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Assessment Of Inundation Area During Flood Drafts From Water Reservoir.

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ASSESSMENT OF INUNDATION AREA DURING FLOOD DRAFTS FROM WATER RESERVOIR

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ABSTRACT

A big amount of towns within the Moscow region are located downstream of the water reservoirs and territories of the towns are covered by water during catastrophic floods. At present in world practice quite successfully are used HEC – RAS technologies for prediction of flooding areas. Accordingly the main aim of the research is assessment of usability HEC – RAS technology in conditions of spring floods for the Moscow region. The aim has required of solving of next problems:

1. Determination of spring flood hydrograph respecting of normative probability.
2. Calculation of drafts from water reservoir through spillway
3. Research of riverbed characteristics downstream
4. Modeling of flood routing of drafts from water reservoir downstream
5. Verification of the model
6. Assessment of the flooding area downstream.

Water reservoir on the river Ruza was chosen by object of research.

Key words: inundation modeling, program HEC-RAS, r. Ruza.

Methods and materials

Calculation of the flood hydrograph was made on the base of long time series of observed data according to normative Russian method. Calculation of drafts from water reservoir through spillway was made according methods of the approximate integration [1,2] on the base of data about flood hydrograph, morphometric water reservoir characteristics and spillway parameters. Both hydrographs are represented on the fig. 1.

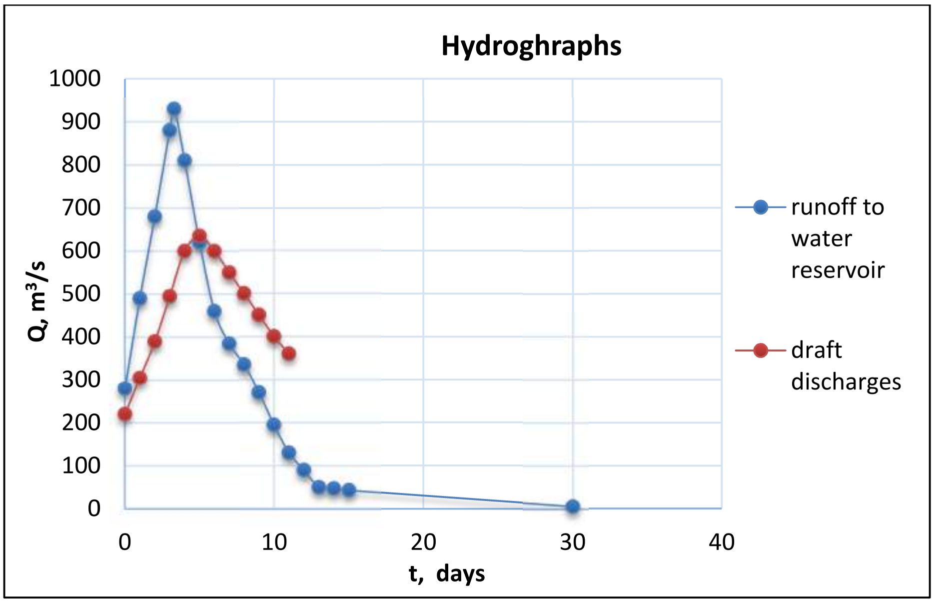

Fig 1. Hydrographs of runoff to the water reservoir and of draft discharges.

We can see with help of figure 1 that maximum discharge of drafts is 630 m^3/s, which defines maximum inundation of territories in the lower reach of water reservoir. Accordantly that discharge used for modeling in HEC-RAS.

Calculation of the water movement in the rivers program HEC-RAS produces on the basis of the topographical, hydrological and hydraulic materials [3,4].

Topographic data provide a description that contains geometry of the River system model, i.e. the width of the bed, cross sectional area, volumes of flooded plains and so on. Hydrological and hydraulic data is the water measurement diagrams and hydrographs, levels, discharges and velocities, marks maximum flood, discharge curves, and so on that used for establishment of boundary conditions in the model.

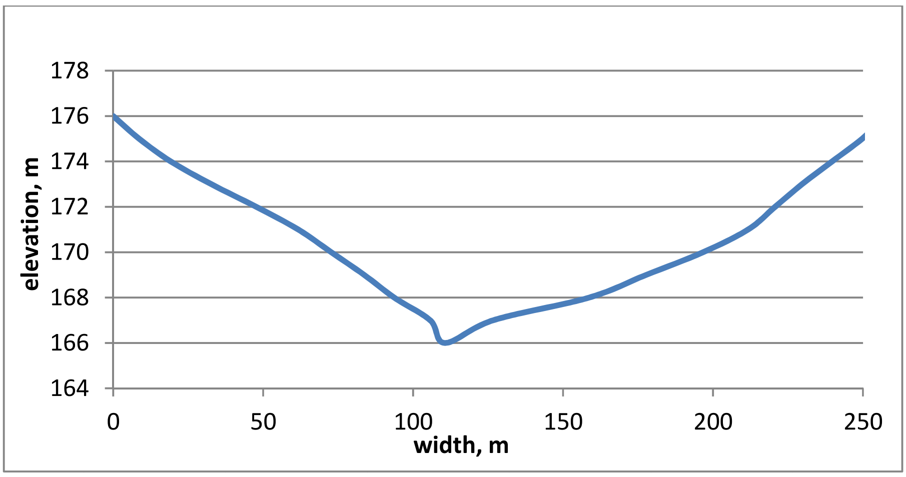

Fig 2. First cross profile of reach.

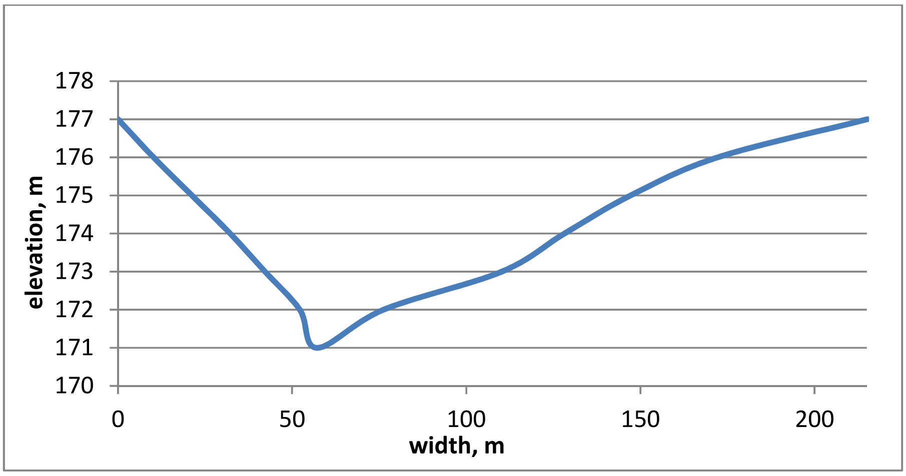

Fig. 3. Last cross profile of reach.

Total amount of cross secessions – 7. At first, the discharges must be entered for each cross section. The input of the boundary conditions requires information of the flow parameters. If subcritical flow is calculated, then the required boundary conditions are necessary for the lower of the stream only. A calculation supercritical flow requires the introduction of boundary conditions at the upper of the stream only. The user needs to put only the external (outside) boundary conditions: a known surface elevation; critical depth; normal depth; the calibration curve. The origin conditions were taken in the view of rating curve which was made on the base of Chezy equation. At first manning's value was defined according to visual observation of river conditions and consequent tables.

Model verification

The verification was made respecting of profile that located downstream approximately 1 km. There are long time series of observation data respect to place of the profile. Two cross sections were chosen for control reach. Rating curve based on observation data was taken for boundary condition. Correspondence between real data and results reached on model achieved by changing Manning's value. The obtained Manning's value was used for main modeling reach.

Results

Results contain hydraulic characteristics of free surface profile, and forecast of flood flow. The obtained model of inundation in the frames of HEC-RAS technology is represented on fig 4.

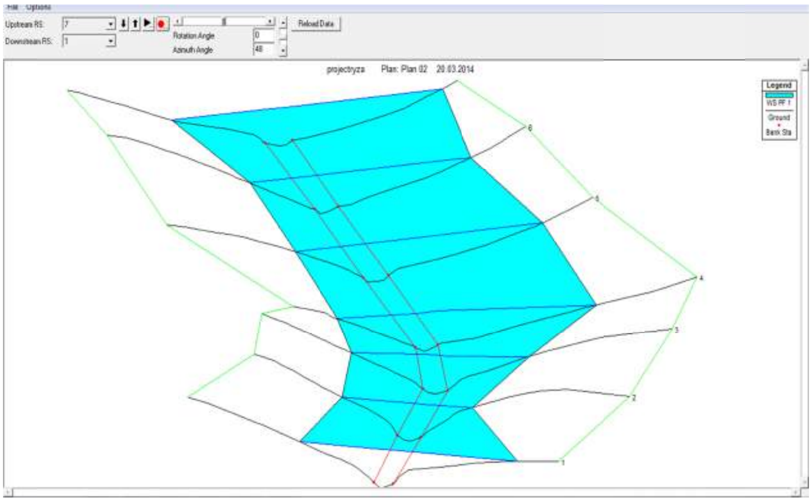

Fig. 4. Flooding model.

Real landscape in the flood condition is represented on fig 5. We can see the settlements are located enough far from territory inundation during spring catastrophic flood.

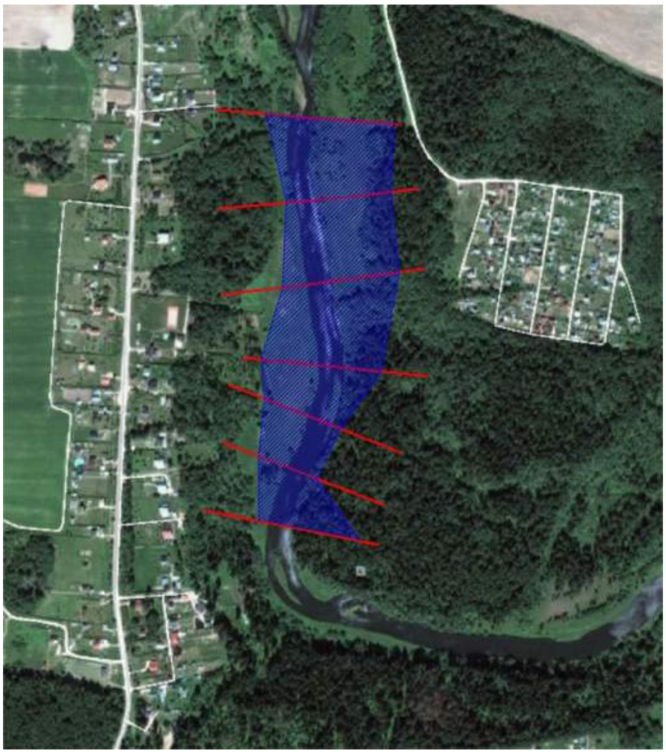

Fig. 5. Map of inundation.

It is necessary to notice that there is place of deformation of riverbed near of second dissection because the river flow has scouring velocities, in particularly near second cross section velocities reach 2.6 m/s.

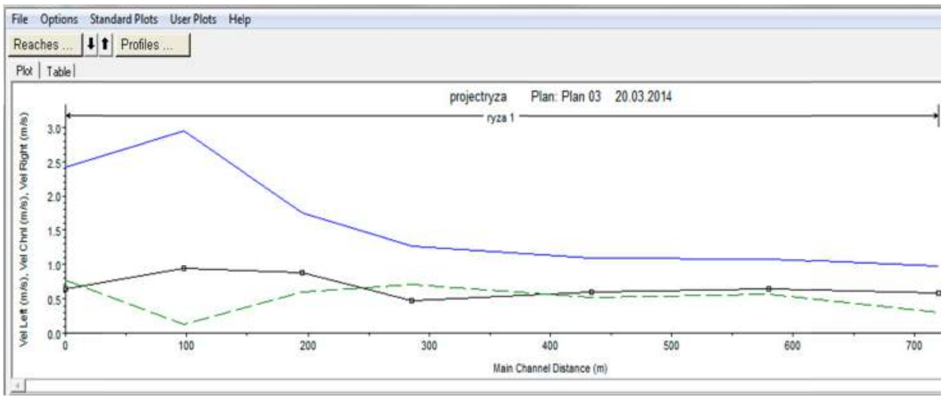

Fig. 6. Changing flow velocity along the reach.

Analyzing results has argued that the model of r. Ruza accurately reflects the hydraulic situation and it can be used to predict the possible effects of the floods.

Standard program of HEC – RAS technologies was used for modeling of flood routing downstream. The model verified by using observed data. The result gives the possibility to determine the canal morphometric characteristics and the territory covered by water during catastrophic flood.

CONCLUSIONS

Technologies of HEC-RAS may be used in conditions of Russian for estimation of inundation territory near rivers.

The riverbed parameters may confirm by solution of inverse problems with help of periodical observation data respect to levels [5].

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