



**The Hashemite Kingdom of Jordan
Ministry of Water & Irrigation
Jordan Valley Authority**

GENERAL INFORMATION

**THE THIRD COUNTRY TRAINING PROGRAMME
For
WATER RESOURCES MANAGEMENT**

August / September 2004

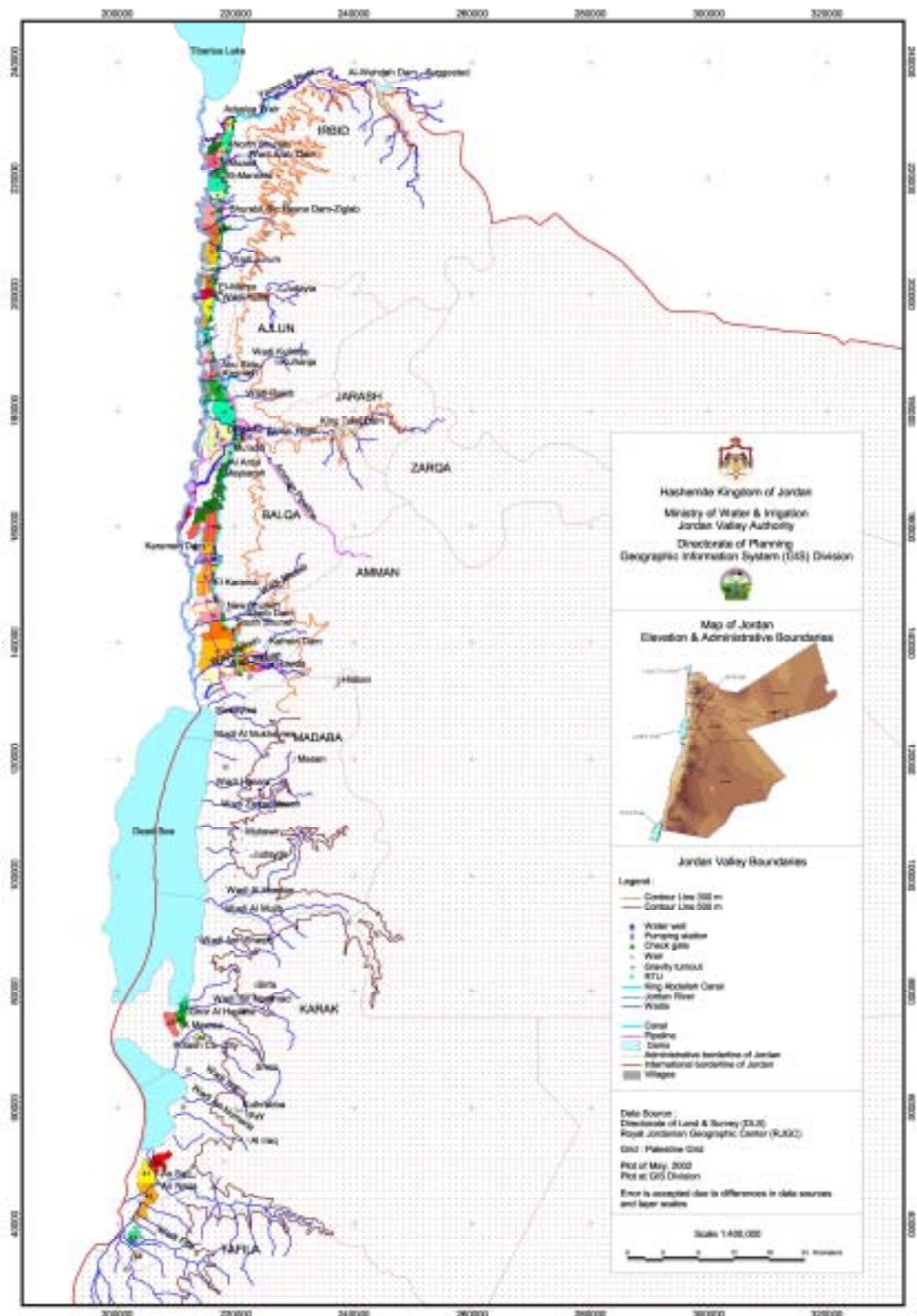


Table of Contents

Background

Jordan Valley Authority (JVA) Role

Water Resources

Surface water resources

Ground water resources

Treated Waste water

Storage Reservoirs in the Jordan Valley

Irrigation Networks

Special Projects

Water Resources Management

Training Programme

Tentative Curriculum of the Programme

Tentative Schedule

Background

The Jordan Rift Valley (JRV) extends from the Yarmouk River in the north to the Gulf of Aqaba in the South for about 360 km, with an average width of 10 km. The elevation of its valley floor varies from -212m south of Lake Tiberias to - 415m at the Dead Sea, and it rises to +250 m in central Wadi Araba.

The variations in temperature, humidity, and rainfall produced distinct agro-climatic zones. Annual rainfall starts in October and ends in May. Precipitation reaches 350-400 mm/year in the north and drops down to 50 mm/year in the south. The warm winter of the valley allows the production of off-season crops and can be considered as a large green house.

The annual available water resources in the valley spins around 250-300 MCM, while the annual demand for irrigation exceeds 500 MCM. Around 60 MCM of water is pumped up to the city of Amman and 20 MCM to Irbid for domestic uses.

Jordan Valley Authority (JVA) Role

The Jordan Valley Authority (JVA) is in charge of the integrated development of the Valley. Its activities include :

A. Development of water resources of the Jordan Valley and their utilization for purposes of irrigated agriculture, domestic and municipal uses, industry, hydropower generation and other beneficial uses. Also, the protection and conservation of these resources, and the implementation of all works related to the development, utilization, protection and conservation thereof, including:

1. Conducting studies required for evaluation of water resources including hydrological, hydro geological and geological studies, drilling of explanatory wells and installation of observation wells.
2. Planning, design, construction, operation and maintenance of irrigation projects and related structures and works of all types and purposes including dams and appurtenant works, pumping stations, reservoirs and water conveyance and

distribution networks, surface and subsurface drainage works, flood protection works, and roads and building needs for operation and maintenance.

3. Soil surveys and classification, and the identification and reclamation of lands for use in irrigated agriculture, and dividing them into farm units.

4. Settlement of disputes arising from the use of water resources.

5. Organizing and directing the construction of private and public wells in coordination with the Water Authority Of Jordan.

6. Developing and improving the environment and the living conditions in the Jordan Valley, and implementing the related works including:

- Setting rules and regulations for areas of land on which construction of buildings is permitted, setback lines, rights of way, etc., outside towns and villages borders.
- Development of lands planned for use as residential, industrial, agricultural and other zones.

B. Planning, design and construction of farm roads.

C. Development of tourism in the Jordan Valley including construction of tourist and recreational facilities.

D. Social development of the Valley inhabitants including the establishment of private institutions in order to help them contribute to the development of the Valley and to the achievement of the development objectives.

Water Resources

Water Resources in the Jordan Valley are traditionally classified into surface and groundwater resources in addition to the treated waste water:

Surface water resources

Water resources in the JRV are characterized by scarcity, variability, and uncertainty. The Jordan River originating at the outlet of lake Tiberias, and discharging into the Dead Sea forms the North-South axis of the valley. Several East-West oriented tributaries flow into the river. The water provided by these tributaries is used, for irrigation and domestic purposes.

Yarmouk River is the major Jordan River tributary. Its water is shared with the upstream and downstream neighboring countries. The flow of the river is highly fluctuating between winter and summer. Average historical records of the river flow were around 400 MCM/year, while in the recent years it dropped down to about 90-130 MCM.

Water flow from the side Wadis of the Jordan Valley is about 150 MCM/year. The main tributaries of the lower Jordan River sub-basin are, the Zarqa River, and the wadis of Arab, Ziglab, Jurum, Rayyan (Yabis), Kufranja, Rajib, Shueib, Kafrein and Hisban. The Zarqa River is the largest tributary, with an annual contribution of around 80-90 MCM.

The East Dead Sea sub-basin consists of catchments draining to the Dead Sea. The sub-basin has a total area of 10,838 km². The major tributaries are the Wadis of Mujib, Wala, Zarqa-Ma'aeen, Karak, Hasa, and other inter-catchments including Wadi Ibn Hammad.

The South Dead Sea sub-basin extends from the southern end of the Dead Sea approximately 100 km south at Gharandal in Wadi Araba. The average surface water resources in this sub-basin amount to about 11.6 MCM. The major streams in this sub-basin are wadis Feifa, Khneizerah, Fidan, Musa, Dana, Siq and Ruqayyah.

Ground water resources

Groundwater is scarce in the Jordan Valley. The three main well fields producing

40-50 MCM/year are:	Mukheiba	20-30	mcm/year
	Wadi Arab	12-15	mcm/year
	South JV	20	mcm/year

Treated Waste water

Treated waste water from Khirbet As-samra is mixed with Zarqa River water at King Talal Reservoir (KTR). An annual average of 50 MCM/year of treated waste water flows into KTR.

Storage Reservoirs in the Jordan Valley

- **Wadi Arab Dam:** (16.8 MCM) receives water from the wadi Arab and from the Yarmouk through the KAC, by means of a pumping station and a 1200 mm pipe. The reservoir stores Yarmouk winter water and return it to the KAC during the summer. The reservoir also provides water to the NEG (North East Ghor) and Wadi Arab irrigation projects.
- **Wadi Ziglab Dam:** (3.9 MCM) stores water from wadi Ziglab. It provides water exclusively to the NEG project.
- **King Talal Dam:** (75 MCM) stores water from the Zarqa river including Amman M&I treated return flow from As-Samra WTP. This water is then released into the Zarqa river for further diversion either to Zarqa Carriers I & II for irrigation of the Middle Ghor area, or to KAC South.
- **Karama Dam:** (53 MCM), stores Yarmouk winter floods flowing via KAC. A project is being implemented to convey Jordan River floods to the dam. This water will be pumped back into the KAC South in order to supply irrigation water for the 14.5 km extension project. Recreational facilities are being planned around the dam.
- **Shueib Dam:** (1.4 MCM) collects water from wadi Shueib and Salt Treatment Plant. It is used as groundwater recharge and for the irrigation of around 2500 dunums in South Shuneh.
- **Kafrein Dam:** (8.4 MCM) collects water from wadi Kafrein and Wadi Sir Treatment Plant. It also receives water from wadi Hisban via a diversion weir and a 400 mm pipe. The reservoir provides water to the Hisban/Kafrein irrigation project.
- **Mujib Dam:** (31.2 MCM) collects water from wadi Mujib for domestic, industrial, tourist and agricultural uses.

- **Wala Dam:** (9.3 MCM) constructed at wadi Wala for multi-uses and artificial recharge.
- **Tannour dam:** (16.8 MCM) constructed at wadi Hasa for agricultural purposes.
- **Wehda dam:** (110 MCM) is being constructed at Yarmouk River for domestic (50 MCM) and irrigation (31 MCM) purposes. Completion expected end of 2005.

Irrigation Networks

All the irrigation networks of the Jordan Valley are pressurized. Conversion from open channels have been completed in order to raise the conveyance and distribution efficiency. The main irrigation projects are:

- **North Ghor:** The conversion to pressurized networks was completed in April 1996 to irrigate 73000 dunums.
- **North East Ghor (NEG):** Supplied by three main resources: Wadi Arab reservoir, Wadi Ziglab reservoir, and wadi Jurum. In addition to KAC to irrigate 42000 dunums.
- **Middle Ghor:** Supplied by KAC North and KAC South. Some networks are also supplied by the Zarqa river via the ZCII carrier. The irrigated area is 64500 dunums.
- **Zarqa Triangle:** Supplied by the Zarqa river via the ZCI carrier. It may also be supplied by KAC North through the “Dual Pumping Station” (T.O.63). Damya irrigation network is considered as part of the Zarqa triangle project and fed by KAC South. The total irrigated area is 16500 dunums.
- **18 km extension:** Supplied by KAC south to irrigate 36500 dunums.

- **14.5 km extension**: The area to be irrigated is 60000 dunums, but no sufficient water is available to irrigate the project.
- **Hisban/Kafrein**: Supplied by the Kafrein dam, and Wadi Hisban. The irrigated area is 16600 dunums.
- **Southern Ghors**: Supplied by Southern Ghors wadis to irrigate around 47500 dunums.
- **Southern Ghors (Stage II)**: Additional 2200 dunums will be irrigated from Mujib southern conveyor at Ghor Mazraa/Haditha and around 7500 dunums from Tannour Dam at Ghor Feifa, Khnaizeireh and Sammar.

Special Projects

These projects aim at the use of advanced technology to raise the efficiency of water management and reduce losses. These technologies are applied in pilot areas in direct cooperation with the local farmers groups. Examples of these projects are:

- **Irrigation Optimization in the Jordan Valley (IO. JOV)**:
This project started at pumping station no. 2 in Adasiya then moved to pumping station no. 41 in Wadi Rayyan (northern Jordan Valley), and now at pumping station no. 55 (middle Jordan Valley) to help the farmers use advanced technologies to define the exact time and amount of irrigation. The farmer's turnouts discharge was reduced from 9 to 6 liters/second and the surface irrigation systems inside the farms were changed to micro-irrigation. Irrigation networks are being simulated and analyzed for equal pressure and discharge distribution along the networks.
- **Automation of the King Abdullah Canal**:
The project helps to automatically monitor and control the 110 km long King Abdullah Canal (KAC). All the inflows into the canal and the outflows from it

are continually measured and observed at the control center in Deir Alla, and the check gates along the canal are remotely adjusted from the center.

- **Water Management Information System (WMIS):**

The system is composed of a series of computer modules for the water management in the Jordan Valley. Seasonal, monthly and daily water balances are performed to balance the available water resources with the demands for both irrigation and domestic uses. Historical Data are analyzed and validated, and reports are provided for the use of JVA management.

- **Water Resources Management in Irrigated Agriculture:**

The project aims at participating farmers in irrigation water distribution. It was able during the past two years to establish the participation of WUA in the water distribution management initially in pilot areas in the Jordan Valley where the distributing networks were impaired by continued misuse over a number of years. Farmers joined in User Associations, experience and learn cooperation among themselves and with JVA staff. They participate in the rehabilitation and maintenance

of the irrigation networks. Suitable organizational forms like Cooperatives, Water Councils and Committees were established at different locations of the Jordan Valley according to the local conditions at each location.

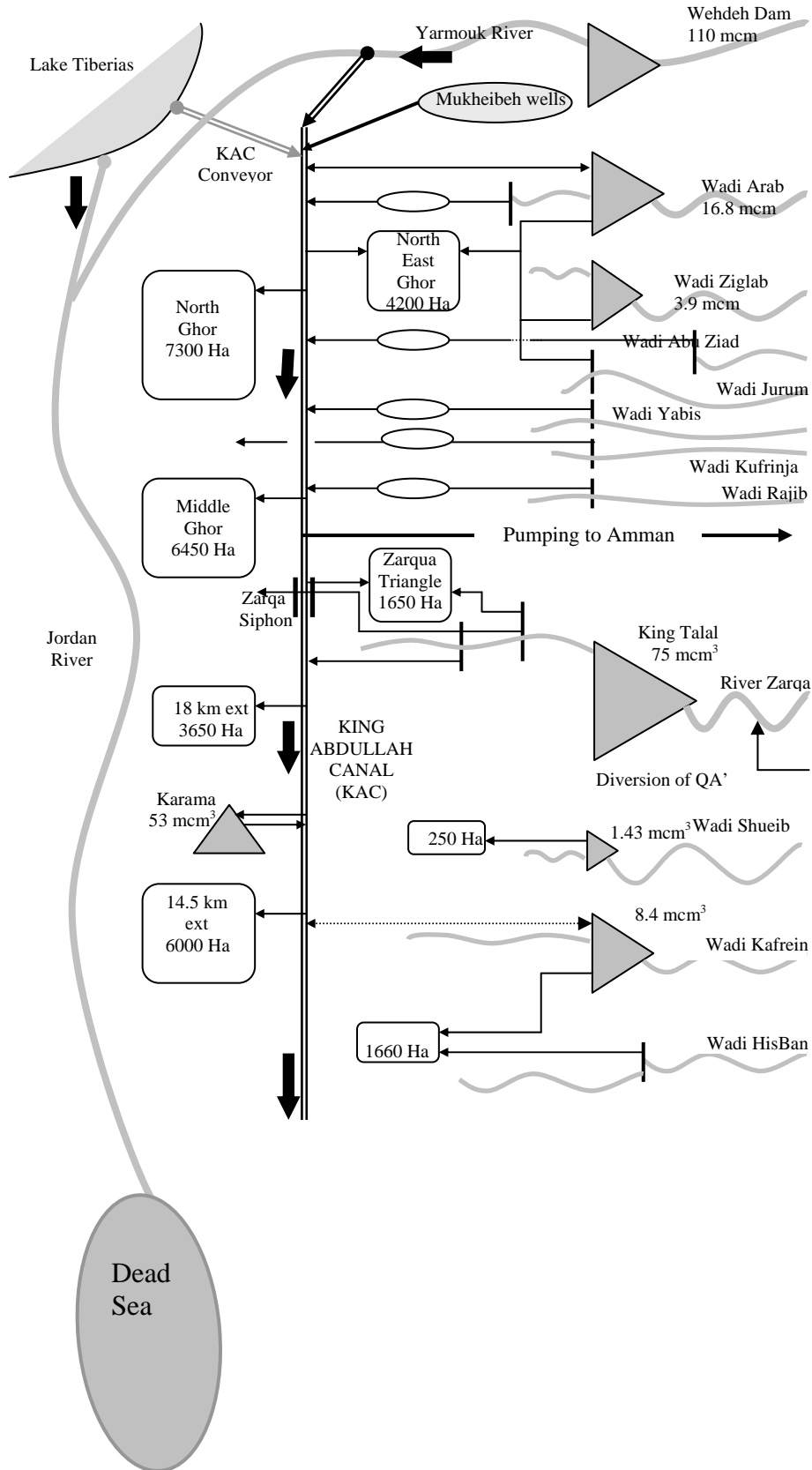
- **Reclaimed Water Project (RWP):**

The project is a succession of the Brackish Water Project which studied the use of brackish water in irrigation and issued a guideline to farmers on the best practices to irrigate certain crops with Brackish water in the Jordan Valley. The new project aims at producing guidelines for the use of Reclaimed water in an environmentally safe and economically viable manner.

- **Kafaa' Project:**

The project aims at raising the efficiency of water use and improving the agricultural practices of farmers, from the seed until marketing the end product, towards a sustainable agriculture.

Figure 1. Jordan Valley Hydraulic Scheme



Water Resources Management

The Jordan Valley Authority (JVA) is responsible for operating and maintaining the hydraulic system in the valley. The major factor in JVA water management is the availability of water resources, which is mostly less than what is needed to irrigate irrigable lands in the valley, thus the main symptom of water management is crisis and drought management.

An irrigation system enables water to be acquired, transported and supplied to users. It requires a hydraulic infrastructure that consists of facilities for diversion, conveyance, regulation and management of water and an organization in charge of its management.

From the perspective of users, four issues are to be considered:

- **Adequacy:** the ability of the water supply schedule to meet the water demand for optimal plant growth.
- **Reliability:** the confidence in the irrigation system.
- **Equity:** the access to a fair share of the water resources.
- **Flexibility:** The ability of user to choose the timing, duration and frequency of water delivery.

The following series of procedures were conducted by JVA in this context:

- The conversion of surface irrigation channels into pressurized pipes. Each farm unit has been equipped with a farm turnout assembly (FTA) including pressure regulator, water meter and a flow-limiting device.
- King Abdullah Canal (KAC) was rehabilitated to reduce losses and improve its operation conditions. Water measurement network was installed along KAC and a SCADA system was applied to monitor and automatically control the canal check gates from a control center in Deir Alla.
- A computerized water management information system was introduced to balance water resources with demands and optimize water distribution to the farm units.
- Pilot projects are being implemented to optimize the water distribution activities, and to raise the water use efficiency inside the farm units by introducing modern technologies and using water saving systems and devices. An Irrigation Advisory Service (IAS) has been established at JVA to help farmers in implementing these systems and devices.
- Farm turnouts discharge is being reduced to the original design of 6 l/s instead of 9 or 12 l/s at the pilot areas, and a hydraulic computerized model (EPANET) is being introduced to optimize and ratify the rotation schedule.
- Farmers are encouraged to change their irrigation systems from surface to micro-irrigation, and to form water user groups to participate in taking over

the responsibilities of water distribution at the secondary and tertiary levels. Opening and closing the farm turnouts by the farmers relieves JVA ditch riders from this cumbersome responsibility and reduces drastically the illegal water use.

- Guidelines were issued to help farmers on the best practices to irrigate certain salt tolerant crops with Brackish water. Guidelines for the use of Reclaimed water in an environmentally safe and economically viable manner are also being prepared.
- The Jordan Valley Development Law no.19/1988 was amended (no. 30/2001) to allow for larger farm units areas, thus more economically feasible agriculture, and to allow for the private sector participation, which opened the door for the farmers participation in water management.
- Instructions for irrigation water use were published to define water allocations according to the geographic area, crop type and month of the year. Leaching requirements were also defined.
- A monthly charge was imposed to keep the farm turnout assemblies including the water meters in good working conditions, thus assuring the sustainability of the irrigation projects.

Training Programme

Purpose

The purpose of the Programme is to provide the participants from the Republic of Iraq with an opportunity to update their knowledge and techniques and to exchange practices and experiences of Jordan in the field of Water Resources Management.

Objectives

At the end of the Programme, the participants are expected to understand comprehensive water resources management system and how to utilize water resources effectively.

Duration

The duration of the Programme will be approximately two (2) weeks and held from August to September 2004.

Number Of Participants

The number of participants shall be twenty-two (22) in maximum.

Facilities And Institutions

The Programme will be carried out at JVA and other related facilities.

Joint Evaluation

Evaluations of the Programme will be conducted jointly by parties concerned in order to examine the achievement and further cooperation programmes at the end of the Programme and after the completion of the Programme.

Day No.	Date		Time		Place	Activity
			From	To		
Day 1	22-Aug	Sun				(Move) Baghdad - Amman
Day 2	23-Aug	Mon				<u>Orientation & Introduction of Jordan Valley</u>
			9:00	9:45	Hotel	Opening Ceremony
			10:00	12:00	Hotel	Orientation of Water Resources Management Training Course
			13:00	15:45	Hotel	Introduction of Jordan Valley and Activity of JVA
			16:00	17:30	Hotel	Presentation by Trainees
Day 3	24-Aug	Tue				<u>Site Investigation</u>
			8:00	10:00	Umm Case	Site visit (Yarmuk River, KAC,...)
			10:00	12:00	Unity Dam	Yarmuk River on the border of Syria and Jordan
			12:00	13:00	Lunch	In the Bus
			13:00	14:00	Wadi Arab Dam	Reservoir and Pump station explain for the operation rule for pump station
			14:00	16:00	King Abdula Canal	Inspection of Check gates, Pump stations
			16:00	17:00	Dead Sea	Site visit
			18:00	19:00	Amman	
Day 4	25-Aug	Wed			Amman	<u>Hydrological Monitoring & SCADA System of Jordan Valley Authority</u>
			9:00	10:00	Control Center	Amman -> Control Center
			10:00	12:00		Introduction of Hydraulic Monitoring System
			12:00	13:00		Lunch Break

			13:00	14:30		Introduction of SCADA System
			15:00	16:30		Introduction of Water Management Information System
			16:30	17:30		Control Center -> Amman
Day 5	26-Aug	Thu				<u>Water Quality Control System of Jordan Valley Authority</u>
			9:00	10:00	Control Center	Control Center -> Amman
			10:00	12:00		Introduction of Water Quality Control System at King Talal Dam
			12:00	13:00		Lunch Break
			13:00	15:00	Site Visit	KAC North/South and King Talal Dam
			15:00	17:00	Site Visit	Zarkah River and Water Treatment Plant
			17:00	18:00		Zarkah River -> Amman
Day 6	27-Aug	Fri				holiday
Day 7	28-Aug	Sat				holiday
Day 8	29-Aug	Sun				<u>On Farm Demand Control System for Irrigation Area</u>
			9:00	10:00	Control Center	Control Center -> Amman
			10:00	11:00		Water Requirement Estimation by Farm Unit
			11:00	12:00		Hourly Water Demand Estimation by Stage Office
			12:00	13:00		Gate Operation Rule / Demand Control and Water Tariff
			13:00	14:00		Lunch
			14:00	17:00	Site Visit	Stage Officers Office and On-Farm Observation
16:00	17:00		Control Center -> Amman			

Day 9	30-Aug	Mon				<u>On Farm Water Saving Technologies</u>
			9:00	10:00		Amman -> Control Center
			10:00	12:00		Introduction of Water Saving Farming Technologies and Cropping Patterns
			12:00	13:00		Lunch
			13:00	16:00	Site Visit	Site Observation for Drip Irrigation, Sprinkler
						Irrigation, Irrigation Area by treated waste water,
						Vynil house farming, Vynil mat farming,
			16:00	17:00		Food Processing, Agricultural Cooperation Control Center -> Amman
Day 10	31-Aug	Tue	Whole Day		Hotel	<u>Discussion 1</u> Project Formulation of Japanese Assisted Water Resources / Irrigation Projects
Day 11	1-Sep	Wed	Whole Day		Hotel	<u>Discussion 2</u> Project Formulation of Japanese Assisted Water Resources / Irrigation Projects
Day 12	2-Sep	Thu	9:00	12:00	Hotel	Evaluation Meeting
			12:00	13:00		Lunch
			13:00	14:45		Closing Lecture by Japanese Expert
			14:00	15:15		Closing Lecture by JVA Water Resources Expert
			15:30	16:30		Closing Ceremony (certificates)
Day 13	3-Sep	Fri				(Move) Amman - Baghdad