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Research Article

Ensuring Organization of Urban Land Rational Use in the Post-Freshet Period

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ABSTRACT.
The article covers the problem of flooding areas with overflow waters, which ranks first among natural disasters in terms of frequency, the area of distribution, economic, physical and moral damage. The establishment of flooded and high water areas is a special protective measure. It is carried out to prevent the negative impact of water and eliminate its consequences. The results of ecological-functional zoning of the flood zone territory are presented, the main measures for the rational use of urban land in the post-freshet period are proposed. The carried out ecological-functional zoning allows specifying measures for the rational use of land in urbanized areas for each flood zone in the post-freshet period. The necessity and obligatory nature of entering information about the use-restricted zone (URZ) into the Unified State Register of Immovable Property are substantiated.

Keywords: Post-freshet period, Use-restricted zones, Ecological-functional zoning, Rational use, Flooded zones.

INTRODUCTION

The rationality of land use represents such its use, which corresponds to the interests of the national economy development, the most effective in achieving the goals which it is provided for, ensuring optimal interaction with the environment and protecting the land in the process of use. Comprehensiveness and efficiency of land use are determined in accordance with its intended purpose, while rational, comprehensive and effective use will be achieved when there is a solution to the problems of normalizing the interaction of society and nature provided, the solution of environmental problems is scientifically based, providing a way out of environment crisis situations. *Flooding and high water* are the most typical natural phenomena and natural disasters for the Tyumen Region, the causes of which are sudden warming that provokes abundant snow melting, high groundwater levels, and a rather pronounced relief. A high water area is an area covered by water as a result of excess water inflow, compared with the capacity of the channel [1]. In 2016, the largest flooding of the last 40 years occurred in the town of Ishim of the Tyumen Region: 518 residential buildings were flooded, 881 people were evacuated. The freshet had a strong influence on all the properties of alluvial soils, iron and aluminum compounds were washed out and the contamination of drinking water with pathogens occurred [2].

Flooded and high water areas are a kind of use-restricted zones (URZs), which are established in order to prevent threats to the health and life of citizens and their property from various man-made and natural impacts [3]. Information on the boundaries of flooded and high water areas is necessary to be entered in the Unified State Register of Immovable Property in order to establish the types of permitted activities within such zones. Land plots located within the

boundaries of URZs are subject to certain restrictions and burdens with respect to human activities.

It is important to understand that the rationality of land use is determined at the stage of ecological-functional zoning of the territory, the purpose of which is to establish the degree of flooding and further address issues regarding the organization of the urban land use. The author performed zoning of the territory of the Ishim city according to the flooding degree in order to ensure the rational use of land in the post-flood period.

The method of ecological-functional zoning is presented as a diagram in Fig. 1.

Table 1: Flooded zones and area in the city of Ishim

Zone No.	Degree of flooding	Flooded area, [m]	Zone area	
			[ha]	[%]
I	Heavy	Up to 600	832	21
II	Medium	from 600 to 1,000	1,328	34
III	Weak	from 1,000 to 1,500	1,612	42
IV	Flooding risk zone		105	3
Flooding zone total area			3,877	100

The zoning scheme of the flooded area of the Ishim city is presented in Fig. 2.

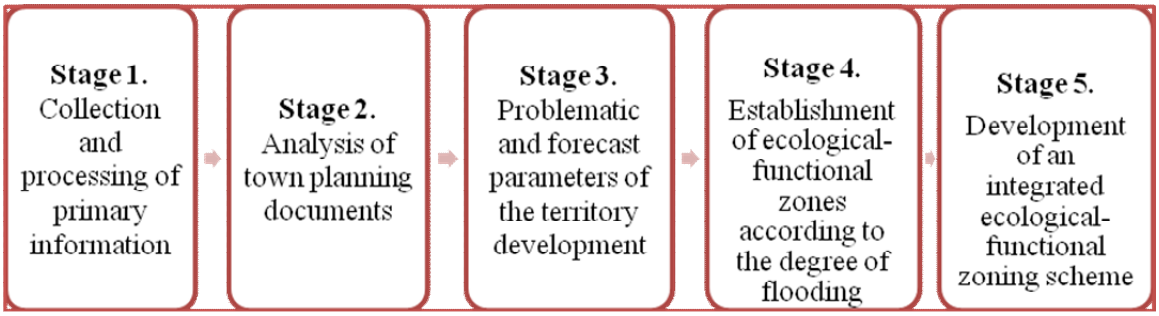

Fig. 1 Methods of ecological-functional zoning of the flooded area.

MATERIALS AND METHODS

In this study, the assessment results of the 2013 flood impact on the physicochemical, chemical and macroelemental composition of alluvial soils in the suburban area of Ishim [4], the soil map and the master plan of the city of Ishim of the Tyumen Region were used as study materials. Abstract-logical, predictive, cartographic, design-constructive, analytical, statistical research methods, the method of analysis and synthesis were used.

RESULTS

The area of Ishim city municipal entity is 6,000 hectares and more than 50% of the urban area is subject to flooding.

As a result of the carried out ecological-functional zoning of the Ishim city territory, taking into account the natural landscape conditions and terrain, three zones were identified according to the degree of flooding and the risk of high water (Table 1).

DISCUSSION AND CONCLUSIONS

The 15 km long zone of heavy flooding is located near the bed of the Ishim River within the city limits. The height of the water rise is 979 cm at the moment of the flood start. This zone is characterized by relatively high frequency and rather high probability of flooding. In case the maximum level of flooding determined by the relief of the zone is exceeded the water spreads to the average and weak flooding zones. Freshet is characterized by a rapid flow of water with a flow rate of 3.5-4.2 km/h. Freshet duration is 12-24 hours.

The zone of average flooding is characterized by the flow speed of 2.0-3.5 km/h. Its length depends on the terrain and water bodies (near the Ishim River, Karasul River, Lake Chertovo), has lower frequency and probability of flooding, a greater area of flooding in relation to a heavy flooding zone. Freshet duration is 48-72 hours.

The weak zone flooding is possible with abnormal changes in the freshet-forming factors (water discharge from the dam, high average annual rainfall, an abnormally high water level

in the Ishim River). The flow rate varies from 0.5 to 1.0 km/h. The frequency of flooding is very low (once in 40-60 years).

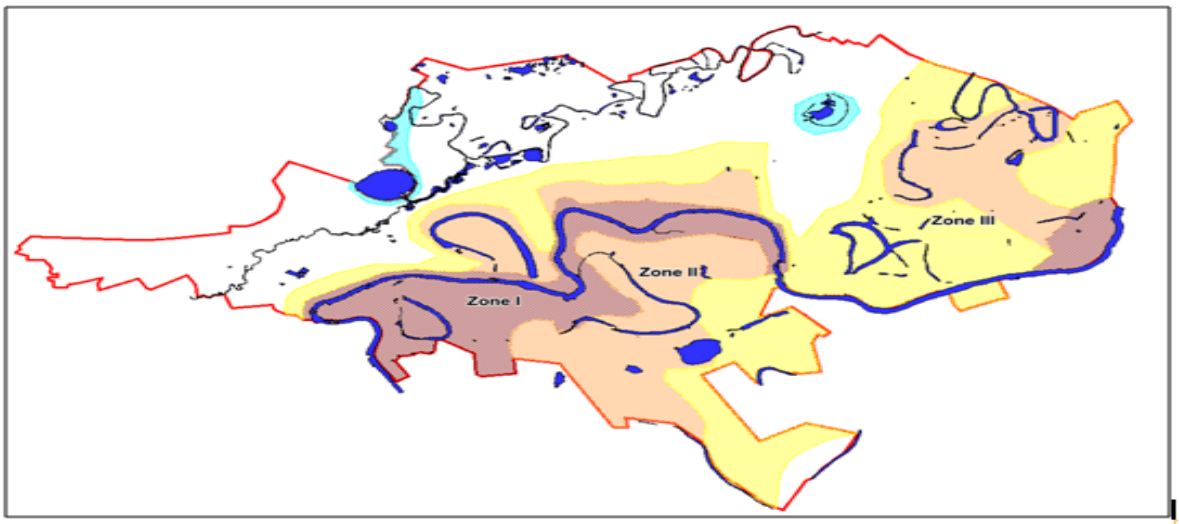

Fig. 2 Flooded zones within the territory of Ishim city.

The flooding risk zone is established provided that water level in Lakes Anikino and Chertovo is exceeded. There is an increased soil moistening during periods of flooding of the territory, which leads to a decrease in its carrying capacity. Basements and underground utilities suffer in the first place. In addition, new and already existing landslides can be attributed as additional consequences of flooding [4]. Cases of karst formation, subsidence of loess soils and swelling of clay soils are not rare. Deformation and sometimes even the complete destruction of underground utilities, buildings and structures occur.

Flooding and high water have a devastating effect on buildings and structures, and the wrong set of flooding elimination measures can lead to flooding of the territory [5]. The destructive consequences of flooding and high water entail financial problems. It is noted that annual damage from the considered processes in the Russian Federation is about 5 billion dollars [4].

The package of measures for the rational use of urban land in the post-freshet period in the Ishim city territory is presented by a diagram in Fig. 3.

The package of measures for rational use of urban land in the post-freshet period in the Ishim city territory should in its very essence be aimed at the possible use of land after the freshet. Firstly, clearly defined types of permitted activities within the boundaries of ecological-functional zones should be legally secured by decisions of the Ishim Administration. Secondly, the boundaries of flooded and high water areas should be mandatory entered into the Unified State Register of Immovable Property for the introduction of a special legal regime and engineering protection systems. Thus, for areas prone to flooding and high water, there is a need to develop basic provisions for land use and development of territories that are located in a flood-hazardous zone, specifying the land allotment rules, construction features and further operation of buildings and structures, as well as setting rules for economic activities implementation.

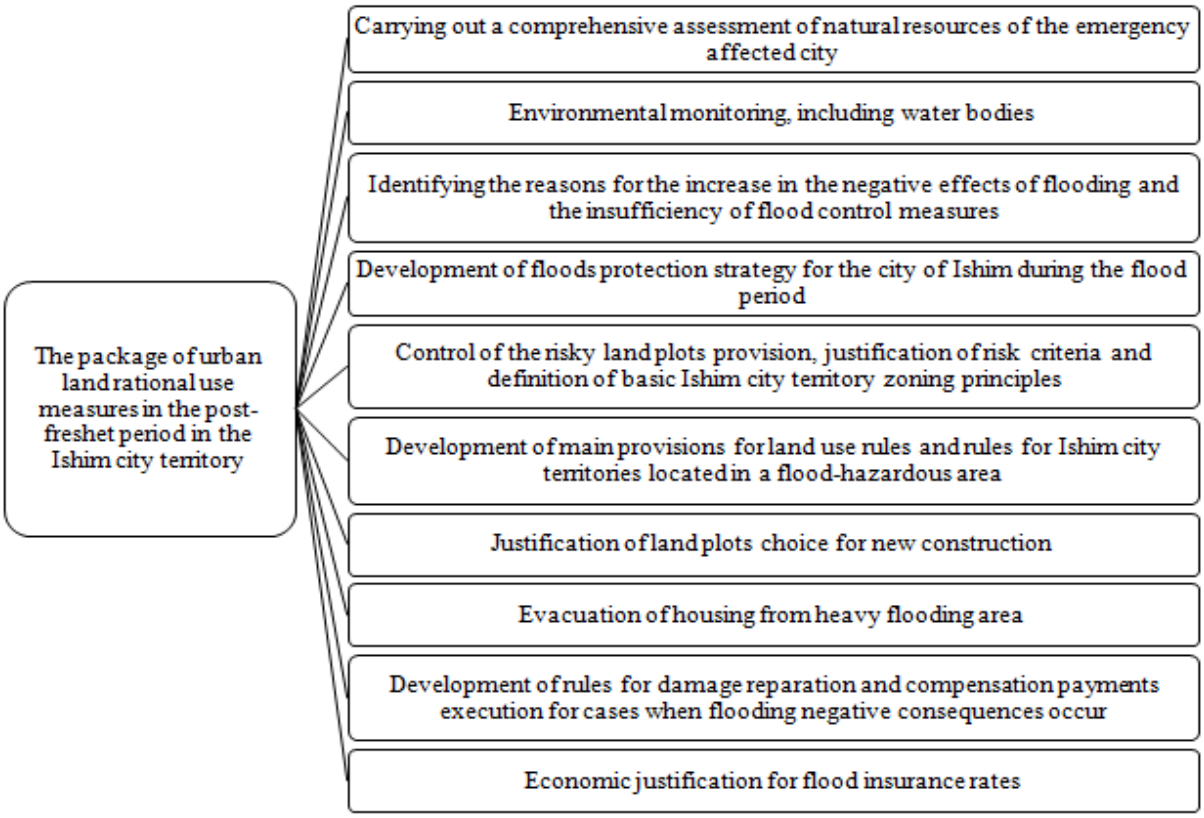

Fig. 3 The package of measures for the rational use of urban land in the post-freshet period in the Ishim city.

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