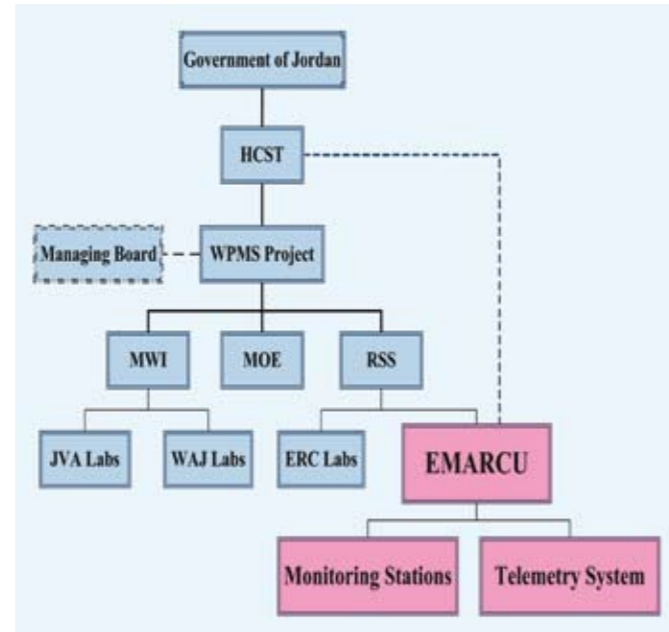


- Flow Injection Analyzer.
- Electrochemical Detector.
- Spectrophotometer.
- Ion Chromatograph (IC).
- ICP- MS & Ultra Pure Water Apparatus for ICP-MS.
- ICP-AES.
- Automatic Titration System.
- Draft Chamber, Mercury Analyzer.
- Field Survey Set, Step-down Transformer.
- Micro-Kjeldal Digestion System.
- Water Distillation Apparatus with Deionizer.
- Gas Chromatograph Mass Spectrometer (GC-MS) & Ultra Pure Water Apparatus for GC-MS.
- Fluorescent Microscope, Water Distillation Apparatus.
- Autoclave, Six Way Filtration System.
- Pretreatment Unit, Distilled Water Reservation Tank.



Project Organizational Chart

A Managing Board has been established by the HCST to oversee, facilitate and advance the project. The board is headed by the Minister of Environment and is comprised of the following members:

- Secretary General of the Ministry of Environment.
- Secretary General of the Higher Council for Science and Technology.
- President of the Royal Scientific Society.
- Secretary General of the Ministry of Agriculture.
- Secretary General of the Ministry of Health.
- Secretary General of the Ministry of Water and Irrigation.
- Secretary General of the Ministry of Energy and Mineral Resources.



ICP-MS at WAJ Central Labs



M2- KAC Tunnel Outlet



M1- Yarmouk River



M13- JR-King Hussein Bridge



M12- JR-Majame' Bridge



M3- KAC-Tiberias Conveyor



M4- KAC-Wadi Arab Dam



M5- KAC-Deir Alla



M6- KAC-Zarka Junction



M7- KAC-Karameh Dam



M8- ZR-Al Hashimyah Bridge



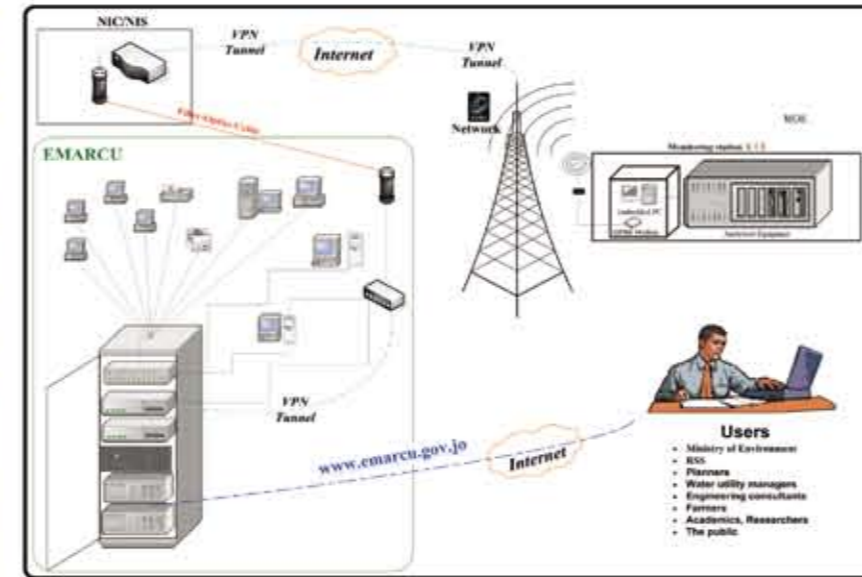
M11- KTR-Outlet



M10- KTR-Inlet



M9- ZR-Tawahin Al Odwan



WPMS - Telemetry System



For more information, please contact:  
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Supporting Environmental Protection through Real-Time Monitoring

## Background

Scarcity of water in Jordan behoves us to spare no effort in making every drop count. Pollution is recognized to be a major cause of rendering increasing amounts of water resources unfit for various uses. Jordan is exerting tremendous efforts to protect its meager freshwater resources. This has been performed through conventional water quality monitoring programs executed by various testing laboratories.

The Higher Council for Science and Technology (HCST) and the Royal Scientific Society (RSS) took upon themselves the task of introducing novel techniques of environmental protection. To achieve this, the HCST approached the Japan International Cooperation Agency (JICA) for a grant to establish a state-of-the-art *real-time* monitoring system for water, air and soil. JICA agreed, for a start, to support the establishment of a Water Pollution Monitoring System (WPMS) comprised of a fully automated on-line water quality monitoring system and to upgrade existing water-testing laboratories through the supply of modern equipment and training. Recipient laboratories are those at the Environmental Research Center (ERC) of RSS, the Water Authority of Jordan (WAJ) and the Jordan Valley Authority (JVA).

The HCST set up the Environment Monitoring and Research Central Unit (EMARCU) at RSS to ensure smooth and efficient utilization of the generous grant aid provided by JICA. The primary tasks of EMARCU are to make sure that the project is executed according to tender documents and to operate and maintain the

system after completion, thus ensuring system sustainability. The long-term goals of EMARCU are:

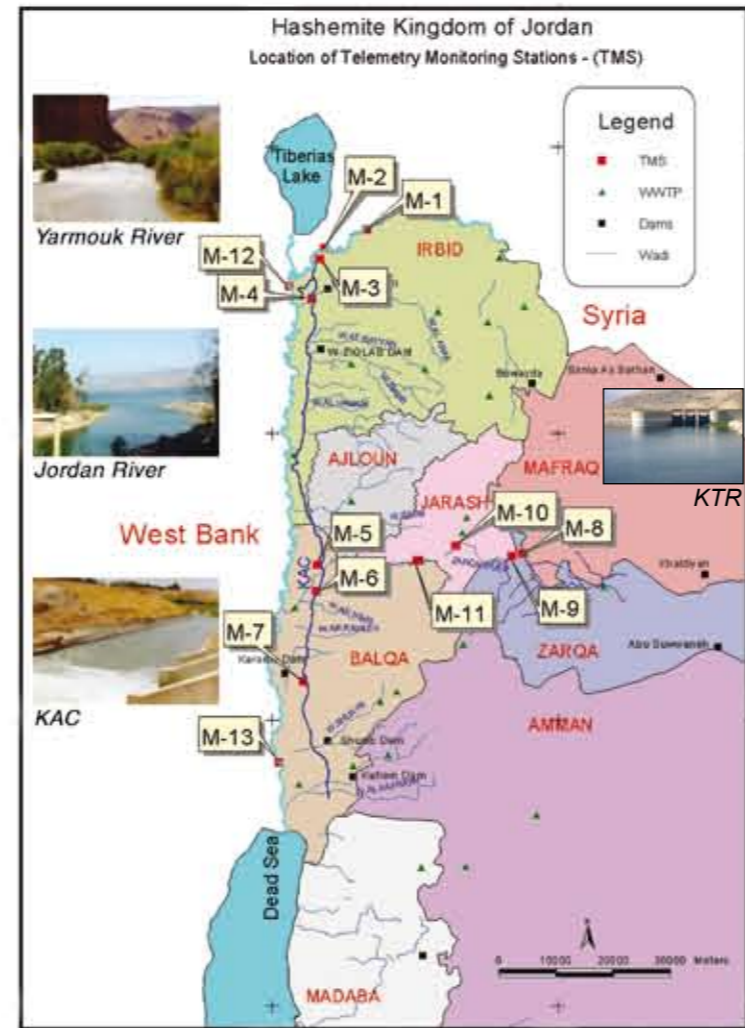
- To collect and make available water quality data on the major surface water resources in Jordan.
- To provide a data collection platform for national water quality.
- To help improve decision making in the water and environment sectors through real-time data provision and system modeling.
- To promote data sharing among the national organizations that monitor water quality and conduct research.

## The Real-Time Monitoring System (RTMS)

**Sampling Location:** Thirteen fully-automated monitoring stations are located on the Jordan, Yarmouk, and Zarqa Rivers, King Abdullah Canal, and at the inlet and outlet of King Talal Reservoir.

**The Monitoring Stations:** Each of the thirteen monitoring stations is comprised of an air-conditioned metal container housing three sets of physiochemical water analysis equipment and an embedded personal computer. The three measuring sets are: 1) for temperature, pH, EC, turbidity & DO measurement, 2) T-N & T-P, and 3) COD. A continuous sampling pump withdraws water from the water body into a conditioning tank inside the container. Samples for analysis are automatically drawn and excess water is drained back into the water body.

**Telemetry System:** Results of analysis are initially stored in the embedded computer and then transmitted through modem to EMARCU in Amman.



Location of Monitoring Stations

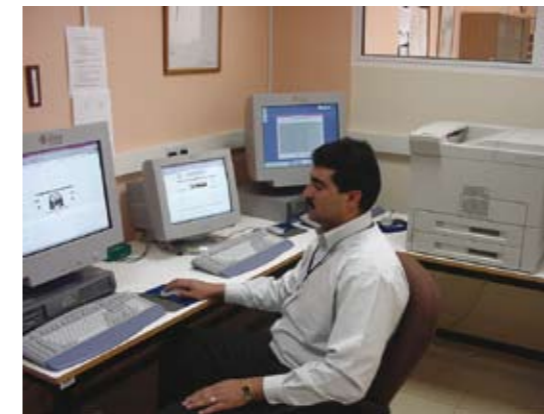
Received data are automatically stored in a database in the main server located at EMARCU. Status and alarm signals are also transmitted to draw attention to system malfunction and/or water quality parameters exceeding regulatory standards.



Monitoring station - outside view

**System Deliverables:** The RTMS is capable of producing data on an hourly basis.

The database is designed to handle transmitted data from the thirteen stations and also data provided by national testing laboratories through their regular water-quality monitoring programs. It thus allows



Server room at EMARCU



Inside the monitoring station

data storage, facilitates retrieval and interpretation.

Design of the system was done by Japanese consultants, while the system's software, civil and electromechanical works were executed by local Jordanian companies.

**Accessing the System:** The software is a web-based application and thus may be accessed from anywhere. However, the user needs to have a username and password which may be provided by EMARCU.

### System Characteristics:

- Real-time: Allows real-time decision making. <http://www.emarcu.gov.jo>
- Accurate and impartial: human interference is curtailed.
- Long-term: data safekeeping, continuity and ease of use.

- Forms a basis for other environmental applications.
- A good demonstration of utilizing IT techniques in serving environmental protection.

### Potential System Users:

- Decision makers.
- Planners:
  - For long-term planning schemes.
  - In emergency cases.
  - As early warning system.
  - For security concerns.

- Water utility managers.
- Engineering consultants.
- Farmers.
- Academics and researchers.
- The public at large.

## Upgrading National Laboratories

- Chemical analysis instruments were supplied to three laboratories (WAJ, JVA and ERC) in order to strengthen the capacity of these laboratories and obtain better accuracy. In return, the three laboratories will provide EMARCU with the available data to be added to the system as the National Water Quality Data, which is considered as a part of the project.

- The project also includes holding training sessions for laboratory technicians by Japanese engineers after installation of the equipment.
- The following chemical analysis instruments were introduced to the laboratories:
  - High Performance Liquid Chromatograph (HPLC).