

# Water Quality Monitoring in Jordan

**EMWIS**

**Mediterranean Joint Process**

**Water monitoring working group meeting**

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Environment Monitoring & Research Central Unit**

Beirut - Lebanon, 6 October 2009

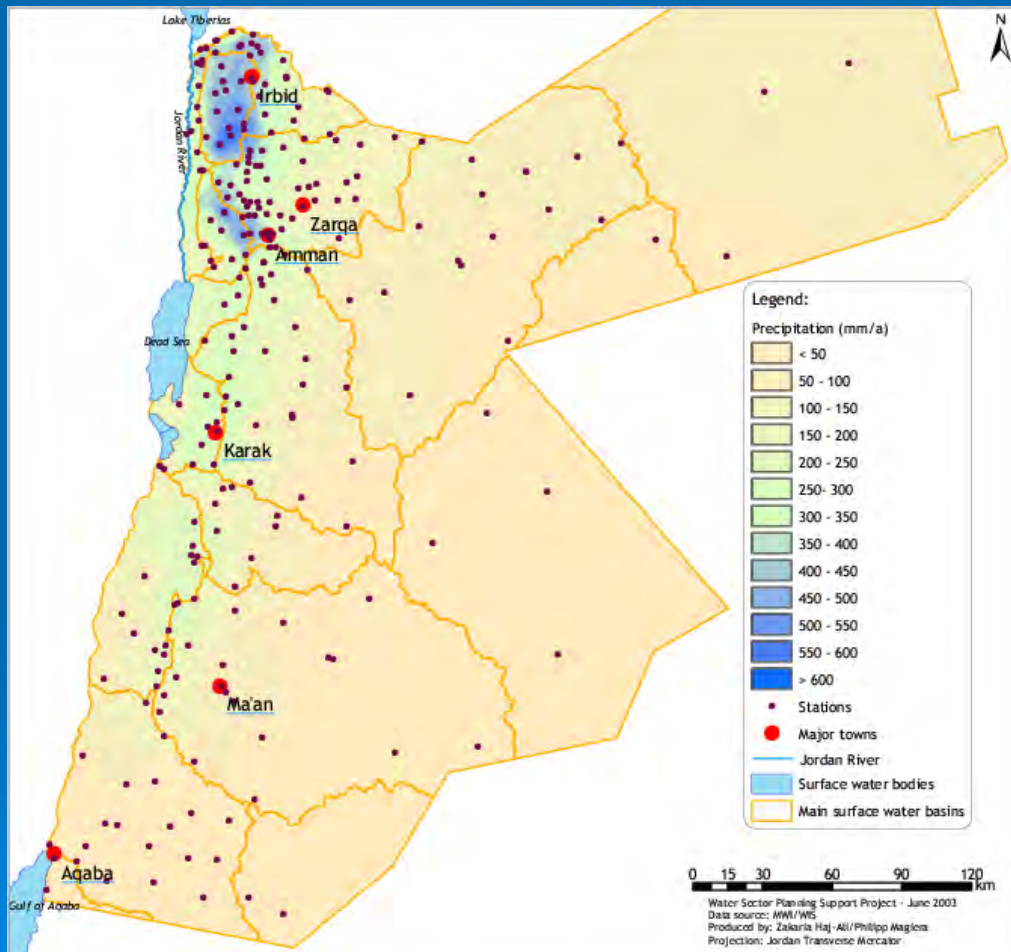
# Jordan



- **Area ~ 92,300 km<sup>2</sup>**
- **Climate: Mostly arid desert; rainy season in west (November to April)**
- **Terrain: Mostly desert plateau in east (80%)**
- **Population: ~ 5.723 million (2007), Growth ~ 2.2%**

# Rainfall

Annual mean (1963-2002)



Range: 50 to > 600,  
average: ~104 mm/yr

~ 75% receives < 100 mm/yr

~ 87% receives < 200 mm/yr

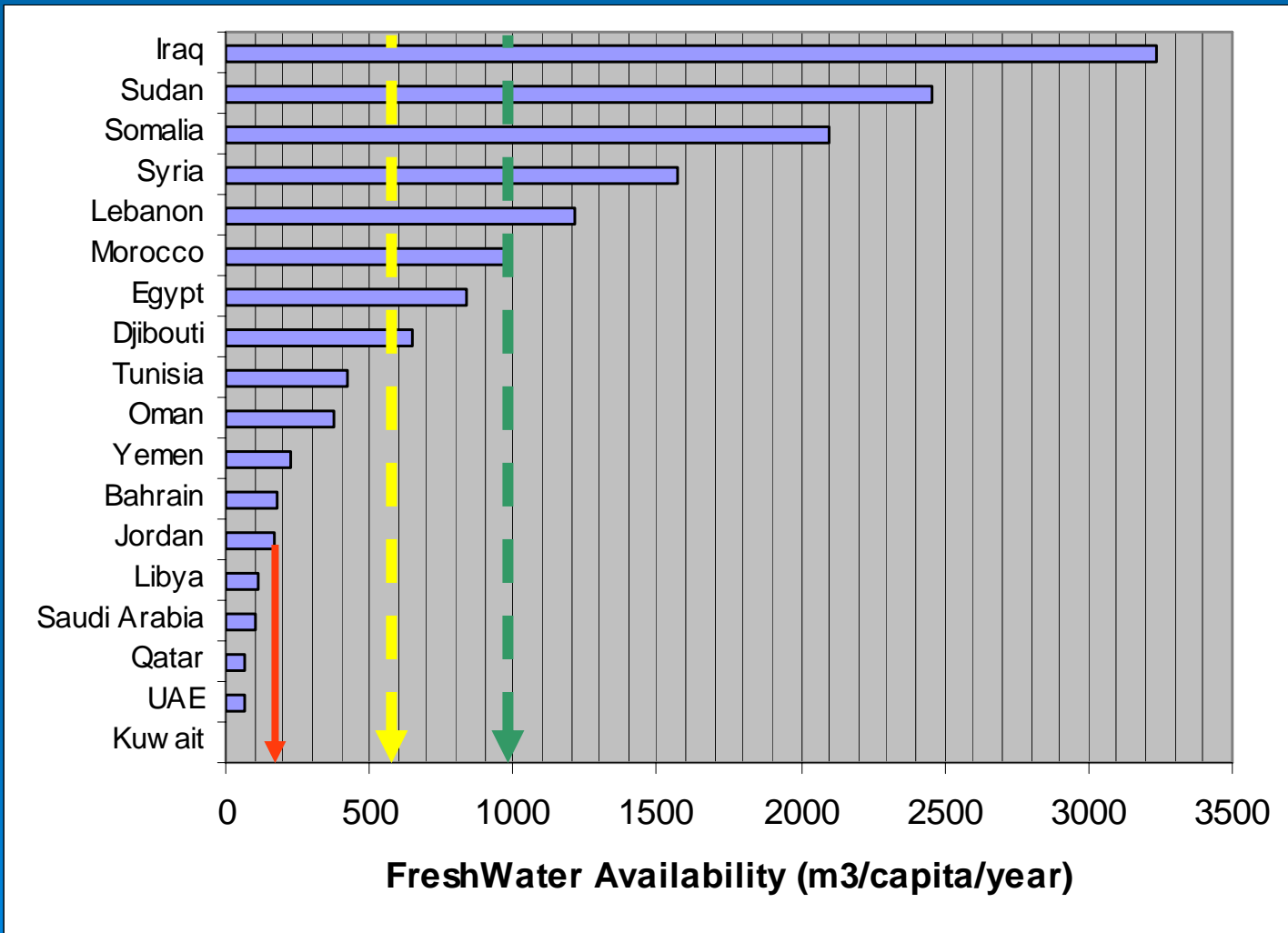
Source: NMP

Oct. 2009

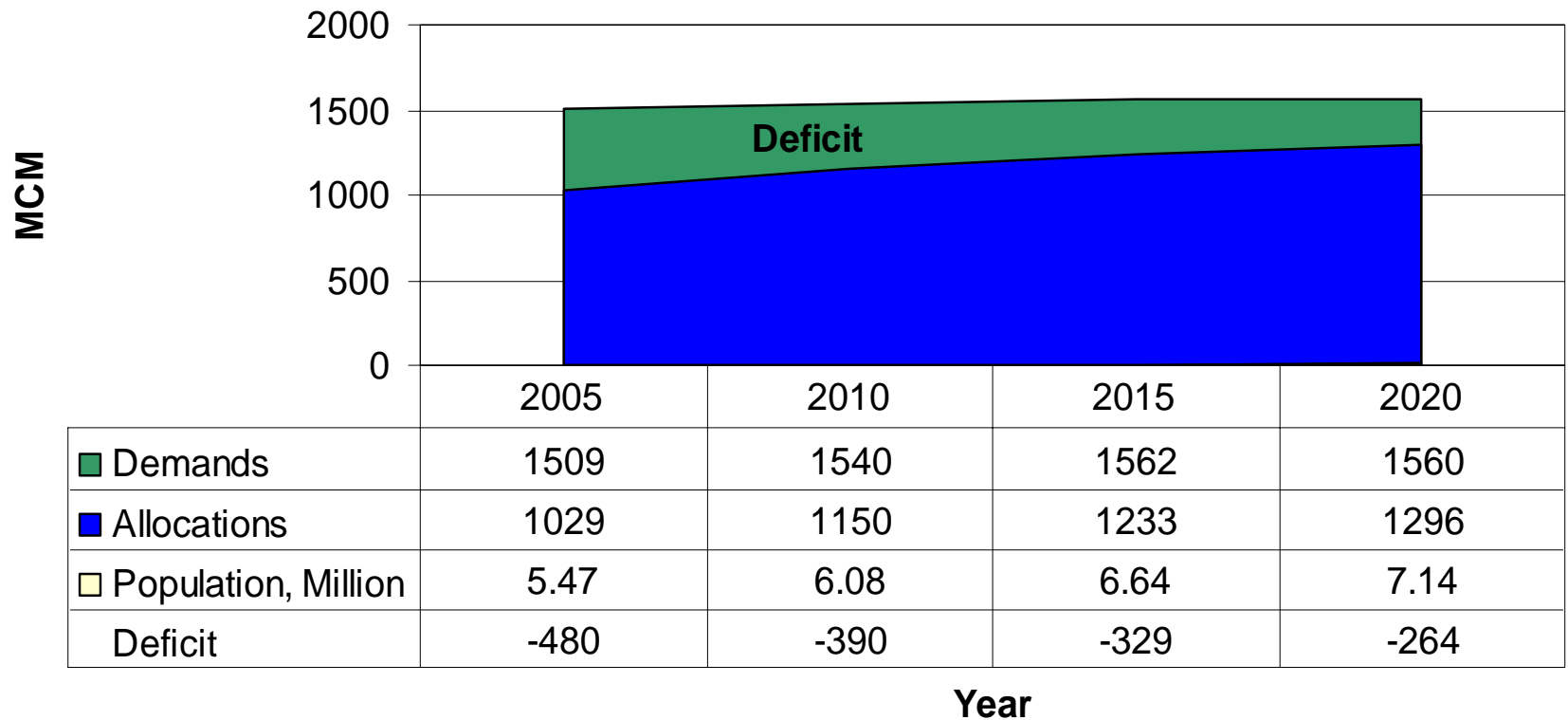
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# Freshwater Availability

(Yr 1999, AQUASTAT, 2002)

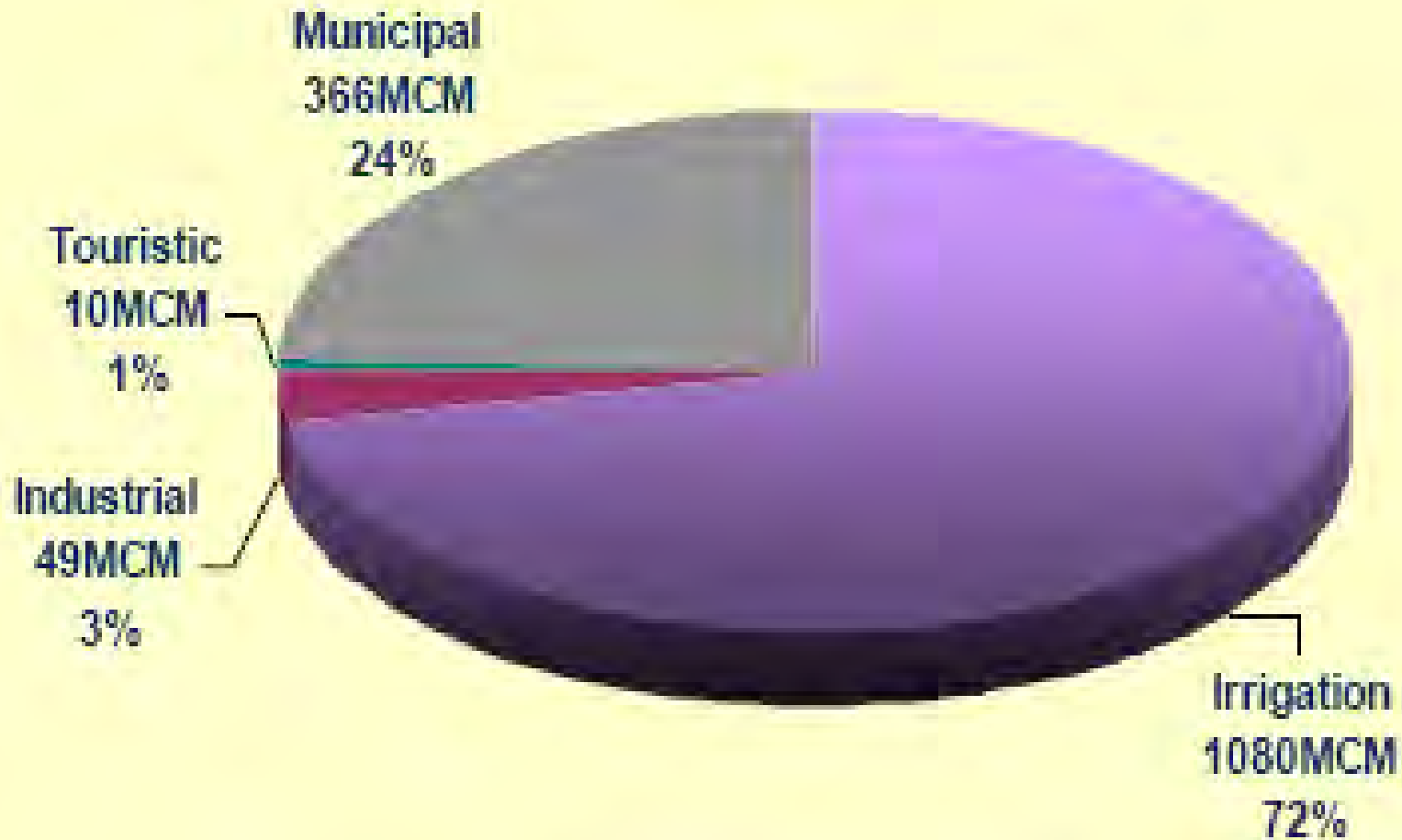


# Projected Demands and Allocations



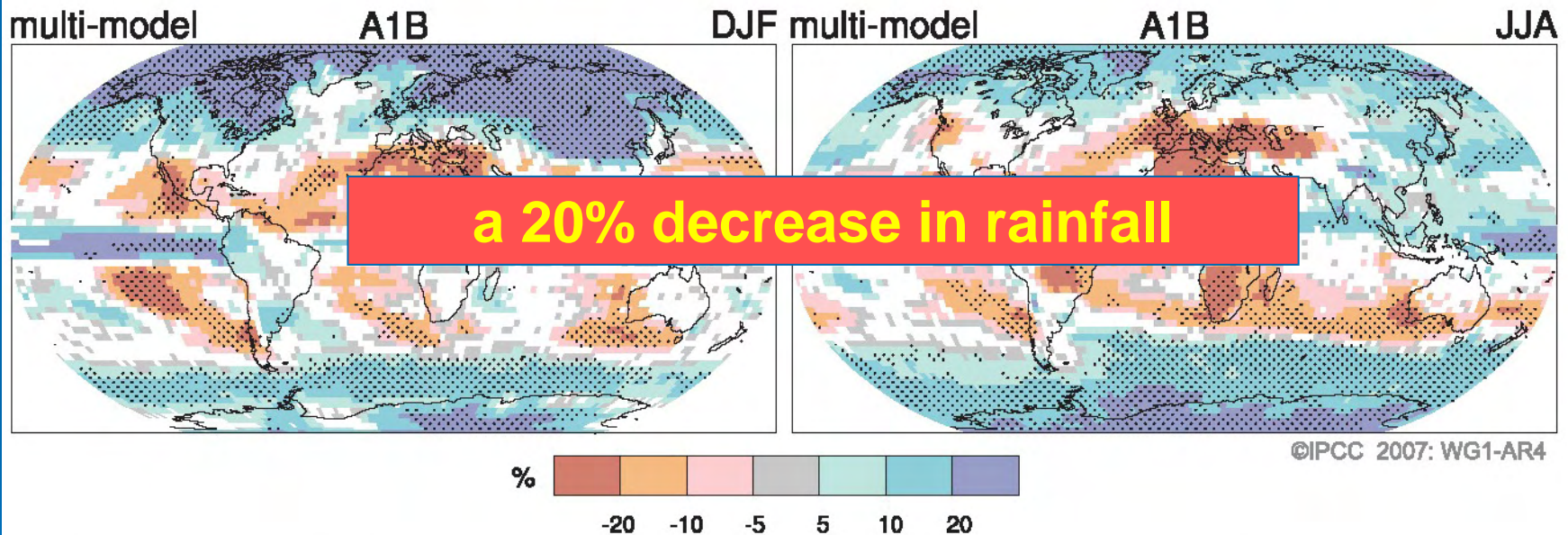
Source: NMP

# Water Demand 2007



# Effect of Climate Change

## PROJECTED PATTERNS OF PRECIPITATION CHANGES



**Figure SPM.7.** Relative changes in precipitation (in percent) for the period 2090–2099, relative to 1980–1999. Values are multi-model averages based on the SRES A1B scenario for December to February (left) and June to August (right). White areas are where less than 66% of the models agree in the sign of the change and stippled areas are where more than 90% of the models agree in the sign of the change. {Figure 10.9}

# Jordan Water Issues ...

## ➤ **Water Availability:**

- sufficiency and continuous supply
  - 97% linked to public water supply systems
  - average of two days supply per week

## ➤ **Water Quality:**

- Groundwater of high salinity
- Surface water is not adequate for drinking



# ... Jordan Water Issues

## ➤ **Physical accessibility**

- most reliable water resources are far from residential centres
- 100% of urban and 87% of rural population have access to piped water

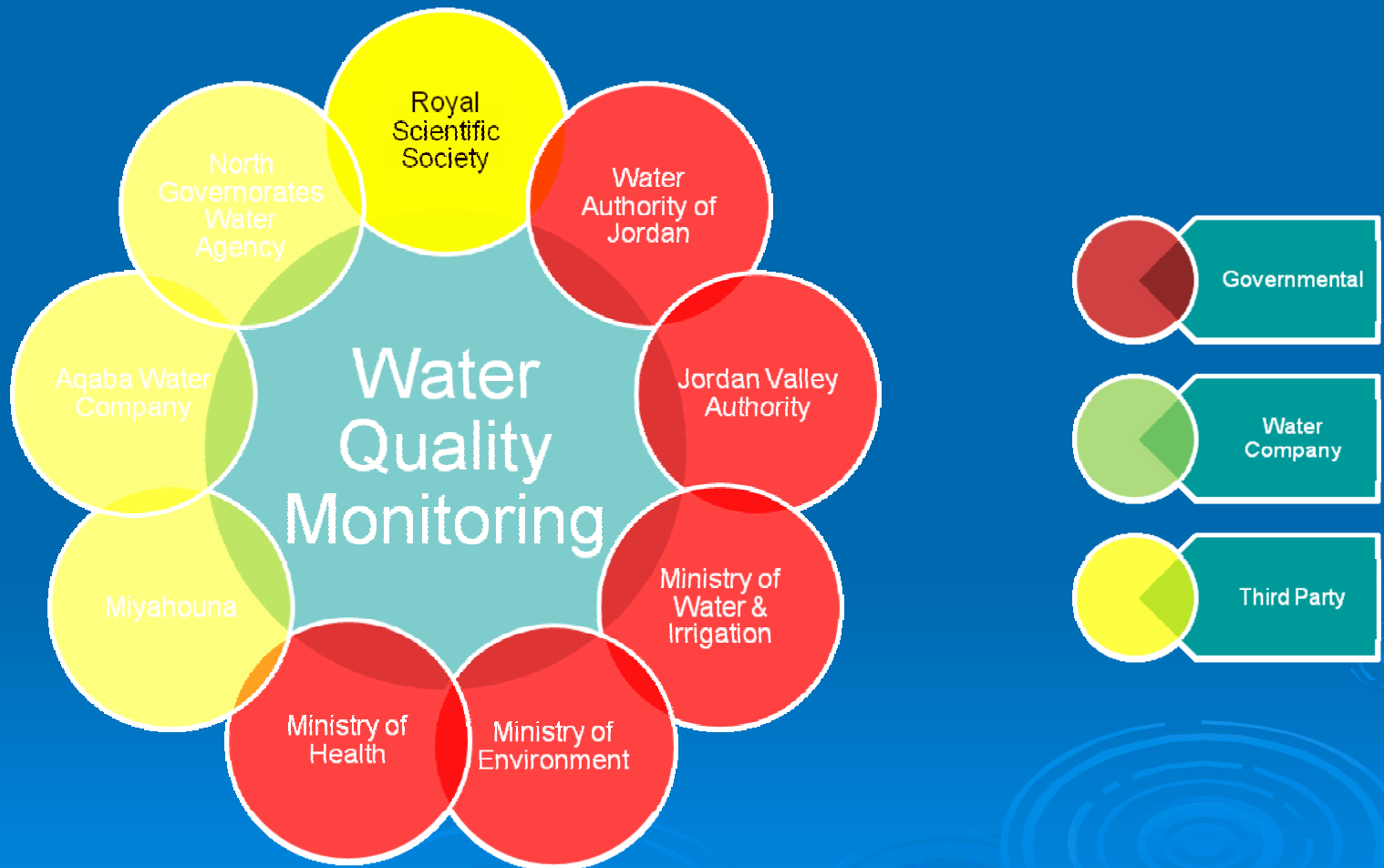
## ➤ **Economic accessibility / affordability**

- Water supply is still subsidized by the government
- water prices still affordable by the poor
- water prices for bottled water and tanked water is 8-10 times more than piped water

# Water Quality Monitoring Networks in Jordan



# Legal Framework for WQ Monitoring



## Water Resources (Envir. Purposes)

- **WAJ** : Surface Water {KAC(6), Wadis (6), Reservoirs (2)}
- **Groundwater**
- **JVA** : Surface water {rivers} (30), & {rivers} (30), / RSS labs (15), Dams (25)
- **RSS** (EMARCU Network) – (13).
- **MoEnv.** (rivers (22) & dams (10) / RSS
- **MOH** – wells for DW
- **MWI**(quantity, quality)

## Pollution Sources (Envir. Purposes)

- **WAJ** : Treated industrial WW to public sewerage (55)
- **MoEnv.** Treated industrial WW to environment or reused (20).  
Effluent of domestic WWTP (33)

## Drinking Water Supply (Operational & Eh)

- **WAJ**: DW in pumping stations, reservoirs, networks & tap
- **NGWA**: DW network & tap
- **Miyahouna**: DW network & tap
- **AWC**: DW in wells, network & tap
- **MOH**: DW & water tankers for environmental health purposes
- **MoEnv**: DW (20) / RSS contract

## Wastewater Treatment Plants (operational & Eh)

- **WAJ**: influent & effluent of WWTP (20 public, 20 private)
- **NGWA**: influent & effluent of WWTP (1)
- **AWC**: influent & effluent of WWTP (2)
- **MOH**: effluent of WWTP (22) - for environmental health purposes

# Reason for WQ Monitoring



# MWI Monitoring Networks

(flow, rainfall & meteorological)

Network	Total Number	Remarks
Rainfall stations	258	Data extends since 1936
Meteorological stations	29	Temp., humidity, windrun, sunshine Other stations: by Meter. Dept. & JVA
Wadi flow gauges	38 (floodflow) , 31 baseflow	
Springs	859 springs, not directly measured but obtained from observed water levels and a stage-discharge relation. Only irregularly observed	
Groundwater monitoring	5,912	Levels (253), salinity (1,476), production (3,203), WQM: cations and anions
WWTP Outflow	17 (till 1999)	Monitoring started 1985, (probably 26 now?).

# ***RSS Real-time Water Quality Monitoring Systems***

- Water quality monitoring and assessment is an essential component of IWRM
- The availability of sufficient water quality data is essential to:
  - trace trends over time and space
- Provide decision-makers with timely data
- Share data with stakeholders;
  - on local, regional and international levels

# RTMS

## Concept & Goal

### ➤ System Concept:

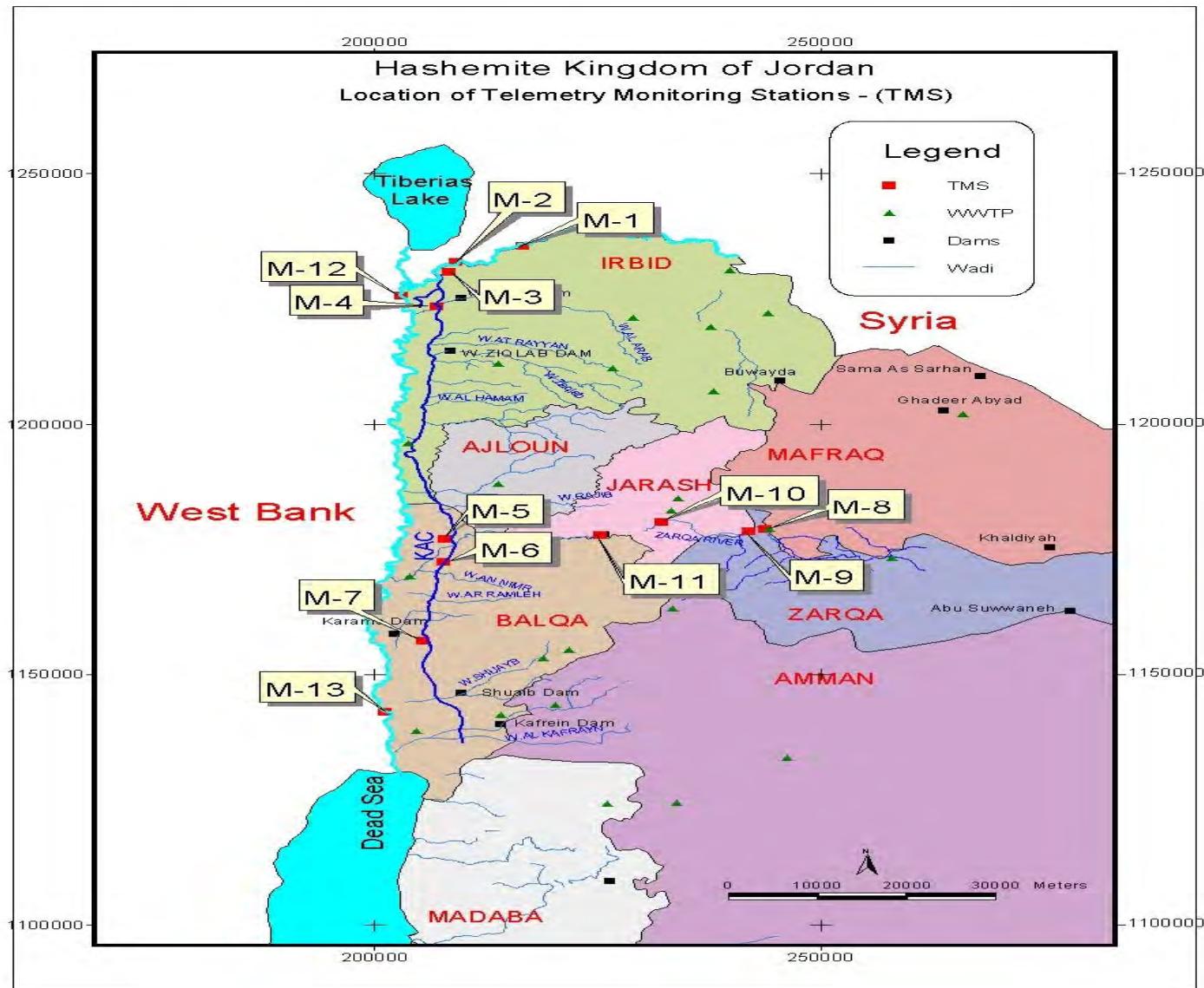
- Continuous, automated, on-site sampling & analysis, data acquisition, storage and dissemination in one system in *real-time*.

### ➤ Major goal:

- Facilitating decision making in the water and environment sectors



# The Real-time Monitoring System in Jordan



# EMARCU

Telemetry System - Windows Internet Explorer

Environment Monitoring And Research Central Unit

Map Reports NWQ Data Setup


Map >> Latest Measurement Data

All Latest Measurements Latest Measurement Data Station Description Archived Data

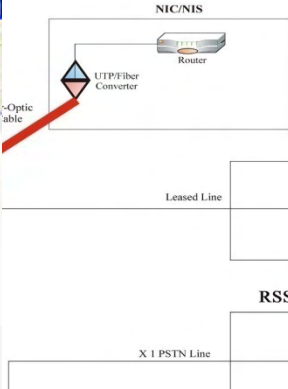
Station Status Alarms View TMS Console

Telemetry Station Name: KACJ Deir Alla Intake (مياه ديراللا) Station Code: C0605

Parameter Name	Unit	Result	Standard	Date/Time
Temperature	°C	22.9	-	01.04.2008 15:02
pH	SU	7.37	-	01.04.2008 15:02
EC	µS/cm	1323	-	01.04.2008 15:02
DO	mg/L	-	-	01.01.2007 13:02
Turbidity	NTU	32.23	-	01.04.2008 15:02
TP	mg/L	<1.00	-	01.04.2008 12:02
TN	mg/L	<1.00	-	01.04.2008 12:02
COD	mg/L	<1	-	01.04.2008 15:02

\* Results shown in red color indicate an out of standard value.  
 \*\* The  icon indicates that the current reading is late.

Back Print



Telemetry System - Windows Internet Explorer

Environment Monitoring And Research Central Unit

Map Reports NWQ Data Setup

Standard Report User-Defined Report Status & Alarms Report

Reports >> Standard Report

Parameter Based

Parameter:

Sampling Location(s):

Sampling Location Based

Sampling Location:

Search Sampling Locations

With Name:

or Code:

Refine Search

Government:

City:

Telemetry System - Windows Internet Explorer

Environment Monitoring And Research Central Unit

Map Reports NWQ Data Setup

Map >> Status

All Latest Measurements Latest Measurement Data Station Description Archived Data

Station Status Alarms View TMS Console

Telemetry Station Name: KACJ Deir Alla Intake (مياه ديراللا) Station Code: C0605

Status Name	State	Status Date/Time
Sampling Pump Operation	ON	01.04.2008 09:02
Under Maintenance	OFF	31.03.2008 11:02
Under Cleaning	OFF	01.04.2008 09:02
Power Failure of W/P	OFF	29.03.2008 11:02
Upper Limit Water Level	OFF	31.03.2008 11:02
Lower Limit Water Level	OFF	31.03.2008 11:02
Sampling Pump Failure	OFF	31.03.2008 11:02
Measuring device abnormality	OFF	31.03.2008 11:02
COD: Power Failure	OFF	31.03.2008 11:02
COD: Under Maintenance	OFF	31.03.2008 11:02
COD: Sample Water Failure	OFF	31.03.2008 11:02
COD: Under Cleaning	OFF	01.04.2008 13:02
COD: Light Source Failure	OFF	31.03.2008 11:02
TN, TP: Power Failure	OFF	26.02.2008 12:02
TN, TP: Sample Solution Measure Abnormality	OFF	31.03.2008 11:02
TN, TP: Solution Measure Abnormality	OFF	29.03.2008 12:02
TN, TP: Under Maintenance	OFF	22.01.2008 14:02
TN, TP: Optical System Failure	OFF	31.01.2008 11:02
TN, TP: Calibration Abnormality	OFF	31.03.2008 11:02



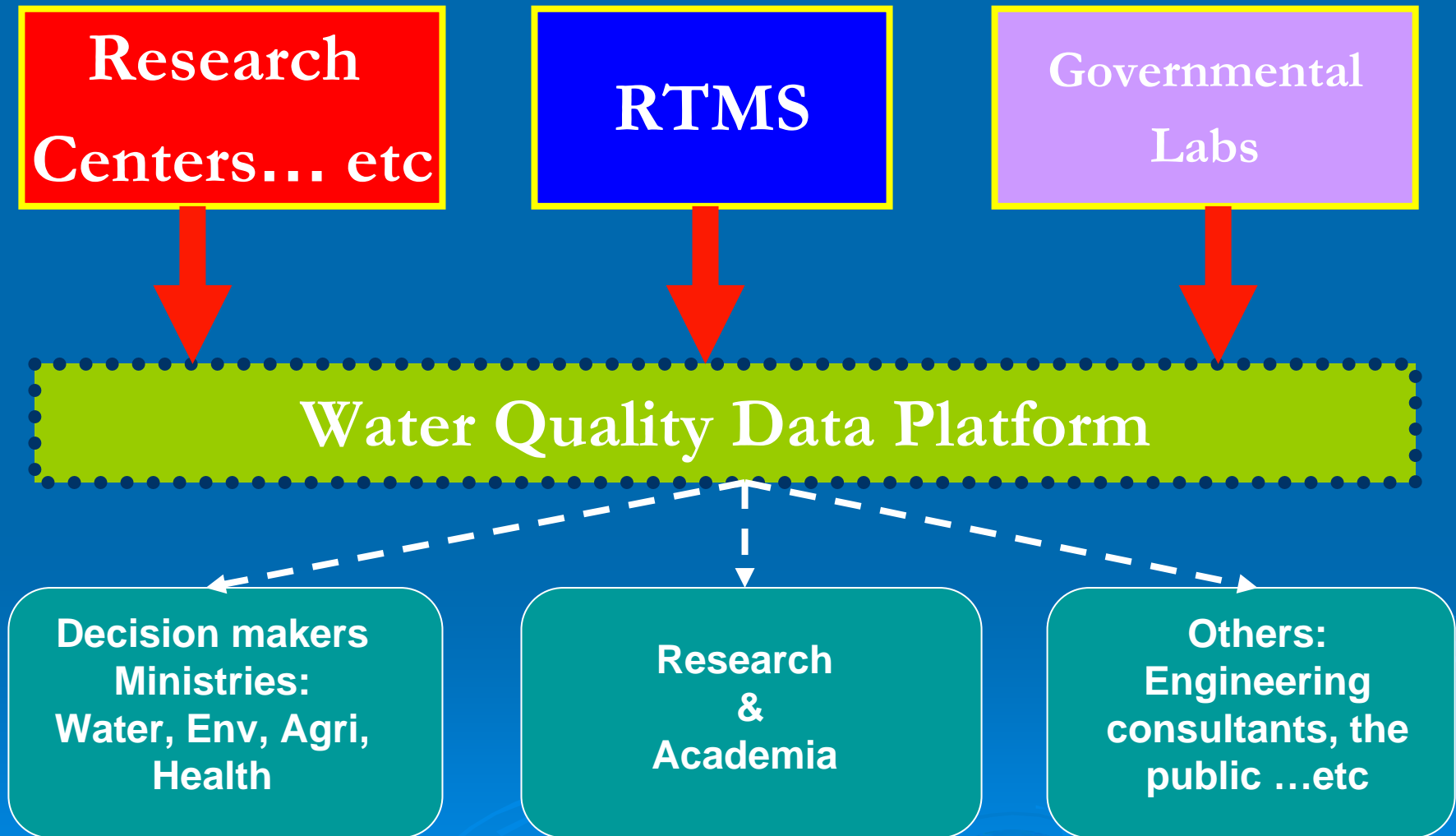
**pH, T, EC, NTU, DO, COD, T-N & T-P**



# Characteristics of the RTMS System

- State-of-the-art technology
- Real-time: *enabling timely decisions*
  - <http://www.emarcu.gov.jo>
- Accurate: *as human errors are minimized*
- Impartial: *records can't be changed*
- Long-term: *data stored in EMARCU database*
- Forms a basis for other environmental applications: *e.g. air & soil pollution monitoring*

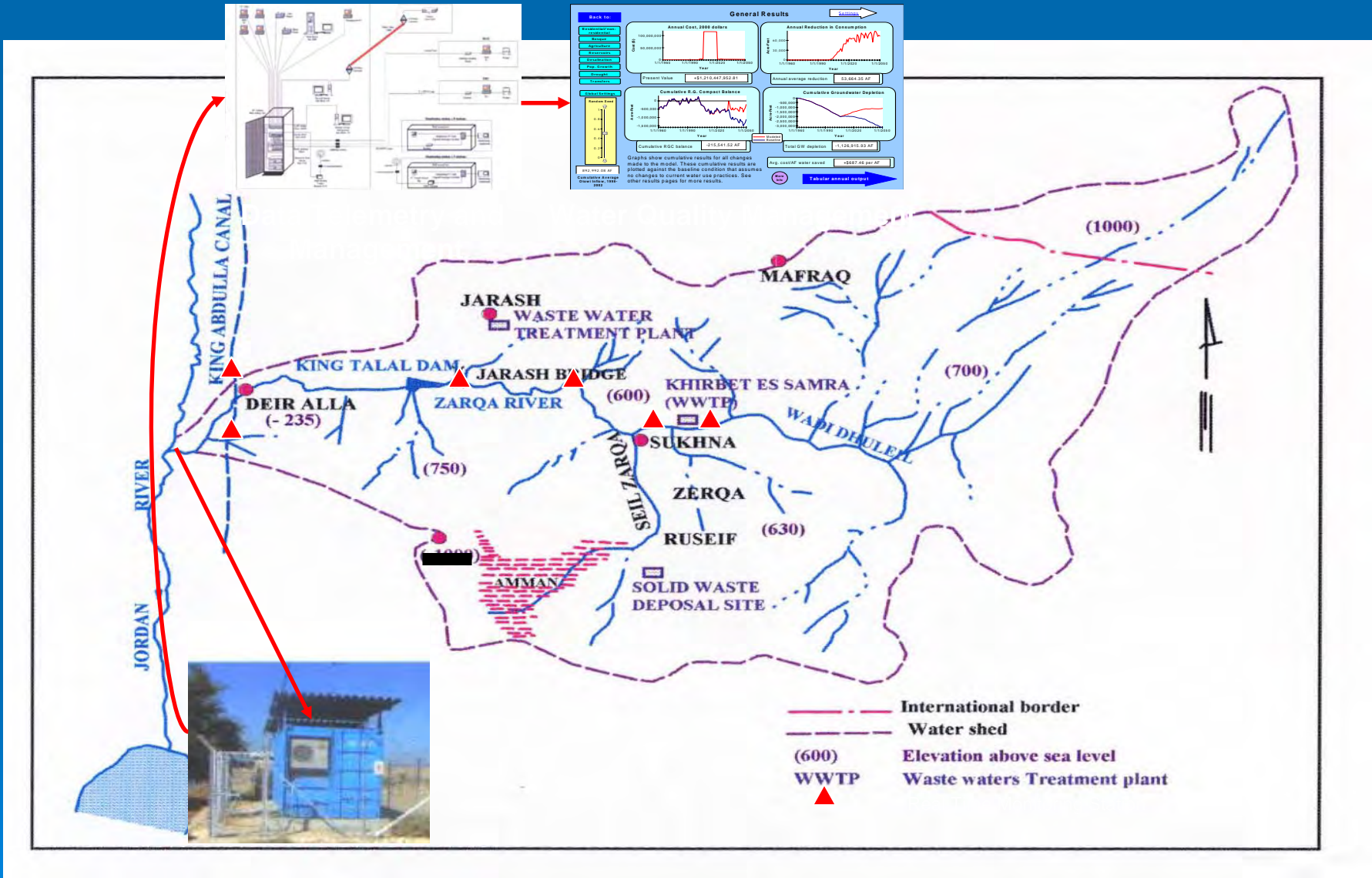
# Real-time On-line Dataflow



# Potential Users *of* RSS RTMS

- Decision makers:
  - *MOE: Enforcing environmental regulations*
  - *MWI: in employing integrated water management*
  - *MOA: managing agricultural water quality*
  - *MOH: public health protection*
- Planners:
  - Long-term planning
  - Emergency
  - For an Early warning System
  - Security
- Water utility managers: *e.g. Zai WTP*
- Engineering consultants: *feasibility and design studies*
- Farmers: *management of salinity & use of fertilizers*
- Academics & Researchers: *through coordinated data provision*
- **The public:** *transparency and confidence building*

# Integrated System for Water Quality Management (ISWAQ)



Real Time  
Data Collection



# Concluding Thoughts

- Harmonize the monitoring process through a unified identification system to Facilitate data sharing and process optimization.
- Promulgate a national water information policy
- Adoption of emerging water quality (& quantity) monitoring technologies
- Encourage cooperation between scientific institutes, water providers and operators and regulatory agencies

THANK YOU  
*for your attention*