ASSESSMENT OF CHANGES IN THE GEOLOGICAL ENVIRONMENT DUE TO TECHNOGENIC IMPACT (FOR EXAMPLE, DASHOGUZ REGION)

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Abstract

Nature of technogenic impact depends on the nature of development of territory and the design features of structure. In accordance with this, type of construction, type of structure and technology of operation are selected as signs of typification. These signs determine the scale of changes in the geological environment (regional or local) and their nature (areal, point or linear). The greatest regional changes occur during reclamation measures that cause the processes of flooding and secondary salinization of lands, which everywhere leads to activation of subsidence process. Reservoirs and sections of large main water pipelines are associated with the flooding of large depressions in the relief and, as a result, formation of a vast zone of groundwater backwater and flooding, for example, Lake Sarykamysh, located in the north in the Dashoguz region.

Keywords: geological environment, construction, flooding, technogenic impact, irrigation, groundwater level

The area of human geological activity is the geological environment - the upper part of the earth's crust and the outer shells of the Earth. The geological environment is formed as a result of a complex and long-term interaction of the outer shells of the Earth under the influence of endogenous and exogenous forces. The totality of all types of human impact on the geological environment is called technogenesis. These impacts are primarily engineering and construction, agricultural, industrial, hydraulic engineering and other industries. The technogenic impact of man is always directed at a certain area of the earth's crust and causes consequences due, on the one hand, to the properties and processes of this part of the geological environment and, on the other hand, the nature and intensity of the impact on it.

The nature of the technogenic impact depends on the nature of the development of the territory and the design features of the structure. In accordance with this, the following are selected as signs of typification the type of construction, the type of structure and the technology of operation. These signs determine the scale of changes in the geological environment (regional or local) and their nature (areal, point or linear) [4]. The greatest regional changes occur during reclamation measures that cause the processes of flooding and secondary salinization of lands, which everywhere leads to the activation of the subsidence process. The flooding of large depressions in the relief and, as a consequence, the formation of a vast zone of groundwater backwater and flooding, for example, Lake Sarygamysh, located in the north in the Dashoguz region, is associated with reservoirs and sections of large main water pipelines [1].

Local changes in the geological environment are caused by industrial and civil construction and the development of mineral deposits. The construction and operation of roads and railways activates aeolian and suffusion processes - an example is the Aksu-Babadurmaz section on the foothill plain of the Eastern Kopetdag. Features of the geological structure, relief, hydrogeological and engineering-geological conditions, climate - all this, together with the technogenic impact, determines the nature and degree of changes in the geological environment.

In terms of area, the greatest regional changes under the influence of various ameliorative construction occurred on sandy loamy alluvial plains along large rivers (Etrek, Tejen, Murgap) and along the Garagum Canal (along the foothill plain of the Kopetdag). The most intense changes also occur in the deltas of large rivers, for example, the Amyderya, which has a low natural outflow. Changes in the geological environment in the Aral Sea region caused by a decrease in the level of the Aral Sea and partial drainage of its bottom are distinguished into independent types. This led to the formation of a saline desert, the salts of which are constantly blown by the wind. A significant part of the territory of Turkmenistan is covered by this process.

Self-flooding is inherent in almost all cities, caused by large volumes of water consumption, changes in the natural pathways of groundwater flow, imperfect technology of production processes, and possibly low quality of utilities.

In the areas of industrial enterprises, the degree of pollution of surface and ground waters is also high. Along the routes of highways and railways, power lines and pipelines, environmental changes are associated with the destruction of the upper soil layer, the development of deflation and subsidence processes, the intensification of linear erosion, soil and groundwater pollution [4]. The regional northwestern direction of the groundwater flow (from the Amyderya River to the Caspian Sea) controls the nature of flooding and salinization of the territory, which reaches its maximum in oases (groundwater comes to the surface). In the foothill plains with good drainage, the changes are, of course, less pronounced.

Loess rocks in flooded zones have been significantly changed, where they have lost one of their main properties - subsidence. On irrigated lands, subsidence processes are maximally developed and are accompanied by the formation of sinkholes and subsidence cracks. Drainage water discharges from the Kopetdag Foothill Plain into the Garagum Desert poison biocenoses of the desert, entail pollution of groundwater and surface watercourses over a large area. Intensive development of the country's territory at the present stage of management has led to profound changes in the geological environment, which are manifested at the local and regional level and depend on the nature and type of technogenic impact. Some regions are already experiencing the results of the irreversible changes that have begun. For example, this is primarily the Aral zone, which includes the Dashoguz region [1]. In connection with the problem of the drying up of the Aral Sea, the processes of drying and salinization of lands, degradation of the ecological situation, a significant deterioration in the quality of drinking water continue, in this regard, an extremely unfavorable epidemiological situation is developing in this region.

In geological activity, underground waters produce a more destructive effect than constructive [3]. So, destructive activity is manifested in dissolution and leaching, which increase with increasing temperature, pressure and content of acids and alkalis in water. First of all, halogen rocks, chloride, sulfate, carbonate, and also sulfide deposits are exposed to the destructive action of ground and surface waters.

The location of Turkmenistan inside the mainland determines the sharp continentality of the climate, which manifests itself in large daily and annual fluctuations in meteorological factors. The territory of the country belongs to the drainless basins of the Aral and Caspian Seas, belongs to the geographic zone of extratropical deserts of the northern hemisphere and has a general inclination from the south-east to the north-west. This region belongs to a zone with a very arid climate, which directly affects all components of the natural environment, including groundwater.

Groundwater, due to its relatively easy accessibility, is of great importance for the national economy as a source of water supply for industrial enterprises, cities, towns, settlements in rural areas, etc. They are characterized by a constant inflow, accumulate both in loose porous and solid rocks [3]. The depth of the GWL depends on the nature of the relief and human economic activity, the intensity of which has increased significantly in recent decades. On the territory of Turkmenistan, the depth of the GWL table varies from 0 to 100 meters or more. Groundwater with a shallow depth of occurrence is widespread in irrigated areas, which are confined to the main waterways of the country. So, along the channel of the Garagum river, the waters occur at depths from 1 m to 3-5 m. As the distance to the Kopetdag mountains and the sands of the Garagum desert increases, the depths of the GWL increase. In the valley of the Amyderya river, the depth of groundwater on the left bank ranges from 2 m to 3 m, on the right bank of the river and in the central part of the Dashoguz oasis up to 5 m. In the southeastern and northwestern directions from the Amyderya delta, the depth of the GWL increases, reaching 100 m and more meters [1].

In Tejen, Murgap and Serahs oases, located within the deltas of Murghap and Tejen, the depth of the GWL is 2-6 m. As the distance from river valleys increases, the depth of groundwater naturally increases, reaching values over 40 m in the Central and Low-lying Garagum. Deep bedding of GWLs are confined to the sandy massif of the Amyderya -Murgap interfluve, to the Kopetdag mountain-fold structure, the Koytendag mountain massif, the Big and Small Balkans and the Badhyz-Garabil Upland, where the depth to water reaches 50-70 meters and more. The underground waters of the foothill plain of the Kopetdag are uncovered at depths of 10 to 20 m and more.

Under conditions of an arid climate, due to the short duration of the fallout and the small amount of atmospheric precipitation, as well as the weak drainage of the area, the groundwater runoff does not develop; in the expenditure part of the groundwater balance, evaporation prevails and their salinization occurs. Near rivers, reservoirs, reservoirs, etc., groundwater is largely desalinated and, in terms of quality, can meet drinking water standards. Groundwater in most of the territory of Turkmenistan is characterized by high mineralization, reaching 50 g/dm^3 or more (mineralization is the sum of all minerals dissolved in water, expressed in grams of absolutely dry residue obtained by evaporation of 1 liter of water). Deposits of fresh (up to 1.0 g/dm^3) and slightly saline (up to 3.0 g/dm^3) groundwater are relatively few in number [1].

Engineering and construction activities of a person and other man-made causes change the natural regime-forming factors and contribute to the emergence of new ones, this is how an artificial (or disturbed) regime of groundwater is formed. Human activity can manifest itself in an increase or decrease in GWL, in a change in their chemical composition, flow rate and temperature.

Under the influence of anthropogenic factors, the GWL can rise by 10-15 m and more. On irrigated areas, due to the seepage of irrigation water into the soil, the GWL rises everywhere. This leads to transpiration (increased evaporation) of groundwater and an increase in their mineralization, therefore, irrigation systems are not designed in our country without the use of drainage. The lowering of the groundwater level is caused by prolonged pumping of water for water supply, drainage of wetlands, construction dewatering, drainage and other methods. The more intensive the work on the extraction of water from the bowels of the earth, the greater the depth of the GWL decreases [2].

The water resources available in the region are limited and, if an increase in irrigated lands is necessary, water should be released through more rational water management on the lands of existing irrigation. At the same time, the task of mobilizing water resources for watering the drained coast of the Aral Sea and stopping the desertification of the Amyderya river delta should be solved. Consequently, in the near future, a reduction in water supply to already developed areas should be expected. Changes in the water regime in the developed and developed territories should also be reflected in the change in the level and salinity of groundwater. It can be expected that the introduction of water-saving technologies in the developed areas will entail a slight decrease in the maximum GWL, but the average depth of occurrence will remain less than 3 m.

The degree of groundwater mineralization in irrigated areas with a weak degree of drainage will in most cases increase, and the ratio of the components will remain unchanged, except that the share of hydrocarbons may decrease. In quantitative terms, the increase in mineralization will depend on many local factors and, first of all, on the initial degree of mineralization and the level of artificial drainage. For areas where groundwater salinity is 1-3 g/dm^3, it can increase to 3 g/dm^3 with a transition from weak sulfate aggressiveness to aggressive discharge (sulfate ion content is more than 800 mg/dm^3).

In areas of new irrigation with a groundwater depth of 10-15 m and more, as a result of a sharp increase in recharge during irrigation, the groundwater horizon will rise until a steady state is achieved, the level of which will be determined by the outflow conditions. The areas planned for irrigation are alluvial-deltaic plains and the periphery of fan cones, which have very difficult conditions for groundwater outflow. Therefore, here over a number of years, the average annual GWL will consistently increase until the "critical depth" (2-3 m) is reached, at which the process of intensive evaporation of groundwater begins to operate and the artificial drainage system begins to work, providing land reclamation well-being [1].

Based on the experience of irrigation of territories similar in hydrogeological conditions: the deltas of the Tejen, Murgap, and Amyderya rivers, the average annual increment of the GWL should be expected to be of the order of 1 m. decrease to 5 g/dm^3, water will retain high sulfate aggressiveness). When the level of "critical" depths is reached, further dynamics of mineralization and aggressiveness of water will depend on the system of reclamation measures.

The conditions for the guaranteed outflow of groundwater in the areas of new irrigation can be created in the upper parts of the fan fans on the Underkopetdag foothill plain when water is pumped from the Garagum river by machine. Here, the rise of the GWL will be limited by an increase in their outflow to the periphery of the fan and will not reach the "critical" depths. At the periphery of alluvial fans, an increase in the inflow of groundwater that does not have a regional runoff will cause swamping of the discharge zone with high sulfate aggressiveness, if measures are not taken in a timely manner to build vertical drainage systems or to intensively exploit fresh groundwater above the discharge zone.

Regional trends in the development of exogenous geological processes in the coming decades will be primarily associated with the drying up of the Aral Sea: increased desertification and salinization. Flooding is common in all large irrigated areas. The process of flooding will intensify in connection with the construction of irrigation facilities and the rise of the GWL, which will lead to secondary soil salinization, therefore, the main reclamation measures will be land leaching and the construction of a collector-drainage network.

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