6.5.4 Extracted water from aquifers, lakes or rivers and utilization of sustainable water extraction technologies on associated university grounds on and off campus

Alexandria University promotes sustainable water resource management through the application of advanced water treatment, desalination, recycling, and efficient irrigation technologies across its campus facilities and associated off-campus research sites.

1. Available evidence from Alexandria University

Project or activity	Relevance	Evidence strength
Water desalination facility at Wadi El-Natroun	University-associated off-campus facility using desalination technology	Strong for sustainable treatment technology; extraction source needs confirmation
Renewable energy-powered desalination research	Demonstrates energy-efficient treatment of saline water	Strong technological evidence
Smart irrigation project at the Faculty of Agriculture	Demonstrates controlled irrigation to reduce water demand	Supporting evidence; does not independently prove extraction
Water management at Abis agricultural research facilities	Demonstrates water reuse and sustainable agricultural water management	Supporting evidence; water abstraction method needs confirmation
AG-WaMED project, Marsa Matrouh, 2025	Research on sustainable use of non-conventional water resources	Strong research evidence; site-level extraction needs verification

The following images illustrate the water management technologies described in Alexandria University's sustainability documentation.



Figure 1. Solar-Powered Water Desalination – Wadi El-Natroun

The Faculty of Agriculture reports a solar-powered desalination facility at Wadi El-Natroun, with a stated treatment capacity of 100 m^3/day. The source of abstracted water requires confirmation. Illustrative photograph, not verified as the Alexandria University facility.

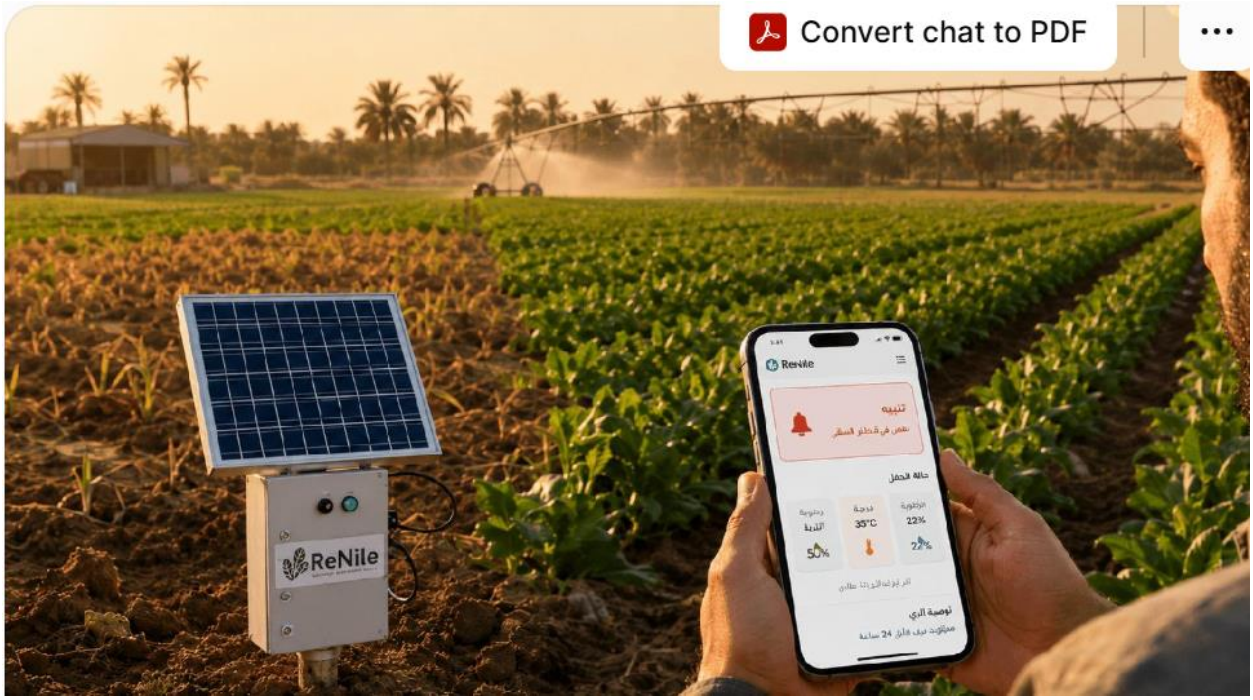


Figure 2. Smart Irrigation Technologies – Faculty of Agriculture

Smart irrigation systems support efficient water application, reduced water losses, and more sustainable agricultural water management. Illustrative photograph of irrigation technology.



Figure 3. Recycling Aquaculture Water – Abis Research Facilities

Figure 3. Recycling Aquaculture Water – Abis Research Facilities
Water from aquaculture activities is reported to be reused for agricultural irrigation, reducing demand for additional freshwater.

The Faculty of Agriculture operates a solar-powered desalination facility at Wadi El-Natroun, with a reported treatment capacity of 100 m^3/day. The University has also developed renewable energy-driven desalination technologies incorporating nanofiltration and multi-stage flash processes. At the Faculty of Agriculture's experimental research facilities in Abis, water from aquaculture activities is recycled for agricultural irrigation. Additional initiatives include smart irrigation technologies, rainwater harvesting, and water recovery systems that reduce pressure on conventional freshwater supplies.
These initiatives demonstrate the University's commitment to improving water-use efficiency, developing sustainable water technologies, and supporting responsible water resource management in Egypt.

The University's official 2024–2025 sustainability documentation provides supporting technical descriptions and photographic evidence of these activities.
Alexandria university applies an integrated water management approach that combines sustainable water extraction from local sources with advanced treatment, recycling, and irrigation systems to protect regional water resources. Through continuous analysis, innovative models, and modern technology, the university enhances wastewater reuse, reduces water pollution, and improves environmental conditions on and off campus. These efforts support efficient processes such as greywater recovery, effluent reuse, desalination, and controlled rain

harvesting, while strengthening system performance and long-term sustainability. This integrated system demonstrates Alexandria university's commitment to developing innovative solutions that enhance water supply, support agriculture, improve water quality, and protect ecosystems across the region, contributing to environmental protection and sustainable development.

Alexandria university implements data-driven sustainable water extraction, management, and recycling practices across its urban campuses and off-campus research sites, supporting water conservation, water supply, and environmental protection.

- The University has allocated approximately 22.41 million m^2, representing 78.89% of its total campus area, to permeable or semi-permeable surfaces that enhance natural water absorption, groundwater recharge, and sustainable stormwater management. These landscapes decrease surface runoff, promote soil infiltration, and strengthen climate resilience while elevating the ecological quality of the campus environment.

- Alexandria University has effectively executed a comprehensive Water Conservation Program, attaining over 50% water savings through optimized irrigation networks, leak detection and maintenance, water-saving technologies, reuse initiatives, and educational awareness campaigns. Water-efficient fixtures, such as low-flow taps, sensor-operated faucets, and high-efficiency flushing systems, are installed across more than 80% of campus facilities. Routine maintenance of water distribution networks further prevents water loss and enhances operational efficiency.

- Water recycling remains a core element within the University's sustainability framework. Over half of all generated wastewater undergoes effective treatment and subsequent reuse across non-potable applications, encompassing landscape irrigation, farming activities, and various campus sanitation. Treated water irrigates green zones, agricultural study farms, modern rooftop gardens, and aquaculture sites. Notable initiatives feature greywater recycling networks, air-conditioning condensate recovery, wastewater treatment units, a 100 m^3 desalination plant, and renewable energy powered desalination technologies effectively highlighting integrated water resource management. To protect vital water supplies, Alexandria University enforces comprehensive modern water pollution control policies featuring wastewater treatment, controlled discharge systems, accredited laboratory monitoring, and thorough continuous water quality assessment.

- Research and innovation advance through the Alexandria University Water Resilience Center of Excellence (AWR-CoE), operating as a national hub for practical research, capacity development, professional training, and global collaboration. The Center drives sustainable water technologies by investigating wastewater treatment, desalination, water reuse, circular economy frameworks, and climate resilience while delivering specialized academic tracks, workshops, scholarships, and strategic partnerships alongside prominent national and international institutions.

SOAC
State-of-the-Art Water Curriculum

SOAC workshop - Alexandria University Water Resilience Center of Excellence AWR-CoE







AWR-CoE
Alexandria University Water Resilience
Center of Excellence

Water Quality Parameters Testing Training &Innovative Teaching Strategies Workshop



Wastewater treatment unit - Faculty of Engineering



100 m^3 Desalination Unit, Wadi El-Natroom - Faculty of Agriculture



Innovative Renewable Energy (RE) Driven - Multi Stage Flash (MSF) System with Salts Precipitator and Nano Filtration (NF) Feed Water preTreatment (RE-NF-MSF) - Faculty of Agriculture

Water recycling initiatives within the university

Alexandria University also documents smaller-scale water recovery initiatives:

- **Faculty of Engineering:** an air-conditioning condensate collection and reuse unit, along with a wastewater treatment unit.
- **Faculty of Pharmacy:** a greywater recycling initiative intended to treat handwashing wastewater for toilet flushing.
- **Faculty of Agriculture:** reuse of water associated with aquaculture and agricultural research for crop irrigation

Alexandria University program for Sewage Disposal

- Providing a sewage treatment plant at the university to make it suitable for irrigating green areas and gardens inside the university campus.
- The irrigated water supplied to the fish farm at the Agriculture Experimental Research Station of the Faculty of Agriculture is recycled to irrigate the crops, vegetables, and fruits of the land farm. The recycled water is rich withnatural fertilizers and enhances the crops production.
- In addition, the water recycling in Fish Aquaculture of the Faculty of Agriculture, Alexandria

University: The watersewage of the Aquaculture of the Faculty of Agriculture, Alexandria University which consist of eight ponds (one acre and quarter/each) in Abis region. Alexandria University used the recycled water for crops culturing in the adjacent agriculture research center in Abis.

- The use of biochar produced from Agricultural waste and waste Forests in residual removal chlorpyrifos pesticide Imidacloprid is from water agricultural drainage. Cooperation project between the Egyptian Academy of ResearchScience and Technology and the Czech Academy of Sciences.
- The sewage water will be treated and reused in the irrigation of green areas in Alexandria National University.
- Faculty of Pharmacy is seeking to implement a grey water (wastewater) recycling system that depends on reusing wastewater from sewage basins only (without using wastewater from laboratory basins) by repumping it into the flushing bins in the toilets after work. Filtration and primary treatment. The grey water recycling initiative has a significant impact on rationalizing water use.



The water sewage of the Aquaculture of the Faculty of Agriculture (Alexandria University, Egypt) The irrigated water supplied to the fish farm at the Agriculture Experimental Research Station of the Faculty of Agriculture is recycled to irrigate the crops, vegetables, and fruits of the land farm.



The sewage water will be treated and reused in the irrigation of green areas in the project (Alexandria University)



Grey water recycling system organized by Faculty of Pharmacy (Alexandria University, Egypt), and reused in rooftop cultivation.





Reclaiming 800 thousand acres in the new delta using treated water from sewage

Off-campus agricultural extraction and desalination

The faculty of agriculture operates two major field sites where raw water extraction and advanced treatment technologies are directly integrated:

- **wadi natroun experimental site:** located in an arid area dependent heavily on groundwater resources, the university operates a 100 cubic meter per day desalination unit. This system treats extracted brackish groundwater through an advanced process to provide an adequate water supply for agricultural research, irrigation, and crop trials.
- **abis research station:** in the abis region, the university manages an extensive aquaculture system consisting of eight large ponds, each spanning 1.25 acres. To reduce reliance on fresh water resources and continuous groundwater extraction, the station implements a closed-loop

water recycling approach. Effluent from fish aquaculture ponds, naturally enriched with organic nitrogen and other nutrients, is captured and redirected to irrigate adjacent fruit, vegetable, and field crops. This process reduces fertilizer requirements, improves water management, and decreases raw water extraction.

On-campus conservation and mechanical recovery

Within the main metropolitan campuses, the university focuses on reducing municipal water intake and introducing alternative water recovery and recycling methods.

- **condensate harvesting:** at the faculty of engineering, specialized air-conditioning water collection and reuse units recover atmospheric condensation from central HVAC systems. This non-potable water is redirected for facility maintenance and campus greenery, improving water conservation and resource efficiency.
- **on-site wastewater treatment:** the faculty of engineering operates a decentralized wastewater treatment unit. Greywater generated on campus undergoes treatment to achieve appropriate quality standards for irrigation of green spaces and gardens, supporting circular water management and reducing wastewater discharge.
- **demand-side reduction:** Alexandria university has retrofitted campus fixtures with sensor-activated faucets, high-efficiency low-flow toilets, and flow regulators. According to the provided data, these measures have reduced overall potable water demand by approximately 50% across university facilities, demonstrating the impact of efficient technologies on water conservation.

Academic and policy leadership

Alexandria university contributes to Egypt's national water strategy through the center of excellence for water, a major research initiative focused on developing innovative solutions to water scarcity, transferring technologies for industrial wastewater treatment, and advancing groundwater modeling. These activities support water resources assessment, water quality monitoring, sustainable desalination, and improved water management, strengthening environmental protection and promoting sustainable development across agricultural, urban, and industrial areas.