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### SOME WAYS TO SOLVE THE PROBLEM OF STORM SEWERS FLOODING IN URBAN CONDITIONS

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Rain is, of course, good. As they say, there is no bad weather in nature. But everything is good in moderation. And after the rain, you want to walk along a street free of water, without dirt, without puddles. But unfortunately, this is not always possible.

To efficiently collect and drain water on urban streets, a system of surface and underground drainage structures is needed, which includes elements such as longitudinal and transverse slopes, gutters, rainwater manholes, inspection manholes, collectors, etc. In old cities, the underground drainage system is often in poor condition, leading to significant accumulation and stagnation of water on the roadway, especially during heavy rain. There are design solutions and measures that provide additional drainage in conditions of an underdeveloped underground drainage system. One of the less noticeable but important components of a complex urban infrastructure is stormwater drainage, which is a component of the water supply and drainage system designed for rainwater runoff, for the purpose of cleaning them from contaminants, and further operation or return to a reservoir.

Why do we need stormwater drainage in principle? Any precipitation that is collected from the roofs of buildings through downpipes negatively affects the condition of the soil next to the building. But if damage to plants can be tolerated, soaking of the building foundation is absolutely unacceptable. The principle of operation of stormwater drainage is simple. Rain streams are collected in a line of channels along a flat inclined surface. The point water intake element is a rainwater receiver, which serves to collect water from gutters, watering taps, etc. They are equipped with filters to clean the effluent from debris and built-in traps. With a properly implemented stormwater drainage system, there should be no dirty gushing streams on the streets of the city. Urban soils are evenly and sequentially polluted. Heavy metals are currently the main pollutant of urban soils. They are more or less contaminated

with almost all urban soils. Heavy metals enter the soil from emissions of industrial enterprises, thermal power plants, household waste, and exhaust gases.

The road network of the city is designed for the movement of vehicles as well as for collecting and draining surface water from the urban area. For this purpose, city streets are designed below the adjacent terrain. Water that flows into the drainage grates of the city streets during rain should be efficiently drained by the underground water drainage system.

Currently, the underground water drainage system in many Ukrainian cities is in an extremely unsatisfactory condition. Pollution of stormwater drainage is not the only problem. The increasing number of cars leads to the need to reconstruct (expand) existing streets, create parking lots, sidewalks, and bike paths, which, in turn, leads to a shortage of free soil that absorbs water. As a result, the volume of surface water runoff increases, so it is necessary to increase the capacity of rainwater collectors. However, the installation of a new rainwater drainage system is only possible with the construction of new and reconstruction of existing city roads and streets. At the same time, for small volumes of runoff, it is possible to use structural measures that provide temporary water storage during periods of rain.

Similarly, to prevent the flooding of the territory, part of the surface runoff can be directed to the household wastewater system. The periodic increase in the speed of fluid flow in pipes and their flushing is ensured by receiving some of the surface runoff.

To prevent further growth of negative cause-and-effect relationships and to prevent the drainage problem from reaching a catastrophic level, it is necessary to stop considering it as a local issue. Efforts of all interested parties should be directed towards combating negative phenomena. This will allow eliminating the shortcomings of water drainage and flooding as the main causes of many crisis situations in the urban development strategy of the region, etc.

## References

1. *Inzhenerni merezhi ta komunikatsiyi. CH. II. Vodovidvedennya : tekst lektsiy* [Engineering networks and communications. Part II. Water drainage: the text of the lectures]. Compilers: S.A. Gornostal, O.A. Petukhova, I.B. Fedyuk and O.L. Oliynyk. P. II. Kharkiv : NUCZU, 2019, 44 p. (in Ukrainian).