USAID FROM THE AMERICAN PEOPLE

Technical Brief 13

CLIMATE-RESILIENT, LOW-EMISSIONS WATER SECURITY AND SANITATION

USAID Water and Development
TECHNICAL SERIES

INTRODUCTION

This technical brief provides guidance on United States Agency for International Development (USAID) climate-resilient and low-emissions water security and sanitation programming. In addition to the United States Government Global Water Strategy and USAID's associated Agency Plan, this technical brief is aligned with USAID's Climate Strategy, Environmental and Natural Resources Management Framework, Resilience Policy, Global Food Security Strategy, and Early Recovery, Risk Reduction, and Resilience framework.

KEY TAKEAWAYS

- Water solutions are climate solutions. Water security and sustainable sanitation services are at the heart of both climate resilience and a net-zero greenhouse gas (GHG) emission future.
- Systemic and targeted action is required to achieve climate-resilient water security and sanitation that meet human, economic and ecosystem needs.
- To drive action on climate solutions, water security and sanitation programs should include interventions focused on policy and regulation; planning, budgeting and management; data collection and analysis; financing; and behavior change, and draw on key principles.
- Practitioners should directly address climate risks to programs and should also use additional recommended practices, including alignment with national climate goals, assessment of potential co-benefits to development outcomes, and adaptive management.

September 2022

THE CHALLENGE

The world faces daunting challenges ensuring that people, the environment, and food systems have the quantity and quality of water they need, even in the absence of adverse climate impacts. Population growth, rapid urbanization, and the expansion of irrigated agriculture increases demand for water, while poor water management wastes existing resources through leaky pipes and inefficient irrigation practices.[1] This, in turn, threatens conflict among water-consuming sectors (e.g., agriculture, industrial use, domestic use), farmers and herders, sub-national regions, and even countries.[2]

Climate change will only make these challenges more acute and complicated, particularly for people, communities, and local institutions in the low-income countries that bear little responsibility for historic GHG emissions. Unless there is an immediate, rapid, and large-scale reduction in GHG emissions, average global temperatures will rise beyond 1.5 degrees or even 2 degrees Celsius above pre-industrial levels by 2040.[3] This will lead to dramatic changes across the water cycle, including new evaporation patterns, glacial melt, flooding/drought frequency and severity, and salt-water intrusion.[4]

Estimates suggest that by 2050, more than 5 billion people will lack sufficient water at least one month per year compared to 3.6 billion today.[5] From droughts to extreme storms, climate change will exacerbate water stress and access inequities. These adverse impacts disproportionately affect marginalized populations, including women, indigenous peoples, and youth. When combined, heightened water scarcity and more frequent disruptions to water supplies and sanitation services due to climate change can undermine economic growth—costing some regions up to 6 percent of their gross domestic product[6]—cause food insecurity, and result in instability, conflict, and migration.

COMMITMENT TO MOBILIZE FINANCE

As part of the President's Emergency Plan for Adaptation and Resilience, USAID announced at the 2021 UNFCCC Conference of the Parties (COP26) its intent to mobilize at least $1 billion in public and private finance for climate-resilient water and sanitation services by 2030. USAID will provide technical assistance to utilities, service providers, and local governments in partner countries to enable them to access commercial and multilateral financing, enhance domestic budget allocations, and increase revenue collection in order to upgrade and expand climate-resilient water and sanitation services.

WATER SOLUTIONS ARE CLIMATE SOLUTIONS

Improved water resources management and climate-resilient water and sanitation services are essential for climate resilience. In fact, improved water resources management is one of the most cost-effective ways to adapt to climate change.[7] Effective water resource planning and allocation, as well as protecting and rehabilitating watersheds, can promote a multitude of co-benefits, including sustainable hydropower generation, downstream water availability, biodiversity habitat conservation, flood mitigation, public health, and water quality. Inclusive access to safely managed water and sanitation services and consistent application

1 Global Commission on Adaptation. (2019). Adapt Now: A Global Call for Leadership on Climate Resilience.
2 Pacific Institute. (2022). Water Conflict Chronology. Oakland, CA.
3 Intergovernmental Panel on Climate Change. (2021). Climate Change Widespread, Rapid, and Intensifying.
4 Global Water Partnership. (2019). Addressing Water in National Adaptation Plans.
5 UNESCO and World Water Assessment Programme. (2018). Nature-Based Solutions for Water: The United Nations World Water Development Report 2018.
6 World Bank. (2016). High and Dry: Climate Change, Water, and the Economy.
7 Global Commission on Adaptation. (2019). Adapt Now: A Global Call for Leadership on Climate Resilience.

of hygiene behaviors are fundamental to household resilience as they directly minimize the disease burden and indirectly minimize other potential climate-related stressors that can lead to conflict, hunger, or human migration. This is especially true for marginalized populations.[8] For example, safely managed sanitation services reduce the risk of polluting water supplies during floods, thereby preventing potential outbreaks of cholera and other diarrheal diseases, which remain a leading cause of death globally for children under five.[9]

SCHEDULED DESLUDGING SERVICES IN INDONESIA

The majority of Indonesia's urban poor rely on unsafe types of onsite sanitation. Septic tank maintenance occurs irregularly, if at all, so feces leach into the surrounding surface and groundwater. Illegal dumping of human waste into nearby rivers or canals is commonplace. Increased potential for flooding as a result of climate change stands to compound these problems. As a result, USAID's Indonesia Urban Water, Sanitation, and Hygiene Penyehatan Lingkungan untuk Semua project worked with 25 cities to help pilot an affordable, scheduled desludging service where vacuum trucks make regular trips to communities to empty latrines and septic tanks. This service is now being replicated elsewhere in Indonesia. The approach minimizes the risk of disease outbreaks during flood events made more frequent by climate change. Scheduled desludging provides reliable services to households, government buildings, and private businesses, while aggregating customers for vacuum truck operators, saving them from making extra trips to the treatment plant. Vocational training facilities are now assembling standardized septic tanks built to enhance ease of desludging and minimize potential overflow should extreme weather events occur.[10]

Water security and sanitation also provide opportunities to mitigate GHGs. The water and sanitation sectors are small but increasingly significant sources of GHG emissions, comprising over 10 percent of the global anthropogenic, or human-caused, total.[11] Fossil fuels used as an energy source for pumping and treating water and sanitation services emit carbon dioxide, while naturally occurring anaerobic processes in the sanitation service chain release methane and nitrous oxide, both potent short-lived climate pollutants. Methane and nitrous oxide emissions can form at any point along the sanitation service chain, but are most significant during containment and treatment.[12] In developing countries where 80–90 percent of the wastewater is neither collected nor effectively treated,[13] increasing the frequency of safe fecal sludge collection can significantly decrease methane and nitrous oxide emissions.[14] Pairing more frequent fecal sludge collection with abatement opportunities at the treatment stage (including increasing the efficiency and effectiveness of treatment processes) using aerobic treatment processes where appropriate, or installing methane capture whenever possible, can further advance mitigation opportunities. Energy efficiency and the use and generation of renewable energy also have the potential to reduce the emissions footprint of both water and sanitation services, while nature-based solutions across watersheds have the potential for carbon sequestration.

---

8 WaterAid. (2021). Programme Guidance for Climate Resilient WASH.

9 World Health Organization (WHO). (2022). Number of Deaths in Children Aged <5 Years, by Cause. The Global Health Observatory.

10 For more information, see The Business of Waste: Professionalizing Septic Tank and Latrine Desludging in Indonesia.

11 Water security and sanitation contribute to GHG emissions in six primary ways: 1) carbon dioxide (CO_2) in energy used to purify and supply water and treat wastewater; 2) methane (CH_4) and nitrous oxide (N_2O) from wastewater and fecal sludge; 3) CO_2, CH_4, and N_2O emissions from surface water bodies into which poorly treated wastewater and agricultural fertilizer are drained; 4) organic material decomposition in reservoirs; 5) degradation and destruction of wetlands (especially peatlands) that store large amounts of carbon; and 6) water-inefficient flooding regimes for rice paddy irrigation that facilitate formation of CH_4 and N_2O. From: Kerres, M., et al. (2020). Stop Floating, Start Swimming; Water and Climate Change – Interlinkages and Prospects for Future Action. GIZ.

12 Johnson, J., et al. (2022). Whole-System Analysis Reveals High Greenhouse-Gas Emissions from Citywide Sanitation in Kampala, Uganda. Communications Earth & Environment 3.1.

13 UN Water. (2020). The United Nations World Water Development Report 2020 Water and Climate Change.

14 Johnson, J, et al. (2022). Whole-System Analysis Reveals High Greenhouse-Gas Emissions from Citywide Sanitation in Kampala, Uganda." Communications Earth & Environment 3.1.

TREATING WASTEWATER HYPER-LOCALLY IN THE DOMINICAN REPUBLIC

Only 25 percent of households in the Dominican Republic are connected to regulated wastewater and sewage services. Some households use on-site septic systems in various states of repair, while many others discharge their wastewater directly into streams, rivers, or bays. This is a problem for the health of humans and ecosystems, and it is particularly acute during large storms that are projected to intensify as global temperatures rise. In part because siting large-scale, centralized wastewater treatment facilities was a challenge, USAID's Climate Risk Reduction Program supported efforts to expand cost-effective, small-scale wastewater treatment systems through multi-family septic tanks attached to small constructed wetlands serving three to five families. Treatment included a grease trap and an underground anaerobic tank. Effluent from the tank flowed into a small "wetland" (as small as 4 square meters) and then through a series of sand, gravel, and rock layers, before entering the water table. By that time, 75 to 80 percent of contaminants had been removed, which reduced pollution and the risk of contamination during floods.[15]

BUILDING BLOCKS FOR CLIMATE-RESILIENT, LOW-EMISSIONS WATER SECURITY AND SANITATION

To maintain healthy human, economic, and ecological systems, water resources and water and sanitation services must be climate-resilient and low-emitting. **Climate-resilient, low-emissions water supplies and services sustainably deliver benefits, or are quickly restored, when climate shocks and stressors strike, and also minimize GHG emissions.** Achieving this requires a spectrum of actions from targeted interventions to systemic change across five key building blocks:

POLICY AND REGULATION

Policies and regulations that incentivize systems change, clear sector-wide strategies, and effective coordination are essential to promoting climate resilience and minimizing GHGs in water and sanitation. At the national level, climate policies or strategies should prominently feature water security and sanitation both as part of priority adaptation needs and mitigation opportunities. Similarly, at the national or subnational levels, policy is needed to incentivize service providers and basin authorities to change practices, including establishing minimum design standards, structuring user fees and targets for equity of service delivery, dismantling inefficient subsidies to industrial or agricultural users to encourage greater efficiency, and minimizing pollution and stormwater runoff. Government institutions are essential for ensuring that policies are properly implemented through a combination of positive incentives and transparent monitoring and enforcement. USAID interventions can support policy or regulation reform, engineering standards and quality assurance, coordination platforms, and targeted training and mentoring for government and civil society.

[15] For more information, see USAID Water Team. (2018). Backyard Cooperation Leads to Wastewater Treatment.

NATIONAL GUIDELINES ON SOLAR POWERED WATER SYSTEMS IN ETHIOPIA

Solar-powered rural water systems were long seen in Ethiopia's dry lowlands as having potential to both build climate resilience and enhance system uptime, given persistent challenges in maintaining diesel-powered systems. Preliminary analysis suggested that solar pumping in rural Ethiopia could achieve economic advantages over diesel-fueled systems after four years of operation; however, more pilots were needed to justify higher upfront costs. USAID's Lowland WASH activity worked in partnership with the Government of Ethiopia and its One WASH National Program, as well as with academics at Addis Ababa University, to update national technical guidance documents, develop a spreadsheet-based solar pumping design tool, and support programs at vocational training centers for installation and maintenance of solar powered water systems.[16]

DATA AND ANALYSIS

Quality data on surface and groundwater supply, user demand, dynamics of conflict and fragility, and projections of future climate conditions and their impacts on water supplies are essential to building climate-resilient, low-emissions water and sanitation systems. Digital technologies can facilitate data acquisition through digitized hardware (like sensors) and geospatial monitoring. Through data analysis, risks can be assessed based on projected changes in water demand due to climate change, as well as population growth, economic development, conflict, and migration. However, the availability of information and the analytical capacity to turn raw data into actionable formats are limited in many countries.

In supporting local institutions, it is critical to train people in the collection and analysis of data, close key data gaps, increase the continuous use of community-derived data, and improve access to climate information services. This can be done through collaboration with public agencies that serve as official sources of weather, climate, and hydrology data collected through a network of instruments (e.g., weather stations, rain gauges, stream flow meters). Partnering with research institutions that perform analytics on raw data is also helpful to turn science into practical and actionable solutions. To the greatest extent possible, data should surface insights into marginalized groups to tailor solutions to their discrete needs.

APPLYING CLIMATE AND HYDROLOGY DATA IN THE PHILIPPINES

In the Philippines, hydrology studies do not inform watershed management, and water resource planning is disconnected from water supply provisioning. In the absence of data and harmonized planning, water resources are extracted with little knowledge of overall conditions and availability, which threatens the sustainability of water resources and long-term water security. The USAID Safe Water activity is addressing these challenges by helping local governments, water utilities, water managers, and other stakeholders shift to and adopt a water security planning process that uses climate and hydrology data, including baseline information on forest cover and water and sanitation access levels. Knowing future water availability, groundwater recharge areas, watershed and forest conditions, and overall threats to water security is so powerful that it has motivated stakeholders to proactively plan and act for the conservation of watersheds, diversify water sources to reduce dependence on groundwater, and prioritize investments in watersheds to ensure a water secure future.[17]

---

[16] For more information, see USAID. (2020). Modernizing Water Governance in Ethiopia: Solar Success in Off-Grid Water Service Delivery.

[17] For more information, see Harnessing Hydrologic Analyses for Evidence-based Watershed Management.

PLANNING, BUDGETING, AND MANAGEMENT

Managing uncertainty requires complex planning, budgeting, and adaptive management based on projected impacts and local knowledge. Using climate data and future projections, scenarios of likely potential climate change hazards that could threaten a community can be identified, while local knowledge can characterize communities' vulnerabilities to hazards and map potential impact pathways. Findings should inform strategic planning processes, budget allocations, and water resources and operations management, as well as infrastructure design,[18] and should consider multiple possible future scenarios given uncertainties. Service providers and basin authorities can adopt a number of approaches, including incorporating risk assessments into their planning process and training staff in adaptive management practices. This may require building up institutional capacities through training and hiring specialized personnel to help systematically incorporate new information and approaches in actionable ways. When feasible, training should be offered inclusively.

Climate-Resilient Water Safety Planning is a comprehensive risk assessment and risk management approach that provides guidance on how to perform each step of risk assessment and how to engage all stakeholders of the water supply system from catchment to consumer. It can provide a simple framework for water suppliers and service providers to incorporate climate change and disaster risk reduction into planning processes, including for emergency response, when needed.[19] Any planning process should encourage the participation of community members, civil society, and organizations for marginalized or underrepresented groups within both risk assessment and intervention prioritization to manage uncertainty in quantitative data, characterize the disproportionate vulnerability to climate for marginalized groups, ensure local knowledge and priorities are taken into account, and ensure equitable outcomes.[20]

WATER ALLOCATION PLANNING IN TANZANIA

The Mara River Basin shared between Tanzania and Kenya is home to more than one million residents, as well as the Serengeti National Park in Tanzania and the Maasai Mara National Reserve in Kenya, two globally important ecological sites. Yet the basin is experiencing water security challenges due to competing and growing demands from mining, agriculture, and animal husbandry, as well as strains caused by climate change and deforestation. The Lake Victoria Basin Water Board, in coordination with the Ministry of Water and with the support of USAID's Sustainable Water Partnership, used extensive stakeholder consultations to develop an innovative water allocation plan in Tanzania's portion of the Mara River Basin to address these threats. Dynamic water use permits allow for allocation of water depending on water availability. The Lake Victoria Basin Water Board must regularly monitor and review new permit applications to make the plan operational.[21]

Far too many local authorities and service providers have been unable to recover operating expenses, even before facing increased shocks and the associated costs of climate change. It is essential to support local authorities and service providers to understand and budget for additional costs associated with climate adaptation. These costs could include regular climate risk assessments, relocation and replacement of pipes, reinforcing the structure or materials of water or sanitation facilities, riverbank protection, and commodity

[18] USAID. (2017). Climate-Resilient Water Infrastructure: Guidelines and Lessons from the USAID Be Secure Project and World Bank. (2020). Resilient Water Infrastructure Design Brief. World Bank, Washington, DC.
[19] For more information on climate-resilient water safety plans, see World Health Organization. (2017). Climate-Resilient Water Safety Plans: Managing Health Risks Associated with Climate Variability and Change.
[20] UNESCO. (2018). Climate Risk Informed Decision Analysis.
[21] For more information, see Water Allocation Plan for the Mara River Catchment, Tanzania.

procurement, stockpiling and reinforcing supply chains for climate-induced shocks. Authorities and service providers will need to maximize the efficient use of existing budgets and resources, including reducing physical water losses. Entry points for technical assistance include assessing the vulnerability of utility assets and operations; incorporating these findings in strategic business plans, feasibility studies, or engineering designs; and mobilizing people and systems for water resource or forest monitoring.

REDUCING PHYSICAL WATER LOSSES IN JORDAN

Jordan is the third most water-scarce country in the world and loses 50 percent of its treated, piped water to illegal theft, leaky pipes, or inaccurate metering. Addressing these significant water losses in municipal and agricultural systems is crucial to improving access to water, bolstering food production, and strengthening climate resilience overall, while also mitigating GHG emissions. Through the Non-Revenue Water Project, USAID is working in partnership with the Government of Jordan and the private sector to construct and rehabilitate water infrastructure networks and services in order to reduce water losses that simultaneously reduce the need for energy-intensive water pumping. Interventions include working with water service providers to improve pressure management, increasing the supply of equipment and tools, and introducing smart metering and rapid leak detection technologies. In addition to infrastructure assistance, USAID supports policy reform, capacity building, and improved planning within the sector more broadly.

FINANCE

More resources are needed for service providers, basin authorities and local governments to cover the incremental costs of climate-resilient water and sanitation services and water resources management approaches, and to harness opportunities to abate GHGs across supply chains. Likewise, resources are needed to support individuals and communities that protect ecosystems and ensure the continuation of ecosystem services.

CLIMATE FINANCE FOR WATER SECURITY AND SANITATION

Climate finance, which includes international and domestic public financing and private investments to support climate change mitigation and adaptation, totaled $632 billion in 2019[22] and represents a large, underutilized source of funding for water security and sanitation. Currently, water receives less than 3 percent of total climate finance,[23] but receives a substantial share—37 percent—of adaptation finance at $17 billion.[24] In order for water security and sanitation to command larger shares of available resources, more analysis is needed to quantify its GHG mitigation potential across approaches, particularly for methane abatement, as well as the capital and operations and maintenance costs of associated technologies. Similarly, coordinated advocacy is needed to highlight the diversity of approaches that can be deployed through water security and sanitation to promote climate resilience—including through extending basic services to underserved communities.[25]

---

[22] Buchner, B., et. al. (2021). Global Landscape of Climate Finance. Climate Policy Initiative (CPI)
[23] Mason, N., et al. (2020). Just Add Water: A Landscape Analysis of Climate Finance for Water.
[24] Buchner, B., et al. (2021). Global Landscape of Climate Finance. CPI.
[25] For more information, see: Mason, N. et al. (2020). Just Add Water: A Landscape Analysis of Climate Finance for Water.

The World Bank estimates that $114 billion per year is needed until 2030 to achieve safely managed water and sanitation services, roughly three times current levels even without the effects of climate change.[26] Major barriers to increasing access to financing exist: for example, accreditation to specialized, public climate funds is onerous and opaque; government revenues are constrained and contested; commercial funds require moderately high returns; and the business case and project pipeline for water security and sanitation is not yet mature. Often, augmenting resources through commercial finance starts with a strong governance system and creditworthy entities, which can be scarce in resource-poor environments.

Given these longstanding challenges, several approaches are needed. Support to service providers and basin authorities can enhance operations and improve cost recovery in order to become creditworthy.[27] National, sub-national, and local governments need assistance with planning and budgeting for adaptation costs that balance competing financial demands. Where appropriate, blending grant funding with debt and equity financing, or utilizing credit enhancements, can mobilize additional resources. Finally, there are a number of disaster risk financing options, including engaging national governments, financial institutions and insurance providers, and micro-, small- and medium-sized enterprises to develop weather-indexed insurance in areas prone to droughts and floods.

SPURRING INVESTMENTS THROUGH PERU'S PAYMENTS FOR ECOSYSTEM SERVICES (PES)

From the droughts, fires, floods, and landslides, to the loss of more than half of its glaciers over the last 50 years, Peru's long-term water security is precarious. The Natural Infrastructure for Water Security (NIWS) project, a joint initiative by USAID, together with the Government of Canada, promotes investments in nature-based solutions to enhance water security. These investments are financed through a variety of sources, including an innovative PES scheme that allows water utilities to earmark and use a portion of water user tariffs to protect and restore upstream water sources. In 2021, NIWS supported Lima's water utility in their first investment under the PES scheme to restore an important wetland in the high Andes. NIWS also supported the utility to design and implement the first PES contract to build a plant nursery, which allowed water utilities to execute PES funds more efficiently while incentivizing communities to be good stewards of the land.

BEHAVIOR CHANGE

Behavior change is critical to sustain climate-resilient, low-emissions water security and sanitation. Past approaches to catalyze climate action have largely failed due to an over-reliance on increasing knowledge and a perceived threat of the environmental catastrophe that awaits, without addressing other crucial factors that influence individual motivations, community norms, incentives, and access to affordable alternatives.

Achieving social behavior change for climate-resilient, low-emissions water security and sanitation needs holistic approaches that include a suite of activities, such as combining structural and communication interventions to increase the likelihood of sustained change.[28] The behaviors that these interventions target are wide ranging, from the household level up to the government level. They may include encouraging

[26] Hutton, G. and Varughese, M. (2016). The Costs of Meeting the 2030 Sustainable Development Goal Targets on Drinking Water, Sanitation, and Hygiene. World Bank, Washington, DC.
[27] For more information, see USAID. (2021). Financing Water and Sanitation Services.
[28] For more information, see USAID. (2021). Social and Behavior Change for Water Security, Sanitation, and Hygiene.

policymakers to act as climate champions, as well as encouraging members of civil society to hold officials accountable. Among utility and basin managers, behaviors could include demand management campaigns and incentives, as well as adoption of new adaptive management and operational practices through capacity-building and incentive structures. Among households, behaviors could include uptake and use of new technologies and conservation practices through interventions that simultaneously address motivation, improve knowledge of new behaviors and increase access to new products or services. In all instances, gender norms and dynamics should be accounted for when designing and conducting behavior change interventions.

WATER DEMAND MANAGEMENT ACROSS USERS IN LEBANON

Despite abundant natural water resources, Lebanon is water scarce largely due to unsustainable water use practices that will likely worsen as a result of climate change. In urban areas, water is available intermittently for just eight hours a day on average. As a result, the USAID Lebanon Water Project worked in partnership with the country's five public water utilities to improve the management of wastewater systems to enhance operations of water services for enhanced reliability and to promote efficient irrigation. **All components relied in part on market signals to change stakeholder behavior**. Interventions included: working with local communities, municipalities, civil society, and the local private sector to strengthen market incentives to recycle and conserve water in the industrial sector; facilitating improved water conservation through upgrades in metering that changed consumer practices; and introducing water-efficient irrigation practices that helped to increase yields.[29]

KEY PRINCIPLES

When seeking to promote adaptation and mitigate GHGs in water and/or sanitation programs, partners should explore how the following programming principles apply in their context and align with both the U.S. Government Global Water Strategy and the USAID Climate Strategy.

Promote localization. Local knowledge and expertise should be emphasized where possible to tailor programming to specific social, cultural, political, economic, and environmental contexts and support empowerment, conflict sensitivity, and sustainability. Tailored solutions are particularly important given how heterogenous adverse climate impacts are across geographies and populations. To the greatest extent possible, decision-making authority and leadership should be deferred to local actors, including to governments at all levels, local private-sector actors, universities, and local communities.

Elevate marginalized groups. Adverse climate impacts experienced through water security and sanitation pathways disproportionately affect marginalized communities, including women, persons with disabilities, and youth. The disparity results from discrete challenges that impact water security or access to services both directly (including menstrual health and hygiene) and indirectly impact it through a range of political, demographic, and systemic factors that themselves create vulnerabilities and multiply barriers to inclusive access and stewardship.[30] At the same time, these populations are a huge and largely untapped source of vital leadership, innovation, and knowledge in all countries. Programming should apply inclusive processes and identify opportunities to elevate their voice and agency, in line with USAID's foundational principles of "do no harm" and "do nothing about them without them."

---

29 For more information, see USAID Water Team. (2019). Saving Livelihoods One Drop at a Time.

30 USAID Technical Brief on Inclusive Development in Water Security, Sanitation, and Hygiene *(forthcoming)*.

Maximize co-benefits. Water security and sanitation interventions often have the potential to achieve co-benefits with climate mitigation. Given the right enabling environment, nature-based solutions and technology-driven solutions can contribute to sectoral goals, promote adaptation and reduce GHG emissions.[31] For instance, a nature-based solution like upstream forest restoration can enhance source water quality, which ultimately can reduce effort and expense for downstream water treatment systems while augmenting carbon stocks and improving biodiversity. Additionally, methane capture and abatement treatment technologies can provide additional finance for service providers when there are markets for recovered resources and high levels of local knowledge and resources for treatment processes, operations and maintenance, and quality sampling—though the technologies are unlikely to lead to self-financing.

EFFECTIVE TRANSBOUNDARY WATER MANAGEMENT BENEFITS RENEWABLE ENERGY EXPANSION IN CENTRAL ASIA

Deep historical ties and shared water resources across Central Asia have created water-based interdependence across Kazakhstan, the Kyrgyz Republic, Tajikistan, Turkmenistan, and Uzbekistan that necessitate cooperative transboundary water resources management. If effectively shared, water can seasonally create hydroelectricity and simultaneously meet irrigation needs across the region. However, market incentives have supported countries forsaking regional needs to the detriment of all, causing downstream flooding in winter and insufficient water for irrigation during spring and summer months. USAID's Regional Water and Vulnerable Environment activity supports the development of a shared vision for basin management using evidence and modeling, fostering collaborative action across sectors and governance levels, and convening stakeholders to ensure water availability for hydroelectricity and agriculture across the region.

Mainstream conflict-sensitivity. Water-related conflicts have more than doubled in the past decade due in part to the mounting impacts of climate change.[32] Programs should prioritize conflict analysis and integrate conflict sensitivity principles and practices, while seeking to create a foundation for peace that will in turn help ensure more effective and sustainable access to water. Water programs should recognize their place within the wider context and emphasize the need to address the resource dynamics of conflict, through avenues such as resource sharing agreements or incentives for land rights protection, as appropriate.[33]

PUTTING IT INTO PRACTICE

While developing climate-resilient, low-emissions water and sanitation programs is a relatively new concept, it is also simply good development. The following section describes practices to follow when designing climate-resilient, low-emissions water or sanitation programming that are not only inclusive of, but go beyond, the Agency's Climate Risk Management (CRM) process—asking programs both to address direct climate risks to assets and people through a spectrum of actions.[34]

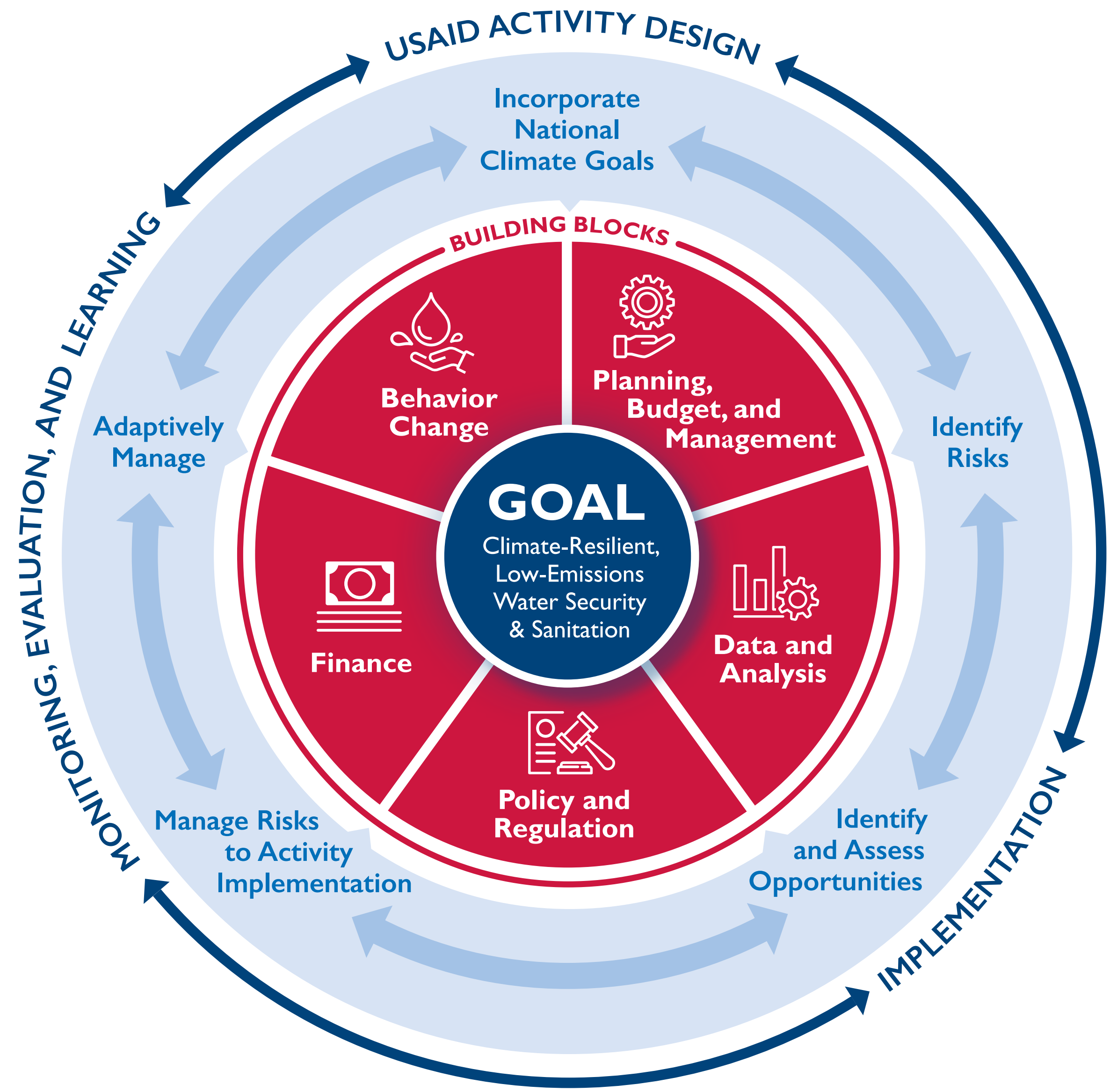
Assess and Manage Risks to Activity Implementation

As outlined in the CRM process, all activities should address climate risks across the Program Cycle that could hinder activity implementation, whether or not the design is focused on improving climate resilience or mitigation. In order to assess risk, stakeholders should seek out climate information at relevant scales,

[31] Stockholm International Water Institute. (2021). Why Water is Crucial to Climate Mitigation.
[32] Safi, M. (2019). Water-Related Violence Rises Globally in Past Decade. The Guardian.
[33] For guidance, see the USAID Water and Conflict Toolkit *(to be updated in 2022)*.
[34] This process also aligns with: Global Water Partnership and UNICEF. (2107). Strategic Framework for WASH Climate Resilience.

including national meteorological data, global risk indexes (e.g., WRI's Aqueduct Water Risk Atlas, ND-GAIN Country Index), country profiles (e.g., USAID Climate Risk and Water Resources profiles), and downscaled climate projections. When translating climate data into risks, stakeholders should account for complex and context-specific risks by following local frameworks and processes, including participatory hazard and vulnerability assessments.

CLIMATE-RESILIENT, LOW-EMISSIONS WATER SECURITY AND SANITATION



Align with National Goals

Nationally Determined Contributions (NDCs) and National Adaptation Plans (NAPs) established under the United Nations Framework Convention on Climate Change are an ideal starting place to identify possible climate-resilient water or sanitation programming priorities. An NDC is a requirement of all signatories to the 2015 Paris Agreement on climate; each country's NDC outlines steps for emissions reductions, as well as plans to adapt to the effects of climate change. A NAP is a voluntary process intended to identify medium- and long-term adaptation goals, as well as actions to meet those goals. While only 35 percent of NDCs include specific reference to Sustainable Development Goal 6 on clean water and sanitation for all,[35] most enhanced NDCs include water-related activities and measures.[36] Additionally, because most NDCs and NAPs reflect countries' self-identified adaptation goals and priority projects, they serve as useful starting points for activity design.

Identify and Assess the Opportunities

In addition to identifying risk severity and risk impact, opportunities to maximize contributions of programs to climate adaptation and GHG mitigation should also be identified and assessed. Opportunities could be specific to climate change or water and sanitation, such as helping a planned infrastructure investment access climate funds, incorporating climate considerations into water and sanitation policies and investment plans, or integrating water and sanitation considerations into the NDC/NAP revision processes. Stakeholders should consider and prioritize opportunities according to the estimated benefit to the activity's core development objectives.[37]

Incorporate the Building Blocks

Stakeholders should draw from the five key building blocks described above—namely, policy and regulation, data and analysis, planning, budgeting and management, finance, and behavior—to design a program that promotes a spectrum of targeted actions and systems change to address underlying climate risk and maximize abatement opportunities, where feasible, and iteratively incorporate findings from risk and opportunity assessments throughout design and implementation.

Engrain Adaptive Management

Climate change poses a challenge for programming in that approaches and interventions are planned to address impacts that are anticipated in the future. While the increased use of climate models and projections are important, uncertainties still exist when predicting the future conditions of natural and social systems.[38] Thus, it is essential to engrain learning and adaptive management, including flexible, shock-responsive design elements—such as crisis modifiers—in program approaches to enable evidence-based decision-making and adjustments in response to new information and changes in the operating environment.[39]

[35] Hebart-Coleman, D. (2021). Analysis of NDC Enhancement: Increased Role for Water and Water-Related Activities.
[36] Cap-Net. (2020). Integrating Water into National Climate Plans.
[37] Resources including the EU-SWIM. (2014). Guidelines for Mainstreaming Adaptation Options in IWRM Plans could aid in prioritizing adaptation options based on potential success of implementation in addition to the ability of the option to mitigate the relevant risk and enhance a resilient outcome.
[38] Climate-adapt. What is Meant by Uncertainty.
[39] For more information, see USAID. (2021). USAID's Discussion Note on Adaptive Management.

MEASURING PROGRESS

To monitor progress, it is important to select standard and custom indicators that measure progress of an activity, while also intentionally planning for collaboration, learning, and adaptation during implementation. Indicators should capture both near-term and long-term changes if possible and build in flexibility to capture emergent changes or responses to shocks during implementation. Where relevant, indicators should be disaggregated by sex and age.

Many standard global climate change (GCC) indicators are relevant to climate-resilient, low-emissions water security and sanitation programs. To facilitate easy application of GCC indicators, see Table 1; core indicators include:

- EG.11-2 Number of institutions with improved capacity to assess or address climate change risks supported by USG assistance (SO2 USAID Climate Strategy)
- EG.11-5 Number of people supported by the USG to adapt to the effects of climate change (particularly important for key targets under PREPARE; SO1)
- EG.12-7 Projected GHG emissions reduced or avoided through 2030 from adopted laws, policies, regulations, or technologies related to clean energy as supported by USG assistance (SO1)
- EG.13-8 Number of hectares under improved management expected to reduce GHG emissions as a result of USG assistance (SO1)

USAID's standard water and sanitation financing indicator (HL.8.4-1) includes a climate-resilience disaggregate that should be reported on whenever possible.

Custom indicators are also a critical component of monitoring for key outcomes, telling USAID's story, and determining the likelihood that services and supplies will be more resilient and sustainable in the long run.[40] Illustrative examples of these are:

- Number of people gaining [or projected # of people likely to gain] access to climate-resilient [water or sanitation] services
- Number of people gaining [or projected # of people likely to gain] access to low-emissions [water or sanitation] services
- Percent reduction in non-revenue water
- Percent of water resources that are monitored and managed for climate shocks and stresses
- Change in run-off ratio in targeted catchments
- Change in water quality as measured by water turbidity

[40] For additional inspiration on custom indicators and methodologies, see: 1) Howard, Guy, et al. "The how tough is WASH framework for assessing the climate resilience of water and sanitation." NPJ Clean Water 4.1 (2021): 1-10. (https://www.nature.com/articles/s41545-021-00130-5); 2) American Water Works Association (AWWA) "Utility Benchmarking Performance Indicators 2022" (2022) (https://www.awwa.org/Portals/0/AWWA/ETS/Programs/Benchmarking/2022UtilityBenchmarkingPerformanceIndicators.pdf); 3) Rogers, Briony C., et al. "Water Sensitive Cities Index: A diagnostic tool to assess water sensitivity and guide management actions." Water research 186 (2020): 116411. (https://www.sciencedirect.com/science/article/pii/S0043135420309465)

CONCLUSION

Building climate-resilient, low-emissions water security and sanitation systems is a non-linear process and lacks clear *ex ante* definitions and thresholds—in other words, one only knows if it is resilient or not following the occurrence of a climate shock. However, the adverse impacts of climate change on water security and sanitation compel us to reduce direct climate risks that we can predict or foresee based on current projections, to pursue mitigation opportunities, and to do so both through focused actions, where appropriate, and through holistic systems change. Given the importance of water security across many sectors critical to economic growth and inclusive development, engaging in the approaches enumerated in this technical brief to change the underlying drivers of GHG emissions and climate vulnerability is also critical.

SELECTED RESOURCES

WaterAid. (2021). Programme Guidance for Climate Resilient WASH.

UNICEF and GWP. (2017). Strategic Framework for WASH Climate Resilient Development.

Omasete, J., Forster, J., and Geere, J. (2022). Water, Sanitation and Hygiene: The Foundation for Building Resilience in Climate-Vulnerable Communities. WaterAid.

USAID. (2017). Toolkit for Climate-Resilient Water Utility Operations.

TABLE 1: CLIMATE-RESILIENT, LOW-EMISSIONS WATER SECURITY AND SANITATION INTERVENTIONS (ILLUSTRATIVE)

BUILDING BLOCK	CLIMATE RESILIENCE (ADAPTATION)	LOW EMISSIONS (MITIGATION)	BOTH	INDICATOR
Policy & Regulation	• Structuring user fees and targets for equity of service delivery • Establishing minimum design standards, including materials, construction methods, siting, etc. (see Climate-Resilient Water Infrastructure)	• Establishing minimum design standards, including energy efficiency (in treatment or pumping), or utilize or capture renewable energy (e.g., anaerobic digesters)	• Instituting conservation-oriented subsidy programs to encourage greater efficiency • Regulating wastewater treatment and requiring its widespread application	Number of laws, policies, regulations, or standards addressing… …climate change adaptation formally proposed, adopted, or implemented [EG.11-3] …clean energy formally proposed, adopted, or implemented [EG.12-3] …sustainable landscapes formally proposed, adopted, or implemented [EG.13-3] Projected GHG emissions reduced or avoided through 2030 from adopted laws, policies, regulations, or technologies related to clean energy as supported by USG assistance [EG. 12-7]
Data & Analysis	• Hydrologic studies that analyze surface and groundwater sources, identify high water recharge areas, water balance, and are informed by climate projections • Assessing the vulnerability of utility assets and operations, including water resources	• Developing GHG inventories for service providers, with analytics to reduce emissions through operational means	• Developing forest cover maps, and identifying high water recharge areas to implement targeted forest protection and reforestation activities	EG. 12-7 Number of institutions with improved capacity… …to assess or address climate change risks [EG.11-2] …with improved capacity to address clean energy issues [EG.12-2] …to address sustainable landscapes issues [EG.13-2] Number of people using climate information or implementing risk-reducing actions to improve resilience to climate change as supported by USG assistance [EG. 11-6]
Planning, Budgeting, & Management	• Supporting the development and regular updates of Climate-Resilient Water and Sanitation Safety Plans • Providing post-disaster rehabilitation support to repair damaged water and sanitation systems, improve the systems to become more climate-resilient (build back better) and increase water utility capacity for business continuity	• Utilizing screening tools, such as the Anaerobic Digestion Screening Tool, to assess if mitigation interventions will be feasible and financially sustainable	• Decreasing non-revenue water • Recovering energy from fecal sludge and wastewater where feasible and sustainable • Planning, budgeting, and implementation of nature-based solutions and green infrastructure	EG.11-2, EG.12-2, EG. 12-7, EG.13-2 Number of people supported by the USG to adapt to the effects of climate change [EG.11-5] Number of hectares under improved management expected to reduce GHG emissions as a result of USG assistance [EG. 13-8]
Finance	• Disaster risk financing, including weather-indexed insurance in areas prone to droughts and floods • Leveraging private capital for watershed management	• Supporting forest conservation enterprises that mobilize private capital and encourage participation in carbon markets • Partnering with the private sector on fecal sludge management, treatment, and resource recovery	• Establishing and/or scaling PES schemes that incentivize upstream forest restoration • Supporting enhancements to decrease non-revenue water • Facilitating country or institutional access to domestic or international climate finance (e.g., Green Climate Fund)	Amount of investment mobilized (in USD) to the water and sanitation sectors as a result of USG assistance [HL.8-4-1]
Behavior Change	• Encouraging adoption of new adaptive management and operational practices • Shifting norms to support adoption of rainwater harvesting, greywater reuse, and use of reclaimed water	• Shifting norms to build demand for biosolids and using energy recovered from waste	• Encouraging water conservation through adoption of efficient technologies, nature-based solutions, and water use behaviors • Supporting upland communities to shift to sustainable livelihoods	EG.11-5, EG. 12-7