

**Economic Commission for Europe****World Health Organization
Regional Office for Europe****Meeting of the Parties to the Protocol on
Water and Health to the Convention on
the Protection and Use of Transboundary
Watercourses and International Lakes****Sixth session**

Geneva, 16–18 November 2022

Item 8 of the provisional agenda

Increasing resilience to climate change**Background Note on Increasing Resilience to Climate
Change through the Protocol on Water and Health****Prepared by the joint secretariat***Summary*

This document was prepared by the joint secretariat with the support of a consultant in 2020. It presents an overview of how the Protocol's framework, areas of work and tools can support climate sensitive action in the water and sanitation sector. It also reviews how the Protocol can support global climate frameworks by promoting integration of policies in a holistic and preventative approach. The document was circulated for comments to all focal points in 2021 and served as a background document for the special session on increasing resilience to climate change at the thirteenth meeting of the Working Group on Water and Health (Geneva (hybrid), 19–20 May 2022).

The Meeting of the Parties may wish to:

- (a) Convey its appreciation to Italy for its leadership in this programme area;
- (b) Encourage countries to use the Protocol's framework and the tools developed under the Protocol to increase the resilience of water and sanitation systems to climate change, including through the target setting mechanism under article 6 and establishing effective early warning, surveillance and response systems as stipulated under article 8 of the Protocol;
- (c) Encourage countries to increase synergies between global climate frameworks and their national implementation documents, such as Nationally Determined Contributions and Protocol targets and activities;
- (d) Recommend that countries use the Background note on Increasing Resilience to Climate Change through the Protocol on Water and Health.



I. Introduction

1. The introduction of water supply and sanitation is a development and medical milestone, boosting improvement of living conditions. There is consensus on the existence of strong links between water supply and sanitation systems and environmental protection, prevention of disease, poverty alleviation and food security. However, in the pan-European region, approximately 16 million people lack access to basic drinking water services and more than 31 million lack access to basic sanitation. Significant inequalities persist between rural and urban areas, and between rich and poor, with rural dwellers and the poorest being the most disadvantaged.¹

2. The impacts of climate change on water and sanitation services (see table 1 below), including water supply, sewerage and wastewater treatment, make it harder to achieve universal and equitable access to safe drinking water and sanitation and compromise their environmental and health benefits. Climate change alters hydrological cycles, altering rainfall patterns and increasing temperatures, and affects the intensity, duration and frequency of drought events. Altered precipitation patterns increase the risk of localized flood events, resulting in direct injury, the spread of infectious diseases and impacts on mental health.²

Table 1

Examples of climate change impacts on water, sanitation and hygiene sector

<i>Climate impact</i>	<i>Impact on WASH sector</i>
Decrease in precipitation: drought	Reduction in raw water availability for drinking water supplies, reduced flow in rivers, less dilution/increased concentration of pollutants in water, challenge to hygiene practices
Increase in precipitation and severe weather: flooding	Pollution of wells, inundation of wells, inaccessibility of water sources, flooding of latrines, damage to infrastructure, landslides around water sources, sedimentation and turbidity, challenges to sustainability of sanitation and hygiene behaviors, and waterborne diseases
Increase in temperatures: heatwaves	Damage to infrastructure, increase in pathogens in water leading to increased risk of disease
Increase in temperatures: melting/thawing of glaciers, snow, sea ice and frozen ground	Seasonality of river flows affected, leading to reduced water availability in summer
Sea level rise: flooding and saline intrusion into freshwater aquifers	Reduction in availability of drinking water, with high impacts on quality

Abbreviations: WASH, water, sanitation and hygiene.

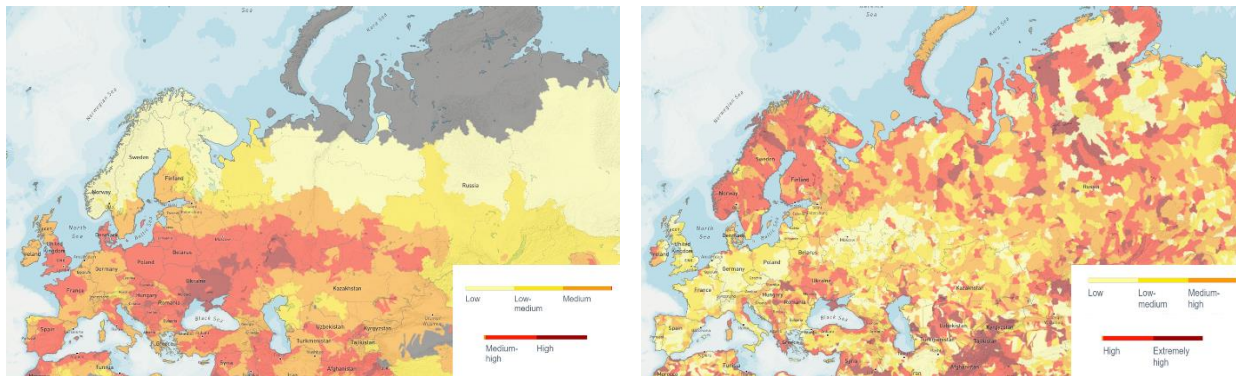
3. Observed climate trends and future climate projections show consistent increases in temperature throughout the pan-European region and varying changes in rainfall. Projected increases in precipitation are expected in Northern Europe and decreasing precipitation in southern latitudes. Climate projections show a marked increase in high temperature extremes,

¹ See www.euro.who.int/__data/assets/pdf_file/0008/466946/water-sanitation-hygiene-health-SDG-brief.pdf.

² Nick Watts and others, “The 2020 report of The Lancet Countdown on health and climate change: responding to converging crises”, *The Lancet*, vol. 397, No. 10269 (January 2021), pp. 129–170.

meteorological droughts and heavy precipitation events, with variations across the pan-European region (see figure below).³

Drought risk (left) and riverine flood risk (right) in pan-European region



Source: World Resources Institute, Aqueduct tools. Available at www.wri.org/aqueduct.

Note: Baselines developed in 2019: (a) drought risk: measures where droughts likely to occur, population and assets exposed, and vulnerability of population and assets to adverse effects; (b) riverine flood risk: measures percentage of population expected to be affected by riverine flooding in an average year (map shows baseline for 2019), accounting for existing flood-protection standards.

4. Climate change impacts in the pan-European region may further exacerbate post-industrial pollution phenomena, hydrogeological and seismic vulnerability and expansion of urban areas and their populations. There is an increasing trend of human migration in the pan-European region due to climate-related risks in neighboring areas and geopolitical and security drivers.

5. Sustainable Development Goal 6 of the 2030 Agenda for Sustainable Development (clean water and sanitation for all) is essential to achieving most of the Goals. Water is also a strategic resource in preventing coronavirus disease (COVID-19), recovering from the COVID-19 pandemic and building resilience to this and other epidemics.

6. The 1999 Protocol on Water and Health to the 1992 Convention on the Protection and Use of Transboundary Watercourses and International Lakes (Water Convention) is the first international agreement of its kind adopted specifically to attain an adequate supply of safe drinking water and adequate sanitation for all, and effectively protect water bodies used as a source of drinking water or for recreation.

7. The United Nations Economic Commission for Europe (ECE)/World Health Organization Regional Office for Europe (WHO/Europe) Protocol joint secretariat convened a special session on climate change within the thirteenth meeting of the Working Group on Water and Health (Geneva (hybrid), 19–20 May 2022). The present document discusses how the Protocol can support establishing climate resilient drinking water supply and sanitation services and strengthening climate considerations in water and sanitation policymaking.

II. Protocol on Water and Health and climate change

8. The Parties to the Protocol have been working, with ECE and WHO/Europe support, to progress towards climate resilient drinking water and sanitation services for the pan-European region, with the aim of strengthening communities’ resilience to water-related disasters and other climate change-induced effects.

³ Sari Kovats and others, “Europe”, in *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part B: Regional Aspects – Working Group II Contribution to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, Vicente R. Barros and others, eds. (New York, Cambridge University Press, 2014), pp. 1267–1326.

A. Climate change and the Protocol's legal provisions

9. Although climate change was not explicitly referred to in the legal text of the Protocol at the time of its drafting, closer analysis reveals the extent to which climate change relates to its provisions. The principles and approaches set out in article 5 (d) of the Protocol refer to management of water resources so that the needs of the present generation are met without compromising the ability of future generations to meet their own needs. This calls for an adaptive management of water resources to climate change where decisions, inter alia, need to be informed by observed climate trends and projections. The “preventive action” principle (art. 5 (e)) implicitly calls for consideration of climate change effects and variability on water resources management, for instance through implementation of water efficiency and conservation programmes and promotion of reuse in drought-prone areas.

10. Furthermore, article 6 (1) requires its Parties to pursue the aims of access to drinking water and provision of sanitation for everyone. In doing so, the impacts of climate change require due consideration, and strengthening the climate resilience of water and sanitation is essential in ensuring universal and equitable access to safe services for present and future generations.

11. According to article 6 (3) of the Protocol, each Party must establish and publish national targets within two years of becoming a Party. The targets shall cover the areas stipulated in article 6 (2) (a)–(n), except where national circumstances make them irrelevant for preventing, controlling and reducing water-related disease.

12. Table 2 below provides selected references showing the impacts of climate change on the different target areas, then shows climate-sensitive targets or issues relating to climate resilience raised by Parties to the Protocol in the first, second, third and fourth reporting cycles. Table 2 also shows examples of generic model targets for inspiration.

Table 2

Climate change considerations to target areas under article 6 (2) of the Protocol

Art. 6 (2) (a) Drinking water quality	Selected references to climate change impacts	<ul style="list-style-type: none"> • Within large reservoirs, higher water temperatures can reduce dissolved oxygen levels and increase benthic nutrient (e.g., phosphorus) release, promoting (harmful) phytoplankton proliferation – including toxic cyanobacteria – and release of sediment-bound metals (e.g., iron, manganese) into water body^a • Higher water temperatures, often coinciding with water scarcity, tend to increase load of pathogens/pollutants/other contaminants, as water dilution capacity is reduced, resulting in decreased chemical and biological water quality conditions^b • Drought induces low water flows and reduced water levels in surface water bodies, increasing concentration of pathogens, chemical pollutants and nutrients.^c Drying and water scarcity may result in overexploitation of groundwater resources, reducing their availability and impairing their quality (through contaminant concentrations) with harmful consequences for drinking water supply to population^d • Extreme weather events or drought trends may result in intermittent drinking water supply, thus inducing serious effects on water quality and health^e • Increasing temperatures may lead to increased growth of pathogens in drinking water supply system, e.g., legionella^f • Target: (in relation to climate action) improve drinking water quality monitoring data collection in emergencies through development of electronic system (Russian Federation and Serbia) • Coordinate water quality (and quantity) monitoring with national climate policies, especially linking hydrological scenarios with climate scenarios and in field of adaptation to impacts of climate change
	Example of climate sensitive targets or issues raised in previous reporting	
	Model targets sensitive to climate change	
Art. 6 (2) (b) Outbreaks of water-related diseases	Selected references to climate change impacts	<ul style="list-style-type: none"> • In water-stressed catchments, wastewater discharges may lead to higher concentrations of fecal matter in surface water sources, containing viral, protozoal and/or bacterial pathogens^g • Water shortage can contribute to spread of microorganisms and increase risk of contracting infectious diseases^h • Under dry conditions, fecal contamination may accumulate in water sources, which may enhance probability of human contact with pathogens causing diarrheaⁱ • Occurrence of waterborne diseases is related to drinking water quality and is affected by changes in run-off, seasonality and frequency of extreme events, such as heavy rains, floods and droughts^j • Intermittent drinking water supply may detach biofilm, warmer temperatures may cause legionella proliferation in distribution systems

Art. 6 (2) (c) Population served – Drinking water supply (collective systems or other means)	Example of climate sensitive issues	<ul style="list-style-type: none"> • There are moves to zero carbon and “pushes” towards lowering warm water temperatures in context of climate change, energy efficiency and cost saving. Lowering water temperatures in water systems due to these considerations could lead to proliferation of legionella and associated health risks. It is essential to improve evidence base and explore appropriate solutions addressing prevention of potential risks of legionella in hot water systems and climate change aspects. Examples include studying effects of lowering water temperatures to human health versus climate-related illnesses and casualties; and investigating and promoting other heat-independent legionella prevention measures in domestic water installations
	Model targets sensitive to climate change	<ul style="list-style-type: none"> • Conduct studies to project water-related disease burden under future climate scenarios, factoring in social and environmental conditions that affect pathogen exposure, host susceptibility, and a community’s ability to respond to stress
	Selected references to climate change impacts	<ul style="list-style-type: none"> • Water stress expected to increase across Central and Southern Europe and Central Asia. Estimated proportion of area of European Union under high water stress forecast to increase from 19 per cent in 2007 to 35 per cent by 2070s, by which time number of additional people affected expected to be 16 million–44 million^k • Globally, each 1°C temperature increase caused by global warming projected to result in a 20 per cent reduction in renewable water resources and affect an additional 7 per cent of population^l • Number of people in European Union and United Kingdom of Great Britain and Northern Ireland living in areas considered to be under water stress for at least one month per year could rise from 52 million nowadays to 65 million, 3°C warming scenario, which is equivalent to 15 per cent of population of European Union^m • Central Asia likely to have reduced availability of fresh water. Similar situations may occur in Southern Europe with decrease in annual freshwater flow by up to 36 per cent by 2070ⁿ
	Example of climate sensitive targets or issues raised in previous reporting	<ul style="list-style-type: none"> • Ensuring delivery of supply, including under increasing impacts of climate change (Netherlands) • Norwegian Food Safety Authority currently preparing guidance on limiting environmental impact and for climate change in water and sanitation planning (Norway) • Maintain minimum drinking water supply in drought periods (Spain)
Model targets sensitive to climate change	<ul style="list-style-type: none"> • Developing national (or subnational) water and sanitation risk assessments linked to main climate hazards and with focus on exposure of population and water-sanitation infrastructure, and vulnerabilities of sector to identify priority interventions • Launching national behavioral change campaigns linked to water stress and scarcity to change consumption and lifestyles • Developing energy efficient desalination plants (where feasible and appropriate) • Incentivizing corporate water footprint assessments linked to overall business sustainability 	

Art. 6 (2) (d) Population served – Sanitation (collective systems or other means)	Selected references to climate change impacts	<ul style="list-style-type: none"> Declining water availability and increased flooding may limit sanitation access and pose major threats to water-reliant sewerage and septic systems. Securing sufficient water to ensure conventional sewers function as designed may be problematic and, even for modified sewerage, securing sufficient volumes of water for flushing and operation may be challenging^o
	Example of climate sensitive targets or issues raised in previous reporting	<ul style="list-style-type: none"> Maintenance of sanitation systems and improvement, also in perspective of climate change (resilience) (Netherlands) Norwegian Food Safety Authority currently preparing guidance on limiting environmental impact and for climate change in water and sanitation planning (Norway)
	Model targets sensitive to climate change	<ul style="list-style-type: none"> Developing national (or subnational) water and sanitation risk assessments linked to main climate hazards and focusing on exposure of population and drinking water and sanitation infrastructure, and vulnerabilities of sector to identify priority interventions Prioritizing provision of facilities and services for safely managed sanitation, and updating sanitation infrastructure in high flood risk areas
Art. 6 (2) (e) Performance of water and sanitation systems	Selected references to climate change impacts	<ul style="list-style-type: none"> Traditionally, water and wastewater services built to protect people from unsafe drinking water and environment from dangerous pollution. Under extreme weather conditions, even “gold-standard” technologies may be challenged and unable to meet these goals Climate change may further accelerate challenges posed by extreme events^p Drought may lead to use of less safe alternative water sources. Any saltwater intrusion into drinking water sources can increase water treatment costs for salt removal^q Higher frequencies of torrential rains, leading to rapid run-off (or ingress to groundwater sources) and poor water quality,^r compromising water treatment performance and increasing treatment costs
	Example of climate sensitive targets or issues raised in previous reporting	<ul style="list-style-type: none"> Finnish Environment Institute and water utilities companies undertook research and drew up plans on climate change vulnerability of groundwater and adaptation of water infrastructure (Finland) Integrating future climate projections into storm-water management to avoid overloading sewerage collecting system (Norway) Target: [Ensure] presence of collective system operators capable of responding at regional level to mitigate effects of extreme weather conditions and serious emergencies (Rep. of Moldova) Target: collecting systems shall be designed, constructed and maintained following best technical knowledge and not entailing excessive costs, notably regarding limitation of pollution of receiving waters due to storm overflows (Spain)
	Model targets sensitive to climate change	<ul style="list-style-type: none"> Assessing exposure and vulnerability of water and sanitation infrastructure

Art. 6 (2) (f) Water supply and sanitation management	Selected references to climate change impacts	<ul style="list-style-type: none"> • Strengthening most at-risk sanitation distribution and treatment infrastructure to prevent service disruptions and water source contamination • Improving most at-risk water distribution infrastructure to increase efficiency • Assessing water storage needs and best solutions in water-scarce and drought-prone areas • Studying right mix of water sources (e.g., surface water, groundwater, rain) to strengthen water systems' resilience in water-scarce and drought-prone areas • Strengthening national planning and implementation of interventions on water infrastructures (e.g., dams, reservoirs) and connection of water distribution systems to drought adaptation • Supporting development of safe and sustainable desalination facilities, including by developing national guidelines • Drought spells may imply restrictions and prioritization of water use, control of drinking water quality and compromised efficiency of sanitation systems^s • Increase in temperature associated with increase in household water demand, especially during hot season, a point that must be considered as part of water demand management^t
	Example of climate sensitive targets or issues raised in previous reporting	<ul style="list-style-type: none"> • All measures related to integrated water resources management are part of river basin planning and focus on: optimum water supply for all users and reducing harmful effects of water due to floods, droughts (climate change) and accidental pollution (Romania)
	Model targets sensitive to climate change	<ul style="list-style-type: none"> • Implementing water demand management policies and strategies to emphasize water conservation, efficiency and reuse • Implementing climate resilient water safety planning and sanitation safety planning • Supporting intersectoral cooperation to develop policy and plans for managing high demand of water for specific uses (e.g., agriculture, irrigation of green infrastructures in cities, industries)
Art. 6 (2) (g) Discharges of untreated waste/storm- water	Selected references to climate change impacts	<ul style="list-style-type: none"> • Of special concern is disruption of sanitation systems during extreme weather events. Flooding may cause contamination and, especially in large cities, storm-water overflows and pollution^u • Prolonged periods of droughts may lead to malfunctioning of wastewater treatment systems^v
	Example of climate sensitive targets or issues raised in previous reporting	<ul style="list-style-type: none"> • Extreme rainfall events causing heavy rains related to climate change will become more usual but, currently, no national statistics are available indicating number of overflows caused by this type of rain. Target: Preventive action shall be taken to prepare for overflows caused by exceptional rainfalls (Finland) • Significant additional operational costs due to increased pumping energy demand and disruption of operation of wastewater treatment plant (Hungary)

		<ul style="list-style-type: none"> • Building rainwater retention basins, storm-water basins and pumping stations helps manage rainy periods that are likely to intensify due to climate change (Luxembourg) • Official Norwegian report (published January 2016) focusing on climate and storm-water in cities and proposals on changes to some national regulations (Norway) • Assessing exposure of wastewater treatment plants to extreme weather events and floods and identifying appropriate solutions to avoid discharges of untreated waste or storm-water
	Model targets sensitive to climate change	
Art. 6 (2) (h)	Selected references to climate change impacts	<ul style="list-style-type: none"> • Treatment of wastewater to raise it to adequate parameters becomes technologically more challenging with increased temperatures and increasing and varying concentrations of pollutants of wastewater inflows^w
Quality of treated wastewater	Example of climate sensitive targets or issues raised in previous reporting	<ul style="list-style-type: none"> • 53 per cent of wastewater in Israel has tertiary treatment (filtration and disinfection) and treated wastewater is reused, mainly in agriculture • National target is to decrease pollutant loads of discharged wastewater from wastewater treatment plants to environment by upgrading facilities and through sustainable maintenance of said plants (Israel) • Assessing, at national level, compliance of treated wastewater effluents with minimum discharge requirements after extreme weather events and flooding, and developing remediation action plans
	Model targets sensitive to climate change	
Art. 6 (2) (i)	Selected references to climate change impacts	<ul style="list-style-type: none"> • Due to expected reductions in water availability caused by increased water use and climate change effects, water reuse becoming important component of water balance in countries. However, treating wastewater to raise it to adequate parameters becomes technologically more challenging with increased temperatures and increasing and varying concentrations of pollutants of wastewater inflows^x • Warmer temperature leads to increased fermentation of solids in sludge, causing odor issues^y • Faecal sludge management chains may be vulnerable to climate impacts. In urban areas, fecal sludge management as a system gaining traction as demand for low-cost toilets drives demand for simple pit latrines, but space constraints preclude approaches used in rural areas (replacing latrines once pit full). Typically, fecal sludge management chains involve collection and transportation of waste in vehicles, with disposal at treatment facility. Risks of flooding will impact emptying vehicles' ability to access communities if roads become impassable^z • Climate change will increase pressure on safe and adequate drinking water supply and sanitation provision. Practice of reuse thus likely to increase, as this can be an effective measure to reduce water scarcity (Netherlands) • Target: Absence of disease cases proven to be related to reuse of treated urban wastewater and to application in agriculture of sewage sludge from wastewater treatment plants (Portugal)
Disposal or reuse of sewage sludge and quality of wastewater used for irrigation purposes	Example of climate sensitive targets or issues raised in previous reporting	

Art. 6 (2) (j) Quality of water used as sources for drinking, bathing or aquaculture	Model targets sensitive to climate change	<ul style="list-style-type: none"> • A national strategy, specific legislation for various uses and a guide for implementation and management of water reuse projects are being finalized (Portugal) • Target: Develop Strategy I Programme for reuse of wastewater in conditions of climate change for Ukraine up to 2030 and relevant regulatory acts (Ukraine) • Prioritizing upgrade of wastewater treatment plants to highest treatment level possible and fostering reuse for irrigation
	Selected references to climate change impacts	<ul style="list-style-type: none"> • Algae proliferation may increase, due to higher temperatures, in source waters, such as cyanobacteria, possibly having impact on recreational activity but also on food-chain through consumption of contaminated fish^{aa} Additional area of concern is seafood production in aquaculture, which takes place in coastal zones^{bb} • Rains lead to higher concentrations of pathogens in aquatic environment, affecting bathing water quality, drinking water resources, and potentially some foods such as aquatic and aquaculture products. Heavy rains and floods can also increase nutrient availability of lakes, inducing cyanobacterial proliferation^{cc} • Climate change also likely to affect quality of coastal waters, by changing either natural ecosystems or quality of waters draining into coastal zones. Recreational users of bathing waters, including tourists, may face poorer water quality and higher risk of infection.^{dd} Along with coastal flooding and encroachment of saltwater farther inland comes increased risk of human interaction with pathogenic <i>Vibrio</i> species, e.g., <i>Vibrio cholerae</i>, <i>Vibro vulnificus</i> and <i>Vibro parahaemolyticus</i>^{ee}
	Example of climate sensitive targets or issues raised in previous reporting	<ul style="list-style-type: none"> • Changes in climate observed in recent years (temperature rise) and other human factors created favorable conditions for algae growth. Large-scale eutrophication processes were observed in coastal areas and in shallows and bays, potentially leading to deterioration of water quality (Armenia) • Protection of priority water catchment being discussed in context of climate change adaptation (France) • Desalinated water provides 50 per cent of drinking water of Israel and is used in water supply systems. National target is to monitor drinking water quality in distribution system through computerized system for efficient monitoring of drinking water quality parameters. Also, water stabilization values and effect on pipes are monitored as well as presence of essential minerals (calcium and magnesium), accompanied by epidemiological and ecological studies (Israel)
	Model targets sensitive to climate change	<ul style="list-style-type: none"> • Developing real time monitoring systems for water quality of sources used for drinking, bathing and aquaculture in areas exposed to climate hazards and extreme weather, linked to early warning systems (including transboundary where appropriate) • Developing safe and sustainable reuse practices in multiple sectors/areas (e.g., agriculture, civil uses, aquifer recharge), including by developing national guidelines and intersectoral programmes

Art. 6 (2) (k) Management of enclosed waters^{ff} available for bathing	<p>Selected references to climate change impacts</p> <p>Example of climate sensitive targets or issues raised in previous reporting</p> <p>Model targets sensitive to climate change</p>	<ul style="list-style-type: none"> • With increased warming, enclosed waters for bathing will undergo larger evaporative water losses due to hot, arid climate, and rely on imported water supplies. Policy measures might be implemented during droughts, including ban on outdoor uses of water^{gg} • Future challenges relate to potential changes in bathing water monitoring system in general and to introduction of new identifiable indicators and methods of analysis, specifically in relation to impacts of climate change (Latvia) • Developing water quality monitoring systems, linked to early warning, in bathing areas exposed to climate hazards and extreme weather • Developing guidelines and (pilot) studies on recreational water safety plans
Art. 6 (2) (l) Remediation of particularly contaminated sites affecting waters	<p>Selected references to climate change impacts</p> <p>Example of climate sensitive targets or issues raised in previous reporting</p> <p>Model targets sensitive to climate change</p>	<ul style="list-style-type: none"> • Contaminated lands, sites with hazardous substances, are vulnerable to flooding and rising sea levels • Epidemiological evidence shows that flooding may lead to mobilization of dangerous chemicals from storage or remobilization of chemicals already in environment, e.g., pesticides. Hazards may be greater when industrial or agricultural land adjoining residential land affected^{hh} • In extreme weather situations rural settlements are vulnerable, since flooding or flooding toilets installed in ground (<i>shumbo</i>) may cause contamination of territories and near charged sources of drinking water with contents of cesspools (Azerbaijan) • Identifying and developing an action plan for remediation of contaminated sites exposed to extreme weather events and flooding
Art. 6 (2) (m) Effectiveness of systems for management, development, protection and use of water resources	<p>Selected references to climate change impacts</p> <p>Example of climate sensitive targets or issues raised in previous reporting</p>	<ul style="list-style-type: none"> • Water use increased sixfold over past century and is rising by about 1 per cent a year. However, it is estimated that climate change, along with increasing frequency and intensity of extreme events – storms, floods and droughts – will aggravate situation in countries already currently experiencing “water stress” and generate similar problems in areas that have not been severely affected. Poor water management tends to exacerbate impacts of climate change, not only on water resources but on society as a wholeⁱⁱ • Measures to be taken to reduce diffuse sources of pollution for groundwater bodies include research on influence of climate change on salinization and sea levels (ongoing) (Belgium – Flanders) • All water and wastewater plants serving more than 50 persons shall have adequate control system that includes risk analysis where climate impacts are included (Norway) • Target: strengthening water resources protection (local scale, in selected protected areas). There is specific reference to improving water quality/status and quantity, including reducing impact of climate change (Slovakia)

Art. 6 (2) (n) Publication of information on drinking water quality supplied	n/a	<ul style="list-style-type: none"> • Target: promoting integrated river basin management. The country considers this an opportunity to take efficient approach to new cross-sectoral challenges in area of water management, including those related to climate change (Switzerland) • Promoting national water management systems to protect water resources in terms of quantity and availability (water quantity assessment and management), including protection against floods and other emergencies (flood management, drought management, climate change adaptation)
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^a Dekoun Hou and others, “Effects of environmental factors on nutrients release at sediment-water interface and assessment of trophic status for a typical shallow lake, northwest China”, *Scientific World Journal*, vol. 2013

^b Gregor Laaha and others, “The European 2015 drought from a hydrological perspective”, *Hydrology and Earth System Sciences*, vol. 21, No. 6 (June 2017), pp. 3001–3024.

^c Dana Sirbu and others, “Water resources and human health in the framework of climate change”, *International Water Technology Journal*, Vol. 1, No. 3 (2012), pp. 200–209.

^d L. Sinisi and R. Aertgeerts, eds., *Guidance on water supply and sanitation in extreme weather events* (Copenhagen, World Health Organization (WHO) Regional Office for Europe, 2011).

^e Ibid

^f Ibid

^g Pramod K. Pandey and others, “Contamination of water resources by pathogenic bacteria”, *AMB Express*, vol. 4, No. 51 (2014).

^h Maurizio Bifulco and Roberta Ranieri, “Impact of drought on human health”, *European Journal of Internal Medicine*, vol. 46, e9–e10 (December 2017).

ⁱ Karen Levy and others, “Untangling the Impacts of Climate Change on Waterborne Diseases: A Systematic Review of Relationships between Diarrheal Diseases and Temperature, Rainfall, Flooding, and Drought”, *Environmental Science and Technology*, vol. 50, No. 10 (2016), pp. 4905–4922.

^j Kirk R. Smith and Kalpana Balakrishnan, “Mitigating climate, meeting MDGs, and moderating chronic disease: the health co-benefits landscape”, in *Commonwealth Health Ministers’ Update 2009* (London, Commonwealth Secretariat, 2009), pp. 59–65.

^k Alcamo and others, “Europe”, *Climate Change 2007: Impacts, Adaptation and Vulnerability – Contribution of Working Group II to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, M.L. Parry and others, eds. (Cambridge, Cambridge University Press, 2007), pp. 541–580.

^l Blanca E. Jiménez Cisneros and others, “Freshwater Resources”, in *Climate Change 2014: Impacts, Adaptation, and Vulnerability. Part A: Global and Sectoral Aspects. Contribution of Working Group II to the Fifth Assessment Report of the Intergovernmental Panel on Climate Change*, C.B. Field and others, eds. (Cambridge, Cambridge University Press, 2014), pp. 229–269.

^m L. Feyen and others, *Climate change impacts and adaptation in Europe*, (Luxembourg, Publications Office of the European Union, 2020).

ⁿ Alcamo, “Europe”.

^o Howard and others, “Climate Change and Water and Sanitation: Likely Impacts and Emerging Trends for Action”, *Annual Review of Environmental Resources*, vol. 41 (2016), pp. 253–276.

^p Sinisi, *Guidance on water supply*.

^q Jiménez Cisneros, “Freshwater Resources”.

^r Ibid.

^s Sinisi, *Guidance on water supply*.

^t Ibid.

^u *Guidance on Water and Adaptation to Climate Change* (United Nations publication, Sales No. 09.II.E.14).

- ^v Sinisi, Guidance on water supply.
- ^w Ibid.
- ^x Ibid.
- ^y Keer Wood Leidal (KWL), Associates Limited, Vulnerability of Vancouver Sewerage Area Infrastructure to Climate Change: Final Report, March 2008, KWL File No. 251.219 (Vancouver, 2008).
- ^z Howard, “Climate Change and Water and Sanitation”.
- ^{aa} Giliane Zanchett and Eduardo C. Oliveira-Filho, “Cyanobacteria and cyanotoxins: from impacts on aquatic ecosystems and human health to anticarcinogenic effects”, *Toxins* vol. 5, No. 10 (2013), pp. 1896–1917.
- ^{bb} Sena S. de Silva and Doris Soto, “Climate change and aquaculture: Potential impacts, adaptation and mitigation” in *Climate change implications for fisheries and aquaculture: Overview of current scientific knowledge – FAO Fisheries and Aquaculture Technical Paper No. 530.*, K. Cochrane and others, eds. (Rome, Food and Agriculture Organization of the United Nations (FAO), 2009), pp. 151–212.
- ^{cc} Sinisi, Guidance on water supply.
- ^{dd} Ibid.; and Jiménez Cisneros, “Freshwater Resources”.
- ^{ee} Brett A. Froelich and Dayle A. Daines, “In hot water: Effects of climate change on Vibrio–human interactions”, *Environmental Microbiology*, vol. 22, No. 10 (October 2020), pp. 4101–4111.
- ^{ff} “Enclosed waters” means artificially created water bodies separated from surface fresh water or coastal water, whether within or outside of a building.
- ^{gg} Valeria Bernardo, Xavier Fageda and Montserrat Termes, “Do droughts have long-term effects on water consumption? Evidence from the urban area of Barcelona”, *Applied Economics*, vol. 47, No. 48 (2015), pp. 5131–5146.
- ^{hh} Euripides Euripidou and Virginia Murray, “Public health impacts of floods and chemical contamination”, *Journal of Public Health*, vol. 26, No. 4 (2004), pp. 376–383.
- ⁱⁱ United Nations Educational, Scientific and Cultural Organization (UNESCO)/UN-Water, *The United Nations World Water Development Report 2020: Water and Climate Change* (Paris, UNESCO, 2020).

13. It is expected that, in future reporting cycles, an increasing number of Parties to the Protocol will set climate-sensitive targets, which will have to be reviewed, monitored and linked to indicators designed to show progress on how climate resilience prevents, controls or reduces water-related diseases, as required by article 7 of the Protocol.

14. Other provisions of the Protocol are also highly relevant to adaptation to climate change, in particular, the Protocol requires Parties to establish joint or coordinated systems for surveillance and early warning systems, contingency plans and response capacities, as well as mutual assistance to respond to outbreaks and incidents of water-related disease, especially those caused by extreme weather events (art. 8. And 12.).

15. Additionally, it is necessary to promote public awareness and better understanding of those impacts at the national and local levels and encourage research and development of integrated information systems to handle information about long-term trends in climate change. The right to access to information, as discussed in article 10 of the Protocol, is also well established in international environment and human rights instruments, including regarding climate change. Indeed, article 6 of the United Nations Framework Convention on Climate Change requires Parties to “promote and facilitate at the national and, as appropriate, at subregional and regional levels ... public access to information on climate change and its effects”.⁴

16. Protocol articles 11, calling for international cooperation, and 12, calling for joint and coordinated international action, are very relevant for both mitigation and adaptation coordinated plans and responses to the impacts of climate change.

B. Climate change and the areas of work under the Protocol

17. The main objective of the Protocol’s programme of work is to support Parties in implementing and complying with the Protocol, and to assist other States in acceding to and applying the Protocol. The programme of work addresses priority challenges related to water, sanitation and health in the pan-European region.

There are seven technical programme areas, and while there is a programme area dedicated to “increasing resilience to climate change”, table 3 below provides considerations of climate relevance within each programme area and explains progress in the programme area on climate change.

⁴ See https://unfccc.int/files/essential_background/background_publications_htmlpdf/application/pdf/conveing.pdf.

Table 3

Climate change considerations in technical areas of work of Protocol

<i>Programme area</i>	<i>Objectives</i>	<i>Climate change considerations</i>
1. Improving governance for water, sanitation and health	Reinforce implementation of Protocol's core provisions on target setting and reporting under articles 6 (Targets and target dates) and 7 (Review and assessment of progress)	Responses to climate change are transitioning from awareness-raising to identifying and implementing actual country-led strategies and plans. Government leadership is essential to advance adaptation and mitigation, considering fundamental connection between resilient water management and climate adaptation and mitigation policies. There is disconnect between national adaptation and mitigation targets and national water and sanitation priorities. One way to overcome problem is by capacitating decision-makers and other stakeholders in key climate concepts and processes, as well as identifying potential adaptation and mitigation interventions for their sector. Moreover, it is necessary to put in place intersectoral frameworks and tools that allow them to formulate targets and implement strategies that integrate climate with water and sanitation. Protocol target setting framework can address these issues within pan-European region and serve as inspiration to others
2. Prevention and reduction of water-related diseases	Support Parties and other States in implementing article 8 of Protocol (Response systems), specifically to: (a) strengthen national and local capacities regarding improving, maintaining and sustaining vigilant public health surveillance and early warning systems for water-related disease; (b) enhance preparedness, outbreak investigation and response capacities; and (c) support building of effective drinking water quality surveillance systems	Regarding adaptation and mitigation in water and sanitation sector, it is important to consider national weather forecasting, as well as early warning and freshwater monitoring systems. Systematic climate monitoring is usually carried out by national meteorological centers and other specialized bodies, and freshwater monitoring is generally carried out by public water resources management body. Since national monitoring systems form part of global network, there should be as much consistency as possible in way measurements and observations are made. World Meteorological Organization performs very important role in this respect and can support health sector regarding monitoring and surveillance of climate-related dimensions in WASH management. Strong partnerships between meteorological services, water resource specialists and health and water and sanitation sector are vital to improve quality of data and therefore accuracy of climate projections to allow for better response mechanisms
3. Institutional water, sanitation, and hygiene	Support Parties and other States to ensure WASH services in institutional settings, particularly in schools, kindergartens and health-care facilities	Schools and health-care facilities must be designed, built and operated recognizing that spatial dimension of water resources being tapped, and waste produced go well beyond limits of facility. Identifying specific climate risks in each context helps adapt drinking water and sanitation services and contribute to low carbon sector. Aim is to be more resilient to regular external shocks and extreme weather events, while at the same time reducing their harmful impact on environment and surrounding communities. It is essential to ensure enough water storage, especially in drought-prone areas and water-scarce contexts, and to protect infrastructure from flood damage that led to contamination of water resources and environment. Water efficiency, conservation and reuse should be observed when designing or updating water and services in institutional settings. Using renewable energy for pumping water or wastewater and recovering energy from waste also need to be considered through intersectoral water-energy-carbon nexus approach. As earlier sections highlight impacts of climate change on sanitation systems, it is equally important to mitigate impact of institutional sanitation systems on future greenhouse gas emissions. Therefore, reduction, adequate treatment and recycling of waste must be

Programme area	Objectives	Climate change considerations
4. Small-scale water supplies and sanitation	Support Parties and other States to: (a) increase policy focus on small-scale water supply and sanitation systems; (b) support policy uptake and implementation of approaches based on good practices in regulation, management and surveillance of small-scale water supply and sanitation at national and local levels; (c) Assist Parties and other States in improving access to safe, sustainable and equitable drinking water and sanitation services in rural areas, small towns and peri-urban areas	<p>ensured. Collaborative actions needed to ensure climate resilience properly addressed when developing national standards for drinking water and sanitation services in institutions</p> <p>Protocol can support dissemination and implementation of recently developed <i>WHO Guidance for Climate Resilient and Environmentally Sustainable Health-Care Facilities^a</i> and <i>Water and Sanitation for Health Facility Improvement Tool (WASH FIT): A practical guide for improving quality of care through water, sanitation and hygiene in health-care facilities^b</i>. Work in future could address supporting countries in improving activities on climate resilient health systems, including review of existing national guidelines and standards; assessing water, sanitation and health-care waste management considering climate resilience and environmental sustainability; and identifying climate-smart and risk-based WASH improvements in institutional settings</p> <p>Regarding drinking water supply, small-scale water supplies are particularly low in climate resilience. This is because they often rely on a single source, because of their vulnerability to contamination, susceptibility to drought (limited storage) and/or difficulty in preventing damage during floods. Small drinking water supplies that use a single source also offer little flexibility regarding location. From adaptation perspective, climate change may also overwhelm ability of operators of small drinking water supplies to deal with problems (e.g., flood damage) in situations where quality and reliability of services already poor. In contrast, larger utilities may have potential to draw on more human and financial capital to deal with problems and invest in more resilient infrastructure. Hence, adaptation to climate change starting in catchment of raw water sources and benefiting from local knowledge is increasingly important in small-scale drinking water supplies and sanitation</p>
5. Safe and efficient management of water supply and sanitation systems	Support Parties and other States to ensure safe and efficient management of water supply and sanitation services by strengthening national capacities regarding sustainable water resource management and scaling up risk-based management approaches, including consideration of impacts of water-related natural disasters on human health and environment	Reliable data, including evidence of observed and projected climate impacts, how most-vulnerable are affected, and climate change impact and vulnerability assessments are crucial for deciding where to invest, how to sustain and improve drinking water and sanitation services, and understanding which policies and strategies work. This is especially necessary for adaptation and mitigation in water and sanitation sector. However, there remains widespread lack of capacity for monitoring, inconsistent or fragmented gathering of data, and limited use of information management systems, which impede effective decision-making in sector planning, resource allocation and policy development. Developing and strengthening platform for information-sharing and mutual accountability requires inclusive system for measuring sector performance against nationally established goals and targets, including those related to water and sanitation that are set out in climate adaptation and mitigation strategies. As mitigation and adaptation to climate change continue to be tested and scaled up in water and sanitation sector, a framework that enables multi-actor involvement in structured process of knowledge creation,

<i>Programme area</i>	<i>Objectives</i>	<i>Climate change considerations</i>
		transfer and mobilization is vital. This Programme area is already undertaking activities, e.g., promoting climate resilient water safety planning and promoting sanitation safety planning as tool to ensure safe sanitation and reuse practices in response to water scarcity and drought. Holistic approach to water security must be taken by ensuring availability, accessibility, water quality, safety, disaster preparedness, proper governance and ecosystem health
6. Equitable access to water and sanitation: translating into practice the human right to water and sanitation	Support implementation of Protocol’s requirement to ensure access to water and sanitation for all, including those suffering disadvantage or social exclusion (art. 5) and, thereby, progressive realization of human rights to safe drinking water and sanitation	The most-at-risk and least-able to deal with impacts of climate change tend to be the most vulnerable populations. Many of region’s most-at-risk from droughts and floods already have low access to sanitation and drinking water. Aligned with ongoing work within this programme area, an important consideration to support elimination of inequalities and build climate resilience is that climate change risks are assessed and mapped and this information is overlaid with locations of disadvantaged communities and low levels of access to drinking water and sanitation. Such mapping should reveal “hot spots” of high climate risks linked to poverty and low levels of water and/or sanitation coverage and needs to be used to set or update priority adaptation interventions, both within climate and water-sanitation agendas, and reinforce advocacy efforts
7. Increasing resilience to climate change	Strengthening communities’ resilience to water-related disasters and other climate change-induced effects. This programme area specifically focuses on building awareness, evidence and capacities in addressing issues of extreme weather events, water scarcity and wastewater reuse in agriculture, and the broader water resource management context	<p>A dedicated programme area on climate change was reintroduced under Protocol work programme in 2017. Previous work on this programme area include development of <i>Guidance on water supply and sanitation in extreme weather events</i>. The document recalls basic scientific findings, provides advice on communication issues, addresses vulnerability of coastal areas and bathing waters, discusses impact on human health, places extreme weather events in context of water safety plans, and formulates advice for adaptation measures for water supply and sanitation services during such events. Although document is almost ten years old and important climate global processes and frameworks have come into place since its publication, technical guidance provided remains mostly valid. Global workshop on building climate resilience through improving water management and sanitation at national and transboundary levels (Geneva (hybrid), 29–31 March 2021),^c organized in partnership with Water Convention, reviewed range of direct and indirect effects of climate change and extreme weather events on water and sanitation services and communities’ health and discussed which measures to take in mitigation of those effects</p> <p>A key focus of this programme area in upcoming work will be organization of workshops and round tables on exchanging experiences and promoting good practices in preparing for and responding to extreme events in cooperation with Water Convention. Additionally, development of guidance documents on good practices, and capacity-building activities promoting adoption of good practices will be central theme in this work area</p>

^a Geneva, WHO, 2020

^b Geneva, WHO, 2022

^c See <https://unece.org/environmental-policy/events/global-workshop-building-climate-resilience-through-improving-water>

III. How the Protocol supports global climate frameworks

18. The Protocol is a powerful instrument for promoting and operationalizing achievement of the 2030 Agenda and its Sustainable Development Goals in the pan-European region. It has placed the region on track by promoting integrating policies in a holistic and preventive approach to achieve safely managed drinking water and sanitation services and universal and equitable access across all settings.

19. While the Protocol specifically focuses on Sustainable Development Goals 3 and 6, it further supports implementing other Goals and targets. Given that the impacts of climate change are deeply linked to water (e.g., floods, storms and droughts), mitigation and adaptation measures need to include water- and sanitation-based interventions. Water is also a strategic means of adaptation and mitigation for managing and reducing risks of climate change across sectors. Therefore, the Protocol can play a key connector role among Sustainable Development Goals 3, 6 and 13 (Take urgent action to combat climate change and its impacts). This further aligns with the Sendai Framework for Disaster Risk Reduction 2015–2030 targets related to improving disaster resilience of new and existing water infrastructure to provide essential life-saving services during and after extreme events (Target (d) and Priority 4).

Table 4 below presents connecting areas of ongoing or potential support between the Protocol and the targets of Sustainable Development Goal 13.

Table 4

Protocol support areas for achievement of targets of Sustainable Development Goal 13

<i>SDG 13 targets</i>	<i>Ongoing and potential Protocol support to SDG 13 targets</i>
13.1 Strengthen resilience and adaptive capacity to climate-related hazards and natural disasters in all countries	<p>Protocol-related targets to expand and upgrade drinking water supply and sanitation infrastructure and services expected to consider need to ensure resilience to climate-related risks</p> <p>Resilient water and sanitation systems expected to contribute to community resilience and increase adaptive capacity to climate change</p>
13.2 Integrate climate change measures into national policies, strategies and planning	<p>Protocol promotes identification of climate risks to water supply and sanitation sector so that they are addressed in sectoral national and subnational policies, strategies and plans</p> <p>Targets set under Protocol on water and sanitation expected to contribute to carbon neutral sector using renewable energies, increasing energy efficiency, and recovering energy from waste</p>
13.3 Improve education, awareness-raising and human and institutional capacity on climate change mitigation, adaptation, impact reduction and early warning	<p>Protocol supports capacity development and promotes good practices on building climate resilience of drinking water supply and sanitation services, including preparing for and responding to extreme weather events. This includes organizing strategic round table (2023) and technical workshops on climate resilience of drinking water supply and sanitation services in pan-European region</p> <p>In cooperation with Water Convention and different programme areas, Protocol promoted stakeholder discussions and facilitated workshop</p>

<i>SDG 13 targets</i>	<i>Ongoing and potential Protocol support to SDG 13 targets</i>
13.b Raising capacity for effective climate change-related planning and management	on climate resilience, water and sanitation and links to water scarcity and transboundary basins in 2021 Protocol supports water and wastewater operators in strategic planning for ensuring climate resilience, including through supporting implementation of water safety planning and sanitation safety planning

Abbreviations: SDG, Sustainable Development Goal.

20. The Paris Agreement adopted under the United Nations Framework Convention on Climate Change addresses the need to limit the rise of the global average temperature to well below 2°C above pre-industrial levels by the end of the century, as well as the need to adapt to the impacts of climate change.

21. The implementation phase of the Paris Agreement focuses on Parties working to define and enact their Nationally Determined Contributions. These, together with other key national and multisectoral strategies such as the National Adaptation Plans and National Communications, form a powerful framework for laying out priorities for climate action, with the potential to guide mitigation and adaptation interventions within the water and sanitation sector. They also provide a basis for investment plans integrating climate vulnerability and resilience in the broader context of the Sustainable Development Goals and the Sendai Framework. In 2020–2021, most countries submitted updated Nationally Determined Contributions to the United Nations Framework Convention on Climate Change.

22. According to the United Nations Framework Convention on Climate Change, water management-related adaptation initiatives are included as a priority in many Nationally Determined Contributions and National Adaptation Plans. However, governance mechanisms and methods for integrating water and climate are often absent, with the interface of drinking water, sanitation and health not being addressed in most cases. The Protocol can play a key role here, as its target setting mechanism offers, by its very nature, an accountability framework at the national and international levels. It is both a useful tool for planning adaptation to climate change, requiring establishing an intersectoral coordination mechanism, broad participation, and an analysis of gaps, development of scenarios and prioritization of measures based on development choices. Furthermore, activities under the Protocol’s programme of work promote implementation of national targets and can provide a regional platform to facilitate exchange of experience and good practices on linking water, sanitation and health goals with climate goals and commitments.

IV. Outcomes of the special session on increasing resilience to climate change and the Protocol on Water and Health

23. At the thirteenth meeting of the Working Group on Water and Health (Geneva (hybrid), 19–20 May 2022), a special session on increasing resilience to climate change and the Protocol on Water and Health was organized, aimed at reviewing actions taken by countries in addressing climate sensitive health and environmental risks and at discussing future activities in this area of work. The present paper served as a background document for the special session.

24. Following an introductory keynote speech and a presentation about the background paper and future proposed activities by Italy as lead country, the session included a panel discussion, where representatives of States, namely Luxembourg, Serbia and Spain, shared their experiences on how they had used the Protocol’s framework to strengthen their efforts to increase resilience to climate change at the national and/or local level. Speakers stressed climate-induced challenges such as increased frequency of intense precipitation, floods, droughts and tornadoes and shared adaptation measures addressing these challenges through effective storm-water management and utilization of green and blue infrastructures.

25. Furthermore, adapting the legal framework to improve governance for climate sensitive watershed management was identified as an approach to increase resilience to climate change. Additionally, representatives stressed the challenges of setting climate-sensitive targets in a coordinated manner due to fragmented institutional responsibilities.

26. The Working Group subsequently re-emphasized that climate change causes significant additional pressures on water, sanitation and health, and the need for urgent action in addressing its effects. Consequently, the Working Group encouraged countries to use the Protocol's framework and the tools developed under the Protocol to increase the resilience of water and sanitation systems to climate change, including through its target setting mechanism and establishing effective early warning, surveillance and response systems. Future proposed activities for 2023–2025 aim to address these challenges, among others.
