



Food and Agriculture Organization  
of the United Nations

# Rehabilitation and waste management of El-Bared canal irrigation system to reduce source-to-sea pollution and improve livelihoods in the Akkar Region of Lebanon



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In Lebanon, like in many places in the world, adequate and reliable management and collection of waste have become increasingly complex and problematic. This issue anticipates cascading and spill-over effect on livelihood, environment, and agriculture. The main-occurring scenario is mostly correlated to the involuntarily waste disposal into irrigation canal and their consequent accumulation through villages and ultimately the sea. Moreover, the population growth in Lebanon spurted due to humanitarian crises in neighboring countries and the insufficient waste collection capacity amplify the problem, exacerbating the severe accumulation of solid waste. These dynamics mainly threaten water resources, endangered by faster spreading pollution.

The enhancement of the environmental performance of the irrigation systems in Lebanon, therefore, urgently requires the rehabilitation of the irrigation canals and the proper removal of solid waste that they contain. In addition, and to ensure an effective and efficient monitoring and control of water quality and waste-management, it is fundamental to strengthen the capacity of the authorities in charge and advocate the adverse effect of this problem amongst involved direct communities while providing them with means alleviation.

In this context, the Food and Agriculture Organization of the United Nations (FAO), in collaboration with the North Lebanon Water Establishment (NLWE), which represents the Ministry of Water and Energy, is implementing the project 'rehabilitation and waste management of El-Bared canal irrigation system to reduce source-to-sea pollution and improve livelihoods in the Akkar Region of Lebanon', financed by the Government of Norway.



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The objective of the project is to determine a direct impact in terms of minimizing the discharge of waste from El Bared system in Lebanon to the Mediterranean Sea, so to improve the livelihoods of the people depending on the system through rehabilitation of irrigation canal system, solid waste disposal, and improved agricultural output and job creation. Given the poor conditions of the irrigation network, the project effectively contributes to the economic, social and environmental development of the El-Bared basin by sustaining the improvement of the irrigation system and thus enhancing agricultural production. Furthermore, the project helps strengthen the local population's sensitivity on pollution, as well as increase the capacities of stakeholders to sustainably manage waste disposal and monitor water quality. More specifically, the holistic approach of the project focuses on three components:

- **Irrigation canal systems in relevant areas are rehabilitated and trash removal equipment is fully installed and operational through the employment of local labor:** rehabilitating El-Bared irrigation canal system through several activities including repair and maintenance works of canals, outlets and delivery system across the lower reaches of the scheme, and through the employment of local labor, while installing various forms of trash removal structures along the main irrigation canals to ensure continuous removal of waste.
- **Water quality monitoring is designed, tested, and carried out to support the improvement of environmental conditions in relevant area:** expending and strengthening the water quality monitoring at key locations within the irrigation scheme.
- **Operational and monitoring capacities of local communities and stakeholders are enhanced, and public awareness is raised to promote waste reduction sensitization:** raising the capacity of both the North Lebanon Water Establishment and local communities on water quality monitoring and on topics such as the reduction of water pollution and waste reduction, through capacity building activities and community-based campaigns.

**Figure 1. Trash removal equipment installed in Akkar canals**



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**Figure 2. Rehabilitation of the canal**



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## The pilot site – El Bared Watershed

Figure 3. Map covering the project command area



(Source: Google Earth Pro v7.3.3.7786 (2020). Lebanon. 34°29'30 N, 35°58'33 E, elevation 40 m modified to comply with UN. 2020. Map of Lebanon, 4282 United Nations January 2010. <https://www.un.org/Depts/Cartographic/map/profile/lebanon.pdf>)

# The project approach

In partnership with the Ministry of Energy and Water (MoEW) and the North Lebanon Water Establishment (NLWE) and in collaboration with international organizations and relevant communities in the pilot area, the project works towards enhancing the environmental performance of the irrigation systems in the region. This will be achieved through the rehabilitation of irrigation canals and the adequate removal of solid waste which it contains. To ensure that this approach is comprehensive, the intervention will also work on strengthening the capacities of authorities in charge of the monitoring, overall and of water quality in the specific.

## Outcome

- Selection of pilot monitoring sites within the NLWE
- Pilot project implementation and development of tools and transfer to end-users

## Activities

- Rehabilitation, upgrades and installation of waste removal techniques on outdated irrigation system
- Water quality monitoring
- Capacity building to main actors
- Communal awareness campaigns

## Actors

NLWE, National and regional institutions

Local community

The project is implemented over a total period of 36 months in two phases:

## Phase 1: the development

Training	Application	Dissemination
Capacity building programme on trash removal from irrigation canals	Assessment of feasible engineering solutions for solid waste and sediment control	Field training for professional staff on operation and maintenance of equipment
	Selection, production, and gradual implementation of trash removal equipment	Awareness campaigns targeting local community
Capacity building programme on rehabilitation of irrigation canals	Assessment and benchmarking of current canal conditions through an established Rapid Appraisal Procedure for Condition Assessment	
	Rehabilitation of selected irrigation canals	Training for professional staff on regular maintenance of rehabilitated irrigation canals
Capacity building programme on irrigation water quality monitoring	Identification of water quality monitoring sites	Training for professional staff on water quality monitoring
	Follow-up and integration of water quality monitoring into existing monitoring system	Awareness campaigns targeting local community

## Phase 2: scaling-up strategy



## Stakeholders and beneficiaries

Beneficiaries, target groups and stakeholders are involved and will benefit from the project throughout its various activities.



Governmental and relevant local authorities, as well as policymakers are engaged in a dialogue platform on integrated water management and the role of water monitoring data to support decision-making at the regional level. They will benefit from the activities of the project which aim at strengthening their capacities in water pollution reduction practices and in water quality monitoring, knowledge sharing and transfer of capacity for informed decision-making to end-users.

Professionals at the ministries, research institutions and universities take part in the various training programmes, to be delivered throughout the project period.

Ultimate beneficiaries include water users across all sectors and, in particular, farmers and those exposed to the environmental risk of unaccounted water quality problems.

In addition to the overall environmental improvement and communal awareness, the project will employ local labor to carry out implementation activities, thus, help increasing the employment rate and enhancing the livelihood conditions of some of the most vulnerable people in the region. Moreover, the project will ensure wider and more effective dissemination of best practices among the most affected population of the El-Bared area.

## The tools

### Prototype Monitoring System

The established Prototype Monitoring System (PMS) at NLWE is an integrated and computerized platform that links the various monitoring components into a comprehensive monitoring system for irrigation water to empower management authorities to better-informed decisions. It combines two complementary methods for data acquisition: in-situ devices for data acquisition of discharge, water quality and weather, and enhanced remote sensing technology for measuring agricultural water demand. In addition, the system integrates an asset management module to enable the inventory, the condition and the criticality scoring of irrigation assets and the rigorous business planning to support decision-makers in planning the adequate operation and maintenance (O&M) of the system and the required budget. The system produces various reports to inform decision-makers about necessary actions in any of the fields.

Figure 4. Central level system of PMS

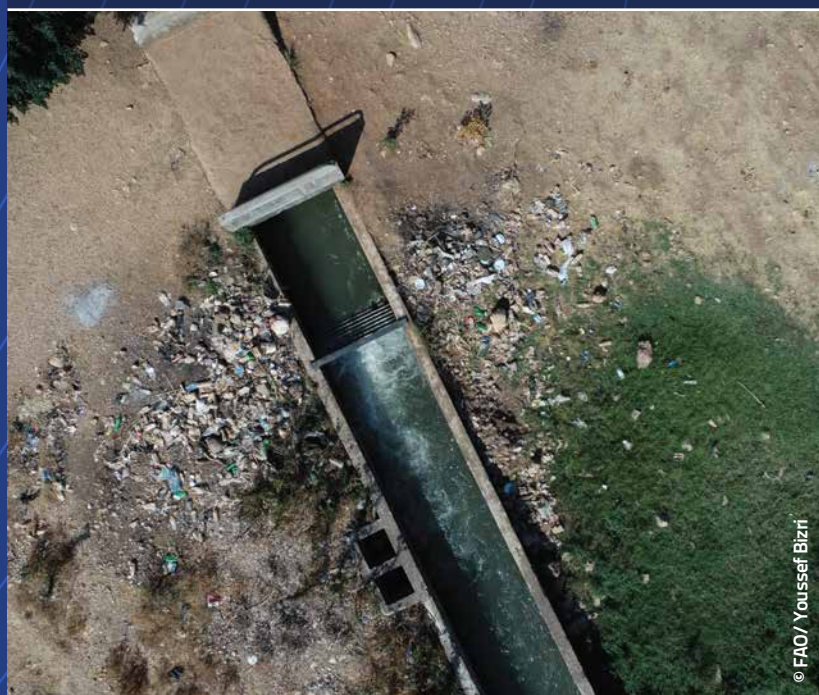


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### Remote-Based Rapid Appraisal Procedure (RE-RAP) for Condition Assessment

An innovative method to assess canal conditions is the remote assessment through a drone-based work, meant to better identify rehabilitation needs. It is a quantitative assessment of canal damage based on aerial photographic survey of the main canal of Akkar, which involves drone flights at a height of 30 m, high-resolution ortho-mosaic imageries and georeferenced images displayable on Google Earth and AutoCAD. The precisely mapped and identified issues within a certain area can be addressed with tailored solutions. The benefits of the remote technology are an easy access to remote places and large areas, the flexibility, and the replicability due to the automation, the generation of big data and remote benchmarking through image analysis methodology.

Figure 5. Drone image of El-Bared dam outlet



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## Aquadrone

Mobile devices such as innovative aquadrones are introduced. Drones are autonomous surface vessel used as on-the-spot solution to clear floating plastics, trash, and other debris from calm water environments, which are then stored in a basket below deck.

They can be operated either manually via an onshore operator (radio controlled) and autonomously with online control and access, thanks to an on-board algorithm detects whenever then drone reached its full capacity. Thus, they are suitable to cover large surface area such as dams to collect floating debris before entering the river and irrigation canals and along the shoreline. Moreover, due to the drones' mobility, there is a high flexibility to transfer the technology from one site to another.

Figure 6. Aquadrone



## iMOMO Discharge App

iMOMO Discharge App is an innovative open-source computational tool for discharge data collection, based on particle image velocimetry method. Developed by Hydrosolutions Ltd., it complements traditional water monitoring and management systems in decision-support processes and provides a direct connection between stakeholder and information sources. Through user-friendly mobile application, it allows crowd-sourced data collection and participatory observation, as well as synchronization with cloud and data management on website. It is employed to foster modernization in low-cost and people-centered monitoring procedures.

Further information on iMOMO application: <https://discharge.ch/>

Figure 7. Obtained discharge data via Discharge App



## For more information

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