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Study of Fishery Importance of the Kuban River Basin

Bakshtanin Alexander Mikhailovich [a], Zhukova Tatyana Yurievna [b]
Federal State Budgetary Educational Institution of Higher Education "Russian State Agrarian University - Moscow Agricultural Academy named after K. A. Timiryazev, Institute of Land Reclamation, Water Management and Construction named after A.N. Kostyakov, Moscow, Russian Federation
bakshtanin@rgau-msha.ru, t.zhukova@rgau-msha.ru

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Abstract: Objective. This study was aimed at studying the variant of fish passage and fish protection structure to prevent obstacles to fish passage for spawning and to reduce environmental impacts from construction of small hydroelectric power station. Materials and methods. Fish protection structure is necessary to prevent young fish from rolling down into the water intake of the diversion channel and dying in hydroelectric units of small hydroelectric power station. Fish protection complex includes fish passage structure of the ladder type with marching chambers, rest chambers and fish protection structure. Results. The analyzed principle of fish protection structure operation is based on operation of vertical jet generator with horizontal nozzles creating high-speed flow. Two variants of fish protection structures are considered: mobile and stationary. Conclusions. The Kuban River is of great importance for fisheries, therefore it is necessary to take into account the impact of the construction and operation of a small hydroelectric power station on the fish stocks of the Kuban River basin and to provide for fish protection complexes during the construction of the hydroelectric power station dams.

[a] https://orcid.org/0000-0001-9307-0865
[b] https://orcid.org/0000-0002-9654-3039

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1 INTRODUCTION

Republic Karachay-Cherkessia has significant potential hydroelectric use drain rivers mountain And foothill zones North Caucasus. Development of this directions Now not enough developed. IN The Republic of Karachay-Cherkessia experiences a significant deficit of electric energy and capacity during the autumn-winter low water period. The republic's main supply electric power capacities is being carried out transmission parts of the capacities from neighboring areas.

Recently, intensive construction of new mountain-climatic facilities has been planned. centers tourist directions, requiring significant additional electrical energy resources. Solid fuel supply of thermal power plants in this region is limited by the lack of such resources and environmental consequences. It should be noted that it is planned to build a small diversion hydroelectric power plant located on the discharge channel of the hydroelectric power plant located upstream. In this case, capital costs are reduced cost on device expensive settling tanks And large retaining hydraulic structures. Due to the significant difference in terrain along channels rivers Kuban succeeds to provide required pressure on hydroelectric power station hydroelectric units. Installed capacity The small hydroelectric power station is planned to be equal to 63.5 MW. It is being designed fish pass And fish protection buildings For preventing obstacles to fish spawning and reducing environmental impacts from the construction of a small hydroelectric power station in the region. River Kuban has important fisheries meaning, necessary consider impact construction And exploitation small hydroelectric power station on fish reserves of the Kuban River basin and provide for fish protection complexes during the construction of hydroelectric dams.

2 MATERIALS AND METHODS

The fish protection complex of a small hydroelectric power station is designed from fish-passing and fish-protecting structural elements. The fish protection complex is intended for: passage of salmon (trout) and carp (Terek barbel, etc.) fish species into the upper pool of the hydroelectric power station to spawning grounds during their mass spawning run; organization of safe migration of fish species and their young back into the lower pool of the hydroelectric power station; protection of fish living in the upper pool of the hydroelectric power station or rolling downstream and zooplankton from getting into the water intake of the hydroelectric power station diversion channel. The fish protection complex includes a fish-passing structure of the ladder fish ladder type with flight chambers and rest chambers and a fish protection structure. The said fish protection complex is included in the hydraulic structures of the small hydroelectric power station. The hydraulic structures of the fish protection complex and their equipment are operated in accordance with the relevant technical documentation and instructions of the small hydroelectric power station operation section.

The ladder fish pass is located on the spillway dam. The upper head of the fish pass is built into the spillway dam at the point where it adjoins the spillway. The upper part of the fish pass, starting from the upper head, passes over the spillway spans and the sludge discharge and goes beyond the concrete structures of the hydroelectric complex . The lower part of the fish pass is made in the soil of the right bank of the river and has two zigzag sections. The lower head of the fish pass is located at a distance of 1 m from the right-bank wall of the spillway span. The total length of the fish pass is 153 m and consists of 38 chambers - 35 flight and 3 rest chambers. The fish protection structure is necessary to prevent juvenile fish from rolling down into the water intake of the diversion channel and dying in the hydroelectric units of the small hydroelectric power station.

3 RESULTS AND DISCUSSIONS

The principle of operation of the fish protection structure is based on the operation of a vertical jet generator with horizontal nozzles that create a high-speed flow - an "artificial rod" in the direction of the spillway or slurry fish discharge, which in this case are fish outlets. An autonomous submersible pump is used as a power source in the jet generator.

Depending on the operating mode of the water intake and, accordingly, various water flows into the diversion channel, the layout and dimensions of the fish protection structure differ. Therefore, with different operation of the head unit, it is necessary to operate two versions of fish protection structures: mobile and stationary.

The maximum flow rate of up to 80 m3/sec passes through the hydraulic structure periodically during floods, in which case the mobile fish protection structure is put into operation, which can move from the head unit to the regulating unit of the junction with the discharge channel of the hydroelectric power station located upstream. The design of the mobile fish protection structure MRZS is two vertical pipes with a diameter of 820 mm and 325 mm, installed under the NPU. The pipe of a smaller diameter, connected to the pump, is located inside the pipe of a larger diameter with an eccentricity of 177.5 mm and is equipped with a row of nozzles with a diameter of 20 mm with a pitch of 145 mm.

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The outer pipe has a bell at the bottom for water intake and a vertical slit on the side 3 m high, 0.05 m wide and 0.7 m long (mixing chamber). The speed of water flow from the nozzles into the mixing chamber is about 30 m/sec.

Water intake into the large pipe at NPU is carried out from a depth of 3.5 m at a speed of 1.0 m/s. Water intake into the smaller pipe is carried out from the area closed by a hydraulic screen.

For transit mode, with a flow rate of up to 3 m3/s, a stationary fish protection structure is used. The location of the fish protection structure, when operating the head unit in transit mode, is the water intake head of the diversion channel with a horizontal canopy and its forebay. Considering that in this mode the water flow rates into the water intake openings are significantly reduced, and the transit ones remain at the same values, the operating conditions of the fish protection structure are simplified, and the requirements for its operational parameters can also be reduced. Due to the possibility of operating the water intake not with the entire front, but only with 2 water intake openings, 10 m long, the length of the hydraulic screen - an artificial rod - changes and, consequently, the energy requirements for its creation.

Taking into account the above, the jet generator is made in the form of a vertical water distribution pipe with a diameter of 520 mm, with five nozzles installed on it: two main ones with a diameter of 120 mm, and three additional ones with a diameter of 50 mm. The local volumetric hydraulic core is created by a system of water jets flowing out of the jet generator nozzles, including two functional rows: main and additional. The jet generator is installed on the central bullhead of the water intake under the cover of a flow-directing vertical threshold. Pressure water is supplied to the jet generator from a submersible pump installed in a vertical pipe with a diameter of 720 mm and fed from a protected water area located in the antechamber of the water intake. To reduce possible clogging of the pump suction, it is equipped with a louvered water intake grate and an additional jet generator with a diameter of 89 mm. The installation diagram of the fish protection structure is shown in Figure 1.

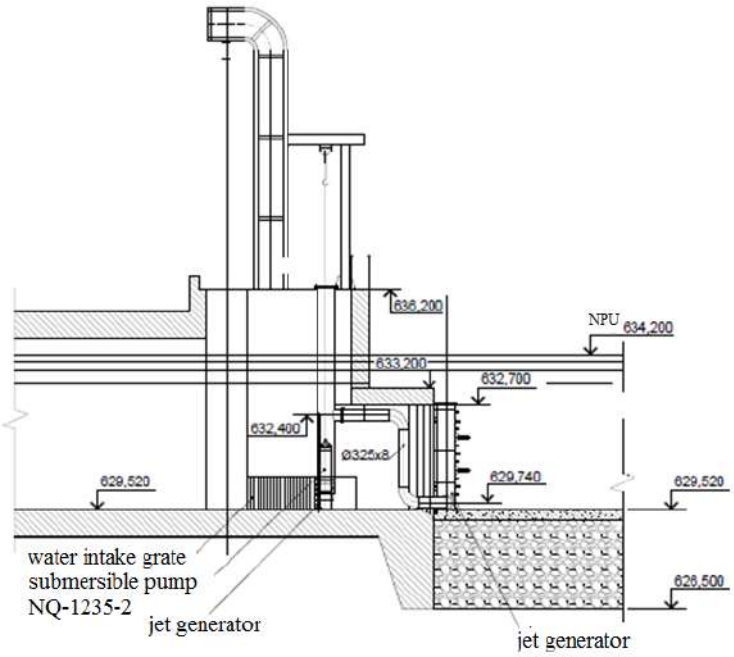

Figure 1: Installation diagram of a fish protection structure.

Depending on the timing, duration, intensity and nature of the downstream migration, as well as the size and species composition of the downstream migrants, the operation of the jet generator that forms water jets can be periodic, corresponding to the intensity of downstream migrations. When operating the fish protection system, it must be finally determined during its adjustment to the working position and testing.

4 CONCLUSIONS

In conclusion, it can be concluded that recently there has been an intensive construction of new mountain-climatic centers for tourism, which require significant additional resources of electric energy. The Republic of Karachay-Cherkessia has

significant potential for hydropower use of river flow in the mountain and foothill zones of the North Caucasus. It should be noted that it is planned to build a small diversion hydroelectric power station located on the discharge channel of the hydroelectric power station located upstream. Fish passage and fish protection structures are designed to prevent obstacles to the passage of fish for spawning and to reduce the environmental impact of the construction of a small hydroelectric power station in the region. The hydraulic structures of the fish protection complex and their equipment are operated in accordance with the relevant technical documentation and instructions of the small hydroelectric power station operation site.

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