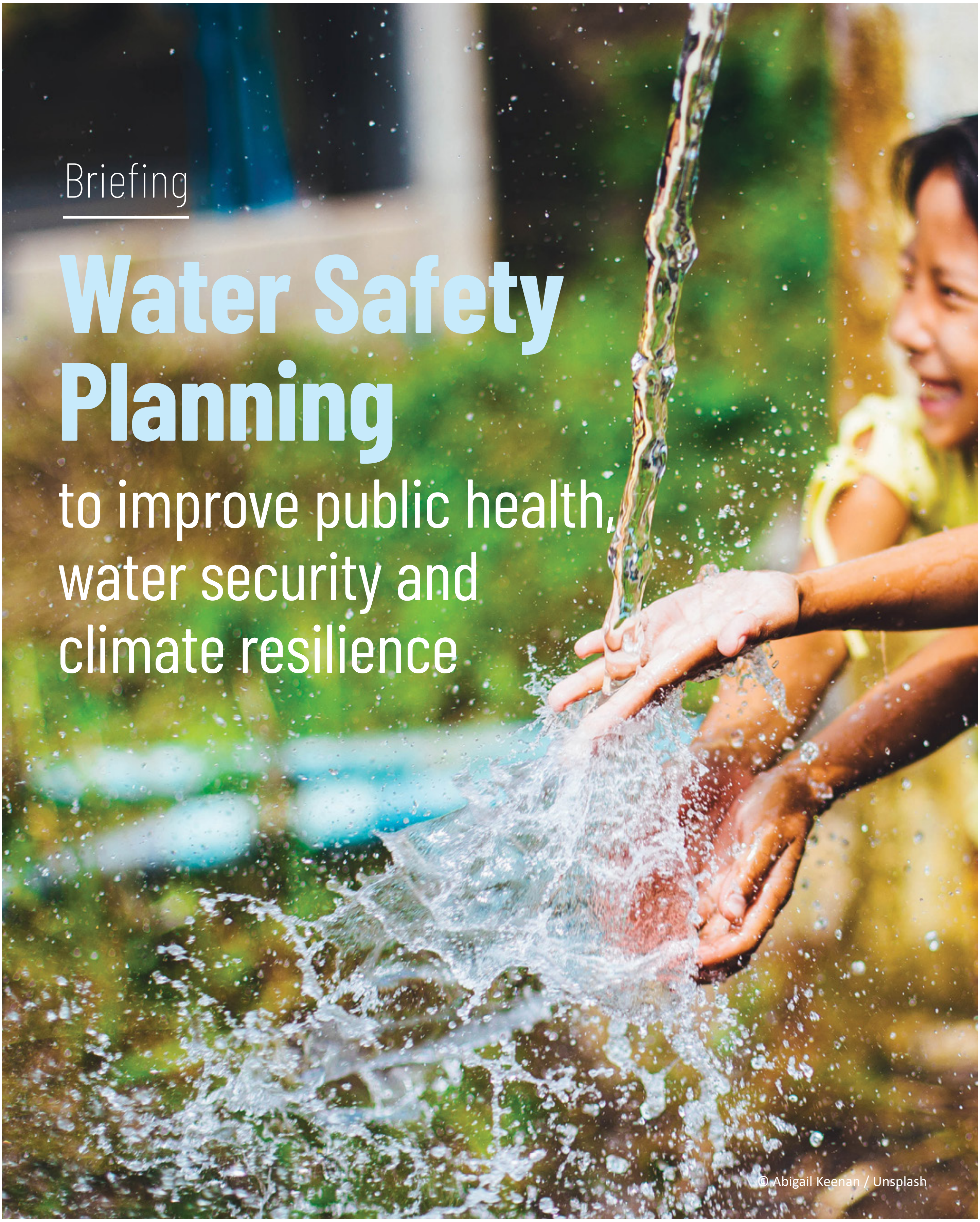
the international water association

Briefing

Water Safety Planning

to improve public health, water security and climate resilience



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About Water Safety Planning

Water safety planning is a comprehensive risk assessment and risk management approach that encompasses all steps in a drinking-water supply chain, from catchment to consumer. A Water Safety Plan (WSP) aims to ensure the safety of drinking water (WHO/IWA, 2009).

The World Health Organization (WHO) recognises WSP as the most reliable and effective way to manage drinking-water supplies to safeguard public health. WSPs provide a proactive approach to ensure water safety through good management of the complete water supply system. This involves understanding the complete system, identifying where and how problems could arise, putting checks and balances, and management systems in place to stop problems before they happen and making sure all parts of the system continue to work properly.

The successful development and implementation of WSPs can help improve the understanding of the water supply system, improve stakeholder collaboration, improve operational efficiencies and provide a robust framework to better target more sustainable long-term capital investments.

WATER UTILITIES NEED TO PREPARE AND PLAN FOR ALL HAZARDOUS EVENTS THAT MAY IMPACT THEIR SYSTEMS

BY 2050, 70% OF POPULATION IN URBAN AREAS

Cities and their water utilities must take an active role in watershed management, as disruption in the supply of freshwater resources to cities can have significant socio-economic, environmental and health consequences.

CLIMATE CHANGE – IRREGULAR PATTERNS OF WATER AVAILABILITY

Climate change will disrupt historical weather patterns and add an additional layer of uncertainty to long-term planning for water utilities and the population they serve.

POPULATION GROWTH – GROWING DEMAND FOR RESOURCES

As global projections show a continued increase in population and urbanisation, that water utilities supplying cities will need to manage increasing demand for the resource.

WATER USERS – COMPETITION FOR WATER RESOURCES

Increased competition for limited water resources between different users means water utilities need to put in place measures to ensure continued provision of safe and secure water supply.

Figure 1. Drivers which can impact water utilities

The primary objectives of a Water Safety Plan are to protect human health and ensure good water supply. This is through reducing contamination of source waters, the reduction or removal of contaminants through appropriate treatment processes, and the prevention of contamination in the distribution network and the domestic distribution system (DWI, 2005). This briefing note highlights the public health benefits of this approach, but also explores additional benefits, including how WSPs can contribute to watershed management and play a role in climate resilience.

Public health benefits

Drinking water is an effective source for the transmission of gastrointestinal microbial pathogens that can cause serious human diseases. Thus, implementing a source to tap approach is key to ensuring a continuous supply of safe drinking water (Hrudey and Hrudey 2004) through applying a WSP. The WSP provides a systematic and comprehensive method to monitor the water supply chain and prevent water contamination. By implementing this risk management approach, water quality, water regulatory compliance, disease, communication, asset management, and other aspects of the water system are improved (Gunnarsdottir et al., 2012).

The application of WSPs have shown public health benefits. In Iceland, the positive impacts of WSPs on drinking water quality and health were examined and it was found that among the water companies implementing WSP, there was 80% reduction in non-compliance with national drinking water regulations, and a reduction in local water-borne diseases (Gunnarsdottir et al., 2012). Water samples from five water utilities showed a declined microbial growth in the water supply system, while the monthly incidence of diarrhoea in the areas serviced by the utilities showed a significant decrease in comparison to before and after WSP implementation. There are also documented public benefits in other countries, for example in Bhutan, WSP-related changes to operations and infrastructure resulted in a significant reduction in faecal coliform detections in treated water (WHO/IWA, 2017). A study by Setty et al (2018) looking at how WSP improve water quality and compliance, found improvement with relevant water quality thresholds at a majority of locations, and evidence for reduced acute gastroenteritis incidence in one of the study sites.

WSPs enhance a sense of ownership and an improved understanding of the greatest risks to each water system, helping to prioritize risks of each water system. In the USA, a rules-based approach sets guidelines for all water systems to comply, regardless of their differences in size, location, or water source. These guidelines have been found to generally align with WSPs, however, there are differences that help highlight the potential added benefits of applying WSPs to US water systems (Baum et al., 2015).

It was found that WSPs could help with addressing gaps in US regulations specifically to control the contributing factors to waterborne diseases, which included backflow from cross connection, corrosion and aging of pipes or storage tanks, distribution monitoring and maintenance failures, lack of treatment and disinfection, and source water contamination (Baum et al., 2015).

For example, in the case of waterborne disease partly due to source water contamination, the issue could be incomplete knowledge on the safety of the source water. A WSP requires all staff to have a thorough understanding of the entire water system starting with source water. With this understanding a water safety plan would ensure better assessment of hazards and implementation of control measures across the system including source water. This understanding can be reinforced with standard operating procedures to clarify roles and responsibilities. According to Byleveld et al., (2008), this helps prevent incidents as employees take greater responsibility for the system and understand the other responsible members roles.

Improving watershed management

On a global scale, 50% of humanity's drinking water needs are met by surface water (UNESCO, 2014), however, because surface water is open, it is vulnerable to anthropogenic activities and hence, contains a wide variety of microorganisms and chemical elements. Run-off containing pesticides and fertilizers of crops introduces chemicals into water bodies. In addition, viruses from human and animal excretions near water sources can also cause contamination of water sources. Such contamination in watershed surface water is considered a hazard and becomes a risk if used as a drinking water supply to residents. Based on the concern for people's health, water safety plans must be used across a catchment to assess and manage surface water risks (Perez-Vidal et al., 2016).

As WSPs widely recognise watershed protection as a critical step or barrier, they can also be a mechanism to encourage improved watershed management. Furthermore, preventive measures should be applied, with a focus on prevention within the watersheds themselves, rather than solely relying on downstream treatment processes (Deere et al., 2008). Example of preventive approaches could be policy related around land use planning, buffer strips and wetlands to improve water quality in the source catchment and reducing access of livestock to water bodies.

WSPs provide a framework to help water utilities manage risks in their processes which are both within and outside of their control. In the case of the catchment, often the water utility has no direct control of suggested control measures but must work in a co-operative manner with the local catchment management authority, farming groups, and other stakeholders. These stakeholders will have differing priorities and interests in land-use planning and in management of potentially polluting activities which may not prioritise raw-water protection. A water supply organisation will need to communicate and influence stakeholder groups to carry out their activities in such a way as to minimize impacts on the surface waterbody (WHO, 2016).

Protection of watersheds contributes to not only safe drinking water, but also recreation, crop irrigation and environmental protection. High quality raw water reduces the steps involved in water treatment and avoids the use of complex technologies, saving money and reducing the impact on water quality. To ensure high quality water from the watershed to the whole water supply system, WHO (2016) highlights the need to carefully select a water source, along with support for protection measures to reduce the risk of contamination in the raw water. Protection can be in the hands of several competing users, and the WSP process provides a mechanism for a multi-stakeholder approach in the management of the watershed, to ensure activities are carried out in ways that minimize impacts on water quality.

Improving resilience to extreme events

Climatic and environmental issues such as floods, droughts, increased temperatures, and rising sea levels have a clear effect on a water utility’s capacity to sustain water service provision and the economic viability and cost-effectiveness of treatment and distribution (WHO, 2017). These risks include declining water quality and quantity at the source, minor to major damage of and higher operation and maintenance costs (IWA, 2019). An example of potential water quality impacts includes: increased pollutant concentrations because of reduced dilution; greater release of dissolved organic matter from soils; and increased eutrophication and consequent cyanobacterial (“algal”) blooms. Again, wetter conditions will also affect water quality. Surface water will be impacted by increased erosion and in-stream turbulence, resulting in a higher solids load. Increased flooding also presents a risk of physical damage to infrastructure.

Many water utilities may not see the immediate urgency of incorporating climate variability and change impacts in their planning processes. This is because of the difficultly in interpreting information on climate and the limited control a water utility has on the water resources to treatment and distribution. With most impacts of climate change felt upstream or downstream, the responsibility many be seen to be with another agency operating at the catchment level other than the utility (IWA, 2019). To address these issues, WSP offers an entry point for water utilities to consider climate change impacts (WHO, 2017), and apply risk management approaches to oversee processes that are beyond the company’s control (IWA, 2019).

Climate-resilient WSPs (CR WSPs) give greater consideration to the impacts of climate change and variability at each step of the water supply system. Risks and hazards are context specific and each water utility needs to understand the added impact of climate change or how existing hazards might be amplified by climate related impacts. The overall aim remains one of ensuring that the utility retains the capacity to anticipate, respond to, cope with, and recover from stress and change, maintaining its essential function, identity and structure in the face of all hazards.

Module 1

THE WSP TEAM

Who will you include as a climate expert in the WSP team?

Module 2

DESCRIBE THE SYSTEM

What part of your system is likely to be affected by climate impacts (e.g. flooding, droughts)?

Module 3

HAZARDS AND RISKS

How are the hazards indentified impacted by climate change (e.g. increased rainfall or lack of rainfall and high temperatures)?

Module 4

CONTROL MEASURES

Will the control measure be sufficient to address the associated risks with the added impact of climate change (e.g. increased rainfall or lack of rainfall and high temperatures)?

Module 5

IMPROVEMENT PLAN

What improved control measures can be put in place to deal with future climate risks?

Module 6

MONITORING CONTROL MEASURES

What indicators are best to monitor the hazards and their control measures?

Module 8

MANAGEMENT PROCEDURES

What management procedures do you have that consider weather emergencies (e.g. flooding and droughts)?

Module 9

DEVELOP SUPPORTING PROGRAMMES

What supporting programmes do you have to develop people's skills in implementing climate resilient WSP?

Module 11

REVIEW AN INCIDENT

What climate risk might result in an incident? What would be the impact on the water supply system (e.g. damage to infrastructure)?

Figure 2. Questions to consider when integrating climate change issues into WSP

A utility may need to engage wider expertise when developing a CR WSP. For example, the team might need to include meteorologists, climatologists, hydrologists, and disaster risk reduction experts. They will help the utility capture relevant climate information in the water supply system description that supports subsequent hazard identification and risk assessment.

Utilities also need to build capacity to manage climate-related risks, through training programmes in areas such as flood and drought management, or demand management. Stakeholder engagement and outreach programmes can help create partnerships for improved management of water resources and quality, while research and development programmes can focus on water supply system modelling to support increased operational and water efficiency.

There are various resources to support CR WSP including the *WHO Climate Resilient Water Safety Planning* publication (WHO, 2017), which identifies the effects that climate change can have on social systems and may lead to extreme events that are socially or naturally occurring. Another resource is the WSP supporting application within the *Flood and Drought Portal* which was developed to help water utilities develop and document their WSP while also integrating climate change considerations in the process (IWA, 2019).

Box 1. Resources to support Climate Resilient Water Safety Planning

Conclusion

The successful development and implementation of WSPs have many benefits common to all drinking water systems, with some that are unique to each system. The major benefit of implementation contributes to improving drinking water safety and quality. To achieve this WSPs provide a framework for risk reduction prevention of hazards and a better response to emergencies, which not only improves public health but can ensure better watershed management and resilience to climate impacts.

References

Baum, R. Amjad, U., Luh, J. & Bartram, J. (2015). An examination of the potential added value of water safety plans to the United States national drinking water legislation. International Journal of Hygiene and Environmental Health, 218 (8), 677-685

Byleveld, P.M.; Deere, D.; Davison, A. (2008) Water safety plans: Planning for adverse events and communicating with consumers. J. Water Health 2008, 6, 1–9.

Deere D., Perdek J., Selvkumar A., Whitehill B., (2008), Risk Management, In: Watershed Management for Drinking Water Protection, Chap. 4, AWWA – AWA, 27-49

DWI (2005): A Brief Guide to Water Safety Plans. London: Drinking Water Inspectorate (DWI)

Gunnarsdottir, M. J., Gardarsson, S. M., Elliott, M., Sigmundsdottir, G., & Bartram, J. (2012). Benefits of Water Safety Plans: microbiology, compliance, and public health. Environmental science & technology, 46(14), 7782–7789.

Hrudey S. E., Hrudey E. J. (2004) Safe Drinking Water, Lessons from Recent Outbreaks in Affluent Nations. London, England: IWA Publishing

International Water Association (IWA). (2019). Strategic Recommendations for Climate Smart Water Utilities Using the Flood and Drought Portal in Planning. United Nations Environment Programme, Global Environment Facility.

Perez-Vidal, A., Torres-Lozada, P., & Escobar-Rivera, J. (2016). Hazard Identification in Watersheds Based on Water Safety Plan Approach: Case Study of Cali-Colombia. Environmental Engineering and Management Journal, 15(4), 861-872. doi:10.30638/eemj.2016.093

Setty, K., O'Flaherty, G., Enault, J., Lapouge, S., Loret, J. F., & Bartram, J. (2018). Assessing operational performance benefits of a Water Safety Plan implemented in Southwestern France. Perspectives in public health, 138(5), 270-278.

UNESCO (2004). Groundwater: resources of the world and their use. Paris: United Nations Educational, Scientific and Cultural Organization (UNESCO) (http://unesdoc.unesco.org/images/0013/001344/134433e.pdf) Accessed 10 February 2016.

World Health Organization and International Water Association (WHO/IWA). (2009) Water safety plan manual. Geneva: World Health Organization.

World Health Organization and International Water Association (WHO/IWA). (2017) Global status report on Water Safety Plans: a review of proactive risk assessment and risk management practices to ensure the safety of drinking-water. Geneva.

Protecting surface water for health: identifying, assessing and managing drinking-water quality risks in surface-water catchments. World Health Organization

Climate-resilient water safety plans: managing health risks associated with climate variability and change. World Health Organization. License: CC BY-NC-SA 3.0 IGO

ABOUT THE INTERNATIONAL WATER ASSOCIATION

The International Water Association (IWA) is the leading network and global knowledge hub for water professionals, and anyone committed to the future of water. IWA, which is a non-profit organisation, has a legacy of over 70 years.

IWA connects water professionals in over 130 countries to find solutions to global water challenges as part of a broader sustainability agenda. IWA connects scientists with professionals and communities so that pioneering research provides sustainable solutions.

In addition, the association promotes and supports technological innovation and best practices through international frameworks and standards. Through projects, events, and publications, IWA engages with its members to stimulate innovative ideas and content in support of IWA's vision of a water-wise world.

Water safety planning has been an important part of the Strategic Programmes since 2011. IWA has coordinated projects supporting the implementation of WSPs in various countries in Africa including: Burkina Faso, Ghana, Guinea, Kenya, Liberia, Morocco, Senegal, Sierra Leone, South Africa, Tanzania and Uganda.

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