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METHOD OF GEORADIOLOCATION IN COMPLEX SCIENTIFIC APPLIED RESEARCHES

Abstract. In this articleare presented results of geophysical studies condition of low-pressure dams wastewater reservoir «Sorbulak», ponds and reservoirs right discharge channel «Sorbulak». For production survey used of a multi-purpose radar "Oko-2" (manufactured by LLC "Logis" of the RF) with field computer type "notebook". GPR sensing results were treated by the processing system «Geoscan 32». The results conductedof geophysical studies show that the application of the georadiolocation method as part of a complex scientifically applied research allows one to unambiguously solve problems in determining: lithological section of the study site, both from the water surface and from the surface of the earth; zones of moisture saturation; zones of soil decompaction; sections of soils with broken structure; depth and relief bottom of water bodies; depth of underground communications.In comprehensive overview analysis of the results engineering surveys, GRL-sensing unambiguously shows the ways of concentrated and directed filtration, spatial position and size of landslide bodies, level of groundwater within the depths of the study.
Keywords: method of georadiolocation, georadar, geophysical research, GRL-sensing, applied research.

To date, thanks to the use of one of the unique and modern geophysical instruments - georadar, which provides the opportunity to work, so-called, environmentally non-destructive method of subsoil research in various structures [1] successfully solved a wide range of tasks, laid down in the principle of its operation. GPR method is based on the study of reflection artificially generated electromagnetic impulses from the boundaries of media having different electrical properties - dielectric permittivity and electrical conductivity. The frequency of the electromagnetic field used in the GPR is typically in the range 10^7-10^9 Hz. These frequencies are considerably higher than frequencies used in electromagnetic geophysical classical methods, which allows increase much detail studies, but limits the depth method. The attenuation of the electromagnetic field depends, first of all, on the frequency and electrical conductivity of the medium in which this field propagates. The lower the frequency and the lower the electrical conductivity, the more electromagnetic pulses penetrate into the medium [2].

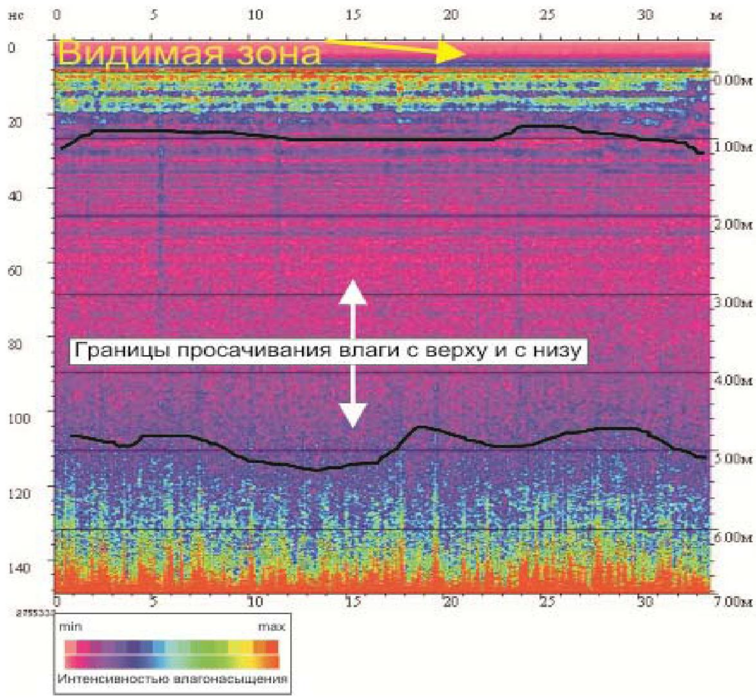
Since 2012, Institute of Hydrogeology and Geoecology, in the process of carrying out scientific, applied and engineering-technical complex studies uses the method of GRL sounding [3].

In the second half of 2012 and in 2013, geophysical studies were carried out on the condition of low-pressure dams «Sorbulak» wastewater reservoir and the ponds and reservoirs of the right discharge channel «Sorbulak». The method of carrying out the work was determined by the technical specification [4] of the hydrotechnical and geomorphological conditions objects research. For production of research, artists used a multi-purpose radar "Oko-2" (manufactured by OC "Logis" of the RF) field computer type "notebook". Processing of the results of georadar sounding sounding was carried out with the help of the processing system "Geoscan 32" [5].

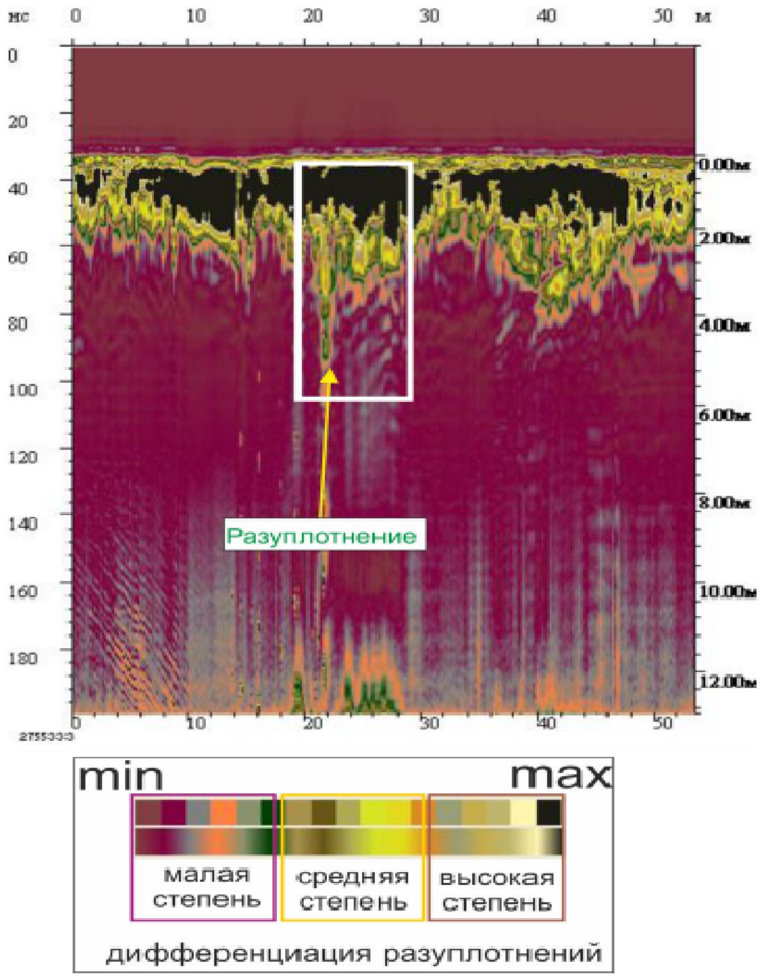
Following the reconnaissance surveys was decided to conduct GRL-sensing in the system of the two longitudinal profiles, one of which is located on the boundary of the dam crest and adjoining upstream slope and second longitudinal profile is located at the border ridge and the adjacent downstream slope. Longitudinal profiles supplemented dam system of transverse profiles that match the piezometric target.An example of the arrangement of geophysical profiles is shown in picture 1. GPR surveys were used for the following tasks (picture 2, 3):

– lithological dissection of the section;
– determination of the boundaries of moisture saturated soils;
– assessment of soil filtration properties;
– determination of groundwater level;
– suffocation changes;
– definition of zones of directed and concentrated filtration;
– distance between pickets is standard, equal to 100 meters.

Picture 1 – Schematic layout of geophysical profiles on the 1st dam wastewater reservoir«Sorbulak»



Picture 2 – An example of saturation zones isolation moisture in the dam body 1 according data GRL-sensing



Picture 3 – An example of saturation areas decompaction in the dam body 1 according data GRL-sensing

After processing and isolation of interference waves, the results of sounding were interpreted on the obtained radar patterns.

The research results obtained during GRL-sensing element dams №1 and 2, supplemented system radarogram transverse profiles coincide with the target piezometric showed:

1. Lithology dams № № 1 and 2 has a uniform consolidated character. The zones of soil decomposition and associated flows of concentrated filtration, both on longitudinal and transverse soil profiles, were not detected;

2. On radargrams of the upper horizons of all sections in the depth range from the surface and up to 0,5 m there is a zone of increased moistening, which is due to precipitation precipitated the day before. The layer of precipitation falling in the form of rain in the previous two decades of October amounted to about 15-20 mm.

3. In the lower horizons forming dams №1 and 2, at depths from 4,5 to 5,0 m there is a zone with increased soil moisture, coinciding in most cases with the position of the piezometric curve.

It also indicates the position of the piezometric levels determined synchronously with the geophysical investigations (GRL-probing). The distance between pickets is 100 m.

In the process of scientific and applied research to study and identify the causes of flooding of communal and industrial facilities in the city of Zhanaozen and development of recommendations for localizing negative impact of groundwater discharged in 2015-2016, geophysical work was carried out using the GRL-sensing method to determine actual lithological structure of soils and their engineering-geological characteristics, revealing direction, character of watering and the presence of ways of concentrated filtration [6, 7].