

Water Supply and Sanitation

Introduction

Purpose: This annex to the Climate Risk Screening and Management Tools is designed to provide you with more information on climate change¹ implications for water supply and sanitation. The information is grouped into the following sub-sections, with the corresponding step from the Tool shown in parentheses:

- Climate Risks to Water Supply and Sanitation (Step 2)
- Adaptive Capacity Related to Water Supply and Sanitation (Step 3)
- Opportunities Related to Water Supply and Sanitation (Step 5)
- Climate Risk Management Options for Water Supply and Sanitation (Step 6)
- Additional Key Resources for Water Supply and Sanitation

The questions and examples provided in this annex are illustrative and designed to stimulate thinking about climate risks, adaptive capacity, opportunities, and climate risk management options. Actual climate risks will depend on the context and anticipated climate changes for particular geographies.

Sectoral focus of this annex: The material in this annex aligns with HL.8 Water Supply and Sanitation of the Standardized Program Structure. Note, to the extent your design involves multiple sectors, you may want to consult other relevant annexes. In particular, if any new construction or rehabilitation² is anticipated, referring to the [Infrastructure, Construction and Energy Annex](#) is highly recommended. Please note, *activity*-level climate risk management (CRM) for engineering design **must** be conducted by the Engineer of Record.³ See the [Infrastructure, Construction, and Energy Annex](#) for solicitation language. In addition, note that the [Health Annex](#) addresses waterborne diseases, and the [Environment and Biodiversity Annex](#) addresses water-related ecosystems and integrated water resources management.

¹ In this document, the term “climate change” refers to both climate variability and climate change. “Climate variability” refers to variations in climate (including the normal highs and lows, wet and dry periods, hot and cool periods and extremes) and can refer to month-to-month variability, year-to-year variability, and even decadal scale variability. In this document, “climate change” refers to those variations as well as persistent change in climate over decades or longer (USAID, 2014. *Climate-Resilient Development: A Framework for Understanding and Addressing Climate Change*).

² USAID Implementation of Construction Activities, A Mandatory Reference for ADS Chapter 303, defines “construction” as: “construction, alteration, or repair (including dredging and excavation) of buildings, structures, or other real property and includes, without limitation, improvements, renovation, alteration, and refurbishment. The term includes, without limitation, roads, power plants, buildings, bridges, water treatment facilities, and vertical structures.” Construction at USAID almost always occurs within another primary programming area (e.g., school building for education, hospital/clinic construction for health).

³ An appropriately qualified engineering firm under contract or subcontract with USAID for the purpose of completing the engineering design.

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Tool Step 2: Climate Risks to Water Supply and Sanitation – Illustrative Examples and Questions

Once you have reviewed this section, you can navigate back to the Tool by clicking on the relevant hyperlink in the header.

Water Quantity	Water and Sanitation Infrastructure	Water Quality	Behavioral Change and Enabling Environment
<ul style="list-style-type: none"> ● Increased evaporative water losses due to higher temperatures. ● Increased demands for potable water and for other uses of water due to higher temperatures. ● Decreased water availability in the dry season due to rapid runoff and reduced infiltration caused by heavy rainfall over sparsely-vegetated watershed. ● Reduced supply of freshwater due to inundation of coastal aquifers from sea level rise. ● Eventual diminished seasonal water supply due to melting glaciers. ● Increased conflicts over water in arid regions due to droughts. ● Increased competition for water for rural and urban needs due to drought and water shortages. 	<ul style="list-style-type: none"> ● Increased damage to water supply and sanitation systems, including collection, treatment, and distribution systems, due to increased intensity of precipitation. ● Reduced efficiency of sanitation systems and treatment performance due to prolonged drought. ● Damage to water supply and sanitation infrastructure due to flooding. ● Damaged pumps due to sea level rise and saltwater intrusion. ● Inundation of low-lying latrines and septic systems caused by sea level rise. ● Damage to water and sanitation infrastructure due to heavy surface flows and floods from melting glaciers and Glacial Lake Outburst Floods (GLOFs). ● Reduced access of marginalized populations⁴ to sanitation infrastructure due to flooding and extreme storm events. 	<ul style="list-style-type: none"> ● Harmful algal blooms (HABs) that produce toxins leading to human health impairment may be created by higher temperatures. ● Reduced water quality due to increased pathogens and lower dissolved oxygen caused by higher temperatures. ● Increased public health risks due to inundation and overflow of latrines and septic systems caused by increased precipitation and storm events. ● Increased disease risks due to exposure of downstream residents to human and animal wastes caused by flooding of sanitation facilities. ● Increased incidence of waterborne infectious diseases due to higher temperatures and flooding. ● Contaminated groundwater through boreholes and unprotected wells due to flooding. 	<ul style="list-style-type: none"> ● Reduced number of stakeholders participating in risk-reducing practices as a result of infrastructure damage and community dislocation due to flooding or sea level rise. ● Reduced resources available for community education as a result of resources required for emergency response. ● Reduced participation in sanitation and hygiene training and awareness- raising due to community disruption and dislocation due to flooding, sea level rise, and extreme events. ● Reduced resources for and enforcement of government policies and regulations related to water use and sanitation due to diversion of government staff and resources to address extreme events and other climate impacts.

⁴ Marginalized populations are groups of people who are excluded, based on their identity, from political, social, and economic power and participation. Often they include women and girls, at-risk youth, the elderly, LGBTI individuals, persons with disabilities, people in linguistic minorities, indigenous people, and/or a combination of any of these identities. (LGBTI individuals refers to lesbian, gay, bisexual, transgender, or intersex individuals. Further information can be found in the LGBT Vision for Action, <https://www.usaid.gov/what-we-do/democracy-human-rights-and-governance/protecting-human-rights/lgbti-inclusive-policies>.)

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Water Quantity	Water and Sanitation Infrastructure	Water Quality	Behavioral Change and Enabling Environment
<ul style="list-style-type: none"> ● Reduced surface water availability and groundwater recharge due to prolonged drought. ● Increase in wells drying up, extending distances travelled to collect household water, due to declining precipitation. ● Borehole failures due to prolonged drought and declining groundwater levels. ● Increased workload, time burden, and caloric expenditure for women and girls. 	<ul style="list-style-type: none"> ● Disruption to supply chains for construction and maintenance of water and sanitation infrastructure due to flooding and/or severe events. 	<ul style="list-style-type: none"> ● High levels of suspended sediments, potentially exceeding water treatment capacity, due to flood waters. ● Higher pollutant concentrations in surface waters and reduced efficiency of sanitation systems due to prolonged drought. ● Reduced ability of rivers to dilute and carry away contaminants due to low-flow periods. ● Back up of discharge and spread of waterborne diseases due to flooded coastal outfalls caused by sea level rise and storm surge.⁵ ● Accelerated salinization of coastal aquifers due to sea level rise, storm surge, and/or reduced rainfall. 	

Illustrative questions by climate stressor:

Temperature:

- Are higher temperatures likely to reduce water quality?
- Are higher temperatures likely to increase demand for drinking water?
- Will higher temperatures impact worker availability or schedules for construction of sanitation or water infrastructure?

Flooding:

- Is flooding likely to damage water supply, wastewater treatment, and/or sanitation infrastructure?
- Is storm damage to other sectors (e.g., electricity supply, transportation) likely to affect water supply and sanitation?

⁵ A temporary sea level rise associated with a storm.

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Drought:

- Is drought likely to impair water supply infrastructure, including wells and boreholes?
- Is drought likely to increase evaporation of surface waters and reduce groundwater recharge, limiting freshwater supply?

Sea level rise and storm surge:

- Is sea level rise and/or storm surge likely to introduce salt water into drinking water supplies?
- Is sea level rise and/or storm surge likely to damage water and sanitation infrastructure?

Illustrative questions by programming or system element:

Water supply:

- Are higher temperatures likely to increase evaporation of surface waters?
- Is declining precipitation likely to reduce recharge rates and groundwater supplies?
- Is flooding likely to reduce infiltration and water availability in the dry season?
- Is prolonged drought likely to increase competition for freshwater?
- Is sea level rise likely to contaminate coastal aquifers and reduce the supply of freshwater?

Water and sanitation infrastructure:

- Is flooding likely to damage water supply and sanitation infrastructure or interfere with operations and maintenance?
- Is flooding likely to inundate sanitation facilities?
- Is drought likely to reduce groundwater levels and lead to borehole failures?
- Is salt from sea level rise and storm surge likely to damage water pumps?

Water Quality:

- Are higher temperatures likely to increase the risk of hazardous algal blooms?
- Is flooding likely to lead to overflows of latrines and septic systems leading to increased public health risks?
- Is prolonged drought likely to increase water treatment costs?
- Is sea level rise contaminating drinking water supplies?

Demand Creation/Enabling Environment:

- Will severe events disrupt community-based education efforts to achieve behavior change regarding sanitation?
- Will severe events result in reduced resources for enforcement of government policies and regulations related to water use and sanitation?

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Tool Step 3: Adaptive Capacity Related to Water Supply and Sanitation – Illustrative Questions

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Information Capacity

- What is the capacity to collect and use information related to climate impacts to water resources and Water, Sanitation, and Hygiene (WASH) services?
 - To what extent do strong and effective systems for monitoring of water resources and WASH services exist, including hydro-meteorological monitoring? Are there information gaps? Are information collection/management and strategic planning systems based on historical averages, or are they dynamic and able to adjust to new information?
 - How well is existing monitoring information of water resources and WASH services used? Is it incorporated into strategic planning of resources (financial, infrastructure, personnel, training, disaster preparedness, etc.)?
 - To what extent is climate change information incorporated into design of WASH infrastructure and facilities?
 - To what extent do current or future WASH efforts take into account the indirect impacts of climate change and other socio-economic and demographic trends in local water availability (especially through agricultural, industrial, and urban water uses)?
 - What is the accessibility and appropriateness of data collection and dissemination (language, literacy, etc.)?

Social and Institutional Capacity

- What is the level of capacity of institutions and civil society (e.g., water and sanitation service providers and utilities) to take action and to adjust to climate impacts on water and sanitation services?
 - Are there effective institutions and leadership in place to support the planning and implementation of actions to address potential impacts and opportunities related to water and sanitation services? To what extent do central and local government non-governmental organizations (NGOs), and the private sector have the capacity to consider and address climate impacts to WASH services?
 - Are roles and responsibilities clearly assigned amongst relevant stakeholders (e.g., government institutions, service providers) such that they facilitate planning for and response to climate impacts?
 - To what extent do national or sub-national policies recognize and address the multiple pressures on WASH services, including climate variability and change? To what extent do national or sub-national WASH guidelines and standards exist that take adequate account of climate change?
 - To what extent are national and local planning, budgeting, and emergency response capabilities able to respond to gradual and rapid onset changes?
 - To what extent are institutions equipped to manage potential conflict between competing water users? How well are institutions able to manage conflict under potentially increasing competition and scarcity? How mature are water management institutions within the country?
 - To what extent do institutions reflect the diversity and different needs of the communities they serve?

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- o How are the multiple needs and roles of users taken into account (i.e., water for people and water for livestock, both managed by women)?

Human Capacity

- To what extent do WASH service providers, managers, and users have the capacity to consider and address climate impacts to water and sanitation services?
 - o Are there effective institutions and leadership in place to support the planning and implementation of actions to address potential impacts and opportunities related to water and sanitation services? Is there capacity to prepare proposals to access financial resources?
 - o To what extent do central and local government, NGOs, and the private sector have the capacity to consider and address climate impacts to WASH services?
 - o What is the level of awareness and appreciation of water users of water conservation and water efficiency? Do users support government or utility-led water conservation programs? Are users currently applying water conservation and protection practices?
 - o Are technical and research organizations in place to train and support communities to adjust to climate impacts to water and sanitation services?

Financial Capacity

- Are there adequate financial resources to support the WASH sector in preparing for climate impacts?
 - o Are investments being made to reduce climate risks to WASH infrastructure and service delivery? Will investment be able to scale up or down as needed to channel resources to key areas to minimize negative impacts to WASH services as a result of climate change?
 - o Are investments being made in technologies that promote efficient use of water and conservation of water?
 - o Are investments being made in research and technical development to reduce climate risks to WASH services?
 - o Are funding sources available to address heightened risk management needs to maintain preparedness for losses and new investments?
 - o Are revenue flows from water services delivery sufficient to allow providers to sustain operations during periods of drought or flood?
 - o Is there any danger that interrupted revenue flows (through, for example, imposed water conservation measures or resource allocation due to extreme events) may lead to “stranded assets” that are no longer economically viable?

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Tool Step 5: Opportunities Related to Climate Risk Management for Water Supply and Sanitation – Illustrative Examples

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The need to address climate risks to health may provide opportunities to:

Develop synergies between disaster risk reduction (DRR) and water-related adaptation

- Climate-proofing water supply and sanitation systems can help integrate DRR and CAA and promote emergency preparedness.

Reduce gender inequalities associated with water and sanitation

- Efforts to increase the resilience of water systems can decrease demands on women who must collect water for household uses, which can consume a significant amount of time in the day. These time demands can increase as the availability of water decreases and women are forced to travel further to access water.
- Efforts to increase the resilience of sanitation systems can support women in maintaining sanitary household conditions and reducing disease in themselves and their families.

Improve water and sanitation infrastructure and infrastructure services

- Making water and sanitation systems more resilient to future climate variability and change may also yield immediate results by addressing insufficient water and sanitation infrastructure and an inadequate supply of clean water and access to sustainable sanitation.

Encourage stakeholder engagement and enhance the sustainability of investments

- New or more varied stakeholders may be engaged in WASH services to help develop and implement climate risk management measures, which can increase the overall sustainability and impact of the investments.
- New coalitions and partnerships may provide cost-effective opportunities to address reduced water supplies and other climate-related challenges to water services.

Take advantage of synergies with other development objectives

- Shared concern about water supply and quality may provide opportunities to promote more holistic approaches to water resource management.
- The need to enhance the resilience of water supply and sanitation services may encourage government officials to prioritize needed improvements in energy systems upon which water supply and sanitation rely.
- Changes in water management infrastructure for WASH services may provide opportunities to expand water and sanitation services to rural communities.
- Improved water conservation measures may reduce the need to transport water, which is energy intensive. Saving energy from transporting water will reduce greenhouse gas emissions.
- The need to rebuild after extreme events may provide an opportunity to inventory and construct improved and more resilient water and sanitation infrastructure.
- Climate surveillance equipment for early warning and emergency response may also provide information to managers and designers of water and sanitation services.

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- Implementing integrated watershed management may help protect water resources vulnerable to reduced rainfall and increased incidence of drought.

Achieve climate change mitigation co-benefits while achieving sustainable water supply and sanitation services

- Water is a critical input for multiple sectors, including energy and agriculture. The water-energy-food nexus should be considered as an important sustainability factor in the water sector and in country plans to reduce emissions, e.g., in low emissions development strategies (LEDS) and nationally determined contributions (NDCs).

Tool Step 6: Climate Risk Management Options for Water Supply and Sanitation – Illustrative Examples

The need to address climate risks related to water supply and sanitation may provide a range of additional opportunities. For moderate/high risk strategic elements, projects, and activities, the important types of opportunities to discuss are climate change mitigation,⁶ potential co-benefits for non-climate development objectives, leveraging political will, and other development issues. For Washington-based and low-risk strategic elements, projects, and activities, opportunities should focus more on how to support resilience more broadly.

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Invest In Climate-Related Information Collection and Management Systems

- Strengthen climate information systems, building on existing regional and national networks.
- Build capacity of national governments to harmonize data across regions.
- Build relevant national and/or regional research programs on the links between climate and water supply and sanitation (e.g., vulnerability index).
- Improve public education and outreach efforts related to watershed protection, water demand, water sanitation, and other factors relevant to water-related climate impacts and adaptation.

Strengthen WASH Policies, Planning, and Systems

- Integrate climate information into WASH system planning.
- Identify and prioritize technologies for water-related adaptation.
- Improve design and construction of water supply and sanitation infrastructure to account for the potential for climate-related risks.
- Improve water storage, conservation, and water demand management to account for climate-driven changes in supply and demand.
- Improve coordination of policies and programs across government agencies to address the additional pressures imposed by climate change.
- Foster integrated resource management with agriculture and energy.
- Improve finance for WASH systems that are more adaptive and better designed for a changing climate, including through private sector investment and incentives; ensure consideration of climate risk in financing approaches.

⁶ In this document “climate change mitigation” refers to efforts to reduce greenhouse gas emissions.

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- Improve monitoring and evaluation systems to measure changes in water-related vulnerability and resilience to climate change and to promote adaptive management.

Consider Rural vs Urban Needs

- Identify changes in demographics, urbanization, and land use that could dictate a shift in WASH investments, particularly in the face of the exacerbating influence of climate change.
- Design urban WASH investments to “reach” more individuals potentially affected by climate change.
- Consider water resource constraints when addressing the complexities of urban migration (family planning, economic opportunities, and integrated public services).

Develop Multi-use Systems to Improve Risk Management for Water Systems

- Integrate WASH infrastructure for multiple uses at the household level to improve resilience to decreased rainfall from climate change and variability.
- Implement rainwater harvesting and greywater reuse for agriculture, where appropriate.
- Strengthen disaster planning and response for water infrastructure and water services.

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Additional Key Resources for Water Supply and Sanitation

The following **resources** provide additional information related to water supply and sanitation and corresponding climate risk management options.

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Title	Author(s)	Organization	Date	Length	Intended Audience	Unique Value
WASH 101: Development Result 4, Water Resources Management Online Training (search for the course title in USAID University)	USAID	USAID	N/A	1 hour	USAID staff	By the end of the online training module, USAID WASH Leads and those managing WASH programs will be able to: <ol style="list-style-type: none"> 1. Describe the importance of Water Resources Management (WRM) and planning. 2. Recognize key concepts and key sector terms in WRM. 3. Identify management practices that affect water quality and availability 4. Describe how to manage climate stressors on water resources.
Sustainable Water Partnership Toolkits	USAID and Winrock International, TetraTech, IUCN, WRI, SEI	USAID and Winrock International, TetraTech, IUCN, WRI, SEI	2017	Six (6) toolkits	Decision-makers in the water sector	The toolkits present a process to address water risks, including long-term water stresses that constrain social and economic development and sudden shocks that can quickly ruin the health and livelihoods of vulnerable populations. The toolkits complement the Climate Risk Screening and Management Tool and provide a more in-depth analysis of water security risks that span beyond climate risks.
Ecosystem-based Adaptation and Water Security	USAID Forestry & Biodiversity Office and USAID BRIDGE	USAID	2018	8 pp.	Development experts, water security experts, policymakers	Provides an overview of ecosystem-based adaptation approaches to address water security.

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Lifelines : The Resilient Infrastructure Opportunity	Hallegatte, S.; Rentschler, J.; Rozenberg, J.	World Bank	2019	Overview 33 pp. Full Report 224 pp.	Governments, stakeholders, and the international community	Building on a wide range of case studies, global empirical analyses, and modeling exercises, Lifelines lays out a framework for understanding infrastructure (including water and sanitation) resilience—the ability of infrastructure systems to function and meet users’ needs during and after a natural shock—and it makes an economic case for building more resilient infrastructure. Offers concrete recommendations and specific actions that can be taken by to improve the quality and resilience of infrastructure services.
<i>Incorporating Climate Change Adaptation in Infrastructure Planning and Design series</i> <ul style="list-style-type: none"> ● Sanitation ● Flood Management ● Potable Water 	USAID	USAID	2015	~60 pp. each	USAID infrastructure project managers	Describes best practices to incorporate climate adaptation in the planning and engineering design of USAID infrastructure activities. For use at the project- or activity-level, after reviewing the reference <i>Addressing Climate Change Impacts on Infrastructure</i> , in order to gain a more detailed understanding of risks and potential adaptation options.
Maintaining Water Security in Critical Water Catchments in Mongolia	USAID Forestry & Biodiversity Office and USAID BRIDGE	USAID	2017	4 pp.	Development experts, water security experts, policymakers	Highlights a project supported by the Adaptation Fund and the United Nations Development Program that used ecosystem-based adaptation approaches to address water security in Mongolia.
Maintaining Water Security in Peru Through Green Infrastructure	USAID Forestry & Biodiversity Office and USAID BRIDGE	USAID	2018	4 pp.	Development experts, water security experts, policymakers	Highlights three sub-national projects supported by the USAID/Peru mission that used ecosystem-based adaptation approaches to address water security.

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<i>Climate Change and Water: An Annex to the USAID Climate-Resilient Development Framework</i>	USAID	USAID	2014	152 pp.	Development practitioners, including country strategy and project teams	Provides a comprehensive overview of water-related vulnerabilities and adaptation actions.
<i>Addressing Climate Change Impacts on Infrastructure: Preparing for Change</i>	USAID	USAID	2013	52 pp.	Development practitioners, including country strategy and project teams	Provides more detailed information than the Tool about climate impacts to water-related infrastructure. Lists potential adaptation measures that will help with identifying ways to address the risks.
<i>Fast-Track Implementation of Climate Adaptation</i>	USAID	USAID	2015	81 pp.	Development practitioners including country strategy and project teams	Can be applied as a next step after screening, to brainstorm water-related infrastructure adaptation options that can be implemented quickly and incorporated into planning and decision-making.