Chapter 13
Management of Drinking Water Resources in the Region of South Moravia, Czech Republic

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13.1 Introduction

The water as an integral part of the environment is a condition of the life and the development of human civilization. Today, the company can replace a number of natural materials, but the water is still irreplaceable.

Water Resources are the most essential for life on the planet, that for our next axistence. Source quality water, especially drinking water, resources may be formerly neglected for its poor quality. Already today, we can still improve the use of water resources and of low quality. A water surface, lakes, ponds and dams, flooded quarries, but also underground water, which in the past have been contaminated by human activity.

The major pressures on the waters are pollution, scarcity (including droughts), floods and modification to water bodies. In particular, pollutants of the aquatic ecosystem have their origin in agriculture industry, municipalities and other sources [1]. Water resources management we understand as a process of comprehensive assessment of the impact of water collection, its use and the return of water to the natural environment. It includes water use and protection of water resources in the area, while respecting the water circulation patterns in ecosystems territories and safeguarding the stability of the water circulation in the country. This process promotes the coordinated development and management of water and land resources in order to maximize the resultant economic and social welfare in an equitable manner, without compromising sustainability of vital ecosystems [2–5].

In the territory of the Czech Republic, especially in the South Moravia region, the settlement has been taking place for centuries, and this also involves regulating the water regime in the area. The first was the drainage of wetlands—swamps and

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marshes, and ponds were set up. As the human settlements expanded, there was a need for flood protection, the regulation of watercourses and the construction of flood protection tanks.

With the development of civilization, the emergence of industry and economic stability, water demand has steadily increased. Water was used in agriculture, industry, and supply of the population. The demands of not only its quantity but also its quality have increased; it has led to the search for new sources of high-quality water. People have constantly been improving in water recovery from the natural environment, as well as improving water treatment, wastewater treatment and water use as a source of energy.

The problem of water supply in sufficient quantity and quality for society has become a global problem at the end of the last century; the need for water protection has become part of a number of international documents. In 1968, the European Water Charter, which in 12 points clearly declares irreplaceability of water as a raw material that is not inexhaustible, has been proclaimed in Strasbourg on 6 May in Strasbourg, it must be maintained and cared for its preservation and expansion, where it is the duty of each of us here purposefully and economically.

In our region, by the year 1989, water management has been influenced by central management and generally underestimated economic and ecological impacts of the ill-considered use of water resources.

In recent years, the situation is finally beginning to change (perhaps not too late), water is no longer seen as a raw material but as part of the environment, which is the need to preserve for the next generation.

Today we are looking for new resources and also, as far as possible, to expand existing resources.

13.2 The Most Important Water Resources in South Moravia for Public Supply

A water source is a body of surface or groundwater that can be used to meet human needs. The inhabitants of the Czech Republic are supplied with 42% of the underground water sources, 32% receive water from surface sources and 26% are covered by mixed sources. All drinking water sources have protection zones. In these protection zones, the conditions of general protection according to the Water Act must be observed [6].

In the South Moravian region, both surface water sources (reservoirs) and underground water resources are used to supply drinking water to the public. In most of the territory, drinking water supplies to a combination of sources of surface and groundwater, with the only exception being Znojmo, where the population is supplied from the surface source of the 'Znojmo Dam' (Fig. 13.1).

Fig. 13.1 Position of South Moravian region in Czech Republic [7]

13.2.1 Water Reservoirs

Water tanks are tanks whose main priority is to accumulate water for further use as drinking water. In the Czech Republic, as 47 water reservoirs [8], of which six reservoirs participate in drinking water supply in the South Moravian Region.

The water reservoir is a water tank intended for the mass supply of potable and industrial water according to [9]. The list of water reservoirs supplying the territory of the South Moravian Region is given in Table 13.1.

The water reservoir Opatovice on the Malá Haná River is located near the village of the same name. The reservoir is a source of water for the area of Vyškov and Bučovice. The reservoir was put into operation in 1997. The water abstraction is realized by a withdrawal tower height of 43.85 m. The catchment extends into the forested part of the Drahanská highlands without significant sources of pollution. The main purpose of the reservoir is to provide water for the supply of the population. Therefore, in the year 1986, the area was declared hygienic protection zones and recreation was excluded. Approximately 2 million m^3 of water per year is taken from the storage volume in the tank for potable water treatment. Another important purpose is to ensure a minimum flow in the flow below the dam. Since 2008, this flow has been used to produce electricity in a small hydropower plant.

The Bojkovice dam on Kolelačský stream is located about 2 km north-east of the village of Bojkovice. The basin is mostly wooded and without concentrated area. The water tank was put into operation in 1966. Water collection is realized from a combined building at two levels. The main purpose of the waterworks is to provide sufficient water for the Uherský Brod group water supply and to ensure a minimum flow in the flow below the dam.

The Znojmo waterworks are located in 132.73 km of the Dyje River, put into operation in 1966. The main purpose is the supply of drinking water for the city of Znojmo and the equalization of flow on the river Dyje.

The Boskovice reservoir is situated on the river Bělá east of the town of Boskovice. The reservoir has been in permanent operation since 1994. The main purpose of the waterworks is to provide a supply to supply Blansko region with drinking water. At present, however, the water supply is suspended. The waterworks also serve to

Table 13.1 Water reservoirs supplying the South Moravian Region

Name of the reservoir	Watercourse	District
Opatovice	Malá Haná	Vyškov.
Bojkovice	Kolelačský potok	Uherské Hradiště, Zlín
Znojmo	Dyje	Znojmo
Boskovice	Bělá	Blansko
Koryčany	Kyjovka	Kroměříž
Vír I	Svratka	Žďár nad Sázavou

improve the low Bela flow under the dam, to reduce the peak flood flow and to generate electricity in a small hydropower plant.

The Koryčany reservoir is located on the Kyjovka River east of Koryčany. The reservoir has been in permanent operation since 1963. Water collection from the bay is realized by a 28-meter-high takeout tower, the collection is possible from four different height horizons.

The water work Vír I is situated on the river Svratka and was put into operation in 1958. The original purpose of the reservoir was water, but flood, recreational, energy, and mining flow in the bed under the tank. It was only after commissioning that it was decided that the reservoir would be primarily used as a water supply, eliminating its other purposes, especially recreation. The sampling object is located in the dyke and allows for collection from three levels of height. The reservoir has designated hygienic protection zones where bathing and fishing are prohibited.

The water from these tanks can only be used for drinking purposes after further treatment. The water is supplied to the potable water treatment plants and then distributed to the consumer. Today, most tanks are threatened by deterioration in water quality due to the development of cyanobacteria in the summer months. Moreover, even tanks that have a relatively good inflow or in the past due to higher altitude problems with cyanobacteria did not.

13.2.2 Water Flows

Surface flows can also be a source of water for supply as a source of potable, service water or main water for use in agriculture or industry. Water from the streams is not used in the South Moravian region for drinking purposes. The water flows are not here.

13.2.3 Underground Sources

Underground water sources are generally understood to be sources of good water. The area of the Blansko district is supplied exclusively by scattered underground sources, as is the Břeclav district. The other districts: Hodonín, Vyškov, Brno are supplied both from underground and surface sources. Underground resources in South Moravia, like all underground sources in the territory of our country, are threatened by the long-lasting dry period (last six years). Inventories of groundwater are becoming smaller and smaller due to lack of precipitation, while the sampling is still the same or even greater with the growing economic maturity of the company. An annual problem, for example, is the mass influx of swimming pools in the spring. Although there are rock sites with high groundwater accumulation capacity in the region, such as the upper Svitavy region where the groundwater source for Brno–Březová nad Svitavou or the rock of the Upper Moravian Vltava, the Quaternary of the Morava River, is located

in recent years, there have been significant decreases in groundwater levels. Due to poor farmland management and an increasing share of paved areas, water does not have the potential to catch up with subsoil stocks.

One of the longest used underground sources is the source Březová nad Svitavou.

The spring field uses large reserves of cracked groundwater in the chalk layer complex near Březová nad Svitavou, supplemented mainly by the infiltration of atmospheric precipitation into the rock environment.

Of the four aquifers formed here, predominantly separate, two intermediate ones are used.

The mounds of them are collected by two sowing rows. Siphon rows of the first Březov waterworks with 14 drilling uncovered wells of profile 650 and 635 mm depths 17–21 m are placed in a 300 m long barrel with a massive brick lining.

The collecting unit water pipeline II. of the Březov waterworks consists of 28 wells to the depths of 12–18 m, the own wells of which are connected to the ascending branch of a 688 m long water pipeline located in access gallery a monolithic bottom with prefabricated walls and a ceiling.

The deeper aquifer is exploited from the II of the Březov watercourse using seven receiving boreholes of depths of 80–130 m with running submersible pumps whose discharge lines are inserted into a common collection line.

The water-permissible withdrawal from the collecting device of the I. Březová water main is 300 l/s, from the collecting device II. The actual take-off is governed by the current hydrological situation according to the status of the groundwater levels and the water demand for the supply of the consumable.

The water from the collecting units of the two Březov water pipes is brought to a common reservoir in Březová nad Svitavou with a volume of 5000 m^3. This reservoir serves both for the fixing of the hydraulic conditions in the siphons as well as for the operationally necessary accumulation for the control of the water consumption from the springs I and II with the berserker, which both divert water from this reservoir. This method of operation lasts from 1975, when it was under construction II of the Březova water supply pipeline in Březová was completed and put into operation. Originally, the I Birch water mains was operated from the collecting facility to the city of Brno without accumulation [10] (Fig. 13.2).

13.3 Water Supply Systems—Distribution of Drinking Water in the Region of South Moravia

In the South Moravian Region, drinking water is distributed to the population mainly by the Water company joint-stock company (VaS), in its divisions (in the territory of the South Moravian Region): Boskovice, Brno and Znojmo. Another company providing water transport is the Brno waterworks and sewerage system (BVaK), which operate not only in Brno but also manage watercourses and many municipalities in

Fig. 13.2 Springfield Březová nad Svitavou [10]

Table 13.2 Overview of Water company joint-stock company and their administration in the territory of the South Moravian Region

	Division Boskovice	Division Znojmo	Division Brno venkov
Water mains (km)	869	720	744
The number of municipalities supplied	90	109	119
Population supplied	86,775	81,184	117,700

the district of Brno venkov or Blansko. Also, there are spas, waterworks and sewerage Kromeriz, Waterworks and Sewerage Zlín, Waterworks and Sewerage Břeclav.

The Water Company was established in 1993. It is one of the largest water companies in the Czech Republic in the field of water supply and sewerage. The individual divisions provide water and sewerage, drinking water production and supply including substitution, maintenance and repairs of water supply and sewerage, drainage and waste water treatment (Table 13.2).

The Brno waterworks and sewerage system was established in 1992. The main activity is the operation of public water supply and sewerage systems, the production and supply of drinking water, the detection of faults on the water supply network, the layout of water supply and sewerage systems, the inspection of sewers using a television camera. Company perform drafting sewege and rainwater and cleaning in Brno—Modřice sewage treatment plant including sludge disposal. Laboratories of the company are conducting analyses of drinking and wastewater. The water supply

system of the city of Brno, including the new Vír regional waterworks, which the company also operates, is also supplied with drinking water to the water mains for Šlapanice and its surroundings, Bílovice n/Svit., Adamov, Malou Lhota, Štěpánovice, Malhostovice and Drásov, Želešice, Rajhrad, Sokolnice, Těšany and other villages adjacent to the southern branch of the Vír Regional Water Supply. The insufficient capacity of the local water resources for the city of Tišnov is complemented by a new supply line from the Vír Regional Water Supply. The length of the administered water supply network is 1415 km, the number of people supplied with drinking water is 410,047.

In the Kroměříž region, the water supply network has been operating since 1993 as the joint-stock company Water supply and sewerage Kroměříž, the source of drinking water is groundwater. The length of the water network being administered is 619 km, and the number of people supplied is 105,891 persons.

In Zlín and the vicinity, there is the water supply and sewerage system Zlín, which manages and disturbs drinking water. The company was founded in 1993. The number of persons supplied with water by this company is 170,138, the length of the administered water network is 1435 km. The water distribution system is provided by the group—Zlín water mains. The advantage of this system is that both water treatment plants, in Klečůvka and the plant in Tlumacov, can represent themselves. The water treatment plant in Klečůvka is able to supply the whole large area of Otrokovice and Tlumačovska in case of emergency. This was confirmed, for example, in the devastating floods of 1997, when Otrokovice and Tlumacov were completely flooded. Should there be an outage on the contrary in Klečůvka, almost all households and businesses in Zlín and the vicinity will supply the water treatment plant.

Region Břeclav has been managed since 1994 by the Water and Sewerage Company Břeclav. The company operates water management facilities in 73 towns and municipalities, supplying them with drinking water to 110,583 inhabitants, the length of the water network in the company's management is 965 km.

Water supply and sewerage Hodonín, a company established in 1994, operates in a region comprising the district of Hodonín and parts of the districts of Břeclav, Vyškov and Kroměříž. Drinking water is drawn from three sources in total: surface water from the water reservoir in Koryčany, groundwater from the quarry of the Morava River between Bzenec and Uherský Ostroh and from underground sources near Moravská Nová Ves. The total length of the network of water mains is 340 km, and the population supplied 136,270.

Water Supply and Sewerage Vyškov is a company operating water and sewage systems with sewage treatment plants on the territory of the Vyškov district. Water comes from more sources, but three are major. Surface water comes from the water treatment plant in Lhota, the underground from the springs in Drnovice and near the Dědice. The company was founded in 1993 and currently manages 628 km of water mains.

The vast majority of inhabitants, municipalities and towns are supplied from public water supply systems, municipalities where the supply of drinking water from the

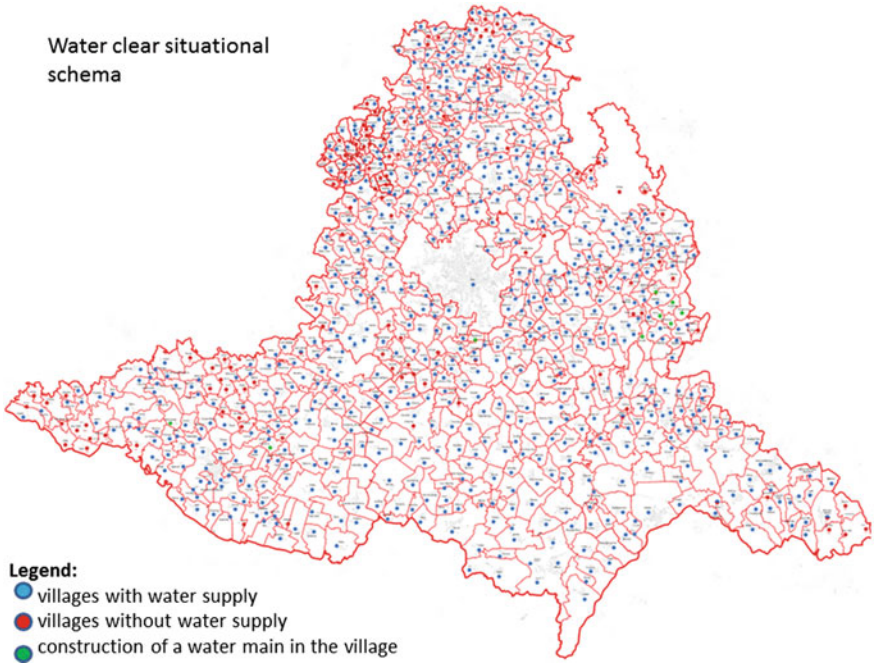

Fig. 13.3 A clear situational scheme of water mains in the South Moravian Region [7]

public network is not yet fully covered, are small municipalities in the north-west part of the region see Fig. 13.3.

South Moravian water companies produced a total of 63.6 million m^3 of drinking water in 2017; the share of quality groundwater was 86.6%. The average consumption is 93 l/person/day, which is the second highest consumption after Prague (109 l/person/day) compared to other regions.

13.3.1 Regional Water Line of Vír

Vír regional supply water systém distributes treated water from the Vírský reservoir. The water is treated in the water treatment plant Svařec. The water pipeline would be built in 1988, and the construction was completed in 2000. The water supply was put into operation in 2002, when the first phase of the Vírský vodovod, part of Švařec—Čebín, was completed, with a length of 47 km. Vodovd is in its route from the water treatment plant Svařec to the Čebín water reservoir and is made of fibreglass pipeline. It is in the reservoir near Čebín north of Brno that water is mixed from Vírský and Březovský water mains.

The water main on its route from the north of the region to the area south of Brno Fig. 13.3 supplies the surrounding villages and other municipalities are still connected. The construction of the District Vírský Vodovod is, thus, still a living building and is constantly expanding.

13.3.2 Březov Water Line

I. Březov feeder

The waterworks was put into operation in 1913. The pipeline is made of cast-iron pipes and is almost all along its length in the closed valley of the Svitavy River, along with roads and railways. In the highly articulated terrain between Blansk and Bílovice nad Svitavou, three massive stoles were pierced for laying the pipeline, the longest of which was 614 m long. The height difference between the groundwater level in the spring and the water level in the Holé Hory reservoir in the city of Brno Lesná, where the feeder ends, is 89 m and ensures a continuous flow of about 264 l/s. Directly from the feeder is water to Adamov and Letovice.

II. Březov feeder

The 55,557-meter self-propelled feeder is made of steel pipes. It was put into trial operation in 1975. The conveyor is led from the reservoir from Březová nad Svitavou and ends in a water reservoir on Palacký hill in Brno. The height difference of the water reservoir levels at both ends of the feeder is 66.50 m and provides a maximum flow of 1140 l/s. Pipeline route is 6× railway, several times Svitavy River and many small streams and streams all along the route.

In 1997, in connection with the construction of the Vír Regional Water Supply, the II the birch duct and the feeder of the Vír Regional Water Supply in the Čebín node. This build allows the mixing of water from the two different water sources in the Čebín water reservoir built within the Vír Regional Water Supply and thus the possibility of qualitative homogenization of the harder waters of the birch and soft water of the Vortice. Furthermore, water is hygienically provided with chlorine dioxide. A part of the mixed water from the Čebín water reservoir is fed back into the piping of the feeder II. water supply system and through the Palackého hill water reservoir to the Brno water supply network. The Čebín pumping station still remains an important node of the system in which the inflow of drinking water from both feeders to the Čebín water reservoir is measured and the outflow to the continuing II. Březov water supply.

Inclusion II of the Březov Water Supply, along with the I Březov Water Supply, a significant complex of quality water resources was created, providing sufficient water for the dynamic development of the whole Brno region and the wider area for many years to come [10] (Fig. 13.4).

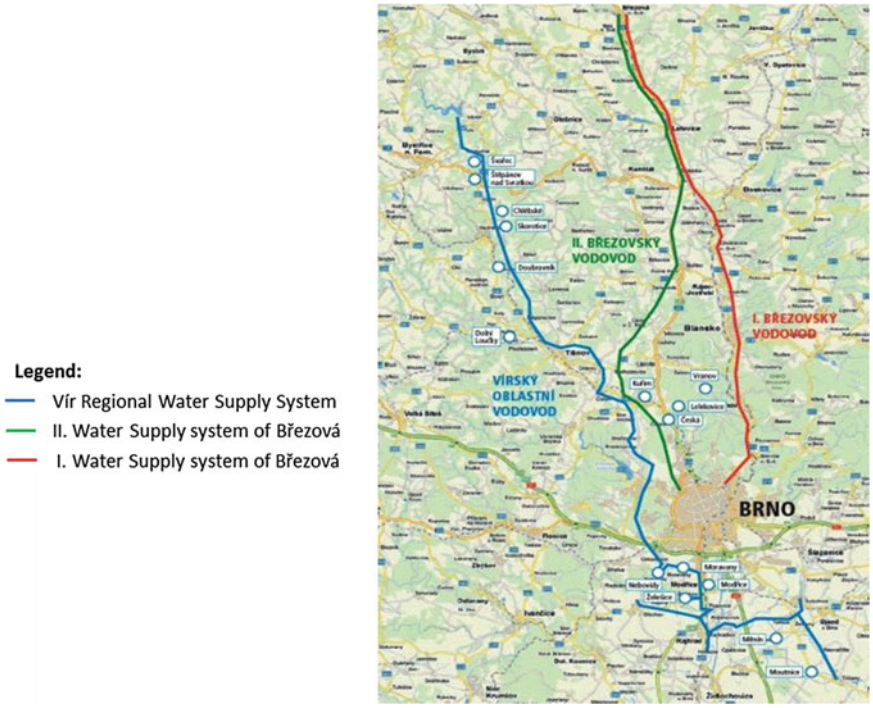

Fig. 13.4 Waterway routes for Brno and surroundings [10]

13.4 Drinking Water Quality

Chemically pure water does not occur naturally, as well as drinking water is a mixture of various substances, minerals, and compounds dissolved in water. The amount of these substances depends on the origin of the water—the groundwater dissolves these substances in the passage through the rocks. Therefore, their content is usually higher than the surface water where the higher proportion of the rainwater with the minimum content of dissolved substances is represented. New research addresses how to protect underground sources from barrier contamination [11].

13.4.1 Springfield Březová nad Svitavou

The quality of the water from the Březová spring is very balanced and meets the requirements of the standard [12]. Which sets out the hygiene requirements for drinking water and hot water and the frequency and scope of drinking water control, as amended) drinking water without modification. The water has a balanced mineral content, a stable temperature of 9–10 °C and is one of the most valuable drinking water

for human consumption. Water quality has not changed much since the beginning of the use of resources. However, the influence of anthropogenic activities in the vicinity of the sources has been manifested by unfavourable development of ox disability and, in particular, the concentration of nitrates, when nitrate levels increased to a level of 40–45 mg/l from around 20 mg/l in the 1970s. However, water quality has always been ensured with the abovementioned Decree on Drinking Water.

To maintain the current state of water quality, protection zones of the water source are declared.

13.4.2 Water from Reservoir Vír I

Another important source of drinking water in the region is the Water Reservoir Vír I Water from this reservoir is supplied gravitationally to about 5 km away from the Švařec water treatment plant. The water is free of impurities and undesirable dissolved substances in the treatment plant. The water is filtered on sand filters and charcoal filters, adjusted by pH liming, ozone disinfection and chlorine dioxide (ClO_2) hygiene. The water from the tank is worse in recent years due to the poor water quality of the inflow. Among the most polluted profiles in the basin of the reservoir are the long profiles of the White Creek, which is the tributary of Svratka from the town of Polička above the water reservoir Vír. The stream is extremely polluted, especially municipal sewage, which comes from the sewerage network directly into the flow, is blamed here. Another factor that degrades the water quality in the tank is the overgrowth of cyanobacteria, especially in the summer. Despite these problems, the water from the Vír reservoir is suitable for drinking purposes according to the relevant legislation (Table 13.3).

Raw water in the reservoir has deteriorated in recent years, mainly due to strong eutrophication.

Table 13.3 Selected parameters of raw water quality of the water reservoir Vír I

Parameter	Measured value
pH	7,07
Nitrates (mg/l)	12,63
Total nitrogen (mg/l)	2,75
Phosphates (mg/l)	0,1
Manganese (mg/l)	0,128

Table 13.4 Selected parameters of water quality from some underground sources in Vyškov

	Dědice	Drnovice	Rašovice	Olšany	Kobeřice	Milešovice	Limit according [6]
pH	7,5	7,46	7,29	6,9	7,37	7,49	6,5–9,5
Hardness (mmol/l)	4,73	3,94	4,09	1,64	5,82	2,67	2–3,5
Nitrites (mg/l)	<0,0005	<0,005	0,014	0,006	0,012	0,06	0,5
Nitrates (mg/l)	26,8	5,8	11,5	4,83	1	13,4	50

Table 13.5 Selected parameters of water quality in the Opatovice reservoir

pH	8,1
Hardness (mmol/l)	1,58
Nitrites (mg/l)	0,003
Nitrates (mg/l)	2,4

13.4.3 Vyškov Region

Vyškov region supplies mainly underground sources, the water of which meets the limits given by the Decree on the Quality of Drinking Water. Some parameters of selected underground sources are in Table 13.4. Generally, the water from these springs is harder, contains higher concentrations of calcium and magnesium, but these never exceed the allowed limits.

The only surface source of water in Vyskov region is the water reservoir Opatovice. Parameters of some quality indicators are in Table 13.5.

13.4.4 Kroměříž Region

In this area, groundwater, which is conditioned by ozonisation, is collected, which ensures sufficient quality for drinking purposes. The quality of water supplied to the city of Kroměříž is shown in Table 13.6.

Table 13.6 Selected parameters of water quality in Kroměříž

Parameter	Measured value	Limit according [6]
pH	7,33	6,5–9,5
Hardness (mmol/l)	3,1	2–3,5
Nitrites (mg/l)	<0,02	0,5
Nitrates (mg/l)	5,0	50

Table 13.7 Water hardness scale

Very soft (mmol/l)	0–0,7
Soft (mmol/l)	0,7–1,4
Medium hard (mmol/l)	1,4–2,1
Hard (mmol/l)	2,1–3,2
Extremely hard (mmol/l)	3,2–5,3
Very hard (mmol/l)	>5,3

13.4.5 Blansko Region–Boskovice Region

In the northern region of the South Moravian Region, there is a large number of predominantly smaller underground sources, the quality of which is satisfactory after ensuring health. Since it is groundwater, it is medium to hard to very hard water, for water hardness assessment see Table 13.7.

13.4.6 Zlín Region

Drinking water in the Zlín region flows from the Klečůvka and Tlumačov water treatment plants. The water has to be treated in the form of a chemical–technological process in a water treatment plant. Drinking water in Zlín is usually medium–hard, which is ideal for everyday consumption. In Zlín and around it, every year they drink and consume millions of cubes of water, which come from two main sources of drinking water.

The water for the eastern part of Zlín, surroundings of Vizovice, Slušovice, Kostelec and Fryšták is pumped from Slušovice reservoir and undergoing subsequent treatment in a water treatment plant in Klečůvka. For the western part of Zlín and around Otrokovice and Napajedla, underground water from wells and hydrogeological wells is collected in two areas: Tlumačov forest and Kvasice–Štěrkoviště. This water passes through the treatment water in Tlumačov. As already mentioned, the quality of the raw water collected is reflected in the quality of the reservoir and its catchment area. It is not surprising that the parameters of raw water taken from Karolina, followed by collection from Slušovice, are by far the best.

Other tanks have their specific problems, for example, the Bojkovice reservoir has high levels of manganese in the raw water, which is released during the summer months in the absence of oxygen at the bottom. Iron and manganese cause the taste of drinking water. In terms of these indicators, Karolinka and Slušovice are the best.

13.4.7 Znojmo Region

In Znojmo, where the Znojmo water reservoir is the main source of water, the quality of the drinking water is ensured at Znojmo water treatment plant. The plant has recently been renovated, and water quality is currently secured by filtering through activated carbon, chlorination and the use of UV lamps. Water is roughly as hard to medium as hard to extremely hard see Table 13.7.

13.4.8 Břeclav Region

Three water treatment plants are in operation for the production and supply of drinking water: Břeclav–Kančí obora, Lednice and Zaječí (Table 13.8).

In the South Moravian Region, water for drinking purposes is treated in 157 water treatment plants in total. Overall, the Břeclav and Blansko districts show a satisfactory state of supply to the public with water from public water supply systems. The most unsatisfactory situation is in the districts of Znojmo and Brno–venkov.

Own water supply is done overwhelmingly by group waterworks, connected to significant water sources and, in some cases, interconnected into integrated district supply systems. As there is a large number of inhabitants in the Czech Republic supplied with drinking water from public water supply systems that are connected to sufficient capacity water supply sources, there has not been a more serious problem with the supply of drinking water in towns and larger municipalities during the last two years. On the contrary, problematic problems were in municipalities using local groundwater resources and individual sources (wells). These resources are not able (by way of exception) to bridge the prolonged drought. Quality control of these local resources is also striking, and in the case of household wells, it is almost zero.

For the further development of water management in the region, it is a priority to ensure the qualitative parameters of drinking water and to reduce losses in water mains.

South Moravian water companies generated 63.6 million m^3 of water in 2017 (62.5 million m^3 in 2015), of which water from groundwater accounted for 86.6%.

Table 13.8 Selected parameters of water quality in Břeclav

Parameter	Measured value	Limit according [6]
pH	8,1	6,5–9,5
Hardness (mmol/l)	3,2	2–3,5
Nitrites (mg/l)	<0006	0,5
Nitrates (mg/l)	2,82	50

13.5 Drinking Water Consumption

Drinking water consumption in the Czech Republic has started to fall sharply since 1990, and the consumption of drinking water for households in the last three years increased to about 89 litres per person per day. The development of water consumption in the Czech Republic is shown in Fig. 13.5. The many-year decline was due to a radical increase in water prices. A slight increase in recent years can be attributed to the growing economic strength of society as well as to the increasing share of connected inhabitants in public water supply systems, which is connected to almost 95% of the population. Current consumption also places us in a group of states with lower water consumption.

South Moravian households have the second largest consumption of drinking water after Prague. The development of water consumption for the regional city of Brno is presented in Fig. 13.6. Consumption in brine is higher than the average water consumption in the whole region. In 2016, a person living permanently in the household in the South Moravian Region, which was supplied with water from the water supply, daily consumed 92.9 litres of water a day, Praguers drank another 15 litres of water from the tap. The lowest average consumption in the Zlín Region is 75 litres per person per day [13] (Fig. 13.7).

The area of South Moravia is one of the driest in the Czech Republic, especially in recent years; the precipitation deficit in this area is deepening. This is related to the decrease in water levels in tanks, where water levels in the river cannot be maintained, as the reservoirs provide the missing flow of water in the water, to preserve life in riverbeds and streams. Very significant is also the decrease in groundwater, which is not subsidized by the absorbing water. Another problem is the constantly increasing share of paved areas due to new construction. Areas of arable land, where the water has naturally plummeted, are now converted into impermeable surfaces, and the

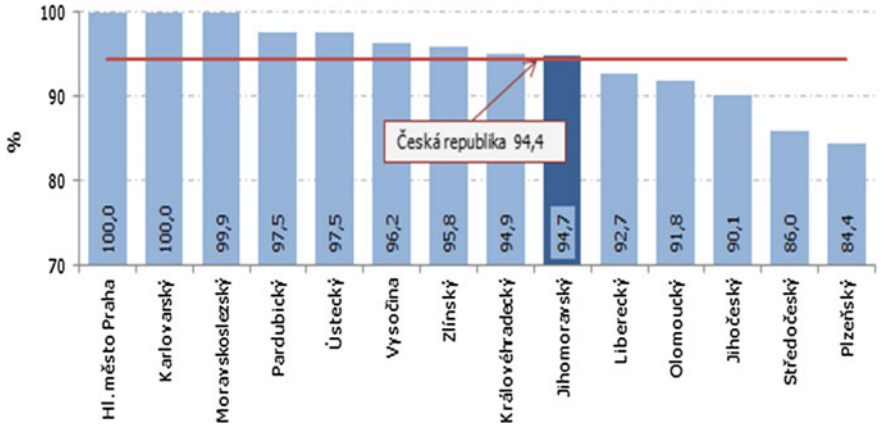

Fig. 13.5 Residents connected to a public water supply

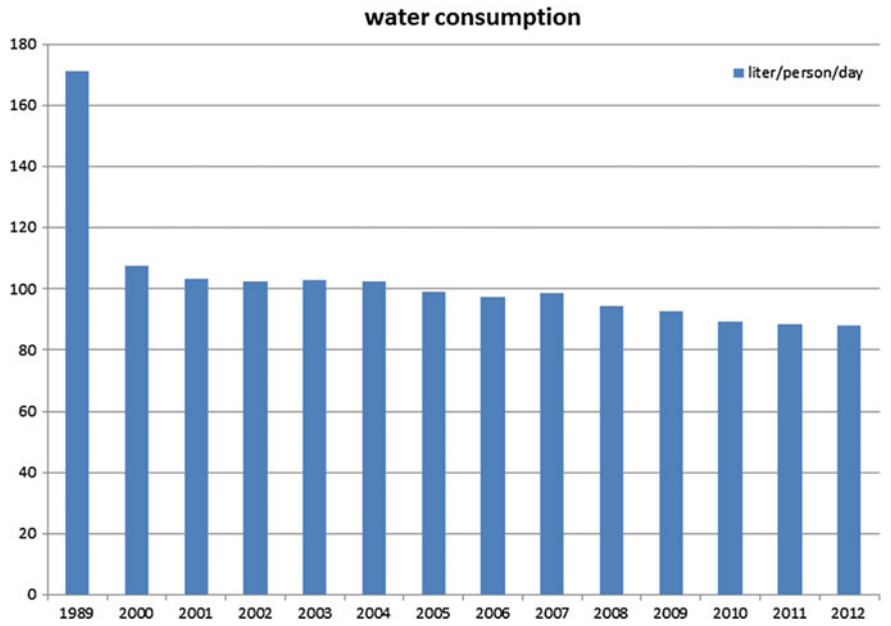

Fig. 13.6 Process of water consumption in the Czech Republic

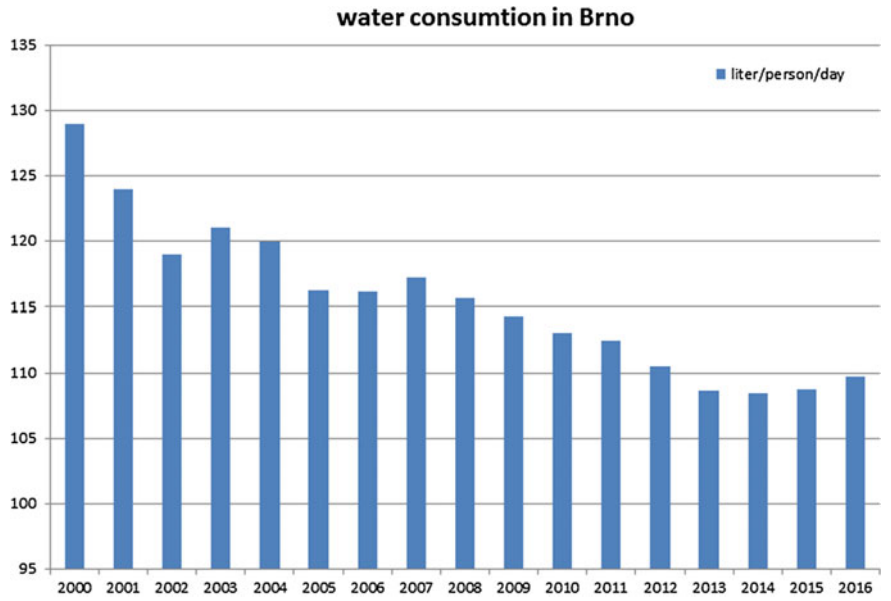

Fig. 13.7 The process of water consumption in Brno City

water is drained through the sewer system directly into the flow channels. Which means that the water does not bounce into the underground. But it is very quickly taken to the waterways where it increases the flows during the rainy season and thus increasing the demands for flood protection. This situation first occurs in shallow underground sources, but it is only a matter of time when water supplies fall in deeper horizons.

Water distribution in South Moravia does not always respect the administrative division, so the parts of some neighbouring regions are included in the text.

13.6 Strategies for Sustaining the Water Supply

The main objectives to ensure the required level of drinking water supply in accordance with the requirements of the European Union are:

- Expansion of the public water supply network, especially in locations where local sources of suitable quality cannot be used. This problem concerns mainly the districts of Znojmo, Brno–venkov and Blansko. These are predominantly smaller municipalities with less than 500 inhabitants.
- Reconstruction and renewal of water mains, which are often in an unsatisfactory condition. The reason is the use of inappropriate material or the age of the water supply. It is necessary to reconstruct the relevant water management objects and to extend the water reservoirs accumulation.
- Enhancement of technological processes to ensure the required level of drinking water to meet the relevant legislative requirements [14].

These measures are already being implemented. In municipalities around large cities, water mains are spreading mainly due to the dynamic development of housing construction.

This implies both the requirements for the construction of the distribution network, but also the increase of the existing network capacities and the increase of the accumulations in the water reservoirs.

In major cities and in the centre, attention has been focused on the renovation and reconstruction of the water mains.

Installations for potable water treatment plants are also being continuously modernized.

Another important strategic measure is the interconnection of water systems. Ensure substitution of individual sources and ensure continuity in water supply even when disconnecting or closing some water management parts and objects on the network.

13.7 Conclusions

With water resources, we have to constantly learn to handle very gently, trying to continually improve this skill. Come with new solutions to reduce water consumption and use it efficiently, expand opportunities and strategies for rebuilding water supplies and increasing both quality and quantity. In recent years, climate change has also been reflected in legislative measures in the Czech Republic. Measures for water retention in the countryside and for the management of rainwater are supported, in the form of subsidy titles. Therefore, these tendencies should be supported, extended and legislatively enforced. It is also necessary to map the existing resources in detail and, if possible, to seek ways of recovering both surface and underground resources. One possibility is detailed monitoring of underground aquifers and sustainable management of their use [15].

The problems faced by South Moravia in recent years are not just a local problem, it is a worldwide problem of the twenty-first century.

Lack of water has undue consequences for human society; one of the consequences is also the limitation of agricultural production. Lack of water will affect what we eat, how we adjust our food, who has enough food and even the ultimate taste of food. Our behaviour and our approach to water resources to use water and its consumption will need to be radically changed.

The South Moravian Region has so far reliable supplies of drinking water, both surface water and groundwater. However, it is evident that the influence of drought is slowly reflected both on the quantity and quality of water. Undertakings that have water and water resources management apply a strategy of interconnection and duplication of individual supply systems, trying to ensure water distribution in the event of a failure of individual regional sources. Such a water-related water supply solution for drinking water supply is far from obvious in the Czech Republic.

Quite often, it seems to be an effective tool to get an advanced company to water, but also to discuss water consumption, to raise prices for water. However, companies that are involved in water distribution, management and production of drinking water are often foreign corporations, which make a significant profit. Then, it is very speculative if the money that is spent is back spent on sustainable water management. According to the World Resources Institute's analysis, a total of 37 countries in the world are currently facing an extremely high level of water stress. For many, it could certainly be an interesting opportunity to invest in the life-giving fluid. Investments in flood-traded funds that are built on the water do not mean that the value of the fund depends on the actual price of water, but it depends on the price of the shares of companies dealing, for example, with the saving or treatment of water and, last but not least, delivering new technologies to the water industry.

13.8 Recommendations

In the past, the Czech Republic, in the face of extreme floods, was preparing to protect itself from increased flows and the occurrence of drought was greatly underestimated. Scientists have warned that floods and drought are two sides of the same coin. There is finally a public debate on the need for water management in the countryside and water resources. It is necessary to prevent the rapid flow of water from the landscape, by appropriate measures, such as the revitalization of watercourses, the construction of reservoirs, pools and wetlands. Last but not least, the change in farming, both on agricultural land and forests. Particularly in the catchments of drinking water supply systems, it is necessary to strictly observe the measures for improving the water absorption into the subsurface layers, by keeping the water in the landscape. A possible tool for improving the situation is artificial water infiltration [16]. Scientists have been inspired by Israeli experts in this context. In the Middle East, water is captured in this way for a long time. South Moravia is the most affected area in the Czech Republic, so the implementation of this measure is about to be done in the South Moravia region and in Břeclav.

In places where the construction of a new building is underway, rainwater management is already required according to the legislation. Rainwater is not discharged through a pipeline into water courses or wastewater treatment plants. Capture tanks and trenches are built to catch it or use it for further use.

These measures, and in particular the building of nature-friendly measures, should be administratively and mainly financially supported by state subsidies.

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