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1. Introduction of drinking water systems in Bulgaria

Bulgaria joined the EU on January 1st, 2007. In the pre-accession period the country harmonized its legislation with EC directives and started strictly to implement Water Framework Directive (WFD) in respect to the main objectives of environment protection, ensuring drinking water supply and other uses, applying environmental standards and regulations. Until 2008, the economic development of the country was marked by sustainable growth, increased investment, high employment, and real income increase. However, towards the end of 2008, the global financial crisis took a heavy toll on Bulgarian economy. In 2009, Gross Domestic Product (GDP) fell by 5.5 percent. A slow economic recovery has lately started, driven mainly by export. In 2011 GDP increased by 1.7 percent and approximately 1 percent in 2012. During the period 2014–2020, GDP is expected to grow by an average of 3.4 percent in real terms and the average increase of the Bulgarian economy will follow the traits of the EU. Nevertheless, there are big differences between Bulgarian regions. The Southwest planning region has the best economic indicators, while the Northwest and North-central are the two poorest planning regions (NUTS2) in Europe.

Thus, careful determination of the population extent agglomerations is strongly necessary in order to reduce the risk of overinvestment in wastewater infrastructure. The population and economic activity in agglomerations greater than 2,000 person equivalents (PE) determine the wastewater infrastructure investment needs. As of the end of 2011, 75 percent (about 5.5 million people) of the population of Bulgaria lived in agglomerations greater than 2,000 PE. Based on estimated trends, the future economic activity and population in these agglomerations will decrease. While the legal requirement to provide wastewater collection and treatment to these agglomerations is clear, the Water Supply & Sanitation (WSS) strategy recommends specific measures to reduce the risk of overinvestment.

Funds were allocated for the creation, development, growth and replacement of its sewer, water supply and water/wastewater treatment amenities (Fig. 1). The water resources used by

sectors with special attention on household's consumption as well as the measures needed for overcoming of water shortages and distribution of drinking water with good quality are of special attention of the government. A health risk impact of residual aluminum in drinking water and alternative investigations for minimizing its coagulants in it is discussed.

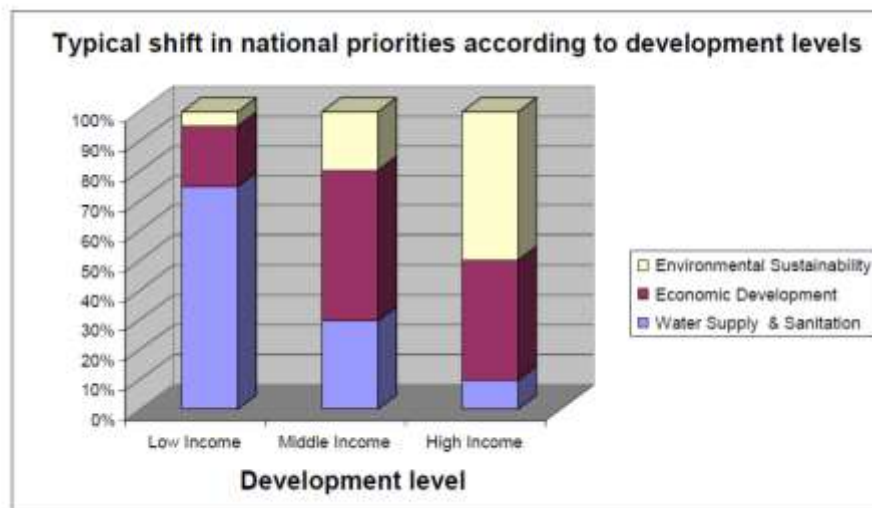


Fig. 1. Development of WSS sector

Recently, the Bulgarian government allows besides primary state-owned water sector, a private participation to take place due to recently enacted legislative changes. The challenges, which the country faces due to the fact that Bulgaria has one of the poorest records of water resources availability, compared with other EU countries. The water supply infrastructure is relatively well developed and the majority of the population (98.4%) possesses access to running water, but the sewage network and the urban treatment plants are not enough. Approximately, 95% of the towns have a sewer network but only 3.2% of the villages have access to the sewerage system.

In addition, a lot of already working wastewater treatment plants (WWTPs) do not meet the minimum standards under EU directives. The National Program for Priority Construction of Urban Waste Water Treatment Plants and the Implementation Program of Directive 91/271/EEC stipulate that Bulgaria is obliged to build more than 400 WWTPs for populated areas of above 2000 PE by 2014. The deadline will be extended as a result of program delays.

Funding for the water sector will be provided through EU post-accession instruments. Priority will be provided to construction of WWTP and sewerage networks of areas of more than

10,000 PE. Currently, the national budget is very limited for developing water infrastructure projects. Water losses remain a major problem, and vary between 40% - 79% of supply, with an average of 59.5%. These data indicate that Bulgaria need to purchase devices and appliances for

leakage detection, reconstruction of the distribution water supply network and water supply system connections to diminish of water losses.

Notwithstanding the high level of water losses in Bulgaria, the water quality is relatively good due to the use of disinfection for all drinking water in the country.

According to the Ministry of Environment and Water, there is a tendency toward growing water consumption, which will lead to water deficits in the near future. There is an average of 2,400 m³ of water resources per capita annually.

Some of the main polluters of surface water include domestic water from the urban sewerage system in the big settlements and industrial wastewater, which is discharged untreated into the rivers. Nitrates are the basic pollutants of underground water in all river basins.

According to the national strategies for the development of the water sector, there is a need to construct 120 drinking water treatment plants. The data has shown that 18 from Bulgaria's 28 districts have low standard drinking water, according to an analysis of the country's water resources demanded by the Ministry of Environment and Water. Since Bulgaria's accession to the EU in 2007, prohibitions have been issued for four drinking water sources (Merichleri, Tatarevo and Poibrene), according to data of the Health Ministry. Water quality is worst in the southern district of Pazardzhik, where the 5% norm for deviations from the standard recommended by the World Health Organization (WHO) has been exceeded over two-fold, according to reports of mass-circulation 24 hours daily.

1.1. Water Resources in Bulgaria

The important issues are River Basin Management Plans. They provide key linkages between the drinking water sector and the larger one, including measures giving opportunity for good water quality in surface and groundwater. In relation to the drinking water sector, the emphasis is on the construction of wastewater collection and wastewater treatment plants following the Bulgarian and EU legislation. These river basin management plans integrate efficiency and cost-recovery measures to decrease water losses in the water supply networks, increase water metering, and introduce volumetric pricing. This drinking water strategy is consistent with the existing river basin management plans.

Currently the data for Bulgaria show that there is a low water stress. The projected total domestic water consumption of 3,340 million cubic meters in 2035 (excluding hydro-energy and nuclear power plants) is much less than the multi-year average internal water resource of 18,547 million

cubic meters (excluding the Danube River) for the period 1974–2008. Prior to 1990, Bulgaria was considered to be close to the threshold of a water-scarce country. Since then, abstractions have fallen drastically for both agricultural and industrial purposes, and today Bulgaria overall is non-stressed. Nevertheless, there are some areas in Bulgaria where water scarcity exists, especially during dry summers. The most vulnerable areas with rainfall below 300 millimeters are: Vidin to Lom and Montana, Pavlikeni, and Sofia in the Danube region; Shabla and Varna in the Black Sea region; Sliven, Plovdiv, Sadovo, Pazardzhik, and Panagyurishte in the East Aegean Sea region; and Blagoevgrad, Sandanski, and Kyustendil in the West Aegean Sea region. These peculiarities are due to the climate change in Southeastern Europe. Climate changes devoted scenarios were prescribed for the period up to 2035. They concern the National Strategy for Management and Development of the Water Sector for the changes in precipitation and water availability. The average temperature is expected to increase by 1.8 to 2.1°C with a particular decrease in the number of frost days. Precipitation and run-off will decrease only slightly, while the intensity and variability of rainfall and the intervals between wet days will increase, and heat waves will become more frequent. As a result, the risk of flooding will increase, as well as the risk of seasonal water scarcity in selected areas.

In response to these climate risks, this water supply strategy needs flexibility. It includes connection of the currently isolated water supplies, as well as a review of the construction standards for buildings and for water supply system.

1.2. Bulgarian National Water Strategy

The National Strategy and Action Plan for Water Sector Management and Development were approved by the Parliament in November, 2012. They outline the overall vision for the water sector, including water resources management, hydropower, flood protection, irrigation, and water supply and sanitation. This defines a more active role of the public authorities in developing and managing the sector. It also specifies the responsibilities of the various institutions in the preparation and implementation of the sub-sector strategies and plans.

The Water Strategy objectives are as follows:

Objective 1. Guaranteed water supply to the population and business under climate change conditions leading to drought;

Objective 2. Protecting and improving the status of surface and ground water;

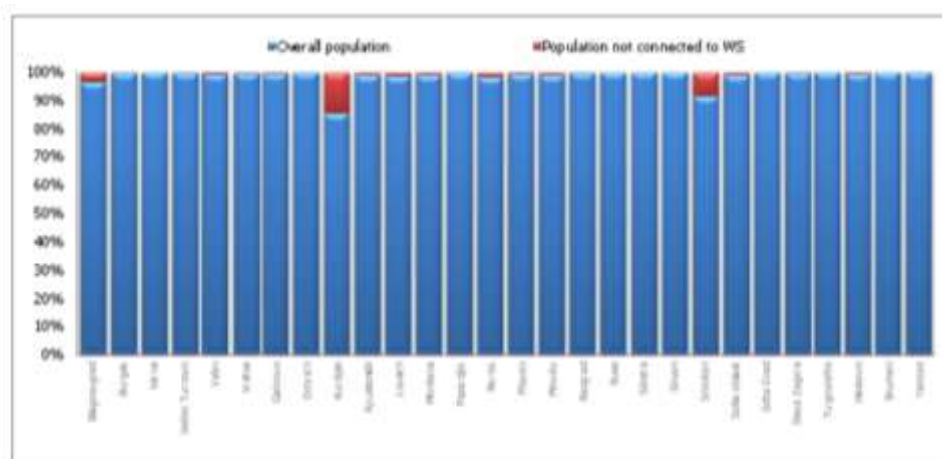
Objective 3. Improving the efficiency of integrated management of the water as an economic resource;

Objective 4. Decreasing the risk of and damage from floods.

This document defines the responsibility of the Ministry of Regional Development (MRD) in elaboration and implementation of a Strategy for Development and Management of Water Supply and Sanitation Sector as stipulated in the Water Act. The present WSS strategy is consistent with the National Strategy and Action Plan for Water Sector Management and Development.

1.3. The Water Supply & Sanitation (WSS) sector

WSS service in Bulgaria was covered by 28 regional utilities or water supply and sanitation companies (WSSC) and one municipal WSSC (Sofia) until 1989 year. The number of these companies correlated to the country's subdivision into 28 administrative districts (Fig. 2). All WSSCs were state-owned, with the exception of the Sofia WSSC which belonged to the municipality.



Source: Analysis prepared by the World Bank for the development of the Strategy.

Fig. 2. Water supply in Bulgaria by district

In 1990s, a general economic restructuring and decentralization took place and some of the water companies were split; they were transformed into jointly-owned by the state and by municipalities companies. This period is characterized with significant increase in the number of

WSSCs. Some companies remained 100 percent state-owned, while others (usually the smaller ones serving one municipality) were wholly transferred to the municipalities. This resulted in inconsistencies of the ownership of regional water storage and transmission infrastructure.

The WSS services in the capital Sofia were improved through creation of the “Sofiyska Voda” concession in 1999. Since 2010, it is jointly owned by Veolia Water and Sofia municipality and in this way the water supply and sanitation fixed assets are public municipal property.

Meanwhile, joint water and energy regulator (State Energy and Water Regulatory Commission–SEWRC) was established in 2005. Then, it was planned all WSSCs to submit and implement approved business plans as a prerequisite to continue their operation. The Water and Sanitation Services Regulation Act is the basis for the regulation of WSSCs and at this time 66 WSSCs provide necessary services to customers. In total, 65 companies have submitted business plans for the current period (2009–2013). In fact the WSS sector in Bulgaria is complex in respect to asset ownership and management (Fig. 3). The latest changes in the Water Act concerning the WSS sector (in force as of September 24th, 2009) threat these issues. They mandated the transfer of management rights from the state and the municipalities to the Water Supply and Sanitation Associations (WSSAs). These associations are responsible for contracting public, public–private or private water operators under the Water or Concession Acts. The beginning of this activity is a creation of a fixed assets inventory currently operated by the existing WSSCs. In November, 2013 amendments to the Water Act were adopted marking the beginning of transfer in ownership of WSS infrastructure.

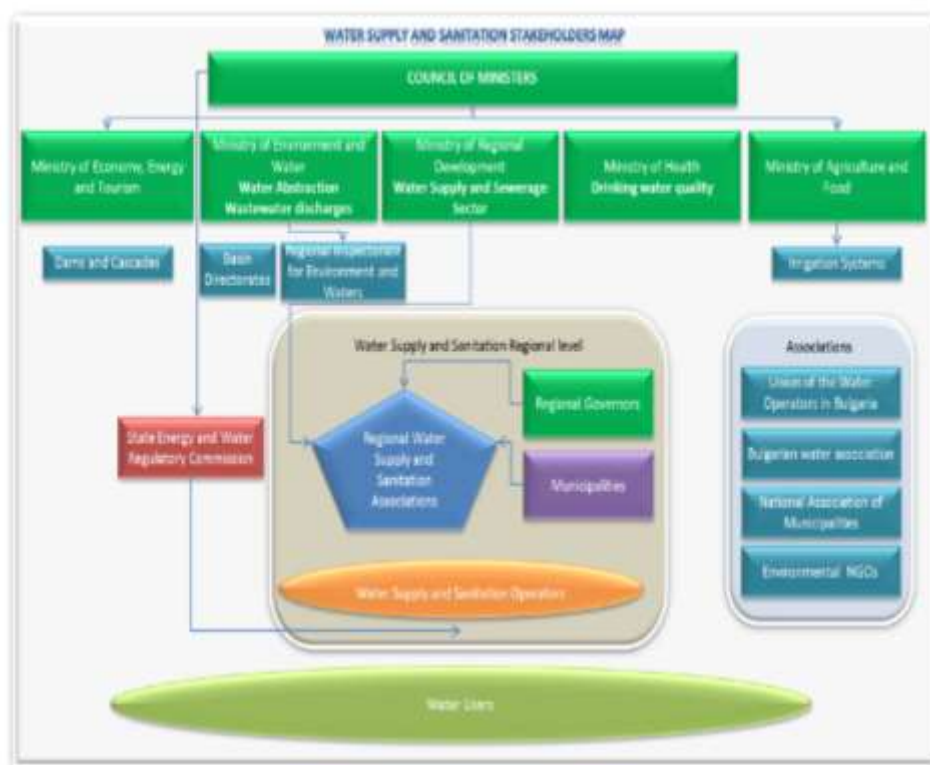


Fig. 3. Key WSS sector stakeholders in Bulgaria (“Strategy for Development and Management of the Water Supply and Sanitation Sector in the Republic of Bulgaria 2014 – 2023”, Ministry of Regional Development)

According to the proposed amendments to the Water Act, there should be one WSSA per administrative region and one water supply and sanitation company (WSSC) per WSSA. Such consolidation would have followed if the Parliament had amended the Water Act as proposed by the government in 2012. Without these amendments, consolidation must be voluntary.

1.4. EU and National Legislation, Regulatory Issues

1.4.1. European legislation

As a member state of the European Union and as part of its Accession Treaty, Bulgaria has committed to certain obligations regarding the EU legislation and reaching compliance within the national one. The process of harmonization is already performed and all European directives concerning water and wastewater are fully implemented into national legislation (Fig. 4). Bulgaria is obliged to ensure that wastewater is collected and the necessary treatment is

performed, before their discharge into water bodies, by December 31th, 2010 for all agglomerations with over 10,000 PE, and by December 31th, 2014 for all agglomerations with 2,000 to 10,000 PE.



Fig. 4. Treatment of drinking water in Bulgaria

The key issues concerning water supply and sanitation management and legal regulation are not addressed by the EU legislation and are an object of the national legislation. They concern the types and management models of the water supply operators, the methods and instruments to regulate water service tariffs and the ownership of these systems and facilities.

1.4.2.National legislation

The Water Act (WA) is the principal part of Bulgarian general legal framework, which regulates the ownership and management of water as a national natural resource as well as the ownership of water development systems and facilities. A comprehensive system of secondary legislation has been developed on the basis of the WA to ensure its implementation. The WA also regulates the management, planning, and construction of water and sewerage systems. It also governs provision of water supply and sewerage services, as well as registration of Water Supply and Sewerage Associations (WSSAs) and Water Supply and Sewerage Companies (WSSCs).

The WA regulates the right of the state, municipalities, and natural persons to possess waters, water bodies, and water development systems and facilities. The basic principle in the act is the

type of the property of that water-supply and sewerage systems serving public needs and it can be a state, public, or municipal public one. In this respect a clear distinction is made between state and municipal ownership, based on the principle that systems operating in the territory of only one municipality and meeting its own needs is a public municipal property. Water and sewerage systems, or parts, servicing more than one municipality constitute state public property. Exceptions are only provided for water and sewerage systems financed and built with EU funds.

In 2009, the WA was amended to define principles for management, planning, and development of WSS services and systems as follows:

- Provisional division of the country into “*designated territories*” and definition of the process for designating and amending their boundaries;
- Establishment of WSSAs with the role of a union of the owners of the WSS systems;
- Assignment of responsibilities for planning and management of the WSS systems, rendering of water and sewerage services, and transferring the management of assets to the WSSAs;
- Assignment to the WSSAs of the right to contract water operators that will own private assets (e.g. offices, equipment, etc.), operate public assets, and provide services (through concession or direct award contract between the utility and the WSSA);
- Preparation of Regional Master Plans as the main tool for planning the development of the WSS systems.

1.5.Regulation of the Water Supply & Sanitation Sector

The said objective of the mentioned above Water Act is to establish an integrated water resources management in community interest and protection of public health. The main goal is provision of sufficient quantity of surface and ground water of good quality for sustainable, balanced and reasonable water uses (*Ministry of Environment and Water, 2008*). A Regulation No. 12 of 18 June 2002 on the requirements for quality and safety of surface water intended for drinking purposes and household supply (*Prom. SG 63/28.06.2002*) corresponds to the Directive 75/440/EEC. It threatens the quality requirements of surface water intended for the abstraction of drinking water, amended by Directive 79/869/EEC. The directive listed the methods of measurement and frequencies of sampling and analysis of this type of water (*Ministry of Environment and Water, 2008*). The Regulation No. 12 concerns all surface water resources designed for human consumption and supplied by distribution networks for public use. In

accordance to this Regulation surface water is divided in three categories (A1, A2 and A3), corresponding to the standard methods of treatment as follows:

- **Category A1:** simple physical treatment and disinfection, e.g. rapid filtration and disinfection,
- **Category A2:** normal physical treatment, chemical treatment and disinfection, e.g. pre-chlorination, coagulation, flocculation, decantation, filtration, disinfection (final chlorination),
- **Category A3:** intensive physical and chemical treatment, extended treatment and disinfection, e.g. chlorination to break-point, coagulation, flocculation, decantation, filtration, adsorption (activated carbon), disinfection (ozone, final chlorination).

The companies working in water supply & sewerage sector have to construct the relevant utilities in order to be able to apply the appropriate methods of surface water treatment in accordance to Regulation No. 12 by 1 January, 2007. Regulation No. 9 of 16 March, 2001 on the quality of water intended for human consumption (*Prom. SG 30/28.03.2001*) is harmonized with Directive 98/83/EC (*Ministry of Environment and Water, 2008*). The objective of this Regulation is to protect human health from the adverse effects of any contamination of drinking water through the introduction and provision of requirements to water quality and safety. Because of the on-going processes in the WSS sector the government is considering to extend the current regulatory period by two years. In this case the next regulatory period would cover 2016 – 2020. The Regional Master Plans (RMP) are approved by MRD by the end of 2013; the WSS assets change of ownership process should be completed by mid-2015 and WSSAs should select and sign up with WSSC by the end of 2015. This would be consistent with the approval of WSSC Business Plans by SEWRC for the next regulatory period covering 2016 – 2020.

The strategy includes specific objectives that are relevant to achieve a compliant WSS sector that remains financially, technically and environmentally viable:

- Coverage of piped water supply remains at 99 percent of the population;
- Seasonal water rationing is experienced by less than 2 percent of the population;
- WSSCs are technically capable of meeting future WSS service requirements;
- Financing is available for WSS system renewal and replacement;
- Required operational expenditures can be fully financed by revenues for all WSSCs;

- Efficient use of natural resources is in line with Bulgarian and EU policies;
- Established sustainable technologies mechanisms in the design, construction and operation of WSS systems and facilities.

1.6. Public acceptance is key to the WSS strategy

Public understanding of the challenges to the sector may be crucial to the implementation of the WSS Strategy. Recent events in the energy sector of Bulgaria have clearly illustrated that the public acceptance of tariffs, awareness of services provided and understanding of the service-tariffs correlation are all of vital importance for the implementation of a rational sector strategy. A survey carried out in support of the National Strategy for Management and Development of the Water Sector finds that the population feels a need to be better informed about the sector. The same survey indicates that the public often perceive the water supplied to be of poor quality, whereas tap-water quality monitoring indicates that Bulgaria has above-average water quality compared to European peers, especially in large water supply zones.

Improved customer satisfaction requires a large number of initiatives. As already noted, low customer satisfaction is partly linked to objective problems, such as turbidity and frequent breakages, that will be resolved as part of the implementation of the water sector strategy, and partly linked to issues, such as poor internal plumbing, that are under the control of the customers or real estate managers. The strategy includes a number of initiatives that will directly and positively influence the service experienced by customers.

The strategy includes a communication plan to inform users about the WSS sector strategy and action plan. Traditionally, WSSCs have done a poor job of explaining what they are responsible for and the quality of the service they deliver. This could, and should, be addressed by WSSCs Strategy Implementation and Action Plan

The basic options for realization of the WSS Sector strategy are: (i) A Big Bang in the form of a new and comprehensive Water Supply and Sanitation Act or (ii) a gradual approach. The Big Bang approach would combine many of the proposed policy actions into one new Water Supply and Sanitation Act. This new Water Supply and Sanitation Act would combine the relevant parts of the current Water Act and the current Regulation of the Water Supply and Sanitation Services Act.

A new and comprehensive WSS Act is a long-term solution. However, a comprehensive act will require several years: first for detailed preparation of the text (plus necessary revisions in other laws), for stakeholders to reach consensus, and for Parliament to discuss and approve it.

Water sector reform requires immediate action and a gradual approach. In particular, the compliance and affordability objectives require immediate action. The strategy assumes that the amendments to the Water Act will be implemented in shortest of terms. At the same time, the responsible ministries and institutions will start to act on a wide range of changes in policies and practice.

1.7. Future Trends and Goals

Some of the challenges in the water sector have been delays in the design and construction of the sewerage networks and WWTPs, lack of sufficient data for the design phase of the projects, financing of non-priority projects, partial financing of the projects and non-existing funding for drinking water projects in 2010.

The Ministry of Environment and Water - currently managing the funds under the EU Operational Program on Environment - is trying to move forward with a number of priority projects for Bulgaria. The European Union has granted trust to the current government, which has been in power for one year and the Bulgarian Ministry of Environment and Water has already spent about 350 million euros of the EU funds for WWTP/sewerage networks projects.

The forthcoming private participation in the water utility companies will be innovative for the sector as well. Despite pressing infrastructure challenges, that are common to other Eastern European countries, the future looks bright. Positive forecasts suggest that further funding will be available for drinking water projects in the coming years. The following measures are intended:

1. The pollution level of the ground, surface and coastal waters will be monitored, pollution level will be reduced to minimum, and further pollution will be prevented through:
 - establishment of a monitoring network for national water sources regarding ground, surface and coastal waters;
 - informing the public about water pollution.

2. Sewage systems and treatment plants will be installed according to the By-law on Urban Waste Water Treatment.
3. The pollution sourced by agricultural nitrate in the water and the soil will be monitored, minimized and prevented.
4. Sustainable utilization from natural water sources and water ecosystems will be ensured.
5. Drinking water will be provided to be reached by more people in sanitary conditions.
6. Pollution arising from the discharge of dangerous substances in waters will be determined, prevented and gradually reduced.
7. Bathing waters and the waters utilized for recreational purposes will be prevented to be polluted by any types of pollutants - mainly by microbiological pollutants - and the pollution on these areas will be monitored, controlled and reported.
8. Treatment and controlled usage in the soil and final disposal of the sludge from treatment plants through appropriate technologies will be provided.

1.8. Action plan for implementation

An action plan for implementation of the measures identified by this WSS strategy, as a condition to achieve the strategic objectives, addresses the following issues:

- what is required for implementation (for example: a new law, ordinance or changed practice);
- who is responsible for the measure; and
- when should (and can) the measure be implemented.

Some of the proposed measures are very specific (for example, the proposal to prepare national guidelines for what constitutes excessive costs); whereas other proposed measures are less specific (for example, to strengthen the ability of WSSCs to enforce collection of bills through changes in legal framework and practice). Implementation of the less specific measures are likely to require action by several institutions and additional work is needed to identify both the specific steps that need to be taken and the responsible institutions.

Some measures are fundamental (for example, amendments to the Water Act and allocation of sufficient government budget); whereas other proposed measures may not be essential. However, the problems encountered in implementing the current Water Act illustrate that any strategy's action plan will need to be revised regularly in order to identify and address obstacles to strategy implementation, which were not foreseen at the time of adoption of the strategy.

2. Identification of target groups

2.1. The vision for the WSS sector development through education at EU/national level

Measures to increase the professionalization of the WSSs will enhance stability, reward achievements, and decrease inefficiencies in staffing. Enhanced autonomy must be supplemented by minimum requirements for capacity and qualifications. The Water Act requires a decree to be set on minimum requirements to WSS professionals, and the terms and order for staff training giving adequate operational skills and competencies.

Water Resources Training and Education is a guide to make available educational opportunities in water resources planning and management around Europe, as well as in Bulgaria.

The education of VET professionals and their professional development is recognized as inherently important for creation of EU knowledge-based society (Communication from the Commission. The Social Agenda [COM92005) 33 final], 2008; <http://europa.eu/scadplus/leg/en/cha/c10127.htm>). A conclusion was made for shifting dimensions of the role of teachers/trainers and other training facilitators, and competencies they need to effectively respond to these changes. These needs were identified by a Working Group (Implementation of “Education & Training 2010” work program and “Improvement Education of teachers and trainers”, 2003), performing previous preparatory work, analyzing the situation at EU level through study visits. The various dimensions at national level were identified and reflected in different qualification networks, such as the BG national one. As the VET professionals are admitted as an important source of subject knowledge, the following basic requirements within the concept for the „changing the role of the teachers/trainers from training to learning” are said in "Education and Training 2010" work program (Education and Training 2010 program; Cluster 'Teachers and Trainers' - Main policy conclusions 2005 - 2007; http://ec.europa.eu/education/policies/2010/doc/reportpeer5_en.pdf): improvement of subject competence and links between theory and practice, as well as use of learner-centered approach. In this respect, the project PureH2O goals are to enhance the quality of education and professional development of VET professionals; to improve the quality of their competence and skills, to establish the links between theory and practice; and to apply the learner-centered approach. They will be reached through a competence-based e-learning system, structured as learning outcomes, assessed through ECVET principles at national/European level. This include building up of structured model in respect to EQF reference levels 5, 6, 7; selection of mix of

learning methods and specific content and set up of multilingual *e*-platform to innovative VET professionals' education. The up-to-date methodological strategy is designed for refreshment of trainees' skills and ability of short- and long-term beneficiaries. The impact is grounded on the development of flexible basis for continuing education with quality enhancement in respect to the national VET requirements as well as on the introduction of a system for teachers/trainers' qualifications validation. Thus, the PureH2O project will contribute for the partners' national VET system development in compliance with the EU standards and will raise the territory network formation.

To follow this, the next considerations concerning different parts of the the PureH2O target groups are taken into account:

1. **The VET teachers competence requirements in VET system are changing.** They are becoming more directly involved in curriculum planning, often in cooperation with enterprises in its development and design. This process is decentralized in most European countries and the requirements for skills and competences of trainees are also developing, and the pace of change is increasing. In order to support VET teachers in exploiting the opportunities of their new role in more decentralized VET system, the following measures are necessary :
 - VET teachers should orient their efforts towards work places and to take the experiences and challenges of the companies where their students and trainees are taking place.
 - They have to integrate this knowledge into their curriculum development work on an ongoing basis.
 - The more central role of VET teachers for curriculum development should include self-reflective development teams, built on well-developed relations with relevant networks of enterprises.
 - Development of clearer professional profiles of VET teachers with focus to increasing VET teachers' own skills and competences. VET trainers have to take care for their own professional development.
2. **Company trainers continue to play an important role in developing of good partnership between training settings and companies.** The application of modern didactic principles in work-place settings is strongly necessary for enterprises in order to maintain a sufficient inflow of well-trained workforce. In this way, the actual gaps and

challenges must be bridged, and school-company partnerships are to be further developed.

- Company trainers should establish close professional relationships with VET teachers. They should maintain current exchanges of experience and, if possible, engage in common training development activities.
- Company trainers should be encouraged to strengthen their pedagogical and didactic competences and to seek about their professional and pedagogical role in relation to trainees.
- Company trainers should increase their focus on their relational competences and other personal competences in order to increase the attractiveness of VET for young.
- In order to keep the interest towards company training, trainers should have flexible and innovative forms, which could be adopted in cooperation between companies and VET institutions

3. VET school managers are responsible to ensure that VET teachers and trainers are aware of the opportunities and challenges of education.

- School managers are also responsible to develop, at the institutional level, the necessary institutional framework and platforms for good partnerships with relevant companies.
- School managers have to understand the new and emerging requirements for VET teachers and establish the necessary conditions to maintain their central role in curriculum development, to encourage teamwork and working relationships with company trainers and companies, etc.
- School managers should, wherever relevant, encourage the establishment of partnerships between schools and enterprises at different levels.
- School managers should organize specific forms of cooperation, in order to insource VET-trainers in companies for a period of time. Also, insourcing of company trainers to VET settings for the implementation of specific tasks is encouraged.
- School managers should increase common continuing training of VET teachers and company trainers, which should also be considered as a way to promote cooperation and the establishment of shared approaches and methods.

4. **The social partners interaction with the VET system.** The provision of good VET is dependent on interaction with social partners and integration of theory, practice of work-based learning, company needs, requirements and perspectives into learning.

- Involvement of social partners in VET development is very important in case good partnership between companies and VET schools are established. This applies at the overall system level, as well as when actual provision of VET is taking place.
- The social partners should strengthen their capacities for contributing actively to VET development. In case of ensuring of providers, a mobilization of the necessary human resources, including training of relevant representatives, for the participation in school management activities are necessary.

5. **Involvement of VET policy makers at EU/national level** .The trend in VET is towards increasing decentralization in respect to efficient adaptation to changes in company needs for skills and competences. Meanwhile, the structural economic development implies appearance of new skills and competence requirements.

- VET policy makers should be innovative and use new ways to ensure flexibility and adaptability in VET systems, and development of systems of output-oriented evaluation of curriculum and learning contents.
- VET policy makers should ensure incentives to develop close and committing partnership with enterprises and the social partners.
- VET policy makers should consider new initiatives in order to further develop the qualifications and competences of VET teachers as well as company trainers.

2.2. PureH2O target groups identification

The potential training needs for the already chosen in PureH2O target groups (teachers, trainers, learning facilitators, guidance professionals, school/institution managers and political decision makers) in regard to drinking water management issues have been identified using the following steps. The scope of the project was refined through consultations with representatives at local/national level. Following this, a postal survey requesting information on key issues, current levels of skills and knowledge, and preferred training formats was carried out. Finally, an

extensive search for suitable existing training materials was performed. The data collection and analysis methods used are described in the following sections.







2.3. Preliminary Scoping




Preliminary scoping exercise was undertaken prior to the development of the surveys used in this study. Preliminary scoping included a review of previous studies related to training and education needs at local and national levels in the partner countries. The preliminary scoping involved investigation of the target representatives (both elected members and staff) from rural and metropolitan areas. Key issues relating to water management were identified during the scoping phase, which were then used to structure the survey. The aim of this phase was to effectively target the survey and to achieve a high return rate of completed actions.

2.4. Building up of competence-based system for sectoral qualification

The scoping study indicated that the water resource management roles, and therefore training and education requirements, were likely to vary across different areas in the country. Therefore, it was decided to develop a series of investigation of qualification characteristics on the basis of ISCO. The results from the above mentioned analysis indicate the existence of a social call for more subject knowledge competencies, linked to the learning processes and to curriculum outcomes, less connected with the subject provided by the educational settings. Such an opportunity is proposed by the innovative Pure H2O project – a competence-based e-learning system, structured in the light of learning outcomes, evaluated through ECVET principles and envisaged for ex-post accreditation and quality enhancement of VET system at national/European level.

Surveys were developed for the chosen target groups in respect to the preliminary selected PureH2O sector specific professional areas as follows:

-  Microbiology
-  Chemistry
-  Civil Engineering
-  Environmental Engineering
-  Electrical Engineering
-  Mechanical Engineering

-  Chemical Engineering
-  Town and Traffic Planning
-  Education / Vocational Training

A competence package development is laid down, which represents a competence map for each PureH2O target VET professional in the water supply sector. Thus, elaboration of a competence standard procedure assuring international transfer of acquired qualification along the PureH2O training is envisaged. Example is given below:

VET providers in Microbiology **ISCO2131** (ESCO)

EQF level7 (corresponding to second cycle European Higher Education – M.Sc.)

Knowledge	Skills	Wider competence
The learner acquired knowledge in (knows, understands, interpret and/or is able to demonstrate):	The learner is able to perform (analyze, implement, evaluate, operate, create, provide, etc.):	The learner is competent to (general skills and attitudes, related to learning process and social presentation):
•	•	•
•	•	•
•	•	•

3. Needs analysis for VET requirements in the sector in Bulgaria

3.1 Development of innovative solutions for education of VET teachers/trainers and other training facilitators: EQF/NQF introduction

A distinctive feature of Bulgaria's lifelong learning strategy is its comprehensive approach to encompass all areas of learning: from pre-school education and training to continuing adult training. The innovative solutions for training of VET professionals encompass development and enrichment of a system for career guidance through offering conditions for adoption of career planning skills. Here, encouragement of the access of „non-conventional” trainees and adults through alternative forms of lifelong learning at the universities is also foreseen to ensure opportunities for non-formal and informal learning that offers personal and professional progress.

3.1.1. Bulgarian national qualifications framework for lifelong learning (BQF)

The Bulgarian national qualifications framework for lifelong learning (BQF) was officially launched with Decision No 96 of 02/02/2012 of the council of ministers. Further, in 2013 BQF was referenced to the European qualifications framework (EQF) and self-certified against the qualifications framework of the European higher education area (QF-EHEA)²⁷.

BQF is considered as an important national priority and mandatory precondition for implementing the EQF. Hence it is included as a pillar of Bulgarian government educational policy in the programme for European development of Bulgaria (2009-13).

The BQF is a comprehensive, nine-level framework (incl. a preparatory level 0). It encompasses qualifications from all levels and subsystems of formal education and training, i.e. pre-primary, primary and secondary general education, vocational education and training (VET) and higher education.

3.1.2. Development and introduction of BQF

In the context of BQF development the efforts of the educational policy makers in Bulgaria were concentrated on two objectives:

- to make the levels of the national education system more transparent and clear to comprehend, and hence – to make mobility and recognition of qualifications easier
- to implement of set of tools to describe them in terms of learning outcomes.

The specific aims addressed by BQF development are to:

- develop a device with a translation and bridging function;
- encourage mobility in both education and labour market;
- stimulate adoption of learning-outcomes based qualifications;
- support validation of prior learning, including non-formal and informal learning;
- strengthen orientation towards a lifelong learning approach;
- increase cooperation between stakeholders.

Apart from offering transparency, the NQF is seen as an important tool supporting national reforms and needs, for example, setting up a system for validating non-formal learning, improving education quality, modernising curricula and strengthening provider accountability. The BQF aims to play an important role in supporting lifelong learning and in promoting participation of adults in learning in Bulgaria.

3.1.3. Prospects for implementation of BQF

BQF's implementation is coordinated by Bulgarian Ministry of Education and Science with an NCP appointed at the international and European cooperation directorate in this ministry.

The actual implementation of BQF is preceded by a currently going on referencing process that will result in issue of new qualification certificates, diplomas and EUROPASS documents coherent to the relevant BQF level and linked to the corresponding EQF level. At present, this is foreseen for the 2015/16 school year, accompanied by the necessary legislative changes.

An important goal of BQF implementation is to assure support to lifelong learning. Since BQF encompasses all educational stages: from pre-primary to doctoral, it can be regarded as a comprehensive framework. However, it must be pointed out that at present it is restricted to the qualifications awarded upon completion of formal education and training. In addition, levels 6 to 8 are restricted to qualifications adopted by higher education. These restrictions impose the future prospects for BQF development in the light of its establishment as a lifelong learning supporting instrument that facilitates the access, progression and participation (especially of adult learners) in education including outside the formal education system.

3.1.4. BQF structure

The BQF comprises eight levels with an additional preparatory level (the so called NQF level 'zero', encompassing pre-school education).

For description of these levels the EQF and QF-EHEA descriptors have been taken into consideration. The levels descriptors differentiated between personal and professional competences and cover:

- knowledge, both theoretical and factual;
- skills, both cognitive and practical;
- wider competences.

The qualification levels are Learning-outcomes-based. The anticipated learning outcomes for a defined qualification level reflect the legal documents that govern the various national subsystems of education and training on the one hand and the approved educational requirements about content of the learning material in general education, and VET.

To emphasize on the important role of learning outcomes in planning education, in 2011, a draft model of a new VET standard (the State educational requirement for acquisition of vocational qualifications for professions) was elaborated in compliance with the principles and the characteristics of EQF and ECVET. It is linked to the structuring of the learning outcomes into

units and is an obligatory prerequisite for setting up a validation system and updating VET curricula. These latter are important priorities of Bulgarian educational policy.

3.2. Bulgarian education and training system

Currently, the Bulgarian education and training system is structured in the following manner: kindergartens; schools (1 - 12 grade), which are primary (1 - 4 grade); basic (1 - 8 grade); lower secondary (5 - 8 grade); upper secondary (9 - 12 or 8 - 12 grade); general secondary (1 - 12 grade); vocational secondary (arts, sports, vocational secondary gymnasiums offering training in programs for acquiring 3rd and 2nd degree of vocational qualification, clerical ones as well); vocational schools enrolling students after 8th grade with programs for 2nd and 1st degree of vocational qualification, vocational schools enrolling students after 5th and 7th grade with programs for 1st degree of vocational qualification); vocational colleges, following programs after secondary education; higher education schools – colleges, universities and specialized higher education schools. The vocational secondary schools are also entitled to deliver training in programs after the secondary education. The structure of the educational system is represented in the figure below (Fig. 5):

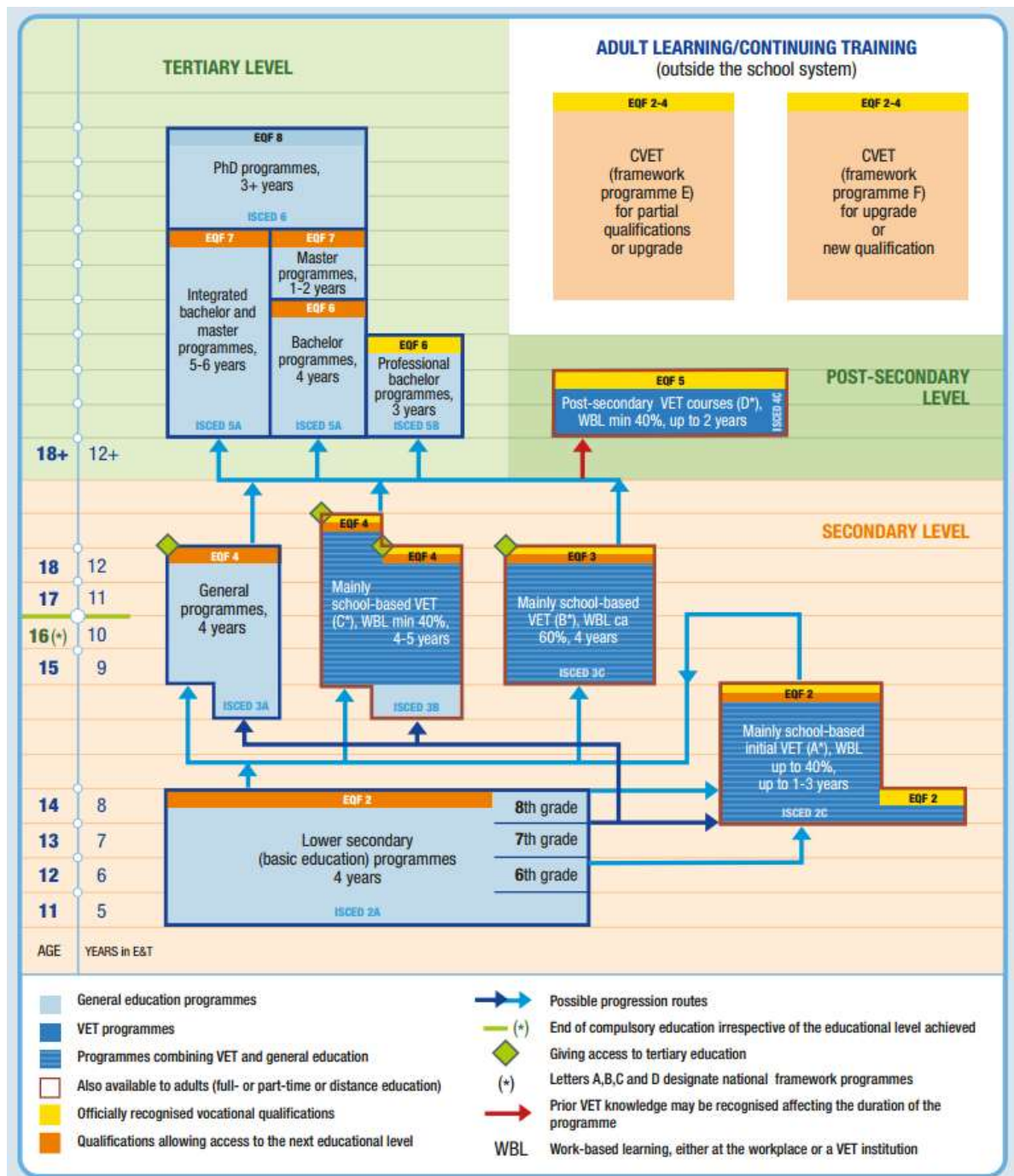


Fig. 5. Bulgarian education and training system (“Spotlight on VET Bulgaria”, CEDEFOP 2013/2014; <http://www.cedefop.europa.eu/>)

3.3. Structure of VET in Bulgaria

As regards the VET in Bulgaria, it is implemented through the integrated activities of the Ministry of Education and Science and the Ministry of Labor and Social Policy. The Ministry of Education and Science carry out the national policy in the field of education and science;

organizes the development and the implementation of the national educational programs as well as implementation of the national policy for qualification and career development. The Ministry of Labor and Social Policy participates in the implementation of the state policy on vocational education and training by identifying the needs of vocational education and training through analyzing trends in the labor market. On the other hand, the National Agency for Vocational Education and Training (NAVET) is a national authority to the Council of Ministers, which is responsible for licensing of activities within the vocational education and training system, as well as for coordination of the institutions related to vocational guidance and vocational education and training.

The main VET providers are VET schools (VET secondary schools, art schools, sports schools), VET colleges and licensed private and public continuing vocational training (CVT) centres.

Framework programs regulate acquisition of VET qualifications by setting age and entry level requirements and specifying content and duration. There are six framework programs:

- school-based initial VET (IVET) programs ‘A’ leading to first level VET qualifications (EQF 2);
- school-based IVET programs ‘B’ leading to second level VET qualifications (EQF 3). These programs give access to higher education (HE);
- school-based VET programs ‘C’ for second and third level VET qualifications (EQF 4), giving access to HE;
- school-based post-secondary non-tertiary VET programs ‘D’ leading to fourth level VET qualifications (EQF 5), offered by VET colleges;
- IVET programs ‘E’ (apprenticeships) offering by CVT centres;
- CVT programs ‘F’ updating or broadening professional qualifications and/or leading to first, second or third level VET qualifications.

3.4. Specifics of Bulgarian VET

Bulgarian VET system is characterized with several specific peculiarities:

- Possibilities for VET are equally assured for trainees, which is based on the common programs and national educational standards that regulate vocational qualifications.
- VET schools have the opportunities to use their capacity and facilities not only for training young people but also for all other types of trainees.

- Municipalities played important role in VET through participating in VET policy implementation (training its own staff, offering vocational guidance and training, training the unemployed and others, providing the necessary equipment and financial support for VET providers and guidance centres).
- National educational standards for VET qualifications at all levels are competence-based.
- Possibility to directly involve professionals in VET. Staff teaching VET subjects only need a higher education diploma in the relevant subject.
- Flexibility in involving industry professionals in order to make VET more attractive and relevant to labor market.

3.5. Institutions providing formal and non-formal education in PureH2O project subject area

Occupation	Professional area	Institution	Educational level / Programme		
			Bachelor degree (formal)	Master degree (formal)	Other (non-formal)
VET providers in Biology	Biology	Sofia University	Biology		<i>Lifelong learning - Information and In-Service Training of Teachers</i>
		New Bulgarian University - Sofia	General and Applied Biology		
		Plovdiv University	Biology		
	Drink water biology	Sofia University		Applied Hydrobiology and Aquaculture	
	Ecology	Sofia University	Ecology and Environmental Protection; Biomangement and Sustainable Development	Ecology; Environmental Protection	<i>Postgraduate Qualification – Ecology and Environmental Protection</i>
		New Bulgarian University - Sofia	Ecology and Environment Management	Ecology and Sustainable Development; Ecological Management	<i>Distance Learning – Bachelor degree - Ecology and Environment Management</i>
		University of Mining and Geology - Sofia	Ecology and Environmental Protection	Ecology and Environmental Protection	
		Agricultural University - Plovdiv	Ecology and Environmental Protection	Ecology of urban systems; Protection and management of biodiversity	

Occupation	Professional area	Institution	Educational level / Programme		
			Bachelor degree (formal)	Master degree (formal)	Other (non-formal)
VET providers in Biology	Ecology	Plovdiv University	Ecology and Environmental Protection	Biodiversity, Ecology and Conservation; Ecology, management and control of environment; Ecology and ecosystem protection	
		Trakia University – Stara Zagora		Protection and management of environment	<i>Postgraduate Qualification – Developing a professional portfolio for teachers</i> <i>Postgraduate Qualification – Environmental problems and sustainable development</i> <i>Continuing education - Professional Qualification of Teachers</i> <i>Short Courses, Seminars and Individual Consultations in the Center for Continuing Education, Faculty of Pedagogy</i>
		South-West University - Blagoevgrad	Ecology and Environment Protection	Ecology and Environment Protection	
		Shumen University	Ecology and Environment Protection		
		Burgas Prof. Asen Zlatarov University	Ecology and environment protection	Ecology and environment protection	
	Microbiology	Sofia University		Microbiology and Microbiological Control	<i>Postgraduate Qualification – General and Industrial Microbiology</i>
	Hydrobiology	Sofia University		Applied Hydrobiology and Aquaculture	
	Biochemistry	Sofia University		Biochemistry	

Occupation	Professional area	Institution	Educational level / Programme		
			Bachelor degree (formal)	Master degree (formal)	Other (non-formal)
VET providers in Chemistry	Chemistry	Sofia University	Chemistry		<i>Lifelong learning</i> - Information and In-Service Training of Teachers
		Plovdiv University	Chemistry		<i>e-Learning</i> - Ecological chemistry and environmental protection
		Shumen University	Chemistry		
	Chemistry, corrosion	Sofia University	Chemistry	Environmental chemistry, Materials science	
	Chemistry, plastic	Sofia University	Chemistry	Polymers	
	Chemistry, polymers	Sofia University	Chemistry	Polymers	
	Chemist, manufacture of rubber and rubber products	Sofia University	Chemistry	Polymers	
	Chemistry, chemical quality control	Sofia University	Chemistry		
VET providers in Architecture	Architecture, engineering facilities	University of Architecture, Civil Engineering and Geodesy - Sofia	Architecture	Structural Engineering	<i>Postgraduate Qualification</i> – MATLAB & SIMULINK for teachers/trainers <i>Non-formal training</i> - Management and Entrepreneurship* <i>Non-formal training</i> - Professional qualification "TEACHER"*
	Urban planning	University of Architecture, Civil Engineering and Geodesy - Sofia	Urban Planning	Urban Planning	<i>Postgraduate Qualification</i> – Natural building materials and construction technologies
		Varna Free University	Design of architectural environment		

* Available for all professional areas in University of Architecture, Civil Engineering and Geodesy - Sofia

Occupation	Professional area	Institution	Educational level / Programme		
			Bachelor degree (formal)	Master degree (formal)	Other (non-formal)
VET provider in Engineering	Engineering, industrial and civil construction	University of Architecture, Civil Engineering and Geodesy - Sofia	Structural Engineering	Analysis and Design of Structures	<i>Postgraduate Qualification – MATLAB & SIMULINK for engineers</i>
	Engineer, construction	University of Architecture, Civil Engineering and Geodesy - Sofia	Structural Engineering	Analysis and Design of Structures	<i>Non-formal training - Computer-Aided Design</i>
	Engineering, water construction	University of Architecture, Civil Engineering and Geodesy - Sofia	Structural Engineering	Analysis and Design of Structures	
	Engineering, hydropower construction	Technical University - Sofia	Hydraulic and Pneumatic Technologies	Hydraulic and Pneumatic Technologies	
		University of Architecture, Civil Engineering and Geodesy - Sofia		Hydraulic Engineering	
		Ruse University	Hydraulic and Pneumatic Equipment	Hydraulic and Pneumatic Equipment	<i>Continuing education - Hydraulic and pneumatic machinery and propulsion systems</i>
		Technical University - Gabrovo		Hydraulic and Pneumatic Engineering	<i>Postgraduate Qualification – Modern educational strategies</i> <i>Postgraduate Qualification – Using ICT in teaching</i>

Occupation	Professional area	Institution	Educational level / Programme		
			Bachelor degree (formal)	Master degree (formal)	Other (non-formal)
VET providers in Engineering	Engineering, hydraulic and pneumatic machinery	Technical University - Sofia	Hydraulic and Pneumatic Technologies	Hydraulic and Pneumatic Technologies	
		University of Architecture, Civil Engineering and Geodesy - Sofia		Hydraulic Engineering	
		Ruse University	Hydraulic and Pneumatic Equipment	Hydraulic and Pneumatic Equipment	
		Technical University - Gabrovo		Hydraulic and Pneumatic Engineering	
		Technical University - Sofia	Hydraulic and Pneumatic Technologies	Hydraulic and Pneumatic Technologies	
	Engineering, water turbines	University of Architecture, Civil Engineering and Geodesy - Sofia		Hydraulic Engineering	
		Ruse University	Hydraulic and Pneumatic Equipment	Hydraulic and Pneumatic Equipment	
		Technical University - Gabrovo		Hydraulic and Pneumatic Engineering	
		University of Chemical Technology and Metallurgy - Sofia	Chemical Engineering	Chemical Engineering	
	Engineering, chemistry	Burgas University	Chemical Engineering	Chemical Engineering	

Occupation	Professional area	Institution	Educational level / Programme		
			Bachelor degree (formal)	Master degree (formal)	Other (non-formal)
VET providers in Engineering	Engineering, chemical processes	University of Chemical Technology and Metallurgy - Sofia	Chemical Engineering	Chemical Engineering	<i>e-Learning</i> – Industrial ecology <i>e-Learning</i> - Assessing the environmental impact
		Burgas University	Chemical Engineering	Chemical Engineering	
	Engineering, water supply and sewerage	University of Architecture, Civil Engineering and Geodesy - Sofia		Water Supply and Sewage; Hydraulic Engineering; Water Management; Water Supply, Sewerage and Facilities; Water and Waste Water Treatment	
				Water Supply and Sewage; Hydraulic Engineering; Water Management; Water Supply, Sewerage and Facilities; Water and Waste Water Treatment	
	Engineering, water purification	University of Architecture, Civil Engineering and Geodesy - Sofia		Water Supply and Sewage; Hydraulic Engineering; Water Management; Water Supply, Sewerage and Facilities; Water and Waste Water Treatment	
	Engineering, hydrology	University of Architecture, Civil Engineering and Geodesy - Sofia		Water Supply and Sewage; Hydraulic Engineering; Water Management; Water Supply, Sewerage and Facilities; Water and Waste Water Treatment	
				Water Supply and Sewage; Hydraulic Engineering; Water Management; Water Supply, Sewerage and Facilities; Water and Waste Water Treatment	

Occupation	Professional area	Institution	Educational level / Programme		
			Bachelor degree (formal)	Master degree (formal)	Other (non-formal)
VET providers in Engineering	Engineering, irrigation	University of Architecture, Civil Engineering and Geodesy - Sofia		Water Supply and Sewage; Hydraulic Engineering; Irrigation and Drainage Engineering; Water Management; Water Supply, Sewerage and Facilities; Water and Waste Water Treatment	
	Engineering, irrigation construction	University of Architecture, Civil Engineering and Geodesy - Sofia		Water Supply and Sewage; Hydraulic Engineering; Irrigation and Drainage Engineering; Water Management; Water and Waste Water Treatment	

3.6. Conclusion: Need analysis for VET training in drinking water sector Bulgaria

The rationale for existing needs in developing updated knowledge, skills and competence of VET teachers /trainers and other learning facilitators in drinking water supply sector was grounded on the basis of the obtained research data in Bulgaria. Summarizing the survey data and their analysis the following general considerations can be made:

- PureH2O Training program should be organized on the basis of the elements introduced by the BQF system (knowledge, skills and wider competencies) and having as a reference the ISCO standards, in order to achieve a necessary transparency of the qualifications and to answer the needs of the EU labor market
- PureH2O training curriculum will reinforce the development of competences in initial training of VET teachers/trainers and other training facilitators, as well as in their continuous professional development.
- Topics, devoted to economics of DWTP, drinking water quality assurance, as well as provision of best practices existing in PureH2O partners' countries are of basic importance for permanent updating and increase of professionalism of the project target groups in terms of theoretical knowledge and technical skills;
- Knowledge and competence on above mentioned topics will be included in the occupational profiles of the specialists working in the drinking water supply sector. In this way, transferability and recognition of qualifications throughout Europe will be promoted.
- Vocational training in PureH2O project through Internet/CD-ROM learning process will facilitate the access and acceptance of learning materials by different target groups, thus attracting more people with experience in the field into VET system.
- More opportunities for VET teachers/trainers and other training facilitators, as well as for VET students will be provided for participation in different subject related activities within formal and informal VET curriculum.
- Introduction of the EQF instruments in the VET systems at the PureH2O partners countries is necessary to optimise the validation of education and the professional interaction between the target groups having crucial role in this process.

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