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Water Security in Arid Regions

From Scarcity to Resilience: Emerging Insights for the UAE

Insights from the 3rd Panel Discussion of the Emirates Environmental Group (EEG) for 2026
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About this Dialogue Brief

The EEG Sustainability Dialogue Series translates expert discussions into accessible, evidence-informed analysis. Each brief synthesises perspectives presented during an EEG dialogue and places selected insights within the context of peer-reviewed research, policy frameworks and established institutional evidence. The series aims to connect dialogue with practical understanding and identify emerging considerations for sustainability policy and practice.

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Executive Perspective

Water security has long been a critical concern across arid geographies. Over the past several decades, the Middle East and North Africa (MENA) region has undergone profound demographic, urban and economic transformation. Rapid population growth has been accompanied by the expansion of major metropolitan centres, infrastructure, agriculture and industrial activity, placing increasing pressure on already constrained water resources.

This transformation has been accompanied by a substantial increase in water demand. Population growth, urbanisation, agricultural expansion and economic development have collectively intensified demand across the region. World Bank modelling estimated total water demand in the MENA region at approximately **261 billion m³ annually** in its baseline assessment, with demand projected to increase to approximately **319 billion m³ annually during 2020–2030**. This trajectory illustrates the growing challenge of balancing rising societal and productive demand with the region's limited natural freshwater resources. (World Bank, 2012).

For arid regions, water security has traditionally been approached principally as a question of supply: **how to secure sufficient water where natural freshwater availability is limited**, but this paradigm is changing.

Increasing climate variability, pressure on groundwater reserves, the energy and infrastructure requirements associated with water production, emerging contaminants, ecosystem degradation and growing competition among users are broadening the meaning of water security. Future resilience will therefore depend on securing additional water supplies and also on improving the way water is understood, allocated, used, protected, recovered and governed.

This broader understanding is reflected in contemporary approaches to water-related risk. The Organisation for Economic Co-operation and Development (OECD) frames physical water risks around four interrelated dimensions: **too little water**, including scarcity and drought; **too much water**, including flooding; **water of inadequate quality** as a result of pollution; and the **degradation of freshwater ecosystems**. These risks are shaped by the occurrence of a hazard as well as by the exposure and vulnerability of affected communities, ecosystems, infrastructure and economic activities.

Water-related risks are therefore increasingly understood as systemic rather than isolated environmental challenges. Scarcity and drought can constrain agricultural production and economic activity; floods and contamination can damage infrastructure and disrupt operations; and deteriorating freshwater systems can generate consequences across communities, businesses and supply chains. Their economic significance is also becoming increasingly apparent, with estimates cited by the OECD placing the potential value of water-related economic risks at the equivalent of **7–9% of global GDP**. (OECD, 2026)

Against this regional and global backdrop, the United Arab Emirates has established a national policy framework aimed at strengthening long-term water resilience. The **UAE Water Security Strategy 2036**, unveiled in 2017, seeks to ensure sustainable access to water during both normal and emergency conditions. Among its stated objectives are reducing total demand for water resources by **21%**, increasing the water productivity index to **USD 110 per cubic metre**, reducing the water scarcity index by **three degrees**, increasing the reuse of treated water to **95%**, and strengthening national water storage capacity to provide up to **two days of supply under normal conditions**. (UAE Government, 2023)

Taken together, these global, regional and national developments point towards a broader conception of water security; one that recognises the close interdependence between **environmental integrity, social resilience and economic stability**. Addressing such interconnected risks similarly requires interconnected responses,

bringing together all concerned parties; policy, science, infrastructure, business, academia and civil society rather than treating water as the responsibility of any single institution or sector.

It was within this evolving context that the **Emirates Environmental Group (EEG)** convened its 3rd panel discussion for the year 2026, **“Water Security in Arid Regions: Innovations for Scarcity, Resilience and Sustainable Growth”**. Bringing together perspectives from government, academia, industry and water stewardship practice, the dialogue explored how emerging technologies, institutional approaches and collaborative models can contribute to more resilient water systems.

A central message emerged across the discussion:

Water security in arid regions cannot be achieved through supply expansion alone. Resilience increasingly depends on understanding water as an interconnected system encompassing availability, quality, infrastructure, technology, ecosystems and collective stewardship.

Five interconnected areas emerged from the dialogue:

1. **water intelligence**
2. **water quality & ecological security**
3. **circular & resource-efficient operational systems**
4. **diversified & decentralised solutions; and**
5. **collaborative water stewardship.**

Together, these themes provide a framework for examining how water security in arid regions can evolve from the management of scarcity towards the development of more adaptive, circular and resilient water systems.

1. From Water Scarcity to Water-System Resilience

The starting conditions for arid regions are challenging. Limited renewable freshwater resources coincide with growing population, economic activity and urban development, while climate change is increasing uncertainty around rainfall, drought, heat and extreme weather events.

In the UAE, water supply depends on a combination of groundwater, desalinated water and treated wastewater. During the dialogue, Dr. Sajid Pareeth (Director – Water & Climate Solutions, Expo City Dubai) highlighted an indicative national water-source profile in which groundwater and desalination account for the largest shares, while treated wastewater represents a smaller but growing component.

This composition illustrates an important strategic challenge. Desalination has enabled urban and economic development in an environment with very limited natural freshwater availability, but it also creates energy and infrastructure dependencies. Groundwater, meanwhile, is a finite strategic resource where extraction can exceed natural recharge. Increasing the productive reuse of treated water, therefore represent one potential route towards greater diversification.

According to UAE Water Strategy 2036 portal, today, 42% of the total water requirement of the country comes from some 70 major desalination plants, which account for around 14% of the world's total production of desalinated water. (UAE Government, 2023). A 2025 peer-reviewed Ocean Modelling study estimated that by end of 2023, Gulf desalination capacity had reached nearly 30 million m³/day, approximately double its 2006 level, with at least another 6.2 million m³/day expected by 2030 (Nesterov, 2025).

Desalination has become indispensable to water security in the Arabian Gulf countries, but its continued expansion introduces environmental pressures that require careful management. Recent Khalifa University-led modelling projects that desalination capacity in the Gulf region could increase more than sixfold by 2050. The research found that brine discharge can alter local salinity, temperature and circulation patterns, particularly around desalination facilities. While the Gulf's natural exchange through the Strait of Hormuz provides an

important buffer against basin-wide accumulation of salinity and heat, the researchers caution that impacts on coastal ecosystems near desalination facilities remain significant and could intensify as desalination expands alongside climate-driven warming. (Khalifa University, 2025)

The implications extend beyond scarcity. The UAE's experience of extreme rainfall in April 2024 demonstrated that arid-region water resilience must simultaneously address scarcity and excess. Water security is therefore increasingly connected to flood management, drainage infrastructure, climate adaptation and urban resilience.

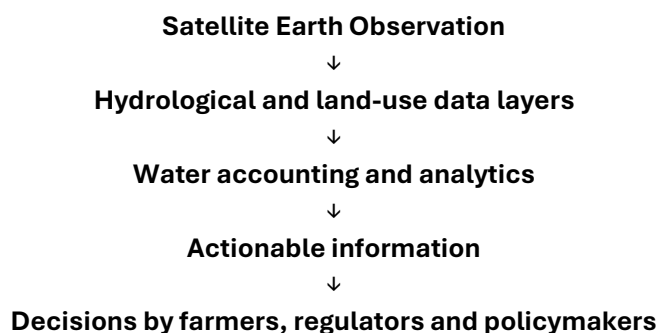
A 2025 study of the event found that 24-hour rainfall exceeded 250 mm in some areas, the highest recorded since observations began in 1949, resulting in widespread flooding and disruption. The researchers found that anthropogenic climate change is increasing the likelihood of such extreme rainfall events, while also identifying a relationship between urbanisation, population density and the severity of flood impacts. These findings reinforce the need for water-security strategies in arid regions to integrate flood preparedness, urban drainage and climate adaptation alongside traditional water-supply planning (Francis et al., 2025).

The question is consequently shifting from "Where will the next unit of water come from?" towards "How can the entire water system become more adaptive, efficient and resilient?"

2. Seeing Water Better: From Data Collection to Water Intelligence

Effective water governance begins with understanding what water is available, where it is being consumed, how demand is changing and where pressures are emerging. One approach to strengthening this information base is the growing use of **Earth Observation (EO)** for water accounting and resource monitoring. Satellite observations can provide recurring information on variables such as precipitation, soil moisture, vegetation condition and evapotranspiration. When combined with ground-level information and analytical models, these datasets can help transform environmental observations into decision-relevant water intelligence.

From Observation to Decision



This progression was illustrated during the EEG dialogue by **Dr. Sajid Pareeth**, who presented the UAE Water Accounting Platform as an example of how satellite-derived observations can be combined with hydrological and land-use information to move beyond environmental monitoring towards actionable water intelligence. The approach supports applications ranging from evapotranspiration-based irrigation assessment to broader water-accounting and resource-planning decisions.

Scientific research increasingly supports the application of these technologies in arid and semi-arid environments. A 2025 review by **Rabie, Elhag and Subyani** found that remote sensing can support the monitoring of key water-related variables, including soil moisture, evapotranspiration, vegetation dynamics and surface-water extent. When integrated with Geographic Information Systems (GIS) and machine-learning techniques, these observations can support hydrological modelling, irrigation planning and water-resource management. Such approaches can be particularly valuable where conventional ground-based monitoring is spatially limited, allowing changing water conditions to be assessed across larger areas and over time (Rabie, Elhag and Subyani, 2025).

The applicability of Earth Observation has also been demonstrated within the UAE. **Ghebreyesus et al. (2016)** applied a multi-satellite approach to assess water-storage variability in the Al Ain region between 2005 and 2014, combining Landsat imagery, GRACE satellite observations and water-budget data.

The study identified a declining trend in water storage, particularly groundwater, demonstrating the potential of satellite-based observations to complement conventional monitoring in an arid UAE context.

Agriculture provides a practical illustration of how such information can translate into action. Rather than relying solely on uniform irrigation schedules, evapotranspiration-based approaches can help estimate crop-water requirements according to climatic and vegetation conditions, creating opportunities for irrigation to respond more closely to actual water demand.

The significance of Earth Observation therefore extends beyond the collection of environmental data. Its greater value lies in converting observations into information that can support decisions; from identifying changing demand and estimating irrigation requirements to benchmarking water productivity and informing more adaptive resource allocation.

Digital water governance is ultimately not about possessing more technology, but about reducing the information gap between changing conditions within a water system and the ability of institutions and resource users to respond.

3. Beyond Quantity: Water Quality as a Security Issue

Increasing water supply is of limited value if the underlying water environment is deteriorating. **Professor Fatin Samara, Professor of Environmental Sciences and Sustainability at the American University of Sharjah (AUS), Deputy Director of the Energy, Water and Sustainable Environments Research Center (EWSERC)** broadened the discussion from water scarcity to **water-quality security**, drawing attention to the ecological conditions of the Arabian Gulf and the growing challenge posed by emerging contaminants.

The Arabian Gulf is a shallow, semi-enclosed marine environment characterised by high salinity, pronounced seasonal temperature variability and annual sea temperatures exceeding 36°C in parts of the southern Gulf. Despite these extreme conditions, it supports important marine biodiversity, fisheries and coastal communities, while also underpinning desalination and other economic activities across the region. Research led by NYU Abu Dhabi's Mubadala Arabian Center for Climate and Environmental Sciences (ACCESS) highlights how these naturally demanding conditions are being compounded by climate change, placing additional pressure on marine ecosystems.

This vulnerability is reflected in peer-reviewed modelling by Wabnitz *et al.* (2018), which projected that, under a business-as-usual climate scenario, the Gulf could experience local losses of up to 35% of its initial marine species richness by 2090 relative to 2010, with some of the greatest impacts projected for the southwestern Gulf, including waters off the UAE.

The relationship between marine environmental quality and water security is particularly significant in the Gulf. Seawater provides the feedwater for much of the region's desalination infrastructure while the marine environment also receives urban and industrial discharges. Protecting water quality is therefore connected not only to biodiversity conservation, but also to the long-term resilience of the region's water-production systems.

Research undertaken by Professor Samara and collaborators across UAE coastal ecosystems further illustrates the importance of understanding water quality within its wider ecological context. Assessment of the Khor al Beida mangrove ecosystem in Umm Al Quwain combined analysis of water and intertidal sediments with biological indicators and found the ecosystem to be generally undisturbed with relatively limited anthropogenic impact, while nevertheless highlighting the importance of continued protection and conservation (Samara *et al.*, 2020). More recent assessment of oyster-bed habitats along the northern Arabian Gulf coast of the UAE

examined contaminants across water, sediments and oyster tissues alongside the biodiversity supported by these habitats. Heavy metals were detected across these environmental compartments, with zinc, arsenic and cadmium occurring at higher concentrations in oysters than in surrounding water and sediments, illustrating the value of examining contaminant behaviour across multiple components of the marine ecosystem (Samara et al., 2023).

Emerging Contaminants

The dialogue highlighted the growing importance of pollutants that may not always be adequately captured by conventional monitoring frameworks, including **microplastics and fibres, per- and polyfluoroalkyl substances (PFAS), pharmaceuticals and chemical additives, heavy metals and other emerging contaminants**.

Research from UAE oyster-bed ecosystems provides further evidence of these pressures. Microplastics were identified in all sediment samples examined across five UAE coastal sites and in approximately half of the oyster samples, with fibres representing the dominant form observed. As the first regional investigation of microplastics in oyster-bed ecosystems, the study highlighted both the presence of these contaminants in ecologically important coastal habitats and the need to better understand and manage their sources (Al Hammadi et al., 2022).

Evidence from marine organisms also demonstrated why contaminant monitoring should extend beyond the water column itself. Analysis of stranded green sea turtles from the Gulf of Oman coast of the UAE detected persistent organic pollutants in 77% of the specimens examined, including PAHs and organochlorine pesticides, demonstrating the presence of contaminant exposure within marine wildlife (Yaghmour, Samara and Alam, 2020).

Recent research provides additional evidence of these pressures within the UAE. Monitoring across marine waters and sediments in Abu Dhabi confirmed the presence of microplastics across diverse environments, with concentrations in water ranging from approximately 4.5 particles/L in relatively natural habitats to 8.2–9.3 particles/L around offshore oilfields, ports and offshore islands, indicating an association with areas of greater anthropogenic activity (Al Hashmi et al., 2026). Beyond microplastics, PFAS are emerging as a concern for arid-region water systems because of their environmental persistence and potential for accumulation; however, monitoring across the Arabian Gulf remains comparatively limited, leaving important gaps in understanding their occurrence and distribution (Arun et al., 2026).

A broader review of emerging contaminants in the Gulf similarly identifies PFAS and microplastics among priority contaminant groups for future monitoring, while highlighting the need for stronger Gulf-specific evidence concerning their occurrence, environmental fate and ecological impacts (Rasool et al., 2026).

Taken together, this evidence demonstrates why marine water-quality assessment increasingly requires an ecosystem-based perspective. Contaminants may occur across water, sediments and biological organisms, and their environmental significance cannot necessarily be understood through measurements of the water column alone. Long-term monitoring across these interconnected compartments can help identify emerging pressures, understand contaminant pathways and assess potential ecological consequences.

The significance of emerging contaminants lies not simply in detecting individual pollutants. Their persistence, long-term ecological exposure, potential for bioaccumulation and interactions with other contaminants create risks that require continued monitoring and scientific investigation.

Water-quality security, therefore, increasingly depends on the ability to detect emerging risks early, understand their pathways through aquatic systems and develop appropriate responses before they become entrenched environmental problems.

From Detection to Treatment

The dialogue also demonstrated how academic research can move beyond identifying environmental pressures towards developing potential treatment solutions.

Research presented by Professor Samara illustrated the potential of advanced materials for treating complex water contaminants. Venkatesh *et al.* (2026) developed a silver-doped β -Bi₂O₃/g-C₃N₄ photocatalyst designed to enhance pollutant degradation under visible light. The material achieved degradation efficiencies of 91% for phenol red and 96% for methylene blue, while persulfate-assisted treatment achieved 85% degradation of the antibiotic tetracycline.

The study also evaluated the catalyst under real-water conditions and examined its reusability, highlighting the potential of advanced photocatalytic materials for treating persistent organic contaminants (Venkatesh *et al.*, 2026).

Monitor → Detect → Understand → Treat → Protect

Such findings demonstrate the technical potential of advanced photocatalytic treatment, but treatment efficiency at laboratory scale should not be equated with readiness for widespread deployment. Cunha *et al.* (2026), reviewing a decade of techno-economic and life-cycle evidence, identified energy demand, catalyst-production impacts, durability, toxicity, cost competitiveness and limited pilot-scale evidence among the continuing barriers to scale-up. Solar-driven systems may reduce the environmental burden associated with artificial UV irradiation, with the review reporting substantially lower impacts for solar-driven approaches. However, this increases the relative importance of catalyst production, durability and reuse. Catalyst recovery and potential secondary environmental impacts must also be considered, particularly where nanomaterial release, metal leaching or toxic degradation intermediates are possible.

The progression from monitoring to treatment, represents an important direction for water-quality security: identifying emerging contaminants, understanding their movement across water, sediments and marine organisms, evaluating their ecological implications, developing technologies capable of removing them and critically assessing whether those solutions can be deployed safely, sustainably and at scale.

4. Making Every Litre Work Smarter: Circularity in Critical Infrastructure

Water efficiency is commonly associated with households, buildings and agriculture. The dialogue demonstrated that the same principles can extend into less conventional but equally important areas of water use, including **emergency response and critical infrastructure**.

Dubai Civil Defence (DCD) framed its approach around an important shift in thinking: the objective is not simply to use less water, but to **make every litre work more effectively while maintaining emergency readiness**. This distinction is particularly important in essential services, where reducing resource consumption cannot come at the expense of operational performance. Innovation must therefore deliver resource efficiency alongside safety, effectiveness and resilience.

In Practice | Precision Firefighting

Lt. Col. Eng. Taher Hassan Al Taher, Director of Institutional Excellence Department, Dubai Civil Defence presented several technologies designed to improve the precision and efficiency with which water is deployed during firefighting operations.

The **One Seven compressed-air foam system** combines water, foam concentrate and compressed air to produce firefighting foam. According to figures presented by DCD during the dialogue, the system can reduce water consumption by approximately **65–70%** while supporting faster fire suppression. Other examples

included remotely operated firefighting systems capable of directing water, water mist or foam more precisely towards affected areas, with the potential to reduce unnecessary discharge and secondary water damage.

The **Shaheen system** was presented as an approach for delivering water or foam to high-rise and difficult-to-access locations, while **Dolphin** enables the use of seawater as a firefighting source in marine and waterfront environments, reducing reliance on conventional hydrant supplies.

Independent research provides useful context for the potential and limitations of compressed-air foam systems (CAFS). Experimental research has found that CAF can support effective fire suppression and cooling while reducing water discharge relative to conventional application in some fire scenarios (Thomitzek *et al.*, 2015). Full-scale compartment testing has similarly evaluated CAF against water-only and conventional water-foam hose streams, demonstrating its potential as an effective suppression technology (Kim and Crampton, 2012).

However, the performance advantage is not universal: research by the US National Institute of Standards and Technology found broadly similar gas-cooling and room-fire suppression performance between CAF and water in the interior structural-fire scenarios examined (Weinschenk *et al.*, 2017).

More recent experimental research further demonstrated that CAFS performance depends substantially on how the system is configured. Zhao, Xu and Yan (2026) found that the gas-liquid ratio influenced foam stability, spreading behaviour and suppression performance, demonstrating that effectiveness depends not simply on combining compressed air, foam and water, but on optimising foam characteristics and operating parameters.

Taken together, the evidence points towards a broader principle relevant to water security: **efficiency is not only a question of reducing volume. Precision — delivering the appropriate quantity of water, in the appropriate form, at the appropriate place and time — can itself constitute a form of resource efficiency.**

Closing the Loop: GAITH

A further concept presented by Dubai Civil Defence was **GAITH**, a closed-loop approach intended to recover, treat and potentially reuse firefighting water, particularly in urban and high-rise firefighting scenarios.

Rather than treating water discharged during firefighting as a single-use resource, the concept proposes a circular sequence:

Fire suppression → Runoff containment → Recovery through vacuum collection → Mobile filtration and treatment → Reuse in firefighting operations

Under the concept presented, containment barriers would limit the uncontrolled movement of potentially contaminated firefighting runoff into drainage and stormwater systems. Recovered water would then be transferred to a mobile treatment unit before being considered for further operational use, where appropriate.

The significance of this approach extends beyond potential water savings. Conceptually, it brings together three dimensions of resilience:

- **Resource efficiency** — recovering water that might otherwise be discharged or lost;
- **Environmental protection** — limiting uncontrolled releases of contaminated firefighting runoff; and
- **Operational continuity** — potentially reducing reliance on continuous external water supplies during prolonged incidents.

The environmental dimension is particularly important because firefighting water can itself become a pollution pathway once it interacts with burning materials, stored chemicals and suppression agents. Contaminated firewater can mobilise combustion products and hazardous substances and, where inadequately contained, transport pollutants into surface waters, groundwater and surrounding ecosystems.

Research examining chemical storage facilities identifies contaminated firefighting runoff as a potentially significant source of secondary environmental damage, particularly where suppression water interacts with

stored chemicals before reaching nearby waterways (Yoon, Jung and Min, 2026). Evidence from lithium-ion battery fires similarly found contaminants in firefighting runoff at concentrations exceeding freshwater environmental limits, reinforcing the importance of containment and appropriate post-incident management (Jalali, Collie and Baroutian, 2026).

The combination of **precision firefighting and closed-loop water management** therefore introduces a broader way of thinking about circularity in critical infrastructure. Rather than focusing exclusively on reducing the water entering an operation, circular approaches also consider what happens to water **after it has been used**; whether it can be contained, recovered, treated and safely returned to productive use.

At the same time, innovative concepts should be distinguished from solutions that have already been independently validated at scale. The approaches presented during the dialogue illustrate promising directions for improving water efficiency and environmental protection in emergency response, but their wider applicability will depend on operational testing, treatment performance, water-quality requirements, safety, economics and the specific conditions under which they are deployed.

5. Diversifying Water Supply - But Evaluating Innovation Carefully

Another perspective raised by Mr. Iftikhar Hamdani, Area General Manager – Northern Emirates, Bahi Ajman Palace Hotel and Coral Beach Resort Sharjah, during the dialogue concerned **decentralised water generation**, including Atmospheric Water Generation (AWG).

AWG technologies extract water vapour from ambient air and condense it into liquid water, followed by appropriate treatment to achieve the required water quality. Under suitable climatic conditions, these technologies may provide supplementary water at individual buildings or facilities.

Their potential attraction in sectors such as hospitality is understandable. On-site generation could, for example, reduce reliance on transported bottled water for certain applications, with potential associated reductions in packaging and logistics. However, the contribution of AWG to water security should be evaluated carefully. Its performance can vary significantly according to:

- humidity and temperature;
- electricity consumption and source;
- technology type;
- water-production efficiency;
- operating and maintenance costs;
- water-quality requirements; and
- scale and context of deployment.

Gulf-focused research has identified the region's climatic conditions as potentially favourable for atmospheric water harvesting, while highlighting the strong dependence of water yield and energy performance on environmental conditions and technology configuration (Ansari *et al.*, 2022).

This sensitivity is demonstrated more directly by longer-term field testing in Masdar City, Abu Dhabi. Khalaf *et al.* (2024) evaluated a vapour-compression refrigeration system (VCRS)-based AWG unit under changing seasonal conditions, finding substantial variation in both water productivity and energy performance. Specific energy consumption ranged from approximately 0.26 kWh/L under more favourable conditions to 0.53

kWh/L during cooler and drier conditions. These findings reinforce the importance of evaluating AWG technologies under actual local operating conditions rather than relying solely on rated production capacity (Khalaf *et al.*, 2024).

Taken together, the evidence suggests that AWG may be most valuable **not as a replacement for centralised desalination, but as a complementary and decentralised water source** where local production, resilience or reduced dependence on distribution infrastructure provides particular value.

This raises a more useful question than whether decentralised technologies can simply produce water:

Under which conditions, at what scale and for which applications can decentralised technologies improve overall system resilience?

This framing allows innovation to be evaluated on **performance, context and system value rather than novelty alone.**

6. From Water Management to Water Stewardship

Ms. Alicia Dauth, a Chartered Environmentalist with over 15 years of Experience shared a broad message emerging that no individual technology, facility or organisation can independently deliver water security. Water moves across administrative and organisational boundaries. The actions of one user can influence communities, ecosystems and other users within the same wider water system. Water stewardship therefore extends beyond conventional site-level water management by considering not only an organisation's own water use, but also the wider water context in which it operates.

Good water management asks: How can an organisation reduce and manage its own water use?

Water stewardship additionally asks: What water system does the organisation depend upon, who else depends upon it, what risks are shared, and what actions require collaboration?

The stewardship framework presented during the dialogue emphasised both site- and catchment-level action, together with stakeholder engagement, governance, water quality, efficiency, reuse and disclosure. These principles align with established international water-stewardship frameworks, including the Alliance for Water Stewardship Standard and the UN Global Compact CEO Water Mandate, which emphasise responsible water use alongside collective action and engagement beyond an organisation's direct operations (Alliance for Water Stewardship, 2025; CEO Water Mandate, n.d.).

For businesses, this broader perspective can have implications for:

- operational continuity;
- supply-chain resilience;
- regulatory preparedness;
- community relations;
- ecosystem health;
- investor expectations; and
- long-term climate resilience.

Water security is the desired condition. Water stewardship is one pathway through which organisations and stakeholders can contribute towards achieving it.

This perspective ultimately positions water security as a **shared-governance challenge as well as a technical and infrastructure challenge**, requiring organisations to consider not only how efficiently they manage water

within their own boundaries, but also how their decisions interact with the wider water systems, ecosystems and communities upon which they depend.

7. Cross-Cutting Insights from the Dialogue

Technology needs enabling institutions

Earth Observation, advanced treatment, precision firefighting and decentralised water generation may all improve aspects of water management. Their effectiveness, however, depends on standards, governance, skills, finance, regulation and institutional capacity.

Local evidence matters

Technologies that perform effectively in one geography cannot automatically be assumed to deliver the same environmental, operational or economic performance under different conditions. Technology selection should therefore be informed by local climate, source-water quality and salinity, soil characteristics, energy systems, infrastructure, intended end use and operational requirements.

UAE-based research on water reuse has similarly highlighted the importance of “fit-for-purpose” approaches that account for local water and soil conditions rather than relying solely on generic treatment assumptions (Seguela, Littlewood and Karani, 2020). Local piloting and performance validation are therefore important steps in determining whether promising water technologies can be translated successfully into arid-region applications.

Water quality and quantity are inseparable

Producing more water while allowing source ecosystems to deteriorate does not constitute long-term security. Availability, quality and ecological integrity need to be addressed together.

Circularity can extend into unexpected sectors

The DCD examples demonstrate that circular-water thinking is not limited to wastewater utilities or industrial processes. Similar principles may potentially be considered across buildings, emergency services, hospitality, landscaping and other water-intensive activities.

Water resilience is ultimately collaborative

Data may reveal problems and technology may provide solutions, but implementation occurs within institutions and communities. Water security consequently requires coordination between government, utilities, business, academia, civil society and end users.

8. What Does This Mean for the UAE?

The UAE has already demonstrated how technological investment, infrastructure development and long-term planning can help overcome severe natural constraints on freshwater availability. Building on these achievements, the next stage of water resilience lies in continuing the transition towards a more **integrated water-system approach** — one that considers supply alongside demand, information, water quality, circularity, technological innovation and shared responsibility.

The dialogue suggested five areas deserving continued attention:

1. **Strengthen national water intelligence:** Continue integrating Earth Observation, utility information, hydrological data and sector-level demand information to support adaptive and evidence-based decision-making.

2. **Increase the circular use of water:** Expand technically, environmentally and economically appropriate reuse, recycling and recovery across municipal, industrial, commercial and institutional applications.
3. **Strengthen water-quality resilience:** Expand monitoring of emerging contaminants and recognise water-quality and ecosystem protection as integral to long-term water security.
4. **Create pathways for responsible innovation:** Support pilots and demonstration projects while requiring evidence on cost, efficiency, environmental performance, operational suitability and scalability before wider implementation.
5. **Advance shared water stewardship:** Encourage organisations to move beyond internal efficiency targets towards stakeholder-inclusive approaches that consider wider water risks, dependencies and opportunities for collective action.

These priorities do not necessarily require a new direction for national water policy. Many are already reflected, directly or indirectly, in the **UAE Water Security Strategy 2036** and related national frameworks, including commitments to reduce water demand, increase treated-water reuse, improve water quality, advance the use of technology and innovation, and strengthen national capabilities (UAE Government, 2023).

The opportunity therefore lies in translating these ambitions into sustained and coordinated implementation, while continuing to adapt approaches as technologies, scientific evidence and water-related risks evolve.

Progress towards 2036 will depend on achieving established targets and also on maintaining momentum across institutions, strengthening implementation pathways and ensuring that **innovation, monitoring, circularity and collaboration continue to evolve alongside the changing water-security landscape. The perspectives shared through the dialogue suggest that the UAE's next water-security gains may come not from any single technology or intervention, but from connecting these capabilities into a more informed, circular, adaptive and collaborative water system.**

9. From Dialogue to Action

The panel demonstrated that the future of water security in arid regions will not be defined by a single technological breakthrough.

Instead, resilience is likely to emerge from the interaction of multiple approaches: better information; better infrastructure; better protection of water quality; greater circularity; responsible innovation; and stronger cooperation.

The transformation is therefore not simply from scarcity to abundance, but from resource management to system resilience.

For the UAE and other arid economies, the central challenge is increasingly clear: securing water for the future will require producing more water and understanding, protecting, recovering and managing every drop more intelligently.

References

- Al Hashmi, A.H., Thankamony, R., Al Hammadi, H.A. and Thiemann, T. (2026)** 'Microplastic pollution in marine waters and sediments of Abu Dhabi Emirate, UAE', *Frontiers in Marine Science*, 13, 1685250.
- Alliance for Water Stewardship (2025)** *AWS Standard*. Available at: [Alliance for Water Stewardship](#) (Accessed: 11 August 2026).

- Ansari, E., Lopez Ferber, N., Milošević, T., Barron, J., Karanikolos, G.N., AlMarzooqi, F., Dumée, L.F. and Calvet, N. (2022)** 'Atmospheric water generation in arid regions – A perspective on deployment challenges for the Middle East', *Journal of Water Process Engineering*, 49, 103163.
- Arun, K.K., Al Yasi, H.S., Wada, O.Z., AlMomani, F. and Mahmoud, K.A. (2026)** 'Comprehensive review of PFAS occurrence, regulatory frameworks, analytical, and remediation methodologies: emphasis on the Arabian Gulf and arid regions', *Environmental Science: Water Research & Technology*, 12, pp. 121–145.
- CEO Water Mandate (n.d.)** *CEO Water Mandate*. Available at: [CEO Water Mandate](#) (Accessed: 11 August 2026).
- Cunha, I.L.C., de Assis, G.C., Metolina, P., Palharim, P.H., Gusmão, C.A., Kulay, L., Teixeira, A.C.S.C. and Ramos, B. (2026)** 'Is photocatalysis ready for scale yet?', *Processes*, 14, 102. doi:10.3390/pr14010102.
- Francis, D., Fonseca, R., Nelli, N., Cherif, C., Yarragunta, Y., Zittis, G. and de Vries, A.J. (2025)** 'From cause to consequence: examining the historic April 2024 rainstorm in the United Arab Emirates through the lens of climate change', *npj Climate and Atmospheric Science*, 8, 183. doi:10.1038/s41612-025-01073-1.
- Ghebreyesus, D.T., Temimi, M., Fares, A. and Bayabil, H.K. (2016)** 'A multi-satellite approach for water storage monitoring in an arid watershed', *Geosciences*, 6(3), 33. doi:10.3390/geosciences6030033.
- Jalali, H., Collie, L. and Baroutian, S. (2026)** 'Air emissions & firewater runoff contamination from lithium-ion battery fires in rubbish trucks', *Environmental Pollution*, 389, 127437.
- Hammadi, M. al, Knuteson, S., Kanan, S., & Samara, F. (2022).** Microplastic pollution in oyster bed ecosystems: An assessment of the northern shores of the United Arab Emirates. *Environmental Advances*, 8, 100214. <https://doi.org/10.1016/J.ENVADV.2022.100214>
- Khalaf, B.T., Lopez Ferber, N., Martins, M., Chiesa, M. and Calvet, N. (2024)** 'Long-term performance evaluation of VCRS-based atmospheric water generation in arid climates', *Case Studies in Chemical and Environmental Engineering*, 10, 100855. doi:10.1016/j.csee.2024.100855.
- Khalifa University (2025)** *The Oceanographic Impact of Desalination in the Arabian Gulf*. Available at: [Khalifa University](#) (Accessed: 11 August 2026).
- Kim, A.K. and Crampton, G.P. (2012)** 'Evaluation of the fire suppression effectiveness of manually applied compressed-air-foam (CAF) system', *Fire Technology*, 48(3), pp. 549–564.
- Nesterov, O. (2025)** 'An assessment of seawater desalination impact on salinities in the Arabian/Persian Gulf using a 3D circulation model', *Ocean Modelling*, 194, 102503. doi:10.1016/j.ocemod.2025.102503.
- OECD (2026)** *Embedding Water-related Risks in Financial Stability Frameworks*. Paris: OECD. Available at: [OECD report](#) (Accessed: 11 August 2026).
- Rabie, A.B., Elhag, M. and Subyani, A. (2025)** 'Remote sensing, GIS, and machine learning in water resources management for arid agricultural regions: A review', *Water*, 17(21), 3125. doi:10.3390/w17213125.
- Rasool, K., Al Yasi, H.S., Krishnankutty, A.K., Saththasivam, J., El-Malah, S.S., Wahib, S., Aktar, M.W., Wada, O.Z., Ben-Hamadou, R., Aris, A.Z. et al. (2026)** 'Emerging contaminants in Arabian Gulf water: Occurrence, risks, and management strategies', *Water*, 18(15), 1856. doi:10.3390/w18151856.
- Samara, F., Bejarano, I., Mateos-Molina, D., Abouleish, M., Solovieva, N., Yaghmour, F., Ali, T., & Saburova, M. (2023).** Environmental assessment of oyster beds in the northern Arabian Gulf Coast of the United Arab Emirates. *Marine Pollution Bulletin*, 195, 115442. <https://doi.org/10.1016/J.MARPOLBUL.2023.115442>
- Samara, F., Solovieva, N., Ghalayini, T., Nasrallah, Z. A., & Saburova, M. (2020).** Assessment of the Environmental Status of the Mangrove Ecosystem in the United Arab Emirates. *Water* 2020, Vol. 12, Page 1623, 12(6), 1623. <https://doi.org/10.3390/W12061623>
- Seguela, G., Littlewood, J.R. and Karani, G. (2020)** 'Water resource management in the context of a non-potable water reuse case study in arid climate', *Energy, Ecology and Environment*, 5, pp. 369–388, issue number (5). doi:10.1007/s40974-020-00169-z.

- Thomitzek, A., Ondruch, J., Chudová, D. and Kučera, P. (2015)** 'Effects of compressed air foam application on heat conditions in fire within a closed space', *Transactions of the VŠB – Technical University of Ostrava, Safety Engineering Series*, 10(2), pp. 20–25.
- UAE Government (2023)** *The UAE Water Security Strategy 2036*. The Official Portal of the UAE Government. Available at: [UAE Water Security Strategy 2036](#) (Accessed: 11 August 2026).
- Venkatesh, G., Mazen, K., Samara, F. and Kanan, S.M. (2026)** 'Boosted reactive radical generation through persulfate activation over silver doped β -Bi₂O₃/g-C₃N₄: Toward enhanced photocatalytic removal of antibiotic, anionic, and cationic dye contaminants', *Journal of the Taiwan Institute of Chemical Engineers*, 185, 106678. doi:10.1016/j.jtice.2026.106678.
- Wabnitz, C.C.C., Lam, V.W.Y., Reygondeau, G., Teh, L.C.L., Al-Abdulrazzak, D., Khalfallah, M., Pauly, D., Palomares, M.L.D., Zeller, D. and Cheung, W.W.L. (2018)** 'Climate change impacts on marine biodiversity, fisheries and society in the Arabian Gulf', *PLOS ONE*, 13(5), e0194537. doi:10.1371/journal.pone.0194537.
- Weinschenk, C.G., Madrzykowski, D.M., Stakes, K. and Willi, J.M. (2017)** *Examination of Compressed Air Foam (CAF) for Interior Fire Fighting*. Gaithersburg, MD: National Institute of Standards and Technology.
- World Bank (2012)** *Renewable Energy Desalination: An Emerging Solution to Close the Water Gap in the Middle East and North Africa*. Washington, DC: World Bank. Available at: [World Bank report](#) (Accessed: 11 August 2026).
- Yaghmour, F., Samara, F., & Alam, I. (2020)**. Analysis of polychlorinated biphenyls, polycyclic aromatic hydrocarbons and organochlorine pesticides in the tissues of green sea turtles, *Chelonia mydas*, (Linnaeus, 1758) from the eastern coast of the United Arab Emirates. *Marine Pollution Bulletin*, 160, 111574. <https://doi.org/10.1016/J.MARPOLBUL.2020.111574>
- Yoon, C., Jung, S. and Min, M. (2026)** 'Development of an environmental-safety risk assessment model for firewater runoff in chemical storage facilities using a double materiality assessment', *Journal of Loss Prevention in the Process Industries*, 101, 105926.
- Zhao, W., Xu, Z. and Yan, L. (2026)** 'Foaming capability, structural stability, and fire extinguishing performance optimization of short-chain fluorocarbon foam by modulating gas–liquid ratio', *Fire*, 9, 59.