WATER QUALITY REPORT

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1 Intoduction

1.1 Scope

The Water Quality Report will include information regarding water quality assessment for the water body (within the relevant river basin) where water is taken from. Parameters such as:

- General Characteristics for the river basin and the water bodies (surface; groundwater; area; etc.)
- Water pollution sources (e.g. point or diffuse; description; etc.)
- Monitoring stations (how many; what parameters are monitored; time series of parameters' values; problems)
- National legislation
- Discussion & Conclusions (comparative analysis).

1.2 Methodology

The methodology followed for the preparation of the report is based information taken from Korca Water Supply and Sewerage Company, reports and audits form Water Regulatory Entity, and also questionnaires and methodology given in work packages of Interreg-IPA CBC, Greece – Albania programme.

2 National Legislation

2.1 Relevant Legal Framework Related to water reserves and its usage

- Law no. 8934, dated 05.09.2002 "On Environmental Protection" (amended in 2008);

- Law no. 8093, dated 21.03.1996 "On Water Reserves" (with all its amendments and sub-legal acts);
- Law on Water Supply and Regulation of the Sanitary Sector (1996);
- Laws and relevant regulations for waterfront development (including the Law on Protected Areas, amended in 2008);
- Law no. 111/2012 On Integrated Water Resources Management
- Decision no. 379, Date 25.5.2016 On the Approval of the Regulation "Quality of Drinking Water"

2.2 Legal framework in the international context on water quality

- Directive 2004/35 / EC “On environmental liability, prevention and repair of damage to the environment”;
- Council Directive 98/83 / EC, "On the quality of drinking water";
- Directive 2000/60 / EC establishing a framework for water policy;
- Directive 91/271 / EEC on urban wastewater treatment;
- Directive 91/676 / EC on the protection of waters against pollution caused by nitrates used in agriculture;
- Directive 2006/7 / EC on the quality management of bathing water;
- Directive 2006/118 / EC on the protection of groundwater against pollution and degradation;
- Directive 2013/39 / EU as regards priority substances in the field of water policy;
- Directive 2009/90 / EC laying down technical specifications for chemical analysis and monitoring of water status;
- Directive 2007/60 / EC on flood risk assessment and management.

3 Water Quality Assessment

3.1 Evaluation of dynamic groundwater resources and their utilization

The Municipality of Korça is known for its Considerable Dynamic Groundwater Sources. Karst and intergranular aquifers are valued for very high-average aquifers, and are of great importance in the supply of large inhabited centers with drinking water. Other cities such as Devoll, Erseka and partly Korca are also supplied by karst springs. From the Quaternary aquifers, the city of Korça is supplied with water from the wells of Turan in the amount of Q = 300 l/s and all the municipalities that surround the hollow filed of Korça. A large number of "illegal" drillings have been carried out in these aquifers, which are used by private persons. Their quantities are not recorded. Water resources are also widely used in agriculture for irrigation. Some of the main watersheds used for concentrated drinking water supply are given in the table below.

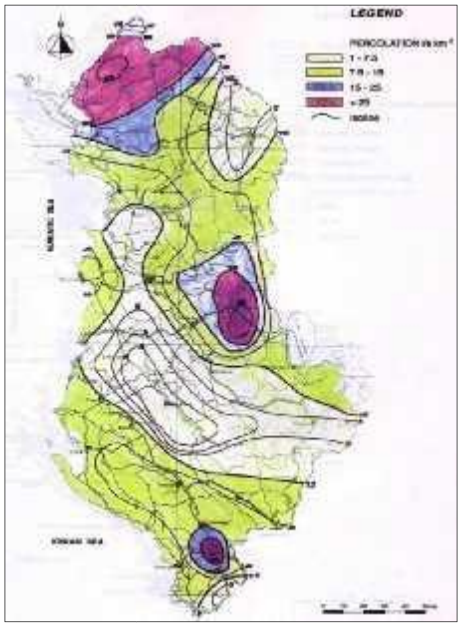
Table 1. Main sources for drinking water supply in Korca Region

Location (name of source)	Water flow (Litre/second)	Source Spring/Well
Turan – Korçë	300	Well
Vreshtas – Podgorie	8	Well
Sheqeras – Korçë	4.5	Well
Bulgarec – Korçë	100	Well
Vloçisht – Korçë	3	Well
Vithkuq- Korçë 2 km West of Greluos quarter	30-40	Spring
Centre of Kapshtica village	10-14	Spring

Table 2. Dynamic groundwater sources and their usage for drinking water supply

Aquifer	Dynamic groundwater sources, m3/s	Exploitation of groundwater m3/s	Usage
The porous aquifer of Korça	0.512	0.4	Drinking water supply
Gore-Mokër poro-crack aquifer	0.15	0.07	Drinking water supply
Valamare-Orenik fault aquifer,	0.15	0.1	Drinking water supply
Non-aquifers	0.07	0.05	Drinking water supply
Total	4.83	1.1	

As can be seen from the table, the total dynamic resources in the Municipality of Korca are estimated at a minimum of 4,832 m3/s (since the resources are taken with the minimum inflows). The reserves that can be used for drinking water supply are also around 3,712 m3/s, mainly from the karstic aquifer.



(Source: S. GURI, UNDP)

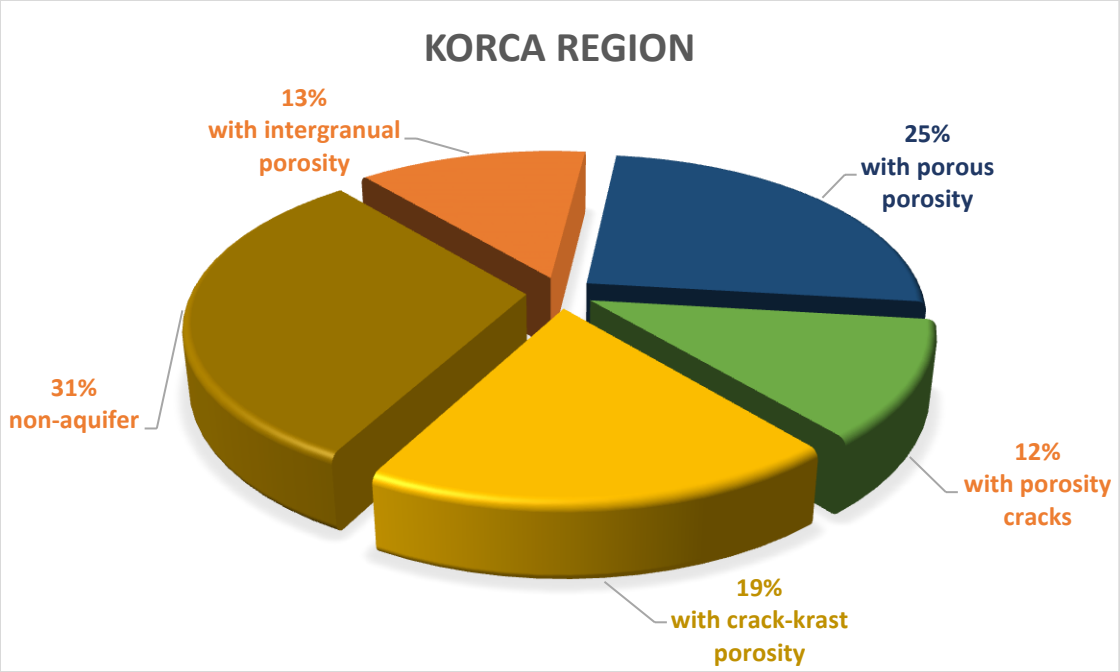
Figure 1. Map of water permeability of surface rocks

3.2 Groundwater Hydrogeological Conditions

Aquifers of different types are spread in the municipality of Korça. The largest area at the county level is occupied by “not aquifers” at the rate of 31% of its total area. Karst carbonate aquifers occupy about 19% of its entire surface. They present the highest mountain parts such as Mali i Thate, Rakicka, etc.

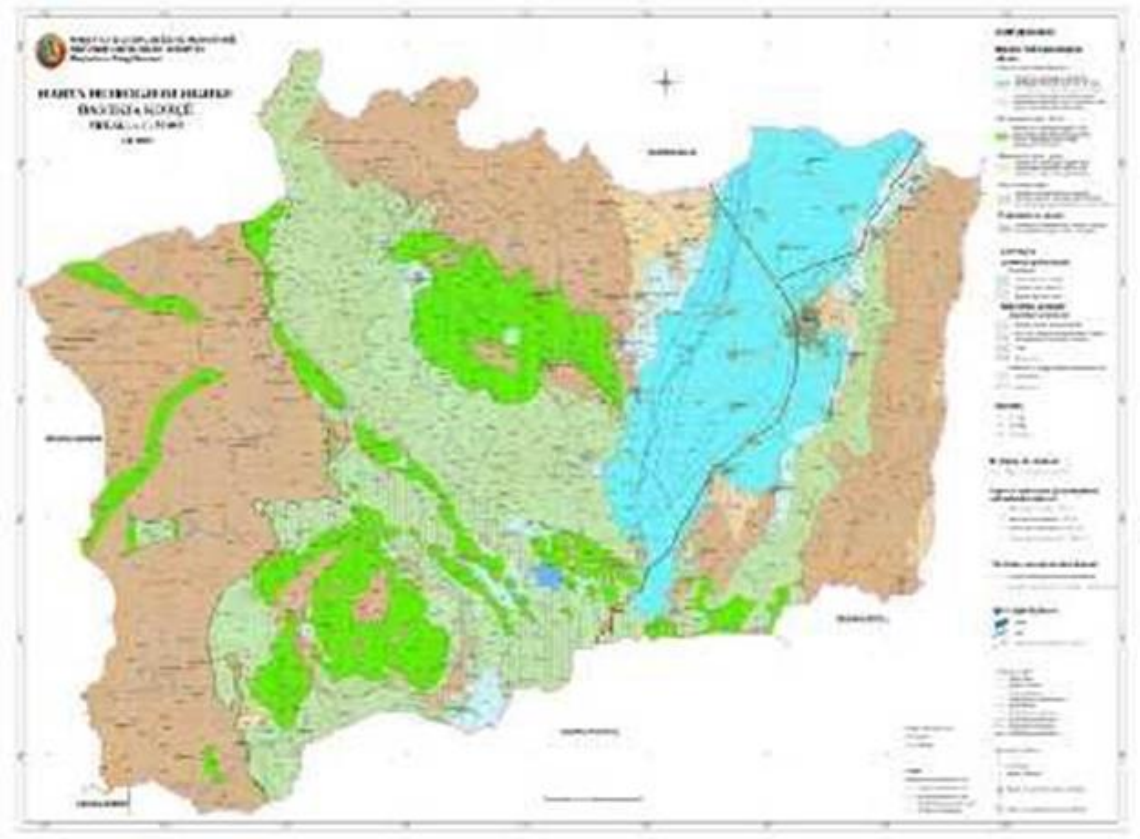
Karst carbonate aquifers contain large groundwater resources. Aquifers with intergranular porosity, have a more limited distribution and lie in the plain areas, such as the Korça hollow field with an average altitude of 820-850m above sea level. Aquifers with intergranular porosity and average water permeability spread to about 9.4% of the county territory. These aquifers also contain important groundwater resources. The following figure shows the surfaces of different aquifer types in the Korça region.

1. aquifers with intergranular porosity and average water retention (13%),
2. aquifer with porous porosity / cracks and medium to low water retention (25%),
3. Aquifer with porosity cracks with medium to low water retention (12%)
4. Crack-karst porosity aquifer with highly variable water content-very high-low (19%)
5. non-aquifer with insufficient porosity to allow the circulation of groundwater in usable quantities



(Source: Albanin Geological Survey)

Figure 2. Aquifer surfaces by type



(Source: Albanin Geological Survey)

Figure 3. Hydrogeological map of Korca region

3.2.1 Korca Aquifer

The Korca Aquifer is part of the inland pits of Albania and is otherwise called the Korça and Devoll plain and is classified as having average water content. It consists of alluvial deposits of the Devoll and Dunavec rivers, where the Devoll river has a total length (196 km).

3.2.2 Low water permeability aquifers

In this aquifer with low water permeability are classified the aquifer of Korca plain and a part of the plain of Devoll. These aquifers are associated with Quaternary deposits consisting of gravel, slope breccias, etc. The hydraulic connection of groundwater and surface water is not good. The exploitable reserves in these aquifers are scarce. They serve for the supply of drinking water to small communities.

Exploitation is realized through springs and in river deposits and spill cones also through drilling. Their physico-chemical properties are generally good, they are sweet and of low hardness.

3.2.3 Aquifers with porosity cracks

In this aquifer we have classified igneous and metamorphic rocks, but mainly ultrabasic. Almost during the whole contact of the ultrabasic rocks in the lowland of Korça, there are springs with inflows that fluctuate in the values from 0.1-3 l/sec.

Groundwater of ultrabasic rocks in terms of physico-chemical properties are fresh, colorless, odorless, transparent, with a temperature ranging from 11 – 14 grades.

3.2.4 Cracks-karst porosity aquifers

Cracked and karstic aquifers with water permeability that vary in very wide boundaries, places with very high values of it, are connected with the carbonate rocks of the Triassic. The type of this aquifer has a considerable spread in the municipality of Korca and lie in an area of 666.15 km2, translated as a percentage of the area occupied by this aquifer in the region about 19% of its area. In these aquifers the karst phenomenon is very developed, and as a result they hold large water resources.

In karst areas the average useful infiltration coefficient goes up to 0.6 – 0.7. Larger quantities of groundwater resources drain mainly at low quotas with surface springs. The groundwater in these aquifers is of good quality and is also widely used for drinking water supply.

From these aquifers is supplied with drinking water many units, as well as a part of Korça with about 0.5 m3/ s. Other significant quantities are used in industry and agriculture. This aquifer has a dynamic flow Qd = 4 m3/s. Aquifers are very vulnerable to human pollution. From the hydrogeological point of view, the karst areas that surround the Korça lowland are distinguished by these features: by the very high infiltration of atmospheric precipitation and by a high-water permeability.

Karst groundwater drains towards lower quotas creating natural outflows in the form of resources with a highly variable regime. The waters of this aquifer are fresh, odorless, colorless and tasteless with a temperature of 9 – 15 grades, the general mineralization of the groundwater of this aquifer varies from 0.205 – 0.423 gr/liter, the total hardness fluctuates in the values 6 – 14 German grades. The waters are of the hydrocarbon-calcium type and more rarely of the hydrocarbon-calcium-magnesium type.

3.3 Hydrogeological conditions of surface waters (lakes, reservoirs and rivers)

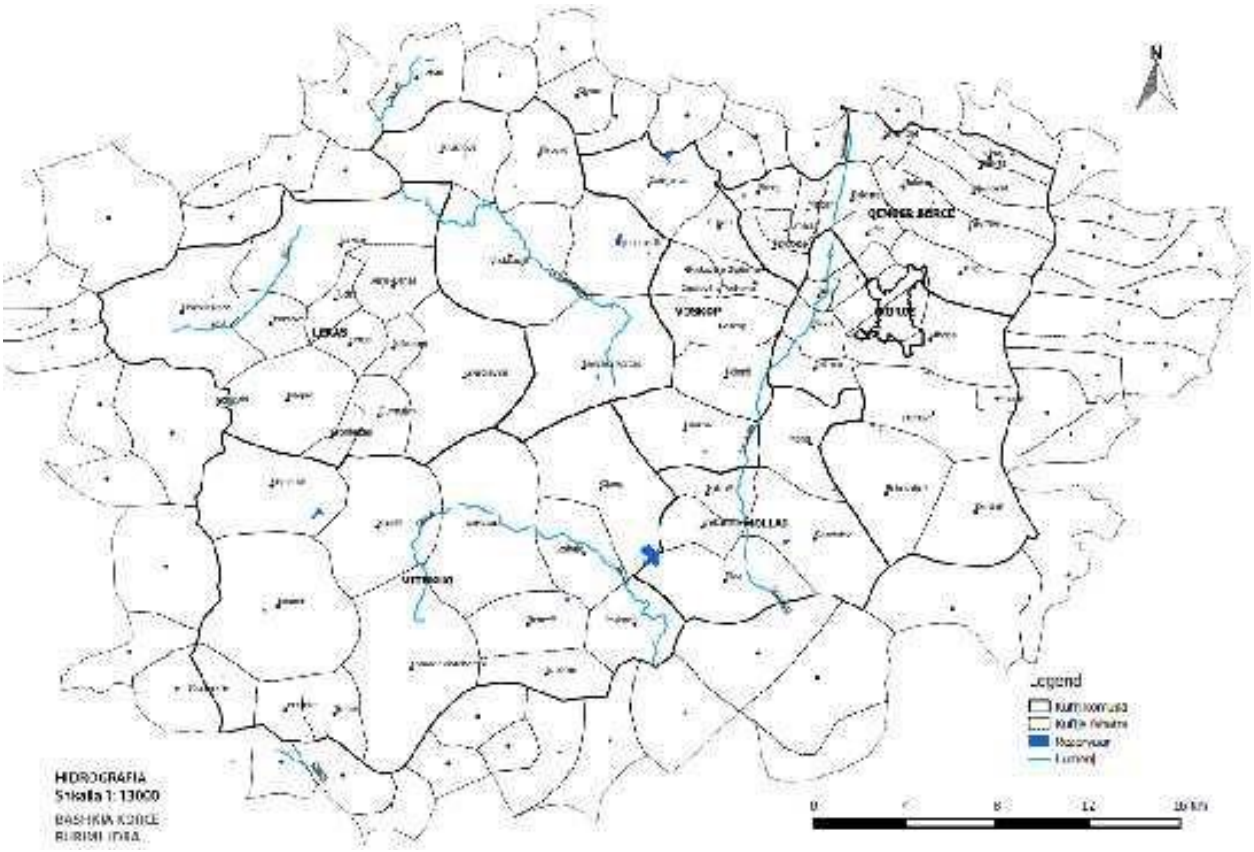
The rivers in the city of Korça are that of Drenica and Dunavec. The Drenica River, which years ago passed through the city of Korca, now its bed is diverted and the river flows into the city ring. The Dunavec River passes at the end of the city of Korça in the South-Western part of the city and there it joins the Drenica River. Many years ago, these rivers were problematic because during the flood they flooded the surrounding areas, while nowadays their water level has dropped and they do not pose any problem in this regard for the city of Korça.

The current state of these rivers is threatened by the development of industrial activities and the dumping of various wastes. Many residents have complained that the irrigation canals, which are fed by water from these rivers, have been polluted and consequently their lands, that their livestock has died and a bad smell invades the area at night. This is especially evident in neighborhoods 15, 16 and 17 of Korça. Industrial activities dump their waste and untreated water into the waters of the Drenica River as well as into another canal leading to the village of Turan.

In addition to lakes as important water resources in this region are rivers such as the Devoll, which crosses the northern part of the lowland, from the gorge of Cangonj in the east to Maliq in the west.

The Devoll River is the second longest with 295 km. This river originates from the Gramoz mountains (outside the borders of our country) and from there enters the Bilisht valley, forming three terraces. Based on the data of the hydrometric station of Orman - Pojan, the minimum levels and flows of the river Devoll, in the lowlands of Korça meet in August - September and have respectively the values 6 – 2 cm and 1.88 – 3.11 m3/sec, while the maximum

values meet in the months of November - April and have the values 339 – 416 cm and 22.9 m3/sec. From the hydrochemical point of view, the waters of the Devoll River are of the type Hydrocarbons - Calcium - Magnesium with a general mineralization Mp= 0.3 gr/liter and a general hardness Fp= 11 German grades. The Dunavec River originates in the south of the Korça lowlands, in its mountainous part composed of ultrabasic and limestone rocks. Now the Dunavec River flows through a new bed. From the hydrochemical point of view, the waters of this river are of the type Hydrocarbonate - Magnesium - Calcium.



(Source: Albanin Geological Survey)

Figure 4. Hydrographic Network of Korca Region

3.4 Surface and Groundwater Quality

3.4.1 Korca aquifer

It is monitored with 4 drillings in the Quaternary gravel aquifer and one spring in the carbonate aquifer: in drilling no.3 Turan, no.1v I. Terova, no.108 Bulgarec, no.173 / 1 Sheqeras and the Mancurisht spring. Three tests were performed in June, September and November for chemical and microelement analysis.

- The total amount of water used is about 465 – 500 l/sec, the largest reserves are used in Turan. The utilization coefficient varies K = 0.3 – 0 .5

The risk of pollution is moderate, favorable are the natural conditions of the extension of some aquifers at depths screened between them with clay layers. The only surface source of pollution may be the Dunavec River from the southeast side of the aquifer, mainly for the first aquifer which is usually not used.

3.4.2 Monitoring results

Groundwater quality monitoring in this aquifer was carried out with 4 drillings: Turan, former farm I. Terova, Bulgarec and Sheqeras. 15 chemical analyzes and 3 analyzes for microelements were performed. Looking at the results of the analyzes carried out during 2014, it results that the groundwater in these areas has physico-chemical properties and good hygienic-sanitary conditions. The waters are odorless, colorless, tasteless.

Dry Residue DR – Dry residue in the three phases of monitoring varies varies DR = 256 – 390 mg/l, while in 2012 it varies DR = 256 – 390 mg/l, content within the allowed norm (500 – 1000 mg/l). drilling no.3 Turan a slight decrease of Na content is observed from 2010 to 2014.

Calcium content Ca – Calcium content in the three monitoring phases varies from 35.72 – 82.04 mg/l, while in 2013 it varies from 37.07 – 82.16 mg/l.

Magnesium content Mg – Magnesium content is in the recommended content up to PML in drilling no.1 v I. Terova.

Iron content Fe – Iron content in the three monitoring phases varies from 0.01 – 0.012 mg/l and in 2013 varies from 0.01 – 0.08 mg/l. Meets content at the recommended rate up to PML in drilling no.108 Bulgarec, no.3 Turan, in Mancurisht spring. Changes in monitoring phases range from 0.01 – 0.4 mg/l to 0.11 mg/l at source Mancurisht.

Ammonia content NH4 – NH4 content is found in the three phases of monitoring. The presence of ammonia in the analysis comes from surface pollution and is related to the non-implementation of sanitary protection areas.

Chlorine Content Cl – Chlorine Content is slightly above STASH R, but below the maximum allowed amount and almost a trend is maintained without major changes, only small seasonal changes are observed.

Sulfate Content SO_4 – The trend over the years tends to increase in drilling no.1V I. Terova. In the other drillings and the Mancurisht spring there are only minor seasonal changes.

Nitrate Content NO_3 – The Nitrate content in the three monitoring phases is small, it varies from 1.86 – 25.36 mg/l, in 2013 it varies from 1.8 – 20.16 mg/l, there is a slight increase in drilling no.1V I. Terova. The content is within the allowed norm (STASH rate 25 – 50 mg/l, EU 25 – 50mg/l). Seasonal

fluctuations of nitrate content in drilling related to fertilization of agricultural lands are observed.

Nitrite content NO_2 – In the monitoring phases the nitrite content is found in the amount below 0.01 mg/l up to the amount of 0.01 – 0.02 mg/l. The average NO2 content varies from 0.0036 – 0.055 mg/l. Occasional occurrences of nitrite content are related to non-implementation of sanitary protection areas; the source of pollution is close and is related to fertilization of agricultural lands.

Oxygen content O_2 – Oxygen content in the three phases of monitoring varies 0.8 – 15 mg/l, in 2013 it varies 1.86 – 7.67 mg/l content is less than the norm up to the norm (rate: - not less than 8).

Analyzes for trace elements - Analyzes for trace elements were performed in drilling no.3 Turan. In these analyzes there is content of microelements: Ni, Mn, Zn, Pb, Cu, Co, Cr, Cd.

3.5 Pollution of water resources

The general characteristics of these waters are presented below:

- High turbidity, since the flow regime is hijacked, the water transports large amounts of suspended matter;
- High bacterial contamination. Man-made or industrial pollution (Prison Institute, leather factories, etc.) is practically present;
- Low temperature. These waters originate from springs or from the melting of snow or glaciers;
- Low color indicator. These colors do not have time to digest the vegetable matter, which is the main source of color.

4 Drinking Water

The city of Korça has a supply of drinking water from the best in Albania both in terms of springs, duration (24 hours) and distribution network and quantity per capita (European directive 11 for water is 200l / d / b). The length of this network reaches about 120km has enabled the reduction of losses in the network, the improvement of the pumping stations as well as the amount of storage. This water supply of the city of Korça is realized by the water supply of the city located in the village of Turan where the pumping station has been set up. In total there are four artesian wells, which are about 150 m deep, where one is located in the village of Turan, while the other three below the village of Porodina. The wells are fenced and airtight. Of these wells for reasons of rational use, two are in use while the other two are left in reserve. In city wells samples are taken 2-3 times a year directly in the well. The water passes through these wells from the Turan pumping station where the water is chlorinated. From there it pumps to the water depots in the hills of the city and through the network, which is within each parameter, hermetic with pipes that are spread throughout the city of Korca from where the water is distributed. The pipelines are new and contemporary and in addition to the city of Korça have extension in the two surrounding villages as Turani and Cifligu which are supplied by the network of the city of Korça.

The water supply is monitored daily by the directorate by taking water samples at 16 points, of which 15 points are fixed and 1 point is mobile according to the problems presented by citizens. This monitoring is done in the morning and in the afternoon. The percentage of chlorine comes out throughout the city the same after daily analysis in our laboratory. The European Drinking Water Directive states that about 48 chemical and microbiological parameters must be monitored daily and regularly, while currently a periodic check is made for a smaller number of elements. In addition to the water supply, the city of Korca also has 11 self-flowing taps, some of which are of hundreds of years old origin.

They are also tested every three months. Their names are: 1. Shetro 2. Cezma E Amzes 3. Former Socks Factory 4. Former Flour Factory 5. Papallambro 6. Radamec 7. Lulishtja Shën Mëria 8. Partizani 9. Rr. Pano Xhamballo 10. Rr. Niko Kovaci 11. Rr. Petraq Shamo.

Table 3. Microbiological analysis of Korca water resource

Microbiolocigal Analysis				
Total coliforms UFC/100ml	Fecal coliforms UFC/100ml	Total bacterial load in 22^0 C UFC/ml	Total bacterial load in 36^0 C UFC/ml	Clostridium sulphite reducers UFC/100ml
0	**0**	**210**	**190**	**0**

Table 4. Drinking water table parametres, City of Korca

Drinking water – City of Korca		
Parameter	**Actual value (mg/l)**	**National Rate (mg/l)**
pH	7,9	6,5-8,5
Residual Cl	0,1-0,3	>1
NH_4^+	0	Max 0,05
NO_2^-	0	>50
NO3 -2	1,4	>5
CO2 -2	12,2	>500
HCO3 -2	267,3	>500
O_3	1,7	
German strongness	13,8°	>20°

(Source: Albanian Geological Service)

This water supply of the city of Korça is realized by the water supply of the city located in the village of Turan where the pumping station has been set up. In villages, there are generally no problems with sources for water supply, but the problem is often depreciated distribution pipes, lack of water meters, abuses of drinking water used for irrigation, etc.

Despite the fact that currently the water situation and water purity of this area is within the standards, according to UKKO the aquifer area is threatened by construction and uncontrolled activities in the area. This is because in these protected areas there are no effective measures regarding water drainage, type of construction and their destination and consequently industrial and urban waste has increased, threatening the cleanliness of this area. The PPV of the city of Korca should consider the implementation of local, national and international criteria, requiring the implementation of very strong criteria regarding the type of activities (fuel depots, chemical industry, livestock, warehouses and other services), permits of construction etc. It is necessary, according to the law, that all these activities before obtaining permits and connecting to the sewage network must submit a project related to the preliminary treatment of waste and water. The proposed implementation for protected areas would be a final solution to this issue.

4.1 Pollution of drinking water

In the study region, in terms of public health insurance, the quality of drinking water is quite important. But, this water does not show hygienic-sanitary problems, because we have:

- Unlimited supply, ensuring constant water pressure;
- No Depreciation of water supply network;
- Interventions are not without criteria in water supply pipelines.

But, on the other hand it may soon show sanitary problem because:

- we have poor protection of sanitary protection belts of water sources due to the erection of buildings or planting of land very close to the source, using too many chemicals;
- Excessive chlorination of water.

All these factors make public health under the constant threat of the spread of waterborne diseases. On the other hand, in the study region, data from bacteriological water examinations are partially or completely missing, due to the lack of laboratories and staff.

4.2 Measures to protect drinking water

- protection of karst springs, as the most important aquifer of the Municipality;
- protection of main springs is related to the protection of river waters, which have good hydraulic connections and contribute to the extent of 30-50% of karst springs and the speed of water movement is very high;
- determination of the sanitary areas of the cracks-karst aquifer resources, as the main aquifer of the Municipality, as well as the most vulnerable to various pollutions;
- disposal of waste away from municipal water collection points;
- Prohibition of quarrying through quarries in the karstic aquifer, or prohibition of further exploitation;
- to carry out continuous monitoring of aquifers, but especially in the Korça and karst aquifers for their qualitative and hydrochemical indicators.