

## Topic Concept Note Template

### Thematic Process, 11<sup>th</sup> World Water Forum

- Theme Number: 1
- Theme Title: Water Security
- Topic Number: 1A
- Topic Title: Groundwater and Surface Water: Determining availability and promoting equitable, cross-sectoral and transboundary management in rural and urban areas
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#### I. Topic Overview

##### Rationale and Context

Groundwater and surface water together form the backbone of water security for societies, ecosystems, and economies. Increasing climate variability, demographic pressure, pollution, and competing sectoral demands are placing unprecedented stress on both resources, with impacts most acute in arid, semi-arid, and transboundary basins where natural scarcity, climate extremes, and governance complexity intersect. Understanding their availability, quality, variability, and interconnections is therefore central to achieving equitable and sustainable water security in both rural and urban contexts, particularly where rural areas face harsher climatic conditions, weaker infrastructure, and limited access to financing compared to urban centers.

This topic addresses global challenges faced across regions, including arid and semi-arid zones, rapidly urbanizing basins, coastal aquifers, and transboundary river basins and aquifers, while highlighting persistent urban–rural disparities in water access, resilience, and management capacity. It responds directly to SDG 6 and particularly SDG indicator 6.5.2, while contributing to SDGs 2, 11, 13, 14, 15, and 17.

Despite its strong technical focus, this topic fully integrates cross-cutting dimensions such as climate resilience, inclusive governance, gender and youth empowerment, digital innovation, partnerships, and sustainable financing. These dimensions are addressed throughout the discussions by strengthening science–policy interfaces, promoting open and shared data, leveraging digital decision-support tools, and fostering cooperative approaches that enable inclusive solutions and targeted investments, particularly in water-stressed and underserved rural settings, supporting evidence-based and actionable water management.

##### Objectives of the Topic

**-Improve decision-relevant understanding of water availability and variability**

Strengthen scientific and technical knowledge of groundwater and surface water systems, with emphasis on integrated assessment, seasonal and long-term variability, and uncertainties relevant to allocation, drought preparedness, and climate risk management.

**- Enable equitable and coordinated water allocation across sectors and boundaries**

Support the development and application of policy, legal, and institutional frameworks that translate scientific evidence into transparent, equitable, and enforceable allocation decisions across sectors (agriculture, domestic, industry, ecosystems) and across administrative and transboundary contexts.

**- Enhance operational capacity for assessment, planning, and risk management**

Promote capacity-building through shared tools, indicators, data platforms, and digital technologies such as GIS, monitoring sensors, and forecasting tools, enabling practitioners and decision-makers to monitor availability, evaluate trade-offs, manage scarcity, and respond to shocks in both rural and urban settings.

## II. Key Issues, Opportunities, and Scope

### Key Challenges

- **Data gaps and limited monitoring of groundwater and surface water systems**, particularly in arid and semi-arid regions where non-stationary hydrological regimes undermine assumptions based on historical records;
- **Fragmented governance across sectors and administrative boundaries**, including transboundary contexts, constraining coordinated responses to structurally water-scarce conditions;
- **Climate variability, extremes, and long-term change**, driving increasing non-stationarity in water availability and compounding existing structural water scarcity;
- **Pollution pressures reducing effective water availability**, disproportionately affecting already scarce and vulnerable water sources;
- **Widespread groundwater overdraft at the global scale**, creating growing imbalances between short-term water use and long-term sustainability, and posing significant risks to future water security, ecosystem integrity, and intergenerational equity;
- **Limited integration of groundwater–surface water interactions in decision-making**, reducing adaptive capacity under conditions of chronic scarcity and hydrological uncertainty

### **Opportunities and Strategic Importance**

Advances in open data, digital tools, vulnerability indicators, nature-based solutions, and cooperative frameworks create opportunities to strengthen evidence-based decision-making, scale conjunctive management practices, and enhance transboundary cooperation. In transboundary basins in particular, shared data, joint assessments, and harmonized indicators serve as critical enablers of trust, transparency, and sustained cooperation among riparian actors, supporting collective understanding of risks, trade-offs, and benefits.

### **Proposed Priorities of the Topic / Guiding Questions**

- How can assessments of groundwater and surface water availability, quality, and variability be translated into decision-relevant information that supports equitable allocation and water security in rural and urban contexts?
- Which indicators, data systems, and digital decision-support tools best capture vulnerability, risk, and uncertainty under climate variability and extremes?
- How can groundwater-surface water interactions and nature-based solutions, including watershed restoration and aquifer recharge, be more systematically integrated into planning, allocation frameworks, and ecosystem protection?
- What governance, institutional, and policy arrangements enable coordinated and conjunctive management of groundwater and surface water across sectors and administrative boundaries?
- How can shared data, common assessment frameworks, and joint monitoring strengthen cooperation in transboundary river basins and aquifers and support trust-based decision-making?
- How can adaptive water allocation rules be designed and implemented under conditions of persistent scarcity, particularly in transboundary basin contexts?

### **Proposed Sessions of the Topic (see detailed description in Annex)**

Session 1A-0 – From Knowledge to Action: Framing Surface Water and Groundwater Security Decisions

Session 1A-1 – Below the Surface: Understanding Groundwater Systems Under Stress

Session 1A-2 – Managing the Flow: Surface Water Under Pressure

Session 1A-3 – Better Together: Conjunctive Water Management in Practice

## **III. Expected Outcomes and Deliverables**

### **Policy and Strategic Outcomes**

Formulation of policy recommendations on integrated groundwater and surface water management, including guidance for allocation, risk management, and coordination across sectors and boundaries

### **Technical and Knowledge Deliverables**

Identification and sharing of technical guidance, indicators, and assessment tools, including methodologies, data platforms, and case studies supporting integrated surface water–groundwater analysis

### **Partnerships and Financing Outcomes**

Strengthened partnerships and financing opportunities, including engagement with development partners, financial institutions, and the private sector to support implementation in water-stressed contexts

### **Actions and Initiatives for Implementation**

Identification of pilot initiatives and basin-level cooperation actions, including demonstration projects, joint assessments, and cooperative mechanisms in national and transboundary settings

### **Communication and Visibility**

Key messages contributing to the Forum declaration, alongside targeted communication outputs to raise visibility of integrated water management challenges and solutions

## **IV. Monitoring and Post-Forum Action**

The 11th World Water Forum will serve as a key gathering to take stock of innovative initiatives already underway on conjunctive groundwater–surface water management, bringing together long-standing partners to assess progress, share operational lessons, and identify gaps. By consolidating experiences, tools, and assessment approaches that are already being applied in practice, the topic will contribute to a strong and durable Forum legacy grounded in action. Particular attention will be given to arid and semi-arid basins, where sustained follow-up is essential due to structural water scarcity and high climate sensitivity.

The Forum will also provide a platform to support the scaling up of these initiatives, adaptation to new contexts, and continuation toward the 12th World Water Forum. Basin- and regional-level follow-up mechanisms—such as joint monitoring processes, periodic assessments, and coordination through existing basin and aquifer organizations—will be encouraged to track progress, maintain momentum, and reinforce cooperation over time. Outcomes will feed into global and regional agendas, including UN-related processes, climate and adaptation discussions, and basin and aquifer cooperation networks, through messages rooted in practical implementation.

## **V. Proposed Cross-Process Dialogue Areas**

- ***Climate–Water–Food Nexus Dialogue:*** Joint discussion with agriculture and climate themes on integrating conjunctive water management and digital tools to strengthen food security under climate stress.

- **Digital Innovation and Inclusive Governance Dialogue:** Collaboration with innovation and social inclusion themes to explore data-driven water governance that supports equity, transparency, and community participation.
- **Financing Resilient Water Systems Dialogue:** Cross-theme dialogue with finance and policy tracks on mobilizing climate finance, PPPs, and investment frameworks for scalable, resilient water solutions.
- **Ministerial–Basin Authorities Dialogue on Climate-Resilient Water Allocation:** A high-level exchange aligning national policies with basin-level conjunctive management, digital decision-support, and drought–flood response strategies to strengthen climate resilience and regional cooperation.
- **Local and Regional Authorities–Parliamentarian Dialogue on Urban Water Security Financing:** A joint dialogue focusing on enabling legislation, budget allocations, and innovative financing for urban recharge, rainwater harvesting, and inclusive, data-driven water governance solutions.
- **South Asia (Indus and Ganges Basins):** High climate variability, water scarcity, and dense populations make it ideal for discussing conjunctive water management, urban recharge, and data-driven governance. Collaboration with regional water authorities can showcase pilot projects and policy integration.
- **Southeast Asia (Mekong and Irrawaddy Basins):** Transboundary water challenges, rapid urbanization, and agricultural demands provide a platform to explore integrated management, digital monitoring, and cross-sectoral solutions, engaging basin authorities, local governments, and regional climate initiatives.

## Annex 1: description of sessions

*Each session follows a consistent structure combining a keynote to frame the topic, concrete case studies illustrating diverse climatic and institutional contexts, a panel discussion to explore implications for decision-making, and a plenary Q&A.*

### **Session 1A-0 – From Knowledge to Action: Framing Surface Water and Groundwater Security Decisions**

#### **Description**

This session sets the scene for Topic 1A by framing how knowledge on groundwater and surface water underpins water security decisions in rural and urban areas. It introduces key concepts related to water availability, variability, vulnerability, and allocation, and explores how scientific assessments are translated into decision-relevant information that informs policy choices, planning priorities, and investment pathways.

The session focuses on the process from assessment to decision-making, including the role of indicators, shared datasets, open data, and analytical tools in supporting allocation decisions, drought preparedness and response, and longer-term investment choices across sectors. Transboundary river basins and aquifers are especially discussed in this session, as settings where cooperation relies strongly on shared evidence, common indicators, and trusted assessment processes, often under conditions of scarcity and uncertainty, within a framing that is relevant across all scales.

#### **Focus**

Linking water assessments, indicators, and data to equitable, cross-sectoral, and transboundary decision-making.

#### **Objectives**

- Establish a shared framing of groundwater and surface water as foundations of water security
- Explain how assessments and vulnerability indicators inform decision-making under uncertainty
- Highlight the role of open data and innovative tools in strengthening science–policy interfaces

### **Session 1A-1 – Below the Surface: Understanding Groundwater Systems Under Stress**

## **Description**

This session focuses on groundwater as a critical, often invisible, and vulnerable component of water security, with attention to both quantity and quality. It examines how groundwater availability and pollution risks are assessed under climate variability, extremes, and uncertainty, including recharge dynamics, abstraction pressures, and contamination pathways, as well as options to enhance aquifer resilience where pressures are intensifying..

Special attention is given to arid, semi-arid, and coastal aquifer systems, where groundwater may represent the primary resource and where pressures such as over-abstraction, salinization, seawater intrusion, and nutrient pollution pose significant risks. The session also addresses groundwater's role in sustaining groundwater-dependent ecosystems (GDEs) and groundwater-surface water interactions in arid, coastal, and transboundary aquifer systems, and how these linkages are reflected through assessment frameworks and indicators.

## **Focus**

Assessing groundwater availability, quality, resilience, and ecosystem dependence under variable and changing conditions.

## **Objectives**

- Advance approaches for assessing groundwater availability and quality under climate variability and extremes
- Address challenges related to data scarcity, uncertainty, and compound pressures affecting groundwater systems, including contexts of conflict and governance disruption
- Explore indicators used to characterize pressure, vulnerability, and risk in groundwater systems
- Highlight the importance of GDEs and groundwater-surface water interactions in groundwater assessments and decision-making
- Share experiences from diverse climatic and hydrogeological contexts, including arid and coastal aquifers, and from the application of tools such as managed or artificial aquifer recharge

## **Session 1A-2 – Managing the Flow: Surface Water Under Pressure**

### **Description**

This session examines surface water availability and quality in rivers, lakes, and reservoirs, with a focus on seasonal variability, extremes, and non-stationarity under climate change, as well as competing demands across sectors. It integrates equity and allocation challenges

across rural and urban areas while explicitly linking surface water management with groundwater interactions.

The session highlights how pollution, sedimentation, and water quality degradation reduce effective availability and complicate allocation decisions, particularly under structural scarcity. It explores how risk-based allocation approaches and digital decision-support tools are used to manage uncertainty and trade-offs. Examples from diverse climatic contexts—including arid basins with highly variable flows—illustrate how allocation systems adapt to climate stress, demographic change, and economic development while safeguarding ecological flows.

### **Focus**

Understanding surface water variability, non-stationarity, and allocation under changing conditions.

### **Objectives**

- Examine surface water variability, non-stationarity, and extremes and their implications for availability
- Explore allocation frameworks that account for equity, sectoral trade-offs, and environmental needs
- Highlight indicators and digital decision-support tools used to support allocation decisions under uncertainty
- Reinforce links between assessments, allocation practices, and basin authorities and transboundary institutions, particularly in arid regions

## **Session 1A-3 – Better Together: Conjunctive Water Management in Practice**

### **Description**

This session addresses how groundwater and surface water can be managed jointly to improve reliability, resilience, and sustainability. It highlights operational approaches that coordinate the use of both sources in response to variability, scarcity, and demand fluctuations.

Examples from rural and urban contexts demonstrate how conjunctive management is implemented through technical tools, operating rules, and institutional coordination, including an example from a **transboundary basin or aquifer**, illustrating how conjunctive approaches can support cooperation and shared water security objectives across borders.

### **Focus**

Applying conjunctive groundwater–surface water management to strengthen water security.

### **Objectives**

- Clarify the operational dimensions of conjunctive water management
- Share practical tools and experiences for coordinated use of groundwater and surface water, including participatory approaches for water resources planning and management
- Highlight institutional arrangements that enable effective conjunctive management
- Demonstrate applicability across diverse climatic and governance contexts, including transboundary settings