WATER RESCUE

Water resources efficiency and conservative use in drinking water supply systems

Interreg
Greece-Bulgaria
WATER RESCUE
European Regional Development Fund

EUROPEAN UNION

WP	**3 Current Status Analysis and Assessment**
Deliverable *Tool*	**3.5.3 Water Quality report** *Joint Deliverable*
Sub-Deliverables integrated	**D.3.1.3, D.3.2.3, D.3.3.3, D.3.4.3, D.3.5.3, D.3.6.3**
Project Beneficiary No	**PB5**
Beneficiary Institution	**Municipality of Gotse Delchev**

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

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Chapter 1. Introduction: The WATER RESCUE project in brief

1.1 The Project in brief

WATER RESCUE project's concept is based on the common cross-border (CB) water management problems in the two international river basin districts (RBDs) shared between Greece & Bulgaria (Struma-Strymonas; Maritsa-Evros). The common CB problems include water resources quality & quantity being at risk due to natural and human activities and climate change conditions. The consequence is that water bodies fail to meet the good ecological status (GES) (recorded in the river basin management plans-RBMP). In particular, drinking water faces significant risks due to the deteriorated water resources quality while at the same time significant water volume is lost in the water distribution networks (WDNs). The project aims at the sustainable and efficient management of drinking water supply by increasing drinking water use efficiency in WDNs and improving water quality in the whole water supply cycle (from the source and back to the environment). Good Ecological Status can be achieved by improving water quality and reducing water abstraction and can be maintained by taking climate change adaptation measures. The project focuses in drinking water supply management suffering from high Non-Revenue Water (NRW) levels and deteriorated water quality jeopardizing the drinking water consumers' safety and health and their quality of life. Urban water volumes end up to the sewerage networks while wastewater treatment plants are a pressure to water resources quality. Surface water bodies are both used for drinking water abstraction and are the final recipient of treated effluents. Thus, their ecological status is affected by both water quantities abstracted and water quality in the whole water supply cycle (from the resource to the water supply and the wastewater treatment plant and back to the environment).

1.2 Theme of the Project

WATER RESCUE project is expected to achieve Non-Revenue Water/water losses reduction by upgrading and adapting already developed methodologies, technologies and tools including Water Balance assessment and Performance Indicators, hydraulic simulation models, decision support systems and GIS tools. Additionally, WATER RESCUE is expected to achieve water quality improvement across the entire water supply chain (from the water intake point and the raw water treatment plant, back to the environment after the waste water treatment plant) through constant monitoring of water quality parameters in real time, water quality simulation models (including water age) and automatic chlorination systems on line and in line. Climate change impacts will be assessed to finally propose and adopt measures for climate change adaptation. WATER RESCUE has a clear innovative character since the methodologies and tools are integrated and do not tackle individual problems. It is the first time that integrated methodologies will be adapted to include the entire drinking water supply cycle. These methodologies/tools will serve as Early - Warning Systems both for water quantity and quality. WATER RESCUE results will improve drinking water management. At the same time as drinking water is involved, the consumers' safety and health are safeguarded and their quality of life is improved. Non-Revenue Water reduction will increase water resources efficiency, since less water will be abstracted from surface and groundwater bodies and reduce energy consumption as water and energy are interconnected in water supply systems (water-energy nexus). Drinking water quality will be improved through real time monitoring of water quality parameters across the entire water supply chain, from the water intake points, to the water treatment plant and the water distribution network, back to the environment through the wastewater treatment plant. Thus, drinking water quality will be safeguarded from its source up to the consumer's tap. As wastewater effluents return to water resources, their quality monitoring prevents water resources degradation due to this pressure. Water and energy resources efficiency will be promoted and the ability of the cross-border area to adapt to climate change conditions will be improved as all possible natural and man-made pressures will be evaluated, including climate change conditions. Water saving will be accomplished through water losses reduction and increase of the environmental awareness of the public. The quality of life is expected to be upgraded with special emphasis to the protection of the natural environment. Joint policy recommendation guidelines and papers will be developed. Good governance, transparency and participation of all stakeholders in the design, implementation and monitoring of these policies is expected. Know-how and technology transfer will take place not only among the beneficiaries but also in the stakeholders' network that will be developed.

1.3 Project Beneficiaries

Lead Beneficiary is the Municipal Water and Sewerage Company of Komotini (Greece); Beneficiary 2 is the Municipal Water and Sewerage Company of Thermi (Greece); Beneficiary 3 is the University of Thessaly-Special Account Funds for Research-Department of Civil Engineering (Greece); Beneficiary 4 is the Municipality of Kardzhali (Bulgaria); Beneficiary 5 is the Municipality of Gotse Delchev (Bulgaria); and Beneficiary 6 is the Municipal Water and Sewerage Company of Thermaikos (Greece).

1.4 The present deliverable

1.4.1 The subject of the present deliverable

The present deliverable refers to WP3.3., and specifically Water quality assessment of water resources. This deliverable includes the assessment of the current status of the water supply systems regarding water quality, including the identification of the pollution sources (agricultural; industrial; livestock; urban) in the cross-border water systems. Their specific, quality and quantity, characteristics will be recorded in order to classify their impact to water. Water quality in drinking water supply systems will be assessed presenting the disinfection methods, water quality monitoring tools and European and national legislation review.

1.4.2 The approach applied developing the present deliverable

As the topics the WATER RESCUE project is dealing with, need precise knowledge of the way water supply and distribution systems operate, it was made clear, even during the kick-off meeting of the project, held in Komotini in January 2018 that WATER RESCUE beneficiaries, beyond their common agreement to work closely together, should be guided by the scientific beneficiary, University of Thessaly, to ensure the prompt delivery of what was expected by the WATER RESCUE project. Thus, the University of Thessaly, prepared the questionnaires for this task. Municipality of Gotse Delchev (PB5) as the WP Leader took over the responsibility to prepare the joint deliverable of Phase 3.3.

Regarding the implementation of Phase 3.3., the beneficiaries reported on the current situation of their Water Supply System(s) (WSS) regarding water quality. University of Thessaly (PB3) provided a questionnaire consisting of introduction and the assessment of water quality including pollution sources, specific water quality problems, actions taken, etc. All beneficiaries provided their deliverables to the WP leader, who properly elaborated the data in order to prepare the joint deliverable. The WP leader prepared the respective deliverable D3.3.

Chapter 2. Water Quality Report – Results & Discussion

The analysis is based on two levels: National Level and Regional / Local level. As there are project beneficiaries who are National organizations (PB3), this beneficiary submitted the deliverable referring to the National level, focusing on the cross-border area. All other beneficiaries, who are water utilities, submitted their deliverable referring to regional / local level.

2.1. PB1 – Municipal Water Supply and Sewerage Company of Komotini, Greece

2.1.1. General description

The PB – the Municipal Water Supply and Sewerage Company of Komotini presented information about water sources which they use - Vosvozis river and the groundwater system of Rodopi. There are presented numbers for 2016:

- 2,750,000 m^3 of water were used from Vosvozis river;
- 3,550,000 m^3 of water were abstracted and used.

2.1.2. Water Quality Assessment

2.1.2.1. Pollution Sources

There is presented information from the RBMP (2017). The document includes details about point pollution sources and diffuse pollution sources met in the River Basin of Komotini – Loutro Evrou streams. The annual loads of BOD, Nitrogen (N) and Phosphorus (P) due to these point pollution and diffuse pollution sources are presented in the following table 1:

Table 1: Annual pollution (point and diffuse pollution) loads in the River Basin of Komotini – Loutro Evrou

Sources	Annual BOD (tons/year)	Annual N (tons/year)	Annual P (tons per year)
Point sources			
Industrial units	27.9	26.1	25.9
Leakages from uncontrolled disposal points of and Landfills	0.0	0.0	0.0
Wastewater treatment plants	70.1	43.0	2.8
Sewerage networks discharge to physical receivers	72.4	14.5	3.0
Large hotels	0.0	0.0	0.0
Aquaculture – fish farming	0.0	0.0	0.0
Large Livestock farming units	3.1	1.8	0.4
TOTAL	**173.6**	**85.3**	**32.1**
Diffuse sources			
Urban	186.7	53.2	1.3
Agricultural	0.0	196.7	11.9
Livestock farming	2,038.2	538.5	19.5
Other sources	0.0	118.0	0.9
TOTAL	**2,224.8**	**906.4**	**33.6**
Total point and diffuse sources	**2,398.4**	**991.7**	**65.6**

As mentioned in the previous report of the PB, it is made water resources quality assessment about both water systems used for water supplying at the territory. The results are:

Table 2: Water resources chemical and quantitative assessment

Water system	Chemical status	Quantitative status	Main pressures	Salt water intrusion	Quality problems
Rodopi	Good	Good	-	No	No
Vosvozis river	Poor	-	-	-	-

2.1.2.2. Legislation

There are listed both national and European legislations – norms and directives about drinking water quality and monitoring. Presently the water utility follows the Greek legislation regarding the monitoring and sampling of water.

2.1.2.3. Water quality Problems and actions taken

There are faced several problems with water quality – in abstraction points far from the river the quality is worse (mainly due to nitrates originated from agricultural activities), in areas near the sea after a certain depth the water gets brackish due to seawater intrusion.

The PB applies the national legislation requirements regarding water quality, but there are not described the measures.

2.1.2.4. Drinking Water Supply System – water treatment

As the PB described they take water from surface and groundwater bodies. For about 7 months of the year, surface water bodies are used, while the remaining 5 months of the year groundwater bodies are used for water supply. The water from surface water bodies is transferred to a drinking water treatment plant where it is treated before being supplied to the inhabitants of the municipality. Regarding water abstracted from groundwater bodies, only disinfection is applied as water treatment.

2.1.3. Conclusions

The report of PB1 presents detailed information about water resources quality and type of pollution in the territory. There is DWTP, which treats surface water for supplying the inhabitants of the municipality. Maybe in close future the municipality will need a treatment for groundwater as well, if the problems with the quality remain and the human activities continues (industrial, agricultural, etc.).

2.2. PB2 – Municipal Water Supply and Sewerage Company of Thermi, Greece

2.2.1. General description

The PB - The Municipal Water Supply and Sewerage Company of Thermi supplies water for the city of Thermi. The water is taken from groundwater bodies, which are:

- Subsystem of down flow of Anthemountas;
- Subsystem of Thermi – N. Risio;
- Subsystem of Cholomontas – Oreokastro.

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2.2.2. Water Quality Assessment

2.2.2.1. Pollution Sources

There is presented information from the RBMP (2017). The document includes details about point pollution sources and diffuse pollution sources met in the River Basin of Chalkidiki.

As the most polluting activities are faced different industries and wastewater treatment plants. The thermal power plant pollution refers mainly to Cr, Zn, As, Cu, HC, PCBs, Cd, Pb, Hg, and Ni. The mines and quarries pollution refer to SO_4^{-2}, Fe, Mn, Zn, Pb, Sb and As.

The annual loads of BOD, Nitrogen (N) and Phosphorus (P) due to these point pollution and diffuse pollution sources are presented in the following table:

Table 3: Annual pollution (point and diffuse pollution) loads in the River Basin of Chalkidiki

Sources	Annual BOD (tons/year)	Annual N (tons/year)	Annual P (tons per year)
Point sources			
Wastewater treatment plants	802.4	501.5	102.5
Industrial units	2,398.4	1,006.54	93.57
Livestock farming units	60.1	33.4	1.5
TOTAL	**3,260.9**	**1,541.44**	**197.57**
Diffuse sources			
Agricultural activities		796.4	551.2
Urban wastewater not discharged to WWTP	873.49	249.58	51.99
Livestock farming	1021.29	450.38	54.53
Urban / roads		98.31	13.12
TOTAL	**1,894.78**	**1,594.67**	**670.84**
Total point and diffuse sources	**5,155.68**	**3,136.11**	**868.41**

As mentioned in the previous report of the PB, it is made water resources quality assessment about the ground water systems used for water supplying at the territory. The results are:

Table 4: Chemical and quantitative status assessment of water resources

Groundwater system	Chemical status	Quantitative status	Increased values due to physical background	Increased values due to human pressures	Main pressures	Salt water intrusion
Down flow of Anthemountas	Bad	Bad	Fe, Mn, B, Cr, As, Cl, E.C.	NO_3, Cl	Agriculture, livestock farming, urban wastewater, salt water intrusion, over-abstraction	Yes
Thermi – N. Risio	Good	Good	Fe, Mn, B, As, Cl, Na, H_2S	-	-	No
Cholomontas - Oreokastro	Good	Good	-	-	-	No

2.2.2.2. Legislation

There are listed both national and European legislations – norms and directives about drinking water quality and monitoring. Presently the water utility follows the Greek legislation regarding the monitoring and sampling of water.

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2.2.2.3. Water quality Problems and actions taken

There are faced two potential problems - increased values of some physical-chemical parameters mainly due to the groundwater geological background and excessive increase of turbidity due to excessive abstraction of groundwater.

The water utility explained that they take measures as for cleaning of the existing boreholes and so for opening of new boreholes.

2.2.2.4. Drinking Water Supply System – water treatment

The only treatment, which is applied, is disinfection with chlorine in different parts of water supply systems – at the boreholes and/or in water reservoirs.

2.2.3. Conclusions

The report of PB2 presents detailed information about water resources quality and type of pollution in the territory. Regarding that there is not any DWTP (only disinfection is applied) and the problems with groundwater, maybe in close future the municipality will need a treatment for the groundwater. It has to be evaluated which solution (cleaning and opening new boreholes or construction of DWTP) is better in operational and economical aspect.

2.3. PB3 – University of Thessaly – Special Account Funds for Research – Department of Civil Engineering, Greece

2.3.1. General description

The PB reports the status analysis regarding water resources quality at national level. Greece consists of 14 Water Districts and the country shares three transnational water resources with Bulgaria. These transnational water resources are:

- RB of Evros (Greece; Bulgaria; Turkey);
- RB of Nestos (Greece and Bulgaria);
- RB of Strimonas (Greece and Bulgaria).

2.3.2. Water Quality Assessment

2.3.2.1. Pollution Sources

The qualitative status of all water bodies (rivers, lakes, coastal, transitional, groundwater) at river basin level has been assessed at the River Basin Management Plans (RBMPs). The total qualitative status of the surface water bodies is assessed at ecological and chemical levels. Regarding groundwater bodies, their assessment was made at quality (chemical) and quantity level.

The results are showed in the following figure:

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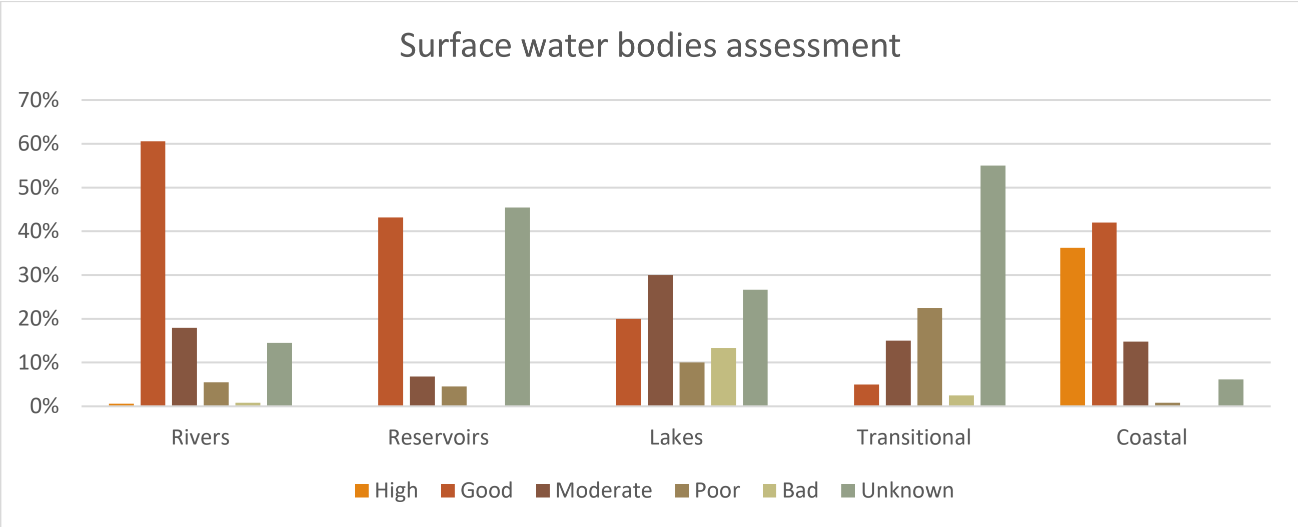

Figure 1. Surface water bodies assessment in Greece

Based on the results from the RBMPs, groundwater bodies in Greece are found to be in good chemical status (84.75%) and good quantitative status (84.04%). Only 85 groundwater bodies are found in poor chemical status and 90 in poor quantitative status.

In addition, the PB has included information about 4 groups of parameters (microbiological, chemical, indicative, radioactive) which have to be monitored in order water quality of the sources to be evaluated.

2.3.2.2. Legislation

There are listed both the Greek and the European legislation responsible for water quality and monitoring, and which are acting presently in Greece.

2.3.2.3. Water quality Problems and actions taken

The report of the PB presents information about all three cross border water sources and their point, diffuse pollution by type of producer, and divided in three categories – BOD, nitrogen and phosphorus.

It is presented general information about surface water bodies and their assessment by river basins, as follows:

Table 5. Assessment of surface water bodies at the River Basin of Strimonas

- River Basin of Strimonas

		Rivers	Heavily modified rivers of lake character	Lakes	Transitional	Coastal
Ecological status	High	1	0	0	0	1
	Good	45	1	0	0	1
	Moderate	17	0	0	0	2
	Poor	5	0	1	0	0
	Bad	1	0	0	1	0
	Unknown	14	0	0	0	0
Chemical status	Good	80	1	0	1	3
	Lower than good	2	0	1	0	0
	Unknown	1	0	0	0	1

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Table 6. Assessment of surface water bodies at the River Basin of Nestos

- River Basin of Nestos

		Rivers	Heavily modified rivers of lake character	Lakes	Transitional	Coastal
Ecological status	High	0	0	0	0	0
	Good	42	1	0	0	1
	Moderate	6	1	0	0	2
	Poor	3	0	0	0	0
	Bad	0	0	0	0	0
	Unknown	12	0	0	3	0
Chemical status	Good	56	2	0	1	3
	Lower than good	6	0	0	0	0
	Unknown	1	0	0	2	0

Table 7. Assessment of surface water bodies at the River Basin of Evros

- River Basin of Evros

		Rivers	Heavily modified rivers of lake character	Lakes	Transitional	Coastal
Ecological status	High	0	0	0	0	0
	Good	42	0	0	0	0
	Moderate	3	0	0	0	4
	Poor	2	0	0	0	0
	Bad	0	0	0	0	0
	Unknown	3	1	0	1	0
Chemical status	Good	48	0	0	0	4
	Lower than good	1	0	0	0	0
	Unknown	1	1	0	1	0

2.3.2.4. Drinking Water Supply System – water treatment

As the PB is the University of Thessaly, they have gave some theoretical, principle staging about surface and ground water treatment and post disinfection methods.

2.3.3. Conclusions

The University of Thessaly could work together with the local authorities and especially with the municipalities in order to help them with water resources assessment (quality, quantity, etc.), finding new treatment technologies - more effective, energy-independent, long term reliable, and their application in the practice.

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2.4. PB4 – Municipality of Kardzhali, Bulgaria

2.4.1. General description

The PB – the Municipality of Kardzhali presented information about water supply infrastructure at the territory. Additionally, there is included data about water consumption by months in 2017:

Table 8: Water consumption per month at the municipality of Kardzhali

January	February	March	April	May	June
191 996	205 375	204 161	207 366	220 022	222 179
July	**August**	**September**	**October**	**November**	**December**
256 392	265 212	273 326	249 817	211 004	187 214

Water sources in use at the territory are Borovitsa dam and several ground and surface bodies:

Table 9. Surface water and groundwater bodies used in Municipality of Kardzhali

Water supply system	Water source	Location	Ground water type	Maximum flow rate, l/s	Place of use /settlement/
PS Beli Plast	spring	Beli Plast	Paleogene aquifer	4,00	Beli Plast
PS Boyno	spring	Boyno	Paleogene aquifer	7,00	Boyno Kokoshane
PS Gorna Krepost	shaft well 10,00 m	Gorna Krepost	Quaternary aquifers	11,00	Gorna Krepost Dolna Krepost Lyulyakovo
PS Murgovo	tubular well 20,00 m	Murgovo	Quaternary aquifers	4,00	Murgovo
PS Volovortsi	spring	Volovortsi	Paleogene aquifer	4,00	Volovortsi
PS Ohlyuvets	spring	Ohlyuvets	Paleogene aquifer	4,00	Ohlyuvets Chilik
PS Rani list	spring	Rani list	Paleogene aquifer	4,00	Rani list
PS Skalna glava	spring	Skalna glava	Paleogene aquifer	4,00	Skalna glava
PS Stremtsi	three shaft wells drainage 4,00 m 8,00 m	Stremtsi	Quaternary aquifers	18,00	Stremtsi Sokolyane Stremovo
PS Shiroko pole	drainage	Shiroko pole	Quaternary aquifers	4,00	Shiroko pole
PS Konevo	spring	Konevo	Paleogene aquifer	4,00	Konevo Byala polyana
PS Chiflik	shaft well 8,00 m	Chiflik	Quaternary aquifers	11,00	Chiflik Mudrets Visoka polyana
PS Perperek	shaft well 6,00 m	Perperek	Quaternary aquifers	11,00	Perperek Kaloyansi Gnyazdovo
PS Miladinovo	spring	Miladinovo	Paleogene aquifer	3,00	Miladinovo
PS Chereshitsa	spring	Chereshitsa	Paleogene aquifer	7,00	Chereshitsa Most
PS Kobilyane		Kobilyane	Paleogene aquifer	1,00	Kobilyane

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2.4.2. Water Quality Assessment

2.4.2.1. Pollution Sources

It is presented an analysis about water quality. It shows that all measured indicators are below the maximum allowable values.

2.4.2.2. Legislation

There is listed one ordinance about water quality assessment, currently valid.

2.4.2.3. Water quality Problems and actions taken

The PB described the problem with high turbidity values of raw water from Borovitsa dam. Usually it occurs in spring after the snow melting.

There are defined measures for treatment improvement. The municipality is expecting some investments in order to realize the project.

2.4.2.4. Drinking Water Supply System – water treatment

There is built up DWTP with capacity 800 l/s, which treats the water taken from Borovitsa. The plant includes two stages – mechanical treatment and disinfection. Parts of mechanical treatment stage are radial settling tanks and single layer sand filters, and parts of disinfection stage are chlorine and ozone stations.

For all other water sources, only disinfection is applying.

2.4.3. Conclusions

It is not provided information about defined water bodies typical pollutants and their sources. Probably the bio-chemical condition of the water resources is good (acc. Bulgarian legislation) as they are used for water supply. Anyway, an analysis could be very helpful for assessment of present state and future measure for improvement of drinking water infrastructure at all.

There is DWTP with relevantly big capacity which is forthcoming (financing has to be found) to be reconstructed in order to treat water with high turbidity from Borovitsa dam. As the trends are for inhabitants' decrease it could be, evaluate if this plant is quite enough to supply potable water for other systems too.

2.5. PB5 – Municipality of Gotse Delchev, Bulgaria

2.5.1. General description

The PB explained that the existing water supply system at the territory supplies drinking water for two municipalities - Gotse Delchev and Garmen.

The water quantities sort by type of source and their maximum capacities are:

Table 10. Water sources and their maximum capacities in Gotse Delchev and Garmen municipalities

Springs		Well		Rivers without dams		Total	
Q-ty	**capacity (l/s)**	**Q-ty**	**capacity (l/s)**	**Q-ty**	**capacity (l/s)**	**Q-ty**	**capacity (l/s)**
3	10,80	2	1,90	1	53,60	6	66,30

In addition, it is provided information about all water bodies, which the utility uses for water supply and water needs of the inhabitants and industry at the territory.

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Table 11. Description of water bodies

- Springs

Name	Short description
Barakata	spring is located 15 km away from Gotse Delchev at altitude 1 555 m. It consist of three springs, collector and a chamber. Water is supplied to a reservoir V=1250 m3 with DN250 mm asbestos cement pipe installed in mid-sixties.
Sofiata	spring is located 16 km away from Gotse Delchev at altitude 1 430 m. It consist of three springs, collecting pipe and a chamber. Water is supplied to a reservoir V=1250 m3 with DN250 mm asbestos cement pipe installed in mid-sixties
Papaz chair	spring is located 16 km away from Gotse Delchev at altitude 1 382 m. Water is supplied to a reservoir V=700 m3 with DN150 mm steel pipe

- Ground water sources

Name	Short description
Tufcha	Ground water source is located 15 km away at altitude 1 110 m. It consist of a chamber with overflow, screen and a sedimentation chamber. Water is supplied to a Potable Water Treatment Plant (PWTP). After water is treated, main quantity is supplied to water supply network of Gotse Delchev and rest is provided for Gospodinovci and Garmen.

- Local water sources

Name	Short description
PS Dabnica	Underground well river Mesta bank
Chuchura	for village Debren
Ilisten	Underground abstraction from river Kurtovska for village Ribnovo
Konsko dere	Underground abstraction from river Goliamo konsko dere for village Ribnovo for village Osikovo
PS Osikovo	for village Osikovo

2.5.2. Water Quality Assessment

2.5.2.1. Pollution Sources

There is not data about any pollutions measured in water sources used in WSS Gotse Delchev. All water sources quality is in accordance with requirements of Directive 98/33/EU for the quality of water provided for potable purposes.

2.5.2.2. Legislation

There is listed one ordinance about water quality assessment, currently valid.

2.5.2.3. Water quality Problems and actions taken

As main problem is described the lack of a reliable automation for disinfection with chlorine. Processes perform manually on daily basis or with local dosing pumps. Other problem is the lack of a water quality monitoring system (except in DWTP Gotse Delchev) for all water storage and pressure reservoirs.

2.5.2.4. Drinking Water Supply System – water treatment

There is DWTP in Gotse Delchev city. It treats significant part of water quantity needed for supplying the inhabitants with potable water. The plant is two-stage type. The first stage includes basin for coagulation and sedimentation tank and the second stage is mechanical - sand filter. In addition, there is applied disinfection with chlorine. After treatment, the water quality through several parameters measures permanently.

2.5.3. Conclusions

It is not provided information about defined water bodies typical pollutants and their sources. Probably the bio-chemical condition of the water resources is good (acc. Bulgarian legislation) as they are used for water supply. Anyway, an analysis could be very helpful for assessment of present state and future measure for improvement of drinking water infrastructure at all.

The PB faced that there is not reliable systems for chlorine adding and systems for quality monitoring for the water storage reservoirs. It is an important feature the presence of reliable infrastructure for disinfection and water storage with constant quality. That is way the PB and the local Water Company could work together to improve and upgrade the existing facilities.

2.6. PB6 – Municipal Water Supply and Sewerage Company of Thermaikos, Greece

2.6.1. General description

The PB uses water from River Water Basin District of Central Macedonia - Water Basin of Halkidiki. The water sources in use are ground type.

2.6.2. Water Quality Assessment

2.6.2.1. Pollution Sources

There is presented information about water bodies in the territory with assessment about their ecological, chemical and for some of them quantitative status.
27 parameters are important and they are measured regular.

2.6.2.2. Legislation

It is listed the Greek National Legislation about water quality audits which has to be followed and respected.

2.6.2.3. Water quality Problems and actions taken

Main problem for the territory of the municipality is the seawater intrusion. Reasons about this are locational, geographical – distance between sea and well, type of ground soils, groundwater depths and flows, etc.

If they detect seawater intrusion in some of the wells, they stop its operation.

2.6.2.4. Drinking Water Supply System – water treatment

The PB did not describe any plant for drinking water treatment. It is mentioned only treatment with sodium hypochlorite – disinfection of water for potable use.

2.6.3. Conclusions

It is not provided information about water bodies and their typical pollutants by nature or source. Probably the bio-chemical condition of the water resources is good (acc. Greek legislation). Anyway, an analysis could be very helpful for assessment of present state and future measure for improvement of drinking water infrastructure at all.

Regarding that there is not any DWTP (only disinfection is applied) and the problems with groundwater, maybe in close future the municipality will need a treatment for the brackish groundwater because of seawater intrusion. It has to be evaluated which solution (opening new boreholes or construction of DWTP) is better in operational and economical aspect.

Chapter 3. Discussion & Conclusions

The most important for water quality assessment is the regular monitoring and pollution prevention. Every water supply company, authorities and public associations have to scheduled monitoring graphs and to establish program for regular monitoring and rules for taking samples according the local legislation. As Greece and Bulgaria are both parts of EU community it is recommended to follow Directive 98/83/EC of 3 November 1998 on the quality of water intended for human consumption.

Other important aspect for water quality no matter surface or groundwater is the human activity. Every industry manufacturer, agriculture manufacturer and other businesses with impact on nature to organize their work and activities in ecological way, they have to build treatment facilities (water, air, etc.), to use environmentally friendly products. Their work and operation have to be controlled and supervised regularly as the clean water is a finite resource and in the near future it is expecting to become more and more demanded resource.

References

River Basin Management Plans (updated) for all WDs, available at: http://wfdver.ypeka.gr/el/management-plans-gr/1revision-approved-management-plans-gr/

River Basin Management Plan (RBMP) of Thrace 1st Revision, 2017. Available at: http://wfdver.ypeka.gr/wp-content/uploads/2017/12/EL12_SDLAP_APPROVED.pdf (in Greek)

River Basin Management Plan (RBMP) of Central Macedonia 1st Revision, 2007. Available at: http://wfdver.ypeka.gr/wp-content/uploads/2017/04/files/GR10/GR10_SDLAP.pdf (in Greek)

River Basin Management Plan (RBMP) of Eastern Macedonia 1st Revision, 2007. Available at: http://wfdver.ypeka.gr/wp-content/uploads/2017/12/EL11_SDLAP_APPROVED.pdf (in Greek)

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

Appendix A: Beneficiaries' reports

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

WATER RESCUE

Water resources efficiency and conservative use in drinking water supply systems

WP	**3 Current Status Analysis and Assessment**
Deliverable *Tool*	**3.1.3 Water Quality report** *Questionnaire*
Project Beneficiary No	**LB/PB1**
Beneficiary Institution	**Municipal Water Supply and Sewerage Company of Komotini**

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

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The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

Name of the organization/institution: Municipal Water Supply and Sewerage Company of Komotini
Beneficiary number: LB/PB1

1 Introduction

DEYA Komotinis takes water both from surface water and groundwater bodies. The related River Basin (RB) is the RB of Komotini Streams – Loutro Evrou.

The water resources used are Vosvozis river (EL1209R0000010085N) and the groundwater system of Rodopi (EL1200120). Their characteristics are:

- Vosvozis river: (EL1209R0000010085N – length: 7.70Km; river basin area: 74.91Km^2; average annual runoff: 42.52hm^3)
- Rodopi system: (EL1200120 - area 755.58Km^2)

From Vosvozis river 2,750,000 m^3 of water were used by DEYA Komotinis in 2016 while from Rodopi system 3,550,000 m^3 of water were also abstracted in the same year.

2 Water Quality Assessment

2.1 Pollution in water bodies and water quality assessment

Initially the pollution loads cannot be assessed at the subsystem level but at the river basin level. Based on the RBMP (2017) there are point pollution sources and diffuse pollution sources met in the River Basin of Komotini – Loutro Evrou streams. Point pollution sources examined are industrial units, wastewater treatment plants, sewerage networks discharging to physical receivers, large hotels, livestocks and aquaculture and fishfarming. The annual loads of BOD, Nitrogen (N) and Phosphorus (P) due to these point pollution sources are presented in Table 1. The most polluting activity is sewerage networks discharging to physical receivers and wastewater treatment plants followed by industries for BOD and nitrogen, while for phosphorus industries contribute the most.

Table 1. Annual BOD, N and P loads due to point pollution sources in RB Komotinis - Loutrou Evrou streams (source: RBMP, 2017)

Point sources	**Annual BOD (tons/year)**	**Annual N (tons/year)**	**Annual P (tons per year)**
Industrial units	27.9	26.1	25.9
Leakages from uncontrolled disposal points of and Landfills	0.0	0.0	0.0
Wastewater treatment plants	70.1	43.0	2.8
Sewerage networks discharge to physical receivers	72.4	14.5	3.0
Large hotels	0.0	0.0	0.0
Aquaculture – fishfarming	0.0	0.0	0.0
Large Livestock farming units	3.1	1.8	0.4
TOTAL	**173.6**	**85.3**	**32.1**

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Diffuse pollution sources include urban, agricultural, livestocks and other sources. Table 2 shows the BOD, N and P annual loads due to diffuse pollution sources to Komotini – Loutro Evrou streams RB. The most polluting activity is livestock, followed by agriculture regarding nitrogen loads.

Table 2. Annual BOD, N and P loads due to diffuse pollution sources in RB Komotinis - Loutrou Evrou streams (source: RBMP, 2017)

Diffuse sources	Annual BOD (tons/year)	Annual N (tons/year)	Annual P (tons per year)
Urban	186.7	53.2	1.3
Agricultural	0.0	196.7	11.9
Livestock farming	2,038.2	538.5	19.5
Other sources	0.0	118.0	0.9
TOTAL	**2,224.8**	**906.4**	**33.6**

Total pollution loads in Komotini – Loutro Evrou streams RB account for 2,398.4 ton/year of BOD, 991.7 tons/year of N and 65.6 tons/year of P. Point sources contribute more to the total pollution loads.

As mentioned before, the groundwater system supplying DEYAK with water is assessed for its chemical and quantitative status (RBMP, 2017) which is found to be good. There are no problems identified in this groundwater system.

Table 3. Water resources quality assessment of the groundwater system of Rodopi (source: RBMP, 2017)

Water system	Chemical status	Quantitative status	Increased values due to physical background	Increased values due to human pressures	Main pressures	Salt water intrusion	Quality problems
Rodopi	Good	Good	-	-	-	No	No
Vosvozis river	Poor	-	-	-	-	-	-

2.2 Water quality characteristics measured by the water utility

The water utility measures at the water body some water quality parameters. The Greek legislation covering the parameters need to be measured is the Joint Ministerial Decision Γ1(Δ) ΓΠ οικ.67322 / 2017 (Government Gazette 3282/19-09-2017), Annex I. These parameters include microbiological parameters, chemical parameters and indicative parameters (Tables 4, 5, 6 & 7).

Table 4: Microbiological parameters – general requirements for drinking water

Parameter	Parametric value (number / 100 ml)
Escherichia coli (*E. coli*)	0
Enterococci	0

Table 5: Chemical parameters of drinking water

Parameter	Parametric value	Unit
Acrylamide	0.10	μg/l

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Antimony	5.0	μg/l
Arsenic	10	μg/l
Benzene	1.0	μg/l
Benzo(a)pyrene	0.010	μg/l
Boron	1.0	mg/l
Bromate	10	μg/l
Cadmium	5.0	μg/l
Chromium	50	μg/l
Copper	2.0	mg/l
Cyanide	50	μg/l
1,2-dichloroethane	3.0	μg/l
Epichlorohydrin	0.10	μg/l
Fluoride	1.5	mg/l
Lead	10	μg/l
Mercury	1.0	μg/l
Nickel	20	μg/l
Nitrate	50	mg/l
Nitrite	0.50	mg/l
Pesticides	0.10	μg/l
Pesticides - total	0.50	μg/l
Polycyclic aromatic hydrocarbons	0.10	μg/l
Selenium	10	μg/l
Tetrachloroethene and Trichlorethene	10	μg/l
Trihalomethanes - total	100	μg/l
Vinyl chloride	0.50	μg/l

Table 6: Indicator parameters of drinking water

Parameter	**Parametric value**	**Unit**
Aluminium	200	μg/l
Ammonium	0.50	mg/l
Chloride	250	mg/l
Clostridium perfringens (including spores)	0	number/100 ml
Colour	Acceptable to consumers and no abnormal change	
Conductivity	2500	μS cm-1 at 20 °C
Hydrogen ion concentration (pH)	≥6.5 and ≤9.5	pH units
Iron	200	μg/l
Manganese	50	μg/l
Odour	Acceptable to consumers and no abnormal change	
Oxidisability	5.0	mg/l O2
Sulphate	250	mg/l
Sodium	200	mg/l

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

Taste	Acceptable to consumers and no abnormal change	
Colony count at 22 °C and 37 °C	No abnormal change	
Coliform bacteria	0	number/100 ml
Total organic carbon (TOC)	No abnormal changes	
Residual chlorine		mg/l
Turbidity	Acceptable to consumers and no abnormal change	

Table 7: Radioactivity of drinking water

Parameter	**Parametric value**	**Unit**
Tritium	100	Bq/l
Total indicative dose	0.10	mSv/year

2.3 Legislation

The Greek and European legislation dealing with drinking water quality monitoring is presented in several regulations:

1. Joint Ministerial Decision Y2/2600/01 regarding the water quality for human consumption according the European Directive 98/83/EC (Official Gazette of the Greek Republic 892/11-7-01) and its amendment ΔΥΓ2/Γ.Π. οικ 38295 [Official Gazette 630/26-4-07]);

2. Official Gazette of the Greek Republic 2017B/9-9-2011 regarding the Determination of the national stations network for monitoring the quality and quantity of the water systems;

3. Joint Ministerial Decision Γ1(Δ) ΓΠ οικ.67322 / 2017 (Government Gazette 3282/19-09-2017), for the quality of water used for human consumption according to the Directive 98/183/EC of the Council of the European Union of 3rd November 1998 as amended by the Directive 2015/1787 (L260,7.10.2015)

European Directives that apply in water for human consumption are:

1. European Directive for the samplings frequency and the control methods for the surface water intended for drinking 79/869/EC;

2. European Directive regarding the required quality of surface waters intended for human consumption 75/440/EC.

The water utility follows the Greek legislation regarding the monitoring and sampling of water.

2.4 Water treatment

The water utility of Komotini takes water from surface and groundwater bodies. For about 7 months of the year surface water bodies are used, while the remaining 5 months of the year groundwater bodies are used for water supply. The water taken from surface water bodies is transferred to a water treatment plant where it is treated before being supplied to the inhabitants of Komotini municipality.

Regarding water abstracted from groundwater bodies, only disinfection is applied as water treatment.

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

2.5 Problems identified

One of the problems faced is that water quality is better when the abstraction point is close to the river bed. As the abstraction points get more distant from the river bed, the water quality is deteriorated. This is mainly due to nitrates originated from agricultural activities. The depth of the boreholes is also an important factor for water quality especially at the areas near the sea. After a certain depth the water gets brackish due to seawater intrusion.

Other human activities affect water quality. For example there are boreholes near livestock farming activities where water quality is affected by such activities.

2.6 Actions taken

The water utility applies the current national legislation regarding water quality.

Literature

River Basin Management Plan (RBMP) of Thrace 1st Revision, 2017. Available at: http://wfdver.ypeka.gr/wp-content/uploads/2017/12/EL12_SDLAP_APPROVED.pdf (in Greek)

WATER RESCUE

Water resources efficiency and conservative use in drinking water supply systems

WP	**3 Current Status Analysis and Assessment**
Deliverable *Tool*	**3.2.3 Water Quality report** *Questionnaire*
Project Beneficiary No	**PB2**
Beneficiary Institution	**Municipal Water Supply and Sewerage Company of Thermi**

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

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Name of the organization/institution: Municipal Water Supply and Sewerage Company of Thermi

Beneficiary number: PB2

1 Introduction

The Municipal Water Supply and Sewerage Company of Thermi (DEYA Thermis) provides with water the city of Thermi. Water is taken from the river basin of Chalkidiki (water district of Central Macedonia EL10). Specifically, the groundwater bodies from which water is taken are:

- Subsystem of down flow of Anthemountas: (EL1000081 – area:92.03Km^2)
- Subsystem of Thermi – N. Risio: (EL1000083 - area 177.00Km^2)
- Subsystem of Cholomontas - Oreokastro: (EL1000193 - area 1597.41 Km^2)

2 Water Quality Assessment

2.1 Pollution in water bodies and water quality assessment

Initially the pollution loads cannot be assessed at the subsystem level but at the river basin level. Based on the RBMP (2017) there are point pollution sources and diffuse pollution sources met in the River Basin of Chalkidiki. Point pollution sources examined are wastewater treatment plants, industrial units, thermal power plant, livestock farming, mines – quarry, aquaculture and fishfarming. The annual loads of BOD, Nitrogen (N) and Phosphorus (P) due to these point pollution sources are presented in Table 1. The most polluting activity is industries and wastewater treatment plants. The thermal power plant pollution refers mainly to Cr, Zn, As, Cu, HC, PCBs, Cd, Pb, Hg, Ni. The mines and quarries pollution refers to SO_4^{-2}, Fe, Mn, Zn, Pb, Sb, As (RBMP, 2017).

Table 1. Annual BOD, N and P loads due to point pollution sources in Chalkidiki RB (source: RBMP, 2017)

Point sources	Annual BOD (tons/year)	Annual N (tons/year)	Annual P (tons per year)
Wastewater treatment plants	802.4	501.5	102.5
Industrial units	2,398.4	1,006.54	93.57
Livestock farming units	60.1	33.4	1.5
TOTAL	**3,260.9**	**1,541.44**	**197.57**

Diffuse pollution sources include urban, agricultural, livestocks and other sources. Table 2 shows the BOD, N and P annual loads due to diffuse pollution sources to Chalkidiki RB. The most polluting activity is livestock, followed by urban wastewater not discharged to WWTT for BOD loads, while agriculture is the most polluting activity followed by livestocks regarding nitrogen and phosphorous loads.

Table 2. Annual BOD, N and P loads due to diffuse pollution sources in Chalkidiki RB (source: RBMP, 2017)

Point sources	Annual BOD (tons/year)	Annual N (tons/year)	Annual P (tons per year)
Agricultural activities		796.4	551.2
Urban wastewater not discharged to WWTP	873.49	249.58	51.99
Livestock farming	1021.29	450.38	54.53
Urban / roads		98.31	13.12
TOTAL	**1,894.78**	**1,594.67**	**670.84**

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

As mentioned before, the three groundwater systems supplying DEYA Thermis with water are assessed for their chemical and quantitative status (RBMP, 2017). The same study provides the parameters with increased values either due to physical background or due to anthropogenic activities. The main pressures and salt water intrusion are also identified (Table 3).

Table 3. Water resources quality assessment of the three groundwater systems (source: RBMP, 2017)

Groundwater system	Chemical status	Quantitative status	Increased values due to physical background	Increased values due to human pressures	Main pressures	Salt water intrusion
Down flow of Anthemountas	Bad	Bad	Fe, Mn, B, Cr, As, Cl, E.C.	NO_3, Cl	Agriculture, livestock farming, urban wastewater, salt water intrusion, over-abstraction	Yes
Thermi – N. Risio	Good	Good	Fe, Mn, B, As, Cl, Na, H_2S	-	-	No
Cholomontas - Oreokastro	Good	Good	-	-	-	No

The subsystem Anthemountas down flow faces pollution problems due to agriculture, livestock farming, urban wastewater and over-abstraction. Salt water intrusion problems also exist. Increased values of Mn, Fe, B, Cr, As, Cl, are due to the physical background. Especially As values are due to geothermic fluids. The system's chemical and quantitative status is bad. The subsystem Thermi – N. Risio does not face pollution problems. Increased values of Fe, Mn, B, As, Cl, Na, H_2S are due to the physical background and especially the geothermic fluids and the Anthemountas crack. Cholomontas - Oreokastro subsystem does not face pollution problems or over-abstraction.

2.2 Water quality characteristics measured by the water utility

The water utility measures at the water body some water quality parameters. The Greek legislation covering the parameters need to be measured is the Joint Ministerial Decision Γ1(Δ) ΓΠ οικ.67322 / 2017 (Government Gazette 3282/19-09-2017), Annex I. These parameters include microbiological parameters, chemical parameters and indicative parameters (Tables 4, 5 & 6).

Table 1: Microbiological parameters – general requirements for drinking water

Parameter	Parametric value (number / 100 ml)
Escherichia coli (*E. coli*)	0
Enterococci	0

Table 2: Chemical parameters of drinking water

Parameter	Parametric value	Unit
Acrylamide	0.10	μg/l
Antimony	5.0	μg/l
Arsenic	10	μg/l
Benzene	1.0	μg/l
Benzo(a)pyrene	0.010	μg/l
Boron	1.0	mg/l
Bromate	10	μg/l
Cadmium	5.0	μg/l

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

Chromium	50	µg/l
Copper	2.0	mg/l
Cyanide	50	µg/l
1,2-dichloroethane	3.0	µg/l
Epichlorohydrin	0.10	µg/l
Fluoride	1.5	mg/l
Lead	10	µg/l
Mercury	1.0	µg/l
Nickel	20	µg/l
Nitrate	50	mg/l
Nitrite	0.50	mg/l
Pesticides	0.10	µg/l
Pesticides - total	0.50	µg/l
Polycyclic aromatic hydrocarbons	0.10	µg/l
Selenium	10	µg/l
Tetrachloroethene and Trichlorethene	10	µg/l
Trihalomethanes - total	100	µg/l
Vinyl chloride	0.50	µg/l

Table 3: Indicator parameters of drinking water

Parameter	Parametric value	Unit
Aluminium	200	µg/l
Ammonium	0.50	mg/l
Chloride	250	mg/l
Clostridium perfringens (including spores)	0	number/100 ml
Colour	Acceptable to consumers and no abnormal change	
Conductivity	2500	µS cm-1 at 20 °C
Hydrogen ion concentration (pH)	≥6.5 and ≤9.5	pH units
Iron	200	µg/l
Manganese	50	µg/l
Odour	Acceptable to consumers and no abnormal change	
Oxidisability	5.0	mg/l O2
Sulphate	250	mg/l
Sodium	200	mg/l
Taste	Acceptable to consumers and no abnormal change	
Colony count at 22 °C and 37 °C	No abnormal change	
Coliform bacteria	0	number/100 ml
Total organic carbon (TOC)	No abnormal changes	
Residual chlorine		mg/l
Turbidity	Acceptable to consumers and no abnormal change	

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Table 4: Radioactivity of drinking water

Parameter	Parametric value	Unit
Tritium	100	Bq/l
Total indicative dose	0.10	mSv/year

2.3 Legislation

The Greek and European legislation dealing with drinking water quality monitoring is presented in several regulations:

1. Joint Ministerial Decision Y2/2600/01 regarding the water quality for human consumption according the European Directive 98/83/EC (Official Gazette of the Greek Republic 892/11-7-01) and its amendment ΔΥΓ2/Γ.Π. οικ 38295 [Official Gazette 630/26-4-07]);

2. Official Gazette of the Greek Republic 2017B/9-9-2011 regarding the Determination of the national stations network for monitoring the quality and quantity of the water systems;

3. Joint Ministerial Decision Γ1(Δ) ΓΠ οικ.67322 / 2017 (Government Gazette 3282/19-09-2017), for the quality of water used for human consumption according to the Directive 98/183/EC of the Council of the European Union of 3rd November 1998 as amended by the Directive 2015/1787 (L260,7.10.2015)

European Directives that apply in water for human consumption are:

1. European Directive for the samplings' frequency and the control methods for the surface water intended for drinking 79/869/EC;

2. European Directive regarding the required quality of surface waters intended for human consumption 75/440/EC.

The water utility follows the Greek legislation regarding the monitoring and sampling of water.

2.4 Water treatment

As water is abstracted from groundwater bodies, only disinfection is applied as water treatment.

Disinfection is applied at the boreholes or at the water tanks. At the boreholes, chlorine is injected to the borehole supply pipe. At the water tanks, chlorine is added inside the water tank.

2.5 Problems identified

The major problem faced regarding water quality is the increased value of some physical-chemical parameters that sometimes is near the allowable maximum values of the legislation. The causes of this problem is the groundwater geological background.

Another problem is the excessive increase of turbidity which is due to the excessive abstraction of the groundwater.

2.6 Actions taken

To confront the problems described above, the water utility takes measures. Some of these measures are the cleaning of the boreholes and the opening of new boreholes.

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Literature

River Basin Management Plan (RBMP) of Central Macedonia 1st Revision, 2007. Available at: http://wfdver.ypeka.gr/wp-content/uploads/2017/04/files/GR10/GR10_SDLAP.pdf (in Greek)

WATER RESCUE

Water resources efficiency and conservative use in drinking water supply systems

WATER RESCUE

WP	**3 Current Status Analysis and Assessment**
Deliverable *Tool*	**3.3.3 Water Quality report** *Questionnaire*
Project Beneficiary No	**PB3**
Beneficiary Institution	**University of Thessaly-Special Account Funds for Research-Department of Civil Engineering**

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

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The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

Name of the organization/institution: University of Thessaly-Special Account Funds for Research-Department of Civil Engineering
Beneficiary number: PB3

1 Introduction

The University of Thessaly reports the current status analysis regarding water resources quality at national level. Greece consists of 14 Water Districts (WDs) (Figure 1).

Figure 1. Water Districts in Greece (source RBMPs)

The country shares three transnational water resources with Bulgaria (RBMP of Thrace, 2017; RBMP of Eastern Macedonia, 2017). These transnational water resources are: River Basin (RB) of Evros (Greece; Bulgaria; Turkey); RB of Nestos (Greece and Bulgaria); RB of Strimonas (Greece and Bulgaria).

Specifically, in the WD of Thrace, the River Basin (RB) of Evros has a total length is 528Km of which 310 Km belong to Bulgaria while 208 Km are the natural borders of Greece with Bulgaria and Turkey. The RB is shared among the three counties as follows: 35,085Km^2 (66.2%) belong to Bulgaria, 14,575Km^2 (27.5%) belong to Turkey and 3,340Km^2 (6.3%) belong to Greece (RBMP of Thrace, 2017).

2 Water Quality Assessment

2.1 Pollution in water bodies and water quality assessment

The qualitative status of all water bodies (rivers, lakes, coastal, transitional, groundwater) at river basin level has been assessed at the River Basin Management Plans (RBMPs). The assessment methodologies can be found at the RBMPs and at http://wfdver.ypeka.gr/). The total qualitative status of the surface water bodies is assessed at ecological and chemical levels. Regarding groundwater bodies, their assessment was made at quality (chemical) and quantity level.

The results showed that the majority of the rivers are found in good qualitative status (60.6%), while only 17.9% are found in moderate status and 14.5% in unknown status (Figure 2). The majority of the reservoirs are found to have an unknown qualitative status (45.5%) while 43.2% of them are found to be in good qualitative status. The majority of the lakes are found in be in moderate status (30%) and 20% of them in good status, while 26.67% of them are classified as unknown qualitative status (Figure 2). Transitional water bodies have unknown qualitative status (55%) while 22.5% of them are found to be in poor status. Finally, coastal water bodies have good qualitative status (41.2%) and high qualitative status (36.2%) (Figure 2).

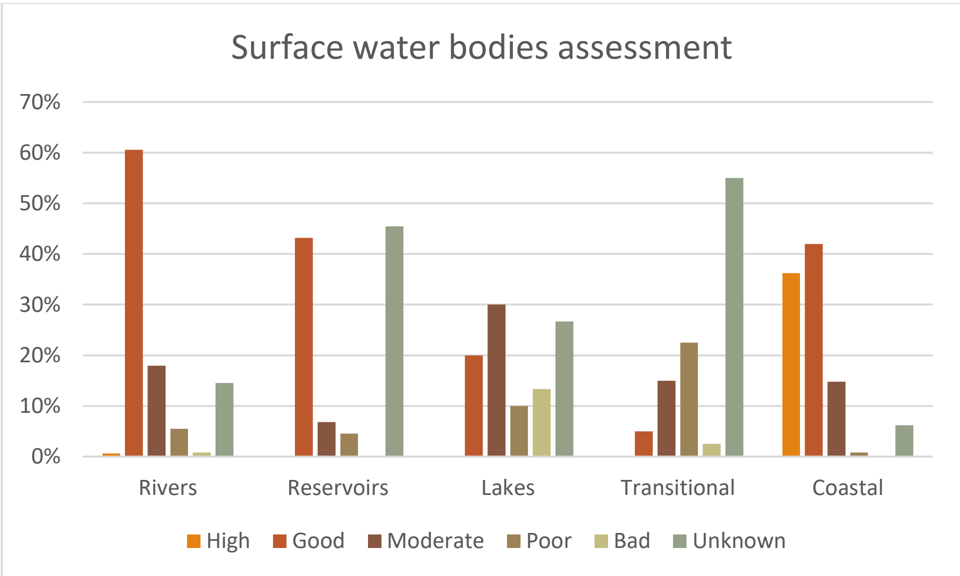

Figure 2. Surface water bodies qualitative assessment (data gathered from the RBMPs, 2017)

Based on the results from the RBMPs, groundwater bodies in Greece are found to be in good chemical status (84.75%) and good quantitative status (84.04%). Only 85 groundwater bodies are found in poor chemical status and 90 in poor quantitative status.

2.2 Water quality characteristics measured by the water utility

Water utilities in Greece need to monitor some quality characteristics of the water resources used for drinking water purposes. The Greek legislation covering the parameters need to be measured is the Joint Ministerial Decision Γ1(Δ) ΓΠ οικ.67322 / 2017 (Government Gazette 3282/19-09-2017), Annex I. These

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

parameters include microbiological parameters, chemical parameters and indicative parameters (Tables 1, 2, 3 & 4).

Table 1: Microbiological parameters – general requirements for drinking water

Parameter	**Parametric value (number / 100 ml)**
Escherichia coli (*E. coli*)	0
Enterococci	0

Table 2: Chemical parameters of drinking water

Parameter	**Parametric value**	**Unit**
Acrylamide	0.10	μg/l
Antimony	5.0	μg/l
Arsenic	10	μg/l
Benzene	1.0	μg/l
Benzo(a)pyrene	0.010	μg/l
Boron	1.0	mg/l
Bromate	10	μg/l
Cadmium	5.0	μg/l
Chromium	50	μg/l
Copper	2.0	mg/l
Cyanide	50	μg/l
1,2-dichloroethane	3.0	μg/l
Epichlorohydrin	0.10	μg/l
Fluoride	1.5	mg/l
Lead	10	μg/l
Mercury	1.0	μg/l
Nickel	20	μg/l
Nitrate	50	mg/l
Nitrite	0.50	mg/l
Pesticides	0.10	μg/l
Pesticides - total	0.50	μg/l
Polycyclic aromatic hydrocarbons	0.10	μg/l
Selenium	10	μg/l
Tetrachloroethene and Trichlorethene	10	μg/l
Trihalomethanes - total	100	μg/l
Vinyl chloride	0.50	μg/l

Table 3: Indicator parameters of drinking water

Parameter	**Parametric value**	**Unit**
Aluminium	200	μg/l
Ammonium	0.50	mg/l
Chloride	250	mg/l
Clostridium perfringens (including spores)	0	number/100 ml
Colour	Acceptable to consumers and no abnormal change	

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

Conductivity	2500	µS cm-1 at 20 °C
Hydrogen ion concentration (pH)	≥6.5 and ≤9.5	pH units
Iron	200	µg/l
Manganese	50	µg/l
Odour	Acceptable to consumers and no abnormal change	
Oxidisability	5.0	mg/l O2
Sulphate	250	mg/l
Sodium	200	mg/l
Taste	Acceptable to consumers and no abnormal change	
Colony count at 22 °C and 37 °C	No abnormal change	
Coliform bacteria	0	number/100 ml
Total organic carbon (TOC)	No abnormal changes	
Residual chlorine		mg/l
Turbidity	Acceptable to consumers and no abnormal change	

Table 4: Radioactivity of drinking water

Parameter	Parametric value	Unit
Tritium	100	Bq/l
Total indicative dose	0.10	mSv/year

2.3 Legislation

The Greek and European legislation dealing with drinking water quality monitoring is presented in several regulations:

1. Joint Ministerial Decision Y2/2600/01 regarding the water quality for human consumption according the European Directive 98/83/EC (Official Gazette of the Greek Republic 892/11-7-01) and its amendment ΔΥΓ2/Γ.Π. οικ 38295 [Official Gazette 630/26-4-07]);

2. Official Gazette of the Greek Republic 2017B/9-9-2011 regarding the Determination of the national stations network for monitoring the quality and quantity of the water systems;

3. Joint Ministerial Decision Γ1(Δ) ΓΠ οικ.67322 / 2017 (Government Gazette 3282/19-09-2017), for the quality of water used for human consumption according to the Directive 98/183/EC of the Council of the European Union of 3rd November 1998 as amended by the Directive 2015/1787 (L260,7.10.2015)

European Directives that apply in water for human consumption are:

1. European Directive for the samplings' frequency and the control methods for the surface water intended for drinking 79/869/EC;

2. European Directive regarding the required quality of surface waters intended for human consumption 75/440/EC.

The water utility follows the Greek legislation regarding the monitoring and sampling of water.

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

2.4 Water treatment

Water utilities using surface water resources have Water Treatment Plants (WTPs) to secure water quality. Water utilities using water from groundwater bodies use only disinfection as a water treatment method.

WTPs can be divided in three phases (figure 3): pre-treatment including screening, pre-disinfection and mixing; primary treatment including flocculation, aggregation, sedimentation, filtration, ozonation and adsorption; and secondary treatment including disinfection.

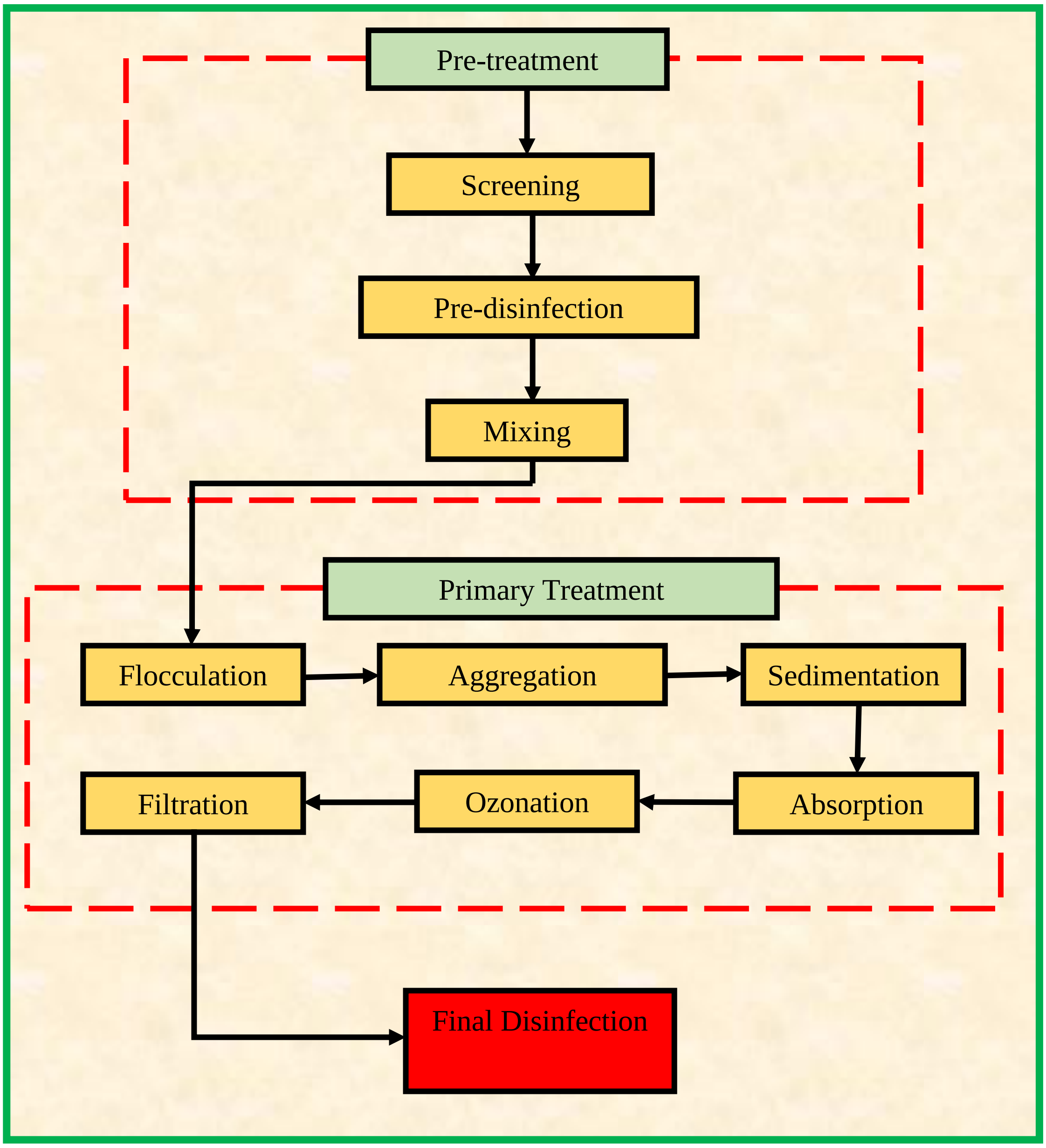

Figure 3. WTPs' flow chart

The phase of final disinfection is used both when surface water and groundwater is used for drinking purposes. Sometimes when groundwater is polluted by pollutants (such as sulfates, magnesium, calcium, etc.) specialized water treatments are used.

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

2.4 Cross-border water bodies' quality problems

2.4.1 River Basin of Strimonas

Point and diffuse sources of pollution contribute to the pollution of the RB of Strimonas (Table 1). In total, BOD annual loads go up to 9,501.7 tons/year, N loads go up to 4,000.2 tons/year and P loads go up to 366.6 tons/year.

Table 1. Total annual pollution loads BOD, N and P due to point and diffuse sources of pollution in Strimonas RB (RBMP of Eastern Macedonia, 2017)

Point Sources of Pollution	**BOD (tons/year)**	**N (tons/year)**	**P (tons/year)**
Industrial units	11.6	440.6	60.2
Leakages from landfills	0	0	0
Wastewater Treatment Plants	289.2	165.2	44.0
Sewage networks discharge to natural receiver	2,013.9	402.8	81.9
Big hotels	0	0	0
Aquaculture, fish farming	51.7	64.0	9.0
Big livestock farming units	734.9	186.6	89.3
TOTAL	**3,101.5**	**1,260.0**	**284.5**
Diffuse Pollution Sources	**BOD (tons/year)**	**N (tons/year)**	**P (tons/year)**
Urban land use	283.2	80.8	2.7
Agricultural land use	0	735.3	48.2
Livestock land use	6,117.0	1,552.8	24.5
Other sources	0	371.3	6.7
TOTAL	**6,400.2**	**2,740.2**	**82.1**
TOTAL POLLUTION LOADS	**9,501.7**	**4,000.2**	**366.6**

From Table 1 it is evident that sewage networks discharging to rivers or lakes and livestock are the activities contributing the most to the water resources pollution.

From the 15 groundwater bodies identified in the RB of Strimonas, only one is assessed to be in bad qualitative status (Eleftheres – N. Peramos system). Regarding surface water systems, the assessment showed that (Table 2):

- 1 river is assessed to be in bad ecological status;
- 2 rivers are assessed to be in lower than good chemical status;
- 1 lake is assessed to be in lower than good chemical status;
- 1 transitional water system is assessed to be in bad ecological status.

Table 2. Surface water bodies assessment

		Rivers	**Heavily modified rivers of lake character**	**Lakes**	**Transitional**	**Coastal**
Ecological status	High	1	0	0	0	1
	Good	45	1	0	0	1
	Moderate	17	0	0	0	2
	Poor	5	0	1	0	0
	Bad	1	0	0	1	0
	Unknown	14	0	0	0	0
Chemical status	Good	80	1	0	1	3
	Lower than good	2	0	1	0	0
	Unknown	1	0	0	0	1

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

2.4.2 River Basin of Nestos

BOD, N and P loads due to point and diffuse sources of pollution are met in the RB of Nestos. From the RBMP (2017) these loads are shown in Table 3.

Table 3. Total annual pollution loads BOD, N and P due to point and diffuse sources of pollution in Nestos RB (RBMP of Thrace, 2017)

Point Sources of Pollution	**BOD (tons/year)**	**N (tons/year)**	**P (tons/year)**
Industrial units	213.3	226.9	87.4
Leakages from landfills	0	0	0
Wastewater Treatment Plants	47.2	219.0	45.6
Sewage networks discharge to natural receiver	32.2	6.4	1.3
Big hotels	0	0	0
Aquaculture, fish farming	335.2	67.4	11.3
Big livestock farming units	122.9	38.9	11.7
TOTAL	**750.8**	**558.6**	**157.4**
Diffuse Pollution Sources	**BOD (tons/year)**	**N (tons/year)**	**P (tons/year)**
Urban land use	57.7	16.4	0.5
Agricultural land use	0	114.7	5.1
Livestock land use	7,353.4	3,728.3	1,003.6
Other sources	0	184.4	1.3
TOTAL	**7,411.1**	**4,044.0**	**1,010.6**
TOTAL POLLUTION LOADS	**8,161.9**	**4,602.6**	**1,168.0**

The activities contributing the most to the pollution of the water systems are livestocks, in the RB of Nestos.

Out of the 3 groundwater bodies identified in the RB of Nestos, only one is assessed to be in bad qualitative status (Nestos Delta system). Regarding surface water systems, the assessment showed that (Table 4):

- 6 rivers are assessed to be in lower than good chemical status;
- 12 rivers are assessed to be in unknown ecological status;
- 3 transitional water systems are assessed to be in unknwon chemical status;
- 1 river is assessed to be in unknown chemical status;
- 2 transitional water systems are assessed to be in unknown chemical status.

Table 4. Surface water bodies assessment in Nestos RB

		Rivers	**Heavily modified rivers of lake character**	**Lakes**	**Transitional**	**Coastal**
Ecological status	High	0	0	0	0	0
	Good	42	1	0	0	1
	Moderate	6	1	0	0	2
	Poor	3	0	0	0	0
	Bad	0	0	0	0	0
	Unknown	12	0	0	3	0
Chemical status	Good	56	2	0	1	3
	Lower than good	6	0	0	0	0
	Unknown	1	0	0	2	0

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

2.4.3 River Basin of Evros

BOD, N and P loads due to point and diffuse sources of pollution are met in the RB of Evros. From the RBMP (2017) these loads are shown in Table 5.

Table 5. Total annual pollution loads BOD, N and P due to point and diffuse sources of pollution in Evros RB (RBMP of Thrace, 2017)

Point Sources of Pollution	**BOD (tons/year)**	**N (tons/year)**	**P (tons/year)**
Industrial units	23.4	17.2	2.3
Leakages from landfills	0	0	0
Wastewater Treatment Plants	120.2	349.8	61.9
Sewage networks discharge to natural receiver	137.7	27.5	5.7
Big hotels	0	0	0
Aquaculture, fish farming	0	0	0
Big livestock farming units	242.8	81.1	41.6
TOTAL	**524.2**	**475.7**	**111.6**
Diffuse Pollution Sources	**BOD (tons/year)**	**N (tons/year)**	**P (tons/year)**
Urban land use	179.4	51.3	1.5
Agricultural land use	0	461.2	37.4
Livestock land use	5,761.0	1,558.7	78.0
Other sources	0	181.8	1.0
TOTAL	**5,940.4**	**2,253.0**	**118.0**
TOTAL POLLUTION LOADS	**6,464.6**	**2,728.7**	**229.6**

Livestock is the activity contributing the most to the pollution of the water systems in the River Basin of Evros.

Table 6. Surface water bodies assessment in Evros RB

		Rivers	**Heavily modified rivers of lake character**	**Lakes**	**Transitional**	**Coastal**
Ecological status	High	0	0	0	0	0
	Good	42	0	0	0	0
	Moderate	3	0	0	0	4
	Poor	2	0	0	0	0
	Bad	0	0	0	0	0
	Unknown	3	1	0	1	0
Chemical status	Good	48	0	0	0	4
	Lower than good	1	0	0	0	0
	Unknown	1	1	0	1	0

Out of the 6 groundwater bodies identified in the RB of Evros, only one is assessed to be in bad qualitative status (Paraevria area – Evros delta system). Regarding surface water systems, the assessment showed that (Table 6):

- 1 river is assessed to be in lower than good chemical status;
- 3 rivers are assessed to be in unknown ecological status;
- 1 heavily modified water system is assessed to be in unknown ecological status;
- 1 transitional water system is assessed to be in unknown ecological status;
- 1 river is assessed to be in unknown chemical status;
- 1 heavily modified water system is assessed to be in unknown chemical status;
- 1 transitional water system is assessed to be in unknown chemical status.

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

Literature

River Basin Management Plans (updated) for all WDs, available at: http://wfdver.ypeka.gr/el/management-plans-gr/1revision-approved-management-plans-gr/

River Basin Management Plan (RBMP) of Eastern Macedonia 1st Revision, 2007. Available at: http://wfdver.ypeka.gr/wp-content/uploads/2017/12/EL11_SDLAP_APPROVED.pdf (in Greek)

River Basin Management Plan (RBMP) of Thrace 1st Revision, 2007. Available at: http://wfdver.ypeka.gr/wp-content/uploads/2017/12/EL12_SDLAP_APPROVED.pdf (in Greek)

WATER RESCUE

Water resources efficiency and conservative use in drinking water supply systems

WP	**3 Current Status Analysis and Assessment**
Deliverable *Tool*	**3.4.3 Water Quality report** *Questionnaire*
Project Beneficiary No	**PB4**
Beneficiary Institution	**Municipality of Kardzhali**

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

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The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

Name of the organization/institution: Municipality of Kardzhali
Beneficiary number: PB4

1 Introduction
-Driving water pipelines - 176,919 km
Distribution network - 178,779 km
Average altitude (m) =
Average working pressure (atm) of 4-5 atm

Types of pipes (material, diameters, lengths)

MUNICIPALITY	length of the water supply network			
	in the settlements		out of populated areas	
	Φ ≤300 мм	Φ > 300 мм	Φ ≤ 300 мм	с Φ > 300 мм
	км	км	км	км
MUNICIPALITY KARDZHALI	171171	7608	143539	33380
Incl.				
ethericity	97668	7608	122202	33380
steel	11975		12811	
PEPP and PVC	61528		8526	

- Age of pipes (per material, diameter) = average age 35 years
- No. of service connections = 19854

Water Utility Level (2017 base year)

Consumption of water by months in 2017

January	February	March	April	May	June	July	August	September	October	November	December
191996	205375	204161	207366	220022	222179	256392	265212	273326	249817	211004	187214

- Water basin where water is taken from = Borovitsa dam

- Water sources (e.g. groundwater or surface water)

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Water supply system	Water source	Location	Underground water body	Maximum flow rate l/s	Place of use
Pump station PS Beli Plast	spring	Beli Plast	Paleogene aquifer	4,00	Beli Plast
Pump station PS Boyno	spring	Boyno	Paleogene aquifer	7,00	Boyno Kokoshane
Pump station PS Gorna Krepost	shaft well 10,00 m	Gorna Krepost	Quaternary aquifers	11,00	Gorna Krepost Dolna Krepost Lyulyakovo
Pump station PS Murgovo	tubular well 20,00 m	Murgovo	Quaternary aquifers	4,00	Murgovo
Pump station PS Volovortsi	spring	Volovortsi	Paleogene aquifer	4,00	Volovortsi
Pump station PS Ohlyuvets	spring	Ohlyuvets	Paleogene aquifer	4,00	Ohlyuvets Chilik
Pump station PS Rani list	spring	Rani list	Paleogene aquifer	4,00	Rani list
Pump station PS Skalna glava	spring	Skalna glava	Paleogene aquifer	4,00	Skalna glava
Pump station PS Stremtsi	three shaft wells drainage 4,00 m 8,00 m	Stremtsi	Quaternary aquifers	18,00	Stremtsi Sokolyane Stremovo
Pump station PS Shiroko pole	drainage	Shiroko pole	Quaternary aquifers	4,00	Shiroko pole
Pump station PS Konevo	spring	Konevo	Paleogene aquifer	4,00	Konevo Byala polyana
Pump station PS Chiflik	shaft well 8,00 m	Chiflik	Quaternary aquifers	11,00	Chiflik Mudrets

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

					Visoka polyana
Pump station PS Perperek	shaft well 6,00 m	Perperek	Quaternary aquifers	11,00	Perperek Kaloyansi Gnyazdovo
Pump station PS Miladinovo	spring	Miladinovo	Paleogene aquifer	3,00	Miladinovo
Pump station PS Chereshitsa	spring	Chereshitsa	Paleogene aquifer	7,00	Chereshitsa Most
Pump station PS Kobilyane		Kobilyane	Paleogene aquifer	1,00	Kobilyane

- Water bodies where the water utility takes water from = there are none

2 Water Quality Assessment

- Please provide data for water pollution in the water bodies from which water is taken from the water utility. Also provide pollutants loads (if data are available)

Drinking water analysis			Date ....
from entrance_treatment plant for drinking water Enchech village Type and location of the water source			
Indicator	Norma under Ordinance 9/2001	Unit	Result
Color	acceptable to the consumer		
Odor	acceptable to the consumer		
Taste	acceptable to the consumer		
Turbidity	acceptable to the consumer		
Active reaction	≥ 6.5 и ≤ 9.5	pH	7.0
Aluminum	200	μg/l	
Ammonium ion	0.50	mg/l	0.08
Electrical conductivity	2000	μS/cm	66.2
Iron	200	μg/l	60
Calcium	150	mg/l	0.211
Magnesium	80	mg/l	7.658
Total hardness	12	mgΣqv/l	1.28
Nitrates	50	mg/l	0.8
Nitrites	0.5	mg/l	0.02
Manganese	50	μg/l	33
Sodium	200	mg/l	
Residual free chlorine	0.3-0.4	mg/l	
Permanent oxidation	5.0	mg O_2/l	
Sulfates	250	mg/l	2.0

Phosphates	0.5	mg/l	
Chloride	250	mg/l	
Zinc	4.0	mg/l	
Coliforms	0/100	KOE/ml	
Number of colonies / microbial number /	No significant fluctuations in water		

- Please provide data on the water quality assessment of these water bodies based on the River Basin Management Plans

Drinking water analysis			Date ....
from exit_treatment plant for drinking water Enchech village Type and location of the water source			
Indicator	Norma under Ordinance 9/2001	Unit	Result
Color	acceptable to the consumer		
Odor	acceptable to the consumer		
Taste	acceptable to the consumer		
Turbidity	acceptable to the consumer		
Active reaction	≥ 6.5 и ≤ 9.5	pH	6.9
Aluminum	200	µg/l	2.0
Ammonium ion	0.50	mg/l	0.01
Electrical conductivity	2000	µS/cm	72.2
Iron	200	µg/l	20
Calcium	150	mg/l	7.509
Magnesium	80	mg/l	0.268
Total hardness	12	mgΣqv/l	1.21
Nitrates	50	mg/l	0.1
Nitrites	0.5	mg/l	0.001
Manganese	50	µg/l	10.0
Sodium	200	mg/l	
Residual free chlorine	0.3-0.4	mg/l	0.37
Permanent oxidation	5.0	mg O_2/l	
Sulfates	250	mg/l	9.0
Phosphates	0.5	mg/l	
Chloride	250	mg/l	
Zinc	4.0	mg/l	
Coliforms	0/100	KOE/ml	
Number of colonies / microbial number /	No significant fluctuations in water		

- Are there any water quality characteristics measured by the water utility? (in the water source)
- Please give some general data on the legislation followed for drinking water quality. Is the Water Drinking Directive followed at national level?

Ordinance No. 9 of 16 March 2001. on drinking water quality - Issued by the Minister of Health, the Minister of Regional Development and Public Works and the Minister of Environment and Water.

- Please describe the actions taken from the water utility to assure good water quality.

  Disinfection of the water with chlorine and chlorine gas of the small water sources and water treatment plants for the water from the dam Borovitsa.

- Please describe the water treatment (if any) including disinfection.

The Water treatment plants is located about 200 m southwest of the village Enchets=
The purification plant is a two-stage with radial settlers and single-layer fast filters and has the following facilities:
- Inlet distribution shaft
- Ershoff mixer
- Radial settlers
- Filter housing
- Drainage basins
- Drying fields
- Reagent Corps
- Chlorine station
- Ozone station
- Laboratory Corps
- Substation

The construction of DWTP is 100%. The capacity is up to 800 l / s. It has been in operation since 1990.

For underground water sources the disinfection of water is carried out with chlorine and chlorine gas.

- Define the main problem(s) in water quality (if any)

  A major problem could be the increased turbidity of the raw water from the Borovitsa dam during the spring months.

- Define the main causes of these problem(s)

  The main cause of the problem is the abundant snowfall and the swallowing of large amounts of water along with earth masses, which hinders the pool.

- Actions taken to confront with these problems

  With a view to improving the water treatment technology, it is envisaged to allocate funds for investments in DWTP mainly by indicator turbulence and improving the operational performance of the facilities and equipment.

3 Comments

Please provide any comments.

WATER RESCUE

Water resources efficiency and conservative use in drinking water supply systems

WP	**3 Current Status Analysis and Assessment**
Deliverable *Tool*	**3.5.3 Water Quality report** *Questionnaire*
Project Beneficiary No	**PB5**
Beneficiary Institution	**Municipality of Gotse Delchev**

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

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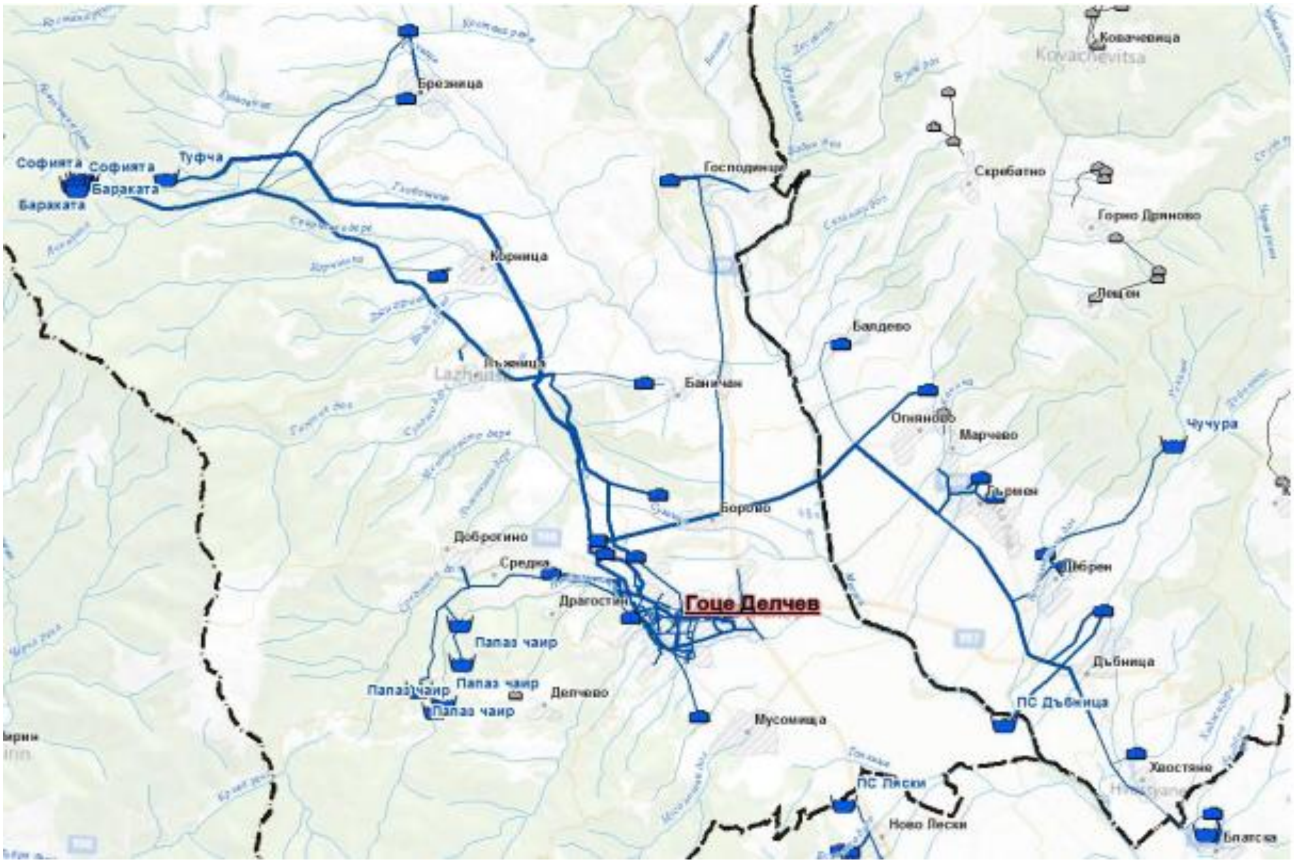
Name of the organization/institution: Municipality of Gotse Delchev
Beneficiary number: PB5

1 Introduction

Water supply system of Gotse Delchev supply settlements from two municipalities – Gotse Delchev and Garmen. Water supply for the system is provided by following water sources located on the territory of Gotse Delchev municipality:

- Spring Barakata – spring is located 15 km away from Gotse Delchev at altitude 1 555 m. It consist of three springs, collector and a chamber. Water is supplied to a reservoir V=1250 m3 with DN250 mm asbestos cement pipe installed in mid-sixties. Capacity of the spring is 91 l/s.
- Spring Sofiata – spring is located 16 km away from Gotse Delchev at altitude 1 430 m. It consist of three springs, collecting pipe and a chamber. Water is supplied to a reservoir V=1250 m3 with DN250 mm asbestos cement pipe installed in mid-sixties. Capacity of the spring is 16 l/s.
- Spring Papaz Chair– spring is located 16 km away from Gotse Delchev at altitude 1 382 m. Water is supplied to a reservoir V=700 m3 with DN150 mm steel pipe. Capacity of the spring is 11 l/s.
- Ground water source Tufcha – Ground water source is located 15 km away at altitude 1 110 m. It consist of a chamber with overflow, screen and a sedimentation chamber. Water is supplied to a Potable Water Treatment Plant (PWTP). After water is treated, main quantity is supplied to water supply network of Gotse Delchev and rest is provided for Gospodinovci and Garmen. Capacity of the water source is 420 l/s.

In addition to those main water source on the territory of water supply system some local wells are used as water sources.



Scheme 1 – water source on the territory of WSS Gotse Delchev

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

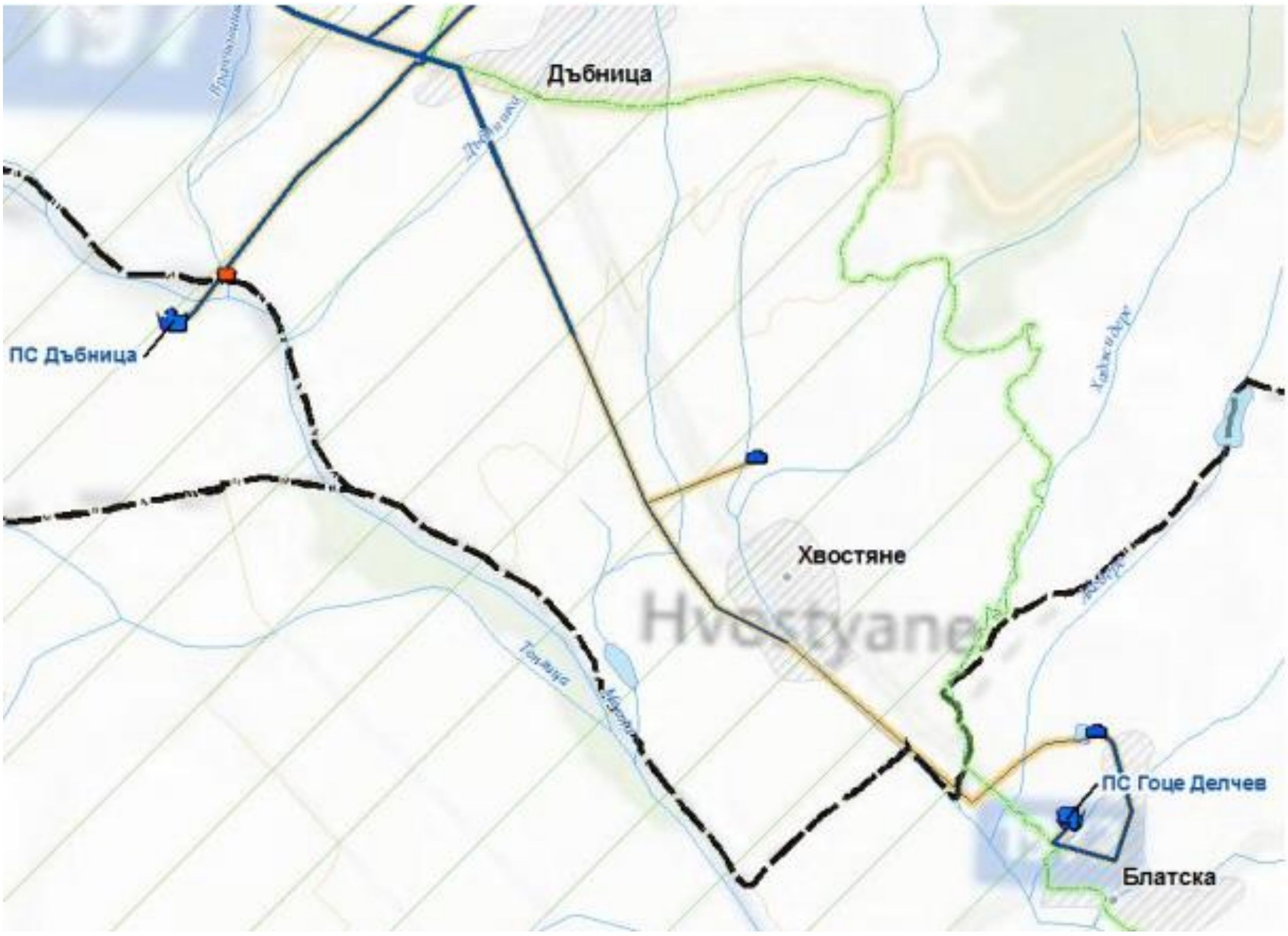
Main facility for the water supply system is potable water treatment plant Gotse Delchev. It is a two stage treatment plant which is put into operation in 2006. Plant is located just above main reservoir of Gotse Delchev with capacity V=7000 m3. Production capacity of the plant is 36 250 m3/day.

On the territory of water supply system of Gotse Delchev 20 reservoirs are used to store water needed for efficient water supply. Three of the reservoirs are used for the water supply of Gotse Delchev – V=7000 m3; V=1250 m3; V=750 m3. Rest reservoirs are used for following settlements – Musomishte V=300 m3; Borovo V=80 m3; Banichan V=120 m3; Kornica V=120 m3; Breznica V=800 m3 and V=80 m3; Gospodinci V=50 m3; Badlevo V=300 m3; Ognyanovo V=800 m3; Garmen V=300 m3 and V=150 m3; Debren V=450 m3 and V=300 m3; Dabnica V=300 m3; Hvostyane V=300 m3; Blatska V=300 m3.

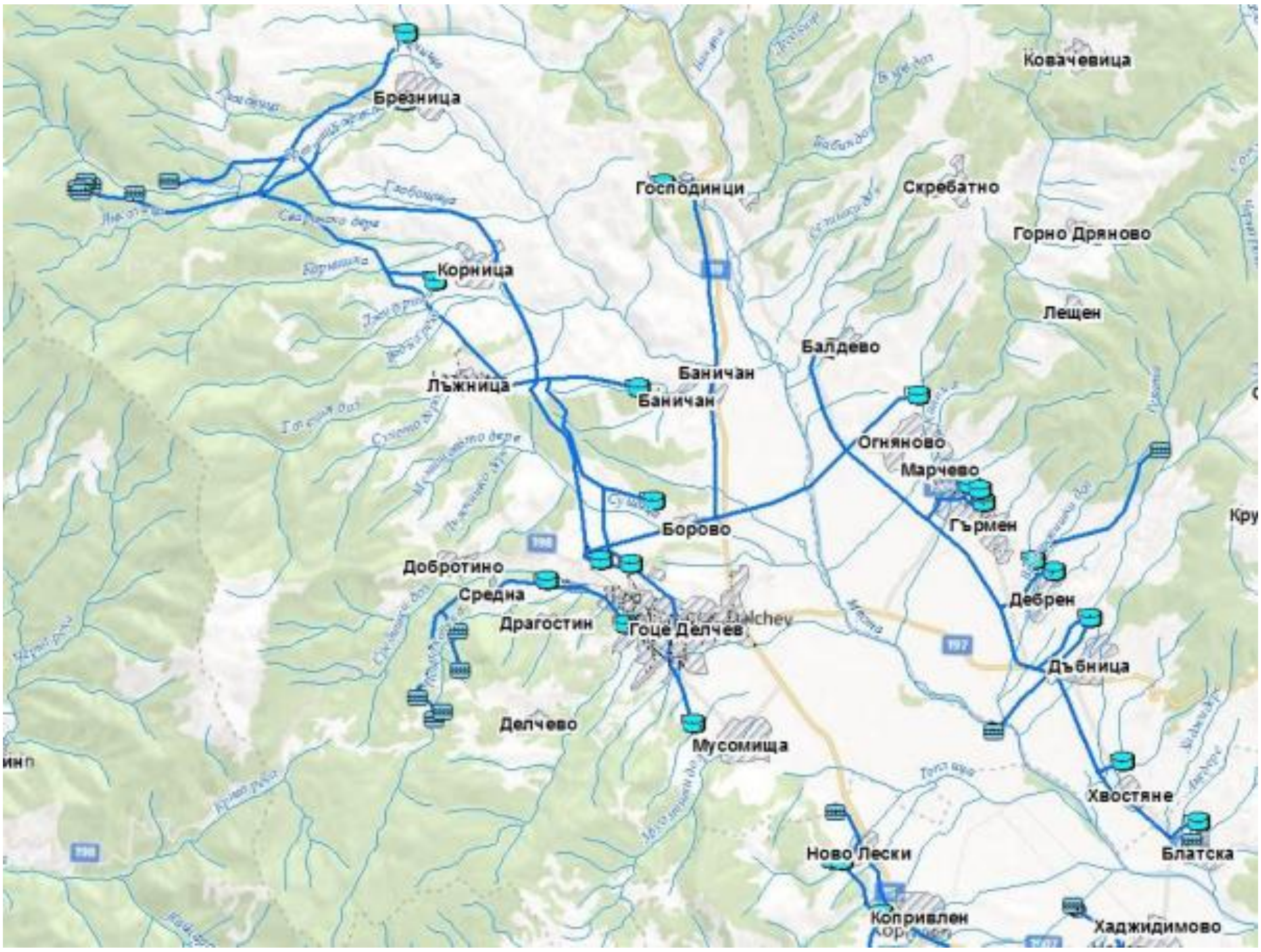
Scheme 2 – water reservoirs on the territory of WSS Gotse Delchev

The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

Only two pumping stations are used in water supply system Gotse Delchev – PS Dabnica and PS Gotse Delchev both of them use water from local underground water sources. PS Gotse Delchev is used to provide water from local water source to water supply network of village Blatska.



Scheme 3 – pumping stations on the territory of WSS Gotse Delchev



Scheme 4 – external pipelines on the territory of WSS Gotse Delchev

Water Utility Level (2017 base year)

- Water basin where water is taken from

Springs		Well		Rivers withour dams		Total	
Q-ty	capacity (l/s)	Q-ty	capacity (l/s)	Q-ty	capacity (l/s)	Q-ty	capacity (l/s)
3	10,80	2	1,90	1	53,60	6	66,30

- Water sources (e.g. groundwater or surface water) – water supply for the region of Gotse Delchev is provided by mixture of different types of water sources. Ground source Tufcha is the biggest water source for the region and water from it is treated in PWTP Gotse Delchev

Springs	Ground water sources	Local water sources
3	1	5

- Water bodies where the water utility takes water from
  - Springs

Name	Short description
Barakata	spring is located 15 km away from Gotse Delchev at altitude 1 555 m. It consist of three springs, collector and a chamber. Water is supplied to a reservoir V=1250 m3 with DN250 mm asbestos cement pipe installed in mid-sixties.

Sofiata	spring is located 16 km away from Gotse Delchev at altitude 1 430 m. It consist of three springs, collecting pipe and a chamber. Water is supplied to a reservoir V=1250 m3 with DN250 mm asbestos cement pipe installed in mid-sixties
Papaz chair	spring is located 16 km away from Gotse Delchev at altitude 1 382 m. Water is supplied to a reservoir V=700 m3 with DN150 mm steel pipe

- Ground water sources

Name	Short description
Tufcha	Ground water source is located 15 km away at altitude 1 110 m. It consist of a chamber with overflow, screen and a sedimentation chamber. Water is supplied to a Potable Water Treatment Plant (PWTP). After water is treated, main quantity is supplied to water supply network of Gotse Delchev and rest is provided for Gospodinovci and Garmen.

- Local water sources

Name	Short description
PS Dabnica	Underground well river Mesta bank
Chuchura	for village Debren
Ilisten	Underground abstraction from river Kurtovska for village Ribnovo
Konsko dere	Underground abstraction from river Goliamo konsko dere for village Ribnovo for village Osikovo
PS Osikovo	for village Osikovo

2 Water Quality Assessment

- Please provide data for water pollution in the water bodies from which water is taken from the water utility. Also provide pollutants loads (if data are available) – there is no data for any pollutions measured in water sources used in WSS Gotse Delchev.
- Please provide data on the water quality assessment of these water bodies based on the River Basin Management Plans – all water sources are in accordance with requirements of Directive 98/33/EU for the quality of water provided for potable needs.
- Are there any water quality characteristics measured by the water utility? (in the water source) – main water quantity for the system is provided by potable water treatment plant Gotse Delchev at which outlet main water characteristics are followed in a real time. In addition to this water utility measures residual chlorine at each reservoir.
- Please give some general data on the legislation followed for drinking water quality. Is the Water Drinking Directive followed at national level? – monitoring of water quality is performed according Ordinance №9 for the quality of water provided for potable needs. Water quality is monitored in accordance with pre-approved programs with Regional Health Inspectorate.
- Please describe the actions taken from the water utility to assure good water quality – main water quantity – main water quantity for the system including for the water supply of Gotse Delchev is provided from PTWP Gotse Delchev which is a two-stage potable water treatment plant. In additional at each reservoir water is disinfected with chlorine.
- Please describe the water treatment (if any) including disinfection – main water quantity for the water supply system including that one for Gotse Delchev passed through PWTP Gotse Delchev. Plant is two stage – first stage is a basin for coagulation and sedimentation and second stage is a sand filter. After treatment water is chlorinated. In all other water sources water is only chlorinated in reservoirs.

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- Define the main problem(s) in water quality (if any) – main problem for the water utility is lack of a reliable automatization of process of chlorination. Process is performed manually on a daily based or with a local dosing pumps. Other problem is the lack of a water quality monitoring system (except PWTP Gotse Delchev) in all reservoirs.
- Define the main causes of these problem(s) – on a utility level there are many exploitation problems and budget for investments of the water utility is limited. This is the main cause for the lack of automatization and monitoring system.
- Actions taken to confront with these problems –

3 Comments

Main challenges for the water utility for exploitation of WSS Gotse Delchev are following:

- Age of pipes – most of the pipelines in WSS Gotse Delchev are older than 50 years which means that they are beyond their operational life.
- High level of water losses – as a consequence of old pipes high level of water losses are reported in the system – 69,44%.
- Reduced billed consumption – as a consequence of the decreasing population legitimate water consumption of the system is also decreasing.
- Declining industry – most of the big production facilities in the area were closed during last 30 years and this trend affects financial condition of the water utility.

Appendix A:

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WATER RESCUE

Water resources efficiency and conservative use in drinking water supply systems

WATER RESCUE

WP	**3 Current Status Analysis and Assessment**
Deliverable *Tool*	**3.6.3 Water Quality report** *Questionnaire*
Project Beneficiary No	**PB6**
Beneficiary Institution	**Municipal Water Supply and Sewerage Company of Thermaikos**

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The Project is co-funded by the European Regional Development Fund (ERDF) and by national funds of the countries participating in the Cooperation Programme Interreg V-A "Greece-Bulgaria 2014-2020".

Name of the organization/institution: MUNICIPAL WATER SUPPLY AND SEWERAGE COMPANY OF THERMAIKOS

Beneficiary number: PB6

1 Introduction

Please provide some general data for your water distribution network.

Water Utility Level (2017 base year)

- Water basin where water is taken from = River Water Basin District of Central Macedonia - Water Basin of Halkidiki
- Water sources (e.g. groundwater or surface water) = Groundwater
- Water bodies where the water utility takes water from = Water Basin of Halkidiki

2 Water Quality Assessment

- Please provide data for water pollution in the water bodies from which water is taken from the water utility. Also provide pollutants loads (if data are available)
- Please provide data on the water quality assessment of these water bodies based on the River Basin Management Plans
-

WB category	WB code	WB name	Ecological status	Chemical Status	Total status
RW	Anthemountas	GR1005R001700029H	POOR	FAILING TO ACHIEVE GOOD	POOR
RW	Anthemountas	GR1005R001700030N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Arapitsa	GR1005R000214020N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Asprolakkas	GR1005R000500023N	GOOD	FAILING TO ACHIEVE GOOD	MODERATE
RW	Aspropetra	GR1005R000204011N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Aksios	GR1003R0F0203006N	POOR	UNKNOWN	POOR
RW	Aksios	GR1003R0F0203005N	POOR	FAILING TO ACHIEVE GOOD	POOR
RW	Aksios	GR1003R0F0205007N	POOR	UNKNOWN	POOR
RW	Aksios	GR1003R0F0207010N	POOR	UNKNOWN	POOR
RW	Aksios	GR1003R0F0207009N	POOR	UNKNOWN	POOR
RW	Aksios	GR1003R0F0207008N	POOR	UNKNOWN	POOR
RW	Aksios	GR1003R0F0209013N	POOR	UNKNOWN	POOR
RW	Aksios	GR1003R0F0209012N	POOR	UNKNOWN	POOR

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WB category	WB code	WB name	Ecological status	Chemical Status	Total status
RW	Aksios	GR1003R0F0209011N	POOR	UNKNOWN	POOR
RW	Aksios	GR1003R0F0201004H	POOR	FAILING TO ACHIEVE GOOD	POOR
RW	Varvaras	GR1005R000206115N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Vardarovasi	GR1003R0F0202014A	UNKNOWN	UNKNOWN	UNKNOWN
RW	Vardarovasi	GR1003R0F0202015N	UNKNOWN	GOOD	UNKNOWN
RW	Vardarovasi	GR1003R0F0202116N	UNKNOWN	GOOD	UNKNOWN
RW	Vasdeki	GR1005R000300022N	MODERATE	FAILING TO ACHIEVE GOOD	MODERATE
RW	Vatonias	GR1005R002701035N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Vatonias	GR1005R002702038N	UNKNOWN	GOOD	UNKNOWN
RW	Vatonias	GR1005R002703036N	UNKNOWN	GOOD	UNKNOWN
RW	Vatonias	GR1005R002704040N	UNKNOWN	GOOD	UNKNOWN
RW	Vatonias	GR1005R002705037N	UNKNOWN	GOOD	UNKNOWN
RW	Vatonias	GR1005R002704039N	UNKNOWN	GOOD	UNKNOWN
RW	Mpogdanou	GR1005R000209009N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Mpogdanou	GR1005R000209008N	UNKNOWN	FAILING TO ACHIEVE GOOD	UNKNOWN
RW	Derveni	GR1005R000203005A	UNKNOWN	UNKNOWN	UNKNOWN
RW	Derveni	GR1005R000203004A	UNKNOWN	UNKNOWN	UNKNOWN
RW	Derveni	GR1005R000207007A	UNKNOWN	UNKNOWN	UNKNOWN
RW	Derveni	GR1005R000205006A	UNKNOWN	UNKNOWN	UNKNOWN
RW	Gallikos	GR1004R000201003N	POOR	FAILING TO ACHIEVE GOOD	POOR
RW	Gallikos	GR1004R000201001N	POOR	FAILING TO ACHIEVE GOOD	POOR
RW	Gallikos	GR1004R000203005N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Gallikos	GR1004R000205006N	GOOD	GOOD	GOOD
RW	Gallikos	GR1004R000206014N	GOOD	GOOD	GOOD
RW	Gallikos	GR1004R000206116N	GOOD	GOOD	GOOD
RW	Gallikos	GR1004R000206015N	GOOD	GOOD	GOOD
RW	Gallikos	GR1004R000201002N	POOR	FAILING TO ACHIEVE GOOD	POOR
RW	Gallikos	GR1004R000201004N	POOR	FAILING TO ACHIEVE GOOD	POOR
RW	Gorgopis	GR1003R0F0206026N	GOOD	GOOD	GOOD
RW	Gorgopis	GR1003R0F0206024N	GOOD	GOOD	GOOD
RW	Gorgopis	GR1003R0F0206025N	GOOD	GOOD	GOOD
RW	Kaprinikia	GR1005R003102048N	GOOD	GOOD	GOOD
RW	Kerasias	GR1005R000202010N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Koutsikarli	GR1005R000206014N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Koza	GR1003R0F0208027N	MODERATE	UNKNOWN	MODERATE
RW	Lakos	GR1005R000900025N	GOOD	GOOD	GOOD
RW	Loudias	GR1003R000400031A	POOR	FAILING TO ACHIEVE GOOD	POOR
RW	Loudias	GR1003R000400032A	POOR	FAILING TO ACHIEVE GOOD	POOR
RW	Lukorema	GR1003R0F0208130N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Mauros Lakos	GR1005R000100021N	MODERATE	FAILING TO ACHIEVE GOOD	MODERATE
RW	Maurorema	GR1003R000000001N	GOOD	GOOD	GOOD
RW	Megalo	GR1005R000208017N	POOR	UNKNOWN	POOR

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WB category	WB code	WB name	Ecological status	Chemical Status	Total status
RW	Megalo	GR1004R000204011N	GOOD	GOOD	GOOD
RW	Megalo	GR1004R000204113N	GOOD	GOOD	GOOD
RW	Megalo	GR1004R000204012N	GOOD	GOOD	GOOD
RW	Megalo	GR1003R0F0208029N	GOOD	GOOD	GOOD
RW	Megalo	GR1003R0F0208028N	MODERATE	UNKNOWN	MODERATE
RW	Metalliko	GR1003R0F0204121N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Miladino	GR1005R003104050N	GOOD	GOOD	GOOD
RW	Miladino	GR1005R003104049N	GOOD	GOOD	GOOD
RW	Mulou	GR1005R001300027N	GOOD	GOOD	GOOD
RW	Mpagialtzas	GR1003R0F0204019N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Petrenio	GR1005R000700024N	GOOD	GOOD	GOOD
RW	Petrorema	GR1003R000400035N	GOOD	GOOD	GOOD
RW	Potamia	GR1005R000210018N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Psarorema	GR1003R0F0204223N	POOR	UNKNOWN	POOR
RW	Psarorema	GR1003R0F0204222N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Rema 1	GR1005R001900031N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Rema 2	GR1003R000000002N	GOOD	GOOD	GOOD
RW	Richios	GR1005R000201003N	MODERATE	UNKNOWN	MODERATE
RW	Richios	GR1005R000201002N	POOR	UNKNOWN	POOR
RW	Richios	GR1005R000201001N	POOR	UNKNOWN	POOR
RW	Salidika Mandua	GR1005R002500034N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Smiksi	GR1005R001100026N	GOOD	GOOD	GOOD
RW	Spanos	GR1004R000207007N	GOOD	GOOD	GOOD
RW	Tafros	GR1003R0F0204017A	UNKNOWN	UNKNOWN	UNKNOWN
RW	Tafros	GR1003R0F0204120A	UNKNOWN	UNKNOWN	UNKNOWN
RW	Tafros	GR1003R0F0204018A	UNKNOWN	UNKNOWN	UNKNOWN
RW	Tsigano	GR1005R002100032N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Chavrias	GR1005R003101042N	GOOD	GOOD	GOOD
RW	Chavrias	GR1005R003103043N	GOOD	GOOD	GOOD
RW	Chavrias	GR1005R003105044N	GOOD	GOOD	GOOD
RW	Chavrias	GR1005R003107045N	GOOD	GOOD	GOOD
RW	Chavrias	GR1005R003109046N	GOOD	GOOD	GOOD
RW	Chavrias	GR1005R003108052N	GOOD	GOOD	GOOD
RW	Chavrias	GR1005R003110053N	GOOD	GOOD	GOOD
RW	Chavrias	GR1005R003111047N	GOOD	GOOD	GOOD
RW	Ksinoneri	GR1005R003106051N	GOOD	GOOD	GOOD
RW	Ksirolakas	GR1005R002300033N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Ksiropotamos	GR1004R000202008N	POOR	FAILING TO ACHIEVE GOOD	POOR
RW	Ksiropotamos	GR1004R000202110N	GOOD	GOOD	GOOD
RW	Ksiropotamos	GR1004R000202009N	GOOD	GOOD	GOOD
RW	Ksiropotamos	GR1003R000400034N	GOOD	GOOD	GOOD
RW	Ksiropotamos	GR1003R000400033N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Ksirorema	GR1003R000000003N	GOOD	GOOD	GOOD
RW	Cholomontas	GR1005R000206013N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Cholomontas	GR1005R000206012N	UNKNOWN	UNKNOWN	UNKNOWN

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WB category	WB code	WB name	Ecological status	Chemical Status	Total status
RW	Cholomontas	GR1005R000206216N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Chora	GR1005R000212019N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Zamouni	GR1005R002900041N	UNKNOWN	UNKNOWN	UNKNOWN
RW	Zografitikos Lakos	GR1005R001500028N	GOOD	GOOD	GOOD
LW	Volvi	GR1005L000000003N	MODERATE	FAILING TO ACHIEVE GOOD	MODERATE
LW	Koronia	GR1005L000000004N	BAD	FAILING TO ACHIEVE GOOD	BAD
LW	Pikrolimni	GR1004L000000005N	UNKNOWN	UNKNOWN	UNKNOWN
LW	Doirani	GR1003L0F0000001N	POOR	UNKNOWN	POOR
LW	Maurouda	GR1005L000000002H	UNKNOWN	UNKNOWN	UNKNOWN
LW	Artificial Lake Artzan	GR1003L000000006A	UNKNOWN	UNKNOWN	UNKNOWN
TW	Estuarine system Aksios	GR1003T0001N	POOR	UNKNOWN	POOR
TW	Lagoon Ag. Mama	GR1005T0003N	UNKNOWN	UNKNOWN	UNKNOWN
TW	Lagoon Aggelochori	GR1005T0002N	UNKNOWN	UNKNOWN	UNKNOWN
CW	Eleuthera Cape	GR1005C0001N	HIGH	UNKNOWN	UNKNOWN
CW	Athos Coast	GR1043C0003N	HIGH	UNKNOWN	UNKNOWN
CW	Kassandra Coast	GR1005C0007N	HIGH	UNKNOWN	UNKNOWN
CW	Sithonia Coast	GR1005C0005N	HIGH	UNKNOWN	UNKNOWN
CW	Ekso Thermaikos Kolpos-Kallikratia	GR1005C0009N	GOOD	UNKNOWN	UNKNOWN
CW	Eso Thermaikos Kolpos-Michaniona	GR1005C0010N	MODERATE	UNKNOWN	MODERATE
CW	Kassandrinos Gulf (Chalkidiki)	GR1005C0006N	HIGH	UNKNOWN	UNKNOWN
CW	Thessaloniki Gulf	GR1005C0011H	MODERATE	UNKNOWN	MODERATE
CW	Ierissos Gulf-Chalkidiki	GR1043C0002N	HIGH	UNKNOWN	UNKNOWN
CW	Siggitikos Gulf-Chalkidiki	GR1005C0004N	HIGH	UNKNOWN	UNKNOWN
CW	Potidaia Canal	GR1005C0008A	UNKNOWN	UNKNOWN	UNKNOWN

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No	GWB Code	Name	Chemical status	Quantitative status
1	GR1000010	Loudia	GOOD	GOOD
2	GR1000020	Paikou	GOOD	GOOD
3	GR1000030	Axiou	BAD	POOR
4	GR100F040	Doiranis	GOOD	POOR
5	GR1000050	Gallikou	GOOD	POOR
6	GR1000061	Subsystem Epanomis - Moudanion	BAD	POOR
7	GR1000062	Subsystem Neas Triglias	GOOD	GOOD
8	GR1000071	Subsystem Koronias	GOOD	POOR
9	GR1000072	Subsystem Volvis	GOOD	POOR
10	GR1000081	Subsystem Kato rou Anthemounta	BAD	POOR
11	GR1000082	Subsystem Galarinou- Galatistas	GOOD	GOOD
12	GR1000083	Subsystem Thermis - N. Risio	GOOD	GOOD
13	GR1000090	Kassandras	GOOD	GOOD
14	GR1000100	Ormilias	BAD	POOR
15	GR1000110	Ierissou	GOOD	GOOD
16	GR1000120	Mavroudas	GOOD	GOOD
17	GR1000131	Subsystem Asprolakka	GOOD	GOOD
18	GR1000132	Subsystem Kokkinolakka	BAD	GOOD
19	GR1000140	Olumpiadas	GOOD	GOOD
20	GR1000150	Kroussion - Kerdillion	GOOD	GOOD
21	GR1000160	Mavroneriou	GOOD	GOOD
22	GR1000170	Agiou Orous	GOOD	GOOD
23	GR1000180	Sithonias	GOOD	GOOD
24	GR1000191	Subsystem Skourion - Mavres Petres	BAD	GOOD

No	GWB Code	Name	Chemical status	Quantitative status
25	GR1000192	Subsystem Olumpiadas	GOOD	GOOD
26	GR1000193	Subsystem Holomonta - Oreokastrou	GOOD	GOOD
27	GR1000200	Neon Rodon	GOOD	GOOD
28	GR1000210	Meseou	GOOD	GOOD
29	GR1000220	Deve Koran	GOOD	GOOD
30	GR100F230	Anatolikou Paikou	GOOD	GOOD
31	GR100F240	Evzonon	GOOD	GOOD
32	GR100F250	Pontoiraklias	GOOD	GOOD
33	GR1000270	Vafiohoriou	GOOD	GOOD
34	GR100F280	Megalis Sternas	GOOD	GOOD

- Are there any water quality characteristics measured by the water utility? (in the water source)
  The Agency conduct regular water quality audits. The parameters which are monitored are:
  1. pH
  2. Conductivity
  3. Calcium
  4. Hardness
  5. Alkalinity
  6. Potassium
  7. Sodium
  8. Magnesium
  9. Turbidity
  10. Ammonia
  11. Nitrite
  12. Fluoride
  13. Chloride
  14. Bromide
  15. Nitrate

16. Sulfate
17. Orthophosphate
18. Iron
19. Manganese
20. Zinc
21. Copper
22. Cadmium
23. Lead
24. Chromium TOTAL
25. Nickel
26. Arsenic
27. Mercury.

- Please give some general data on the legislation followed for drinking water quality. Is the Water Drinking Directive followed at national level?

The Agency follows the Greek National Legislation for the water quality audits and in particular the Κ.Υ.Α. ΥΠ' ΑΡΙΘ. Υ2/2600/2001 (ΦΕΚ 892/ΤΒ' /11/7/2001 περί ποιότητας νερού ανθρώπινης κατανάλωσης), της τροποποίησής της με την Κ.Υ.Α. ΔΥΓ2/Γ/Π/οικ. 38295/2007 (ΦΕΚ 630/τ.β./26-4-07) με τη διόρθωση σφαλμάτων (ΦΕΚ 986.β/18-6-2007) και της Εγκυκλίου του Υπ. Υγείας και Κοιν. Αλληλεγγύης υπ' αριθ. Πρωτ. ΔΥΓ2/οικ. 94097/19-7-2007

- Please describe the actions taken from the water utility to assure good water quality.
    - Daily measurement of chlorine residual in the network
    - Every two months microbiological and chemical audits in 15 points in the network

- Please describe the water treatment (if any) including disinfection.
    - The drinking water is treated with sodium hypochlorite

- Define the main problem(s) in water quality (if any)
    - The main problem of the network is the seawater intrusion

- Define the main causes of these problem(s)
    - Proximity of the wells to the sea

- Actions taken to confront with these problems
    - When seawater intrusion is detected in a well then that well is not been operated any more.

3 Comments

Please provide any comments.

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Appendix A:

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