - length of the selected area; (m)

e - evaporative layer on the surface of the water in the time unit (mm/day). e=15mm/day

In this case, taking into account that the duration of water discharge measurement is 6 hours, than e=3,75 mm / day.

Thus, 4% of total water loss is due to evaporation, and the remaining 96% correspond to filtration, so the coefficient of efficiency for BFC from PK 2000 + 00 to PK 2100 + 00 is equal to formule:

$$\text{C.E.W.} = \frac{Q_1 - S}{Q_1} = \frac{26.95 - 2.27}{26.95} = 0.91 \quad (3)$$

This indicator, which achieved in field experiments, was 6% higher than the projected C.E.W. [10-11].

One method of analyze of filtration process on the Big Fergana channel can be insufficient, that means hydrometric method gives main attention for calculation filtration and evaporation of total lost. Meanwhile, the accuracy of the measurements in the water taking parts from channel did not given main attention. Therefore, the dynamics of underground waters were investigated using observational wells located around the BFC from PK 2000+ till PK 2100 + 00. For this purpose, data for the vegetation period in 11-72, 11-75 and 11-110 wells from PK 2000 + 00 till PK 2100 + 00 were collected, and during the research analyzed this data. Provided analysis with comparing groundwater levels in observation wells with the water level in the canal. As a result obtained filtration value with using the hydro geologic method from PK 2000 + 00 till PK 2100 + 00.

3 Results

According to the results, the change of groundwater levels in PK 2000 + 00 and the average coefficient of filtration of rocks in several layers are obtained according to formula (CR and R) and the filtration value at PK 2000 + 00 was $q_f = 8.44m^2/day$ or $q_f = 0.97m^3/day$ for the length of the channel. Similar analysis were also providedat PK 2100 + 00 and $q_f = 19.60m^2/day$ and for all selected area $q_f = 2.27m^3/day$. If we give main attention to the value of the results which determined by the hydrogeological method, has difference from the results which determined by the hydrometric method. It is because of adding underground water to the channel from left bank of the channel and filtration from channel is equal to zero. This decrease continues from PK 2000 + 00 to PK 2100 + 00. The reason that the part which provided analysis includes into the Sukh conus. In Table 1 there were given results of analysis of changes underground water level in chosen channel area (Table 2).

In order to increase the accuracy of the results were determined filtration with the hydraulic method. Hydraulic calculations provided at the same area which provided other calculations. For hydraulic calculation of the filtration there were used average results of hydrogeological method. But the result differs from each other's. It is normal, because the results of all methods which used are the empirical connection. However, there has possibility to determine filtration discharge with low error and with the faster way. [12-15].

The results which analyzed with the above methods are given in the table below.

Table 2. Information about filtration calculation for the part of the Big Fergana channel from PK 2000 to PK 2100

	Hydraulic method		Hydrogeological method		Hydrometric	
	q, [m^2/day]	C.E.W	q, [m^2/day]	C.E.W	q, [m^2/day]	C.E.W
PK 2000	13,21	0,94	8,44	0,96	18,83	0,92

	Hydraulic method		Hydrogeological method		Hydrometric	
	q, [m^2/day]	C.E.W	q, [m^2/day]	C.E.W	q, [m^2/day]	C.E.W
PK 2100	20,7	0,91	19,60	0,91	18,83	0,92

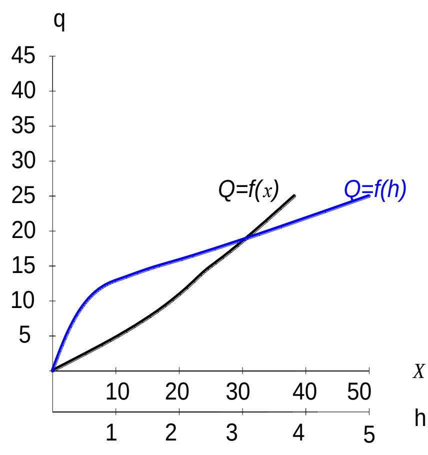

Fig. 2. Perimeter of channel wetted and depth filtration dependency graph of PD 2000 + 00 of large Fergana channel

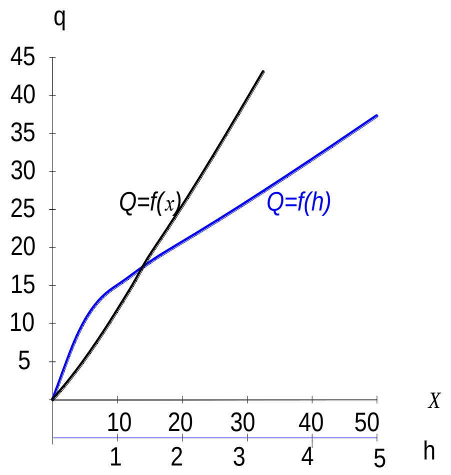

Fig. 3. Perimeter of channel drainage and depth filtration dependency graph on PK 2100 + 00 part of large Fergana channel

The results of the research in the field of hydraulic efficiency and operational reliability of irrigation channels in the changing regime indicate that in most cases there are sharp changes due to the activation of the hydraulic elements and deformation processes of the irrigation canals design stage.

Studies carried out on the major Fergana and Tashkent trunk-channels in the field of natural-gravity conditions indicate that the activation of deformation processes in these channels today leads to a decrease in water-carrying capacity and FSI.

4 Conclusions

According to the results of the measurements made in PK 2000 + 00 on PK 2100 + 00 on the study of filtration processes taking into account the dynamics of underground waters in the Greater Fergana canal, 13.0 m^3/h in hydraulic mode, 18.83 in hydrometric mode m^3/h and 8.44 m^3/day in the hydrogeological method, indicates a lot of problems in this direction.

Filtration processes in soil-watered irrigation canals are determined by various methods and filtering of the Greater Fergana channel PK 2000 + 00 up to PK 2100 + 00 and channel C.E.W. The graph of change has been developed. This graph allows you to define FSI on the channel site, depending on the level of water in the canal and water consumption.

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