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FACT SHEET

POTABLE WATER SYSTEMS

ADDRESSING CLIMATE CHANGE IMPACTS ON INFRASTRUCTURE:
PREPARING FOR CHANGE

Water pump in Iloilo, Philippines. Photo Credit: Jessica Troell

- Climate change may reduce availability of reliable water, due to droughts, degradation of water quality, and disruption in service.
- Since safe potable water is essential to the economic and physical health of a community, climate change impacts on potable water supplies will have wide-reaching implications for development projects and programs.
- Adaptation options such as improving water capture and storage, spreading and implementing best practices in water conservation, and protecting water quality, reduce climate change risks.

POTABLE WATER SYSTEMS ARE INTEGRAL TO DEVELOPMENT PRIORITIES

Potable safe drinking water is crucial to a community's economic and physical health. Water-related diseases are the most common cause of illness and death among the poor in developing countries. Unsafe drinking water, inadequate sanitation, and poor hygiene cause nearly two million deaths due to diarrhea each year, with children under the age of five accounting for the vast majority of these deaths. Providing potable water goes hand-in-hand with improving sanitation and hygienic practices to protect public health.

Recognizing that potable water is an essential requirement for development, USAID and other development practitioners are already actively supporting potable water projects throughout the developing world. ***Accounting for climate change in water project design and implementation will ensure that investments provide effective, long-term, and sustainable solutions.***

CLIMATE STRESSORS CAN SIGNIFICANTLY IMPACT POTABLE WATER SYSTEMS

Climatic patterns greatly influence both water supply and quality. Climate change can affect the availability of water supplies by increasing the severity of short- and long-term droughts, the melting of glaciers, and the intensity of storms. Rising sea levels and storm surges can cause salt water intrusion leading to the salinization of fresh water supplies. Rising temperatures can increase water demand for drinking, irrigation, and green spaces, while also causing greater evaporation from reservoirs. These effects can all necessitate additional water storage. Competing priorities for water (e.g., drinking water, hydropower, and agriculture) can further exacerbate reduced availability and increased costs of potable water.

POTABLE WATER SYSTEMS INCLUDE:

- Water supply systems
- Water treatment systems
- Water storage and distribution infrastructure

POTABLE WATER SYSTEMS SUPPORT:

- Health
- Food security
- Economic productivity
- Tourism

Climate change can also affect water quality. More intense storms can lead to increased sediment and pathogen loading. Increased temperatures may degrade water quality by promoting algal blooms, increasing pathogen concentrations, and lowering dissolved oxygen levels. In cities, the "urban heat island effect" can intensify temperature increases, exacerbating water quality issues. Changes in water quality could require significant investment in improved source water protection, water treatment, or development of new sources of water.

Impacts that lead to decreasing water supply and quality may have far-reaching impacts on public health, economic growth, and other development goals. Table 1 on the next page provides examples of how climate stressors may impact water supply, treatment, and storage and distribution. These risks vary in relative importance, with a range of cost implications, compounding effects, and impacts on development objectives.

POTABLE WATER-RELATED ADAPTATION CAN BE MAINSTREAMED INTO EXISTING PROGRAMS

Climate changes will require the adaptation of potable water systems. To ensure a reliable and sustainable supply of safe potable water, the development community should consider climate change impacts and

Table 1. Examples of Potential Climate Change Impacts on Potable Water Infrastructure and Services

	Water Supply	Water Treatment	Water Storage and Distribution
Temperature Increase	• Reduced capacity of existing infrastructure (pumps, pipes, storage, and treatment facilities) to meet increased demands • Decreased water quality increasing likelihood that existing treatment infrastructure is inadequate	• Increased water treatment requirements and costs to address lower water quality (e.g., increased algal blooms and bacterial and fungal content)	• Increased storage capacity requirements due to increased demand • Increased water losses during storage • Decreases in water quality during storage and distribution
Increased Intensity of Precipitation and Storm Events	• Increased turbidity loading in reservoirs, due to greater runoff • Less groundwater recharge due to faster runoff • Damage to or inundation of infrastructure	• Lower treatment efficiency due to rapidly changing water quality • Inundation of treatment facilities during storm events • Loss of power disrupting treatment operations • Damage to water treatment facilities and distribution networks	• Additional storage facilities needed to capture water during short, high intensity storm events • Greater need to ensure distribution system integrity, to minimize inflow of contaminated waters during storm events • Damage to storage facilities and distribution systems from increased runoff • Increased contamination of wells from contaminated runoff
Prolonged Drought	• Need for additional sources of water, and associated conveyance, storage, and treatment infrastructure, to respond to short- and long-term droughts	• Increased water treatment costs and requirements to address lower water quality (e.g., higher pollutant concentrations due to reduced dilution)	• Need for additional water storage to address drought periods • Need to reduce water losses, and implement water conservation • Need for deeper wells to reach lower water tables • Increased cost and energy requirements to distribute water from new sources
Seal Level Rise	• Saltwater intrusion of freshwater supplies • Corrosion of water conveyance infrastructure	• Inundation of low-lying treatment facilities and wells	• Need for additional water storage to replace wells impacted by saltwater intrusion

adaptation in existing programs and projects. Adaptation may involve additional investment, improved operation and maintenance, and long-term planning. To maximize the impact of investments, decision-makers need to consider four key factors when prioritizing adaptation efforts. These include:

- ***Criticality*** – How important is the potable water infrastructure to achieving development objectives in a particular region?
- ***Likelihood*** – What is the probability of the climate impact occurring and affecting the infrastructure?
- ***Consequences*** – Will the climate impact temporarily or permanently decommission the use of the potable water infrastructure? Will the impact reduce water availability below a critical threshold?
- ***Resources available*** – What financial and technical resources are available to integrate adaptation options into program activities?

As shown in Table 2, there is a range of adaptation options to increase the availability of water, to ensure water quality, and to protect and harden water treatment facilities. Both hard and soft responses exist. "Hard" options refer to structural changes such as constructing reservoirs, holding ponds, rainwater harvesting systems, and water treatment facilities. "Soft" options refer to management, operational, or policy changes such as changes in maintenance activities, changes in land protection or zoning practices to protect water quality, and training and education for water conservation.

By intentionally integrating climate information into program development and investment decisions, USAID and other development practitioners can avoid maladaptive projects, such as constructing a new well in an area where sea level rise will cause saltwater intrusion of groundwater thus rendering the well unusable, or building a new water treatment facility in a location that may be susceptible to flooding from extreme precipitation events (or in a location that will not yield sufficient water, given future extended dry periods). While an ad-hoc approach to potable water development may result in positive short-term effects, an integrated, climate-resistant approach will maintain value over the long term. Table 2 illustrates this approach, aligned with the Climate-Resilient Development (CRD) Framework. See the Overview for further guidance on the CRD Framework.

Table 2. Examples of Potable Water-Related Actions by Project Cycle Stage

Project Cycle Stage	Project Cycle Actions		
SCOPE	• Identify water-related development goals important to the country, community, or sector you are working with • Identify inputs and enabling conditions necessary to achieving those goals • Consider the impacts of climate and non-climate stressors on those inputs		
ASSESS	• Assess climate impacts on water quality and the need for additional water treatment or other management options • Assess climate impacts on water availability and the need for additional storage, water conservation, etc.		
DESIGN Planning Policy Changes Project Development	**Adaptation Options (Examples)**		
	INCREASE AVAILABILITY	ENSURE WATER QUALITY	PROTECT/HARDEN/RETREAT
	• Develop redundant services to Increase water capture and storage options • Develop projects to reduce water losses • Evaluate new sources of water including reclaimed water • Develop policies to limit the use of potable water and increase the use of recycled water for irrigation • Develop water conservation programs	• Develop a source water protection strategy • Investigate land use and waste management policies to improve source water quality • Develop a coastal aquifer protection strategy • Evaluate treatment options to improve water quality	• Plan back-up power systems for water treatment and pumping facilities • Evaluate options to relocate water treatment infrastructure • Improve distribution system infrastructure
IMPLEMENT and MANAGE Construction Operation Maintenance Program Activities	**Adaptation Options (Examples)**		
	INCREASE AVAILABILITY	ENSURE WATER QUALITY	PROTECT/HARDEN/RETREAT
	• Install new or improved water storage options • Implement training and education programs to promote water conservation	• Implement programs to protect source water quality • Work with local governments to implement land use practices and waste management policies to improve water quality • Build and operate upgraded water treatment facilities	• Relocate at-risk facilities out of flood-prone areas • Provide back-up power sources
EVALUATE and ADJUST	• Track performance of water systems and the availability of water during short-term events and over time • Monitor changing environmental conditions affected by climate and their impact on water supply and treatment		

FURTHER READING

U.S. Agency for International Development, 2012. Drinking Water, Sanitation and Hygiene. http://transition.usaid.gov/our_work/cross-cutting_programs/water/water_sanitation.html

Questions, feedback, suggestions, and requests for support should be sent to **climatechange@usaid.gov.**

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