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Modeling of flows and sediment transport in riverbeds associated with the production of non-ore materials

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Growth of capital and road construction in Russia promotes the dynamic development of the non-ore materials market. Its growth rate corresponds to the total construction market growth; it is about 10-15% per year. Non-ore construction materials industry has the following peculiarities: large number of the sandpits with wide variety of their performances - from tens of thousands to several million cubic meters of natural resources and strong connection of mining operations with the processing of natural resources at the sandpit. Most of the sandpits are located along the riverbeds, this makes important the development of the models of the bottom sandpits behavior for the successful planning, implementation and use of new mining sites of non-ore materials accounting for the hydrological and hydrochemical characteristics of the river body. The description of the above processes using traditional two-dimensional hydrodynamic models based on the shallow water equations is not correct since the horizontal and vertical dimensions of the bottom sandpits are comparable. That is why, the solution of these problems within the framework of the shallow water equations is appropriate only for estimate of the change in the velocity of main current and for very rough estimate of the intensity of sandpit spreading. For the correct modeling of the described problems we need to develop the three-dimensional models of flows and sediment transport in rivers. The paper presents the results of the numerical modeling of the processes associated with the production of non-ore materials under complex hydrochemical river regime. The simulation of flows arising in the presence of a sandpit is performed for various values of the river depth and the characteristic dimensions of the sandpit. The characteristics of vortices arising in the pit are determined for various dimensions of the pit and flow velocities. Numerical data on temporal evolution of the sandpit in the water body are obtained.

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