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Recommendations for Strengthening the Hydraulic Calculation and Coastal River of the River in Amudarya with Adjusted Conditions

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Abstract: The article provides recommendations for hydraulic calculations and shore protection in the construction of protection and adjustment facilities to create safe conditions in the settlements along the river in the lower reaches of the Amudarya and to prevent flooding in arable lands. In our previous work, the morphological characteristics of the riverbed in the lower reaches of the Amudarya were studied, the calculated calculations were used and recommendations for the use of gabion structures to strengthen the river banks were developed.

Keywords: riverbed, depth of stream, width of stream, flow velocity, radius of curvature of stream, spur, dam, gabion structures

1. Introduction

Recommendations have been prepared based on the study of changes in the hydraulic parameters of the river under conditions of water flow in the Amudarya. As a result of the study, new computational connections were obtained for the hydraulic parameters of the riverbed under adjusted water flow conditions. The calculation of the hydraulic parameters of the riverbed bank reinforcement and the riverbed is given below.

2. Materials and methods

In the design of hydraulic structures on the river (adjustment, protection, etc.), the hydraulic calculation of the riverbed is developed.

Hydraulic calculations include the width of the channel, the average and maximum depth of the flow, the average and maximum speed, the radius of curvature of the channel, and so on. should be set and produced for.

Object of researches. Hydraulic calculation is performed in two stages:

Stage 1 is the collection and processing of preliminary basic data (determination of the calculated water consumption corresponding to the water supply, setting the granulometric composition of turbid sediments, setting the average slope of the river along the longitudinal section).

Step 2 - Perform hydraulic calculations for the width of the direct stream, the average and maximum depth of the flow, the average and maximum velocity of the flow, the radius of curvature of the stream, and other parameters.

During the implementation of the first stage, it was established that the calculated water consumption is provided in accordance with the normative documents. The slope of the longitudinal section of the riverbed measured under natural conditions and the granulometric composition of turbid sediments were determined.

3. Results and discussion

In the second stage, the hydraulic parameters of the channel were set using the new calculated connections obtained for the adjusted conditions of the water flow:

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The width of the stream is according to the following formula [2]:

$$B = 10\left(\frac{Q}{\sqrt{gi}}\right)^{0,37} d^{0,075} \quad (1)$$

Average flow depth [2]:

$$H_{cp} = 200\left(\frac{Q}{\sqrt{gi}}\right)^{0,15} d^{0,625} \quad (2)$$

here Q - calculated water consumption 5-10 supply, m^3/s;

i - river slope;

d - average diameter of turbid sediments, m;

B - the width of the stream, m;

H - average depth of flow, m.

We assume the maximum flow depth for the straight-line sections of the channel as follows:

$$H_{\max} = (1,2 - 1,4) H_{cp} \quad (3)$$

The average flow rate is determined by the following formula:

$$V_{cp} = \frac{Q}{\omega} = \frac{Q}{B \cdot H} \quad (4)$$

The maximum speed is taken as follows:

$$V_{\max} = (1,2 - 1,4) V_{cp} \quad (5)$$

For the design of the terrace, areas of the river with a straight line or low curvature of the river are selected. Under adjusted water flow, low water consumption is carried to the lower basin throughout the year, and the river is divided into permanent and temporary flowing parts. Between the terraces there are new curves of the river, where the river is meandering (figure 1).

The radius of curvature of the new channel is set according to the following formula [3]:

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$$R = 150 \frac{Q^{0,35} \cdot d^{0,125}}{(\sqrt{gi})^{0,35}} \quad (6)$$

here Q - water consumption 60-75 supply, m^3/s.

Longitudinal dams and culverts will be constructed in the area where the curvature of the permanent watercourse is completed to prevent possible coastal erosion. It is envisaged that the banks of the river will be strengthened to prevent dams and shoreline washes in the curved areas of the river.

Short spurs are recommended in construction to strengthen the banks. These spurs have the effect of protecting the shores and reducing the flow rate, serving to dissipate the energy of the strong current.

The spurs are built of local soil, the slopes on both sides are reinforced, and the front is protected by stone.

The length of the spurs is 10-30 m. accepted.

The width of the spore surface is -8-10 m.

The spacing of the spurs is set according to the following formula [1]:

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$$L = \frac{L_{ш}}{tg\,(\beta + \varphi)} \quad (7)$$

here L – length of spurs;

β = (0-30^0) – probability angle of circulating flow;

φ = (8-10^0) – the angle of propagating current.

To facilitate the calculation, Table 1 shows the values of the distances (m) between the spurs, based on formula (7), the different lengths of the spurs and the angles of rotation of the stream.

Table 1. Length values for distances between spurs.

The length of the spurs, м	$tg\,(\beta + \varphi)$		
	9^0	19^0	29^0
10	65	30	15
20	125	59	36
30	190	89	55

Rock sizes for shoreline reinforcement vary in diameter, from 0.3 to 1.0 meters. The width of the pavement should not be less than 1.5 meters, the average size of the pavement will be from 0.5 to 3 layers.

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3. Results of analysis on the plan-forms

We can accept the use of a gabion structure to protect the shores from erosion. The gabion structure is made of nerjavik wire mesh (Figure -2). Small stones can be used for flooded gabion boxes. It is required that the stone dimensions (0.7-0.8) not be larger than the dimensions of the mesh boxes. Gabion structures should also be able to withstand maximum water consumption. The layout of the individual elements of gabion structures and spurs is shown in Figure 2.

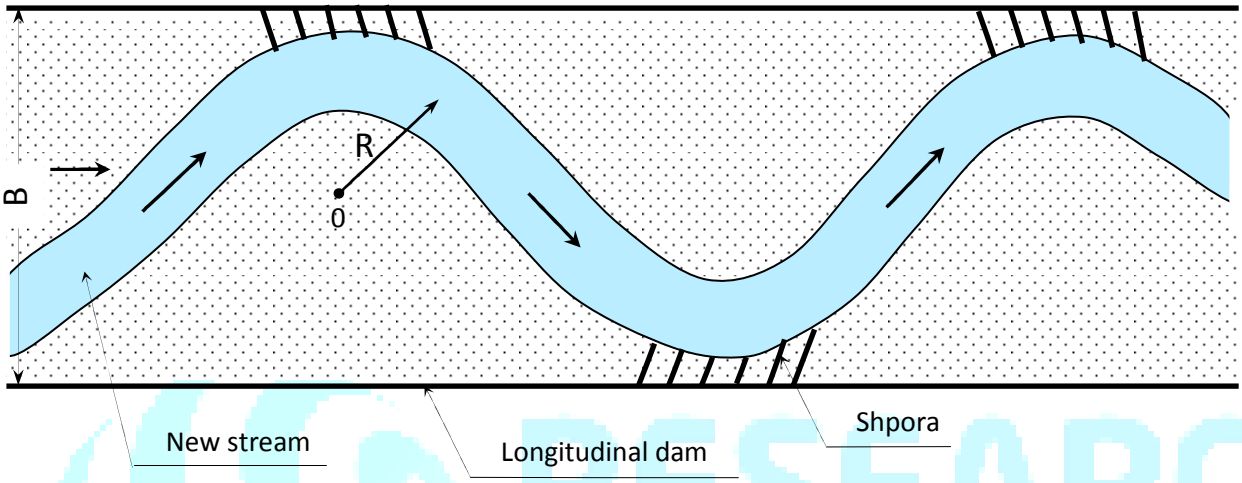

Figure 1. General scheme of the adjusted riverbed.

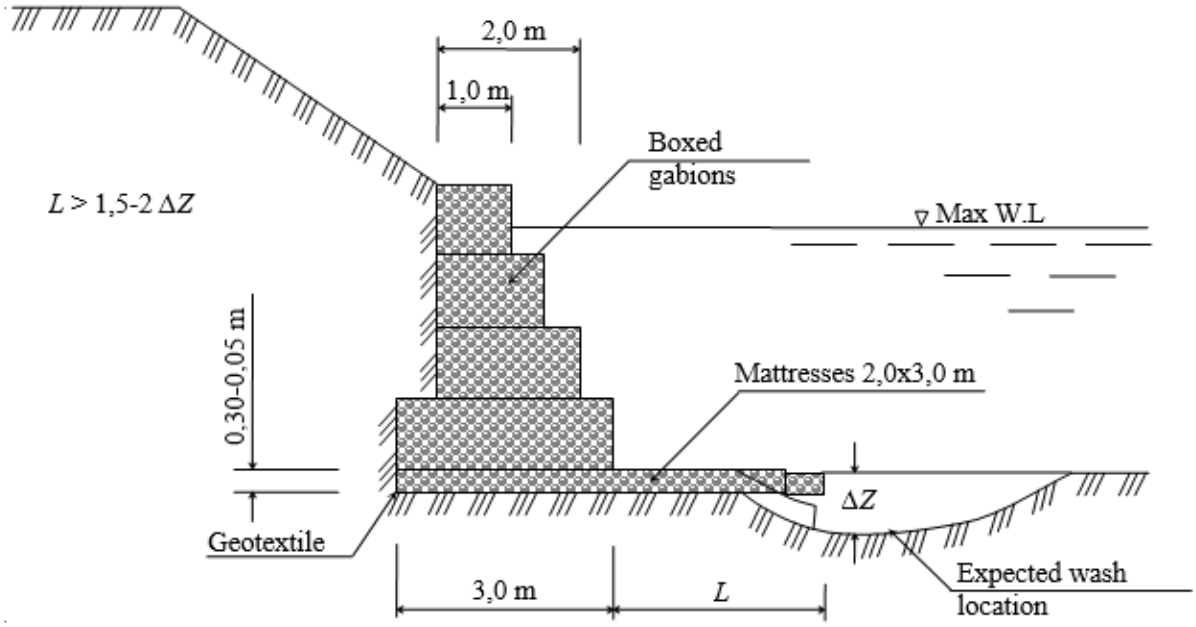

Figure 2. Scheme of shore protection through gabion construction.

4. Conclusions

In conclusion, it should be noted that the recommendations on hydraulic calculation of the riverbed and protection of river banks in the conditions of adjusted water flow in the Amudarya improve the permeability of the river in the lower reaches of the Amudarya and create safe conditions in floodplains,

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protect crops from floods. - It is expedient to use in the construction of embankments and the development of coastal protection measures.

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