

Zahle treated water reuse project

Technical, governance and regulatory works

UNITED NATIONS
الاسكوا
ESCWA

Shared Prosperity Dignified Life

unicef
for every child

UN HABITAT

UNITED NATIONS
الاسكوا
ESCWA

Shared Prosperity **Dignified Life**

VISION

ESCWA, an innovative catalyst for a stable, just and flourishing Arab region

MISSION

Committed to the 2030 Agenda, ESCWA's passionate team produces innovative knowledge, fosters regional consensus and delivers transformational policy advice. Together, we work for a sustainable future for all.

Zahle treated water reuse project

Technical, governance and regulatory works

United Nations

This document describes the installation and operation of a treated water reuse system in Zahle, Lebanon. It was prepared by UNICEF, with support from ESCWA, under the project Resilient Water Solutions Against Climate Change in Jordan and Lebanon (RWS-CCAF), which is led by UN-Habitat and funded by the Adaptation Fund.



Contents

Executive summary 5

Pillar 1: Technical component 6

A. Assessment 6
B. Design and execution 6
C. Water quality 11

Pillar 2: Local governance 12

A. Role and responsibilities 12
B. Core activities 12
C. Guiding principles 13
D. Voting and decision-making 13
E. Decision-making bodies 13
F. Water tariff collection 14

Pillar 3: Interministerial regulation 15

Financing, costs and sustainability 17

Impact and lessons learned 18

A. Impact 18
B. Lessons learned 18

Conclusions and potential for extension 19

Annexes

Annex 1. النظام الداخلي لجمعية مستخدمي مياه الري في منطقة زحلة، حوش الأمراء 21

Annex 2. Regulator Committee Terms of Reference 26

Annex 3. Proposed incident report template 34

Annex 4. Emergency response notification protocols 38

List of tables

Table 1. Classes of reclaimed water quality 11

Table 2. Responsibilities per function and linkages 16

List of figures

Figure 1. Reuse scheme and phases 6

Figure 2. Daily water needs in a year based on cultivated crops in 2024 7

Figure 3. Roles of the members of the Regulator Committee 15

Figure 4. Sampling points and monitoring responsibilities 17

Executive summary

The targeted agricultural area in Zahle, Lebanon, experiences severe hydric stress, as its primary irrigation source, the Berdaouini River, becomes inaccessible to the area from June onwards. Confronted with this seasonal water scarcity, farmers have increasingly resorted to unlicensed private wells, many of which are solar-powered. This has resulted in widespread, unregulated groundwater abstraction, posing a significant threat to the long-term sustainability of the underlying aquifer.

To address this critical challenge, a project funded by the Adaptation Fund and implemented by UN-Habitat in partnership with UNICEF assessed the feasibility of reusing treated effluent from the Zahle Wastewater Treatment Plant (WWTP) as an alternative and underutilized water resource. Zahle WWTP is currently the only large-scale wastewater treatment facility in Lebanon equipped with a fully operational tertiary treatment system, comprising disc filtration and UV disinfection units, with a designed treatment capacity of 37,500 m^3/day. The initiative aims to mobilize up to 12,500 m^3/day of treated wastewater to irrigate approximately 840 hectares of agricultural land, thereby reducing uncontrolled groundwater abstraction with a reliable, safe, and equitably managed water supply.

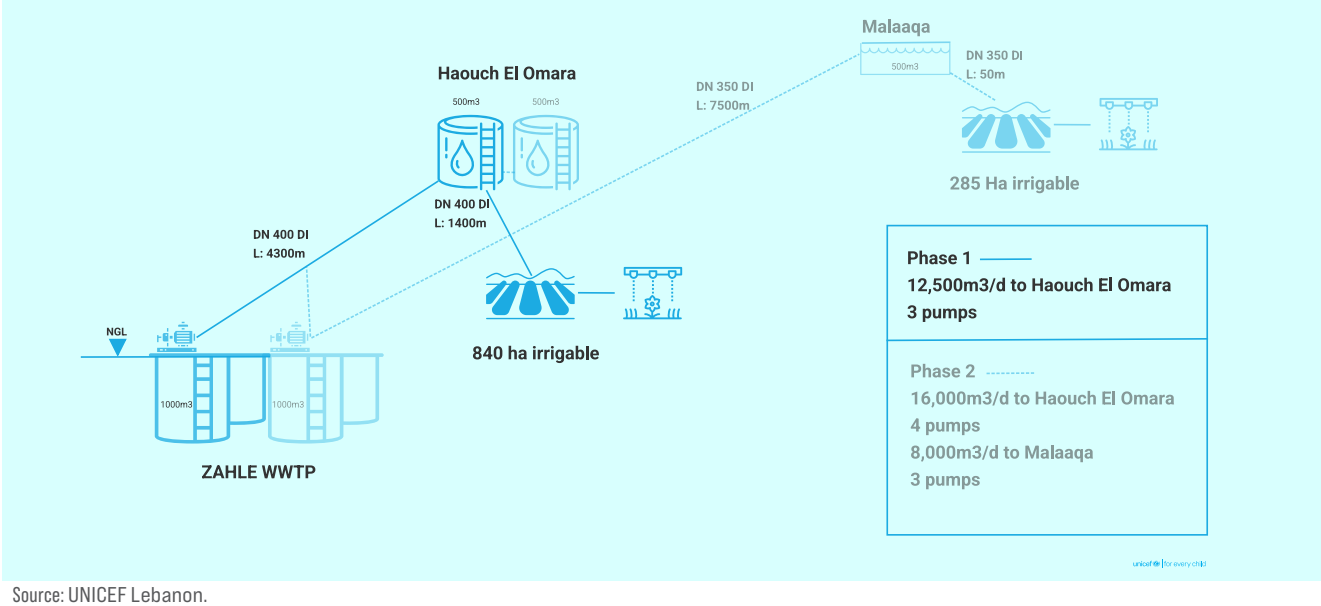
UNICEF developed a comprehensive intervention structured around the following three integrated pillars:

- **Technical component:** designing and constructing storage reservoirs, pumping facilities and irrigation distribution networks to ensure reliable service delivery and equitable water allocation at the individual plot level.
- **Local governance:** establishing the Water Users Association (WUA) responsible for irrigation system operation and maintenance, fair water distribution and the implementation of cost-recovery and tariff collection mechanisms, which liaises constantly with the utility company, namely the Bekaa Water Establishment (BWE).
- **Interministerial regulation:** forming a regulatory committee bringing together the Ministry of Energy and Water, BWE, the Ministry of Agriculture, the Ministry of Environment, the Ministry of Public Health, the Ministry of Industry and the Ministry of Economy and Trade. The Committee oversees regulatory compliance, water quality monitoring, inspection protocols, and the development of standardized monitoring and reporting tools.

Phase 1 of the project, fully financed by the Adaptation Fund, was successfully completed in 2025. Phase 2 aims to expand the reuse scheme by extending the supply capacity to 16,000 m^3/day towards Haouch El Omara, and delivering an additional 8,000 m^3/day to Malaaqa Aradi. This phase will require the construction of an additional pumping station. The estimated capital expenditure for phase 2 is $3.3 million. In addition, a 400 kW photovoltaic (PV) system will be installed to reduce operational energy costs and strengthen the scheme's long-term financial sustainability.

Figure 1 presents the executed phase 1 components and the designed phase 2 with current and project daily flow for the reuse of the treated water generated by Zahle WWTP.

Figure 1. Reuse scheme and phases



Source: UNICEF Lebanon.

Pillar 1: Technical component

A. Assessment

UNICEF, with the support of the Lebanese Organisation for Studies and Training (LOST) (a local non-governmental organization), undertook a detailed assessment to define the extent of the targeted agricultural area, land tenure arrangements, and the types of crops currently cultivated. The assessment also examined existing irrigation practices, coping mechanisms adopted to address the absence of surface water after June, and corresponding agricultural water requirements.

This assessment constituted a cornerstone for the project design, enabling a sound understanding of farmers' needs, priorities, and expected outcomes, and ensuring that the proposed infrastructure and governance arrangements were appropriately tailored to local conditions.

The following map presents the targeted area of 840 hectares benefitting from the reuse of the treated water.

Based on the findings, the assessment quantified farmers' water costs at approximately $0.45/m^3 and established baseline irrigation demands. The analysis demonstrated that the planned reuse scheme would cover between 30% (at 12,500 m^3/day) and up to 50% (at 16,000 m^3/day) of total agricultural water needs within the targeted area.

Farmers expressed a strong preference for a fully metered water delivery system at the plot level, with discharge rates sized according to the irrigated surface area. While this option was technically assessed, its implementation would have been challenging and required a capital investment approximately three times higher than the available budget and was therefore not pursued under the current project scope.

B. Design and execution

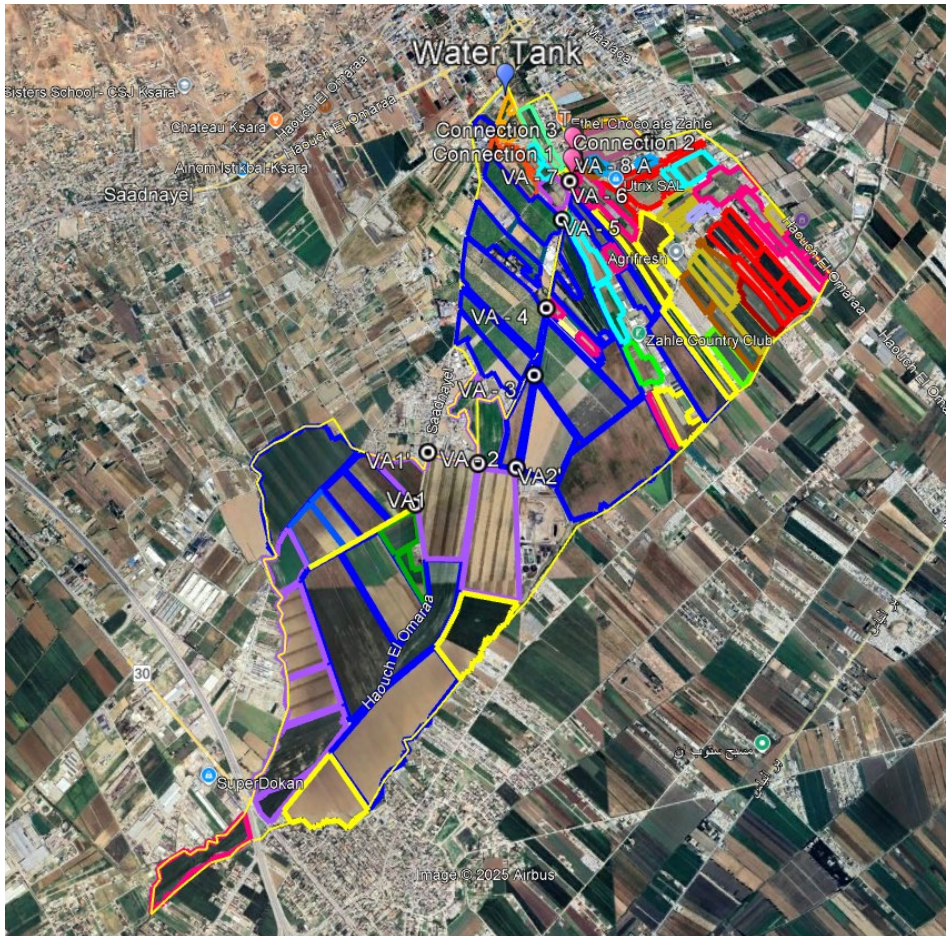
The system design was developed in response to the topographical, hydrological and operational constraints of the region. The infrastructure comprises two main reservoir sites, a dedicated pumping station, transmission pipelines, and multiple distribution outlets connected to existing irrigation channels.

1. Key infrastructure components

(a) Reinforced concrete reservoirs

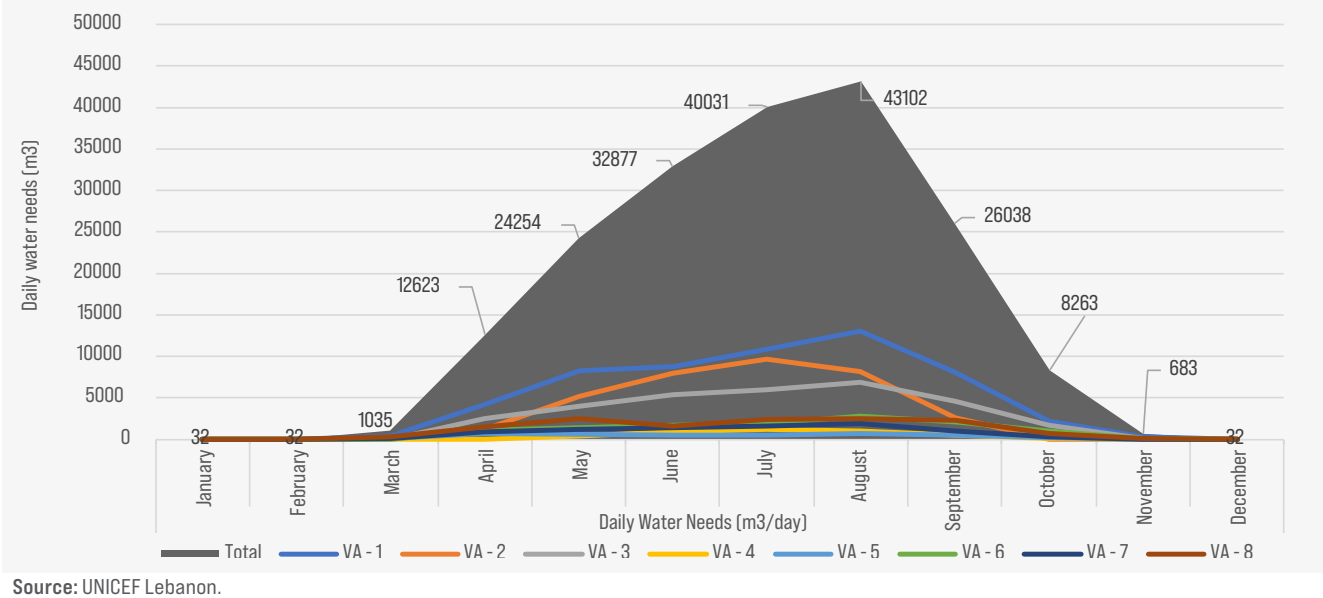
Reservoir 1 (equalization tank): located within the Zahle WWTP premises at a lower elevation, this 1,000 m^3 equalization tank receives treated effluent (after tertiary treatment) prior to pumping. The pumping station is constructed directly above the tank. Before the tank an automatic shutdown and diversion to avoid pumping or contaminating the equalization tank with uncompliant water.

Map. Haouch El Omara targeted area



Source: Provided by UNICEF and LOST.

Figure 2. Daily water needs in a year based on cultivated crops in 2024



Source: UNICEF Lebanon.
Note: VA – valve.

Reservoir 2 (storage tank): a 500 m^3 storage reservoir located in Haouch El Omara at a higher elevation, enabling gravity-fed distribution to downstream irrigation networks.

Pumping station: constructed adjacent to the Zahle WWTP, the pumping station includes a sump pit and is equipped with three submersible single-stage pumps (each with a capacity of Q = 62 l/s and a head of 70.5 m). The pumps lift treated effluent from the WWTP to the elevated Haouch El Omara reservoir. The reservation for a fourth pump was installed to ease future installation.

(b) Transmission pipelines

- **Pumping line:** a 400 mm diameter ductile iron pipeline extending 4,300 m from the Zahle WWTP to the Haouch El Omara reservoir.
- **Gravity line:** a 400 mm diameter pipeline extending 1,400 m from the Haouch El Omara reservoir to the existing irrigation channels.

Distribution system: the system connects to existing concrete and steel irrigation channels at multiple delivery points (DP1, DP2, DP3, DP4, DP5, the UNDP channel, and the New Zone). This configuration enables equitable water distribution across approximately 840 hectares of agricultural land within the targeted area.

Solar power rehabilitation: the existing solar power system at Zahle WWTP was rehabilitated to supply energy to the pumping station, reducing operational costs and enhancing the overall sustainability of the scheme. Still to cut the energy cost of the current scheme, the installation of a 400kWp solar farm would reduce water costs by 85%. This work could not be undertaken under the current project but should be a priority for WUA and other stakeholders.



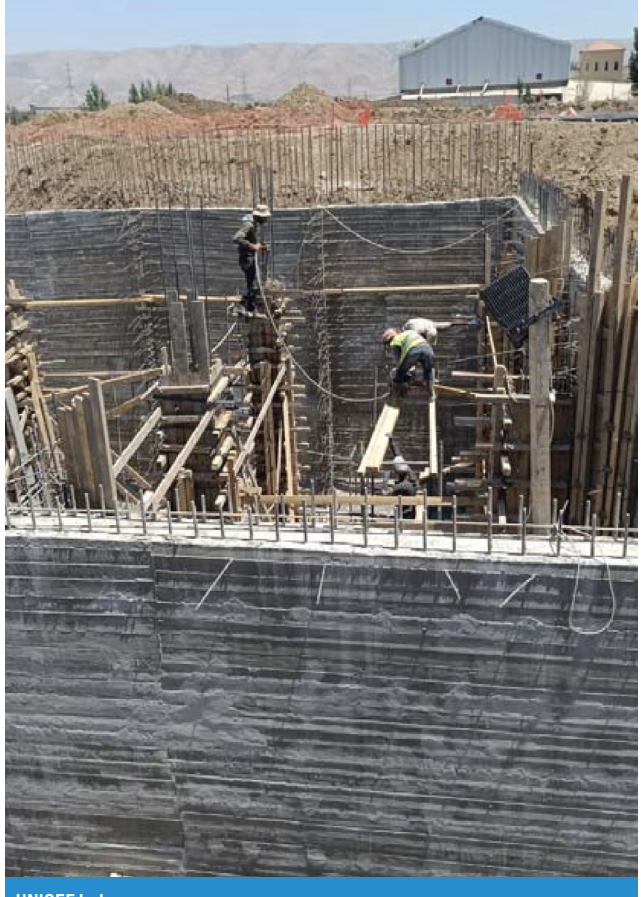
Pumping station at Zahle WWTP
UNICEF Lebanon



Signboard presenting all the stakeholders in the construction of the reuse scheme
UNICEF Lebanon



Reservoir under construction
UNICEF Lebanon



UNICEF Lebanon



UNICEF Lebanon



UNICEF Lebanon





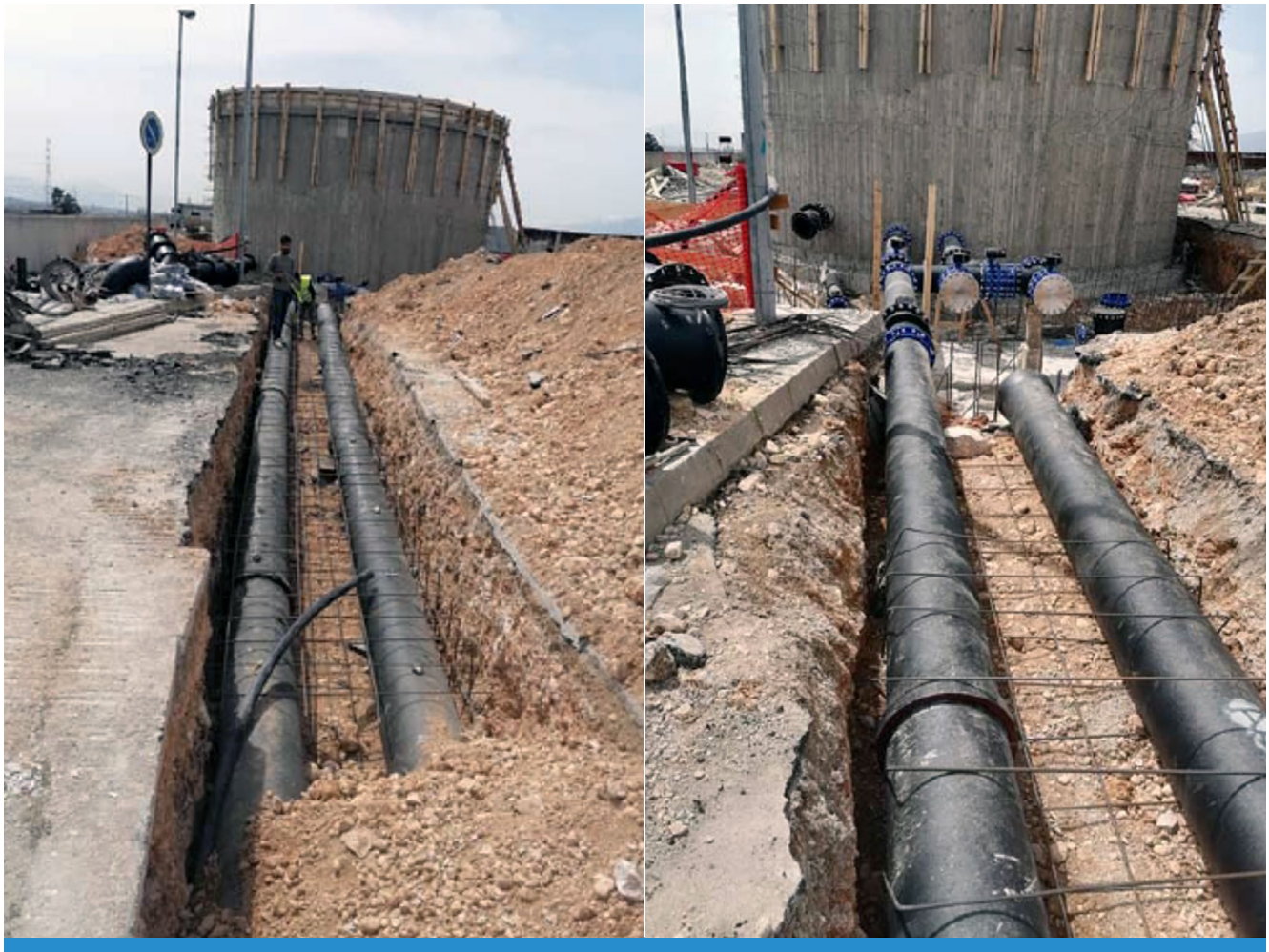
Reservoir of 500m^3 in Haouch El Omara
UNICEF Lebanon



Metered discharge point providing water to the existing distribution channels
UNICEF Lebanon



Reinforcement of the pressurized transmission line lifting water from Zahle WWTP to the elevated reservoir of Haouch el Omara
UNICEF Lebanon



Reservoir and the associated transmission and distribution lines
UNICEF Lebanon

C. Water quality

Treated wastewater produced at the Zahle WWTP complies with class I effluent requirements under the Lebanese National Water Reuse Standard NL 819:2024. Monitoring data indicate consistent compliance following tertiary treatment, with biochemical oxygen demand below 20 mg/L, chemical oxygen demand below 100 mg/L, total suspended solids below 10 mg/L, and Escherichia coli concentrations below 10 CFU/100 mL.

Table 1. Classes of reclaimed water quality

Reclaimed water quality class	BOD5 (mg/L)	COD (mg/L)	TSS (mg/L)	E.coli (CFU/100 mL)	Intestinal nemotodes_helminth eggs (eggs/L)	Other
I	≤20	≤100	≤25	≤100	1	Legionella spp.: <1,000 CFU/L where there is risk of aerosolization in greenhouses
II	≤25	≤125	≤25	≤1,000		
III	≤100	≤250	≤60	≤10,000		

Source: LIBNOR standards - NL 819-2024 Water Reuse in Irrigation, 2024.

The BWE, as the local water utility, is responsible for the operational management of WWTP and for water quality assurance. BWE conducts self-monitoring at the WWTP outlet in accordance with the minimum monitoring frequencies prescribed by the Lebanese Standards Institution (LIBNOR) standards.

In addition, the Ministry of Energy and Water, with the support of the Ministry of Environment, independently assesses the quality of the treated effluent on a monthly basis during the irrigation season, providing regulatory oversight and external quality control.

To further mitigate any risk of non-compliant effluent entering the reuse system, UNICEF has commissioned the contractor responsible for the scheme's construction to install an automatic shutdown and diversion mechanism linked to an online TSS probe. This safeguard prevents treated wastewater exceeding the permissible TSS threshold from entering the 1,000 m^3 equalization tank located at the pumping station, thereby avoiding contamination of downstream infrastructure and unintended reuse.

Throughout the operational reuse period, treated water quality was tested in accordance with LIBNOR requirements and remained fully compliant. By mid-December 2025, the TSS probe sensor had been fully installed and commissioned, ensuring that any non-compliant effluent is automatically diverted and prevented from entering the reuse system, thus safeguarding public health, agricultural production, and system integrity.

Pillar 2: Local governance

A. Role and responsibilities

WUA is a non-profit organization under Lebanese law to manage treated water distribution, ensure equitable access, and promote sustainable irrigation practices in the Zahle region. The statutes, bylaws and map of the perimeter of the association are presented in annex 1.

The primary objective is to manage irrigation water within the geographic scope specified in the licensing decree, in accordance with Lebanese water law, the Ottoman Irrigation Law, and the decree on organizing irrigation water user associations.

B. Core activities

Operation, maintenance and upkeep: managing the distribution network within the association's jurisdiction in coordination with BWE and the municipality.

Water allocation and tariff collection: regulating water use and collecting irrigation water fees and membership contributions in exchange for services provided. The irrigation tariff is established through an annual contract between WUA and BWE. The WUA Board and the General Assembly will approve any additional fees to be borne by water users to cover the costs of operating and maintaining the association, as well as the association's own administration and maintenance responsibilities.

Environmental protection: implementing measures to combat soil vulnerability, salinity, pollution and promote environmental protection.

Capacity-building: training members on modern irrigation techniques, irrigated agriculture practices, water conservation methods, and rational use of agricultural fertilizers and pesticides.

Infrastructure management: providing equipment, machinery, irrigation tools and materials necessary for operating and maintaining the water distribution network.

Infrastructure development: contributing to the establishment, improvement, rehabilitation, operation and maintenance of complementary irrigation project infrastructure, particularly main and secondary drainage channels, with Municipality and Water Establishment.

Dispute resolution: seeking to resolve disputes among association members or with third parties.

Stakeholder representation: the Board members elected on the 21 November 2025 shall represent the association and monitor its files and those of its members before relevant official authorities.

C. Guiding principles

Justice and equity: ensuring fair and equitable decision-making and water distribution, in line with the hydraulic model developed by the Bureau Technique pour le Développement (BTD) presented after. Each year, once the subscriptions are collected and finalized, WUA will run a new simulation to ensure the provision of the water to every plot considered as subscribing based on its surface area.

Rational resource use: managing distribution networks rationally to avoid excessive water use, soil erosion, salinization, pollution, and promote environmental protection.

Non-discrimination: no association member shall be subject to discrimination in any form.

Transparency and participation: operating transparently and encouraging active member participation in governance bodies.

Financial viability: ensuring sustainable financial management.

Regulatory compliance: respecting laws, general directives and implementation plans.

WUA will ensure equitable water distribution among members based on cultivated land area. The distribution model, developed by BTD, allocates the available 12,500 m^3/day (144.7 l/s) proportionally across six irrigation zones.

Within each irrigation zone, water is distributed to individual farmers proportionally to their cultivated area through time allocation. Each irrigation zone operates on a six-day cycle (144 hours), with each farmer receiving irrigation time calculated as follows:

$$\text{Allocated Time (hours)} = \frac{\text{Farmer's Plot Area } (m^2)}{\text{Total Zone Area } (m^2)} \times 144 \text{ hours}$$

This approach ensures the following:

- Water distribution is transparent, predictable, and equitable.
- Farmers with larger plots receive proportionally more water.
- All farmers within a zone receive water within the same six-day cycle or on a shorter period based on the approved allocation and distribution planned by WUA, ensuring that everyone gets the volume allocated to them.
- The system operates continuously (24 hours/day) to maximize water resource availability.
- A shawa (a local irrigation monitoring personnel) has been hired and trained to ensure and monitor the distributed water resource.

D. Voting and decision-making

Owners have decided to be represented based on the percentage of land owned, and the statutes and bylaws have been defined accordingly. The vote weight is based on the percentage of the land owned or cultivated with legal representation from the owner.

Each member's voting weight is calculated as: (member's irrigated area/total association irrigated area) × 100.

For example, a member with 5 hectares in the 840-hectare total area would have 0.595% of total votes.

Major decisions requiring membership approval (tariff changes, infrastructure investments, bylaw amendments) are approved if supported by members representing at least 50% of the total irrigated area.

Extraordinary decisions (dissolution, merger, major financial obligations) require support from members representing at least 66.7% of the irrigated area.

E. Decision-making bodies (composition of WUA)

General Assembly: composed of all WUA members, meets at least annually to:

- Approve annual budgets and financial reports.
- Elect the Board of Directors.
- Approve tariff structures and fee schedules.
- Review operational performance and approve strategic plans.
- Amend bylaws and approve major policy changes.

Board of Directors: elected by the General Assembly for defined terms (typically three years), responsible for:

- Undertaking day-to-day management and operational oversight.
- Hiring and supervising WUA staff members.
- Implementing decisions of the General Assembly.
- Preparing budgets and financial reports.

- Representing WUA in external relations.
- Resolving routine disputes and enforcement actions.

Technical committees: composed of two different technical committees.

Mediation and Arbitration Committee: composed of three to five members for three years.
Tasked to resolve disputes related to the use and distribution of water among members.

Monitoring Committee: composed of three people for a minimum of three years. Members are tasked with:

- Supervising the financial activity of WUA, which must be audited at least once a year.
- Submitting the annual report on the financial and economic management of WUA.

A representative of BWE responsible for supervising WUA automatically participates in the Monitoring Committee, without the right to vote.

The committees are established to oversee the following functions:

- Infrastructure maintenance and improvement priorities.
- Water quality monitoring and agricultural practices.
- Financial management and audit oversight.
- Conflict resolution and dispute mediation.

F. Water tariff collection

WUA collects revenues from multiple sources to cover operational costs, maintenance and services.

1. Revenue sources

- **Annual membership contributions**: may be proportional to the different voting rights members hold, covering fixed, recurring and various association expenses.
- **Distribution network maintenance fees**: fixed portion of tariff paid by members, calculated based on irrigated property area.
- **Volume of water use**: WUA monitors the volume of water delivered at each distribution point and allocates irrigation time based on an annual distribution model, which is determined by the number and area of irrigated plots. This represents the largest component of the irrigation tariff and is currently estimated at $0.15/m^3$.
- **Subsidies, grants and financial aid**: when available.
- **Interest**: on overdue fees owed to WUA and on funds deposited in bank accounts.
- **Other service fees**: for services provided by WUA.

Fixed tariff components (paid annually, whether property is irrigated or not): could be fixed between $10 and $50 per hectare and may include:

- Distribution network maintenance costs.
- Operation and maintenance costs for monitoring equipment and common facilities.
- Special service fees.
- Salaries and wages of work teams and other fixed association costs.
- Provision of balance to the association's reserve fund.

Variable tariff components (calculated based on water usage):

- Proportional to quantity of irrigation water used (measured by water meters in pressurized networks) or number of irrigations per season (in open channel networks).
- Includes operational costs for distribution, water delivery, salaries, electricity for water supply and fees paid to the water establishment or project investor as per supply contract.
- The remaining costs are recovered through a volumetric water tariff. In February 2026, WUA approved an initial variable tariff, estimated to add $0.02–0.03/m^3$ to the fixed rate paid to the establishment, resulting in a total tariff of approximately $0.17–0.18/m^3$.

2. Reserve Fund

- WUA maintains a reserve fund in a secure interest-bearing bank account to finance emergency repairs and long-term rehabilitation. Initial reserves were established during a transitional period in which UNICEF supported operation and maintenance costs and BWE supplied water free of charge, enabling farmers' contributions to seed the emergency fund.
- All surplus revenues are transferred to the reserve fund.
- To ensure compliance, WUA may apply interest on overdue payments and impose sanctions, including warnings, fines (up to 10% of the monthly bill), temporary water suspension (up to two weeks), seasonal deprivation of irrigation and, if necessary, legal action.

Enforcement: the association may impose a reasonable interest rate on overdue fees. Members who fail to pay owed amounts may face sanctions including warnings, fines (up to 10% of monthly bill), temporary water supply suspension (up to 2 weeks), or deprivation of irrigation for one or two seasons. Legal proceedings may be initiated for persistent non-payment.

Pillar 3: Interministerial regulation

The Regulator Committee serves as the central governance and oversight body for the Zahle wastewater reuse project, operating under Lebanese National Water Reuse Standard NL 819/2024. The Committee functions as an integrated multi-ministerial coordination mechanism where each member's obligations are systematically interconnected and mutually reinforcing, ensuring comprehensive oversight from water treatment through agricultural applications and trade compliance.

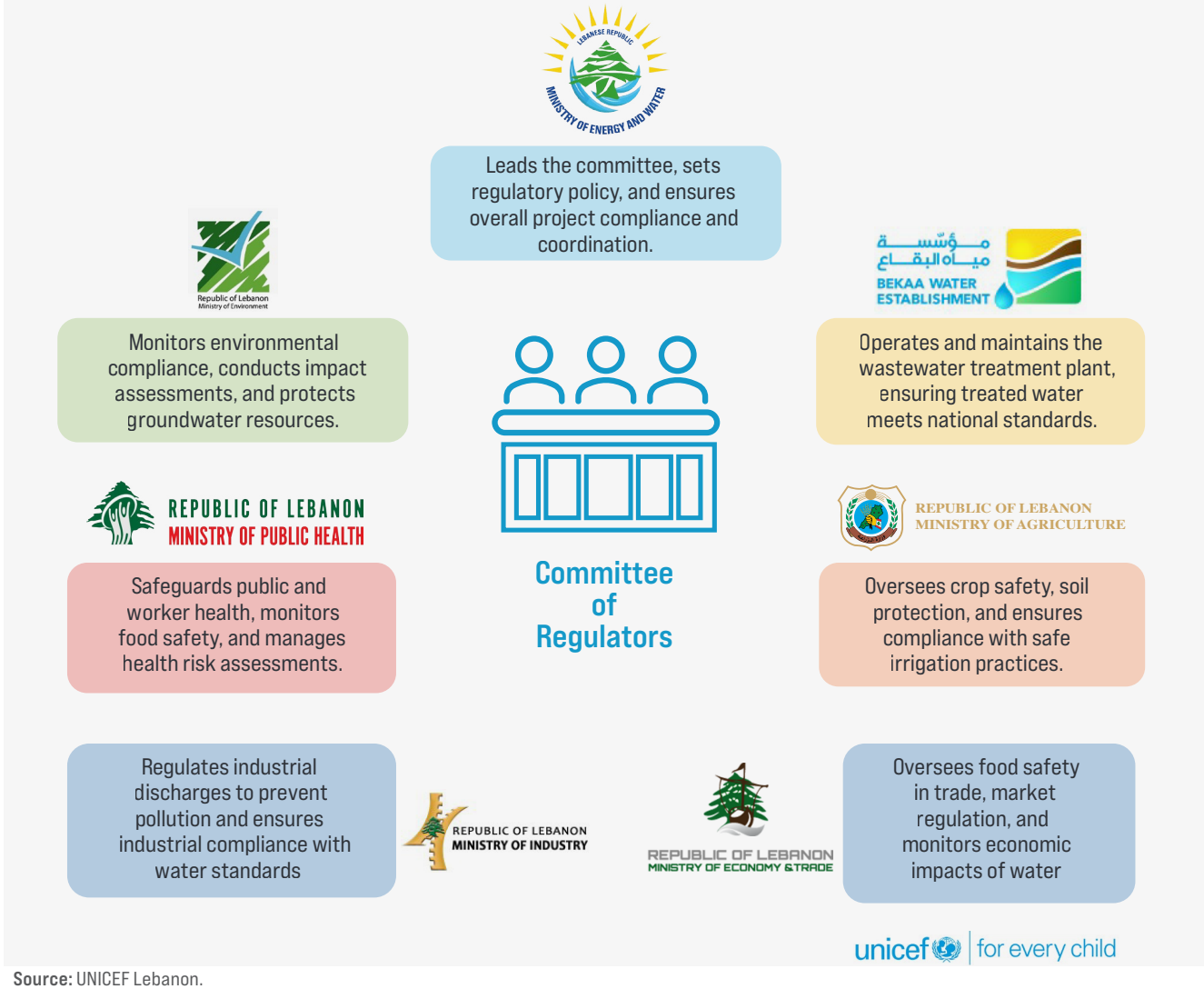
1. Government policy leadership

- Developing integrated policies (decrees) and binding decisions.
- Coordinating resources across project ministries/stakeholders.
- Managing relationships with WUA, farmers, communities.

2. Operational oversight

- Coordinating monitoring activities.
- Providing emergency response.
- Enforcing compliance with standards and regulations.
- Conducting overall project performance evaluation.

Figure 3. Roles of the members of the Regulator Committee



Source: UNICEF Lebanon.

3. Coordination

- Aligning all government agency activities towards a common goal.
- Resolving conflicts between different stakeholders.
- Ensuring consistent communication across different levels.

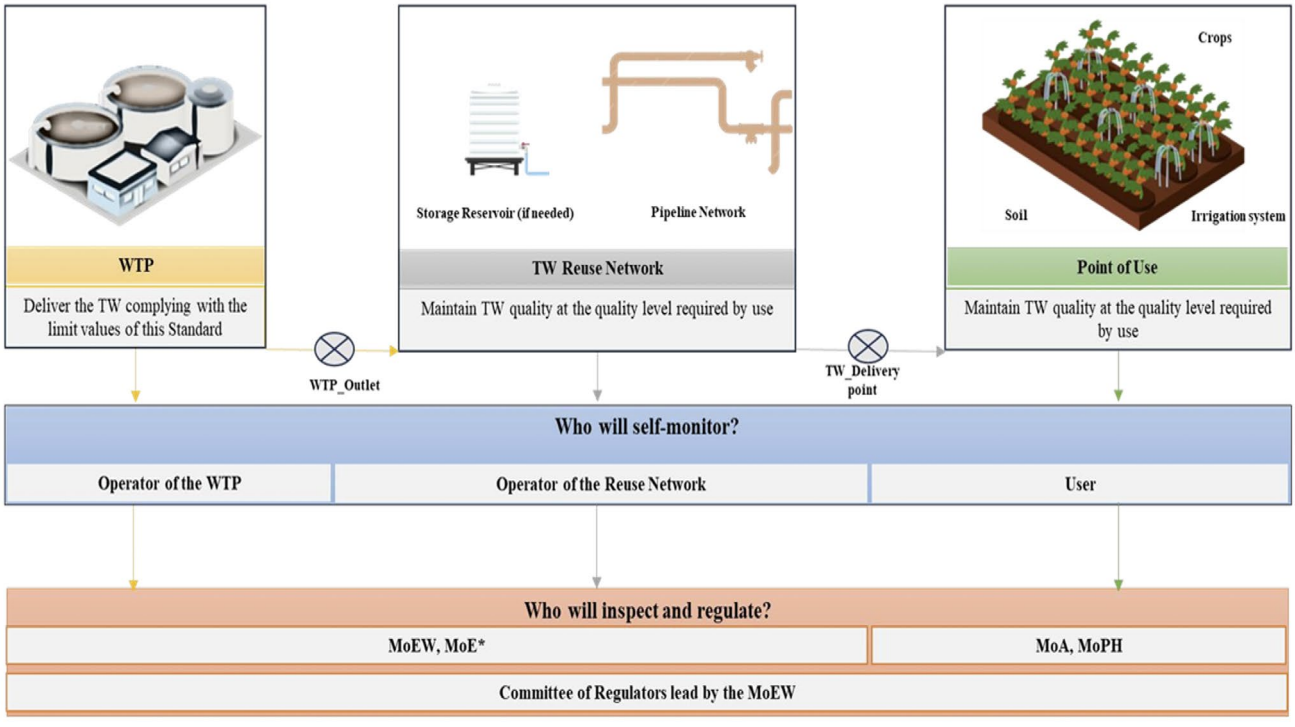
Table 2 sets out the different roles and responsibilities per function.

Table 2. Responsibilities per function and linkages

Function	Lead party	Supporting partners	Obligation linkages
Water quality assurance	BWE	MoEW, MoE, MoPH	BWE monitors → MoEW validates → MoE assesses environmental compliance → MoPH evaluates health risks → All ministries use data for sector-specific decisions
Agricultural safety	MoA with LARI	MoPH, MoET, BWE	MoA with LARI inspects crops, soil and irrigation water at the users' fields → MoPH validates food safety → MoET ensures trade compliance → BWE provides quality assurance data → All ministries coordinate enforcement
Environmental protection	MoE	MoEW, MoI, BWE	MoE monitors environmental compliance from Decision 8/1 (2001) – MoE → MoI controls industrial certification and MoE monitor the discharges risks → BWE reports treatment effectiveness → MoEW coordinates regulatory response → All ministries implement environmental measures
Public health protection	MoPH	MoA, MoET, BWE	MoPH Monitors health risks in case of alert → MoA implements agricultural controls → MoA monitors food safety with support of MoET → BWE ensures water quality → All ministries coordinate health protection
Industrial compliance	MoI	MoE, BWE, MoEW	MoE/MoI monitors environmental compliance of discharge → MoI enforces permits → BWE reports treatment impacts → MoEW coordinates enforcement → MoI / MoE and MoEW ensure industrial compliance (only MoI can request corrective actions)
Trade compliance	MoET	MoA, MoPH, MoI	MoET monitors trade standards → MoA ensures agricultural quality → MoET/MoA validates food safety for local market and exported products → MoI ensures industrial compliance → All ministries coordinate trade protection

Source: UNICEF Lebanon.

Figure 4. Sampling points and monitoring responsibilities



Source: LIBNOR Standards NL 819-2024, 2024.

Financing, costs and sustainability

The project was fully financed under the "Resilient water solutions against climate change" programme, funded by the Adaptation Fund, with UN-Habitat serving as the implementing entity and UNICEF and ESCWA acting as executing entities. A total of $2.2 million was disbursed to cover the design, development and construction of the reuse scheme and the development of WUA.

As illustrated in figure 1, a second phase could be developed to increase the total reuse capacity to 24,000 m^3/day. This expansion would be achieved by increasing the supply to the area currently served under phase 1 from around 12,500 m^3/day to 16,000 m^3/day, and providing an additional 8,000 m^3/day to agricultural plots located at higher elevation in the Malaaqa Aradi area. The civil works required for phase 2 are estimated at an additional $3.3 million in capital expenditure.

Implementation of phase 2 will be considered only after several years of demonstrated success of phase 1, both in terms of technical performance and social acceptance, as well as the establishment of a sustainable and effective operational relationship between BWE and WUA, including sound internal governance within the WUA itself.

Subject to the successful validation of phase 1 outcomes, the relevant ministry should seek external financing to cover the phase 2 capital expenditure of $3.3 million. In the interim, and as a transitional optimization measure, the ministry could procure an additional pump to increase system performance up to 16,000 m^3/day, along with the installation of a 400 kWp PV system, which would reduce operational energy costs by approximately 85%.

However, the current footprint of the Zahle WWTP is highly constrained due to existing infrastructure, planned treatment extensions, and the proposed installation of solar sludge dryers. As a result, additional land outside the WWTP premises must be secured to enable the installation of the proposed PV system and associated infrastructure.

Impact and lessons learned

A. Impact

The Zahle treated wastewater reuse project generated significant and measurable impacts across water security, environmental sustainability, institutional strengthening and social cohesion, demonstrating the value of treated wastewater as a strategic resource in water-stressed agricultural contexts.

Water security: the project successfully mobilized up to 12,500 m^3/day of treated effluent, enabling the irrigation of approximately 840 hectares of farmland. This supply provided a critical alternative to unsustainable groundwater abstraction during the peak summer months, when the Berdaouini River ceases to flow. The reused water covered approximately 30% of the estimated irrigation demand in the targeted area and became the only publicly managed water resource available during midsummer, as all other sources consisted of private, deep, and largely unregulated wells.

Environmental impact: by substituting groundwater abstraction with treated wastewater, the project significantly reduces pressure on aquifers already threatened by uncontrolled extraction. It promotes a shift towards sustainable and circular water management, closing the loop between wastewater treatment and agricultural reuse. Environmental safeguards were reinforced through systematic monitoring led by the Ministry of Environment, ensuring protection of groundwater resources and soil quality throughout the reuse period.

Institutional impact: the project established the functional WUA with legal status, democratic governance structures, and transparent operational procedures. In parallel, the integrated multi-ministerial Regulatory Committee was created, linking water treatment, agricultural use, environmental protection, public health, and market compliance. This institutional arrangement represents a replicable governance model for wastewater reuse projects in Lebanon and the wider region.

Social impact: the reuse scheme enabled equitable water distribution across six irrigation zones covering approximately 840 hectares, reducing tensions associated with unequal access to water. Farmers were empowered through participation in WUA governance and decision-making processes, while targeted training improved knowledge of modern irrigation techniques, water conservation practices, and the safe handling of treated wastewater.

B. Lessons learned

A critical lesson emerged regarding farmer engagement. During the early stages of the project, farmer involvement remained limited, as many farmers were initially reluctant to engage fully in the design process or in establishing WUA. This hesitancy was largely driven by the technical complexity of the project and the involvement of multiple institutional actors, which made the initiative difficult to grasp and, at times, reduced confidence in its effective implementation. While farmers' comments were collected, reviewed and technically assessed, meaningful engagement only increased once physical infrastructure became visible during construction, providing tangible reassurance that the project would be effectively delivered. Farmer participation intensified significantly during the 2025 drought, which served as a critical reality check and clearly demonstrated the necessity and value of the reuse scheme.

This experience highlighted that early and continuous farmer engagement is essential to ensure ownership, trust and long-term sustainability. Farmers should be actively consulted during the technical design phase to ensure that infrastructure configurations align with actual irrigation practices and field realities and that technical decisions or imperatives are totally understood. Transparent communication on system benefits, operational rules and governance arrangements should begin well before construction, while site visits and hands-on demonstrations during implementation have significantly strengthened confidence and participation.

1. Recommendations for future projects

Future wastewater reuse initiatives should prioritize the following:

- **Early stakeholder engagement**, including farmer consultations and participatory design workshops during planning and design stages to understand the effect of the climate change on their habits and farmer uses.

- **Capacity-building** on wastewater reuse benefits, health safeguards, irrigation techniques and WUA governance prior to system commissioning.
- **Transparent and continuous communication** through regular community meetings, field visits and demonstration activities.
- **Demonstration plots** to showcase safe irrigation practices and crop performance under treated wastewater reuse. Zahle could be one of those systems for farmers in the Bekaa region.
- **Gradual formation of water user associations**, starting during the design phase to ensure operational readiness upon infrastructure completion.

2. Institutional coordination

The integrated multi-ministerial Regulatory Committee proved effective in providing comprehensive oversight but requires sustained institutional support. Clear terms of reference and decision-making authority for each ministry, regular coordination mechanisms (daily operational monitoring, monthly reviews, quarterly assessments, and annual stakeholder forums), shared information systems for real-time data exchange, and dedicated resources for coordination and emergency response are essential to maintain effectiveness.

Overall, the project demonstrates that treated wastewater reuse can deliver strong climate adaptation, environmental protection, and social benefits when supported by robust institutions, inclusive governance, and sustained stakeholder engagement.

Conclusions and potential for extension

The Zahle treated wastewater reuse project has successfully demonstrated that an integrated and well-governed reuse scheme can provide a viable, sustainable response to chronic hydric stress in water-scarce agricultural regions. By strategically mobilizing treated wastewater as a non-conventional water resource, the project addressed both immediate irrigation needs and long-term water security challenges, while reducing pressure on overexploited groundwater aquifers.

The project's success lies in its comprehensive approach, which combined robust technical infrastructure, inclusive and democratic local governance, and coordinated multi-ministerial regulatory oversight. Together, these elements established a functional and replicable model for wastewater reuse that is aligned with national standards and adaptable to similar contexts in Lebanon and across the Arab region.

From a technical perspective, the scheme delivered high-quality infrastructure, including reservoirs, pumping stations, transmission pipelines and distribution interfaces, designed to ensure reliable service delivery and equitable water allocation across a large and diverse agricultural area. The system demonstrated its operational effectiveness under real conditions, particularly during periods of minimal rainfall when farmers traditionally rely on rainfed agriculture or emergency groundwater abstraction.

Equally important was the project's governance innovation. The establishment of the legally recognized WUA introduced transparent, participatory decision-making mechanisms at the local level, enabling farmers to collectively manage water distribution, resolve disputes and engage constructively with BWE. This institutional arrangement strengthened accountability, built trust among users, and enhanced the social acceptance of treated wastewater reuse.

At the regulatory level, the creation of the multi-ministerial Regulatory Committee brought together all relevant authorities, spanning water, agriculture, environment, health, industry and economic oversight, under a single coordination framework. This structure ensured systematic compliance with Lebanese National Water Reuse Standard NL 819:2024, reinforced environmental and public health safeguards, and enabled clear delineation of roles and responsibilities for monitoring, inspection and enforcement.

Environmental and health protection were central to the project design and implementation. Continuous water quality monitoring, independent verification during the irrigation season, and the installation of automated emergency shutdown mechanisms ensured that only compliant class I effluent entered the reuse system. These measures significantly reduced health risks and reinforced confidence among farmers, regulators, and consumers.

Financial sustainability was also addressed through a combination of tariff collection mechanisms, reserve fund planning, and the integration of solar energy to reduce operational costs. This approach helped ensure affordability for smallholder farmers while maintaining the long-term viability of the system.

In doing so, the project effectively responded to a series of critical challenges: the seasonal cutoff of the Berdaouni River after June, unregulated groundwater extraction threatening aquifer sustainability, the need for equitable water sharing among diverse farmers, complex inter-institutional coordination requirements, and the imperative to safeguard environmental and public health standards within tight financial constraints.

Looking forwards, the project presents strong potential for extension. Phase 2 could increase reuse capacity from around 12,500 m^3/day to 16,000 m^3/day for the Haouch El Omara area through the installation of an additional pump, while a further extension could supply 8,000 m^3/day to higher-elevation agricultural plots in the Malaaqa Aradi area. In addition, the installation of a 400 kWp photovoltaic system would enable to cut the actual cost of treated water by 85%.

Such expansion should be pursued only after several years of demonstrated success of phase 1, particularly in terms of technical reliability, farmer satisfaction, and the durability of institutional arrangements between the water establishment and WUA. In parallel, UNICEF is currently assessing additional wastewater reuse opportunities to further replicate and scale this model.

Overall, the Zahle wastewater reuse scheme stands as a proof of concept that treated wastewater, when supported by institutions, sound regulation and community engagement, can become a cornerstone of climate-resilient agricultural water management in Lebanon and can be replicated as recommended by the National Adaptation Plan 2025 and Nationally Determined Contributions 3.0.

Annex 1.

النظام الداخلي
لجمعية مستخدمي مياه الري في منطقة زحلة، حوش الأمراء

المادة 1: التعاريف

تُعتمد، لأغراض هذا النظام الداخلي، التعاريف الواردة في النظام الأساسي.

الباب الأول: الهيئة العامة

المادة 2: تأليف الهيئة العامة

(أ) تضم الهيئة العامة جميع أعضاء الجمعية، وهي السلطة العليا فيها؛

(ب) يشارك حكماً في الهيئة العامة ممثل عن مؤسسة المياه بصفة إشرافية، ويُدعى إلى اجتماعاتها ويشارك في مناقشاتها من دون أن يكون له حق التصويت. ويُكلَّف هذا الممثل طوال مدة ولاية الهيئة الإدارية.

المادة 3: اجتماعات الهيئة العامة

(أ) مع مراعاة الأحكام المنصوص عليها في النظام الأساسي، تجتمع الهيئة العامة مرة واحدة على الأقل في السنة؛

(ب) يُعتبر اجتماع الهيئة العامة قانونياً إذا اكتمل النصاب بحضور نصف الأعضاء زائداً واحداً، بناءً على الدعوة الأولى. وفي حال عدم اكتمال النصاب، يكون الاجتماع المنعقد بناءً على الدعوة الثانية قانونياً بمن حضر، باستثناء الاجتماعات حول القرارات التي يتطلّب اعتمادها أكثرية موصوفة، إذ يجب ألا يقل النصاب عن الأكثرية اللازمة لاتخاذ القرار؛

(ج) يوقّع رئيس الجمعية وأمين السر محاضر اجتماعات الهيئة العامة، ثم تُختم وتُحفظ في سجلات الجمعية.

المادة 4: توزيع الأصوات

(أ) في اجتماعات الهيئة العامة، يكون لكل عضو عدد من الأصوات يتناسب مع مساحة الأراضي التي يملكها من مجموع الأراضي المرويّة الواقعة ضمن نطاق الجمعية؛

(ب) تُحدَّد حقوق التصويت عند استكمال إجراءات تأسيس الجمعية، وتُعدَّل بموجب القرارات التصحيحية اللاحقة الصادرة عن الهيئة الإدارية عند حدوث أي تغيير في الملكيات العقارية الواقعة ضمن النطاق الجغرافي للجمعية.

المادة 5: الاجتماعات العادية للهيئة العامة

(أ) تلتئم الهيئة العامة في اجتماع عادي سنوي خلال الأشهر الثلاثة الأولى من السنة، بناءً على دعوة رئيس الهيئة الإدارية. وإذا تخلّف الرئيس عن توجيه الدعوة خلال هذه الفترة، تلتئم الهيئة العامة حكماً بناءً على دعوة أي من أعضاء الهيئة الإدارية أو العضو الأكبر سناً أو مدقق حسابات الجمعية، إن وُجد، وفقاً للشروط المحددة في هذا النظام؛

(ب) يجوز دعوة الهيئة العامة إلى اجتماعات عادية إضافية خلال السنة كلما دعت الحاجة؛

(ج) يكون اجتماع الهيئة العامة العادي قانونياً بحضور الأكثرية المطلقة للأعضاء الذين تتألف منهم الهيئة. وإذا لم يكتمل النصاب، تُدعى الهيئة العامة إلى اجتماع ثانٍ يُعقد بعد أسبوعين من تاريخ الاجتماع الأول، ويكون الاجتماع الثاني قانونياً أياً كان عدد الأعضاء الحاضرين؛

(د) تتولى الهيئة العامة، في اجتماعاتها العادية، المهام والصلاحيات الآتية:

1. البت في طلبات العضوية في الجمعية.
2. بحث التقرير السنوي العام ومناقشته واتخاذ القرارات المناسبة بشأنه.
3. بحث التقرير المالي السنوي ومناقشته واتخاذ القرارات المناسبة بشأنه، وإقرار حسابات السنة المالية المنصرمة والمصادقة على موازنة السنة المالية المقبلة.
4. تحديد قيمة الاشتراكات السنوية.
5. تعيين مدقق حسابات الجمعية بناءً على اقتراح الهيئة الإدارية، إذا ارتأت أن أعمال الجمعية تستلزم هذا التعيين، على أن يكون مستقلاً عن الجمعية وأعضائها.
6. انتخاب أعضاء الهيئة الإدارية، عند الاقتضاء.

7. بحث جميع البنود المدرجة على جدول أعمال الاجتماع، بما يتفق والأنظمة المرعية الإجراء، ومناقشتها، واتخاذ القرارات المناسبة بشأنها.

المادة 6: الاجتماعات غير العادية للهيئة العامة

(أ) تُدعى الهيئة العامة إلى اجتماع غير عادي لتعديل النظام الأساسي و/أو النظام الداخلي للجمعية، أو لحلّ الجمعية؛

(ب) تُدعى الهيئة العامة إلى اجتماع غير عادي في إحدى الحالتين الآتيتين:

1. بناءً على اقتراح الهيئة الإدارية.
2. بناءً على طلب ثلاثين في المائة (30 في المائة) من أعضاء الهيئة العامة.

في الحالة الثانية، يكون رئيس الجمعية، أو نائب الرئيس أو مدقق حسابات الجمعية في حال تخلّف الرئيس، ملزَماً بدعوة الهيئة العامة إلى اجتماع غير عادي خلال شهر من تاريخ ورود الدعوة إلى أمانة السر؛

(ج) يُحدَّد جدول أعمال الاجتماع غير العادي في الدعوة، وتُبلَّغ الدعوة إلى الأعضاء قبل موعد الاجتماع بأسبوعين على الأقل، بموجب كتب خطية أو بإعلان يُنشر في صحيفتين محليتين، إضافةً إلى إلصاقه على لوحات الإعلانات في المركز الرئيسي للجمعية وفي فروعها كافة، إن وُجدت؛

(د) لا يكون اجتماع الهيئة العامة غير العادي قانونياً إلا بحضور ثلاثة أرباع أعضائها؛

(ه) إذا لم يكتمل النصاب، تُدعى الهيئة العامة مجدداً، بعد انقضاء شهر، إلى اجتماع غير عادي بجدول الأعمال ذاته، ولا يكون اجتماعها قانونياً في هذه الحالة إلا بحضور الأكثرية المطلقة للأعضاء على الأقل؛

(و) إذا لم يكتمل النصاب المنصوص عليه في الفقرة (ه) أعلاه، يُسحب جدول الأعمال، ولا يجوز دعوة الهيئة العامة إلى اجتماع غير عادي للنظر في المواضيع ذاتها إلا بعد انقضاء سنة، ووفقاً للشروط والأصول نفسها المبينة أعلاه؛

(ز) عند دعوة الهيئة العامة إلى اجتماع غير عادي للنظر في حل الجمعية، تُراعى أحكام المادة 9 من النظام الأساسي في ما يتعلق بالأكثرية اللازمة لاتخاذ القرار.

الباب الثاني: الهيئة الإدارية

المادة 7: تأليف الهيئة الإدارية

(أ) تتألف الهيئة الإدارية من عدد من أعضاء الجمعية لا يقل عن خمسة ولا يزيد على تسعة. ويمثل هؤلاء الأعضاء فئات العضوية وحجم الملكيات العقارية تمثيلاً نسبياً، بما يكفل تمثيل الملكيات الكبيرة والصغيرة، وفقاً للحصص التي يحددها مرسوم الترخيص؛

(ب) تنتخب الهيئة العامة أعضاء الهيئة الإدارية، بمن فيهم الرئيس، وفقاً لما يحدده مرسوم التأسيس. وينتخب أعضاء كل فئة مرشحيهم في حدود الحصة المخصّصة لهم في الهيئة الإدارية، لولاية لا تتجاوز ثلاث سنوات، وفقاً للأصول الآتية:

1. تتمثل في الهيئة الإدارية الفئتان الآتيتان من الأعضاء العاملين:
   - فئة مالكي العقارات الخاصة ومستثمريها.
   - فئة مالكي العقارات العامة ومستثمريها.
2. تنتخب كل فئة من فئات الأعضاء العاملين ممثليها في الهيئة الإدارية، وتُعد كل فئة هيئة انتخابية مستقلة ضمن الهيئة العامة.

(ج) تُعلَن نتائج الانتخابات فور انتهاء فرز الأصوات. ويفوز المرشحون الذين ينالون أكبر عدد من أصوات المقترعين ضمن كل فئة من فئات الأعضاء. وإذا تساوى مرشحان في عدد الأصوات، يُعد فائزاً المرشح الأقدم انتساباً إلى الجمعية؛ وإذا تساويا في تاريخ الانتساب، يُعد فائزاً المرشح الأكبر سناً إذا كان شخصاً طبيعياً، وإلا تُجرى القرعة؛

(د) يُعاد تشكيل مكتب الهيئة الإدارية سنوياً؛

(ه) إذا شغر أكثر من ثلث مقاعد الهيئة الإدارية وكان قد بقي من مدة ولايتها أكثر من ستة أشهر، وجبت دعوة الهيئة العامة إلى اجتماع عادي، وفقاً للأصول، لانتخاب أعضاء لملء المقاعد الشاغرة؛

(و) في جميع الأحوال، تستمر الهيئة الإدارية ورئيسها وأعضاؤها في ممارسة مهامهم إلى حين انتخاب هيئة إدارية جديدة؛

(ز) عملاً بالقوانين المرعية الإجراء، تتولى أمانة السر إبلاغ مؤسسة المياه والوزارة بأي تعديل أو تغيير يطرأ على الهيئة الإدارية؛

(ح) يجوز انتخاب عضو الهيئة الإدارية لأكثر من ولاية واحدة؛

(ط) لا يحق لأي شخص الترشح لانتخابات الهيئة الإدارية إذا كان يتولى مسؤوليات في لجان أخرى أو إذا كانت قد فُرضت عليه عقوبات تحول دون ترشحه؛

(ي) لا يجوز لعضو الهيئة الإدارية أن يكون، في الوقت نفسه، عضواً في لجنة المراقبة أو عضواً في مؤسسة المياه أو مستخدماً لديها أو موظفاً في الوزارة؛

(ك) يشغل أعضاء من الهيئة الإدارية المناصب الدائمة الآتية: الرئيس، ونائب الرئيس، وأمين السر، وأمين الصندوق. ويجوز للهيئة الإدارية إنشاء مناصب أو تحديد مسؤوليات أخرى أو تأليف لجان متخصصة عند الحاجة، على أن تحدد

مهامها وتختار رؤساءها وتوافق على عضويتها بناءً على اقتراح رئيس اللجنة المعنية؛

(ل) يجوز للهيئة الإدارية، بناءً على اقتراح الرئيس، تعيين جهاز إداري مسؤول عن التنفيذ التشغيلي لأنشطة الجمعية، يعمل تحت مسؤولية الرئيس وإشرافه.

المادة 8: أصول الترشّح

(أ) يحق لأي من الأعضاء العاملين الترشح لانتخابات الهيئة الإدارية، على أن يقدم إلى أمانة السر طلب ترشح خطياً قبل موعد الانتخابات بأسبوع على الأقل. وتنظر الهيئة الإدارية مجتمعةً في طلبات الترشح، ولا يُقبل أي طلب لا يستوفي هذه الشروط؛

(ب) تنشر أمانة السر في مراكز الجمعية، قبل موعد الانتخابات بخمسة أيام على الأقل، جدولاً أولياً بأسماء المرشحين وجدولاً آخر بأسماء أعضاء الهيئة العامة. وتُقبل الاعتراضات على الجدولين حتى اليوم السابق لموعد الانتخابات، ويصبحان نهائيَّين بعد انقضاء هذه المهلة.

المادة 9: اجتماعات الهيئة الإدارية

(أ) تجتمع الهيئة الإدارية مرة كل شهرين على الأقل، وكلما دعت الحاجة، بناءً على دعوة الرئيس. ويكتمل النصاب بحضور الأكثرية المطلقة لأعضائها، شرط أن تتمثل كل فئة من فئات الأعضاء بشخص واحد على الأقل. وتُتخذ القرارات بأكثرية ثلثي أصوات الأعضاء الحاضرين؛

(ب) يجوز لثلث أعضاء الهيئة الإدارية طلب عقد اجتماع. وعلى الرئيس، في هذه الحالة، الدعوة إلى الاجتماع المطلوب خلال أسبوعين من تاريخ ورود الطلب إلى أمانة السر؛

(ج) يشارِك حكماً في الهيئة الإدارية ممثل عن مؤسسة المياه بصفة إشرافية. ويُدعى إلى اجتماعات الهيئة ويشارك في مناقشاتها من دون أن يكون له حق التصويت. ويُكلَّف هذا الممثل طوال مدة ولاية الهيئة الإدارية.

المادة 10: مهام الرئيس

يتولى الرئيس، بصفته هذه، المهام الآتية:

1. تمثيل الجمعية لدى الغير ولدى جميع السلطات الوطنية والدولية، بما فيها السلطات السياسية والإدارية والقضائية والعسكرية، وتولي مهمة الناطق الرسمي باسمها، ما لم يُكلَّف أحد أعضاء الهيئة الإدارية، بصفته أميناً للإعلام، بهذه المهمة. ويكون الرئيس مسؤولاً عن حسن سير أعمال الجمعية وعن امتثالها للأنظمة والقوانين المرعية الإجراء.
2. الدعوة إلى اجتماعات الهيئة الإدارية واجتماعات الهيئة العامة العادية وغير العادية وترؤسها، باستثناء الحالات التي ينص فيها هذا النظام على خلاف ذلك.
3. التوقيع، بالاشتراك مع أمين السر، على محاضر اجتماعات الهيئة العامة والهيئة الإدارية وعلى جميع المعاملات الرسمية العائدة للجمعية.
4. التوقيع على أوامر الصرف بالاشتراك مع أمين الصندوق.

المادة 11: مهام نائب الرئيس

يتولى نائب الرئيس مهام الرئيس وصلاحياته كافة في حال غيابه، أو بناءً على تفويض منه في مواضيع محددة وخلال فترات زمنية يحددها.

المادة 12: مهام أمين السر

يتولى أمين السر المهام الآتية:

1. الإشراف على حفظ السجلات القانونية وتنظيمها، بما في ذلك سجلات الأعضاء وسجلات محاضر اجتماعات الهيئة العامة والهيئة الإدارية، والتوقيع عليها بالاشتراك مع الرئيس.
2. حفظ جدول عام بأسماء الأعضاء، على اختلاف فئاتهم، وتنظيمه.
3. تلقي المراسلات والمخابرات الواردة وحصرها وحفظها، بالتعاون والتنسيق مع المدير ومع جهازه الإداري، إن وُجد.
4. توجيه الدعوات وإبلاغ قرارات الجمعية إلى أصحاب العلاقة والإدارات الرسمية.
5. الحلول محل أمين الصندوق في حال غيابه.

المادة 13: مهام أمين الصندوق

تُعهد إلى أمين الصندوق أموال الجمعية المنقولة وغير المنقولة، ويتولى الإشراف على ما يأتي:

1. تنظيم سجلات حسابات الجمعية.
2. قبض الاشتراكات والهبات والتبرعات وعائدات الأنشطة المختلفة.
3. صرف الحوالات والأوراق المالية كافة وفقاً لقرارات الهيئة الإدارية.
4. تقديم كشف بحسابات الجمعية كلما دعت الحاجة.
5. تسديد قيمة المشتريات والنفقات.
6. التوقيع على أوامر الصرف بالاشتراك مع الرئيس.
7. التعاون مع مدقق حسابات الجمعية، إن وُجد.

المادة 14: تنحية أعضاء الهيئة الإدارية

(أ) يجوز تنحية أي من أعضاء الهيئة الإدارية في حال تخلّفه عن أداء مهامه أو مخالفته أنظمة الجمعية أو تجاوزه حدود صلاحياته؛

(ب) تقرر الهيئة العامة التنحية في اجتماع يُعقد خصيصاً لهذا الغرض، بناءً على دعوة الرئيس وعضوين من أعضاء الهيئة الإدارية، أو بناءً على دعوة أربعة من أعضاء الهيئة الإدارية. ويُتخذ قرار التنحية بالاقتراع السري وبأكثرية ثلثي مجموع الأعضاء المنتسبين الذين تتألف منهم الهيئة العامة قانوناً؛

(ج) يحضر العضو المعني الاجتماع، ولكن لا يشارك في التصويت.

الباب الثالث: الجهاز الإداري والأُجراء

المادة 15: آلية تعيين الجهاز الإداري

(أ) يجوز للجمعية تعيين مدير و/أو غيره من أفراد فريق العمل التنفيذي، بمن فيهم محاسب، للعمل بدوام كامل أو جزئي أو على أساس موسمي؛

(ب) إذا تقرر تعيين مدير، يجري تعيينه بموجب مباراة أو امتحان تنظمه الهيئة الإدارية، استناداً إلى معايير علمية وموضوعية محددة سلفاً، وبعد إطلاع مؤسسة المياه على ذلك. ويجب أن يتمتع المدير بالمؤهلات المناسبة والخبرة ذات الصلة بإدارة الري. ولا يجوز لمدير الجمعية أن يكون عضواً فيها. ويقدم المدير تقارير إلى الهيئة الإدارية ويسدي المشورة إليها، ويحضر اجتماعاتها عندما يُطلب منه ذلك، من دون أن يحق له المشاركة في اتخاذ القرارات أو التصويت عليها؛

(ج) المحاسب: على الجمعية تعيين محاسب من غير أعضائها يتولى تدقيق الحسابات ورفع تقرير إلى الهيئة الإدارية، على أن تجدد الهيئة الإدارية الثقة به كل سنتين بموجب قرار تتخذه بأكثرية الثلثين. وتخضع حسابات الجمعية لقوانين المحاسبة العامة وأنظمتها ولرقابة الهيئة العامة ولرقابة لجنة المراقبة المشرفة على الإدارة المالية للجمعية، المشار إليها في المادة 18 من مرسوم تنظيم جمعيات مستخدمي مياه الري؛

(د) يجوز تعيين أُجراء آخرين، عند الحاجة، لتنفيذ خطة العمل، على أن تُراعى في جميع الأحوال الموازنة وقواعد الاختيار التنافسي، وبعد موافقة لجنة المراقبة. ولا يجوز بأي حال أن يكون الأجير، في الوقت نفسه، عضواً منتخباً في الجمعية؛

(ه) يخضع الأجراء لأحكام قانون العمل اللبناني.

الباب الرابع: مرور الأنابيب ونظام توزيع مياه الري

المادة 16: الأنابيب

على كل عضو منتسب إلى الجمعية أن يسمح بمرور أنابيب شبكة مياه الري في أرضه. ولا يحق له الاعتراض إلا لطلب تغيير مسار خط الشبكة إذا كان المسار المحدد في الخريطة الأصلية يلحق به أضراراً جسيمة.

يُقدَّم الاعتراض إلى الهيئة الإدارية، التي يتعين عليها البت فيه خلال عشرة أيام من تاريخ تبلّغها إياه.

ويحق للمتضرر، إذا لم يُرفع عنه الضرر بعد البت في اعتراضه، اللجوء إلى لجنة الوساطة والتحكيم المنصوص عليها في المادة 19 من مرسوم تنظيم جمعيات مستخدمي مياه الري.

المادة 17: التعويض

يحق للعضو الذي يلحق به ضرر جسيم من جراء ممارسة حق المرور لمد الشبكة الحصول، لمرة واحدة فقط، على تعويض يتناسب مع حجم الضرر الذي لحق به.

المادة 18: المرور المؤقت لأنابيب المياه

(أ) يسمح كل عضو في الجمعية لسائر الأعضاء بمد أنابيب وخراطيم المياه من المخرج أو المصدر ذي الصلة، إذا لم يكن قد اكتمل بعد تنفيذ شبكة مياه الري في أرض العضو المستفيد؛

(ب) يحق للعضو المتضرر من جراء ذلك الحصول على تعويض يعادل الضرر الذي لحق به.

المادة 19: نظام توزيع مياه الري

(أ) إذا نشأ خلاف بشأن توزيع مياه الري، تفصل فيه لجنة الوساطة والتحكيم المنصوص عليها في المادة 19 من مرسوم تنظيم جمعيات مستخدمي مياه الري؛

(ب) يُعاد تقييم نظام توزيع المياه كل سنتين، ويُعاد النظر فيه عند الضرورة، بما يتناسب مع أي تغيير يطرأ على مساحة الأراضي المروية التي يملكها الأعضاء. ويجوز أيضاً إعادة النظر في هذا النظام قبل انقضاء مهلة السنتين كلما طرأ تغيير على المحاصيل.

الباب الخامس: المخالفات والعقوبات

المادة 20: المخالفات

(أ) يجوز للهيئة الإدارية فرض عقوبات على أي عضو من الأعضاء إذا ارتكب أياً من المخالفات الآتية الواردة على سبيل المثال لا الحصر:

8. التعدي على شبكة التوزيع.
9. عدم السماح بممارسة حق المرور.
10. عدم السماح بإنشاء مناهل المياه ومخارجها.
11. عدم تسديد الموجبات المالية.
12. عدم التقيد بالقرارات، ولا سيما تلك المتعلقة ببرنامج الري.
13. التعرض لشرطي المياه أو لأي من أعضاء الهيئة الإدارية أو لأي طرف ثالث يعيّنه رئيس الجمعية أو يوكله بمهمة.
14. مخالفة أحكام مرسوم تنظيم جمعيات مستخدمي مياه الري أو النظام الأساسي.

(ب) على الهيئة الإدارية أن تفرض عقوبة على كل مخالفة يرتكبها أي عضو، وإن لم تكن تلك المخالفة منصوصاً عليها في مرسوم تنظيم جمعيات مستخدمي مياه الري؛

(ج) يخضع تحديد أي مخالفة غير منصوص عليها أعلاه للمبادئ

القانونية والإدارية العامة، ويُبت فيها وفقاً لمبدأ حسن النية وعناية رب الأسرة الصالح؛

(د) لا يجوز فرض عقوبة على مخالفة ما لم ينجم عنها ضرر مؤكد.

المادة 21: العقوبات

(أ) للهيئة الإدارية فرض العقوبات المحددة حصراً أدناه:

1. التنبيه.
2. الإنذار.
3. غرامة لا تتجاوز عشرة في المائة (10 في المائة) من كامل قيمة الفاتورة الشهرية.
4. غرامة مضافاً إليها تعويض للمتضرر.
5. الحرمان من حق الانتخاب.
6. الحرمان من حق الترشح.
7. الحرمان من الري، بقطع إمدادات المياه عن الأطراف المخالفة أو الممتنعة عن دفع المبالغ المستحقة عليها، لمدة محددة لا تتجاوز أسبوعين.
8. الحرمان من موسم ري واحد.
9. الحرمان من موسمَيْ ري.
10. الملاحقة القانونية، ولا سيما لتحصيل المستحقات المالية.

(ب) يجوز فرض أكثر من عقوبة بحسب جسامة المخالفة؛

(ج) يجوز للعضو الذي فُرضت عليه إحدى العقوبات المحددة حصراً أعلاه اللجوء إلى التحكيم أمام لجنة الوساطة والتحكيم. ويجوز له الطعن في قرار اللجنة وفقاً لما هو محدد في الفقرة (ح) من المادة ١٩ من مرسوم تنظيم جمعيات مستخدمي مياه الري؛

(د) في حال عدم وجود لجنة للوساطة والتحكيم، تُعرض المسألة على الهيئة العامة للجمعية، ويجوز الطعن في قراراتها أمام القضاء العدلي المختص.

الباب السادس: الرقابة الخارجية

المادة 22: الرقابة بواسطة ممثل مؤسسة المياه لدى الجمعية

(أ) يمارس ممثل مؤسسة المياه المكلّف بتمثيلها في الهيئة الإدارية الرقابة على أعمال الجمعية وفقاً للآليات الآتية:

1. التشجيع على التدريب على المهارات المتعددة اللازمة لحسن إدارة الجمعية.
2. تقديم المساعدة التقنية والدعم للجمعية، بواسطة مؤسسة المياه، في مجالات إدارة المياه، ورصد المياه الجوفية ونمذجتها، والمحاسبة والتخطيط المالي، وتقنيات الري وتطبيقها وفقاً للأصول العلمية، والصيانة.
3. الإشراف القانوني والمالي على أعمال الجمعية.
4. مراقبة امتثال الجمعية لأحكام مرسوم تنظيم جمعيات مستخدمي مياه الري ولنظامها الأساسي ونظامها الداخلي.

(ب) إذا ثبت وجود سوء إدارة مالية أو ارتكاب مخالفات لأحكام مرسوم تنظيم جمعيات مستخدمي مياه الري، يحق لممثل مؤسسة المياه الدعوة إلى اجتماع استثنائي للهيئة الإدارية أو الهيئة العامة لعرض النتائج عليها. ويجوز أن يتضمن جدول الأعمال اقتراح تنحية أعضاء الهيئة الإدارية، جميعهم أو بعضهم، وانتخاب هيئة إدارية بديلة أو أعضاء بدلاء. وإذا لم تؤد هذه التدابير إلى حلول مناسبة، يحق لممثل مؤسسة المياه رفع المسألة إلى مجلس إدارة مؤسسة المياه و/أو الوزارة لاتخاذ التدابير والقرارات المناسبة.

الباب السابع: البنى التحتية للري

المادة 23: نقل حق الانتفاع بشبكات التوزيع

(أ) تكون جميع البنى التحتية المتعلقة بالري الواقعة ضمن نطاق الجمعية في عهدتها، على أساس حق الانتفاع بها وإدارتها، اعتباراً من تاريخ تأسيس الجمعية وطوال مدة عملها؛

(ب) على الهيئة الإدارية إعداد جرد كامل لجميع المنشآت والتجهيزات والأقنية التي تديرها، على أن يتضمن وصفاً مفصلاً لشبكة التوزيع وحالتها.

المادة 24: الإشراف التقني

(أ) على الجمعية أن تقدم إلى مؤسسة المياه، فور ورود طلب منها، معلومات عن صيانة شبكة التوزيع المنقولة إليها وحالتها، وفقاً للنموذج المعتمد؛

(ب) يحق للموظفين المختصين في مؤسسة المياه الدخول إلى جميع البنى التحتية ومعاينتها. ولهم أن يطلبوا من الجمعية، عند الضرورة ولا سيما في حالات الطوارئ، القيام بأعمال محددة من أجل ما يأتي:

1. منع إلحاق الضرر أو الأذى بتلك البنى التحتية.
2. منع إلحاق الضرر بأملاك الدولة أو أملاك الغير.

المؤسسون

Annex 2. Regulator Committee Terms of Reference

1. Regulator Committee structure and authority

The present document establishes the **Regulator Committee** as the central governance and oversight body for treated water reuse projects, operating under Lebanese National Water Reuse Standard NL 819:2024. The Committee functions as an integrated multi-ministerial coordination mechanism where each member's obligations are systematically interconnected and mutually reinforcing, ensuring comprehensive oversight of all project aspects from water treatment through agricultural applications and trade compliance.

The Committee serves as the primary decision-making authority transforming individual ministerial responsibilities into a cohesive regulatory framework through structured coordination, shared accountability, and integrated monitoring systems. This approach ensures that no aspect of the project operates in isolation, creating a seamless chain of oversight that protects public health, environmental integrity, and agricultural productivity.

A. Primary role and functions

The Committee serves as the central governance authority for wastewater reuse operation as follows:

1. Government policy leadership

- Developing integrated policies that align all regulatory requirements.
- Making binding decisions affecting all project stakeholders.
- Coordinating resources across participating government agencies.
- Managing relationships with farmers, water user associations, communities and other stakeholders.

2. Operational oversight

- Coordinating monitoring and inspection activities throughout the project according to Standard 819:2024.
- Leading emergency response to incidents and system failures.
- Enforcing compliance with national standards and regulations.
- Evaluating overall project performance and effectiveness.

3. Coordination

- Aligning all government agency activities toward common goals.
- Resolving conflicts between different stakeholders.
- Ensuring consistent communication across all operational levels.
- Building institutional capacity for effective project implementation.

B. Decision-making authority

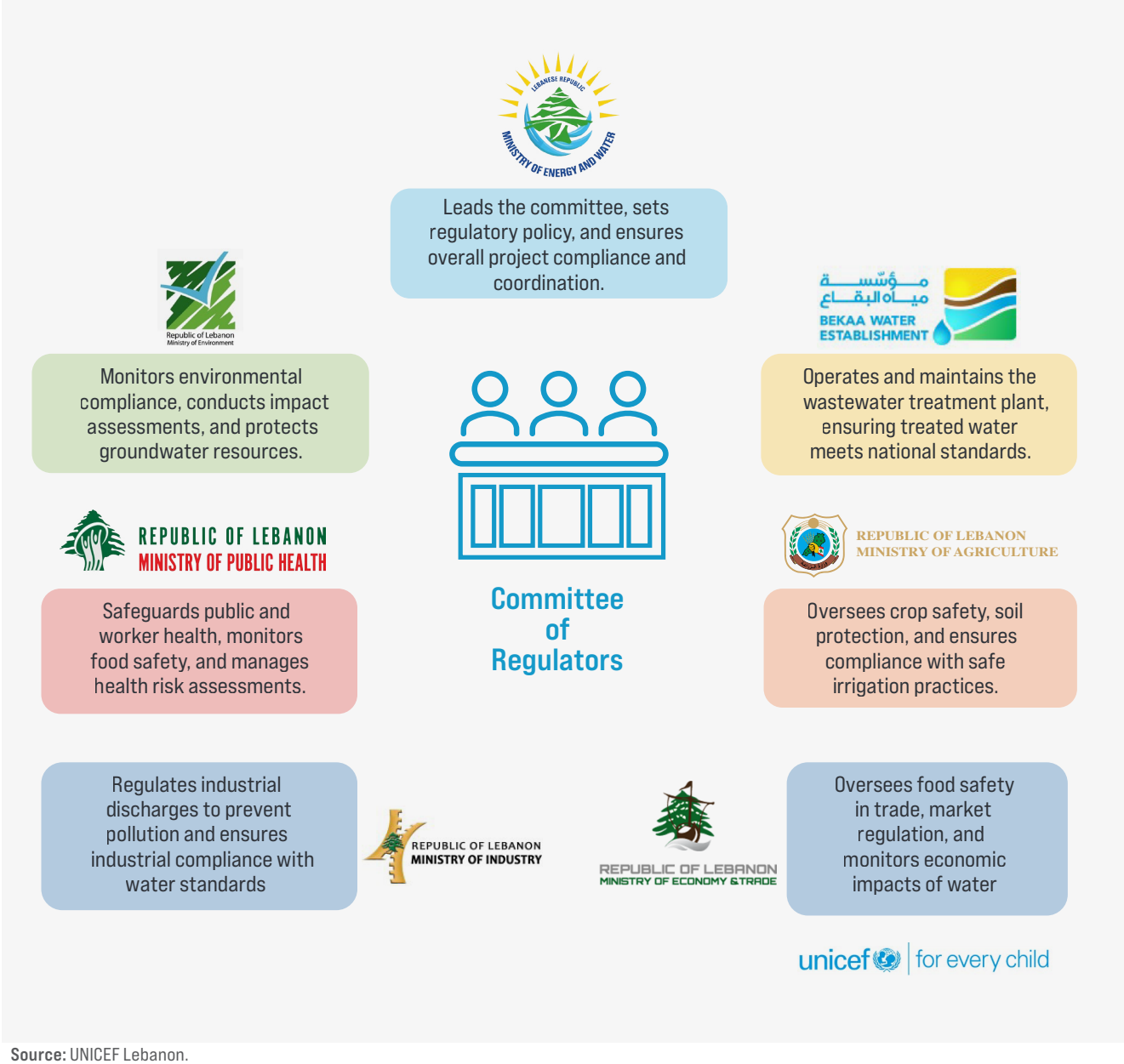
1. Legal foundation

The Committee operates under Lebanese National Water Reuse Standard NL 819:2024 with authority derived from participating ministries and support of the Lebanese Agriculture Research Institute (LARI). All Committee decisions are binding on member agencies and their institutions.

2. Decision categories

- **Policy decisions:** require majority committee approval (standards, resource allocation).
- **Operational decisions:** require majority approval (routine operations, monitoring adjustments).
- **Emergency decisions:** chair authority with subsequent committee ratification.
- **Technical decisions:** technical working groups with committee endorsement.

C. Committee composition



Source: UNICEF Lebanon.

1. Chair: Ministry of Energy and Water

- Overall project leadership and policy coordination.
- Primary regulatory authority and compliance oversight.
- External relations: international cooperation and stakeholder engagement.
- Crisis management: emergency response coordination and resource mobilization.

2. Core members

(a) Bekaa Water Establishment (BWE) – operational lead in charge of:

- Technical implementation and operational management.
- Real-time operational data and technical expertise for all Committee decisions.
- Technical advisory services to all Committee members.

(b) Ministry of Agriculture with LARI in charge of agricultural safety:

- Inspecting crops, soil and irrigation water.
- Agricultural compliance and food safety oversight.
- Farmer training and crop monitoring.
- Agricultural risk assessment and safety validation.

(c) Ministry of Environment in charge of environmental protection:

- Environmental compliance and impact assessment.
- Groundwater and soil protection monitoring.
- Environmental risk evaluation and mitigation plans.

(d) Ministry of Public Health in charge of public health protection:

- Health risk assessment and worker safety oversight.
- Food safety compliance monitoring.
- Health impact evaluation and safety protocols.

(e) Ministry of Industry in charge of industrial compliance:

- Industrial discharge control and source pollution prevention.
- Factory inspection and compliance enforcement.
- Industrial expertise and technical support.

(f) Ministry of Economy and Trade in charge of trade standards:

- Trade compliance and market oversight.
- Economic impact monitoring and market development support.
- Food safety standards for export products.

2. Member roles and obligations

A. Obligation integration model

The Committee operates through integrated coordination where individual ministerial responsibilities are interconnected duties that reinforce each other, as follows:

- **Sequential dependency**: each ministry's performance directly enables or constrains the next ministry's ability to fulfil its obligations.
- **Shared accountability**: all Committee members share collective responsibility for overall project success.
- **Information integration system**: monitoring data, assessments, and decisions flow through integrated systems to ensure comprehensive visibility and coordinated response, subject to dedicated resources for setup.
- **Resource sharing**: Committee members pool resources, expertise and capacity to achieve objectives that no single ministry could accomplish alone.

B. Responsibility matrix

Function	Lead party	Supporting partners	Obligation linkages
Water quality assurance	BWE	MoEW, MoE, MoPH	BWE monitors → MoEW validates → MoE assesses environmental compliance → MoPH evaluates health risks → All ministries use data for sector-specific decisions
Agricultural safety	MoA with LARI	MoPH, MoET, BWE	MoA with LARI inspects crops, soil and irrigation water at the users' fields → MoPH validates food safety → MoET ensures trade compliance → BWE provides quality assurance data → All ministries coordinate enforcement
Environmental protection	MoE	MoEW, MoI, BWE	MoE monitors environmental compliance from Decision 8/1 (2001) – MoE → MoI controls industrial certification and MoE monitor the discharges risks→ BWE reports treatment effectiveness → MoEW coordinates regulatory response → All ministries implement environmental measures

Function	Lead party	Supporting partners	Obligation linkages
Public health protection	MoPH	MoA, MoET, BWE	MoPH Monitorshealth risks in case of alert → MoA implements agricultural controls → MoA monitors food safety with support of MoET → BWE ensures water quality → All ministries coordinate health protection
Industrial compliance	MoI	MoE, BWE, MoEW	MoE/MoI monitors environmental compliance of discharge →MoI Enforcement of permit→ BWE reports treatment impacts → MoEW coordinates enforcement → MoI / MoE and MoEW ensure industrial compliance (only MoI can request corrective actions)
Trade compliance	MoET	MoA, MoPH, MoI	MoET monitors trade standards → MoA ensures agricultural quality → MoET/MoA validates food safety for local market and exported products → MoI ensures industrial compliance → All ministries coordinate trade protection

Note: MoEW: Ministry of Energy and Water; MoE: Ministry of Environment; MoPH: Ministry of Public Health; MoA: Ministry of Agriculture; MoET: Ministry of Economy and Trade; MoI: Ministry of Industry.

C. Committee meeting structure

1. Daily operations

- **Real-time data sharing:** all monitoring data are made immediately available to Committee members using shared templates. The choice of platform (Google Sheet or an integrated information system) will be defined based on the available capacity of the Ministry of Energy and Water.
- **Instant alert system:** critical incidents or risks trigger immediate multi-ministerial emergency response, as detailed in **annex 4**.
- **Coordination calls:** during peak operational periods, daily calls are held to ensure synchronization.
- **Shared decision platform:** all operational decisions are formally recorded and managed via the agreed information system.

2. Monthly coordination cycle

- **Performance review:** monthly assessment of ministerial performance and monitoring activities.
- **Issue resolution:** jointly address and resolve operational challenges and conflicts.
- **Strategic alignment:** review how activities align with overall objectives.
- **Operational coordination meeting:** ministers' operational representatives meet to deliver monthly reports, make operational adjustments, and agree on corrective actions. Sessions are held online or in person, with detailed action plans.

3. Quarterly integration and strategic review

- **Comprehensive assessment:** quarterly evaluation of integration effectiveness, and feedback from stakeholders.
- **Process optimization:** refine integration mechanisms, procedures, and incorporate lessons learned.
- **Performance enhancement:** identify and implement improvements for committee functioning.
- **Strategic planning session:** senior management meets quarterly for long-term planning, policy updates, and resource allocation decisions. Documentation is produced for all major strategic outcomes.

4. Annual stakeholder engagement forums

- **Purpose:** stakeholder consultation and public engagement.
- **Participants:** Committee members, farmers, non-governmental organizations, and community representatives.
- **Deliverables:** stakeholder feedback reports, public communication materials, and engagement strategies.
- **Duration:** half-day public sessions with comprehensive documentation.

3. Decision-making process

The table below presents the different decision-making process to follow for strategic, operational and emergency decisions.

Decision-making process	Strategic decisions (policy, standards, resource allocation)	Operational decisions (routine operations, monitoring adjustments)	Emergency decisions (crisis response, immediate actions)
Authority	Full Committee majority decision	Committee majority decision	Chair authority with subsequent Committee ratification
Process	Proposal → Technical review → Stakeholder consultation → Committee debate → Decision → Implementation planning	Proposal → Technical review → Committee discussion → Decision → Implementation	Assessment → Immediate decision → Implementation → Committee notification → Ratification
Timeline	1 to 2 months	1 to 2 weeks	1 to 2 days
Documentation	Formal decision records with implementation timelines	Operational decision logs with tracking systems	Emergency decision records with post-crisis evaluation to capitalize for future revision

4. Emergency response and crisis management at the Zahle wastewater treatment plant

A. Emergency procedures specific to the Zahle wastewater treatment plant reuse scheme

To ensure continuity and safety in case of system failures or emergencies, the following emergency plan has been developed. Each part of the plan addresses a specific potential problem that may occur during operation, especially in the early stages of implementation. The plan outlines mitigation measures. The main problems that may arise are power supply interruptions, natural disasters, non-conforming effluent, and interruption in the treatment.

1. Back-up power supply

Power supply is essential for the treatment plant and the pumping station. Power outages can halt all operations in the wastewater treatment process, including pumping, aeration, disinfection, and monitoring. This may result in untreated or partially treated water being stored or released, posing environmental and health risks.

The wastewater treatment plant (WWTP) already has a service line which is available for 20/24 hours, a back-up solar power system and a generator. The solar system is rehabilitated by the ongoing regional project entitled "Resilient water solution against climate change" led by UN-Habitat and UNICEF.

The pumping station dedicated to the reuse scheme is directly connected to the station and is not in standalone supply. In the event the pumping station is to be disconnected from the main WWTP, the following actions/ options need to be implemented:

- Install a standby generator on-site for the water reuse project with fuel storage for at least 48 hours of generator operation. The operator would need to schedule monthly testing and preventive maintenance of the generator.
- Supply and install a new solar system for the pumping station of the water reuse project. For this option, the end users of the system are currently exploring the possibility

of funding the installation of an additional 400 kWp solar system to supplement the existing one. This aims to reduce the financial burden of the tariff, as energy costs account for approximately 85% of the current tariff structure.

2. Natural disasters and unusual events

The treatment plant and reuse system may be exposed to natural hazards such as flooding, earthquakes, high winds and fires. These disasters can damage infrastructure, disrupt power or prevent access to the site, leading to partial or full interruption of the treatment process and potential risks to public health and the environment.

Various precaution measures have been put in place:

- **For flooding:**
  - Control panels and sensitive equipment are elevated above foreseen flood levels.
  - A proper drainage and stormwater diversion system is installed.

An additional precautionary measure could be that the operator would need to ensure emergency, mobile pumping equipment and sandbags on-site.

- **For earthquakes:**
  - The equipment and tanks are constructed using seismic anchoring systems.
  - The operator must inspect infrastructure after any seismic event for damage or leakage.

- **For high winds/storms:**
  - Secure loose items and exposed components like solar panels.
  - Store mobile equipment in protected areas during storm warnings.

- **For fire:**
  - The facility is equipped with fire extinguishers in all critical areas.
  - Former staff members were trained on fire safety and ensuring access for emergency vehicles; BWE staff might need to be trained.

3. Non-conforming effluent

There is a possibility that due to process upsets or equipment failure, the treatment plant may produce effluent that does not meet the required water quality standards. If such non-compliant water is released, it could pollute the environment and pose risks to public health. These issues may result from power outages, equipment breakdowns, chemical dosing failures or human error, particularly during the early stages of implementation.

To mitigate these risks, the following precautions have been integrated into the system's design:

- A bypass line is in place to divert non-compliant effluent directly to the river adjacent to the treatment plant.
- In the event of a water quality issue, the operator will implement the following emergency shutdown procedures:
  - Turn off the reuse pumps.
  - Follow the emergency response and notification protocols (annex 4).
  - Open the bypass line.
  - Open the pump washout valve to discharge the sump pit to the river if the automatic shutdown was not operational.

Additionally, to enable closer monitoring and enhance system responsiveness, it is recommended that WWTP be equipped with a real-time effluent quality monitoring and alarm system to detect deviations from water quality standards. The estimated cost for this system is approximately $25,000.

4. Interruption in the supply of treated water

Treated water from WWTP is intended primarily for reuse in irrigation during the summer. Any interruption in this supply, whether due to power outages, poor effluent quality or system damage, can negatively impact farmers and other users who rely on it. The current system design provides only a limited portion of the total water needs of end users, so it does not fully cover their irrigation demands. As a result, in the event of a disruption, users are likely to increase their reliance on existing water sources, primarily private wells located on their own or neighbouring lands.

Nevertheless, interruptions in the reclaimed water supply may lead to crop losses or create pressure to resort to the use of untreated water as a substitute.

In addition to their actual water sources, end users with the support of BWE can identify solutions:

- Identify and secure a well near the Haouch El Oumara reservoir and equip it with a pump to ensure an emergency water supply when needed.
- Pre-arrange and install connection points for rapid integration of alternative water supplies.

- Keep temporary storage tanks or mobile reservoirs to bridge short-term interruptions.

B. Committee emergency response

1. Emergency command structure

- **Committee Chair** (Ministry of Energy and Water)**:** overall emergency command and coordination.
- **Operation technical lead** (BWE)**:** operational emergency response and technical implementation.
- **Sector specialists:** immediate sector-specific response and expertise.
- **Committee support:** all members provide resources and specialized support as required.

2. Emergency response protocols

Level 1 - Operational emergencies (water quality, equipment failure)

- **Detection:** BWE continuous monitoring systems.
- **Response:** BWE immediate operational response + MoEW coordination + Committee notification.
- **Timeline:** Immediate response, 2-hour Committee notification, 24-hour Committee assessment.
- **Authority:** BWE operational authority with MoEW coordination support.

Level 2 - Sector emergencies (agricultural, environmental, health)

- **Detection:** Sector-specific monitoring + Cross-ministerial verification.
- **Response:** Sector lead + BWE support + MoEW coordination + Committee mobilization.
- **Timeline:** 4-hour response, 12-hour Committee coordination, 48-hour comprehensive assessment.
- **Authority:** Sector ministry lead with full Committee support.

C. Integrated crisis communication system

1. Internal communication protocols

- **Immediate alerts:** automated system notifications (done through WhatsApp to all Committee members within 30 minutes).
- **Situation reports:** hourly updates during active emergencies with comprehensive status information.
- **Decision coordination:** real-time decision-making platforms for emergency coordination.
- **Resource mobilization:** instant resource request and allocation systems.

2. External communication framework

- **Stakeholder notification:** immediate notifications to affected farmers, communities and organizations.
- **Public communication:** coordinated public statements within six hours of major incidents.
- **Media relations:** unified media response with committee designated spokesperson coordination.
- **International coordination:** notification to international partners and donors, as required.

5. Continuous improvement and sustainability

A. Performance enhancement

1. Performance monitoring

- **Monthly performance reviews:** at each monthly coordination meeting, the Chair conducts a comprehensive assessment of Committee effectiveness and member performance, proposing adjustments as needed.
- **Quarterly strategic assessments:** at quarterly sessions, the Committee undertakes a strategic review of performance and project outcomes.
- **Annual performance evaluation:** based on identified corrections and strategic needs, the Chair or any Committee member, may propose a comprehensive annual assessment, supported by an external evaluator if budget allows.
- **Continuous improvement planning:** every meeting of the Committee serves as a platform to identify and propose improvements.

2. Adaptive management

- **Flexible response systems:** the Committee adapts procedures and processes in response to experience and feedback.
- **Learning integration:** the Chair ensures systematic integration of lessons learned and best practices, based on meeting feedback and proposals.
- **Innovation encouragement:** the Committee promotes innovative approaches and continuous improvement.
- **Stakeholder feedback integration:** the Committee regularly incorporates stakeholder input and feedback into its processes.

B. Long-term development and sustainability

1. Institutional development

- **Capacity-building:** the Committee ensures continuous capacity development for its members and staff, with support from specialized field experts.
- **Knowledge management:** drawing on feedback from quarterly strategic meetings, the Committee appoints a member responsible for compiling lessons learned and key resources to strengthen institutional knowledge. These are submitted for review and formal endorsement.
- **Technology integration:** subject to available funding, the Committee supports BWE in adopting new technologies and establishing online monitoring systems.
- **Partnership development:** the Committee explores and develops strategic partnerships and collaborations to enhance monitoring and improve operational performance.

2. Sustainability planning

- **Financial sustainability:** the Committee oversees long-term financial planning and resource security for plant operations, and the management of revenues generated from irrigation schemes.
- **Technical sustainability:** in collaboration with BWE and the Ministry of Energy and Water, the Committee ensures the maintenance of technical capacity and the sustainability of infrastructure.
- **Environmental sustainability:** based on collected data and the expertise of the Ministry of Environment, with technical support from the Ministry of Energy and Water, the Ministry of Agriculture and the Ministry of Public Health, the Committee safeguards long-term environmental protection and sustainability.
- **Social sustainability:** through annual stakeholder meetings and continuous feedback collection, the Committee promotes community engagement and ensures social acceptance of the reuse project.
- **Research and outreach sustainability:** the Committee supports research on wastewater reuse to generate local evidence on safe practices that protect human health and safeguard the environment, and to produce outreach materials and build the capacity of relevant stakeholders.

6. Conclusion

The Committee is an integrated governance body where the collective authority supersedes individual ministerial boundaries while maintaining clear accountability structures. The framework ensures that the Zahle wastewater reuse project operates under unified leadership that transforms separate ministerial responsibilities into interconnected obligations that reinforce each other.

The Committee's role extends beyond coordination to become the primary decision-making authority that ensures seamless integration of all project aspects. Through structured obligation linkages, systematic performance monitoring and adaptive management processes, the Committee provides the institutional framework necessary for safe, compliant, and sustainable wastewater reuse.

The success of this framework depends on the commitment of all Committee members to prioritize collective success over individual institutional interests, maintain transparency in all interactions, and continuously adapt to emerging challenges and opportunities. Through this integrated approach, the Committee will ensure that the Zahle wastewater reuse project serves as a model for effective multi-ministerial governance in the Lebanese water sector.

Annex 3. Proposed incident report template

INCIDENT REPORT TEMPLATE		
1. INCIDENT IDENTIFICATION	Incident ID	
Date of Incident: [DD/MM/YYYY]		
Time of Incident: [HH:MM]		
Location: [Specific location within the water reuse system]		
Reporting Entity: [Entity detecting/reporting incident]		
Date of Report: [DD/MM/YYYY]		

2. INCIDENT CLASSIFICATION					
Type of Incident: [Water Quality/Equipment Failure/Operational Issue/Other]					
Severity Level:	Critical		Major		Minor	
Parameters Affected:					
	E. coli		COD		
	Heavy Metals		TSS		
	BOD		Other		

Measured Values: [Actual measurements and applicable limits]

E. coli		Limit class I 100 [CFU/100ml] | Limit class II 1,000 [CFU/100ml] Limit class III 10,000 [CFU/100ml]	
Heavy Metals		cf libnor	mention libnor limits and [unit]
BOD		Limit class I 20 [mg/l] | Limit class II 25 [mg/l] Limit class III 100 [mg/l]	
COD		Limit class I 100 [mg/l] | Limit class II 125 [mg/l] Limit class III 250 [mg/l]	
TSS		Limit class I 25 [mg/l] | Limit class II 25 [mg/l] Limit class III 60 [mg/l]	
Other		cf libnor	mention libnor limits and [unit]

3. NOTIFICATION TIMELINE	
Initial Detection: [Date, Time, Entity]	
Initial Notification: [Date, Time, Entity notified]	
Committee of Regulators Notification: [Date, Time]	

4. INCIDENT DESCRIPTION

Detailed Description of Incident: [Comprehensive description of what occurred]

Potential Causes: [List of potential causes identified]

Immediate Actions Taken: [Actions taken immediately after detection]

Responsible Entities: [Entities responsible for implementing actions]

5. CORRECTIVE ACTIONS

Short-term Corrective Actions: [Actions taken to immediately address the incident]

6. MONITORING AND VERIFICATION

Follow-up Monitoring Plan: [Plan for monitoring to verify resolution]

Verification Method: [How effectiveness of corrective actions will be verified]

Verification Timeline: [When verification will be conducted]

7. LESSONS LEARNED

Root Cause Analysis: [Analysis of underlying causes]

Preventive Measures: [Measures to prevent similar incidents]

Recommendations: [Recommendations for system improvements]

8. ATTACHMENTS

Test Results: [Attach relevant test results]	
Photos/Documentation: [Attach relevant photos or documentation]	
Other Supporting Information:	

9. APPROVALS

Prepared by:	Name	
	Signature	
Date		
Reviewed by:	Name	
	Signature	
Date		
Approved by:	Name	
	Signature	
Date		

Available at Wastewater Reuse Zahle / ESCWA - Google Drive.

Annex 4. Emergency response notification protocols

The following table outlines the communication flow for various types of incidents, specifying the responsible party for detection, initial notification timelines and recipients, secondary notification requirements, and the conditions under which the Committee of Regulators and the general public should be informed.

It provides a breakdown of the roles and responsibilities of each party involved, and the immediate actions required in response to each type of incident.

Incident type	Primary detector	Immediate action	Secondary action
Water quality exceedance (COD/ BOD5/ E.coli/ heavy metals) and treatment process failure	BWE, if WWTP Operator (the WWTP operator informs the BWE and WUA and the BWE informs the Ministry of Energy and Water)	Temporary halt of the system, bypass of the sum pit and immediate information of WUA and the Ministry of Energy and Water	The Ministry of Energy and Water decides to convene an emergency meeting of the Committee of Regulators within 24 hours to determine the next steps and assess the need for a public notification, depending on the level of public health risk.
Distribution system failure	BWE	Temporary halt of the system, bypass of the sum pit and immediate alert of WUA and the Ministry of Energy and Water	Immediate alert of the Committee on the interruption of services. Based on the duration of the service disturbance, the public might be notified with the support of the local council.
Irrigation system contamination	Farmers/Ministry of Agriculture	Inform the Ministry of Energy and Water within 24 hours	The Ministry of Energy and Water decides to convene an emergency meeting of the Committee within 48 hours to determine the next steps and assess the need for public notification, depending on the level of public health risk.
Crop contamination	Ministry of Agriculture/ Ministry of Public Health	Inform the Ministry of Energy and Water within 24 hours	The Ministry of Energy and Water decides to convene an emergency meeting of the Committee within 48 hours to determine the next steps and assess the need for public notification, depending on the level of public health risk.
Worker health issue	Farmers/workers/ Ministry of Public Health	Inform the Ministry of Energy and Water within 24 hours	The Ministry of Energy and Water decides to convene an emergency meeting of the Committee within 48 hours to determine the next steps and assess the need for public notification, depending on the level of public health risk.
Public complaint	Anyone related to the public complaint	Inform the Ministry of Energy and Water within 24 hours	The Ministry of Energy and Water decides to convene an emergency meeting of the Committee within 48 hours to determine the next steps and assess the need for public notification, depending on the level of public health risk.

2600276E