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SWP
SUSTAINABLE WATER PARTNERSHIP

# WATER SECURITY ASSESSMENT

Toolkit #2

This series of toolkits presents an effective and efficient process to address risks to water security, both long-term water stresses that constrain socioeconomic development and threaten political stability, as well as sudden shocks that can endanger the health and livelihoods of vulnerable populations. These toolkits aim at disseminating the practice of water management. Local decision-makers as well as development specialists should use these toolkits as guidelines to engage water users in a collaborative process that results in improved water resources management.

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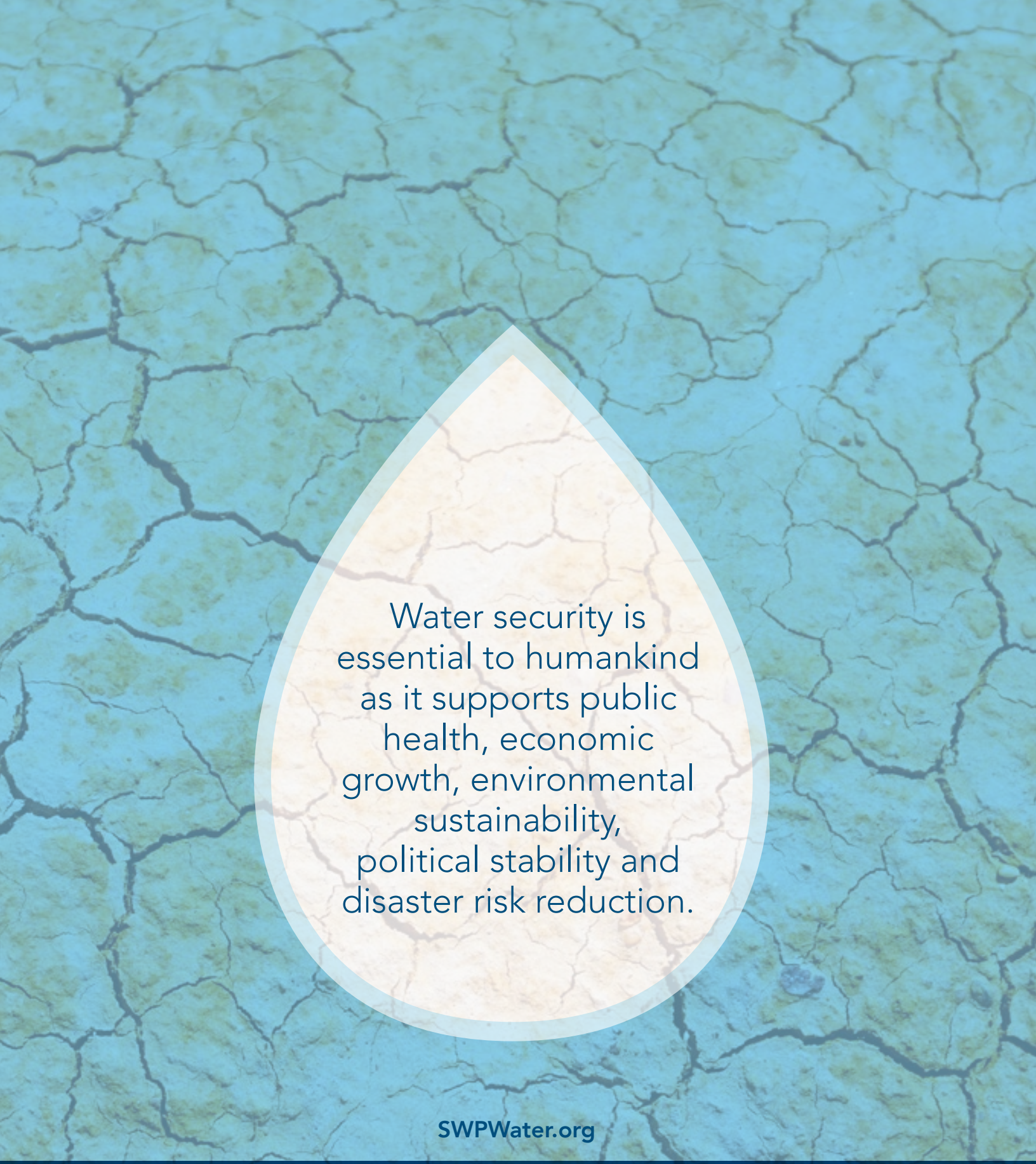


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# PREFACE

## Water Security Is Essential to Life and Humankind, by Supporting:

**Public health:** Safe drinking water, sanitation, and hygiene (WASH) are the most fundamental human needs.

**Economic growth:** Income generation and poverty alleviation heavily rely on water availability for agriculture, energy production, transportation and other livelihood activities.

**Environmental sustainability:** Natural ecosystems rely on water; they rapidly deteriorate when deprived of natural flows, directly affecting public health and livelihoods.

**Political stability:** When basic health and livelihood needs are not met, the strain on populations affects the legitimacy and sustainability of governing authorities and can lead to civil unrest.

**Disaster risk reduction:** Floods, landslides, droughts, tsunamis, and harmful algal blooms can be catastrophic events that claim lives, affect local economies, and may multiply due to climate variability and change.

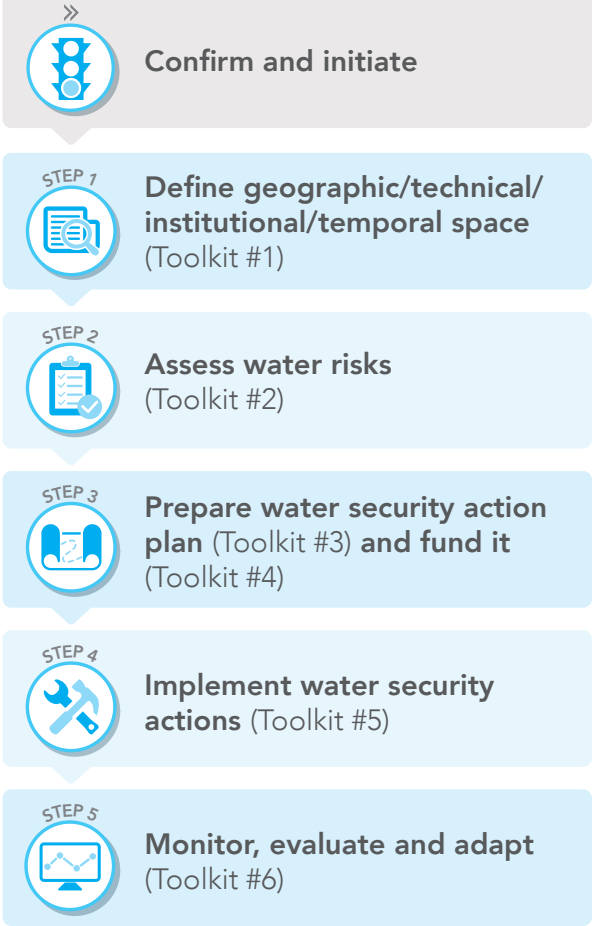
Population growth, urbanization, industrialization, rising living standards and Westernized diets are likely to further increase the over-extraction and pollution of water resources. This will raise insecurity and uncertainty over water access and the vulnerability of communities and infrastructure to natural disasters.

This **series of toolkits** presents an effective and efficient process to address water risks, including long-term water stresses that constrain social and economic development and sudden shocks that can quickly jeopardize the health and livelihoods of vulnerable populations.

Improving water security is about focusing actors and resources on key water risks. It is also about collaboratively planning and implementing specific activities to mitigate risks and provide tangible benefits to water users. Water security activities should combine gray and green infrastructure (including improved operation and maintenance of existing infrastructure), awareness raising and behavior change campaigns, management as well as policy and institutional improvements (such as better data and better informed decision-making).

Improving water security must be a cross-sectoral theme. Development strategies and investments that ignore water security usually fall short of their objectives when water issues and conflicts undermine political and social cohesion, supply and value chains, public and environmental health, and service delivery and infrastructure operation.

## The Water Security Improvement (WSI) Process



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Water security is the adaptive capacity to safeguard the sustainable availability of, access to, and safe use of an adequate, reliable, and resilient quantity and quality of water for health, livelihoods, ecosystems, and productive economies.

# EXECUTIVE SUMMARY

## What Is a Water Security Assessment?

A water security assessment aims to enhance the understanding of water risks within a defined water security improvement (WSI) space (defined geography, actors, and risks). The approach and focus of a water security assessment process is informed and guided by the WSI space; it can be as exhaustive, specific, or rapid as necessary, depending on stakeholder priorities and the water-related risks they want to address. The assessment is conducted from a risk perspective that identifies potential hazards, their likelihood and severity, the vulnerable populations or areas, and the resulting criticality of the risks.

### Water Security Improvement (WSI) Space

- Socio-institutional space: Who to involve?
- Technical scope: What are the water risks?
- Geographic focus: Where will we work?
- Time horizon: When should we act?

Conducting a water security assessment is an essential step in the process of addressing water risks. It establishes a common and agreed-upon information base on the severity and extent of water risks, now and in the near future. This information will be the foundation for the planning, implementation, and monitoring of water security activities. It is also a critical justification to ensure support from funders and governing authorities.

## Guiding Practices for the Water Security Assessment

**The assessment must follow the eight WSI guiding practices:**

1. Pragmatic focus on specific water risks
2. Engagement and mobilization of water users
3. A "systems thinking" approach to address causes and not just symptoms
4. Robust decision-making that considers uncertainties
5. Negotiated solutions that provide tangible benefits to different water user groups
6. Science-based actions that combine infrastructure development with watershed management, behavior change, and institutional improvements
7. Adaptive management and learning to improve over time and build the capacities of stakeholders
8. Sustainability through economic efficiency, environmental soundness, and social equity

### Risks to water security come from:

- **Known and predictable trends or stressors** (e.g., population, economic and trade growth, land-cover change, urbanization, technology availability, poverty, and investment)
- **Unpredictable shocks** (e.g., natural disasters such as floods, droughts, tsunamis, and landslides as well as human-related events such as toxic algal blooms, oil/chemical spills, economic and political events, and conflicts)

A specific requirement for the water security assessment is to be timely and pragmatic. This is about finding an "optimal balance" between producing a detailed and exhaustive understanding of the water security situation and providing adequate and timely information to define and implement tangible activities to address priority water risks. Stakeholder perceptions of the magnitude and urgency of current water risks and associated priorities are the deciding factor.

After initial review of existing knowledge to identify gaps, the gathering of additional information is conducted through data collection on water and related themes, field surveys, key interviews, and targeted field and technical studies. Where possible, using computer-based geographic information systems and models can help to visualize and analyze the water security situation.

## Assessment Themes

Assessment activities follow longstanding disciplinary approaches, including hydrology, engineering, modeling, biology, chemistry, economics, sociology, and environmental and institutional analyses. **Three themes are useful to frame the dimensions of a water security assessment: the physical status of water (surface and ground) and related resources, the management setting, and risks.** These help to systematically organize information and findings related to the goal of water security.

» **Physical water security** is first about the availability, mobilization and supply of sufficient volumes of water (surface and ground) to address all water needs. Conducting a "water balance" is to identify and compare water availabilities and usages (of both surface- and ground-waters) in the target area to define spatial and seasonal deficits and surpluses. Second, water quality assessments examine the physical, biological, and chemical characteristics of water resources in the natural environment and when used by human activities. Last, environmental and ecosystem assessments examine other natural resources such as land and biodiversity and their interactions with water resources.

» Assessments of the **water management setting** examine issues related to infrastructure, institutions, and social dynamics. These directly frame water management and significantly influence water security.

- Assessing water **infrastructure** is about examining its existence, location, physical condition, and adequacy to fulfill intended functions.
- **Institutions** cover the wide range of organizations, as well as policies and legal instruments, that guide, govern, and possibly constrain everyday water management decisions. In addition to examining the performance of water agencies, it is often useful to analyze the entire water sector and how it is organized and operates. Accountability and transparency in service provision are also critical topics for assessing management capacities.
- **Social assessments** examine water use practices and behaviors. They study how water management decisions and activities influence water security. Stakeholder analysis is at the center of social assessment, because it can define the characteristics of the main water user groups, their sensitivity to and interactions with water resources, and water management decisions.

» Assessment from a **risk perspective** identifies the potential for undesirable outcomes. A classical vulnerability and risk study will identify and define specific hazards or threats; characterize vulnerabilities by looking at exposed populations, assets, and ecosystems; and assess the magnitude or severity of the risks by combining threat likelihoods and potential impacts.

## How Is a Water Security Assessment Implemented?

### A water security assessment involves six tasks:

1. Confirm the WSI space (in terms of socio-institutional, technical, geographic scopes and time horizon)
2. Review and synthesize existing information
3. Identify, plan, and conduct additional assessment studies
4. Share findings and seek feedback
5. Possibly adjust the WSI space
6. Finalize and share the assessment

In addition to a thorough description of the current situation, a key outcome of the water security assessment is the production of one or more "business as usual" scenarios. Considering forecasting uncertainties, these present the likely future situation if additional water security improvement efforts are not undertaken.


TALAWONA COMMUNITY MAP
25/04/2017
Core Zone
KEY
Borehole
Hill
pond
River
Road
HIPPO LODGE
Farm lands
clinic

# INTRODUCTION

The WSI process involves an inception phase focus and five steps: define the WSI space; assess the situation; plan and secure financing; implement water activities; and monitor progress. This toolkit covers Step 2: Assessment of the WSI process and **has four objectives**:

1. Discuss the water security assessment and its purpose
2. Describe the key practices that should guide a water security assessment
3. Define common assessment themes (water resource status, water management capacities, and water risks)
4. Describe the tasks in the assessment process

# WATER SECURITY ASSESSMENT

A water security assessment is an essential early step in the process of addressing water risks. It is meant to enhance the knowledge of water security in the WSI space, and establish a common and agreed-upon information base that will allow stakeholders to understand:

1. The **quantitative and qualitative dimensions of the current and future water cycle** in the geographic focus area

2. The **management setting** in terms of water infrastructure, water governance framework (laws, policies, management entities and service providers), and social landscape (water user groups with their rights, water use behaviors and priorities)

3. The **main risks to water security,** combining vulnerabilities of populations and assets with threats (i.e., current and future stressors such as population growth and sudden shocks such as natural disasters)

The water security assessment will also be the foundation for planning, financing, implementing, and monitoring water security activities. It will be a critical justification to ensure support from funders and governing authorities.

## Water Data Management

The collection, verification, storage, analysis, and dissemination of water data is an essential input to water security assessments and water resources management. A water monitoring network that regularly collects quantity and quality data on surface and groundwater is a modest investment in equipment and staff, but it can provide massive returns in proper planning, design, implementation, and monitoring of water projects and activities.

In many developing countries, data collected by public agencies and donor-funded projects tends to be difficult to access due to dubious "national security" concerns. This is more of a lack of transparency or accountability: water agencies are concerned that alarming water data could expose them to criticism regarding their performance. Conversely, by not properly using said data, these agencies tend to not improve over time. And water data remains confidential and of questionable accuracy, coverage, and frequency (actual use would increase accuracy through feedback).

There are today numerous online water data sources, many of which are rapidly improving. These include the Aqueduct tool from the World Resources Institute, and open-access databases provided by the Food and Agriculture Organization of the United Nations, the US National Aeronautics and Space Administration, the US Geological Survey, the UN Educational, Scientific, and Cultural Organization, and the World Health Organization.

After identifying relevant stakeholders in Step 1: Defining the WSI space (See Toolkit #1), assessment is where stakeholders will first interact. Therefore, it is useful to initiate the negotiation process with a reformulation of priority water risks to confirm the focus. This is also an opportunity for stakeholders to understand each other's perspectives about the magnitude and relevance of water risks.

## The assessment must follow the eight WSI guiding practices:

- Pragmatic focus on specific water risks
- Engagement and mobilization of water users
- A "systems thinking" approach to address causes and not just symptoms
- Robust decision-making that considers uncertainties
- Negotiate solutions that provide tangible benefits to different water user groups
- Science-based actions that combine infrastructure development with watershed management, behavior change, and institutional improvements
- Adaptive management and learning to improve over time and build the capacities of stakeholders
- Sustainability through economic efficiency, environmental soundness, and social equity

A specific requirement for the water security assessment is to be timely and pragmatic.

## There is a necessary trade-off between:

The **necessity** to produce a solid understanding of the current (and likely future) water security situation, and to develop sustainable and trusting relationships among all engaged parties

The **pressure** to address water risks by defining and implementing activities to produce tangible benefits for water users

How thoroughly risks are examined depends how stakeholders perceive the magnitude and urgency of current water risks and associated priorities. The extent and depth of the assessment will also depend on the availability of resources (e.g., funding and technical capacities to conduct technical studies).

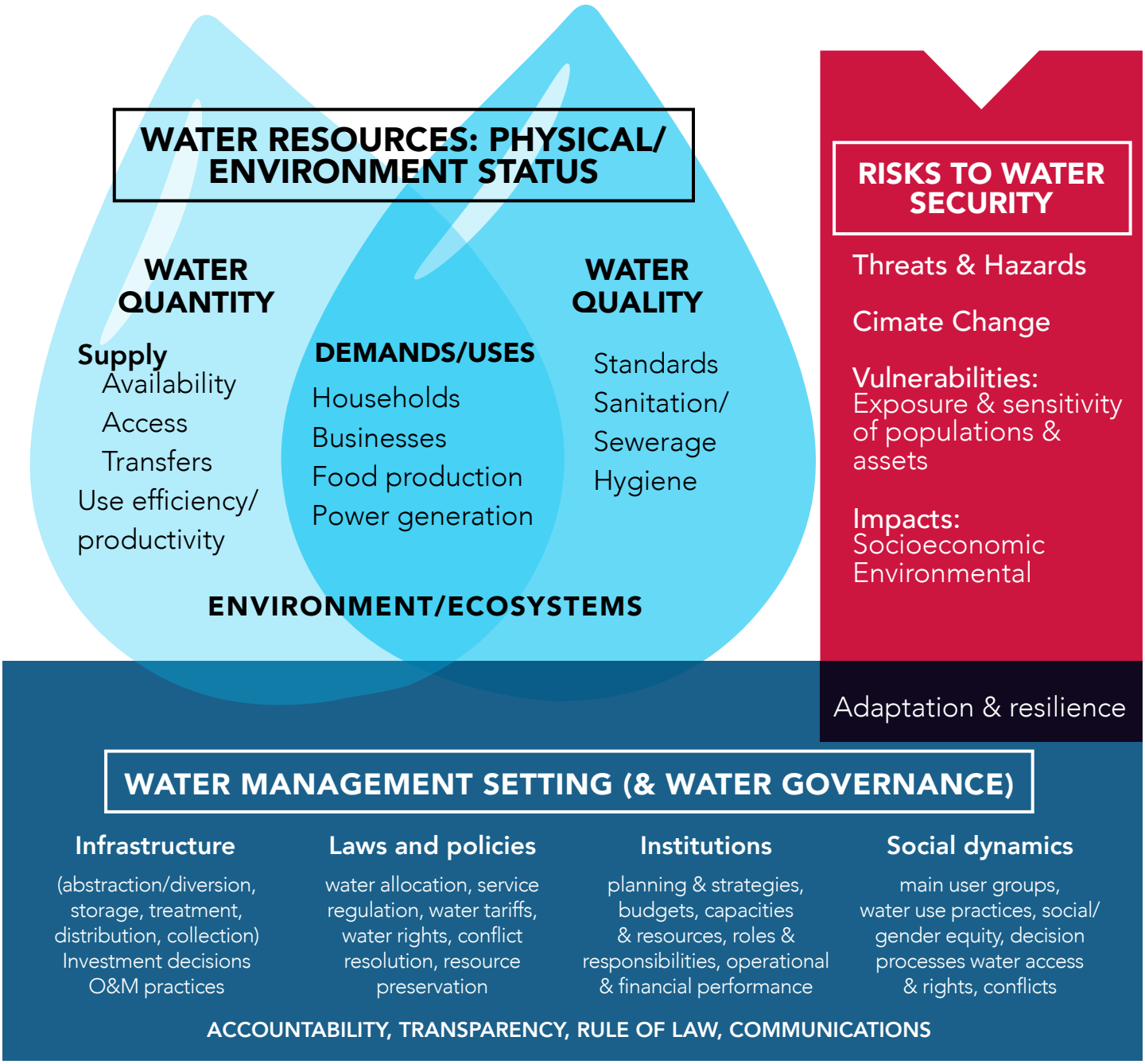
## After initial review of existing knowledge to identify gaps, the gathering of additional information is conducted through:

- Collection and analysis of data on water resources and related issues (e.g., land use, environmental conditions, and socioeconomic factors)
- Interviews of key water users, individually or in groups, and of knowledgeable local specialists
- Technical investigations such as field visits and measurements, household surveys, and social, environmental, or economic studies
- Use of computer-based geographic information systems (GIS) that can integrate, compare, and display large sets of spatial data
- Use of computer-based hydrological, hydraulic, or basin decision support models that can simulate the analytical framework of linkages between surface and groundwater flows and transfers, and between water uses and impacts, and can help analyze the past, current and future effects of changes in water use, land use, and climate on water resources (quantity, quality, timing). Such models can run multiple simulations with different parameters, creating a large array of possible scenarios.

# ASSESSMENT THEMES

Assessment activities follow longstanding disciplinary approaches, including hydrology, engineering, modeling, biology, chemistry, economics, sociology, and environmental and institutional analyses. Three themes are useful to frame the dimensions of a water security assessment: the physical status of water (surface and ground) and related resources, the management setting, and risks. These help to systematically organize assessments and findings related to the goal of water security.

## THE THREE WATER ASSESSMENT THEMES




Assessment activities are based on the current technical and scientific knowledge of natural and socioeconomic processes. Such knowledge is always incomplete due to various uncertainties (lack of data, difficulties to predict the future, etc.). Acknowledging these uncertainties is essential to define the range of possible water security futures and avoid overconfidence in water security planning and implementation.

# WATER RESOURCES: PHYSICAL/ ENVIRONMENTAL STATUS

## Water Quantity

Water management is primarily about the availability, mobilization, and supply of sufficient volumes of water (surface and ground) to address all water needs. This can be determined by conducting a water balance i.e. by identifying and comparing water availabilities and usages (of both surface- and ground-waters) in the target area to define spatial and seasonal deficits and surpluses.

A water balance is performed for a specific area. It considers the entire water cycle: precipitation and evaporation; runoffs and aquifer recharge; river diversions and groundwater withdrawals; evapotranspiration (whereby vegetation and crops lose water to the atmosphere); and other consumptive uses. It supports stakeholder understanding of how much water is available, where and when. From a water security perspective, assessments of water use/demand are essential because they reveal the current situation and expected variability, as well as probable future changes in water supply and demand (caused by factors such as population growth, economic development, land use, and climate change). Since water resources, especially in arid and semi-arid areas, are becoming increasingly scarce, knowledge of diverse uses is essential to manage water resources effectively, efficiently, and equitably.

A water balance relies mostly on the collection and analysis of historical hydrologic data (e.g., river flows, aquifer levels, and usage data from meters) to establish past, current, and future availabilities and uses of water resources. Although hydrologic stationarity assumes that future weather conditions will mirror past conditions, climate change has added uncertainty into the predictive process.

### Water Balance

A water balance is an accounting exercise where freshwater availabilities (average untapped stream flows along with groundwater recharge, and storage in reservoirs and snowpacks) are inventoried along with actual water supplies, and compared to water consumptions (for all types of usages).

It is preferably performed on a specific river basin so that the boundaries are clear and there are limited, if any, or well defined water flow exchanges with other neighboring areas. It is usually performed using average yearly volumes, with monthly balances being assessed to inform seasonal surpluses and deficits.

When uses exceed availabilities, there is a deficit and the situation is unsustainable (e.g., rivers dry up and aquifer levels drop). The objective of a water balance assessment is to appraise the current status and trend of water use and then guide water management decision-making.

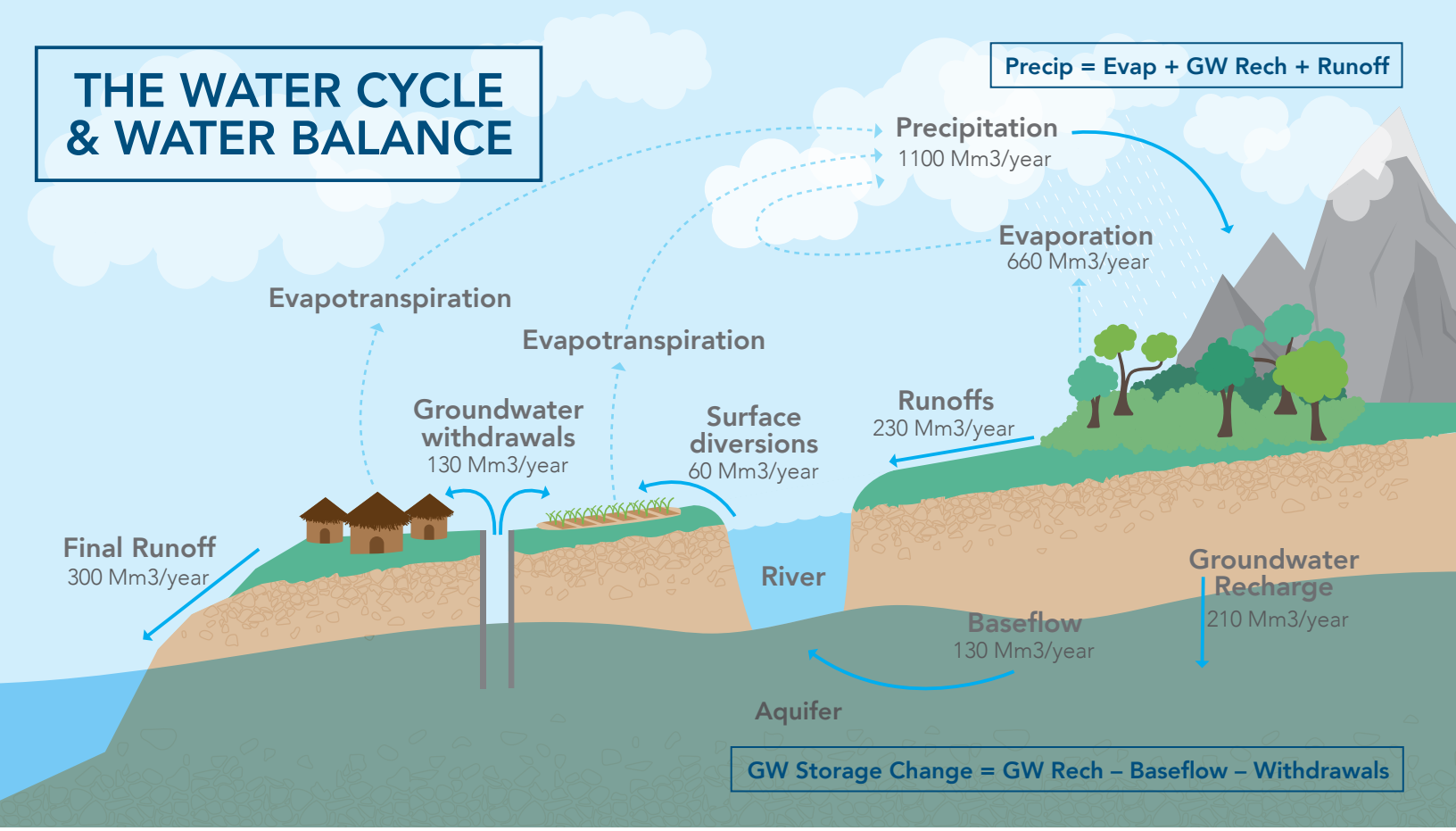
An important distinction is between:

- Demands: what water users would like in terms of water volumes, quality and timing
- Uses: what they actually use, which is conditioned by their water supply and access
- Needs: what they actually need (may be substantially lower and differently timed than actual uses) to achieve similar results (or even higher results with improved techniques and practices)

Differences between uses and needs provide opportunities for demand management and improved water use productivity by promoting and incentivizing better use practices or penalizing wasteful ones.

## Hydrologic Stationarity and Climate Change

- "Stationarity" means that, statistically speaking, the future will look like the past, at least within human timescales or infrastructure lifetimes (a few decades). Hydrologic stationarity assumes that significant weather changes happened over longer time periods
- Hydrologists base forecasts for average and exceptional precipitation, runoff, or other flows on past conditions, going as far back as available (up to 150 years of river flow data on the Nile River). These forecasts are used to plan and design water structures. Historical hydrologic data is also an essential input to the assessment of specific risks such as floods and droughts.
- Climate change is now challenging hydrologic stationarity as weather patterns have started to change more quickly. Historic data remains the only available reference and can still be used to predict future conditions and guide water management. But sufficient safety margins must be used to account for the uncertainty of what future weather will be. As climate models improve, they provide ranges for future weather conditions.




Similarly, predictions of future uses are uncertain because they rest on assumptions about the continuance or variation of past trends. Those assumptions and uncertainties can relate to human behaviors, technological changes, and socioeconomic policies.

An important water usage is by ecosystems. The concept of environmental flows refers to the availability of water in rivers and associated systems such as wetlands, lakes, and deltas to preserve ecosystems and the livelihoods of communities that rely on them.

## Water Quality

Assessments of water quality examine the physical, biological, and chemical characteristics of water resources in the natural environment and as used by human activities. They usually evaluate the adequacy of water resources with intended uses to prevent negative consequences such as diseases to humans, livestock, and crops, or failed or reduced agricultural and industrial outputs. Water quality standards are often available as a reference for the acceptable values of different water uses.

Water quality assessments collect data on surface and groundwater resources. They also gather data about water at usage points (e.g., after abstraction, storage, conveyance, and treatment) and at points where effluents are released (e.g., after use, and treatment/decontamination). When existing data is limited, additional investigations should be carried out through either in-situ tests (i.e., tests at water sources) or collection of field samples to be analyzed at proper laboratories.

Water quality data is compared to scientifically set standards that define acceptable values and identify hotspots and pollution sources. Such information also allows the detection of diffuse or incremental pollution, such as caused by over-application of agricultural fertilizers and pesticides, which can over the years contaminate groundwater resources.

## Environmental Flows

The concept of environmental flow describes the quantity, quality and timing of water flows needed to remain in rivers, lakes and natural ecosystems to sustain these as well as the ecological and non-ecological benefits they provide, notably those supporting livelihoods.

## Water Quality Standards

- **Drinking water** quality standards provide benchmarks for the expected characteristics (or maximum thresholds) of water resources. Most countries have such standards for drinking water quality, often inspired by or identical to the World Health Organization's water drinking quality guidelines (fourth edition, 2011).
- **Indicators** of water quality standards include: physical (e.g., temperature, conductivity, and turbidity), chemical (e.g., pH, dissolved oxygen, presence of heavy metals, phosphates, and nitrates), and biological (e.g., biodiversity, inventories of invertebrates and insects).
- **Ambient water** quality standards sometimes guide or regulate industrial or agricultural uses and effluent releases, and monitor water resources in rivers, aquifers, lakes, and wetlands.

## Environment and Ecosystems

An environmental and ecosystem assessment examines natural non-water resources such as soil, vegetation, biodiversity, fossil fuels, minerals and their interactions with water resources, both through natural processes and through human activities that use these resources.

### Typical questions for an environmental and ecosystem assessment include:

- What are the current conditions of natural resources and ecosystems?
- How do ecosystems rely on and interact with water resources?
- What kinds of services do these natural resources and ecosystems provide? How and where?
- Can any trends be identified in these resources and ecosystems? What are the stressors and threats to these natural resources and ecosystems?
- How would these natural resources and ecosystems respond to changes?

Environmental and ecosystem assessments provide essential information to predict the success of water activities during Step 3: Planning (See Toolkit #3).

## Review of Past, Ongoing, and Upcoming Water Activities

Water security assessments usually occur while agencies and communities are already conducting or considering water projects and activities. These must be identified and analyzed as part of the assessment to recognize:

- The planning, design, implementation, and monitoring process
- Information and assumptions used in the design
- Benefits expected and achieved
- Lessons learned (successes and failures) from stakeholders' perspectives

# WATER MANAGEMENT (AND SOCIO-INSTITUTIONAL) SETTING

**Assessments of the water management setting examine infrastructure, institutions, and social dynamics that directly frame water management and significantly influence water security.**

## Water Infrastructure

Water infrastructure accomplishes many tasks. It can abstract, divert, store, convey, treat, and distribute water from rivers, aquifers, and other sources. It can collect, drain, clean, and release wastewater. Assessing water infrastructure is about examining its existence, location, physical condition, and adequacy to fulfill intended functions. Infrastructure assessments are usually carried out through field visits, observations, and interviews with operators of the infrastructure.

## Water Institutions

Institutions cover the wide range of organizations, policies, and legal instruments that guide, govern, and possibly constrain everyday water management decisions.

A direct follow-up to the infrastructure assessment is to examine

## Human & Institutional Capacity Development – for Larger Administrative Entities

**This methodology assesses performance on six factors:**

- Three factors on context or environment of the organization: (i) information (mission, roles), (ii) resources and tools, (iii) incentives
- Three factors on performance of staff: (i) knowledge and skills, (ii) capacities, and (iii) motives.

## Organizational Capacity Assessment – for Local Stakeholder Organizations

**This tool assesses capacity in seven areas:**

1. Governance and legal structure
2. Administration and procurement
3. Human resources systems
4. Financial management, cost recovery
5. Organizational management
6. Program management
7. Project performance management

the capabilities of the government agencies in charge of operations and maintenance. An organizational assessment can examine their technical, administrative, managerial, and financial ability to sustainably use infrastructure to deliver intended water services. Such an organizational assessment would also consider an agency's mission and goals, management structure, administrative and financial systems, procurement and human resource procedures, unit and staff performance monitoring—anything that might affect their ability to perform their work.

Organizational assessments can also be applied to river basin agencies and stakeholder organizations, such as water user associations or boards and farmer cooperatives and other similar groups. These can be carried out using the Human & Institutional Capacity Development or Organizational Capacity Assessment approaches.

**Beyond the performance of individual water organizations, it is also often useful to analyze the entire water sector, including:**

- How the sector is organized, and how roles and responsibilities are defined and exercised
- How water resources are monitored, and how water information is collected, verified, and disseminated
- How water resources and ecosystems are protected from abuses
- How water services are regulated and priced, and how water funding is secured and allocated
- How water plans and strategies are prepared and implemented
- How water rights are defined, recorded, and enforced, and how water conflicts and disputes are handled and adjudicated

### Water User Knowledge, Attitude, and Practices Survey

It is a type of public survey that investigates water users' awareness, understanding, and perspectives on water resources, usages, and issues. It provides essential information on local circumstances and cultural factors, and can reveal misconceptions that may hinder water security activities. Furthermore, the survey can guide the design and implementation of behavior change campaigns.

Accountability and transparency in service provision are critical for assessing management capacities. Reviews of the water sector should include a systematic assessment of how water agencies and organizations monitor their water activities (and possibly the activities of other entities); how they assess their compliance with water laws, strategies, and plans; how they share information; how they evaluate and respond to monitoring and feedback; and how (or if) they adjust their policies and operations and improve over time. Understanding current levels of accountability and transparency provides entry points to consider and foster behavior and institutional changes to improve water security.

## Social Dynamics

Social assessments examine water use practices and behaviors, and how they affect the availability and access of water resources for other uses. Social assessments also seek to understand how water management decisions and activities can influence water security: assessing water use behaviors can point to inefficient or damaging water practices (e.g., pollution and wastages) that cause water insecurity.

Stakeholder analysis is the foundation of social assessments. Information about stakeholders can define the characteristics of the main water user groups; their sensitivity to, interactions with, and influence on water resources and water management decisions; and relationships between these groups. Stakeholder analysis should focus on existing and potential conflicts between water user groups, which can be serious obstacles to the WSI process and should be recognized as water security risks.

**During Step 3: Planning** (See Toolkit #3), social assessments provide essential information for predicting the success of water activities in terms of socio-cultural and political feasibility and their impacts on water user groups. The information can be used to design behavior change activities and suggest institutional improvements. It is especially useful to evaluate how the costs and benefits of water security activities are distributed among water user groups, including women, youth, and other marginalized populations.

## Stakeholder Analysis

Stakeholder analysis is the natural follow-up to the stakeholder identification performed during Step 1: Defining the WSI space (See Toolkit #1) to determine which stakeholders to engage in the WSI process. It is about collecting and analyzing qualitative information to assess how water risks and water security changes and activities affect water user groups, now and in the future.

It is also important to assess how stakeholders contribute to water management decision-making, as the allocation of resources and benefits often depends on these processes. The goal is to improve the sustainability of WSI planning and activities by arranging for fair representation and involvement of all significant actors, for smoother implementation and for fair distribution of water security benefits. In the long term, such social equity contributes to government legitimacy and political stability.

> For each significant stakeholder group, the analysis should identify their awareness and understanding of each priority (and possibly other) water risks, their vulnerability to and influence on these risks, as well as their perspectives and concerns, priorities and expectations. It is also useful for supporting the WSI process, to assess the implementation capacity, funding and technical resources of each stakeholder group.

Stakeholder analysis can be achieved through a series of interviews with key informants, water user representatives, government officials, and decision-makers. Focus groups, community meetings, surveys, field visits, and observations are also effective.

Investigating the power structures, influences, and relationships among stakeholder groups can also be helpful to ensure participation, equity, and transparent decision-making. These types of investigations can be assisted by technical tools, often computer-based, such as Social Network Analysis, the International Food Policy Research Institute's Net-Map, and tools from the Water Stewardship Initiative.

# RISKS TO WATER SECURITY

**Risk cannot be managed if it is not adequately understood and measured.**

Assessment from a risk perspective identifies the potential for undesirable outcomes, including negative externalities, to occur and ultimately defines the severity and extent of water risks, now and in the near future.

## Risks to water security come from:

- Known and predictable trends or stressors (e.g., population, economic and trade growth, land-cover change, urbanization, technology availability, poverty, and investment)

- Unpredictable shocks (e.g., natural disasters such as floods, droughts, tsunamis, and landslides as well as human-related events such as toxic algal blooms, oil/chemical spills, economic and political events, and conflicts)

Priority water risks were identified during Step 1: Defining the WSI space (See Toolkit #1). Assessing these risks is meant to broaden the understanding of their causes and impacts in terms of populations, geographies, and specific assets and ecosystems. This is achieved through a classical vulnerability and risk study process whereby:

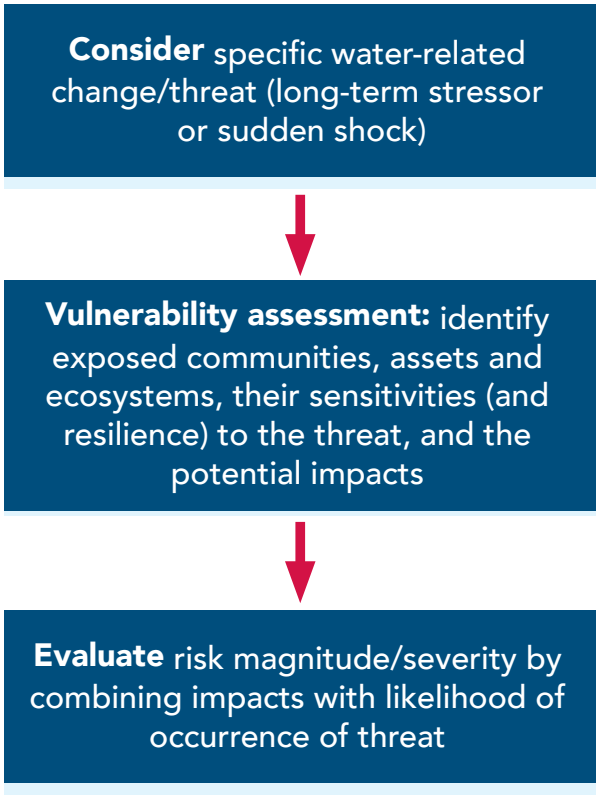
- Specific changes or threats (long-term stressors and sudden shocks) are considered and defined in terms of their nature and geography.

- Vulnerabilities are identified for each threat by looking at populations, assets, and ecosystems, and their potential exposure (Are they inside the geography at risk?) and sensitivity (Would they be affected? To what extent? How resilient or adaptive are they to the threat?)

- Socioeconomic and environmental impacts of all types are examined in terms of their likelihood to assess the magnitude or severity of the impact.

The potential for harm from a hazard can be minimized by reducing exposure and/or sensitivity. **Risk assessments should examine the adaptive capacities of communities, entities, and assets to cope with or withstand hazards by anticipating and reducing vulnerability or quickly recovering from negative impacts.** Such adaptive capacities often rely on access to information, ownership of or access to resources, and technical skills.

## WATER RISK ASSESSMENT




## Two Examples of Long-Term Water Security Risks: Climate Change and Land Use Changes

**Climate change** is affecting weather patterns around the world (temperatures and precipitation, both averages and extremes) and thus directly affecting water security. The most significant impact is on agriculture and irrigation, the largest water user worldwide and the primary livelihood for large populations in developing countries. Poor and subsistence farmers struggle to adapt their practices as the timing and intensity of rainy seasons changes, and many lose their livelihoods. Temperature changes also affect agricultural practices for crop and livestock production.

Furthermore, climate change has increased the occurrence and intensity of extreme events such as floods and droughts. Combined with larger populations in exposed areas (e.g., deltas and arid/semi-arid lands), this causes massive damages that can have lasting socioeconomic consequences.

As human activities expand with population, forests give way to agricultural lands, which are eventually overtaken by urbanization. Such **land use changes** directly affect water resources by increasing water demands and modifying infiltration and runoff processes, groundwater recharge, sediment and water yields and evapotranspiration.

Deforestation and urbanization reduce water infiltration and groundwater recharge, increase runoff in streams and rivers, and hasten soil erosion. The disappearance of wetlands and similar ecosystems directly decreases biodiversity, which affects livelihoods, and increases flooding by speeding up water flows.

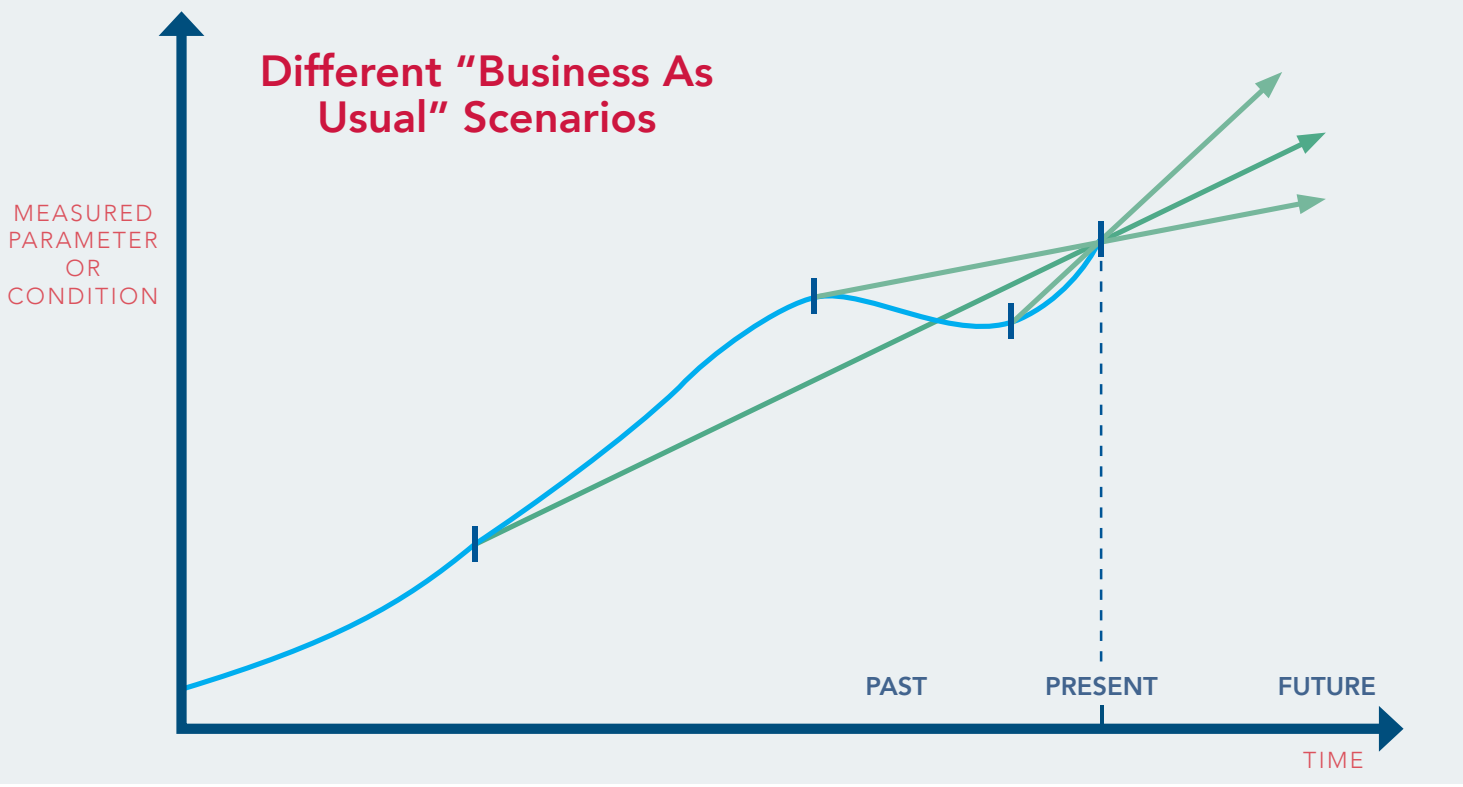
# UNCERTAINTIES

Assessment activities are based on the current technical and scientific knowledge of natural and socioeconomic processes. Such knowledge is always incomplete due to various uncertainties:

- **INFORMATION:** Knowledge is always partial and evolving; data is neither spatially nor temporally comprehensive.
- **SCIENCE:** How will ecosystems respond to planned water activities? Do technical models/assumptions accurately represent the real processes of natural and human systems?
- **TECHNOLOGY:** What better technologies will be available in the near future?
- **CLIMATE VARIABILITY & CHANGE:** Past and current conditions may not accurately predict the future.
- **HUMAN BEHAVIORS:** Will farmers plant these crops or use these technologies? Where will urbanization expand?
- **ECONOMIC FACTORS:** Will this equipment or these techniques remain affordable and relevant?
- **POLITICAL BACKGROUND:** Will the government change riorities/policies?

Acknowledging these uncertainties is essential to define the range of possible water security futures in the geographic focus area through several "business as usual" scenarios. It will be useful to:

- Avoid over-confidence in planning and implementation of water security activities—the "predict then act" engineering approach often leads to such over-confidence with actual outcomes being often different from the expected ones
- Designing, testing, and selecting robust solutions, i.e. solutions that provide positive outcomes through the range of possible water security futures
- Using adaptive management practices during implementation, through monitoring and evaluation mechanisms, to adjust approaches and resource allocation to optimize beneficial outcomes, and also learn from experience



# WATER SECURITY ASSESSMENT PROCESS AND OUTPUT

A water security assessment involves six tasks:

1. **Confirm the WSI space**
   (in terms of socio-institutional, technical, geographic scopes and time horizon)
2. **Review and synthesize existing information**
3. **Conduct additional assessment studies**
4. **Share findings and seek feedback**
5. **Revise the WSI space as needed**
6. **Finalize and share the assessment**

## Task 1: Confirm the WSI Space

Linked with Step 1: Defining the WSI space (See Toolkit #1) of the WSI process, the first task of a water security assessment is to confirm the WSI space with stakeholders in terms of socio-institutional, technical, geographic scopes and time horizon, answering these questions:

- Which stakeholders are currently engaged in the WSI space and to what extent?
- What are the priority water risks that will be studied and possibly addressed?
- What is the geographic area of focus and study for the water security assessment?
- What time horizon should be set for identifying the likely future water security conditions?

This check-up can be done quickly at a single meeting or workshop but is essential when all stakeholders are assembled in one place for the first time; most will have been consulted before the gathering, but not all may have been involved in the definition of the WSI space. This meeting or workshop is also an opportunity to identify and inventory the technical, administrative, and financial resources available to carry the WSI process to fruition—especially those resources that can be used during the assessment phase. This is also the time to discuss and decide how rapid and/or thorough the assessment should be, trying to balance the pressure to address water risks quickly and the need to do it properly.

## Task 2: Review and Synthesize Existing Information

Substantial amounts of relevant data and information may already exist about the geographic area of focus on water and related resources, institutional and social settings, and threats to water security. Such reports, documents, and other media should be collected and reviewed during Task 2. These may have been produced by national and/or international donors, government, research organizations, non-governmental or private-sector entities.

Once stakeholders are educated on the current water security situation, information gaps should be identified to define, what additional investigations and studies should be conducted in Task 3 to better understand the priority water risks in the geographic area of focus.

## Task 3: Conduct Additional Studies

These investigations are often carried out by specialists and experts, including water and irrigation engineers, economists, environmentalists, sociologists, and institutional specialists. These specialists rely on field visits, surveys, interviews of key informants and user groups, technical measurements, and possibly computer modeling.

**Within the WSI space, these studies are meant to:**

- Ensure enough information is available to describe the current and probable future water security situation as it relates to the priority water risks
- Educate stakeholders so they can discuss and prioritize water risks, and later discuss and select water security activities
- Inform water users at large so they can support the WSI process (or at least not oppose it) and contribute to data collection for the assessment
- Guide the design of behavior change campaigns
- Clarify the relationships or linkages between water users, water risks, and other factors, and forecast the probable outcomes from different water activities during Step 3: Planning (See Toolkit #3)
- Provide baseline data that will be used to monitor changes and see how implemented water security activities are mitigating water risks

## Task 4: Share Findings and Seek Feedback

After sufficient information about the water security situation in the geographic area of focus has been collected, results should be widely shared in the geographic area of focus.

Stakeholder workshops and public meetings can be considered to present the assessment findings, and open the floor for questions, comments, and suggestions. Doing so will further collective understanding of the water security situation, provide additional information on stakeholder perspectives and potential water activities and their socio-cultural or political feasibility. The gatherings would also be opportunities to explain and legitimize the WSI process, and ensure higher support to increase the chances of success during planning and implementation.

## Task 5: Revise the WSI Space as Needed

**Assessment findings may lead to a redefinition of the WSI space in terms of:**

- Engaging additional stakeholders from significant water user groups or water managing entities
- Adjusting the geographic area of focus to optimize the WSI effort
- Including additional water risks that are closely related to priority water risks or excluding risks that are less relevant than initially thought

This redefinition should be validated by the stakeholders and recorded as part of the assessment.

**Problem formulation** should be another outcome of reviewing knowledge and information about the priority water risks. This process defines the symptoms and possible causes of each risk, identifies and shares stakeholder perspectives, and helps ensure that each risk is described in clear terms.

## Task 6: Finalize and Share the Assessment

This is the final task of the water security assessment process. The findings should be shared in different forms through a variety of media (e.g., summaries, print, television, radio, and blogs) so they reach the widest possible audience of water users and the public at large.

# Output: Contents of a Water Security Assessment

**A water security assessment should cover most of the following topics:**

### Physical status

- Water quantity: balance between availability (surface and groundwater) and uses (all types, volumes, and timing)
- Water quality data (surface and groundwater) and adequacy for its uses (comparison to standards and guidelines)
- Environmental and ecosystems: status and interactions with water resources

### Water management setting

- Condition, operations, and maintenance of water infrastructure
- Analysis of policies and laws (regarding water allocation, service regulation, water tariffs, water rights, conflict resolution, resource preservation) that guide, govern, and possibly constrain everyday water management decisions
- Water organizations: planning & strategies, budgets, capacities & resources, roles & responsibilities, operational & financial performance
- Identification of main water user groups with their use practices, water access & rights, expectations and conflicts

**Risk studies,** combining the likelihood of hazards (both socioeconomic and environmental trends/stressors, as well as sudden shocks such as natural disasters, with the vulnerability of communities, assets, and ecosystems to these threats, considering casualties, infrastructure damage, and socioeconomic and environmental impacts.

"Business as usual" scenarios should be developed to visualize the most likely mid-term (5-year) and long-term (10/20-year or more) horizons. These scenarios assume normal circumstances will continue, with no significant changes in people's attitudes and practices, technology, economics, or policies. In the context of current and future uncertainties, several different scenarios can be developed to illustrate the range of reasonably possible futures.

# RESOURCES

## On Water Resources Assessment:

**FAO (2016). Water Accounting and Auditing: A Sourcebook.**

This sourcebook provides practical advice on the application and use of water accounting and auditing techniques and is meant to help users to plan and implement water accounting and auditing processes.

**Milly, P. C. D., et al. (2008). Stationarity is Dead: Whither Water Management? *Science*, 319, 573–574.**

**UNESCO (1998). Guidelines for Conducting Water Resources Assessment.**

Water resource assessment is defined as the "determination of the sources, extent, dependability and quality of water resources, upon which is based an evaluation of the possibilities for their utilization and control and long-term development." This guide provides a methodology for the evaluation of water resources with respect to their quantity and quality, and their temporal and spatial variability, with substantial attention given to the evaluation of the comprehensive water resources balance.

## On Organizational Assessment:

**USAID (2010). Human and Institutional Capacity Development Handbook: A USAID Model for Sustainable Performance Improvement.**

Through a comprehensive analysis of organizational performance based on these six performance factors, (information, resources and tools, incentives, knowledge and skills, and capacity motives), [Human & Institutional Capacity Development] identifies performance gaps and introduces performance solutions to close those gaps. Appropriate performance solutions are designed depending on which of the six performance factors lie at the fundamental causes of the performance gap.

**USAID (2016). Instructions for the USAID Organizational Capacity Assessment (OCA) Tool.**

The Organizational Capacity Assessment (OCA) is a structured tool for a facilitated self-assessment of an organization's capacity followed by action planning for capacity improvements. The self-assessment approach increases ownership of the action plan. The OCA format helps the organization reflect on its processes and functions, and score itself against benchmarks. Based on the discussions and the scoring, the organization shapes and sets priorities for actions it can take to strengthen its capacity.

**Regional Environmental Center (REC) (2016). Local Water Security Assessment for Improved Water Management in Selected Countries in the Middle East and North Africa (MENA) Region.**

This technical report on the project "Sustainable Use of Transboundary Water Resources and Water Security Management (WATER SUM)" assesses local water security for improved water management in selected countries in the MENA region: Morocco, Algeria, Tunisia, Libya and Egypt in North Africa; and Lebanon, Jordan and Syria in the Middle East. The study is based on a comprehensive review of literature on water management and water security issues covering: (1) The political, economic and social background of each country; (2) An analysis of existing country-based strategic documents and processes; (3) The territorial organization and administrative structure; and (4) The current situation in the water sector and water use.

## On Stakeholder Participation:

**EPA (2013). Getting in Step: Engaging Stakeholders in Your Watershed. 2nd edition.**

This guide is intended for federal, state, tribal and local agency personnel, as well as nongovernmental organizations, that are involved in watershed management activities and are building a stakeholder group. It provides the tools needed to effectively engage stakeholder groups and use such groups to communicate with others to restore and maintain healthy environmental conditions through community support and cooperative action.

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