



**SANITATION
AND WATER
FOR ALL**

Climate Task Team

Definition of climate-resilient water, sanitation and hygiene services

Definition:

Climate-resilient water, sanitation and hygiene services anticipate, respond to, cope with, recover from, adapt to or transform based on climate-related events and trends - all while striving to achieve and maintain universal and equitable access to safely managed services, minimizing emissions where appropriate, and paying special attention to the most exposed and vulnerable groups.



Introduction

This document presents the Definition and Response Framework for Climate-Resilient Water, Sanitation and Hygiene Services, developed through a two-year consultative process led by the Sanitation and Water for All (SWA) Climate Action Task Team.

A first version of the definition was launched at COP29 in Azerbaijan (November 2024). Over the past year, governments, development partners and service providers have used it to assess the climate resilience of water, sanitation and hygiene services and to guide national and local programmes. Their feedback has shaped this 2025 edition.

Released at COP30, this updated edition introduces a Response Framework: a practical ‘menu of adaptation options’, spanning transboundary, national, sub-national and local levels. The framework supports implementation of Target 9a of the UAE Framework for Global Climate Resilience, which calls for progress towards climate-resilient water supply and sanitation. It recognizes that identifying and managing climate risks must be followed by context-specific adaptation actions rooted in national and local realities.

The Definition and the Response Framework are designed for water, sanitation and hygiene and climate stakeholders, including governments, regulators, utilities, development partners, civil society, and related sectors such as health, food security, infrastructure and ecosystems. It positions climate-resilient water, sanitation and hygiene services as a foundation for community resilience, since reliable access to water and sanitation underpins health, livelihoods and social stability in a changing climate.

Building on this foundation, the framework aims to drive transformational, system-wide change – linking adaptation, mitigation and sustainable development. It promotes stronger coherence between water, sanitation and hygiene and broader climate and development agendas, helping partners plan, finance and monitor climate-resilient services in a consistent and coordinated way.

By bringing diverse actors together around a common definition and practical framework, this document provides a shared basis for aligning policies, investment and monitoring toward a unified global goal: climate-resilient sanitation and water systems for all – always and everywhere.

Definition:

Climate-resilient water, sanitation and hygiene services anticipate, respond to, cope with, recover from, adapt to or transform based on climate-related events and trends - all while striving to achieve and maintain universal and equitable access to safely managed services, minimizing emissions where appropriate, and paying special attention to the most exposed and vulnerable groups.

Water and sanitation are daily human needs and recognized human rights. Secure access to these services is among the key determinants of community resilience to climate change.¹

Water, sanitation and hygiene services must continue to function in the context of both extreme climate events and slow-onset changes. Droughts, floods, storms and sea-level rise all pose severe threats to the continuity of service systems.

The definition of climate-resilient water, sanitation and hygiene services has been developed primarily for the benefit of climate, water, sanitation and hygiene stakeholders. It focuses on the resilience of basic services as a key entry point for enhancing adaptive capacity and reducing vulnerabilities. However, building climate resilience also requires close examination of the wider water cycle - including considering its linkages with environmental sustainability, water-resource management, and, where possible, with resilient food and health systems.

In many regions, water sources cross administrative and national boundaries, underscoring the importance of transboundary water cooperation as part of resilient and sustainable service delivery.

The need for a definition

Given the increasing climate risks, water, sanitation and hygiene stakeholders are integrating climate change adaptation and mitigation into their operations. There is, however, no universally agreed definition of what constitutes a climate-resilient water supply, sanitation or hygiene service.

The adoption of the [UN UAE Global Climate Resilience Framework](#) at COP28,² which prioritizes

working towards “climate-resilient water supply and climate-resilient sanitation” as a key target, has created an urgent need for stakeholders to align on a clear and comprehensive definition.

To address this, **the Sanitation and Water for All (SWA) Climate Action Task Team** convened its diverse members to develop a definition reflecting the sector’s collective experience and expertise.

The definition will help align and standardize efforts across climate, water and sanitation stakeholders, and support the development of indicators consistent with key global processes, including:

- **Paris Agreement** [and United Arab Emirates \(UAE\) Global Climate Resilience Framework](#)
- **Sustainable Development Goals, through the custodian of global data on water supply, sanitation and hygiene** [UNICEF-WHO Joint Monitoring Programme \(JMP\)](#) and the [UN-Water Global Analysis and Assessment of Sanitation and Drinking-Water \(GLAAS\)](#).

The definition also provides a foundation for revising and formulating climate policies such as Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs), as it enables the integration of clear priorities and actions to enhance the resilience of essential water, sanitation, and hygiene services in the face of climate impacts. It also plays a critical role in promoting access to, and the effective use of, climate financing mechanisms by providing a common basis to identify, justify, and structure investments that strengthen these systems. The Green Climate Fund (GCF), has developed guidelines for developing climate-resilient water supply and sanitation financing proposals.³ which could, for example, benefit from adopting such a definition.

Equally, the definition is important for informing the revision and modernization of national and subnational water, sanitation, and hygiene policies, many of which do not yet account for climate risks or the need for climate-resilient service delivery.

A consensus on what constitutes climate-resilient water supply and climate-resilient sanitation will also strengthen the climate, water and sanitation stakeholders’ credibility, avoiding the risk of fragmented approaches and inconsistent criteria among partners.

Definition of climate-resilient water supply, sanitation and hygiene services

The definition of climate-resilient water, sanitation and hygiene services draws on previous research and practical experience from across the WASH and climate sectors. These inputs informed the consensus on the **key attributes of climate-resilient services** – such as their ability to anticipate, respond, adapt and transform in the face of climate impacts.

For monitoring or assessment purposes, the climate resilience of water, sanitation and hygiene services can be evaluated through their **functionality and user experience** – that is, how well they meet the needs of the entire population in the short, medium and long term.⁴ Given the diversity and context-specific nature of climate impacts, locally determined thresholds will often be required for service level, reliability, acceptability, affordability and safety.

The key elements of the definition of climate-resilient water, sanitation and hygiene services are described in the table below:

Definition fragment

Explanation of climate-resilient water, sanitation and hygiene services

“Climate-resilient water, sanitation and hygiene services”

This terminology is aligned with relevant sub-components of the UAE Framework for Global Climate Resilience global target “*a climate-resilient water supply, climate-resilient sanitation and towards access to safe and affordable potable water for all.*” Although the word “hygiene” is not explicitly mentioned in the UAE Framework, it is considered under the scope of “water and sanitation”, since ‘sanitation’ encompasses protection from disease transmission, including hygiene.

In line with the IPCC Sixth Assessment Report (AR6) definitions, climate-resilient development combines strategies for adapting to climate change with actions to reduce greenhouse-gas emissions, supporting sustainable development for everyone.⁵

The definition of climate-resilient water, sanitation and hygiene places emphasis on the resilience of these services across five dimensions, spanning human and natural systems: (i) service authorities; (ii) service providers; (iii) users and wider society; (iv) water-related ecosystems; and (v) infrastructure. Together, these dimensions enable the integration of adaptation, mitigation and sustainable development across human and natural systems.

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IPCC basis of the definition

Water, sanitation and hygiene application

“anticipate”

Proactive risk understanding and management to prevent realization of impacts

e.g. forecasting, and risk assessments that incorporate climate scenarios, emergency response and preparedness plans

The IPCC AR6 defines anticipation as part of proactive adaptation, involving forward-looking approaches to manage climate risks from both extreme events and slow-onset changes. It includes understanding future climate projections, trends and disturbances, and acting to reduce exposure and vulnerability across social systems and infrastructure.

Anticipation therefore implies being prepared for climate hazards that may affect water, sanitation and hygiene services. This is achieved by employing early-warning systems, forecasting and risk assessments that incorporate climate scenarios, the use of climate-information systems and scenario-based planning, as well as integrating local knowledge with scientific data. It can also include efforts to reduce underlying vulnerabilities.

For water and sanitation services, “anticipate” involves risk assessment and adaptive planning for infrastructure and service delivery, using climate information and scenarios. These processes should be led by service authorities and providers in collaboration with communities and citizens. This analysis can forecast changes in factors such as water availability or flood risk arising from extreme weather events or slow-onset changes such as sea-level rise. In turn, forecasting can then inform proactive strategies to prevent service interruptions, as well as emergency response and preparedness plans. Anticipatory response efforts also involve efforts to strengthen the institutional and social systems underpinning water and sanitation service delivery.

“respond to”

early-warning and coordination systems to trigger a response

e.g. early warning systems, multisectoral crisis coordination mechanisms

The IPCC AR6 distinguishes between anticipatory and reactive responses, undertaken not as one-off actions but as part of an ongoing cycle of assessment, action, reassessment, learn and response.⁶ Reactive responses occur after climate-related impacts and focus on short-term recovery efforts to minimize immediate harm and support recovery, as further detailed in the sections below.⁷

Both depend on effective early-warning and decision-making systems that define and trigger timely responses.

For water and sanitation services, anticipatory responses are as described above, while reactive responses include emergency water supply, sanitation and hygiene service provision (explored further in the sections below). The capacity to respond depends on the existence of early-warning systems linked to multi-sectoral coordination and decision-making mechanisms that enable timely action during climate shocks. This should be complemented by post-crisis evaluation and learning, to strengthen response mechanisms.



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	IPCC basis of the definition	Water, sanitation and hygiene application
“cope with” Manage and endure immediate climate impacts where adaptation is not possible, ensuring short-term survival under resource-constrained and uncertain conditions <i>e.g. short-term emergency water, sanitation and hygiene services, backup systems, rationing, altering sanitation practices</i>	When a system or population cannot adapt to climate events and trends, “coping” happens instead. The IPCC notes that coping depends on currently available resources, and that repeated use of coping mechanisms without adequate time or provision for recovery can reduce coping capacity and increase vulnerability to future hazards.⁸ For this reason, there is a need to shift from coping strategies to strengthened adaptation measures to ensure long-term sustainability and avoid maladaptation.⁹ Socio-economic measures such as short-term subsidies can cushion populations during climate events, but these are often stop-gap measures rather than long-term solutions.¹⁰	For water and sanitation services, coping mechanisms are reactive responses focused on short-term survival and stability. They include: the emergency provision of services or hygiene materials by service providers or authorities, practices to reduce or ration water use, short-term reliance on backup systems, and temporary subsidies to ensure equitable access during and after events. Coping also applies to gradual changes such as declining water quality or increasing salinity. In these cases, coping might involve rationing water use, upgrading filtration systems, or altering sanitation practices to maintain functionality and avoid contamination. Such measures can support short-term response but may also heighten future vulnerability. Over-reliance on groundwater extraction during droughts illustrates maladaptation: it offers short-term relief but, when sustained, depletes the resource and undermines long-term water security.
“recover from” Restoring and upgrading systems ‘build back better’ <i>e.g. reconstruction, restoring services, integrating lessons learned</i>	Recovery supports restoration to a pre-disaster state. Ideally, the opportunity is used to enhance adaptiveness to future climate events and trends by ‘building back better’ to reduce losses.¹¹ It encompasses both physical rebuilding and the strengthening of institutional and governance frameworks to ensure inclusive recovery actions.¹²	For water and sanitation services, recovery may involve rebuilding infrastructure, restoring services, and ensuring that essential water and sanitation needs are met, while integrating lessons learned to enhance future resilience. Recovery from slow-onset changes, such as sea-level rise or drought, may require major changes in how services are managed.

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	IPCC basis of the definition	Water, sanitation and hygiene application
“adapt to or transform based on climate-related events and trends.” System-wide change to adapt to climate change <i>e.g. comprehensive (widespread and long-term) climate actions across a system</i>	Adaptation refers to the process of “adjustment to actual or expected climate and its effects, to moderate harm or exploit beneficial opportunities.”¹³ Incremental adaptations reduce losses and enhance benefits up to the point that adaptation limits are breached and residual risks remain high. Beyond these limits, transformational adaptation is required, involving system-wide, multi-level change that also addresses structural inequalities. Transformational adaptation goes beyond incremental change, fundamentally shifting the structures and systems that drive vulnerability. This may include changes in governance, planning, financing, or even in the values and norms that underpin risk and resilience.¹⁴	For water and sanitation services, adaptation involves adjustments to physical infrastructure and configuration, in the actions of service providers and authorities, and in wider policy, institutional, regulatory and financial settings. These aim to minimize service disruptions from climate events and trends while maximizing opportunities for co-benefits in water-resource management and other related sectors. Incremental adaptation typically involves modifying existing water sources and sanitation technologies. In contrast, transformative adaptation may fundamentally alter infrastructure configurations and technologies, address structural inequalities in service delivery and access, support integration with other sectors (for example, energy), and promote circularity and diversification of approaches. To adapt effectively, systems need to be inclusive, flexible and forward-looking. That means empowering those most affected, reforming governance to support shared decision-making, and designing infrastructure and institutions that can adjust as conditions change - rather than becoming stuck in approaches that no longer work as the climate shifts.
“all while striving to achieve and maintain universal and equitable access to safely managed services”	Water and sanitation are daily needs, fundamental to both individual and community resilience, and are recognized human rights. The definition’s reference to ‘achieving and maintaining’ these service levels reflects the low levels of access in many countries highly exposed to climate impacts, and acknowledges the threat that climate change poses to both establishing new services and maintaining existing ones - even in locations that had already achieved universal access to safely managed services. The service levels for Sustainable Development Goals (SDGs) 6.1 and 6.2 are defined by the WHO-UNICEF Joint Monitoring Programme as access to sanitation and drinking water facilities that meet specific criteria to ensure health and safety. • Safely Managed Drinking Water: Use of improved drinking water sources that are accessible on premises, available when needed, and free from contamination. • Safely Managed Sanitation: Use of improved sanitation facilities that are not shared and where excreta are either safely disposed of in situ or treated off-site. • Basic Hygiene Service: Presence of a handwashing facility with soap and water available at home.	

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“where appropriate, minimizing emissions”

‘Climate resilient development’ proposes concurrent pursuit of both adaptation and mitigation hence the definition includes efforts to minimise emissions associated with the delivery of water, sanitation and hygiene services.

Recent studies suggest water, sanitation and hygiene services may account for more than 5 per cent of global greenhouse-gas emissions.¹⁵ Emission-reduction measures should be pursued only where feasible and appropriate, as it is essential that such actions do not compromise service functionality, sustainability, user experience, or public-health outcomes.

“and paying special attention to the most exposed vulnerable groups.”

In the same way that Sustainable Development Goal 6.2 emphasizes “paying special attention to the needs of women, girls and persons with disabilities, including others in vulnerable situations”, there is broad recognition that climate change disproportionately affects the most vulnerable groups - often those with the lowest levels of service. This highlights the need to focus on ensuring services for populations most exposed and vulnerable to climate hazards.

Main principles that apply to the definition

- **Universal:** This definition aims to be applicable to all countries and contexts regardless of their human, social, ecological and financial capacities. It emphasizes those currently receiving the lowest levels of service (or no service), who are often the most vulnerable to climate hazards, as well as those with existing water supply, sanitation and hygiene services.
- **Solutions adapted to the local context:** Activities to achieve the desired outcomes are context-specific; there is no one-size-fits-all solution. Each stakeholder will develop their own strategies and guidelines to align with the agreed definition through locally led adaptation.
- **Aspirational:** The definition describes an aspirational state for water, sanitation and hygiene services. Although this may not yet be fully realized in many contexts, it serves as a driver for continuous adaptation.
- **Transformational:** Significant and immediate shifts in planning and programming are required, because climate-change risks can rapidly reverse decades of progress. Stakeholders supporting water, sanitation and hygiene services must adopt new ways of working, to integrate climate risks into decision-making, planning, design and management of infrastructure and services.
- **Able to evolve:** The criteria defining what constitutes a climate-resilient service should themselves be able to evolve over time. This recognizes that mainstreaming climate resilience in water, sanitation and hygiene sector planning, programming and systems will take time – as well as acknowledging the diversity of countries and contexts.



Implementation of climate-resilient water, sanitation and hygiene services

Implementation refers to the practical process of translating global commitments and agreed definitions of climate-resilient water, sanitation and hygiene services into concrete actions at national and local levels. This often requires overcoming significant institutional, financial and capacity barriers. Implementation ensures that agreed principles and targets are embedded in the governance, financing, planning and delivery systems that sustain services over time. It goes beyond policy declarations: it means operationalizing climate resilience so that water, sanitation and hygiene services can anticipate, withstand, recover from and transform in response to climate-related shocks and stresses, while minimizing emissions and advancing sustainable development.

Within the UAE Framework for Global Climate Resilience, implementation is central. Target 9a on climate-resilient water and sanitation is a cornerstone of the framework and interacts with other targets on health, food security, ecosystems, and infrastructure. Advancing implementation in this area therefore not only strengthens water and sanitation but also supports synergies across the wider set of targets, ensuring that resilience-building is coherent and mutually reinforcing.

The definition of climate-resilient water, sanitation and hygiene services emphasizes the resilience of these “services” within the wider system of institutions, and relationships that connect water

resources, infrastructure, providers, and users. This requires integrating adaptation, mitigation and sustainable development across human and natural systems. Implementation is about enabling key actors – governments, regulators, service providers and communities – to deliver, sustain and restore services under changing climate conditions. These actors operate at different levels (supra-national, national, sub-national and local), and their interactions determine whether resilience can be achieved in practice.

There are **five interdependent dimensions** that need to be considered, in order to implement climate-resilient water, sanitation and hygiene services:

1. Service authorities
2. Service providers
3. Users and wider society
4. Water-related ecosystems
5. Infrastructure

The first three dimensions represent the actors and institutions whose decisions, relationships and behaviours shape service resilience. The latter two represent the physical assets that these actors depend on, manage and interact with. Healthy ecosystems underpin water availability and quality, while robust and adaptable infrastructure ensures that services can cope with and recover from shocks.

Together the five dimensions are connected through governance and constitute the water, sanitation and hygiene system. Strengthening this system – and the interdependencies among its dimensions – will result in more resilient water, sanitation and hygiene services.

The five dimensions together create the foundation for climate-resilient services. They are the actors who govern, deliver and use the services, and the assets and systems that sustain them. The five dimensions are:

- 1. Service authorities:** National ministries, regulators, and local governments responsible for policy, regulation, coordination, and oversight of water and sanitation services. Their key governance functions include strategy and planning, coordination, financing, service delivery arrangements, monitoring, regulation, and capacity development.
- 2. Service providers:** Public utilities, private operators, institutional managers (e.g. schools and health-care facilities), municipalities, water departments, NGOs, and community-based or informal actors responsible for reliable, inclusive, and safe water, sanitation and hygiene service delivery.
- 3. Users and wider society:** Households, CSOs, consumers groups, academia, business, and communities that use and depend on water, sanitation, and hygiene services. Their relationships, practices, and behaviours influence demand, accountability, and resilience outcomes.
- 4. Water-related ecosystems:** Rivers, streams, springs, lakes, wetlands, aquifers glaciers, and upstream catchments that supply, regulate, and receive water, together with the plant, animal, and microbial life they support. Healthy, well-managed ecosystems sustain water availability and quality, buffer climate impacts, and provide essential environmental services for resilient water, sanitation and hygiene systems.
- 5. Infrastructure:** Physical assets, networks, and processes for collecting, treating, storing, and distributing water, and for managing wastewater and faecal sludge, including safe disposal and reuse.

Delivering resilience through the five dimensions

The five dimensions of climate-resilient water, sanitation and hygiene services provide a structured way to analyse the resilience of these basic services and to assess how they contribute to broader societal resilience. Examining at all dimensions and their governance interrelations makes it possible to identify where systems are more resilient and where vulnerabilities persist.

Assessing vulnerabilities and capacities across these dimensions reveals strengths and gaps in the enabling environment, institutions and systems that determine service resilience. This analysis helps to prioritize where and how to invest in strengthening resilience and to track progress over time. Applying the definition of climate-resilient water, sanitation and hygiene services through these dimensions enables governments, regulators, service providers, development partners and civil society to translate climate resilience into practice through planning, financing, monitoring and capacity development. Because the five dimensions are interdependent and mutually reinforcing, weaknesses in any one of them can undermine the system's overall ability to provide resilient services.

Addressing identified risks requires adaptation and mitigation solutions across all five dimensions. Importantly, mitigation measures, such as reducing greenhouse gas emissions or promoting circular economy approaches in water and sanitation should be applied where possible and appropriate. However, in contexts where even basic resilient services are lacking, adaptation and universal access must remain the primary priority.

Moving from risk identification to appraisal of contextualized solutions must be a consultative process. It requires engaging governments, regulators, service providers, civil society, and communities in joint diagnosis, prioritization, and planning. This participatory approach helps ensure that solutions are technically sound, socially legitimate, and financially viable.

A useful way to guide this process is through a **response framework** that offers a menu of

options at different levels: national (including transboundary where appropriate), sub-national, and local. Countries can draw from this menu to identify and adapt solutions most relevant to their context. At above-national and national levels, the framework emphasizes governance reforms, integration of climate risks into policies, financing, and planning. At sub-national and local levels, it highlights infrastructure design, service delivery practices, and community engagement.

This response framework does not prescribe a one-size-fits-all model, but provides structured guidance to support governments and partners in contextualizing the implementation of climate-resilient water, sanitation and hygiene services. The following section outlines desired outcomes across the five dimensions, followed by a menu of potential outputs across dimensions and implementation levels.

Practical application: a response framework with a menu of options

The five dimensions are not solely about providing a way to define and analyse climate resilience in water, sanitation and hygiene services. They also provide a basis for developing practical response frameworks. These frameworks translate desired outcomes into concrete, context-specific solutions that countries can adopt at different levels of governance and service delivery.

The table below sets out desired outcomes across each of the five dimensions. These outcomes represent the 'what' of resilience: the state that service authorities, ecosystems, providers, infrastructure, and users should achieve to ensure continuity, adaptability, and equity under climate stress.

Table: Outcomes for climate-resilient water, sanitation and hygiene services across the five dimensions

Dimension		Expected outcome
Governance	1. Service authorities	Water, sanitation and hygiene services are supported by strong, inclusive and well-coordinated governance across above-national, national, sub-national and local levels. Governance systems enable anticipatory, adaptive and transformative responses to climate risks and uncertainties by: establishing and enforcing policies, standards and regulations; mobilizing and tracking financing; ensuring effective coordination across sectors and levels of government; and institutionalizing monitoring and early-warning systems. Access to and use of hydrological and climate data are guaranteed for informed decision-making, while transboundary and regional cooperation reinforce resilience efforts at every level.
	2. Service providers	Water, sanitation and hygiene services are delivered by service providers that are equipped and resourced to anticipate, adapt to, and recover from climate-related events, trends, and disturbances. Providers ensure emergency response, service continuity, and reliability by applying national standards, using weather, climate and hydrological data for adaptive management, and deploying innovative and resource-efficient solutions, supported by reliable supply chains for maintenance materials and spare parts. Financial and operational resilience are strengthened to minimize disruptions and potential damage, while ensuring equitable access and prioritizing the needs of the most exposed and vulnerable groups.

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Dimension	Expected outcome
Governance	3. Users and wider society Girls, boys, women and men in all communities experience equitable access to continuous and rapidly recovering water and sanitation services, reducing the risk of water-borne diseases during climate shocks and stresses. They contribute actively to preparedness and response through adapted practices such as household water storage, water use efficiency and community risk management. Users are informed, engaged and empowered to promote accountability among service providers and authorities, while inclusive participation ensures that the voices and needs of the most vulnerable and marginalized groups are prioritized. Water, sanitation and hygiene services also contribute to broader societal resilience by safeguarding daily needs, fostering equity and inclusion, strengthening links with health, education, food and climate systems, and drawing on indigenous and local knowledge to build adaptive and transformative capacities.
	4. Water-related ecosystems Water, sanitation and hygiene services are underpinned by healthy and well-managed ecosystems. Catchments, surface water, and groundwater resources are protected, restored, and used sustainably, with water and sanitation needs fully integrated into water resources management and climate adaptation planning. Ecosystem-based approaches and nature-based solutions are deployed to enhance resilience, while environmental data and monitoring systems support informed decisions. At transboundary level, cooperation mechanisms ensure that shared water-related ecosystems contribute to climate-resilient services for all.
	5. Infrastructure Water, sanitation and hygiene infrastructure is designed, implemented and maintained to anticipate and withstand climate-related events, trends and disturbances, while enabling adaptation and transformation over time. Infrastructure is guided by national standards and technical guidelines that promote robustness, flexibility and redundancy. It is supported by strong operation and maintenance, quality control and asset management systems; and increasingly integrates low-carbon, circular-economy and nature-based solutions. By minimizing risks of failure, accounting for supporting infrastructure and enabling rapid recovery, infrastructure ensures reliable, safe and sustainable service provision under changing climate conditions.

To complement these outcomes, countries also need guidance on the 'how'. This is where a response framework with a menu of options becomes indispensable. The framework offers representative interventions and solutions at national (including transboundary where applicable), sub-national and local levels, which can be adapted to specific socio-environmental and institutional contexts. By structuring options in this way, the framework provides governments, service providers and partners with:

- **A diagnostic tool**, helping them see which dimensions are stronger or weaker in their systems;
- **A planning reference**, outlining typical measures that have proven effective across contexts;
- **A flexible menu**, allowing for tailoring rather than imposing a one-size-fits-all model.

The following tables present a menu of potential options in greater detail, highlighting interventions across the five dimensions at national and transboundary levels, and then at sub-national and local levels. While climate adaptation must ultimately be localized and tailored to specific contexts, this menu provides illustrative examples of the types of interventions that countries and partners may consider and adapt to their circumstances. Together, these tables, alongside the outcomes framework, aim to support countries in moving from risk assessment to the identification and implementation of contextualized solutions for climate-resilient water, sanitation and hygiene services.

National-level outputs

(Menu of potential options)

Service authorities

(Develop and enforce national policies, climate-resilient standards, and financing strategies; coordinate across sectors and levels to integrate planning and regulation)

A.1 National standards and guidelines for climate-resilient water and sanitation services (for various settings, i.e. rural, urban and healthcare facilities) are developed or adapted, institutionalized and enforced. They cover emergency preparedness and business continuity, climate-risk assessment and adaptive planning, infrastructure design, environmental safeguards, and equity and inclusion considerations for climate-exposed populations.

A.2 Alignment and coordination is ensured between national climate and water, sanitation and hygiene priorities in sector planning and review processes (e.g. Joint Sector Reviews, coordination platforms, NAPs and NDCs).

A.3 Legal and regulatory institutions and frameworks for water and sanitation, water resources and ecosystems management, are updated and enforced to ensure compliance with climate resilience standards, safeguard ecosystems, and promote inclusive and adaptive service delivery.

Service providers

(Develop climate standards for service continuity; preparedness and adaptive management through data; financial resilience mechanisms)

B.1 National standards for service continuity, quantity, quality and recovery time related to climate events are established (e.g. climate-resilient water safety planning).

B.2 Climate hazard emergency preparedness and business continuity are institutionalized, including thresholds for implementation of emergency plans.

B.3 Data-informed adaptive management is institutionalized, with service providers collecting, reporting and using climate-sensitive performance indicators, and with systems established to provide hydrological and climate data to guide operations and planning.

Infrastructure

(Set national standards for resilient, low-emission, and adaptive infrastructure; integrate climate risk into design, planning, and investment)

C.1 National standards and technical guidelines for infrastructure are established, incorporating hazard-specific risk considerations, equity, and resilience attributes (robustness, flexibility, redundancy and modularity). They also include options for nature-based solutions, greenhouse-gas mitigation and circular-economy approaches (e.g. renewable energy, water-use efficiency, water reuse and recycling, energy recovery, non-revenue-water reduction measures, and low-carbon construction materials).

C.2 Climate risk assessments and adaptation planning are systematically integrated into infrastructure feasibility studies, design processes and national investment planning.

Water-related ecosystems

(Promote integrated and transboundary management of ecosystems, embedding nature-based solutions in national strategies and policies, and developing national monitoring systems)

D.1 Nature-based solutions and water conservation are embedded in national strategies for source-water and catchment protection, wastewater treatment, and, where necessary, used in combination with grey solutions.

D.2 Institutional frameworks and intersectoral coordination mechanisms between actors responsible for water, sanitation and water resources management are established or strengthened to enable joint planning, monitoring, and allocation that incorporates climate risks and uncertainties.

D.3 Shared early warning systems ensure water availability for service provision, and limit wastewater pollution during and after climate events.

Users and wider society

(Institutionalize inclusion and equity in national water, sanitation and hygiene frameworks; empower civil society and integrate Indigenous knowledge)

E.1 National guidelines and standards for inclusive service design are updated and enforced to address the distinct needs of women, children, persons with disabilities, Indigenous peoples and other marginalized groups.

E.2 Community engagement frameworks and accountability mechanisms are institutionalized to ensure inclusive participation in water and sanitation-related climate risk management and decision making at national, subnational and community levels.

E.3 Coordinated mechanisms for social protection and equity are established to ensure continuity and affordability of water and sanitation services for the most vulnerable during climate shocks and crises, including incorporation into social protection schemes.

Service authorities

(Develop and enforce national policies, climate-resilient standards, and financing strategies; coordinate across sectors and levels to integrate planning and regulation)

Service providers

(Develop climate standards for service continuity; preparedness and adaptive management through data; financial resilience mechanisms)

Infrastructure

(Set national standards for resilient, low-emission, and adaptive infrastructure; integrate climate risk into design, planning, and investment)

Water-related ecosystems

(Promote integrated and transboundary management of ecosystems, embedding nature-based solutions in national strategies and policies, and developing national monitoring systems)

Users and wider society

(Institutionalize inclusion and equity in national water, sanitation and hygiene frameworks; empower civil society and integrate Indigenous knowledge)

A.4 Cross-sectoral coordination mechanisms across water, sanitation, health, food, climate, and disaster risk management authorities are established and operationalized to support policy coherence, integrated planning and delivery.

A.5 National early warning and information systems are established or strengthened and institutionalized to provide timely and relevant information for water and sanitation sector planning, emergency preparedness, and service continuity.

A.6 Monitoring, evidence and reporting systems are developed or enhanced to track climate-related water and sanitation vulnerabilities, adaptation and mitigation actions, and sector performance, with alignment to SDG and Paris Agreement commitments including the Global Goal on Adaptation and research-based evidence to improve resilience of services.

A.7 Financing strategies for climate adaptation, mitigation, disaster response, and sector resilience are in place and tracked, ensuring increased and diversified funding that accounts for higher costs of provision, infrastructure, and recovery.

B.4 Financial adaptation and mitigation mechanisms (e.g. tariff policies, subsidies, contingency funds, climate risk finance instruments) are developed to support cost recovery and service continuity and equity under climate stress.

B.5 Innovation and efficiency are incentivized towards low-emission and resource-efficient practices (e.g. renewable energy, digital tools, circular economy approaches) are supported through national programs and incentives

D.4 National systems for environmental and hydrological data collection, modelling, and analysis (e.g. hydrogeological mapping, groundwater recharge modelling, soil and land cover atlases) are developed incorporating uncertainty and institutionalized to inform planning.

E.5 Recognition and integration of Indigenous and local knowledge in preparedness, adaptation, and risk management strategies are institutionalized, to enhance resilience at community level.

E.6 Civil society organizations and communities are supported to advocate for increased public and climate financing for resilient water, sanitation and hygiene services, including through capacity building on climate, water, sanitation and hygiene, and advocacy skills.

Service authorities

(Develop and enforce national policies, climate-resilient standards, and financing strategies; coordinate across sectors and levels to integrate planning and regulation)

Service providers

(Develop climate standards for service continuity; preparedness and adaptive management through data; financial resilience mechanisms)

Infrastructure

(Set national standards for resilient, low-emission, and adaptive infrastructure; integrate climate risk into design, planning, and investment)

Water-related ecosystems

(Promote integrated and transboundary management of ecosystems, embedding nature-based solutions in national strategies and policies, and developing national monitoring systems)

Users and wider society

(Institutionalize inclusion and equity in national water, sanitation and hygiene frameworks; empower civil society and integrate Indigenous knowledge)

A.8 Institutional and human resource capacities are strengthened to support the risk assessment, design, regulation, and oversight of climate-resilient water, sanitation and hygiene services, including emissions reduction and emergency response, through revised curricula, workforce training, and targeted support to enable national institutions to access and manage climate finance.

Above-national / transboundary (as relevant)

A.9 Transboundary governance mechanisms are established or strengthened to integrate climate resilience into shared basin and aquifer management, aligned with national water, sanitation and hygiene policies.

A.10 Cross-border data sharing early warning systems and monitoring are institutionalized between countries to inform climate-resilient water and sanitation planning and emergency preparedness.

A.11 Countries collaborate globally to exchange knowledge, technologies, and experiences, and to contribute to and benefit from the global architecture for climate change adaptation in the water and sanitation sector and related sectors. Such collaboration enhances learning, innovation, and coherence across national and regional efforts.

B.6 Regional associations or platforms of service providers exchange best practices, technical knowledge, mutual support mechanisms and innovations for climate-resilient and low-emission service delivery.

C.3 Regional financing mechanisms and investment programmes support climate-resilient infrastructure development in shared basins and vulnerable cross-border areas.

D.5 Transboundary cooperation mechanisms support the scaling up of nature-based solutions (e.g. wetlands restoration, forest management) to enhance ecosystem services that underpin water, sanitation systems.

E.6 Regional civil society platforms and education programs promote exchange of experiences, advocacy, and participation in transboundary water and sanitation resilience efforts across countries.

Sub-national and local-level outputs

(Menu of potential options)

Service authorities

(Implement land-use planning; establish early-warning and contingency systems; enforce service standards; mobilize local financing and technical support)

a.1 Land use, planning and fair reallocation processes are in place to reduce population growth and settlement in high climate-risk areas.

a.2 Climate-informed early warning systems and contingency mechanisms are in place at sub-national and local levels to anticipate, respond to, and recover from climate-related disruptions in water and sanitation services.

a.3 Horizontal coordination structures between sub-national and local authorities, and vertical coordination structures between sub-national and national authorities, are operationalized for climate planning, coordination, and emergency response.

Service providers

(Develop capacity for emergency preparedness; establish contingency funds; last-mile delivery and service continuity)

b.1 Coordination mechanisms among sub-national service providers are established to enable resource sharing, technical assistance, and joint emergency response across municipalities and districts.

b.2 Service providers are trained, equipped and financed to enhance preparedness and operational continuity and quality under climate stress, using updated tools and where possible, real-time data systems.

b.3 Service delivery preparedness, emergency and continuity plans (covering emergency protocols, backup systems, and flexible delivery arrangements) are operationalized by service providers to respond effectively to climate-related disruptions.

Infrastructure

(Redesign, relocate, and upgrade local water and sanitation infrastructure for durability and recovery; apply decentralized, low-carbon solutions; ensure inclusive access and proactive maintenance)

c.1 Climate-resilient and inclusive water, sanitation and hygiene infrastructure designed and implemented across sub-national and local projects (including for schools, healthcare facilities, and communities) to minimize the consequences of failure and enable rapid recovery from climate shocks and facilitate equitable access.

c.2 Critical water and sanitation infrastructure (e.g. reservoirs, supply lines, treatment and drainage systems) is relocated, elevated, upgraded, and maintained to ensure reliable functionality during extreme climate events, with redundancy and diversity built into service models (e.g. backup communal toilets, rainwater harvesting or storage systems, water tankers) to sustain access when primary systems fail.

Water-related ecosystems

(Strengthen local catchment and groundwater governance and community and Indigenous stewardship; implement nature-based solutions)

d.1 Inclusive catchment-level governance structures are established and resourced to coordinate equitable local land-use, water allocation and ecosystem protection across municipalities.

d.2 Coordinated action across different actors – solid waste, agriculture, industry and water resources – is undertaken to reduce the impact of human activities on water-related ecosystems.

d.3 Ecosystems supporting water, sanitation and hygiene services (e.g. forests, wetlands, watersheds) are protected, managed, and restored in areas vulnerable to climate stress.

Users and wider society

(Foster local awareness, behaviour change, and participatory risk mapping and local accountability; apply traditional knowledge)

e.1 Awareness and behaviour change campaigns are rolled out at scale, informing users about climate risks, water conservation, hygiene practices, and preparedness, coping and recovery measures.

e.2 Create public demand for climate-resilient and safely managed water, sanitation and hygiene services and incentivize members of the public to upgrade to safely managed water and sanitation services (e.g. make use of desludging services, connect to utility water supplies instead of using unsafe sources)

e.3 Participatory approaches are utilised to draw on diverse local and traditional knowledge bases to inform the identification of climate risks, the design of solutions and local constraints.

Service authorities

(Implement land-use planning; establish early-warning and contingency systems; enforce service standards; mobilize local financing and technical support)

a.4 Enforce standards for climate-resilient water, sanitation services through licensing, permits and resourcing for independent regulators to have oversight of services.

a.5 Resource allocation and technical support mechanisms are established at sub-national level to guide and backstop municipal authorities and service providers in integrating climate risk assessment and adaptation into area-wide master planning, investment, emergency response and build skills and capacities.

a.6 Local financing mechanisms are established and institutionalized to support adaptation and mitigation investments, ensure service continuity during climate shocks, and facilitate recovery after climate-driven disruptions, with specific support to vulnerable groups.

Service providers

(Develop capacity for emergency preparedness; establish contingency funds; last-mile delivery and service continuity)

b.4 Performance monitoring systems include climate-sensitive indicators to track resilience and equity in service provision, integrating digital and data-driven tools for real-time analysis and predictive maintenance, with results informing adaptive planning and accountability.

b.5 Policies, regulations, and tariff frameworks are in place to ensure service providers maintain continuity, affordability and equity for exposed, vulnerable, and marginalized groups during and after climate shocks and stresses

b.6 Localised financial mechanisms (e.g. community contingency funds, flexible payment schemes) are established to complement service authorities/government budgets and support continuity of water and sanitation services under climate stress.

Infrastructure

(Redesign, relocate, and upgrade local water and sanitation infrastructure for durability and recovery; apply decentralized, low-carbon solutions; ensure inclusive access and proactive maintenance)

c.3 Greenhouse gas emissions are managed through solar-pumping, non-revenue water reduction measures (including leak detection, pressure management, and network rehabilitation), water recycling, use of low-carbon construction materials, water efficiency and conservation, optimization of wastewater and faecal sludge treatment processes including methane capture or waste-to-energy systems.

c.4 Climate risk assessments are systematically integrated into feasibility studies, investment planning, and project design for water and sanitation infrastructure, supported by participatory mapping of at-risk infrastructure and services to identify geographic areas especially susceptible to climate hazards and adaptation limits.

c.5 Community-level infrastructure systems (e.g. decentralized sewage, gravity and solar water schemes) are adapted and maintained through inclusive participation and training.

Water-related ecosystems

(Strengthen local catchment and groundwater governance and community and Indigenous stewardship; implement nature-based solutions)

d.4 Groundwater and surface water resources and related ecosystems are monitored and managed, identifying ecological and water resource thresholds using localized, climate-smart tools and community-based systems.

d.5 Nature-based solutions (e.g. constructed wetlands, riparian buffers, retention ponds, check dams, terracing, reforested recharge zones) are implemented to reduce erosion, improve water quality, and mitigate the impact of climate-related hazards.

d.6 Community-based stewardship mechanisms (e.g. user associations, local watershed committees) are institutionalized to manage and protect water-related ecosystems that underpin local service resilience.

Users and wider society

(Foster local awareness, behaviour change, and participatory risk mapping and local accountability; apply traditional knowledge)

e.4 Community-based risk mapping, preparedness, and response planning mechanisms are established to enable locally tailored resilience actions.

e.5 Communities have capacity to anticipate and prepare to shocks through dissemination of climate information; technical skills and knowledge to interpret climate information; knowledge on how to prepare for climate risks related to water, sanitation and hygiene.

e.6 Services are designed and constructed with vulnerable groups including women, children, persons with disabilities, and marginalized communities, to ensure equity and resilience in service delivery.

e.7 Local accountability mechanisms (e.g. user committees, scorecards, citizen monitoring) are institutionalized to ensure transparency and responsiveness of service providers and authorities, including during climate events.

Service authorities	Service providers	Infrastructure	Water-related ecosystems	Users and wider society
(Implement land-use planning; establish early-warning and contingency systems; enforce service standards; mobilize local financing and technical support)	(Develop capacity for emergency preparedness; establish contingency funds; last-mile delivery and service continuity)	(Redesign, relocate, and upgrade local water and sanitation infrastructure for durability and recovery; apply decentralized, low-carbon solutions; ensure inclusive access and proactive maintenance)	(Strengthen local catchment and groundwater governance and community and Indigenous stewardship; implement nature-based solutions)	(Foster local awareness, behaviour change, and participatory risk mapping and local accountability; apply traditional knowledge)
a.7 Local markets and supply chains are strengthened to guarantee the availability of affordable, climate-resilient technologies, emergency stocks, repair services and supporting infrastructure (power, roads and bridges) through targeted incentives and partnerships.	b.7 Partnership frameworks and innovation platforms are in place to co-develop climate-responsive solutions and ensure last-mile delivery in vulnerable and remote areas. b.8 Hygiene promoter capacities and supply chains are strengthened to ensure availability of soap, menstrual products and relevant hygiene messages during and after climate events.	c.6 Operation, maintenance, and asset management systems are revised and strengthened to ensure continuity, durability, and cost-effectiveness of infrastructure under climate stress. c.7 Asset management procedures are in place to guide local authorities and utilities in maintaining climate-resilient infrastructure, including proactive investment to strengthen resilience.		

About SWA

Sanitation and Water for All (SWA) is a UNICEF-hosted partnership working towards a joint objective of water, sanitation, and hygiene for all, always, and everywhere. The partnership uses innovative ways to increase political support for the human rights to water and sanitation. It does this through the mobilization of partners in governments, utilities, regulators, donors, financial institutions, UN agencies, civil society and research organizations, and the private sector. For this exercise, we engaged in a thorough consultative process, inviting both SWA members and non-SWA members of the SWA Climate Action Task Team to participate and provide valuable inputs.

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References

- ¹ Literature on community resilience also notes other determinants of community resilience, across social, institutional, economic, infrastructure and environmental domains, with no consensus on or evidence for the most important specific factors. See Willetts et al., Willetts, J., Rodgers, D., Kohlitz, J., Medina Valenzuela, A. *Determinants of community resilience to climate change and the contribution of water, sanitation and hygiene*. Prepared for UNICEF East Asia and the Pacific Regional Office by the University of Technology Sydney – Institute for Sustainable Futures, Bangkok, 2024. <https://knowledge.unicef.org/wash/resource/eapro-determinants-community-resilience-climate-change-and-contribution-water-sanitation>
- ² Decision 2/CMA.5 on the Global goal on adaptation, paragraph 9.
- ³ GCF Water Project Design Guideline's Part 3: Practical Guidelines for Designing Climate-Resilient Sanitation Projects: [Sectoral guide: Water security | Green Climate Fund](#)
- ⁴ For indicators across each dimensions refer to the JMP, WHO and UNICEF project to identify indicators for monitoring *climate-resilient WASH* to support the progressive integration of climate resilience information into national and global WASH monitoring frameworks. Source: [UN-Water \(2024\). JMP/GLAAS project to monitor climate-resilient WASH](#)
- ⁵ [AR6 WGII Overarching FAQs_FAQ6_16 June 23_final](#)
- ⁶ IPCC AR6, WGII, Chapter 1, 2022
- ⁷ IPCC AR6, WGII, Chapters 16 and 17. 2022
- ⁸ [IPCC, SR, WGs I and II, Section 1.4.1.2, 2012](#)
- ⁹ IPCC WGII, Chapter 16, Section 16.3, 2022
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