USING A MATHEMATICAL MODEL TO EVALUATE THE ECONOMIC AND ENVIRONMENTAL DAMAGE CAUSED BY THE FLOODING

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There are destroyed materials of underground communications; swampy areas, inundation of underground facilities of industrial and residential buildings as a result of flooding process. This leads to emergence of mosquito, development of fungi, toxic fumes in the air that adversely affects the health of the population and leads to significant material losses. Moreover, accidents of the sewer systems and increased infiltration from the surface have led to significant contamination of the upper horizons of groundwater, reduction of drinking and household water reserves.

Created mathematical model allows to evaluate groundwater level changing process and the process of flooding development of the urban territories to consider the credit and debit of the water balance of groundwater. On the data of groundwater level changing it is possible to evaluate future environmental and economic damage caused by flooding process.

We are accepting the following conditions for the mathematical model calculation (Fig.1.):

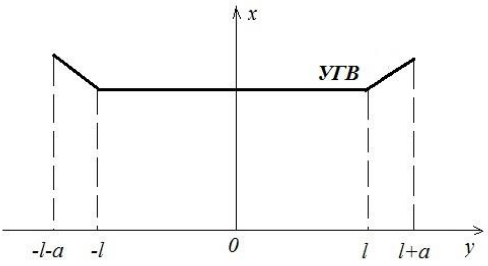

Figure. 1. Symmetric model of the groundwater level changing

The case of a flat filtration has been considered in the paper.
Filtration pressure equation:

$$\frac{\partial^2 h}{\partial x^2} + \gamma^2 \frac{\partial^2 h}{\partial y^2} = 0$$

The lateral inflow and outflow are equal have been accepting in the paper because of performing of the modeling process for small areas of urban territory (industrial objects, buildings etc.).

$$\left.\frac{\partial h}{\partial y}\right|_{l+a,-l-a}=0 \begin{cases} \left.\frac{\partial h}{\partial y}\right|_{x=l+a}=0 \\ \left.\frac{\partial h}{\partial y}\right|_{x=-l-a}=0 \end{cases}$$

The initial level is taken as the starting point, *h=0*:

$$\left.h\right|_{x=0}=0$$

There is no infiltration, water withdrawals, transpiration and evaporation processes at a distance *–l ÷0* and *0÷l*, because of pavement in this area of territory:

$$\left.\frac{\partial h}{\partial x}\right|_{-l\le x\le l}=0$$

Infiltration, water withdrawals, transpiration and evaporation processes are occur at the distance *a*:

$\left.\frac{\partial h}{\partial n}\right|_{l\le y\le l+a} = f_1+s_1-g_1-d_1-k_1$, где f_1 – the function of additional infiltration to groundwater; s_1 – function of precipitation; g_1 – function of transpiration; d_1 – function of evaporation; k_1 – function of water withdrawals.

The future treatment will be concerned on analytical solution of differential equation and implementation on the specific objects for obtaining real results of groundwater level changing and evaluation of prevented environmental and economic damage.

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