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RESEARCH ARTICLE

ON ACCOUNTING FOR EVAPORATION OR INFILTRATION FREE SURFACE IN SOME PROBLEMS OF FILTRATION THEORY

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ABSTRACT

The following filtration flows with unknown free boundaries are investigated: in case of a flow past the Zhukovsky groove in the case when the soil layer is underlain along its entire length with an impermeable base and evaporation from the free surface occurs; in case of a flow past the Zhukovsky groove in the case when the underlying layer is a completely well-permeable aquifer and infiltration occurs on the free surface; when groundwater moves in a rectangular bridge with a partially impenetrable vertical wall in the presence of evaporation from the free surface; when groundwater moves to an imperfect gallery in the presence of evaporation from the free surface.

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INTRODUCTION

Within the theory of the flat established filtering of an incompressible fluid under Darcy's law in homogeneous and isotropic soil some tasks connected with currents in the presence of evaporation or infiltration on a free surface of subsoil waters are considered.

Currents at flow of a groove Zhukovsky: The task about flow of a groove was for the first time studied by N.E. Zhukovsky (1) where Kirchhoff's method altered by it in the theory of streams was used for a solution of tasks with a free surface and special analytic function which is widely used in the theory of filtering is entered. Since function, and a task and a groove bear a name of Zhukovsky (2-6). Work (1) opened a possibility of mathematical modeling of the movement of subsoil waters under Zhukovsky's groove and laid the foundation for researches of the specified class of filtrational currents (see, for example, reviews (2-6)). It should be noted that in tasks about flow of a groove of Zhukovsky application of function of Zhukovsky only then results in effective results when in addition to a free surface the border of area of a current contains only horizontal lines of equal potential and

vertical lines of current (V.V. Vedernikov, F.B. Nelson Furriers, S.N. Numerov, V.I. Aravin, etc.). However in actual practice hydrotechnical construction, (2-5), the irrigated agriculture (2, 4, 7), etc. directly under integumentary deposits along with horizontal pressure head water-bearing layers more high-permeability (7) also horizontal waterproof inclusions often meet that radically affects the nature of filtrational currents (8-12). At the same time so far there are no works devoted to a special research of impact of evaporation or infiltration on filtrational processes. Accounting of these important physical factors for the present did not become broad property of exact analytical solutions. In the presented work on the example of two limit filtrational schemes which arise at flow of a groove of Zhukovsky, the impact of evaporation or infiltration on a current picture is studied. The first limit scheme corresponds to a case when the layer of earth on all the extent is spread by the impenetrable horizontal basis and from a free surface there is a uniform evaporation of intensity ε ($0 < \varepsilon < 1$). The current is provided with water inflow from the left part of a band of flooding with a liquid layer, invariable on time. As the right edge of a band of flooding serves the impenetrable vertical screen in the form of a groove

- The received results give an idea (at least qualitatively) of possible dependence of characteristics of a current by filtering consideration already to the imperfect well or a tubular well.

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