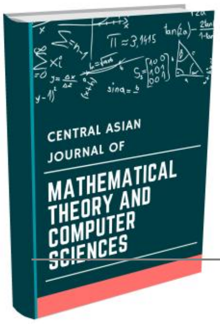


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# DRAINAGE AND GROUND WATER LEVEL REDUCTION

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***Abstract***

*In this article, prevention of underground water entering pits, ditches and work sites, treatment of ditches and trenches with the help of open drainage when the flow of groundwater is small, artificial lowering of the water level before starting work if the water flow and thickness of the aquifer are large, open drainage pumps information on water absorption from pits or trenches is provided.*

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**INTRODUCTION:**

When organizing excavation works in areas located below the level of underground water, it is necessary to ensure drying of water-saturated soil and carrying out work under normal conditions.

In addition, it is necessary to prevent underground water from entering pits, trenches and workplaces during their work.

An effective technological method to solve such problems is to eliminate groundwater.

When the flow of groundwater is small, ditches and trenches are treated using open drainage, if the flow of water and the thickness of the aquifer are large, the water level is artificially lowered before starting work. Open drainage is used to draw water from pits or trenches with the help of pumps.

Open drainage groundwater is directed to specially placed pits on the sides and bottom of the pit, from where water is sucked by diaphragm or centrifugal pumps.

Pumps are selected depending on the water input and the water input is calculated according to the formulas for the stable movement of groundwater.

Drainage ditches are installed at a depth of 1...2 m with a bottom width of 0.3...0.6 m and a slope of 0.01...0.02 m depending on the depth.

- Open drainage is a simple and inexpensive method of dealing with groundwater, but it has a serious technological drawback. Flows of underground water flowing through the walls and bottom of pits and trenches dilute the soil and release small particles from it to the surface. As a result of such washing, this method has a number of important disadvantages:
- the natural strength of the excavation base is reduced due to its erosion by water flow;
- the presence of water at the bottom of the pit makes it difficult to remove the soil;
- it is required to fasten the walls of the pits;

- inflow of water into the water collecting ditch may cause weakening of the foundation of the buildings and structures located next to the object under construction.

In cases where the drainage is not appropriate, the artificial lowering of the underground water level (Water reduction) is used.

Dewatering ensures that the groundwater table is below the depth to be excavated later.

Lowering the groundwater level involves pumping the groundwater with submersible pumps or drilling wells located close to the trench. As a result, the level of underground water drops sharply.

It will be possible to reduce the water to maintain the integrity of the trench and prevent the removal of soil from under the foundations of nearby buildings.

Several more effective methods have been developed to artificially reduce water, the main of which are needle filter, vacuum and electroosmotic. The needle filter method of artificially lowering the level of underground water consists of a filter element (needle filter) at the bottom, a water collecting collector on the surface of the ground and a pump working with electric current.

Steel pipes are embedded in the soil along the perimeter of the pit or along the trench. The needle filter consists of two types: a filter block and a filter tube (needle filter diameter 40.....50 mm).

The filter element, in turn, consists of an inner tube and an outer tube. This pipe is surrounded by wire on the outside, reinforced with filtering and protective nets.

Drilling wells are used to bring needle filters into working condition in complex soils, into which needle filters are lowered. (at a depth of 6-9 meters).

In sandy and loamy soils, needle filters are immersed by washing the soil with pressurized water up to 0.3 MPa.

Under the influence of its own weight, the needle filter sinks into the ground, and in the process of sinking the pipe, the annular valve closes the gap between the outer and inner pipes. After the needle filter is immersed in the working depth, the space around the pipe is partially filled with soil, sand or gravel.

After the entire system is in suction mode, the ball valves of the needle filters rise up under the influence of vacuum and close the hole, while the poppet valve goes down and opens the way for water.

Needle filters with a one-story arrangement allow the groundwater level to drop by 4...5 meters to 7...9 meters in a two-story arrangement.

Needle filters are placed at a distance of 0.5 meters from the edge of the pit or trench. Narrow trenches with a depth of up to 4.5 meters and a width of up to 4 March are drained with a row of needle filters, and with a larger width and depth - with two rows.

The distance between the needle filters is determined depending on the characteristics of the soil and the depth of lowering the groundwater level. For medium-grained soils with a filtration coefficient of 2...60 m/day, the distance is taken within 1-1.5 meters, in sandy gravel soils, the distance is reduced to 0.75 meters. The needle filter device consists of needle filters that are sunk into the ground along the perimeter of the pit on one or both sides of the trench. On the surface, the needle filters are connected to the pumping unit through the water collector. When the pumps operate in suction mode, the water table in the needle filters and the surrounding soil layers decreases, which leads to the formation of a new water table called a depression curve.

The vacuum method of lowering the water level is based on the use of ejector water lowering devices. These devices are used to reduce the level of underground water in silty sands, loams, with a filtration coefficient of 0.02-1 m per day. In vacuum dewatering devices, a vacuum is created in the filter zone with an ejector needle.

The ejector device is used to pump underground water to a depth of 15-20 meters. The optimal conditions for the operation of the ejector are 8...18 meters. When the column falls to the required level, an internal pipe with an ejector is lowered into it. During operation, water is supplied to the ejector nozzle under a pressure of 0.75...0.8MPa in the annular space between the inner and outer pipes.

The water flow from the ejector nozzle creates a vacuum in the annular space and sucks water from the main working pipe. As a result of a sudden change in the speed of movement of the working water, a vacuum is created in the nozzle, which ensures the absorption of underground water.

Groundwater mixed with working water rises up under the action of the suction pump and flows into the circulation tank.

The absorbed water is discharged from the water reservoirs through pipes to the outside of the construction site.

The phenomenon of electroosmosis is used to expand the scope of application of needle filters in soils with a filtration coefficient of less than 0.05 m per day.

In this case, along with needle filters, steel pipes or booms are buried at a distance (0.5...1 meters) from the well points on the sides of the pit and at a uniform depth. Needle filters are connected to the negative (cathode) and tubes or rods are connected to the positive (anode) pole. The electrodes are arranged in a checkerboard pattern. The distance between anodes and cathodes is assumed to be uniform within 0.75...1.5 meters.

Welding machines or mobile transformers are used as the power source.

The power of the direct current source is determined from the current of 0.5 -1 A required for 1 m2.

Under the influence of electric current, the water in the pores of the soil is removed and the needle moves towards the filters.

Due to electroosmosis, the soil filtration coefficient increases 5...25 times. The use of each of the above methods to reduce the level of groundwater depends on the thickness of the water layer, soil filtration coefficient, earthworks and construction site parameters.

## CONCLUSIONS

The decision to choose a method should also be justified from the point of view of environmental protection and ecological safety of the object under construction. The use of devices to artificially lower the water level requires solving environmental problems. First of all, this requires the use of environmentally friendly technologies that do not allow the contamination of groundwater by harmful substances.

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