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Ministry of Water and Irrigation

Jordan Valley Authority

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Policy and Adaptation in the Jordan Valley

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EXECUTIVE SUMMARY

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The Jordan Valley Authority (JVA) under the Ministry of Water and irrigation is entrusted with the integrated socio-economic development of the Jordan Valley. During the last 30 years, JVA completed numerous infrastructure projects in the Valley that changed the life style of its inhabitants and reversed rural to urban migration and even attracted others to settle in the area.

Presently, JVA is focusing its efforts on water and land resources development, management and protection, in addition to tourism development and promotion in the Jordan Valley.

Jordan Water Strategy and Policies were summarized, and the Institutional set-up in the Jordan Valley was discussed and the twenty adaptive measures to apply these policies were introduced.

A modern water control center, using an advanced Supervisory, Control and Data Acquisition System (SCADA), was installed in the Valley to monitor and control the water management activities, and a Water Management Information System (WMIS) was developed to provide the necessary decision support tools for optimum water distribution of the limited water resources to satisfy the agricultural and domestic water users.

The WMIS modules help system managers in the development of the seasonal water management strategies, and to follow up the monthly and daily water management activities and to balance available water supply and water demand.

Water tariffs were introduced, with an increasing block structure to encourage farmers to reduce water consumption and save irrigation water.

A participatory water distribution management approach was implemented to encourage farmers to form water-user groups that suite their particular situations in order to share the responsibility of irrigation water distribution with the JVA. This approach became possible after the amendment of the Jordan Valley Development Law no. 30/2001 which allowed the participation of the private sector in the operation and management of the irrigation system in the Jordan Valley, as reflected in the JVA Strategic Plan for the years 2003-2008.

Keywords : Jordan Valley, JVA Mandate, Strategic Plan, Water Management Information System, SCADA, JWC, Red Sea-Dead Sea Water Conveyance Project.

1. BACKGROUND

The Jordan Valley (JV) is part of the Great Rift Valley that extends from south Turkey to the horn of Africa. In the Hashemite Kingdom of Jordan (HKJ), it extends for about 400 km from the Jordanian borders south of Lake Tiberias in the north to the Gulf of Aqaba in the South. According to the JV Development law, it extends Westwards to the western Jordanian borders and Eastwards to 300 meters above sea level north of the Dead Sea and 500 meters above sea level south of the Dead Sea. The valley is 5-10 km wide, and its floor varies in elevation from -212m south of Lake Tiberias to - 417m at the Dead Sea, and it rises to +250 m in central Wadi Araba before it drops down to sea level in Aqaba.

The variations in temperature, humidity, and rainfall produce distinct agro-climatic zones. Annual rainfall starts in October and ends in May, most of which fall from December to February. The northern area receives about 400 mm/year, while the southern areas receive 100 mm/year. In dry years precipitation drops down to 200 mm in the northern area, and to 50 mm at the Dead Sea, while in wet years these same locations receive up to 650 mm and 250 mm respectively.

The salient variations between northern, central, and southern parts of the JV are also clear in terms of water availability, water quality, soil type, and cropping pattern. Water resources in the JV are scarce and deteriorating, which severely constrains agricultural production. The annual available water resources in the valley are estimated to be 300 –350 million cubic meters (MCM), while the annual demand exceeds 500 MCM. The agricultural land that could be irrigated represents about 60% - 70% of the irrigable land in the valley due to the lack of water resources, and the gap between supply and demand is increasing due to the competition between municipal and industrial (M&I) water users and irrigation water users.

The Jordan Valley can be considered a natural green house with the relative advantage of producing off-season fruits and vegetables. Although its area represents less than 5% of the HKJ area and its population less than 6% of the country's population, the valley produces more than 60% of the Kingdom's fruits and vegetables.



Figure 1: Jordan Valley Mandate North of the Dead Sea



Figure 2: Jordan Valley Mandate South of the Dead Sea

2. WATER RESOURCES IN THE JORDAN VALLEY

2.1 Surface water resources

Water resources in the JV are characterized by scarcity, variability, and uncertainty. One of the main sources of water in the JV is the Jordan River. The lower Jordan River originates at the outlet of lake Tiberias and discharges into the Dead Sea, and it forms the North-South axis of the valley, with several tributaries flowing from the east and west of the river.

The Yarmouk River is the major lower Jordan River tributary, and its waters are shared with neighboring countries located upstream and downstream of the river. The main eastern tributaries of the lower Jordan River sub-basin are, the Zarqa River, and the side wadis of Arab, Ziglab, Jurum, Rayyan, Kufranja, Rajib, Shueib, Kafrein and Hisban.

The East Dead Sea sub-basin includes the wadis of Mujib, Wala, Zarqa-Ma'een, Karak, Hasa, Ibn Hammad and other inter-catchments. The South Dead Sea sub-basin includes the wadis of Feifa, Khneizerah, Ad Dahil, Fidan, Musa, Dana and As Siq.

The total surface water resources currently available in the JV amounts to about 337 MCM/year, of which 217 MCM/year is in the northern part of the Valley and 120 MCM/year is in the south.

2.2. Ground water resources

Groundwater is scarce in the JV. There are three main well fields producing about 45 MCM/year:

The Mukheibeh well field (25 MCM/year), the Wadi Arab well field (12 MCM/year), and the Kafrein well field (8-12 MCM/year).

2.3 Treated Waste water

There are 22 waste water treatment plants (WWTP) in Jordan producing about 80 MCM/year, of which 60 MCM flows down to the Jordan Valley, with Khirbet Al-samra, discharging to Zarqa river being the largest with a flow of about 50 MCM/year. Figures 2 and 3 summarize the currently available water resources and demands in the JV areas north and south of the Dead Sea.

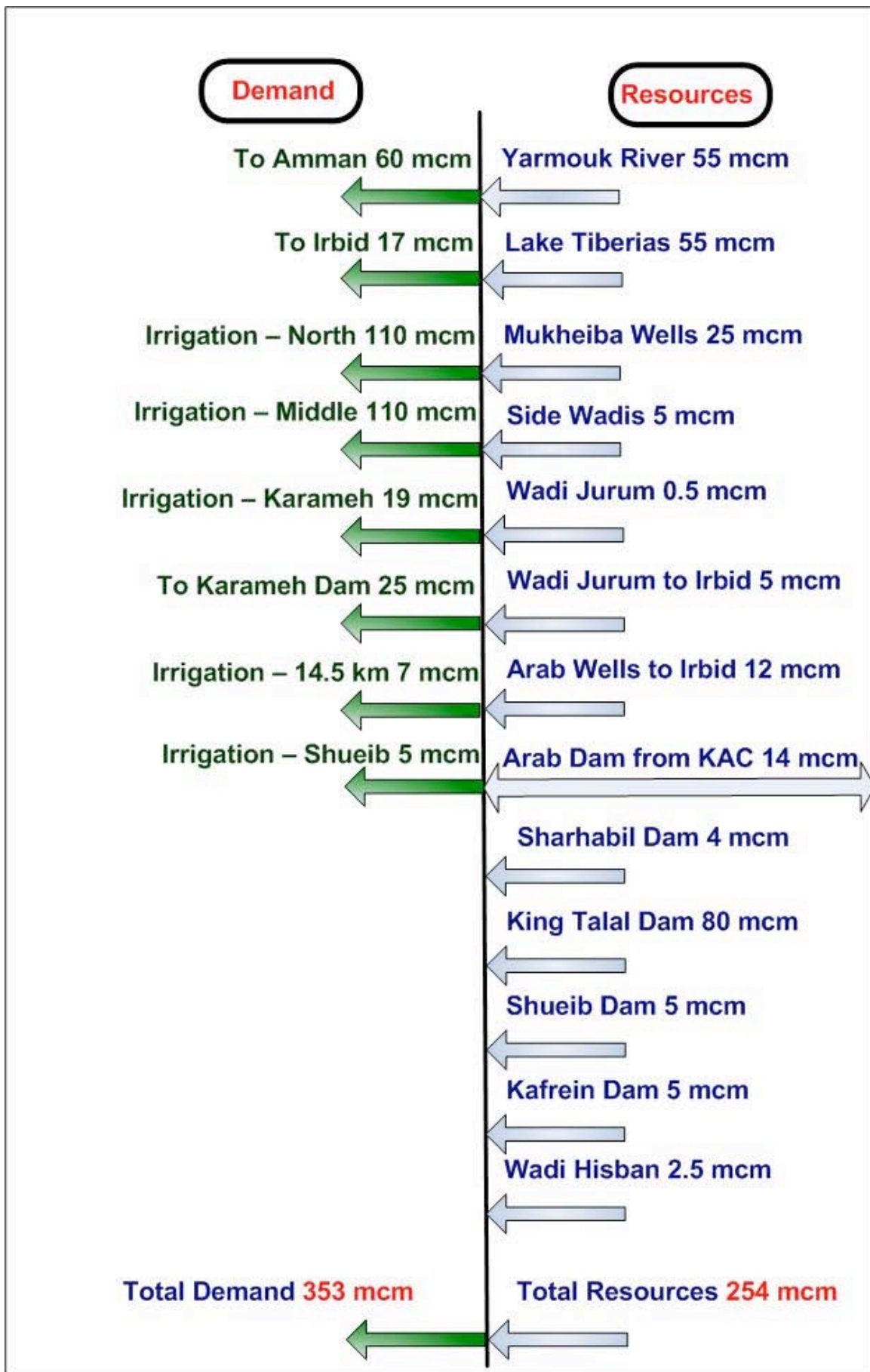


Figure 3: Current Demand and Resources North of the Dead Sea

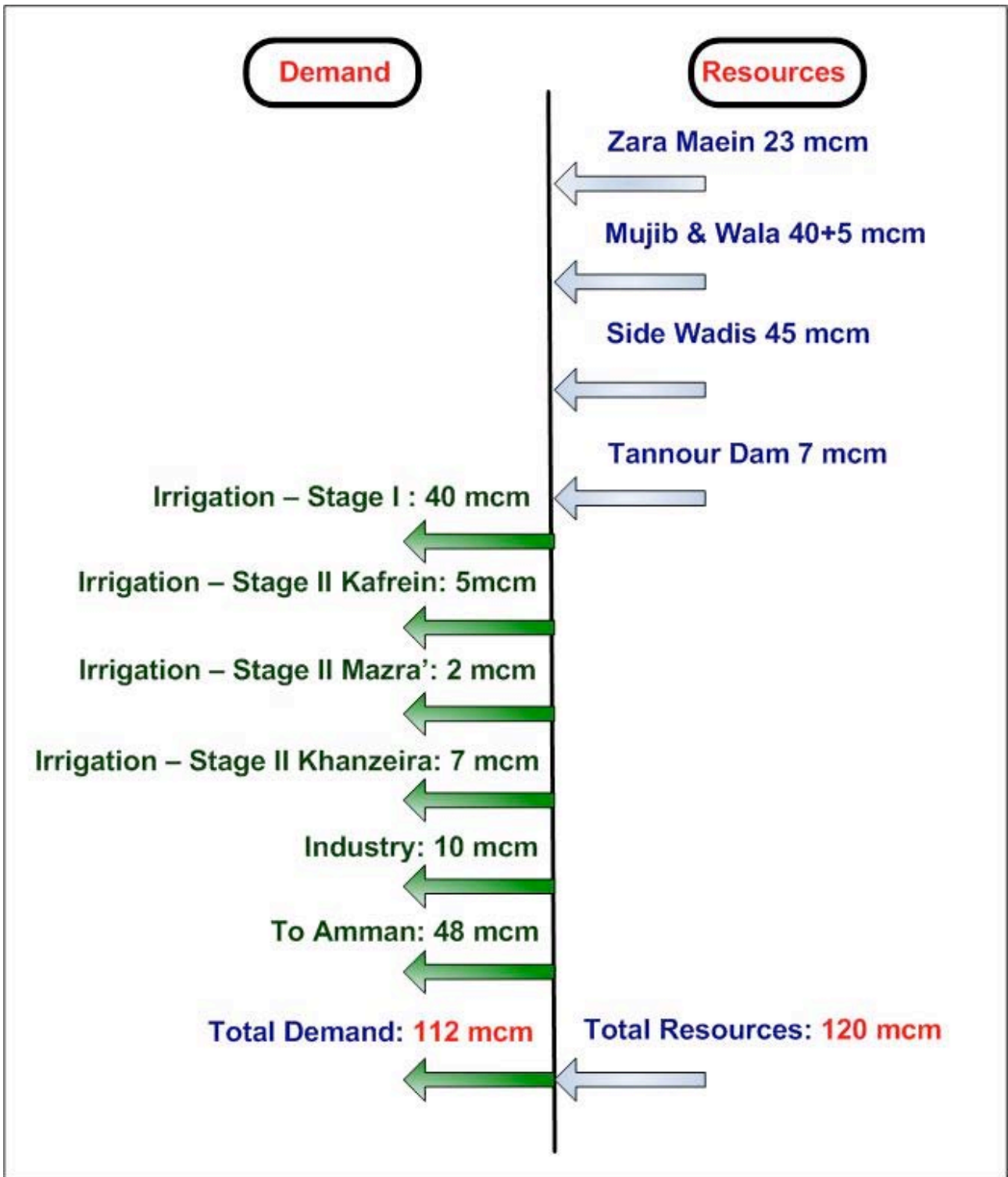


Figure 4: Current Demand and Resources South of the Dead Sea

3. INFRASTRUCTURE DEVELOPMENT IN THE JORDAN VALLEY

The Jordanian Government, through the Jordan Valley Authority (JVA) and its predecessor organizations, started since the early fifties of the last century to implement infrastructure and irrigation projects development in the Jordan Valley.

In 1958 the construction of the East Ghor Canal (now King Abdullah Canal) allowed the conveyance of water from the Yarmouk River to irrigate lands in the JV. The first phase was 70 km long ending at the Zarqa River and irrigating 12000 hectare. The canal was later extended by 8 kms, 18 kms and finally by 14.5 kms in 1989 for a total length of about 110 kms.

Other irrigation projects were constructed and irrigated directly from other water sources such as the North East Ghor (NEG) project which is supplied by the reservoirs on wadi Arab and wadi Ziglab in addition to wadi Jurum water to irrigate 4200 hectare, the Zarqa Triangle project which is supplied from the Zarqa River via the Zarqa carrier to irrigate 1650 hectare, and the Kafrein/Hisban project which is supplied from Kafrein dam and wadi Hisban to irrigate 1660 hectare. These projects increased the total area equipped with irrigation infrastructure to about 31000 hectare.

South of the Dead Sea, stage I of the Southern Ghors irrigation scheme was constructed in the period 1983-1985, to bring about 4750 hectare under modern drip irrigation. Recently, other 900 hectare were developed in Ghor Mazraa, Fefa and Khneizerah.

In parallel with irrigation projects, the developed agricultural land in the JV was divided into farm units of 3-4 hectares each and were distributed to farmers in the JV.

Dams construction started in 1967 by building the Sharhabil (Ziglab) Dam (4MCM), and in 1968 the Shueib Dam (1.5 MCM) and the Kafrein Dam (8.4 MCM raised in 1994). In 1977 the King Talal Dam was constructed (75 MCM raised in 1987), and the Wadi Arab Dam (MCM) was

constructed in 1986. In 1994 the construction of the Karameh Dam (53 MCM) started and was completed in 1997.

In addition to the dams in the north, three dams in Southern Ghors: the Mujib (35) MCM, the Wala (9.3) MCM and the Tannour (16.8)MCM were recently completed. Two conveyors from Mujib Diversion were also recently completed to convey water northwards (48 MCM) to the city of Amman, and southwards (12 MCM) to the Dead Sea industrial complexes, and to the agricultural areas in the Southern Ghors.

Al-Wehda Dam (110 MCM) is being constructed on the Yarmouk River, and it is expected to be completed by the end of 2006.

Other dams are planned on the Karak, Ibn Hammad, Meddain, Qai, Whaideh, Rahmeh, and many other sites, pending the finance availability.

The total storage capacity of the current dams is 218 MCM, and will amount up to 328 MCM after the completion of Al-Wehda Dam.

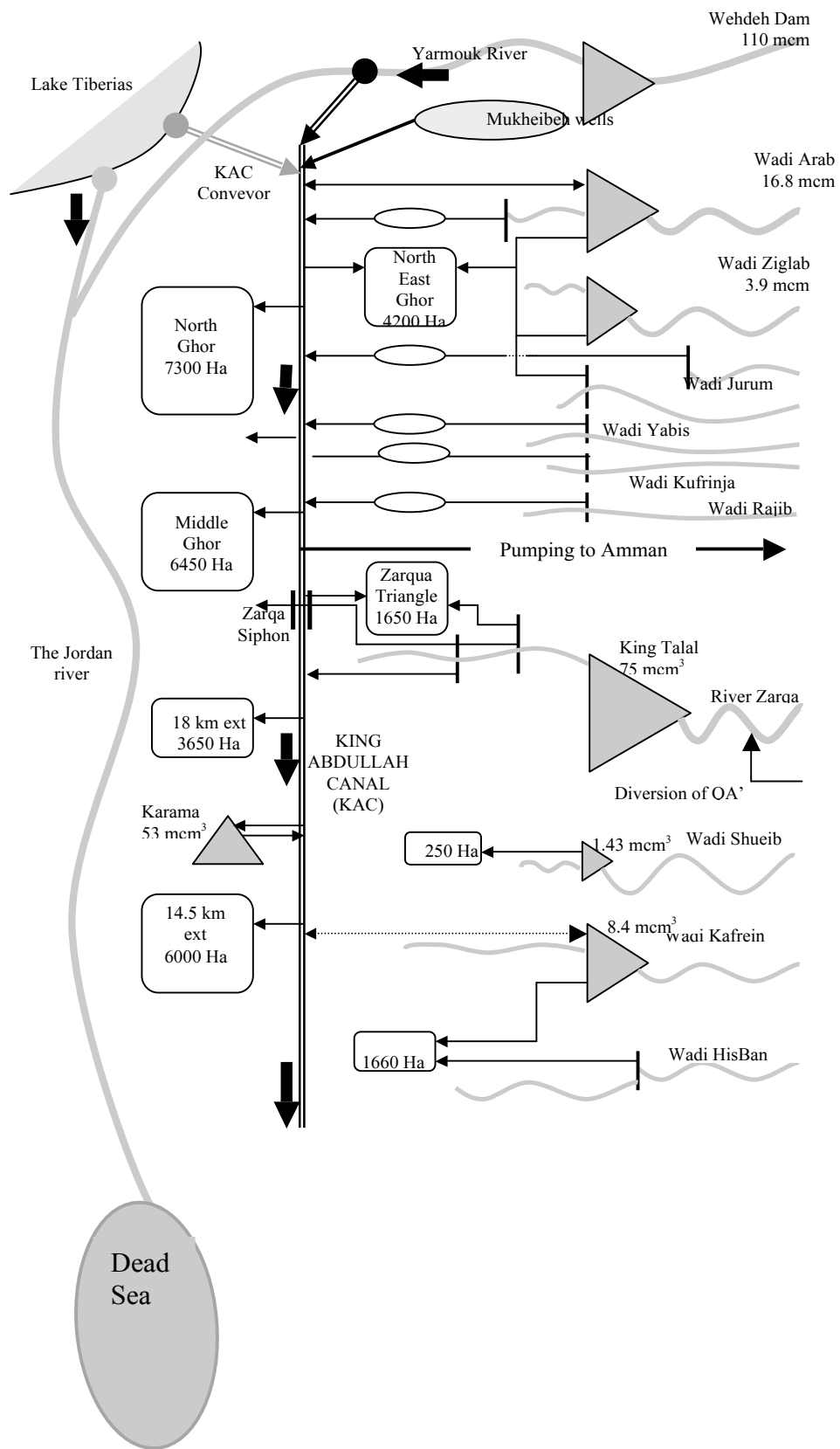


Figure 5. Jordan Valley Hydraulic Scheme

4) WATER SECTOR STRATEGY AND POLICIES

The Ministry of Water & Irrigation (MWI) has published in 1998 the Jordan Water Strategy and developed a set of Policies related to Irrigation, Groundwater, Wastewater and Utility. The following are the main features of the water strategy and policies:

4.1 On Resource Development:

- Water is a national resource and shall be valued as such at all times. A comprehensive national water data bank will be established and kept at the Ministry of Water and Irrigation, and shall be supported by a decision support unit. It will be supported by a program of monitoring and a system of data collection, entry, updating, processing and dissemination of information, and will be designed to become a component of a regional water data bank.
- The full potential of surface water and ground water shall be tapped to the extent permissible by economic feasibility, while addressing the social and environmental impacts. Investigation works of deep aquifers shall be conducted to support development planning. The interactive use of ground and surface water with different qualities shall be considered. Assessment of the available and potential resources shall be conducted periodically.
- Wastewater shall not be managed as "waste". It shall be collected and treated to standards that allow its reuse in unrestricted agriculture and in other non-domestic purposes, including groundwater recharge. Appropriate wastewater treatment technologies shall be adopted with due considerations to economy in energy consumption, and quality assurance of the effluent for use in unrestricted agriculture. Consideration shall be given to blending of the treated effluent with fresh water for appropriate reuse.
- Marginal quality water and brackish water sources shall be enlisted to support irrigated agriculture. They shall be listed, along with sea water for desalination to produce additional water for municipal, industrial and for commercial consumption. Technology transfer and the

findings of advanced research in genetic engineering shall be introduced to the extent possible for this purpose.

- A long term plan shall be formulated for the development of the resources, and a revolving five years plan shall be derived from it and updated as necessary. The revolving plan shall be compatible with those formulated for other sectors of the economy. A parallel investment plan shall accompany the development plan.
- The priority criterion for project implementation, and for additional water allocation shall be based on economic, social and environmental considerations. A "critical path" shall be established for the allocation of each new source of water. Consideration shall be given to the sustainability of the allocation in light of the national water balance situation and the economic, social and environmental opportunity cost of forgone alternative uses of water.
- First priority will be given to allocation of water to satisfy basic human needs; as such the first priority shall be given to the allocation of a modest share of 100 liters per capita per day for domestic water supplies. Expensive additional water shall be allocated for municipal purposes as a first priority, followed by tourism and for industrial purposes.

4.2 On Resource Management:

- Priority shall be given to the sustainability of use of the previously developed resources including resources mobilized for the irrigated agriculture in the Jordan Valley and for other established uses. Special care shall be given to the protection of water from pollution and from quality degradation and depletion.
- Mining of renewable groundwater aquifers shall be checked, controlled, and reduced to sustainable extraction rates. Mining of fossil aquifers shall be planned and carefully implemented.
- Resource management shall continually aim at achieving the highest possible efficiency in the conveyance, distribution, application and use. It shall adopt a dual approach of demand

management and supply management. Tools of advanced technology shall be adopted to enhance the resource management capabilities.

- A dynamic regime of demand and supply shall be instituted and updated. Minimum cost of operation and maintenance shall be targeted. The cost of production of future industrial, commercial, tourism and agricultural projects shall be evaluated in terms of their water requirements per unit of production.
- Interactive use of multiple resources shall be targeted to maximize the usable flows, and to maximize the net benefit from the use of a unit of water.
- Human resources development shall rank high in the priority scale. Continuous education, on-the-job training and overseas training programs shall be organized and implemented. Over-employment shall be trimmed to reach optimum employment levels compatible with efficient management entities elsewhere in the world..
- Management of wastewater shall receive attention with due regard to public health standards. Industrial wastewater shall be carefully monitored to avoid degrading the quality of the effluent of wastewater treatment plants destined for reuse.

4.3 On Legislation and Institutional Set-Up:

- Periodically review institutional arrangements and legislation in effect to appraise adequacy of the status quo through the changing conditions and times. Institutional restructuring shall be made to match the changing needs.
- Update legislation whenever necessary to respond to emerging needs including the needs for improving performance efficiency. Laws in effect shall be enforced with due diligence.
- Introduce and enhance the participation of stake- holders, and legislate for their involvement whenever necessary.
- Assure co-operation and co-ordination among public and private entities involved in water development and management.

4.4 On Shared Water Resources:

- The rightful shares of the Kingdom shall be defended and protected through bilateral and multilateral contacts, negotiations, and agreements. Peace water and wastewater projects, including the scheme for the development of the Jordan Rift Valley, shall be accorded special attention for construction, operation and maintenance.
- Due respect will be given to the provisions of international law as applicable to water sharing, protection and conservation, and those applicable to territorial waters.
- Bilateral and multi-lateral co-operation with neighboring states shall be pursued, and regional co-operation shall be advocated, preferably within the provisions of a Regional Water Charter.

4.5 On Public Awareness:

- The public shall be educated through various means about the value of water for them and the well being of the country for the sustainability of life, and for the economic and social development.
- Challenges in the water sector are to be faced not only by the water administration, but also equally by the public if not more. The roles in water conservation to be played by the different sectors of society shall be defined and assigned.
- Facts about water in Jordan shall be disseminated along with the cost incurred to provide the service, and the mounting pressure of population on the water resources. Introduction, adoption and use of water saving and recycling systems and devices shall be promoted.
- Economic measures shall be adopted to reinforce public awareness. Such measures as demand management, efficiency improvements within supply management techniques shall be employed.

4.6 On Performance:

- Performance efficiency of the water and wastewater systems and the management thereof shall be monitored and rated, and the improvements on performance shall be introduced with due consideration to resource economics.
- Human resources performance shall be continually appraised to upgrade capabilities and sustain excellence. Incentives for excellence shall be introduced in compliance with the needs for dedication.

4.7 On Health Standards:

- Setting and enforcing national health standards shall be enhanced and sustained, especially in regards of municipal water supply.
- Concerns for public health and the health of workers shall be a focus in the programs of reuse of treated wastewater.
- Laboratories for controls shall be maintained and properly equipped.

4.8 On Private Sector Participation:

- The role of the private sector shall be expanded. Management contracts, concessions and other forms of private sector participation in water utilities shall be considered and adopted as appropriate.
- The concepts of BOT/ BOO shall be entertained, and the impact of such concepts on the consumers shall be continually assessed, and negative impacts mitigated.
- The private sector role in irrigated agriculture shall also be encouraged and expanded. Emphasis shall be placed on the social benefits in conjunction with the private investments.

4.9 On Financing:

- Recovery of the cost of utilities and the provision of services shall be targeted. Recovery of operation and maintenance cost shall be a standard practice. Capital cost recovery shall be carefully approached. The role of water tariffs shall be considered as a tool to attract private investment in water projects.
- Cost recovery shall be linked to the average per capita share of the GDP and its level. It shall also be connected to the cost of living and the family basket of consumption. However, profitable undertakings in industry, tourism, commerce and agriculture shall be made to pay the fair water cost.
- Until the cost recovery is full, and the national savings become at levels capable of domestic financing of development projects, project financing will depend on concessionary loans, private borrowing and/ or BOO and BOT arrangements.

4.10 On Research and Development:

- Efforts to encourage and enhance indigenous water research targeted at the improvement of resource management, enhancing the understanding resource economics, and adapting the research findings in other environments to local conditions, including but not limited to, crop water requirements, minimizing evaporation and controlling evapo-transpiration and the like.
- Emphasis will be placed on liaison with international institution to keep abreast with modern technological advances, and to facilitate technology transfer and adaptation.

In addition to the above a Water Demand Policy is being prepared. The Irrigation Water Policy will be annexed with two additional policies on Water Allocation and Irrigation Equipment.

A Groundwater by-law was issued to monitor and organize groundwater abstraction, and instructions were issued to organize and protect the use of irrigation water.

5. LEGISLATIONS AND INSTITUTIONAL SET-UP

5.1 JVA Mandate

The Jordan Valley Authority (JVA) was established in 1977 with a broad mandate for the integrated development of the Jordan Valley encompassing all aspects of life. In 1988 the JVA became part of the Ministry of Water and Irrigation (MWI). Its mandate includes :

A. The development and use of water resources of the Jordan Valley for purposes of irrigated agriculture, domestic and municipal uses, industry, hydropower generation and other beneficial uses, for 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 exploratory 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. In coordination with the Water Authority of Jordan, organize and direct the construction of private and public wells.

6. Development and improvement of the environment and the living conditions in the Jordan Valley, and implementation of the related works including:

- Setting rules and regulations for areas of land outside town and village borders on which construction of buildings is permitted, setback lines, rights of way, etc.
- Development of land zoning to define land-use: residential, industrial, agricultural, etc.

B. Planning, design and construction of farm roads.

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

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

E. Additional development activities as requested from the cabinet.

During the last 30 years, JVA completed numerous infrastructure projects including electricity, telecommunications, roads, schools, health centers, governmental and residential buildings, in addition to its core activities in land and water resources development.

JVA has invested a significant effort and resources to improve the infrastructure at the East Coast of the Dead Sea to attract investments in tourism and for the development and care of religious and archeological sites in this region of the country, the most important of which is Jesus Christ Baptism site at the Jordan River.

Presently, JVA is focusing its efforts on water and land resources development, management and protection, in addition to tourism development and promotion.

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.

A five-year Strategic Plan for the period 2003 – 2008 was developed to cope with the new government policies and the new JVA future role. The Strategic Plan is also seen as a tool to improve the level of service JVA offers to its customers and to improve JVA's operational efficiency and cost recovery. It is centered on the following four main goals:

- Water Resource Development and Management
- Water Supply and Distribution
- Land Development and Management
- Organizational Performance Improvement and Development

Each of these goals has a number of objectives, which in turn were developed into a number of strategies. Finally, specific actions were developed for each strategy, the implementation of which will ensure the successful realization of the Plan's goals.

5.2 Water Management

Water resources scarcity and fluctuation, the complexity of the Jordan Valley hydraulic scheme and the competition between water users implies on JVA the use of a modern water management procedures to cope with challenges. A clear division is defined between water supply and water distribution activities as detailed below:

5.2.1 Water Distribution. Activities related to water distribution, mainly operation and maintenance of the irrigation networks is under the responsibility of four Directorates. The Directorates depend on Stage Offices to organize water distribution among farmers, open and close farm turnouts, and follow up billing and accounting operations. The organization between Directorates and Stage Offices is shown in Figure 6. The water distribution turn outs are represented in figure 7 for the North Ghor, Figure 8 for Middle Ghor, figure 9 for Karama Area, and figure 10 for Southern Ghors.

5.2.2 Water Supply. Water supply is performed by the *Control Division* under the responsibility of the Water Control & Management Directorate which is under the direct supervision of the O&M Assistant Secretary General for Operation & Maintenance. This division is located at the Deir Alla Control Center in the Jordan Valley, which houses the supervisory control and data acquisition system (SCADA).

The following activities are performed at the Deir Alla Control Center:

- Water management strategy: definition of monthly target volumes for each reservoir and monthly water allocation to each Stage Office.
- Daily water balance in order to ensure that water requests stay within the amount of available resources. According to this balance, decisions are made regarding the release from dams or pumping to dams, transfer from the King Abdullah Canal northern section to the southern section and management of shortage situations.
- Control of the King Abdullah Canal through the adjustment of check gates settings.
- Revision of quotas for crops, irrigation suppliers and feeders according to the current water situation, and proposing reduction percentages in case of water shortage.

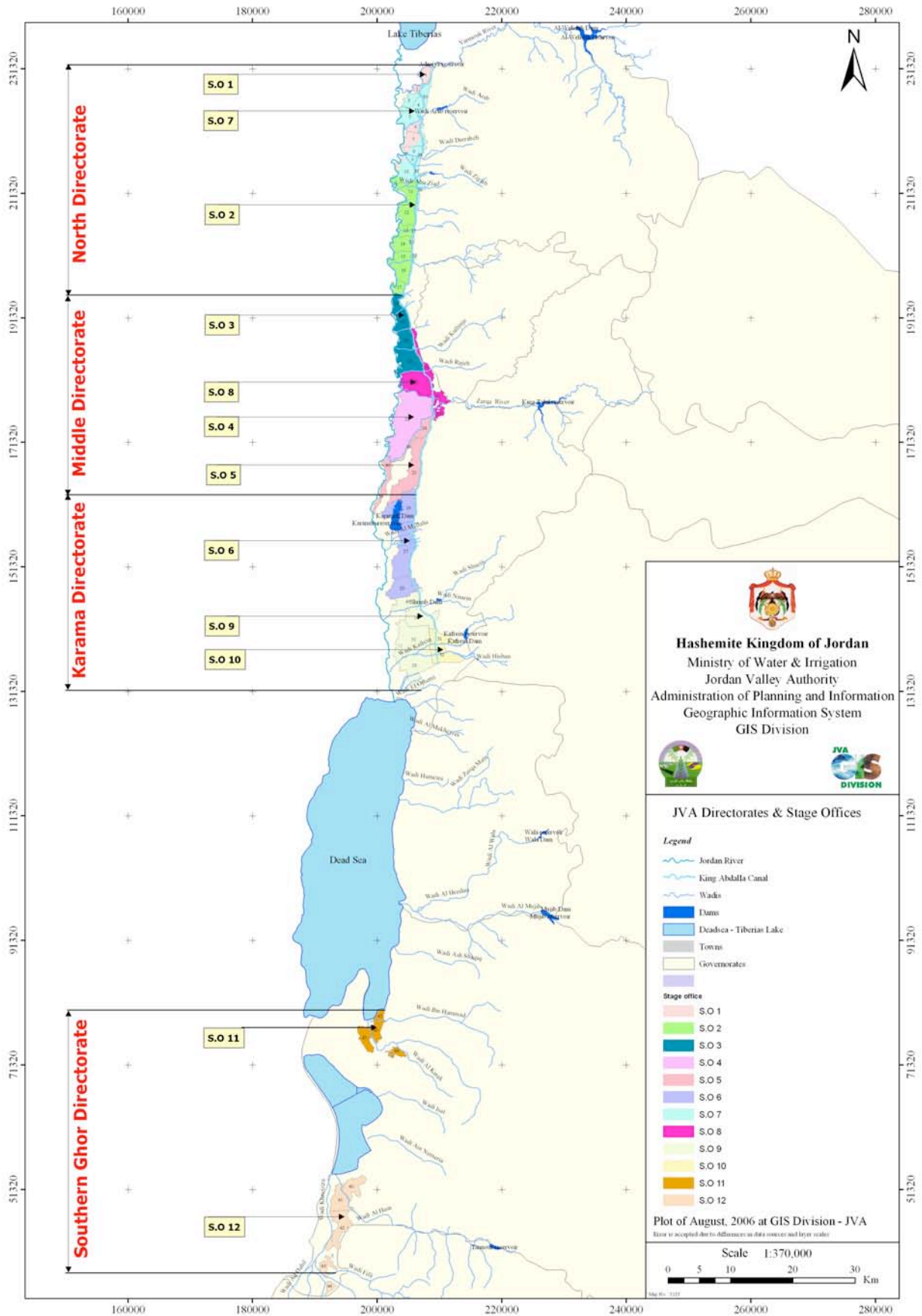


Figure 6: Jordan Valley Operation & Maintenance Administration

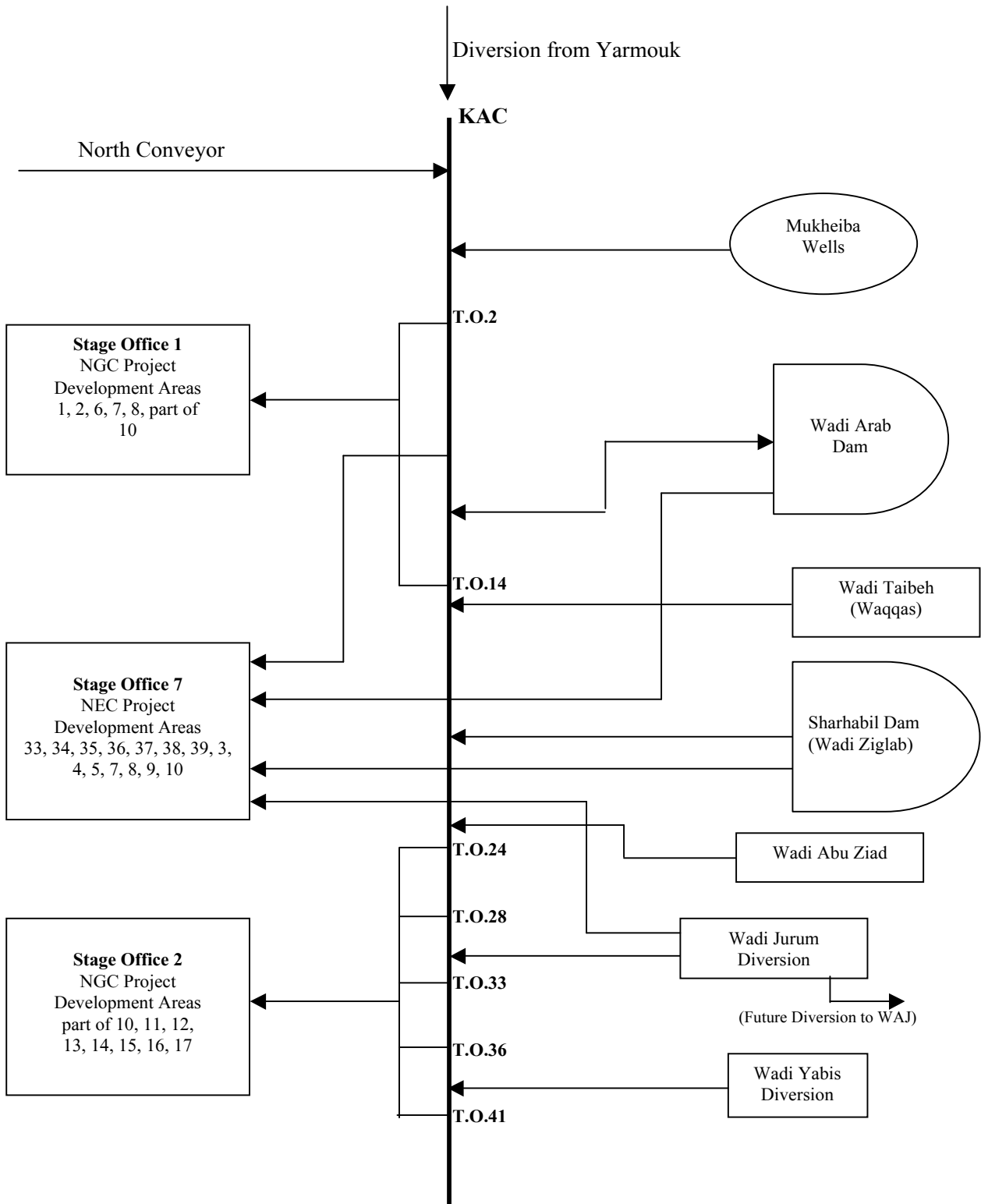


Figure 7: Irrigation Scheme in the North Directorate

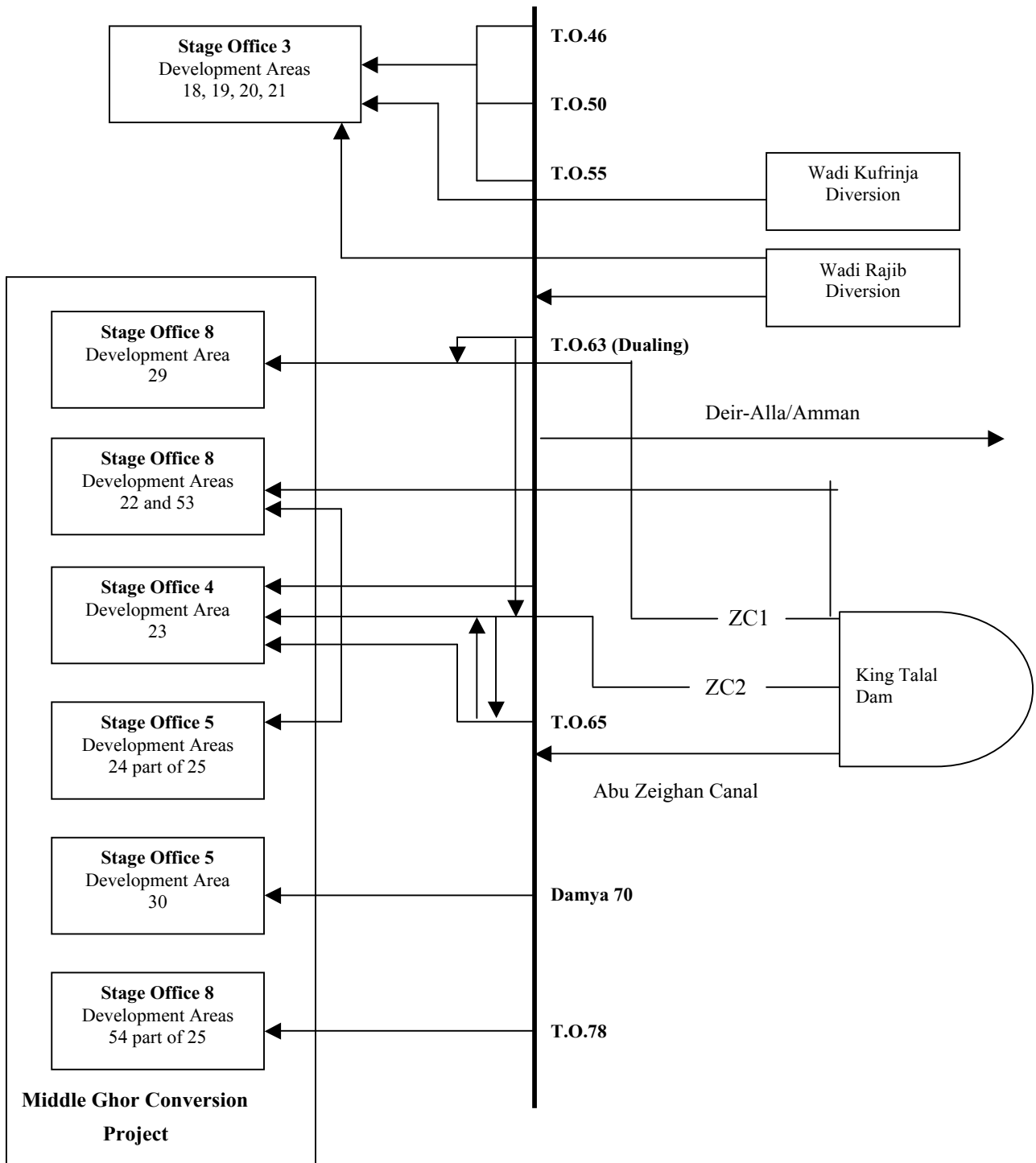


Figure 8: Irrigation Scheme in the Middle Directorate

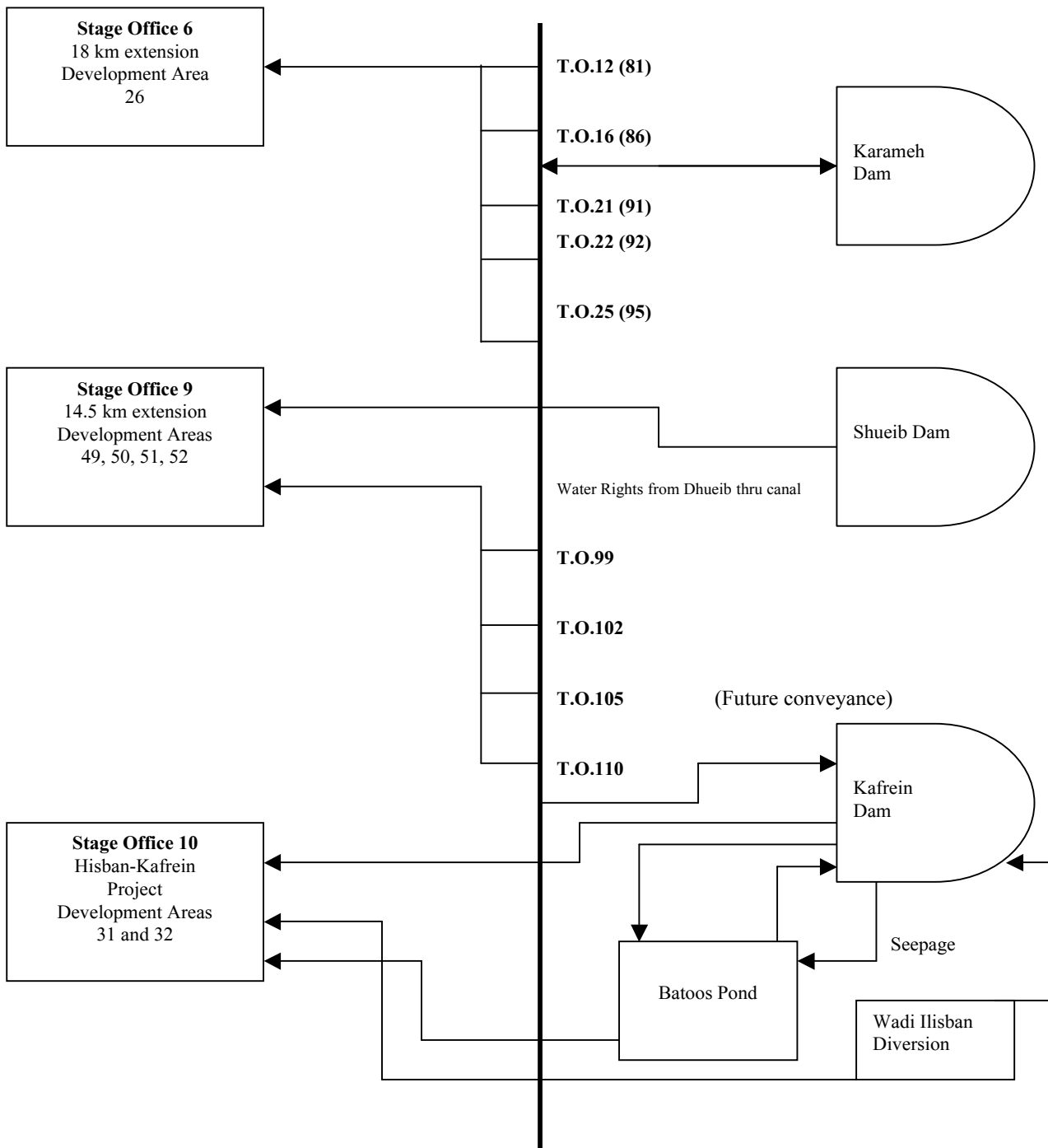


Figure 9: Irrigation Scheme in the Karama (South) Directorate

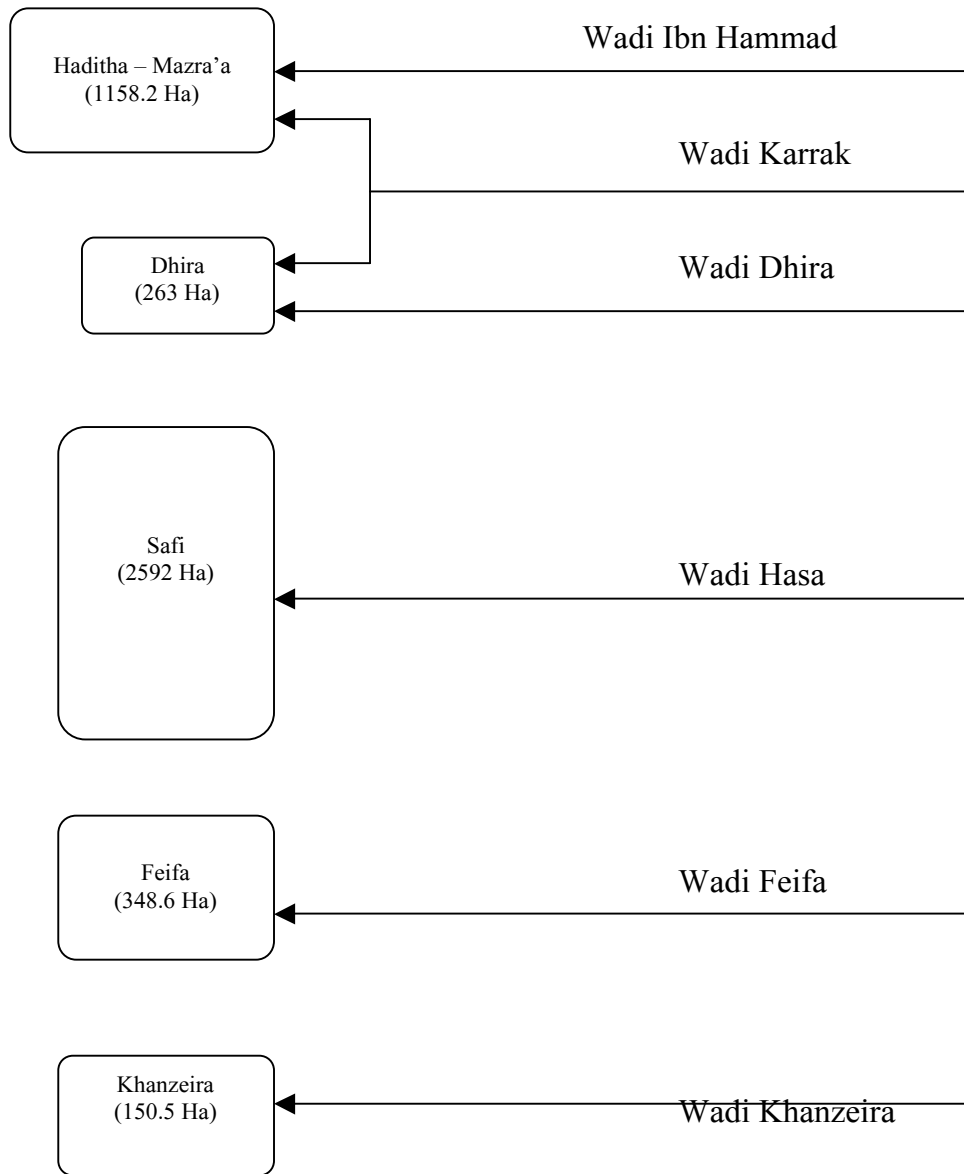


Figure 10: Irrigation Scheme in the Southern Ghors

6. ADAPTATION ACTIVITIES

The main factor that JVA considers in water management is the availability of water resources, which is far less than what is needed for the different uses. The following adaptive activities are performed to face this situation:

1. The conversion of surface irrigation channels to pressurized pipe networks. Each farm unit was equipped with a farm turnout assembly (FTA) including a pressure regulator and a flow-limiting device that limits the flow to 6-9 liters/second. It should be noted that the flow at the farm gate was 20 liters/second when the open channels networks were used before the conversion into pressurized systems.
2. The rehabilitation of king Abdullah Canal (KAC), which is the main water conveyor in the valley reduced losses and improved its operational conditions. A water measurement network was installed along KAC, and a SCADA system was used to monitor and automatically control water flow in the canal from a Control Center located in the JV.
3. A computerized Water Management Information System (WMIS) was introduced to help in making decisions to balance water resources and demands and to optimize water distribution to farm units. The system allows for calculation of seasonal, monthly and daily water balances, and in setting reservoirs target volumes and operational efficiencies of the different sections of the hydraulic network.
4. Pilot projects were introduced with the help of donors to illustrate how to optimize water use inside the farm units by the use of tensio-meters to help identify the exact time of irrigation according to crops needs. An irrigation advisory service, IAS, was also instituted to help farmers use these devices and schedule their irrigation frequency. Universities, research centers and non-governmental organizations (NGO's) are involved in the activities at the pilot areas.
5. A hydraulic simulation model (EPANET) is used to stabilize pressure and flow in each irrigation line from the water source to the FTA's. As a result the pressure was

stabilized to 3 bars throughout the irrigation network, and the flow at the FTA's was adjusted to 6 liters/second thereby increasing equity and farmers satisfaction in addition to raising the efficiency of irrigation water use.

6. Farmers were also encouraged to change their irrigation systems at the farm unit level from surface to micro-irrigation (drip and mini sprinklers), and to introduce advanced technologies to maximize irrigation water use efficiency (crop per drop).

7. Good Agricultural Practices (GAP) are introduced and many farmers are certifying their products for export to external markets. Cash crops such as Charentais Melon, Strawberry, Early Grapes and other cash crops are being planted to maximize the benefits from irrigation water.

8. Farmers were encouraged to form water-user groups of different forms (water committees, local water councils and water user associations) according to geographic zones and social nature. Around 40% of the Jordan Valley farmers participate in one way or another in these groups at 16 different locations along the Valley. The main function of these groups is their participation in irrigation water distribution activities. Farmers now open and close their FTA's according to the irrigation schedule, thereby alleviating this burden from JVA. In addition, there has been a significant reduction in water losses and illegal water use due to this self controlled water distribution activities.

9. Guidelines were issued to help farmers in using the best practices to irrigate certain salt tolerant crops with brackish water (slightly saline), which is available mostly in the shallow aquifer north of the Dead Sea. The brackish water is used directly to irrigate salt tolerant crops or it can be blended with fresh water, or even desalinated water by small Reverse Osmosis (RO) units by some farmers (23 private desalination units were already installed in the JV).

10. Guidelines for the use of reclaimed water in an environmentally safe and economically viable manner were prepared by JVA to help farmers to apply the best

practices in using the reclaimed water, which use is on the increase for irrigation in the JV due to the lack of fresh water and its diversion for municipal purposes. Programs are being conducted to monitor surface water, ground water soil and crops. The results of these monitoring programs are analyzed and used to take mitigation measures to remedy any negative effects from using reclaimed water.

11. Water tariff was introduced, with an escalating categorized structure that encourages farmers to reduce consumption and save irrigation water. The bills for low income vegetable growing farmers are normally in the lower tariff category, while the bills for those who consume larger water quantities are in the higher categories. A fixed rate is charged on the monthly water bill to cover the cost of FTA's maintenance. Water sales for agriculture and industry covers most of the operation and maintenance costs of JVA.

12. In case of severe droughts farmlands are rented from farmers by JVA to save water, and farmers are compensated for losing their planting season. Irrigation water rationing became a general practice in the summer season, and summer vegetables are banned in some areas due to the lack of irrigation water.

13. Licenses for planting banana and citrus trees are no longer issued to farmers, as these are high water consuming trees. Farmers with old licenses are given the water requirements when water is available, but in case of droughts a minimum amount of water is given to these trees to keep them alive.

14. The Jordanian-Syrian Committee for the utilization of the Yarmouk River Basin Water meets regularly to coordinate the utilization of the basin water according to the agreement signed between the two countries.

15. The Joint Water Committee (JWC) which was formed after the signature of the Peace Treaty between Jordan and Israel meets regularly to follow up the implementation of the water annex (Annex II) in the Peace Treaty.

16. A water conduit was built from the Dajania Gate, at the southern outlet of Lake Tiberias, and the King Abdullah Canal to convey a similar amount of the water stored from the Yarmouk River in the Lake in winter time to the KAC in the summer, in addition to the water quantities that were agreed upon in the Annex and other agreement implementation protocols.
17. A diversion weir was constructed on the Yarmouk River in Adasiyeh to control and regulate the flows of the Yarmouk to both sides.
18. Al Wehda Dam is being constructed at the Yarmouk in the Maqarin area at the borders between Jordan and Syria to store the floods and to regulate the base flow of the river at that site.
19. Several studies were conducted to supply Jordan with the additional 50 MCM/year of water of drinkable standards as stipulated in the agreement between Jordan and Israel, and the issue is still under discussion.
20. Finally, great emphasis is being paid for the implementation of the feasibility study of the Red Sea – Dead Sea Water Conveyance Project which aims at saving the Dead Sea, an international heritage, whose level is decreasing dramatically due to the diversion of fresh water resources which used to feed it. In later stages the difference in level between the two seas will be exploited to generate electricity and to desalinate sea water.