

**INSPECTION OF THE TECHNICAL CONDITION OF THE KHACHKAB
HYDRAULIC SYSTEM AND RECOMMENDATIONS FOR INCREASING
THE RELIABILITY OF THE STRUCTURE**

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Annotation. The irrigation system of the Shakhrud canal is a large irrigation system of the Bukhara region, irrigating the entire left bank of the river. Zarafshan in the Bukhara oasis with the exception of the Abumuslim canal system. The Khachkab hydroelectric complex (water divider) is located in the middle reaches of the Shakhrud canal, which receives water from the Duaba water complex on the river. Zarafshan. Hydromechanical equipment - there are no DPZ and limit switches, on the 3rd gate there is no horizontal connecting shaft that connects the right and left lifting screws of the gate. Supply channel - inspect the bottom of the supply channel in the absence of water and draw up a report on the technical condition, and, if necessary, remove silt. Regulator of the left bank Shahrud canal - after stopping the water supply, carry out a technical inspection of the condition of the concrete parts of the structure and draw up a report on its technical condition.

Keywords. Khachkab hydroelectric complex, Shakhrud canal, Regulator, Hydromechanical equipment, technical inspection.

Introduction.

In the period from January 14 to 16, 2022, she carried out an inspection of the technical condition of the Khachkab hydroelectric complex, checked the availability of technical documentation (operating instructions, data on the maintenance of

mechanical equipment, working drawings, reports of previous inspections and other materials).

When performing a survey along the Shakhrud branch, a flow rate of 75.3 m³/s was supplied to the waterworks, and it was distributed through:

- regulator of the right bank canal of the North-Western branch - 42.0 m³/s;
- regulator of the left bank canal Shakhrudskaya branch – 33.3 m³/s.

The Khachkab waterworks complex (water divider) is located in the middle reaches of the Shakhrud canal, receiving water from the Duaba waterworks on the Zarafshan river. The irrigation system of the Shakhrud canal is a large irrigation system of the Bukhara region, irrigating the entire left bank of the river. Zarafshan in the Bukhara oasis with the exception of the Abumuslim canal system.

After the commissioning of the first stage of the Amu-Bukhara canal, most of the Shakhrud irrigation system (49.2 thousand hectares) was switched to irrigation with water from the river. Amu Darya. After this, the Shahrud irrigation system began to be used only by 15-20%, which led to intensive siltation of the Shahrud canal above the Khachkap hydroelectric complex.

The base area of the waterworks is represented by fine soils in the form of loam with an admixture of sandy loam, sand and gypsum. The thickness of the fine earth is 3-8 m. Under the fine earth lie pebble-gravel-sand deposits with a thickness of 20 to 25 m. The depth of groundwater is 3-5 m, the outflow of groundwater is difficult. The filtration coefficient of fine earth is 0.04-0.5 m/day. The depth of groundwater is 3-5 m, the outflow of groundwater is difficult. The filtration coefficient of fine earth is 0.04-0.5 m/day. The Khachkab hydroelectric complex was built and put into operation in 1965. The main purpose of the hydroelectric complex is to serve as a water divider between the North-Western branch and the Shahrud Canal. The operating organization is the Amu-Bukhara Basin Department of Irrigation Systems. The command area of irrigated land is 59.36 thousand hectares. The capital class of the hydraulic system is II.

Method.

The hydroelectric complex includes: supply channel; regulator of the left bank canal Shakhrudskaya branch; regulator of the right bank canal North-Western branch; a siphon through the old bed of Shahrud on the North-Western branch in the downstream of the regulator.

The supply channel of the Shahrud canal, 10.989 km long, is a canal in an earthen channel that starts from the Kuyumazar pumping station. In the area of the Khachkab hydroelectric complex, the bed of the Shakhrud canal is designed to pass 110.0 m³/s. The depth at the waterworks is 5.20 m.

Regulator of the left bank Shahrud canal - the regulator consists of a three-span panel box 19.0 m wide, 6.2 m long and 5.2 m high. Each span is blocked from above

by a diaphragm 2.2 m high. Therefore, all spans are blocked by flat wheeled bottom gates of the size 5.0 x 3.0m. The valves are adjusted by electrified twin-screw lifters. The spans from the upper and lower tails are equipped with sander grooves, which allows for repair work when passing water for irrigation. Monorails and manual winches are installed on the structure.

On top of the panel box there is a service bridge 1.35 m wide. It also serves as a cable channel through which power cables are laid to the lifts. The panel box with the downstream is connected by a rectangular box with diving walls, with the upstream one diving retaining wall and the other reverse. There is no road crossing through the waterworks. Behind the diving box there is a return filter and a trapezoidal well 30.0 m long with a lining t-15-30 cm. At the end of the well there is a return tooth and backfill with torn stone. The suspended irrigation area is 31.87 thousand hectares.

Regulator of the right-bank canal The North-Western branch-regulator is structurally absolutely similar to the left-bank regulator. The only difference is that the well of the right-bank regulator is connected not to a channel in the earthen channel, but to the entrance to the siphon.

A four-point duker with opening dimensions of 2.5 x 2.5 m. Wall thickness 0.3 m. The length of the duker is 64.0 m. The duker with the upper and lower pools is mated to rectangular boxes with diving walls 12.5 m long, 7 m high .85 m. The lower pool is trapezoidal in shape with slopes of 1.5, 20.0 m long. At the end there is a tooth covered with torn stone. Vehicle passage is provided at the entrance and exit points. All structures of the waterworks are made of monolithic reinforced concrete.

Results and discussions.

As a result of the inspection of the waterworks and verification of the necessary documents, the following was revealed:

Supply channel - it was not possible to examine the condition of the supply channel of the canal due to the passage of water through it.

Regulator of the left bank canal Shahrud - it was not possible to examine the technical condition of the concrete parts of the structure due to the passage of water.

Hydromechanical equipment - no DPZ and limit switches;

On the 3rd bolt there is no horizontal connecting shaft that connects the right and left lifting screws of the bolt;

Due to corrosion, the bolt of the shutter shield is damaged in the form of delamination;

The rubber seal on the valves allows water to pass through, and in some there is no seal at all;

There is no lattice floor covering;

There is no anti-corrosion coating on shutter panels and hydromechanical equipment, as well as on stopper panels;

The gate shields have exhausted their service life and must be completely replaced.

Regulator of the right bank canal of the North-Western branch - it was not possible to inspect the technical condition of the concrete parts of the structure due to the passage of water.

Hydromechanical equipment - no DPZ and limit switches;

On the 2nd bolt, the bearing in the left lifting gearbox is broken, as a result of which the bolt does not rise;

Due to corrosion, the bolt of the shutter shield is damaged in the form of delamination;

The rubber seal on the valves allows water to pass through, and in some there is no seal at all;

There is no lattice floor covering;

There is no anti-corrosion coating on shutter panels and hydromechanical equipment, as well as on stopper panels;

Between the 2nd and 3rd spans of the gates in the upper part of the bullhead there is a crack propagating towards the downstream;

The gate shields have exhausted their service life and must be completely replaced.

Dyker on the North-Western branch - it was not possible to inspect the concrete fastening of the bottom of the water supply pipe of the siphon due to the passage of water through it;

There is a destruction of the fastening of the concrete facing of the slope on the right side;

There is no railing on the upstream and downstream sides, as well as a lattice floor covering.

Observations of settlements and deformations have not been carried out since the construction was put into permanent operation.

Telemechanics and automation at the waterworks are not provided for by the project.

The power supply to the waterworks is carried out from the main line coming from the Kagan RES feeder 2.5 km 10 kV with a connection to a complete transformer substation 6/0.4 kV located on the left bank 200 m from the control room building. There is no backup line and diesel generator.

There are no rules for the technical operation of the Khachkab hydroelectric complex. Availability of an action plan in an emergency situation - there is no regulation approved in the Ministry of Emergency Situations of the region on action in an emergency situation. Availability of a land allocation plan - A state cadastre was not compiled for the hydroelectric complex. The territory of the hydroelectric complex

does not have a fixed contour of the water protection zone; there are only installed gates.

Based on the results of the inspection of the Khachkab hydroelectric complex, its technical condition is assessed as working, but to increase the reliability of the structure

Conclusions and recommendations.

Supply channel - inspect the bottom of the supply channel in the absence of water and draw up a report on the technical condition, and, if necessary, remove silt.

Regulator of the left bank Shahrud canal - after stopping the water supply, carry out a technical inspection of the condition of the concrete parts of the structure and draw up a report on its technical condition.

Hydromechanical equipment

Install DPZ and limit switches;

Install the missing horizontal connecting shaft on the 3rd bolt, which connects the right and left lifting screws of the bolt;

Replace the rubber seal on the valves, and, if possible, replace the valve shields themselves;

Install the grated floor covering;

Apply anti-corrosion coating to all mechanical equipment.

Regulator of the right bank canal of the North-Western branch - after stopping the water supply, carry out a technical inspection of the condition of the concrete parts of the structure and draw up a report on its technical condition.

Hydromechanical equipment

Install DPZ and limit switches;

Replace the bearing on valve 2 of the left lifting gearbox;

Replace the rubber seal on the valves, and, if possible, replace the valve shields themselves;

Install the grated floor covering;

Apply anti-corrosion coating to all mechanical equipment;

Between the 2nd and 3rd spans of the gates in the upper part of the bullhead, install beacons between the spreading crack and monitor its opening. Dyker on the North-Western branch - to inspect the concrete part of the siphon after disconnecting and pumping water from it and draw up a report on its technical condition. Carry out local repairs to the damaged concrete facing the slope on the right side. Install the missing railing on the upstream and downstream sides, as well as install a lattice floor covering.

Other: secure a water protection zone around the hydroelectric complex, establish reliable communication with the operation department, complete the archive of the operation service with the missing design documentation, create the necessary emergency stock of materials according to the approved list, develop and approve in

the Ministry of Emergency Situations of the region a regulation on action in case of an emergency, develop rules for the operation of a waterworks, taking into account the accumulated experience and modern requirements, develop an action plan in an emergency. With the participation of representatives of the State Inspectorate, conduct an inspection of the actions of the waterworks operation service in an emergency.

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