# REPORT CONTROL SHEET

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|---|---|---|---|
| **CLIENT:** | MINISTRY OF REGIONAL DEVELOPMENT AND PUBLIC WORKS (MRDPW) | | |
| **PROJECT:** | PREPARATION OF REGIONAL WATER AND WASTE WATER MASTER PLANS FOR THE **CENTRAL REGION** OF THE REPUBLIC OF BULGARIA | Loan No | 7834 - BG |
| | | Job No: | MIDP – MP – QCBS2 |
| **REPORT TITLE:** | Regional Final Master Plan for the designated territory of VKS EOOD Peshtera | | |

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# REPORT CONTROL SHEET

## ADVICE

*This MP has been prepared on the basis of best available data. Data has not always been forthcoming and all obtained data is included in the Annex in digital form. As a result of this, the assessment and investment measures (incl. option analysis) proposed in this MP will need to be revised and possibly significantly amended in subsequent pre-investment studies (e.g. Pre-Feasibility Study, Feasibility Study). A full revision of the MP shall be undertaken no later than 2018.*

# TABLE OF CONTENTS

# LIST OF FIGURES

# LIST OF TABLES

# LIST OF APPENDICES

| № | Name | Language (English / Bulgarian / Both) |
|---|---|---|
| **Chapter 1** | | |
| 1-1 | Projects conducted in Peshtera Municipality | Both |
| 1-2 | Regulatory framework in Bulgaria | Both |
| 1-3 | Regulatory framework in the European Community | Both |
| **Chapter 3** | | |
| 3-1 | Local operation resources of the water abstraction facilities in Peshtera Municipality | Both |
| 3-2 | Groundwater quality | Both |
| 3-3 | External Water Supply System of the Town of Peshtera | Both |
| 3-4 | External Water Supply System of the villages of Radilovo and Kapitan Dimitrievo | Both |
| 3-5 | External Water Supply System of Saint Constantine Holiday Resort | Both |
| 3-6 | Water distribution network of the Town of Peshtera | Both |
| 3-7 | Sludge Management | Both |
| 3-8 | Requirements which should be covered to connect industrial wastewaters to the urban wastewater system | Both |
| 3-9 | Industrial entities | Both |
| **Chapter 4** | | |
| 4-1 | Daily and hourly peak coefficient and domestic consumption | Both |
| 4-2 | Comparison of combined and separate sewerage systems | Both |
| 4-3 | Description of possible final disposal ways | Both |
| 4-4 | Climate change impact | Both |
| 4-5 | Investment Costs (Water Supply) | Both |
| 4-6 | Investment Costs (Waste Water) | Both |
| 4-7 | Prioritization system | Both |
| 4-8 | Review of the reservoirs' volume in the town of Peshtera | Both |
| 4-9 | Development of the Sewerage Network of the Town of Peshtera | Both |
| **Chapter 7** | | |
| 7-1 | Environmental Assessment Procedure | Both |

# LIST OF ADDITIONAL INFORMATION

| № | Name | Language (English / Bulgarian / Both) |
|---|---|---|
| **Chapter 1** | | |
| 1-1 | Capital expenditure for Peshtera Municipality for the year 2012 | Bulgarian |
| **Chapter 2** | | |
| 2-1 | Climate Characteristics | Bulgarian |
| 2-2 | Maps of the protection zones | Bulgarian |
| 2-3 | Geological - Lithological Structures | Bulgarian |
| 2-4 | Water borne Health Problems | Bulgarian |
| 2-5 | Deviations in water quality indicators | Bulgarian |
| 2-6 | Water supply and sewerage companies | Bulgarian |
| **Chapter 3** | | |
| 3-1 | Practices for water quality monitoring of drinking water supply | Bulgarian |
| 3-2 | Batak Hydroelectric Power Cascade | Bulgarian |
| 3-3 | Sludge Management and Disposal for the town of Peshtera | Bulgarian |
| 3-4 | Drinking Water Treatment Plant of the town of Peshtera | Bulgarian |
| 3-5 | Drinking water treatment plant for Saint Constantine Holiday Resort | Bulgarian |
| 3-6 | Recapitulation of the network according to the Detailed Desgn for the town of Peshtera | Bulgarian |
| 3-7 | Wastewater Treatment Plant of the Town of Peshtera | Bulgarian |
| 3-8 | Wastewater treatment plant at the village of Kapitan Dimitrievo | Bulgarian |
| 3-9 | Sludge Treatment for the Town of Peshtera | Bulgarian |
| 3-10 | Biovet Wastewater Treatment Plant | Bulgarian |
| **Chapter 4** | | |
| 4-1 | Description of treatment processes – Water supply | Both |
| 4-2 | Description of disinfection processes – Water supply | Both |
| 4-3 | Design of the storage facilities | Both |
| 4-4 | Design of the water supply network | Both |
| 4-5 | Design of the water supply pumping stations | Both |
| 4-6 | Design of the combined sewers | Both |
| 4-7 | Design of the gravity collectors | Both |
| 4-8 | Design of the pressure pipes | Both |
| 4-9 | Design of the pumping stations | Both |
| 4-10 | Design of the storm overflows | Both |
| 4-11 | Design of the retention tanks | Both |
| 4-12 | Description of Treatment Processes for WWTP | Both |
| 4-13 | Description of sludge treatment management | Both |
| 4-14 | Detailed calculation for the WS options for Peshtera | Both |

# LIST OF MAPS

| № | Name of the map | Scale |
|---|---|---|
| 1 | Master Layout of VKS EOOD Peshtera | 1:50 000 |
| 2 | Layout of existing external water supply in the municipality of Peshtera | 1:25 000 |
| 3 | Existing water supply network in the town of Peshtera | 1:5 000 |
| 4 | Existing sewerage network in the town of Peshtera | 1:5 000 |
| 5 | Existing situation for sewerage in VKS EOOD Peshtera | 1:50 000 |
| 6 | Layout of existing external water supply in the municipality of Peshtera – Proposed investments | 1:25 000 |
| 7 | Water supply network in the town of Peshtera – Proposed investments | 1:5 000 |
| 8 | Layout of sewerage network in the town of Peshtera – Proposed investments | 1:5 000 |

# LIST OF ACRONYMS

| | |
|---|---|
| AC | Asbestos-Cement |
| BA | Biodiversity Act |
| BDBSR | Basin Directorate – Black sea Region |
| BDWMDR | Basin Directorate for Water Management in Danube Region |
| BGN | Bulgarian Leva |
| $BOD_5$ | *Biochemical Oxygen Demand – 5 days* |
| BP | Business Plan |
| BPS | Bunker pumping station |
| CBA | Cost Benefit analysis |
| CC | *Collection Chamber* |
| CCTV | Closed Circuit Television |
| CM | Constant Monitoring |
| COD | *Chemical Oxygen Demand* |
| CSG | Community Strategic Guidelines |
| DB | Deep Borehole |
| DBP | Disinfection by product |
| DC/DS | Distribution Chamber/Distribution Shaft |
| DNHWL | District Non-hazardous Waste Landfill |
| DWD | Drinking Water Directive |
| DWTP | Drinking Water Treatment Plant |
| EA | Environmental Assessment |
| EBRD | European Bank for Reconstruction and Development |
| EMAPA | Enterprise for Management of Environmental Protection Activities |
| EIA | Environmental impact assessment |
| EIB | European Investment Bank |
| EOP | Environment Operational Programme |
| EPA | Environmental Protection Act |
| EU | European Union |
| € | €uro |
| GAC | Granulated Activated Carbon |
| GDP | Gross Domestic Product |
| GIS | Geographic Information System |
| GVA | Gross Value Added |
| GWI | Ground Water Infiltration |
| HMS | Hydrometric stations |
| IFIs | International Financing Institutions |
| IS | Irrigation system |
| IURDP | Integrated Urban Recovery and Development Planning International |
| IWA | Water Association |
| IWSN | Internal Water Supply Network |
| l/c/d | Liter per capita per day |
| MA | Managing Authority |
| MEET | Ministry of Economy, Energy and Tourism |
| MoEW | Ministry of Environment and Water |
| MRDPW | Ministry of Regional Development and Public Works |
| N | Nitrogen |

| | |
|---|---|
| NDP | National Development Plan |
| NES | National Environmental Strategy |
| NL | Natural landmarks |
| NP | Natural park |
| NPV | Net Present Value |
| NSMDWNSRF | National Strategy for Management and Development of the Water Sector |
| NSRF | National Strategic Reference Framework |
| NRW | Non-Revenue Water |
| NUTS | Nomenclature of Units for Territorial Statistics |
| NWMP OP | National Waste Management Programme Operational Programme |
| P | Phosphorus |
| PA | Protected areas |
| PE | Population Equivalent |
| PM | Periodical Monitoring |
| PR | Pressure Reservoir |
| PS | Pumping Station |
| PU | Pump unit |
| Q | Flow |
| RMP | Regional Master Plan |
| RIEW | Regional Inspectorate of Environment and Water |
| RIPCPH | Regional Inspectorate of Protection and Control Public Health |
| RR | Relieve Reservoir |
| RWC | Regional Water Companies |
| RWSSSA | Regulation of Water Supply and Sewerage Services Act |
| SC | Spring Catchment |
| SCF | Structural and Cohesion Funds |
| SEWRC | State Energy and Water Regulatory Commission |
| SPZ | Sanitary Protection Zone |
| SS | Suspended solids |
| SW | Shaft Well |
| TR | Transitional Reservoir |
| TW | Tube Well |
| UCDB | Unit Cost Data Base |
| US | Urban sewerage |
| UWWTD | Urban Waste Water Treatment Directive |
| WA | Water Act |
| WA | Water Associations |
| WB | World Bank |
| WB | Water Body |
| WC | Water Cycle |
| WFD | Water Framework Directive |
| WSS | Water supply and sewerage |
| WSSC | Water Supply and Sewerage Companies (ViKs) |
| WWTP | Waste Water Treatment Plant |

# 0. EXECUTIVE SUMMARY

## 0.1. OBJECTIVES AND SCOPE OF THE REGIONAL MASTER PLAN

*This section relates to chapter 1 of the main report.*

The Government of Bulgaria has received a loan from the World Bank to implement a Municipal Infrastructure Development Project. Its strategic aims are to (a) improve the reliability and quality of water provision to the communities in selected settlements in the project area and (b) assist municipalities to improve investment-planning capacity. The Seureca, SCE, Arcadia Engineering and Hidroproekt Joint-Venture has been engaged through the Bulgarian Ministry of Regional Development and Public Works (MRDPW) to provide consultancy services for the Preparation of the Regional Water Supply and Sewerage Master Plans in the Central Region of Bulgaria.

The objective of the project is to improve the water supply and sewerage systems on the considered region in compliance with the European Directives and the National Environmental Strategy of Bulgaria, which main objective is to "*provide good quality and sufficient quantity of water for different purposes"*. This will be done by defining the assets, assets' improvement and non-investment measures allowing meeting the needs of the population and the financial plan to be applied for such an achievement. The Regional Master Plan implementation period is 2014-2038.

The Regional Master Plan will be supporting the Water and Sewage Infrastructure development policy and the corresponding financing plan. It will serve as basis for the further stages of development: feasibility studies, Application Forms, Tender Documentation, design and construction.

The present report is exposing the outcomes of the Study conducted on the territory of the VKS EOOD Peshtera within the framework of the Regional Water Supply and Sewerage Master Plans in the Central Region of Bulgaria.

## 0.2. CURRENT SITUATION AND DEFICIENCIES

*This section relates to chapters 2 and 3 of the main report.*

### 0.2.1. GENERAL CHARACTERISTICS

#### *0.2.1.1. Project area*

The region operated by VKS EOOD Peshtera includes only the Municipality of Peshtera which is part of the Oblast (District) of Pazardzhik. The figure below shows the location of VKS EOOD Peshtera on the maps of the Republic of Bulgaria.

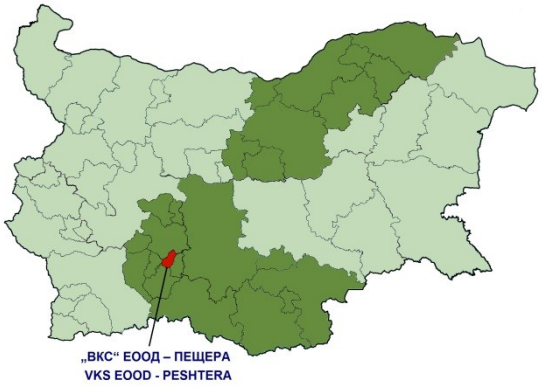



*Figure 0-1 Location of VKS EOOD Peshtera in Bulgaria*

The general situation of the territory of VKS EOOD Peshtera is presented in drawing N°1.

### 0.2.1.2. Natural features

**Geographical features**

The area covers around 175 km$^2$. It is a relatively low mountain region from Western Rhodopes with two main rivers going through it: the Stara Reka River and Dzhurkovitsa (Pishmanka) River, which are right tributaries to Maritsa River. Stara Reka River is the main water artery within the boundaries of the Municipality. Its main tributaries are the Rivers of Dalbochitsa, Novomahlenska and Pizditsa.

Climate is moderate continental with an average annual rainfall of 610 mm per year.

**Hydro-geological conditions**

Within the area served by VKS EOOD Peshtera the hydro-geological conditions are determined by fissure, karst and pore groundwater. For more details, see section 3.2.

**Environmental and Ecological features**

The main contributors to the pollution of air, water and soil are the development of the following economic fields: agriculture, forestry, farming and use of energy sources, as well as the lack of modern and highly efficient waste and wastewater treatment facilities.

There are three protected areas and four NATURA 2000 zones, which need to be taken into consideration for all new projects on the territory of Peshtera Municipality.

All surface water bodies on the territory of VKS EOOD Peshtera are listed as “Sensitive zones”.

### 0.2.1.3. Socio-economic features

The population is equal to 18,899 inhabitants, which tends to decrease due to the negative natural growth, the ageing of population and the increased levels of out-migration.

Peshtera Municipality includes 3 settlements, the town of Peshtera (16,746), the village of Radilovo (1,385) and the village of Kapitan Dimitrievo (768), together with Saint Constantine Holiday Resort, the population of which increases seasonally during summer (around 1,620 temporary residents are considered to stay for 160 days). The town of Peshtera is the only settlement counting more than 2,000 inhabitants. More information is provided in section 2.3.

The population distribution is as follows:

*Table 0-1Population distribution in the municipality of Peshtera*

| Municipality | Settlements (Population) | Above 2,000 inhab. (Population) | Below 2,000 inhab. (Population) | Operated by VKS EOOD Peshtera (Population) |
|---|---|---|---|---|
| Peshtera | 3 (18,899) | 1 (16,746) | 2 (2,153) | 3 (18,899) |

#### 0.2.1.4. Water and wastewater services

VKS EOOD Peshtera is operating all of the 3 settlements of Peshtera Municipality, as well as Saint Constantine Holiday Resort. The commercial company was established in 1992 and registered under the Commercial Act as 100% municipal property. It can be defined as a for-profit organization, yet its finances are dependent on municipal participations.

The total number of employees of VKS EOOD Peshtera is 32, of which 29 are working in water supply division and 3 are working in sewerage division. Revenue for 2011 was thousand BGN 971.

### 0.2.2. CURRENT SITUATION FOR WATER SUPPLY AND SEWERAGE

The synthesis of the current situation and the compliance with EU directives regarding water supply and sewerage, settlement by settlement, is presented in chapter 0.10.

100% of the settlements have access to drinking water.

#### 0.2.2.1. Water Resources

##### 0.2.2.1.1. General

Peshtera Municipality is currently supplied by groundwater sources. VKS EOOD Peshtera often purchases water from ViK Pazardzhik for the settlements of Radilovo and Kapitan Dimitrievo.

There are three water supply zones[1]: the first one includes the town of Peshtera, the second zone includes the settlements of Radilovo and Kapitan Dimitrievo and the last one includes Saint Constantine Holiday Resort.

There are no problems related to water source quality and water shortage.

#### 0.2.2.1.2. Peshtera Water Supply Zone

The town of Peshtera uses groundwater intakes for its potable water supply: 4 tube wells and 9 catchment systems (springs).

| Guaranteed minimum water supply capacity in 2011 [m 3] | Water production in 2011 [m 3] | Invoiced water quantities in 2011 [m 3] |
|---|---|---|
| 2,027,765 | 2,159,488 | 712,631 |

One surface water intake from Pizditsa River is to be put into operation. According to the water use permit, the authorised water abstraction is equal to 15l/s and not more than 315,360m3/year.

#### 0.2.2.1.3. Radilovo and Kapitan Dimitrievo Water Supply Zones

The settlements of Radilovo and Kapitan Dimitrievo get water from 7 catchment systems (spring), 6 for Radilovo and 1 for Kapitan Dimitrievo. They are also supplied by the existing reservoirs of the town of Pazardzhik, managed by ViK Pazardzhik.

| Guaranteed minimum water supply capacity in 2011 [m 3] | Water production in 2011 [m 3] | Invoiced water quantities in 2011 [m 3] |
|---|---|---|
| 471,463 | 187,119 | 79,994 |

#### 0.2.2.1.4. Saint Constantine Holiday Resort Water Supply Zone

Saint Constantine Holiday Resort is supplied by 1 catchment system (spring) and through water abstraction from the derivation feeding Batak Dam.

| Guaranteed minimum water supply capacity in 2011 [m 3] | Water production in 2011 [m 3] | Invoiced water quantities in 2011 [m 3] |
|---|---|---|
| 173,448 | 31,357 | 10,975 |

### 0.2.2.2. Water Pollution

According to the monitoring performed by RHI and the Water Operator in the water supply networks of the town of Peshtera and the village of Kapitan Dimitrievo, accidental contamination by microbiological indicators is observed: coliforms and Escherichia coli.

The main problems related to the contamination of drinking water on the territory of Peshtera municipality are:

[1] A water supply zone is a group of settlements interconnected by external water mains, which use the same water sources. A settlement, receiving water from one or more water sources, which do not deliver water to other settlemetns, is a separate zone.

- Common failures in the distribution networks, inability to perform good disinfection after their removal. Lack of clear rules for carrying out repair works, method of disinfection of the repaired section and the system, which supplies the disinfectant.
- Ineffective chlorination in water reservoirs and failure to maintain residual chlorine within the specified range.
- Diffusion pollution from settlements without sewerage networks. Penetration of pollution in the network in case of compromised sealing of the connections between the pipes.

For more details, see section 2.3.11 and section 3.2.

### 0.2.2.3. Current Water Consumption

The water consumption for VKS EOOD Peshtera in the year 2011 is summarized in the table below. More details are given in section 3.3.

*Table 0-2 Water consumption in 2011*

| Settlements | Total Water Demand including NRW | Total Water Demand excluding NRW | Domestic Water Demand | Non-domestic Water Demand | Specific Domestic Consumption | NRW percentage |
|---|---|---|---|---|---|---|
| | $m^3$/year | $m^3$/year | $m^3$/year | $m^3$/year | l/c/d | % |
| Peshtera | 2,159,488 | 712,631 | 481,070 | 231,561 | 117 | 67% |
| Radilovo | 135,881 | 50,276 | 47,998 | 2,278 | 99 | 63% |
| Kapitan Dimitrievo | 51,238 | 29,718 | 27,578 | 2,140 | 106 | 42% |
| Saint Constantine | 31,357 | 10,975 | 9,876 | 1,099 | 42* | 65% |
| **Total VKS** | **2,377,964** | **803,600** | **566,522** | **237,078** | **112** | **66%** |

* Seasonal population i.e. present only in part of the year (160 days).

### 0.2.2.4. Current Water Supply Zones

The sections below describe the current water supply zones, taking into account "on-going" projects[2]. For more information detailed descriptions (materials, diameters, age etc.), see section 3.4 and the appendices from 3-6 to 3-12. The water supply zones of the region are presented on drawing N°2.

There are three water supply zones in the territory of Peshtera Municipality, served by VKS EOOD Pesthera:

- Water supply zone Peshtera (Zone 1)
- Water supply zone Radilovo and Kapitan Dimitrievo (Zone 2)

[2] On-going projects are projects that have been already approved and financed. To be included in the current situation, they must have been approved and financed before the 15th July 2012.

- Water supply zone St. Constantine (Zone 3)

Facilities of the water company can be summarized as follows:

*Table 0-3 List of assets of the water company*

| Facility | Measure | Quantity |
|---|---|---|
| External water supply | | |
| DWTP | бр. | 3 |
| Water sources | бр. | 24 |
| Pubmping stations | бр. | 10 |
| Water suppy mains | км | 52.87 |
| Water reservoirs | бр. | 13 |
| Water distribution | | |
| Pumping stations | бр. | 1 |
| Distribution networks | км | 81 |

#### *0.2.2.4.1. Peshtera Water Supply Zone*

Peshtera water supply zone includes the town of Peshtera, having a population of 16,746 inhabitants. Assets may be summarised as follows:

*Table 0-4 List of assets of Peshtera water supply zone*

| Asset | Measure | Quantity | Notes |
|---|---|---|---|
| External Water Supply | | | |
| DWTP | number | 2 | - 2 treatment plants |
| Water Sources | number | 14 | - 9 catchment systems (springs)<br>- 4 tube wells<br>- 1 river intake |
| Disinfection | | - | Chlorination :<br>- 2 pressure reservoirs with add of sodium hypochlorite by dosing pumps |
| Pumping Stations | number | 5 | - 4 bunker pumping stations<br>- 1 with horizontal pumps |
| Water Mains | km | 25.91 | Old and depreciated pipelines Diameter ranging between ∅300 and ∅50;<br>Material: steel (22%), asbestos cement (64%) and polyethylene (14%). |
| Distribution network | | | |
| Pumping Stations | number | 1 | |
| Reservoirs | number | 5 | Pressure reservoirs |
| Distribution Network | km | 47 | Depreciated pipelines characterised by a large number of failures.<br>Diameter ranging between ∅60 and ∅315<br>Material: steel (11%), asbestos cement |

| Asset | Measure | Quantity | Notes |
|---|---|---|---|
| | | | (57%), cast iron (8%), PVC (1%) and PE (23%) |

Remark: the river water catchment has not been put into operation yet.

The existing water supply networks of Peshtera are presented in drawing N° 3.

Within the framework of Operational Programme Environment 2007-2013 (Water Cycle 1), a feasibility study and detailed designs were prepared for the replacement of 12.6 km of water pipes from the distribution network of the town of Peshtera (≈27% of the length of the existing network). The project is approved for financing and its implementation has started (currently the construction is performed). More detailed information is provided in Annex 1-1.

Water pipes to be rehabilitated under the current project are shown in drawing № 7.

The characteristics of the water supply and water distribution network of the town of Peshtera are summarised below:

- Some of the spring catchments are in poor condition.
- One of the main problems for the proper operation of the self-cleaning sand filters is their freezing in the winter as well as desinfectin of water, which does not correspond to the actual flow and the residual chlorine in water. Disinfection with chlorine gas is not safe for the operational personnel.
- The pipes are old and built of asbestos cement, which causes a large number of failures and water losses.
- In some sections of the external water pipelines (2/3 of their length), failures are not easy to repair due to broken and difficult-to-access terrain.
- Total water losses in the distribution network of Peshtera for the year 2011 were about 67%.
- The real (technical) losses in the distribution network of the town of Peshtera for the year 2011 were about 36%.
- There is no distribution network zoning in the town of Peshtera. The low parts of the town are characterised by high pressure (over 6 atm.).
- The town of Peshtera is prevented from water scarcity due to the large amount of small water sources (in case of a failure in some of the transmission mains, only a small part of the town is left without water).
- Pumping stations are in good condition. No increased energy consumption or reduced capacity has been recorded.
- Water metering is not accurate enough for part of the domestic consumers. Water meter reading activity is not good enough and there is insufficient number of water meters on the external water pipeline to measure water supplied to the town.

- All water sources, which supply water to the town of Peshtera, are provided with sanitary protection zones according to the requirements of Ordinance №3.

#### *0.2.2.4.2. Radilovo and Kapitan Dimitrievo Water Supply Zone*

The water supply zone of Radilovo and Dimitrievo includes Radilovo and Dimitrievo, which have a population of 2,153 inhabitants.

Assets may be summarised as follows:

*Table 0-5 List of assets of Radilovo and Kapitan Dimitrievo water supply zone*

| Asset | Measure | Quantity | Notes |
|---|---|---|---|
| External Water Supply | | | |
| DWTP | number | 0 | Water quality does not require treatment |
| Water Sources | number | 8 | - 7 catchment systems (spring catchments), 6 for Radilovo and 1 for Kapitan Dimitrievo<br>- 1 water supply from the existing reservoirs located in the VIK Pazardzhik |
| Disinfection | | - | Chlorination<br>- Add of sodium hypochlorite in the reservoirs of the villages<br>- Chlorination of the water entering the reservoirs located in the VIK Pazardzhik |
| Pumping Stations | number | 1 | |
| Water Mains | km | 24.46 | Old and depreciated.<br>Diameter ranging between ∅219 and ∅60<br>Material: steel and asbestos cement |
| Distribution network | | | |
| Pumping Stations | number | 0 | None |
| Reservoirs | number | 5 | Pressure reservoirs (3 for Radilovo and 2 for Kapitan Dimitrievo) |
| Network | km | 24.5 | Old and depreciated.<br>Diameter ranging between ∅60 and ∅80<br>Material: mainly asbestos cement |

Within the framework of OPE 2007-2013 (Water Cycle 1), a technical design was prepared for replacement and construction of the water pipelines for the settlements of Radilovo (17.53 km) and the settlement of Kapitan Dimitrievo (10.42 km) along the streets of the settlements. The project funding is provided and construction is ongoing. More detailed information is provided in Annex 1-1.

The characteristics of the water supply and water distribution network of the villages of Radilovo and Kapitan Dimitrievo are summarised below:

- Although catchment systems are old, they are in good condition. However, a major part of them is difficult to access, especially in the period from December to March, which is the reason why good maintenance is not possible to carry out.

- Pipes are old and built of asbestos cement, which causes a large number of failures resulting in high water losses.
- Water losses in the distribution network of the villages of Radilovo and Kapitan Dimitrievo for the year 2011 were respectively about 63% and 42%.
- The pumping station is in good condition. No increased energy consumption or reduced capacity has been recorded.
- There is inadequate water disinfection in the reservoirs supplied by a local water source. There is no power supply and water disinfection is not proportional to the water flow.
- Insufficient number of metering devices along the water mains after the water sources (e.g.: the water coming from the catchment systems is not metered).
- All catchment systems delivering water to both villages are provided with sanitary protection zones.

#### *0.2.2.4.3. Saint Constantine Holiday Resort Water Supply Zone*

The water supply zone for Saint Constantine Holiday Resort includes the vacation settlement, which has a population of 1,620 temporary residents.

Assets may be summarised as follows:

*Table 0-6 List of assets of Saint Constantine water supply zone*

| Asset | Measure | Quantity | Notes |
|---|---|---|---|
| Water Supply | | | |
| DWTP | number | 1 | 1 treatment plant |
| Water Sources | number | 2 | - 1 catchment system (spring)<br>- 1 Water abstraction from the derivation, supplying Batak Dam |
| Disinfection | | - | - 1 chlorination by using sodium hypochlorite in the existing PR of V=32 $m^3$ |
| Pumping Stations | | 4 | |
| Water Mains | | 2.50 km | Diameter ranging from ∅133 to ∅75<br>Material: steel and polyethylene pipes |
| Distribution network | | | |
| Pumping Stations | number | 0 | None |
| Reservoirs | number | 3 | Pressure reservoirs |
| Distribution Network | km | 9-10 | Diameter ranging between ∅63 to ∅90 mm<br>Material: Polyethylene |

The characteristics of the water supply and water distribution network of Saint Constantine Holiday Resort are summarised below:

- Catchment system is old, but in good condition.
- The operation of Rapid Sand Filter is difficult during winter (freezing) and disinfection systems do not meet the requirements.

- The external water mains for Saint Constantine Holiday Resort are relatively short and new. There are no registered failures on them.
- Water losses in the distribution network of the Holiday Resort for the year 2011 were about 65%. Pipes are in relatively good condition. Probably, water losses are mainly commercial losses caused by inaccurate water metering and losses formed in the service connections.
- Pumping station is in good condition. No increased energy consumption or reduced capacity has been recorded.
- Insufficient volume of the pressure reservoirs.
- Water metering inaccuracy has been observed.
- A major part of the sanitary protection zones of the spring falls within the built-up area of St. Constantine and this does not satisfy the legal requirements.

### 0.2.2.5. Current Wastewater Systems

Current wastewater systems, taking into account "on-going" projects[3], are described in the sections below. For more detailed descriptions (diameters, age, etc), see section 3.5 and the appendices from 3-13 to 3-18.

#### 0.2.2.5.1. Peshtera

The percentage of sewerage network coverage is 94% of the existing street network (98 % of the population is connected to a wastewater network). The wastewater receiving body is Stara Reka River.

*Table 0-7 List of assets of Peshtera wastewater system*

| Asset | Measure | Quantity | Notes |
|---|---|---|---|
| Wastewater | | | |
| WWTP | number | 0 | None (under construction) |
| Pumping Station | number | 0 | None (under construction) |
| Sewerage | km | 43 | Combined sewerage system |

The existing sewerage network in the town of Peshtera is presented in drawing N°4.

Within the framework of OPE 2007-2013 (Water Cycle 1), a detailed design was prepared for the construction of Peshtera WWTP. ("*Modernization of the integrated water cycle of the town of Peshtera - Completion and rehabilitation of the existing water supply and sewerage network and construction of WWTP Peshtera*). The project has approved funding and its implementation has begun. More detailed information is provided in Annex 1-1.

[3] On-going projects are projects that have been already approved and financed. To be included in the current situation, they must have been approved and financed before the 15th July 2012.

The main objective of the project is to collect the unauthorised discharges of the urban sewerage network into Stara Reka River and to convey them to the WWTP, as well as to rehabilitate the critical sections of the wastewater network.

The scope of the project is in part Sewerage Network and WWTP:

- Newly constructed sewerage network - 2.071 km;

- Rehabilitated sewerage network - 11.258 km;

- Construction of a treatment plant for domestic waste water for 25,000 PE;

This number includes the building of inlet sewer to WWTP Peshtera.

**Remaining problems related to sewerage network**

- The network that needs to be rehabilitated, has a length of L= 33,290 m (69 % of the total), after implementation of the current project.
- Sewer overflows are insufficient to unload sewerage network. The main deficiency is that when South Main Collector passes through Stara Reka river, it is not released from stormwater quantities;
- Sewerage network of the town of Peshtera is in poor physical condition (old network, damaged pipes, in some locations pipe couplings are displaced);
- The predominant diameter in the sewerage network is ∅200 (20,053 m or 41.86%), which is less than the diamater of ∅300 required by the current regulations. This diameter prevails in the outermost areas of the town. The main deficiencies are as follows:
    - It is not always that stomwater quantities from the drainage area can actually enter the sewerage. Street gullies are insufficient to receive all stormwater quantities and are often clogged and unable to get optimal water amount;
    - There are steep areas, where stormwater passes over the street gullies (in good functional condition) and only part of it is received by the sewerage;
    - The insufficient hydraulic capacity of diameter equal to 200, implies the following: The sewerage is unable to receive all stormwater quantities. As a result they run down the street and do not enter the sewer. The frequency of this event cannot be determined as no modular surveys have been carried out. In such a sewer, which is part of mixed sewerage, the ratio of domestic (0,05 - 0.5l/s) to stormwater quantity (about 30 l/s) is over 60 times;
- The main deficiency is the small diameter, which is a precondition for more frequent cloggings. It is necessary to provide regular surveillance and cleaning.
- Not all of the industries in the town of Peshtera have their own wastewater treatment systems before discharging into the river, which contributes to polluting the receiving water body.

### *0.2.2.6. Other Wastewater systems*

**Radilovo and Kapitan Dimitrievo**

The settlements of Radilovo and Kapitan Dimitrievo have a sewerage network, but no WWTP of the network.

The sewerage network coverage for the settlements of Radilovo and Kapitan Dimitrievo are respectively 90% (6.73 km) and 60% (5.16 km).

Within the framework of OPE 2007-2013 (Water Cycle 1), detailed designs have been prepared for construction of water supply system and Kapitan Dimitrievo WWTP, which will collect and treat wastewater of both settlements i.e. Kapitan Dimitrievo and Radilovo. The projects are approved for funding and construction is forthcoming. More detailed information is provided in Annex 1-1.

The scope in part sewerage and WWTP includes:

- Sewerage network in the villages Radilovo - 14 km, Kapitan Dimitrievo - 12 km;

- Outlet sewer for the two villages to the WWTP Kapitan Dimtrievo;

- Construction of WWTP Kapitan Dimitrievo.

Three of the industrial companies (ET Nagi Trans, Chico OOD and Bratya Angelovi OOG) cannot be connected to the sewerage network and therefore, should construct their own industrial wastewater treatment facilities.

**Saint Constantine Holiday Resort**

The sewerage network coverage is 100% (7.24 Km), but currently there is no WWTP and sewerage discharges into a creek. There is a site selected for the construction of a new WWTP. At present, the existing wastewater network is used as a stormwater network.

### *0.2.2.7. On-going and Pending Projects*

Several equipment or infrastructure improvement projects have been conducted lately by different organizations out of the framework of the present Regional Master Plan. Once identified, these projects are considered in different ways:

- Completed projects to date are included in the existing situation
- On-going projects (projects that were approved and financed before 15th July 2012 but not completed to date) are also included in the existing situation. In fact, corresponding assets are considered as existing, investment costs are not included within the Regional Master Plan but future operation and maintenance costs are included for the macro-affordability assessment.
- Projects not approved to date, but the purpose of which are in line with the Regional Master Plan objectives, are included in the Regional Master Plan. Corresponding design, investment costs and timeframes are newly assessed according to the Consultant's methodology
- Other projects, which are not in line with the objectives and criteria of the Regional Master Plan, are either not included or substantially altered.

For the Regional Master Plan of the designated territory of VKS EOOD Peshtera, all non-completed projects were either considered as on-going (and thus their costs were not included in the Investment Programme) or considered approved and included in the

Regional Master Plan. The initial designs were also kept by the Consultant. More detailed information is provided in Annex 1-1.

## 0.3. PROJECTIONS

*This section relates to chapter 5 of the main report.*

The technical options defined to adapt water and waste water systems to the needs of the population are established according to the expected demographic evolution and its impact on water demand and wastewater generation.

### 0.3.1. POPULATION EVOLUTION

The major part of the population served by VKS EOOD Peshtera lives the urban centres. The relative share of urban population amounts to 88.97%, distributed in three settlements i.e. Peshtera, Kapitan Dimitrievo and Radilovo. Saint Constantine is characterised by substantial seasonal activity (during summer). Only the town of Peshtera has a population of over 2,000 inhabitants.

*Table: 0-8 Population evolution between 2011 and 2038*

| Settlement | Population 2011 | Population 2016 | Population 2021 | Population 2028 | Population 2038 |
|---|---|---|---|---|---|
| Peshtera | **16 746** | **16 205** | **15 631** | **14 804** | **13 660** |
| Radilovo | **1 385** | **1 292** | **1 247** | **1 1811** | **1 089** |
| Kapitan Dimitrievo | **768** | **717** | **691** | **655** | **604** |
| Saint Constantine | **0*** | **0*** | **0*** | **0*** | **0*** |
| **Total for VKS** | **18 899** | **18 214** | **17 569** | **16 640** | **15 353** |

*Saint Constantine Holiday Resort has 1,620 temporary residents. This number is expected to remain stable until 2038.

The main tendencies in the demographic processes are similar to the national ones, differing only in the intensity of their manifestation. The population of Peshtera Municipality is decreasing at a lower rate compared to the national average levels for the country.

### 0.3.2. WATER DEMAND

Water demand forecast has been obtained on the basis of population evolution with the main hypothesis that for domestic consumption, individual consumption in 2038 will go toward a standard value of 120 lpcd.

The table below shows the water demand (including physical and commercial losses), which has to be covered by the water sources yield. For 2011, the overall efficiency[4] of networks are listed below (source: VKS EOOD Peshtera).

- Peshtera: 33%
- Total for VKS EOOD Peshtera: 34%[5]

The performance objectives for the year 2038 are 80% for new networks and 75% for already constructed networks.

*Table 0-9 Water demand projections, including physical and commercial losses (annual volumes in m³)*

| Settlement | Water demand 2011 | Water demand 2016 | Water demand 2021 | Water demand 2028 | Water demand 2038 |
|---|---|---|---|---|---|
| Peshtera | 2,159,488 | 1,572,878 | 1,270,127 | 1,306,597 | 1,323,949 |
| Radilovo | 135,881 | 99,366 | 81,084 | 80,926 | 78,986 |
| Kapitan Dimitrievo | 51,238 | 48,791 | 47,712 | 47,204 | 46,051 |
| Saint Constantine | 31,357 | 29,933 | 29,162 | 35,780 | 43,263 |
| **Total VKS** | **2,377,964** | 1,750,969 | 1,428,085 | 1,470,507 | 1,492,248 |

The second table below indicates the projected water demand, exluding the physical and commercial losses.

*Table 0-10 Water demand projections, excluding physical and commercial losses (annual volumes in m³)*

| Settlement | Water demand 2011 | Water demand 2016 | Water demand 2021 | Water demand 2028 | Water demand 2038 |
|---|---|---|---|---|---|
| Peshtera | 712,631 | 770,710 | 825,582 | 895,019 | 992,961 |
| Radilovo | 50,276 | 50,677 | 52,705 | 55,434 | 59,239 |
| Kapitan Dimitrievo | 29,718 | 30,007 | 31,013 | 32,335 | 34,538 |
| Saint Constantine | 10,975 | 14,967 | 18,955 | 24,509 | 32,447 |
| **Total VKS** | **803,600** | **866,360** | **928, 255** | **1,007,297** | **1,119,186** |

For more details, see section 5.2

### 0.3.3. WASTE WATER GENERATION

Wastewater flows are calculated from the water consumption, percentage of sewerage network coverage and infiltration.

[4] Efficiency is measure by the percentage of supplied water, generating revenue.

[5] The NRW percentage for the whole WSSC is the ratio between the overall NRW volume (sum for the whole WSSC) and the overall water demand including NRW (sum for the whole WSSC).

The table below does not include infiltration.

The current infiltration levels are presented below (source: VKS EOOD Peshtera).The aims of network presentation for the year 2038, including infiltration are 15% for new network and 20% for old network.

- Peshtera – 48%,
- Kapitan Dimitrievo – 52%
- Radilovo – 36%
- Saint Constantine – 0% (it is currently used as stormwater network)
- Total for VKS EOOD Peshtera : 47%[6]

*Table 0-11 Wastewater flow projections (Annual volumes in m³) between 2011 and 2038*

| Agglomeration | Waste Water 2011 | Waste Water 2016 | Waste Water 2021 | Waste Water 2028 | Waste Water 2038 |
|---|---|---|---|---|---|
| Peshtera | 628,541 | 693,639 | 743,024, | 805,517 | 893,665 |
| Radilovo | 40,724 | 45,609 | 47,434 | 49,891 | 53,315 |
| Kapitan Dimitrievo | 16,048 | 27,006 | 27,912 | 29,101 | 31,085 |
| Saint Constantine | 9,878 | 13,470 | 17,060 | 22,058 | 29,203 |
| **Total for VKS** | **695,190** | **779,724** | **835,429** | **906,566** | **1,007,268** |

For more details on wastewater flow projections, see section 5.3.

The percentage of sewerage coverage for the year 2011 ranges from 60% to 100%. It is expected that after the implementation of the above-said projects this percentage will reach 100% in 2016 for all settlements in the Municipality.

## 0.4. NATIONAL OBJECTIVES AND REGIONAL TARGETS

*This section relates to chapter 1 of the main report.*

As a member of the European Union since 2007, Bulgaria is committed to improve environmental quality in order to achieve compliance with the EU Acquis Communautaire as stated in Chapter 22 – Environmental Protection. Bulgaria has therefore harmonised its legislation in the fields of environment, water and sanitation with the one of the EU, and compliance with this legislation is part of the national objectives.

On the basis of the analysis of the current situation, the Operational Programme Environment 2007-2013 (managed by the Ministry of Water and Environment) sets the country priority areas for the environmental sector to be implemented and financed by the

[6] The NRW percentage for the whole WSSC is the ratio between the overall NRW volume (sum for the whole WSSC) and the overall water demand including NRW (sum for the whole WSSC).

EU through the Cohesion Fund and the European Regional Development Fund. The first priorities are given to:

- Compliance with the Water Framework Directive 2000/60/EC and Directive 98/83/EC: 100% of the population should be sufficiently supplied with drinking water of good quality
- Compliance with the Urban Wastewater Directive 91/271/EC: every agglomeration counting over 2,000 PE must treat wastewater in a WWTP, and the ones counting over 10,000 PE should include nutrients removal.

During the negotiations under Chapter 22, two transitional periods have been negotiated with regard to the implementation of UWWD 91/271/EC: until 31 December 2010 for all agglomerations over 10,000 PE and until 31 December 2014 for all agglomerations between 2,000 and 10,000 PE.

On the territory of VKS EOOD Peshtera, the national objectives apply and there is no specific regional target.

## 0.5. OPTION ANALYSIS AND REGIONAL STRATEGY

### 0.5.1. WATER SUPPLY

*This section relates to chapter 4 of the main report*

The measures to be conducted for water supply improvement on the territory of VKS EOOD Peshtera are listed below: For more information, see section 4.2.

The investments concerning the external water supply systems[7] are presented in drawing N°5.
To solve the deficiencies of Peshtera, the decentralized option (predominant gravity-fed water supply) was preferred to the centralized option (connection of the town of Peshtera and the village of Radilovo to centralised pump-fed water supply) due to the lower investment, operation and maintenance costs of this option.

The strategic options for External Water Supply System to be applied are explained in sections 4.2.1. and 4.2.3

They are adapted to the specificities of the Bulgarian context and of the territory of VKS EOOD Peshtera.

[7] External water supply system is a combination of water intake facilities, transmission (external) water mains and equipment for them (pumping stations, transitional pressure reservoirs etc.). One external water supply system supplies water to one or more settlements. A settlement can receive water from several external water supply systems.

### 0.5.1.1. Peshtera Water Supply Zone

The investments concerning the water supply network of the town of Peshtera are presented in draing No.7

**Short Term:**

The main concern is the difficult operation of the self-cleaning sand filter in winter months as well as the inadequate disinfection of water, supplied to the town of Peshtera, which is not safe to the working personnel.

The major problem related to distribution network is the presence of old and obsolete pipes and numerous failures on them.

There is no distribution network zoning in the town of Peshtera. The low parts of the town are characterised by high pressure (6 atm.).

The activities that need to be carried out are as follows:

*For treatment facilities and water disinfection:*

- Construction of separate chlorination room for chlorine gas at Peshtera DWTP, according to the requirements.
- Water disinfection in the existing reservoirs according to the requirements of the health authorities, the regulations and the good practice.
- Construction of facilities, which will protect water treatment equipment from freezing in the winter.
- Restoration or new power supply of the reservoirs, where water will be disinfected.

*For distribution network:*

- Rehabilitation of 993 m of water pipelines. (old and obsolete asbestos cement water pipelines, parallel to sewer branches, planned to be constructed under the short-term operational programme)
- Distribution network zoning through installation of pressure regulators.

Expected results:

- Improving water treatment of the town of Peshtera.
- Reducing the number of failures and water losses.

Capacity:

- Peshtera DWTP has capacity ranging from 12 l/s to 30 l/s, depending on the average daily flow of the water source

DWTP for Lukovitsa Quarter has capacity ranging from 4 l/s to 15 l/s. According to the water use permit, water quantity abstracted from the water intake is equal to 15 l/s and not more than 315 360m$^3$/year. Estimated cost: 253,100 €

**Medium Term:**

The major concern is related to obsolete external water pipelines of the town of Peshtera as well as the poor condition of some of the catchment systems. It is necessary to provide water connections, supplying pressure reservoirs, which have large regulating volumes. There are no facilities for treatment of backwash water of DWTP.

The main problems of the town distribution network are the need of network zoning as well as the old and obsolete pipes. It is necessary to rehabilitate 4 old pressure reservoirs.

The activities that need to be carried out are as follows:

*For external water supply systems:*

- Rehabilitation of 11.6 km of external water pipelines for the town of Peshtera.
- Construction of new water supply connections to existing pressure reservoirs – 1.3 km.
- Repair of 1 catchment system.
- Construction of facilities for treatment of backwash water of DWTP.

*For distribution network:*

- Rehabilitation of 11 km of water pipelines.
- Construction of 7 pressure reducing valve chambers for establishment of the zones.
- Rehabilitation of 4 pressure reservoirs.

Expected results:

- Increasing water supply security for the town of Peshtera and for consumers in the town.
- Preventing pollution of surrounding environment, surface water and ground water.
- Reducing water losses.
- Improving the condition of pressure reservoirs. Adequate use of their volumes.

Estimated cost: 3,850,300 €

**Long Term:**

The major concerns are the obsolete external water pipelines and catchment systems as well as already worn-out Siniyat Kainak Pumping Station.

The main problem of the distribution network is related to old and obsolete pipes.

The activities that need to be carried out are as follows:

*For external water supply systems:*

- Rehabilitation of 7.5 km of external water pipelines for the town of Peshtera.
- Repair of 2 catchment systems.
- Rehabilitation of Siniyat Kainak Pumping Station

*For distribution network:*

- Rehabilitation of 11.4 km of street water pipelines.

Expected results:

- Increasing water supply security for the town of Peshtera and for consumers in the town.
- Reducing water losses.

Estimated cost: 2,816,200 €

### *0.5.1.2. Radilovo-Kapitan Dimitrievo Water Supply Zone*

**Short-Term:**

The main problem is related to inadequate water disinfection in the reservoirs supplied by a local water source. There is no power supply and water disinfection is not proportional to the water flow.

The activities that need to be carried out are as follows:

- Water disinfection in the existing pressure reservoirs, according to the requirements of the health authorities, the regulations and the good practice.
- Installation of power supply of the reservoirs, where water will be disinfected.

Expected results:

- Improvement of water disinfection in the existing reservoirs of the villages of Radilovo and Kapitan Dimitrievo.

Capacity: 14.95 l/s

Estimated cost: 26,800 €

**Medium Term:**

No medium-term investments have been envisaged for the villages of Radilovo and Kapitan Dimitrievo.

**Long Term:**

The main problem is related to the deficiencies of the external water pipelines of the villages of Radilovo and Kapitan Dimitrievo, which are old and obsolete. Catchment systems are in poor condition too.

The activities that need to be carried out are as follows:

- Rehabilitation of 14.5 km of external water pipelines for both villages.
- Repair of 6 catchment systems.

Expected results:

- Increasing water supply security of the villages.
- Reducing water losses in the external water pipelines.

Estimated cost: 1,244,200 €

### *0.5.1.3. Saint Constantine Holiday Resort Water Supply Zone*

**Short Term:**

The main concern is the difficult operation of the self-cleaning sand filter in winter months.

The activities that need to be carried out are as follows:

- Construction of facilities, which will protect water treatment equipment from freezing in the winter.
- Improvement of technological process of reagent treatment of water, according to the proposed change of reagents.

Expected results:

- Improving water treatment of the town of Saint Constantine Holiday Resort.

Capacity: 5 l/s

Estimated cost: 11,000 €

**Medium Term:**

A major concern is the lack of facility for treatment of DWTP backwash water.

The activities that need to be carried out are as follows:

- Construction of facilities for treatment of backwash water of DWTP

Expected results:

- Preventing pollution of surrounding environment, surface water and groundwater.

Estimated cost: 12,000 €

**Long Term:**

No activities have been envisaged in the long-term period of the investment programmes for Saint Constantine Holiday Resort.

## 0.5.2. SEWERAGE

The main measures to be conducted for wastewater treatment on the territory of VKS EOOD Peshtera are listed below:

### *0.5.2.1. Peshtera*

For Peshtera, the investment program below did not require an option analysis. See section 4.3 for more details. Investments concerning the sewerage network of Peshtera are presented in drawing N°8.

**Short Term:**

It is envisaged to rehabilitate the most critical areas in order to improve the operation of the sewerage network and to reduce infiltration:

- Reconstruction of the Main sewer collectors, the tracks of which are located on both sides of Stara Reka River, which have a total length of 1,450m.
- Construction of stormwater overflow

Estimated cost: 1,215,500€

**Medium Term:**

The medium-term programme includes investment measures aiming at:

- Rehabilitation of connected sewerage networks in order to reduce infiltration and to eliminate other major deficiencies, which will ensure effective operation of WWTP.

Planned measures**:**

- Reconstruction and rehabilitation of existing sewer collector.
- Reconstruction and rehabilitation of sewer collectors, having a total length of 3,330 m, characterised by high infiltration levels.
- Construction of stormwater overflows

Estimated cost: 2,173,600€

**Long Term:**

The long-term programme includes investment measures aiming at:

- Rehabilitation of connected sewerage networks, having a total length of 20,030 m, in order to reduce infiltration and to eliminate other major deficiencies, which will ensure effective operation of WWTP.
- Restoration of the electromechanical equipment in Peshtera WWTP

Planned measures:

- Reconstruction and rehabilitation of existing sewerage networks.

Estimated cost: 12,030,500 €

### 0.5.2.2. Saint Constantine

**Medium-term:**

The medium-term programme includes investment measures aiming at

- Treating the wastewater coming from Saint Constantine Holiday Resort (1,620 PE).

Planned measures:

- Construction of a WWTP.

## 0.6. INVESTMENT PROGRAMME AND ECONOMICAL ANALYSIS

*This section relates to chapter 6 of the main report.*

Required investments have been identified and planned within three periods corresponding to each investment programme

- Short-Term (2014-2020)
- Medium-Term (2021-2028)
- Long-Term (2029-2038)

In the three sections below are presented the synthesis of the costs of the three investment periods (short, medium and long term). Detailed costs (per water system for water supply and per agglomeration for sewerage) are presented in sections 6.2 to 6.4. In sections 6.2.2, 6.3.2 and 6.4.2 (respectively for the short, medium and long-term period) are presented summary tables with the prioritization of the measures (according to the Consultant's methodology for priorities presented in appendix 4-20) along with the outcomes of the measures.

Besides the investment programme described below, the Consultant suggests that a set of studies or programmes are conducted following the submission of the present Regional Master Plan.

These studies and programmes are not included in the investment programmes and cannot be quantified at this stage. This set of studies and programmes includes (see section 6.1.2):

- Institutional studies (more details are provided in section 6.1.2)
- Sludge management study (more details are provided in section 4.3.1)

Concerning the industrial wastewater discharges into surface water bodies and urban sewerage networks, the Consultant recommends the following actions.

- For the industries discharging wastewater directly into the river, it is necessary to implement an autonomous treatment tools, suitable for specific industrial wastewater discharges.
- For industries discharging wastewater into the urban sewerage network, it is necessary to implement pre-treatment tools, after studying the type of effluents they discharge.

Investments are the responsibility of the private entities concerned. Therefore, the related costs are not included in the present investment programmes.

### 0.6.1. SHORT-TERM PROGRAMME

*Table 0-12: Overall short-term investments for water supply*

| Code | Category of work | Total Cost |
|---|---|---|
| WS_1 | Water abstraction | - € |
| WS_2 | DWTP | 141,600 € |
| WS_3 | Water mains | - € |
| WS_4_1 | Distribution networks | 149,300 € |
| WS_4_2 | Reservoirs and tanks | - € |
| WS_4_3 | Pumping stations | - € |
| WS_5 | Miscellaneous | - € |
| **WS Construction Cost** | | **290,900 €** |

| | |
|---|---|
| Percentage for the feasibility studies (environmental, geotechnical, topo, …) | 1% |
| Percentage for the design | 4% |
| Percentage for the supervision | 5% |
| Percentage for the project management | 3% |
| **Studies and supervision cost** | **37,800 €** |

| | |
|---|---|
| Percentage for contingencies | 10% |
| **Contingency cost** | **29,100€** |

| | |
|---|---|
| **Total investment cost** | **357,800 €** |

*Table 0-13: Overall short-term investments for wastewater*

| Code | Category of work | Total Cost |
|---|---|---|
| WW_1 | WWTP | - € |
| WW_2 | Mains collectors | 1,151,800 € |
| WW_3_1 | Sewerage network | 63,700 € |
| WW_3_2 | WW Pumping station | - € |
| WW_4 | Miscellaneous | - € |
| **WW Construction Cost** | | **1,215,500 €** |

| | |
|---|---|
| Percentage for the feasibility studies (environmental, geotechnical, topo, …) | 1% |
| Percentage for the design | 4% |
| Percentage for the supervision | 5% |
| Percentage for the project management | 3% |
| **Studies and supervision cost** | **158,000 €** |

| | |
|---|---|
| Percentage for contingencies | 10% |
| **Contingency cost** | **121,600 €** |

| | |
|---|---|
| **Total investment cost** | **1,495,100 €** |

*Table 0-14:* Prioritizaiton of the short-term investment program

| Ranking | Number of Investment on the maps | Name of WS zone / Agglomeration | Component Description | Investment Costs | Population concerned* |
|---|---|---|---|---|---|
| 1 | 1 | Peshtera | Reconstruction of 2 sewerage collectors | 1,215,000 | 16,746 |
| 2 | 1 | Peshtera Saint Constantine | Construction of a separate gas chlorine station according to the requirements (3 chlorine stations) | 68,153 | 18,366 |
| 3 | 2 | Peshtera Radilovo | Improving the chlorination in the existing water tanks (three pressure tanks) | 73,459 | 18,131 |
| 4 | 3 | Peshtera | Rehabilitation of the water supply network L=0.993 km (along the envisaged domestic sewerage network) | 149,285 | 16,746 |

** Population is as of 2011 according to NSI data.*

| ***Category*** |
|---|
| Water Supply |
| Waste water |

## 0.6.2. MEDIUM-TERM PROGRAMME

*Table 0-15: Overall Medium-term investments for water supply*

| Code | Category of work | Total Cost |
|---|---|---|
| WS_1 | Water abstraction | 15,000 € |
| WS_2 | DWTP | 36,000 € |
| WS_3 | Water mains | 1,843,100 € |
| WS_4_1 | Distribution networks | 1,822,100 € |
| WS_4_2 | Reservoirs and tanks | 78,500 € |
| WS_4_3 | Pumping stations | - € |
| WS_5 | Miscellaneous | 67,600 € |
| **WS Construction Cost** | | **3,862,300 €** |

| | |
|---|---|
| Percentage for the feasibility studies (environmental, geotechnical, topo, …) | 1% |
| Percentage for the design | 4% |
| Percentage for the supervision | 5% |
| Percentage for the project management | 3% |
| **Studies and supervision cost** | **502,100 €** |

| | |
|---|---|
| Percentage for contingencies | 10% |
| **Contingency cost** | **386,200 €** |

| | |
|---|---|
| **Total investment cost** | **4,750,600 €** |

*Table 0-16: Overall medium-term investments for wastewater*

| Code | Category of work | Total cost |
|---|---|---|
| WW_1 | WWTP | 1,800,000 € |
| WW_2 | Mains collectors | 2,025,200 € |
| WW_3_1 | Sewerage network | 148,400 € |
| WW_3_2 | WW Pumping station | - € |
| WW_4 | Miscellaneous | - € |
| **WW Construction Cost** | | **3,973,600 €** |

| | |
|---|---|
| Percentage for the feasibility studies (environmental, geotechnical, topo, …) | 1% |
| Percentage for the design | 4% |
| Percentage for the supervision | 5% |
| Percentage for the project management | 3% |
| **Studies and supervision cost** | **516,600 €** |

| | |
|---|---|
| Percentage for contingencies | 10% |
| **Contingency cost** | **397,400 €** |

| | |
|---|---|
| **Total investment cost** | **4,887,600 €** |

*Table 0-17 Prioritizaiton of the medium-term investment program*

| Ranking | Number of Investment on the maps | Name of WS zone / Agglomeration | Component Description | Investment Costs | Population concerned* |
|---|---|---|---|---|---|
| 1 | 1 | Peshtera | Reconstruction of the main sewer collectors, part of the adjacent | 2,173,600 | 16,746 |

| Ranking | Number of Investment on the maps | Name of WS zone / Agglomeration | Component Description | Investment Costs | Population concerned* |
|---|---|---|---|---|---|
| | | | network | | |
| 2 | 2 | Peshtera | Rehabilitation of the catchments – 2 pcs. | 15,000 | 16,746 |
| 3 | 2 | Saint Constantine | Construction of a WWTP | 1,800,000 | 1,620 |
| 4 | 1 | Peshtera<br>Saint Constantine | Construction of separate facilities for treatment of the flushing water from WWTP – 3 pcs. | 36,000 | 18,366 |
| 5 | 4 | Peshtera | Rehabilitation of the distribution network – 11.033 km | 1,867,427 | 16,746 |
| 6 | 5 | Peshtera | Rehabilitation of the pressure reservoirs – 4 pcs. | 78,460 | 16,746 |
| 7 | 3 | Peshtera | Rehabilitation of the feeding water mains – 11.57 km | 1,865,410 | 16,746 |

** Population is as of 2011 according to NSI data.*

| ***Category*** |
|---|
| Water Supply |
| Waste water |

## 0.6.3. LONG-TERM PROGRAMME

*Table 0-18: Overall long-term investments for water supply*

| Code | Category of work | Total Cost |
|---|---|---|
| WS_1 | Water abstraction | 37,600 € |
| WS_2 | DWTP | - € |
| WS_3 | Water mains | 2,078,100 € |
| WS_4_1 | Distribution networks | 1,770,900 € |
| WS_4_2 | Reservoirs and tanks | - € |
| WS_4_3 | Pumping stations | 29,900 € |
| WS_5 | Miscellaneous | 143,900 € |
| **WS Construction Cost** | | **4,060,400 €** |

| | |
|---|---|
| Percentage for the feasibility studies (environmental, geotechnical, topo, …) | 1% |
| Percentage for the design | 4% |
| Percentage for the supervision | 5% |
| Percentage for the project management | 3% |
| **Studies and supervision cost** | **527,900 €** |

| | |
|---|---|
| Percentage for contingencies | 10% |
| **Contingency cost** | **406,000 €** |

| | |
|---|---|
| **Total investment cost** | **4,994,300 €** |

*Table 0-19: Overall long-term investments for wastewater*

| Code | Category of work | Total cost |
|---|---|---|
| WW_1 | WWTP | 942,000 € |
| WW_2 | Mains collectors | - € |
| WW_3_1 | Sewerage network | 11,088,500 € |
| WW_3_2 | WW Pumping station | - € |
| WW_4 | Miscellaneous | - € |
| **WW Construction Cost** | | **12,030,500 €** |

| | |
|---|---|
| Percentage for the feasibility studies (environmental, geotechnical, topo, …) | 1% |
| Percentage for the design | 4% |
| Percentage for the supervision | 5% |
| Percentage for the project management | 3% |
| **Studies and supervision cost** | **1 564 000 €** |

| | |
|---|---|
| Percentage for contingencies | 10% |
| **Contingency cost** | **1,203,100 €** |

| | |
|---|---|
| **Total investment cost** | **14 797 600 €** |

*Table 0-20* Prioritization of the long-term investment program

| Ranking | Number of Investment on the maps | Name of WS zone / Agglomeration | Component Description | Investment Costs | Population concerned* |
|---|---|---|---|---|---|
| 1 | 1 | Peshtera, Radilovo, Kapitan Dimitrievo | Rehabilitation of catchments – 9 pcs. | 37,600 | 18,206 |
| 2 | 1 | Peshtera | Reconstruction of secondary sewerage network | 11,088,000 | 16,746 |

| Ranking | Number of Investment on the maps | Name of WS zone / Agglomeration | Component Description | Investment Costs | Population concerned* |
|---|---|---|---|---|---|
| 3 | 2 | Peshtera | WWTP – replacement of electrical and mechanical equipment | 942,000 | 16,746 |
| 4 | 5 | Peshtera | Rehabilitation of the distribution network – 11.423 km | 1,770,856 | 16,746 |
| 5 | 6 | Peshtera | Rehabilitation of PS "Siniya Kaynak" | 29,850 | 16,746 |
| 6 | 7 | Peshtera, Radilovo, Kapitan Dimitrievo, Saint Constantine | Introduction of SCADA management and control system | 125,000 | 20,519 |
| 7 | 2 | Peshtera | Rehabilitation of external water transmission mains – 7.54 km | 868,154 | 16,746 |
| 8 | 4 | Kapitan Dimitrievo | Rehabilitation of external water transmission mains – 0.42 km | 39,198 | 768 |
| 9 | 3 | Radilovo | Rehabilitation of external water transmission mains – 14.08 km | 1,189,631 | 692 |

** Population is as of 2011 according to NSI data.*

| ***Category*** |
|---|
| Water Supply |
| Waste water |

## 0.7. MACRO-AFFORDABILITY

*This section relates to chapter 5.4 of the main report.*

Macro-affordability investment assessment is required in order to determine the viability of investments in water and wastewater systems and to establish realistic limits on the maximum investment value. Tariffs depend on multiple variables – type and timing of investments, operation and maintenance costs, depreciation policies, sources of financing for the investment (loans, grants, etc.). All these components are integral part of tariff formation and thus influence the affordable investment amounts.

The affordability threshold set by Bulgarian legislation is 4% of the average household income at minimum water consumption of 2.8 m3 per household member. Other sources set maximum limits of 2-2.5% of the average household income. In accordance with the

instructions of the Client, a limit of 4% of the average income of the first three decile groups (representing the poorest strata of the population) is used in this document.

The maximum affordable tariffs at various affordability limits are shown in the table below:

*Table 0-21 Affordability study between 2015 and 2038*

| Affordability constraint | 2011 | 2016 | 2021 | 2028 | 2038 |
|---|---|---|---|---|---|
| Average household income, VKS EOOD Peshtera, EUR (constant 2011 values) | 4,396 | 5,279 | 6,301 | 7,909 | 10,943 |
| Maximum affordable price per m3, (4% of average income) EUR | 2.25 | 2.61 | 2.81 | 3.22 | 4.09 |
| Maximum affordable price per cubic metre, EUR (4% of income of the first three decile groups) | 1.19 | 1.38 | 1.48 | 1.70 | 2.16 |

The potential incremental revenues are easily calculated showing the annual maximum and minimum affordable amount of incremental revenues compared to the existing situation.

Water and wastewater tariffs have to be increased to be in compliance with the EU beneficiaries/polluters pay principle. The Regulator has to start monitoring that the WSSC are acting in line of the EU principles. The Regulator could also consider the possibilities of differentiating the tariffs based on type of consumers and/or implementing increasing block tariff systems to protect the poorest consumers and so assure the financial viability and sustainability of WSSC's operations. For the region of Peshter there is no need of special measures or water tariff differentiation because the proposed investments are affordable, both for the population with average income and for the population with the lowest income, and 100% of depreciation for new assets may be included in the tariffs. Despite the relatively small size of the served territory, the water operator is able to generate profit and so far the relatively low level of investment in the short-term program creates conditions for comparability of large-scale investments with the increased income of the population at the end of the forecast period.

## 0.8. PRIORITIZATION OF INFRASTRUCTURE INVESTMENTS

*This section relates to chapter 6 of the main report.*

Infrastructure investments have been designed to address the deficiencies identified in the current situation analysis and forecasted needs (see summary tables 0-22 and 0-23 for summarized data on the current situation for water supply and sewerage and the compliance with EU directives). All infrastructure projects identified in the investment programmes have been prioritized.

The prioritization consists in calculating an amount of points[8] for each investment, based on the following factors:

[8] Note: the scoring system has been harmonized for the preparation of Regional Master Plan in the western, central and eastern regions of Bulgaria.

- The size (population / population equivalent) of the settlement / agglomeration
- The economic efficiency (cost per inhabitants / cost per equivalent inhabitant)
- The current service coverage
- The investment readiness to date
- The importance of the investment implementation according to the Water Framework Directive / Urban Wastewater Directive

The details of the methodology for prioritization are given in Appendix 4-7.

The implementation of this prioritization results in one list of prioritized investments for each investment programme period. They can be seen in:

- Table 6-6 for the short-term investment programme
- Table 6-11 for the medium-term investment programme
- Table 6-16 for the long-term investment programme

## 0.9. PUBLIC CONSULTATIONS

*This section relates to chapter 8 of the main report.*

The Draft Regional Water and Wastewater Master Plan of the designated territory of VKS EOOD – Peshtera was first submitted to the Ministry of Regional Development on: 08 May, 2013 and released for Public Consultation on 20 August 2013.

The District Development Council coordinated the Master Plan after deliberation on the 2nd October 2013.

The Municipal Council of Peshtera Municipality coordinated the Master Plan after deliberation on the 25th October 2013.

## 0.10. OVERVIEW OF THE TERRITORY OF VKS EOOD PESHTERA

The schemes and tables presented below show the general information for all the settlements in the considered territory with respect to water supply and sanitation.

In particular, issues of water quality, water scarcity and direct discharge of wastewater into the environment are highlighted.

# Water Supply: General Situation
## VKS EOOD Peshtera


**LEGEND** :

| General information | | Compliance with the Water Framework Directive 2000/60/EC | | |
|---|---|---|---|---|
| | WSS Company borders | NOVO SELO | ■ ● | Settlement compliant |
| | District borders | NOVO SELO | ■ ● × | Settlement NOT compliant for water quality reasons |
| | Municipality borders | NOVO SELO | ■ ● × | Settlement NOT compliant for water quantity reasons |
| | Surface water bodies | NOVO SELO | ■ ● × | Settlement NOT compliant for water quality and quantity reasons |

| Settlements | | Drinking water treatment plants | |
|---|---|---|---|
| ■ NOVO SELO | Settlement with population over 10,000 inhabitants | | Existing DWTP |
| ● NOVO SELO | Settlement with population between 2,000 and 10,000 inhabitants | | On-going construction of DWTP |
| × | Settlement with a population under 2,000 inhabitants | | DWTP to be constructed during the implementation of the Master Plan |

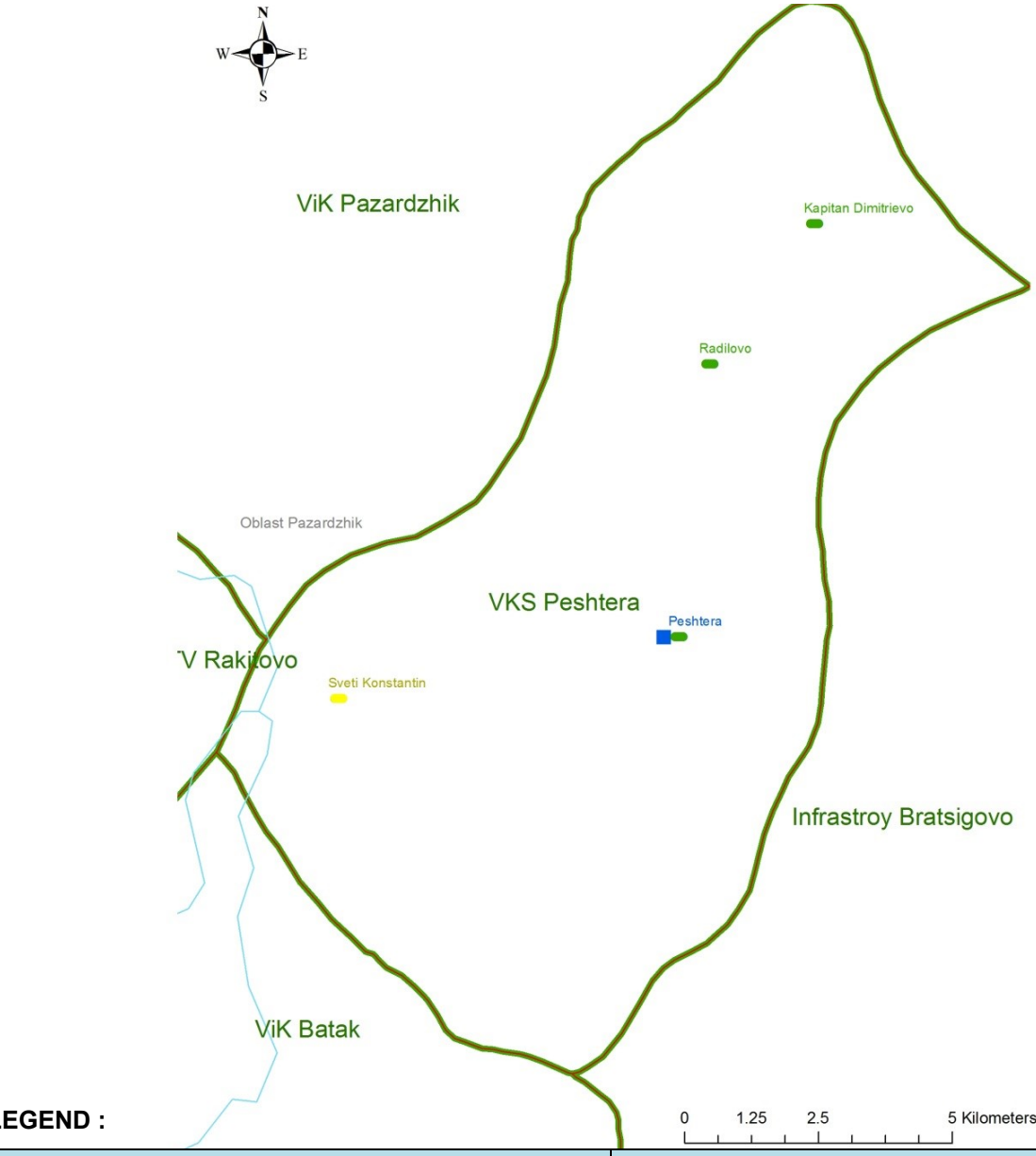
*Figure 0-2 General situation for water supply*

*Table 0-22 Summary data about the settlement*

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 | 16 | 17 | 18 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID | Municipality | Settlement | Water supply & sewerage operator | Population | Population equivalent | WS Zone Code | Length of the water distribution network | Domestic Water Demand | Specific Domestic consumption | Non-Domestic Water Demand | Total Water Demand (excl. NRW) | Total Water Demand incl. NRW | NRW percentage | Water Supply Connection rate | Water quantity compliance | Water quality compliance | Comments (major deficiencies…) |
| - | Name | Name | Name | Number | Number | - | km | m³ / year | l/c/d | m³ / year | m³ / year | m³ / year | % of 12 | % of total | Yes/No | Yes/No (1) | - |
| 36124 | Peshtera | Kapitan Dimitrievo | VKS EOOD Peshtera | 768 | 779 | 2 | 8.5 | 27,578 | 98 | 2,140 | 29,718 | 51, 238 | 42 | 100 | Yes | Yes | |
| 36277 | Peshtera | Peshtera | VKS EOOD Peshtera | 16,746 | 18,611 | 1 | 46.84 | 481,07 | 79 | 213,561 | 712,631 | 2,159,488 | 67 | 100 | Yes | Yes | |
| 61371 | Peshtera | Radilovo | VKS EOOD Peshtera | 1,385 | 1,402 | 2 | 16 | 47,998 | 95 | 2,278 | 50 ,276 | 135,881 | 63 | 100 | Yes | Yes | |

(1) If the answer is "no", the non-complying parameter(s) are put in brackets.

# Sewage: General Situation
## VKS EOOD Peshtera




**LEGEND :**

| General information | | Coverage rate of sewerage for agglomeration | |
|---|---|---|---|
| | WSS Company borders | NOVO SELO | ≥ 90% |
| | District borders | NOVO SELO | < 90% |
| | Municipality borders | NOVO SELO | 0% |
| | Surface water bodies | Waste water treatment plants | |
| Agglomeration | | | Existing WWTP |
| NOVO SELO | Agglomeration with population over 10,000 inhabitants | | On-going construction of WWTP |
| NOVO SELO | Agglomeration with population between 2,000 and 10,000 inhabitants | | WWTP to be constructed during the implementation of the Regional Master Plan |
| | | | Other issue concerning wastewater |

*Figure 0-3 General situation for sewage*

*Table 0-23 Summary table about sewerage*

| 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | 14 | 15 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| ID | Municipality | Settlement | Water supply & sewerage operator | Population | Population equivalent | WW Zone Code (1) | Length of the sewerage network | Total Waste-Water generated | Actual pollution load collected | Sensitive Area | Wastewater connection rate | Connection to a WWTP | Compliance with UWWD | Comments (major deficiencies…) |
| - | Name | Name | Name | Number | Number | Number | km | $m^3$/year | $PE_{60}$ | Yes/No | % of total | Yes/No/ Partial/ On-going (2) | Yes/No | - |
| 36124 | Peshtera | Kapitan Dimitrievo | VKS EOOD Peshtera | 768 | 779 | 2 | 5.1464 | 16,048 | 471 | No | 60 | On-going | No | |
| 36277 | Peshtera | Peshtera | VKS EOOD Peshtera | 16,746 | 18,611 | 1 | 43 | 628,541 | 18,276 | No | 98 | On-going | No | |
| 61371 | Peshtera | Radilovo | VKS EOOD Peshtera | 1,385 | 1,402 | 2 | 6.732 | 40,724 | 1,263 | No | 90 | On-going | No | |

(1) "0" means that there is no wastewater collection for the settlement

(2) "Yes" means there is a connection to an operational WWTP. "No" means that currently there is no connection to a WWTP and no project on-going for a connection in the future. "Partial" means that only parts of the sewerage network are connected. "On-going" means that a project has been "approved and financed" before the 15.07.2012 so the settlement is connected in the future.

# 1. INTRODUCTION

## 1.1. PROJECT FRAMEWORK

### 1.1.1. GENERAL FRAMEWORK AND POLICY CONTEXT

Bulgaria, as member of the European Union (EU), is committed to improve environmental quality in order to achieve compliance with the EU Acquis Communautaire. In this respect, Bulgaria has adopted most of the Acquis in the field of environmental protection. The fulfilment of the commitments made by Bulgaria in the negotiation process for Chapter 22 – Environmental Protection, involves the implementation of major investment projects in environmental infrastructure.

Before Bulgaria's accession to EU, part of the funds needed for environmental investments were available through different European programmes (i.e. PHARE, ISPA, SAPARD) or through projects financed by International Financing Institutions (IFIs) (like: EBRD, EIB, WB, etc.). After 1st of January 2007, Bulgaria has continued to receive EU financial support from the Structural and Cohesion Funds (SCF).

In order to ensure an efficient absorption and use of EU funds, the Bulgarian Ministry of Environment and Water (MoEW), as Managing Authority for the Operational Programme (OP) "Environment", prepared a strategic document for the programming period 2007 – 2013 developed in line with the Community Strategic Guidelines (CSG); the National Development Plan (NDP); the National Environmental Strategy 2005-2014; the National Strategic Reference Framework (NSRF); the National Waste Management Programme 2009-2013; the National Strategy for Management and Development of the Water Sector 2004 – 2015; and the programmes for the implementation of the requirements of different "heavy" directives, elaborated in 2003, such as 91/271/EEC concerning urban waste water treatment.

On the basis of the analysis of the current situation, the OP "Environment 2007-2013" sets the country priority areas for the environmental sector to be implemented and financed by the European Union through the Cohesion Fund and the European Regional Development Fund. Priority axis 1 concerns the improvement and development of water and wastewater infrastructure in settlements with over 2,000 population equivalent (PE) and in settlements below 2,000 PE within urban agglomeration areas. The priority axis is based on the purpose of Council Directive 2000/60/EC laying down the framework for community activities related to water - Water Framework Directive (WFD) as well as the purposes of Council Directive 91/271/EEC for urban waste water treatment.

During the negotiations under Chapter 22, two transitional periods have been negotiated with regard to the implementation of the requirements of Directive 91/271/EEC, which are as follows:

- Till 31 December 2010 – for all agglomerations over 10,000 PE (85 no in total);

- Till 31 December 2014 – for all agglomerations between 2,000 and 10,000 PE (273 no in total).

This requires measures that include:

- Water supply: extension, reconstruction, modernization, NRW reduction programmes as well as construction of Drinking Water Treatment Plants (DWTP), reservoirs…
- Sewerage: extension, reconstruction and modernization, as well as construction of new sewerage systems including urban Waste Water Treatment Plans (WWTP) sceptic tanks, soakaways….

According to the Report for Implementation of Directive 91/271/EEC by the end of 2010 issued by the MoEW, there is a delay in the fulfillment of the Directive requirements for agglomerations above 10,000 PE. This imposes to give first priority to the design and construction of sewerage networks and urban WWTP for agglomerations over 10,000 PE.

Joining the EU in 2007, Bulgaria was urged to reform the water sector and adopt stricter regulations and environmental standards. The European Commission requested from Bulgaria an urgent action plan for reform in the water infrastructure sector. As a result, the Ministry of Environment and Water prepared a strategy and completed a map for the water supply and sewage sector development, in coordination with other ministries, regional authorities, municipalities and operators.

As an attempt to solve the problem of infrastructure ownership, divided between the state, municipalities and private companies, regional water associations were created. The latter own the water supply and sewage infrastructure and give it for management to water supply and sewage companies. This was also a way to assume EU funding since water supply and sewage operators, being commercial entities, could not apply for EU financing.

This Regional Master Plan (RMP) is the first important step giving the framework for the development strategy of the municipalities in the water supply and sewerage sector for the period 2014 - 2035. An identification of necessary investment measures to achieve full compliance with relevant EU Directives and other objectives defined in the Terms of Reference is given in the present document, as well as a prioritisation and phasing of these measures in short, medium and long term. Special attention is paid to the preparation of the short term investment programme intended to be financed by the next Operational Programme “Environment 2014-2020”.

### 1.1.2. PROJECT OBJECTIVES AND SCOPE OF WORK

The project objectives and scope of work below have been defined in accordance with the Terms of Reference of the “Regional water and wastewater Master Plans for the central region”

The Government of Bulgaria has received a loan from the World Bank to implement a Municipal Infrastructure Development Project. Its strategic aims are to (a) improve the reliability and quality of water provision to the communities in selected settlements in the

project area and (b) assist municipalities to improve investment-planning capacity. These objectives are in line with Bulgaria's National Strategy on Environment (2005-2014), which pursues the following goal: "To provide good quality and sufficient quantity of water for different purposes".

There are three project components:

- Component 1: Project Implementation Support;
- Component 2: Technical assistance for Regional and Municipal Infrastructure Development;
- Component 3: Completion and Rehabilitation of Dams.

This assignment covers Component 2 under which the project will support the Strategy for Water Supply and Sewerage Management and Development in the Republic of Bulgaria through the preparation of 24 Regional Master Plans for water supply and sewerage systems for the designated territories in the Central region with a planning horizon of 2038. According to a first assessment based on 2011 population census and in compliance with the Terms of Reference for the project, the Regional Master Plans should focus on 143 settlements above 2,000 PE. Small settlements will be taken into account at general level within the activity of the Water Supply and Sewerage Companies (WSSCs) and the situation assessment. The plans will be the first step for identification of priority investments for rehabilitation of existing facilities and construction of new facilities for water supply and wastewater collection and treatment needed to cover the requirements of the EU Directives concerning the environment.

The present report aims to prepare a Regional Master Plan for the water supply and sewerage systems for the designated territory of the WSSC - "VKS" EOOD serving the Peshtera Municipality. The borders of its territory are the designated territory of "Water Supply and Sewerage" EOOD – Pazardzhik, "Infrastroy" EOOD – Bratsigovo, "VKTV" EOOD – Rakitovo and "ViK-Batak" EOOD – Batak. The Peshtera Municipality includes three settlements and an important holiday resort: The town of Peshtera (16,746 inhabitants), the village of Radilovo (1,385 inhabitants), the village of Kapitan Dimitrievo (768 inhabitants) and the holiday resort Saint Constantine (1,620 inhabitants during 160 days throughout the year). According to the "Report on the Application of the Requirements of EU Directive 91/271/EEC" issued by the MoEW, the agglomeration concerned is Peshtera, with the united Classificatory for the Administrative and Territorial Units (EKATTE) being 56,277. It includes only one town of more than 2,000 PE, the town of Peshtera.

The Regional Master Plan has the following objectives:

- Assess the current state of water and wastewater systems;
- Enable the preparation of feasibility studies for individual investment projects;
- Ensure compliance with the Environmental Acquis and all relevant EU directives, in particular the DWD and the UWWTD, within the committed deadlines;
- Ensure efficient use of water resources;
- Facilitate co-financing from EU grants (Cohesion Fund);
- Build capacity for project preparation at regional/local level;

- Define short (2014-2020), medium (15 years horizon) and long term (25 years) investment programmes;
- Serve as a basis for environmentally sound water projects.

In particular, regarding the water supply sector, the Regional Master Plan aims:

- To supply the population with drinking water of good quality, in sufficient quantity;
- To reduce water losses in water supply systems;
- To increase equipment energy efficiency;
- To increase the population connected to the water supply network;
- To decrease operation and maintenance costs;

Regarding the sewerage sector, the Regional Master Plan aims:

- To reduce the direct discharge of untreated wastewater through the construction of WWTP covering the requirements of Directive 91/271/EEC and Bulgarian legislation;
- To optimize the operation of WWTP through infiltration reduction in sewerage networks and other improvements;
- To increase the population served by sewerage networks;
- To increase the proportion of the population for which waste water undergoes complete purification.
- To provide efficient sludge management;
- To decrease operation and maintenance costs;

The project has the following scope of the services:

1) Data collection and review, including:
   - General, socio-economic and technical indicators for the last three years from official publications;
   - Establishment of a unit costs database from previous projects and available sources (e.g.: MoEW) to assess the costs of proposed investment projects;
2) Assessment of existing situation and needs of the water supply and sewerage system, with detailed evaluation for:
   - Water resources, including all surface and ground water resources for potable water supply, water catchment areas and the main characteristics of rivers and dams;
   - Water pollution, including all major polluters, volume of wastewaters discharged, pollution loads and evaluation of the impact on surface and ground water;
   - Condition of existing main water supply systems including water intakes, water treatment plants, transmission mains, raw and treated water reservoirs, pumping stations;
   - Condition of existing water distribution network including the networks of settlements with more than 2,000 inhabitants and areas with disturbed water supply, based on existing data including age, pipe material and diameters, records of leak detection and repairs and existing studies;
   - Condition of existing sewerage network with focus on structural condition, hydraulic capacity and energy efficiency, based on existing data and studies for

the drainage area and visual inspections of pumping stations, storm water overflows and other assets.

- Condition of existing wastewater treatment in terms of capacity, structural condition, energy efficiency and compliance with the conditions set in the discharge consents, based on existing data and studies, and visual inspections, as well as, assessment of sludge handling and disposal.
- Condition of industrial wastewaters describing present industries discharging effluents.

3) Priorities for water and sewerage system development to achieve compliance with the EU Directives and Environmental Acquis including:
   - Proposed Basic Design Criteria based on data analysis, Bulgarian regulations requirements and best European practices.
   - Options for water supply and sewerage system development such as rehabilitation of existing facilities, system rationalization, construction of new facilities.
4) Socioeconomic forecast including macroeconomic prospective, demographic forecast, household income forecast and economic activities forecast with a planning horizon of 2035. Three scenarios will be developed: optimistic, pessimistic and balanced.
5) Macro-affordability assessment and financing capacity for different scopes of the investment programmes, under different amounts and investment phasing and other related costs within the planning period.
6) Short term program (2014-2020), medium term program (2021-2028), and long-term program (2029-2038) investment programmes including priority measures, a timeframe for their implementation and indicative investment costs.
7) Environmental Assessment including environmental screening for proposed investment impacts and, if necessary, a full Environmental Impact Assessment report.
8) Public Consultation, assisting the client in organizing and carrying out consultations with the stakeholders, the public, interested institutions and other persons that might be affected by the Regional Master Plan during the different stages of its preparation.
9) Review of all the settlement in the territory of the WSSC with general water supply and sewerage data for each of them.

### 1.1.3. PROJECT LEGAL BACKGROUND

The Managing Authority for the project is the Ministry of Regional Development and Public Works (MRDPW). It has contracted the Consortium consisting of the international consultancy companies Seureca (part of Veolia Environment), SCE, Hidroproekt - Sofia and Arcadia Engineering to prepare the Regional Master Plans for Central region of Bulgaria. The contract agreement was signed on 8th December 2011. The project commenced on 27th December 2011 and will be implemented over a period of 18 months.

The project is funded through a loan from the World Bank No.7834-BG, Ref. MIDP-MP-QCBS2.

### 1.1.4. OTHER RELEVANT PROGRAMMES AND PROJECTS

Peshtera Municipality carries out a successful policy in the field of environment at the local level according to the Municipal Programme for Environmental Protection approved in 2009. The strategic goal set out in the programme is "sustainable use of water resources through rehabilitation of the existing infrastructure and construction of new one in order to reduce water losses and ensure reasonable use and protection of water". For achieving this goal, the municipality applies under the following project funding schemes:

- Priority axis 1 of OP Environment 2007-2013: „Improvement and development of water and wastewater infrastructure" under Procedure Reference №: BG161PO005/08/1.10/02, for financing from the Cohesion Fund 2007-2013.
- Priority axis 1 of OP Environment 2007-2013: "Improvement and development of water and wastewater infrastructure in agglomerations with over 10,000 PE with Procedure Reference №: BG161PO005/10/1.11/02/16, for financing from the Cohesion Fund 2007-2013.
- Priority axis 1 of OP Environment 2007-2013: „Preparation and implementation of projects for improvement and development of water and wastewater infrastructure in agglomerations with over 10,000 PE "under Procedure Reference №: BG161PO005/10/1.11/03/19, for financing from the Cohesion Fund 2007-2013.
- Rural areas development programme 2007-2013. Measure 321 – Main services provided to the population and companies in the rural areas.

Peshtera Municipality has been conducting the following projects (see Appendix 1-1 for details on the main objectives and expected results and section 3.8 for more details on pending projects):

1. Project: "Modernisation of the Integrated Water Cycle of the town of Peshtera – Completion and rehabilitation of the existing water supply and sewerage network and construction of WWTP in the town of Peshtera"

- Project cost: BGN 27,661,359.07.
- Project completion date: November 2013.

2. Project: "Reconstruction and rehabilitation of the sewerage network in the village of Radilovo – Southern part, Peshtera Municipality"

- Project cost: BGN 1,919,277.16.
- Project completion date: December 2013.

3. Project: "Reconstruction and rehabilitation of water supply network in the village of Kapitan Dimitrievo and construction of WWTP in the village of Kapitan Dimitrievo, Peshtera Municipality, Pazardzhik District"

- Project cost: BGN 5,717,980.55.

- Project completion date: December 2013.

4. Project: “Reconstruction and rehabilitation of sewerage network in the village of Radilovo – Northern part and the village of Kapitan Dimitrievo”.

- Project cost: BGN 5,659,174.42.
- Project completion date: December 2013.

5. Project: “Reconstruction and rehabilitation of the water supply network in the village of Radilovo, Peshtera Municipality“

- Project cost: BGN 5,866,417.80.
- Project completion date: December 2013.

### 1.1.5. REPORT STRUCTURE

The Regional Master Plan provides an overview of the existing situation, such as the socio-economic and institutional framework as well as the current service levels of existing water and wastewater facilities. Investigations, measurements and analysis were made for the identification of future water demand and wastewater flows and characteristics in order to define the realistic needs of the population in the water sector.

The Regional Master Plan structure is as follows:

0) Executive Summary

1) Introduction (presentation of the general scope of study, project framework , policy context, goals and general objectives, legal background, other relevant projects, report structure, institutional and regulatory framework, stakeholders, legal aspects of funding opportunities etc.)

2) Data Collection and Review (description of project area, natural features, socio-economic features, water and wastewater services).

3) Assessment of the existing situation and needs for water supply and sewerage (water resources, water consumption, water sources pollution, existing water and wastewater infrastructure facilities and current performances in towns and rural areas, sufficiency of data and conclusions regarding current deficiencies and database definition for projection)

4) Priorities for water and wastewater infrastructure development to achieve compliance with EU Directives and Environmental Acquis (methodologies and assumptions, options for water supply and sewerage systems development), based on the analysis carried out in chapter 3 and the projections made in chapter 5.

5) Socio-economic forecasts and macro-affordability assessment (socio-economic projections, water demand forecasts, projected wastewater flow and assessment of the investment programmes (detailed in chapter 6) macro-affordability)

6) Short, medium and long term Investment programmes to meet water and wastewater development targets (key performance indicators, list of priority investment measures, timeframe for their implementation and indicative investment costs, based on the methodology and option analysis made in chapter 4)

7) Environmental Assessment

8) Public consultations

9) Settlement review (general summary of the information on each settlement)

Appendices (general and specific appendices for the chapters) including maps and drawings.

## 1.2. INSTITUTIONAL AND REGULATORY FRAMEWORK

### 1.2.1. GENERAL ADMINISTRATIVE FRAMEWORK

The main responsibilities for water management and water supply and sewerage are shared among the following institutions:

The **Ministry of Regional Development and Public Works** is responsible for the overall policy related to the design, construction and operation of water supply and sewerage systems in the country. The Minister represents the state in water supply and sewerage companies with over 50% state share. The Ministry also coordinates water association activities and provides methodological guidance on the preparation of the water supply and sewerage Regional Master Plans.

The **Ministry of Environment and Water (MoEW)** is responsible for the management and the distribution of water resources at the national level. The Minister issues the permits for water-taking of mineral water – exclusive state property. The MoEW is also responsible for environmental protection and the implementation of the Operational Program Environment, under which water and wastewater infrastructure is funded.

The **Council of Ministers** defines the state policy in the water supply and sewerage sector as part of the country's water policy and the National strategy for development and management of the water sector in Bulgaria. The Council of Ministers approves a Strategy for development and management of the water supply and sewerage sector in Bulgaria for a period of at least 10 years. The strategy defines the main objectives, priorities, stages and necessary resources and sources of funding for the construction and development of water supply and sewerage systems and for improvement of water supply and sewerage service quality. The policy in the water sector is implemented by: 1. The Minister of Regional Development and Public Works, 2. Municipal councils and mayors of municipalities.

The **Ministry of Health** is responsible for the control on the quality of water intended for drinking and household needs, the quality of mineral water intended for drinking or used for prophylactic, therapeutic and hygienic purposes, including bottled mineral water in the commercial network and the quality of water intended for bathing.

**Basin Directorates** undertake water management at the basin level. There are four basin directorates: (i) Danube Basin Directorate – Pleven, (ii) Black Sea Basin Directorate – Varna, (iii) West Aegean Basin Directorate – Blagoevgrad and (iv) East Aegean Basin Directorate – Plovdiv. Directorates develop River Basin Management Plans and Flood Risks Management Plans. They are also responsible for issuing permits for water use

and abstraction, for controlling the compliance with the parameters set in these permits, for controlling the activities in river beds, and for water quantity and quality monitoring. Their management of water is based on basin principles.

**Water Associations** are non-profit legal entities. They manage water supply and sewerage systems within the boundaries of a designated territory in the cases where water supply and sewerage system ownership is divided either between the state and one or more municipalities or among several municipalities. If the WSS system, which falls within the specified territory, is the property of a single municipality, the management is performed by the municipal council.

The governing bodies of a Water Association include a General Assembly, which consists of representatives of the state (District Governor), and the municipality(ies), with the district governor being the chairman. In the cases where the state and more than one municipality participate in the Water Supply and Sewerage Association, the state is entitled to 35 per cent of the votes, and the other 65 per cent of the votes are allocated among all municipalities in proportion to their population. The funds necessary for the Water Associations operation are provided by the state and municipalities according to the proportion of their votes.

Regarding the Water Act, water associations are responsible for the preparation of the regional Master Plans and the investment programmes attached to the plans. Assignment and approval of these specific Regional Master Plans is made by the MRDPW. The regional Master Plans are accepted and approved by the MRDPW only after they are endorsed by the respective Water Association or Municipal Council.

**Water supply and sewerage companies (WSSC)** (referred to as ViK, VKS, VKTV or INFRASTROI in the Central Region) are responsible for the operation, management and maintenance of water supply and sewerage facilities in the settlements as well as the provision of water supply and sewerage services to consumers. A WSSC is a commercial, state or municipal company – a legal entity, which has signed a contract with the chairman of the corresponding Water Association or with the mayor of the respective municipality. The term of the contract with a WSSC, signed in accordance with the Water Act, cannot be longer than 10 years, provided that it does not include an obligation for the WSSC to build new water and sewerage infrastructure; or 15 years, if it obliges the WSSC to undertake construction of new infrastructure. In all other cases, the procedure and selection of a water operator as well as the signature of the contract is carried out in accordance with the Concession Act.

**Municipalities** are direct beneficiaries of the OP "Environment". The **mayor** of a municipality develops and implements the policies related to planning, management, construction, reconstruction and modernization of water supply and sewerage networks and facilities that are municipal property.

**Municipal councils** control the municipal participation in water supply and sewerage companies (in those companies, in which the municipalities have shares). They also approve municipal development plans and mayor’s statements regarding the business plans developed by WSSCs.

The **State Energy and Water Regulatory Commission (SEWRC)** are responsible for regulating the tariffs, affordability and quality of water supply and sewerage services under the Water Supply and Sewerage Services Regulation Act.

The **Environmental Executive Agency** under the Minister of Environment and Water guides the National environmental monitoring system.

## 1.2.2. REGULATORY FRAMEWORK

### *1.2.2.1. Regulatory Framework in Bulgaria*

The regulatory framework in Bulgaria includes the following acts, laws and policies (see Appendix 1-2 for more details):

- **The Water Act (WA):** The WA (SG 67/27.07.1999; last proposal for amendment April 2012) is the main legal act in Bulgaria that sets out the relations in the management of water as a nation-wide natural resource.
- **New Draft Water Law:** *Draft Law on amendment and supplements to the Water Act,* which has been prepared in April 2012.
- Draft National strategy on management and development of the water sector: it has been elaborated according to the requirements of art. 151 of the WA.
- **Environmental Protection Act (EPA):** The EPA (SG91/25.09.2002) is the basic act concerning all environmental components – air, water, soils, ground, landscape, natural sites, biodiversity and their interrelation.

Other relevant policies and regulations are:

- State policy for protection of the environment
- The Regulation of Water Supply and Sewerage Services Act (RWSSSA)

### *1.2.2.2. Regulatory Framework in the European Community*

The main Directives of the European Union concerning the water and wastewater sector are listed below (see Appendix 1-3 for more details):

- The Water Framework Directive 2000/60/EC establishing a legal framework to protect and restore clean water across Europe and ensuring its long-term, sustainable use.
- Directive 91/271/EEC on urban waste-water treatment Directive 75/440/EEC concerning surface water used or intended for the abstraction of drinking water
- Directive 2006/118/EC concerning the protection of groundwater from pollution and worsening
- Directive 2006/7/EC concerning the quality of bathing water
- Directive 1975/EC concerning the bathing waters quality

- Directive 98/83/EC concerning the quality of water intended for human consumption
- Directive 2006/44/EO on the quality of fresh waters needing protection or improvement in order to support fish life and Directive 2006/113/EO on the quality required of shellfish waters
- Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources
- Directive 80/68/EEC on the protection of groundwater against pollution caused by certain dangerous substances
- Directive 2006/11/EC on water pollution caused by certain dangerous substances discharged into the aquatic environment of the Community and seven daughter Directives
- Directive 85/337/EEC on Environmental Impact Assessment
- Directive 2004/35/EO on environmental liability with regard to the prevention and remedying of environmental damages
- Directive 90/313/EEC repealed by Directive 2003/4/EC on public access to environmental information
- Directive 2001/42/EC on environmental impact assessment of certain plans and programmes
- Directive 80/777/EC on rapprochement of member states legislations concerning exploitation and selling of natural mineral waters
- Directive 2003/40/EC on making list, concentration limits and requirements for show-cards about the natural mineral waters components and conditions for the use of ozone treated air on natural mineral and sources waters
- Directive 2008/56/EC on EC action framework creation for the maritime environment policy
- Directive 2007/60/EC on evaluation and management of flood' risk
- Directive 92/43/EEC on protection of natural habitations and wild flora and fauna
- Directive 2009/90/EC on determination according to Directive 2000/60 of technical specifications for chemical analysis and monitoring of water's
- Directive 86/278/EEC on environment protection and especially of earth after using sludge from waste water treatment in agriculture
- IPPC Directive 2008/1/EC ("Integrated Pollution Prevention and Control") aims to achieve a high level of protection of the environment through prevention and reduction of integrated pollution from a wide range of industrial and agricultural activities. It is the codified version of Directive 96/61/EC of 24 September 1996. The IPPC Directive will gradually be replaced by Directive 2010/75/EU on industrial emissions directive called IED. This new directive brings together in a single text seven separate directives on industrial emissions. IED Directive came into force January 6, 2011 and must be transposed by January 7, 2013.

- Directive 2008/98/EC of 19 November 2008 on waste and repealing certain Directives is the relevant Solid Waste Directive mentioned thereafter.

#### 1.2.2.3. International Agreements and Conventions

The international agreements and conventions in the field of water management and those with water reference in the field of environment protection are:

- Convention for Cooperation for Protection and Sustainable Use of Danube River, ratified in 1999 (SG, no 30 of 1999), enforced on 6.04.1999
- Convention for Protection of Black Sea against Pollution, ratified in 1992 (SG, no 99 of 1992), enforced on 15.01.1994
- Convention for Protection and Use of Cross border Water Streams and the International Lakes, ratified in 2003 ( SG, no 86 of 2003), enforced on 26.01.2004
- Convention for Wetlands of International Importance, especially as habitats for water birds (Ramsar Convention), ratified in 1974, enforced on 24.01.1976
- Convention for Environmental Impact Assessment in Cross Border Context, ratified in 1995 (SG, no 28 of 1995), enforced on 10.09.1997
- Agreement between the European Community and the Republic of Bulgaria in relation to the participation of the Republic of Bulgaria in the European Environmental Agency and the European Network for Information and Monitoring, ratified in 2000

### 1.2.3. STAKEHOLDERS

The main stakeholders and their role in the project are summarised in the following table:

*Table 1-1 Main stakeholders involved in preparation of the Regional Master Plans*

| Stakeholder | Role |
|---|---|
| Ministry of Regional Development and Public Works (MRDPW) | MRDPW drives the preparation of the Regional Water Supply and Sewerage Master Plans and approves them. It is also responsible for coordinating the management of water supply and sewerage systems at national level. The ministry functions as the principal in the 100% state-owned and the jointly owned WSSCs. It also coordinates the activities of water associations and provides methodological guidance on the preparation of the Regional water supply and sewerage Master Plans.<br>Changes in the new Strategy:<br>MRDPW shall prepare and maintain a National Register of water infrastructure, including owners and operators of facilities;<br>MRDPW elaborates an Integrated Plan for Water Infrastructure<br>MRDPW manages facilities – state property in the water sector |
| Ministry of Environment and Water (MoEW): | The MoEW is responsible for environmental protection and the implementation of the Operational Program "Environment", under which water and wastewater infrastructure, included in the investment program projects, will be funded. MoEW is involved in the approval of the |

| Stakeholder | Role |
|---|---|
| | Regional Master Plans. |
| Ministry of Economy, Energy and Tourism (MEET) | Changes in the new Strategy:<br>Management of all dams, used for drinking water and hydro-energy purposes<br>Control of the technical condition of dams and micro dams by “Dams and cascades” enterprise |
| Ministry of Agriculture and Foods | Changes in the new Strategy:<br>Management of all dams in public state ownership not managed by the Ministry of Economy, Energy and Tourism, signing contract for maintenance and monitoring with the operator for irrigation systems |
| Ministry of Health | Responsible for monitoring drinking water quality. Gets information on problems related to water quality. |
| Ministry of Labour and Social Policy | Changes in the new Strategy:<br>Creation of a new program “Water Assistance” which aims at helping the population with low revenues to pay the water service fees. |
| VKS EOOD Peshtera (WSSC) | Provides water supply and sewerage services within Peshtera designated territory. Operates and maintains water supply systems and facilities; supplies data for the project. Involved in the preparation of Business Plans including tariffs. It is also the project beneficiary. |
| Peshtera Municipality | Formulates and implements the water sector policy at local level. Responsible for the investments in the water supply and sewerage sector on the territory of the municipality. It is a direct beneficiary of OP "Environment“. It is involved in the preparation of Municipal Development Plans and in the approval of the Regional Master Plans. |
| Water Association | Non-profit legal entity, which plays the role of a union of the owners of water supply and sewerage systems. Management of water supply and sewerage systems within the boundaries of the designated territory. Responsible for the preparation of the regional Master Plans and the investment programmes attached to the plans. Approval of Regional Master Plans. The Municipality of Peshtera is not part of any Water Association yet. |
| State Energy and Water Regulatory Commission (SEWRC) | Responsible for the regulation of water tariffs, affordability and the quality of water supply and sewerage services under the Water Supply and Sewerage Services Regulation Act. It also approves the Business Plans of the WSSCs.<br>Changes in the new Strategy:<br>Prices regulation not only in the water sector but also in the “Hydro-energy” and “Hydro-melioration” sectors. Defining the price level, taking into account the necessity for implementation of priority investments by the owners of the facilities. |
| East Aegean Basin Directorate – Plovdiv | Responsible for the management of surface waters, underground waters and other water resources which are state owned. Provides database with maps, GIS data, water quality and quantity. Conducts water monitoring. Grants permits for discharge and water intakes. |
| Regional Inspectorate of | Responsible for Environmental Impact Assessments. Advices on |

| Stakeholder | Role |
|---|---|
| Environment and Water (RIEW) - Pazardzhik | Environmental Impact Assessments. Approval of EIA screening report. |
| European Commission | Approval of the Regional Master Plans. Financing of projects included in the investment programmes through EU funds. |
| World Bank | Financing projects and Regional Master Plans. |
| Regional Inspectorate of Protection and Control of Public Health – Pazardzhik | RIPCPH Pazardzhik is an administrative structure of the Ministry of Health, which is responsible for the organization and implementation of the state health policy on the territory of district Pazardzhik. RIPCPH develops and participates in the implementation of regional programmes and projects in the area of health control; collects and summarizes information about the quality of drinking water in the region. |

### 1.2.4. Regulation of Water Supply and Sewerage Services Provision

The service performance of water companies is managed at national level, basin level, regional, and municipal level. The regulation at each level is performed by the authorities as described in the table below:

*Table 1-2 Regulation of Water Supply and Sewerage Services Provision*

| Level of Regulation | Authorities involved | Role of Regulating Authorities |
|---|---|---|
| National level | The Ministry of Regional Development and Public Works | Implements the state policy pertinent to operation, construction, rehabilitation and modernization of water systems and facilities |
| Basin level | Basin Directorates | Develop river basin development plans, and programs for measures for improving, protecting and maintaining the state of waters |
| Regional level | Regional Environmental and Water Inspectorates Regional governors | Environmental and water protection |
| Municipal level | Mayor | Implements the policies pertinent to activities involving operation, construction, rehabilitation and modernization of water systems and facilities – municipal property |
| | Municipal councils | Implement the rights of the sole-owner in the RWSSCs, solely owned by the municipalities or the rights of the shareholder in the RWSSCs, jointly owned by the state and the municipalities. |

The service performance regulation is performed at two levels – external and internal. The external regulation is performed by the State Energy and Water Regulatory Commission. The regulation principles are set in the Ordinance on the long-term level, the conditions and the order for the annual target levels of the indicators of water supply and sewerage services quality. The internal regulation is performed by the company shareholders through the general principles set in the Commercial Act, the Regulation on the Order for Execution of the Rights of the State in the Commercial Companies with

State Share in the Capital, the company's Constitutive act and the contract for management assignment.

The **Water Supply and Sewerage Services Regulation Act** establishes the legal framework for the regulation of prices, accessibility and quality of water-supply and sewerage services provided by the water supply and sewerage companies.

The prices and quality of water supply and sewerage services are regulated by the **State Energy and Water Regulatory Commission (SEWRC)**, regardless of the forms of ownership and management of water supply and sewerage systems. The Commission is guided by the following principles:

1) Ensuring conditions for provision of universal access and social affordability of water supply and sewerage services;
2) Prevention of abuse of dominant position;
3) Protection of consumer interests;
4) Economic justification of water supply and sewerage services prices;
5) Taking into consideration the needs of consumers placed at a disadvantage for geographic, ground or other reasons;
6) Creation of conditions for water and sewerage operators to operate and maintain the system and to make investments upon reduction of operating costs;
7) Encouragement of expedient and effective planning of investments in time;
8) Speed and procedural economy of proceedings before the Commission;
9) Encouragement of reduction of water losses, efficient and economic use by consumers of the water quantities delivered;
10) Environmental protection;
11) Creation of conditions for attraction of resources for investment and participation of the private sector in the provision of water-supply and sewerage services;
12) Encouragement of introduction of modern technical methods and achievements in the provision of water-supply and sewerage services.

SEWRC measures and assesses the quality of water supply and sewerage services by means of the following quality indicators:

1) Coverage rate of water supply services;
2) Drinking water quality;
3) Non-interruption of water supply (uninterrupted water delivery and duration of disruptions);
4) Total water losses in the water-supply systems and time limits for the reduction thereof;
5) Water supply system breakdowns;
6) Water supply system pressure;

7) Sewerage service coverage rate;
8) Raw wastewater and treated wastewater quality;
9) Sewerage system breakdowns;
10) Flooding of third party corporeal immovable caused by the sewerage system;
11) Operational indicators of efficiency;
12) Financial indicators of efficiency;
13) Time limit for reaction to written complaints by consumers;
14) Time limit for connecting new consumers with the water supply and sewerage systems;
15) Staff size in proportion to the number of consumers serviced.

The Commission regulates prices by setting an upper limit for prices or for revenues and a rate of return. Price regulation methods, pricing rules reflecting the structure of costs, the procedure for price proposal submission and for the endorsement thereof, as well as the procedure for disclosure of information, are determined by an ordinance adopted by the Council of Ministers on a motion by the Commission. WSSCs submit the prices formed according to this ordinance to the Commission for endorsement. The prices proposed by the WSSCs may not be higher than the prices endorsed by the Commission. The tariff is proposed for each planning period. The application must be submitted not later than four months before expiration of the old price period or the coming into force of the proposed approval or change of the approved price.

### 1.2.5. LEGAL ASPECTS OF FUNDING OPPORTUNITIES

After amendments were made to the Water Act in 2009, it was decided that the ownership of the former state and municipal water companies would be removed from their assets and become public state and public municipal property to be managed by water associations. The purpose of the change was to make it possible for them to participate in the utilization of funds under Operational Program "Environment" and to use EU funds for renovation of the water network. The upgrade and construction of water and wastewater treatment infrastructure is set as Priority 1 of OP "Environment". 71.3 % of the total financial package or nearly EUR 1.3 billion has been allocated to this priority for the period 2007-2013. 80 % of this amount, i.e. EUR 1.03 billion is provided by the Cohesion Fund of the EU and the remaining amount – by the national budget. Funding for the water sector is also provided under the National Plan for Rural Development (EUR 600 million), the Regional Development Operational Programme (EUR 150 million), the pre-accession programme ISPA (unallocated funding for 2007-2010 to the amount of EUR 300 million), the World Bank (over EUR 100 million). The projected investments from the private sector are expected to amount to EUR 2 billion.

When one or more municipalities apply for European Union funds for reconstruction and modernization of water supply and sewerage facilities - public state property, they make a request to the Minister of Regional Development and Public Works for a change of the facility ownership, indicating the program, the name of the procedure by which proposals

will be submitted and the deadline for their submission, if such is defined. The Minister of Regional Development and Public Works, within one-month period from the submission of the request, submits a draft decision to the Council of Ministers for a change of the facility ownership from public state to public municipal. By decision of the Council of Ministers the ownership of the facility is granted to the municipalities, provided that it is reconstructed or modernized in whole or in part with funds received under programs financed by European Union funds.

The municipal budget is the main financial plan of a municipality for a fiscal year and its framework must be robust and adaptable, allowing the municipality to accumulate substantial resources in support of its municipal priorities and initiatives. Since 2003, municipal budgets are drawn up and implemented under the conditions of fiscal decentralization. The division of expenditure responsibilities between the state and municipalities increased the responsibilities of the municipalities for determining their own revenue, which is the main source of funding of municipal activities. Municipal budgets are developed in accordance with Art. 11 of the Municipal Budgets Act, the State Budget Act of the Republic of Bulgaria, Decision № 937/08.12.2009 of the Council of Ministers, and the local regulations in force, adopted by decisions of the local Municipal Council.

The strategic development plan of a municipality is the main document determining the strategic objectives and priorities of the municipal policy, developed in accordance with the requirements of the Law on Regional Development and the National Strategy for Regional Development of the Republic of Bulgaria for the period 2005-2015. The plan is the starting point for directing the efforts of the municipal management and all interested parties in the municipality to reach the objectives of that development and turn the strategic planning into a main instrument for the development of the municipality.

In the Municipality of Peshtera, the capital expenditures for the year 2012 amount EUR 212,453.

### 1.2.6. CONCLUSIONS AND RECOMMENDATIONS

As a member of the European Union, Bulgaria has harmonised its water and environmental legislation with the one of the EU. The European legislation in the field of water management is transposed to the Bulgarian legislation by means of the Water Act and the regulations for its implementation.

The effective policy in the water supply and sewerage sector is the most important commitment of Bulgaria joining the EU. The main investment and management tool of the Government in this area is the OP "Environment", by means of which the sector can be financially supported by EU funds. Municipalities were defined as the sole beneficiary of this funding.

For the purposes of effective management, planning and construction of water supply and sewage systems and the provision of water supply and sewerage services, the territory of the country has been divided into 51 separate areas. Their limits and coverage are essential for the formation of the water associations, which provide integrated

management of water systems consisting of two main groups of ownership of the water assets - public state and public municipal property.

The planning of the development of the water supply and sewerage systems is done by means of Regional Master Plans and Long-term investment programs. These plans and programs consider all the settlements in the studied area and, in accordance with the Terms of Reference, more in depth analysis are given for settlements with population over 2,000 inhabitants for the water supply part and agglomerations with over 2,000 equivalent inhabitants for the wastewater part. The Regional Master Plans and are prepared for a period of 25 years. The scope of work for the plans and programs includes performing a comprehensive analysis of the conditions of the water supply and sewerage systems and facilities, setting objectives and priorities for the development of water supply and sewerage systems and the development of short and long-term investment programs. One of the main requirements for the plans is that they contribute towards meeting the requirements of the European Directives for the use and treatment of water, and to ensure the effectiveness of public investment in the water supply and sewerage infrastructure.

Numerous stakeholders are involved at the national, regional and local levels. Ministries play a significant role at the national level: The Ministry of Environment and Water is responsible for the management and distribution of water resources, while the Ministry of Regional Development and Public Works is in charge of the overall policy related to the design, construction and operation of water supply and sewerage systems. The MRDPW also drives the preparation of the regional water supply and sewerage Master Plans and approves them. Basin Directorates undertake water management at the basin level and regulate permit issuance for water abstraction. At the local level, municipalities formulate and implement the water sector policy. Besides, Water Supply and Sewerage Companies are commercial, state or municipal companies that operate and maintain water supply and sewerage facilities. They are contracted by municipalities or by Water Associations. The latter are non-profit legal entities which manage water supply and sewerage systems when the systems' ownership is divided either between the state and one or more municipalities or among several municipalities. Regarding the Water Act, Water Associations are also responsible for the preparation of the Regional Master Plans and therefore must endorse them before approval of MRDPW. The regulation of water tariffs, affordability and quality of water supply and sewerage services is undertaken by the State Energy and Water Regulatory Commission.

Since commercial entities, such as WSSCs, cannot apply for EU funds, Water Associations may undertake this responsibility as non-profit legal entities. Therefore, a procedure has been implemented so that the ownership of water and sewerage facilities can be transferred from state and municipal companies to Water Associations. The Ministry of Regional Development and Public Works receives requests which must be subsequently approved by decision of the Council of Ministers. This procedure aims to facilitate the implementation of the OP Environment and the use of EU funds for reconstruction and modernization of water supply and sewerage infrastructure.

The regulatory framework is based on a few texts. The main legal act is the Water Act (1999) which sets out the relations in the management of water as a nation-wide resource

and regulates the state policy for the operation, construction, reconstruction and modernization of water supply and sewerage infrastructure. The scope of the Water Act spans interdisciplinary fields: It regulates for example water body statuses, issuance of permits for water uses and water intakes, land easements, water protection, financial and economic organization in water management, administrative and citizen responsibilities etc. It is supported by 14 ordinances that specify terms and conditions or requirements for specific activities related to water. This Water Act is to be amended and supplemented in the future as a Draft Law has already been prepared in April 2012. Those new components of the Water Act come mainly from the transposition of European Union Directives. Along with the Water Act, two laws complement this regulatory framework: The Environment Protection Law (2002) for questions related to environmental components (including air, water, soils, ground, landscape, and biodiversity) and the Regulation of Water Supply and Sewerage Services Act for prices, accessibility and water supply and sewerage services quality.

# 2. DATA COLLECTION AND REVIEW

## 2.1. PROJECT AREA

### 2.1.1. REGIONAL MASTER PLAN STUDY AREA

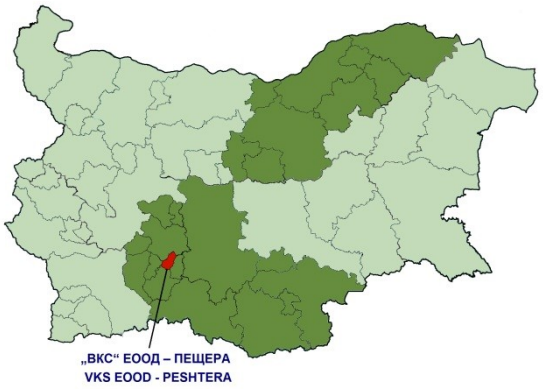



*Figure 2-1 Map of the Regional Master Plan study area*

The Regional Master Plan study area covers the designated territory of VKS EOOD Peshtera, encompassing the territory of Peshtera Municipality and the following settlements: the town of Peshtera and the villages of Radilovo and Kapitan Dimitrievo.

Peshtera Municipality is located in the southern part of Pazardzhik District. To the North and Northwest of Peshtera Municipality is located Pazardzhik Municipality, to the West - Rakitovo Municipality, to the South and Southwest - Batak Municipality and to the East - Bratsigovo Municipality. Peshtera Municipality is situated at the foot of the relatively low North-western hills of Western Rhodopes in a picturesque valley. It encompasses an area of 174.72km². It is located in South Central Bulgaria in the Western Rhodopes part of the Ossogovo - Rhodopes zone.

The town of Peshtera is in the centre of the Municipality. It is located 20 km south from Town of Pazardzhik, 40 km Southwest from Town of Plovdiv and 125 km from Sofia City.

A road, passing along the gorge of Stara Reka River, connects the municipality with the villages of Byaga, Isperihovo and Novo Selo to the East; the city of Plovdiv and the town of Bratsigovo to the Southeast; the towns of Batak, Velingrad, Dospat and the dams "Batak," "Beglika", "Shiroka Poliana" and "Dospat" to the West. The road to the district centre is branched off one kilometre to the Northeast from the town of Peshtera. This road provides a direct transport link to the settlements in the Municipality - the villages of Radilovo and Kapitan Dimitrievo.

### 2.1.2. ADMINISTRATIVE DIVISIONS


*Figure 2-2 Location of VIK EOOD - Peshtera in Pazardzhik District*

Peshtera Municipality has an area of 174.72km$^2$ and a population of 18,899 people (NSI data as of 01.02.2011). It includes the town of Peshtera (16,746 inhabitants), the villages of Kapitan Dimitrievo (768 inhabitants) and Radilovo (1,385 inhabitants) and Saint Constantine Holiday Resort. The Municipality is part of Pazardzhik District and falls within the South-Central planning region. By its territory, Peshtera Municipality is the smallest municipality within Pazardzhik District, occupying only 3% of its area.

In the case of VKS EOOD Peshtera, the designated territory coincides with Peshtera Municipality and water systems and facilities are public municipal property.

*Table 2-1 Administrative units*

| Settlements | EKATTE | Municipality of | District of |
|---|---|---|---|
| Town of Peshtera | 56,277 | Peshtera | Pazardzhik |
| Village of Radilovo | 63,371 | Peshtera | Pazardzhik |
| Village of Kapitan Dimitrievo | 36,124 | Peshtera | Pazardzhik |

### 2.1.3. RIVER BASINS

The territory of Peshtera Municipality includes parts of the water catchments in the middle and upper streams of Stara Reka and Dzhurkovitsa (Pishmanka) Rivers, which are right tributaries to Maritsa River. Stara Reka River is the main water artery in the boundaries of the Municipality. It springs from the foot of mount Batashki Snezhnik at an altitude of

2,082 m, Batashka Mountain, Western Rhodopes. Its tributaries are the rivers Dalbochitsa, Novomahlenska, Pizditsa and other smaller gullies and gorges. Along the river valley, there are 3 towns and 15 villages and a big part of the territories of the municipalities of Batak, Peshtera and Bratsigovo. After the construction of the facilities of the cascade “Batashki vodnosilov pat”, about 50% of the average yearly runoff flow of Stara Reka River was taken away, and this led to a disruption of the natural runoff conditions.

Stara Reka River is the main source of surface water in the region. It is also a major water receiving body of domestic and industrial waste water in the municipality. According to Ordinance № 7/86 on the indicators and norms determining the qualities of surface running water, Stara Reka River at the town of Peshtera is a receiving body of II project category water site.

## 2.2. NATURAL FEATURES

### 2.2.1. GEOGRAPHICAL FEATURES

*Figure 2-3 Overview of the town of Pestera*

Peshtera Municipality is located in the Western Rhodopes Region of the Ossogovo - Rhodopes zone. Here are located parts of the Besaparski, Karkarski and Batak Hills. The terrain is hilly. The highest points of the Municipality include the Eastern slopes of Karkariya hill and the Northern slopes of Batashka Mountain hills. They are fragmented by the valley of the Stara Reka River and its tributaries. A road, passing along the gorge of Stara Reka River, connects the municipality with the villages of Byaga, Isperihovo and Novo Selo and the city of Plovdiv to the East; the town of Bratsigovo to the Southeast; the towns of Batak, Velingrad, Dospat and the dams "Batak," "Beglika", "Shiroka Poliana", "Dospat" to the West.

Peshtera town is located at the boundary between the Southwestern part of Gornotrakiiskata lowland and the Northwestern part of the Rhodopes Mountain and to the South and the West it is surrounded by it. To the North and Northeast it is open towards the Gornotrakiiskata lowland. The altitude of the town is 450 meters.

Out of the total area of Peshtera Municipality, 10,031 ha are agricultural land, 7,001 ha are forestry fund and 440 ha are urbanized territory in the town area. 57.4% of its territory is taken by agricultural lands and 40% is taken by forestry fund. This sufficient reserve provides an opportunity for development of logging, wood industry and hunting tourism.

### 2.2.2. CLIMATIC CHARACTERISTICS

The region of Peshtera Municipality is part of the intermediate- continental subzone of the European continental climatic zone. Climatic and meteorological parameters are significantly affected by the relief features of the region and its proximity to Gornotrakiiska lowland. The Municipality is characterised by moderate continental climate. No severe temperature variations are observed.

Climate is one of the preconditions for availability of natural groundwater and surface water in the designated territory.

The morphographical features of the region have a big influence on the rainfall pattern. The Northern parts of Western Rhodopes are in a rainfall “shade” and there is less rainfall compared to the same altitudes in other regions. Average yearly rainfall is between 500 mm, in the low parts and from 750 mm to 1,000 mm in the high mountain belt. The maximum amount of rainfall is observed in June and the minimum in September. The average yearly amount of rainfall at Peshtera station is 610 mm. Division by seasons is as follows: winter- 131 mm, spring- 182 mm, summer- 157 mm and autumn- 139 mm.

With the increase of the altitude, temperatures drop and there are more favourable conditions for thicker snow cover. At altitudes from 1,500 m to 2,000 m, the snow cover lasts for about 200 days and in March reaches 180 cm. During the spring season, high water of Stara Reka River is fed from melting snow. The average thickness of the snow cover is about 10 cm and the average yearly number of days with snow cover is about 27.

The prevailing winds are from the Northeast and the Northwest and their frequency is almost identical.

### 2.2.3. ENVIRONMENTAL AND ECOLOGICAL FEATURES

#### *2.2.3.1. Air*

Air is polluted by partial /accidental/ emissions from the treatment facilities of BIOVET AD, by the motor vehicles crossing the town and by burning wood, coils, petroleum, etc.(mainly during winter due to domestic heating of private and public buildings). For the villages of Radilovo and Kapitan Dimitrievo, pollution is insignificant and does not exceed the permissible levels.

#### *2.2.3.2. Lands and soils*

Soils and agricultural lands are the main natural resource underlying economic development (development of agriculture, animal breeding and use of raw materials for food industry development). Introducing good agricultural practice, providing controlled

fertilization, preventing unauthorized accumulation of manure masses from animal farms and of solid domestic waste, etc. will ensure soil and water protection in the region.

Peshtera Municipality has a total area of – 17,472 ha. The distribution is as follows: Agricultural land – 10,031 ha (57.4%); Forests – 7,001 ha (40.1%); Urbanized territory within the planning boundaries - 440 ha (2.5 %). There is potential to develop food industry, timber industry, wood-processing and hunting tourism.

Soils on the territory of the Municipality are mainly polluted by industry, transport, plant protection activity (PPA), landfills. Soil pollution with heavy metals and presence of acidic or saline soils has not been found.

There are many locations in the designated area, comprising small farms, which store manure illegally and its subsequent use is a precondition for diffuse ground and surface water pollution. It is necessary that animal farms execute the Rules for good agricultural practice protecting water and soils from contamination with nitrates released by agricultural sources.

As a result of wind erosion, part of Peshtera Municipality is deforested (over the past years, the State Forestry Administration of Peshtera has carried out afforestation activities aiming at soil conservation).

Over the past years, a tendency of reducing land and soil pollution has been observed. Economical use of pesticides and fertilizers in agriculture programmes for ecological agriculture and stock-breeding, control introduced to limit the emission pollution related to air, waters and waste management, technological renewal of production processes are activities leading to reduction of land and soil degradation.

### *2.2.3.3. Water*

- **Surface water**

Stara Reka River is the main receiving body of waste water from the town of Peshtera. Waste water from the town of Peshtera, the villages of Dimitrievo and Radiolovo and the Saint Constantine Holiday Resort is currently discharged into the water bodies without any treatment and exerts substantial negative influence on water ecosystem. Waste water containing high levels of organic substances, biogenic elements, etc., is directly discharged. Oxygen content and self-cleaning capacity of water bodies is reduced, Health risk conditions are created with regard to the population in the region. There are high levels (isolated samples) of the main pollutants: ammonium nitrogen, nitrite and nitrate nitrogen, phosphates, detergents, etc., after urban wastewater discharge points.

A more significant site-emitter, influencing surface water in the town of Peshtera is Biovet AD– a company producing food additives, pharmaceutical products, intermediate pharmaceutical forms and active substances. The enterprise has an integrated permit (IP) and a programme for water protection and rational use. Biovet AD-Peshtera uses process water from a river intake, connected to the lower channel of Peshtera Hydroelectric power plant, as well as a small amount of groundwater from an own water source in the Quaternary aquifer. Two boreholes have been constructed for own monitoring of groundwater condition on the territory of WWTP. Wastewater is treated in WWTP having

three stages of biological step and the sludge after being treated and stabilised is used as a soil enhancer “Kompovet”.

A major point pollution source of Stara Reka River is the wastewater directly discharged by the population and the industries of the town of Peshtera through 3 urban collectors. An Urban Wastewater Treatment Plant (UWWTP) is to be constructed. Vinprom Peshtera AD is significant site, discharging waste water into the urban sewerage without any pre-treatment.

- **Groundwater**

In the region of Peshtera Municipality, there are mostly upstream springs from the cracks in the rhyolite, part of the Bratsigovo- Dospatsko drop, distinctive for this part of the Rhodopes. Southwest from the town in the region of the formed karst where the cave “Snezhanka” is located, a number of small karst springs exist, which in the dry periods become dry. Ground waters are observed in the small river terraces around Stara Reka River and in the alluvial deposits in the valley near the road to Bratsigovo. The derivation canal from WEP “Batak” used for a daily equalizer of WEP “Aleko” forms several migrating springs and feeds a groundwater lens of PS “Stariya Kainak”. Biovet Peshtera uses a small amount of groundwater for technical needs from their own source (from a quaternary aquifer).

There are no known springs and mineral waters fields on the territory of Peshtera Municipality.

### 2.2.3.4. Noise pollution

Pursuant to the Environmental Noise Protection Act, inspections of the industrial companies, sources of environmental noise, have been conducted yearly. No exceeding of regulatory requirements has been found.

### 2.2.3.5. Waste management

Peshtera Municipality includes the following settlements: the town of Peshtera and the villages of Radilovo and Kapitan Dimitrievo. Saint Constantine Holiday Resort is located 18 km away from the town. Peshtera Municipality has available an approved waste management. Domestic and construction waste neutralisation is carried out at the municipal landfill in Gramadite area – land belonging to the town of Peshtera. The rural solid waste landfills have been closed - in the villages of Radilovo and Kapitan Dimitrievo and the unauthorised landfill serving the holiday resort. Currently, the only illegal landfill is situated around the Romany quarter of Lukovitsa, which is to be eliminated. There is neither effective system for separate collection of domestic waste nor biodegradable waste composting.

The municipal territory includes two industries, which use and store large amounts of hazardous chemical substances and preparations- Vinprom Peshtera AD and Biovet AD. No violations of the regulatory framework, related to storage of hazardous chemical substances and preparations, have been asserted in those sites. There are no violations found in the other companies and sites located on the municipal territory.

### 2.2.3.6. Population and human health

The factors of surrounding and working environment, with levels above the standard and continuous expositions, could have an adverse effect on the health of population and labourers at individual sites, included in the implementation of investment programmes.

Data indicate that air pollution cannot cause a significant adverse effect on the health of population living in the town of Peshtera and the other settlements in the Municipality, as no levels above the standard with continuous expositions have been measured.

### 2.2.3.7. Biodiversity, protected areas and zones

Peshtera Municipality is one of the Bulgarian municipalities having rich biodiversity.

*Table 2-2 Protected areas within the territory of VKS EOOD - Peshtera*

| № | Name of Protected Area | Settlement | Establishment Order | Updating Order of surface area/ ha |
|---|---|---|---|---|
| 1 | Reserves | | | |
| 1.1. | *"Kupena"* Biosphere Reserve of world importance (protected by UNESCO). | Peshtera Municipality and Bratsigovo Municipality. The two rivers of Pzditsa and Novomahlenska run through the reserve. | 24.09.1961 | Total surface area of 1 761 ha |
| 2. | Protected localities /PL | | | |
| 2.1. | *"Sokola"* | Peshtera Municipality | 1973 | Total surface area of 127 ha |
| 2.2. | *"Gramadite"* | Peshtera Municipality and Bratsigovo Municipality | | |

According to Habitats Directive and Birds Directive, parts of the territories of the protected zones of Natura 2000 fall within the designated territory of VKS EOOD Peshtera.

*Table 2-3 Natura 2000 protected zones in the designated territory of VKS EOOD - Peshtera*

| № | Protected zones | Scope | Surface Area/decares |
|---|---|---|---|
| 1. | According to Habitats Directive 92/43/EEC on the conservation of natural habitats and of wild flora and fauna | | |
| 1.1 | *„Besaparian Hills" Protected Zone, code BG0000254* | situated in the southwest part of the Thracian lowland at the foot of the Rhodopes in Peshtera, Blagoevgrad and Smolyan Districts | 67,430.6 decares |
| 1.2. | *Western Rhodopes Protected Zone, code BG0001030* | Peshtera, Blagoevgrad and Smolyan Districts<br>The zone is a key location for bear protection.<br>The site of WWTP Peshtera is located about 3 km north of the nearest point of the protected zone | 2,728,514.1 decares |

| № | Protected zones | Scope | Surface Area/decares |
|---|---|---|---|
| 2. | According to Birds Directive 79/409/EEC on the conservation of wild birds | | |
| 2.1 | *„Besaparian Hills" Protected Zone, code BG0002057* | Encompasses the territories of Pazardzhik and Plovdiv Districts Pazardzhik, Bratsigovo, Peshtera, Stamboliyski and Krichim, limited to the East and North by Vacha and Maritsa Rivers | 1,528,562.5 decares |
| 2.2 | *Western Rhodopes Protected Zone, code BG0002063* | | 1,335,724 decares |

According to Order № RD – 970 of 28.07.2003 of the Minister of Environment and Water, the water site of Stara Reka River and its tributaries are not classified as "sensitive zone" and do not require any specific management system aiming to prevent or reduce the entry of biogenic elements into the water bodies, followed by deterioration in the ecological status of the surface water bodies. It is not necessary to reach individual emission limits of treated waste water, discharged into the water sites from the catchment area with regard to nitrogen and phosphorus content.

#### 2.2.3.8. Conclusion

The Project implementation will solve a number of environmental issues in the region, which are currently creating preconditions for population health risk in the area, by:

- Ensuring high quality of living space and environment. Preventing situations creating health risk for the population in the designated territory as well as risk for water ecosystem;
- Providing sufficient quantity of good quality water to the population. Reducing water losses in the water supply network;
- Eliminating discharge of untreated waste water from the industry and the population of the town of Peshtera and the villages of Radilovo and Kapitan Dimitrievo as well as from Saint Constantine Holiday Resort;
- Constructing missing sewerage of some sections in the settlements of the municipality and modern treatment facilities.

### 2.2.4. GEOLOGICAL AND HYDRO-GEOLOGICAL CONDITIONS

#### 2.2.4.1. Geological - Lithological Structure

In terms of structure, the territory of Peshtera Municipality and the area around it, falls within the northern part of Rhodopes massif and the southern part of Maritsa fault zone – The lithostratigraphic section of these structural units includes Precambrian metamorphites, upper Cretaceous, paleogenic, paleogenic-neogenic and Neogene sediments and volcanogenic rocks and Quaternary formations (Kozhuharov, etc., 1990).

### 2.2.4.2. Engineering-Geological Conditions

The above-stated information on the geological-lithological structure implies that the implementation of the water supply and sewerage network of the treated settlements will be carried out under engineering-geological conditions, determined by the physico-mechanical properties of:

- Quaternary formations and Neogene sediments, classified as „earth soils", which are possible to dig up by using excavators;
- Precambrian metamorphites, upper Cretaceous vulcanites, paleogenic and paleogenic-neogenic vulcanites and sedimentary rocks, classified as „rocky soils", which are possible to dig up by using explosives and/or high capacity excavators.

Table 2-4 introduces the estimated volume of excavation works in earth and rocky soils along the routes of the water supply branches and sewage collectors.

*Table 2-4 Estimated volume of excavation works in earth and rocky soils*

| № | Section of the Water Supply and Sewerage Network | Reference % of the volume of excavation works | |
|---|---|---|---|
| | | Earth soils | Rocky soils |
| 1 | Water Supply of the Town of Peshtera | | |
| *1.1* | *Transmission main from catchment systems Chepinski Vriz and Siniyat Kainak* | 70 | 30 |
| *1.2* | *Transmission main from catchment systems of Dalbochitsa 1 and Dalbochitsa 2* | 20 | 80 |
| *1.3* | *Transmission main from Novomahlenski catchment system* | 20 | 80 |
| *1.4* | *Transmission main from catchment systems of Kievo, Kievo Kale, Studenata Voda and Cheshme Bashi* | 30 | 70 |
| *1.5* | *Transmission main from tube wells TW1, TW2, TW3 and TW4* | 90 | 10 |
| *1.6* | *Distribution network* | 80 | 20 |
| 2 | Water supply of the village of Radilovo | | |
| *2.1* | *Transmission main from catchment systems of Malinovi Livadi and Chatal Uluk, Borov Chuchur 1, Borov Chuchur 2, Demishki Dol and Kapinov Dol* | 40 | 60 |
| *2.2* | *Distribution network* | 60 | 40 |
| 3 | Water supply of the village of Kapitan Dimitrievo | | |
| *3.1* | *Transmission main from Osmanagovitsa catchment system* | 40 | 60 |
| *3.2* | *Distribution network* | 60 | 40 |
| 4 | Water supply of Saint Constantine Holiday Resort | | |
| *4.1* | *Transmission main from Kukusheva Cheshma catchment system* | 20 | 80 |
| *4.2* | *Distribution network* | 30 | 70 |
| 5 | Sewerage network of the town of Peshtera | 80 | 20 |
| 6 | Sewerage network of the village of Radilovo | 50 | 50 |
| 7 | Sewerage network of the village of Kapitan Dimitrievo | 50 | 50 |
| 8 | Sewerage network of Saint Constantine Holiday Resort | 20 | 80 |

### 2.2.4.3. Physico-Geological processes and phenomena

The most significant physico-geological processes and phenomena on the territory of Peshtera Municipality and area around it are the weathering, erosion-accumulation and karst processes and phenomena.

The weathering processes has influenced mainly the Precambrian, upper Cretaceous and paleogenic rocks that are exposed at the surface. They have led to their physical fragmentation and disintegration.

The erosion-accumulation processes include surface denudation and river-bed erosion. They have contributed to the formation of the contemporary hilly and low to high mountainous appearance of the area featuring developed river-ravine system as well as Quaternary gravelly-sandy, boulder and clays alluvial, diluvial and colluvial formations deposited in Stara Reka River Valley.

The karst processes and phenomena have affected mainly the marbles of Dobrostan formation in the Precambrian period, which are exposed south- southwest of the Town of Peshtera and west of the village of Radilovo. They are expressed in production of various karst forms – caverns, pot-holes, funnels, caves (Snezhanka, Yubileina, etc.)

### 2.2.4.4. Hydro-geological conditions

The hydro-geological conditions within the area of the water supply and sewerage networks of the Town of Peshtera, the villages of Radilovo and Kapitan Dimitrievo, and Saint Constantine Holiday Resort are determined by crack, karst and pore groundwater, constituting limited parts of the following groundwater bodies: (River Basin Management Plan of Basin Directorate for Water Management in East Aegean Sea Region, 2010).

- Groundwater body „Fissure water – West Rhodope Complex" under code BG3G00000Pt047 – it is a pressureless body characterised by shallow circulation of groundwater in the hypergenic, cracked and weathered zone of Precambrian metamorphites It is mainly fed by rainfall infiltration and drained through tube wells and springs, whose yield changes depending on the season. Among them are the spring catchment Novomahlenski, Dalbochitsa 1, Dalbochitsa 2 and Kukusheva Cheshma and the tube wells TW1 and TW2.
- Groundwater body „Karst water – Central Rhodope Massif" under code BG3G00000Pt041, combines the groundwater in the karst massifs Perushtitsa – Ognyanovski, Mihalkovski, Kuklen-Dobrostanski and Laki-Hvoinenski. Groundwater is free-flowing and deeply drained in the high uncovered areas of marble above the erosion basis and percolates under pressure in the graben. It is fed by infiltration of rainfalls and surface water from the river-ravine network. It is drained through water abstraction facilities and descending and ascending springs (Tri Voditsi, Chervena Cherkva, Kaisov Kainak), which are situated outside the territory of Peshtera Municipality.
- Groundwater body „Fissure water – Peshtera-Dospat" under code BG3G0000PgN020. In this area, it forms narrow streams with intensive flow and short circulation line. It is mainly fed by rainfall infiltration and drained through

multiple springs, the flow of which changes depending on the season. Among them are the spring catchments Kievo, Kievo Kale, Studenata Voda, Siniya Kainak and Chepisnki Vriz, Chatal Uluk, Borov Chuchur 1, Borov Chuchur 2, Demishki Dol, Kapinov Dol, Malinovi Livadi and Osmanagovitsa.

- Groundwater body BG3G0000PgN020 includes pore groundwater, accumulated in the Quaternary formations around the town of Peshtera, which has a direct hydraulic connection with fissure water in the paleogenic, paleogenic-neogenic sediments and volcanogenic rocks. Pore water is mainly recharged by rainfalls and snow water, by the surface water of Stara Reka River and its tributaries and by the fissure and karst water, discharging in the river terrace. The water level is established at different depths, from 3 to 4 m south-southwest of the Town of Peshtera to 1 to 2 m close to the banks of Stara Reka River.

Tube wells TW3 and TW4 are used for the water supply of the Town of Peshtera. They collect pore water, south-west of the town, which is accumulated in Quaternary colluvial and alluvial-colluvial formations made of boulders and gravel with sandy-clayey filler.

### 2.2.5. HYDROLOGICAL CONDITIONS

The hydrological conditions on the territory of Peshtera Municipality are determined by the orohydrographic and run-off characteristics of Stara Reka River and its tributaries, Dalbochitsa, Novomahlenska, Pizditsa and other creeks and ravines.

Stara Reka River under water body code BG3MA700R146 and BG3MA700R144, is a right tributary of Maritsa River. It rises from Batashka Planina Mountain – Batashki Snezhnik peak (2,082 m). The river has a length of 61 km and a catchment area of 350 $m^2$. It has an average run-off modulus of 6.357 l/s/$km^2$, average slope of 0.319 m and an average altitude of the catchment basin of 1,280 m. In the section between the town of Batak and the town of Peshtera, the river flows in a deep gorge with steep side slopes, fully forested.

The hydrological regime of Stara Reka River coincides with the typical features of the right tributaries along the valleys of Maritsa River, characterised by higher water till the very autumn and even till the winter, when its flow decreases. Spring high water is observed from the end of February till the end of July, when the period of low summer water starts. During the months of November and December another rise in water levels is registered, which is called second autumn high water.

## 2.3. SOCIO-ECONOMIC FEATURES

### 2.3.1. DEMOGRAPHIC DEVELOPMENT

The territory served by WSSC Peshtera coincides with the territory of Peshtera Municipality, which includes 3 settlements: the town of Peshtera, the village of Radilovo and the village of Kapitan Dimitrievo, plus the resort Saint Constantine.

As of 2011 the population in Peshtera Municipality amounts to 18,899 persons – approximately 0.26 % of the total national population. For the 10-year period between the last two Censuses (2001-2011), Peshtera Municipality has lost some 2,700 people – a decline of 12.4%, which exceeds the average decrease of 11.3% for Pazardzhik District and the average national decrease of 7.2%.According to statistical data, the decline is due not only to the negative natural growth and ageing of the population, which is similar to national tendencies, but also to increased levels of out-migration.

*Table 2-5 Population in the service territory*

| Population | 2001* | 2011** | Change |
|---|---|---|---|
| WSSC Peshtera service territory | 21,575 | 18,899 | -12.4% |
| Pazardzhik District | 310,741 | 275,548 | -11.3% |
| Bulgaria | 7,932,984 | 7,364,570 | -7.2% |

*as of 01.03.2001, Census 2001, *Source*: http://www.nsi.bg/Census/PopObsht.htm
**as of 01.02.2011, Census 2011, *Source*: http://censusresults.nsi.bg/Census

The share of urban population in Peshtera Municipality has kept stable over the period 2001-2011 at around 89% of the population. This share is higher than the national average of 72.5%, which is normal, given the fact that this is a small municipality with only one urban centre and two small villages. As a share of the total district, the population of Peshtera Municipality has remained steadily around 7% during the last years. Natural growth has been positive but decreasing and net migration has been negative during the last years.

Age distribution is very close to national and district average, but there is a continuous process of ageing with only 15.76% of the population on the territory served by WSSC Peshtera being below 15 years of age. The age dependency ratio (ratio of persons under 15 and persons over 65 years per 100 of the population aged 15 - 64 years) is 46.7% and almost identical to the national average. The coefficient of demographic replacement (people aged 15-19 years, entering active working age versus the people aged 60-64 years, leaving active working age) is 0.80, i.e. each 100 persons leaving the working age group in 2011 are replaced by only 80 persons entering the same group.

*Table 2-6 Age structure of the population*

| 2011, Census | 0-14 | 15-65 | 65 plus | Age dependency ratio | Coefficient of demographic replacement |
|---|---|---|---|---|---|
| Peshtera Municipality | 15.8% | 68.2% | 16.1% | 46.7% | 0.8 |
| Pazardzhik District | 14.4% | 68.0% | 17.6% | 47.0% | 0.8 |
| Bulgaria | 13.2% | 68.3% | 18.5% | 46.5% | 0.7 |

*Source*: http://censusresults.nsi.bg/Census

The similarity of regional and national ratios and coefficients also defines the resemblance in future demographic development – it is very likely that the territory served by the WSSC will continue to decrease its population in short- and medium term,

although the decline might not be as rapid as current historical trends. The falling number of women in fertile age will continue to influence negatively birth levels, while the process of population ageing (decreasing relative share of the kids below 15 years and increasing share of the population over 65 years) will keep mortality at a constant degree. Outmigration will be mostly influenced by the likely economic development of the region, outlined in Section 5.

*Table 2-7 Population dynamics in Peshtera Municipality**

| | 2004 | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 |
|---|---|---|---|---|---|---|---|---|
| Population - total | 21,558 | 21,545 | 21,675 | 21,702 | 21,689 | 21,691 | 21,575 | 18,850 |
| *- urban population* | *19,090* | *19,127* | *19,302* | *19,302* | *19,337* | *19,363* | *19,288* | *16,719* |
| *- rural population* | *2,468* | *2,418* | *2,373* | *2,400* | *2,352* | *2,328* | *2,287* | *2,131* |
| Births | 266 | 281 | 263 | 267 | 285 | 319 | 259 | 257 |
| Deaths | 230 | 235 | 247 | 256 | 248 | 242 | 252 | 253 |
| Natural growth | 36 | 46 | 16 | 11 | 37 | 77 | 7 | 4 |
| Migration | -213 | -59 | 114 | 16 | -50 | -75 | -123 | -55 |

*All population figures are as of 31.12 of the respective year to establish proper dynamics.

*Source*: http://www.nsi.bg/ORPDOCS/Pop_6.1.1_Pop_DR.xls

## 2.3.2. ECONOMIC INDICATORS

### 2.3.2.1. *Gross Domestic Product (GDP)*

The Gross Domestic Product (GDP) of Bulgaria has reached values of BGN 75,265 million in current prices in 2011, which is BGN 4,754 million higher than the value in 2010. However, in constant 2005 prices, the 2011 GDP amounts to BGN 52,833 million, representing a real growth of only 1.67%. These results outline the slow economic recovery of the country following the first negative growth of GDP for the last 15 years in 2009. Despite some positive signals, Bulgaria is still struggling to achieve the average economic growth of over 6% from the pre-crisis period, which is unlikely to happen in near future. The industrial sector is practically the only one with substantial growth for 2011, with increase of 9.1% in Gross Value Added (GVA). The total real increase in GVA for 2011 stood at a low 1.81%. The following figure outlines the trend in GDP development for the last 11 years.

Exports of goods and services increased by 8.5 % in real terms during 2011, while imports fell by 12.0 %. On a chain basis gross fixed capital formation (investments)[9] increased in real terms by 0.9 %, but due to the considerable fall in inventories gross capital formation contracted by 3.7 % and had a negative contribution to GDP growth.

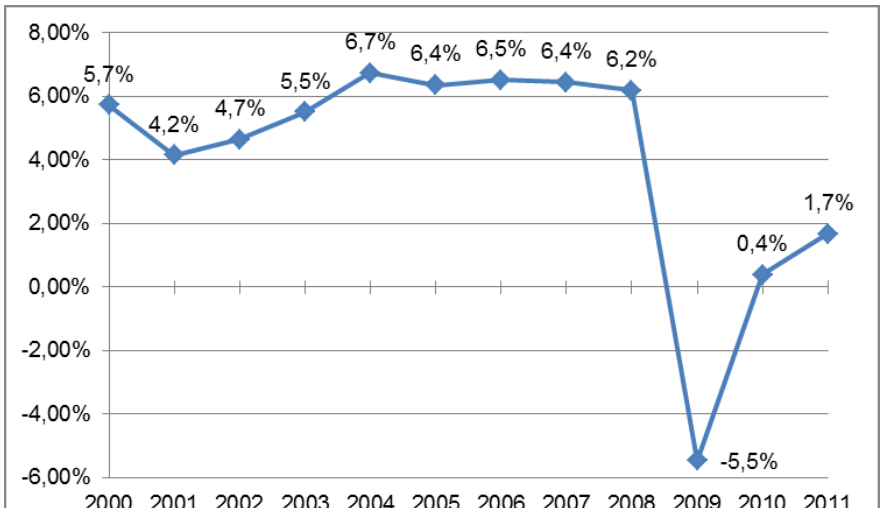



*Figure 2-4 GDP growth rate (2005 constant prices)*

*Source*: http://www.nsi.bg/ORPDOCS/GDP_1.1.1.xls

Regional GDP information is only available up to the pre-crisis period of 2009 but nevertheless provides useful base for analysis and comparison. The major part of the service territory falls within the boundaries of South Central Region, which produces approximately 15% of the national GDP and has lower economic growth as compared to national tendencies. These differences are significant and growing with time (indicated by the gap between the trend lines on the following figure) and it can be assumed that while regional economic growth will follow national trends, it will increase at a lower rate.

[9]Gross fixed capital formation includes the acquired fixed assets owned by residential producers and households less disposal ones during the reporting period. Gross fixed capital formation covers the investments for the tangible and intangible assets, produced in the production process (or imported), which are used many times over than one year.

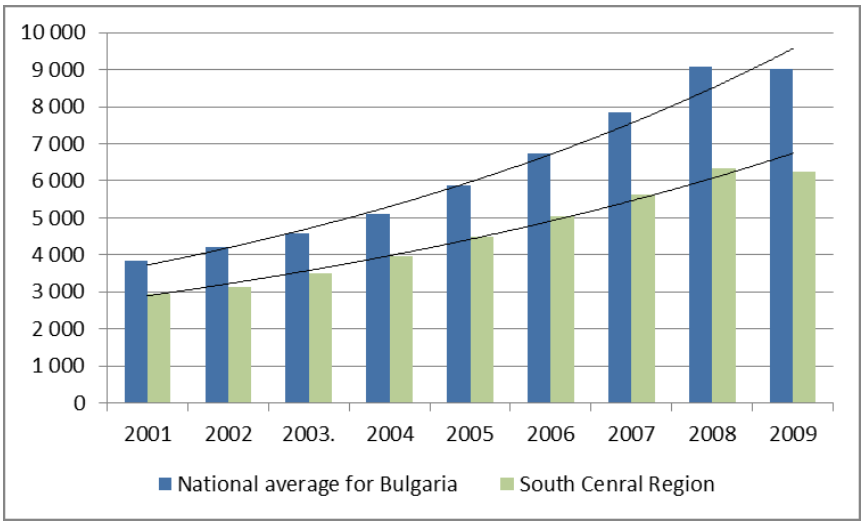



*Figure 2-5 Comparison of regional and national per capita economic growth, BGN*

*Source*: http://www.nsi.bg/ORPDOCS/GDP_1.1.4.xls

### 2.3.2.2. *Inflation*

The annual inflation for 2011, measured by means of the consumer price index with respect to the average prices for the previous year, was 4.2% and the highest for the last 3 years, but also well below the average inflation in medium term. The increase is largely due to rapid growth of fuel prices because of the unstable international environment. The average inflation for the first half of 2012 is well below 2% and the expected all-year inflation is about 3.5-3%. This tendency is expected to be stable for the coming years and Bulgaria will be one of the countries in the EU with lowest increase in consumer prices.

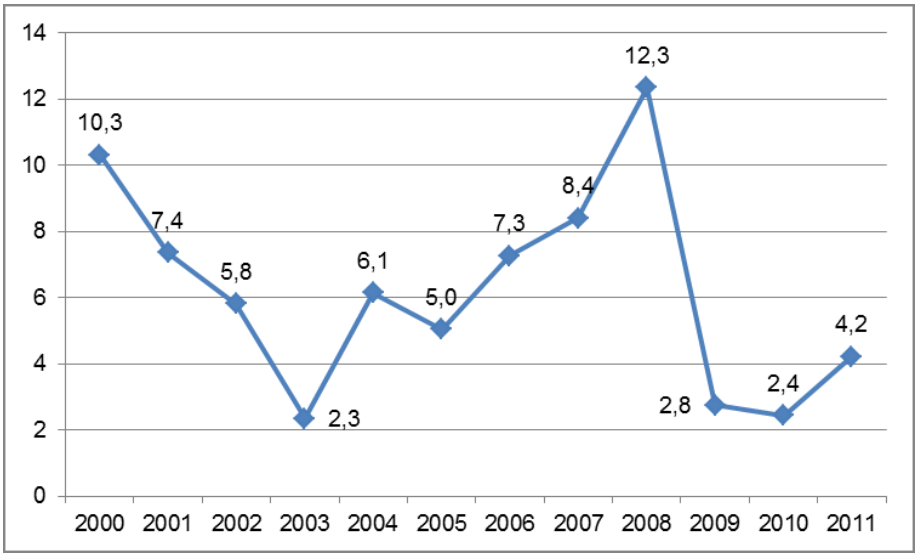



*Figure 2-6 Figure: Inflation in Bulgaria, measured by Consumer price index, %*

*Source*: http://www.nsi.bg/otrasal.php?otr=14

#### 2.3.2.3. Exchange rate

Since the end of 1999 the exchange rate in Bulgaria is fixed at BGN 1.95583 per one euro. Data on real effective exchange rate (REER) for the total Bulgarian economy (based on nominal unit labour costs) and on REER for manufacturing (based on nominal unit wage costs in manufacturing) show that REER in Bulgaria appreciated compared to 1999 but not to the extent observed in other Member States, including those with floating exchange rate.

Real effective exchange rates in the new EU Member States over the last ten years have been on an upward trend. Empirical evidence shows that this is mainly due to fundamentals and to the successful nominal and real convergence attained through higher growth in labour productivity compared with the EU average (weighted by the volumes of trade realised by trading partners). The increase in REER needs to be viewed as an equilibrium development driven by fundamental factors rather than a loss of competitiveness.

In the medium term, REER in the new EU Member States is expected to continue appreciating as a result of and depending on maintaining a positive differential in labour productivity growth and real convergence speed relative to advanced EU countries. (Bulgarian National Bank, www.bnb.bg).

### 2.3.3. HOUSEHOLD CHARACTERISTICS

The number of households on a national level has increased despite the negative trend in population development in the last years. The 2001 Census has counted 2,921,887 households, while the 2011 Census indicates that there are 3,005,589 separate households in the country. This situation points out a rapid decline in the “people per household” indicator which falls to 2.4 people in 2011 from 2.7 people in 2001.

*Table 2-8 Number of households and persons per household in Pazardzhik District*

| | 2001 | | | 2011 | | |
|---|---|---|---|---|---|---|
| | households | persons in the households | average number of persons per household | households | persons in the households | average number of persons per household |
| Total for the country | 2,921,887 | 7,848,395 | 2.7 | 3,005,589 | 7,296,459 | 2.40 |
| Pazardzhik district | 107,458 | 307,559 | 2.9 | 102,481 | 272,062 | 2.70 |

*Source*: http://www.nsi.bg/census2011/pagebg2.php?p2=175&sp2=192&SSPP2=194

The observed trends are similar on a regional level. The number of persons per household in Pazardzhik District, where Peshtera Municipality is located, decreased from 2.9 in 2001 to 2.7 in 2011. Still, the number is slightly higher than the national average. The larger number of people per household in the region is primarily due to the fact that

there are a substantial number of households with 4 and more than 5 people, as indicated in the following table.

*Table 2-9 Household characteristics, 2011 Census*

| Households | Total | 1-person | 2-persons | 3-persons | 4-persons | 5-persons and more |
|---|---|---|---|---|---|---|
| Bulgaria | 3,005,589 | 925,385<br>30.8% | 853,735<br>28.4% | 606,613<br>20.2% | 401,517<br>13.4% | 218,339<br>7.3% |
| Pazardzhik District | 102,481 | 26,547<br>25.9% | 28,254<br>27.6% | 20,937<br>20.4% | 15,782<br>15.4% | 10,961<br>10.7% |
| *- Urban* | 64,492 | 16,571<br>25.7% | 17,938<br>27.8% | 14,185<br>22.0% | 9,817<br>15.2% | 5,981<br>9.3% |
| *- Rural* | 37,989 | 9,976<br>26.3% | 10,316<br>27.2% | 6,752<br>17.8% | 5,965<br>15.7% | 4,980<br>13.1% |

*Source:* http://www.nsi.bg/census2011/pagebg2.php?p2=175&sp2=192&SSPP2=196

Household income on a national level has increased steadily in nominal terms for the last 10 years. 2010 is the first year with officially registered decrease of 1.2%. However, despite the observed nominal increase, real incomes have grown with much lower rates. Real household income for 2010 has declined with 3.6% compared to 2009, taking into account the influence of inflation. The 2010 income is also lower compared to the two previous years – 2007 and 2008.

*Table 2-10 National household income by source (BGN)*

| | 2001 | 2003 | 2005 | 2007 | 2009 | 2011 |
|---|---|---|---|---|---|---|
| **Total** | **4,532** | **5,887** | **6,577** | **8,429** | **9,550** | **9,629** |
| Total income | 4,307 | 5,584 | 6,158 | 7,818 | 9,122 | 9,251 |
| Wages and salaries | 1,711 | 2,234 | 2,685 | 3,732 | 4,762 | 4,793 |
| Other earnings | 218 | 214 | 252 | 364 | 387 | 127 |
| Entrepreneurship | 179 | 234 | 277 | 428 | 434 | 590 |
| Property income | 30 | 32 | 46 | 76 | 59 | 61 |
| Unemployment benefits | 50 | 30 | 24 | 24 | 50 | 65 |
| Pensions | 1,022 | 1,152 | 1,366 | 1,724 | 2,519 | 2,789 |
| Family allowances | 29 | 32 | 47 | 42 | 84 | 78 |
| Other social benefits | 56 | 70 | 119 | 191 | 164 | 158 |
| Household plot | 644 | 1017 | 827 | 624 | 283 | 162 |
| Property sale | 19 | 37 | 36 | 126 | 12 | 10 |
| Miscellaneous | 349 | 532 | 479 | 487 | 368 | 419 |
| Interest income | 128 | 140 | 221 | 321 | 276 | 277 |
| Loans and credits | 88 | 151 | 190 | 275 | 142 | 93 |
| Loans repaid | 9 | 12 | 8 | 15 | 11 | 8 |

*Source*: http://www.nsi.bg/ORPDOCS/HH_1.1.3_en.xls

Wages, salaries and pensions are the main income sources for Bulgarian households, but their relative shares have changed significantly over the years. The ageing of the population has dramatically increased the share of pension in the total household income,

while salaries also continue their relative growth. Incomes from own agricultural production constantly lose their significance.

Salaries and wages account for 51.8% of the total household income in 2011, increasing from 39.7% in 2001. Pensions add up an additional 30.1% in 2011 compared to 21.4% in 2001. Household agricultural production income loses a lot of its potential and its share in the total income is reduced to 1.7% in 2011 from 15.0% in 2001.

The average nominal increase of salaries and pensions and social benefits is similar over the last 10 years – 11.1% for salaries and 10.8% for pensions and social benefits, so it is expected that all households will increase their income in a similar manner over the years. However, because of these similarities in development over time, the gap between richer and poorer households (unemployed, pensioners) will continue to open. It is considered that household's disposable income will grow as equal to real GDP growth. As a result, the current data collected, split by income deciles are projected using a growth rate equal to the GDP growth. Despite the fact that the income of the lower three deciles is likely to evolve at a lower pace than the average income, which is indexed fully to GDP growth, no such observations are justified by existing statistical data. To that extent, historical income averages during the last 5 years are used to determine the percentage of growth rate that can be attached to the average income and the income of the last three deciles. These values are further used in the affordability analysis.

Regional household income in Pazardzhik District has a similar structure to the national one, but the share of wages and salaries is lower than the national average. While the age structure of the population in the service territory is identical to the national averages, these differences can be explained by two major factors – lower level of salaries and higher unemployment rates.

*Table 2-11 Comparison of household income structure on national and regional level*

| 2010 | Share of the income from wages and salaries | Share of the income from pensions |
|---|---|---|
| Bulgaria | 51.1% | 31.4% |
| Pazardzhik District | 45.5% | 31.7% |

*Source*: http://www.nsi.bg/otrasalen.php?otr=44&a1=2241&a2=2242#cont

The above facts explain the differences between the household income in the designated territory and the national average. In 2009 GDP per capita in Pazardzhik district was BGN 5,390 or only 60% of the national average value (Source: Local Statistical Bureau - Pazardzhik).

On the basis of the income distribution statistics we can group the households according to the indicator "total income per capita" into ten decile groups, with each group containing approximately equal number of persons. The average income for all decile groups is BGN 8,455, while the average income for the first three (or poorest) decile groups is BGN 4,472. These estimates are used to determine the affordability level in Section 5 as the poorest population in first three decile groups needs special attention when setting the water tariffs.

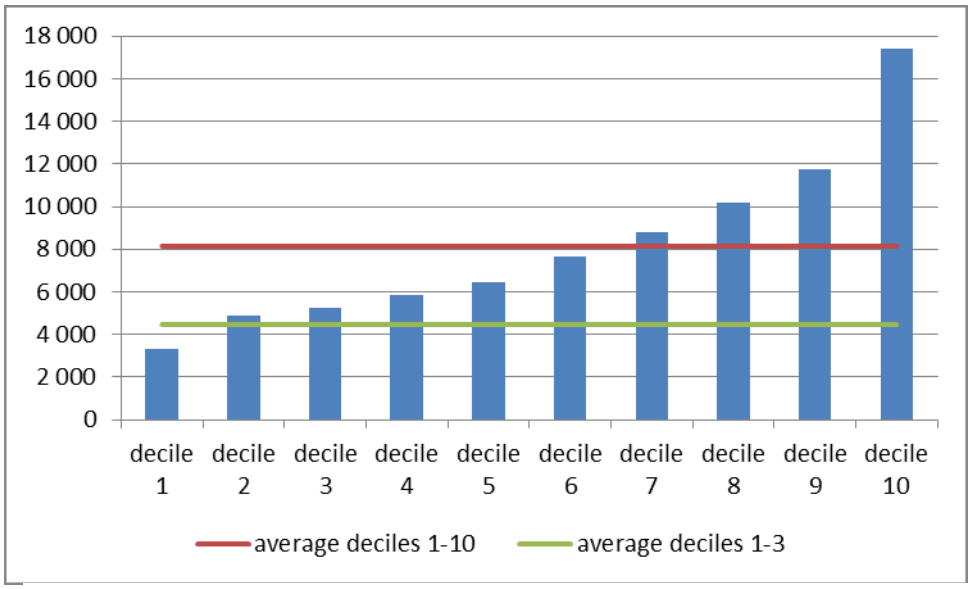



*Figure 2-7 Figure: Income distribution across income deciles, 2010*

*Source*: http://www.nsi.bg/publications/HBS2010.pdf

Household expenditure follows the tendency and dynamic changes of the income during the last 10 years. Consumer expenditure within the total household expenditure has not changed considerably within the observed period and is about 86%. The share of expenditures on housing, water, electricity and fuels has increased from 12.1% in 2001 to 14.1% in 2011. However, the increase of this expenditure is not bigger than the other cost categories.

*Table 2-12 National household expenditures by cost categories (average per household, BGN)*

| Expenditure groups | 2001 | 2003 | 2005 | 2007 | 2009 | 2011 |
|---|---|---|---|---|---|---|
| **Total** | **4,043** | **4,861** | **5,736** | **7,776** | **9,060** | **8,981** |
| Total expenditure | 3,850 | 4,585 | 5,346 | 7,195 | 8,236 | 8,547 |
| Consumer total expenditure | 3,315 | 3,970 | 4,612 | 6,121 | 7,057 | 7,177 |
| Foods and non-alcoholic beverages | 1,727 | 1,854 | 2,063 | 2,696 | 3,004 | 3,095 |
| Alcoholic beverages and tobacco | 142 | 186 | 226 | 333 | 387 | 380 |
| Clothing and footwear | 137 | 161 | 183 | 252 | 254 | 255 |
| Housing, water, electricity, gas and fuels | 465 | 644 | 748 | 899 | 1,194 | 1,206 |
| Furnishing and maintenance of the house | 110 | 150 | 177 | 272 | 303 | 236 |
| Health | 150 | 199 | 253 | 338 | 438 | 479 |
| Transport | 204 | 245 | 301 | 481 | 493 | 501 |
| Communication | 128 | 214 | 272 | 335 | 371 | 397 |
| Recreation, culture and education | 124 | 162 | 193 | 259 | 318 | 295 |
| Miscellaneous goods and services | 128 | 155 | 196 | 256 | 295 | 333 |
| Taxes | 120 | 142 | 151 | 210 | 266 | 446 |
| Household plot | 119 | 119 | 111 | 140 | 109 | 74 |
| Other expenditure | 296 | 354 | 472 | 724 | 805 | 849 |
| Saving deposits | 108 | 125 | 168 | 269 | 413 | 112 |
| Purchase of currency and securities | 1 | 5 | 0 | 1 | 1 | 0 |
| Debt paid out and loan granted | 84 | 146 | 222 | 311 | 410 | 322 |

*Source*: www.nsi.bg/ORPDOCS/HH_2.1.3.xls

The poverty line in Pazardzhik district is BGN 6,668 for 2009 or 90% of the national average (Source: http://www.nsi.bg/otrasal.php?otr=72&a1=2687&a2=2692&#cont). Keeping in mind the income sources and expenditure structure (large share of expenditures for food and similar products), these values can be explained by the presence of a share of self-subsistence agricultural production in the settlements.

### 2.3.4. UNEMPLOYMENT RATE

National unemployment rate was 11.2% in 2011, which is the highest level for the last 5 years. Regional unemployment rate in Pazardzhik district was 17.2% in 2011, which is higher than the rate for the South Central Region (12.7%) and the national average (http://www.nsi.bg/otrasal.php?otr=26&a1=735&a2=741&a3=744#cont). These results are directly related to the existing problems with out-migration of economically active people as a driver for population decline.

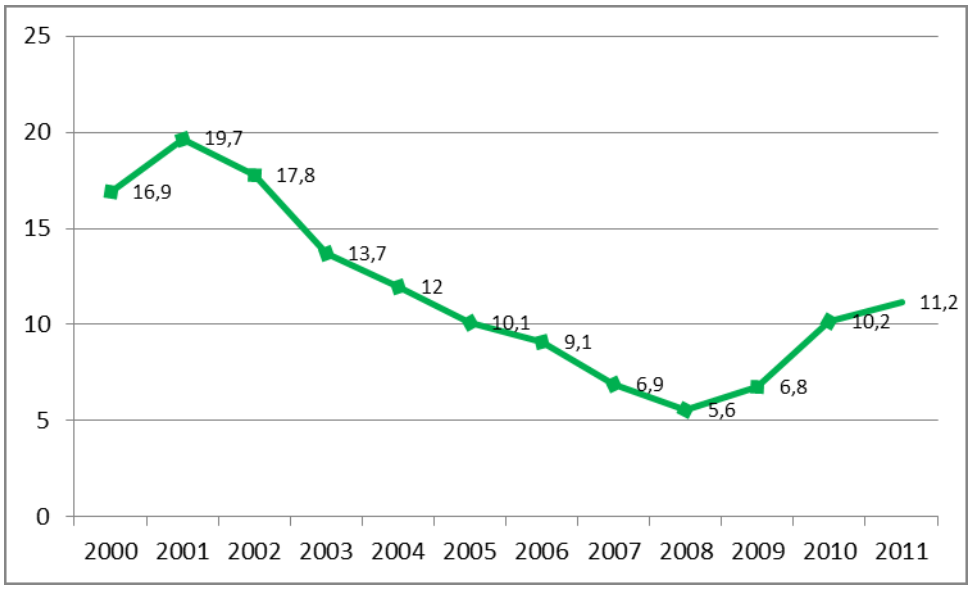



*Figure 2-8 Figure: National unemployment rate, %*

*Source*: http://www.nsi.bg/otrasal.php?otr=26&a1=735&a2=736&a3=739

Unemployment in Peshtera Municipality was 10.7% in 2011, however increased to 12.7% as of April 2012. 55% of the registered unemployed are women. 20.8% of the unemployed are young people of age below 29 years, with the lack of proper education and qualification being the main reason for their unemployment. The share of unemployed of age over 55 years is 21% and their unemployment is a long-term problem (Labour Bureau – Peshtera).

### 2.3.5. DENSITY AND TYPE OF HOUSING

As of 2010, population density in Bulgaria is 67.6 people per square km. Population density in Peshtera Municipality is very high – 159.3 people per square km – the second highest in Pazardzhik District. This could be explained by the large share of population

(90%) concentrated in the urban centre. Housing in the service territory is dominated by family houses – 1, 2 or 3-storey houses with small yards of around 350 m².

*Table 2-13 Population density as of 31.12.2010*

| Settlement | Area – sq.km | Population density per sq.km |
|---|---|---|
| **Pazardzhik District** | **4,456.9** | **64.6** |
| Batak | 677.3 | 9.2 |
| Belovo | 346.4 | 26.2 |
| Bratzigovo | 229.4 | 43.9 |
| Velingrad | 803.1 | 51.5 |
| Lesichovo | 209.4 | 27.2 |
| Pazardzhik | 636.7 | 189.1 |
| Panagyurishte | 598.9 | 42.9 |
| **Peshtera** | **135.4** | **159.3** |
| Rakitovo | 246.4 | 62.6 |
| Septemvri | 349.4 | 77.5 |
| Strelcha | 224.5 | 23.6 |

*Source:* http://www.nsi.bg/publications/REGIONS_2010.pdf

### 2.3.6. EDUCATION AND HEALTH-CARE

The service area has 7 kindergartens and 10 schools – 2 primary schools (1-4 grade), 5 secondary schools (1-8 grade), and 3 high schools (up to 12$^{th}$ grade).

Health care is a main element of the social infrastructure of Peshtera Municipality, accounting for around 30% of municipal budget spending. There is one municipal hospital with 120 beds, one dispensary, one medical centre, 2 policlinics, 2 enterprise medical centres and 2 medical offices in the villages. No water-borne health problems are observed in the area. One of the main health problems is the high percentage (25.3%) of complications of pregnancy, childbirth and the after-birth period. This is mainly due to the large proportion of the Roma population in the service area (over 30%).

### 2.3.7. ECONOMIC DEVELOPMENT IN THE AREA

The local economy of Peshtera Municipality has an industrial-agricultural structure. The most important sectors include the chemical, wine, shoe, textile and wood industries. The production of electricity is concentrated at HPP "Peshtera" - the second step of "Batashki hydroelectric Rode" cascade.

**Chemical industry**

The main representative of this sector is the factory “Biovet” JSC. Its activity includes the production and marketing of products for veterinary practice and agriculture, with a wide range of products, mainly antibiotics and stimulants, ensuring effective prevention and

treatment of farm animals. "Biovet" produces plant protection chemicals and drugs for human medicine. It is the largest plant in this sector on the Balkan Peninsula. The equipment in the plant is technologically advanced and its production is extremely competitive and focused mainly on international markets.

**Food industry**

The main player in this sector is the winery "Vinprom Peshtera" - a leading Bulgarian producer of high quality wines and high-alcoholic drinks. The company develops, produces and establishes world-class products of high quality distillates, developed in conformity with the consumers' demands and preferences, on the national and international market.

Other companies in the sector include: "Nicotiana Holding", which deals with drying and processing of tobacco; 4 pastry shops producing snacks and bakery products; the mill "Ekovik", which processed cereals and produces compound feed. There are also several points for the purchase of mushrooms, berries and herbs.

**Light Industry**

The light industry is represented by several wood processing companies: "Sokola", "Mary-Kostadin Dzharov", "Cherven Bor" manufacture mattresses and bedroom and kitchen furniture and sell on the domestic market; "Georgi Simeonov" produces furniture and sells on the domestic market; "Brunei" is engaged in timber processing and manufacturing of pallets; "Valkin" deals with logging and wood processing; "AS&Co" manufactures furniture; ET "Asparuh Kukusheva" produces bedroom furniture and mattresses.

There are also three tailoring and dress making companies that operate in the municipality: "Bratia Gorovi", "Diamant 91" and ET "Mriani". The companies work mainly with materials supplied by the client.

**Metalworking**

This sector is represented by the company "Gudeks", manufacturing caps for the food industry. The production is of very high quality and most of it is sold on foreign markets. Another company is "Unitech", which produces satellite dishes, garden furniture and aluminium windows. Another representative of the industry is "Passat Anteni", producing satellite dishes and also serving as Internet provider for the municipality. The company "Plamen Voinov" produces water containers and water heaters for households. Its production is sold on the domestic market. "Chico" produces caps for the food industry and brushes for household and industry. "TECHNOCOM" produces vans mainly for export. "Gerkand" produces household stoves and fireplaces for heating. The firm offers high quality and competitive prices, and sells both in the domestic and foreign market.

**Footwear industry**

The industry occupies a large part of the micro and small businesses in the municipality and a large part of the population works in this industry. The largest company in this sector is the footwear factory "Stara Reka", which was privatized and is now owned by the Italian company Comyp. The factory produces mainly male shoes and more than 90%

of its production is for exports. Other footwear companies include "Barry", "Gido" and "Svik" LTD.

**Agriculture**

The agricultural fund of Peshtera Municipality amounts to 51,359 decares. The arable land in the municipality is 31,000 decares. Over 80% of the land has been returned to its owners. The state and development of vine-growing, vegetable growing and private livestock breeding is relatively good. Fruit-growing is in relatively bad shape. The internal network for irrigation of agricultural land is about 24 km long and is well maintained.

### 2.3.8. MAJOR EMPLOYERS IN THE AREA

The main employers in the service area, providing the largest number of jobs, are the pharmaceutical company Biovet, the winery Vinprom Peshtera and the enterprise for leather and adhesives Vasil Muletarov. Other employers include a number of smaller firms, mainly in the footwear and wood-processing sector (see the table in Section 2.3.9).

### 2.3.9. COMMERCIAL AND INDUSTRIAL ACTIVITIES

The biggest water consumers within the service area include industrial enterprises across multiple economic sectors. Their consumption ranges from 125 to 62,500 $m^3$ per year, as described in the table below.

*Table 2-14 Industrial water consumption on the territory of Peshtera Municipality*

| № | Company name | Type of activity | 2009 | 2010 | | |
|---|---|---|---|---|---|---|
| | | | Industrial + domestic water | Industrial water | Domestic water | Number of workers |
| | | | [$m^3$/year] | [$m^3$/year] | [$m^3$/year] | |
| 1 | AVTOPAL 99 EOOD | Tyre shop | 17 | 0 | 25 | 1 |
| 2 | Ahmed Arnaudov EOOD | Shoe production | 161 | 0 | 110 | 10 |
| 3 | Mehanika AD | Tobacco processing | 1,773 | 0 | 1,100 | 88 |
| 4 | VM Vasil Muletarov EOOD | Leather, adhesives | 5,670 | 1,250 | 8,750 | 560 |
| 5 | MERI-Kostadin Dzharov EOOD | furniture | 288 | 0 | 200 | 20 |
| 6 | Nagi Trans Peshtera | trnasport | 509 | 0 | 375 | 14 |
| 7 | Gribash EOOD | Production of boza | 956 | 500 | 1,000 | 7 |
| 8 | Herkal EOOD | metal | 1,067 | 0 | 750 | 80 |
| 9 | Adi OOD | Shoe production | 318 | 0 | 250 | 50 |
| 10 | Grigorov & son ET | Car wash | 3,406 | 2,500 | 250 | 2 |
| 11 | Atanas Palikarov | Car wash | 676 | 250 | 25 | 3 |

| № | Company name | Type of activity | 2009 | 2010 | | |
|---|---|---|---|---|---|---|
| | | | Industrial + domestic water | Industrial water | Domestic water | Number of workers |
| | | | [m3/year] | [m3/year] | [m3/year] | |
| | ET | | | | | |
| 12 | Fresh Clean System EOOD | public laundry and trade with detergents | 1,025 | 0 | 750 | 4 |
| 13 | As & Co OOD | Furniture production | 761 | 0 | 525 | 16 |
| 14 | TPKI Bratia Gorovi | Fabrics and clothes | 1,664 | 0 | 1,150 | 9 |
| 15 | Nota Bene Shoes | Shoes, leather, adhesives | 162 | 0 | 125 | 22 |
| 16 | Chico OOD | Brushes, wire, fiber and other | 889 | 250 | 625 | 25 |
| 17 | Gudeks AD | caps | 189 | 125 | 125 | 59 |
| 18 | Gerkand OOD | Fireplaces, metal | 830 | 0 | 625 | 32 |
| 19 | Doan-69-Sunay-Karaasan ET | Transport | 412 | 0 | 375 | 46 |
| 20 | Tatiana Kostadinova ET | Swimming pool | 1,746 | 0 | 1,250 | 7 |
| 21 | Vinprom Peshtera AD | Alcoholic beverages | 50,000 | 62,500 | 1,250 | 502 |
| 22 | Stefan Ivanchev – TEKTAN ET | shops | 249 | 0 | 175 | 1 |
| 23 | PGHVB At. Chengelov OOD | High school – food industry | 235 | 0 | 250 | 0 |
| 24 | Bratia Angelovi OOD | Hen breeding for eggs | 8,397 | 183 | 8,099 | 0 |
| 25 | Angelov ET | offices | 45 | 0 | 26 | 6 |
| 26 | SD Uniteh | Production of metal works | 173 | 0 | 227 | 0 |
| 27 | TPK Petar Mishev | services | 171 | 0 | 224 | 8 |
| 28 | Egar Intercommerce OOD | Identical to Ahmed Arnaudov | 161 | 0 | 104 | 0 |
| 29 | Kriola EOOD | shops | 82 | 0 | 105 | 3 |
| 30 | Ryadkov 2008 EOOD | Shoe production | 68 | 365 | 591 | 24 |
| 31 | Technocom EOOD | Metal production | 259 | 182 | 33 | 2 |
| 32 | Yanko Dzharov ET | Shoe production | 1,146 | 182 | 1,269 | 146 |
| 33 | Shterio Tahov ET | Hen breeding for eggs | 690 | 365 | 770 | 10 |
| 34 | Transservice OOD | Transport | 3,679 | 0 | 4,011 | 0 |
| 35 | Daf Trance EOOD | Transport | 662 | 0 | 579 | 0 |
| 36 | Dar-2000 EOOD | Cafe | 466 | 0 | 461 | 0 |
| **Total for the year** | | | **89,002** | **68,652** | **19,810** | **m3/year** |

*Source*: VKS EOOD Peshtera, feasibility studies for WWTP in Peshtera

## 2.3.10. URBAN DEVELOPMENT PLANNING

Development of basic infrastructure in the context of urban development is determined by the statutory provisions of the Spatial Planning Act (SPA).

The elements constituting the networks and the technical infrastructure are subject to special treatment under SPA. Elements of technical infrastructure include water supply and wastewater sewage networks and related facilities in regulated and non-regulated territory. Elements of the technical infrastructure are defined in development plans and schemes. An integral part of the development plans are the specialized schemes containing information about the type, the size and the technical parts of the elements of the technical infrastructure.

Pipes and technical infrastructure facilities are constructed, maintained and repaired by and at the expense of the state, municipalities or respective operating companies, except in certain cases, determined by a special legislation.

In plots that are located on or near the ground or other underground communication networks and technical infrastructure, erection of structures and facilities should be made in a way, which does not adversely affect construction of technical infrastructure and does not enter the easement limits for the operation and maintenance of such an infrastructure.

Disposition of underground and surface street networks and technical infrastructure is determined by general and detailed development plans in compliance with the relevant technical rules and regulations.

Water supply and sewerage networks are constructed according to approved designs in accordance with the general and detailed development plans as well as the respective specialized schemes and landscaping plans.

The general development plan of a municipality, or part of it, determines the location of network equipment and technical infrastructure on the territory of the municipality and its relations with the territories of neighbouring municipalities and infrastructure networks, facilities and structures of national importance.

The general development plan of a city with its adjacent territory or settlement formation of national importance determines the areas of networks and facilities and the technical infrastructure.

Detailed development plans specify the structure and the type of buildings in the settlements and their lands. Detailed development plan is accompanied by landscaping plans, as well as by plans and schemes for water supply and sewerage networks.

When planning the construction of new housing areas and industrial zones within a municipality, sufficient capacity of water supply and sewerage systems must be ensured by reconstruction and/or extension of the existing ones or by carrying out a completely new design and construction of such systems in order to adequately address the needs of water services.

Measures for the construction of new and the rehabilitation of existing water supply and sewerage infrastructure are included in the Municipal Development Plan of Peshtera

Municipality, more specifically in priority 2 - Development and modernization of local infrastructure, creating conditions for growth and employment:

- Rehabilitation of the water supply network, uninterrupted water supply and guaranteed potable water quality;
- Completion and reconstruction of the sewerage network and construction of wastewater treatment facilities in accordance with the EU standards.

### 2.3.11. LAND USE AND OWNERSHIP

The right of land ownership includes the right to possess, use and dispose of the land. For the purpose of water projects the municipality shall own the land where the facilities are located or shall be granted a servitude right, which is a special type of limited real right over the land owned by another.

Servitude rights in connection with water projects are settled in Chapter 7 of the Water Act (Art. 103-115). The servitude established by law shall have as a subject thereof public or private benefit. Land servitudes established for public benefit shall refer to ensuring access to water bodies – public property for common use, for construction of the infrastructure necessary for that purpose, as well as for maintenance of water systems and facilities designated for provision of the services of water supply for the population and for irrigation. Land servitudes for a private benefit arise in connection with the location of the land and the right to pass and conduct water across the land. A change in the land ownership does not terminate the effect of the servitude.

Each land owner shall be obliged to grant the right to conduct water across his property to all who have permanent or temporary need to do so. If it is necessary to construct pipelines or facilities for transferring water, servitude strips shall be determined with a size not bigger than the diameter of the pipeline, increased with 60 cm, where construction or perennial planting shall not be permitted. The right to conduct water across another's property shall be established with an agreement of the owners of the dominant property and of the subservient property and if such an agreement cannot be reached - with an act of the body under Art. 52, paragraph 1, item 4 of the Water Act, observing the procedure of Art. 34 and 36, without ruling the alienation of the property concerned.

The implementation of investment projects in the water sector may require the purchase of additional undeveloped land and a change in the purpose of use of land. The change of the purpose of use of agricultural land for non-agricultural needs is permissible for:

- Construction of elements of technical infrastructure under the Spatial Planning Act;
- Creation or expansion of building boundaries of existing urbanized territories (settlements and settlement formations);
- Creation or expansion of the boundaries of separate regulated land plots outside the building limits of existing urban territories (settlements and settlement formations).

## 2.3.12. WATER BORNE HEALTH PROBLEMS

**Drinking water monitoring in the designated territory of VKS EOOD Peshtera.**

Permanent monitoring (PM) is conducted in the individual points, following an approved schedule, which is updated every year together with periodical monitoring (PrM) performed in a period of 1-2 month.

Monitoring points for analysis of water intended for drinking purposes in VKS EOOD Peshtera designated territory are located in the water supply network of the following settlements: the town of Peshtera (5 points), the village of Kapitan Dimitrievo (2 points), the village of Radilovo (2 points) and Saint Constantine Holiday Resort (2 points). Monitoring is also carried out for the local water sources.

Water supplied to consumers is of good quality and fully suitable for drinking purposes. No infectious or other water borne diseases have been registered. In about 3 % of the samples, deviations have been found from Ordinance №9 /16.03.2001 on the on the quality of water intended for drinking purposes. Parts of the problems are due to emergency repairs of treatment/disinfection facilities. Based on data obtained from the operator those facilities are characterised by low reliability and have to be replaced with modern disinfection equipment. There are water sources containing nitrates above the permissible levels. In many cases, pollution comes as a result of water pollution from unauthorized fertilization of agricultural lands, illegal accumulation of manure masses, waste, etc. Having observed the conditions of good agricultural practice and the strict control and management of territories, water pollution has been decreasing over the past years.

The PM, conducted during the period 2009-2010 (covers only part of monitored indicators) and PrM, indicated discrepancies in the following indicators:

- Microbiological indicators – number of colonies (microbial number at 220C), coliforms, Escherichia coli (Peshtera zone n°17 and Kapitan Dimitrievo zone)
- Physico-chemical indicators – (Peshtera zone n°17) and Kapitan Dimitrievo Zone. Insignificant deviation from pH indicator – isolated sample in Peshtera zone №17 and high levels of nitrates in Kapitan Dimitrievo zone.

All analysed indicators, except for the specified deviations, are within the limits of the permissible standards.

**Measures to improve drinking water quality**

It is necessary to ensure sufficient quantity of good quality drinking water, meeting all regulatory requirements of the valid legislation, harmonized with the European laws, by proceeding to solve the existing problems. The measures that need to be taken are legislative and financial:

- Legislative measures - addressing issues concerning ownership and management of the water supply networks and facilities,

- Financial measures - providing funds for reconstruction and modernization of the water supply networks and facilities, the Water Company and the Municipality should actively seek for financing sources in order to obtain EU funds.
- Building new water treatment and disinfection facilities,
- Searching and putting into operation new sources,
- Providing strict control and effective management of water in the designated territory of VKS EOOD Peshtera. Updating the sanitary protection zones around water sources. Increased control over the observance of the prohibitions and restrictions in them.
- Providing full water monitoring, according to the European and national legislation. Improving the equipment of some laboratories of RHI in order to analyse indicators, associated with possible specific water pollution.
- Avoiding drinking water pollution with nitrates and pesticides by increasing the control over the observance of the rules for good agricultural practice and other measures aiming at preventing water pollution with nitrates from agricultural activities (pursuant to Directive 91/676/EEC concerning the protection of waters against pollution caused by nitrates from agricultural sources) and implementing programmes to train farmers to introduce the good agricultural practice.

### 2.3.13. CONCLUSIONS

The service territory of WSSC Peshtera can be characterised as mostly urban with approximately 90% of the population living in the town of Peshtera, leading to high population density. Decreasing natural growth, population ageing and net out-migration have triggered population decline over the last ten years. If this negative demographic development continues, it will exert significant influence on future investments in the water supply and wastewater networks. (see section 5.1. for population forecasts). Therefore, it is necessary to implement measures that would stop the out-migration, especially of young people, and avoid demographic breakdown in the long run.

In general, Peshtera municipality is characterised by stabilized economic processes. The company Biovet is the only manufacturer of products for veterinary practice and agriculture. Vinprom Peshtera is a leading manufacturer of alcoholic beverages. The Municipality has accumulated experience and traditions in the footwear, wood processing and clothing industry. There are also good opportunities for the development of tourism and agriculture.

Still, the economy in the service area is growing at a lower than the national average rate for the last 10 years. GDP per capita remains at only 60% of the national average value. The higher than the national average unemployment rate is another problem. If this tendency continues regional and national disparities will get bigger unless both national and local measures are taken. These include improvement of existing infrastructure and business environment, incentives for investors, promotion of entrepreneurship and employment by improving the qualification and skills of young people, etc.

# 2.4. WATER AND WASTEWATER SERVICES

## 2.4.1. WATER SUPPLY AND SEWERAGE COMPANIES

The commercial company VKS EOOD – Peshtera was established in 1992 and registered under the Commercial Law as a 100% municipality-owned company by virtue of Decision 2808 dated 22.06.1992 of Pazardzhik District Court.

The main activity of the company includes operation, maintenance, construction, investments, provision of water supply and sewage as well as construction services.

VKS EOOD – Peshtera is a water operator and carries out regulated activities under the Water Supply and Sewerage Services Regulation Act (WSSSRA), promulgated in SG. No. 18 of 25.02.2005, in force since 20.01.2005.

On the grounds of the provisions of Art. 21, paragraph 1, paragraph 4 and paragraph 54, Art. 23, para.1 of WSSSRA, the operator is subject to annual regulatory audit of the achieved levels of the quality indicators for the water and sewerage services, the implementation of price and comparative analysis of the reported and approved revenues and costs, as well as the implementation of the investment and repair program.

*Table 2-15 Details on WSSC Peshtera EOOD*

| | |
|---|---|
| Name of the water supply and sewerage company | "Water Supply, Sewerage and Construction" EOOD (VKS EOOD Peshtera) |
| Legal status | Single-member Limited Liability Company, 100% owned by the municipality |
| Date of registration | Company file № 850/1992 – Pazardzhik District Court |
| UIC (code under BULSTAT) | 822104714 |
| Headquarters and address of management | 4,550 Peshtera<br>2, Osvobozhdenie St. |
| Correspondence address | 4,550 Peshtera<br>2, Osvobozhdenie St. |
| Subject of activity | Operation, maintenance, construction, investments, water supply, sewage and construction services on the territory of Peshtera Municipality and Saint Constantine Resort. |

According to the 2011 Profit and Loss Account of the company, total revenue from operating activities was BGN 971,000, while total expenditure amounted to BGN 926,000. The financial result /profit before tax/ was respectively BGN 45,000, and after deduction of taxes, net profit for 2011 amounted to BGN 41,000.

Net revenue from provision of water supply and sewerage services to customers amounted to BGN 860 thousand, including:

- Revenue from provision of water supply to consumers – BGN 796,000;
- Revenue from wastewater disposal – BGN 64,000;

In volume terms, this is equivalent to 803,600 m3, for the amount of BGN 796 thousand. Revenue from sewerage fees is BGN 64.44, revenue from services – BGN 71,000, from financing – BGN 17,000.

In general, the company is in good financial standing compared to the previous years. There is a tendency of improvement of the financial results and profitability, efficiency, liquidity and financial independence indicators, which should be maintained in the future.

### 2.4.2. WATER SERVICES AND TARIFF POLICY

The WSSC has the right to determine the level of the prices in accordance with the Water Supply and Sewerage Services Regulation Act, the Ordinance on the price formation of water supply and sewerage services, and the Methodological guidelines for the preparation of Business plans of the WSSCs, published by the SEWRC.

The state regulation of the activities in the energy sector and water supply and sewerage services is carried out by the SEWRC. The SEWRC is responsible for monitoring the implementation of the quality of the services provided by the WSSCs and used in their business plans.

The business plan of each WSSC clearly describes, using a specific methodology for determining the prices, all the parameters required by SEWRC to assess the appropriateness and lawfulness of the prices offered by the WSSC.

A financial model records and calculates:

- The cost of system operation and maintenance;
- Planned investments to be implemented with funds of the WSSC and to remain its property;
- Depreciation charges on assets owned by the WSSC;
- Costs and effects of reducing losses;
- Necessary revenues to cover the eligible expenses;
- The social acceptability of offered prices;

The business plans of the WSSC do not include the projects that are financed by EU funds and those of which the beneficiaries are the Municipalities.

There are two methods for price formation of the water services: defining an "upper price ceiling" and "rate of return". In the current regulatory period SEWRC applies the **"upper price limit" method**. The Regulator approves prices for the water operator for the first year of the regulatory period and adjusts them at the end of each year of the regulatory period with the inflation index, decreased by a coefficient for improving the efficiency of the water operator. The duration of the regulatory period is equal to the period of the approved business plan (2009 - 2013).

The "upper price ceiling" method defines the price of the service of provision of water supply to consumers as a ratio of the necessary annual revenue for the service and the

difference between the water quantities at the inlet of the water supply system and the maximum amount of the permissible total water losses.

The necessary annual revenue of the water operator includes costs subject to approval by the Regulator, and a rate of return on invested capital calculated by the following formula:

NAR = RAE + (RBA*RR), thousand BGN

Where:

- NAR – necessary annual revenue, BGN
- RAE - recognized annual expenses of the water operator, BGN
- RBA- regulatory basis of the assets, BGN
- RR - rate of return on the capital for the regulatory period, %.

The regulatory basis of the assets, directly related to the waters services, is the recognized value of the assets, which generate a rate or return on invested capital for the operator and are calculated by the following formula:

RBA = A-F-D + WC + Inv.average

Where:

- RBA- regulatory basis of the assets
- recognized value of the assets, which are used and have a useful life
- F - recognized value of the assets acquired free of charge
- D - accumulated depreciation for the expired period of the use of assets for carrying out the activities, subject to regulation;
- WC- necessary working capital
- Inv. average. – average forecast amount of investment financed by WSS operator using own and borrowed funds, approved by the Commission, which will be made during the regulatory period, decreased by the average amount of deductible depreciation expenses;

Detailed instructions for regulating the prices of water and sewerage services by using the upper price ceiling method is described in the following document: http://www.dker.bg/files/DOWNLOAD/direct_vik5.

*Table 2-16 Tariffs in the territory serviced by VKS EOOD Peshtera*

| № | Consumers | Water supply | | Wastewater discharge | | Wastewater treatment | |
|---|---|---|---|---|---|---|---|
| | | 2007-2009 | 2010 г. | 2007-2009 | 2010 г. | 2007 -2009 | 2010 г. |
| 1 | Domestic and other equivalent public, commercial, etc. consumers | 0.88 | 0.99 | 0.07 | 0.08 | 0.00 | 0.00 |
| 2 | Industrial and other business consumers | 0.88 | 0.99 | 0.08 | 0.10 | 0.00 | 0.00 |

*Source*: Business Plan of WSSC Peshtera and data from decisions of the SEWRC

WSSC Peshtera applies uniform tariffs for the services of provision of drinking water and differentiated tariffs for wastewater discharge and treatment services with regard to domestic and industrial consumers.

Currently the clients of WSSC Peshtera pay for the services of water supply and wastewater discharge. After completion of the WWTP the tariff will include a component for wastewater treatment.

The tariff for the new service of wastewater treatment is calculated in accordance with the requirements of the National Guidelines for Cost Benefit Analysis in the Water and Wastewater Sector, i.e. the projection of tariffs should cover fully the cost of operation and maintenance of WWTP and part of the depreciation within the limits of social affordability.

*Table 2-17 Prices of the services provided by WSSC Peshtera, approved by SEWRC (as of 01.01.2012)*

| Water service | Prices proposed by the water operator (BGM./m3, VAT excluded) | Upper ceiling prices approved by SEWRC as of 01.02. 2012 (BGM./m3, VAT excluded) |
|---|---|---|
| Water supply | 0.99 | 0.99 |
| Wastewater discharge | 0.08 | 0.08 |
| Industrial wastewater discharge – 2nd degree of pollution | 0.10 | 0.10 |

*Source*: SEWRC

### 2.4.3. PROVISION OF CENTRALIZED HOT WATER SERVICES

According to information available on Peshtera Municipality's website, a procedure started in 1999 for the construction of gas supply networks in the town of Peshtera. So far 11 pipelines have been constructed for the industrial sector, 37 pipelines for the public and administrative sector and 158 for the residential sector with a total length of 19,793

m. Out of these, the active ones are 3 lines for the industrial sector, 26 for the public and administrative sector and 49 for the domestic sector, with a total monthly consumption during the winter period – 200,000 $m^3$ / h and a total annual consumption of 1,100,000 $Hm^3$.

### 2.4.4. PRIVATE WATER SUPPLY OR WASTEWATER SYSTEMS IN THE AREA

Currently, there is no private WSSC in the area of Peshtera Municipality. ViK-Peshtera, which is servicing the area, is 100% owned by the Municipality.

### 2.4.5. CONCLUSION AND RECOMMENDATIONS

The price of water supplied by VKS EOOD Peshtera is close to the national average of BGN 1.05 per $m^3$. (excluding VAT), however it exceeds the average price of BGN 0.73 per $m^3$ (excluding VAT) in Pazardzhik District. The price of water supply in Pazardzhik District varies from BGN 0.45 per $m^3$ (excluding VAT) for WSSC Rakitovo to BGN 1.19 per $m^3$ (excluding VAT) for WSSC Panaguyrishte. This variability is even larger at the national level: BGN 0.26/$m^3$ for WSSC Breznik and BGN 0.4/$m^3$ for WSSC Burzia to BGN 1 98/$m^3$ for WSSC Razgrad, BGN 2.05/$m^3$ for WSSC Targovishte and BGN 2.09/$m^3$ for WSSC Isperih.

The prices of water supply and sewerage services are determined by the SEWRC. They reflect the costs for network maintenance, for water treatment and delivery as well as the investment costs. If there is a great need for investment, this is revealed in the price of water supply and sewerage services. It is up to the Municipality or the Regulator to decide what level of investments they will have, in order to ensure loss reduction and service quality. Compared to other European countries, water price in Bulgaria is low. In Germany, for example, over the years substantial investments have been made in renovating the network and as a result there are very little losses along the network. At the same time, however, water prices are very high. So, it is a matter of political decision and choice of policy. If Bulgaria decides it wishes to have a higher price, this would allow provision of more investments in the network, loss reduction, treatment of larger amount of wastewater, as these activities are not carried out in many towns in Bulgaria. All of this requires investments. They may also be provided by the European Union, but part of them would probably come from the price of water supply and sewerage services.

# 3. ASSESSMENT OF THE EXISTING SITUATION AND NEEDS FOR WATER SUPPLY AND SEWERAGE SYSTEMS

## 3.1. WATER RESOURCES

### 3.1.1. GENERAL CHARACTERISTICS

Peshtera Municipality has available the following water resources:

- **Surface water** – Stara Reka River, Novomahlenska River and Pizditsa River

Stara Reka River is a main water artery within the boundaries of the Municipality. Its tributaries, located on the territory of the municipality are the rivers of Dalbochitsa, Novomahlenska, Pizditsa and other smaller creeks and gulches.

*Table 3-1 Water bodies of "river" category in the valley of Stara Reka River on the territory of VKS EOOD Peshtera*

| N | Type of Water Body | Description of Water Body type | Code EU_CD | Description of Water Body |
|---|---|---|---|---|
| 1 | TR30 | 020111 | BG3MA700R146 | Stara Reka River from Derindere to the town of Peshtera |
| 2 | TR27 | 011111 | BG3MA700R144 | Stara Reka River from the town of Peshtera to the river mouth |
| 3 | TR30 | 020111 | BG3MA700R148 | Pizditsa (Zvezditsa) River |
| 4 | TR30 | 020111 | BG3MA700R147 | Novomahlenska River |

*Source*: River Basin Management Plan, 2009

- **Groundwater** - from groundwater bodies of "Fissure water, West Rhodopes Complex" under code BG3G00000Pt047 and „Fissure water, Peshtera-Dospat" under code BG3G0000PgN020, as described above in section 2.2.1.

The area, resources and permitted groundwater abstraction at regional level are presented in the table below.

*Table 3-2 Regional Resources and Permitted Groundwater Abstraction*

| Code of the groundwater body (GWB) | Area of GWB Km$^2$ | Regional resources, l/s | | Total abstraction, l/s | |
|---|---|---|---|---|---|
| | | Natural | Available | Permitted annual abstraction | Free quantities |
| BG3G00000Pt047 | 845 | 850 | 190 | 55.7 | 134.3 |
| BG3G0000PgN020 | 748 | 1,122 | 1,122 | 168.3 | 953.7 |

*Source:* Basin Directorate for Water Management in East Aegean Sea Region - River Basin Management Plan in East Aegean Sea Region

The water supply is conducted by gravity from 17 spring catchments (four from GWB BG3G00000Pt047 and 13 from GWB BG3G0000PgN020) and through abstraction from four tube wells (two from GWB BG3G00000Pt047 and two from GWB BG3G0000PgN020). The local resources of these water sources correspond to the sum of the average minimum flow of the spring catchments and the average annual water quantities abstracted from the tube wells with permissible water level in them covering the period of their operation.

The total volume of groundwater abstracted from the indicated water abstraction facilities constitutes 3.4207*$10^6$ $m^3$/year (108.47 l/s), including from:

- GWB BG3G00000Pt047 – 1.1858*$10^6$ $m^3$/year (37.60 l/s);
- GWB BG3G0000PgN020 – 2.2349*$10^6$ $m^3$/year (70.87 l/s).

## 3.1.2. SURFACE WATER RESOURCES

### *3.1.2.1. General*

**Stara Reka River** is a right tributary of Maritsa River**.** It rises from Batashka Mountain, (Batashki Snezhik peak (2,082 m). Stara Reka River cuts through the massif of the West Rhodopes. Before making its way into the Peshtera valley, surrounded by Rhodope branches, in the section from the town of Batak to the town of Peshtera, the river runs in a deep gorge having steep sides, entirely covered by coniferous forest made up mainly of pines, firs and spruces as well as of spruce and white firs in some small spots. Cinnamic forest soils and alluvial meadow soils are most typical of the catchment area. The agricultural lands represent 38 % of the municipal territory, of which 78% are arable areas. About 53% of the total municipal territory is occupied by forests

Stara Reka River has a total length of 61 km and catchment area of 350km. Its valley comprises 3 towns and 15 villages as well as a major part of the territory of the Municipalities of Batak, Peshtera and Bratsigovo. The river has a length of 27 km up to the town of Peshtera and catchment area of 135 $km^2$. The average altitude above sea level of the river up to the town of Peshtera is 1.280 m, and its gradient is 51.2 ‰. The average slope of the catchment area is e 0.319.

By the construction of the facilities to Batak Hydroelectric Power Cascade, the average annual flow of the river was reduced by about 50%, which resulted in disruption of the river run-off conditions.

**Novomahlenska River** is a right tributary of Stara Reka River. It rises in the foothills of Varteleshka Peak (1990.7 m) and Kozuyurussu (1902 m). The river has a length of 15.8 km and catchment area of 27.8 $km^2$. It flows into Stara Reka River before the town of Peshtera. Part of the water is diverted by Nova Mahala derivation to Batak water supply system.

**Pizditsa (Zvezditsa) River** is a right tributary of Stara Reka River, which rises from Yurgatan Dere below a peak at elevation of 1,710 m. It goes from south to north and this direction is changed in its final part from east to west up to the flowing point into Stara

Reka River after the town of Peshtera at a distance of 32.7 km from the mouth. The river has a length of 17.9 km and catchment area of 35.5 km $^2$, which is almost entirely located on the territory of Peshtera Municipality and crosses the villages of Radilovo and Kapitan Dimitrievo.

Surface water in the area of the town of Peshtera is also used for irrigation of agricultural lands and for animal watering.

### 3.1.2.2. Surface Water Quantity

The designated territory of VKS EOOD Peshtera includes one surface water abstraction facility intended for the needs of drinking water supply.

The measurement of surface water quantity and quality in the designated territory of VKS EOOD Peshtera is realized with the existing reference hydrometric network of the Valley of Stara Reka River and its tributaries. There is one hydrometric station on Pizditsa River (Zvezditsa): HMS № 71280 in Zvezdtitsa area, reflecting the river runoff in the subject territory. Another station is placed at the mouth of Stara Reka River in order to keep track of water quality of the river and its runoff.

*Table 3-3 Surface Water Flow*

| No | Location of Hydrometric Station | Area of Catchment Basin [km$^2$] | Average flow [m$^3$/s] | Minimum Flow [m$^3$/s][10] | Maximum Flow [m$^3$/s][11] |
|---|---|---|---|---|---|
| 1 | Stara Reka River, at the mouth | 350 | 2.387 | 1.194 | 3.841 |
| 2 | Pizditsa (Zvezditsa), HMS № 71280 in Zvezditsa locality | 26.87 | 0.269 | 0.077 | 0.505 |

*Source:* River Basin Management Plan, 2009

*Table 3-4 Surface water abstraction for the year 2011 (Data are given as according to permit No31110013 / 04.05.2010*

| No | River/dam – Location of water intake | Type of water use | Permitted water quantity [l/s] | Limit of water used [m$^3$/year] |
|---|---|---|---|---|
| 1 | Pizditsa River | Drinking-domestic water supply | up to 15 | 315,360 |

*Source:* VKS EOOD Peshtera, Basin Directorate for Water Management in East Aegean Sea Region

Part of the water of Stara Reka River is conveyed to Water Supply System of Batak Hydroelectric Power Cascade through Ravnogor CD (Collection Derivation). **Fluctuations in the volumes of surface water, monthly and yearly for 2011:**

[10] Exceedance probability 90 %

[11] Exceedance probability 10 %

The characteristics of the annual natural run-off in water quantities and in water volumes measured by the HMS at Stara Reka River and falling within the designated territory of VKS EOOD Peshtera are introduced in Table 3-5.

*Table 3-5 Characteristics of the annual run-off of Stara Reka River in water quantities – Q, m³/s and water volumes – W, millions of m³*

| № | River-Point (№ of HMS) | F | M | Q | Probability % | | | |
|---|---|---|---|---|---|---|---|---|
| | | km² | l/s.km² | W | Average | 75 | 90 | 95 |
| 1 | Stara Reka River, at the mouth | 350 | 7.45 | Q | 2.387 | 1.554 | 0.953 | 0.763 |
| | | | | W | 75.28 | 49.01 | 30.07 | 24.07 |
| 2 | Pizditsa (Zvezditsa) River HMS № 71280 in Zvezditsa locality | 26.87 | 5.782 | Q | 0.269 | 0.200 | 0.127 | 0.104 |
| | | | | W | 8.48 | 6.313 | 4.020 | 3.281 |

*Source:* River Basin Management Plan, 2009

The variations of the annual discharge of the rivers depend on the combinations and distributions of precipitations, the snow cover and the air temperature. In the high mountainous parts of the region, the water flow in the winter is low, having its minimum in January, due to the reduced flow of water under the thick snow cover and the low temperatures. In this area, the heavy precipitations in the spring and the presence of intensive snow melting lead to sudden formation of high waters, which starts in the middle or the end of February. It continues till the end of May. The water flow starts to decrease in the beginning of July and this trend continues till the end of October. The water flow starts to increase in November, which is mostly visible in November and December. The maximum water quantities vary from 15 to 80 m³/s, and the minimum ones from 0.05 to 0.400 m³/s.

Run-off distribution by seasons is approximately the following:

- Spring high water - 70%; - Summer season: 16%; - Autumn high water: 14%.

*Table 3-6 Annual run-off distribution of Stara Reka River, at the mouth and HMS № 71280 Pizditsa (Zvezditsa) River*

| Month | I | II | III | IV | V | VI | VII | VIII | IX | X | XI | XII | Yearly average |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Stara Reka River at the mouth | | | | | | | | | | | | | |
| Qaverage | 1.748 | 2.285 | 3.982 | 5.693 | 5.007 | 3.300 | 1.514 | 0.913 | 0.745 | 0.776 | 1.148 | 1.602 | 2.387 |
| Max | 5.603 | 5.451 | 8.185 | 11.19 | 12.55 | 17.14 | 4.494 | 5.440 | 2.977 | 4.379 | 3.821 | 5.211 | 3.841 |
| Min | 0.253 | 0.356 | 1.697 | 1.887 | 1.521 | 0.559 | 0.281 | 0.174 | 0.191 | 0.210 | 0.239 | 0.231 | 1.194 |
| Pizditsa (Zvezditsa) River at HMS № 71280 | | | | | | | | | | | | | |
| Qaverage | 0.141 | 0.240 | 0.504 | 0.767 | 0.632 | 0.344 | 0.152 | 0.087 | 0.052 | 0.066 | 0.106 | 0.144 | 0.269 |
| Max | 0.649 | 1.379 | 1.240 | 1.649 | 1.857 | 0.829 | 0.490 | 1.100 | 0.310 | 0.860 | 0.540 | 0.620 | 0.505 |
| Min | 0.018 | 0.028 | 0.129 | 0.180 | 0.052 | 0.015 | 0.020 | 0.008 | 0.006 | 0.007 | 0.014 | 0.018 | 0.077 |

*Source:* River Basin Management Plan, 2009

#### 3.1.2.3. Surface Water Quality

The parameters of surface water from Pizditsa (Zvezditsa) River, intended for water supply of the town of Peshtera, are consistent with the requirements for drinking water use. There no data for pollution above the standard. Monitoring is carried out for water used for domestic purposes.

*Table 3-7 Summary of the status of surface water bodies in the designated territory of VKS EOOD Peshtera:*

| № | Code | Water Body | Type | Ecological status | Chemical status | Overall status | Explanation |
|---|---|---|---|---|---|---|---|
| 145 | BG3MA700R144 | Stara Reka River from the town of Peshtera to the mouth | TR27 | 1 | 2 | 1 | |
| 146 | BG3MA700R145 | Ravnogorska Reka River | TR30 | 4 | 2 | 2 | |
| 147 | BG3MA700R146 | Stara Reka River from Derindere to the town of Peshtera | TR30 | 3 | 2 | 1 | moderate |
| 148 | BG3MA700R147 | Derindere | TR30 | 3 | 2 | 1 | moderate |
| 149 | BG3MA700R148 | Stara Reka River from spring to Derindere River, drinking - domestic water supply | TR30 | 4 | 2 | | |
| 185 | BG3MA900L192 | Batak Dam | TR32 | 3 | 2 | 1 | moderate |

*Source:* River Basin Management Plan, 2009

### 3.1.3. GROUNDWATER RESOURCES

#### 3.1.3.1. General

Operational resources are given in the table below. Detailed breakdown by SCs (spring catchment) and TWs (tube well) is presented in Appendix 3-1.

*Table 3-8 Local operational resources of water abstraction facilities in Peshtera Municipality*

| № | Water Abstraction Facility | Operational Resources, $Q_{oper}$ | |
|---|---|---|---|
| | | l/s | $m^3/d$ |
| **I** | **Total for the town of Peshtera** | **99.15** | **8,566.56** |
| | ∑ SC (spring catchment) | 73.70 | 6,367.68 |
| | ∑ Tube wells (TW) | 25.45 | 2,198.88 |
| **II** | **Total for the village of Radilovo** | **6.52** | **563.33** |
| **III** | **Total for the village of Kapitan Dimitrievo** | **1.60** | **138.24** |
| **IV** | **Total for Saint Constantine Holiday Resort** | **1.20** | **103.68** |
| | **Overall Including: from GWB BG3G00000Pt047**<br>**from GWB BG3G0000PgN020** | **108.47**<br>37.60<br>70.87 | **9,371.81**<br>3,248.64<br>6,123.17 |

#### 3.1.3.2. Groundwater Quantity

Groundwater quantity abstracted in the period from 2009 to 2011 is depicted in the table below:

*Table 3-9 Groundwater quantity abstracted from 2009 to 2011*

| № | Agglomeration /Location | Groundwater quantity abstracted / m³/year / | | |
|---|---|---|---|---|
| | | 2009 | 2010 | 2011 |
| 1 | The town of Peshtera | 2,395,914 | 2,111,628 | 2,159,488 |
| 2 | The village of Radilovo | 135,881 | 135,881 | 135,881 |
| 3 | The village of Kapitan Dimitrievo | 50,615 | 52,935 | 51,238 |
| 4 | Saint Constantine Holiday Resort | 31,357 | 31,357 | 31,357 |
| | **Total for Peshtera Municipality** | **2,613,670** | **2,331,704** | **2,377,964** |

#### 3.1.3.3. Groundwater Quality

According to the results of the studies, presented in Appendix 3-2, groundwater from all springs, supplying Peshtera Municipality, is fresh and suitable for drinking purposes. Its compliance with the permissible parameters is given in the table below:

*Table 3-10 Summary of Water Quality*

| Water Supply Zone /Groundwater Body/ | Compliance with Standards | Problematic parameter | Comments |
|---|---|---|---|
| Fissure water, West Rhodopes Complex under code **BG3G00000Pt047** | Groundwater quality is compliant with Ordinance № 9/16.03.2001, Ordinance № 1/10.10.2007 and Directive 98/86/EC/ | No problematic parameters | Water is suitable for drinking purposes |
| Fissure water, Peshtera-Dospat under code **BG3G0000PgN020** | Groundwater quality is compliant with Ordinance № 9/16.03.2001, Ordinance № 1/10.10.2007 and Directive 98/86/EC/ | No problematic parameters | Water is suitable for drinking purposes |

### 3.1.4. WATER RIGHTS AND OVERALL UTILISATION OF RESOURCES

#### 3.1.4.1. Water Rights

A main principle with regard to ownership of natural resources on the territory of the Republic of Bulgaria is that they are **state property**. This principle is also applicable to the property right of water and water bodies. Public state property is river water as well as water in reservoirs including water in dams and micro-dams, natural lakes and groundwater.

Groundwater and surface water abstraction is carried out on the basis of water abstraction permits, issued by the Basin Directorate for Water Management in East Aegean Sea Region, with centre the city of Plovdiv for Peshtera Municipality, and presented in the table below:

*Table 3-11 Water Rights and Overall Utilization of Resources*

| № | Settlement | Water Abstraction Facilities | Number and Date of the Water Abstraction Permit | Code of the Water Site |
|---|---|---|---|---|
| 1 | The town of Peshtera | Water intake of Pizditsa River | № 31110013/04.0252010 | BG3MA700R148 |
| | | Tube wells TW3 and TW4 | № 300388/25.05.2004 | BG3G0000PgN020 |
| | | Spring catchments, 9 pcs | № 300625/30.11.2004 | BG3G0000PgN020 |
| | | Tube wells TW1 and TW2 | № 300657/20.12.2004 | BG3G00000Pt047 |
| 2 | The village of Radilovo | Spring catchments, 6 pcs | № 31510064/25.05.2008 | BG3G0000PgN020 |
| 3 | The village of Kapitan Dimitrievo | Osmanagovitsa spring catchment | № 31510058/01.02.2008 | BG3G0000PgN020 |
| 4 | Saint Constantine Holiday Resort | Kukusheva Cheshma spring catchment | № 31510057/31.01.2008 | BG3G0000PgN020 |

A water user and a holder of the permits for water extraction from water abstraction facilities (one river intake, 19 spring catchments and four tube wells) for water supply of Peshtera Municipality is „Vodosnabdyavane, kanalizatsya i stroitelstvo" (Water supply, sewerage and construction) EOOD, Peshtera.

### *3.1.4.2. Problem areas with scarcity of water or conflicts among various consumers (domestic, industrial, agricultural and power production)*

Main water consumers are as follows:

**For domestic water supply**

Water intake built at the river of Pizditsa under water site code № BG3MA700R148. It has a water use permit № 31110013/04.0252010 with limit of used water up to 315,360 $m^3$/year. There is a water supply network to Lukovitsa Quarter of the town of Peshtera.

**For irrigation**

Peshtera irrigation system encompasses the areas north of the town of Peshtera. It has an area of 3 thousand ha, of which 1.881 ha are suitable for use. The main water source for the system is Peshtera HPP, from second to fourth "Window" of the cascade through the channels 1-C-5, $P_1$, and 1-C-2; and from the lower reservoir of Aleko HPP. Stara Reka River is used as a water source as well. Water is diverted by water intake. A certain part of the irrigation areas are provided with water by 6 small irrigation dams with a total storage volume of $2.077*10^6$ $m^3$.The existing Kapitan Dimitrievo Dam has a small volume of $V_o$ = $0.49*10^6$ $m^3$ and does not considerably contribute to the water supply of the system.

**For power production**

Peshtera HPP comprises the Basin of Stara Reka River and part of Batak Hydroelectric Power Cascade. It uses water from Batak Dam. Water flow is 26.6 m3/s, head - 580m,

power 128 MW, design power production 441 GWh. 20,450,000 $m^3$/year of Stara Reka River are used for hydraulic power generation.

The small number of settlements indicates that there is no scarcity of water resource in terms of quantity. Taking into account that precipitations mainly form the surface water resource, their change in the future with regard to the average annual rainfall of 631 mm for the region and under the conditions of the contemporary climate (1961 to 1990) is important for the expected investment intentions in VKS EOOD Peshtera. The realistic scenario for 2038 shows that the average annual precipitations will decrease by 9% and the average summer precipitations by 20%.

#### 3.1.4.3. *Important restrictions on the use of surface and/or groundwater for each agglomeration*

EU Directives on Bird Habitats and the Decisions of the Council of Ministers set out the respective areas, where the use of surface and/or groundwater is restricted.

*Table 3-12 Zones with restricted use of surface and/or ground water*

| No | Agglomeration | River | Natura 2000 | Other protected areas |
|---|---|---|---|---|
| 1 | Peshtera | Stara Reka River | BG0002063 „Western Rhodopes", partially<br>BG00001030 „Western Rhodopes", fully | None |
| | | Pizditsa (Zvezditsa)River | BG0002063 „Western Rhodopes ", partially<br>BG00001030 „Western Rhodopes", fully | |
| 2 | Radilovo | Stara Reka River | BG0002057 „Besaparian Hills", partially<br>BG0000254 „Besaparian Hills", partially | None |

In order to ensure the conservation of natural habitats and species habitats, the plans, programmes, projects and investment intentions undergo assessment for conformity with the subject and the goals of the conservation of the relevant protected area. The terms and conditions for carrying out such an assessment are laid down in Ordinance under Art.31 of the Biodiversity Act.

### 3.1.5. POTENTIAL POLLUTION THREATS

The potential pollution threats in the area of the designated territory of VKS EOOD Peshtera are among of the major problems having negative impact on the quality of surface water and groundwater.

The potential pollution of different activities in the area, as a result of which water bodies are identified as being at risk, are described in the table below (the actual water pollution observed on the territory of the WSSC is discussed in section 3.2.):

*Table 3-13 Type of pressure used to determine water bodies in risk by different activities*

| | Type of Pressure | Significant sector/Activity |
|---|---|---|
| 1 | Diffuse pollution | - Urbanized territories without sewerage system and WWTP.<br>Risk of water pollution above the standard is created.<br>- Stock-breeding – Waste landfills, unauthorised dump sites, uncontrolled accumulation of construction and domestic waste in the outskirts of the settlements<br>- Car repair and transport activity |
| 2 | Point pollution | - Urbanized territories, where settlements have sewerage systems (the town of Peshtera (WWTP under construction)), the village of Radilovo and the village of Kapitan Dimitrievo (WWTP under construction), etc.<br>- Industry |
| 3 | Morphological alterations | Industry/extraction of sand and inert materials, etc. Embankments and corrections of rivers |
| 4 | Other specific items | Erosion processes, intrusion |

### 3.1.6. CONCLUSIONS AND RECOMMENDATIONS

- Peshtera Municipality is supplied by groundwater sources – average operating water quantity (108.47 l/s).
- Stara Reka River – for irrigation.
- The total guaranteed minimum water quantity for Peshtera Municipality is 64.30 l/s.
- One surface water intake from Pizditsa River is to be put into operation. According to the water use permit, the authorized water abstraction is equal to 15 l/s and not more than 31,360 m3/year
- From water sources having a different owner i.e. pressure reservoirs of Pazardzhik - 10 l/s as well as from derivation supplying Batak Dam – 4.6 l/s. Total water amount is equal to 1,261 m3/d.
- There are no restrictions on the use of surface water and groundwater for drinking water supply and other purposes as their determined resources and water quality fully satisfy the requirements in the relevant legal and statutory documents.

The parameters of surface water from Pizditsa (Zvezditsa) River, intended for water supply of the town of Peshtera, are consistent with the requirements for drinking water use. There is no data for pollution above the standard.

There are no restrictions on the use of surface water and groundwater for drinking water supply and other purposes as their determined resources and water quality fully satisfy the requirements in the relevant legal and statutory documents i.e. Water Act, Ordinance № 1/10.10.2007 on groundwater exploration, use and protection, Ordinance № 2 concerning the protection of waters against pollution caused by nitrates from agricultural

sources, Ordinance № 3/16.10.2000 on the terms and conditions for investigation, design, approval and operation of sanitary protection zones around water sources and facilities for drinking-domestic water supply as well as around mineral water sources used for medicinal, preventive, drinking and hygienic purposes, Ordinance № 9/16.03.2001 on the quality of water, intended for drinking purposes, Directive 98/86/EC/ concerning the quality of water intended for human consumption, etc.

It is necessary to conduct procedures for:

- Renewing expired Water Abstraction Permits in conformity with the requirements of Ordinance № 1/10.10.2007 on groundwater exploration, use and protectionof 13 water abstraction facilities.
- Re-establishing of the existing sanitary protection zones around the water abstraction facilities in accordance with the requirements of Ordinance № 3/16.10.2000 on the terms and conditions for investigation, design, approval and operation of sanitary protection zones around water sources and facilities for drinking-domestic water supply as well as around mineral water sources used for medicinal, preventive, drinking and hygienic purposes.

## 3.2. WATER POLLUTION

### 3.2.1. MAJOR POLLUTION SOURCES

Water pollution sources are related to anthropogenic activities.

**Point sources of surface water pollution:**

- Discharges of untreated wastewater from the sewer collectors of Saint Constantine Resort Site, hotels, villas, etc.
- Wastewater from backwashing of filters in the Drinking Water Treatment Plants. The said wastewater does not **affect** water quality of the sources.
- Direct discharge of wastewater by the enterprises in the town of Peshtera (Nagi Trans, Chico OOD, Bratya Angelovi, etc).

Biovet Peshtera - The local WWTP treats wastewater to the extent specified in the requirements of the Discharge Permit.

Point sources of pollution are the main reason for pollution of water bodies above the standards and for deterioration of their chemical and ecological status.

**Diffuse sources of pollution:**

- Unauthorised domestic solid waste landfills ;
- Uncontrolled waste disposal;
- Road and railway transport, as well as activities related to transport maintenance.

The main sources, forming the total wastewater flow of the point sources of pollution are the population and the industries in a given settlement.

The population produces pollution load characterised by the main indicators of $BOD_5$ and COD, Suspended solids and biogenic elements with organic content, demonstrated in the various forms of nitrogen and phosphorus.

### 3.2.1.1. Industry – a source of wastewater pollution.

The main sources of pollution are the following major industrial companies:

*Pharmaceutical industry* – the main representative of this industry is the company of Biovet AD – Peshtera, manufacturing veterinary products and food supplements. Treated wastewater qualities correspond to the requirements of the standard and do not additionally pollute the receiving water body.

*Food Industry and Tobacco Products* is represented by the following companies:

Vinprom Peshtera AD is the main producer of high-alcoholic drinks on the territory of the municipality. Raw material is processed in distilleries located outside the territory of the town of Peshtera. Wastewater pollution is highly reduced compared to the operating programme, including wine production. The expected $BOD_5$ during the peak production activity will not exceed 400 mg/l. The remaining industries form water having content similar to domestic wastewater.

*Wastewater from backwashing of filters in DWTP*

Peshtera DWTP – treats backwash water from the filters and process water. Produced sludge is removed (disposed to Domestic Solid Waste Landfill).

DWTP of Saint Constantine Holiday Resort and Water intake for Lukovitsa quarter. The proposal is the same as for Peshtera DWTP.

*Table 3-14 Pollution sources and quantities, discharged into the river water for the town of Peshtera*

| River Basin | Pollution Source | Wastewater Volume discharged into receiving water [m³/year] | Pollution load discharged into receiving water [kg.BOD/year] | | Assessment (compliance with discharge permit (for wastewater), treatment level) |
|---|---|---|---|---|---|
| Stara Reka River, tributary of Maritsa River | Peshtera WWTP | 1,497,595 | 37,440 | 0.62 | 100 % will be treated |
| | Biovet | No data | No data | No data | 100% of wastewater is treated in WWTP. It undergoes a three-stage treatment process by fully observing the treatment technology. The sludge from the treatment plant is dewatered and disposed according to an individual plan, agreed by the respective authorities for the particular sludge, dewatered |

| River Basin | Pollution Source | Wastewater Volume discharged into receiving water [m³/year] | Pollution load discharged into receiving water [kg.BOD/year] | | Assessment (compliance with discharge permit (for wastewater), treatment level) |
|---|---|---|---|---|---|
| | | | | | and processed in the treatment plant. There are currently no data on the quantitative and qualitative parameters of the wastewater and the sludge from BIOVET WWTP. |
| | Peshtera DWTP | 1,680 | 84 | 1.4 | Backwash water is directly discharged without any treatment. The treatment plant is located far from the water sources and, in practice, it does not affect water quality. |
| | DWTP of Saint Constantine Holiday Resort | 1,200 | 84 | 1.4 | Same as for Peshtera DWTP |
| | Lukovitsa Water Intake | 1,200 | -84 | 1.4 | Same as for Peshtera DWTP |
| | Industries | 68,652 | No data | No data | Some of the companies have local treatment plants – sludge and grease traps. The companies, which have specifically polluted water should construct the relevant treatment facilities |
| | Domestic Solid Waste Landfill | | No data | No data | There is no study on the quantity and quality of infiltrated water. The landfill is to be closed. There is an on-going procedure for elaboration of a detailed design for alternative landfill and construction is to be started. |
| | Agriculture | | No data | No data | No data |

## 3.2.2. IMPACT OF WASTEWATER DISCHARGE

### 3.2.2.1. *Impact on Surface Water*

The qualities of surface water in the region are influenced by point and diffuse sources of pollution, as a result of anthropogenic activity

Water bodies, receiving wastewater in the area of the designated territory, are Stara Reka River and its tributaries, including a number of creeks in its catchment basin.

Surface water quality monitoring is carried out by the subdivisions of MoEW on the basis of special programmes for surveillance and operational monitoring.

The main objective of surveillance monitoring programme is to provide comprehensive and detailed summaries of the ecological and chemical status of the various water bodies, by identifying the base line of their status and ensuring option for classification of the water sites in five categories according to the statutory definitions.

*The monitoring points at Stara Reka River are not included in the surveillance monitoring programme.*

In general, the frequency of monitoring is consistent with the variability in parameters, obtained as a result of natural or anthropogenic conditions.

*Table 3-15 Relation of biological categories with the adopted classification of receiving water bodies according to Ordinance № 7 (08.08.1986.; SG No. 96/86)*

| BI | Ordinance 7, 1986 | Water Quality |
|---|---|---|
| 5; 4-5 | I | Clean, unpolluted high quality water |
| 4 | I | Clean, unpolluted good quality water |
| 3-4 | II | Slightly polluted water |
| 3 | II; III | Slightly to moderately polluted water |
| 2-3 | III | Moderately polluted water |
| 2 | III; out of the categories | Heavily polluted water |
| 1-2; 1 | out of the categories | Very heavily polluted water; ecologically "damaged" river stretch |

Biotic index is only applicable to rivers. It cannot be used for drying river, brackish waters, artificial channels and others.

Out of the biological elements, only macrozoobenthos is identified at the monitoring points for Stara Reka River.

The surface water monitoring points at Stara Reka River in the designated territory are included in the Operational monitoring programme of water bodies falling within «river » category in Maritsa River Basin.

Code of point - BG3MA00725MS0870; Name of point - Stara Reka River, between the town of Peshtera and the village of Byaga, Pazardzhik Regional Laboratory.

Geographical coordinates - N42002/59//E24020/20,2//

Code of point – BG3MA00721MS0860 name of point – Stara Reka River mouth

Code of point - N - 42008/01,6//E24029/55,9//

The impact, induced by point sources of pollution i.e. untreated urban wastewater, is of major importance.

*Table 3-16 Chemical status of surface water in the designated territory*

| | Code | Name | Chemical status | Parameters above the permissible limit values |
|---|---|---|---|---|
| 61 | BG3MA700R148 | Stara Reka River, from the springs to Derin Dere River – drinking water supply | Good | None |
| 62 | BG3MA700R147 | Derin Dere River - drinking water supply | | |
| 63 | BG3MA700R146 | Stara Reka River, from Derin Dere River to the Town of Peshtera | | |
| 64 | BG3MA700R145 | Ravnogorska Reka River | | |
| 65 | BG3MA700R144 | Stara Reka River, the Town of Peshtera to the river mouth | | |

*Table 3-17 Ecological status*

| | Code | Water Body | Type | Heavily modified water body | Total | Hydromor-phological parameter | Biological para-meter | Physico-chemical parameter |
|---|---|---|---|---|---|---|---|---|
| 145 | BG3MA700R144 | Stara Reka River, the Town of Peshtera to the river mouth | TR27 | Yes | 2 Poor | 3 Moderate | 2 Poor | 2 Poor |
| 146 | BG3MA700R145 | Ravnogorska Reka River | TR30 | | 4 Good | 5 Very good | Good | |
| 147 | BG3MA700R146 | Stara Reka River, from Derin Dere River to the Town of Peshtera | TR30 | | 3 Mode-rate | 3 Moderate | | |
| 148 | BG3MA700R147 | Derin Dere River - drinking water supply | TR30 | | 3 Mode-rate | 4 Good | | 3 Moderate |
| 149 | BG3MA700R148 | Stara Reka River, from the springs to Derin Dere | TR27 | | 4 Good | | 4 Good | |

| | Code | Water Body | Type | Heavily modified water body | Total | Hydromor-phological parameter | Biological para-meter | Physico-chemical parameter |
|---|---|---|---|---|---|---|---|---|
| | | River - drinking water supply | | | | | | |

**Biotic Index** Evaluation of water bodies' status is also conducted through hydrobiological control at the points established along the river. The hydrobiological analyses identify what is the effect of the overall impact of pollutants on environment by using the relevant selected biological indicators. The employed method is very sensitive to organic pollution as well as to water toxicity. Biotic Index (BI) is a 5-grade scale for assessment of the quality of surface running water. The highest value BI5 is given to the purest water, unaffected by anthropogenic impacts, whereas BI1 indicates heavily polluted water. The relation of the biological categories with the adopted classification of receiving water bodies, according to the effective Ordinance No 7 (08.08.1986; SG No. 96 of 12.12.1986) is presented in the table.

### 3.2.2.2. Impact on Groundwater

*Table 3-18 Impact of pollution on groundwater quality for the town of Peshtera*

| River Basin / Location | Pollution Source | Pollution Risk | Critical Parameters | Comments |
|---|---|---|---|---|
| Stara Reka River | Peshtera WWTP | Low/ None | No | In a process of construction. Evaluation, according to the detailed design. |
| | Biovet WWTP | Low/ None | No | Operational. According to the protocols of Pazardzhik RIEW, the plant treats wastewater to the extent specified in the permit for discharge of treated wastewater. |
| | Peshtera DWTP | Low | Suspended solids | Backwash water is discharged without any treatment. Practically, it has no influence on river pollution as the way to the river is long and backwash water is settled along the route. |
| | Saint Constantine DWTP | Low | Suspended solids | As indicated above |
| | Water intake for Lukovitsa quarter | Low | Suspended solids | Backwash water is discharged without any treatment. Treatment is conducted without adding reagents and suspended solids returned to the river are not dangerous for the |

| River Basin / Location | Pollution Source | Pollution Risk | Critical Parameters | Comments |
|---|---|---|---|---|
| | | | | flora and fauna in the river. |
| | Industry | Low | COD, oils and petroleum products | Production companies, located within the borders of the town of Peshtera form water having content similar to domestic wastewater. Companies, which have no local treatment plants, should build the relevant treatment facilities for the period of construction of Peshtera WWTP.<br>The companies, which are not possible to connect their wastewater to the urban sewerage, should elaborate designs that will meet the requirements set out in the integrated permit. |
| | Domestic solid waste landfill | No data | No data | A contest is being conducted for preparation of a detailed design. Forthcoming construction |
| | Agriculture | Low | No data about impact on surface and groundwater | All data concerning groundwater indicate its compliance with the requirements of the Ordinance on drinking water |
| | Old and leaking sewerage | | BOD, suspended solids | |

### 3.2.3. SLUDGE MANAGEMENT AND DISPOSAL

There is an elaborated and approved Sludge Management Report for the sludge of the future wastewater treatment plant of the town of Peshtera. It envisages that sludge will be disposed to the existing domestic waste landfill. After the construction of the regional domestic solid waste landfill for Pazardzhik region, the existing one will be closed and recultivated.

The sludge from the joint wastewater treatment plant of the villages of Radilovo and Kapitan Dimitrievo, which is still at conception design stage, is planned to be disposed similarly to the sludge from Peshtera WWTP. The Consultant recommends this to be done only while the sludge is being tested and a more effective way of utilization of the sludge is to be proposed.

In the area of Peshtera Municipality, there are limited number of agricultural and lots of forest terrains suitable for fertilization, or damaged sites available for recultivation.

The technologies for sludge treatment and removal included in the designs of both wastewater treatment plants are fully compliant with the requirements of the relevant national legislation.

According to the requirements for preparation of designs of the regional solid waste landfill, the volume of received waste should also contain the sludge and the waste from the future wastewater treatment plants in the adjacent area, including from the treatment plants of Peshtera and Kapitan Dimitrievo. The Consultants' opinion is that this should be doen only during the period of testing the sludge.

The management of sludge from WWTP in the area of Peshtera Municipality meets the requirements of the national legislation in this field and is not expected to create any insurmountable problems. An exception in this respect is the problem related to treatment of wastewater from the regional landfill, of which there is no current information.

## 3.2.4. WATER QUALITY MONITORING

### 3.2.4.1. *Drinking Water Quality Monitoring*

*Table 3-19 Drinking Water Quality Monitoring*

| Entity responsible for monitoring | Location: River Basin / Code of Monitoring System / Location of measuring point | Frequency of Monitoring | Data Availability (from year to year) | Parameters Monitored | Comments |
|---|---|---|---|---|---|
| Water Sources | | | | | |
| VKS EOOD Peshtera | All water sources available (catchment systems, river intakes, tube wells) | Once per year | 2007 – 2011 | According to Ordinance №9 of 16.03.2001 | No deviations from the indicators have been found |
| Water Distribution Network of the town of Peshtera | | | | | |
| VKS EOOD Peshtera | Three points of the distribution network (one for each zone of the network) | - monthly, ten months of the year, reduced analysis<br>- twice per year (in two of the months), expanded analysis | 2007 – 2011 | According to Ordinance №9 of 16.03.2001 | No deviations from the indicators have been found |
| Water Distribution Network of the village of Radilovo | | | | | |
| VKS EOOD Peshtera | In one random point of the distribution network | - monthly, ten months of the year, reduced analysis<br>- Once per year (in one of the months), expanded analysis | 2007 – 2011 | According to Ordinance №9 of 16.03.2001 | No deviations from the indicators have been found |
| Water Distribution Network of the village of Kapitan Dimitrievo | | | | | |
| VKS EOOD Peshtera | In one random point of the distribution network | - 4 times per year, reduced analysis<br>- Once per year, expanded analysis | 2007 – 2011 | According to Ordinance №9 of 16.03.2001 | No deviations from the indicators have been found |
| Water Distribution Network of Saint Constantine Holiday Resort | | | | | |
| VKS EOOD Peshtera | In one random point of the distribution network | - twice per year, reduced analysis<br>- Once per year, expanded analysis | 2007 – 2011 | According to Ordinance №9 of | No deviations from the indicators have been found |

**Conclusions and Recommendations:**

No deviations have been registered from the requirements of Ordinance №9/of 16.03.2001 on the quality of water intended for drinking purposes.

There have not been recorded any infectious or other water borne diseases during the past years in Peshtera Municipality.

Water supplied to the consumers is of good quality and entirely suitable for drinking purposes.

### 3.2.4.2. Wastewater quality monitoring

Water quality monitoring is carried out by Pazardzhik Regional Inspectorate for Environmental Protection /RIEW/. Sampling points are to be set up on Stara Reka River. So far, only the water course in the discharge area of the urban sewerage in the river has been monitored. The design develops a Plan for self-monitoring after the construction of the treatment plant. Such surveillance monitoring is periodically conducted by RIEW authorities. These control measurements normally take place every month. The following parameters characterise wastewater qualities and are compulsory to monitor: Suspended solids, BOD5, COD, Nt, Pt, ph. Water quantity is also determined. Waste water from the individual enterprises, which is discharged or will be discharged into the sewerage system of the settlement, should be compliant with the requirements of Ordinance 7/2000 on the terms and conditions for discharge of industrial water into the sewerage systems of the settlements. The monitoring, exercised by RIEW over the industrial companies, which do not discharge into the urban sewerage network is executed on the basis of a contract with each enterprise and may not occur at intervals longer than once per 4 months. The following parameters characterise wastewater qualities and are compulsory to monitor: Suspended solids, BOD5, COD, Dissolved Oxygen, $NO_3$ as well as specific pollution.

*Table 3-20 Wastewater Quality Monitoring*

| Entity responsible for monitoring | Location: River Basin / Code of Monitoring System / Location of measuring point | Frequency of Monitoring | Data Availability (from year – to year) | Parameters Monitored | Comments |
|---|---|---|---|---|---|
| Pazardzhik RIEW | Stara Reka River | Monthly | The site is under construction | BOD/COD | The site is under construction |
| VKS EOOD Peshtera | Water abstraction in points determined by the monitoring institutions | Monthly | 2000 - 2011 | NO3, turbidity, | Frequency of sampling should be observed, without missing any months |

**Conclusions and Recommendations**

Currently, the main source of pollution is untreated wastewater, discharged in the water coming from the town of Peshtera and from the other settlements in the municipal territory (Stara Reka River, a tributary of Maritsa River). The WWTP of the town of Peshtera is now under construction. Another, less important pollution source is the process of backwashing from the drinking water treatment plants of Peshtera, Saint Constantine Holiday Resort and Lukovitsa water intake. It is recommended to construct a tertiary

stage of the plants, where this water will be treated. Some industrial polluters / ET Nagi Trans, Chiko OOD and Bratya Angelovi OOD/ are located outside the agglomeration borders. It is obvious that local wastewater treatment facilities need to be built as soon as possible in order to ensure the necessary degree of treatment.

## 3.3. CURRENT WATER CONSUMPTION

### 3.3.1. CURRENT WATER CONSUMPTION BY CATEGORY OF WATER USERS

The table below shows the development of water consumption rate from the year 2009 until 2011 in VKS EOOD Peshtera.

*Table 3-21 Development of Water Consumption of the settlements in VKS EOOD Peshtera for the period from 2009 to 2011*

| Settlement | Customer | Unit | 2009 | 2010 | 2011 | % in 2011 |
|---|---|---|---|---|---|---|
| The town of Peshtera | Domestic Customers | m³/ year | 470,963 | 471,886 | 481,070 | 68% |
| | Public Customers (schools, kindergartens, administration, etc.) | m³/ year | 31,136 | 36,573 | 31,565 | 4% |
| | Industrial and Commercial Customers (companies) | m³/ year | 165,098 | 141,623 | 199,996 | 28% |
| | Total water sold | m³/ year | 667,197 | 650,082 | 712,631 | 100% |
| The village of Radilovo | Domestic Customers | m³/ year | 44,985 | 44,616 | 47,998 | 95% |
| | Public Customers (schools, kindergartens, administration, etc.) | m³/ year | 917 | 871 | 633 | 1% |
| | Industrial and Commercial Customers (companies) | m³/ year | 2,492 | 2,380 | 1,645 | 3% |
| | Total water sold | m³/ year | 48,394 | 47,867 | 50,276 | 100% |
| The village of Kapitan Dimitrievo | Domestic Customers | m³/ year | 28,146 | 28,851 | 27,578 | 93% |
| | Public Customers (schools, kindergartens, administration, etc.) | m³/ year | 9 | 15 | 14 | 0% |
| | Industrial and Commercial Customers (companies) | m³/ year | 1,749 | 2,677 | 2,126 | 7% |
| | Total water sold | m³/ year | 29,904 | 31,543 | 29,718 | 100% |
| Saint Constantine | Domestic Customers | m³/ year | 7,967 | 9,591 | 9,876 | 90% |
| | Public Customers (schools, kindergartens, administration, etc.) | m³/ year | | | | 0% |
| | Industrial and Commercial Customers (companies) | m³/ year | 2,428 | 2,792 | 1,099 | 10% |

| Settlement | Customer | Unit | 2009 | 2010 | 2011 | % in 2011 |
|---|---|---|---|---|---|---|
| | Total water sold | m³/ year | 10,395 | 12,383 | 10,975 | 100% |
| Total for VKS EOOD Peshtera | Domestic Customers | m³/ year | 552,061 | 554,944 | 566,522 | 70% |
| | Public Customers (schools, kindergartens, administration, etc.) | m³/ year | 32,062 | 37,459 | 32,212 | 4% |
| | Industrial and Commercial Customers (companies) | m³/ year | 171,767 | 149,472 | 204,866 | 25% |
| | Total water sold | m³/ year | 755,890 | 741,875 | 803,600 | 100% |

*Table 3-22 Summary of Water Consumption for VKS EOOD -Peshtera for the year 2011*

| Settlement | Total Population in Service Area | Population served | Service Coverage | Domestic Water Consumption | Percentage of Domestic Water Consumption | Non-Domestic Water Consumption | Percentage of Non-domestic Water Consumption | Total Consumption (Domestic + Non-Domestic) | Specific Domestic Consumption | Specific Total Water Consumption |
|---|---|---|---|---|---|---|---|---|---|---|
| | number | number | % | m³/year | % | m³/year | % | m³/year | l/c/d | l/c/d |
| The Town of Peshtera | 16,746 | 16,746 | 100% | 481,070 | 68% | 231,561 | 32% | 712,631 | 79 | 117 |
| The Village of Radilovo | 1,385 | 1,385 | 100% | 47,998 | 96% | 2,278 | 4% | 50,276 | 95 | 99 |
| The village of Kapitan Dimitrievo | 768 | 768 | 100% | 27,578 | 93% | 2,140 | 7% | 29,718 | 98 | 106 |
| Saint Constantine Holiday Resort | 1,620 | 1,620 | 100% | 9,876 | 90% | 1,099 | 10% | 10,975 | 38 | 42 |
| **Total** | **20,519** | **20,519** | **100%** | **566,522** | **71%** | **237,078** | **29%** | **803,600** | **79** | **109** |

Notes:

1. The number of population for the year 2011 is taken from the Census.

2. The given number of visitors for Saint Constantine Holiday Resort includes the ones staying in the resort season well as in the weekends. The rate is calculated on the basis of 160 days

### 3.3.2. WATER BALANCE AND NON-REVENUE WATER ASSESSMENT

**Methodology:**

The table below presents a standard water balance, according to IWA. The main components of the water balance are: Total drinking water produced, billed (sold) water and unbilled water, which is the difference between total water produced and water sold. According to IWA, the unbilled water itself is divided into several components depending on the reasons why the relevant quantity has not been invoiced.

*Table 3-23 IWA Standard Water Balance*

<table>
<tr><td rowspan="8">Total drinking water produced (system input) (m3/year) [Q]</td><td rowspan="4">Authorized consumption (m3/year)</td><td rowspan="2">Billed authorised consumption (m3/year)</td><td>Billed metered consumption (m3/year) [A]</td><td rowspan="2">Revenue water (billed) (m3/year)</td></tr>
<tr><td>Billed unmetered consumption (m3/year) [B]</td></tr>
<tr><td rowspan="2">Unbilled authorised consumption (m3/year)</td><td>Unbilled metered consumption (m3/year) [C]</td><td rowspan="6">Non-Revenue water (water losses) (m3/year)</td></tr>
<tr><td>Unbilled unmetered consumption (m3/year) [D]</td></tr>
<tr><td rowspan="4">Water Losses (m3/year)</td><td rowspan="2">Apparent (Commercial) losses (m3/year)</td><td>Theft (m3/year) [E]</td></tr>
<tr><td>Metering inaccuracies (m3/year) [F]</td></tr>
<tr><td rowspan="3">Real (Technical) losses (m3/year)</td><td>Leakage on mains and transmission water pipelines (m3/year) [G]</td></tr>
<tr><td>Leakage from overflow at storage tanks (m3/year) [H]</td></tr>
<tr><td>Leakage on service connections before customer meter (m3/year) [I]</td></tr>
</table>

Detailed information:

- [Q]: total water produced and delivered to the settlements of Peshtera Municipality. It is determined by means of water meters, installed on the feeding pipelines and according to the flow rates of the water sources.
- [A]: total consumption invoiced to all customers who are equipped with water meters
- [B]: total consumption invoiced to customers without meters (this is by definition an estimate); there are no such customers on the territory of VKS EOOD Peshtera
- [C]: total consumption that is metered but not invoiced (consumers, who get free water, but on legal ground for this –there are no such customers on the territory of VKS EOOD Peshtera
- [D]: total consumption that is neither metered nor billed, but authorised, consumption by fire hydrants or fountains, reservoir washing, flushing of filters at the treatment plants, etc. this is by definition an estimate
- [E]: water that is stolen through illegal connections or other means; this is by definition an estimate

- [F]: water that is consumed by metered customers whose water meters incorrectly record water(less water than the real consumption)
- [G]: water that is lost due to hidden leaks or failures on the pipelines (transmission and distribution); it is given on the basis of observations and assumptions of WSS company staff. No precise studies and measurements have been conducted.
- [H]water that spills from reservoirs and service tanks; there is currently no such water
- [I]: water that is lost due to hidden leaks or failures on the service connections; it is given on the basis of information provided by WSS company staff. No specialized measurements have been carried out.

The following assumptions were made to determine the components of water balance:

*Table 3-24 Assumption for assessment of water balance components*

| Losses | Assumptions |
|---|---|
| Non-revenue water | Data on water produced and water billed water are provided by VKS EOOD Peshtera. Total non-revenue water is calculated as the difference between the total water quantity supplied to the water supply systems (water produced) and the total quantity of water billed (sold). For unmetered water sources, the quantity of the water has been estimated. |
| Unbilled metered consumption | This information is provided by Billing department, for metered users, which are not invoiced<br>There are no customers, endowed with water meters, which are not billed on the territory of Peshtera Municipality, respectively VKS EOOD Peshtera i.e. there are no consumers who legally get free water. |
| Unbilled unmetered consumption | This water quantity is mainly produced as a result of backwashing of filters and from water intended for periodical washing of water chambers of the pressure reservoirs as well as to a lower degree due to fire hydrant or public fountains. |
| Unauthorised consumption | Based on information provided by the WSS operator, there are a certain number of illegal connections to the distribution networks in the town of Peshtera as well as in both villages, Radilovo and Kapitan Dimitrievo. Their exact number is difficult to establish, except when the street water distribution pipelines are replaced.<br>It is assumed that ≈10% of delivered water is used as unauthorized consumption. We point out that it is not sure that after finding the illegal connections, this unauthorized consumption will turn into authorized one. It may be presumed that in the best case between 1/4 and 1/5 of it will become legal consumption. The remaining part will be dropped out as consumption. |
| Metering Inaccuracies and data error correction | Based on information provided by VKS EOOD Peshtera, 100% of the registered consumers have water meters, including the private, public and industrial ones.<br>The data from all water meters are read on a monthly basis. According to the conducted inspections of the old water meters, 80% of these water meters give indications lower that the real flows.<br>The exact accuracy of water meters is not known. According to VKS EOOD Peshtera the metering inaccuracy results in apparent (commercial) losses of about 10 to 11% of delivered water. |
| Real Losses in the | The physical losses in the network result from invisible leakages, visible failures, reservoir overflow, drawdown of distribution networks for repair |

| Losses | Assumptions |
|---|---|
| network | works or in case of breakdowns, etc.<br>Real losses are calculated as a difference between non-revenue water (unbilled water) minus the above mentioned types of losses.<br>Based on information provided by VKS EOOD Peshtera about 1/4 of the real losses in the network are formed due to failures and leakages at service connections.<br>No water overflows have been registered at the reservoirs over the past years. |

The table below shows the results of the water balance and its components for the year 2011.

*Table 3-25 IWA Water Balance for the town of Peshtera in 2011*

<table>
<tr><td rowspan="8">Total drinking water produced (system input) 2,377,964 m3/year [Q]</td><td rowspan="3">Authorised consumption 1,040,725 m3/year</td><td rowspan="2">Billed authorised consumption 803,600 m3/year</td><td>Billed metered consumption 803,600 m3/year [A]</td><td rowspan="2">Revenue water (billed) 803,600 m3/year</td></tr>
<tr><td>Billed unmetered consumption 0 m3/year [B]</td></tr>
<tr><td rowspan="2">Unbilled authorised consumption 237,125 m3/year</td><td>Unbilled metered consumption 0 m3/year [C]</td><td rowspan="7">Non-Revenue water (water losses) 1,574,229 m3/year</td></tr>
<tr><td>Unbilled unmetered consumption 237,125 m3/year [D]</td></tr>
<tr><td rowspan="5">Water Losses 1,337,239 m3/year</td><td rowspan="2">Apparent (Commercial) losses 431,000 m3/year</td><td>Theft 204,725 m3/year [E]</td></tr>
<tr><td>Metering inaccuracies 226,275 m3/year [F]</td></tr>
<tr><td rowspan="3">Real (Technical) losses 774,918 m3/year</td><td>Leakage on transmission and distribution lines 581,188 m3/year [G]</td></tr>
<tr><td>Leakage from overflow at storage tanks 0 m3/year [H]</td></tr>
<tr><td>Leakage on service connections 193,730 m3/year [I]</td></tr>
</table>

The table below summarises water production, water consumption and non-revenue water for the water supply zones in Peshtera.

*Table 3-26 Summary of Water Production, Water Consumption and Non-Revenue Water in the period from 2009 to 2011 for the settlements on the territory, served by VKS EOOD Peshtera*

| Year a | Total water quantities delivered | Inhabitants | Total Water Sold in m3/year and norms | | | | | | | Overall Rate | NRW (total losses) |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Domestic | Overall Rate | Industries and companies | Rate | Public services | Rate | Total water sold | | |
| | m3/year | number | m3/year | l/c/d | m3/year | l/c/d | m3/year | l/c/d | m3/year | l/c/d | % |
| Water Supply of the town of Peshtera | | | | | | | | | | | |
| 2009 | 2,395,914 | 19,363 | 470,963 | 67 | 165,098 | 23 | 31,136 | 4 | 667,197 | 94 | 72 |
| 2010 | 2,111,628 | 19,288 | 471,886 | 67 | 141,623 | 20 | 36,573 | 5 | 650,082 | 92 | 69 |
| 2011 | 2,159,488 | 16,746 | 481,070 | 79 | 199,996 | 33 | 31,565 | 5 | 712,631 | 117 | 67 |
| Water Supply of the village of Radilovo | | | | | | | | | | | |
| 2009 | 135,881 | 1,448 | 44,985 | 85 | 2,492 | 5 | 917 | 2 | 48,394 | 92 | 64 |
| 2010 | 135,881 | 1,434 | 44,616 | 85 | 2,380 | 5 | 871 | 2 | 47,867 | 91 | 65 |
| 2011 | 135,881 | 1,385 | 47,998 | 95 | 1,645 | 3 | 633 | 1 | 50,276 | 99 | 63 |
| Water Supply of the village of Kapitan Dimitrievo | | | | | | | | | | | |
| 2009 | 50,615 | 746 | 28,146 | 103 | 1,749 | 6 | 9 | 0 | 29,904 | 110 | 41 |
| 2010 | 52,935 | 750 | 28,851 | 105 | 2,677 | 10 | 15 | 0 | 31,543 | 115 | 40 |
| 2011 | 51,238 | 768 | 27,578 | 98 | 2,126 | 8 | 14 | 0 | 29,718 | 106 | 42 |
| Water Supply of St. Constantine Holiday Resort | | | | | | | | | | | |
| 2009 | 31,357 | 1,480 | 7,967 | 34 | 2,428 | 10 | 0 | 0 | 10,395 | 44 | 67 |
| 2010 | 31,357 | 1,530 | 9,591 | 39 | 2,792 | 11 | 0 | 0 | 12,383 | 51 | 61 |
| 2011 | 31,357 | 1,620 | 9,876 | 38 | 1,099 | 4 | 0 | 0 | 10,975 | 42 | 65 |
| Total for VKS EOOD Peshtera | | | | | | | | | | | |
| 2011 | 2,377,964 | 20,519 | 566,522 | 79 | 204,866 | 27 | 32,212 | 4 | 803,600 | 107 | 66 |

Notes:

1. The number of population for the year 2011 is taken from the Census.

2. The given number of visitors for Saint Constantine Holiday Resort includes the ones staying in the resort season well as in the weekends. The rate is calculated on the basis of 160 days.

### 3.3.3. CONCLUSIONS AND RECOMMENDATIONS

**Conclusions:**

It is striking that water losses in the water supply systems of Peshtera Municipality are too high, but not unusual for the water supply in Bulgaria. Losses within that range indicate

poor condition of the water supply systems, in terms of their physical state (failures, leaking pipes. etc.), as well as with regard to water metering accuracy (i.e. water produced and consumed).

**Recommendations:**

Systematic measures should be undertaken to reduce losses.

The activities intended for reducing physical losses should include the following:

- Replacement of old water transmission (external) mains.
- Replacement of old water distribution pipelines and the associated service connections
- Timely repair of failures on the water pipelines.
- Detection and repair of invisible leakages (failures)

The activities necessary for reducing commercial losses are:

- Installation of water meters on all water transmission mains after the water sources.
- Installation of water meters on feeding pipes of reservoirs
- Implementation of the programme for verification and replacement of water meters of domestic consumers.
- Detection and interruption of unauthorised water connections.

## 3.4. WATER SUPPLY INFRASTRUCTURE

### 3.4.1. GENERAL FEATURES

There are three external water supply systems, located on the territory of VKS EOOD – Peshtera, which are not connected to one another, namely:

**Water supply system of the town of Peshtera**

The system consists of 6 comparatively small external water supply groups, which take water from 14 water sources of different type (9 catchment systems, 1 river intake and 4 tube wells).

Two of the external water supply groups provide water by pumping, and four of them fully rely on gravity water delivery. The water supply system of the town of Peshtera has two treatment facilities (rapid filters) and 5 pressure reservoirs with a total volume of V=3,530 $m^3$. Water from the reservoirs is conveyed to the town distribution network with a total length of L=46.84 km.

**Water supply system of the villages of Radilovo and Kapitan Dimitrievo**

The system comprises 3 small external water supply groups. The water sources are7 catchment systems and the pressure reservoirs of V=36,000 $m^3$ of the town of Pazardzhik.

Two of the groups deliver water to the villages by gravity, one to Radilovo (from 6 catchment systems) and the other to Kapitan Dimitrievo (from 1 catchment system).

The third external water supply group transports water by pumping and serves both villages. It sends water from the reservoirs of the town of Pazardzhik.

The village of Radilovo is served by 3 pressure reservoirs with a total volume of V=920 $m^3$. The distribution network of the village has a length of L=16,000 m.

The village of Kapitan Dimitrievo has 2 pressure reservoirs with a total volume of V=420 $m^3$. The distribution network of the village has a length of L=8,500 m.

**Water supply system of Saint Constantine Holiday Resort**

The system consists of two external water supply groups. Both systems deliver water by pumping.

Water sources – 1 catchment system and a water tower, reservoir on channel feeding Batak Dam.

The resort has 3 pressure reservoirs with a total volume of V=107 $m^3$.

## 3.4.2. WATER SUPPLY ZONES

The existing external water supply zones on the territory of VKS EOOD Peshtera are presented on Layout 2 – Layout of current external water supply of the settlements in Peshtera Municipality.

### *3.4.2.1. External Water Supply Systems of the town of Peshtera (Zone 1)*

#### *3.4.2.1.1. General Features*

Water supply system comprises the following components:

*Table 3-27 General Features of External Water Supply System of the town of Peshtera*

| Component | Description |
|---|---|
| Water Sources | - 9 catchment systems (spring catchments)<br>- 4 tube wells<br>- 1 river intake |
| Treatment Facilities | - 2 treatment plants endowed with rapid self-flushing sand filters and chlorination |
| Chlorination | - 2 pressure reservoirs, where sodium hypochlorite is added by dosing pumps |
| Water Storage | 5 pressure reservoirs |
| Pumping Stations | 5 pumping stations, of which<br>- 4 BPSs (borehole pumping stations) with submersible pumps in the tube wells. One of the BPSs is out of operation.<br>- 1 horizontal pump and a suction tank of V=50 $m^3$. |
| Transmission mains | A total of 25.910 km having diameter of between |

| | |
|---|---|
| | ∅300 and ∅50 and built of steel, asbestos cement and polyethylene pipes. |
| Connected Settlements | 1 - the town of Peshtera |
| Total Population in Service Area | 16,746 people (for the year 2011) |
| Connected Population | 16,746 people |
| % of connected population | 100% |

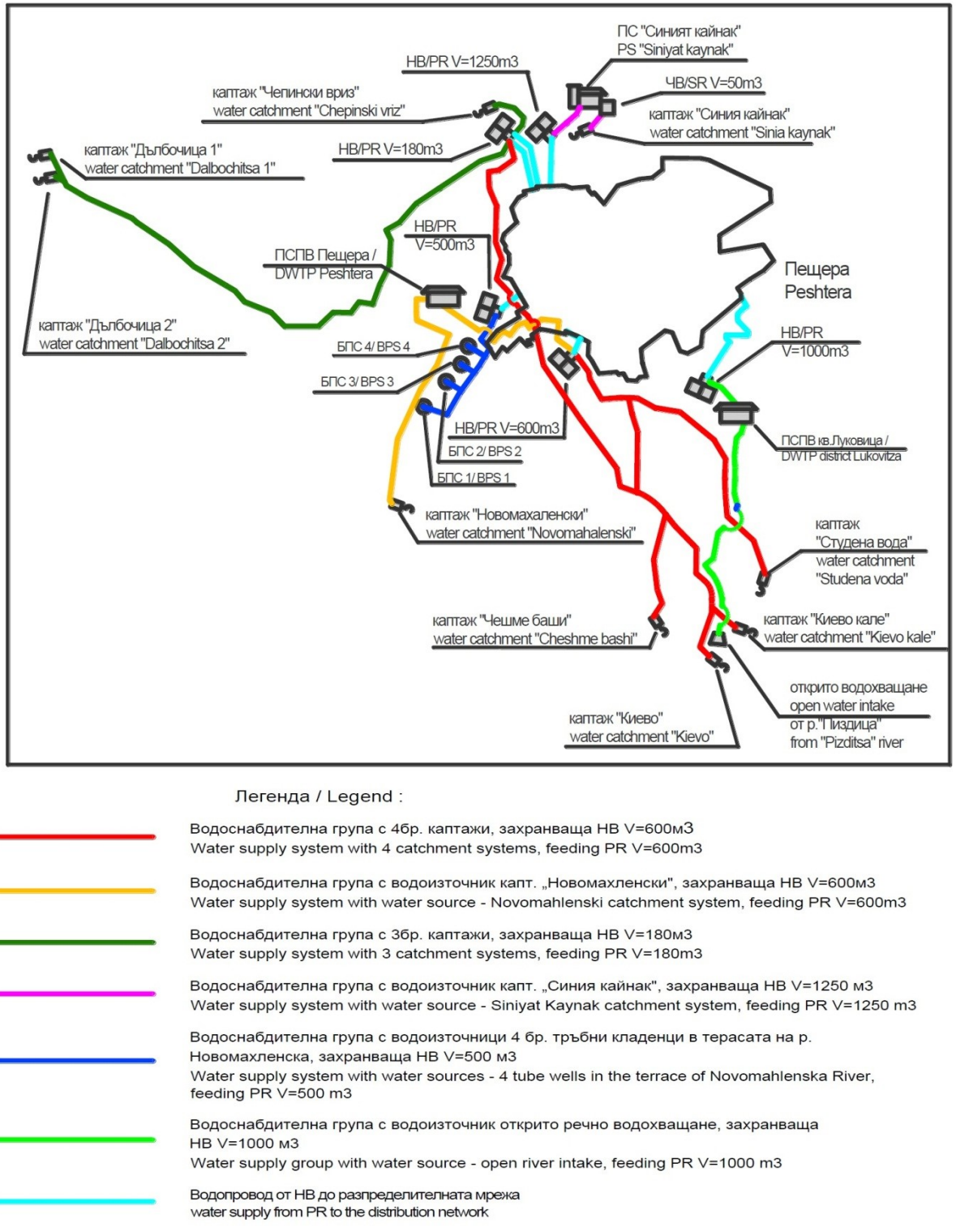



*Figure 3-1 Plan of external water supply of the town of Peshtera*

#### 3.4.2.1.2. Water Sources

The characteristics of the water sources are presented by water supply groups in the tables below and outlined in more detail for every water sources in item 3.1 and in Appendix 3-3.

*Table 3-28 Water supply system with 4 catchment systems, feeding PR of V=600m3, main characteristics of the water sources*

| Name of Water Source | Flows* | | | Year of construction | Notes: |
|---|---|---|---|---|---|
| | Qmin l/s | Qoper. l/s | Qmax. l/s | | |
| Studenata Voda | 2.50 | 4.80 | 9.00 | 1930 | Catchment system is in poor condition. Pipe connection with the water main to Peshtera is broken and the catchment system is currently non-operational |
| Kievo Kale | 3.00 | 3.15 | 4.50 | 1967 | In good condition |
| Kievo | 16.00 | 18.90 | 25.00 | 1930 | In good condition |
| Cheshme Bashi | 0.50 | 2.40 | 6.00 | 1930 | Reconstructed in 1968. In good condition. |
| Total water quantity | 22.00 | 29.25 | 44.50 | N/A | - |

*Table 3-29 Water Supply Group with Water Source of Novomahlenski Catchment System, feeding PR of V=600m3 – main characteristics of the water source*

| Name of Water Source | Flows* | | | Year of construction | Notes: |
|---|---|---|---|---|---|
| | Qmin l/s | Qoper. l/s | Qmax. l/s | | |
| Novomahlenski | 12.00 | 18.10 | 30.00 | 1962 | Karst spring. Its water becomes turbid during heavy rainfalls and snow melting. |

*Table 3-30 Water supply system with 3 catchment systems, feeding old PR of V=180m3 of Chepinski Vriz - old, main characteristics of the water sources*

| Name of Water Source | Flows* | | | Year of construction | Notes: |
|---|---|---|---|---|---|
| | Qmin l/s | Qoper. l/s | Qmin l/s | | |
| Dalbochitsa 1 | 2.50 | 3.00 | 4.00 | 1965 | Water is lost. At present, no water is delivered. |
| Dalbochitsa 2 | 2.50 | 3.00 | 4.00 | 1994 | In good condition |
| Chepinski Vriz | 1.00 | 2.10 | 4.00 | 1967 | The intake chamber is not in very good condition |
| Total water quantity | 6.00 | 8.10 | 12.00 | N/A | - |

*Table 3-31 Water supply system with water source of Siniyat Kamak catchment system, feeding new PR of V=1,250 m3 of Chepinski Vriz, main characteristics of the water source*

| Name of Water Source | Flows* | | | Year of construction | Notes: |
|---|---|---|---|---|---|
| | Qmin l/s | Qoper. l/s | Qmin l/s | | |
| Siniya Kainak | 12.00 | 18.10 | 30.00 | 1968 | Belt I around the catchment system is unfenced |

*Table 3-32 Water supply system with water sources represented by 4 tube wells in the terrace of Novomahlenska River, feeding PR of V=500 m3, main characteristics of the water sources*

| Name of Water Source | Flows* Q [l/s] | Year of construction | Notes: |
|---|---|---|---|
| Tube well1 (TW1) | 6.2 | 1992 | In good condition |
| Tube well2 (TW2) | 6.1 | 1992 | In good condition |
| Tube well3 (TW3) | 2.5 | 1992 | The pump sucks sand– non-operational |
| Tube well4 (TW4) | 4.5 | 1992 | Unreliable well, set in operation only as a last resort. |
| Total water quantity | 19.3 | N/A | - |

* The value of the specified flows is taken from the hydrological reports for those water sources, drawn up by Vodokanal AD-Plovdiv. These reports include the results of the flow monitoring and measurement conducted by VKS EOOD Peshtera.

We point out that the water sources that can be considered reliable are only TW1 and TW2, with a total yield of 12.3 l/s. TW4 is just used in case of exceptional necessity and cannot be considered a permanent and reliable water source for the town of Peshtera. This well has not been put into operation because of concerns it could be damaged as TW3.

*Table 3-33 Water supply group with water source represented by open river intake, feeding PR of V=1,000 m3, main characteristics of the water source*

| Name of Water Source | Flows | | Year of construction | Notes: |
|---|---|---|---|---|
| | Qmin l/s | Qmax l/s | | |
| Open river intake | 8.00 | 15.00 | ≈ 2008 | It is currently out of operation. |

All water sources, supplying water to the town of Peshtera, are provided with sanitary protection zones according to the requirements of Ordinance №3 (Prom. SG. Issue 88/2000).

In general, the water sources of the town of Peshtera are in good condition, except for Studenata Voda catchment system, Dalbochitsa 1 catchment system and Tube Well 3. Both catchment systems can be reconstructed and renovated. It may be assumed that TW3 will not be put into operation again.

Taking into account the condition of water sources and the data specified above, the guaranteed minimum water quantity that can be delivered to the reservoirs of the town of Peshtera is as follows:

*Table 3-34 Guaranteed minimum water quantities for the town of Peshtera from the existing water sources*

| Type of Water sources | Flow |
|---|---|
| | l/s |
| From catchment systems | 52 |
| From tube wells (without TW3 and TW4) | 12.30 |
| Total: | 64.30 |

After putting the river intake (Qmin=8 l/s) into operation, the total guaranteed minimum water quantity will amount to 72.30 l/s.

TW4, with a yield of 4.5 l/s can also be launched, if necessary. Its permanent operation is not recommended since it could be damaged, just like TW3.

An average of 67 to 68 l/sec (for the year 2011) is currently supplied to the network of the town of Peshtera.

In the presence minimum flow of 72.30 l/sec and possibility to deliver 76.8 l/sec when TW4 is in operation, the water consumption of the town is fully covered by the water sources.

There are no water supply restrictions to the consumers in the town of Peshtera.

#### *3.4.2.1.3. Water Treatment for the Town of Peshtera*

Drinking Water Treatment

**A. Drinking Water Treatment Plant of the town of Peshtera**

It is envisaged to provide water treatment without using reagents. Disinfection is carried out by adding chlorine gas. Backwash water is directly discharged into surrounding environment.

#### *3.4.2.1.4. Water Storage*

The list of reservoirs for the water supply zone of Peshtera is presented in the table below. More details about the reservoirs are given in Appendix 3-3.

*Table 3-35 Reservoirs of the water supply zone Peshtera*

| Name | Location | Total volume [m³] | Year of construction | Notes |
|---|---|---|---|---|
| PR of V=600 m³, south | The town of Peshtera | 600 | 1965 | In good condition |
| Old PR of V=180 m³, Chepinski Vriz | The town of Peshtera | 180 | 1950 | In good condition |
| PR of V=500 m³ | The town of Peshtera | 500 | 1993 | In good condition. Corroded pipe systems and handrails |
| New PR of V=1,250 m³, Chepinski Vriz | The town of Peshtera | 1,142 | 1987 | In good condition |
| PR of V=1000 m³ | The town of Peshtera | 1,000 | 2010 | Not yet put into operation. |
| **Total for the town of Peshtera** | | **3,422** | N/A | - |

*Figure 3-2 Pressure reservoir of V=500 m3*

### *3.4.2.1.5. Pumping Stations of Water Supply Zone Peshtera*

The list of pumping stations of Peshtera water supply zone is presented in the table below. More detailed data are given in Appendix 3-3.

*Table 3-36 Pumping stations of Peshtera water supply zone*

| Name | Number of pumps | Operating capacity of pumps [m³/h] | Suction Tank [m³] | Year of construction | Observations |
|---|---|---|---|---|---|
| BPS 1 (borehole pumping station 1) at TW1 | 1 | 29 | | 1992 | The pump and the borehole are in good condition |
| BPS 2 (borehole pumping station 2) at TW 2 | 1 | 36 | | 1992 | The pump and the valve chamber are in good condition |
| BPS 3 (borehole pumping station 3) at TW 3 | 1 | 9 | | 1992 | The pump and the valve chamber are in good condition. Not in use. |
| BPS 4 (borehole pumping station 4) at TW 4 | 1 | 16 | | 2992 | The pump and the valve chamber are in good condition. It is launched in extreme cases. |
| Siniyat Kainak PS | 3 | 108 | V=50 m³ | 1969-1970 | The standby pump is dismantled. Groundwater penetrates into the engine room of the PS and is extracted by a small pump. |
| **Total in theory** | N/A | **198** | N/A | N/A | - |
| **Total for normal operation** | N/A | **173** | N/A | N/A | - |

BPS 3 (at TW 3) has not been used in the past years. This pumping station and the water source to it (TW3) will be most probably put out of operation.

BPS 4 (at TW 4) is rarely used, only in case of exceptional necessity.

*Figure 3-3 Borehole pumping station 1 (BPS 1)*

*Figure 3-4 Siniyat Kainak PS*

#### *3.4.2.1.6. Transmission Mains of Peshtera Water Supply Zone*

The list of transmission mains is given in the tables below. More detailed data are presented in Appendix 3-3.

*Table 3-37 Total Transmission Mains of Peshtera Water Supply Zone*

| Material | Diameter [mm] | Length [km] | Year of construction | Observations |
|---|---|---|---|---|
| Asbestos cement | 80 - 300 | 16.610 | 1963-1969 | Obsolete pipes |
| Steel | 50 - 273 | 2.480 | 1967-1992 | Failures may be expected due to pipe age |
| Steel (Mannesmann) | 90 | 3.180 | 1950 | In relatively good condition |
| PE | 140 - 250 | 3.640 | 2006-2009 | In good condition |
| **Total length of external water pipelines** | N/A | **25.910** | N/A | - |

Deficiencies:

- The majority of transmission mains of the town of Peshtera are built of asbestos cement pipes (L=16.610km, or 64%) more than 35 to 40 years ago. The failures on these water pipelines are not very frequent, but are difficult to repair due to the

rugged and difficult-to-access terrain, especially in winter months from December to March.

- The probable losses on these water mains are estimated to be about 10% of the real losses in the water supply system of Peshtera (≈77,500 m³/year).
- The major deficiency is the pipe material. The varying discharges of the water sources lead to formation of high flow velocities, which make the walls of asbestos cement pipes thinner.

#### 3.4.2.1.7. Supplied Settlements

The water supply systems in Zone 1 provide water only to the town of Peshtera.

*Table 3-38 Settlements in Peshtera water supply zone*

| Name of Settlement | Total Population [number] | Population connected to network [number] | Share of population connected to network [%] | Quantity of Water Supplied [m³/year] | Water meter installed [yes/no] |
|---|---|---|---|---|---|
| The town of Peshtera | 16,746 | 16,746 | 100 | 2,159,488 | No |

*Measurement of water sent to the town of Peshtera*.

- Water discharging by gravity from the water sources to the reservoirs of Peshtera is only measured at the water pipeline from Novomahlenski catchment system (after the filter) and before the reservoir of V=1,000 m³ of the new water supply group (not yet put into operation). Water from all catchment systems, delivering water by gravity to the town of Peshtera is presented on the basis of its flows.
- Water pumped to the reservoirs is metered at Siniya Kainak PS and at each BPS (borehole pumping station) of the four boreholes.

#### 3.4.2.1.8. Efficiency of the Water Supply Systems

Operation and Maintenance Costs:

The annual operation and maintenance costs of VKS EOOD Peshtera are presented in the table below.

*Table 3-39 Operation and Maintenance costs of the water supply systems operated by VKS EOOD - Peshtera*

| Cost Item | Value (thousand BGN/year) | Share of Total [%] |
|---|---|---|
| 1. Energy | 81 | 9 |
| 2. Materials | 287 | 32 |
| 3. Personnel | 312 | 35 |
| 4. Maintenance | 216 | 24 |
| 5. Others | - | - |
| **Total** | **896** | **100** |

**Failures on the external water pipelines for the town of Peshtera and water supply security:**

According to the data provided by VKS EOOD –Peshtera the total number of failures on external water pipelines of the town of Peshtera for the year 2011 is 6. Three of them were located on the asbestos cement water pipeline of ∅300 from Novomahlenski catchment system to the treatment facility. For a length of 2.30 km of this section, the number of failures per kilometre is 1.3 pcs/km/year.

There is no data on the exact location of the remaining failures. The nature of breakdowns is not identified too.

For a total length of the water pipelines, conveying water to the town of Peshtera equal to 25.91 km in 2011, the number of failures per kilometre is 0.23 pcs/km and 0.0164 pcs/day

Despite the old and obsolete pipes, the relatively small number of visible failures is probably due to the low pressures in the water pipeline sections, as a result of the presence of break-pressure chambers.

Although the external water supply system of the town of Peshtera is predominantly old and built of obsolete asbestos cement pipes, in general, water supply is comparatively stable. This is due to the large number of water sources and groups, which supply the pressure reservoirs. In case of an external failure, it is not possible that big parts of the town are left without water.

**Water losses:**

Based on the information obtained from VKS EOOD Peshtera probably about 10% of the real losses in the water supply system of Peshtera are formed along the external water pipelines; these are ≈ 77,500 $m^3$/year (the major part are most likely caused by small invisible failures, which are difficult to detect or are not found at all).

**Energy Efficiency:**

The assessment reveals that:

The pumps in the existing pumping stations of the systems are new models (“PLEUGER” brand) and are in good condition. No increased energy consumption or reduced capacity is registered.

### 3.4.2.1.9. Summary of Main Deficiencies

*Table 3-40 Summary of main deficiencies in the water supply system of the town of Peshtera*

| № | Components | Main Deficiency |
|---|---|---|
| 1 | Water Sources | - Some of the catchment systems are in poor condition. Repair works and reconstruction are required (Studenata Voda and Dalbochitsa 1 catchment systems)<br>- BPS 3 is out of operation<br>- BPS 4 is operated only in case of emergency cases.<br>- A major part of the catchment systems is difficult to access, especially in the period from December to March |
| 2 | Water Treatment(purification and chlorination) | - Water entering PR of V=180 $m^3$ is not chlorinated.<br>- Backwash water from the rapid filters and water from the sedimentation tanks is discharged into the surrounding environment without any treatment<br>-Water disinfection with chlorine is carried out without meeting the requirements for safe work. The injected amount of chlorine is not automatized proportionally to the introduced flow. No system is envisaged for signalization and automatic deactivation of releases as a result of possible disruption of connections tightness along the line for introducing chlorine.<br>- Rapid self-cleaning filters are sand filters installed outdoors. In case of low ambient temperatures they freeze over, which makes their self-cleaning difficult. |
| 3 | Water Storage (reservoirs) | - Reservoirs are in need of better current maintenance, fight against external corrosion of pipes and fittings, replacement of old Stop Valves, pipes, handrails, ladders, etc. |
| 4 | Pumping Stations | - There is no standby pump in Siniyat Kainak PS.<br>- is necessary to provide better maintenance to the steel pipe systems in the engine rooms and the chambers. |
| 5 | Transmission Mains | - The major part of the pipes is old and obsolete, particularly the ones made of asbestos cement. Despite of the relatively small registered failures, these pipes are in poor condition, being a potential source of problems for the external supply of the town of Peshtera<br>- About 2/3 of the length of the external water pipelines is located in difficult-to-access areas. The access to these sections is extremely hard in the presence of snow cover in the period from December to March.<br>- The water pipeline from Kievo Kale catchment system is currently disconnected due to on-going construction works. |
| 6 | Water Metering | - Insufficient metering devices at the water sources and at the inlet of reservoirs. The measurement of water sent to the external system is not accurate. |

### 3.4.2.2. External Water Supply Systems of the villages of Radilovo and Kapitan Dimitrievo (Zone 2)

#### 3.4.2.2.1. General Features

Water supply system comprises the following components:

*Table 3-41 General Features of External Water Supply System of the villages of Radilovo and Kapitan Dimitrievo*

| Component | Description |
|---|---|
| Water Sources | - 7 catchment systems (spring catchment), 6 for Radilovo and 1 for Kapitan Dimitrievo<br>- water supply from the existing pressure reservoirs of the town of Pazardzhik of V=36,000 m$^3$, through Kapitan Dimitrievo PS |
| Treatment Facilities | - Water quality does require any treatment |
| Chlorination | - Chlorination of water from the catchment systems is carried out by adding sodium hypochlorite in the reservoirs of the villages.<br>- Water entering the reservoirs of the town of Pazardzhik is chlorinated. |
| Water Storage | 5 pressure reservoirs (3 for Radilovo and 2 for Kapitan Dimitrievo) |
| Pumping Stations | 1 pumping station with two groups of horizontal pumps. (1 group for Radilovo and 1 group for Kapitan Dimitrievo) and Suction Tank of V=100 m$^3$ |
| Transmission mains | A total of 24.46 km having diameter of between ∅219 and ∅60; steel and asbestos cement pipes |
| Connected Settlements | 2 – the villages of Radilovo and Kapitan Dimitrievo |
| Total Population in Service Area | 2,153 people (for the year 2011) |
| Connected Population | 2,153 people |
| % of connected population | 100% |

#### 3.4.2.2.2. Water Sources

Characteristics of water sources are presented by water supply systems (groups) in the tables below and outlined in more detail for each water source in item 3.1 as well as in Appendix 3-4.

**Water sources, supplying water to the village of Radilovo**

*Table 3-42 Water supply system (group) with 6 catchment systems, feeding PR of V=120 m3 and PR of V=300 m3 of high zone, main characteristics of the water sources*

| Name of Water Source | Flows* | | | Year of construction | Notes: |
|---|---|---|---|---|---|
| | Qmin l/s | Qoper. l/s | Qmax. l/s | | |
| Malinovi Livadi | 0.15 | 0.63 | 4.00 | 1930 | In good condition |
| Chatal Uluk | 0.30 | 0.73 | 4.20 | 1959 | In good condition |
| Borov Chuchur 1 | 0.20 | 0.32 | 2.50 | 1930 | In good condition |

| Name of Water Source | Flows* | | | Year of construction | Notes: |
|---|---|---|---|---|---|
| | Qmin l/s | Qoper. l/s | Qmax. l/s | | |
| Borov Chuchur 2 | 0.10 | 0.25 | 2.50 | 1967 | In good condition |
| Demishki Dol | 2.80 | 4.28 | 19.00 | 1968-1969 | In good condition |
| Kapinov Dol | 0.20 | 0.31 | 1.50 | 1967 | In good condition |
| **Total water quantity** | **3.75** | **6.52** | **23.70** | N/A | - |

**Water sources, supplying water to the village of Kapitan Dimitrievo**

*Table 3-43 Water supply system (group) with water source of Osmanagovitsa catchment system, feeding PR of V=120 m3, main characteristics of the water sources*

| Name of Water Source | Flows* | | | Year of construction | Notes: |
|---|---|---|---|---|---|
| | Qmin l/s | Qoper. l/s | Qmax. l/s | | |
| Osmanagovitsa | 1.20 | 1.60 | 2.40 | 1944 | In good condition |

* The value of the specified flows is taken from the hydrological reports for those water sources, drawn up by Vodokanal AD-Plovdiv. These reports include the results of the flow monitoring and measurement conducted by VKS EOOD Peshtera.

Water supply from the existing pressure reservoirs of the town of Pazardzhik of V=36,000 $m^3$.

Water delivery from the reservoirs of Pazardzhik takes place through gravity transmission main section, Kapitan Dimitrievo pumping station and pressure pipelines – one to PR of V=300 $m^3$ for Kapitan Dimitrievo and second to PR of V=500 $m^3$ for Radilovo.

The total water quantity supplied by the reservoirs of Pazardzhik is 10 l/s, where 5 l/s are conveyed to Kapitan Dimitrievo and 5 l/s to Radilovo.

Water is purchased to ViK Pazardzhik.

All catchment systems, supplying water to both villages are provided with sanitary protection zones, according to the requirements of Ordinance №3.

*Table 3-44 Guaranteed minimum water quantities for the villages of Radilovo and Kapitan Dimitrievo from the existing water sources*

| Type of Water sources | Flow l/s |
|---|---|
| From catchment systems | 4.95 |
| From reservoirs of the town of Pazardzhik | 10.00 |
| Total: | 14.95 |

There is no restriction on water supply to the consumers in the villages of Radilovo and Kapitan Dimitrievo.

#### *3.4.2.2.3. Water Treatment*

There are no treatment plants or special treatment facilities.

Chlorination of water from the catchment systems is conducted in the pressure reservoirs by adding sodium hypochlorite (NaOCl). It is injected by manually controlled dosing pump and has permanent dose, determined in the course of operation, which meets the requirements of the standard for presence of residual chlorine in drinking water. Thus, in certain hours, water is either over-chlorinated or insufficiently chlorinated.

Water from the reservoirs of Pazardzhik is chlorinated when sent to Kapitan Dimitrievo pumping station.

#### 3.4.2.2.4. Water Storage

The list of reservoirs for the water supply zone of the villages of Radilovo and Kapitan Dimitrievo is presented in the table below. More details about reservoirs are given in Appendix 3-4.

*Table 3-45 Reservoirs of the water supply system in the villages of Radilovo and Kapitan Dimitrievo*

| Name | Location | Total volume Vo [m³] | Year of construction | Notes: |
|---|---|---|---|---|
| PR of V=300 m³, high zone | The village of Radilovo | 300 | 1992-1993 | In good condition |
| PR of V=120 m³, high zone | The village of Radilovo | 120 | 1959 | In good condition |
| PR of V=500 m³, low zone | The village of Radilovo | 500 | 2000 | In good condition |
| Total for the village of Radilovo | | **920** | - | - |
| PR of V=120 m³ | The village of Kapitan Dimitrievo | 120 | 1959 | In good condition |
| PR of V=300 m³ | The village of Kapitan Dimitrievo | 300 | 1991 | In good condition |
| Total for the village of Kapitan Dimitrievo | | **920** | - | - |

#### 3.4.2.2.5. Pumping Stations

The list of pumping stations of the water supply zone of the villages of Radilovo and Kapitan Dimitrievo is introduced in the table below. More detailed data are given in Appendix 3-4.

*Table 3-46 Pumping stations of the water supply system of the villages of Radilovo and Kapitan Dimitrievo*

| Name | Number of pumps | Operating capacity of pumps [m³/h] | Suction Tank [m³] | Year of Construction | Observations |
|---|---|---|---|---|---|
| Kapitan Dimitrievo PS | 4 | 18 m3/h each | V=100 m³ | 1991 | Pumping station is in good condition |

#### 3.4.2.2.6. Transmission Mains

The list of transmission mains is presented in the table below. More detailed data are given in Appendix 3-4.

*Table 3-47 Transmission Mains of the Water Supply System of the villages of Radilovo and Kapitan Dimitrievo*

| Material | Diameter [mm] | Length [km] | Year of construction | Observations |
|---|---|---|---|---|
| Asbestos cement | 60 - 100 | 10.980 | 1955-1967 | Obsolete pipes |
| Steel | 108 – 219 | 12.680 | 1944-2000 | Before 1955– Old corroded pipes; The remaining ones are in good condition |
| Steel (galvanized pipes) | 51 (2”) | 0.800 | 1967 | Obsolete pipes |
| **Total length of external water pipelines** | N/A | **24.460** | N/A | - |

#### 3.4.2.2.7. Supplied Settlements

The list of settlements in this water supply zone is presented in the table below.

*Table 3-48 Settlements in the water supply zone*

| Name of Settlement | Total Population [number] | Population connected to network [number] | Share of population connected to network [%] | Quantity of Water Supplied [m³/year] | Water meter installed [yes/no] |
|---|---|---|---|---|---|
| The village of Radilovo | 1,385 | 1,385 | 100 | 135,881 | No |
| The village of Kapitan Dimitrievo | 768 | 768 | 100 | 51,238 | No |
| **Total** | **2,153** | **2,153** | **100** | **187,119** | N/A |

Metering of water supplied to the settlements:

- Water discharging by gravity from the catchment systems is not metered. There is neither individual water meter for each of the catchment systems, nor main water meter before the relevant pressure reservoir. The quantity of water delivered from them is given on the basis of their average flow rates.
- Water supplied by the reservoirs of Pazardzhik is collectively metered at the inlet of the suction tank of V=100 $m^3$ at Kapitan Dimitrievo PS.

#### 3.4.2.2.8. Efficiency of the Water Supply Systems

**Failures on the external water pipelines for the settlements of Radilovo and Kapitan Dimitrievo, and water supply security:**

According to the data provided by VKS EOOD Peshtera, the total number of failures on external water pipelines of both villages for the year 2011 is 4 (2 for Radilovo and 2 for Kapitan Dimitrievo). These failures are not many. Taking into account the great length of the external water pipelines, this failure rate is insignificant.

However, it should be considered that the gravity water pipelines for both villages are old and may cause, at any time, serious problems related to their water supply.

The replacement of the old asbestos cement pipes is of utmost importance.

**Water Losses:**

Similar to the external water supply of the town of Peshtera, it may be assumed that about 10% of the real losses for both villages occur in the external water pipelines (mainly gravity water pipelines from the catchment systems, which are old and obsolete).

**Energy Efficiency:**

The assessment reveals that:

- Kapitan Dimitrievo Pumping Station is comparatively new. No overconsumption of electricity is observed with regard to the pumps of both sets, as a result of ineffective operation of the pumps.
- Four of the pump units, which send water, are relatively new ("Grundfos" brand) and no increased energy consumption is registered.

#### 3.4.2.2.9. Summary of Main Deficiencies

A summary of the main deficiencies of the water supply system of the villages of Radilovo and Kapitan Dimitrievo is presented in the table below.

*Table 3-49 Summary of Main Deficiencies of the Water Supply System of the villages of Radilovo and Kapitan Dimitrievo*

| № | Components | Main deficiency |
|---|---|---|
| 1 | Water Sources | A major part of the catchment systems are difficult to access, especially in the period from December to March. Probably, this is the reason why their current maintenance is insufficient. |
| 2 | Water Treatment(purification and chlorination) | There is no adequate sodium hypochlorite dosing in line with water flow and residual chlorine quantity. |
| 3 | Water Storage (reservoirs) | It is necessary to provide better maintenance to the pipe systems, fixtures, etc. in the dry chambers of the reservoirs |
| 4 | Pumping Stations | No substantial deficiencies |
| 5 | Transmission Mains | - Water pipelines from the catchment systems are old and obsolete. This mainly applied to the old asbestos cement pipes.<br>- About 60% of the length of the external water pipelines is located in difficult-to-access areas.<br>- The poor condition of the asbestos cement pipes is a potential source of problems for the external water supply of both villages. |
| 6 | Water Metering | Water coming from the catchment systems is not metered. No water meters are installed. |

### 3.4.2.3. External Water Supply Systems of Saint Constantine Holiday Resort (Zone 3)

#### 3.4.2.3.1. General Features

Water supply system comprises the following components:

*Table 3-50 General Features of External Water Supply System of Saint Constantine Holiday Resort*

| Component | Description |
|---|---|
| Water Sources | - 1 catchment system (spring catchment)<br>- Water abstraction from water tower of the supply system of Batak Dam<br>- Emergency water pumping abstraction from the 2nd window of the tunnel, supplying Batak dam |
| Treatment Facilities | Two-stage treatment plant including settling, pre-chlorination, coagulation with aluminium sulphate and SK16 rapid sand filters |
| Chlorination | - 1 chlorination by using sodium hypochlorite in the existing PR of V=32 $m^3$ (for water from the catchment system) |
| Water Storage | 3 pressure reservoirs |
| Pumping Stations | - 1 pumping station for Kukusheva Cheshma catchment system<br>- 3 chambers with pumps for water abstraction from the supplying system of Batak dam |
| Transmission mains | A total of 2.500 km having diameter of between ∅133 and ∅75, made of steel and polyethylene pipes |
| Connected Settlements | 1 - Saint Constantine Holiday Resort |
| Total Population in Service Area | 1,620 people (for the year 2011) |
| Connected Population | 1,620 people |
| % of connected population | 100% |

### *3.4.2.3.2. Water Sources*

Characteristics of the water sources are presented by water supply systems (groups) in the tables below and outlined in more detail for every water source in item 3.1 as well as in Appendix 3-5.

*Table 3-51 Water supply system (group) with water source of Kukusheva Cheshma catchment system, feeding PR of V=32 m3 - main characteristics of the water sources*

| Name of Water Source | Flows | | | Year of construction | Notes |
|---|---|---|---|---|---|
| | Qmin l/s | Qoper. l/s | Qmax l/s | | |
| Kukusheva cheshma | 0.90 | 1.60 | 2.20 | 1928 | In good condition |

The value of the specified flows is taken from the hydrological reports for those water sources, drawn up by Vodokanal AD-Plovdiv. These reports include the results of the flow monitoring and measurement conducted by VKS EOOD Peshtera.

**Water delivery by the system, supplying Batak dam:**

The water delivery from the water tower and from window №2 of the tunnel takes place through water abstraction supplying the pressure reservoirs of the holiday resort of V=25 $m^3$ and V=50 $m^3$.

Water quantity sent by pumping is Q=4.6 l/s.

Water is purchased from NEK "Yazoviri I Kaskadi" EAD.

Guaranteed minimum water quantity, which may be sent to the reservoirs of Saint Constantine Holiday Resort, is presented in the table below:

*Table 3-52 Guaranteed minimum water quantity for Saint Constantine Holiday Resort from the existing water sources*

| Type of Water sources | Flow l/s |
|---|---|
| From catchment system | 0.90 |
| From the supplying system of Batak Dam | 4.60 |
| **Total** | **5.50** |

There is no restriction on water supply to the consumers of Saint Constantine Holiday resort.

#### *3.4.2.3.3. Water Treatment for Saint Constantine Holiday Resort (Zone 3)*

The treatment plant is supplied by the derivation feeding Batak Dam. There is a two-stage process scheme, including pre-chlorination and coagulation. Treated water is disinfected by adding sodium hypochlorite.

Chlorination of water coming from Kukucheva Cheshma catchment system is carried out in PR of HB V=32m$^3$.

In both chlorination points, hypochlorite incorporation is not proportional to the water flow, being adjusted according to the amount of residual chlorine.

#### *3.4.2.3.4. Water Storage*

The list of reservoirs for the water supply zone of Saint Constantine Holiday Resort is presented in the table below. More details are given in Appendix 3-9.

*Table 3-53 Reservoirs of the Water Supply System of Saint Constantine Holiday Resort*

| Name | Location | Total Volume Vo [m$^3$] | Year of construction | Notes |
|---|---|---|---|---|
| PR of V=32 m$^3$ | Saint Constantine Holiday Resort | 32 | 1960 | In good condition. Counter-pressure tank |
| PR of V=25 m$^3$ | Saint Constantine Holiday Resort | 25 | 1978 | In good condition |
| PR of V=50 m$^3$ | Saint Constantine Holiday Resort | 50 | 1999 | It is a cistern made of stainless steel |
| **Total for Saint Constantine Holiday Resort** | | **107** | N/A | - |

#### *3.4.2.3.5. Pumping Stations of the Water Supply Zone of Saint Constantine Holiday Resort (Zone 3)*

The list of pumping stations of the water supply zone of Saint Constantine is presented in the table below. More detailed data are given in Appendix 3-5.

*Table 3-54 Pumping stations of the Water Supply system of Saint Constantine Holiday Resort*

| Name | Number of Pumps | Operating capacity of pumps [m³/h] | Suction tank [m³] | Year of Construction | Observations |
|---|---|---|---|---|---|
| Kukusheva Cheshma PS | 2 | 7 | 15 | Before 1960 | Maintained in good condition |
| Pump chamber I-st lift | 1 | 16.6 | 27 | 1999 | In good condition |
| Pump chamber II-nd lift | 1 | 16.6 | 27 | 1999 | In good condition |
| Pump chamber from window №2 | 1 | 18 | sucks directly from the tunnel | 2000 | In good condition. It is switched on, only if necessary. |
| **Total** | N/A | **23.6** | N/A | N/A | **-** |

#### 3.4.2.3.6. Transmission Mains of the Water Supply Zone Saint Constantine

The list of transmission mains is introduced in the table below. More detailed data are given in Appendix 3-5.

*Table 3-55 Transmission Mains of the Water Supply System of Saint Constantine Holiday Resort*

| Material | Diameter [mm] | Length [km] | Year of construction | Observations |
|---|---|---|---|---|
| Steel | 90 – 133 | 2.450 | 1960 - 1999 | In relatively good condition |
| PE | 75 | 0.050 | | In good condition |
| **Total length of external water pipelines** | **-** | **2.500** | N/A | **-** |

#### 3.4.2.3.7. Supplied Settlements

Water supply systems in this zone provide water only to Saint Constantine Holiday Resort.

*Table 3-56 Settlements connected to the Water Supply Zone Saint Constantine*

| Name of Settlement | Total Population [number] | Population connected to network [number] | Share of population connected to network [%] | Quantity of Water Supplied [m³/year] | Water meter installed [yes/no] |
|---|---|---|---|---|---|
| Saint Constantine Holiday Resort | 1,620 | 1,620 | 100 | 31,357 | No |

Metering of water supplied to Saint Constantine Holiday Resort.

Water sent by water sources is not metered. The data on water delivery are provided on the basis of catchment system flow, capacity of the pump units and the duration of the pumping water supply.

#### 3.4.2.3.8. Efficiency of the Water Supply Systems of Saint Constantine Holiday Resort

**Failures on the external water pipelines for Saint Constantine Holiday Resort and water supply security:**

According to the data provided by VKS EOOD Peshtera for the year 2011, no failures are registered on the external water pipelines. Failures in the feed water supply system are only recorded in the pumping stations i.e. 4 for the year 2011.

It may be assumed that the water delivery to Saint Constantine Holiday Resort is secure enough throughout the year.

**Water Losses:**

The external water pipelines for Saint Constantine Holiday Resort are comparatively short and made of steel. 80% of the pipes are new (1999) and no failures are registered on them.

**Energy Efficiency:**

The assessment reveals that:

Four of the existing pumping units, used to send water, are relatively new ("Grundfos" brand) and no excessive electricity consumption has been noticed. Therefore, it is assumed that the energy efficiency of these pumps is high and no renewal is currently necessary.

#### 3.4.2.3.9. Summary of Main Deficiencies

The main deficiencies of the water supply system of Saint Constantine Holiday Resort are presented in the table below:

*Table 3-57 Summary of Main Deficiencies in the Water Supply System of Saint Constantine Holiday Resort*

| № | Components | Main deficiency |
|---|---|---|
| 1 | Water Sources | Kukusheva Cheshma catchment system is located too close to Peshtera–Saint Constantine road. A major part of the sanitary protection zones (SPZ) of the spring falls within the construction area and therefore the facility does not meet the requirements of Ordinance №3 (Concerning the terms and conditions for investigation, design, approval and operation of sanitary protection zones around water sources and facilities for drinking water supply; Prom.SG. No 88/2000) |
| 2 | Water Treatment(purification and chlorination) | - Chlorination of water coming from Kukusheva Cheshma catchment is carried out in a conscientious manner, but taking into account the problems related to the sanitary protection zone, it is necessary to strictly monitor the quality of drinking water from this water source.<br>- Backwash water from the rapid filters and water from the sedimentation tanks is discharged into the surrounding environment without any treatment<br>Rapid self-cleaning filters are sand filters installed outdoors. In case of low ambient temperatures they freeze over, which makes their self-cleaning |

| № | Components | Main deficiency |
|---|---|---|
| | | difficult. |
| 3 | Water Storage (reservoirs) | - Reservoirs have a total volume of V=107 $m^3$. In certain periods (August) this volume turns out to be insufficient.<br>- There is no fire prevention reserve. |
| 4 | Pumping Stations | No substantial deficiencies |
| 5 | Transmission Mains | No substantial deficiencies |
| 6 | Water Metering | There is no water meter installed at Kukusheva Cheshma water source (i.e. water metering is inaccurate). |

VKS EOOD Peshtera has a monitoring and management system for the most significant parts of the water supply systems.

It is possible to keep track of the levels in the pressure reservoirs and the operation of the pumping stations at tube wells 1, 2, 3 and 4, Siniyat Kainak pumping station, Kapitan Dimitrievo pumping station as well as the pumping stations in Saint Constantine Holiday Resort, repumping water from the supplying system of Batak Dam. Pumps can be started and stopped remotely.

Monitoring and management is conducted from the control unit, established in the storehouses and workshops VKS EOOD Peshtera. The town office of the WSS Company is only able to carry out monitoring.

Pump chambers in the distribution networks are not included in the monitoring and management system.

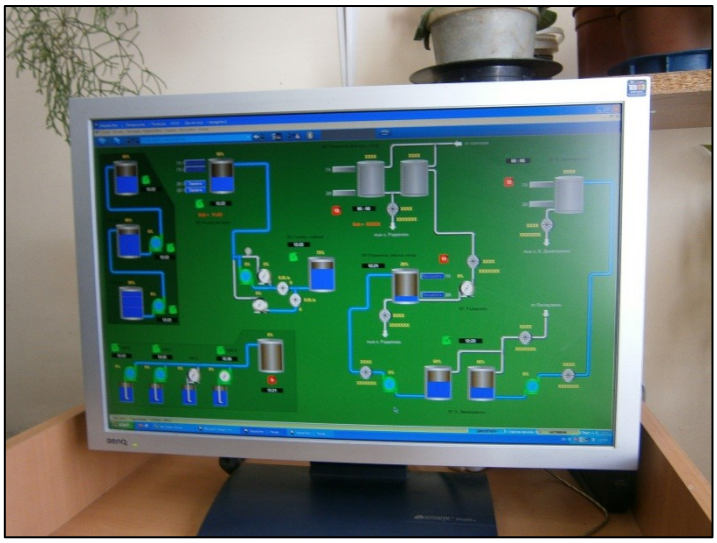


*Figure 3-5 Monitoring and management system in the control unit of VKS EOOD Peshtera*

## 3.4.3. DISTRIBUTION NETWORKS

### 3.4.3.1. Distribution Network of the Town of Peshtera

The existing water distribution network of the town of Peshtera is given on: Layout 3 – Current internal water supply network of the town of Peshtera

#### 3.4.3.1.1. Characteristics of Water Supply Network

**Water Supply Network**

The types of pipes by diameters and material are presented in the table below. More detailed data are introduced in Appendix 3-6.

The majority of problems in the network are due to asbestos cement pipes.

*Table 3-58 Distribution network in the town of Peshtera*

| Material | Nominal Diameter [mm] | Length [km] | Share of total Length [%] | Year of construction | Observations |
|---|---|---|---|---|---|
| Asbestos Cement | 60 – 300 | 26.638 | 56.87 | before 1985 | There are failures on most of the pipes |
| Cast iron | 60 – 200 | 3.616 | 7.72 | before 1955 | In relatively good condition |
| Steel | 40 – 250 | 5.208 | 11.12 | before 1995 | In relatively good condition |
| PE | 63 – 315 | 10.778 | 23.01 | after 2000 | Good condition |
| PVC | 315 | 0.600 | 1.28 | 1994 | - |
| **Total** | | **46.840** | **100** | N/A | - |

| Material | Nominal Diameter [mm] | Length [km] | Share of total Length [%] | Year of construction | Observations |
|---|---|---|---|---|---|
| Service Connections | ½" - 2 ½" | 41 | - | - | The majority of service connections are made of galvanized steel pipes, which are old and in poor condition. They are characterised by high water losses. |

**Booster Pumping Stations**

At present, there is 1 booster pumping station, with a capacity of≈ 20 $m^3$/hour, which serves to increase the pressure in Lukovitsa Quarter. The pumping station is a chamber, in which a pump is installed. The pump chamber is in good condition and the pump is new (installed in 2006).

The pumping station will become unnecessary when water starts to be sent to Lukovitsa Quarter from the river intake.

**Pressure Reservoirs**

Pressure reservoirs of the town of Peshtera are indicated in the table below. More detailed data are given in Appendix 3-3.

*Table 3-59 Pressure Reservoirs of the Town of Peshtera*

| Name | Total volume Vo [$m^3$] | Year of construction | Notes |
|---|---|---|---|
| PR of V=600 $m^3$, south | 600 | 1965 | In good condition |
| Old PR of V=180 $m^3$, Chepinski Vriz | 180 | 1950 | In good condition |
| PR of V=500 $m^3$ | 500 | 1993 | In good condition. Corroded pipe systems and handrails |
| New PR of V=1250 $m^3$, Chepinski Vriz | 1,142 | 1987 | In good condition |
| PR of V=1000 $m^3$ | 1,000 | 2010 | Not yet put into operation. |
| Total for the Town of Peshtera | 3,422 | N/A | - |

### *3.4.3.1.2. Water Metering*

Water consumption metering is carried out as follows:

- According to data obtained from VKS EOOD Peshtera, 100 % of the registered consumers have water meters. All households registered as consumers have water meters.
- Apart from the individual water meters for consumers, all blocks of flats are provided with main water meters.

- All public and industrial consumers (large and small) are endowed with water meters.
- Water meter reading is carried out on a monthly basis.
- There is an approved schedule for verification and calibration or if necessary for replacement of water meters. This schedule is chiefly performed for the main water meters and insufficiently for the small (house) water meters. (According to the legislation, verification and calibration should be conducted every 5 years.)
- The water meters of the major public and industrial consumers are verified and calibrated regularly.
- In general, it could be concluded that water consumed in the town of Peshtera is conscientiously and accurately metered. Metering accuracy of domestic consumption is not quite clear.

*Table 3-60 Customer Metering in the town of Peshtera*

| № | Quantity [number] | Percentage |
|---|---|---|
| Total number of service connections | 5,749 | |
| Total number of customers | 5,743 | 100 % |
| Number of customers with water meters | 5,743 | 100 % |
| Number of customers with operational water meters | 5,743 | 100 % |
| Number of water meters installed | 7,280 | |

Notes:

1. There may be more than one consumer, respectively more than one customer on a single service connection.

2. One customer may be provided with more than one water meter.

#### *3.4.3.1.3. Water Supply System Performance*

**Pipe failures and water supply insecurity:**

According to the data provided by the operator, the total number of failures in the distribution network of Peshtera for the year 2011 is 138 breaks per year. This means 0.34 failures/km per year or about 0.38 failures per day. The number of failures in Peshtera is significant, but is still lower compared to other towns in Bulgaria. It should be considered that the number of failures mentioned above applies to the visible leaks and breakdowns, which are detected without using special equipment.

The operator i.e. VKS EOOD Peshtera reported only two problematic sections made of asbestos cement pipes. The table below gives information on these two sections.

*Table 3-61 Pipe Failures in the year 2011*

| Pipe | Location | Length [km] | Number of Failures |
|---|---|---|---|
| Ø 80 mm – asbestos cement | Simon Nalbat Street | 0.465 | 4 |
| Ø 80 mm – asbestos cement | Stefan Karadzha Street | 0.091 | 2 |
| **Total** | **-** | **0.556** | **6** |

Based on data obtained from the operator, failures in the network of Peshtera, with the exception of the above-stated sections, occur in different areas and on various pipe sections. No zones featuring high failure rate were outlined. Again, according to the information of the operator, failures take place most frequently on asbestos cement pipes.

Despite the substantial number of failures, water delivery to consumers is sufficiently well guaranteed. Water supply is disconnected in a given quarter or quarters only during the performance of intervention works for the respective failure.

Pressure in the network is sufficient to supply all buildings and Peshtera quarters that are located in high areas.

**Water Losses:**

Non-revenue water assessment for the entire network of Peshtera has been presented in Item 3.3.2 Water Balance and Non-revenue Water Assessment.

Real losses in the distribution network are estimated to be 32% of the total water input of Peshtera network. We emphasize that no accurate measurements have been conducted by the operator in order to determine the losses in the network.

With reference to Chapter 3.3.2 Water Balance and Non-revenue Water, it can be seen that non-revenue water is equal to 68% and a major part of it is due to real losses which are estimated to be about 36%[12] of the total system input. It is noted that no accurate measurements have been conducted by the operator in order to determine the losses in the network. Out of the total quantity of real losses, it is estimated that about 28 % of them are related to service connections.

*Table 3-62 Estimation of Real Water Losses in the Distribution Network of Peshtera for the year 2011*

| Types of Real Losses | Quantity of Losses [m³/year] | Share of Total [%] | Comment |
|---|---|---|---|
| Real losses in the street water distribution pipelines | 503,688 | 72 % | - |
| Real losses in the service connections | 193,730 | 28 % | - |
| Real losses due to overflow of pressure reservoirs | - | - | At present, there are no such losses |
| **Real losses (total)** | **697,418** | **100 %** | **-** |

#### *3.4.3.1.4. Summary of Main Deficiencies*

The following table contains a summary of the main deficiencies of Peshtera distribution network.

[12] For the entire water supply system

*Table 3-63 Summary of Main Deficiencies in the Distribution Network of Peshtera*

| № | Components | Main Deficiency |
|---|---|---|
| 1 | Water Distribution Network | - There is a great range of diameters and materials<br>- 11% of the network is built of pipes having a small diameter (inconsistent with the statutory requirements) - ∅40 and ∅60<br>- 57% of the network is made of asbestos cement pipes, the useful life of which has expired<br>- 67% of the network is made of pipes featuring low reliability in urban conditions, mainly asbestos cement and steel pipes.<br>- The network has no explicitly established low and high zones<br>- Insufficient number of stop valves and fire hydrants, the existing ones are in poor condition |
| 2 | Service Connections | - 50% of service connections are in poor condition, being a source of failures and water losses<br>- 80% of service connections are made of galvanized steel pipes<br>- Presence of unauthorised connections |
| 3 | Water Metering | - Inaccurate metering of water supplied to the network<br>- A large number of old water meters (80% of the verified water meters are inaccurate and measure smaller quantities) |
| 4 | Booster Pumping Stations | The pumping station for Lukovitsa Quarter resembles a pump chamber. It has not been constructed as a pumping station for many years of use. It is a temporary solution for maintaining the pressure in Lukovitsa Quarter. It is planned to put it out of operation |
| 5 | Pressure Reservoirs | There are no water losses at the pressure reservoirs - no leaks from the reservoirs themselves and no water overflow from the reservoirs is allowed. |

In 2010, Preliminary Design, Feasibility Study and Detailed designs were elaborated for the water distribution network of the town of Peshtera.

The preliminary design envisages water supply network zoning. It is planned to establish three water supply zones:

- North High Zone
- Central Part Low Zone
- South High Zone

As a first stage, the preliminary design recommends the replacement of 12,250 km of street water pipelines.

During the same year, a feasibility study and detailed designs were prepared for the replacement of 12,613 km of water pipes of the distribution network of the town of Peshtera (≈27% of the length of the existing network).

The above stated studies for the water supply network have been drawn up in relation to “Technical assistance for preparation of investment projects under priority axis 1 of

Operational Programmed Environment 2007 to 2013" and are part of the project "Completion and rehabilitation of the existing water supply and sewerage network and construction of wastewater treatment plant of the town of Peshtera".

The project beneficiary is Peshtera Municipality, procedure BG 161PO005/10.1.11/02/16. The project is approved for financing and its implementation has started.

### 3.4.3.2. Distribution Network in the Village of Radilovo

**Characteristics of Water Supply Network**

Water distribution network of the village of Radilovo has a total length of about 16 km. It is mainly built of asbestos cement pipes having diameter of between ∅60 and ∅80 and a small part of it is made of steel pipes with a diameter of ∅100, as well as galvanized steel pipes of ∅3/4″. Network is obsolete (all pipes are older than 35 - 40 years.)

The settlement has an elaborated technical design for replacement of water distribution network. The design comprises replacement and construction of 17.53 km water pipelines along the streets of the village. Project funding is provided and construction is to be started.

### 3.4.3.3. Distribution Network in the Village of Kapitan Dimitrievo

**Characteristics of Water Supply Network**

Water distribution network of the village of Kapitan Dimitrievo has a total length of about 8.500 km. It is mainly built of asbestos cement pipes of ∅60 and ∅80 and a small part of ∅100 steel pipes. There are laid branches having diameter of ∅3/4″, which are made of galvanized steel pipes.

The settlement has an elaborated technical design for replacement of water distribution network. The design comprises replacement and construction of 10.42 km water pipelines along the streets of the settlement. Project funding is provided and construction is to be started.

### 3.4.3.4. Distribution Network in Saint Constantine Holiday Resort

**Characteristics of Water Supply Network**

Water distribution network in the resort is about 9 to 10 km long. It is thoroughly made of polyethylene pipes having diameter ranging from ∅63 to ∅90 mm.

No construction works have been envisaged with regard to the network of Saint Constantine Holiday Resort.

A main deficiency is the insufficient volume of the pressure reservoir, in view of the high hourly irregularity of water consumption in the summer months.

### 3.4.3.5. Summary of Main Deficiencies of Distribution Networks

The following table contains a summary of the main deficiencies of the distribution networks in all settlements.

*Table 3-64 Summary of Main Deficiencies of Distribution Networks in all settlements*

| Components Settlements | Water Distribution Network | Service Connections | Metering | Booster Pumping Stations | Pressure Reservoirs |
|---|---|---|---|---|---|
| The Town of Peshtera | 67% of the network is made of pipes unsuitable for street water distribution network | 50%are in very poor condition | Inaccurate metering of water supplied to the network. Inaccurate metering of water intended for household needs (old uncalibrated water meters) | Temporary Pump chamber | Good condition |
| The Village of Radilovo | Old and obsolete network (project for pipe replacement is about to start) | 80% are in poor condition - old galvanized steel pipes | Inaccurate metering of water supplied to the network. Inaccurate metering of water intended for household needs (old uncalibrated water meters) | - | Good condition |
| The Village of Kapitan Dimitrievo | Old and obsolete network (project for pipe replacement is about to start) | 80% are in poor condition- old galvanized pipes | Inaccurate metering of water supplied to the network. Inaccurate metering of water intended for household needs (old uncalibrated water meters) | - | Good condition |
| Saint Constantine Holiday Resort | No problems | No problems | Inaccurate metering of water supplied to the network. Inaccurate metering of water intended for household needs (old uncalibrated water meters) | - | Good condition |

# 3.5. WASTEWATER INFRASTRUCTURE

## 3.5.1. WASTEWATER INFRASTRUCTURE OF PESHTERA AGGLOMERATION

### *3.5.1.1. General Features*

VKS EOOD Peshtera provides water supply and sewerage services on the territory of Peshtera Municipality (Layout No1 – General Layout of VKS EOOD - Peshtera) for the following settlements: The town of Peshtera, the villages of Radilovo and Kapitan Dimitrievo and Saint Constantine Holiday Resort.

**Peshtera WWTP** includes the town of Peshtera (43 km of sewerage network). There is a detailed design, which is approved for funding and its implementation has started. The project Beneficiary is Peshtera Municipality, in procedure

BG161P0005/08/1.30/01/01„Technical assistance for investment projects under priority axis 1 of Operational Programmed Environment 2007 – 2013".

The full name is as follows:

*Technical assistance for preparation of investment project "Modernisation of the integrated water cycle of the town of Peshtera; Completion and rehabilitation of the existing water supply and sewerage network and construction of wastewater treatment plant of the town of Peshtera "(briefly referred to as PSDD (Peshtera Sewerage Detailed Design)*

The main objective of the project is to collect the unauthorised discharges of the urban sewerage network into Stara Reka River and to convey them to the WWTP, as well as to rehabilitate the critical sections of the wastewater network.

**Kapitan Dimitrievo WWTP** includes the villages of Radilovo and Kapitan Dimitrievo. Wastewater from Radilovo is conveyed by external collector to the sewerage network of Kapitan Dimitrievo and then to WWTP.

The village of Radilovo: Sewerage network coverage is 90%; the length of the sewerage network is 6,732m having diameters ranging between Ø250 and 300 – 6,732 m of concrete pipes;

The village of Kapitan Dimitrievo: Sewerage network coverage is 60%; the length of the sewerage network is 5,164 m having diameters ranging between Ø250 and 300 – 3,640 m of concrete pipes; Ø400 – 500 – 1 524 m of corrugated PE pipes.

Both settlements have ready detailed designs for water supply, sewerage and construction of WWTP, which are approved for funding and building is expected to start. After the project implementation, sewerage network coverage will reach 100%.

**Saint Constantine Holiday Resort** is located 16 km west of the town of Peshtera, close to Batak Dam. The sewerage network coverage is 100%, but currently there is no WWTP and wastewater is discharged into a creek. It is now used as stormwater sewerage till LWWTP is constructed. There is a site selected for the construction of a new WWTP. The

length of the sewerage network is 7,237m (258 m Ø200 PE; 6,759m Ø315 PE, 220 m Ø400 PE)

The total length of the sewerage network operated by VKS EOOD Peshtera is 62,133m. The town of Peshtera has over 10,000 PE and the remaining settlements in the Municipality have less than 2,000 PE.

In this regard and due to the fact that there is a WWTP built for the rest of the settlements, the subject of the study herein is the internal sewerage network.

*Table 3-65 General Features of the Wastewater System of Peshtera*

| Component | Description as of 2012 | Description – after the implementation of PSDD |
|---|---|---|
| Wastewater Network | Mixed system, having a length of 43 km | Combined system, having a length of 47.9 km |
| Pumping Stations | None | 1 |
| Wastewater Treatment Plant | None | 1 |
| Connected Settlements | 1 (the town of Peshtera) | 1 (the town of Peshtera) |
| Total Population in Agglomeration | 16,746 for 2011 (19369 for 2010) | 16,746 for 2011 (19,369 for 2010) |
| Population connected to the sewer network | 18,982 (Annex C to the invitation for application under procedure BG161PO005/10/1.11/02/16 ) | 18,982 (Annex C to the invitation for application under procedure BG161PO005/10/1.11/02/16 ) |
| % of population connected to the sewer network | 98% | 100% |

The existing sewerage network of the town of Peshtera is shown on Layout 4- Current Sewerage Network.

### 3.5.1.2. Wastewater Collection System

The town of Peshtera is situated in the Eastern-Aegean basin, in Maritsa River Valley. Wastewater receiving body is Stara Reka River.

Peshtera is a IIIrd category town. The settlement has an area of 251 ha.

The sewerage network of the town of Peshtera is combined system i.e. domestic, industrial and storm wastewater is collected in one pipe. Domestic, industrial and storm wastewater is discharged by gravity to the natural receiving body of Stara Reka River, crossing the centre of the town in west-east direction. There is no existing WWTP.

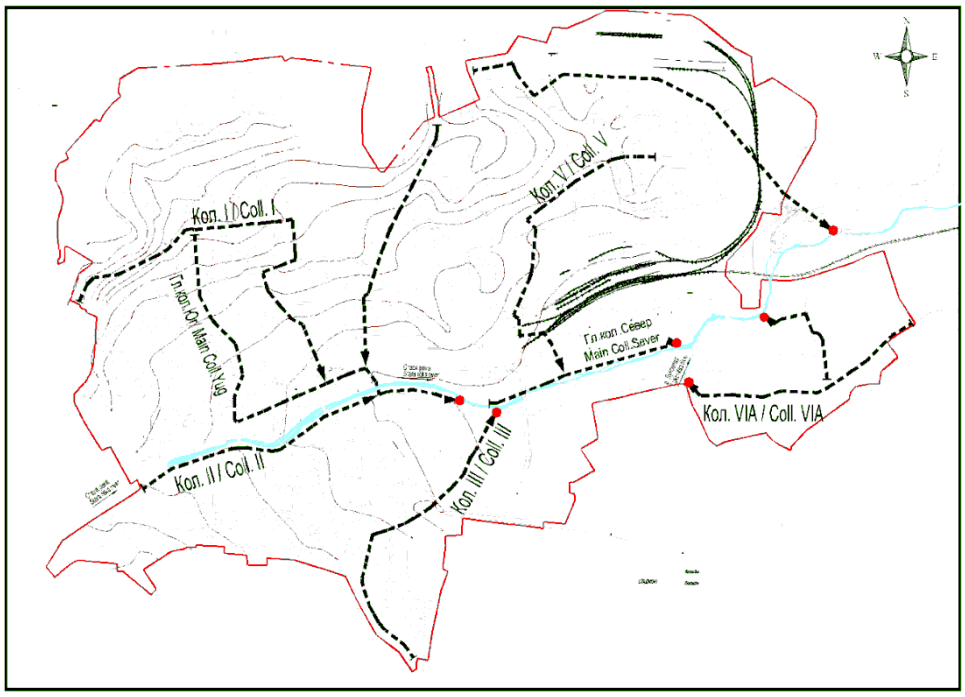



*Figure 3-6 Plan of the Main sewer collectors of the town of Peshtera*

The construction of sewerage network has started before 1940. 70% of the network has been constructed before 1970.

- 22% has been constructed from 1970 to 1990 and
- 8% has been constructed after 1990.

Since 2008, only 1,287 m of sewer network have been constructed due to the limited funds available to the Municipality and the Operator.

According to the existing sewerage network, the backbone of the wastewater network consists of main sewer collectors laid in parallel to the river, on northern and southern side, discharging domestic and non-overflow wastewater in eastern direction to the end of the town, where they discharge into Stara Reka River and six sewer collectors that drain the individual parts of the town. The site of the future WWTP is located on the left bank of the river, 250 to 300 m east of the town and 180 m north of the outermost houses of Lukovitsa Quarter. Sewer collector discharges in the area of the site.

Technical data on sewerage network, after the implementation of the above-said project are presented in the table below.

*Table 3-66 Wastewater Network, pipe material and diameter - after implementation of PSDD*

| Diameter | Length of Network [m] material | | | |
|---|---|---|---|---|
| [mm] | Concrete | PVC/PE/PP | Unknown | Total Length |
| 1. Wastewater network /mixed/ | | | | |
| 160 | | 20 | | 20 |
| 200 | 20,033 | | | 20,033 |
| 250 | 783 | | | 783 |
| 300 | 2,373 | 6,679 | | 9,052 |
| 350 | 236 | | | 236 |
| 400 | 3,386 | 2,304 | | 5,690 |
| 500 | 1,834 | 1,936 | | 3,770 |
| 600 | 571 | 2,045 | | 2,616 |
| 800 | 1,960 | 1,284 | | 3,244 |
| Ovoid 600/900 | 933 | | | 933 |
| Ovoid 700/1,050 | 484 | | | 484 |
| 1000/1,000 | 250 | | | 250 |
| 40/2,000 | 50 | | | 50 |
| **Total for item 1** | **32,770** | **14,268** | | **47,038** |
| 2.Stormwater network | | | | |
| 500 | | 11 | | 11 |
| 600 | | 287 | | 287 |
| **Total for item 2** | | **298** | | **298** |
| 3.Domestic wastewater network | | | | |
| 200 | | 143 | | 143 |
| 240 | | 240 | | 240 |
| 187 | | 187 | | 187 |
| **Total for item 3** | | **570** | | **570** |
| **TOTAL** | **32,770** | **15,136** | | **47,906** |

Layout of the on-going reconstruction of the sewerage network is presented on Layout N°8.

The expected results after implementation of the project and recapitulation of the sewerage network are:

- Improving quality of environment on the territory of the town of Peshtera, as a result of completion and reconstruction of the sewerage network, by which all unauthorised discharges into the receiving waters of Stara Reka River will be encompassed.
- 100% population connected to sewerage network;
- Wastewater from industrial enterprises will be conveyed to the future treatment plant, where its treatment will be carried out;

Recapitulation of replaced network compared to unreplaced network:

*Table 3-67 Recapitulation of sewerage network*

| | | Diameter | Length | % |
|---|---|---|---|---|
| | | mm | m | |
| Existing network | Concrete | 200 | 20,053 | 41.86 |
| | | 250 | 783 | 1.63 |
| | | 300 | 2,373 | 4.95 |
| | | 350 | 236 | 0.49 |
| | | 400 | 3,626 | 7.57 |
| | | 500 | 2,021 | 4.22 |
| | | 600 | 571 | 1.19 |
| | | 800 | 1,960 | 4.09 |
| | | Ovoid600/900 | 933 | 1.95 |
| | | Ovoid700/1,050 | 484 | 1.01 |
| | | 1,000/1,000 | 250 | 0.52 |
| | PE/PP | 300-600 | 1,287 | 2.69 |
| **Rehabilitated** | | | **8,287** | **17.31** |
| **New** | | | **5,042** | **10.52** |
| **Total length** | | | **47,906** | **100** |

The length of the remaining network that needs to be rehabilitated is L= 33,290 m (69 %);

*Table 3-68 Parameters of the sewerage network after implementation of the detailed design*

| № | Indicator | Unit |
|---|---|---|
| **1** | **Total length of wastewater network (including stormwater and main collectors**) | **47.906 km** |
| *1.1* | Length of stormwater network | *0.298 km* |
| *1.2* | Length of main sewer collectors - combined | *9.685 km* |
| *1.3* | Length of secondary sewer collectors - combined | *37.353 km* |
| *1.4* | Length of secondary sewerage network - domestic | *0.570 km* |
| **2** | **Type of sewerage network** | **98.8 % mixed** |
| **3** | **Length of wastewater network rehabilitated recently (past 5 years)** | **14.616km** |
| 3.1 | Before implementation of detailed design | *1.287 km* |
| 3.1 | After implementation of detailed design | *13.329 km* |
| **4** | **Percentage of wastewater network rehabilitated (connected to existing network)** | **30.5%** |
| **5** | **Population per length of wastewater network** | **350 inh./km** |
| **6** | **Capacity of storm water retention basins** | **-** |
| **7** | **Number of unauthorised discharges into receiving waters** | **0** |
| **8** | **Number of sewerage service connections** | **2, 796** |

**Sewerage network analysis (deficiencies):**

The on-site inspection of the sewerage network, the communication with representatives of the Municipality and the Operator (WSS company), led to the following conclusions:

- As mentioned above, a great part of the sewerage network is built before 1970, with parameters lower than the ones that are currently adopted, a major part of the old sewerage is made of concrete pipes of Ø200 and 250 – a diameter smaller than the minimum permissible Ø 300 according to the valid standards;
- Physical condition of the sewerage network is not good. It is almost entirely built of concrete profiles, but their useful life has expired and their replacement should be started stage by stage;
- Its functional condition is not good, as a result of the town expansion over the last 50 years and the connection of new quarters to the existing old sewerage, which leads to overloading of the current wastewater network. In addition, the newly connected areas disturb the hydraulic behaviour in terms of sewers capacity. During intensive rainfalls, not all of the network can take the stormwater quantities, resulting in stormwater retention in the street and slower draining into the sewerage network.
- In some places there are streets having higher slope, which are connected to streets with lower slope and no drop manholes are constructed to reduce the velocities and to avoid water banking;
- There are reverse gradients in some parts of the existing sewerage;

In the period after completing the phase of detailed design, which will serve as a basis of construction, the following problem areas have been found:

- Collector IV, along Mihail Takev Street from ref. point 444 to ref. point 212, has capacity insufficient to collect waste waters;
- Collector I, along Atanas Gorov Street from ref. point 114a to ref. point 114, the sewerage is clogged, due to the disturbed integrity of the pipe and the existence of roots inside the sewer pipe;
- The predominant diameter in the sewerage network is ∅200 (20,053 m or 41.86%), which is less than the diameter of ∅300 required by the current regulations. This diameter prevails in the outermost areas of the town.

### 3.5.1.3. Wastewater Pumping Stations

*Table 3-69 Wastewater Pumping Stations*

| Location | Number of Pumps | Total Production Capacity of Pumping Station [m³/h] | Year of construction | Observations |
|---|---|---|---|---|
| In Spas Zafirov Street to ref. point 383 | 1+1 | 7.2 | 2012 | Under construction |

### 3.5.1.4. Wastewater Treatment Facilities

It is envisaged to construct two wastewater treatment plants (WWTP) in Peshtera Municipality, one for the town of Peshtera and one joint WWTP for the villages of Kapitan

Dimitrievo and Radilovo. The WWTP for Saint Constantine will be constructed at a later stage.

**A. Wastewater Treatment Plant of the town of Peshtera**

For treating the wastewater of Peshtera, in 2011 a detailed design for urban wastewater treatment plant (WWTP) is elaborated and approved following the relevant procedures. The treatment plant is designed for operation period of 30 years, until 2040 and has a capacity for 25,000 population equivalent (PE). Based on official data obtained from VKS EOOD Peshtera, information from the NIS (National Statistical Institute) and a detailed survey of water consumption conducted in the detailed design, revised at the end of 2011, a water supply rate of 110 l/inh. per day is approved for the town. The drainage rate is determined to be 99 l/inh. per day, according to the valid "Standards and rules for sewerage design" of 1989. At the stage of detailed design the wastewater treatment plant of the town of Peshtera is designated for 25,000 population equivalent. Water quantities used to size the treatment plant are consistent with the standards. According to the same standards, an overflow should be constructed in an appropriate location before the treatment plant, after which the dry-weather wastewater flow and the infiltrated water quantity enter the plant. The process scheme includes mechanical treatment and biological treatment in aeration tank with low sludge loading, regeneration of activated sludge, simultaneous nitrification and denitrification. Qualities of wastewater that will be discharged in the receiving waters are consistent with the statutory requirements.

**B. Wastewater Treatment Plant of Kapitan Dimitrievo**

Kapitan Dimitrievo WWTP includes the villages of Kapitan Dimitrievo and Radilovo

Treatment efficiency:

The construction of wastewater treatment plants of Peshtera and Kapitan Dimitrievo is forthcoming. The designs are duly approved and are expected to fulfil their purpose as well as to achieve the treatment effect as set out in the design.

**C. Wastewater Treatment Plant of Saint Constantine**

Currently there is no WWTP and no on-going project for the holiday resort Saint Constantine. A site has been selected for the construction. Studies will be necessary to determine the appropriate type of treatment needed considering the specificities of the settlement (located in the mountains in difficult geologic conditions and population varying greatly throughout the year).The Consultant recommends choosing one of the two following options which are cost-effective and flexible:

- SBR (Sequencing Batch Reactors) WWTP
- BioDisc WWTP*

* The Biodisc treatment is also called "fixed culture". It can treat carbon and ammoniac. It includes a biomass-mounting bracket, which is a series of rotary biological contactors, and an element made up of multiple disks dips in a primary settling tank. Aeration is natural, provided that each time the biofilm is emerged. This treatment is followed by a

settling tank. The main advantage of this treatment is its low energy consumption. The main disadvantages are the absence of nitrate treatment and the lower performance compared to activated sludge.

### 3.5.1.5. Wastewater System Performance

**Operation and Maintenance of Sewerage Network:**

- The operator carries out only emergency cleaning of the sewerage network. Insignificant clogging is manually cleaned by the WSS Company itself. More substantial blockings, which need cleaning through suction and jetting are assigned to external service provider.
- No preventive maintenance and inspection is conducted through CCTV observation of sewerage.
- Data from simulation surveys (if available) with regard to the hydraulic capacity of the existing wastewater network for characteristic hydraulic loads by using software products - **there are no available data from simulation surveys**.
- Synchronized data from measurements, registered at least throughout one spring-summer season, by means of rain gauges (pluviometers) installed in the urbanized area and metering devices in the trunk sewers in order to calibrate and verify the software product when using it to prove the hydraulic capacity of the existing and/or newly designed sewerage network - **no measurements have been carried out.**

**Operation and Maintenance of WWTP:**

The construction of the wastewater treatment plants of Peshtera and Kapitan Dimitrievo is forthcoming. The designs are duly approved and are expected to fulfil their purpose as well as to achieve the treatment effect as set out in the design

*Table 3-70 Current Operation and Maintenance Costs of the Wastewater Systems, operated by VKS EOOD Peshtera*

| Cost Item | in 2011 [thousand BGN] | in % of Total |
|---|---|---|
| 1. Energy | - | |
| 2. Materials | 9 | 23% |
| 3. Personnel | 30 | 77% |
| 4. Maintenance | - | - |
| 5. Others | - | - |
| **Total** | **39** | 100% |

### 3.5.1.6. Summary of Main Deficiencies

The table below summarizes the main deficiencies of Peshtera Agglomeration. Remarks were based on EU Solid Waste and Sludge Directive.

*Table 3-71 Main Deficiencies of the Wastewater System of Peshtera Agglomeration*

| № | Components | Main Deficiencies |
|---|---|---|
| 1 | Wastewater network | - The remaining network, that needs to be rehabilitated, has a length of L= 33,290 m (69 %).<br>- There is infiltration and/or exfiltration of groundwater or water from leaking water pipelines or sewers due to damaged pipes, joints or couplings of service connections<br>- Sewer overflows are insufficient to unload sewerage network. The main deficiency is that when South Main Collector passes through Stara Reka river, it is not released from stormwater quantities.<br>- Poor physical condition (old network, damaged pipes, in some locations pipe couplings are displaced) of the sewerage network of the town of Peshtera.<br><br>- The predominant diameter in the sewerage network is ∅200 (20,053 m or 41.86%), which is less than the diameter of ∅300 required by the current regulations. This diameter prevails in the outermost areas of the town. The main deficiencies are as follows:<br>It is not always that stormwater quantities from the drainage area can actually enter the sewerage. Street gullies are insufficient to receive all stormwater quantities and are often clogged and unable to get optimal water amount;<br>There are steep areas, where stormwater passes over the street gullies ( in good functional condition ) and only part of it is received by the sewerage;<br>The insufficient hydraulic capacity of diameter equal to 200 implies the following: The sewerage is unable to receive all stormwater quantities. As a result they run down the street and do not enter the sewer. The frequency of this event cannot be determined as no modular surveys have been carried out. In such a sewer, which is part of mixed sewerage, the ratio of domestic (0,05 - 0.5l/s) to stormwater quantity (about 30 l/s) is over 60 times;<br>The main deficiency is the small diameter, which is a precondition for more frequent clogging. It is necessary to provide regular surveillance and cleaning. |
| 2 | Wastewater Pumping stations | Under construction |
| 3 | Wastewater Treatment Plant | The construction of the treatment plant is forthcoming. The design is duly approved. The proposed treatment process is modern and can be expected to achieve the treatment effect.<br>There is no WWTP in Saint Constantine. |

## 3.5.2. SLUDGE MANAGEMENT

It is envisaged to construct two wastewater treatment plants (WWTP) in Peshtera Municipality, one for the town of Peshtera and one joint for the villages of Kapitan Dimitrievo and Radilovo. The sludge in both plants is mechanically dewatered. Sludge is envisaged to be disposes in compliance with the waste management decision made by the Municipality. Waste quantities are taken into account for the calculation of the capacity of the regional domestic solid waste landfill of the village of Aleko Konstantinovo. The Consultant recommends the landfill to be used only during the testing stage of the sludge for further utilization. After signing contracts with the concerned authorities sludge will be disposed at the landfill only in emergency situations.

### *3.5.2.1. Current Sludge Volume and Management Practices*

There is an elaborated and approved Sludge Management Report for the sludge of the future wastewater treatment plant of the town of Peshtera. It envisages that the sludge will be disposed to the existing municipal waste landfill, and after its closure, to the regional solid waste landfill in the area of Pazardzhik.

The sludge from the joint wastewater treatment plant of the villages of Radilovo and Kapitan Dimitrievo, which is still at design stage[13], should be disposed similarly to the sludge from Peshtera WWTP.

Total sludge quantity is as follows:

[13] Preliminary design

*Table 3-72 Sludge treatment and reuse/disposal by WWTP in Peshtera and Kapitan Dimitrievo*

| Settlement / WWTP | Commissioning Year | Capacity in PE | Sludge Treatment Technology | Type of Sludge Reuse / Disposal | Sludge Volume | |
|---|---|---|---|---|---|---|
| | | | | | to DS[14]/a | Humidity (%) |
| Peshtera WWTP | After 2012 (on-going construction) | 25,000 | Aerobic stabilizer and mechanical dewatering by belt filter press | Peshtera Municipal Landfill /Planned Regional Landfill in Pazardzhik | 302 | 75 % |
| Kapitan Dimitrievo WWTP | 2012 (on-going construction) | 2,870 | Aerobic stabilizer and mechanical dewatering by belt filter press | | 34 | 75 % |

It has been found in the conducted study, there are no areas suitable to receive sludge from the treatment plants. In the future disturbed forest terrains are likely to be proposed for recultivation with sludge from the treatment plants. However, the only current alternative left is disposal to the domestic solid waste landfill, which is now existing, but will be closed and regional landfill will be built in the future. Sludge management is worked out in detail in Appendix 3-16.

#### 3.5.2.2. Sand and Grease Removal

All materials that will be removed from the screens at inlet of the new WWTPs will be disposed of in a controlled and approved manner. See Appendix 3-7, for sludge quality and type.

### 3.5.3. Industrial Wastewater Facilities

#### 3.5.3.1. General

The joint disposal and treatment of industrial and domestic wastewater is possible and admissible only under certain conditions. This should be decided for each particular case. This issue is extensively examined in terms of regulatory framework in Annex №7 on the terms and conditions for wastewater discharge into the urban sewerage and the level of its treatment. Some additional requirements are given in Appendix 3-8.

Water quality downstream of Biovet WWTP is compliant with the relevant permit.

#### 3.5.3.2. Polluter Pays Principle

The polluter-pays-principle is one of the core principles of international environmental law accepted by all governments of the OECD. The principle's goal is that the polluter pays the full costs of the own pollution.

[14]Dry substance

The polluter-pays-principal has been recognized as a general principle of international environmental law since 1990 [OECD 1989, 1992]. However, it is an economic and not a juridical principle. This implies that the principle does not mean to punish the polluter, but to establish the necessary economic conditions so that all the environmental costs associated with the operation of a polluter will be considered as leading to sustainable development. It is obvious that the principle aims at limiting waste in natural resources and reducing environmental costs.

According to international experience, a set of conditions should be met for the polluter-pays-principle to be implemented successfully:

- Clear designation of pollution sources and accurate measurements of pollution loads;
- Sense of fairness should be present and understood by all involved parties so that they agree to cooperate in good will;
- Public support is needed;
- Strong institutional framework is also needed to implement any suggestions successfully.

In addition, the implementation of the polluter-pays-principle can lead to better environmental conditions. This may take place by carrying out the principle and then it will create incentives for the industries to decrease pollution discharges.

Considering these general aspects, the application of the polluter-pays-principle will be an important task of WSS companies and should be included in the “Reduction Action Plan, Control of Industrial Discharges”, which are to be prepared by them.

### *3.5.3.3. Inventory of Industries*

The two major industrial companies on the territory of the town of Peshtera are:

- Biovet AD, the only manufacturer of products for the veterinary practice and the agriculture, is endowed with its own treatment plant and is not connection to the urban wastewater network.
- Vinprom Peshtera AD, a leading producer of alcohols, is connected to the urban wastewater network. The production programme of the company has changed and Vinprom Peshtera does not currently produce wines. It only produces and bottles high-alcoholic drinks made of spirit, which is delivered by distilleries located outside the territory of the settlement. Thus the main pollutions formed in wine production, wine lees, tartars, etc. are not part of the waste water of Vinprom Peshtera. The remaining industrial companies form water having content similar to domestic wastewater produced by population. Those of them, characterised by specific pollutions, are equipped with local treatment facilities. For that reason, the concentration of BOD5 pollution is not indicated.

Based on data obtained from VKS EOOD Peshtera, the total industrial wastewater quantities amount to **134,131.5 $m^3$/year = 367 $m^3$/day.**

Industrial companies are presented in detail in Appendix 3-9

### 3.5.3.4. Conclusions

- The industrial entities ET Nagi Trans, Chiko OOD and Bratya Angelovi OOD are located outside the town-planning boundaries and their connection to the urban wastewater network is difficult mainly due to topographical reasons. Therefore these industries currently discharge untreated wastewater to the receiving water. Once the problem concerning waste water from the town of Peshtera is settled, their treatment should be established as well. Apparently, it is required to construct local treatment facilities, which would ensure the necessary degree of treatment. The main industrial activity is related to food industry which is appreciated that represents generally between 70% and 90% of the total industrial wastewater generated. No industry with potential hazardous discharges have been identified, therefore it can be concluded that there is no danger of hazardous discharges which may affect the WWTP process.
- The total amount of wastewater discharged by the industry into the sewerage represents maximum 11% of the total wastewater generated in all agglomerations.
- The total industrial pollution expressed as BOD load discharged by the industry on the basis of water quantities, represents maximum 14% of the total load generated in agglomeration (as BOD volume)

**Recommendations**

Construction of local treatment facilities, which would ensure the necessary degree of treatment for the industries of ET Nagi Trans, Chiko OOD and Bratya Angelovi OOD.

The following table summarizes the data for industrial pollution of Peshtera agglomeration.

*Table 3-73 Performance Indicators of Industrial Pollution for Peshtera Agglomeration*

| N° | Indicator | Unit | Peshtera Agglomeration |
|---|---|---|---|
| 1 | Total number of industrial units in agglomeration * | % | 100 |
| 2 | Percentage of industrial units NOT connected to the wastewater system | % | 19 |
| 3 | Percentage of connected industrial units without pre-treatment facilities | % | 52 |
| 4 | Percentage of connected industrial units with pre-treatment (compliant with EC/RO regulations) | % | 29 |
| 5 | Percentage of industrial pollution load reduced by pre-treatment | % | No data |
| 6 | Number of industrial units discharging dangerous substances into the aquatic environment | Number | None |

* Considered a minimum number

# 3.6. SUFFICIENCY OF DATA

## 3.6.1. LIST OF DATA SOURCES

The following information has been provided by Peshtera Municipality:

- Feasibility Study „Completion and rehabilitation of water supply and sewerage network" of the town of Peshtera
- Preliminary Design "Completion and rehabilitation of water supply and sewerage network" of the town of Peshtera
- Detailed Design "Completion and rehabilitation of water supply and sewerage network" of the town of Peshtera
- Technical Design "Additional water supply of Lukovitsa Quarter, Peshtera"
- Technical Design "Water supply network of the village of Radilovo", 2009
- Technical Design "Water supply network of the village of Kapitan Dimitrievo", 2009
- Detailed Design "Sewerage of the village of Kapitan Dimitrievo, Peshtera Municipality"
- Detailed Design "Sewerage of the village of Radilovo, Peshtera Municipality"
- Layout of the Feasibility Study in digital format;
- CONSTRUCTION AND TOWN-PLANNING SCHEME of the town of Peshtera - CZP / 1985 Approved by Order № RD-14-02-1144 /04.12.1985, in paper format
- CONSTRUCTION AND TOWN-PLANNING SCHEME of the town of Peshtera, Extension "NORTH" Approved by Order № 02 /06.02.1991, in paper format
- Approved by Order № 1611 /09.12.1987
- Municipal Development Plan of Peshtera Municipality 2007-2013
- MUNICIPAL ENVIRONMENTAL PROTECTION PROGRAMME
- Programme for management of sludge from wastewater treatment in WWTP, Peshtera and Kapitan Dimitrievo 2010-2015
- WASTE MANAGEMENT PROGRAMME 2008–2013.

The following sources have been used:

- Data obtained from the WSS operator VKS EOOD Peshtera
- Kozhuharov D., etc. 1990. Geological map of Bulgaria. Map sheet of Pazardzhik, on a scale of 1:100 000
- Kozhuharov D., etc. 1990. Geological map of Bulgaria. Map sheet of Rakitovo, on a scale of 1:100 000
- Basin Directorate for Water Management in East Aegean Sea Region, 2010. River Basin Management Plan for East Aegean Sea Region

- Vodokanalproekt AD, 2004. Hydrogeological report. Water supply of the town of Peshtera from nine spring catchments, Klevo, Kievo Kale, Studenata Voda, Cheshme Bashi, Novomahalenski, Siniyat Kamak, Chepinski Vriz, Dalbochitsa 1 and Dalbochtisa 2. Assessment of local operation resources. Design for sizing of sanitary protection area and abstraction design
- Vodokanalproekt AD, 2004. Hydrogeological report. Water supply of the town of Peshtera from two tube wells (TW1 and TW2) in the proterozoic aquifer. Assessment of local operation resources. Design for sizing of sanitary protection area and abstraction design
- Vodokanalproekt AD, 2004. Hydrogeological report. Water supply of the town of Peshtera from two tube wells (TW3 and TW T4) in the quaternary aquifer. Assessment of local operation resources. Design for sizing of sanitary protection area and abstraction design
- Vodokanalproekt AD, 2008. Hydrogeological report. Water supply of the village of Radilovo, Peshtera Municipality from six spring catchments, Malinovi Livadi, Chatal Uluk, Borov Chukur 1, Borov Chukur 2, Demishki Dol, and Kapinov Dol. Assessment of local operation resources. Design for sizing of sanitary protection area and abstraction design
- Vodokanalproekt AD, 2007. Hydrogeological report. Water supply of the village of Kapitan Dimitrievo, Peshtera Municipality from spring catchment Osmanagovitsa. Assessment of local operation resources. Design for sizing of sanitary protection area and abstraction design
- Vodokanalproekt AD, 2007. Hydrogeological report. Water supply of Saint Constantine Holiday Resort, Peshtera Municipality from spring catchment Kukusheva Cheshma. Assessment of local operation resources. Design for sizing of sanitary protection area and abstraction design
- Institute of Vodokanalproekt, Water supply programme for projection period until 2010 of the municipalities and the adjacent settlements in NRB, Plovdiv District, Pazardzhik Region, Peshtera Municipality, 1989.
- Information from the internet
- Data from the National Statistical Institute

### 3.6.2. REVIEW OF DATA

For the elaboration of the present analysis, available information obtained from the following sources has been used: WSS Company, Peshtera Municipality, NIS and the completed Questionnaires returned by the WSS Operator, as well as data collected by the consultant during the field visits. To get clearer notion of the quality of used information, an attempt has been made to systemize and arrange it in tabular form, as follows:

*Table 3-74 Review of used data*

| Parameter description | Reliability and accuracy of input data |
|---|---|
| Number of population connected to water supply networks | Very high (data from WSS company and detailed designs) |
| Annual number of failures on external water pipelines, water distribution networks and service connections | Very high (official records) |
| Number of water supply service connections, number of water meters and number of customers | Very high (official records) |
| Lengths and diameters of external water mains | High. Data from WSS company, business plan and drawings |
| Lengths and diameters of water distribution networks | High. Data from WSS company, business plan and drawings |
| Data on water delivered from water sources to distribution networks | Insufficient reliability |
| Data water consumed (invoiced) | Very high. Data from Collection Department of WSS operator. The accuracy of water metering is questionable |
| Condition of water supply facilities – pumping stations, reservoirs, water sources | Very high. Inspections carried out by the Consultant. Data from WSS company |
| Number of population using sewerage services of WSS company | Very high(approved Detailed Design, under construction) |
| Annual number of failures on sewerage service connections | Very high (official records) |
| Number of sewerage service connections operated by WSS operator | Very high (official records) |
| Annual number of failures in wastewater network | Very high (official records) |
| Lengths and diameters of wastewater network | Data from WSS operator, Business plan and maps drawn up in Feasibility study, Preliminary and Detailed designs |
| Depths of wastewater network | Insufficient |
| Total area of the town of Peshtera, serviced by WSS operator | High. Elaborated maps |
| Total design capacity of water supply and sewerage networks | Very high. Based on approved detailed and technical designs |
| Number of WSS operator personnel, responsible for provision of water supply services | Very high |
| Number of WSS operator personnel, responsible for provision of sewerage services | Very high |
| Annual number of occupational accidents | Very high |
| Total number of personnel, providing water supply and sewerage services | Very high |
| Total number of drinking water treatment plants | Very high |
| Number of samples for drinking water quality, | Very high. Data from official records of |

| Parameter description | Reliability and accuracy of input data |
|---|---|
| complying with regulatory requirements for physicochemical and radiological indicators | laboratory analyses. |
| Total design capacity of wastewater treatment plant | Very high. Based on approved detailed and technical designs |

### 3.6.3. RECOMMENDATIONS

The Consultant recommends the application of the following measures in order to improve data availability concerning water supply, sewerage and treatment systems:

- Improvement of mapping for the external water supply systems: Changes in the system should be timely depicted on maps and plans
- Improvement of mapping for distribution networks of settlements i.e. digitization of water supply and sewerage network, by indicating diameters and depths.
- Introduction of Geographic Information System, using GIS based software.
- Measurement of water supplied by water sources and to water distribution networks has to be improved, yearly and monthly water supply should be metered.
- Collection of additional data on water quality and/or initiating a campaign for water quality analysis (for priority areas in the feasibility study and for the other regions included in the terms of reference of the forthcoming technical assistance contracts.
- Renegotiating the conditions for connection of waste water to the urban sewerage with the industrial customers on the basis of the requirements laid down in Ordinance № 7 on the quality of industrial waste water discharged in the sewerage systems of the settlements. Obliging the enterprises to conclude a contract for own monitoring with an accredited laboratory.
- Collection of data for yearly, daily and hourly wastewater flow from discharge points of industrial undertakings in conformity with Ordinance №2 of 8th June 2011 on the issuance of permits for wastewater discharge into water bodies and determination of individual emission limitations of point sources of pollution.
- Average (daily mixed sample) and maximum data (from random samples) on quality of wastewater and quantity in different discharge points, should be collected.

## 3.7. CONCLUSIONS AND RECOMMENDATIONS

### 3.7.1. WATER RESOURCES

Peshtera Municipality is currently supplied by groundwater sources. The main water sources are 17 spring catchments (57.85 l/s), located south and northwest of Peshtera Town as well as 4 tube wells (12.30 l/s).

A river intake from Pizditsa River is to be put into operation (surface water source - Q=8 l/s).

The total quantity of water abstracted in Peshtera Municipality will amount to 6,752 m³/day (guaranteed minimum).

Additional water quantities are obtained from the pressure reservoirs of the town of Pazardzhik (10 l/s) to the villages of Radilovo and Kapitan Dimitrievo (10 l/s) as well as from the supplying system of Batak dam to Saint Constantine Holiday Resort (4.60 l/s).

The total water quantity from external water sources is 1,126 m3/day (guaranteed minimum).

There are no restrictions on the use of surface water and groundwater for drinking water supply and other needs, as their determined resources and water quality fully satisfy the requirements in the relevant legal and statutory documents.

### 3.7.2. WATER POLLUTION

The conducted on-site investigations indicate that the current polluter of Stara Reka River is the settlements in the agglomeration. The construction of the wastewater treatment plant of the town of Peshtera is forthcoming. After completing the construction, it is expected that by putting into operation the wastewater treatment plant, pollution of Stara Reka River will decrease substantially.

It is necessary that the WSS Company should renegotiate the conditions for industrial wastewater connection to the urban sewerage network.

Other, not so substantial pollutants, as mentioned above, are process backwash waters from the drinking water treatment plants. They discharge waste water into the surrounding space without any treatment. It is recommended to build a tertiary stage to the plants, where these waters will be treated.

Some industrial undertakings, ET Nagi Trans, Chiko OOD and Bratya Angelovi OOD, are located outside the zoning plan boundaries and their connection to the urban sewerage is very difficult mainly due to topographical reasons. They discharge untreated waters and once the problem concerning waste water from the town of Peshtera is settled, their treatment should be established as well. Apparently, it is required to construct local treatment facilities, which would ensure the necessary degree of treatment.

After the construction of the regional domestic solid waste landfill near the town of Pazardzhik, the existing one will be closed and recultivated. Thus, the infiltration of polluted water from the landfill will be eliminated.

### 3.7.3. CURRENT WATER CONSUMPTION

Currently 20,519 inhabitants (100 % coverage rate) in Peshtera Municipality (Town of Peshtera, village of Radilovo, village of Kapitan Dimitrievo, Saint Constantine Holiday Resort) are supplied with water from VKS EOOD Peshtera, consuming about 566,600

m³/year at an average domestic per capita consumption of 79 litres/ capita/ day. In addition, non-domestic customers are supplied with 237,000 m³/year and thus, total consumption in the municipality is about 803,600 m³/year (25.5 l/s). Over the past three years consumption has slightly increased due to the higher industrial and commercial consumption.

The average rate of non-revenue water for the territory of VKS EOOD Peshtera is about 67 %, out of which 20 % are due to apparent (commercial) losses and another 11 % are due to unbilled authorised consumption. The remaining 34 % are due to real (physical) losses in the network. It is evident that the water losses in the water supply systems of Peshtera Municipality are too high, but not unusual for the water supply in Bulgaria. In general, losses within that range indicate (i) poor condition of the water network, in terms of their physical state (failures, leaks from pipes, etc.), (ii) inaccuracy of water metering (i.e. water produced and consumed) (iii) insufficient leakage control (high run-time for failure repair) and (iv) inadequate pressure management.

**Conclusions**

The major problems related to non-revenue water are as follows:

- Inaccurate water Metering (10 %): (i) Inaccurate or inexistent production metering, (ii) inaccurate customer water meters
- Illegal Consumption (11 %) (water theft)
- Unbilled authorised consumption (11 %)

The Consultant, therefore, recommends improvement of the above-said deficiencies through implementation of the following measures:

**Recommendations**

- Installation of water meters for all water sources providing water to the town of Peshtera and the villages, which are not equipped with such devices yet.
- Installation of water meters before and after pressure reservoirs, servicing the settlements.
- It is necessary to follow the schedule for verification, calibration and replacement of consumers' water meters (particularly for domestic and small commercial customers).
- Reduction of water thefts (apparent losses) remains one of the biggest challenges as illegal connections are difficult to detect. However, localisation of unauthorised connections is possible in the course of replacement of existing water distribution network (in particular asbestos cement or steel pipes).

### 3.7.4. WATER SUPPLY INFRASTRUCTURE

**Conclusions**

There are three independent water supply systems on the territory of VKS EOOD Peshtera, namely:

- Water supply system for the town of Peshtera consists of spring catchments supplying the town by gravity, one river intake and 4 tube wells. The length of the transmission mains is about 26 km and the distribution network is about 47 km long.
- Water supply system for villages of Radilovo and Kapitan Dimitrievo, which are mainly supplied from a Reservoir of Pazardzhik Water Supply System and several small spring catchment systems. The length of the transmission mains is about 25 km and the distribution network is about 25 km long.
- Water supply system for Saint Constantine Holiday Resort, which consists of two pumped water supply systems fed by a spring catchment and a connection to the water supply system of Batak Dam. The length of the transmission mains is about 2.5 km and the distribution network is about 10 km long.

The main deficiencies of the external water supply system of Peshtera are related to the obsolete gravity transmission mains. Currently, the water supply system for the town of Peshtera is secured due to the large number of feeding water sources and pipelines. In case of a failure on one of the water pipelines, the remaining ones have sufficient capacity to supply the town. However, in order to ensure future supply security it is recommended that at least part of the mains (in line with future water demand) be replaced.

The following table contains a summary of the main deficiencies of the water supply system of VKS EOOD Peshtera.

*Table 3-75 Summary of Main Deficiencies*

| Components | Main deficiency |
|---|---|
| Water Sources | The water sources, supplying the settlements on the territory of Peshtera Municipality are in satisfactory condition.<br>Exceptions: Studenata Voda and Dalbochitsa 1 catchment systems. They need reconstruction and major repair. The remaining water sources require comparatively minor repair works.<br>The SPZ of Kukusheva Cheshma catchment system is not established as according to the requirements of Ordinance 3. |
| Treatment Plants, Disinfection | Water discharging from the water sources undergoes treatment in the treatment plants. Two treatment plants and one water intake of alpine type, including water treatment, are envisaged. The facilities are not leaking but are built outdoors, which causes problems with freezing of filters in the winter. The water from backwashing the filters is discharged into the surrounding space without any treatment. The technology of chlorination in Peshtera DWTP does not correspond to the standard and is carried out under dangerous conditions for the personnel. We recommend that Saint Constantine treatment plant should use aluminium oxychloride instead of sodium sulphate, which is more efficient in case of low temperatures and does not require additional polyelectrolyte. Sodium hypochlorite is added by sight or by flow pump, unproportionally to the water sent. The treatment is adequate, except for the water delivered to part of the town of Peshtera, which is not chlorinated and SPZ of the water supply system is in bad condition. |
| Water Mains | All gravity water pipelines (mainly the ones made of asbestos cement pipes) from spring catchment systems to the pressure reservoirs of settlements are obsolete and should be |

| Components | Main deficiency |
|---|---|
| | replaced in stages. Failures on these mains can be expected to occur. The facilities on these water mains, break-pressure chambers, collection chambers, air-valve chambers and draining shafts are also in poor condition and need renovation.<br>Additionally, due to difficult access to the gravity water mains, repair and maintenance works are tough. |
| Pumping Stations | All pumping stations are equipped with new pumps and there is no current problem related to water pumping. |
| Reservoirs | All reservoirs are in good condition.<br>Pipes and fittings are partly in poor condition (corrosion).<br>Some SPZs are lacking fences and other protection facilities.<br>The reservoirs for Saint Constantine Holiday Resort have no fire-prevention reserve and their volume is insufficient in certain periods (August). |
| Water Distribution Network | Distribution networks are generally in poor condition. (Except for the fully replaced water supply network in Saint Constantine Holiday Resort.)<br>Real water losses in all networks are high (in Peshtera about 33 %) due to poor condition of the network.<br>The equipment of Peshtera network (i.e. fittings, stop valves and fire hydrants) is inadequate and does not correspond to the regulatory requirements.<br>The condition of distribution networks in the villages is similar. |

**Recommendations**

For external water supply systems

- Repair and reconstruction works for all spring catchment systems
- Although SPZ of Kukusheva Cheshma water source for St. Constantine is not entirely established in accordance with the requirements of Ordinance 3, so far there have been no deviations with regard to drinking water. It is fully compliant with the requirements of Ordinance 9. The consultant recommends that VKS EOOD – Peshtera should conduct strict control over the quality of drinking water from this water source (increasing the number of samples). If deviations are found – water supply should be interrupted. In case of permanent deviations, the water source should be taken out of operation.
- Replacement of certain water transmission mains, which is necessary to cover future water demand and to ensure supply security.
- Rehabilitation of reservoirs including replacement of pipes, valves, metering devices, devices against water overflowing for some reservoirs (those fed by gravity from the catchment systems), ladders, doors and handrails in the reservoirs, restoration of fences of Belt I of SPZ
- As regards pressure reservoirs of Saint Constantine, the consultant puts emphasis on the following: the insufficient volume of the reservoirs (August), does not cause restriction on water supply to the consumers; the resort does not have a status of settlement with permanent population and the provision of additional capacity with fire-prevention reserve is advisable to be implemented by

Peshtera Municipality or VKS EOOD Peshtera using own funds or funds under different development programmes.

For water distribution networks:

- Overall staged replacement of old and obsolete asbestos cement and steel pipes including service connections.
- The detailed design (financing approved, start in 2012) for the town of Peshtera includes replacement of 12.6 km of the distribution network (27% of the total length of existing network) and thus 23.5 km (50 %) will remain to be replaced in further stages.
- According to the designs approved for the villages of Radilovo and Kapitan Dimitrievo, water distribution networks will be fully replaced. Implementation of these investment measures is forthcoming.
- It is proposed to carry out accurate flow measurements for the estimation of water losses after the implementation of the projects in Peshtera and both villages in order to assess the effect of replacement of distribution branches and service connections.

Drinking Water Treatment Plants (DWTP)

1. Peshtera DWTP

Rapid sand filter:

- New building should be constructed, a light construction for rapid sand filter, allowing minimum cost maintenance of constant positive temperature in case of low ambient temperatures.
- Tertiary stage of the treatment plant should be envisaged. It will take the waters coming from washing of the sand filter and the waters form the sedimentation tank and will treat it to an extent as set out in the permit for discharge of that water

Chlorination station

- The chlorination compartment should be brought in compliance with the requirements for safe work. It is necessary to install a control system for presence of chlorine gas in the operation premises, as well as a system for its automatic deactivation.
- The chlorination compartment itself should be completely equipped with a standby chlorine barrel as well as with an automatic system for switching over the operating barrel with the standby one. This will be carried out for „exhaustion of chlorine in the operating barrel" mode, as well as for „accidentally suspended delivery of chlorine from the operating barrel" mode
- The chlorination compartment should be brought in compliance with the contemporary requirements for safe work with chlorine gas. The respective air freshening facilities should be installed.

- In case of existing chlorine gas detected by the gas analysers installed in the operation premises, the alarm system for the personnel should be activated, by blocking the entrance door and forbidding the access to the premise from the outside.
- The premise which has no contact with the chlorination compartment should be equipped with cupboard for personal protection means. It is obligatory to provide at least two oxygen insulating sets, rubber aprons, gloves, etc. rather than masks, according to the instructions for safe work in chlorination station where chlorine gas is incorporated.
- The operational personnel should be directed against signature that they are aware of the conditions and instructions for work with chlorine gas.

2 Saint Constantine Resort DWTP

Rapid sand filter of SK16 type

- New building should be constructed i.e. a light construction for rapid sand filter, allowing minimum cost maintenance of constant positive temperature in case of low ambient temperatures.
- Tertiary stage of the treatment plant should be envisaged. It will take the waters coming from washing of the sand filter and the water from the sedimentation tank and will treat it to an extent as set out in the permit for discharge of that water

Reagent storage

- The reagent treatment of water should be carried out by using much more effective reagent, aluminium oxychloride instead of sodium sulphate
- Sodium hypochlorite is incorporated in proportion to the water sent for disinfection

3. Water abstraction for Lukovitsa Quarter

Rapid sand filter of SK16 type

- New building should be constructed i.e. a light construction for rapid sand filter, allowing minimum cost maintenance of constant positive temperature in case of low ambient temperatures.
- Tertiary stage of the treatment plant should be envisaged. It will take the waters coming from washing of the sand filter and the water from the sedimentation tank and will treat it to an extent as set out in the permit for discharge of that water

It is necessary to install a suitable mechanically cleaned screen instead of the currently operated manually cleaned screen. It is recommended that the same is placed in a small building, light construction or other type of structure proposed by the Investor.

All drinking water treatment plants and the water abstraction of Lukovitsa Quarter have a completed and operational system for visualizing the condition of water supply system. We recommend that the visualization system is initially expanded and incorporated

together with a system for remote control of the process, and in perspective, provision of automated control of the processes by a parameter.

The sanitary protection zones are in poor condition. Therefore, they need to be rehabilitated according to the approved designs for SPZ.

## 3.7.5. WASTEWATER INFRASTRUCTURE

### *3.7.5.1. Wastewater Network*

**The designated agglomerations on the territory of VKS EOOD Peshtera are as follows:**

- Peshtera Agglomeration – 15,978 PE (according to report on the application of the requirements of Directive 91/271/EEC concerning urban wastewater treatment for settlements of over 2,000 PE). As of 2011: coverage rate of sewerage network is 98% and its length is equal to 43 km. A detailed design is approved for sewerage extension and WWTP construction (25,000 PE). Funding is secured and construction works are to be started.
- Kapitan Dimitrievo Agglomeration (The village of Kapitan Dimitrievo (768 inhabitants) and the village of Radilovo (1 385 inhabitants). As of 2011: sewerage coverage rate is 90% in Radilovo and 60% in Kapitan Dimitrievo. Sewerage network has a total length of11.8 km. Both settlements are not subject to the requirements, set out in UWWTD 91/271/EEC. For those settlements, a detailed design is approved for rehabilitation of the existing sewerage network as well as for construction of new one (100% population connected) and construction of a joint WWTP for 2 870 PE. Funding is approved and construction works are to be started.
- St. Constantine Holiday Resort Agglomeration (1,620 temporary inhabitants): coverage rate of sewerage network is 100% and its length is equal to 7.2 km. Although a site for new WWTP has been selected, no detailed design is approved and funding is missing. Saint Constantine Holiday Resort does not have a status of settlement with permanent population but the construction of a WWTP is necessary in the medium term phase.

**Conclusions**

- The remaining network, that needs to be rehabilitated, has a length of L= 33 290 m (69 %).
- There is infiltration and/or exfiltration of groundwater or water from leaking water pipelines or sewers due to damaged pipes, joints or couplings of service connections
- Sewer overflows are insufficient to unload sewerage network. The main deficiency is that when South Main Collector passes through Stara Reka River, it is not released from stormwater quantities.

- Poor physical conditions (old network, damaged pipes, in some locations pipe couplings are displaced) of the sewerage network of the town of Peshtera.
- The predominant diameter in the sewerage network is ∅200 (20,053 m or 41.86%), which is less than the diameter of ∅300 required by the current regulations. This diameter prevails in the outermost areas of the town. The main deficiencies are as follows:
    - It is not always that stormwater quantities from the drainage area can actually enter the sewerage. Street gullies are insufficient to receive all stormwater quantities and are often clogged and unable to get optimal water amount;
    - There are steep areas, where stormwater passes over the street gullies ( in good functional condition ) and only part of it is received by the sewerage;
    - The insufficient hydraulic capacity of diameter equal to 200 implies the following: The sewerage is unable to receive all stormwater quantities. As a result they run down the street and do not enter the sewer. The frequency of this event cannot be determined as no modular surveys have been carried out. In such a sewer, which is part of mixed sewerage, the ratio of domestic (0,05 - 0.5l/s) to stormwater quantity (about 30 l/s) is over 60 times;
    - The main deficiency is the small diameter, which is a precondition for more frequent clogging. It is necessary to provide regular surveillance and cleaning.

**Recommendations**

- As-built drawings should be elaborated after the project completion;
- Levelling survey of the remaining sewerage network, chiefly main sewer collectors;
- Stimulation investigations with regard to the hydraulic capacity of the existing wastewater network for characteristics loads by using software products
- This will be the basis employed in the subsequent design phases for creating an overall hydraulic picture of the sewerage network in order to provide precise forecast for reconstruction and extension of the network in the whole town.
- Provision of operation and maintenance so that the sewerage system meets the requirements of the European standards and the local Bulgarian regulations.
- An Action plan may help for ensuring fully effective operation. The plan should contain tasks for inspection, instructions for operation in relation to the system parts and emergency procedures. The plan has to include the type of maintenance strategy, which needs to be applied to the individual parts of the system as well as the requirements for monitoring and frequency of execution.

### *3.7.5.2. Wastewater Treatment Plant*

The design of wastewater treatment plant is duly approved and is in a process of construction. The process scheme is expected to fulfil its purpose after the project implementation.

The production undertakings in the agglomeration and their subjects of activity are presented in the attached list. The review of the above said companies indicates that the activity of the major part of them does not involve formation of process waste water containing dangerous substances. The remaining part of them connected to the urban sewerage produce domestic and bio-dissolvable waste waters. These waters are included in the general balance of the treatment plant as organic loads in the detailed design. The control over the construction of local treatment plants is responsibility of the supervisory bodies from RIEW and the local administration. Normally, their funding should be provided by the undertakings, at their own expense, and is not subject to the study herein.

### *3.7.5.3. Sludge Management*

There is an elaborated and approved Sludge Management Report for the sludge of the future wastewater treatment plant of the town of Peshtera. It envisages that the sludge will be disposed to the existing municipal waste landfill of Peshtera, and after its closure – to the regional municipal landfill for the area of Pazardzhik. The sludge from the joint wastewater treatment plant of the villages of Radilovo and Kapitan Dimitrievo, which is still at the stage of public procurement for selection of builder, is planned to be disposed similarly to the sludge from Peshtera WWTP. From both WWTP about 336 tons of sludge (dry substance) will be disposed to the landfills per year (75 % humidity). As already mentioned above, the Consultant recommends the landfill to be used only during the testing stage of the sludge quality for possible further utilization. After this relevant contracts must be signed for utilization of the sludge. The sludge will be disposed at the landfill only in emergency situations. Както вече бе споменато, препоръката на Консултаната е ползването на депото да става временно, докато продължава изследването на качествата на утайката и възможните области на приложения за оползотворяването и. След това следва да се сключат съответните договори за оползотворяване на утайката. Повторното депониране в депото за отпадъци е възможно само в случай на при някакво аврийно състояние.

### *3.7.5.4. Industrial Wastewater*

The total wastewater quantity discharged by industries in Peshtera is equal to about 148,000 m³/year. Most of them are connected to the sewerage network, but almost none of these industries are endowed with pre-treatment facilities. The major part of these industries does not produce wastewater containing dangerous substances. There are two main industrial companies in Peshtera, Biovet AD (Pharmaceutical and veterinary products) and Vinprom Peshtera AD (Manufacturer of alcoholic beverages).Only Biovet AD has its own treatment plant (effluents discharging to receiving water are in compliance with standards) and Vinprom Peshtera AD, which is connected to the municipal wastewater network, does not have any pre-treatment facility. Three of the industrial enterprises are located outside the agglomeration boundaries and it is not possible to connect them to the urban wastewater network. They are currently discharging untreated waste water into the nearby located creek. These industries should be urged to construct (and finance) their own treatment facilities.

#### 3.7.5.5. Other Pollution Sources

The Consultant's assessment reveals that most of the DWTPs in the territory of VKS EOOD Peshtera discharge backwash water from rapid sand filters to the receiving water without any treatment. Therefore, it is recommended to envisage recycling and treatment facilities for backwash water and to dispose the remaining sludge in compliance with the respective standards.

## 3.8. ON-GOING AND PENDING PROJECTS

Several equipment or infrastructure improvement projects have been conducted lately by different organizations out of the framework of the present Regional Master Plan. Once identified, these projects are considered in different ways:

- Completed projects to date are included in the existing situation (chapter 3)
- On-going projects (projects that were approved and financed before 15th July 2012 but not completed to date) are also included in the existing situation. In fact, corresponding assets are considered as existing, investment costs are not included within the Regional Master Plan but future operation and maintenance costs are included for the macro-affordability assessment (chapter 3).
- Projects not approved to date, but the purpose of which are in line with the Regional Master Plan objectives, are included in the Regional Master Plan. Corresponding design, investment costs and timeframes are newly assessed according to the Consultant's methodology (chapter 4).
- Other projects, which are not in line with the objectives and criteria of the Regional Master Plan, are either not included or substantially altered.

For Peshtera Regional Master Plan, all non-completed projects were either considered as on-going (and thus their costs were not included in the Investment Programme) or considered appropriate and included in the Regional Master Plan. The initial designs were also kept.

The table below summarizes the existing projects that have been included in the present Regional Master Plan, after being considered appropriate by the Consultant:

*Table 3-76 Existing projects included in the Regional Master Plan*

| Municipality | Project |
|---|---|
| Peshtera | "Modernisation of the Integrated Water Cycle of the town of Peshtera – Completion and rehabilitation of the existing water supply and sewerage network and construction of WWTP in the town of Peshtera" |
| Peshtera | "Reconstruction and rehabilitation of the sewerage network in the village of Radilovo – Southern part, Peshtera Municipality" |
| Peshtera | "Reconstruction and rehabilitation of water supply network in the village of Kapitan Dimitrievo and construction of WWTP in the village of Kapitan Dimitrievo, Peshtera Municipality, Pazardzhik District" |

| Municipality | Project |
|---|---|
| Peshtera | “Reconstruction and rehabilitation of sewerage network in the village of Radilovo – Northern part and the village of Kapitan Dimitrievo”. |
| Peshtera | “Reconstruction and rehabilitation of the water supply network in the village of Radilovo, Peshtera Municipality“ |

# 4. PRIORITIES FOR THE DEVELOPMENT OF THE WATER AND WASTEWATER INFRASTRUCTURE TO ACHIEVE COMPLIANCE WITH EU DIRECTIVES AND ENVIRONMENTAL ACQUIS

## 4.1. METHODOLOGY AND ASSUMPTIONS

### 4.1.1. BASIC DESIGN CRITERIA

#### *4.1.1.1. Reference periods for investment programmes*

Investment program periods are set as follows[15]:

- Short-term: 2014 – 2020;
- Medium term: 2021 – 2028;
- Long term: 2029 – 2038.

In addition to the above mentioned key dates for the investment programming periods, the Consultant defined the following dates and terms:

- **Existing situation**: Average of data from 2009 to 2011; Infrastructure which has been put into operation until the end of 2011 has been taken into account;
- **Situation after implementation of on-going projects**: All on-going projects approved before 15th July 2012 will not be included in the Regional Master Plans' investment programme, but respective data are presented separately in Chapter 3. The impact of these investment projects with completion dates between 2012 and 2016 will be taken into consideration in the year 2016 (first year of projection);
- **2016**: First year of operation of infrastructure proposed in the Short-term investment programme.

#### *4.1.1.2. Population forecast criteria*

Population forecast takes into account:

- NSI population forecasts up to the year 2060, with starting level corresponding to 2011 census data;
- Population is forecasted based on population dynamics: birth rate, death rate and net migration (mechanical growth);
- Birth rate and death rate are forecasted with conventional methods. A trend is established and a constant coefficient or a steady increase/decrease over the

[15] In agreement with MRDPW the program periods deviate from those defined in the ToR in order to ensure consistency with the operational programming period.

years is applied. This approach takes into account the population specifics of each municipality and settlement.

The forecast for each subsequent year is obtained from the population of the previous year, by adding births and subtracting deaths and net migration. In practical terms:

| **Population for the forecasted year** | **=** | **Population for the year before** | **+** | **Births** | **-** | **Deaths** | **+** | **Net migration** |
|---|---|---|---|---|---|---|---|---|

The population forecast for the Central Region of Bulgaria are presented in Chapter 5.1 related to socio-economic projections.

### 4.1.1.3. Water Supply systems

This section develops the design criteria which were used for defining and designing the proposed infrastructures for water supply systems.

At regional master plan level only basic design criteria have been taken into consideration, while more detailed criteria will be developed in the subsequent feasibility studies.

#### 4.1.1.3.1. Water demand forecast and design flows

The “effective water demand” is the quantity of water demanded of a given quality at a specified price. The analysis of demand for water, including realistically forecasted future levels of demand, is an important and critical step in the realization of a Regional Master Plan, for both water supply and sewer systems. This section presents the methodology for assessing the evolution of water demand from present situation till the design horizon. This methodology is based on the water balance defined by the IWA and synthesized in the following table.

*Table 4-1 Water balance according to IWA terminology*

<table>
<tr><td rowspan="3">Own sources</td><td rowspan="6">Total system input volume</td><td>Water exported</td><td rowspan="3">Authorised Consumption</td><td rowspan="2">Invoiced Authorized Consumption</td><td>Invoiced water exported</td><td rowspan="3">Revenue Water</td></tr>
<tr><td rowspan="5">Water supplied</td><td>Invoiced metered consumption</td></tr>
<tr><td>Invoiced unmetered consumption</td></tr>
<tr><td rowspan="3">Water losses</td><td rowspan="2">Uninvoiced Authorized Consumption</td><td>Uninvoiced metered consumption</td><td rowspan="5">Non-Revenue water</td></tr>
<tr><td rowspan="3">Water imported</td><td>Uninvoiced unmetered consumption</td></tr>
<tr><td rowspan="2">Commercial losses</td><td>Unauthorised Consumption (illegal connections…)</td></tr>
<tr><td>Customer metering inaccuracies</td><td rowspan="3">Physical losses</td><td>Leakage on Mains</td></tr>
<tr><td>Leakage on Service Lines</td></tr>
<tr><td>Leakage & Overflows at Storage</td></tr>
</table>

The Water Demand includes the following components:

- Revenue water, including:
  - Invoiced exported water;
  - Invoiced domestic consumption;
  - Invoiced industrial consumption;
  - Invoiced commercial and institutional consumption.
- **Non-Revenue Water** (NRW), including:
  - Uninvoiced water (cleaning of the streets, public parks watering, fire service...);
  - Apparent losses such as illegal consumptions and accuracy errors of the water meters;
  - Real losses which correspond to pipe leaks.

Unrealistic projections could lead to inadequate priority and long-term investment programs in terms of sizing of the facilities and can have serious consequences on the functioning of water supply systems (insufficient/excessive pressures, dysfunction of pumping stations and reservoirs, excessive residence time and low water quality...).

Numerous factors can directly or indirectly influence water demand. They are synthesized in the following diagram.

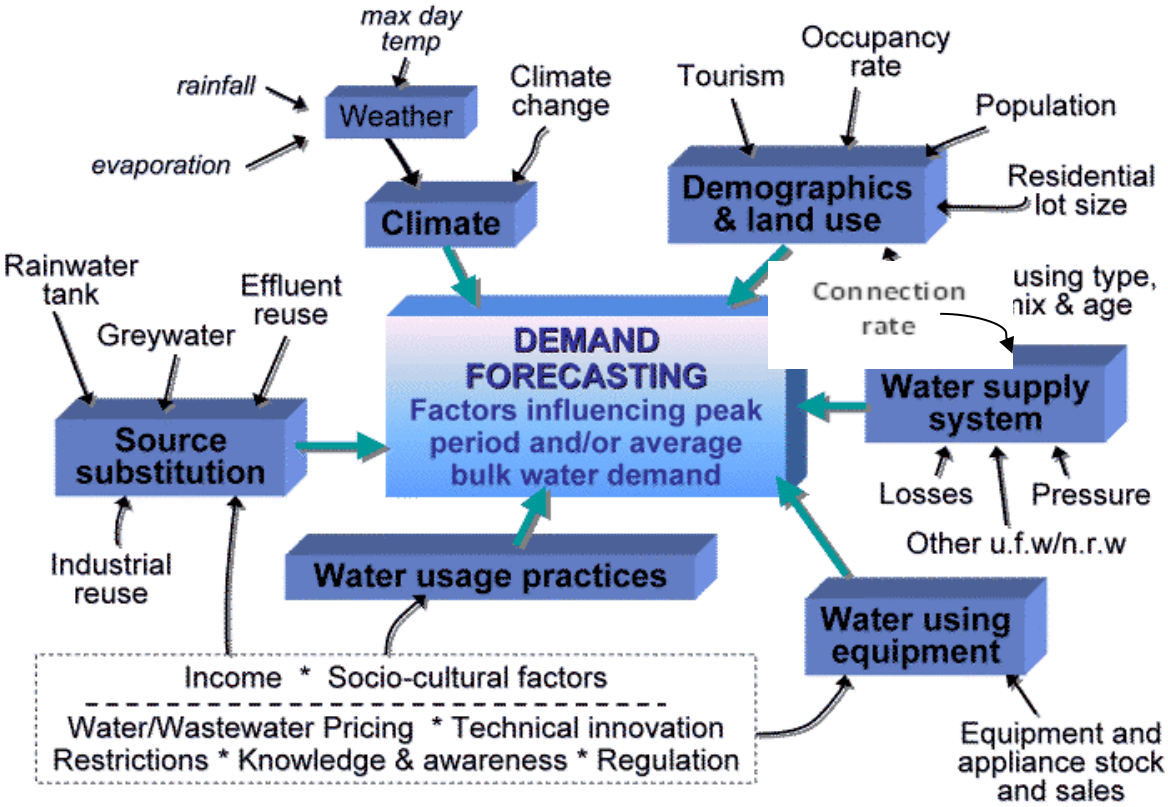



*Figure 4-1 Factors influencing water demand*

***Domestic consumption***

- Connection rate and population served

The connection rate to water supply system is determined through the following principles:

- For year 2011, this rate is the present rate provided by the WSSCs;
- For year 2021 and the following years, this rate is set to 100%;
- For year 2016, this rate is assessed by taking into account the current situation and the on-going projects which will impact this rate (extension of water supply systems…).

The population served is then deducted by multiplying the total population assessed on the considered date by the connection rate assessed on the same date.

- Domestic per capita consumption
- Calculation of present permanent consumption per capita:

The present domestic consumption in 2011 is the average domestic consumption from 2009 till 2011 provided by the WSSCs. The consumption per capita can then be deducted from the previous value and from the official population data (census 2011).

It was noticed that for some of the settlements in the study area, this specific consumption per capita per day reaches a very high level, up to 400 l/c/d and even more. Additional investigations showed that these high rates are due to seasonal factors, such as temporary agricultural works (grape harvest…), temporary population having holiday homes... This temporary population not being accounted in the population statistics from the census, the Consortium proposes the following methodology:

- Calculation of consumption per capita based on average domestic consumption from 2009 to 2011 and corresponding population data from the same year;
- Identification of settlements affected by **temporary consumption** (settlements with consumption per capita **above 120 l/c/d**);
- For settlements not concerned with such temporary consumption, calculation of the **permanent consumption per capita** by averaging data from 2009 to 2011 (**temporary consumption** being null in this case);
- For settlements affected by temporary domestic consumption, **permanent consumption per capita is set to 120 l/c/d**, the rest of the consumption being considered as temporary consumption[16].

- Calculation of permanent consumption per capita in 2038:

The permanent consumption per capita is set to 120 l/c/d (17)

16 Example: Small village with consumption per capita (average from 2009 to 2011) equal to 220 l/day/inh., with 500 inhabitants. Then, the permanent consumption per capita will be assumed to be 120 l/day/inh. and the rest, e.g. 100 l/day/inh. x 500 = 50 $m^3$/day will be considered as temporary domestic consumption.

- Calculation of the permanent consumption per capita for intermediate reference dates (2016, 2021 and 2028):

Consumption per capita is assessed based on a linear interpolation between present and 2038 values.

Note: Regarding the Macro-Affordability Model for the assessment of the proposed investment programmes, the affordability criterion is that the monthly water bill should not exceed 4% of the average monthly household income at a consumption level of 2.8 $m^3$ per person per month (93.3 l/capita/day)[18].

- Average domestic consumption

It is proposed to assess the average domestic consumption as follows for each of the reference dates:

- Calculation of the present domestic consumption:
  - Calculation of the **permanent domestic consumption** by multiplying the consumption per capita on the considered date by the total population served on the same date;
  - For settlements affected by temporary domestic consumption, calculation of **temporary domestic consumption** based on the difference between average domestic consumption from 2009 to 2011 and previous permanent domestic consumption.
- Calculation of the domestic consumption in 2038: The main assumption is that in 2038, all households will get house connection and reach the reference per capita domestic consumption:
  - Calculation of **permanent domestic consumption** based on consumption per capita of 120 l /c/d[19] and permanent population forecast in 2038;
  - Calculation of **temporary domestic consumption** on the basis of present assessed value and socio-economic forecast.
- Calculation of the permanent and temporary domestic consumptions for intermediate reference dates (2016, 2021 and 2028) based on a linear interpolation between present and 2038 values.

- Daily peak coefficient and domestic consumption

The daily peak consumption is assessed by multiplying the daily peak coefficient (5) (see Appendix 4-1) and the average domestic consumption.

- Hourly peak coefficient and domestic consumption

[17] According to Ordinance N°2 from March 2005 for “Design, construction and exploitation of water supply systems”.

[18] According to the Terms of Reference, Art. 6.2 Macro-Affordability Assessment.

[19] According to Ordinance N°2 from March 2005 for “Design, construction and exploitation of water supply systems”.

The hourly peak consumption is assessed by multiplying the hourly peak coefficient (see Appendix 4-1) and the daily peak domestic consumption.

***Non-domestic consumption***

It is proposed to apply the following principles:

- Categories: the non-domestic consumption is divided into three categories:
- Public facilities;
- Industrial;
- Agricultural.
- Calculation of non-domestic consumption in 2011:
- If the information for 2011 is known, the non-domestic water demand for subsequent reference years is obtained by linear extrapolation, applying the following two rates:
  - Projected economic growth (based on data from International Institutions like the World Bank, the Internatonal Monetary Fund and Economist Intelligence Unit);
  - 1% of annual decrease of the initial consumption, as a consequence of a water savings policy for businesses and public institutions.
- If the information is unknown for the year 2011, the non-domestic water demand for subsequent reference years is assessed accordingly with the following principles:
  - For settlements with less than 2,000 inhabitants in 2011, the unit consumption will be 12 litres/capita/day (10% of the target consumption per capita), from which the non-domestic water demand is deducted by multiplying this unit consumption by the estimated population of the reference year for which it is calculated;
  - For settlements with more than 2,000 inhabitants in 2011, the unit consumption will be 40 litres/capita/day [20][21], from which the non-domestic water demand is deducted by multiplying this unit consumption by the estimated population of the reference year for which it is calculated.

**Non-Revenue Water**

Non-Revenue Water (NRW) is the sum of:

- Unbilled authorized consumption;
- Apparent losses (unauthorised consumption and customer metering inaccuracies);
- Real losses (leakages).

[20] In conformity with Ordinance N°2 from March 2005 for “Design, construction and exploitation of water supply systems”, Art 17.7, §(2).

[21] In conformity with the Operational Programme Environment 2007 – 2013, Requirements for preparation of investment projects in agglomerations of between 2,000 and 10,000 PE.

Water losses are the sum of apparent losses and real losses. At the Regional Master Plan stage, the repartition between these two types of losses cannot be estimated.

The commercial losses should be reduced through targeted rehabilitation programs which are defined in the Regional Master Plan as well as through specific NRW Reduction programs to be implemented by water supply and sewerage companies before the reference year 2021.

In order to asses NRW on the reference dates, the following criteria are used:

- In the case of a new or rebuilt water supply network, the NRW Rate will be as follows:
  - 2011: 0% (non-existent network);
  - 2016: 15% (new network);
  - 2021 and 2028: linear interpolation between the values for 2016 and 2038;
  - 2038: 20 %.
- In the case of an existing water supply network, the NRW Rate will be as follows:
  - 2011: present value provided by the WSSCs and based on water loss monitoring data (assessment based on water loss measurements carried out by the VIK);
  - 2016, 2021 and 2028.
    - If no particular rehabilitation program is defined in the Regional Master Plan, linear interpolation between the values for 2011 and 2038, in relation with the NRW reduction program to be implemented by the ViK.
    - If specific rehabilitation program is defined, calculation of the NRW rate at the date of rehabilitation based on 15% NRW rate for the rehabilitated network and linear interpolation between the values for 2011 and 2038 for the rest of the network.
  - 2038: 25% (target for an existing network in operation)[22];
  - Particular case: if, when calculated by linear interpolation, the NRW rate for the reference year 2021 exceeds 35%, it is set at 35% for 2021 and the value for 2016 is assessed through interpolation between present and 2021 values. The NRW rate for the reference year 2028 is subsequently set to 32%.

Note: Obviously, the reduction of NRW Rate is closely linked to the NRW reduction programs implemented by the various WSSCs. In fact, the NRW reduction programmes to be implemented are designed so that the above-mentioned objectives are met.

***Summary – Water supply component***

The methodology for water demand forecast is summarised hereafter:

[22] To maintain conformity with European Standards, the objective of 20% is kept but for a year beyond 2038.

$$\textbf{Population served} = (\text{Present or forecasted Population}) \times (\text{Connection rate})$$

$$\textbf{Domestic Water consumption} = (\text{Present or forecasted Population}) \times (\text{Present or forecasted Consumption per capita per day}) + (\text{Present or forecasted temporary consumption})$$

$$\textbf{Non Domestic Water Consumption} = \begin{cases} \text{Present or forecasted value if known or, if unknown:} \\ \text{Population} \times 12 \text{ LPCD if Population} < 2000\ inh. \\ \text{Population} \times 40 \text{ LPCD if Population} > 2000\ inh. \end{cases}$$

$$\textbf{Water Consumption} = (\text{Domestic Water Consumption}) + (\text{Non Domestic Water Consumption})$$

$$\textbf{Non} - \textbf{Revenue Water} = \frac{(\text{Present or forecasted water consumption})}{(1 - \text{Present or forecasted NRW Rate})}$$

$$\textbf{Total Water Demand} = (\text{Water Consumption}) + (\text{Non} - \text{Revenue Water})$$

Note: LPCD = Litres Per Capita per Day

### *4.1.1.3.2. Technical design criteria*

***Water resources and Treatment***

- Technical and Sanitary Criteria

Within the present Regional Master Plan, the sanitary criteria required by the European Union (EU Drinking Water Directive 98/83/EC) and the Government of Bulgaria (Ordinance N°2 from March 2005 for “Design, construction and exploitation of water supply systems”) have to be met for all housings (Described in Ch.1).

- Technical Description of treatment processes

The following table summarizes the arguments for the different treatment processes and gives a qualitative evaluation for the operation under general conditions. This table does not summarize disinfection processes. It has to be noted that, when treatment options are chosen, the type of treatment is to be discussed at the Feasibility Study stage.

*Table 4-2 Technical description of treatment processes*

| | Usual treatment | | | | Complementary treatment | | |
|---|---|---|---|---|---|---|---|
| **Type** | Primary Sedimentation | Sand filtration | Coagulation + Flocculation + Settling | Filtration by membranes | Activated carbon + Filtration | Aeration + Filtration | KMnO4 + Filtration |
| Type of raw water | High turbidity (>200NTU). Used as pre-treatment | Low turbidity (<2NTU) with some variation of turbidity | Higher turbidity (>2NTU) with some variation of turbidity | High turbidity (<200NTU). Used with pre-treatment | Used with presence of organic matter | Used with presence of Iron or/and manganese | Used with presence of Manganese and/or Iron |
| Technical | ⊕ Very simple technology<br>⊕ Variation of flow and load possible<br>Θ Large surface | ⊕ Simple technology<br>⊕ Variation of flow and load possible<br>⊕ Small surface | ⊕ Small surface<br>⊕ Variation of flow and load possible<br>Θ Require coagulant and polymer | ⊕ High treatment standards<br>⊕ Compact plant<br>Θ Sophisticated technology | ⊕ Simple technology<br>Θ Require regular removing of activated carbon | ⊕ Simple technology<br>Θ | Θ Require KMnO4, which is dangerous product |
| Operational | ⊕ Easy O&M<br>⊕ Low energy input | ⊕ Easy O&M<br>⊕ Low energy input | ⊕ Low energy input<br>Θ Moderate maintenance costs<br>Θ Moderate O&M. Need availability of the operator staff. | ⊕ Energy consumption<br>Θ Complex technology<br>Θ Complex O&M | ⊕ Easy O&M<br>⊕ Low energy input<br>⊕ Moderate maintenance costs | ⊕ Easy O&M<br>⊕ Low energy input | ⊕ Moderate O&M<br>⊕ Low energy input<br>⊕ Moderate maintenance costs |
| Economical | ⊕ Low investment costs<br>⊕ Low O&M costs | ⊕ Low investment costs<br>⊕ Low O&M costs | ⊕ Moderate investment costs<br>⊕ Moderate O&M costs | Θ High investment costs<br>Θ High O&M costs (energy consumption) | ⊕ Moderate investment costs<br>⊕ Low O&M costs | ⊕ Moderate investment costs<br>⊕ Low O&M costs | ⊕ Moderate investment costs<br>⊕ Moderate O&M costs |
| Application | ⇨ Rural areas<br>⇨ Small-medium-large size WTP | ⇨Rural areas<br>⇨Small-medium size WTP | ⇨ Small-medium size WTP | ⇨Large WTP | ⇨Small-medium-large size WTP | ⇨Small-medium-large size WTP | ⇨ Medium-large size WTP |

- Technical Description of disinfection processes

The treatment will depend on the quality and length of the network.

The following table summarizes the arguments for the different disinfection processes and gives a qualitative evaluation for the operation under general conditions.

*Table 4-3 Technical description of disinfection processes*

| Type | UV | Bleach | Chlorinated water | $Cl_{2g}$ (Chlorine) | ClO (Dioxide chlorine) | Ozone |
|---|---|---|---|---|---|---|
| Network | ⊕ Short and/or clean network. In good condition and well-maintained network<br>⊕ Low and high flow | ⊕ All type of network<br>⊕ Low flow | ⊕ Long and/or dirty network. Defective and poorly maintained network<br>⊕ Low flow | ⊕ All type of network<br>⊕ High flow | ⊕ Long and/or dirty network. Defective and poorly maintained network<br>⊕ High flow | ⊕ Short and/or clean network. In good condition and well-maintained network<br>⊕ High flow |
| Technical | ⊕ Simple technology<br>⊕ Variation of flow possible | ⊕ Simple technology<br>⊕ Variation of flow possible<br>⊕ Easy to conserve bleach solution | ⊕ Simple technology<br>⊕ Variation of flow possible<br>⊕ easy to conserve bleach solution | ⊕ Variation of flow possible<br>Θ Sophisticated technology<br>Θ Dangerous product: high risk of explosion. Need important rules of security to conserve it | ⊕ Variation of flow possible<br>Θ Sophisticated technology<br>Θ Dangerous product: high risk of explosion. Need important rules of security to conserve it | ⊕ Variation of flow possible<br>Θ Sophisticated technology<br>Θ Dangerous product: high risk of explosion. Need important rules of security to conserve it |
| Operational | ⊕ Easy O&M<br>Θ Moderate energy consumption<br>Θ Moderate maintenance costs | ⊕ Easy O&M<br>⊕ Low energy consumption<br>⊕ Moderate product cost | ⊕ Easy O&M<br>⊕ Low energy consumption<br>⊕ Moderate product cost | ⊕ Moderate energy consumption<br>Θ Complex and dangerous technology<br>Θ Complex O&M | ⊕ Moderate O&M<br>⊕ Moderate energy input<br>⊕ Moderate maintenance costs | ⊕ High energy consumption<br>Θ Complex and dangerous technology<br>Θ Complex O&M |
| Economical | ⊕ Low investment costs<br>⊕ Low O&M costs | ⊕ Low investment costs<br>⊕ Low O&M costs | ⊕ Moderate investment costs<br>⊕ Moderate O&M costs | Θ High investment costs (need specific storage)<br>⊕ Moderate O&M costs | ⊕ Moderate investment costs<br>⊕ Moderate O&M costs | Θ High investment costs<br>⊕ Moderate O&M costs |
| Application | ⇨ medium-large size WTP | ⇨Rural areas<br>⇨Small-medium-large WTP | ⇨Rural areas<br>⇨small-medium WTP | ⇨Medium-large WTP | ⇨Medium-large WTP | ⇨Medium-large WTP |

- Operational criteria

In order to guarantee an error-free function of the Water Treatment Plants, operational aspects have to be considered for the different technical options, which have been described above.

A simple and comprehensive operation shall ensure that:

- the personnel can be trained quickly in operation and maintenance;
- the staff could intervene quickly in case of an emergency;
- the staff is able to identify operation problems early.

Furthermore, an operation concept shall assure that:

- the technical requirements concerning effluent standards can be met permanently;
- the plant is operated economically;
- a maximum of accident prevention is foreseen.

If these precautions are not taken, any malfunction of a water treatment plant can cause a sanitary damage (diseases) for humans. This damage can cause legal actions such as claim of compensation.

***Storage facilities***

The dimensioning of the storage is made according to Ordinance N°2 from March 2005 for "Design, construction and exploitation of water supply systems".

***Network***

According to Ordinance N°2 from March 2005 for "Design, construction and exploitation of water supply systems", several parameters were taken into account for the dimensioning of the network

***Pumping stations***

According to Ordinance N°2 from March 2005 for "Design, construction and exploitation of water supply systems", several parameters were taken into account for the dimensioning of the network.

### 4.1.1.4. Sewerage systems

This section develops the design criteria, which were used for defining and designing the proposed infrastructures for sewerage systems.

#### 4.1.1.4.1. Dry weather discharges and pollution loads

The dry weather flows include the following components:

- Sanitary flows, generated by domestic and non-domestic customers;
- Ground Water Infiltration (GWI) flows, generated by the drainage of ground water through the sewerage network;
- Runoff flows, generated by rainfall events in combined sewer systems.

The dry weather wastewater flows are determined by:

- The drainage factor of consumed water (proportion of water demand discharged into the sewerage network);
- The groundwater infiltration rate;
- The connection rate (proportion of water users connected to the sewerage network).
- The network characteristics (combined or separated)

Unrealistic projections could lead to inadequate priority and long-term investment programs in terms of sizing of the facilities and can have serious consequences on the functioning of sewer systems (overflows occurring in Dry Weather Flow conditions, overloading of the network and of the treatment facilities...).

***Connection rate and connected population***

The connection rate to sewerage system is determined as follows:

- For year 2011, this rate is the present rate provided by the WSSCs;
- For settlements with over 2,000 inhabitants:
  - For the reference years 2016 and 2021 the rate is set to 90% (or the 2011 rate if it is more important than 90%);
  - For the following years, the rate ranges from 90 to 100% depending on the proposed investment programmes.
- For the settlements with less than 2,000 inhabitants [23]:
  - For the reference year 2028, an intermediate value is determined depending on the proposed investment programmes;
  - For the reference year 2038, the rate is set, as a minimum, to 90%;
- Particular case: if a settlement is already connected (or if there is an existing project for its connection) to a city of over 2,000 inhabitants, the connection rate is set, as a minimum, to 90% for the reference year 2028. For the other reference years, an intermediate value is determined based on the investment programmes to be proposed.

The connected population is then deducted by multiplying the total population assessed on the considered date by the connection rate assessed on the same date.

***Domestic Wastewater discharges***

- Wastewater generation factor and discharge rate

The wastewater generation factor, which corresponds to the ratio between wastewater discharge and water consumption, is considered to be constant equal to 0.9 [24].

The wastewater discharge rate, which corresponds to the average daily wastewater discharge per capita and per day, is assessed for each reference date by multiplying the consumption per capita (see o by the wastewater generation factor.

$$\textbf{Wastewater discharge rate} = (\text{Consumption per capita}) \times (\text{wastewater generation factor})$$

- Average domestic wastewater discharge

[23] According to the Terms of Reference and according to the European Directive 91/271/EEC, settlements below 2,000 PE should be included in this study.

[24] According to the Terms of Reference, Art. 5.1 Proposal of Basic Design Criteria, and according to the effective Standards for design of sewerage systems of 1989, Art. 33

It is proposed to assess the average permanent domestic wastewater discharge as follows according to the Bulgarian norms [25], by multiplying the wastewater discharge rate on the considered reference date by the total connected population on the same date:

$$Q_{av,d} = \frac{N \times a}{1000}$$

Where:

- $Q_{av,d}$ is the daily average wastewater flow in $m^3$ per day
- N is the connected population on the reference date
- a is the wastewater discharge rate in l/c/d

Moreover, for settlements affected by temporary domestic consumption, the **temporary domestic wastewater discharge** is assessed by multiplying the **temporary domestic consumption** (see o on the considered date by the wastewater generation factor and the connection rate.

$$\text{Domestic Wastewater discharge} = [(\text{Wastewater discharge rate}) \times (\text{Population}) + (\text{temporary domestic consumption}) \times (\text{wastewater generation factor})] \times (\text{Wastewater Connection Rate})$$

- Common unevenness peak coefficient and hourly peak wastewater discharges

Common unevenness peak coefficient for sewerage systems is set as follows, in accordance with Bulgarian norms [26]:

$$Q_{max,h} = Q_{av,d} \times K_{0\ max,h}$$

Where:

- $Q_{max,h}$ is the maximum hourly wastewater flow, in $m^3$ per day
- $Q_{av,d}$ is the daily average wastewater flow in $m^3$ per day
- $K_{0\ max,h}$ is the coefficient for common unevenness, calculated as follows:

$$K_{0\ max,h} = 1 + \frac{2.5}{Q_{av,d}^{0.22}}$$

***Non-domestic wastewater discharges***

Non-domestic wastewater discharge, comprising discharges from industries as well as public-servicing buildings, is assessed based on:

- Non-domestic water consumption, comprising consumption from industries and public-servicing buildings;
- Connection rate of the non-domestic consumers to the sewerage system;

[25] Bulgarian Norms for design of sewerage systems, issued in 1990

[26] Bulgarian Norms for design of sewerage systems, issued in 1990, Chapter 3, Part 1, Article 34

- Wastewater discharges from customers that have their own water supply resource and are connected to the sewerage network;
- Wastewater generation factor;
- The average time of activity of the considered customer.

$$\text{Non Domestic Wastewater Discharge} = [(\text{Non Domestic Water Consumption}) \times (\text{Non} - \text{domestic connection rate}) + (\text{Water Volumes from own resource})] \times (\text{Wastewater generation factor}) \times (\text{Average daily activity time})/24$$

***Groundwater and leakage infiltration discharge***

Concerning the permanent groundwater and leakage infiltration discharge in sewerage networks, in dry weather conditions, we propose to implement the following methodology in accordance with the requirements for the preparation of investment projects under priority axis 1 of OPE (Operational Programme – Environment 2007 - 2013) approved by the Minister Nona Karadzhova on 30.06.2010 (page 20):

- In case of available measurements and detailed study regarding the studied sewerage system, it is proposed to take into account the results of the study regarding the infiltration discharges to take into account for present situation and to project it for reference dates based on the evolution of the area of the catchment area;
- In case no such study is available, the methodology defined in the German technical guidance – Document ATV/DWA – A128e is applied, e.g.

- Infiltration water are related to the total sewerage catchment area $A_{C,s.}$
- The infiltration discharge in dry weather conditions is determined as follows using a location-specific infiltration discharge rate $q_{iw}$:

$$Q_{iw} = q_{iw} \cdot A_{C,s}$$

Where:

- $q_{iw}$ corresponds to the infiltration water discharge rate in dry weather condition, which should be between 0.05 and 0.15 l/s/ha, depending on the state of the sewerage network and the level of leakages in the water supply system.
- $A_{C,s}$ corresponds to the area of the catchment area covered by the sewerage system

***Pollution loads***

In accordance with the Terms of Reference, the rates of pollution loads of domestic wastewater are set as follows:

- $BOD_5$ : 60 g/person/day;
- Suspended Solids : 70 g/person/day;
- Total Nitrogen : 11 g/person/day;

- Total Phosphorus : 2 g/person/day;
- COD: 120 g/person/day.

Pollutant concentrations of non-domestic wastewater will be based on Appendix 2 of "Ordinance N°7 of November 11, 2000, for Conditions and order for discharge of industrial waste waters in sewerage systems of settlements.

Default values are set based on the intermediate values proposed by the State Energy and Water Regulatory Commission, as of 31.12.2012. (II degree in the table below). Concerning BOD5, the extreme values admissible is between 25 mg/l (in accordance with I degree below), and I400 mg/l (in accordance with Ordinance n°7).

These values may be modified in the case of an apparent particular context, after justification by an analysis of the existing situation in the settlement.

*Table 4-4 Pollution loads depending on pollution degree*

| N | Parameter | Value (mg/l) | Value (mg/l) | Value (mg/l) |
|---|---|---|---|---|
| | | I degree | II degree | III degree |
| 1. | Non suspended solids | ‹ 50 | ‹ 300 | › 300 |
| 2. | BOD 5 | ‹ 25 | ‹ 200 | › 200 |
| 3. | COD Chemical oxygen demand | ‹ 50 | ‹ 400 | › 400 |

***Wastewater quality***

It has to be noted that the wastewater quality needs to be assessed more in depth at the Feasibility Study stage.

### *4.1.1.4.2. Stormwater discharges*

***Separate sewerage systems***

In the case of separate sewerage systems, there is always a part of unavoidable stormwater run-off entering the sewerage system, in relation with improper customer connections (internal stormwater networks connected to the public wastewater network) and other factors such as infiltration from the manhole covers…

In order to assess these unavoidable run-off flows, it is proposed to implement the methodology detailed hereafter, compliant with Bulgarian Norms for design of sewerage systems, issued in 1990:

- In case of available measurements and detailed study regarding the studied separate sewerage system, it is proposed to take into account the results of the study regarding the run-off flows in stormy weather conditions to take into account for present situation;
- In case no such study is available, it is considered that the amount of stormwater discharge, together with the groundwater infiltration into the sewerage system, is equal to the hourly peak wastewater discharge:

$$Q_{isw} = Q_{av,d} \times K_{0\ max,h}$$

***Combined sewerage systems***

In that case, stormwater flow is a normal component of the total discharge in the sewers and is defined according to the rational method, in accordance with *Bulgarian Norms for design of sewerage systems, issued in 1990*.

#### *4.1.1.4.3. Synthesis of the design flows for sewerage systems*

Based on the previous methodology, the following formula should be used in order to determine the design flow for the elements of the **separate sewer systems** (gravity collectors, pumping stations, pressure pipes…):

$$\mathrm{Q_{Design}} = 2 \cdot \mathrm{Q_{av,d}} \cdot \mathrm{K_{0\ max,h}} + Q_{Max,h,Non-Domestic}$$

Regarding the combined sewer systems, the following formula should be used in order to determine the design flow for the elements of the system (gravity collectors, pumping stations, pressure pipes, storm overflows…):

$$\mathrm{Q_{Design}} = \mathrm{Q_{av,d}} \cdot \mathrm{K_{0\ max,h}} + Q_{Max,h,Non-Domestic} + Q_{iw} + Q_{SW}$$

#### *4.1.1.4.4. Technical design criteria*

***Gravity collectors***

For gravity sewerage systems, two different systems can be implemented. While combined sewer systems are designed to convey both wastewater and stormwater flows, separate systems are designed in order to convey separately wastewater and stormwater flows through different networks. For new networks, separate systems will be usually preferred. Advantages and disadvantages are presented in Appendix 4-2.

Designs were made in accordance with Bulgarian Norms for design of sewerage systems, issued in 1990.

***Pressure pipes***

Designs were made in accordance with Bulgarian Norms for design of sewerage systems, issued in 1990. ***Pumping Stations***

Designs were made in accordance with Bulgarian Norms for design of sewerage systems, issued in 1990. ***Storm overflows***

Designs were made in accordance with Bulgarian Norms for design of sewerage systems, issued in 1990. ***Retention tanks***

Designs were made in accordance with Bulgarian Norms for design of sewerage systems, issued in 1990.

***Wastewater treatment plant***

- Technical and Environmental Criteria

Within the present Regional Master Plan, the environmental criteria required by the European Union and the Government of Bulgaria have to be met for all agglomerations with a population equivalent of more than 2,000.

Due to high risk of eutrophication and the risk of high concentrations of nitrates in surface waters jeopardizing the quality of drinking water in the region, the territory of Bulgaria has been classified as Sensitive Area. Technically the current law requires the implementation of advanced treatment considering the additional removal of nitrate and phosphorus for agglomerations with a population equivalent of more than 10,000.

- Technical Description of treatment processes

Treatment processes will depend on the inlet load which can be translated by Population Equivalent (P.E.):

*Table 4-5 Wastewater treatment system depending on the amount of Population Equivalent*

| P.E. | Treatment System |
|---|---|
| 0 – 5,000 | SBR or Bio-rotating filters |
| 5,000 – 50,000 | Extended aeration |
| Above 50,000 - | Activated sludge with anaerobic stabilisation. |

The following table summarizes the arguments for the different treatment processes and gives a qualitative evaluation for the operation under general conditions.

*Table 4-6 Technical description of wastewater treatment processes*

| Type | Pond Systems | Aerated Lagoons | Trickling Filter | Activated Sludge Treatment (with digestion) | Extended Aeration Process | SBR | Membrane Technology |
|---|---|---|---|---|---|---|---|
| Technical | ⊕ Very simple technology<br>Θ Limited treatment capacity<br>Θ Large surface | ⊕ Simple technology<br>Θ Limited nutrient removal | Θ Nitrogen removal not possible<br>Θ No integrated sludge stabilisation | ⊕ High treatment standards<br>⊕Sophisticated technology<br>⊕ Integrated nutrient removal | ⊕ Process allows integrated sludge stabilisation<br>⊕ Process allows nitrification<br>Θ No denitrification | ⊕ Very compact plant<br>Θ Requires constant flow + loads | ⊕ Very high treatment standard<br>Θ Very sophisticated technology |
| Operational | ⊕ Easy O&M<br>⊕Low energy input | ⊕ Moderate O&M<br>Θ Higher energy input | ⊕ process allows easy operation of the plant | ⊕ Energy consumption<br>Θ Complex technology | ⊕ Process allows easy operation of the plant<br>⊕ Moderate maintenance costs<br>Θ Higher energy consumption | Θ Very complex O&M | Θ Very complex O&M |
| Economical | ⊕ Low investment costs<br>⊕ Low O&M costs | ⊕ Low investment costs<br>Θ Higher O&M costs (energy) | ⊕ Moderate investment costs | ⊕ Low O&M costs (energy production)<br>Θ Relatively high investment costs | ⊕ Moderate investment costs | Θ High investment costs | Θ High investment costs<br>Θ High O&M costs |

| Type | Pond Systems | Aerated Lagoons | Trickling Filter | Activated Sludge Treatment (with digestion) | Extended Aeration Process | SBR | Membrane Technology |
|---|---|---|---|---|---|---|---|
| Application | ⇨ Rural areas<br>⇨ Developing Countries | ⇨Rural areas | ⇨Small-medium size WWTP | ⇨Large WWTP | ⇨Small-medium size WWTP | ⇨Industrial application | ⇨ Industrial application<br>⇨ Application for very sensitive areas |

- Operational Criteria

In order to guarantee an error-free function of the Wastewater Treatment Plants, operational aspects have to be considered for the different technical options which have been described above.

A simple and comprehensive operation shall ensure that:

- the personnel can be trained quickly in operation and maintenance;
- the staff could intervene quickly in case of an emergency;
- the staff is able to identify operation problems early.

Furthermore, an operation concept shall assure that:

- the technical requirements concerning effluent standards can be met permanently;
- the plant is operated economically;
- a maximum of accident prevention is foreseen.

If these precautions are not taken, any malfunction of a wastewater treatment plant can cause a substantial environmental damage (fish dying or eutrophication) in the receiving water bodies. This damage can cause legal actions such as claim of compensation. It is furthermore to be considered that biological processes, which usually form the basis of appropriate municipal wastewater treatment options, need a relatively long time to overcome breakdowns and to regain full treatment capacity.

***Wastewater Sludge treatment***

- Technical and Environmental Criteria

To choose the right sludge treatment, it is important to know the final destination of the sludge. For example, if there are industries in the area, heavy metals are expected to be found in the sludge. Sludge should be sent in land disposal.

If there are no major industries in the area, no heavy metals are expected to be found in the sludge. Sludge could be used in agriculture as a fertilizer.

- Technical Description of Treatment Processes

In order to minimize transportation cost and to facilitate sludge handling a sludge dryness of 25% will be targeted.

Anaerobic digestion of the sludge or sludge drying requires high capital expenses (CAPEX) and a technicality that is not thought to be relevant of the wastewater and sludge treatment plant.

*Table 4-7 Sludge treatment system depending on the amount of Population Equivalent*

| P.E | Treatment system |
|---|---|
| 0 – 5,000 | Thickening or Dewatering |
| 5,000 – 50,000 | Dewatering |
| Above 50,000 | Dewatering and stabilization (optional) |

- Technical, Operational and Economic Criteria

The following table summarizes the arguments for the different treatment processes and gives a qualitative evaluation for the operation under general conditions:

*Table 4-8 Technical description of sludge treatment processes*

| Type | Thickening | Dewatering | Stabilisation |
|---|---|---|---|
| Technical | ⊕ Very simple technology<br>Θ Sludge is still liquid and difficult to transport | ⊕ Simple technology<br>⊕ Sludge is solid and easy to transport | Θ Technology more complicate<br>Θ Need reagent |
| Operational | ⊕ Easy O&M<br>⊕ Low energy input | ⊕ Moderate O&M<br>Θ Higher energy input | ⊕ Moderate O&M<br>⊕process allows easy operation of the plant |
| Economical | ⊕ Low investment costs<br>⊕ Low O&M costs | Θ Higher investment costs<br>Θ Higher O&M costs (energy) | ⊕ Moderate investment costs<br>Θ Higher O&M costs (reagent and energy) |
| Application | ⇨WWTP with Drying bed or other waste treatment plant near WWTP | ⇨small size WWTP | ⇨Small-medium size WWTP |

***Overview of possible final disposal routes***

Wastewater treatment shall not be envisaged without thinking about the way of handling the sludge that is produced during the wastewater treatment process. The following features should be investigated when setting up sludge management plans.

- The quantity and the quality of the sludge, which differ depending on the processes implemented at the WWTP;
- The local regulatory framework related to sludge management and disposal;
- The possibilities of considering sludge as a product and not only as a waste, through adapted treatment and/or monitoring procedures.

The main final sludge disposal routes, as can be experienced worldwide, are presented in the following sections.

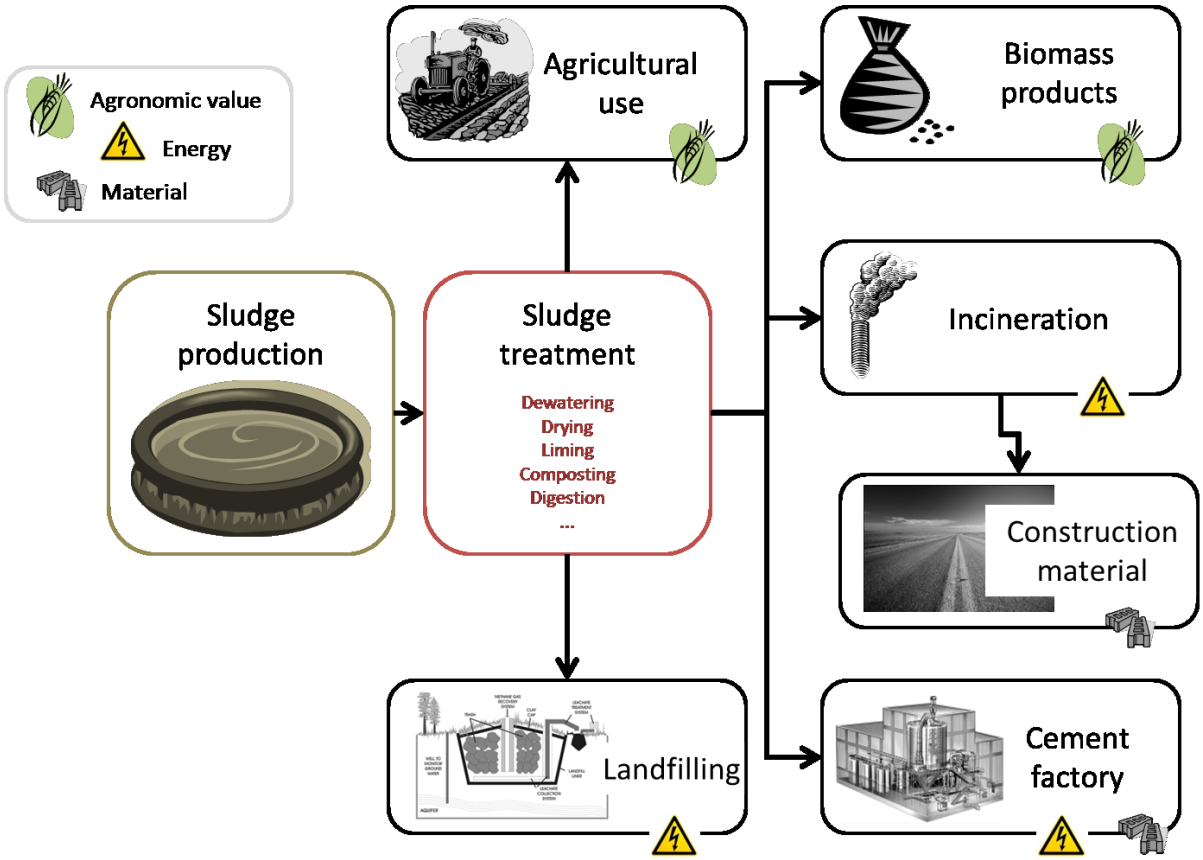



*Figure 4-2 Presentation of main final sludge disposal routes*

Each process for possible final disposal route is detailed in Appendix 4-3.

**Odour treatment facilities**

- Description of the possible odour treatment processes

The main sources of odours in a WWTP are generally located at the following places:

- At the first stages of the wastewater treatment schemes (i.e. in the pre-treatment building);
- In the sludge treatment building and sludge storage facilities.

Odours are caused by various molecules that are released during the transformation of wastewater, during its transport in the sewerage network, and the subsequent wastewater and sludge treatment processes. These molecules can contain sulphide (such as $H_2S$ and mercaptans), nitrogen (ammonia, methylamine, indole, etc.) or oxygen (various acids) and are spread around the WWTP depending on the wind direction and strength.

In order to limit odour spreading and to protect the neighbourhood from odours it is recommended to install the pre-treatment works inside a building from which air is extracted by dedicated fans and transferred to an air treatment facility. Similarly the extracted air from the sludge treatment facility would be directed to the air treatment facility.

Air treatment can be performed in different ways. Chemical and biological and physical processes can be differentiated as follows.

Physico-chemical treatment

It consists in transferring the molecules at stake from the gas phase to the liquid phase in a reactor, where air is contacted with chemical solutions of different characteristics thus allowing the phase transfer. The treated air is released into the atmosphere while the liquid phase is generally sent back to the wastewater treatment line.

Biological processes

They rely on the ability of a specific biomass – generally fixed to a supporting material to degrade the molecules responsible for odours.

Physical processes

They include adsorption onto activated carbon surface, thermal oxidation and photo-catalysis.

- Process selection

The same criteria apply for the air treatment process selection as for the wastewater process selection. They are the following:

- Robustness;
- Flexibility;
- Cost-efficiency.

In the local context of Bulgaria it is therefore recommended to extract the air of sensitive buildings and to transfer the polluted air to biological filters that do require neither a high CAPEX nor a high OPEX since they are almost maintenance-free and do not require any chemical.

The polluted air is distributed through the central cylindrical screen of the biofilter to the filter media and evacuated through the external perforated fibre glass structure. The filters are filled with special calibrated organic media that provides support for the biomass to grow and also provides the necessary nutrients that the microorganisms need in order to biodegrade the volatile pollutants. The lifespan of the filtering media is 5 years. Water is sprayed on top of the filters to provide the necessary humidity for the microorganisms.

#### *4.1.1.4.5. Climate change impact*

Several scenarios have been developed trying to forecast the evolution of climatic environment and its impact on the regional hydrologic conditions. The effects of a possible climatic evolution are presented in Appendix 4-4.

Practically, in regions which could be submitted to a reduction of precipitation, the options to be considered will have to include the improvement of water supply safety for places already enduring water scarcity or having a water use close to the maximum potential of natural resource.

### 4.1.2. PROPOSED UNIT COSTS

To calculate the investment costs for each investment measures, a Unit Cost Data Base (UCDB) has been developed. This database is mainly based on the unit cost database of the Ministry of Environment and Water, which was completed with missing prices and slightly adjusted.

The calculated investment costs will be compared to cost estimates of available designs projects, if existing. In case of major differences between cost estimates of existing design projects and the Consultant's cost estimate the most reasonable costs will be retained (expert's assessment).

The unit costs presented in below are net costs excluding VAT, constant price base 2011 in EURO.

Safety coefficients were applied in case of dense urban context, difficult geological conditions, asphalt covering.

#### *4.1.2.1. Water supply*

##### *4.1.2.1.1. Investment costs*

The following unit costs were considered in the framework of the project. Intermediate values were interpolated based on a polynomial regression. The assets are ranging from minimum to maximum values. A complete list is presented in Appendix 4-5.

*Table 4-9 Investment costs (Water Supply)*

| Description | Unit | Unit Cost (€) |
|---|---|---|
| ***Construction of well*** | | |
| Q = 5 l/s | mWC | 230.00 € |
| Q = 100 l/s | mWC | 765.00 € |
| ***Construction of Drinking Water Treatment Plant***[27] | | |
| Capacity = 10 l/s | U | 300,000 € |
| Capacity = 2,500 l/s | U | 17,950,000 € |
| ***Supply and installation of water mains and distribution pipes*** | | |
| DN75 | m | 75.00 € |
| DN710 | m | 440.00 € |
| ***Supply and installation of service connection*** | | |
| Cost per service connection | U | 400.00 € |
| ***Construction of water tower*** | | |
| Capacity = 50 m³ | U | 70,000.00 € |
| Capacity = 15,000 m³ | U | 6,040,000.00 € |
| ***Construction of ground reservoir*** | | |
| Capacity = 50 m³ | U | 45,000.00 € |
| Capacity = 15,000 m³ | U | 2,400,000.00 € |
| ***Construction of pumping station - H = 40 m*** | | |
| Capacity = 5 l/s | U | 24,000.00 € |

[27] *Costs refer to "classical" raw water treatment, including Flocculation/Sedimentation, filtration and disinfection*

| Description | Unit | Unit Cost (€) |
|---|---|---|
| ***Construction of well*** | | |
| Capacity = 100 l/s | U | 110,000.00 € |
| ***Construction of pumping station - H = 80 m*** | | |
| Capacity = 5 l/s | U | 49,000.00 € |
| Capacity = 100 l/s | U | 379,000.00 € |
| ***Implementation of District Metering Areas for leakage reduction and operational management*** | | |
| Control Centre | U | 100,000.00 € |
| Network | km | 735.00 € |
| Facilities (production points, water tanks and pumping stations) | U | 8,000.00 € |
| ***Local and detailed study of type: network diagnostic study and regional master plan*** | | |
| Network diagnostic study and regional master plan, minimum below 300 inhabitants | U (number of settlements) | 10,000.00 € |
| Network diagnostic study and regional master plan, above 300 inhabitants | U (number of inhabitants) | 35.00 € |

The other types of investments, such as rehabilitation of existing facilities, were calculated on a case-by-case basis, as they strongly depend on the context and general unit costs can be defined.

For settlements of less than 2,000 inhabitants, a solution must be found in the following situations:

- Rate of Population not connected to a network of drinking water less than 100%;
- Problem of water quality;
- Problem of water scarcity.

The proposed work or study can be integrated into the short-term investment programmes.

Moreover, the share of investment per type of material, which was considered, is the following:

*Table 4-10 Share of investment per type of material (Water Supply)*

| Infrastructure | Pipes | Civil works | Mechanical &Electrical Equipment |
|---|---|---|---|
| Wells | | 70% | 30% |
| Reservoirs | | 85% | 15% |
| Water mains | 100% | | |
| Pumping stations | | 60% | 40% |

### *4.1.2.1.2. Operation and Maintenance costs for new assets and investments*

**Operation costs**

- Pumping Stations

The operation costs related to pumping stations, which were considered, are the following:

Electricity costs*: 0.11 €/kWh or 0.043 €/m³/100m.

They were calculated either based on rate in €/m³/100mWC or with own assessment of pump capacity and given electricity tariff.

- DWTP

Operation costs related to water treatment were assessed on a case-by-case basis as they strongly depend on the type of pollution and of the treatment process.

**Maintenance costs**

The maintenance costs, which were considered, including staff (repair, material, etc.) but excluding engineering costs, design and works supervision, as well as replacement costs, are the following, expressed in % of investment costs per year:

- Water Mains: 0.15% / year;
- Distribution network: 0.50% / year;
- Civil works (Reservoirs, buildings, etc.): 0.50% / year;
- Equipment, machinery: 3% / year.

## *4.1.2.2. Wastewater*

### *4.1.2.2.1. Investment costs*

The following unit costs were considered in the framework of the project. Intermediate values were interpolated based on a polynomial regression. The assets are ranging from minimum to maximum values. A complete list is presented in Appendix 4-6.

*Table 4-11 Investment costs (Wastewater)*

| Description | Unit | Unit Cost |
|---|---|---|
| ***Supply and installation of gravity collectors*** | | |
| DN200 | ml | 165.00 € |
| DN2400 | ml | 2,300.00 € |
| ***Installation of service connections*** | | |
| Installation of service connection | U | 700.00 € |
| ***Construction of Pumping Station*** | | |
| Power = 5 kW | U | 12,000.00 € |
| Power = 5,000 kW | U | 324,500.00 € |
| ***Supply and installation of pressure pipes*** | | |
| DN63 | m | 28.00 € |
| DN400 | m | 144.00 € |
| ***Construction of Wastewater Treatment Plant[28]*** | | |
| Capacity = 2,000 PE | U | 1,650,000.00 € |
| Capacity = 150,000 PE | U | 12,100,000.00 € |
| ***Implementation of flow monitoring*** | | |
| Control Centre | U | 60,000.00 € |
| Network | km | 260.00 € |
| Facilities (overflows and pumping stations) | U | 7,000.00 € |
| ***Local and detailed study of type: network diagnostic study and regional master plan*** | | |
| Network diagnostic study and regional master plan, minimum below 300 inhabitants | U (number of settlements) | 15,000.00 € |
| Network diagnostic study and regional master plan, above 300 inhabitants | U (number of inhabitants) | 50.00 € |
| ***Settlements below 2,000 inhabitants*** | | |
| Zoning sanitation study, minimum below 667 inhabitants | U (number of settlements) | 10,000.00 € |
| Zoning sanitation study, above 667 inhabitants | U (number of inhabitants) | 15.00 € |
| Establishment of a sanitation system for settlements with less than 2,000 inhabitants in programs for medium and long term | U (number of inhabitants | 650.00 € |

The other types of investments, such as rehabilitation of existing facilities, were calculated on a case-by-case basis as they strongly depend on the context and general unit costs can be defined.

For settlements with less than 2,000 inhabitants, not connected to an agglomeration with more than 2,000 inhabitants and with a rate of population connected to the sewerage

[28] *Cost refer to "classical" wastewater treatment, including pretreatment (screening, grit removal, fat and grease removal…), primary treatment and secondary treatment (activated sludge).*

system less than 90%, a Sewerage Zoning study must be proposed into short-term investment programmes. The Sewerage Zoning study will define collective sanitation, small collective sanitation, autonomous sanitation and rainwater purification systems zones for the studied settlements. The implementation of solutions presented in the Sewerage Zoning study must be proposed into medium and long-term investment programmes.

Moreover, the share of investment per type of material, which was considered, is the following:

*Table 4-12 Share of investment per type of material (Wastewater)*

| Infrastructure | Distribution network | Main collectors | Civil works* | M&E |
|---|---|---|---|---|
| WWTPS | | | 55% | 45% |
| Main collector | | 100% | | |
| Pumping station | | | 60% | 40% |
| Sewerage Network | 100% | 100% | | |
| * 30% Buildings and 70% Facilities (as per requirements defined by the National Regulator) | | | | |

#### *4.1.2.2.2. Operation and Maintenance costs for new assets and investments*

**Operation costs**

- Pumping stations

The operation costs related to pumping stations, which were considered, are the following:

- Electricity costs*: 0.11 €/kWh or 0.026 €/m³** (0.01 – 0.05 €/m3)

* For specific pumping stations with more than 5 m elevation, calculation was done based on electricity consumption.

** For pumping stations with up to 5 m elevation, the simplified cost estimate was applied, based on annual pumped volume and the following rates:

- Flat areas with long distance transport and no gravity flow: 0.05 €/m³;
- Areas with good drainage and mainly gravity flow: 0.01 €/m³;
- Average (if no information available): 0.026 €/m³.

- Wastewater Treatment Plant

See below

**Maintenance costs**

Wastewater Maintenance costs, which were considered for sewer network and pumping stations, including staff (repair, material, etc.), but excluding engineering costs, design and works supervision as well as replacement costs, are the following, expressed in % of investment costs per year:

- Equipment, machinery: 3% / year;
- Main collector: 0.20% / year;
- Secondary sewer network: 0.60% / year;
- Civil works (buildings, etc.): 0.60% / year.

The average annual operation and maintenance costs related to Wastewater Treatment Plants, all inclusive were assumed to be 4.5% / year of the investment costs (see here before).

## 4.1.3. GENERAL METHODOLOGY FOR OPTION ANALYSIS

### *4.1.3.1. Objective*

The general objective of the option analysis is, for each identified deficiency in the systems, to duly justify the proposed investment measures by considering other alternatives, calculating and comparing costs and benefits and finally selecting the most appropriate option considering technical, financiel,and environnemental factors.

The process for such analysis is the following:

- Identification and screening of options for each water supply and wastewater zone, the objective being to define the set of options or alternatives to be compared;
- Evaluation of options, through NPV calculation and analysis of the key benefits on health, environment, quality of service.

### *4.1.3.2. Identification and screening of options for each water supply and wastewater zones*

**Description of key deficiencies**

The first step of the option analysis consists in synthesizing, for each of the agglomerations in the study area, the key deficiencies identified through the assessment of the existing situation.

**Identification of potential options**

Then, the potential options enabling to solve these deficiencies and the timeframe for their implementation, depending on the urgency of rectification, must be clearly identified. As far as possible possible, a minimum of 2 options must be considered for each of the deficiencies to be solved.

Depending on the deficiency to be suppressed, the options can consist in:

- Considering centralized / decentralized systems for water treatment (DWTP and WWTP);
- Considering various tracings and configurations for the network to be built/renewed;

- …

**Screening based of qualitative analysis – Advantages / Disadvantages**

The third step consists in performing a qualitative analysis of each of the potential options previously selected and identifying their key advantages / disadvantages from the technical, sanitary, operational, environmental and social points of view.

**Selection of viable options to be further analysed**

Then, the options to be evaluated are selected based on the results of the previous analysis. Ideally, a minimum of 2 options should be considered for each option. However, for some "trivial" investments, a unique option can be analysed but it should then clearly be justified.

### *4.1.3.3. Evaluation of options*

**Description of the necessary investments**

For each of the options to be evaluated, the investments to be performed need to be described and quantified in order to further evaluate their cost.

The "basic" design of each of the investments (capacity of pumping stations, reservoirs, DWTP and WWTP, diameter of the pipes and collectors…) must be briefly justified (reference to hydraulic / quality calculation).

**Risk assessment (externalities - health, environmental…)**

For each investment, risk assessment will be performed for each selected option in order to compare them. Risk assessment consists, at the technical, operational, sanitary, environmental and social levels, in:

- Determining which risks are likely to affect the project;
- Documenting the characteristics of each;
- Assessing the intensity of the impact (High / Medium / Low) and its probability of occurrence (Unlikely / Probable / Very likely);
- Prioritizing these risks based on the previous parameters.

**Cost assessment and financial evaluation**

The methodology for cost assessment is the following:

- Assessment of the investment costs based on the Unit Cost Data Base (UCDB, see 4.1.2) and on case-by-case basis for particular investments, such as rehabilitation measures;
- Synthesis of the investment costs per category of investment:

- For Water Supply:
  - Water Abstraction/Wells;

- Drinking Water Treatment Plant;
- Water Mains;
- Distribution Network;
- Reservoirs and Tanks;
- Pumping Stations;
- Miscellaneous.

- For Sewerage:
  - Waste Water Treatment Plant;
  - Main Collectors;
  - Sewerage Network;
  - Pumping Stations;
  - Miscellaneous.

- Assessment of the annual operation and maintenance costs for each of the options and each category of investment (see 4.1.2).

**Financial evaluation**

Based on these costs, financial evaluation is then performed through NPV (Net Present Value) calculation with the following parameters:

- Reference period: 2013 – 2038 (25 years);
- Discount rate: 5%;
- Considered lifespan[29]:
  - Pipes: 50 years;
  - Civil works : 45 years[30];
  - Electrical and mechanical equipment: 10 years.
- Renewal of the investment at the end its lifespan (equipment renewed every 10 years…);
- Residual value of the investment at the end of the reference period is assessed by considering a linear decrease of its value through its lifespan.

**Synthesis of selected option**

By default, in case the risk levels are not too high and/or similar, the option with the lowest NPV is selected for each investment.

A table is prepared for each of the investments emphasizing:

[29] As per requirements defined by the National Regulator

[30] As per requirements defined by the National Regulator, assuming that Civil works consists of 30% Buildings and 70% Facilities.

- The key deficiency that the investment enable to solve;
- For each evaluated option:
- The risk level;
- The investment and O&M costs;
- The NPV of the investment.
- Justification of the selected option, if it doesn't have the lowest NPV, due to the results of risk assessment.

### 4.1.4. GENERAL METHODOLOGY FOR PHASING AND PRIORITIZATION

#### *4.1.4.1. Identification of Measures*

All measures identified by the Consultant during its assessment are included into the investment program. Projects for which financing has been approved before 15th July 2012 are considered as "*on-going*" and therefore have not been included into the investment program. A list of all on-going measures is presented in Appendix 1-1.

#### *4.1.4.2. Phasing of Investments*

The identified investment measures have been grouped into the three investment phases, based on the following criteria:

**Phase 1: Short-term investment program**

- All investments necessary to achieve compliance with *Directive 91/271/EEC* - Urban Wastewater Treatment Directive (UWWTD) and the respective Bulgarian legislation. This will include compliance with Article 3 of the UWWTD (wastewater collection) and Article 4 of the UWWTD (wastewater treatment) as well as measures necessary to ensure effective operation of the systems;
- All investments necessary to achieve compliance with the *Directive 98/83/EC* – Drinking Water Directive (DWD) and the respective Bulgarian legislations. This will include all measures aiming to remediate major deficiencies related to water quality and water quantity.

**Phase 2: Medium-term investment program**

- Investment measures aiming to improve efficiency of the systems (NRW reduction, energy efficiency);
- Rehabilitation of water supply and wastewater systems to ensure sustainability (replacement of assets);
- Priority replacement of networks (i.e. asbestos cement pipes, pipes with high number of bursts);
- Improvement of the level of service (i.e. pressure, shortages…).

**Phase 3: Long-term investment program**

- All other measures not mentioned above;
- Continuation of measures started in Phase 2 (i.e. measures aiming to reduce water losses, infiltration into sewer networks, etc.).

#### *4.1.4.3. Prioritization of investment measures*

Priorities of investment measures will be defined by the Ministry according to the European Directives and applied at national level.

A tentative prioritization system based on five criteria has been set up and is presented in Appendix 4-7.

## 4.2. OPTIONS FOR THE DEVELOPMENT OF THE WATER SUPPLY SYSTEM

### 4.2.1. STRATEGY APPLIED TO THE PROGRAM TO REDUCE NON REVENUE WATER

A NRW reduction program is based on the following four pillars:

- Active search for leaks
- Rapid response to repair detected leaks
- Pressure management and control
- Targeted asset management

First, it is necessary to evaluate the level of physical and commercial losses.

Yet to be effective, a NRW reduction program must be based on the actual situation and the particular context in which it applies. In addition, it must include in its approach other system parameters.

The situation of drinking water systems in Bulgaria and especially on the territory of VKS EOOD – Peshtera is very critical; it can be summarized as follows:

- Low reliability of subscriber counting, which leads to major uncertainties about the actual level of physical and commercial losses
- High level of estimated losses
- The bigger part of the pipes are made of asbestos cement and some of steel. These pipes have expired service life and are severely amortised.
- Insufficient number of stop valves, which results in big sections of the network emptied during breakdowns.Недостатъчен брой спирателни кранове, водещи до изпразване на големи участъци от мрежата при авария.
- Lack of precise metering of the water from the water sources which results in lack of distinctness in terms of the abstracted water quantities.Липса на точно измерване на водата от водоизточниците, което води до неясноти по отношение добива на вода.

- The number of illegal connections is assumed by operators and municipalities, which leads to major uncertainties about the actual level of physical and commercial losses.

In this context, it is proposed a strategy primarily based on targeted asset management, namely:

- Recommendation: The operators must have a policy management and meter replacement, based on age (recommended maximum between 10 and 14 years), the efficiency of the counting (meter size should be suitable for the pattern of consumption of the subscriber) and the quality of the installation and monitoring. The same policy should be conducted at the level of the metering points on the external water supply system (the age of replacement depends on the material). This is an important recommendation but is not integrated since it is not possible to quantify and since this programme should be financed by the operators
- Priority measure applied: Replacement / renewal / rehabilitation of pipes. This is the only measure that can significantly reduce both physical losses and health risks (simultaneous removal of asbestos cement pipes and resizing). In addition, by applying a policy of systematic replacement of connections, it contributes to detect illegal connections and thus to reduce commercial losses
- In a second step, in the case of large water systems, it is proposed to apply the principle of pressure control. In fact, the level of physical loss can be greatly reduced by positioning autonomous pressure regulators in appropriate (feasible) locations (without the use of external energy). The function of these regulators is to lower the pressure at the time of low water demand (typically at night) and to allow a greater pressure during peak periods. In theory, the level of losses depends on the diameter and shape of the hole in the pipe, on the pipe material but also on the water pressure.
- Finally, in the medium or long term, the Consultant proposes to apply the principle of diagnosis and permanent monitoring of flow, pressure and water levels at the production level but also to work on strategic points of the distribution network. This leads to a permanent sectorization system. From the results of self-monitoring, research programs and leak repairs can be conducted. This principle is effective but only when the actual level of losses are within a reasonable range (lower than 30-35%) in order to gain the few yield point necessary to achieve yields of about 80 - 90%.

## 4.2.2. STRATEGIC OPTIONS FOR EXTERNAL WATER SUPPLY SYSTEM OF THE TOWN OF PESHTERA AND THE VILLAGE OF RADILOVO

### *4.2.2.1. Defining alternatives*

The Consultant screened two possible options for establishment of external water supply system of the town of Peshtera and the village of Radilovo with regard to their advantages and disadvantages. The results are presented in the table below.

*Table 4-13 Screening of Options – External Water Supply System of the town of Peshtera and the village of Radilovo*

| Water Supply Zone | Description of key deficiencies | Identification of options | First screening | Justification for selection |
|---|---|---|---|---|
| The town of Peshtera and the village of Radilovo | - A large number of water sources (catchment systems, tube wells, river intake), located in the vast mountainous area.<br>- A large number of transmission mains.<br>- Part of the catchment systems are in poor condition and need to be repaired.<br>- Most of the gravity transmission mains are old, built of asbestos cement pipes and need to be replaced.<br>- A major part of the water sources and the transmission mains are difficult to access, especially in the winter months. This hampers their maintenance and repair of failures.<br>- Chlorination with chlorine gas in Peshtera DWTP is not compliant with the standards.<br>- The chlorine for Lukovitsa DWTP and reservoirs is not incorporated proportionally to the | **1. Centralised solution:**<br>Connection of the town of Peshtera and the villages of Radilovo and Kapitan Dimitrievo to centralised pump-fed water supply from the pressure reservoirs of the town of Pazardzhik (V=12,000m$^3$). Water supply will be carried out through two consecutive pumping station (two lifts) – Kapitan Dimitrievo PS and Radilovo PS.<br>Water will be purchased to ViK Pazardzhik at a price, for the year 2011, equal to 0.85BGN/m$^3$ (0.425€/m$^3$).<br>Out of the existing water supply system of the town of Peshtera only the recently constructed polyethylene water pipeline to Lukovitsa quarter will be kept– Ø200 PE. The water pipeline will convey the water from the catchment systems of Kievo and Kievo Kale. The river intake and the drinking water treatment plant will be taken out of service.<br>The village of Radilovo will be entirely supplied by both pumping stations. The present | **retained** | Advantages (compared to option 2):<br><br>- Presence of only one large water source – pressure reservoirs of the town of Pazardzhik **(V=12,000m$^3$).**<br>**- No need to maintain a large number of water sources and the accompanying sanitary protection zones.**<br>**- Better accessibility of water pipelines and facilities of water supply system.**<br>**- Easier control over water quality. Centralised chlorination.**<br>**- Easier centralised metering of supplied water.**<br>**- No need for treatment facilities.**<br><br>Disadvantages:<br><br>- Entirely pump-fed water supply, with very high energy consumption.<br>- Water should be purchased to ViK Pazardzhik at prices of **0.85BGN/m$^3$ (0.425€/m$^3$).**<br>- System vulnerability in case of failure in the water pipelines or pumping station – almost the entire water supply to the town of Peshtera will be disconnected<br>- Current water sources providing high quality water will be taken out of service.<br>- This option will require overall construction of the water supply system from the reservoirs of the town of Pazardzhik to the town of Peshtera. It is not possible to carry out construction works in stages i.e. large single investment is necessary. |

| Water Supply Zone | Description of key deficiencies | Identification of options | First screening | Justification for selection |
|---|---|---|---|---|
| | water flow.<br>- Backwash water of both DWTPs is discharged into the receiving water body without being treated.<br>- Water is not chlorinated in the reservoirs of 600 and 180m$^3$ of the town of Peshtera. | water supply system will be kept for the village of Kapitan Dimitrievo. Post-chlorination will be carried out at Siniya Kainal PS, if residual chlorine deficiency is found. | | Justification for selection:<br>Compactness; No need for treatment facilities. |
| | | **2. Decentralised solution**<br>The current water system will be kept for the town of Peshtera – a large number of water sources providing water to the individual pressure reservoirs of the town of Peshtera.<br>It is envisaged to repair the catchment systems, which are in bad condition and to replace the old transmission mains.<br>Based on conducted water demand forecast for the town of Peshtera, some of the water sources and the transmission mains are planned to be taken out of service i.e. tube wells TW1, TW2, TW3 and TW4.<br>It is planned to construct new water supply connections from DWTP to PR of V=500m$^3$ and from CC (collection chamber) to PR V=1000m$^3$. These connections are necessary for supplying | **retained** | Advantages (compared to option 1):<br><br>- A major part of the water sources deliver water by gravity to the reservoirs of the town of Peshtera. Much lower energy consumption.<br>- This system is more flexible and secure than the centralised water supply. It is practically impossible to leave the town of Peshtera without any water supply.<br>- Possibility to replace external water pipelines in stages and to perform repair works at the water sources (catchment systems).<br>- Water sources providing high quality water. |
| | | | | Disadvantages:<br><br>- Water pipelines and catchment systems are more difficult to access, which hampers the operation.<br>- Maintenance of a large number of water sources, together with the accompanying sanitary protection zones.<br>- Need for maintenance of 2 treatment facilities – with rapid filters and the associated improvements in there process systems.<br>- Need for chlorination in several individual points.<br>- Need for metering in several individual points. |
| | | | | - Justification for selection: |

| Water Supply Zone | Description of key deficiencies | Identification of options | First screening | Justification for selection |
|---|---|---|---|---|
| | | the reservoirs as well as for full use of their volumes.<br>The current water system will be kept for the village of Radilovo as well. It is envisaged to repair the catchment systems and to replace the old transmission mains.<br>Bringing the existing chlorination systems into compliance with the standards and providing chlorination, where such is missing i.e. reservoir of 300 m3 and 120 m3<br>The current water system will be kept for the village of Kapitan Dimitrievo.<br>Bringing the existing chlorination systems into compliance with the standards and providing chlorination, where such is missing i.e. reservoir of 600 $m^3$ and 180 $m^3$<br>Creating conditions for normal operation of the filters.<br>Treatment of backwash water from filters and sedimentation tanks. | | Gravity water supply; Supply security; Very good water quality. |

### 4.2.2.2. Evaluation of Options for External Water Supply System of the town of Peshtera and the village of Radilovo

Description of retained Options:

In the table below the necessary investments for the centralised and decentralised option are described:

*Table 4-14 Description of Options – External Water Supply System of the town of Peshtera and the village of Radilovo*

| Option | Description of Option | Specific Investments |
|---|---|---|
| **Option 1** | **Centralised solution**<br>Connection of the town of Peshtera and the village of Radilovo to centralised pump-fed water supply from the pressure reservoirs of the town of Pazardzhik (V=12,000m$^3$).<br>Water supply will be carried out through two consecutive pumping stations (two lifts) – Kapitan Dimitrievo PS and Radilovo PS. | - New gravity water pipeline from the reservoirs of the town of Pazardzhik (V=12,000m$^3$) to Kapitan Dimitrievo Pumping Station. It has a length of L=3.00 km.<br>- Reconstruction and renewal of equipment of Kapitan Dimitrievo PS. (Extension and repair of the building, installation of new pump units for the town of Peshtera and the village of Radilovo, replacement of pipe systems in the pumping station and the suction tank. Installation of new power supply system and new transformer station. Installation of protection system against hydraulic hammer)<br>- New pressure pipeline from Kapitan Dimitrievo PS to the New Radilovo PS. It has a length of L=6.30 km.<br>- New Radilovo PS, right next to existing PR of V=500 m$^3$, including power supply and service road of L=400 m.<br>- New transitional reservoir of V=50 m$^3$.<br>- New gravity transmission main supplying four of the pressure reservoirs of the town of Peshtera. It has a length of L=6.45 km.<br>- Installation of equipment for intermediate automatic post-chlorination for residual chlorine in the water supplied to Siniya Kainak PS |
| **Option 2** | **Decentralised solution**<br>The current water system will be kept for the town of Peshtera – 10 water sources providing water to the individual pressure reservoirs of the town of Peshtera.<br>Predominant gravity-fed water supply. | For the town of Peshtera:<br>- Repair of 3 catchment systems.<br>- Rehabilitation of 17.81km of gravity transmission mains from the water sources (catchment systems) to the pressure reservoirs of the town of Peshtera.<br>- Renewal of equipment of Simiyat Kainak PS – installation of new pump units, replacement of pipe systems in the pumping station, new electrical equipment, installation of protection system against hydraulic hammer.<br>- Replacement of 0.70 km of pressure pipeline from Siniyat Kainak PS to existing PR of V=1,250 m3.<br>- Construction of 1.30 km of water supply connections from DWTP to PR of V=500 m$^3$ and from CC (collection chamber) to PR of V=1,000 |

| Option | Description of Option | Specific Investments |
|---|---|---|
| | | m3.<br>- Peshtera DWTP:<br>• Chlorine gas installation with capacity of up to 3.5 kg chlorine per hour.<br>• Protection of filter fixtures from freezing.<br>• Treatment of backwash water from the rapid filter and the sedimentation tank,<br>- DWTP for Lukovitsa quarter:<br>• Installation of system for proportional dosing of sodium hypochlorite.<br>• Protection of rapid filter fixtures from freezing<br>• Treatment of backwash water from the raid filter and the sedimentation tank.<br>- Reservoir of 600 $m^3$ of the town of Peshtera:<br>• Installation of system for proportional dosing of sodium hypochlorite in a separate new premise, which is consistent with the requirements.<br>• Medium voltage power supply of the reservoir - L=300 m.<br>- Reservoir of 180 m3 of the town of Peshtera:<br>• Installation of system for proportional dosing of sodium hypochlorite in a separate new premise, which is consistent with the requirements.<br>• Medium voltage power supply of the reservoir - L=600 m.<br><u>for the village of Radilovo:</u><br>- Rehabilitation of 14.08 km of gravity transmission mains from the water sources (catchment systems) to the pressure reservoirs of the village of Radilovo.<br>- Repair of 5 catchment systems.<br>- Reservoir of 300 $m^3$ and 120 $m^3$ of the village of Radilovo:<br>• Installation of system for proportional dosing of sodium hypochlorite in a separate new premise, which is consistent with the requirements.<br>• Medium voltage power supply of the reservoir - L=600 m |

Both options for establishment of external water supply system of the town of Peshtera are graphically presented in the following drawings.

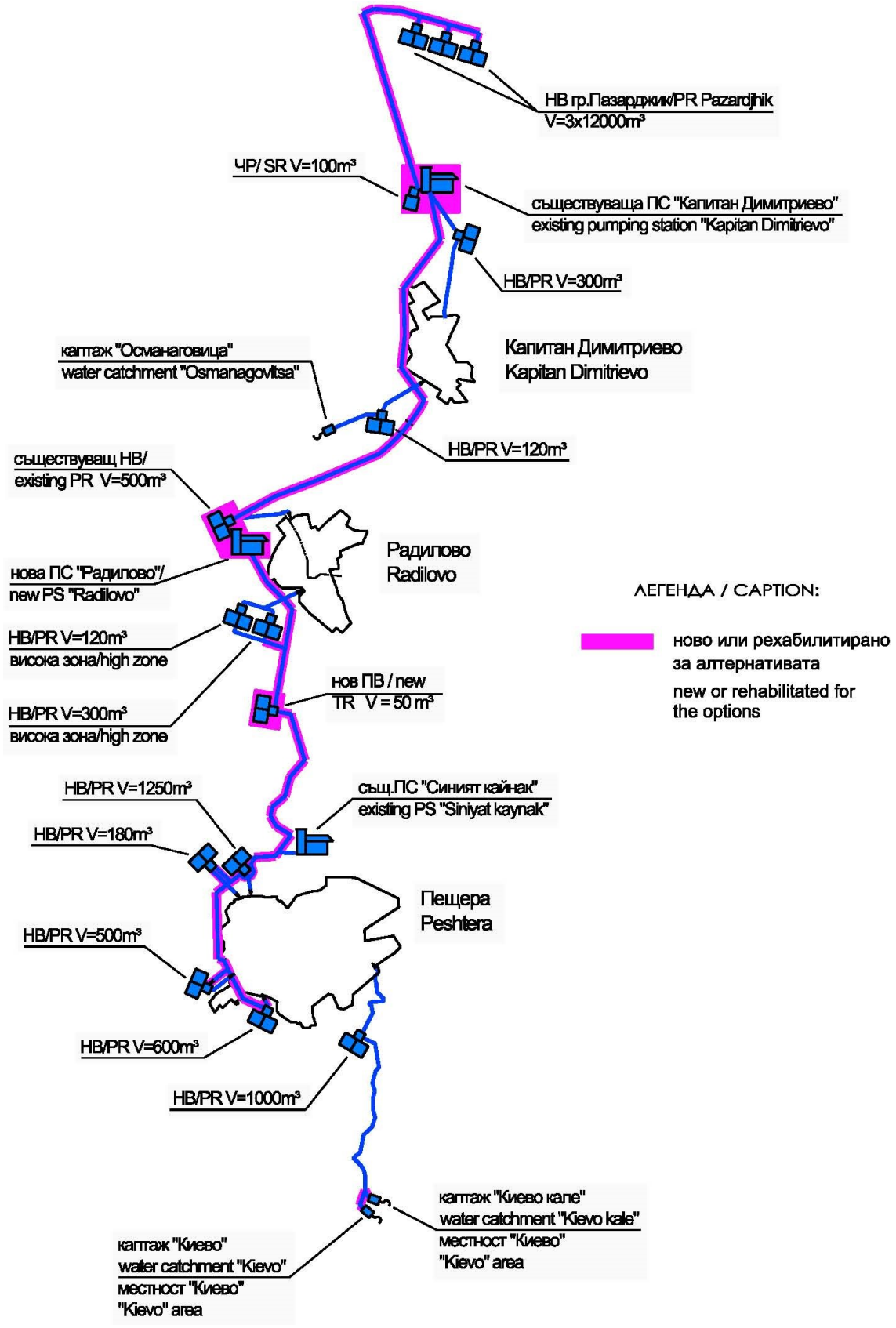



*Figure 4-3 Centralised solution – External water supply of the town of Peshtera – Option 1*

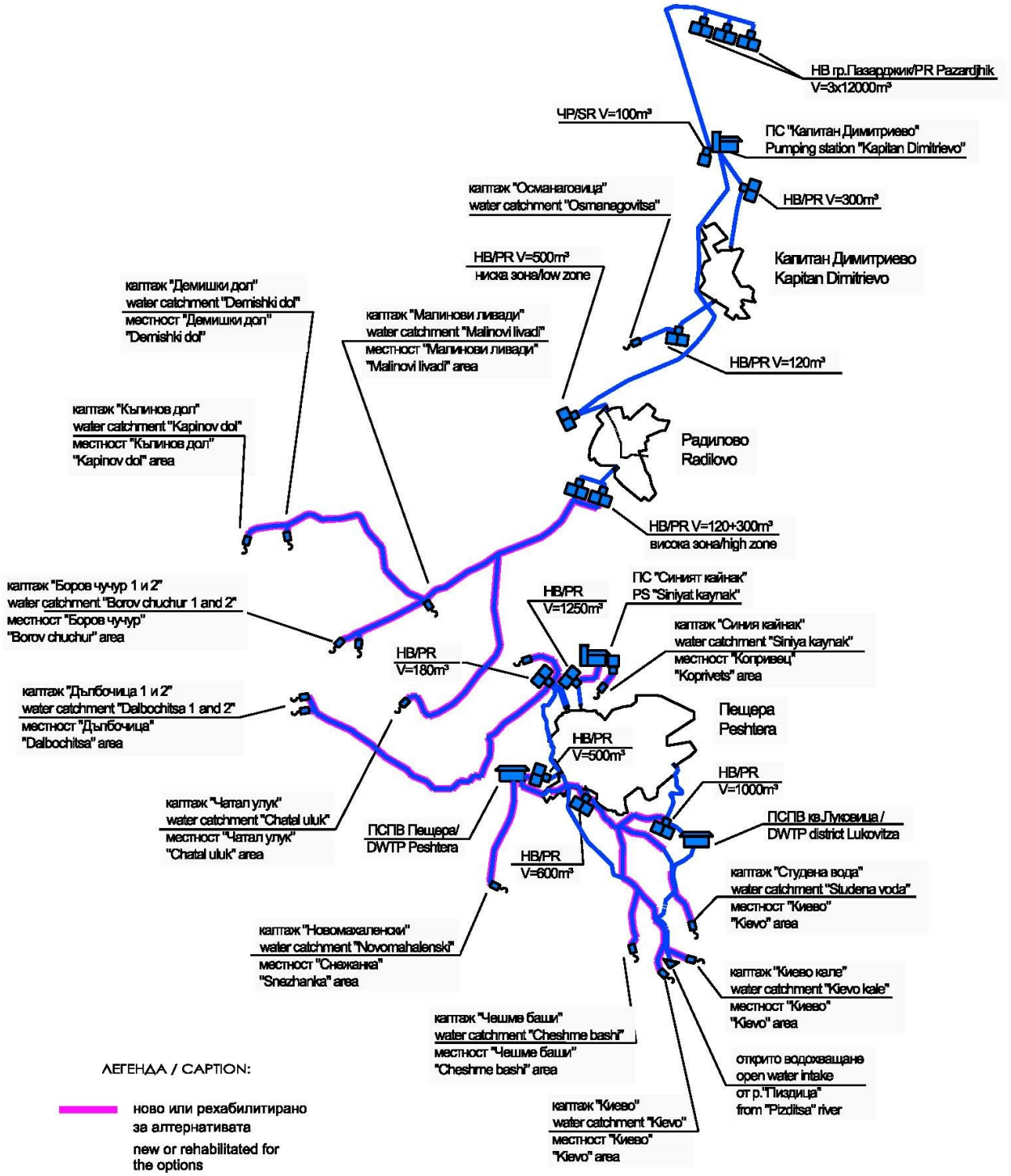



*Figure 4-4 Decentralised – External water supply of the town of Peshtera – Option 2*

**Technical comparison of options:**

*Table 4-15 Comparison of Investments for External Water Supply System of the town of Peshtera*

| Option | Investment |
|---|---|
| 1. Centralised solution – pump-fed water supply of the town of Pazardzhik. | - Water pipelines with a total length of 18.65 km from the reservoirs of the town of Pazardzhik of V=12,000 $m^3$ to the pressure reservoirs of the town of Peshtera.<br>- Reconstruction and renewal of equipment of 1 pumping station (Kapitan Dimitrievo PS).<br>- 1 new pumping station, including power supply connection (Radilovo PS).<br>- 1 new transitional reservoir of V=50$m^3$.<br>- Installation of equipment for intermediate automatic chlorination for residual chlorine in Siniya Kainak PS |
| 2. Decentralised solution | - Water pipelines with a total length of 33.19 km (replacement of 31.89 km of existing water pipelines and 1.3 km of new water pipelines.<br>- Renewal of equipment of 1 pumping station – Siniyat Kainak PS.<br>- Rehabilitation of 8 catchment systems<br>- Renewal of equipment and reconstruction of Peshtera DWTP and DWTP for Lukovitsa quarter<br>- Reservoir of 300 $m^3$, 120 $m^3$ of the village of Radilovo, Reservoir of 600 $m^3$ of the town of Peshtera Reservoir of 180 m3 of the town of Peshtera – Installation of New disinfection systems, including power supply |

**Financial comparison of options**

The evaluation of both options reveals that the cost of the envisaged investments is almost equivalent. **Option 2 - Decentralised solution** is a little bit more expensive.

The comparison of both options does not take into account the investments for the village of Kapitan Dimitrievo, due to the fact that for the two of them water supply to the village is carried none and same manner – the current water supply scheme is retained.

**Option 1 – Centralised solution** includes much higher energy consumption.

For Option 1, water delivered to the town of Peshtera and the village of Radilovo needs to be purchased to ViK Pazardzhik (for the year 2011 – 0.85 BGN/$m^3$). This water is conveyed by gravity from the wells in the terrace of Maritsa River and chlorinated before being sent to the town of Peshtera and the villages of Radilovo and Kapitan Dimitrievo.

For the comparison of both options, some typical risks have been assessed.

*Table 4-16 Net Present Value (NPV) Calculation for considered Options*

| Parameter | Option 1. Centralised Option – Pump-fed water supply of the town of Peshtera and the village of Radilovo from the pressure reservoirs of Pazardzhik | Option 2. Decentralised Option – Retaining the current water supply scheme. (Predominant gravity-fed water supply) |
|---|---|---|
| Investment Costs in € | 4,088,960 | 4,151,272 |
| Costs for alienation of terrains in € | 2,500 | - |
| Operation and Maintenance Costs in € | 139,606 | 26,211 |
| **NPV at discount rate of 5 % in €** | **4,378,572** | **2,597,259** |
| Externalities | - Risk of full (total) interruption of water supply to the town of Peshtera and the village of Radilovo, due to:<br>- failure in the power supply<br>- failure in the transmission mains | - Risk of limited water supply due to failure in some of the transmission mains.<br>- Risk of accidental pollution of some of the numerous springs.<br>- Considerably lower costs for purchase of water to ViK Pazardzhik (only for the low zone of the village of Radilovo) |

**Selected Option:**

**Option 2** - Decentralised solution has been selected. The current water supply scheme is retained. Water supply to the pressure reservoirs of the town of Peshtera will be mainly gravity-fed (exception – Siniyat Kainal PS and catchment system).

It is envisaged to:

- Replace the asbestos cement transmission mains and to construct two new water supply connections to the pressure reservoirs of the town of Peshtera.
- Renew the equipment of Siniyat Kainal PS
- Rehabilitate catchment systems, which are in poor condition.

**Option 2** has been preferred because of its good financial and economic indicators. Its main advantage is the much lower energy consumption.

As a result of the decreasing water consumption (mainly due to loss reduction), there is no need for pump-fed water delivery from the tube wells of TW1, TW 2 and TW4. The same could be kept as backup water sources, but investments for this pump-fed water supply system are envisaged in none of the three periods of the investment programmes.

### *4.2.2.3. External Water Supply System of the village of Kapitan Dimitrievo*

The following investments are included with regard to the external water supply of the village of Kapitan Dimitrievo:

- Repair of 1 catchment system (Osmanagovitsa)
- Replacement of 420 m of gravity transmission main, built of asbestos cement pipes

Although we do not consider development options for Saint Constantine Holiday Resort, we envisage that this system should be harmonized with the requirements of the standards and the good practice for water disinfection and treatment, by providing funds for:

- Installation of system for proportional dosing of sodium hypochlorite.
- Protection of the rapid sand filter's fixtures from freezing.
- Treatment of backwash water from the filter and the sedimentation tank.

## 4.2.3. DEVELOPMENT OF WATER DISTRIBUTION NETWORK OF THE TOWN OF PESHTERA

### *4.2.3.1. Identification of Options*

No options have been considered for the distribution network of the town of Peshtera. The Consultant proposes that the development of the urban water supply network should be carried out according to the regulations and the projects approved within the framework of Operational Programmed Environment 2007 – 2013.

According to the detailed designs, approved for funding, 12,613 m of street water pipelines are planned to be rehabilitated. This length includes only water supply sections, parallel to the sewer branches that are constructed under the same programme.

Based on the strategy, adopted in the preliminary design, it is necessary to ensure overall rehabilitation of the existing water supply network as well as its zoning. According to the preliminary design, there is no need for new volumes of the pressure reservoirs – the current regulating and fire prevention volumes are entirely sufficient. (Verification of reservoir volumes of the town of Peshtera is given in Appendix 4-22)

After the implementation of the detailed design by 2016, a total of 23,391 m of water pipelines will be built of polyethylene pipes and their service connections will be replaced i.e. rehabilitated (this means ≈ 50% of the whole network).

23,449 m of water pipelines will remain to be rehabilitated. Their replacement will have to be carried out within the framework of the investment programmes for the period 2021 – 2038.

### 4.2.3.2. Activities, intended to develop and improve the condition of the distribution network of the town of Peshtera (according to approved projects)

The activities to be carried out are consistent with the methodology and the assumptions specified in Item 4.1.1.

The table below contains description of the activities and investments necessary to complete the rehabilitation of the distribution network in the town of Peshtera.

*Table 4-17 Necessary Activities and Investments*

| Description of Main Deficiencies of the distribution network | Description of necessary activities | Specific Investments |
|---|---|---|
| - Old and obsolete pipes (67% of the network).<br>- 50% of service connections are in poor condition.<br>- Large number of failures.<br>- Water losses (36% of the water supplied to the network represent physical losses).<br>- Pipes having small diameters of Ø40–Ø60 (11% of the network).<br>- Insufficient number of fire hydrants and stop valves (their number is not consistent with the statutory requirements). | - Overall staged replacement of old and obsolete pipes and the associated water supply service connections. | - Rehabilitation (replacement) of 23,449m of water distribution branches.<br>- Rehabilitation of 2,735 of water supply service connections. |
| - No normally detached zones (high and low). As a consequence, there is high pressure in some of the town areas. | - Establishment of three zones within the distribution network:<br>North High Zone<br>South High Zone<br>Low Zone<br>The zones will be established by constructing pressure reducing valve chambers | Construction of chambers and installation of 7 pressure reducing valves for establishing the zones. |
| - Pipe systems and fixtures in the pressure reservoirs need to be replaced (exception – the new PR of V=1,000 m3 – Lukovitsa). | - Rehabilitation of pressure reservoirs (except for PR of V=1,000 m3 – Lukovitsa) – replacement of pipe systems and fixtures in pressure reservoirs. | - Rehabilitation of 4 pressure reservoirs:<br>PR of V=1,250 m3<br>PR of V=180 m3<br>PR of V=500 m3<br>PR of V=600 m3<br>Replacement of pipe systems and fixtures. Installation of devices against overflowing. |
| - Water supplied to the distribution network is not accurately metered. | - Installation of water meters on the feeding pipes of | - Installation of 3 water meters on feeding pipes of pressure |

| Description of Main Deficiencies of the distribution network | Description of necessary activities | Specific Investments |
|---|---|---|
| | pressure reservoirs. | reservoirs:<br>PR of V=1,250 m3 – Chepinski Vriz, new<br>PR of V=500 m3<br>PR of V=1,000 m3 - Lukovitsa |

## 4.3. OPTIONS FOR THE DEVELOPMENT OF THE SEWERAGE SYSTEM

### 4.3.1. STRATEGIC WASTEWATER OPTIONS

#### *4.3.1.1. Identification of Options*

With reference to the statements specified in item 3 and the approved detailed design, which is in a process of construction: Technical assistance for preparation of investment project "Modernisation of the integrated water cycle of the town of Peshtera – Completion and rehabilitation of the existing water supply and sewerage network and construction of wastewater treatment plant of the town of Peshtera ", alternatives regarding the location of WWTP and the possibility of connecting other settlement are unattainable.

The detailed design has been elaborated on the basis of the preceding Feasibility Study and the subsequent Preliminary Design. Two options for sewerage network development have been considered in the Preliminary design. The option approved in the preliminary design served as a basis for the above-mentioned detailed design, which is now being implemented.

The reconstruction and the extension of the sewerage network, after the project implementation, are depicted on Layout No8.

#### *4.3.1.2. Sludge management*

This chapter covers the wastewater treatment plant of Peshtera, the joint WWTP for the villages of Kapitan Dimitrievo and Radilovo as well as the treatment plant of St. Constantine resort which are planned to be built in the short-term programme.

Techniques of sludge treatment and end use options are described in detail in the chapter dedicated to the methodology (section 4.1.1.4.4 Technical Design Criteria, subsection Wastewater Sludge Treatment).

Throughout Bulgaria, the final destination of sludge in almost all situations is landfills. However, in some cases, sludge enhancement is carried out for land use (non-farming) after sludge digestion (usually vermiculture).

This situation stems from the fact that first, non-domestic discharges are not mastered by operators (risk of pollution of sludge) and second because prospective studies on sludge management for agricultural use have not been conducted.

These studies and actions are the responsibility of the feasibility and design studies (or specific studies), not included as part of this regional master plan. Therefore, the Consultant's investment programmes do not include such measures.

However, the consultant recommends to initiate this type of thinking in future feasibility and design studies but also to initiate a specific study on actions to conduct at the national level with several pilot sites.

This action study includes several components:

- Analysis and proposed regulatory changes regarding Bulgarian sludge management
- Assessment of the industrial situation on the pilot sites
- Assessment of the existing management of sludge on the pilot sites
- Determination of potential agricultural uses on the pilot sites
- Prospective actions with potential users
- Socio-economic actions and communications to educate the public concerned
- Design educational courses
- Assistance in the implementation of contracts between operators and end users of sanitation sludge

The Consultant recommends integrating the reuse of treated water from WWTP to this sludge management approach.

The Consultant recommends choosing one pilot site in the territory of the designated territory. Indeed, this territory is particularly appropriate with suitable forest terrains in the mountain part.

#### *4.3.1.3. Proposed Options*

Two agglomerations are established on the territory operated by VKS EOOD Peshtera. They are presented in the table below:

*Table 4-18 Retained Strategic Option Analysis – Wastewater Clustering*

| N° | Name of Agglomeration /Cluster | Preferred Option |
|---|---|---|
| 1 | Peshtera WWTP | Existing situation |
| 2 | Kapitan Dimitrievo WWTP | Approved funding, a joint WWTP for the villages of Radilovo and Kapitan Dimitrievo. |
| 3 | Saint Constantine WWTP | One WWTP for Saint Constantine holiday resort. |

Currently there is no WWTP and no on-going project for the holiday resort Saint Constantine. A site has been selected for the construction. Studies will be necessary to determine the appropriate type of treatment needed considering the specificities of the settlement (located in the mountains in difficult geologic conditions and population varying

greatly throughout the year). The Consultant recommends choosing one of the two following options which are cost-effective and flexible:

- SBR (Sequencing Batch Reactors) WWTP
- BioDisc WWTP*

* The Biodisc treatment is also called “fixed culture”. It can treat carbon and ammoniac. It includes a biomass-mounting bracket, which is a series of rotary biological contactors, and an element made up of multiple disks dips in a primary settling tank. Aeration is natural, provided that each time the biofilm is emerged. This treatment is followed by a settling tank. The main advantage of this treatment is its low energy consumption. The main disadvantages are the absence of nitrate treatment and the lower performance compared to activated sludge.

Based on the above-mentioned, the final list of Agglomerations is presented in the table below.

*Table 4-19 Final List of Agglomeration and Clusters*

| Agglomeration Code | Name of Agglomeration | Population Equivalent | Code of Cluster | Name of Cluster | Treatment Requirement |
|---|---|---|---|---|---|
| WW01 | Peshtera | 25,000 | - | - | - |
| WW02 | Kapitan Dimitrievo | 2,780 | | | |
| WW03 | Saint Constantine | 1,620 | | | |

#### 4.3.1.4. Sewerage zoning studies

As mentioned in section 4.1.2.2., “the Sewerage Zoning Study will define best options among collective sanitation, small collective sanitation, autonomous sanitation, and rainwater purification systems zones for the studied settlements”. They are meant to be applied to settlements not concerned by wastewater investments and for which a sanitation option has to be determined.

Since sanitation options already exist for all the settlements on the territory of VKS EOOD Peshtera (collective sanitation for all the settlements and on-going measures of WWTPs in Peshtera and Radilovo / Kapitan Dimitrievo groups), no sewerage zoning studies are required.

### 4.3.2. Options for Sewerage Networks

#### 4.3.2.1. Management of non-domestic wastewater

This chapter applies to all types of non-domestic wastewater in urban sanitation. However, it does not take into account industries that discharge their effluents directly into the receiving body since it falls under the responsibility of the RIEW. Only industries discharging into the wastewater collection system are concerned by the following recommendations.

The realization of this Regional Master Plan showed that the management of such effluent is generally not mastered by WSSC.

The nature and amount of these effluents have a major impact on the management of wastewater collection systems and WWTP. They also have an impact on treated water and sludge, since their quality directly affects potential uses (e.g.: agricultural) and their final destination.

Studying each particular case is not foreseen in the framework of the Regional Master Plan; however, a general recommendation can be made.

It is important to note that the Bulgarian legislation is not fully in line with the corresponding European Directives. It is therefore difficult to establish specific measures without encountering contradictions between the different regulations.

The Consultant recommends the implementation of a comprehensive study, which may include the following:

- General study at national level:
  - Analysis and review of European legislation
  - Analysis and assessment of the Bulgarian legislation
  - Proposition of ammendments
- General principles to implement at the local level:

  Establish a specific contract between the WSSC and each wastewater sector stakeholders, which may include the following:

  - Descriptions of industrial processes and the nature of the effluent
  - Establishment of a point of continuous flow monitoring with periodic return data to the WSSC and to the corresponding public authorities (municipality, town council etc…)
  - Implementation of a tracking point pollution control with periodic return data to the WSSC and to the corresponding public authorities (choice of parameters depending on the nature of the effluent, the minimum COD, $BOD_5$, TSS, N, P)
  - Discharge authorization with a description of the permitted effluent quality
  - Implementation of treatment before discharge to the wastewater collection system with tight monitoring and periodic return data to the WSSC and to the corresponding public authorities, if necessary

#### *4.3.2.2. Defining alternatives*

The options for solution and development of a sewerage network may be as follows:

- Regarding selection of system. For selection of system, it is also taken into account that where a sewerage network is constructed as a combined one, it is difficult to convert it into a separate one, as the practice in Bulgaria proves that it continues to function as a combined one although the street sewerage has been reconstructed as a separate one. The reason is that the transformation of the street sewerage into a separate one requires reconstruction of internal building

installation in the block of flats, which is quite a capital consuming activity, difficult to synchronize under the conditions existing in our country.

- Regarding scheme – solution for sewerage network.

As the Consultant already pointed out in item.4.3.1, the town of Peshtera has a project under construction, defining:

- Sewerage system as a combined one. High coverage percentage of the exiting sewerage network as a combined one, as well as terrain configuration. This underlies the conducted technical and economic comparison and the system is decided to be retained as combined one.
- Perpendicularly crossed sewerage scheme.

Therefore, there is no option for solution of the sewerage network for the town of Peshtera. An alternative may be sought with respect to sewerage infrastructure development in the future.

The general goals for improvement of the existing sewerage infrastructure of the town of Peshtera are as follows:

- Replacement of old sewer pipes having diameter insufficient to convey the expected wastewater flow in order to prevent flooding, potential failures and operation problems.
- Replacement of sewerage network sections in bad structural condition, with poorly executed parts and built of low quality materials in order to reduce to the minimum wastewater exfiltration in soil and infiltration of unwanted external water into the network to permissible levels for the network as well as for the treatment plant operation.
- Replacement of service connections in poor condition, causing exfiltration/infiltration.
- Possible future extension of the network for wastewater discharge from the future expansion areas, closing gaps in the system or relieving overloaded sections of the existing network.

As the funds for the measures are limited, the activities necessary to achieve the goals should be conducted in stages, according to the reference dates specified in section 4.1.1.1.

#### *4.3.2.2.1. Improvement Works in Short-term Period 2014-2020.*

The most important objective of the sewerage network development strategy in this period is to extend the existing network in order to ensure compliance with the Urban Wastewater Treatment Directive, after the construction of WWTP and the collectors to it.

Secondly, the aim is to reduce high flows of infiltration water in the system. This is accomplished by reconstructing the main collectors and the sewer service connections to them, depending on the hydraulic needs. The pipes in poor condition, located in some sections of the secondary network, will be replaced as well.

It is assumed that measures concerning water supply service connections at this stage will also reduce infiltration flow in the sewerage network.

#### *4.3.2.2.2. Improvement Works in Medium-term Period 2021-2028.*

The objective of this phase is additional improvement of the sewerage network by reconstructing parts of the secondary network, which is generally characterised by the presence of smaller diameters.

Groundwater infiltration in the network and wastewater exfiltration out of the network will be additionally reduced.

The following types of works will be carried out:

- Replacement of pipes depending on the hydraulic needs in the secondary network;
- Replacement of pipes and inspection manholes in the secondary network, which are in poor structural condition;
- Replacement of the associated SSC (sewer service connections) in the secondary network.

#### *4.3.2.2.3. Improvement Works in Long-term Period 2029-2038*

The goal of this period is additional improvement of the remaining parts of the urban sewerage network as well as the associated SSCs.

Wastewater exfiltration out of the network and external water infiltration in the network will be reduced.

The types of works are the same as for the medium-term period.

The network, which is not covered by the above-said project, has a length of L = 34,577 m, where 3,325 m of it are planned to be retained (1,287 m have been replaced in the past 5 years + 855 m in the past 25 and have the required hydraulic capacity + 1,183 m under the terrain of industrial companies in the northern industrial zone). The remaining network to be replaced is 31,252 m long, which is 65% of the total network.

With regard to the above-stated, an option is envisaged to reconstruct the sewerage network in three stages, by starting with the rehabilitation of the backbone of the sewerage network i.e. main collectors, located close to the river, which are characterised by high infiltration rate. The Second stage includes the remaining sewer collectors and the third stage - the secondary sewerage network.

The envisaged measures are based on the adopted parameters in Preliminary Design approved by Peshtera Municipality. The table below contains the technical specifications of the sewerage networks to be replaced:

*Table 4-20 Technical Specification of the Sewerage network to be replaced*

| No | Name | Diameter | Length |
|---|---|---|---|
| Phase I (Short-term) | | | |
| I.1.Reconstruction of Main collectors | | | **Total: 1,450** |
| | | 300 | 82 |
| | | 500 | 183 |
| | | 600 | 216 |
| | | 800 | 462 |
| | | 900 | 90 |
| | | 1,000 | 236 |
| | | 1,200 | 114 |
| | | 1,400 | 67 |
| Phase II ( Medium-term ) | | | |
| II.1. Reconstruction of Main collectors | | | **Total: 3,330** |
| | | 300 | 435 |
| | | 400 | 290 |
| | | 500 | 138 |
| | | 600 | 1,524 |
| | | 800 | 420 |
| | | 900 | 175 |
| | | 1,000 | 133 + 215 |
| II.2. Reconstruction of Secondary network | | | **Total: 55** |
| | | 600 | 55 |
| Phase III ( Long-term ) | | | |
| III.1. Secondary network | | | **Total: 26,852** |
| | | 300 | 20,112 |
| | | 400 | 2,609 |
| | | 500 | 2,542 |
| | | 600 | 954 |
| | | 700 | 152 |
| | | 800 | 483 |

### 4.3.2.3. Proposed Options

Sewerage network option assessment of the town of Peshtera has been conducted in the preliminary design and fully developed and presented in item 4.3.2.

To achieve the above-described options, it is recommended to prepare a new preliminary design, specifying pipe diameters and describing the hydraulic behaviour of the whole sewerage network. It is also necessary to measure infiltration in order to get a real notion of the physical condition of the sewerage network, which will also make it possible to adjust the levels of the spill edge of the existing stormwater overflows in the subsequent design phases.

# 5. SOCIOECONOMIC FORECASTS AND MACRO-AFFORDABILITY ASSESSMENT

## 5.1. SOCIO-ECONOMIC PROJECTIONS

### 5.1.1. MACROECONOMIC FORECASTS

Macro-economic forecasts include relevant projections for gross-domestic product, inflation and unemployment rates at national and regional levels to be used in the financial analysis of selected investment measures. These forecasts are important as they exert significant influence over future operation and maintenance costs of water and wastewater systems, household incomes and affordability constraints. Relevant details for the specific impact and application of each indicator within the framework of water and sewerage investments are provided in its respective section.

Macro-economic projections are based on existing statistical data from official sources (National Statistical Institute, Regional Statistical Bureaus, National settlement register, Eurostat, International Monetary Fund, World Bank, etc.) and international and national guidance and methodological materials (Guidelines for cost benefit analysis of water and wastewater projects supported by the Cohesion fund in 2007-2013). These documents are cited accordingly throughout the report.

**Gross Domestic Product**

Gross domestic product (GDP) forecasts are indicative of the level of economic development at a certain territorial level (national, regional, local). In addition, real growth of GDP is the main indicator used for income projections[31] and expenditures for salaries and wages within the financial analysis of investment measures. Consequently, as a major driver for household income, GDP growth projections are crucial for determining macro affordability thresholds and therefore for establishing the maximum value of proposed investments in water and wastewater systems and networks.

As indicated in Section 2.3, GDP growth in the country has slowed down considerably since 2009, which was the first time in 10 years with a negative economic growth, caused by the consequences of the global financial and economic crisis. Current annual growth is within the limits of 0.5% to 2.0% and much lower than pre-crisis levels reaching 6%.

The “Guidelines for cost benefit analysis of water and wastewater projects supported by the Cohesion fund in 2007-2013”, prepared with the assistance of JASPERS, assumes the following dynamics of real GDP growth over the 2006-2021+ period.

[31] “It is recommended considering household’s disposable income growth as equal to GDP growth. As a result, current data collected, split by income decile, will be projected using a growth rate equal to the GDP growth” – “*Guidelines for cost benefit analysis of water and wastewater projects supported by the Cohesion fund in 2007-2013”.*

*Table 5-1 GDP growth assumptions (% per year), Guidelines for CBA*

| 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 |
|---|---|---|---|---|---|---|---|
| 6.32 | 6.17 | 6.5 | 6.5 | 6.9 | 6.4 | 5.71 | 5.34 |
| 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 | 2021 and beyond |
| 5.02 | 4.67 | 4.39 | 4.02 | 3.74 | 3.57 | 3.38 | 3.3 |

The Guidelines advise that the assumptions should be used cautiously, making sure that they are consistent with the latest published forecasts. Since the above projections are based on figures before the crisis period, they need to be adjusted in accordance with current trends and economic development scenarios.

Several prominent financial institutions produce short- and medium-term economic forecasts. The International Monetary Fund (IMF) predicts Bulgarian real GDP growth of 0.8% for 2012, 1.5% for 2013 and 4.5% for 2014 (*Source*: http://www.imf.org/external/pubs/ft/weo/2012/01/pdf/text.pdf , World Economic Outlook 2012). An average growth of 2.7% for the period 2012-16 is expected by the Economist Intelligence Unit (EIU) with 0.7% increase for 2012 (*Source*: EIU Country Report – Bulgaria, http://country.eiu.com). The World Bank foresees a very modest growth of 0.6% for 2012 and 2.5% and 3.3% for 2013 and 2014 respectively (*Source*: EU11 Regular Economic Report, June 2012).

Based on the projections of these international financial organisations, the following GDP growth pattern has been established.

*Table 5-2 GDP growth assumptions (% per year)*

| 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | 2018 | 2019 | 2020 and beyond |
|---|---|---|---|---|---|---|---|---|
| 1.2 | 1.9 | 3.5 | 4.0 | 3.3 | 3.3 | 3.3 | 3.3 | 3.3 |

In medium-term (5 years), growth will follow the predictions of the World Bank, reaching 3.5% in 2016. Valid long-term GDP forecasts are very difficult to provide keeping in mind the uncertainty in European economic development. For these reasons the recommendations of the Contracting Authority are used. They are considered to be realistic and in line with expected EU economic growth.

**Inflation**

Inflation level forecasts are important for water and wastewater investments for two major reasons:

- Inflation is used to determine constant and nominal costs and tariffs (e.g. conversion of data from operators' business plans);
- Some relevant components of cost formation (e.g. fuels, electricity, etc.) might increase or decrease with lower or higher rates than the average inflation rate, which influences cost projections when constant values are used.

These considerations require that inflation forecasts be provided on 2 separate levels – total inflation, represented by the consumer price index and inflation for major cost

components, used in water and wastewater investment projects. The differences between these two levels can be used when projecting the various costs for the proposed investment measures.

Average national inflation rate for the last 10 years has been 5.7%, ranging widely from 2.3% (2003) to 12.3% (2008). The last three years of this period (2009-2011) are most relevant, as inflation has stabilised within narrower limits to an average value of 3.1%.

The "Guidelines for cost benefit analysis of water and wastewater projects supported by the Cohesion fund in 2007-2013" assume the following dynamics of inflation rate over the 2006-2021+ period:

*Table 5-3 Inflation dynamics assumptions (growth rate per year in %)*

| 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 and beyond |
|---|---|---|---|---|---|---|---|
| 6.08 | 11.57 | 9.24 | 4.41 | 5.22 | 4.07 | 3.00 | 2.7 |

IMF forecasts inflation rate of 2.1% in 2012, 2.3% in 2013 and 2.7% in 2014 (Source: World Economic Outlook Database, April 2012). Average inflation, according to the EIU, will be 2.7%, 2.5% and 3.5% for 2012, 2013 and 2014 respectively.

As the proposed values of inflation within the CBA Guidelines are consistent with the ones proposed by the most recent projections of international financial institutions, they are considered relevant and can be used in the financial analysis of investment alternatives.

Projection of operation and maintenance costs of water and wastewater systems requires prediction of individual inflation rates for the major cost categories – materials, fuels and electricity, and external services. These categories are not identically represented in the consumer price index and the following categories have been used as closest substitutions: non-food products, electricity, liquid fuels and services. The dynamics of these categories over the last 3-year period is presented in Table 5-4.

*Table 5-4 Inflation dynamics of major cost categories (growth rate per year in %)*

| | 2009 | 2010 | 2011 | Average | Ratio to total inflation |
|---|---|---|---|---|---|
| Total inflation | 2.8 | 2.4 | 4.2 | 3.1 | |
| Non-foods (materials) | 3.6 | 6.5 | 3.5 | 4.5 | 1.46 |
| Services (incl. external) | 4.8 | 1.2 | 1.6 | 2.5 | 0.82 |
| Electricity | 5.0 | -0.8 | 1.9 | 2.1 | 0.67 |
| Liquid fuels | -21.1 | 19.7 | 13.5 | 4.0 | 1.30 |

Materials and fuel prices grow at a faster rate compared to average inflation, while electricity and services tend to rise slower than the average inflation. Electricity and fuel prices in Bulgaria are dependent on global commodity prices thus making projections somewhat unreliable, but the existing stable trends provide some assurance to calculations. This reasoning is applied when determining growth assumptions for these major cost categories over the years.

*Table 5-5 Inflation dynamics assumptions - cost categories (growth rate per year in %)*

| | 2012 | 2013 and beyond |
|---|---|---|
| Total inflation | 3.00 | 2.70 |
| Non-foods (materials) | 2.10 | 1.80 |
| Services (incl. external) | 3.70 | 3.30 |
| Electricity | 4.50 | 4.00 |
| Liquid fuels | 2.30 | 2.10 |

**Exchange rate**

Exchange rate is kept at a constant level of BGN 1.95583 for EUR 1. No changes are expected in this aspect. Even if Bulgaria joins the euro zone, the fixed rate will be applied for the conversion. The unlikely event of floating exchange rate would have immediate effect on inflation, which cannot be quantified at the present moment.

**Taxation**

All direct and indirect taxes (Table 5-6) are assumed to remain constant throughout the reference period of the regional master plan. Every change of these taxes (especially indirect taxes) will have immediate and potentially undesirable effect on inflation. If any long-term changes take place, inflation forecasts will need to be revised at least for the year of the change.

*Table 5-6 Taxes by categories, 2011*

| Taxes | Value |
|---|---|
| Corporate tax | 10% |
| Income tax | 10% |
| Value Added Tax (VAT) | 20% |
| Social security | 22.3% |
| Health insurance | 8% |

Social security tax has different values depending on the scope of services for the insured persons - pensions, sickness, illness, maternity, etc., and also the year of birth as those born after 1959 have to pay an additional 2% for additional compulsory pension insurance. An average rate is adopted for the country, with employers currently paying about 60% of the contributions due, with a tendency to change this ratio by 2015 to 50% / 50% for the employer and employee respectively.

**Unemployment**

Unemployment levels have a noteworthy influence in water and wastewater investment projects and particularly on income projections and macro-affordability thresholds. Areas with higher unemployment have lower income and different income structure, relying more on pensions, social benefits and subsistence farming. These characteristics lead to lower affordability thresholds thus hindering large-scale investments.

As indicated in Section 2.3, unemployment in the designated territory has been lower than the national average, but significant differences exist among individual municipalities. The unemployment in Peshtera Municipality was 10.7% in 2011, but it

starts to increase in the beginning of 2012 and we can assume that unemployment rate in Peshtera Municipality is about 90% of the national average rate.

Information is based on unemployed persons registered by Pazardzhik Labour Office and refers to December of the current year. Unemployment is projected to follow national trends, but regional specifics will also be persistent over the reference period, meaning similar to the current income structure.

### 5.1.2. FORECAST OF POPULATION GROWTH

**Introduction**

The population in the project area, in connection with water services consumption, is characterised by a slight increase. There is no strongly expressed seasonality, therefore the average annual amounts, which are necessary for the financial calculations, can be used directly, without adjustment for seasonality. Three scenarios have been developed for the future population of the region– optimistic, realistic and pessimistic. All scenarios use strictly official Census data (2001, 2011). No adjustments have been made for possible undercounts as the reports of NSI indicate low levels of unaccounted people.

***The optimistic scenario*** (lowest negative growth) assumes that population development will follow recent historical trends with respect both to natural and mechanical changes. However, the scenario assumes that the loss of population will be lower than in the other two scenarios. The forecast indicates a trend, which is related to the forecasted Optimistic development of NSI at National and District level until 2060. The methodology describes the links between District, Municipality and each settlement level forecast.

***The realistic scenario*** (slow negative growth) assumes that population development will follow the same historical trends as in the optimistic one, but assumes that the loss of population will be slower, because of the stable age structure, which is now identical to the national average. Migration abroad is also likely to decline, although it still may be expected some internal migration from villages to towns. However, internal migration is a dynamic phenomenon at the regional level which may change dramatically in a very short period. Scenario allows slow but steady regional economic growth, creating opportunities for new jobs and attracting skilled and well-educated young people, supported by favourable regional policies as key conditions for the successful development of the regional economy.

***The pessimistic scenario*** (high negative growth) assumes that population development will follow the same historical trends as in the previous scenario, but assumes that the loss of population will be according to the Pessimistic forecast of NSI for population growth until 2060.

**Methodology**

Ideally, population projections at regional level need to be prepared by using a cohort-component procedure. Unlike simple extrapolation techniques, such as discounting methods and regression, which project future population without disaggregating it, or identifying the causes for past trends, cohort-component procedures deal separately with the three major components of population change – fertility, mortality and migration. The method is based on the traditional demographic accounting principle:

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Population (at the end of the period) | = | Population (at the beginning of the period) | + | Births | - | Deaths | + / - | Migration |

Unfortunately, there is no possibility to establish age-gender cohorts at individual settlement level, because such information is not reported by the national statistics. However, NSI and Eurostat use the cohort-component procedure in the preparation of aggregated forecasts at NUTS III level (districts).

The projection model used by these institutions is characterised by the following features:

- Fertility: age-specific fertility rates applied to the female population; breakdown of births into boys and girls in fixed proportions (51.5% boys, 48.5% girls);
- Mortality: age- and sex-specific death rates applied to population;
- Migration: net migration by age and sex (international and internal migration).

For each of the regional population projections scenarios, assumptions have been formulated in terms of key summary measures for each component of population change. The key summary measures are as follows:

- Fertility: cohort total fertility rate, total fertility rate, mean age at childbearing;
- Mortality: life expectancy at birth, for men and women separately;
- Migration: measuring the intensity of moving to another region.

These key summary measures are subsequently translated into numerical values for each year of the projection period. The regional population projections are conceptually a straightforward generalisation of the national population projections: the only difference is that, while in the national projections the population is just classified by age and sex, in the regional projections there is an additional dimension of population breakdown, namely region of residence.

To ensure full consistency between the national and regional scenario, the regional projection model checks, for each type of event, whether the regional numbers add up to the national number from the national scenario. If not, the regional numbers of events are proportionally adjusted to the national levels.

The results of this procedure are summarised in regional projection tables for each district in three scenarios (pessimistic, realistic and optimistic). Table 5-7 indicates the relevant

values for the district in the pessimistic and realistic scenarios and Table 5-8 calculates the annual population changes, which reflect all major demographic components – births, deaths and migration.

*Table 5-7 Regional demographic projections 2015 – 2040, number of people*

| Scenario/District | 2011 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 |
|---|---|---|---|---|---|---|---|
| Pazardzhik District optimistic | 273,803 | 266,534 | 257,903 | 249,515 | 241,396 | 233,602 | 226,057 |
| Pazardzhik District realistic | 273,803 | 266,197 | 256,581 | 246,817 | 237,105 | 227,613 | 218,343 |
| Pazardzhik District pessimistic | 273,803 | 265,859 | 255,259 | 244,118 | 232,813 | 221,623 | 210,628 |

*Source:* http://www.nsi.bg/otrasal.php?otr=19

*Table 5-8 Projected demographic changes (growth rate per year in %)*

| Scenario/District | 2011 | 2015 | 2020 | 2025 | 2030 | 2035 | 2040 |
|---|---|---|---|---|---|---|---|
| Pazardzhik District optimistic | base | -0.81% | -0.65% | --0.65% | --0.65% | --0.81% | --0.81% |
| Pazardzhik District realistic | base | --0.81% | --0.69% | --0.71% | --0.79% | --0.82% | --0.81% |
| Pazardzhik District pessimistic | base | --0.81% | --0.9% | --0.93% | --0.96% | --1.24% | --0.81% |

*Source:* http://www.nsi.bg/otrasal.php?otr=19 and own calculations

In order to account for local level differences, sensitivity coefficients have been obtained at settlement level by deriving a ratio between the 2001-2011 change in population at settlement and district level. These coefficients indicate how individual settlements change demographically with respect to the region and are later used to adjust the above regional projections for each settlement.

$$\text{Sensitivity coefficient at settlement level} = \frac{\text{Yearly change in population (settlement level) 2001-2011}}{\text{Yearly change in population (district level) 2001-2011}}$$

If any obvious inconsistencies (e.g. growth rate much higher or lower than expected) exist between NSI / Eurostat projections and 2011 Census data, these are adjusted to reflect the most recent data. All adjustments are clearly indicated in the report.

**Summary results**

On the basis of the proposed methodology, the following results have been obtained for population changes in the designated territory of VKS EOOD Peshtera in the available scenarios. The realistic scenario envisages a decline of 55,461 people for the designated territory and 47,746 people in the optimistic scenario. The decline in the pessimistic scenario is 63,175 people and all of these figures are officially presented by NSI.

*Table 5-9 Population projections for designated territory at the municipal level*

| Scenario | Realistic | | | Optimistic | | Pessimistic | |
|---|---|---|---|---|---|---|---|
| Year | 2012 | 2025 | 2038 | 2025 | 2038 | 2025 | 2038 |
| Municipality Peshtera | 18,765 | 17,035 | 15,353 | 18,211 | 16,721 | 15,858 | 13,986 |
| Peshtera town | 16,695 | 15,155 | 13,660 | 16,202 | 14,877 | 14,109 | 12,443 |
| Villages population | 2,070 | 1,879 | 1,694 | 2,009 | 1,845 | 1,749 | 1,543 |

The realistic scenario should be used as a foundation for all further calculations about future investments in the water and wastewater networks as it is based on assumptions, which are most likely to happen in the service area during the reference period of the regional master plan. The pessimistic scenario is necessary only for potential risk assessment of proposed investments in order to prove their viability in unfavourable conditions.

**Detailed results**

The detailed results on settlement level are presented in table 5-10 in descending population order. These are provided for the realistic scenario only, as the numbers are used for determination of future water demand and affordability calculations. At the end of the reference period, only Peshtera town will have population over 2,000 people in the served area.

*Table 5-10 Population projections for the designated territory at settlement level*

| Settlement | Population 2011 | Population 2016 | Population 2021 | Population 2028 | Population 2038 |
|---|---|---|---|---|---|
| Peshtera | 16,746 | 16,205 | 15,631 | 14,804 | 13,660 |
| Radilovo | 1,385 | 1,292 | 1,247 | 11,811 | 1,089 |
| Kapitan Dimitrievo | 768 | 717 | 691 | 655 | 604 |
| **Total for VKS*** | **18,899** | **18,214** | **17,569** | **16,640** | **15,353** |

*The forecast is for the permanent residents, based on data from the settlements.

The proposed population projections should not be considered as precise forecasts. They show the probable demographic development on the basis of educated and realistic assumptions about fertility, mortality, migration, economic development and unified methodology for regional predictions, applicable across the EU.

### 5.1.3. FORECAST OF BUSINESS DEVELOPMENT

Business development of the region is the subject of strategic documents such as the Municipal Development Plan of Peshtera Municipality and the Development Strategy 2005-2015 of Pazardzhik District. These documents analyse various industries and sectors and their prospects for development. The Regional Master Plan considers business development only for the purposes of proper planning of the development of infrastructure for ensuring access to water services to the business.

The method for determining business growth and forecasting business development is based on available data for local budget revenue for Peshtera Municipality. It measures the business activity in the area of the municipality, because it reflects indirectly the level of property and non-property taxes paid as well as the development of the economy as a whole. On the other hand, the Regional Master Plan considers business development for the purpose of determining the need for development of the infrastructure providing access to water services and the development of the water consumption of the business consumers.

From this point of view, economic growth in the municipality can be horizontal, i.e. there are no new subjects, however the existing ones are expanding and respectively generating higher revenue in the municipal budget. This development gives an idea of the level of consumption of existing commercial customers and could explain the reduction in their consumption or a certain growth that does not involve new investments and could be analysed based on analysed consumed quantities consumed and the methodology used to estimate the consumption of water services.

*Table 5-11 Revenue growth in the municipal budget*

| Indicators | 2005 | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012* |
|---|---|---|---|---|---|---|---|---|
| Local revenue, BNG million. | 3,500 | 3,522 | 4,7 | 5,865 | 6,871 | 6,9145 | 6,958 | 7,165 |
| Local revenue, EUR million | 1,790 | 1,801 | 2,403 | 2,999 | 3,513 | 3,535 | 3,558 | 3,663 |
| Local revenue in real terms, EUR million | 1,679 | 1,687 | 2,254 | 2,819 | 3,706 | 3,528 | 3,497 | 3,583 |
| Average annual real growth of revenue for the period | 13.8% | 0.5% | 33.6% | 25.1% | 31.5% | -4.8% | -0.9% | 2.5% |
| Tax revenue | | 0.516 | 0.589 | 0.512 | 0.527 | 0.598 | 0.601 | 0.6 |
| Tax revenue growth | | | 14.1% | -13.1% | 2.9% | 13.5% | 0.5% | -0.2% |

*Source: Budget of Peshtera Municipality, 2012

The results indicate that Peshtera Municipality has a sustained trend of growth of the local revenues at an annual average rate of 12.7% and an average annual tax revenue growth of 3%. This is an indication of a stable economy, which despite the impact of the global economic crisis, has managed to maintain a level of development comparable to the overall development of the country.

Regarding the forecasts of the consumption of water services, what is important are the municipal plans with regard to development of new business areas that would need additional infrastructure for water supply and waste water services.

In this respect, the Municipal Development Plan envisages the development of a detailed site development plan of a new industrial and/or business zone outside the regulation of the town of Peshtera, based on lands under Art. 19 of the Ownership and Use of Agricultural Land Act, with compact mass over 150 decares.

### 5.1.4. FORECAST OF HOUSEHOLD INCOME

**Introduction**

Income projections have a central role in the planning of future water and wastewater systems as they are the basis for macro-affordability assessments and are determinative of the maximum value of investments. In addition, incomes are important for the overall attractiveness of the region and influence directly internal in-migration.

Household income projections are dependent on the current household income levels and the predicted economic growth of the region. The "Guidelines for cost benefit analysis of water and wastewater projects supported by the Cohesion fund in 2007-2013" provide the following definition: "It is recommended considering household's disposable income growth as equal to GDP growth. As a result, current data collected, split by income decile, will be projected using a growth rate equal to the GDP growth". The proposed approach is adopted in the regional master plan and included as part of the applied methodology.

**Methodology**

The average household income in the designated territory is determined at district level. The following approximation procedure has been applied to derive a common income value:

- Determination of the average household income level in 2011 for Pazardzhik District;
- Establishment of income projections for the district using real GDP growth, indicated in Table 5-2 Identical GDP growth rates have been used for all districts and the analyses have demonstrated no significant differences at regional and national level;
- Projected income is distributed in decile groups on the basis of NSI reported distribution statistics[32] ;
- Income per capita is calculated on the basis of 2.2 people per household throughout the whole reference period, despite the observed historical tendency for smaller households. This indicator is relatively stable and changes are slow and insignificant.

**Summary results**

Forecasts for household income within the designated territory are presented in the table below Real income is projected to increase up to BGN 21,402 by 2038, but will still be below the national average of BGN 22,531.

[32] Decile groups are used for the distribution of households into ten groups according to the level of their income. The first decile group represents 1/10 or 10% of households with the lowest incomes, while the tenth decile group represents respectively 10% of the households with the highest incomes. Typically households are divided into low-income or poor (first, second and third decile), middle class (fourth, fifth, sixth and seventh decile) and high-income or rich (eighth, ninth and tenth decile).

*Table 5-12 Household income projections, BGN/year*

| Average household income | 2011 | 2016 | 2021 | 2028 | 2038 |
|---|---|---|---|---|---|
| Bulgaria | 9,587 | 11,513 | 13,741 | 17,247 | 22,531 |
| Pazardzhik District | 8,599 | 10,326 | 12,324 | 15469 | 21,402 |

Projected income is additionally split into decile groups on the basis of income distribution statistics at national level (Section 2.3). Although income of the lower three deciles is likely to evolve at a slower pace than the average income, which is indexed fully to GDP growth, existing statistical data do not provide such justification[33]. Consequently, real GDP growth is used for the projections across all income deciles.

*Table 5-13 Income distribution in decile groups for the service area*

| Nr of Decile group | % of average | 2011 | 2015 | 2020 | 2025 | 2030 | 2038 |
|---|---|---|---|---|---|---|---|
| 1 | 39.0% | 3,355 | 3,860 | 4,655 | 5,476 | 6,441 | 8,351 |
| 2 | 57.9% | 4,978 | 5,726 | 6,907 | 8,124 | 9,556 | 12,390 |
| 3 | 61.8% | 5,311 | 6,109 | 7,368 | 8,667 | 10,195 | 13,218 |
| 4 | 69.5% | 5,974 | 6,873 | 8,289 | 9,750 | 11,469 | 14,870 |
| 5 | 76.4% | 6,569 | 7,556 | 9,114 | 10,720 | 12,609 | 16,349 |
| 6 | 90.2% | 7,759 | 8,925 | 10,765 | 12,662 | 14,894 | 19,311 |
| 7 | 104.4% | 8,973 | 10,322 | 12,449 | 14,644 | 17,225 | 22,333 |
| 8 | 120.7% | 10,374 | 11,934 | 14,394 | 16,931 | 19,915 | 25,822 |
| 9 | 138.8% | 11,936 | 13,730 | 16,561 | 19,480 | 22,913 | 29,709 |
| 10 | 205.5% | 17,673 | 20,330 | 24,521 | 28,843 | 33,926 | 43,988 |

The data for household income by delice group and the average income for the first three decile groups is used in determining the social affordability of tariffs presented in section 5.4.

## 5.2. WATER DEMAND PROJECTIONS

This subchapter gives the result of the water demand projections carried out on the territory of WSSC Peshtera. It is based on information and methodologies described in previous chapters:

- First, the current situation concerning the water demand in the considered area, which is described in Chapter 3.
- Second, the methodology to establish the projections and the assumptions made which are presented in section 4.1.1.

[33]Only 2-year time-series exist at the present moment (2009-2010) and income changes appear to be random across deciles. No correlation can be isolated for such a short time period. In addition time-series are both in the pre-crisis and crisis periods, making them incomparable.

### 5.2.1. SUMMARY OF WATER DEMAND PROJECTION AT THE WSSC LEVEL

Based on the existing situation presented in Chapter 3, projections are carried out for the years 2016 (first year of operation for investments implemented in the short-term program), 2021 (beginning of the medium-term program), 2028 (end of the medium term program) and 2038 (end of the long-term program).

The table presented below is a summary of the water demand projection at the WSSC territory level. It is therefore an aggregation of the data for the 4 settlements of the WSSC territory.

*Table 5-14 Water demand projection at the WSSC level*

| N° | Parameters | Unit | 2011 | 2016 | 2021 | 2028 | 2038 |
|---|---|---|---|---|---|---|---|
| 1 | Population | number | 20,519 | 20,392 | 20,266 | 20,090 | 19,839 |
| *1.1* | *Permanent* | number | 20,519 | 20,392 | 20,266 | 20,090 | 19,839 |
| *1.2* | *Temporary* | number | 0 | 0 | 0 | 0 | 0 |
| 2 | Water Supply Connection rate | % of total | 100% | 100% | 100% | 100% | 100% |
| 3 | Population Served | number | 20,519 | 20,392 | 20,266 | 20,090 | 19,839 |
| 4 | Specific Domestic Consumption | l/c/d | 79 | 87 | 94 | 105 | 120 |
| 5 | Domestic Water Demand | m³ / year | 566,522 | 616,225 | 665,735 | 733,925 | 829,063 |
| 6 | Non-Domestic Water Demand | m³ / year | 237,078 | 250,136 | 262,520 | 273,372 | 290,124 |
| 7 | Total Water Demand excluding NRW | m³ / year | 803,600 | 866,360 | 928,255 | 1,007,297 | 1,119,186 |
| 8 | Non-Revenue Water (NRW) | m³ / year | 1,574,229 | 884,609 | 499,830 | 463,210 | 373,062 |
| 9 | NRW percentage | % of 10 | 66% | 51% | 35% | 32% | 25% |
| **10** | **Total Water Demand (including NRW)** | m³ / year | **2,377,964** | **1,750,969** | **1,428,085** | **1,470,507** | **1,492,248** |

### 5.2.2. WATER DEMAND PROJECTION AT WATER SUPPLY ZONE LEVEL

On the same model as the water demand projection for the whole WSSC territory, detailed water demand projections are carried out for the town of Peshtera, which is a settlement with over 2,000 inhabitants. The results of those projections are presented below in the following table.

*Table 5-15 Water demand projection for the town of Peshtera*

| N° | Parameters | Unit | 2011 | 2016 | 2021 | 2028 | 2038 |
|---|---|---|---|---|---|---|---|
| 1 | Population | number | 16,746 | 16,701 | 16,589 | 16,432 | 16,209 |
| *1.1* | *Permanent* | number | 16,746 | 16,701 | 16,589 | 16,432 | 16,209 |
| *1.2* | *Temporary* | number | 0 | 0 | 0 | 0 | 0 |
| 2 | Water Supply | % of | 100% | 100% | 100% | 100% | 100% |

| N° | Parameters | Unit | 2011 | 2016 | 2021 | 2028 | 2038 |
|---|---|---|---|---|---|---|---|
| | Connection rate | total | | | | | |
| 3 | Population Served | number | 16,746 | 16,701 | 16,589 | 16,432 | 16,209 |
| 4 | Specific Domestic Consumption | l/c/d | 79 | 86 | 94 | 105 | 120 |
| 5 | Domestic Water Demand | m³ / year | 481,070 | 526,395 | 569,175 | 628,008 | 709,936 |
| 6 | Non-Domestic Water Demand | m³ / year | 231,561 | 244,315 | 256,411 | 267,010 | 283,025 |
| 7 | Total Water Demand excluding NRW | m³ / year | 712,631 | 770,710 | 825,582 | 895,019 | 992,961 |
| 8 | Non-Revenue Water (NRW) | m³ / year | 1,446,857 | 802,168 | 444,544 | 411,578 | 330,987 |
| 9 | NRW percentage | % of 10 | 67% | 51% | 35% | 32% | 25% |
| **10** | **Total Water Demand (including NRW)** | m³ / year | **2,159,488** | **1,572,878** | **1,270,127** | **1,306,597** | **1,323,949** |

The water demand projection for all the settlements below 2,000 inhabitants in the territory of WSSC Peshtera is presented in the table below. It is therefore an aggregation of the data for the 3 small settlements concerned in the WSSC territory.

*Table 5-16 Water demand projection for all settlements below 2000 inhabitants*

| N° | Parameters | Unit | 2011 | 2016 | 2021 | 2028 | 2038 |
|---|---|---|---|---|---|---|---|
| 1 | Population | number | 3,773 | 3,691 | 3,677 | 3,657 | 3,630 |
| *1.1* | *Permanent* | number | 3,773 | 3,691 | 3,677 | 3,657 | 3,630 |
| *1.2* | *Temporary* | number | 0 | 0 | 0 | 0 | 0 |
| 2 | Water Supply Connection rate | % of total | 100% | 100% | 100% | 100% | 100% |
| 3 | Population Served | number | 3,773 | 3,691 | 3,677 | 3,657 | 3,630 |
| 4 | Specific Domestic Consumption | l/c/d | 82 | 89 | 96 | 106 | 120 |
| 5 | Domestic Water Demand | m³ / year | 85,452 | 89,829 | 96,564 | 105,917 | 119,126 |
| 6 | Non-Domestic Water Demand | m³ / year | 5,517 | 5,821 | 6,109 | 6,362 | 7,099 |
| 7 | Total Water Demand excluding NRW | m³ / year | 90,969 | 95,650 | 102,673 | 112,278 | 126,225 |
| 8 | Non-Revenue Water (NRW) | m³ / year | 127,372 | 82,441 | 55,285 | 51,632 | 42,075 |
| 9 | NRW percentage | % of 10 | 58% | 46% | 35% | 32% | 25% |
| **10** | **Total Water Demand (including NRW)** | **м³ / year** | **218,476** | **178,091** | **157,958** | **163,910** | **168,300** |

## 5.3. PROJECTED WASTEWATER FLOW

This subchapter gives the result of the wastewater flow projections carried out on the territory of WSSC Peshtera. It is based on information and methodologies described in previous chapters:

- First, the current situation concerning wastewater flow in the considered area, which is described in Chapter 3.
- Second, the methodology to establish the projections and the assumptions made which are presented in section 4.1.1.

In accordance with the Terms of Reference, the pollution load rate is set at 60 grams of $BOD_5$ per person per day. The "Population Equivalent ($PE_{60}$)" of a settlement is therefore the ratio of the pollution load ($BOD_5$) produced at the settlement level in one year to the individual pollution load produced by one person in the same time.

### 5.3.1. SUMMARY OF WASTEWATER FLOW PROJECTION AT THE WSSC LEVEL

Based on the existing situation presented in Chapter 3 and based on the socio-economic projections carried out in chapter 5.1, wastewater flow projections are carried out for the years 2016 (first year of operation for investments implemented in the short-term program), 2021 (beginning of the medium-term program), 2028 (end of the medium term program) and 2038 (end of the long-term program).

The table presented below is a summary of the wastewater flow projection at the WSSC territory level. It is therefore an aggregation of the data for the 4 settlements of the WSSC territory.

*Table 5-17 Wastewater flow projections at the WSSC level*

| N° | Parameters | Unit | 2011 | 2016 | 2021 | 2028 | 2038 |
|---|---|---|---|---|---|---|---|
| 1 | Population | number | 20,519 | 20,392 | 20,266 | 20,089 | 19,839 |
| 2 | Wastewater connection rate | % of total | 96% | 100% | 100% | 100% | 100% |
| 3 | Population served | number | 19,738 | 20,392 | 20,266 | 20,089 | 19,839 |
| 4 | Domestic wastewater | m³ / year | 486,963 | 554,602 | 599,161 | 660,532 | 746,157 |
| 5 | Non-Domestic wastewater | m³ / year | 208,227 | 225,122 | 236,268 | 246,034 | 261,111 |
| 6 | Total wastewater generated | m³ / year | 695,190 | 779,724 | 835,429 | 906,566 | 1,007,268 |
| 7 | Infiltration | m³ / year | 620,483 | 466,957 | 415,387 | 342,266 | 251,817 |
| 8 | Infiltration percentage | % of 9 | 47% | 37% | 33% | 27% | 20% |
| **9** | **Total wastewater collected** | **m³ / year** | **1,315,673** | **1,246,682** | **1,250,817** | **1,248,833** | **1,259,085** |
| 10 | Actual pollution load collected (Population Equivalent) | $PE_{60}$ | 21,640 | 22,448 | 22,424 | 22,337 | 22,223 |

| N° | Parameters | Unit | 2011 | 2016 | 2021 | 2028 | 2038 |
|---|---|---|---|---|---|---|---|
| 11 | Potential pollution load generated (Population Equivalent) | $PE_{60}$ | 22,420 | 22,448 | 22,424 | 22,337 | 22,223 |

### 5.3.2. WASTEWATER FLOW PROJECTION AT THE AGGLOMERATION LEVEL

On the same model as the wastewater flow projection for the whole WSSC territory, detailed wastewater flow projections are carried out for each agglomeration (above 2,000 P.E.). The results of those projections for the WSSC territory are presented in the table below.

*Table 5-18 Wastewater flow projection for the agglomeration of Peshtera*

| N° | Parameters | Unit | 2011 | 2016 | 2021 | 2028 | 2038 |
|---|---|---|---|---|---|---|---|
| 1 | Population | number | 16,746 | 16,701 | 16,589 | 16,432 | 16,209 |
| 2 | Wastewater connection rate | % of total | 98% | 100% | 100% | 100% | 100% |
| 3 | Population served | number | 16,411 | 16,701 | 16,589 | 16,432 | 16,209 |
| 4 | Domestic wastewater | m³ / year | 424,304 | 473,756 | 512,254 | 565,207 | 638,943 |
| 5 | Non-Domestic wastewater | m³ / year | 204,237 | 219,883 | 230,770 | 240,309 | 254,722 |
| 6 | Total wastewater generated | m³ / year | 628,541 | 693,639 | 743,024 | 805,517 | 893,665 |
| 7 | Infiltration | m³ / year | 580,191 | 462,426 | 408,140 | 330,468 | 223,416 |
| 8 | Infiltration percentage | % of 9 | 48% | 40% | 35% | 29% | 20% |
| **9** | **Total wastewater collected** | **m³ / year** | **1,208,732** | **1,156,066** | **1,151,164** | **1,135,985** | **1,117,082** |
| 10 | Actual pollution load collected (Population Equivalent) | $PE_{60}$ | 18,276 | 18,709 | 18,697 | 18,627 | 18,535 |
| 11 | Potential pollution load generated (Population Equivalent) | $PE_{60}$ | 18,611 | 18,709 | 18,697 | 18,627 | 18,535 |

The wastewater flow projection for all the settlements below 2,000 inhabitants in the territory of WSSC Peshtera is presented in the table below. It is therefore an aggregation of the data for the 3 settlements concerned in the WSSC territory.

*Table 5-19 Wastewater flow projection for all settlements below 2,000 P.E*

| N° | Parameters | Unit | 2011 | 2016 | 2021 | 2028 | 2038 |
|---|---|---|---|---|---|---|---|
| 1 | Population | number | 3,773 | 3,691 | 3,677 | 3,657 | 3,630 |
| 2 | Wastewater connection rate | % of total | 83% | 100% | 100% | 100% | 100% |
| 3 | Population served | number | 3,327 | 3,691 | 3,677 | 3,657 | 3,630 |
| 4 | Domestic wastewater | m³ / year | 62,659 | 80,846 | 86,907 | 95,325 | 107,214 |
| 5 | Non-Domestic wastewater | m³ / year | 3,990 | 5,239 | 5,498 | 5,725 | 6,389 |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 6 | Total wastewater generated | m³ / year | 66,649 | 86,085 | 92,405 | 101,050 | 113,602 |
| 7 | Infiltration | m³ / year | 40,292 | 4,531 | 7,247 | 11,798 | 28,401 |
| 8 | Infiltration percentage | % of 9 | 38% | 5% | 7% | 10% | 20% |
| **9** | **Total wastewater collected** | **m³ / year** | **106,941** | **90,616** | **99,653** | **112,848** | **142,003** |
| 10 | Actual pollution load collected (Population Equivalent) | $PE_{60}$ | 3,364 | 3,739 | 3,727 | 3,710 | 3,688 |
| 11 | Potential pollution load generated (Population Equivalent) | $PE_{60}$ | 3,809 | 3,739 | 3,727 | 3,710 | 3,688 |

### 5.3.3. SUMMARY OF DESIGN WASTEWATER FLOW AND LOAD

For all the agglomeration above 2,000 inhabitants, the year with the highest "total wastewater collected" is defined as the "*design year wastewater flow*". It is selected among the milestones 2011, 2016, 2021, 2028 and 2038. Similarly, the year with the highest "actual pollution load collected" is defined as the "*design year pollution load*".

Following the results of the option analysis presented in Chapter 4, a Wastewater Zone (WWZ) is defined as a group of agglomerations/settlements discharging wastewater to the same WWTP. The parameters for each agglomeration as well as the aggregated data for each wastewater zone (if any) are presented in the table below.

*Table 5-20* Summary of Design wastewater flow and load

| Aggl / WWZ Code* | Agglomerations/ Wastewater Zones** | Design year wastewater flow | Average daily dry weather flow | Design year pollution load | Pollution load BOD5 | Maximum pollution load |
|---|---|---|---|---|---|---|
| - | - | - | $m^3$/day | - | kg/day | $PE_{60}$ |
| **56277_00** | **Peshtera** | **2011** | **3,312** | **2016** | **1,122** | **18,709** |
| **V29-WW-2** | **Kapitan Dimitrievo** | **2038** | **289** | **2016** | **172** | **2,870*****|
| - | Radilovo | 2038 | 183 | 2016 | 79 | 1,314 |
| - | Kapitan Dimitrievo | 2038 | 106 | 2016 | 45 | 743 |

* In its complete form, the agglomeration code is BGAG_56277_00. The WWZ Code is: V29-WW-1.

** The name of the wastewater zone corresponds to the largest agglomeration/settlement and the connected agglomerations/settlements are given into brackets.

*** Capacity of the future WWTP

## 5.4. MACRO AFFORDABILITY ASSESSMENT

### 5.4.1. METHODOLOGY AND ASSUMPTIONS

Macro-affordability assessment is required in order to determine the viability of the proposed investments in water and wastewater systems and to establish realistic limits on the maximum investment values. Macro-affordability is dependent on multiple variables – type and timing of investments, projected operation and maintenance costs, established and expected depreciation policies, sources of financing for the investment (loans, grants, etc.). All these components are integral part of tariff formation and thus influence affordability. Affordability calculations are only applied to domestic consumption as industrial consumers are able to calculate any water tariffs in their products or services cost formation.

The calculation of maximum tariffs uses the following major assumptions:

- Actual projected domestic water consumption is used throughout the period instead of legislative requirements for minimal consumption of 2.8 $m^3$ per member of households if there is no data about the actual consumption. In most of the cases, actual water demand is higher than the artificial threshold and thus the approach does not contradict with legislative requirements;
- Affordability constraint is established on the basis of expected income growth throughout the reference period and the real increase in GDP is used to determine income levels;
- As indicated by statistical data, household size is relatively stable for the last decade and is kept at a constant level of 2.7 people per household;
- Affordable tariffs are calculated at 4% of the average income of the households with the lowest income - the first three decile groups).

*Table 5-21 Affordability thresholds and prices*

| Items | 2011 | 2016 | 2021 | 2028 | 2038 |
|---|---|---|---|---|---|
| Household size | 2.70 | 2.70 | 2.70 | 2.70 | 2.70 |
| Projected water consumption, m3/capita/month | 2.42 | 2.50 | 2.77 | 3.03 | 3.30 |
| Average household income, VKS EOOD Peshtera, EUR (constant 2011 values) | 4,396 | 5,279 | 6,301 | 7,909 | 10,943 |
| Maximum affordable price per m3 (4% of average income), EUR | 2.25 | 2.61 | 2.81 | 3.22 | 4.09 |
| Maximum affordable price per m3 (4% of the average income of the first three decile groups), EUR | 1.19 | 1.38 | 1.48 | 1.70 | 2.16 |

Based on the data in chapter 5.1.4 concerning the level of affordability for the population in the served area and the relations found between all consumers groups, an assessment of the investments was prepared.

VKS EOOD Peshtera uses a different tariff for a pollution of Industry's waste water - with 20% higher (0.1 BGN/m3) than the one for domestic and budget organisations (0.08 BGN/m3).

Tariffs are assumed to cover all operation and maintenance costs throughout the whole projection period. The differences reflecting new investments are related to the individual extent of depreciations included in the operating costs.

Industry's consumption of water services is 24.96% for water and 24.09% for waste water. These percentages for Budget organizations are respectively 4.89% for water consumption and 4.42% for the other water services provided by VKS EOOD Peshtera. These figures show that the biggest consumer group is the population and its development will have the most significant influence on the forecasted level of investment affordability.

In the next chapter, the necessary investments will be compared with the financial opportunities for payment and, based on this analysis, sources of financing will be proposed.

### 5.4.2. EXISTING REVENUE AND EXPENSES

According to the official financial reports for 2011 VKS EOOD Peshtera has revenue from invoiced water quantities in the amount of BGN 163 000 (EUR 83 340) and general expenses in the amount of BGN 188 000 (EUR 96 130).

More detailed information on the operating revenues and expenses for 2011 is provided in the table below, using official data from the provided profit and loss account of the Company:

*Table 5-22* Operating revenue and expenses, EUR thousand

| Category | 2011 |
|---|---|
| Expenses | |
| Materials | 72,603 |
| xternal services | 72,092 |
| Remunerations | 118,111 |
| Social security contributions | 43,726 |
| Other | 24,542 |
| Depreciation | 38,858 |
| Current and emergency repair | 88,965 |
| Total expenses | 420,040 |
| Revenue | 494,419 |
| Profit/Loss | 74,379 |

It is evident from the data that the company is profitable and this has been the tendency during the last years, based on data from the Water Operator.

Reported depreciation is EUR 38.858 thousand in 2011 and has been kept at that level since 2009, which indicates that no new depreciable assets have been acquired during that period.

Maintenance costs are reported separately in the Business Plan of VKS EOOD Peshtera and represent more than 20% of the total cost of the operator, which is significantly higher than the average level for other water operators. We can conclude that with this amount of funds earmarked for ongoing and emergency repairs, VKS EOOD Peshtera keeps in good condition the assets it operates.

Costs are expected to remain relatively stable, if no investment activities are performed (scenario "without the project") in the short term (next 5 years). Costs in current prices will increase due to anticipated inflation, but no significant changes are expected in the constant prices for 2011. One noteworthy exception is the personnel cost, which will be affected by real GDP growth. Prices of fuels and electricity can be increased at a faster rate than inflation in view of the trends observed in the first half of 2012, but the historical data do not provide sufficient evidence for such an assumption.

### 5.4.3. AFFORDABLE INVESTMENT PROGRAMS

Affordability estimates require the establishment of incremental operation and maintenance costs that will influence tariff formation and the ability-to-pay for water and wastewater services. Incremental operation and maintenance costs are calculated on the basis of the assumptions, listed in detail in Chapter 4, while a summary is provided below:

- Water supply – annual maintenance and operation costs as follows: Equipment and machinery (3% of construction costs), Water mains (0.15%), Distribution network (0.5%), Civil works (0.5%), Electricity (0.11 €/kWh);
- Wastewater discharge – annual maintenance and operation costs as follows: Equipment and machinery (3% of construction costs), Main collectors (0.20%), Secondary sewerage network (0.6%), Civil works (0.6%), Electricity (0.11 €/kWh);
- Wastewater treatment plants – annual maintenance and operation costs of 4.5% (all inclusive).

In addition, the following distribution of construction investment costs has been assumed in order to derive a realistic estimate of incremental operation and maintenance costs.

*Table 5-23 Distribution of construction investment costs*

| | Pipes | Civil works | Mechanical and electrical |
|---|---|---|---|
| Wells | - | 70% | 30% |
| DWTP | - | 55% | 45% |
| Water mains | 100% | - | - |
| Distribution networks | 100% | - | - |
| Reservoirs and tanks | - | 85% | 15% |
| Pumping stations | - | 60% | 40% |
| WWTP | - | 55% | 45% |
| Mains collectors | 100% | - | - |
| Sewerage network | 100% | - | - |
| WW Pumping station | - | 60% | 40% |

The methodology of affordability calculations involves several subsequent steps as follows:

- Determination of the maximum possible revenues given the projected consumption and the upper limit of tariffs for the different scenarios. This calculation does not include level of revenue collection as water operators are not allowed to account for this category when proposing tariffs in front of the Regulatory body. Revenues from institutional and industrial clients are also included in order to fully simulate the income cash flow within the operato, regardless of the fact that they are not affected by the affordability calculations;
- Projections for the existing operation and maintenance costs and depreciations ("without the project" scenario). After a statistical analysis for price changes against the average inflation, all operation and maintenance costs are held at their current level in constant 2011 prices except for personnel costs which increase in line with the real GDP growth;
- Projections for the incremental costs of new investments ("with the project" scenario) for each of the investment periods. The above assumptions have been used to calculate operation and maintenance costs for new investments. Due to the larger share of investments in water supply systems in the medium- and long-term, existing costs have been reduced because of efficiency improvements and reduction of losses;
- Projections for the incremental depreciations as a result of the new investments ("with the project" scenario) for each of the investment periods. The following assumptions have been used: 50 years useful life for pipes; 45 years useful life for civil works; 10 years useful life for mechanical and electrical equipment, 30 years useful life for all other infrastructure elements. All assets which reach the end of their useful life are replaced and depreciations are calculated on the replacement value. Different scenarios can be assumed for depreciations – equal depreciations for each of the years in the reference period, increasing depreciations, partial depreciations (as required by the rules of current Operational Programme) etc.
- Accounting for the sources of financing – EU and national grant funding, municipal co-financing, loans from national or international financing institutions. Only one scenario is calculated - 100% grant because the analysis of the municipal budgets shows that the municipality is not able to take and repay loans.
- Determining the difference between overall revenues and overall operation and maintenance costs (without including depreciation for the new assets). If the difference is a positive number, investments are considered affordable as the operator will generate enough revenues from affordable tariffs to cover all operation and maintenance costs (including replacement of assets with shorter life span). If the established difference is negative, then investments are not affordable and an investment limit is provided for each of the periods.
- The extent of possible coverage of depreciation is the final step in determining the affordability, if there is such possibility, i.e. if investments are affordable

without the inclusion of depreciation for new assets. The total amount of all necessary expenses for depreciation is compared with the difference between total revenue and total costs. This ratio indicates the degree of inclusion of depreciation that can be covered by the affordable level of income set at 4% threshold of the average income of the first three decile groups.

The maximum possible revenues within the defined affordability thresholds are indicated below.

*Table 5-24 Maximum level of revenues at the affordability thresholds*

| | 2016 | 2021 | 2028 | 2038 |
|---|---|---|---|---|
| Domestic revenues* at tariffs set to 4% of the income of the poorest three decile groups, EUR | 550 075 | 639 110 | 687 240 | 789 270 |
| Public and industrial revenues at tariffs set to 4% of the income of the poorest three decile groups, EUR | 294 241 | 325 119 | 374 293 | 444 952 |
| Total revenues at tariffs set to 4% of the income of the poorest three decile groups, EUR | 844 316 | 964 229 | 1 061 533 | 1 234 222 |

*The revenue from domestic consumption takes into account the revenue relative to the maximum affordable tariffs, with deducted VAT, which is included in the maximum affordable tariff levels.

Existing operation and maintenance costs are calculated on the basis of the historical figures from 2011 (constant process in 2011). The table below illustrates the situation in which no investments will be implemented in the reference period ("without the project" scenario).

*Table 5-25 Current and projected O&M costs ("without-the-project" scenario). EUR*

| Type of cost | 2016 | 2021 | 2028 | 2038 |
|---|---|---|---|---|
| Materials, including | 72,603 | 72,603 | 72,603 | 72,603 |
| Electricity | 56,753 | 56,753 | 56,753 | 56,753 |
| External services | 72,092 | 72,092 | 72,092 | 72,092 |
| Personnel | 187,096 | 220,073 | 276,229 | 382,184 |
| Salaries | 136,545 | 160,612 | 201,596 | 278,923 |
| Social security | 50,551 | 59,461 | 74,633 | 103,261 |
| Other costs | 24,542 | 24,542 | 24,542 | 24,542 |
| Current repair | 88,965 | 88,965 | 88,965 | 88,965 |
| Depreciation | 38,858 | 38,858 | 38,858 | 38,858 |
| Total O&M cost | 445,299 | 478,275 | 534,431 | 640,386 |

Incremental O&M costs are calculated for the new investment. In practice, these are newly arising costs, which accumulate over the current costs presented in the previous table and they together should be covered by the new tariffs for the services. In the affordability analysis of the investment we examine the possible degree of coverage of these total costs.

*Table 5-26 Incremental O&M ("with the project" scenario), EUR*

| Type of cost | 2016 | 2021 | 2028 | 2038 |
|---|---|---|---|---|
| Incremental O&M Cost | 0 | 10,350 | 10,350 | 31,421 |
| Incremental CAPEX - depreciation (100%) | 0 | 42,256 | 278,661 | 713,229 |

Regarding depreciation, we have calculated the ability of the water operator to cover all or part of its value. The amount of incremental depreciation is compared to the difference between total revenues and total costs but without including depreciation for the new assets. The ratio between these two values is the percentage of possible coverage of depreciation costs for new assets by the generated revenues, using a 4% threshold of the income of the first three decile groups. Capital expenditures for depreciation include only gradually increasing depreciation resulting from new investments only and do not take into account existing depreciation. Existing depreciation, including current investments, is identical and used in both scenarios "without the project" and "with the project". Periodic maintenance costs are included in operating expenses based on the assumptions listed in Chapter 4 of the Regional Master Plan

*Table 5-27 Determining the level of coverage of incremental depreciation costs*

| Indicators | 2016 | 2021 | 2028 | 2038 |
|---|---|---|---|---|
| Total revenue – Total costs (excluding depreciation for the new assets ) | 795,968 | 889,350 | 1,040,303 | 1,269,282 |
| Ability to cover incremental depreciation, in % | | 319% | 146% | 178% |

The results in the table indicate that after the implementation of the investment programs, the revenues from water services may cover the operating costs, with fully included epreciation for new assets.

Partial loan financing can be considered as a complement to different depreciation scenarios. Currently, one scenario is elaborated – full grant financing. The ground for this is provided by the analysis the bdgets of Peshtera Municipality, which cannot afford to take loans in the foreseeable future. The situation could be different for the medium and long term programs, however an up-to-date analysis should be prepared and decisions for potential loans should be taken on a project by project basis.

It has to be noted that the assumption of using municipal loan payments in tariff formation is not realistic at the current moment because it does not represent an expenditure of the water company and consequently it cannot be justified before the Regulatory authority.

We can conclude from these results that all planned investments are socially affordable for the project region for all three programs.

The Water Operator is in a good financial position, but the municipality has negligible budget for capital expenditures and could hardly afford any co-financing in the amount of the planned investment programs, so loans are not considered as an alternative for funding.

By iterations of the amount of the proposed investment, the Consultant concluded that all investments are affordable for Peshtera Municipality, with the inclusion of the full amount of depreciation for new assets.

Whatever part of the proposed investment programs is be implemented, it must be subject to a 100% grant funding.

# 6. SHORT, MEDIUM AND LONG-TERM INVESTMENT PROGRAMME TO MEET WATER AND WASTEWATER DEVELOPMENT TARGETS

## 6.1. INVESTMENT PROGRAMME OVERVIEW

### 6.1.1. GENERAL APPROACH

In this chapter short, medium and long-term investment programmes, including all investment measures necessary (i) to achieve full compliance with EU and national regulations and (ii) to meet the targets defined in the national water strategy, have been developed. The proposed investment programmes take into consideration the results of all Chapters described above. The main tasks performed in the chapters above and in this chapter are as follows:

- Comparison of the existing situation with national targets and strategies;
- Identification of all investment measures which are necessary to meet the targets and to remediate current deficiencies;
- Calculation of the investment costs;
- Evaluation of various options and the identification the least costly, most affordable solution;
- Grouping of all identified investment measures in short-term, medium-term and long-term investment phases;
- Prioritization of the identified investment measures in each phase;
- Description of the outcomes and benefits expected from the investment measures;
- Assurance of the financial viability of the proposed programmes, the verification of the sustainability of the programmes and the assessment of the risks related to the programme implementations.

Reference is made to Chapter 4.1.4. “General Methodology for Phasing and Prioritization” for a detailed description of the methodology and to Chapter 4.1.2 “Unit Costs”.

### 6.1.2. SUMMARY OF THE INVESTMENT PROGRAMME

A summary of investment costs for all investment phases is presented in the table below. The costs of the short-term investment programme have been estimated at € 1.85 million, the costs for the medium-term investment programme at € 9.64 million and the long-term investment programme at € 19.79 million. The overall investment costs for the entire programming period are about € 31.2 million.

The short, medium and long-term investment programs are affordable for all population groups, both within the 2.5% and 4% threshold of income. For the short and medium-term programs this is valid for 100% inclusion of depreciation in the water tariff, while for the

long-term program – this is valid for a maximum of 60% of the depreciation included in the tariff.

*Table 6-1 Investment costs for all phases (in €)*

| Investment Component | Short-term | Medium-term | Long-term | Total |
|---|---|---|---|---|
| Water Supply | 290,900 | 3,862,300 | 4,060,400 | **8,213,600** |
| Wastewater | 1,215,500 | 3,973,600 | 12,030,500 | **17,219,600** |
| **Total Construction Costs** | **1,506,400** | **7,835,900** | **16,090,900** | **25,433,200** |
| Studies and Supervision | 195,800 | 1,018,700 | 2,091,900 | **3,306,400** |
| Contingencies | 150,700 | 783,600 | 1,609,100 | **2,543,400** |
| **Total Investment Costs** | **1,852,900 €** | **9,638,200 €** | **19,791,900 €** | **31,283,000 €** |

Concerning the industrial wastewater discharges into surface water bodies and urban sewerage networks, the Consultant recommends the following actions.

- For the industries discharging wastewater directly into the river, it is necessary to implement an autonomous treatment tools, suitable for specific industrial wastewater discharges: ET Nagi Trans Peshtera (transport activity), Chiko OOD (brushes, wires, fibres factory) and Bratya Angelovi OOD (breeding hens for eggs)
- For industries discharging wastewater into the urban sewerage network, it is necessary to implement pre-treatment tools, after studying the type of effluents they discharge. The sectors concerned are: food and beverages (Vinmprom Peshtera), metalworking, leather and adhesives (Vasil Muletarov EOOD), shoe factories and tobacco factories (Mehanika AD – Nicotiana Holding).

Investments are the responsibility of the private entities concerned. Therefore, the related costs are not included in the present investment programmes.

At current and projected income levels for the poorest decile groups, it is possible to implement the investment program in full, with 100% inclusion of depreciation for newly acquired assets.

The main problematic points are indicated for each period of the investment program below.

Besides the investment programme described hereafter, the Consultant recommends carrying out several studies or programme, as follows:

**Institutional studies**

A set of institutional studies (and analysis of the effectiveness of territorial services) should be conducted after the publication of the new Water Act which is currently in being prepared. These studies, which should integrate local, district and national levels, must contain:

- Analysis of services in terms of human and technical management
- Analysis of the effectiveness of territorial services

- Analysis on the possible merging of different WSSCs (publics, private)
- Analysis of results of settlement exchanges between diffrents WSSC
- Analysis of budget results regarding the actual rule applied by the Bulgarian Regulator and the recommended European rules

These studies are not included in the investment program and cannot be quantified at this stage. The Consultant proposes this type of study because ambitious technical investment programmes can only be effective if it is consistent with a high level of service.

**NRW reduction programme**

The operators must have a policy management and meter replacement, based on age (recommended maximum between 10 and 14 years), the efficiency of the counting (meter size should be suitable for the pattern of consumption of the subscriber) and the quality of the installation and monitoring. The same policy should be conducted at the level of the metering points on the external water supply system (the age of replacement depends on the material). This is an important recommendation but is not integrated since it is not possible to quantify and since this programme should be financed by the operators

**Sludge management study**

The Consultant recommends scoping alternatives for sludge management in future feasibility and design studies but also to initiate a specific study on actions to conduct at the national level with several pilot sites.

This action study includes several components:

- Analysis and proposed regulatory changes regarding Bulgarian sludge management
- Assessment of the industrial situation on the pilot sites
- Assessment of the existing management of sludge on the pilot sites
- Determination of potential agricultural uses on the pilot sites
- Prospective actions with potential users
- Socio-economic actions and communications to educate the public concerned
- Design educational courses
- Assistance in the implementation of contracts between operators and end users of sanitation sludge

The Consultant recommends integrating the reuse of treated water from WWTP to this sludge management approach.

The Consultant recommends choosing one or several pilot sites in the territory of VKS EOOD – Peshtera.

**Non-domestic wastewater management programme**

The Consultant recommends the implementation of a comprehensive study, which may include the following:

- General study at national level:
    - Analysis and review of European legislation

- Analysis and assessment of the Bulgarian legislation
- Proposition of ammendments

- General principles to implement at the local level:

  Establish a specific contract between the WSSC and each wastewater sector stakeholders, which may include the following:

  - Descriptions of industrial processes and the nature of the effluent
  - Establishment of a point of continuous flow monitoring with periodic return data to the WSSC and to the corresponding public authorities (municipality, town council etc…)
  - Implementation of a tracking point pollution control with periodic return data to the WSSC and to the corresponding public authorities (choice of parameters depending on the nature of the effluent, the minimum COD, $BOD_5$, TSS, N, P)
  - Discharge authorization with a description of the permitted effluent quality
  - Implementation of treatment before discharge to the wastewater collection system with tight monitoring and periodic return data to the WSSC and to the corresponding public authorities, if necessary

## 6.2. SHORT-TERM INVESTMENT PROGRAMME

### 6.2.1. INVESTMENT COSTS

The investment costs presented in the tables below are net costs excluding VAT, constant price base 2011 in Euro.

#### *6.2.1.1. Water supply*

The main problems of the external water supply systems are as follows:

- A large number of the disinfection facilities have low reliability and do not meet the legislative requirements (under Ordinance № 2 of 19.04.2005);
- Water supplied by some of the water sources of the town of Peshtera is not directly disinfected. (It relies on the mixing with the already chlorinated water from other sources.);
- The external mains on the territory of VKS EOOD Peshtera are long 52.87 km - asbestos cement, steel, manesman and polyethylene. Of these, 52% are asbestos cement, 41% are steel and manesman, and 7% are polyethylene. The mains placed during the period 1990 - 2009 are 16.92 km long (32%) - steel and polyethylene. The mains placed during 1950 - 1990 are 35.95 km long (68%), made mainly of asbestos cement, are old and worn out. Their facilities are also obsolete.

The main problems of the water distribution networks are as follows:

- The distribution networks are mainly built of asbestos cement pipes and their service life has expired. This is the reason for the high water losses and failures in the network (water losses vary from 40 to 67%);
- The water supply service connections are mainly made of galvanized pipes and their service life has expired. They are in bad condition and often cause failures;
- The network in the town of Peshtera is not zoned according to the regulations

The short-term programme includes investment measures aiming at:

- Eliminating the main shortages, related to water quality and quantity;

The estimated costs for the short-term programme – Water Supply, amount to EUR 290,900 and include the following investment components:

- Rehabilitation and modernization of the WWTP and the chlorinating stations;
- Chlorination installation as required by the regulations for the pressure water reservoirs of the town of Peshtera and the pressure water reservoirs of the high zone of the village of Radilovo (including power supply);
- Rehabilitation of 993 meters of water pipes in the distribution network of the town of Peshtera. (These are obsolete asbestos cement pipes, running parallel to the sewerage branches to be built under the short-term operational program.).

The following results will be achieved by carrying out the envisaged activities:

- Supplying good quality drinking water to the consumers;
- Eliminating the risk of the spread of diseases due to water that is not disinfected;

The proposed chlorination activities will affect the quality of water supplied to 19,059 consumers.

- The rehabilitation of obsolete pipelines in the town of Peshtera will reduce the risk of failures in these sections and will provide safe and continuous water supply to about 4,200 inhabitants.

A summary of the short-term investment costs for water supply is presented in the table below.

*Table 6-2 Short-term investments for water supply (in €)*

| Category of work | Water abstraction | DWTP | External Water mains | Distribution networks | Reservoirs and tanks | Pumping stations | Miscellaneous | Total WS Short-term construction costs |
|---|---|---|---|---|---|---|---|---|
| Code | WS_1 | WS_2 | WS_3 | WS_4_1 | WS_4_2 | WS_4_3 | WS_5 | S-T |
| ***Construction cost per category*** | **0** | **141,600** | **0** | **149,300** | **0** | **0** | **0** | **290,900** |
| Peshtera | 0 | 103,800 | 0 | 149,300 | 0 | 0 | 0 | 253,100 |
| Radilovo | 0 | 26,800 | 0 | 0 | 0 | 0 | 0 | 26,800 |
| Saint Constantine | 0 | 11,000 | 0 | 0 | 0 | 0 | 0 | 11,000 |

### 6.2.1.2. Wastewater

The analyses, based on the studies of the wastewater collection, disposal and treatment infrastructure lead to the following conclusions concerning the current state of the structures and facilities:

- The sewerage networks, where constructed, function as combined ones – dispose domestic and industrial waste water and storm water;
- There are no data from measurments of the infiltration in the existing sewerage networks;
- A design has been accepted and approved for rehabilitation of wastewater network as well as for its completion so that the implementation ensures 100% population connected to sewerage network. The consultant recommends that after the project implementation, the necessary investigations and measurements should be conducted to assess the actual capacity of the sewerage network (hydraulic model), The short-term and long-term programmes give priority to the most problematic and loaded points of the sewerage network.
- WWTP Peshtera – the approved detailed design is prepared in accordance with the current regulations in force and is expected to perform its function without any additional investments during the short and medium term investment period.
- No WWTP in Saint Constantine Holiday Resort.

The estimated costs for the short-term program - part Sewerage - amount to EUR 1,215,500 and include the following components:

- Reconstruction of the main sewer collectors, located on both sides of Stara Reka River.
- Construction of storm-water overflow

The envisaged activities are essential for improving the operational state of the sewerage network and will lead to the following results:

- Reducing the infiltration formed in the land near the river, where the underground water level is the highest and the collectors do not have sufficient capacity to absorb the waste water that would be accumulated after the implementation of this project.

- The construction of the storm water overflow will reduce the load of the network and the water collected in the North-western part of the town will flow into the river before the collector crosses it.

A summary of the short-term investment costs for waste water is presented in the table below.

*Table 6-3 Short-term Investments for Wastewater*

| Category of work | WWTP | Mains collectors | Sewerage network | WW Pumping station | Miscellaneous | Total WW Short term construction costs |
|---|---|---|---|---|---|---|
| Code | WW_1 | WW_2 | WW_3_1 | WW_3_2 | WW_4 | S-T |
| Construction cost per category | 0 | 1,151,800 | 63,700 | 0 | 0 | 1,215,500 |
| Peshtera | 0 | 1,151,800 | 63,700 | 0 | 0 | 1,215,500 |

### 6.2.1.3. Overall short-term Investment Costs

A summary of the short-term investment costs, at the level of the WSSC, for water supply and wastewater is presented below. The table includes the costs for all investment measures identified for the short-term investment phase (irrespective of the priorities). The overall short-term investment costs amount to about € 1.9 million.

*Table 6-4 Overall short-term investments for water supply*

| Code | Category of Work | Total Cost |
|---|---|---|
| WS_1 | Water abstraction | - € |
| WS_2 | DWTP | 141,600 € |
| WS_3 | External water mains | - € |
| WS_4_1 | Distribution Network | 149,300 € |
| WS_4_2 | Reservoirs and tanks | - € |
| WS_4_3 | Pumping stations | - € |
| WS_5 | Miscellaneous | - € |
| **WS construction cost** | | **290,900 €** |

| | |
|---|---|
| Feasibility studies | 1% |
| Design | 4% |
| Construction supervision | 5% |
| Project management | 3% |
| **Studies and supervision cost** | **37,800 €** |

| | |
|---|---|
| Contingencies | 10% |
| **Contingency cost** | **29,100 €** |

| | |
|---|---|
| **Total investment costs** | **357,800 €** |

*Table 6-5 Overall short-term investments for wastewater*

| Code | Category of Work | Total Cost |
|---|---|---|
| WW_1 | WWTP | - € |
| WW_2 | Main collectors | 1,151,800 € |
| WW_3_1 | Sewerage network | 63,700 € |
| WW_3_2 | WW Pumping station | - € |
| WW_4 | Miscellaneous | - € |
| **WW construction cost** | | **1,215,500 €** |

| | |
|---|---|
| Feasibility studies | 1% |
| Design | 4% |
| Construction supervision | 5% |
| Project management | 3% |
| **Studies and supervision cost** | **158,000 €** |

| | |
|---|---|
| Contingencies | 10% |
| **Contingency cost** | **121,600 €** |

| | |
|---|---|
| **Total investment costs** | **1,495,100 €** |

### 6.2.2. PRIORITIZED SHORT-TERM INVESTMENT PROGRAMME

The table below shows a list of all identified investment components once prioritized according to the Consultant's methodology (see appendix 4-7). The investment costs for each component, the population in the respective Water Supply Zone (or Population Equivalent for wastewater components), the cost per inhabitant (or equivalent inhabitant) as well as the expected outcome of the measures are presented in the table. The table reveals that the components cover all measures necessary to achieve compliance with EU and national legislation as well as measures for efficiency improvement.

*Table 6-6 Short-term investment program*

| Ranking | Number of Investment on the maps | Category (WS/WW) | Name of WS zone / Agglomeration | Component Description | Investment Costs | Population concerned* | Cost per inhabitant / equivalent inhabitant | General outcome | Points ** |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | WW | Peshtera | Reconstruction of 2 sewerage collectors | 1,215,000 | 16,746 | 72,6 | Reducing the infiltration and alleviating the load of the network | 64 |
| 2 | 1 | WS | Peshtera Saint Constantine | Construction of a separate gas chlorine station according to the requirements (3 chlorine stations) | 68,153 | 18,366 | 3,7 | Improving the quality of water and reducing the health risk to the population | 64 |
| 3 | 2 | WS | Peshtera Radilovo | Improving the chlorination in the existing water tanks (three pressure tanks) | 73,459 | 18,131 | 4,1 | Improving the quality of water and reducing the health risk to the population | 64 |
| 4 | 3 | WS | Peshtera | Rehabilitation of the water supply network L=0.993 km (along the envisaged domestic sewerage network) | 149,285 | 16,746 | 8,9 | Reducing the losses of water and reducing the infiltration in the sewerage system as a result of failures in the water supply network | 41 |

**Population for Water Supply components and Population Equivalent (P.E.) for Waste Water components in the year 2011 according to data of NSI.*

*** According to the Consultant's methodology (see appendix 4-7)*

### 6.2.3. FINANCIAL AND ECONOMIC CONCLUSIONS

Based on the results from the affordability analysis in section 5.4 we can make the conclusion that the proposed investment program is affordable both for the average-income population and for the poorest segments of the population. . This is confirmed by the analysis of social affordability for the first three decile groups, using the defined threshold of 4% of their average income.

The tariffs calculated include 100% of the depreciation of the planned investments, which is relatively insignificant in the short-term program.

At the end of the forecast period of the short-term investment program, the tariff for all water services offered by the operator reaches a value of BGN 2.71/$m^3$ (EUR 1,38/$m^3$), including the cost of wastewater treatment.

In view of these conclusions, there is no need for the municipality or the operator to undertake any special measures in connection with the introduction of the new tariff systems, nor introduce any special conditions for support of the poor population, etc.

## 6.3. MEDIUM-TERM INVESTMENT PROGRAMME

### 6.3.1. INVESTMENT COSTS

The investment costs presented in the tables below are net costs excluding VAT, constant price base 2011 in Euro.

#### *6.3.1.1. Water supply*

The medium-term programme includes investment measures aiming at:

- Rehabilitation and extension of water supply systems ensuring sustainability – continuity and safety of water supply.
- Increasing the efficiency – reducing the non-revenue water (Water Losses), energy efficiency, etc.;

The estimated costs for the medium-term programme – Water Supply, amount to EUR 3,862,300 and include the following investment components:

- Rehabilitation of water transmission mains and feeding pipelines – 23% of the external pipelines of all settlements in Peshtera Municipality.
- Rehabilitation of distribution networks – 23.6% of the network of the town of Peshtera. Network zoning for leakage reduction.
- Rehabilitation of reservoirs and replacement of fittings and pipe systems.
- Construction of separate facilities for treatment of flushing water from DWTP.

The following results will be achieved by carrying out the envisaged activities:

- Increasing the safety of water supply of the town of Peshtera. Reducing failures and water losses along the water transmission mains.
- Reducing water losses in the distribution network of the town of Peshtera;
- Improving the condition of the pressure reservoirs;
- Preventing the pollution of surrounding environment and surface and ground water.

A summary of the medium-term investment costs for water supply is presented in the table below.

*Table 6-7 Medium-term investments for water supply*

| Category of work | Water abstraction | DWTP | External Water mains | Distribution networks | Reservoirs and tanks | Pumping stations | Miscellaneous | Total WS Medium term construction costs |
|---|---|---|---|---|---|---|---|---|
| Code | WS_1 | WS_2 | WS_3 | WS_4_1 | WS_4_2 | WS_4_3 | WS_5 | M-T |
| ***Construction cost per category*** | **15,000** | **36,000** | **1,843,100** | **1,822,100** | **78,500** | **0** | **67,600** | **3,862,300** |
| Peshtera | 15,000 | 24,000 | 1,843,100 | 1,822,100 | 78,500 | 0 | 67,600 | 3,850,300 |
| Saint Constantine | 0 | 12,000 | 0 | 0 | 0 | 0 | 0 | 12,000 |

### 6.3.1.2. Sewerage

The medium-term programme includes investment measures aiming at

- Rehabilitation of the connected sewerage networks in order to reduce the infiltration and to eliminate other major deficiencies, which will ensure efficient WWTP operation.
- Treating the wastewater coming from Saint Constantine Holiday Resort

The estimated costs for the medium-term programme – Waste Water, amount to EUR 3,673,600 and include the following investment components:

- Reconstruction and rehabilitation of the existing sewerage collectors
- Reconstruction and rehabilitation of the sewerage collectors featuring high infiltration
- Construction of overflow manholes
- Construction of a WWTP in Saint Constantine (type of treatment to be chosen between SBR WWTP and BioDisk WWTP)

The following results will be achieved by carrying out the envisaged activities:

- Reducing the risk of discharge of waste water into rivers and other water bodies without any treatment.
- Improving the level of WSS services to the population and the environmental condition of the settlements;
- Reducing the infiltration, permanent mode of WWTP operation, reducing the operating costs for treatment of over-diluted waste water;
- Protecting the networks from overloading, reducing the risk of flooding, soil and groundwater pollution;
- Improving the capacity of the sewerage network;
- Terminating the discharge of waste water into soils, rivers and other water bodies without any treatment.

A summary of the medium-term investment costs for wastewater is presented in the table below.

*Table 6-8 Medium-term Investments for Wastewater*

| Category of work | WWTP | Mains collectors | Sewerage network | WW Pumping station | Miscellaneous | Total WW Medium term construction costs |
|---|---|---|---|---|---|---|
| Code | WW_1 | WW_2 | WW_3_1 | WW_3_2 | WW_4 | M-T |
| ***Total per category*** | **1,800,000** | **2,025,200** | **148,400** | **0** | **0** | **3,973,600** |
| Peshtera | 0 | 2,025,200 | 148,400 | 0 | 0 | 2,173,600 |
| Saint Constantine | 1,800,000 | 0 | 0 | 0 | 0 | 1,800,000 |

### 6.3.1.3. Overall Medium-term Investment Costs

A summary of the short-term investment costs, at the level of the WSSC, for water supply and wastewater is presented below. The table includes the costs for all investment measures identified for the medium-term investment phase (irrespective of the priorities). The overall medium-term investment costs amount to about € 9.6 million.

*Table 6-9 Overall medium-term investments for water supply*

| Code | Category of work | Total Cost |
|---|---|---|
| WS_1 | Water abstraction | 15,000 € |
| WS_2 | DWTP | 36,000 € |
| WS_3 | Water mains | 1,843,100 € |
| WS_4_1 | Distribution network | 1,822,100 € |
| WS_4_2 | Reservoirs and tanks | 78,500 € |
| WS_4_3 | Pumping stations | - € |
| WS_5 | Miscellaneous | 67,600 € |
| **WS Construction Cost** | | **3,862,300 €** |

| | |
|---|---|
| Feasibility studies | 1% |
| Design | 4% |
| Construction supervision | 5% |
| Project management | 3% |
| **Studies and supervision cost** | **502,100 €** |

| | |
|---|---|
| Contingencies | 10% |
| **Contingency cost** | **386,200 €** |

| | |
|---|---|
| **Total investment costs** | **4,750,600 €** |

*Table 6-10 Overall medium-term investments for wastewater*

| Code | Category of Work | Total Cost |
|---|---|---|
| WW_1 | WWTP | 1,800,000 € |
| WW_2 | Main collectors | 2,025,200 € |
| WW_3_1 | Sewerage network | 148,400 € |
| WW_3_2 | WW Pumping station | - € |
| WW_4 | Miscellaneous | - € |
| **WW construction cost** | | **3,973,600 €** |

| | |
|---|---|
| Feasibility studies | 1% |
| Design | 4% |
| Construction supervision | 5% |
| Project management | 3% |
| **Studies and supervision cost** | **516,600 €** |

| | |
|---|---|
| Contingencies | 10% |
| **Contingency cost** | **397,400 €** |

| | |
|---|---|
| **Total investment costs** | **4,887,600 €** |

### 6.3.2. PRIORITIZED MEDIUM-TERM INVESTMENT PROGRAMME

The table below shows the list of all identified investment components once prioritized according to the Consultant's methodology (see appendix 4-7). The investment costs for each component, the population in the respective Water Supply Zone (or Population Equivalent for wastewater components), the cost per inhabitant (or equivalent inhabitant) as well as the expected outcome of the measures are presented in the table. The table reveals that the components cover all measures necessary to achieve compliance with EU and national legislation as well as measures for efficiency improvement.

*Table 6-11 Medium Term Investment Program*

| Ranking | Number of Investment on the maps | Category (WS/WW) | Name of WS zone / Agglomeration | Component Description | Investment Costs | Population concerned* | Cost per inhabitant / equivalent inhabitant | General outcome | Points ** |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | WW | Peshtera | Reconstruction of the main sewer collectors, part of the adjacent network | 2,173,600 | 16,746 | 129.8 | Reducing the infiltration and improving the network capacity. | 64 |
| 2 | 2 | WS | Peshtera | Rehabilitation of the catchments – 2 pcs. | 15,000 | 16,746 | 0.9 | Improving the safety of water supply and quality and quantity of supplied water | 63 |
| 3 | 2 | WW | Saint Constantine | Construction of a WWTP | 1,800,000 | 1,620 | 1,111.1 | Treating wastewater and reducing environmental pollution | 59 |
| 4 | 1 | WS | Peshtera<br>Saint Constantine | Construction of separate facilities for treatment of the flushing water from WWTP – 3 pcs. | 36,000 | 18,366 | 2.0 | Preventing the pollution of surrounding environment and surface and ground water | 42 |
| 5 | 4 | WS | Peshtera | Rehabilitation of the distribution network – 11.033 km | 1,867,427 | 16,746 | 111.5 | Reducing the failures and water losses. Ensuring uninterrupted water supply. | 41 |
| 6 | 5 | WS | Peshtera | Rehabilitation of the pressure reservoirs – 4 pcs. | 78,460 | 16,746 | 4.7 | Improving the safety of water supply and fire safety. | 32 |
| 7 | 3 | WS | Peshtera | Rehabilitation of the feeding water mains – 11.57 km | 1,865,410 | 16,746 | 111.4 | Improving the safety of water supply. Reducing the failures and water losses. | 32 |

**Population for Water Supply components and Population Equivalent (P.E.) for Waste Water components in the year 2011 according to data of NSI.*

*** According to the Consultant's methodology (see appendix 4-7*

### 6.3.3. FINANCIAL AND ECONOMIC CONCLUSIONS

Similar to the short-term investment program, the mid-term investment program is also socially affordable for all population groups, including the first three devile groups, using a threshold of 4% of their average income.

The tariffs calculated include 100% of the depreciation. The depreciation of the short-term investment program is added up to the depreciation of the medium-term investment program.

As a result of the new costs, the price of water services increases during the period by about 10% and reaches a level of BGN 2.76 /$m^3$ (EUR 1.48 /$m^3$),

In view of these results, we can again make the conclusion that no special measures are needed to be taken by the municipality or the operator in connection with the introduction of the new tariffs systems. There is no need to introduce any special conditions for support of the poor and vulnerable population segments.

## 6.4. LONG-TERM INVESTMENT PROGRAMME

### 6.4.1. INVESTMENT COSTS

The investment costs presented in the tables below are net costs excluding VAT, constant price base 2011 in Euro.

#### *6.4.1.1. Water supply*

The long-term programme includes investment measures aiming at:

- Rehabilitation and extension of water supply systems ensuring sustainability – infrastructure rehabilitation and adaptation.
- Increasing the efficiency – reducing the non-revenue water (water losses), energy efficiency, etc.;

The estimated costs for the medium-term programme – Water Supply, amount to EUR 4,060,400 and include the following investment components:

- Rehabilitation of some of the catchments in Peshtera, Radilovo and Kapitan Dimitrievo
- Reconstruction of feeding water transmission mains – 42% of the external water pipes of all settlements in Peshtera Municipality;
- Replacement of pumps and equipment of PS “Sinia Kaynak”, town of Peshtera;
- Rehabilitation of the distribution network - 24.3% of the network of the town of Peshtera (replacement of asbestos cement and manesman pipes);
- Introduction of SCADA system for management and control.

The following results will be achieved by carrying out the envisaged activities:

- Improving the safety of water supply to the settlements and keeping the quality and quantity of supplied water;
- Reducing the losses of water along the external water mains – up to 2 to 3%.
- Optimizing the operation of the pumps in PS "Sinia Kaynak", increasing system energy efficiency and reducing electricity costs for this pumping station;
- Reducing water losses in the distribution network of the town of Peshtera up to 25% of water supplied to the network;
- New management and control system.

A summary of the long-term investment costs for water supply is presented in the table below.

*Table 6-12 Long-term investments for water supply*

| Category of work | Water abstraction | DWTP | External Water mains | Distribution networks | Reservoirs and tanks | Pumping stations | Miscellaneous | Total WS Long term construction costs |
|---|---|---|---|---|---|---|---|---|
| Code | WS_1 | WS_2 | WS_3 | WS_4_1 | WS_4_2 | WS_4_3 | WS_5 | L-T |
| ***Construction cost per category*** | **37,600** | **0** | **2,078,100** | **1,770,900** | **0** | **29,900** | **143,900** | **4,060,400** |
| Peshtera | 22,200 | 0 | 860,900 | 1,770,900 | 0 | 29,900 | 132,300 | 2,816,200 |
| Radilovo | 10,600 | 0 | 1,179,700 | 0 | 0 | 0 | 9,900 | 1,200,200 |
| Kapitan Dimitrievo | 4,800 | 0 | 37,400 | 0 | 0 | 0 | 1,800 | 44,000 |

### 6.4.1.2. Wastewater

The long-term programme includes investment measures aiming at:

- Rehabilitation of connected sewerage networks in order to reduce infiltration and to eliminate other major deficiencies, which will lead to efficient WWTP operation.
- Restoration of the electrical and mechanical equipment of WWTP Peshtera.

The estimated costs for the long-term programme – Wastewater, amount to EUR 12,030,500 and include the following investment components:

- Reconstruction and rehabilitation of the existing sewerage networks;
- Reconstruction and rehabilitation of the existing sewer collectors;

The following results will be achieved by carrying out the envisaged activities:

- Preventing the pollution of groundwater and minimizing the risk to human health. Reducing the risk of discharging wastewater without being treated into rivers and other water bodies.

- Improving the level of WSS services to the population and the environmental condition of the settlements.
- Reducing the infiltration, permanent mode of WWTP operation, reducing the operating costs for treatment of over-diluted waste water;

A summary of the long-term investment costs for wastewater is presented in the table below.

*Table 6-13 Long-Term Investments for Wastewater*

| Category of work | WWTP | Mains collectors | Sewerage network | WW Pumping station | Miscellaneous | Total WW Long-term construction costs |
|---|---|---|---|---|---|---|
| Code | WW_1 | WW_2 | WW_3_1 | WW_3_2 | WW_4 | L-T |
| ***Construction cost per category*** | **942,000** | **0** | **11,088,500** | **0** | **0** | **12,030,500** |
| Peshtera | 942,000 | 0 | 11,088,500 | 0 | 0 | 12,030,500 |

### 6.4.1.3. Overall long-term investment costs

A summary of the long-term investment costs, at the level of the WSSC, for water supply and sewerage is presented below. The table includes the costs for all investment measures identified for the long-term investment phase (irrespective of the priorities). The overall long-term investment costs amount to about EUR 21 million.

*Table 6-14 Overall long-term investments for water supply*

| Code | Category of work | Total Cost |
|---|---|---|
| WS_1 | Water abstraction | 37,600 € |
| WS_2 | DWTP | - € |
| WS_3 | Water mains | 2,078,100 € |
| WS_4_1 | Distribution network | 1,770,900 € |
| WS_4_2 | Reservoirs and tanks | - € |
| WS_4_3 | Pumping stations | 29,900 € |
| WS_5 | Miscellaneous | 143,900 € |
| **WS system Construction Cost** | | **4,060,400 €** |

| | |
|---|---|
| Feasibility studies | 1% |
| Design | 4% |
| Construction supervision | 5% |
| Project management | 3% |
| **Studies and supervision cost** | **527,000 €** |

| | |
|---|---|
| Contingencies | 10% |
| **Contingency cost** | **406,000 €** |

| | |
|---|---|
| **Total investment cost** | **4,994,300 €** |

*Table 6-15 Overall long-term investments for wastewater*

| Code | Category of work | Total cost |
|---|---|---|
| WW_1 | WWTP | 942,000 € |
| WW_2 | Main collectors | - € |
| WW_3_1 | Sewerage network | 11,088,500 € |
| WW_3_2 | WW Pumping station | - € |
| WW_4 | Miscellaneous | - € |
| **WW Construction Cost** | | **12,030,500 €** |

| | |
|---|---|
| Feasibility studies | 1% |
| Design | 4% |
| Construction supervision | 5% |
| Project management | 3% |
| **Studies and supervision cost** | **1,564,000 €** |

| | |
|---|---|
| Contingencies | 10% |
| **Contingency cost** | **1,203,100 €** |

| | |
|---|---|
| **Total investment cost** | **14,797,600 €** |

### 6.4.2. LONG-TERM INVESTMENT PROGRAMME

The table below shows a list of all identified investment components. They are grouped on the basis of the investment measures. Further, the table indicates the investment costs for each investment measure, the population in the respective Water Supply Zone (or Population Equivalent for wastewater components) and the expected impact of the investment. Reference is made to Chapter 4.1.4. “General Methodology for Phasing and Prioritization”. The table reveals that the components cover all measures necessary to achieve compliance with EU and national legislation as well as measures for efficiency improvement.

*Table 6-16 Long-term investment program*

| Ranking | Number of Investment on the maps | Category (WS/WW) | Name of WS zone / Agglomeration | Component Description | Investment Costs | Population concerned* | Cost per inhabitant / equivalent inhabitant | General outcome | Points ** |
|---|---|---|---|---|---|---|---|---|---|
| 1 | 1 | WS | Peshtera, Radilovo, Kapitan Dimitrievo | Rehabilitation of catchments – 9 pcs. | 37,600 | 18,206 | 2.1 | Improving the safety of water supply and maintaining the quality and quantity of supplied water | 64 |
| 2 | 1 | WW | Peshtera | Reconstruction of secondary sewerage network | 11,088,000 | 16,746 | 662.1 | Reducing the infiltration and improving network conductivity | 60 |
| 3 | 2 | WW | Peshtera | WWTP – replacement of electrical and mechanical equipment | 942,000 | 16,746 | 56.3 | Improving the WWTP | 46 |
| 4 | 5 | WS | Peshtera | Rehabilitation of the distribution network – 11.423 km | 1,770,856 | 16,746 | 105.7 | Reducing the failures and water losses,<br>Ensuring uninterrupted water supply | 41 |
| 5 | 6 | WS | Peshtera | Rehabilitation of PS “Siniya Kaynak” | 29,850 | 16,746 | 1.8 | Optimizing the operation of pumps, increasing the energy efficiency and reducing electricity cost | 41 |
| 6 | 7 | WS | Peshtera, Radilovo, Kapitan Dimitrievo, Saint Constantine | Introduction of SCADA management and control system | 125,000 | 20,519 | 6.1 | Improving the safety of water supply,<br>Ability of immediate action in case of large failures in the water mains. | 34 |

| Ranking | Number of Investment on the maps | Category (WS/WW) | Name of WS zone / Agglomeration | Component Description | Investment Costs | Population concerned* | Cost per inhabitant / equivalent inhabitant | General outcome | Points ** |
|---|---|---|---|---|---|---|---|---|---|
| 7 | 2 | WS | Peshtera | Rehabilitation of external water transmission mains – 7.54 km | 868,154 | 16,746 | 51.8 | Improving the safety of water supply, Reducing the failures and water losses | 32 |
| 8 | 4 | WS | Kapitan Dimitrievo | Rehabilitation of external water transmission mains – 0.42 km | 39,198 | 768 | 51.0 | Improving the safety of water supply, Reducing the failures and water losses | 24 |
| 9 | 3 | WS | Radilovo | Rehabilitation of external water transmission mains – 14.08 km | 1,189,631 | 692 | 1,719.1 | Improving the safety of water supply, Reducing the failures and water losses | 16 |

**Population for Water Supply components and Population Equivalent (P.E.) for Waste Water components in the year 2011 according to data of NSI.*

*** According to the Consultant's methodology (see appendix 4-7)*

### 6.4.3. FINANCIAL AND ECONOMIC CONCLUSIONS

The results of the affordability analysis of the long-term investment program depend not only on the investments during this period, but also on the accumulated investments from the previous two programs. They show that in the case of setting a limit of 4% of the income of the poorest population, all investments during this period are socially affordable, including 100% of the depreciation in the tariffs of water services. Using the estimates made, the tariffs will reach a level of BGN 4.23 / m³ (EUR 2,16 / m³) at the end of period.

The proposed long-term as well as short- and medium-term investments are socially affordable for the population of the served territory.

No special measures are needed to be taken by the municipality to offset the social unaffordability of tariffs.

# 7. ENVIRONMENTAL ASSESSMENT

## 7.1. ENVIRONMENTAL ASSESSMENT PROCEDURE

Environmental Assessment (EA) of plans and programs is a preventative tool to evaluate the potential significant impacts on the environment, resulting from the implementation of plans and programmes at national, regional and local levels. The assessment is carried out simultaneously with their development, i.e. the approach aims to integrate processes. EA execution is fully consistent with statutory national procedures for preparation and approval of plans/programs and the authorities responsible for their endorsement should conform to EA statement.

EA gives a notion of the expected changes that will occur in the environment as a consequence of the performance of the investment intentions, set out in plans and programmes.

The goal is to provide a high level of environmental protection by determining the expected impact of the activities covered by the strategic planning.

The Environmental Assessment procedure is described in appendix 7-1.

## 7.2. ENVIRONMENTAL ASSESSMENT OF THE REGIONAL WATER AND WASTEWATER MASTER PLAN OF VKS EOOD PESHTERA DESIGNATED TERRITORY

For the present Regional Water and Wastewater Master Plan of designated territory of VKS EOOD Peshtera, information has been prepared for Evaluation of the need for Environmental Assessment in compliance with para. 2 of Art. 8 of the Ordinance on the terms, conditions and methods for carrying out EA of plans and programmes.

Chapter 0 exposes the outcomes of the Study conducted on the territory of VKS EOOD Peshtera within the framework of the Regional Water Supply and Sewerage Master Plans in the Central Region of Bulgaria.

Chapter 2 presents the environmental features of the area, which may be impacted by the implementation of the Regional Water Supply and Sewerage Master Plan.

Since the territory falls within the scope of the protected areas under Directive 92/43/EEC on the conservation of natural habitats and of wild fauna and flora and under Directive 79/409/EEC on the conservation of wild birds, the plan is subject to Compatibility Assessment (CA) procedure, pursuant to Art. 2, para. 2 of the Ordinance on the terms and conditions for carrying out compatibility assessment of plans, programmes, projects and investment proposals with the subject and objectives of conservation of protected areas (SG. No 73/2007) of EPA.

The contracting authority of the plan i.e. the Ministry of Regional Development and Public Works shall submit a written request to the competent authority for Evaluation of the need for EA. This request shall contain all data on the implementation of the plan and the investment programme, the stages that EA will undergo and the period for which the

programme will be prepared. The request shall be accompanied by possible impact of the plan on the environment (CA), characteristics of the affected area and the expected effects on the environment, map of the affected territory, plans and tables, etc.

Regional Water and Wastewater Master Plan of the designated territory of VKS EOOD Peshtera is an environmentally sound plan, which includes all investment measures necessary to solve the problems of the designated territory, related to ensuring:

- Needed water quantity of good quality for all purposes
- High quality of living space and environment
- Prevention of conditions causing health risk situations
- Conditions for sustainable development of water ecosystem and the biodiversity in it.

It is guaranteed that all necessary requirements, related to impacts on protected territories, protected sites and protected areas are observed (the proposed investment measures for wastewater treatment are positive for the conservation of protected areas).

Chapter 4 presents all strategic options for the development of the water supply and sewerage systems as well as the technical, economic and environmental criteria for the selected options, which are included in the investment programmes.

Chapter 6 contains a detailed description of the proposed short-term, medium-term and long-term investment programmes, including all investment measures, required for fulfilling the objectives, set out in the national water strategy and for achieving full compliance with the European and national legislation.

In the implementation of investment measures in short-term, medium-term and long-term plan, a system of measures will be applied for reducing to the rational minimum the negative impact on environment.

Taking into account the suggested measures, in the implementation of different sites, included in the investment programmes, it is not expected to have negative effects on the individual environmental components during construction, operation and closure. None of the protected territories, sites and areas is affected.

The following main goals will be achieved:

- Supplying good quality water for all purposes to the population in the area of the designated territory.
- Reducing drinking water losses in the system to 25%.
- Ensuring wastewater treatment consistent with the set requirements for water body protection, increasing self-cleaning capacity.
- Creating conditions for sustainable development of water ecosystem and biodiversity.
- Creating high living standard for the population in the area of the designated territory and preventing health risk.

The expected impacts of the implementation of Regional Water and Wastewater Master Plan of designated territory of VKS EOOD Peshtera have been summarized below.

For every investment intention envisaged in the Regional Master Plan the required EIA procedures and the CA (compatibility assessment) will be carried out during the preparation stage of the feasibility studies and all of the measures and conditions set in the respective Decisions of RIEW Pazardzhik will be complied with and enforced during its implementation.

The activities within boundaries of the protected areas will be carried out within the scope of the existing facilities, under rigorous control and in compliance with the regimes introduced by an order for their establishment and the Protected Areas Act.

The activities within the territory of Kupena Reserve will be carried out under rigorous control and in compliance with the following mandatory conditions:

- During the placement of the fences in the internal belt, which are intended for the establishment of an SPZ on the territory of the reserve, no construction activities should be implemented and the fences should consist of natural materials or plant species typical for the reserve.
- The repair activities on the existing catchment within the boundaries of the reserve are to be implemented within the scope of the existing facilities.
- A method, which will not damage or destroy any parts of the reserve's territory, should be used for the rehabilitation of the water mains within the boundaries of the reserve.

**Expected impacts on protected zones:**

Overall, the measures proposed for implementing modern infrastructure investment projects in short-term, medium-term and long-term plan on the designated territory are not expected to not exert any adverse effects on the subject and objectives of the protected zones of Natura 2000, the protected areas and sites.

**Expected impact of the water supply part of the Regional Master plan:**

In 2011, water supply is provided by groundwater resources (spring catchments and tube wells). Although there is no water quantity issue (only 5.7% of the available groundwater resources are abstracted, which is 34% of the quantity authorized by the water abstraction permit), the water supply systems are not efficient enough, the Non-revenue water representing 59% of the total water production. By implementing the Regional Master Plan measures, such as rehabilitation of equipment, the percentage of non-revenue water will decrease from 59% to 25% and the pressure on the water resource will decrease from 5.7% to 3.6%. More data about the previous calculations are presented in the table below.

*Table 7-1 Current (2011) and expected (2038) water supply systems performance parameters*

| Parameters | 2011 | 2038 |
|---|---|---|
| Percentage of population served (Population served) | 100% (20,519) | 100% (19,839) |

| Parameters | 2011 | 2038 |
|---|---|---|
| Available groundwater (m3/year) | 41,375,232 | 41,375,232* |
| Groundwater abstraction permit (m3/year) | 7,064,064 | 7,064,064* |
| Total Water Demand (including NRW, m3/year) | 2,377,964 | 1,492,248 |
| Percentage of the available water resources abstracted for water supply | 5.7% | 3.6% |
| Percentage of the permitted groundwater abstraction actually abstracted | 34% | 21% |
| Percentage of non-revenue water | 59% | 25% |

* Due to a lack of more accurate data for 2038, the volume of available groundwater and the groundwater abstraction permit are assessed to be steady between 2011 and 2038.

To ensure a safe disinfection and a reliable distribution of drinking water to the local population, old asbestos cement water pipes as well as the obsolete water treatment equipment will be rehabilitated or replaced during the implantation of this Regional Master Plan. The positive impact of these measures will be the guarantee to distribute quality compliant water and the reduction of water borne disease spreading risk.

As a first investment priority the Regional Master Plan includes appropriate measures to solve the problems with the drinking water quality in all of the settlements, where permanent and frequent deviations from the permissible levels are observed.

**Expected impact of the sewerage part of the Regional Master plan:**

In 2011, wastewater systems are either incomplete or in poor conditions for all settlements within the boundaries of VKS EOOD Peshtera. In fact, there is no wastewater treatment plant for any of the three settlements of the designated territory. Therefore, a high amount of wastewater is then discharged directly into the surrounding environment without any treatment, which leads to soil and water pollution as well as negative impacts on Human health and Biodiversity. Most of those issues will be addressed through on-going projects (construction of 2 WWTPs, reconstruction and rehabilitation of sewerage networks, see appendix 1-1) and after that, the Regional Master Plan measures will aim at reinforcing the outcomes expected from those on-going measures.

Further network reconstructions will be carried out to reduce infiltration on one hand, and to adjust the capacity of the network on the other. Additionally, stormwater overflows will be constructed to enable the wastewater systems to cope in case of intense rainfall. Finally, a WWTP will be constructed in the holiday resort of Saint Constantine. The positive impacts expected from those measures are:

- Flooding prevention in the urban areas
- Groundwater pollution prevention
- Reduction of untreated wastewater discharge in the environment in case of intense rainfall
- Reduction of operation and maintenance costs for the WWTPs

The Regional Master Plan objective is to collect and treat at least 90% of wastewater in 2038 either by collective or by autonomous sewerage systems. By implementing the on-going measures, 100% of the population will be connected to sewerage network and

92.7% of the $BOD_5$ produced will be treated. After the implementation of the Regional Master plan measures for the period 2011-2038, the percentage of the population connected to a sewerage network will be 100% and the 100% of the $BOD_5$ will be treated.

Besides, the percentage of infiltration will decrease from 47% to 20%.

More data about the previous calculations are presented in the table below

*Table 7-2 Current (2011) and expected (2016 and 2038) wastewater systems performance parameters*

| Parameters | 2011 | 2016 (After implementation of on-going measures) | 2038 |
|---|---|---|---|
| Sewerage network connection rate (population served) | 96% (19,738) | 100% (20,392) | 100% (19,839) |
| Percentage infiltration | 47% | 37% | 20% |
| Actual pollution load collected (PE60) | 21,640 | 22,448 | 22,223 |
| Potential pollution load generated (PE60) | 22,420 | 22,448 | 22,223 |
| Actual collected mass of BOD5 (ton BOD5/year) | 474 | 492 | 487 |
| Percentage of collected mass of BOD5 | 96.5% | 100% | 100% |
| Mass of BOD5 treated (ton BOD5/year) | 0 | 456 | 487 |
| Percentage of BOD5 treated | 0% | 92.7% | 100% |

Information has been prepared for the Assessment of the Need for Environmental Assessment of the Draft Regional Master Plan for water supply and sewerage of the designated territory of VKS EOOD-Peshtera, which corresponds to the level of detail of the plan and the programme and of the assessment methods. The information contains the following:

- Description of the main objectives of the plan and its connection with other plans and programmes;
- Current situation of the components and factors and their potential development without the implementation of the plan or programme;
- Environmental characteristics for the territories which can be significantly affected;
- Existing environmental problems identified at different levels, which are relevant to the plan, including those relating to any areas of a particular environmental importance;
- Objectives of environmental protection at national and international level, which are relevant to the plan and the way those objectives and all environmental considerations have been taken into account during the preparation of the plan;

- Potential significant effects on the environment, including the components and factors and connections between them and the measures envisaged to prevent, reduce and eliminate to a maximum degree the negative environmental consequences of the implementation of the plan or programme.

Pursuant to Decision N-EO 46/2013 of MoEW regarding the Regional Master Plan of VKS EOOD-Peshtera no environmental assessment is required in the implementation of a plan, which is not going to exert significant impact on the environment and human health. The conditions set in the Decision have been taken into account in the final Regional Master Plan. During the preparation stage of the feasibility studies prepared for the investment projects envisaged in the Regional Master Plan, their Contracting authorities will prepare a Plan with measures to prevent, reduce or eliminate the negative environmental impacts during the implementation of the projects and will coordinate it with RIEW – Pazardzhik.

# 8. PUBLIC CONSULTATIONS

## 8.1. DRAFT MASTER PLAN DELIVERY

The Draft Regional Water and Wastewater Master Plan of the designated territory of VKS EOOD – Peshtera was first submitted to the Ministry of Regional Development on: 8th May, 2013.

After review and assessment by PISA on 25th July 2013, it has been delivered to the Ministry of Regional Development for public consultation on 20th August 2013.

The associated Prerequisite report on Environmental Impact Assessment (EIA) was delivered to the Ministry of Regional Development for transmission to the Ministry of Environment and Water (MoEW) on 27th July 2013.

## 8.2. ASSESSMENTS AND COMMENTS

### 8.2.1. GENERAL

Beside the Public Consultations to be conducted within the framework of the involved District Development Council(s) and Water Association or Municipal Council for municipal Water and Sewage Service Company for Master Plan endorsement, several involved organization reviewed the draft Master Plan and addressed their comments for consideration.

It is to be noted that final position of the Ministry of Environment and Water on associated Environmental Impact Assessment is necessary for the decision of Water Association or Municipal Council to be officially applicable.

### 8.2.2. COMMENTS FROM PUBLIC AUTHORITIES

On behalf of the Ministry of Regional Development, the PISA consulting company addressed an Assessment note to VKS EOOD – Peshtera on 25th July 2013.

The Ministry of Public Health addressed general remarks on the Regional Master Plans by letter from the 2nd August 2013. This was answered by letter on 21st August 2013 for all the Master Plans to be produced on the central region of Bulgaria.

The East Aegean Water Basin Directorate expressed its position by letter on 27th September 2013: No objection on the Master Plan.

Comments by the Ministry of Environment and Water have not been sent.

The Ministry of Environment and Water expressed its position on EIA by letter EO46 dated 06th November 2013. The position is that no EIA needs to be completed on the territory of VKS EOOD – Peshtera.

## 8.3. PUBLIC CONSULTATIONS

### 8.3.1. DISTRICT DEVELOPMENT COUNCIL

The District Development Council deliberation about the Regional Water and Wastewater Master Plan of the designated territory of VKS EOOD – Peshtera took place on the 2nd October 2013.

The District Development Council coordinated the Master Plan.

### 8.3.2. MUNICIPAL COUNCIL OF PESHTERA MUNICIPALITY

The meeting with the Municipal Council about the Regional Water and Wastewater Master Plan of the designated territory of VKS EOOD – Peshtera took place in the town of Peshtera at the building of Peshtera Municipality on 25th October 2013.

The meeting gathered the members of the Municipal Council and the Project Team.

The Municipal Council agreed to coordinate the Master Plan.

### 8.3.3. OUTCOME OF PUBLIC CONSULTATIONS

The Regional Water and Wastewater Master Plan of the designated territory of VKS EOOD – Peshtera is agreed by the involved authorities.