since year 2000 the dams in Kungur have became the experimental area for the application of different reinforcing technologies. For the first time in Permsky Kray the following dam reinforcement technologies were applied:

- gabions;
- geoinjection of slopes,
- different biotechnologies (as cocas mesh, boimates, etc.),
- wave energy diminishing copes.

The gabions were designed using the technology of the "Mackaferry Gabions" Company (Italy). Fixing of the sliding slopes were performed via geoinjection method , which was proposed by "Gabions" Company (Russia, Perm). This method was applied for the wet slope for the first time On the dams of our region the boimates of "Mackaferry Gabions" have being successfully applied. Currently they are one of the main technologies of low-crest dam slope fixation, especially for the dams exposed to active surface water influence. These biotechnologies are used all around the world.

The Iren river dam in Kungur built in 2005 can be regarded as an example of a protecting flood wall. Its length amounts to 330 m. It provides protection against the flood for 531 houses with the popularity 3000 people. The prevented damage amounts to 332 million rub.

In some cases especially having a new building development, the protection against floods is fulfilled with soil filling. But this method is economically sound only if the embankment is not very high. The cost of this work usually is two or three times higher than the cost of the protecting dams.

In practice a method of river channels clearing is used. Depositions of wood and sandy silt material affect the water-transmitting capability of the Sylva river and this has resulted in a bad river shallowing. The channel clearing decreases a flood level, reduces the stream bank erosion and overgrowing of shallows, increases the river water quality.

Conclusion

The most radical way of flood protection is to regulate the flow with water storages. Reducing the flood damages is achieved by the redistribution of the flow in time. The water storages specially built up for the flood preventing, are constructed with the help of the dams of different height and length. For their arrangement artificial and natural hollows are used. A routing channel between the river and a detention pond is build to route flood water to and from the detention pond during high and low (water) flow respectively. The channel has constructions for regulating its transmitting capacity.On rivers which have wide flood valleys anti-flood storages are constructed –of a river or lake-river type, or a range of storages on the main river and its feeders. When projected, the designing of variants of location, water marks and operating conditions, the effectiveness of water storage construction is required. Water storages can become a reason of numerous negative processes – karst, erosive, hydrochemical, hydrobiological that can change the naturally developing nature system. Therefore a thorough investigation of the whole complex of questions is required. Any attempt of an isolated solution is doomed to failure as it doesn't lift the threat of a flood, but either intensifies it or leads to new negative consequences.

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RAISING THE EFFICIENCY OF ENGINEERING SURVEY AS ONE OF THE WAYS OF ENVIRONMENTAL PROTECTION

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Caring about nature is a motto of the modern world. The most significant events under such logo are meetings, protests, and attempts to recover from already done mistakes. At the same time, one should not forget about preventing the environmental degradation under human activity. Sometimes damage caused to the nature is not clearly seen or is not significant itself; however, accumulating, even small environmental damages may result in a huge problem.

Mankind regularly affects the environment by building houses, factories, roads, communications, etc. And before building, it carries out engineering surveys. During those surveys wells are drilled and rock samples are taken, which damages so-called geological environment. Thus, even if a piece of land appeared to be not appropriate for building, environment is already breached. For example, during the projecting of trans-Siberian oil pipeline the surveys, to be exact, deforesting was already started before the project was approved. Later, the project was changed under the society pressure, but what about deforested lands?

It is understandable, that we can't refuse from building at all, but we can try to minimize damage that is caused to our planet. An alternative for standard methods of engineering survey are geophysical ones. Geophysics studies physical properties of rocks, such as elastic waves speed, specific electrical resistance, radioactivity, etc. In this case surveys may be carried out not only in wells, but on the surface. For those purposes the surface of the area is laid out with profiles and pickets, and then a recipient and a source of a certain kind of signal is set up. In such method as seismic prospecting a source lets out elastic waves (due to a shock or ultrasound), which go through rocks and reach a recipient in a certain time. Basing on the data from seismic recipient a time section of the area is plotted and then it is mathematically transformed

into depth section. Later, a specialist-interpreter reforms depth section into geological one. The more experienced such specialist, the more precise his forecast about geological structure and physical properties of rocks for the area, and on the base of this particular forecast a decision about building is made.

The word “forecast” is not used occasionally here. A problem to define geological structure and physical properties of rocks on the base of geophysical data is called forecasting because in this case we can’t see what’s under our feet in real. However, using standard methods there are no 100% guarantee in precision as well, otherwise it is required to dig out all area’s surface.

Back to geophysical methods, it’s appeared that to solve the problem of forecasting effectively enough, it is required to know values of two rock properties [1, 2]: elastic waves speed and density. The last one may be evaluated by different methods (e.g. density gamma-method or laboratory measures, in which case comparatively less amount of samples is required).

Researches showed that the forecast based on those two properties matches real geological structure of the area not less than 80%, which indicates the efficiency and perspectivity of such approach. This forecast became possible due to such method of intellectual systems as expert systems, which are systems based on knowledge of experts in a certain subject. Knowledge in those systems are represented according to specific models. In the described experiment a rule-oriented model was applied, when knowledge is represented as a set of rules “if-then” [1, 2].

Applying expert systems is caused by the fact that knowledge and experience of a specialist-interpreter play the major role, as it was already told before. Expert systems allow to accumulate and to use the experience of specialists in engineering geology and geophysics instead of starting from the scratch when expert is substituted with a young specialist, who has no practical experience yet. In this case experimental expert system is able to play its role of interpreter on 80%.

It is necessary to note that the precision of 80% is not a limit so far. In the future it is necessary to carry out further researches, and first of all, it is necessary to make a detailed rocks classifier based on two properties: elastic waves speed and density. It is possible that one more property – specific electrical resistance – should be used, because electrical prospecting is one of the most popular geophysical methods, as well as seismic prospecting. As to the rocks classifier, it will be a value itself, because it will unite the knowledge of engineering geologists and geophysicists for one purpose – to protect the nature. Such engineering survey will reduce the damage caused to the environment by human activity.

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