9. Waste Water management

9A. Present Situation

Current available data:

<table>
<thead>
<tr>
<th>Index</th>
<th>Unit</th>
<th>Data</th>
</tr>
</thead>
<tbody>
<tr>
<td>Share (%) of the total one-year load of generated waste water connected to the waste water collection system + municipal wastewater treatment plants</td>
<td>%</td>
<td>2014</td>
</tr>
<tr>
<td>Number of municipal wastewater treatment plants</td>
<td>2 (3*)</td>
<td>2014</td>
</tr>
<tr>
<td>Rated efficiency of wastewater treatment plants (PE)</td>
<td>PE</td>
<td>2014</td>
</tr>
<tr>
<td>Total wastewater transferred to wastewater treatment plants (PE)</td>
<td>PE</td>
<td>2014</td>
</tr>
<tr>
<td>Total one-year wastewater load generated by the city (PE)</td>
<td>PE</td>
<td>2014</td>
</tr>
<tr>
<td>Treatment level applied in every wastewater treatment plant: secondary treatment or tertiary treatment; nitrates and/or phosphates, disinfection etc.</td>
<td>2 degree with in-depth nutrient removal</td>
<td>2014</td>
</tr>
</tbody>
</table>

(3*) – the third of the municipal treatment plants is located outside of Warsaw’s administrative limits i.e. in Pruszków and provides service for the so-called Pruszków band and one of Warsaw’s districts — Ursus.

Majority of numerical data in the below text refer to the two other treatment plants.

Around 370 km² of Warsaw’s area is covered by a rainwater drainage system network.

Warsaw aims to manage rainwater/thawing waters at their source (discharging into the soil). Local zoning plans recommendations define guidelines for rainwater/thawing water management from investment areas. Rainwater is also stored in reservoirs.

The discharge/wastewater treatment system consists of a collective, municipal drainage network (total length: 2 930 km), including collectors, secondary channels and connections, 3 large wastewater treatment plants (capacity: 575 000 m³ of sewage/day) and several local wastewater treatment plants. It is mainly a gravity and mixed system, equipped with general sewers (central city areas) and a sanitary and rainwater (separate) sewage system. Over 90 pumping stations guarantee the system’s proper operation.

Czajka collects communal and industrial wastewater and rainwater from the northern and central regions of Warsaw’s left river bank and its right bank and several nearby cities and towns.
Czajka is a mechanical-biological wastewater treatment plant with an in-depth removal system of nitrogen and phosphorus. It meets strict EU regulations.

Czajka (nominal capacity: 2 100 000 PE) has a nominal average daily hydraulic capacity of 435 300 m³/day.

In 2014, Czajka treated 154 million m³ of sewage.

The received pollutants load: BOD5: 38 270 tonnes/year, COD 79 461 tonnes/year, Nog: 8 118 tonnes/year, Pog: 953 tonnes/year respectively.

In the effluent - treated wastewater BOD5: 768 tonnes/year, COD: 4 765 tonnes/year, Nog: 1 383 tonnes/year, Pog: 80 tonnes/year respectively.


Wastewater sludge is incinerated in two fluidized furnaces. Exhaust gases are treated in several stages and monitoring of their composition shows that they meet required standards.

The volume of currently generated and incinerated deposits at Czajka: 32 515 tonnes/year (dry matter).

Biogas generated during sludge fermentation is used to generate heat and electricity for the facility’s operational purposes. Amount of generated biogas: 15 million m³/year.

Electricity production from biogas covers 40% of the facility’s own energy needs. Energy consumption amounted to 0.47 kWh/m³ of sewage and 28 kWh/year/PE.
The *South* Plant located in the southern part of Warsaw’s left-bank treats sanitary sewage from the districts of Mokotów, Ursynów and Wilanów - parts of the separate drainage system.

![South Wastewater Treatment Plant](image-url)

### South Wastewater Treatment Plant
Photo: Archives of the City of Warsaw

This facility meets wastewater treatment level requirements.

The treatment plant nominal capacity: 580 000 PE. Nominal average-daily hydraulic capacity: 80 000 m³/day.

The plant received and treated around 20 million m³ of sewage (2014).

The load of received pollutants: BOD5: 6 913 tonnes/year, COD 11 697 tonnes/year; Nog: 1 277tonne/year; Pog: 162 tonnes/year.

The effluent - treated sewage: BOD 5: 61 tonnes/year, ChZT 487 tonnes/year; Nog: 142 tonnes/year; Pog: 11 tonnes/year.

Reduction of pollution BOD5: 6 852 tonnes/year; COD: 11 210 tonnes/year
Nog 1 135 tonnes/year; Pog: 151 tonnes/year.

The wastewater sludge generated in the facility is dried. Dried sludge reaches the level of 80-90% of dry matter and is deposited in safe locations (3 480 tons/year of dry mass).

Thermal energy from incineration, generated in the biogas facility is used for operational puropses (i.e. the drying of wastewater sludge).

Energy consumption: 28 kWh/year/PE.
The *Pruszków Plant* is located outside of Warsaw’s administrative borders and services the Ursus district and the towns of *Pruszków, Piastów* and *Michałowice*.

Energy consumption amounted to 0.79 kWh/year.

Facility’s hydraulic capacity: 60 000 m³/day.

The facility is currently undergoing modernization. Completion of modernization works is planned for December 2015.

All wastewater treatment facilities use their own sewage - both for the wastewater and sludge treatment process.

The amount of wastewater generated and invoiced in Warsaw (2014) amounted to around 98 million m³.
Table no. 9 – Warsaw’s wastewater treatment level

<table>
<thead>
<tr>
<th>Year</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sp – invoiced wastewater amount discharged in Warsaw [thousand m³]</td>
<td>115 268,2</td>
<td>112 801,1</td>
<td>109 671,5</td>
<td>106 149,4</td>
<td>106 535,0</td>
<td>106 638,0</td>
<td>102 733,3</td>
<td>98 704,5</td>
<td>98 291,9</td>
</tr>
<tr>
<td>So – amount of treated wastewater [thousand m³]</td>
<td>72 713,5</td>
<td>91 162,1</td>
<td>86 687,3</td>
<td>83 699,9</td>
<td>98 728,6</td>
<td>97 714,0</td>
<td>124 135,4</td>
<td>173 969,1</td>
<td>161 848,0</td>
</tr>
<tr>
<td>Sno – amount of wastewater discharged to receivers without treatment [thousand m³] (*)</td>
<td>60 250,1</td>
<td>41 398,0</td>
<td>41 745,1</td>
<td>41 632,9</td>
<td>39 911,9</td>
<td>39 803,2</td>
<td>20 250,1</td>
<td>0,0</td>
<td>0,0</td>
</tr>
<tr>
<td>S = So + Sno = amount of wastewater discharged to waste water treatment plants through the waste drainage system [thousand m³] (*)</td>
<td>132 963,6</td>
<td>132 560,1</td>
<td>128 432,4</td>
<td>125 332,8</td>
<td>138 640,5</td>
<td>137 517,2</td>
<td>144 385,5</td>
<td>173 969,1</td>
<td>161 848</td>
</tr>
<tr>
<td>So / (So+Sno) = share of treated wastewater in wastewater discharged via the drainage system [%] (*)</td>
<td>54.7%</td>
<td>68.8%</td>
<td>67.5%</td>
<td>66.8%</td>
<td>71.2%</td>
<td>71.1%</td>
<td>86.0%</td>
<td>100.0%</td>
<td>100%</td>
</tr>
<tr>
<td>Q – theoretical total average annual wastewater treatment plant capacity [m³/day]</td>
<td>277 500</td>
<td>330 000</td>
<td>330 000</td>
<td>330 000</td>
<td>330 000</td>
<td>427 500</td>
<td>525 000</td>
<td>525 000</td>
<td>525 000</td>
</tr>
<tr>
<td>Average annual wastewater treatment plant exploitation [%]</td>
<td>71.8%</td>
<td>75.7%</td>
<td>72.0%</td>
<td>69.5%</td>
<td>82.0%</td>
<td>81.1%</td>
<td>79.6%</td>
<td>90.8%</td>
<td>84.5%</td>
</tr>
</tbody>
</table>

Data presented in the table is the total amount of wastewater for the Czajka and South Plant basins

(*) – Estimated amounts
Sp – invoiced wastewater (sanitary and industrial)
So – treated wastewater – mix of sanitary, industrial wastewater and rainwater/sludge water - amounts measured at the wastewater treatment plants
Table 10- Access to wastewater treatment – data applies to the Capital City of Warsaw

<table>
<thead>
<tr>
<th>Year</th>
<th>2006</th>
<th>2007</th>
<th>2008</th>
<th>2009</th>
<th>2010</th>
<th>2011</th>
<th>2012</th>
<th>2013</th>
<th>2014</th>
</tr>
</thead>
<tbody>
<tr>
<td>Spw</td>
<td>invoiced amount of waste water discharge services for receivers in Warsaw [thousand m³]</td>
<td>115 268.2</td>
<td>112 801.1</td>
<td>109 671.5</td>
<td>106 149.4</td>
<td>106 535.0</td>
<td>106 638.0</td>
<td>102 733.3</td>
<td>98 704.5</td>
</tr>
<tr>
<td>Spgd</td>
<td>invoiced amount of waste water discharge services for households [thousand m³]</td>
<td>84 992.9</td>
<td>82 786.6</td>
<td>80 424.4</td>
<td>77 096.7</td>
<td>77 563.7</td>
<td>80 455.1</td>
<td>77 980.4</td>
<td>75 402.0</td>
</tr>
<tr>
<td>Nm</td>
<td>population [thousand]</td>
<td>1 625.8</td>
<td>1 635.7</td>
<td>1 639.2</td>
<td>1 644.6</td>
<td>1 650.2</td>
<td>1 658.6</td>
<td>1 649.4</td>
<td>1 668.4</td>
</tr>
<tr>
<td>Ns</td>
<td>population residents with access to the municipal drainage system [thousand] (*)</td>
<td>1 481.1</td>
<td>1 496.2</td>
<td>1 509.6</td>
<td>1 518.1</td>
<td>1 530.9</td>
<td>1 539.5</td>
<td>1 565.3</td>
<td>1 599.7</td>
</tr>
<tr>
<td>%</td>
<td>of Warsaw residents with access to the municipal drainage system (**)</td>
<td>91.1%</td>
<td>91.5%</td>
<td>92.1%</td>
<td>92.3%</td>
<td>92.8%</td>
<td>92.8%</td>
<td>94.9%</td>
<td>95.9%</td>
</tr>
<tr>
<td>Average daily amount of waste water discharged by a single Warsaw resident [dm³/day] (**)</td>
<td>157</td>
<td>152</td>
<td>146</td>
<td>139</td>
<td>139</td>
<td>143</td>
<td>136</td>
<td>129</td>
<td>128</td>
</tr>
</tbody>
</table>

(*) estimate values based on GIS data
(**) estimate values
Nm – persons accommodated in Warsaw (permanently or temporarily) until 2011 – based on BAiSO Office of the Capital City of Warsaw data
Nm – persons accommodated in Warsaw (permanently or temporarily) until 2012 - based on GIS data.

Diagram no. 16 Percent of resident connection to water supply network

9B. Past performance

For decades, wastewater management in Warsaw was reduced to maintaining the sewage collection and transport system. Sewage was discharged into the environment (primarily into the Vistula river) without prior treatment.

In the early 1990’s, one of the largest wastewater treatment plants in Europe was put into operation - located in the northern part of Warsaw’s right river bank – the Czajka, serviced Warsaw’s right river bank.

In 2006, the South Wastewater Treatment Plant began operation, treating wastewater from the separate sewage system - sanitary sewers from southern regions of Warsaw’s left bank. The percentage of treated wastewater significantly increased. Wastewater redirected to the South plant relieved the wastewater system’s central section, since for many years, its capacity was too small in relation to its needs.

With the end of 2012, a modernized and expanded Czajka was put into operation. In addition to wastewater from Warsaw's right-bank area, wastewater was transferred from the central and northern part of Warsaw's left-bank area (which was previously
discharged into the river without treatment).

Due to these investments, in recent years, all sewage generated within the Warsaw area included in the municipal drainage system is currently treated.

78.1% of wastewater’s total volume is generated by residents, 21.9% is generated by the industry, services and public utilities. The dominant industry in terms of industrial waste is the food industry (food production and processing).

During 2005-2015 there has also been a significant increase in the length of the drainage network.

A number of measures aimed at adapting water and wastewater management to existing Polish and EU law were undertaken and implemented. A water and wastewater program for Warsaw was developed and implemented - its main part is the Water supply and sewage treatment in Warsaw, 60% of which is funded from the European Cohesion Fund.

The specific objectives of the project were:

- improving accessibility to the wastewater system within the agglomeration;
- improving environmental protection;
- improving collector hydraulics (Warsaw’s left bank).

Due to the complexity of the works, the project was divided into the following phases:

- **Phase I:** Development of a system of wastewater treatment and collection system
from Warsaw’s southern districts - the construction of a pumping station and raw wastewater transmission system to the South plant and a treated wastewater transfer tube from the facility to the discharge point at the Vistula river;

- **Phase II**: Improvement of drinking water quality supplied to Warsaw’s residents - expansion of water mains and distribution pipe networks and reconstruction, replacement and renovation of the existing distribution network. The modernization of water treatment processes at two water treatment stations was carried out. Phase I and Phase II of the project were completed in 2010;

- **Phase III**: Czajka’s expansion and modernization. The purpose of this task was to develop the water and wastewater management system. The project included the construction of collectors enabling the transmission of wastewater from the Warsaw’s left-bank area to the facility, the facility’s modernization, renovation and expansion of the drainage system, including modernization of selected facilities. Phase III of the Project was completed in 2012.

The main objectives achieved as a result of the project:

- optimization of the currently operating water and wastewater system;
- ensuring that the composition of treated wastewater discharged into the receiver meets regulation standards;
- improvement of the functioning of wastewater treatment plants with regard to the use of biogas as a renewable energy source;
- a comprehensive solution to wastewater sludge management.

A major problem of the agglomeration was the lack of a comprehensive management and disposal system of wastewater sludge. The solution was the construction of a thermal wastewater utilization facility Czajka (STUOŚ). This investment enabled the successful management of deposits generated at the facility and ultimately in the entire Warsaw agglomeration. The solution minimizes the negative effect of deposits on the environment. The use of modern technology renders possible the full optimization of the incineration process, while providing a multi-stage, highly efficient exhaust gas cleaning system with full emissions monitoring and a stable end product. It is one of the best solutions to wastewater sludge management.

The completed project contributed to:

- reducing storage of wastewater sludge;
- increasing the amount of wastewater sludge processed prior to its introduction into the environment;
- increasing the amount of wastewater sludge used for energy purposes;
- increasing the amount of thermally processed wastewater sludge mass;
- dynamic renewal of the Vistula river’s and Gdańsk Lagoon’s biological life.

The investment ensured environmental protection of natural resources and indirectly contributed to the sustainable economic growth of the region. In the longer term it will reduce social and economic gaps among EU’s citizens.

The objectives of the project fully comply with objectives defined in the Infrastructure and Environment Operational Program and the following documents:
• EU Strategy for the Baltic Sea Region;
• National Strategic Reference Frameworks 2007-2013;
• Ecological Policy for 2003-2006 including the 2007-2010 perspective;
• National Program of Municipal Wastewater Treatment;
• Environment Program of the Mazovian Voivodship for 2007-2010, taking into account the prospects for 2014;
• Mazovian Voivodship development strategy until 2020 (updated) – water and Wastewater management by eliminating discharge of untreated wastewater.

9C. Future plans

The Water supply and wastewater treatment in Warsaw - Phase IV project includes a range of measures with regard to improvement of water and wastewater management based on the principle of sustainable development.

The main objectives of the project:

• Ensuring a long-term method of wastewater sludge management (objective is achieved to a large extent, as described in Section 9B);
• Increasing the level of sewerising of the agglomeration by connecting new customers;
• Improving the functioning of Warsaw’s left-bank drainage system.

Phase IV of the project is a continuation of activities carried out under previous phases, including measures improving the functioning of the existing system for wastewater collection and treatment in the agglomeration. The project will help adjust system parameters of the water supply and drainage in Warsaw to the requirements of Polish and EU law. The priority is to expand the drainage network and expand the scope of provided services of 98% of Warsaw’s residents by the end of 2015.

The project is consistent with available sectoral plans and programs related to the implementation of Community policies and regulations for water and wastewater. This project is the implementation of the first axis of the Infrastructure and Environment Operational Program: Water and Wastewater Management for 2007-2013. It is compatible with:

• National Development Strategy 2007-2013;
• National Program of Municipal Wastewater Treatment;
• National Ecological Policy for 2007-2010 including the 2011-2014 perspective;
• Water Management Strategy;
• Environment Program of the Mazovian Voivodship.
A list of the key objectives of Phase IV of the project is presented below:

**Modernization of the South Plant:**

- modernization of the sludge dewatering facility;
- construction and installation of a cogeneration facility;
- construction and modernization of a wastewater pumping station;
- modernization of the Saska pumping station.

**Construction of sanitary drainage:**

- construction of 51.72 km of sanitary drainage network for connecting 2,695 buildings.

Due to the insufficient retention capacity of the wastewater network in Warsaw's left-bank area and Czajka’s limited wastewater collection capabilities (wastewater is transferred by a wastewater transfer system under the Vistula River), it is still necessary to solve the wastewater retention problem during heavy rainfall and torrential rains in the general wastewater system network of Warsaw’s left-bank area.

The *Burakowski-Bis* collector (constituting a bypass for the exploited *Burakowski* collector, which is one of the most important elements of the network) is nearly completed. It will enable sewage retention in the events described above.

The construction of this collector will not entirely solve the wastewater retention problem during heavy rainfall. Storm overflows will continue to operate - as a consequence, the transfer of untreated wastewater directly to the receiver will continue. Currently storm overflows transfer (each year) a load of COD: 1,857 tonnes which constitutes 2.0% of the load generated in the city, but around 26% of the load contained in treated wastewater.

To improve this situation, during the years 2015-2020, the **Development of the Central Wastewater Network Control System in the Capital City of Warsaw** project will be implemented. It foresees a number of investment projects, among others:

- construction of a reservoir in the form of a collector under streets along Vistula river’s left bank;
- construction of the reservoir on a green area of the Czajka;
- construction of a pressure pipe from the Powiśle pumping station to the reservoir along the Vistula;
- reconstruction of an effluent structure on several rainwater drains;
- development and implementation of a central sewer network control system for optimal use of retention capacity and wastewater transfer to the Czajka.

The **Water supply and wastewater treatment in Warsaw - Phase IV** project is financed from MPWiK’s own resources (49.1%) and the EU’s Cohesion Fund (48.6%) under the Infrastructure and Environment Operational Program and in part from loans from the European Investment Bank (2.3%).
The implementation of the project, including the wastewater system and water supply system investment projects, will help to achieve results required by the above mentioned strategic documents, as well as acts of Community law with regard to the protection of surface and groundwaters, soil conservation, wastewater discharging and freight reduction as well as water supply.

In total, during 2013-2020, MPWiK SA intends to spend € 194 698 on the development of the drainage network and put into operation 456.9 km of new drainage network. The implementation of the plan will significantly increase resident access to the municipal drainage network and will help to achieve uniform coverage of various areas of the city.

The reconstruction/renovation of the drainage network is planned (for 2013-2020 expenditures of € 11 593 are allocated). This amount will enable the trenchless renovation of the drainage network of a length of around 18.9 kilometers and modernization of measuring points on the drainage network in Warsaw.

9D. References

Documents confirming the information provided are: a report on the implementation of the National Communal Wastewater Treatment Program (KPOŚK), reports for the Main Statistical Office (GUS) and internal reports of the company (MPWiK SA operates the drainage system in Warsaw), and:


- Directive 91/271/EEC on municipal wastewater treatment;

- Directive 76/464/EEC on restrictions on discharge into surface waters of certain substances considered hazardous to their quality (e.g. heavy metals, detergents, pesticides, etc.);

- Directive 75/440/EEC on the quality of surface water as a source of drinking water;

- Directive 98/83/EC on the quality of drinking water;

- Directive 91/271/EEC - through the implementation of the National Urban
Wastewater Treatment Program;

- Directive 76/464 / EEC - by performing tasks related to the reduction of supplying dangerous substances to waters;

- Directive 2000/60 / EC - establishing a framework for Community action in the field of water policy.

**Websites:**

http://infrastruktura.um.warszawa.pl
www.mpwik.com.pl