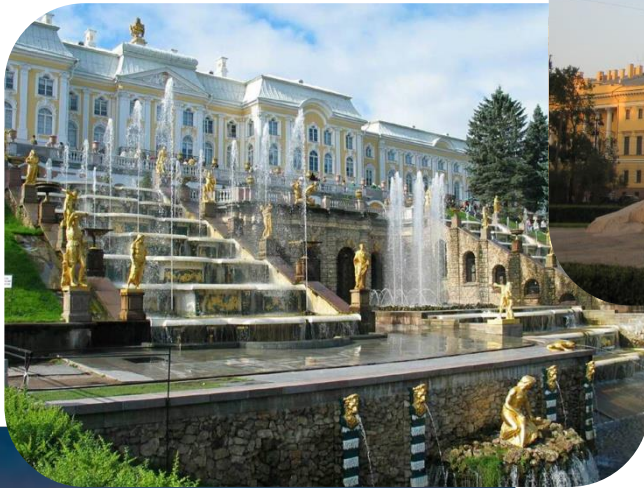


ST.PETERSBURG WATER AND WASTEWATER SYSTEMS. CURRENT STATUS AND DEVELOPMENT PROSPECTS.

St. Petersburg - the city of rivers and canals



St. Petersburg – the second largest city in the Russian Federation

The population – 5,000,000 people

The city area – 1,439 km²

The main city water stream – the Neva River

The total length of the city rivers – 282 km

St. Petersburg is located on 42 islands



SUE "Vodokanal of St.Petersburg" provides drinking water to 5 mln. inhabitants as well as dozens of thousands of companies and organizations of the city.

Vodokanal is also responsible for St.Petersburg wastewater disposal – wastewater collection, transportation and treatment.

Vodokanal's history began in 1858.

The centralized water supply system was established by St.Petersburg Water Pipelines Joint-Stock Company, which Charter was approved by the Russian Emperor Alexander II on 10 October 1858.




Mission of "Vodokanal of St.Petersburg" is

provision of affordable water and sewerage services, ensuring decent quality of life for customers, city's sustainable development, formation of water consumption culture and preservation of the Baltic Sea basin.



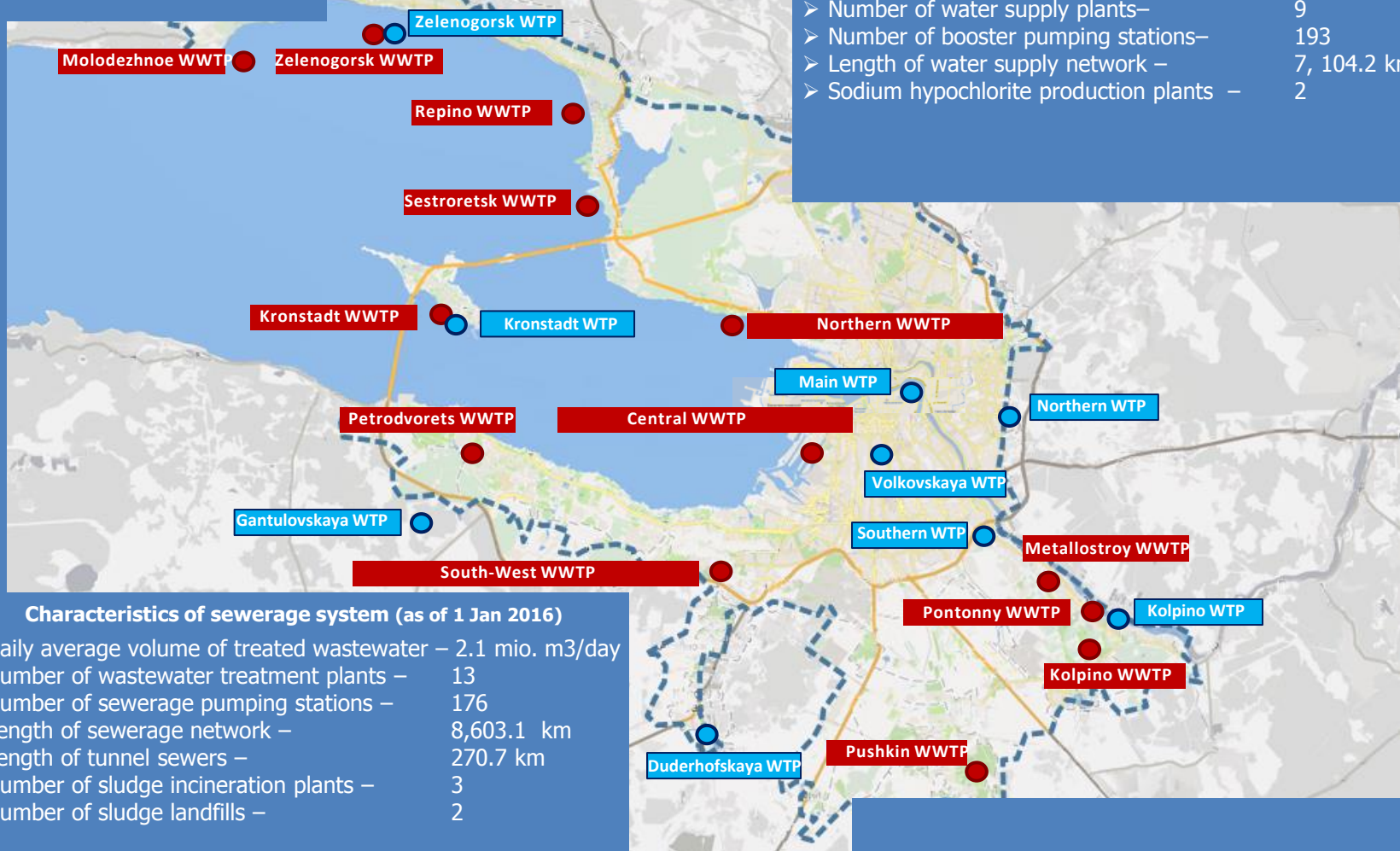
Water and Wastewater Systems of St. Petersburg

Legend:

-  boundaries of St.Petersburg
-  Water Supply Plant (WTP) of SUE "Vodokanal of St.Petersburg"
-  Wastewater Treatment Plant (WWTP) of SUE "Vodokanal of St.Petersburg"

Characteristics of water supply system (as of 1 Jan 2016)

- Daily average volume of water supply 1.6 mio. m3/day
- Number of water supply plants – 9
- Number of booster pumping stations – 193
- Length of water supply network – 7, 104.2 km
- Sodium hypochlorite production plants – 2



Characteristics of sewerage system (as of 1 Jan 2016)

- Daily average volume of treated wastewater – 2.1 mio. m3/day
- Number of wastewater treatment plants – 13
- Number of sewerage pumping stations – 176
- Length of sewerage network – 8,603.1 km
- Length of tunnel sewers – 270.7 km
- Number of sludge incineration plants – 3
- Number of sludge landfills – 2

Drinking water in St.Petersburg – absolutely safe

All drinking water in St. Petersburg is subject to ultraviolet light treatment.

- Guarantees epidemiological safety of water
- Fully automated disinfection process



- **The unique biomonitoring system based on crayfish and fish is established at all city water intakes**

It was developed by experts from St. Petersburg Research Centre for the Environmental Safety under the Russian Academy of Sciences.

Sensors are fixed to the crayfish carapaces. They record the heart rhythm and stress-index of the animals.

A web-camera monitors the fish behavior. The standard crayfish heart rhythm is from 30 to 60 hits per minute.

If toxic substances occur in water, the indicator sharply increases. Operators immediately get the alarm signal. 6 crayfish and 2-3 fish work at each water intake.

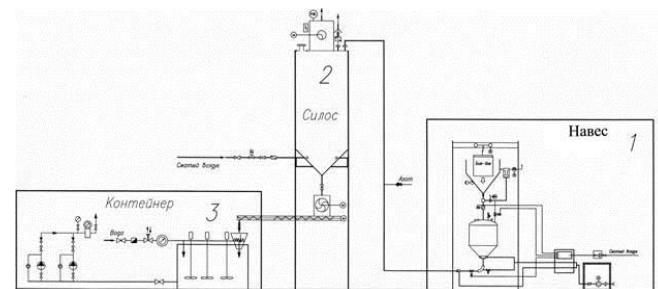


Introduction of PAC (powdered activated carbon) Dosing System



Facilities where PAC dosing system has been implemented:

1. Main Water Treatment Plant
2. Southern Water Treatment Plant
3. Volkovskaya Water Treatment Plant
4. Northern Water Treatment Plant
5. Kolpino Water Treatment Plant
6. Kronstadt Water Treatment Plant



The purpose of PAC dosing system

- ✓ the efficient removal of organic matter – odorants forming unpleasant water taste and odour, and the improvement of organoleptic properties of water;
- ✓ the efficient removal of oil products if they are identified in the source water;
- ✓ the removal of toxic substances in emergency situations.

The automated PAC dosing system consists of 3 blocks:

- 1) The block for big bag emptying (it is installed under the shelter).
- 2) The block for activated carbon storage (it consists of the storage silo, the accumulation tank, the pneumatic activated carbon pumping and the screw conveyor).
- 3) The block for preparing and dosing (it is installed in a container with heating, ventilation and air conditioning systems).

Use of Up-to-Date Water Treatment Technologies

In 2011, the new block at Southern Water Treatment Plant started to supply drinking water to the city.

Capacity of K-6 block –
350,000 m³/day

Thanks to the process solutions used in its design and construction, it is possible to cope with any changes in the water quality occurred in the Neva intakes.

In the nearest future Vodokanal plans to construct new water treatment blocks at Northern, Main and Kolpino water treatment plants.

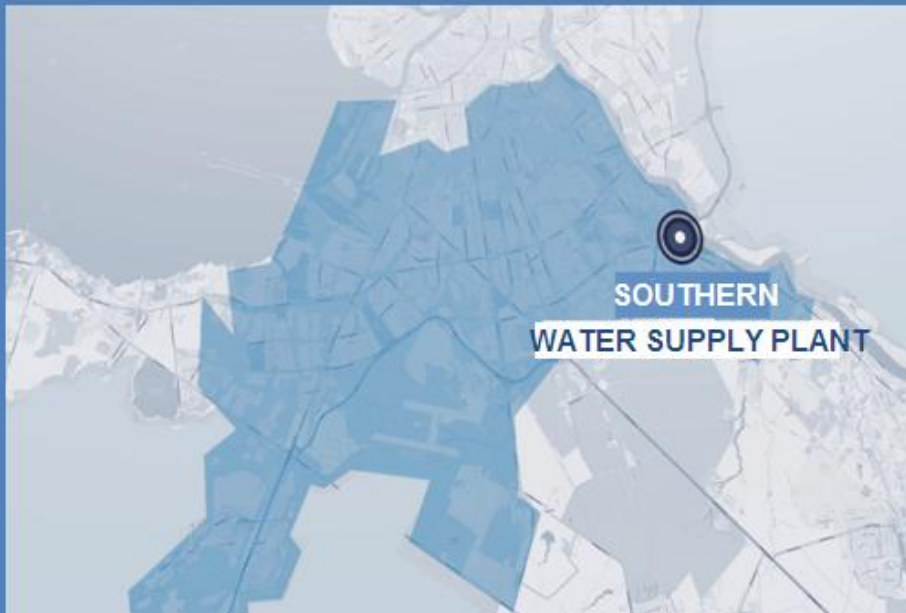




Establishment of Water Supply Management System in the Southern Districts of St.Petersburg

Characteristics of the southern city districts

Population	1,274 thous. peo.
Catchment area	194,7 km ²
Daily average water supply	496 thous. m ³ /day
Length of the network	1,686 km
Southern Water Supply Plant	1
Pumping stations	6
Booster pumping stations	45
Number of residential houses	6,498



Scope of works

1st stage. Establishment of the Southern Water Supply Zone in St.Petersburg including upgrading of booster pumping stations:

- 5 named pumping stations;
- 29 numbered pumping stations;

introduction of the integrated system for collection, registration, storage, processing and transmission of the data about water consumption of the customers – 6,687 facilities;

introduction of the automated water quality control system– 30 items;

establishment of dispatching and water balance matching system – 1

2nd stage. Reconstruction of water feed facilities of the Southern Water Supply Plant including machine rooms (MR):

- MR no.2, the Southern Water Supply Plant – 2014
- MR no.3, the Southern Water Supply Plant – 2015

Results of reconstruction works

Parameters	Prior to reconstruction	After reconstruction	Results
Monthly average energy consumption, thous. kW	6,149	4,345	29%
Unaccounted for water, %	12.4	7	44%
Emergency rate per 10 km/year	4.89	2.6	47%

Set into operation in September 2005

Project implementation results:

- **stopping the discharge of untreated wastewater in the amount of 330 thous. m³ per day**
- **Reduction of pollutants discharge into the Neva Bay:**
 - **suspended solids by 21,000 tons per year**
 - **BOD by 23,000 tons per year**
 - **total nitrogen by 3,200 tons per year**
 - **total phosphorus by 520 tons per year**
- **Introduction of wastewater disinfection by means of UV technology**
- **Compliance with Sanitary Regulations and Standards SanPIN 2.1.5.980-00 “Hygienic requirements to surface waters preservation”**
- **Enhancement of the sanitary state of water in the Gulf of Finland**
- **Closure of Krasnoselskaya Wastewater Treatment Plant and rechanneling of wastewater to South-West WWTP**



Northern Tunnel Collector Construction

Main tunnels length – two lines, 12.2 km each

Diameter – 4 m

Depth – 40-90 m

Stagewise commissioning since 2008

Construction was completed in October 2013.

Outcome – treatment of 98.4% of the city wastewater

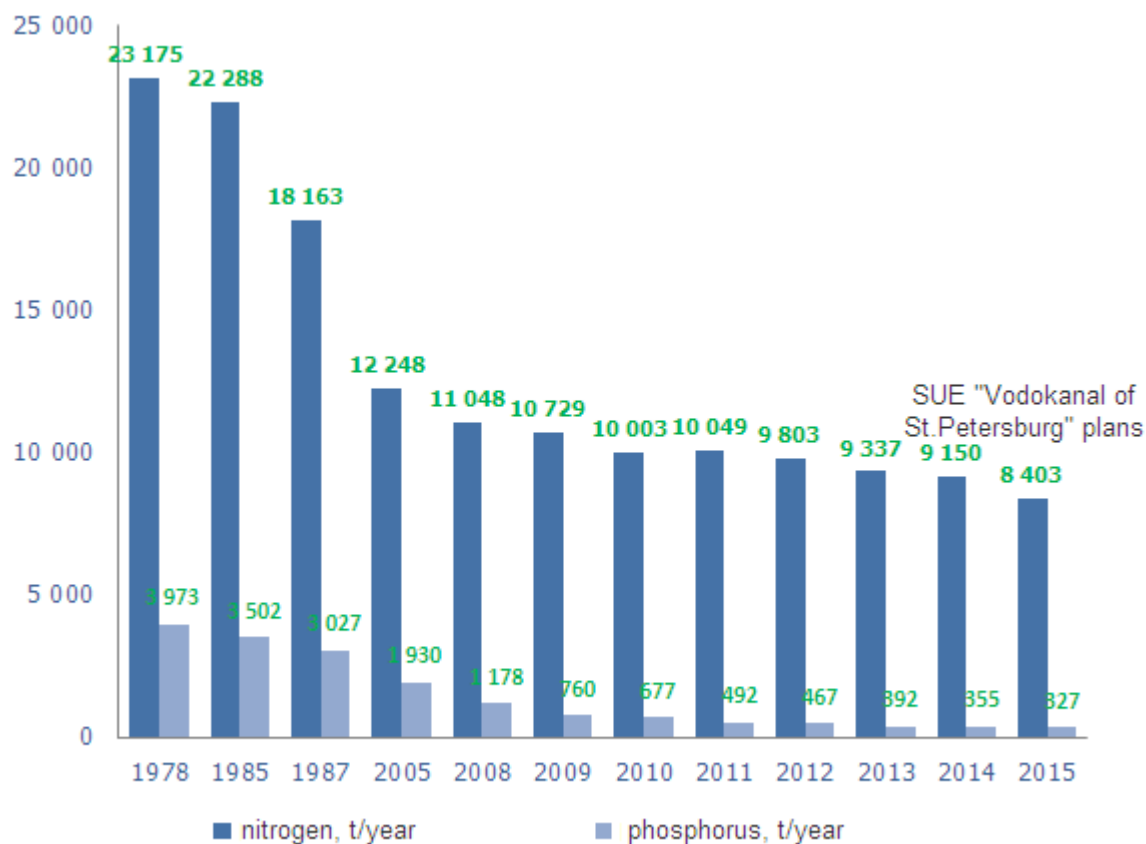


Phosphorus and Nitrogen Removal

Enhanced phosphorus removal technologies are implemented at all wastewater treatment plants in St. Petersburg.

Since 2011, St. Petersburg fully complies with the HELCOM recommendations:

Phosphorus and nitrogen concentrations in the treated effluent do not exceed 0.5 mg/l and 10 mg/l respectively.



Blue-Green Algae in the Baltic Sea



The Gulf of Finland is free of the blue-green algae

This photo by NASA was ordered by the Swedish Institute of Meteorology and Hydrology.

It was presented at the World Wildlife Fund (WWF) seminar (August 2011, Stockholm).

Sludge Incineration Plants



Plant at Central WWTP – 1997



Plant at South-West WWTP – 2007



Plant at Northern WWTP – 2007

St.Petersburg is the first city to solve the wastewater sludge utilization problem.

Vodokanal has 3 sludge incineration plants.

- 100% utilization of dewatered sludge;
- Sludge incineration with ash formation, 10 times reduction of sludge volume;
- Commercial use of ash is possible;
- No pathogens or unpleasant odor in the ash;
- Concentrations of hazardous substances in the cleaned flue gases produced by sludge incineration fully comply with the standards of the Russian Federation and EU
- Flue gas heat recovery for hot water supply and space heating;
- Steam utilization. Electricity production is possible.

Biomonitoring of Effluent and Flue Gases



Snails control the composition of flue gases at sludge incineration plants. They breathe air containing fumes from the plant stack. In automatic mode, metering equipment control snails' condition by heart rate and motility.



Apart from control instruments, wastewater treatment quality is monitored by **crayfish**. Crayfish work seasonally:
in warm season – Australian red claw crayfish;
in cold season – native narrow-clawed crayfish.

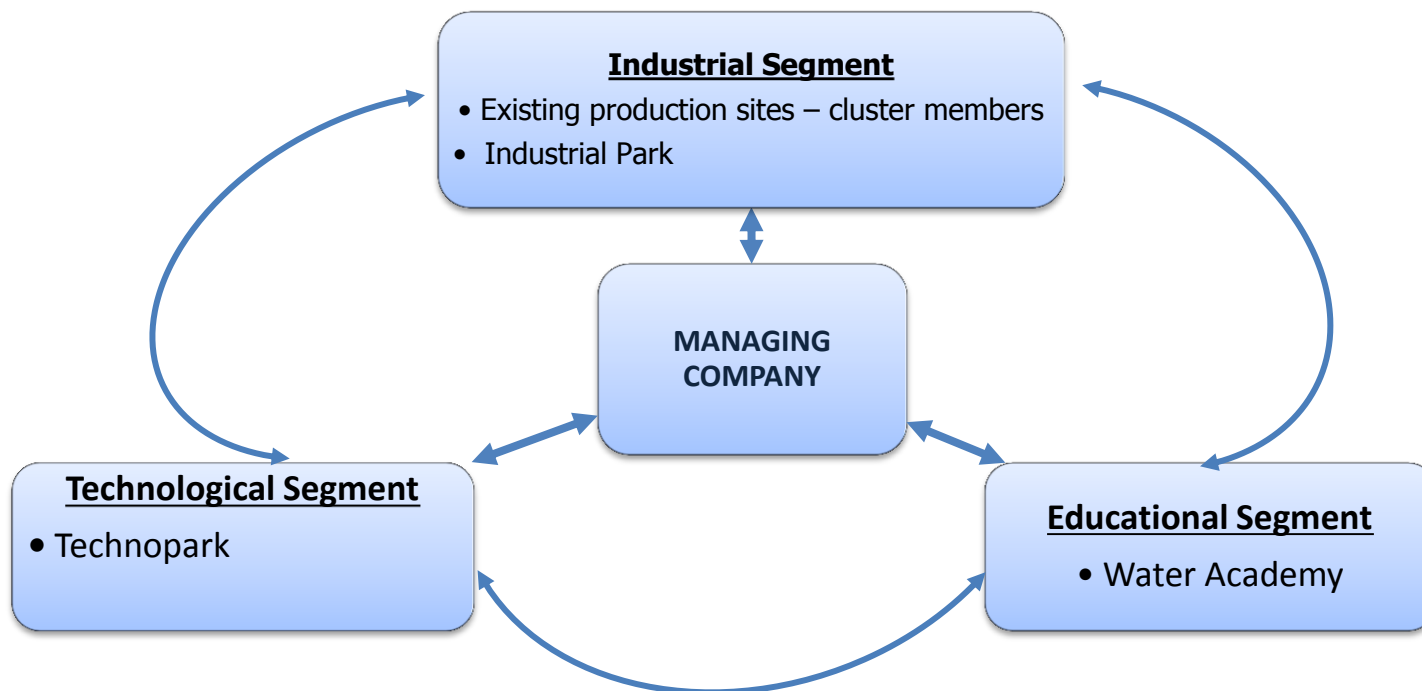
Biomonitoring system has been developed by the experts of St.Petersburg Science and Research Center for Ecological Safety under the Russian Academy of Sciences

Water Supply and Wastewater Disposal Cluster Structure

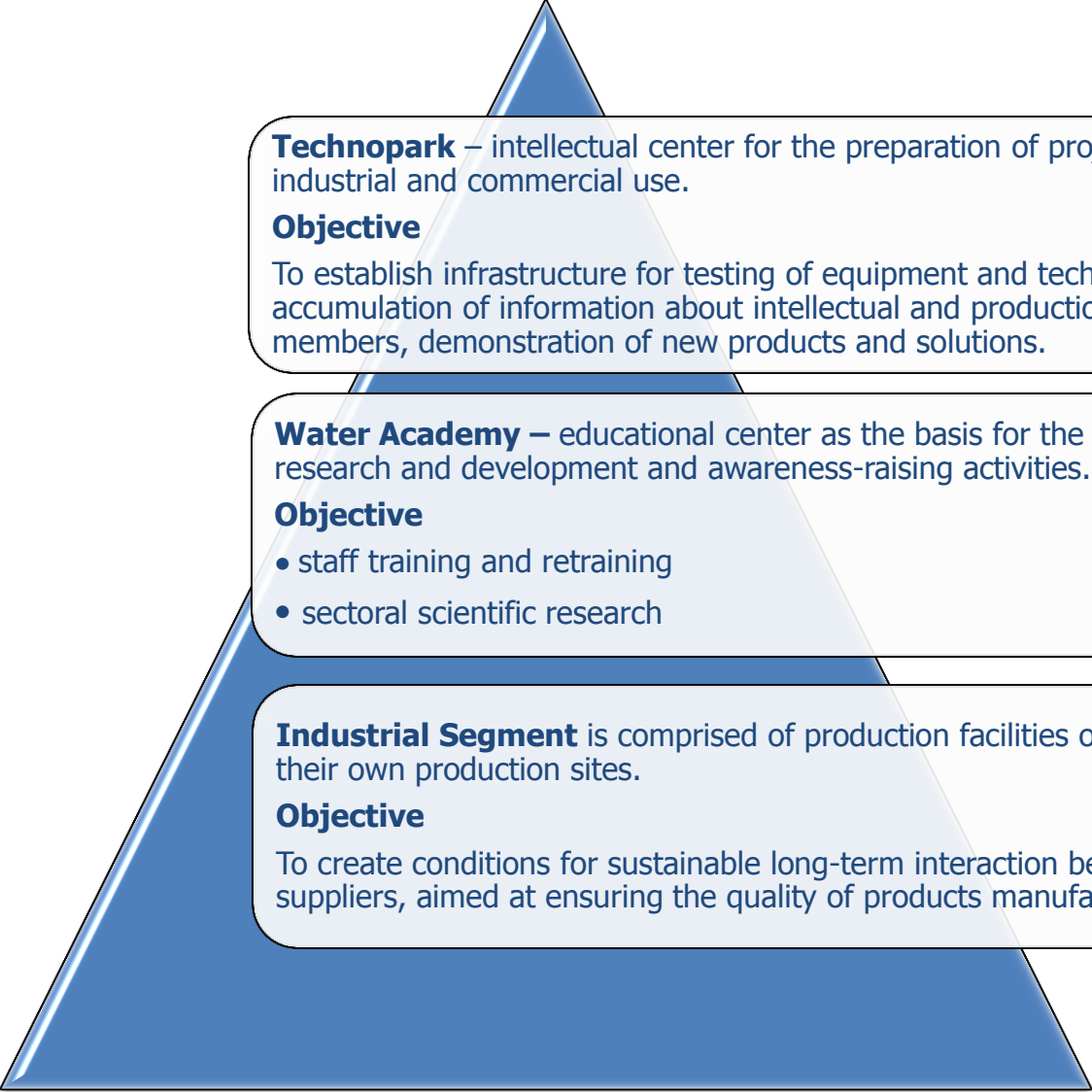
Resolution of St.Petersburg Government dated 13 April 2015 no.350 approves the Concept on promoting the establishment and development of **Water Supply and Wastewater Disposal Cluster** in St.Petersburg.

Objective of the cluster implementation policy - to ensure high rates of economic growth and diversification of the economy by improving the competitiveness of enterprises, suppliers of equipment, components, specialized production and aftersale services, research and educational organizations, forming the territorial-production clusters.

Water Supply and Wastewater Disposal Cluster Structure



Water Supply and Wastewater Disposal Cluster Segments



Technopark – intellectual center for the preparation of projects of the cluster for industrial and commercial use.

Objective

To establish infrastructure for testing of equipment and technological solutions, accumulation of information about intellectual and production capabilities of the cluster members, demonstration of new products and solutions.

Water Academy – educational center as the basis for the development of sectoral research and development and awareness-raising activities.

Objective

- staff training and retraining
- sectoral scientific research

Industrial Segment is comprised of production facilities of cluster members located at their own production sites.

Objective

To create conditions for sustainable long-term interaction between consumers and suppliers, aimed at ensuring the quality of products manufactured by cluster companies.

Production of tubular goods

St.Petersburg has 2 big polyethylene pipes manufacturing plants

The annual scope of works related to water and sewerage networks reconstruction ranges from 200 to 300km.

ZAO "Nordpipe" is an up-to-date manufacturer of polymer pipes, one of the top three market leaders in Worth-West Russia.

ООО "Ikaplast" produces domestic materials for trenchless technologies of pipeline rehabilitation.



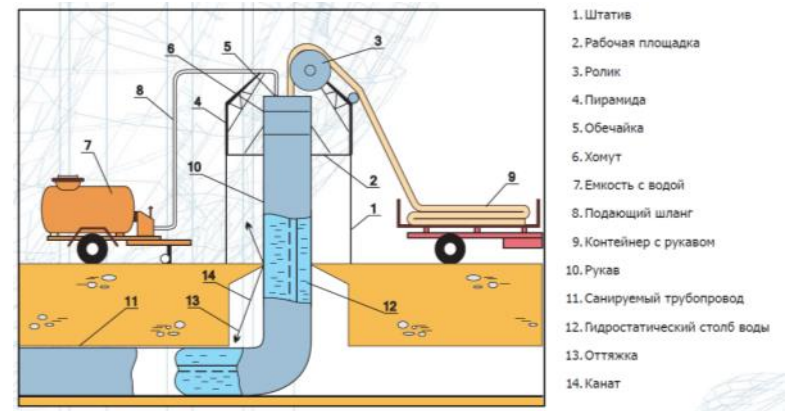
Water pipes



Sewerage pipes



Plastic pipes for manholes



Production of valves and pumps

- ✓ **Around 32,000 valves in the water supply and wastewater disposal systems require replacement by 2030.**

ZAO "ENEKOS Group"



Main advantages of butterfly valves manufactured by ZAO "ENEKOS Group":

- Use of advanced polymer coating and alloy steel welding of a structure ensures corrosion resistance; products are easy to use.
- Two-directional water supply is possible.
- Small face-to-face dimensions and size.
- No need for continuous maintenance.
- Possibility of tubeless installation; electric drive can be installed with a local control unit.

ARMSPETSENERGO (factory "Znamya Truda")

Designing and manufacturing of various types of valves:

- Valve gates
- Ball valves
- Back flow valves
- Non-return valves
- Check valves



- ✓ **Over 1,000 pumps in the water supply and wastewater disposal systems require replacement by 2030.**

Baltic Hydraulic Equipment Factory

DVN-type vertical centrifugal pump

A pump is designed for pumping water and other liquids similar in viscosity and chemical activity provided that the amount and size of suspended solids is below 3 g/l and 0.1 mm correspondingly, the amount of abrasive particles is below 2 %, temperature is below 45 °C (318 K).



Equipment of Local Manufactures used for the project on the establishment of Water Supply Management System

Water meters and pressure sensors



Pressure sensor

OOO "Alliance-Electro"

OOO "Alliance-Electro" is the manufacturer of its own product line ranging from metering instruments up to intellectual data acquisition and transmission devices and programme software.

OAO "Avangard"

OAO "Avangard" is engaged in developing innovative technologies and manufacturing of electronics equipment, microcircuitry products and professional equipment as well as basic load-bearing structures for electronic equipment by using up-to-date foreign equipment.



NEMO AQUA Software

NEMO Aqua - automated energy resource metering and balance composition system

Nemo Aqua, the automated metering system, is the result of efficient cooperation of OOO "Alliance-Electro" and partner-companies including such local companies as OAO "Avangard" (St.Petersburg), OAO Operating Company "Zavod Vodopribor" (Moscow), OOO "Meter" (St.Petersburg).



Environmental Awareness-Raising



Youth Environmental Center:

- Operates since **2002**
- More than **50 projects** implemented
- **Over 350,000 children** took part in its programs, projects and lessons

The Universe of Water Museum Complex:

- Operates since **2003**
- Three unique expositions
- Over **215,000** visitors per year



Over 1.92 mio. persons visited the Youth Environmental Center and the Universe of Water Museum Complex during **2002-2014** period