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Ensuring Proper Functioning of Wastewater Consumption

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Abstract: In the article, the calculation of the flow rate of the surface flow necessary for the sections of sewerage networks in the conditions of reducing the consumption of wastewater by determining the norms of wastewater generated in residential areas.

Keywords: quarter, hourly consumption, living space, sewerage, discharge module, housing fund.

Introduction.

Wastewater is water collected for domestic purposes, production and agriculture, as well as from a certain polluted area. Wastewater is divided into 3 types depending on the conditions of harvesting.

1. Household wastewater of daily life (MOS);
2. Industrial wastewater (SOS);
3. Atmospheric wastewater (AOS).

It is calculated on the basis of indicators of networks and structures in sewage systems. Estimated population is the number of people who may be born in the settlement at the end of the estimated period. Estimated period for cities and settlements is 20...25 years. For industrial enterprises, the accounting period refers to the entire start-up period of the enterprise.

Estimated population is based on the perspective plan of the city, taking into account the laws of population growth. The population is calculated on the basis of the population density in quarters and districts, that is, the number of people living in one hectare of land at the end of the estimated period. During the development of working drawings, the population is determined based on accurate calculations. That is, it is performed on the basis of the areas where the population lives. The population density depends on the size of the city, the number of floors of the buildings, and the housing stock, and is determined using the following equation:

$$N_p = \sum p \cdot F \cdot \beta \qquad (1)$$

p - population density, people/ga;

F- residential area, ga;

β - level of sewerage.

Estimated consumption of sewage refers to the consumption that ensures the maximum flow capacity of networks and structures during the estimated period. Day, night, hourly and second costs are determined in the calculation of networks and facilities. Usually, day and night consumption is charged in units of m^3, and second consumption - 1.

The level of wastewater pollution is determined by the concept b, that is, the mass of pollutants per unit of water, mg/l; gram/m.cubic. in sizes. The amount of waste water is determined by the ratio of the volume of waste water per unit of time, m^3/ day; m^3/hour; l/sec.

Rainwater is mainly contaminated with mineral substances and a small amount of organic substances. The amount of rainwater can be 50-150 times higher than domestic and agricultural wastewater in the city construction area.

Rainwater from industrial enterprises may contain waste and waste belonging to industrial enterprises.

Estimated costs of domestic wastewater are determined using the following equations based on accepted standards:

$$Q_{o'r.kk} = q \cdot \frac{N}{1000}, m^3/kun \quad (2)$$

$$Q_{o'r.s} = q \cdot \frac{N}{24 \cdot 1000}, m^3/s \quad (3)$$

$$Q_{o'r.sek} = q \cdot \frac{N}{24 \cdot 3600}, l/sek \quad (4)$$

$$Q_{mak.kk} = q \cdot \frac{N_{Kkk}}{1000}, m^3/kun \quad (5)$$

$$Q_{mak.s} = q \cdot \frac{N_{Kum}}{24 \cdot 1000}, m^3/sek \quad (6)$$

$$Q_{mak.sek} = q \cdot \frac{N_{Kum}}{24 \cdot 3600}, l/sek \quad (7)$$

q - the rate of waste produced by one person, l;

N - estimated population, person;

Kkk - night and day unevenness coefficient of sewage discharge;

Domestic sewage is produced in permanent residences, temporary residences (hotels, railway stations, medical and recreation centers), cultural and household institutions and production enterprises. Effluent consumption can be determined using two methods: based on the above equations and through the discharge module. In this method, the amount of waste water is based on the generation proportional to the area of residential areas. Discharge module:

$$Q_o = n \cdot p/86400 \quad (8)$$

Here n is the rate of household wast, l/person

Domestic waste produced in industrial enterprises is taken into account separately. Domestic waste generated in industrial enterprises is taken into account separately. Estimated expenses are determined as follows for the shift with the largest number of employees:

$$Q_{kk} = \frac{25N_1 + 45N_2}{1000} \quad (9)$$

$$Q\ maks.sm = \frac{25N_3K_c + 45N_4K}{T1000} \quad (10)$$

$$Qmaks.sek = \frac{25N_3K_c + 45N_4K_c}{T3600} \quad (11)$$

Here: N1, N2 - the number of workers working in "cold" and "hot" workshops;

N3, N4- The number of workers working in "cold" and "hot" shops in the maximum shift;

T- shift duration.

Estimated consumption of wastewater generated in showers is determined using the following equations:

$Q\kappa\kappa = 500\ Nc / 1000;$ (12)

$Qmak\ sek = 500\ Nc / 45 \cdot 60$ (13)

Here: Ns the number of shower nets is derived from the number of shower receivers in the table depending on the production category; 45 duration of shower for one hour, min.

Estimated costs of production waste depend on product production efficiency and standards:

$Q\kappa\kappa = m \cdot M$; (14)

$Qmax\ sec = m \cdot M1 \cdot 1000\ Kc / T \cdot 3600$ (15)

M - production efficiency;

M1 - maximum shift production productivity;

T - duration of production.

In the general heating system, different types of sewage are discharged through a network and cleaned in a treatment plant. In this system, the total length of networks is 30-40% shorter than in a full-fledged system, but the need to lay large-diameter pipes, the construction of large treatment facilities and pumping stations requires more money. From a sanitary point of view, this system is complete. However, domestic and rainwater disposal facilities pose certain environmental risks. These devices make it possible to reduce the diameters of the collectors and the power of the pumps.

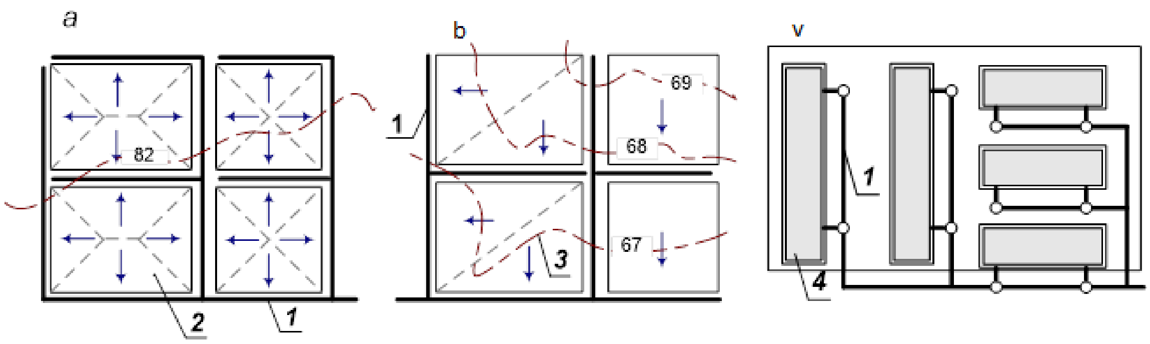

Figure 1. Sewage network tracing.

a - general washing; b - take to the bottom; v – sewage system; 1 – sewage networks; 2 – quarters; 3 – ground signs; 4 – buildings

In complete systems, domestic, industrial and atmospheric wastes are discharged through separate networks. In some cases, dirty industrial effluents can enter the household sewage network, and conditionally clean industrial effluents can enter the atmospheric sewage network. Atmospheric effluents are usually dumped directly into basins. The need to lay two or more networks in this system increases capital costs, but the fact that the treatment plant, pumping station, and collectors are calculated for household and industrial wastes creates difficulties in the system's uniform operation and their use. The need to build two independent networks is a disadvantage of this system. Atmospheric effluents entering the basins is a drawback of this system from a sanitary point of view.

Conclusion: The combination of industrial and household wastes is justified only if their treatment is carried out using the same methods in the same facilities, if the combination of different industrial wastes does not produce explosive gases and vapors, the temperature of the wastes should not exceed 40 °C; can form compounds that have a negative effect, filling effluents, containing oil, grease, tar, gum, gasoline, petroleum products, heavy insoluble impurities, fibrous substances that clog the pipes and have a negative effect on the operation of the pump it is allowed after local treatment of all wastes up to RChU;

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