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Influence of groundwater extraction on river flows and the surrounding ecosystem

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Influence of groundwater extraction on river flows and the surrounding ecosystem.
Change of hydro-geological conditions and the conditions of environment connected with them? One of the most adverse consequences of the large centralised operation of underground waters coastal (riverine) water fences. Such situation is predicted on the Permilovsky deposit reconnoitered for water supply of Arkhangelsk.
The projected water fence was planned in a valley of the river of Vajmugi on its left coast. The predesigns spent on hydrogeodynamic of model of a deposit, show that as a result of operation of underground waters the damage to a drain of the river Vajmuga approximately equal of a water fence that leads to a considerable shallowing of the river, especially during its periods , up to a drain total disappearance on a water fence site is formed. On the average, on territories of a deposit expenses of the river concerning natural state can be reduced more than to 50 %.
Reduction of a river drain will lead to considerable negative consequences in environment, including:
- changes in surface runoff, reduced groundwater levels, inhibit vegetation and changes in plant communities, draining wetlands, changing soil moisture conditions, a decrease of spring runoff, damage to forestry;
- earth's surface subsidence, damage to streets and roads, buildings, structures and communications, drainage wells, the development of karst processes and suffosion;
- the formation of deep depressions, capturing several zones of water exchange, which could lead to mixing of water of different chemical composition and mineralization of the runoff into surface water bodies, increase the nitrogen content in groundwater;
- discontinuity separating the layers and the increased vulnerability of groundwater and surface water, the action of man-made agents.
The aim of this study was a preliminary study of alternative schemes of exploitation of underground water deposits, in which damage to river flow, essentially inevitable, will be minimized.
The alternative scheme provides reduction of productivity of the basic water fence during the periods critical aquaticity. During these periods, for preservation of volume of water giving, the additional (compensatory) water fence is entered into operation. Settlement remoteness compensatory water fence is defined by a condition that for rather short-term period (in low flow) water fence works, its hydrodynamic influence did not reach the river and basic water fence. At the same time, during the periods high aquaticity when compensatory water fence does not work, stocks horizon on the area of its depression should be restored completely.
For use of this scheme it is necessary to define the periods of an inadmissible damage to a drain during which reduction discharge of the basic water fence both use compensatory water fence, and operational loading basic water fence and compensatory water fence during the periods of their teamwork is required. Is minimum admissible expense for the given territory should be defined after the special ecological analysis. For tentative estimations 2 variants are considered: 1) in the river of Vajmuga, in a water fence alignment, the expense not below 25 % from minimum low-flow natural size all-the-year-round should remain; 2) on a water fence site in the river the expense not below 25 % from mid-annual size should remain.
For both variants the periods of reduction of productivity of the basic water fence are proved and introductions in operation of the compensatory water fence. Have been calculated values of reduction of productivity of the basic water fence, its new discharge and as discharge of the compensatory water fence. It is received that discharge of the basic water fence should be reduced to 35 and 37 % for the first and second settlement variants accordingly. The quantity of knots of chinks and their arrangement stole up in the course of modelling.

It is as a result received that at use of the given scheme, the drain of the river of Vajmuga does not reach values below the critical. On model it is received that at work of the compensatory water fence the funnel is formed local depression, and settlement falls of levels do not reach basic water fence and the rivers. It means that operation of the compensatory water fence does not influence a river drain and is provided drawdown capacities aquifer horizon.

Result of the performed work was the proof of basic possibility of the alternative scheme of operation of underground waters on a deposit at which change of a drain of the rivers will have admissible limits and will not cause essential changes of ecological conditions of territory as a whole.