PROGRAM ON WATER GOVERNANCE

LESSONS FROM THE EU APPROACH TO GOVERNING SMALL DRINKING WATER SYSTEMS

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The European Union is in the process of revising its drinking water legislation, with a focus on improving the safety of small drinking water systems (SWS). At this critical juncture, this policy brief summarizes the state of SWS in the EU and the EU's approach to drinking water governance, before outlining how this approach is expected to change under new legislation. The report concludes by highlighting ongoing challenges for SWS governance moving forward. This policy brief draws together insights from recent reports on the state of small drinking water systems in the EU, and evaluations of the EU Drinking Water Directive. We aim to highlight key themes and considerations that might be of interest for those involved in small water systems governance more generally.

The University of British Columbia's Program on Water Governance and Res'Eau-WaterNET researchers have been investigating issues of small water systems governance for several years. Please see www.watergovernance.ca for details and related publications. There you will find other resources published in conjunction with this report—including a bibliography and a journal article on SWS governance (Environmental Reviews, 2018).

SMALL WATER SYSTEMS IN THE EU

SWS are those that supply drinking water to a small number of premises and/or consumers, and include private and individual facilities, community-managed supplies, and publicly managed supplies in villages, small towns, and peri-urban areas. These systems may or may not include drinking water treatment, storage, and distribution (Rickert, Barrenberg, & Schmoll, 2016). While definitions and terminology vary between EU member states (MS), they have generally been defined as systems that supply less than 1,000 m^3/day or serve less than 5,000 people.[1] Very small systems supply less than 10 m^3/day or serve less than 50 people.

[1] However, in proposed revisions to the DWD, SWS have been redefined as systems supplying less than 500 m^3/day or serving less than 5,000 people (European Commission, 2018b).

SWS are the backbone of water supply in rural areas of the pan-European region (World Health Organization, 2011), with 85,000 SWS serving 20% of the population (European Commission, 2016). However, reliance on SWS varies significantly across the EU. While large supplies serve much of Western Europe (with some exceptions such as France and Spain, which both have large numbers of SWS), up to one third of the population in eastern member states (e.g. Romania, Estonia) are served by small and very small systems (Orru & Rothstein, 2015).

The provision of safe drinking-water is a challenge for SWS in rural, peri-urban, and indigenous communities globally (see forthcoming article by McFarlane and Harris *Environmental Reviews,* 2018), and this is also the case in the EU. Generally, SWS share a range of managerial, financial, and institutional challenges that make them vulnerable to inadequate management, system breakdown, and disease outbreaks. Such challenges contribute to recurring issues of unsafe service or insufficient access in small communities, impacting the health of these communities (Rickert, Barrenberg, & Schmoll, 2016). According to Rickert, Barrenberg, and Schmoll (2016), the main challenges for the safe management of SWS in the EU are operational and include: limited technologies; lack of financing; lack of operator training and awareness; remoteness of water systems and isolation of operators; higher risk from climate change impacts; and a weak regulatory framework for SWS. Similar challenges are also identified as contributing factors to SWS's underperformance in Canada and the USA (see Braden & Mankin, 2004; Christensen, Goucher, & Phare, 2010; Ford, Rupp, Butterfield, & Camper, 2005). The World Health Organization (2011) states that SWS require specialized policies due to their particular administrative, managerial, and resourcing characteristics (again, see McFarlane and Harris, 2018 for overview).

EU DRINKING WATER GOVERNANCE

The EU has a highly regulated approach to drinking water quality, which strives to seek a balance between harmonization and subsidiarity across MS.[2] The main regulation concerning drinking water is the *"EU Drinking Water Directive (98/83/EC) on the Quality of Water Intended for Human Consumption"* (DWD), which seeks to ensure clean, wholesome drinking water provision. The DWD sets out strict safety standards and monitoring requirements, which MS are responsible for implementing through specific actions (e.g. baseline analyses, target setting, capacity building, surveillance, strengthening regulatory frameworks, and remedial measures).

In addition, drinking water is included as one aspect in the EU's highly celebrated "*Water Framework Directive*" (WFD). The WFD aims to achieve "*good status*" for all waters by set deadlines (2015 – 2021 – 2027), covering ecological, quantitative, and chemical objectives for surface water, groundwater and protected areas. The WFD addresses drinking water directly in two articles: Article 7 on drinking water protected areas and Article 9 on cost recovery and pricing. SWS receives no specific mention.

[2] Subsidiarity is a key principle of EU governance that devolves decision-making and action to the lowest level of governance (i.e. Member States) to ensure that powers are exercised as close to citizens and locales as possible.

DWD requirements

The DWD establishes minimum requirements for water quality, and obligations for remedial action, monitoring, and reporting of water intended for human consumption. Sampling and analysis requirements are linked to the volume of water distributed. According to the DWD, MS must:

- Ensure wholesomeness and cleanliness of drinking water and not allow deterioration of present quality
- Implement regular monitoring
- Investigate and remediate any failure to meet parameters
- Prohibit use of water if health is endangered in any way
- Take all measures necessary to prevent pollution/contamination
- Ensure up-to-date consumer information on water quality
- Publish regular reports (to be sent to European Commission)

The directive identifies a series of microbiological, chemical and indicator parameters that must be monitored and tested at specified intervals. These water quality parameters are based on the WHO's drinking water guidelines and advice from the Commission's Scientific Advisory Committee (European Commission, 2018a).

The drinking water quality parameters are set in Annex I of the EU DWD for all members states, and while higher standards may be set by individual MS, they are not allowed to lower them.

However, following the 2015 revisions of the DWD annexes, *"Member States may provide for the possibility to derogate from the parameters and sampling frequencies in Part B, provided that a risk assessment is performed in accordance with this Part."* (European Commission, 2015, p. 11). The list of parameters, standards, and monitoring requirements are likely to be revised further under proposed amendments to the DWD (see below), including the addition of several new microbiological and chemical parameters in line with WHO recommendations (European Commission, 2018b).

EU legislation applies to all MS of the European Union, and each MS is directly responsible to the EU for implementing regulations. In addition, all MS are required to send reports to the European Commission on a regular basis. Complaints and infringements can be filed and eventually brought to the European Court of Justice – if infringements are not remediated, legal action can be taken (i.e. fines to MS).

How different EU directives are actually implemented will depend on individual states. Given the diversity of governance and water distribution systems across MS there is considerable variability in implementation approaches and management of SWS. Regulatory approaches range from largely decentralized systems to public asset ownership, ministerial guidance, or budget control (European Commission, 2016).

INCLUSION OF SWS WITHIN THE EU DWD (PRE-2018 REVISIONS)

Inclusion/exclusion from regulations

Despite efforts to date, and as noted above, EU policies have not catered to the particular challenges of SWS. Most provisions in the DWD apply equally to small and large systems, although monitoring frequencies vary by system size class, and small systems are subject to reduced reporting requirements. Very small systems, which supply less than 10m^3/day or 50 persons, can be exempted from DWD requirements. Responsibility to design and implement sustainable strategies for SWS largely falls within the purview of national and subnational decision-makers.

The DWD allows MS to decide whether to include more demanding regulations for SWS in their national regulations. However, studies report that member state regulations for SWS, when they exist, are often infeasible and associated with weak enforcement mechanisms due to lack of staff or finances (Rickert, Barrenberg, et al., 2016). The majority of countries do not cover SWS in their national legislation (Rickert, Samwel, Shinee, Kožíšek, & Schmoll, 2016).

Monitoring and reporting

Under the current DWD, requirements for monitoring frequency differ according to the volume of water supplied and the number of people served by a water supply system:

- monitoring requirements apply to all systems serving more than 50 people or supplying more than 10 m3 per day
- the requirement to report water quality results to the EU applies only to large water supplies
- very small water systems are exempt from monitoring[3] and reporting regulations in most cases. Consequently, the quality of these water supplies is generally unknown (Hulsmann and Smeets, 2011).

A survey by Rickert, Samwel, et al. (2016) demonstrates the degree of variability in requirements for SWS monitoring and surveillance across countries:

- 43% of countries reported having requirements in place for both independent regular drinking water quality monitoring/inspections and self-checking by operators
- 5% of countries reported having neither requirement in place.

At present, no systematically gathered water quality data exists for small and very small supplies across MS – a concern across the Region that makes it difficult to assess the state of these systems (European Commission, 2016; Hulsmann & Smeets, 2011; World Health Organization, 2015).

Compliance

Information about the level of compliance with national standards for drinking water

[3] *E*xemption from monitoring is not an exemption from action when a potential danger is apparent, or a supply is part of economic activity

quality across the EU is limited. For those countries where information is available, the compliance rate for microbiological contaminants is observed to vary with system size:

- Large water systems in the EU have a very high compliance rate (European Commission, 2014). Most member states have compliance rates for microbiological and chemical parameters between 99% and 100%.
- The compliance rate for microbiological parameters with national standards is estimated to be significantly lower for small water systems, ranging from 40 to 100% (Rickert, Samwel, et al., 2016).

Table 1. Microbial compliance rates of large and small systems in 27 countries reported by EUROSTAT

Microbial compliance	Large Systems	Small Systems
<90%	0	6
90-95%	0	4
95-99%	4	14
>99%	23	3

Table adapted from: (WHO/UNICEF Joint Monitoring Programme for Water Supply and Sanitation, 2017)

- The compliance rate for chemical parameters in small supplies was reported to be lower than 90% for ammonium, manganese, iron and nitrate/nitrite across a broad range of MS according to survey results in Rickert et al (2016).

While survey data from 2012-2013 and background research indicates that monitoring and compliance is improving as compared to previous years (Rickert, Barrenberg, et al., 2016; Rickert, Samwel, et al., 2016), close to one third of the small supplies are still not properly monitored and small system compliance rates with national standards are for the most part unknown. Given the considerable proportion of the European population dependent upon SWS, this lack of compliance poses a significant health risk.

SUMMARY OF DWD EVALUATIONS TO DATE

Several evaluations of the EU DWD have been completed in the last 5 years. The key findings of relevance to SWS are summarized below:

- The EU recognizes that MS are *"struggling to manage small supplies in a safe way"* (European Comission, 2014, p. 5).
- Small and very small water systems are falling through cracks in the EU regulatory framework. The DWD was mostly developed with large supply systems in mind, and amendments are needed to address SWS particularities (Hulsmann & Smeets, 2013).
- Currently, responsibility for SWS management primarily lies with MS, where approaches and resources differ widely (Rickert, Samwel, et al., 2016).
- There is a lack of comprehensive information on SWS, limiting systematic assessments of current conditions. National registries of SWS are recommended to serve as a baseline and evaluate small-scale supplies' risk factors and water quality parameters of concern, which can inform identification of effective mechanisms and prioritization of interventions (Rickert, Samwel, et al., 2016).

- The current regulatory system in which only large supplies need to be reported to the EU is too limited (European Commission, 2016). However, mandatory reporting on SWS would put an enormous administrative burden on MS, especially those with many SWS in their territories (European Commission, 2016). Reporting requirements should be adapted to SWS contexts and consider regional variation.
- End-point testing of water quality, as required by the DWD, is a limited approach to guaranteeing a safe water supply. This is especially true for SWS where the common combination of infrequent testing, highly variable water quality, and high vulnerability to acute events (e.g., heavy rainfall, thaw, or contamination by livestock) can lead to inadequate management and system breakdown, resulting in significant health impacts (Hulsmann & Smeets, 2011).
- The financial benefits outweigh the investment costs of improvements to SWS in the pan-European region. Is has been estimated that a $1 investment in SWS results in a mean return ranging from $2 in more affluent countries to $21 in less affluent countries (Rickert, Barrenberg, et al., 2016).

Given these challenges and opportunities in SWS governance and management, it has been a priority to increase policy attention and action for SWS management since 2007 under Protocol on Water and Health[4] programmes (Rickert, Barrenberg, et al., 2016).

Assessments of the current state of SWS and evaluations of the EU DWD (Rickert, Barrenberg, et al., 2016; Rickert, Schmoll, Rinehold, & Barrenberg, 2014; World Health Organization, 2015) have made the following recommendations to the EU Commission to improve SWS governance and management:

- To establish or update enforceable legislation for SWS
- To specify qualifications and training requirement for SWS operators, as well as external support
- To introduce risk-based approaches to SWS monitoring, appropriate to local contexts
- To promote water safety plans as recommended in WHO guidelines.

FUTURE DIRECTIONS FOR EU DRINKING WATER GOVERNANCE

In 2003 the European Commission initiated a process, with broad stakeholder participation, to revise the drinking water directive (Hulsmann & Smeets, 2013). One of the key steps in this process was an evaluation of the effectiveness, efficiency, coherence, relevance, and added value of the existing DWD (European Commission, 2018a). In 2015, the first revisions were completed, including amendments to Annex II of the DWD, which specifies minimum requirements for monitoring programmes. Then, in February 2018 the European Commission adopted a proposal for a revised drinking water directive to improve drinking water quality and provide greater access and information to citizens.

[4] The Protocol on Water and Health to the 1992 Convention on the Protection and Use of Trans-boundary Watercourses and International Lakes.

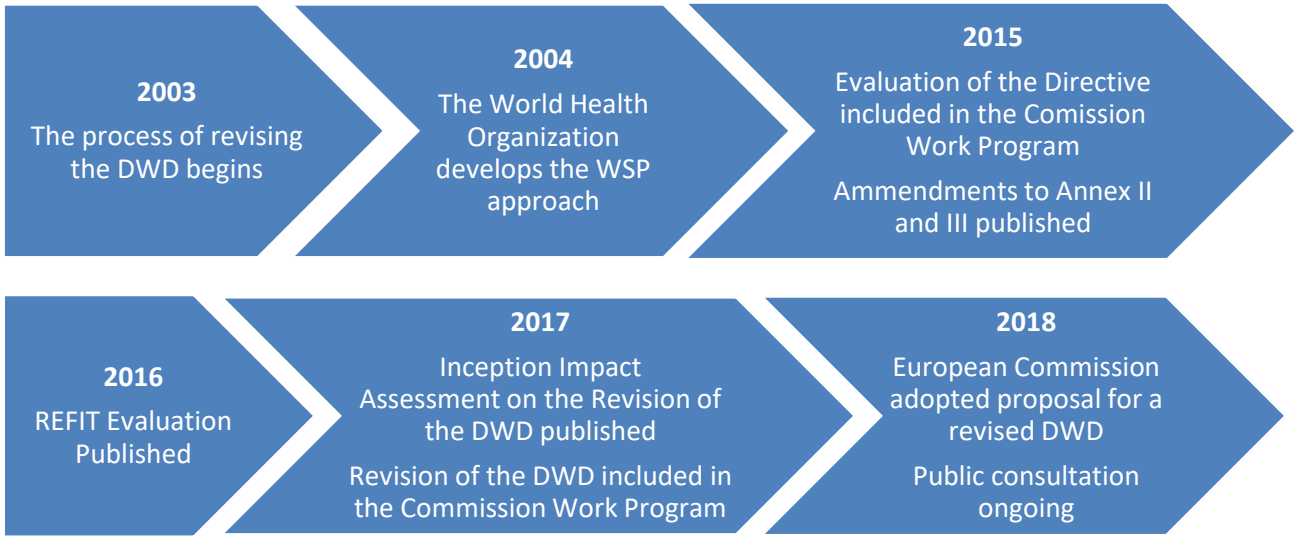

Figure 1. Key steps in process to revise the EU DWD

The Commission's evaluation of the DWD found that while the DWD is effective in achieving its objectives and has contributed to the protection of human health from the adverse effects of contamination to date, some of its parameters and/or parametric values are outdated; it provides too much flexibility to member states in determining necessary measures; and it does not refer to the protection of sources of drinking water (European Commission, 2018b). Public consultation also revealed a strong desire for more up-to-date online information on drinking water quality. As such, the main areas of the DWD identified for improvement were:

- the list of parameters
- movement towards a risk-based approach
- attend to lack of transparency and promote access to up-to-date information for consumers, and
- harmonization of standards for materials and products in contact with drinking water.

In line with WHO recommendations, amendments to Annex II of the DWD incorporated a problem-oriented monitoring approach that focused on improving the regulatory framework for SWS (Klaassens et al., 2016). The new monitoring and control systems in place more explicitly consider the capacity-limitations of SWS, reducing unnecessary, costly, and burdensome analyses for small systems and concentrating efforts on controls that are most likely to protect communities based on their context.

Further revisions to the EU DWD also feature a focus on improving drinking water regulation for small and marginalized communities. According to the EC's preliminary impact assessment on the comprehensive DWD revision

> *"[e]xpanding the current scope of the DWD to include provisions supporting the human right to safe drinking water and sanitation to all citizens as well as increasing the application scope of drinking water quality standards to cover all*

> *small communities and any person living in Europe would have significant social impacts as up to 23 million of people would get access to safe drinking water"* (European Commission, 2017).

In line with this emphasis on equitable access, the latest legislative proposal introduces a general obligation for member states to improve access to clean drinking water for all, especially for vulnerable and marginalized groups.

Summary of major revisions to the DWD in the 2018 legislative proposal

- new article on risk-based approach to water safety
- new article on hazard assessment of drinking water sources
- new article on supply risk assessment
- new article on domestic distribution risk assessment
- new monitoring obligations
- clarification of obligations to inform consumers when parametric values are exceeded or a risk detected
- removal of article allowing derogations from parametric values
- new article on improving/ensuring access to drinking water
- more detailed provisions regarding public access to information
- replacement of data reporting system
- new article on access to justice for citizens and NGOs
- new article on evaluation of the DWD
- addition of new microbiological and chemical parameters to Annex I
- addition of operational monitoring obligations to Annex II
- new annex listing consumer information that must be available online

As with previously published amendments to the DWD technical annexes (European Commission, 2015), the proposed revised DWD clearly moves towards a **preventative risk based approach** to improving drinking water quality. This approach focused on the water source all the way through the supply chain, to the tap. A risk-based approach aims to ensure water safety beyond monitoring aspects, focuses time and resources on risks that matter, is based on cost-effective source measures, and avoids non-relevant analyses and efforts (European Commission, 2018b). This approach builds on the well-established principles of 'think small first', 'hazard analysis and critical control point' (HACCP), as well as the Water Safety Plan approach laid out in the WHO Guidelines for Drinking Water Quality (European Commission, 2015). The risk-based approach has been incorporated into the legislative proposal through three new components (European Commission, 2018b):

1) **Hazard assessment:** the revisions introduce obligations for hazard assessments of water bodies used as drinking water sources. This process requires MS to identify abstraction points and their potential hazards and pollution sources, monitor relevant parameters, and undertake appropriate measures (including exemption, prevention, mitigation).

2) **Supply Risk Assessment:** the revisions reinforce the 2015 amendments to the technical annexes by including obligations related to carrying out a supply risk assessment in the main articles of the DWD. Earlier, Annex II (on monitoring) had been updated to incorporate more flexibility in the monitoring frequency for certain parameters (enabling suppliers to adapt monitoring to the main risks), provided credible risk assessments are performed.

3) **Domestic distribution risk assessment:** the revisions introduce obligations for MS to carry out domestic distribution assessments to identify possible risks stemming from the domestic distribution systems; monitor two specific parameters (Legionella and lead); and undertake appropriate measures (e.g. training, treatment).

Generally, smaller suppliers are expected to benefit from the simplified and staged implementation of a risk-based approach. In what follows, we elaborate on how the risk based-approach will apply to SWS as per the current proposed amendments:

- MS should ensure that the supply, treatment, and distribution of water providing more than 10 m^3 a day on average for human consumption is subject to a risk-based approach.
- The risk-based approach will be implemented gradually. SWS will be granted a longer period (6 years) to implement the risk-based approaches than large and very large water suppliers (3 years).
- Supply risk assessments should be reviewed at intervals of 6 years maximum, to be updated as necessary.
- Supply risk assessments should be based on the general principles of risk assessment established by international standards (i.e., EN 15975-2 concerning 'security of drinking water supply, guidelines for risk and crisis management), or the WHO Guidelines for Drinking Water Quality.
- Concerning the parameters and monitoring frequencies, core parameters (i.e., E. coli) should always be monitored at the minimum frequencies set out in Table 2.

Table 2. Minimum frequency of sampling and analysis for compliance monitoring

Volume (m3) of water distributed or produced each day within a supply zone	*Minimum number of samples per year*
≤ 100	10a
> 100 ≤ 1 000	10a
> 1 000 ≤ 10 000	50b
>10 000 ≤ 100 000	365
>100 000	365

a: all samples are to be taken during times when the risk of treatment breakthrough of enteric pathogens is high. **b**: at least 10 samples are to be taken during times when the risk of treatment breakthrough of enteric pathogens is high

- For the rest of the parameters, substances or pollutants established in Annex I, monitoring frequency may be determined on the basis of the hazards identified in

the supply risk assessment. This means that MS may decide not to monitor certain parameters in Annex 1 provided that that no factor that can be reasonably anticipated is likely to cause deterioration of the quality of the water after risk assessments are done on a given water supply.

- MS shall ensure that risk assessments are approved by their relevant competent authority, and that information is available showing that a risk assessment has been carried out, together with a summary of its results.
- MS will be required to establish and maintain accessible data sets containing only relevant data given the context, such as exceedances of parametric values and incidents of a certain significance. SWS will have to update on-line information less regularly than larger suppliers: once a year.

In parallel to the DWD revision process, the EC has drawn from successful approaches in different MS to develop a series of best practice guidelines specifically for SWS, under its 2014 *"Framework for Action for the management of small drinking water supplies."* (European Commission, 2014). Under this framework, guidance documents such as *"Water safety plan: a field guide to improving drinking-water safety in small communities"* (Rickert et al., 2014) and *"Taking Policy Action to Improve Small-Scale Water Supply and Sanitation Systems: Tools and good practices from the pan-European region*" (Rickert, Barrenberg, et al., 2016) have been produced. These reports feature examples of efforts by MS to implement risk assessment and management measures, including Water Safety Plans (e.g., Hulsmann & Smeets, 2011, 2013). Through those reports the EU aims to support the development of enabling environments for effective water governance across the EU landscape based on successful country case studies – something we elaborate below.

Water Safety Plans (WSPs)

Water safety planning, which is built on the principles of risk analysis and management from source to tap, is promoted internationally by the WHO as a key approach to improving the management of SWS (Hulsmann & Smeets, 2011; World Health Organization & International Water Association, 2017).

WSPs focus on the prevention of risks that might threaten access to and the safety of water systems. This risk-based approach offers a holistic and proactive way to identify and systematically manage risks in SWS from catchment to tap by developing appropriate strategies for local contexts. WSPs thus offer opportunities to focus time and effort on relevant risks that matter in each context and to avoid unnecessary analyses of non-occurring parameters in SWS (European Commission, 2016).

WSPs require a risk assessment that includes all components of the water supply cycle to identify hazards, hazardous events, risks, and existing control measures. Based on this information an incremental improvement plan is developed and implemented. This plan is then updated and refined in an iterative manner based on monitoring of risk management control measures and assessment of the effectiveness of the WSP (Hulsmann & Smeets, 2011; Rickert et al., 2014; World Health Organization & International Water Association, 2017).

Benefits of the WSP approach for SWS are expected to include:

- early identification of potential risks and prevention of negative outcomes that cannot be addressed by mere end-point testing
- increased community understanding of the water supply system (including risks to health) and involvement in improving drinking water safety
- improving day-to-day system management and operation
- prioritization of risks facilitates SWS improvement as managers often lack resources to perform exhaustive risk-assessment and implement all improvements at once
- greater awareness about health risks beyond the system, e.g. effects of environmental protection.

Several MS have already incorporated a risk-based approach in national legislation, including Iceland, Sweden, Norway, (Gunnarsdottir, Persson, Andradottir, & Gardarsson, 2017), Switzerland, United Kingdom, Netherlands, Estonia, Slovenia, and France (Hulsmann & Smeets, 2011). Other MS have formally approved policy or regulatory instruments concerning WSP, such as Andorra, Austria, Belgium, Bosnia and Herzegovina, Denmark, Hungary, Ireland, Netherlands, and Spain (World Health Organization & International Water Association, 2017). For example:

- risk assessment is incorporated into the Netherlands' drinking water legislation
- risk assessment and management are legally required in Switzerland for water suppliers supplying to third parties
- a 'hazard analysis critical control points' approach is required for all systems serving more than 50 people in Slovenia
- local authorities in Scotland are required to carry out source-to-tap risk assessment on all private water supplies which provide >10m3 per day (or serve 50 or more persons).

In some countries special attention is being given to risk assessment and management for SWS (despite not being required by legislation), with the development of tools to adapt WSP to the limitations and needs of small systems. For instance, WSP pilots are underway in small/rural communities in Finland, Czech Republic, Germany, and Italy, while Portugal and Finland are considering a legal obligation for risk assessment of SWS (Hulsmann & Smeets, 2011; World Health Organization & International Water Association, 2017).

At a larger water supply scale, other European countries and regions are also recommending or considering implementation of WSPs, and are engaged in pilot programs and research, including Cyprus, Flanders region of Belgium, Malta, Latvia, Luxembourg, and Romania, among others (see p. 25-27 in Hulsmann & Smeets (2011).

Approaches to create an enabling environment

Reports on drinking water in the EU highlight that SWS challenges are more than technical, and are driven by capacity constraints in the management and governance of SWS (WHO, 2011). Recent policy guidance has responded to these issues, suggesting a range of tools and good practices that promote the creation of enabling environments to improve the state of EU SWS (Rickert, Barrenberg, et al., 2016).

Key recommended policy tools include:

- **Legislation and regulations:** Establishment of, or amendments to, existing national/regional drinking-water quality policies targeted to SWS. These instruments need to specify mandate and responsibilities of surveillance agencies as well as describe specific activities and frequencies associated with different types of SWS. A gradual approach to the implementation of new requirements is recommended and it is suggested to start with a baseline analysis and target setting according to the point of departure of the particular region/area
- **Surveillance:** Establishing or improving current procedures for local surveillance of SWS to include accessible protocols for drinking-water quality monitoring and inspection (for example, on the basis of the recommendations of the WHO Guidelines for drinking-water quality). To minimize challenges related to the large number, remoteness, and widespread locations of SWS, surveillance may be supported by regular self-check by operators, field testing kits and regular communication.
- **Financing:** Establishing sustainable financial support programmes for SWS and improving access to financing to enable small-scale water suppliers to invest in system improvements. It is recommended that policy-makers make provisions for securing sustainable financing through for example taxes, tariffs, transfers, subsidies and other means.
- **Training and qualification programmes:** Establishment of support mechanisms and structures to train and support operators of small-scale water supplies. This includes promotion of WSP, educational programs, accessible guidelines, establishment of national/regional resource centres with access to expertise and support for operators, and promotion of partnership programs to foster cooperation, information sharing, and outreach. Establishing minimum training and qualification requirements is recommended, or testing the level of knowledge of staff/operators according to the size of the system.
- **Awareness-raising:** Includes outreach and communication campaigns to increase awareness of risks, improve hygiene practices, and enhance understanding of the benefits of sustainable water resource management and overall water and health issues in rural populations. It also includes promoting the advantages of investing in prevention and SWS improvement to specialized audiences such as decision-makers, health workers, etc.
- **Cooperative partnership arrangements:** Establishment of cooperation mechanisms with funding/donor agencies to support long term investments, as well as with local NGOs to help in the implementation of program awareness and the development of WSP in rural areas.

THE CHALLENGES THAT REMAIN

- Small water systems are at particular risk in the EU despite its comprehensive regulatory framework and excellent drinking water quality for large water systems.
- Addressing the main challenges requires more than just legislation or traditional end-point testing. Special attention should be given to prevention by adopting risk

assessment, and creating an enabling environment that includes contextually-driven mechanisms for funding, training, monitoring, and local involvement catered to SWS. The European Commission seems to be moving in that direction. The risk-based approach, often implemented through Water Safety Plans, is a welcome development (European Association of Public Water Operators, 2018)

- Improvement of SWS makes economic sense in the long term, but considerable investment is required with regards to financing, capacity training, development of collaborative networks and monitoring. Thus, the critical importance of creating awareness regarding the beneficial outcomes of the above-mentioned approaches to create the necessary incentives for long-term investments.
- Well-adapted legislative frameworks for SWS will support the improvement of SWS across Europe. Implementing such frameworks will require significant involvement at the local level, but also will produce the most varied benefits across scales in the long run.
- The most challenging work remains the development of comprehensive and coherent institutional frameworks that include all stakeholders. In this direction the European Association of Public Water Operators (2018) recommends assigning clear responsibilities to the institutional bodies that can put forward measures to address risks identified.
- Overall, the need for strong guidance and support for SWS as they face the challenges inherent in implementing new provisions in the DWD and moving towards a risk-based approach is critical and cannot be overemphasized (see Kot, Castleden, & Gagnon, 2017).

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