
WATER PROTECTION IN THE REPUBLIC OF SERBIA

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INTRODUCTION

Construction of municipal and industrial sewerage systems in Serbia during the past decades was not harmonized with the development of water supply which resulted in significant getting behind in solving problems of evacuation of waste and storm waters. In addition, treatment of municipal and industrial wastewater has so far been considered an unnecessary burden to the national economy. The efficiency of the existing treatment plants/facilities for municipal and industrial wastewater is at minimum.

Accidental pollution coming through international rivers to our regions (two recent pollution waves in the Tisa river being the most drastic example) revealed to a certain degree incompetence of the institutions to provide needed services concerning information and organizational tasks while monitoring transport and assessing pollution impact.

Among the zones and objects which suffered the most severe damage caused by the bombing of Federal Republic of Yugoslavia in 1999, are the water supply resources in Novi Sad (destroyed oil refinery is situated nearby the main resource of underground water), Kraljevo (serious lack of drinking water caused by the increase of consumers when 50 000 refugees from Kosovo settled in the area) and the settlements which are supplied by the water from alluvial aquifers along the Danube river, downstream from the oil refinery in the town of Pančevo.

In the Republic of Serbia, the plants/facilities for treatment of municipal wastewater were built in the following towns: Arandjelovac, Bor, Bečej, Vlasotince, Velika Plana, Vršac, Gornji Milanovac, Dimitrovgrad, Kladovo, Kragujevac, Kikinda, Medvedja, Negotin, Paraćin, Požarevac, Sombor, Surdulica, Soko Banja and Ruma. Treatment plants have not usually been tested for working conditions. In rare instances when the tests were conducted, the applied methodology was inadequate.

It is very difficult to estimate efficiency of treatment plants/facilities based on the existing investigations because of poor practice to collect instant samples. The results are often contradictory (concentrations of pollutants are higher in effluent than in influent etc).

TENDENCIES IN DEVELOPEMENT AND WATER PROTECTION SOLUTIONS

Today's general tendency is to develop the country and join the European Community, which brings new tasks in the domain of water protection. Those tasks should: (1) provide water quality protection up to the level at which they can be used with highest quality

demands and (2) provide protection of quality and quantity of water up to the sustainable level of aquatic ecosystems with good ecological status. These tasks can be achieved only within integral, complex and unique water management system of Serbia.

The main elements of such water management system are: rational intake of quantities of water, measures within technological processes, rational technical-technological measures on wastewater and other waste materials, measures for water regime improvement of recipient water and surface water generally, control of dispersed and potential sources of water pollution, control of managing and utilization of dangerous materials as well as other non-investment measures.

Programme for water quality protection must unconditionally include :

- establishing a new pollution and sources of pollution control system , preventive actions system, creation of information base and the current state sanitation
- technical and technological industry development based on a minimized release of wastewater (techniques which need usage of smaller quantities of water, techniques which have the possibility of maximal recycling of technological water)
- review of the basic questions which ought to be legally and organization-wise dealt with
- establishing priorities in the direct protection measures usage
- forming an expert team for the accidental pollution cases

THE SEWERAGE SYSTEM

Within the realization of water protection program in the next five years, it is realistic to survey the level of the completeness of construction work and particularly the functional status of the existing sewerage system. The reconstruction and completion of the existing sewerage system should be given priority in order to catch up with development of water supply system.

The construction of storm sewer system must not get behind the construction of sanitary sewer system, and at the same time the next requirements should be fulfilled:

Probability of the design storm to be collected by storm sewer system, should be increased;
The capacity of sanitary sewer system should be enlarged to collect the first wave of polluted rainwater;

The degree of dilution within the common system should be adjusted to capacities of recipients, to protect its water quality status.

In the next five years it is realistic to expect construction of the sewer system:

As common sewer system	125 km
Sanitary sewer system	375 km
Storm sewer system	250 km.

WASTEWATER TREATMENT PLANTS

Several existing treatment plants of municipal wastewater should be tested on functionality in the next five years. For this purpose a few larger and contemporary facilities, facing serious operational difficulties should be chosen. Testing should be done according to legislative regulations.

The goal of the proposed activities is to identify all obstacles that hamper optimal function of the considered facilities and to propose remedial measures. General guidelines should be set up to prevent the same mistakes in the future.

Industrial wastewater treatment plants require much more elaborate approach, including previous study on wastewater characteristics. Therefore it is not possible to talk about general guidelines applicable to all industries.

In the next five years it is necessary to:

Put into operation all the existing treatment plants;

Define project data and to prepare project documentation for all first priority plants;

Start construction of wastewater treatment plants in the settlements, which directly endanger water supply sources.

The number of first priority plants is estimated to be around ten. The towns or regions with the belonging sewer system connected to or gravitating to those plants shall be the next ones:

The Gruža reservoir (Vracesnica and surrounding wastewaters);

The Celje reservoir (sewerage system of the settlements of Blace and Brus);

Sewerage system of the Ostružnica region;

Sewerage system of the settlement of Batajnica (including the communities of Indjija, Stara and Nova Pazova);

The city of Zrenjanin with the surrounding villages;

The town of Cajetina with the surrounding settlements;

The towns and industries of Crvenka, Vrbas and Kula;

The town of Obrenovac with the surrounding communities;

The city of Nis with gravitating settlements;

Tourist complex on the Vlasina lake;

The town of Bačka Palanka with the surrounding settlements.

In view of the exceptional importance and size of the canal network, a special attention should be paid to water protection within land reclamation, irrigation and navigation system (the Danube-Tisa-Danube system).

Planned construction of central wastewater treatment plants in the above mentioned settlements should be performed with approximate rate of two plants per year.

PROTECTION FROM NON-CONCENTRATED SOURCES OF POLLUTION

Dispersed or non-concentrated pollution comes from urban and other non-permeable surfaces, agriculture, forestry, mines, large construction sites, disposal places for solid waste, sludge and slag. Non-concentrated sources of pollution contribute more than 50% of total water pollution. They deliver 70% of total nitrogen, 50% of total phosphorus and 90% of faecal and total number of coliform bacteria. Urban runoff is specific because it carries large quantities of heavy metals and petroleum derivatives. That's why this problem should get proper attention.

Emission control of pollution from non-concentrated sources should be conducted on those areas where there is neither technical nor economic justification for implementing direct protection measures. Emission control of dispersed sources requires highly specific measures and should not be only under the authority of water management. Instead, they should be integrally managed on the national level. These measures include:

Providing safe retention of storm water from separate and common sewer systems with subsequent treatment of wastewater;
Construction of sanitary disposal places and waste dumps which are protected against floods and cracking as well as against contacts with ground water;
Control and prevention of soil erosion;
Specifying the land use pattern of the flood prone areas;
Establishment of strict control over the usage of pesticides and mineral fertilizers;
Regulating disposal and recycling of refuse coming from cattle breeding;
Strict control over carrying away of deposits and other material from large construction sites in settlements and out of them.

WATER SUPPLY SOURCES

The water supply source protection has got the priority and the utmost significance. The intake areas for water supply and the regions of exceptional natural value are subjected to very strict preventive measures including prohibition to build new structures and plants, as well as compulsory dislocation of the existing objects, which are the source of pollution. Significant ground water quantities are stored in the alluvial aquifers along the Morava and Danube rivers. Based on their size and available capacities they represent water sources of regional importance. This makes water quality protection in the river basin of the Morava River and in the coastal region of the Danube River a very important task. The first step in protection program is to start with protection of the Nišava River. There are several big towns with highly developed industry in the Nišava river basin, and there is also the Zavoj reservoir, which is planned for water supply in the near future.

WATER SUPPLY RESERVOIRS

The activities within the drainage basin area are long-term and complex. Still they must be consistently applied aiming to eliminate or reduce inflow of pollution to the lake, primarily of nutrients because of the eutrophication processes which bring about the change of the lake ecological status with degraded water quality. Otherwise, remedial measures must be undertaken, such as hypolimnetic water aeration and other specific measures, combined with very complex treatment procedures necessary for drinking water production. This should be kept in mind particularly in cases when water supply is arranged from reservoirs that were constructed for other primary purpose.

During the next five years protective measures should be undertaken on those reservoirs which serve the regional systems supplying the largest number of consumers. This regards the next reservoirs: Gruža, Čelije, Vrutci, Vlasina, Grošnica, Bovan, Grlište, Zavoj, Gazivode, Batlava, Gračanica, Tisa, Brestovac, Barje, Prvonek, Selova and Stuborovni. Special attention should be paid to both the Djerdap reservoir and the hydro system of canals DTD (Danube-Tisa-Danube) which are in difficult position as far as water protection is concerned.

In order to make an optimal use and protection of those reservoirs, the best practices comprising both the application of mathematics model (for management of each reservoir) and preparation of the master plan (for the whole water regime management on the subject water stream) should be introduced and implemented.

Necessary Capital Investments for Implementation of Water Protection Solutions

To accomplish planned solutions to water protection it is necessary to provide significant investments, which are going to be defined here as total investments under the particular elements of water protection solutions.

Necessary capital investments for construction of sewer systems are:

Common sewer system	61.50 million EUR
Sanitary sewer system	42 million EUR
Storm sewer system	63 million EUR
Total sewer system	140 million EUR
Necessary capital investment for construction of industrial wastewater pre-treatment plants is estimated to	200 million EUR
Necessary capital investment for putting into operation the existing treatment plants and devices for municipal wastewater is estimated to	10 million EUR
Necessary capital investment for the definition of project parameters for construction of wastewater treatment plants in the first-priority settlements as well as for preparing necessary technical documentations, is estimated to	29 million EUR
For treatment plants of wastewater discharged from the settlements which directly endanger the existing and the planned water sources for water supply, the number of which is estimated to be around ten, the necessary capital investment amount	83 million EUR
Capital investments for the activities and measures for protection of water supply reservoirs, the Morava and Danube river basin, as well as for partial implementation of measures are estimated to be around	29 million EUR
For preparation of necessary laws, ordinances and regulations, as well as for establishing and equipping the intervention teams for monitoring accidental pollution of surface and ground water, necessary investments are estimated to be around	2,5 million EUR
Total necessary capital investments for the implementation of anticipated solutions for water protection in the next five years are	475 million EUR

LITERATURE

[1] *Elements of the Development Programme of Water Protection in the Serbia 2001-2005*, Institute "Jaroslav Černi", 2001.

[2] *Water Master Plan of the Serbia*, Institute "Jaroslav Černi", 2001.