

# Strengthening climate resilience in the drinking water and sanitation sector through the Protocol on Water and Health

Draft Strategic paper prepared by the University of Bristol, with support of the UNECE-WHO/Europe secretariat

## Executive summary

Climate change poses substantial new challenges for water and sanitation services across the pan-European region. Increasing threats of floods, droughts, increased temperatures, wildfires, storm surges and loss of glaciers risk damage to infrastructure and auxiliary services, interrupting access to water and sanitation, and deteriorating water quality, increasing the risk to human health. Building the resilience of water and sanitation services is therefore critical.

At the same time, water and sanitation services are themselves sources of the greenhouse gases that cause climate change, with methane in particular being of concern. Actions to reduce emissions as part of strategies to achieve net zero carbon are being developed and offer opportunities to yield multiple benefits.

Actions are already being undertaken to build resilience. Integrating climate change considerations into water safety plans and sanitation safety plans are widely promoted as effective mechanisms to understand and manage risk. Improving water efficiency, reducing leakage, the reuse of treated wastewater and developing investment strategies linked to climate threats all build resilience. Nonetheless, further action is required to develop adaptive management strategies and scenario-based planning. The use of climate risk narratives may support utilities in identifying and planning for future risks.

Regulators are starting to demand greater action on climate change, although in general these require suppliers to demonstrate how they have taken climate change threats into consideration in their operations. Most regulators utilise existing regulations related to safety of services to ensure actions is being taken. However, specific targets remaining largely undeveloped and more could be done in this space.

Not all actions to build resilience in water and sanitation services can be achieved with existing resources and in some cases additional investment will be required to upgrade and improve infrastructure, environment, and operational capability. Ensuring water and sanitation feature in National Adaptation Plans and Nationally Determined Contributions is important to ensure that both climate-related finance and climate-related policy addresses the needs of the sector.

The Protocol on Water and Health provides a framework for addressing climate change, with a renewed dedicated programme of work and actions on climate identified in other work areas under the Protocol. Specifically, the Protocol provides a useful mechanism for bringing together environment, water and health sectors, harmonising approaches, sharing lessons, facilitating target setting for climate resilience and collecting climate-related data through its mandatory reporting framework.

## Introduction

There is consensus that the global climate is changing because of human activity that leads to the release of greenhouse gases that causes global heating (IPPC 2023). The pan-European region is already feeling the effects of global heating, and these effects will increase as global, and regional average temperatures increase.

The consequences of global temperature increases are experienced through extreme events such as heatwaves, droughts, floods, and wildfires, and slower moving effects of increased ambient temperature, unpredictable precipitation, sea-level rise and loss of snow and ice. The pan-European region covered by the Protocol does not map directly onto the regions included the Intergovernmental Panel on Climate Change (IPCC) regions, although most countries fall under the Europe chapter and a small number included in west Asia as part of the Asia chapter. IPCC 6<sup>th</sup> Assessment Report (6AR) from Working Group II regional chapters on Europe noted that the regional temperature increases exceed the global average (Bednar-Friedl et al. 2022). Four key risks were identified, two of which – water scarcity, and increased risk of floods – directly affect water supply and sanitation services. While parts of Europe have substantial capacity and capability to support adaptation, the IPCC concluded that examples of adaptive planning and management across the region remain limited. The projections for West Asia (Shaw et al. 2022) include countries in the middle east and thus the greatest risks are driven by changes in those areas that are more vulnerable. Nonetheless, issues of drought and water scarcity are increasing issues.

The changes in climate pose a direct challenge to the delivery of water and sanitation services, highlighting the urgent need to adapt systems and increase their resilience to uncertain futures (Dodman et al 2022; Howard et al. 2016). The provision of safe, sufficient and reliable water and sanitation services is central to building the wider resilience of societies (Kohlitz et al 2020) and increases in water-related disease is noted to be a risk as the climate changes (Cissé et al. 2002). This emphasises the need for increased investment in these services, to extend access to service levels that provide effective protection for public health and to ensure the services are themselves sustainable and resilient. Without investment in knowledge and actions to build resilience, climate change is likely to undermine progress toward universal access to water and sanitation services.

At the same time, the provision of water and sanitation services results in the release of greenhouse gases, notably methane, nitrous oxide, and carbon dioxide, that drive global heating. This calls for action to look to ways of reducing unavoidable emissions and for strategies to support a move to a net zero carbon sector in the future.

## Purpose of this paper

Given the emerging threats from climate change, the Parties to the UNECE-WHO Regional Office for Europe Protocol of Water and Health have recognised that work needs to intensify to address climate change challenges and support increased resilience in water and sanitation services. The Protocol's [programme of work for 2023-2025](#) includes a dedicated area on climate change that foresees activities on guidance development, capacity building and exchange of experience across countries in the region.

This paper is aimed at supporting climate work under the Protocol, including by providing strategic insight into its role in addressing the climate crisis, including through support of the development of targets and action plans at national level. The paper sets out some of the key issues that water and sanitation service providers and regulators should consider when addressing issues of resilience and net zero in the sector. It provides an overview of the options for action available for service providers and regulators, and flags where there are

potential links to other climate-related processes. It highlights the particular challenges and needs facing small systems and settings with limited resources.

### The Protocol of Water and Health and climate change

In 2022, the joint secretariat of the Protocol issued a [Background Note on Increasing Resilience to Climate Change through the Protocol on Water and Health](#). The Background Note provides examples of how climate considerations could be addressed under the framework of the Protocol. It noted that there were six technical areas of work under the Protocol where climate change could be addressed: governance, prevention and reduction of disease, institutional water and sanitation, small water supplies and sanitation, safe and efficient management, and equitable access to water and sanitation, plus a dedicated programme of work on climate resilience.

A dedicated programme of work on increasing resilience to climate was reintroduced into the Protocol work programme in 2017, and the Background Note also set out how climate change could be integrated into the other six programmes of work under the Protocol. The Background Note summarises the special session on increasing resilience of water and sanitation under the protocol.

The Background Note sets out the ambition for the Protocol to provide a framework to encourage Parties to invest in and promote resilience to climate change in water and sanitation services. It also sets out how the Protocol relates to other international instruments on climate change, including Nationally Determined Contributions and National Adaptation Plans, both falling under the UNFCCC Paris Agreement.

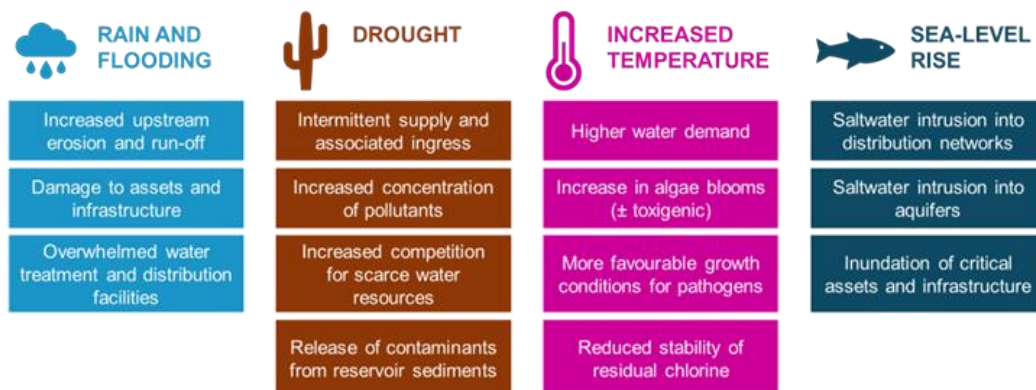
Previous work under the Protocol has also addressed aspects of climate hazards and changes in climate. Guidance was prepared in 2011 on water and sanitation in extreme events ([WHO & UNECE 2011](#)). This provided recommendations on a range of actions, including adaptation measures for drought and floods, early warning systems, and disaster response and subsequent rehabilitation.

## Section A - Climate change and water and sanitation – state of the art and key concepts

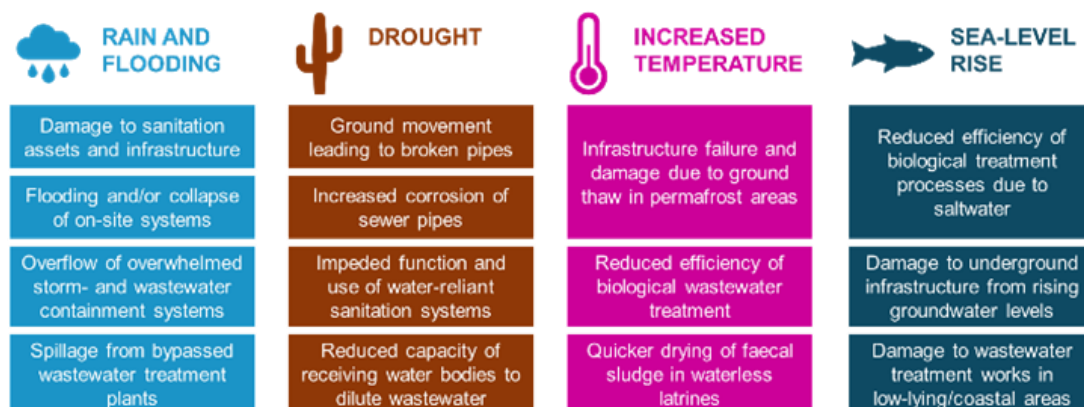
There are a large number of climate impacts on water and sanitation services as shown in figure 1 below. These threats have the potential to damage infrastructure, interrupt services, impose restrictions on supply and create new water and wastewater quality challenges. These impacts may mean a loss of temporary, or under extreme circumstances permanent, loss of access to safe water supply and sanitation; increased contamination of drinking water with pathogens and hazardous chemicals; and release of contaminated wastewater into natural water courses. These all result in an increase in the risk to human health either through consumption of contaminated water, reduced hygiene, or exposure to pathogens and hazardous chemicals through recreational uses of water. The IPCC 6AR notes the close link between floods, drought and increased heat and diarrhoeal disease, which makes a significant contribution to the projected additional 250,000 deaths per year attributable to climate change by 2050 (Cissé et al 2022).

### **Figure 1: Impacts of climate change on water quality and quantity, and on sanitation systems**

### Climate change altering water quality and quantity patterns



### Climate change altering sanitation systems



The most important climate threats to water and sanitation services are flooding and drought, both of which are expected to increase with global heating. The risk of flooding is increasing with climate change as extreme rainfall events increase in frequency leading to pluvial (surface water), fluvial (river) and groundwater flooding. The IPCC 6AR notes that the past three decades have seen the highest number of floods in the past 500 years (Caretta, et al 2022). At an average global temperature increase of above 3°C the number of people in the IPCC Europe region affected by precipitation and river flooding will double (Bednar-Friedl et al 2022).

Flooding leads to damage and inundation of water and sanitation infrastructure; damage to auxiliary services such as roads, communications and energy; and may interrupt the supply chains that support services. Floods degrade catchments; lead to changes in the quality of water sources; contaminate piped water supplies; and cause widespread environmental contamination from overwhelmed sanitation systems.

Drought leads to periodic shortages of water and, over the long-term, declining and more unpredictable rainfall, which combined with increasing demands will increase risks of water scarcity. This will compromise drinking-water supplies and put additional requirements on wastewater treatment as the dilution available in receiving waters declines. It may also put strains on sewer systems requiring higher volumes of water.

The EEA (2021) estimates that water stress already affects 20% of the European territory and 30% of the European population on average every year and that this will increase with climate

change. The IPCC 6AR indicates that risk of water scarcity will become high with average temperature rise of 1.5°C and very high at 3°C GWL in Southern Europe and will increase from moderate to high in Western Central Europe. The IPCC estimates that over one-third of the population in Southern Europe will be exposed to water scarcity with temperature rise of 2°C GWL, a risk which doubles at 3°C. It is likely that Parties to the Protocol that fall under the IPCC Asia region<sup>1</sup> will also be increasingly at risk from drought and water scarcity, although the projections provided in the IPCC 6AR are primarily driven from countries that are not party to the Protocol and are more vulnerable to climate change.

In addition to floods and droughts, climate change will lead to other threats to water and sanitation services. The IPCC 6 AR projects that coastal flood damage will increase at least tenfold by the end of the 21st century in Europe and concludes that sea level rise represents an existential threat for coastal communities.

Sea-level rise will increase threats of saline intrusion into coastal freshwater, potentially exacerbated by storm surges caused by increasing frequency and intensity of windstorms. Increasing salinity will reduce availability of freshwater in coastal aquifers, increasing costs of treatment. Storm surges may directly inundate wastewater treatment plants in coastal areas, damaging infrastructure and causing release of untreated waste into the environment.

Wildfires are expected to become more common leading to degraded water quality and reduced water yields. Melting glaciers alter river flows, affect groundwater recharge, and lead to water quality problems. Rising temperatures will increase demand for all water users, increase evapotranspiration losses, and increase unpredictability in hydrology, making planning and adapting more difficult.

The increasing impacts of climate change on water and sanitation will increase human exposure to pathogens, toxic chemicals and to source water quality deterioration that compromises subsequent water treatment. Heavy rainfall events are likely to increase suspended solids loads in surface water, resulting in turbidity spikes that exceed removal capacity.

Droughts in the pan-European region have led to increasing concerns regarding the mobilisation of contaminants, including heavy metals, from bottom waters and sediments in reservoirs as pumping has extended to deeper levels. It is unclear whether current treatment systems will be able to cope with sudden spikes in contamination, or indeed whether these spikes will be detected in time given lack of routine monitoring.

Increasing ambient temperatures are leading to more algal blooms in surface waters. In addition to concerns regarding toxins released as blooms die, the presence of blooms can interfere with treatment systems unless screening is applied. Furthermore, blooms that die reduce dissolved oxygen in water, further increasing risks of contaminant re-mobilisation. Increased ambient temperatures may affect the efficiency of currently used treatment processes, making it more difficult to meet water quality objectives in wastewater treatment works. The impact on increasing temperatures on distribution networks may exacerbate risks associated to pathogens survival and growth, as well on compromising disinfection and change disinfection-by-products levels.

The melting of glaciers and permafrost pose further specific threats in parts of the pan-European region. The retreat of glaciers results in changes in water availability, contributing in the long-term to overall declines in water security and in the short-term to increased threats of

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<sup>1</sup> Armenia, Azerbaijan, Georgia are classed as 'West Asia' by the IPCC and Russian Federation the is classified under 'North Asia'

both floods and droughts. The loss of permafrost may lead to the release of unknown microbial contaminants, increase risks from chemical contaminants and may result in contamination of water supplies as the flow of water in the sub-surface increases as it becomes unfrozen. Where infrastructure crosses permafrost, there are increasing risks of infrastructure damage, caused by, often sudden, land surface collapse and creation of sink holes.

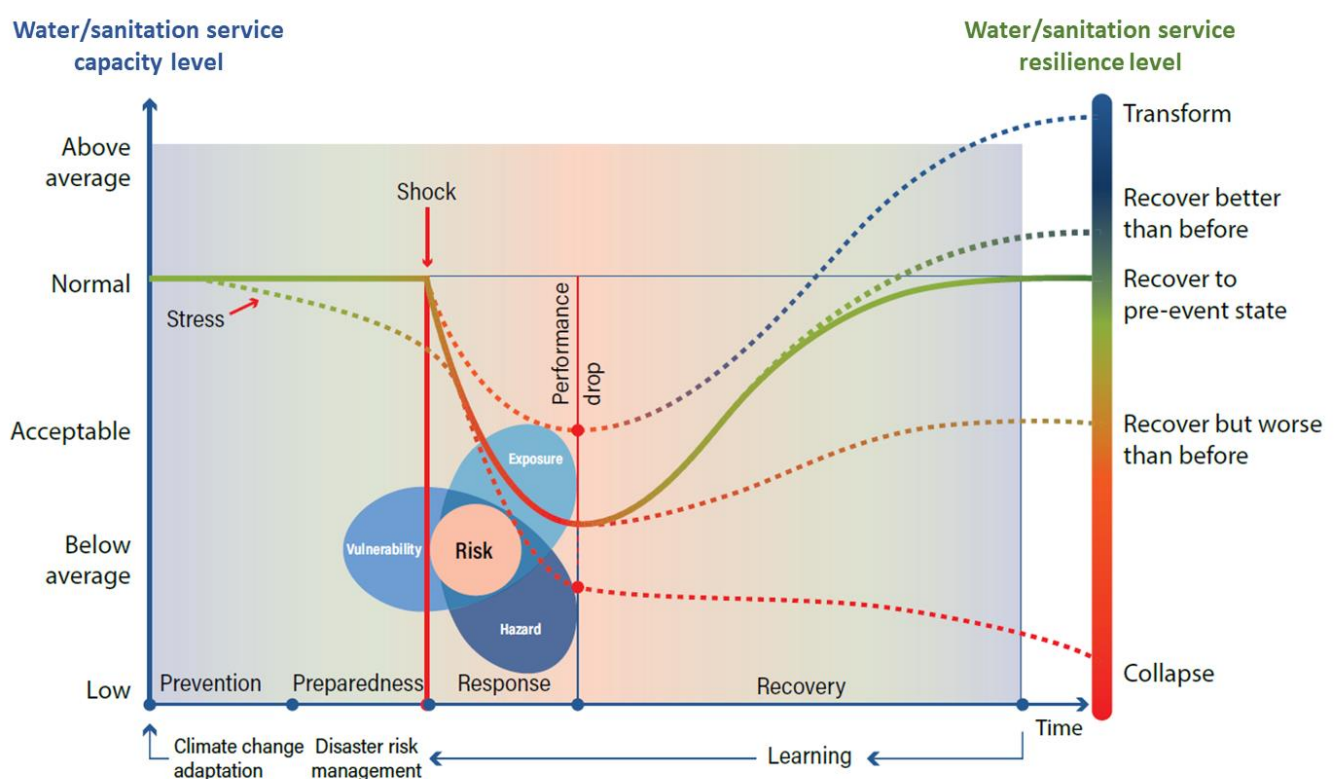
### Understanding climate resilience in water and sanitation services

In order to maintain the supply of safe drinking water and sanitation, the systems designed to deliver these services must be resilient to future climate change and the hazards this may bring. Resilience is a concept which can have multiple meanings. The IPCC defines resilience as *'The capacity of interconnected social, economic and ecological systems to cope with a hazardous event, trend or disturbance, responding or reorganizing in ways that maintain their essential function, identity and structure. Resilience is a positive attribute when it maintains capacity for adaptation, learning and/or transformation'*.

In this paper, the IPCC definition of resilience is taken as the starting point, but following the use of the term in other sectors such as health systems (WHO 2015), resilience is also understood to mean the ability to build back from an event to ensure services are restored to at least the same, or preferably higher level. This is illustrated in figure 2 below, which is adapted from the WHO Operational Framework for building climate resilient health systems (WHO 2015). This conceptual definition shows that that resilience does not mean 'never fail'; rather, it means that interruptions or short-term deterioration may occur but these should be minimised, services restored rapidly, lessons are learnt and systems adapt to prevent failure in light of an event of similar magnitude in the future. This further implies that resilience also requires effective short-term emergency response during and the immediate aftermath of hazardous events that cause loss or deterioration in service should be integrated into operational planning so that public health is protected while normal services are restored.

### Figure 2: Climate resilience of water and sanitation services (modified from WHO, 2020)

Reference: WHO guidance for climate-resilient and environmentally sustainable health care facilities. Geneva: World Health Organization; 2020.



## Section B– Options for Action

Despite the formal recognition through multiple forums of the importance of resilience for water and sanitation services, the public evidence base remains surprisingly limited. A number of countries have initiated actions and requirements for water and sanitation.

While it is likely that substantive action is being taken, but it is striking that visibility of actions specific to the provision of water and sanitation services remains limited. Much of the action around water is geared towards overall water management and there remains limited sector-specific approaches in the service provision sector. This is perhaps unsurprising given that other users require more of the available water resources, but also points to the need for more concerted action in particular related to sanitation and wastewater treatment.

### Supplier actions to achieve resilience

There are a number of actions that providers of water and sanitation services can take to improve the resilience of their systems. Some of these build on emerging experience, whereas others remain at an earlier stage of development, implementation, and evaluation.

In most settings most impact on resilience and net zero will be achieved through improving management of existing water supplies and sanitation systems. Put simply, it is usually unnecessary and unaffordable to completely replace systems. Much of these actions are low regret, for instance by reducing leakage or improving water efficiency (see for instance EEA 2021).

Improved management systems need to be based on understanding the threats posed by climate change on individual systems and to use this to plan how these threats can be managed or mitigated. Where new water and sanitation services or existing services are undergoing rehabilitation or upgrading, then these should be designed taking into account likely future climate threats. Improving the resilience of small systems or where resources are very limited will pose greater challenges than for large and well-resourced service providers.

### Water safety plans and Sanitation safety plans

Adding climate issues to existing risk management approaches such as water safety plans (WSPs) is a widely promoted approach given that these are already based on the principle that safe management requires detailed risk assessment and actions designed to mitigate identified risks. Many of the immediate actions to manage threats from climate, including actions on water treatment, distribution, and catchments primarily lie in adapted management of existing systems as opposed to new investments.

Climate resilience is now embedded into the guidance for water safety plans (WSPs) (WHO, 2023) and there is evidence of integration of climate issues into WSPs developed by water suppliers in the pan-European region (Rickert et al 2019). However, more needs to be done to embed climate change into an understanding of hazardous events and the control measures required to mitigate threats and in particular greater lesson-sharing across practitioners. Furthermore, development and implementation of any WSPs for small systems remains challenging (WHO 2023), and integrating climate concerns even more so given limited human, technical and financial resources ( ).

Integrating climate change considerations to WSPs means that climate experts should be included within the WSP team. Climate considerations should support the definition of hazardous events, taking into account site-specific climate scenarios, and be integrated into the identification and definition of control measures, critical limits and corrective actions. Associated monitoring, validation, verification and surveillance programmes will all also need

to consider the extent to which climate change may need to be addressed and what changes this may require.

Guidance on sanitation safety plans (SSPs) also integrates climate resilience (WHO 2022), although uptake of SSPs is less widespread than WSPs. Mandating of SSPs in regulations remains little developed. Further work is required to understand how climate change can be embedded within SSPs and whether this is the right vehicle for promoting more effective action on climate resilience. While adaptive management is likely to be important for sanitation, as is the case for drinking-water, it is likely that infrastructure investment will be a priority to cope with threats related to climate change.

### Improving efficiency in water use and reusing wastewater

In addition to adaptive management, including the use of WSPs and SSPs, resilience may also be enhanced through more efficient use of water and encouraging greater re-use of treated wastewater. Water efficiency measures include reducing unaccounted-for-water and in particular physical losses case by leakage. By reducing losses, systems will become more resilient and less prone to contamination, and will reduce the energy and chemical requirement as volumes of water treated and pumped are better matched to demand.

Wastewater re-use is an important strategy to increase resilience of water supply because this provides a stream of usable water that can be re-introduced into water sources and subsequent treatment trains. This is in addition to the re-use of treated wastewater and sludge in agriculture which forms part of a circular economy. The quality of wastewater in reuse must be carefully controlled to maintain safety. In the European Union this is regulated through the Water Reuse Regulation ([Water Reuse Regulation](#)). Guidance of safe reuse of wastewater has been prepared by WHO (2006) in four volumes ([WHO Reuse guidelines](#)).

### Investment strategies

Not all risks from climate change can be managed simply through better management of existing infrastructure. Some threats require new investment in infrastructure to secure resilience and net zero. For instance, the development of multiple sources of water is important to protect against risks of drought and water scarcity (see for instance case studies on the Creating resilient water utilities website ([Adaptation Case Studies for Water Utilities \(arcgis.com\)](#))). Investment strategies may include expansion of within-system storage in areas where short-term interruption in supply may become more common, or extension of connections to water distribution systems.

Investments to reduce leakage are also likely to be required, both to improve resilience and contribute to net zero. It may also involve upgrading of water treatment plants to cope with changing source water quality and the need to either remove contaminants that are increasingly found, or are found at greatly increased concentrations that may compromise existing treatment processes (e.g. turbidity and algal blooms). New treatment technologies such as desalination may also be needed to cope with water scarcity or with saline intrusion, although the impact on energy and environmental costs should be considered.

It may also mean upgrading of sewer systems, in particular where combined sewers are used, and wastewater treatment systems to both cope with reduced dilution in receiving waters, but also in storing excess flows from combined sewers during excessive rain events. The use of combined sewers is increasingly questioned as rainfall patterns change and the risks of overflows as a consequence of intense rainfall increase. This may require the development of new stormwater infrastructure. Sewers themselves may need re-routing if flooding becomes more intense and Wastewater treatment works may require re-location if they are likely to be exposed to increased flooding. Ensuring on-site systems become more robust may well



require capital investment, depending on whether the current stock of septic tanks function as such or are in fact simply holding tanks.

In some cases, investment strategies may need to focus or at least incorporate auxiliary services, including energy and communications. These may require dedicated investment by service providers to secure resilient supplies and systems. Other infrastructure is also critical. For on-site sanitation, for instance, the resilience of roads is essential to support resilient faecal sludge management and for water supply resilient roads are essential to maintain supply chains for chemicals. Direct investments in roads falls outside of the water and sanitation sector mandate, so engagement with the transport sector to ensure priority is given the ensuring resilient road connections to water and sanitation facilities will be critical.

Investment strategies must be based on a sound understanding of projected changes in climate and how these will affect water and sanitation services (sources, treatment, distribution) and allied auxiliary services. This additional investment requirements to improve resilience will need to be clearly set out with comparisons to investment costs in the absence of ensuring resilience to understand the additional cost. No or low regrets investments – that is investments that yield substantial other benefits and are useful to make irrespective of climate change - should be identified. Doing this will allow for economic evaluation of costs and effectiveness.

Investment strategies should also cost in redundancy – that is investments that must be made in light of potential threats that are not ultimately required because the presumed hazard does not occur within the working life of the infrastructure. An example is the development of a back-up water source for an urban water supply in case of an extended or extreme drought. If this does not occur then the sources is not required and is therefore redundant. Redundancy arises from uncertainties around the intensity and frequency of anticipated events, but a failure to plan for such events could lead to catastrophic consequences. Factoring in redundancy means adjusting value for money analyses to account for investments that ultimately not required.

### Scenario-based planning

Developing scenario-based planning is a useful mechanism by which to consolidate the assessment of resilience investment needs and for forward planning. This is particularly useful when considering risks of redundancy as it can define the conditions under which additional investments should be made, thus reducing risks of redundancy from initial investments. Some climate-related decisions, particularly those involving large investment costs, major infrastructure construction or upgrading, are of a scale that means that they should only be embarked upon when the balance of evidence suggests strongly that there is a time-defined period within which they are needed. Scenario-based planning may draw on climate scenarios as a way of defining the trigger points or conditions under which an investment is required. For example, the case study of the Seattle water supply on the Climate Ready Water Utilities programme (see: [Case Study: Water and Wastewater Utilities Planning for Resilience - Seattle Public Utilities \(ago-item-storage.s3.amazonaws.com\)](#)) demonstrates how this utility adopted principles of scenario-based planning to identify the conditions under which investments will be needed.

The key for scenario-based management is that it must be adaptive. That means both that actions will change as the conditions within a scenario change, but also that scenarios themselves will change over time and will have to be updated. Therefore, there needs to be flexibility built into decision-making to allow course corrections as scenarios evolve in the way described above.

Scenario-based planning must have a set of plausible scenarios to give a range of different futures. To do this effectively, it is critical that scenario development integrates climate

expertise to understand how different socio-economic pathways and emissions profiles lead to different future climates. A particularly helpful way to look at this is the development of climate risk narratives (CRN) which combine climate projections under different conditions at different points in time with plausible ways in which the sector could have developed in terms of technology, finance, human resources and environmental protection.

CRNs are usually best defined by multi-stakeholder groups and in the context of water and sanitation services this should at least include suppliers, regulators and consumer representatives. The Protocol could add support to this activity, by bringing together stakeholders into national workshops to co-develop CRNs. Multiple CRNs can be developed that set out how different levels of risk depending on both changes in climate and which socio-economic pathway is pursued. These can then be analysed in the framework of climate resilient development pathways to understand how threats can be managed over time, identifying key decisions points.

### Monitoring and assessing resilience

Actions on resilience and on net zero both require robust systems of monitoring and assessment. As with other aspects, the needs of small systems must be considered separately as expectations differ as service providers have more limited capacity, skills and resources.

Resilience is multi-dimensional: in addition to the infrastructure and technology used, and the environment within which the system is located, systems of management, governance, finance, supply chains and auxiliary services are critical to securing resilience. Without a rounded picture of all aspects of the system, assessing resilience becomes ineffective and of limited value. The multi-dimensional nature of resilience therefore has implications for measurement and monitoring. Table 1 shows the different domains to be considered for resilience and means of measurement.

Domain	Assessment method	Scale of assessment
Infrastructure	Assessment of sanitary integrity and protection, water quality and yield analysis	Individual water supply and sanitation systems
Environmental setting (catchment)	Geospatial analysis of remotely sensed images, climate models/climate risk narratives	Catchment/regional scale
Service management	Focus group discussion and key informant interviews	Service provider/ community managers
Supply chains	Focus group discussion and key informant interviews, infrastructure assessment, geospatial analysis of remotely sensed images	Service provider/community managers, plus regional scale for infrastructure and geospatial analysis
Governance and accountability	Focus group discussion and key informant interviews	Service users, governance boards, regulators
Institutional support	Focus group discussion and key informant interviews	Parent organisations, national government, professional associations

**Table 1: Domains of resilience**

For small systems, the resilience in each domain is assessed using a Likert scale. Data for the domain is analysed and the supply matched to one of five scenarios that are considered

to demonstrate different levels of resilience. The scenarios are given a score ranging from a score of 1 (very low resilience) to 5 (very high resilience). The scenarios defined are based on the likelihood that the water supply or sanitation system will be able to cope with climatic events and so prevent adverse impact. Table 2 shows how each level of resilience is defined for each domain for small piped water supplies.

Developing standardised metrics is preferred for comparative analysis across a country and in some circumstances to aid prioritisation. For utilities, development of complex metrics may be justified, such as those proposed by United Utilities and ARCADIS (2017). Utility monitoring needs in part to be designed specifically for the systems being operated, in the same way that water safety plans are tailored to meet the needs of each system and the hazards that cause threats. However, developing simplified score cards that allow comparison between different utilities is useful.

For small systems, comparative metrics are particularly useful. This allow prioritisation of systems or regions where resilience is weaker. Such approaches also allow for the identification of systematic weaknesses that require a broader response. Metrics have been developed that permit such comparative analysis (Howard et al 2021).

Score	Domain					
	Infrastructure	Catchment	Water supply management	Community governance	Institutional support	Supply chain
1 (very low)	No protective measures against risk of damage and inundation in place, no data on trends in yield or evidence of declining yield, very high sanitary risks at source and within distribution system, major damage and leaks in the distribution network, numerous raised tanks at risk from wind	Source is downhill of extensive, steeply sloping built-up land/bare soil, or is in an area frequently (annually) inundated with river or sea water, with no flood protection measures, and/or is in a densely populated setting with open defecation and pit latrines at high risk of inundation, other water users severely impact on water availability	No effective management, including financial, with no action taken to resolve problems in supply, no understanding of climate adaptive management, no participation in risk assessments, untrained and unskilled operators, no representation of women.	No formal community governance structures; no informal feedback or accountability to communities; lack of involvement of community members in decision-making; exclusion of marginalized groups from decision making.	No formal risk management programme in place in local government, no steps taken to support water supply managers to develop adaptive measures, substantial delay in procuring parts or technical support after an emergency	Only one source of consumables and parts, only one route exists between community and the market with high risk of damage to roads, bridges or mobile communication networks from natural hazards, user committees do not store surplus parts needed to carry out repairs
2 (low)	Limited protective measures against risk of damage and inundation, substantial seasonal declines in yield and overall decline in yield, high sanitary risk at source and within distribution system, some damage and leaks in the distribution network, some raised tanks at risk from wind	Source is downhill of some steeply sloping built-up land/bare soil, or is in an area regularly (once every 3-5 years) inundated with river or sea water, with partial flood protection measures, and/or is in a densely populated setting with some open defecation or pit latrines at medium risk of inundation other water users impact on water availability	Management is weak, including financial, with actions to address problems ad hoc and rarely in good time, basic understanding of climate change and adaptive management, no participation in risk assessments, operators with limited partial training with limited skills, minimal representation of women	No formal community governance structure but some informal governance mechanisms; some informal and occasional feedback to community but no accountability mechanisms; occasional involvement by community members in decision-making; limited inclusion of some marginalized groups in decision making	No formal risk management programme in place in local government, but ad hoc support for water supply managers is provided to develop and undertake adaptive measures, some delay in procuring parts or technical support	Limited sources of consumables and parts, only one route exists between community and the market, medium risk of damage to roads, bridges or mobile communication networks from natural hazards, user committees do not store parts needed for repair
3 (medium)	Partial protective measures against risks of damage and inundation in place, relatively small seasonal declines in yield but evidence of overall decline, medium sanitary	Source is downhill of moderately sloping managed or cultivated land, or is in an area occasionally (once every 10 years) inundated with river or sea water, with	Management is reasonably good, including financial, with actions taken when problems arise although not necessarily in good time, limited	Formal community governance structure in place, but weak and limited power; formal feedback and accountability mechanisms exist but	Local government has a limited risk management programme and provide limited risk management training to water supply managers, but does not provide support to	Limited sources of consumables and parts, multiple routes exist between community and the market, medium risk of damage to roads, bridges or mobile

	risk at source and within distribution system, minor damage and leaks in the distribution network, few raised tanks at risk from wind	flood protection measures, and/or is in a densely populated area with no open defecation but pit latrines at medium risk of inundation, other water users have limited impact on water availability	understanding of climate change and adaptive management, limited participation in risk assessments, operators with basic training with moderate range of skills, moderate community engagement and support, some representation of women but none in leadership position	only infrequently used; regular but limited involvement of community members in decision making; limited inclusion of most marginalized groups in decision making	implement adaptive measures and no coordination with other sectors, slight delay in procuring parts or technical support after an emergency	communication networks from natural hazards, user committees have some surplus parts needed to carry out repairs
4 (high)	Protective measures against risks of damage and inundation in place, little seasonal decline in yield and little evidence of overall decline, low sanitary risk at source and within distribution system, limited leakage, no raised tanks at risk from wind	Source is downhill of gently sloping managed or cultivated land, or is in an area rarely (once in 20 years or more) inundated with river or sea water, with flood protection measures, and/or is in a densely populated area with no open defecation but pit latrines at limited risk of inundation, other water users may have minor impact on water availability	Competent management, including financial, with actions taken in a timely manner to address supply problems, moderate understanding of climate change and adaptive management, moderate participation in risk assessments, operators with extended training and skills, good community engagement and support, equal representation of women on committees but few in leadership positions	Effective formal community governance structure in place; formal feedback systems in place and used regularly but infrequently, accountability mechanism in place, but infrequently used; community members involved in decision making; moderate inclusion of most marginalized groups in decision making	Local government has a developed risk management programme and provides risk management training to water supply managers and some limited support to implement adaptive measures and has limited coordination with 1-2 other sectors, no delay in procuring parts or technical support after an emergency	Multiple sources of consumables and parts, multiple routes exist between community and the market with low risk of damage to roads, bridges or mobile communication networks from natural hazards, user committees store most surplus parts needed to carry out repairs
5 (very high)	Comprehensive protective measures against risks of damage and inundation in place, no evidence of seasonal or overall decline in yield, no evidence of reducing yield, very low sanitary risk at source and within distribution system leakage within national	Source is downhill of gently sloping natural land, has flood protection measures and is in an area never inundated with river or sea water, and/or is in an area with no open defecation and pit latrines at no risk of inundation, other water users have negligible	Strong management, including financial, system able to anticipate problems and prevent these from disrupting supply, good understanding of climate change and adaptive management, active participation in risk assessments, well-trained	Strong community governance structures in place with regular engagement with service managers; regular and frequent feedback to community and strong accountability mechanism; active engagement by community members in	Local government has a comprehensive risk management programme and provides risk management training to water supply managers and ongoing support for adaptive measures with cooperation with all other sectors, no delay in procuring parts or	Multiple sources of consumables and parts, multiple routes exist between community and the market, no risk of damage to roads, bridges or mobile communication networks are from natural hazards, user committees store most or

	limits, no raised tanks at risk from wind	impact on water availability	operators with range of skills, women take equal number of leadership and decision-making roles	all decision making; inclusion of all marginalized groups in decision making	technical support after an emergency	all parts needed to carry out repairs
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**Table 2: Scoring framework for Resilience domains: small piped water supplies**

### Framework for establishing priorities for supplier action on resilience

A key element of building resilience is to define the priorities for investment and action, taking into account how future climate change may impact on services and what changes in action and investment may be required. At a basic level, the collection of data across the multiple domains of resilience using standardised metrics can be an effective way to identify where priorities for action lie. The data collected may be used to look across multiple systems and use this as a means of comparative analysis and to identify systemic issues. This approach has particular value for small systems. Data may also be collected to analyse individual systems to identify where actions are required in response to likely future threats. Such approaches should be used for larger systems where capacity exists to undertake such detailed analysis. They may also be applied to small systems, but this is likely to be more challenging as may acting on the evidence.

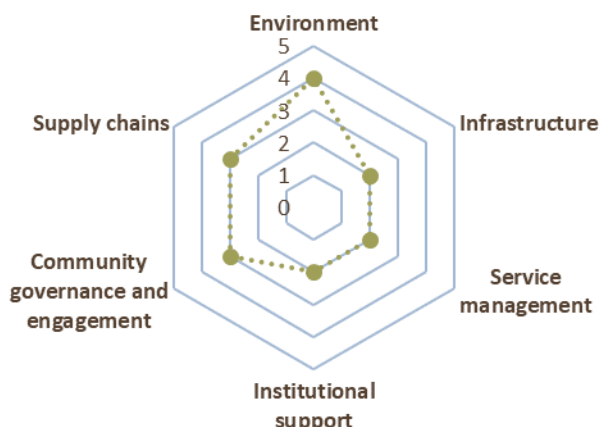
The example in Table 3 below provides an example of data from assessments of multiple small to medium-sized piped water supplies can be used to rank individual supplies in terms of existing resilience and therefore priority for action. Figure 3 shows how data can be aggregated to identify the domains where there is overall lower resilience and where a sustained effort to effect systemic change should be focused.

Total score	Resilience	Priority	Qualifier
25-30	Very high	Low	If score reduces because of failure on one domain, action required in that domain
19-24	High	Low	Action focused on specific indicator failures
13-18	Medium	Medium	Likely to be across multiple indicators
7-12	Low	High	Action required across all indicators
6	Very low	Very high	Action required across all indicators

**Table 3: Scoring of systems across multiple domains**

For small systems, collection of this data is likely to be best done by an independent assessor who can then build a consistent approach to assessing resilience across multiple systems. This type of approach may be used by national authorities, including regulators, who have responsibility for ensuring access to safe drinking water. Whilst this potentially useful as a regulatory tool, for small systems in particular it is likely to be used less as a means of enforcing action and more as a means of understanding how available budget for improvements should be allocated.

The approach above is useful when looking across multiple systems and in support of policy or national and regional level planning, but more detailed frameworks for individual supplies should also be considered, particularly for larger systems. While such assessments may necessarily involve modifications to address system-specific issues, retaining a consistent approach to allow comparisons is important for regulators if they want to assess performance across the sector.



**Figure 3: Trends in domain scores across multiple water supplies**

Using metrics that look at the different domains of resilience, system-specific priorities can be identified and developed into a framework for action that considers the likelihood and severity of impact from specific threats, the timeframe over which impacts will be felt, and the costs of action and inaction. Table 4 provides a basic framework that can be developed in order to undertake prioritisation. Prioritisation frameworks can build on CRNs and be integrated into scenario-based planning, leading to transparent and structured investment planning.

Climate threat	Scale of impact	Likelihood of impact	Timeframe of impact	Cost of inaction	Cost of action	Priority
Nature of threat (drought, flood, wildfire, water scarcity, water quality etc)	Distribution, localised Distribution, system-wide Water source Water treatment	Almost certain Highly likely Likely Unlikely	1-5 years 6-20 years 20-50 years 50+ years	Increased service costs Regulatory penalties Emergency provision Repair and replacement Loss of customer confidence	Infrastructure, technology, staff training, consumables, auxiliary services	High/medium/low Short/medium / long

**Table 4: Basic framework for developing system-specific assessments**

Assessments of individual supplies can either be done by an independent assessor or by the service provider themselves. The latter approach is often more appropriate as the staff involved will have a much better understanding of the system and the threats it faces. It will be critical that such assessments draw on available climate expertise and can show a credible link to climate projections. Regulators was also demand that regulators report back on these assessments and if so, a standardised framework should be deployed that ensures suppliers must report across the key domains of resilience.

### Regulatory actions required for climate change

Regulations may be defined for both actions to reduce the greenhouse gas emissions and actions to increase resilience. In general, regulators have so far not set specific regulatory



requirements for climate resilience of drinking water supplies or sanitation systems within the pan-European region, or globally. Instead, many regulators use existing regulations which provide the basis for ensuring water supplies improve operational resilience and invest in catchments.

In the European Union, a study by the EEA (2022) found water management was one of the key areas that most Member States were addressing through climate risk assessments and national adaptation planning. In most cases, actions focused on wider water management, including domestic supply, but some countries, for instance the Netherlands, make specific provision for clean drinking water. The EU Drinking Water Directive requires suppliers to take into account climate change as part of a risk-based approach to water safety management. This provides the basis for action to build climate resilience, although this is not mandated and would be covered through regulations that applied to water safety management where inadequate resilience led to compromised safety.

In the United Kingdom, the Water Services Regulation Authority (Ofwat) required all water companies in England and Wales to undertake analysis and prepare reports on anticipated climate impacts on water supplies under their area of operation and to set out plans for ensuring resilience in water sources and distribution. This also requires water companies to take action in catchment, treatment systems, and operations to ensure that there is no deterioration in water quality. These plans will be reviewed, but it is unclear what regulatory actions may result.

The USEPA developed a framework for adaptation to climate change for water utilities as part of their creating resilient water utilities initiative. This framework provides tools, case studies, and training in how utilities can address climate change within their operations. It also signposts where funding is available for utilities to invest in strengthening resilience.

In terms of reducing emissions, regulators in some jurisdictions require utilities to take actions, often in the context of a contribution to net zero targets. For instance, public bodies duties imposed on the utility in Scotland requires them to take actions to achieve net zero within their organisation in line with Scottish Government targets. Such requirements require the utility to work to limit their emissions as far as possible without compromising public health or excessive increases in tariffs. The utility is also required to demonstrate it has taken action to secure resilience of its services.

It would seem that to date regulators are more focused on creating incentives for service providers to build in considerations of climate change into operation practice and investment planning rather than mandating specific actions or imposing regulatory penalties for poor performance. This is likely driven by three factors. There is limited consensus on what constitutes a resilient system and more specifically how that would be assessed at an outcome level (the usual approach adopted by regulators). Most drinking water and sanitation regulators at this point do not have extensive expertise in climate change and therefore developing a more complete regulatory framework will depend on building capability and skills. Finally, climate change in many situations is a risk multiplier – that is enhancing existing known risks – and thus existing risk management approaches should be effective in managing risks and hazards. There are some situations where new risks may be introduced and in these cases it will be important for regulators to build their knowledge and capability to enable proposed actions by service providers to be properly assessed.

### Regulatory instruments

Developing regulatory instruments to create the right incentives for investment in resilience is central to promoting action. It is important to consider what type of instruments lend

themselves most effectively to regulation. It is likely that these will vary across different countries and for different types and scales of service providers. In some cases, regulators may mandate certain types of activity, for instance requiring the development of climate resilient water safety plans, sanitation safety plans, operational resilience plans, adaptation plans, or investment plans. However, care should be taken to ensure that if specific types of activity are defined, these cover the full range of actions that may be required. For instance, climate-resilient WSPs may miss major investment decision-points unless explicitly established to do so.

For larger utilities, regulations requiring them to put in place programmes of regular analysis of climate trends and threats within their operational area, analysis of the implications for their operations, and proposed actions to manage and mitigate threats are likely to be most appropriate. This should be backed up by regular reporting requirements placed on suppliers to regulators to demonstrate the actions they are taking. The period of reporting is best defined at country level and may depend on the robustness of initial analysis. Where initial reports appear weak, more regular subsequent reporting may be mandated to provide confidence while more robust initial analysis may provide the benefit of reduced reporting. Offering these options can be effective in securing robust analyses in the first instance, as routine reporting tends to be relatively resource-intensive with no financial return. In all cases, reporting should only stretch to 5 years if it is to remain robust and operational.

Requirements may include presentation of detailed projections of climate trends, including highlighting changing levels of risks of extreme events and changes that may lead to increased water quality threats. Climate projections will need to be taken from credible sources and cover a range of time frames from relatively short-term operational time horizons (up to 20 years) as well as longer timeframes suited to investment timeframes (50-100 years). It would be expected that reports will set out the specific risks that are anticipated, the consequences of these for operations and infrastructure, and response plans including operational changes, monitoring systems, and major investment decision-points.

Small systems represent a greater challenge for regulators. Small systems in this context are understood to be single systems operated by local communities or individuals. Smaller systems operated by utilities or local governments should fall under the requirement for reporting noted above as they are part of larger organisations which may reasonably be expected to have the skills and capacity to address climate risks. It is unrealistic to expect small systems operators, who often have limited technical skills and resources, to be able to undertake the detailed kind of assessment envisaged for utilities. Nonetheless, these are the systems – whether drinking water or sanitation – that are likely to be most vulnerable to the effects of climate change and where investments in resilience are most required.

Approaches to regulation in such systems therefore should focus on enabling support functions to help systems become more resilient. In the medium-term, options to consider include the potential for shifting responsibility for these systems to either utilities or an umbrella body that is better resourced. It is highly recommended that national governments commission a comprehensive assessment of climate projections and associated threats to small systems across their country, noting specific regional and other variations. Assessment should also include likely current resilience, priority areas for investment and a roadmap for implementing actions. Critical for effective implementation is to identify institutional leadership, resources required and the development of a monitoring system to track progress. The USEPA creating resilient water utilities initiative and website provides useful examples of how resources may be made available to service providers. A range of tools and guides are available, as well training and signposting for climate adaptation funding through grants awarded by the EPA.

### Establishing targets for climate resilience

Targets for resilience may be established at national level. There is potential for the Protocol to support this process through the use of agreed targets set by the Parties and collecting data on implementation of such targets through the Protocol reporting system. There are several issues that can be considered when setting targets for resilience. Firstly, it is important to clearly define resilience, including implications for measuring and monitoring compliance. Resilience relates to wider systems and is always a process, with embedded learning, change, periodic failure and reinstatement of service.

In this light, one approach to setting resilience targets could be to require service providers to demonstrate taking a proactive and ongoing approach to integrating climate change into their planning, operations and finance. As noted above, this requires demonstrating that comprehensive assessments of climate change threats are undertaken, that the implications of these threats to systems are understood, and plans of action to adjust operations, skills, and technology to mitigate the impacts of these threats are in place. By placing the onus on suppliers to demonstrate action reduces the burden on regulators. However, as noted above this does raise questions regarding how such actions are judged to be adequate or not and issues around capacity in regulators to perform this role. An alternative approach to setting targets may be to work with the community of service providers to develop a consensus view on benchmarks for action on resilience. This would ensure greater buy-in but equally may result in an overly-conservative set of targets.

A key element for regulators to consider will be the extent to which actions to build resilience should be reflected in changes in tariffs. This will require considerations of the trade-offs and economic evaluation of these measures. On the one hand, investments in resilience are likely to increase costs of service delivery and it is therefore legitimate for providers to increase tariffs to cover these costs or expect subsidies from the state. On the other hand, investments in resilience result in greater longevity of systems and reduced outages, resulting in avoided loss of income and penalties. Over the medium-term, such investments may therefore offer financial returns and thus increases in tariffs not warranted. It is strongly recommended that regulators undertake detailed economic evaluation around proposed interventions and use this as the basis for establishing whether tariff increases are acceptable, taking into account affordability for users.

### Economic instruments to incentivise climate actions

Economic incentives – for instance allowance for increase in tariff, increases in state subsidy, bonus payments for performance, opening access to new sources of finance (e.g. climate finance) – can be effective in encouraging change in utilities and other suppliers. Use of economic instruments needs to be carefully considered as it is important not to create artificial incentives for action that could be expected to occur without the need for additional incentives. It is important to avoid creating perverse incentives where actions to improve resilience are deferred or delayed to maximise subsequent financial rewards to upgrade systems.

Nonetheless, in some circumstances, economic incentives will be more likely to achieve objectives than either relying on penalties (which often fail to deter) or expectations that suppliers will see the need for action. For example, providing access to low or zero interest loans to invest in upgrading infrastructure, or improvements in catchment management may persuade suppliers to take actions that would otherwise be considered financially unviable. Alternatively, supporting suppliers to develop programmes of work that attract climate finance as additional of capital investment or for essential re-skilling of key workers may also provide useful incentives for action.

## Net zero in water and sanitation

The water and sanitation sector is a source of greenhouse gas emissions that are driving human-caused climate change. These emissions come from sanitation, as the organic material in faecal waste decomposes to release methane, carbon dioxide and nitrous oxide. They also come from the emissions associated with the energy used in pumping and treatment systems, transport and the use of treatment chemicals.

Under the IPCC reporting, emissions from wastewater are counted under the overall heading of waste. In 2019, global emissions from waste were 1.63 MtCO<sub>2</sub>e, and contributed 1.49 MtCO<sub>2</sub>e of methane, which is more potent greenhouse gas than carbon dioxide (Ritchie et al 2020). In the European Union, waste accounted for over 145 million tonnes CO<sub>2</sub>e, of which around 40 million tonnes CO<sub>2</sub>e comes from wastewater treatment and discharge (EEA 2020). Global reviews have estimated that onsite sanitation contributes 5% of total anthropogenic methane emissions (Cheng et al. 2022).

Addressing these emissions is generally done through strategies and targets to achieve net zero carbon. It is important to note that net zero does not mean eliminating emissions. Some greenhouse gas emissions from sanitation cannot be avoided. Net zero means trying to balance unavoidable emissions with actions that absorb carbon. The development of strategies for net zero are of increasing importance in water and sanitation. Some of these are mandated by national authorities – for instance public bodies duties – while others are voluntary and implemented by utilities aiming to be at the forefront of developing actions to reduce their footprint.

There are multiple approaches for achieving net zero. Some of the most obvious include switching to renewable energy sources and transport; making processes and systems more energy efficient; reducing leakage and other losses; and optimising wastewater treatment to select appropriate aerobic and anaerobic processes depending on local conditions (examples). Energy generation within water and sanitation systems sources can yield substantial reductions in emissions – for instance Scottish Water's Glencourse water treatment works generates 91% of its energy requirements through deployment of turbines on the incoming raw water. Wastewater treatment plants also offer potential for energy generation as large biogas plants operating at scale. However, smaller community level plants tend not to offer such potential as sludge generation is too small and they become heavily reliant on animal sludge.

To achieve greater reductions and move to net zero, other approaches tend to also be required. These can include participation in carbon off-set schemes and participation in carbon markets to buy credits. The latter may be most appropriate where private sector entities are involved in service provision and are able to make best use of the commercial opportunities available. The use of in-setting approaches is also increasingly attractive where water companies (whether private or public) own land in their catchments. In such cases, utilities can work with tenants and land managers to create carbon sinks – for instance through re-forestation and restoration of peat bogs and wetlands. Ownership of land also offers opportunities for utilities to either put up their own wind turbines or solar arrays to provide the energy they need. It may also open opportunities to work with energy companies for them to invest in renewable technologies with carbon credits accrue to the water utility.

Regulators or national Governments may wish to establish targets for net zero, which are usually defined as a date (usually expressed as a year) by which net zero will be achieved. This will usually be linked to overall national targets for net zero. Over 70 countries have set national net zero targets, the majority with a date of 2050 in line with the Paris Agreement. . Targets can be set to achieve net zero (or interim level of positive emissions), with interim and

final targets established, monitored, and regulated. Targets may also be framed as percentage reduction in overall emissions without the expectation of achieving net zero. Softer targets can also be set on the basis of demonstration of detailed analysis of emissions associated with service provision and the development of a road-map to reduce these.

As with resilience, it is important for regulators to consider the economic costs and opportunities of achieving net zero and use this to consider whether economic incentives should be offered. Costs are likely to be incurred in a move to net zero as investment is needed in infrastructure, technology, catchments and skills. At the same time, action to reduce carbon emissions often results in improved efficiencies and lower energy costs meaning a medium-term gain for service providers. A thorough economic evaluation of costs, opportunities and timeframes over which these arise is important when setting regulations.

### Way forward

It is important that water and sanitation stakeholders increase attention to and investments in climate resilience and, in this respect, the Protocol on Water and Health offers a useful instrument to promote and support climate action at national and inter-state levels.

As discussed further below, it is also important for water and sanitation authorities and service providers to engage with other processes related to climate change and climate finance, and in particular contributions to and engagement with National Adaptation Plans and Nationally Determined Contributions. In addition, there are opportunities for the sector to engage with national, regional, and global systems of climate finance, whether operated by private investors or through inter-governmental agreements and structures.

### The role of the Protocol on Water and Health

The Protocol enshrines a legal obligation for States Parties cooperate across sectors to develop a consistent set of targets in areas that are specified in the legal text of the treaty and to regularly report on progress in achieving those targets as well as to collect data on the situation with water, sanitation and health. Target areas cover aspects such as quality of drinking water, access to water and sanitation, performance of water and sanitation services, wastewater treatment and reuse and protection of water resources. Targets set on these topics may address revision of laws or policies, monitoring, infrastructural development, public awareness campaigns, and other activities. The Protocol promotes the use of water safety plans and sanitation safety plans as mechanisms to address climate change. The target-setting and reporting framework under the Protocol could be used to promote, assess and monitor climate interventions.

The ground for this work has been laid by the Background paper prepared in 2022, which showed how climate resilience could be integrated under existing targets. It is recommended that the Parties consider going further and develop a set of specific climate targets, differentiating between those water supply and sanitation systems that are well-resourced and those which have more limited human, technical and financial resources. Targets may also differentiate between what is expected in drinking-water supply systems and sanitation systems. Reporting under the Protocol offers an opportunity to monitor actions being taken to set and monitor targets and collect climate-related data, as well as help harmonise approaches across the pan-European region.

The Protocol could also be a useful mechanism to establish consistent comparative means of measurement and monitoring of climate resilience and net zero across all member states. These would need to be based on agreed targets, which would include clear reporting requirements, but it suggested that monitoring extends beyond this. The Protocol also offers opportunities for harmonisation in monitoring of climate-related targets and climate policies in

the water and sanitation sector more widely. Furthermore, as it offers an inter-governmental and inter-sectoral framework, Parties and other countries in the pan-European region can exchange on common challenges, lessons learned and good practices.

Future work under the Protocol should be informed by a mapping of support needs across Parties and an analysis of the extent to which these can be met through the Protocol. A first step that is strongly recommended is to undertake detailed assessment of resilience where these do not yet exist and synthesis of evidence where these have been undertaken. This could be done by each country that is a Party to the Protocol, or if resources permit an activity supported by the Joint Secretariat drawing on expertise available in the pan-European region. Using a single, comparative metric will greatly aid the interpretation and subsequent use of this evidence.

### Links to NAPs, NDCs

Action on climate change is also driven by global climate processes, such as the Paris agreement, which requires the development of Nationally Determined contributions NDCs and NAPs. Synergies should be explored between the work undertaken under the Protocol and such processes, to promote coherence and build on ongoing processes. The EEA (2020) notes that in the European Union most countries have adopted an approach to integrate climate change adaptation into sector policies as a result of NAPs. Water supply and water resources are common features in most NAPs (see for instance [UNFCCC-NAP2021-Progress-report.pdf](#)), but sanitation features less prominently. It is important for the water and sanitation sector to work more closely with climate policies to ensure that adaptation is supported.

While much of the action to improve climate resilience should be driven by the water and sanitation sector itself, it is also important to explore how actions facilitated through the Protocol can be linked with NAPs and NDCs. In the case of NAPs, it is important that the water and sanitation authorities and service providers set out what adaptation is required in the sector, how adaptations will contribute to wider societal resilience as well as system resilience, the means and timeframes for these adaptation measures and the budget implications of adaptation measures. This should create the basis for discussion and negotiation with funders of NAPs to secure adequate financing for adaptation investments, where this is required and cannot be met within existing sector envelopes. Financiers such as the EIB and EBRD also increasingly require proposals for loans to include evidence of how climate resilience will be secured.

It is important as noted above, that not all investment for adaptation is seen as being external to existing financial resources. Many adaptations and actions to promote resilience can be covered by existing finance as improved management of existing systems will be important. Thus, it is important to focus actions to attract climate finance on those areas where improvements in existing practice or use of existing resources will not be sufficient.

In parallel it is important that the water and sanitation sector gets a better assessment of the emissions associated with the delivery of services as part of NDCs to support more accurate and reliable reporting. This particularly important when considering how improvements in management, infrastructure and technology will be financed if reduced emissions required additional finance. Without a credible baseline of emissions, setting targets and securing the finance to achieve these will be extremely difficult.

### Conclusion

It will also be important for the Parties to consider how the Protocol could support greater access to climate finance, whether from multi-lateral bodies, inter-governmental global funds

or private investors. Increasingly, bids to multi-lateral development banks require evidence that investments will be resilient, as well as sustainable, and that carbon contributions are estimated and minimised.

The Protocol can support the development of greater resilience, by supporting national targets set under its framework and by developing common systems of monitoring of progress and reporting. Such approaches should be aimed at supporting Parties to work with service providers in developing business cases for investment to build climate resilience. and clearly specifying the “climate rationale” of projects or other action taken on water and sanitation. Emissions may also be considered, particularly if donors demand evidence that investments make a positive reduction to emissions reduction. The [Protocol](#) can also support capacity-building and lesson sharing.

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