

Drinking water supply through the public water supply system

The text is based on the chapter *Drinking water supply through the public water supply system* published in yearbook *Prague Environment* 2006.

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The public water supply system in Prague and the drinking water treatment plants for the customer drinking water supply has been administered by the joint stock company of Pražská vodohospodářská společnost, a. s. since the beginning 1998.

The joint stock company of Pražské vodovody a kanalizace, a. s. (PVK, a. s.) is the operator of the Prague's water supply system.

Fig. Drinking water production since 1986 in respective water treatment plants

Source: PVK, a. s.

Drinking water treatment plants

In 2005 the long-term descending trend in the water production continued. Yet the annual decrease was slower than in previous years. Compared to the situation in 2004 the production dropped by 4,100,000 m³ water, i.e. the decrease by 3.1 %.

Compared to the previous year in the area of drinking water supply no substantial change happened in the output of water treatment plants.

Drinking Water Treatment Plant Podolí has been in use for a minimum time due to the long-term, decrease in the water consumption. It has been, however, permanently maintained at the operating state.

In 2005, when the Water Treatment Plant Podolí was under operation merely for one month, it produced 1,100,000 m³ drinking water, that is its share of the total water produced in PVK, a. s. was 0.87 %. It is a relatively small share, however, the water treatment plant forms a very important spare water source to Prague. Compared to the situation in 2004 the production of the Water Treatment Plant Podolí dropped by 172,000 m³.

Drinking Water Treatment Plant in Kárané is located at the confluence of the Jizera River and the Labe River. It was commissioned in 1914 when it became the first water treatment plant providing Prague with innocuous drinking water.

Its maximum capacity is approx. 1,900 l.s⁻¹. The water is pumped to Prague by means of three discharge mains 23 km in length each. A portion of the water produced is supplied to municipalities and communities to the plant immediate surroundings.

The Water Treatment Plant in Kárané is the only one of three water treatment plants serving Prague, which a portion of water comes from groundwater sources from sand-gravel strata and artesian wells. Its other source of water is surface water from the Jizera River treated by the artificial groundwater recharge.

Advantage of water from the treatment plant is its excellent quality. The drawback is its long-term as well as short-term limitations by weather conditions and the need of energy-demanding pumping to Prague.

The time dependence of water abstraction from classic (groundwater) sources is shown in Figure. It is obvious from the time dependence given that the most significant short-term drops happened in summer 2002 and 2005, and in spring 2006 partly in relation to the slated reconstruction of collecting mains and shutdown of pump stations, and by the shutdown of a part of classic sources caused by flooding. Concerning the long-term development it is essential that recently the drop of these abstractions relates to the decreasing trend in water consumption and also for the reason of increased fees for the groundwater abstraction.

In 2005 the Káraný Plant produced in total 31,700,000 m³ drinking water (summary of traditional sources and artificial recharge ones), which was approximately the same volume as in the previous year. This also means the Káraný Plant's production accounted for 24 % of the total drinking water production of the PVK, a. s. that is a slight increase in the share compared to 2003 (by 0.66 per cent point).

Drinking Water Treatment Plant Želivka is the most modern drinking water source to Prague having the largest capacity as well. It was commissioned in 1972. Its maximum output is about 7,000 l.s⁻¹ yet due to the decreasing water consumption it has been utilised up to its half only. Besides Prague the plant supplies drinking water a part of the Vysočina Region and smaller areas in the Central Bohemia Region.

This water treatment plant water source is raw water from the Želivka River accumulated in the Švihov Water Reservoir. The water reservoir was designed as a many-year reservoir with the usable volume of storage space 246 million m³ in between the spot heights 377.00 m and 343.10 m. The water level in the reservoir from January 1993 is shown in Figure. Since the beginning of 1995 the permanent trend in water level increase has been apparent and since January 1996 water in the reservoir has been fully swollen and only short-term drops in water level occur depending on precipitation. The fact also relates to the drop in the water consumption and thus with the decrease of the water production in the Water Treatment Plant Želivka in recent years. The extremely dry spell in 2003 incurred the lowest drop of level since 1996 down to the spot height 373 m yet when compared to the situation in the first half of the 1990s this is a low importance drop concerning the reservoir operation. In the course of the first half of 2004 the level got swollen back almost reaching the maximum level and no further significant drops happened. The short-term increase in the water level in spring 2006 was caused by floods.

Raw water is treated by sand percolation filters with fast filtration. The filtered water is taken to ozonation, which improves organoleptic properties of water. Health innocuousness is provided by means of chlorine dosing.

Treated water is led to Prague through a shaft mains approx. 52 km long and 2.64 m in diameter to the distribution reservoir in Jesenice. From the distributing reservoir water is delivered to the territory of the City of Prague in the area in between Písnice and Hrnčíře.

Major advantages of the source Želivka encompass the relative stability of raw water quality, substantial capacity of the source, and low energy demand due to the gravitational transport of water to Prague.

In 2005 the Želivka Water Treatment Plant produced in total 99,400,000 m³ drinking water, which means 75.1 % of the total water production of the company of Pražské vodovody a kanalizace, a. s. The plant production decreased annually by 3,900,000 m³.

Besides the drinking water sources mentioned here above the company of Pražské vodovody a kanalizace, a. s. also operates an **industrial water supply system**, which delivers industrial water to enterprises in the Northeast part of the City. The abstraction station thereof is located on the Libeňský Island and it uses the Vltava River as water source. In 2002 floods the pump station was submerged and heavily damaged. For the reason the industrial water supply system had to be shutdown. At present it is under reconstruction and its re-commissioning is under preparation.

Tab. The production of treated water in respective treatment plants of the Pražské vodovody a kanalizace, a. s. in 2005

Treatment Plant	Production [1,000 m ³]	Share [%]
Želivka	99 369	75,13
Káraný	31 746	24,00
Podolí	1 149	0,87
Industrial water supply system	0	0,00
Total	132 264	100,00

Source: PVK, a. s.

Water supply system

Because of complex topography the water distribution across the City territory is very demanding for technology. The drinking water supply system utilises 3,455 km of water mains (out of that 3,415 km are drinking water mains), 701 km of water branches, 40 pumping stations, and 71 distribution reservoirs of total volume 960,000 m³.

The water supply system features a relatively high failure rate due to its age, conditions of its construction, corrosion, material composition, and other effects. Approximately 1,000 km that is almost one third thereof out of the total system of pipes are over sixty years old. In 2005 the number of opened accident pits, which had to be performed in order to provide for the Prague's water supply system operation, accounted for 7,241, which is by 446 more than in 2004. In total 85 accidents of 1 st category (water supply disruption to over 1,000 inhabitants or to important buildings and premises) and 251 accidents of 2 nd category (water supply disruption to 300 to 1,000 inhabitants or to important buildings) were fixed. Compared to 2004 the number of accidents of 1 st category decreased by 17 and those of 2 nd category increased by 21 incidents in 2005.

In recent years the company managed substantially reduce water loss. The highest water loss was found in the half of the 1990s (up to 46 %). Since 1996 the water loss has been decreasing year after year. The trend is demonstrated in Figure.

Fig. Time dependence of water abstraction from classic sources in Kárané

Source: PVK, a. s.

Fig. Water level development in the Water Reservoir Švihov

Source: PVK, a. s.

Fig. Share of respective water treatment plants of the total production of drinking water

Source: PVK, a. s.

Fig. Share of groundwater of the total volume of drinking water produced

Source: PVK, a. s.

Fig. Water loss in water supply system

Source: PVK, a. s.

Water consumption and supply

In 2005 the total water production was 132,264,000 m³, out of that volume 14,211,934 m³ were supplied to clients located outside the Prague's territory. All water consumed in Prague was produced in sources operated by Pražské vodovody a kanalizace, a. s.

The tendency in the drinking water production since 1986 and in respective water treatment plants is shown in Figure. The graph clearly demonstrates still continuing long-term trend in every year decreasing water production lasting since 1991. The year 1996 was the only exemption when annual water production increased. It is obvious in recent years that the rate of the water consumption decrease has been gradually slowing down.

Percentage shares of respective water treatment plants on the total water production since 1986 are depicted in Figure. Within the period plotted the Water Treatment Plant Podolí recorded the highest drop in share of total production. While in the half of the 1980s its share was about 20 % in 2005 it was mere 0.9 %. In 2005 in the case of the Water Treatment Plant Kárané its share of the drinking water produced was 24.0 %, which is approximately the value from the second half of the 1980s. In 2005 the Water Treatment Plant Želivka attained the share of 75.1 %, which was a substantial increase compared to the 1980s and the 1990s.

The groundwater share of the total volume of the drinking water produced is graphically demonstrated in Figure illustratively documenting that following a couple years of permanent growth each year its share has slightly dropped since 2002. In 2005 the share was 13.3 %.

Fig. Diagram of the water distribution system of Prague and customers outside Prague

Source: PKV, a. s.