Demand Management for Irrigation Water in Jordan Valley
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By
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Ministry of Water and Irrigation (MWI)

Water Authority of Jordan (WAJ)

Jordan Valley Authority (JVA)
Jordan Valley: General Overview

- 360 km long.
- 13 km average width.
- 1.8% over all slope.
- 400,000 population.
- It is comprises of three parts:
  - Jordan Valley.
  - Dead Sea.
  - Southern Ghors and Wadi Araba.
Typical cross section in the Jordan Valley

East
Highland
Ghor
Katar
Zor
Jordan
River
West

13 km
Jordan Valley Profile
Land and cropping

- Total area 36,000 h
- Irrigated area 30,000 h
- No. of farm unit 10,000
- Farm unit area 3-4 h
- Citrus 7,000 h
- Banana 300 h
- Vegetables 18,000 h
- Other trees (date, grapes)
- Others
Water Resources in the Jordan valley

I- Conventional Water Resources
   * Surface water resources
   * Ground water resources

II- Non-conventional Water Resources
   * Treated Waste Water
   * Desalinization of medium-salinity (Brackish water)
Ground Water

- Total potential of renewable ground water in the Jordan Valley: 55-60 mcm/year:
  - Mukheibeh deep wells: 30 mcm.
  - Wadi Arab deep wells: 12 mcm.
  - Kafrein wells: 8-13 mcm.
  - Others (separated): 5 mcm.
More than 80% of the area of Jordan is indicated as desert with rainfall < 100 mm/a.
Irrigation Water Challenges in the JV

• Seasonal rainfall is the main source of water and limited Renewable water resources.
• Competition between Irrigation and domestic water.
• Increasing irrigation water demand.
• Jordan Valley receives a large share of its water from trans-boundary water resources.
• Budget deficit particular for new irrigation projects and maintenance for existing infrastructure.
• Weak legislation against the illegal water use.
• Weak on-farm management.
King Abdallah Canal (KAC)

- It is the backbone of Jordan Valley hydraulic infrastructure.
  - 110 km long (between Yarmouk River and Dead Sea)
  - Lined and trapezoidal shape.
  - 20-3.2 m$^3$/sec capacity.
  - 32 check gates
  - 28 pump stations (including gravity turns out)
Storage dams in JV

- Wadi Arab Reservoir : 17 mcm
- Ziglab Reservoir : 3.8 mcm
- King Tallal Reservoir : 75 mcm
- Karama Reservoir : 55 mcm
- Shueib Reservoir : 1.4 mcm
- Kafriens Reservoir : 8.4 mcm
- Mujib Reservoir : 35 mcm
- Tannour Reservoir : 16.8 mcm
- Waleh Reservoir : 9.3 mcm
- Wahdeh Dam : 110 mcm

» Total : 327.7 mcm
Irrigation Networks In the JV

- All the irrigation networks in the Jordan Valley are pressurized pipes.
- Each farm unit has provided with Farm Turn out Assembly (FTA) which consist of:
  - gate valve
  - pressure regulator.
  - Flow limiting device (9 l/s or 6 l/s)
  - flow meter
  - concrete box.

Hydraulic Operating Pressure Distribution

- Less than 2 bars
- 2 to 3.3 bars
- more than 3.3 bars

FTA

Flow meter
Pressure gage
Concrete Box
G.V
F.L.D
On farm irrigation systems in the JV

- Surface irrigation (5%)
- Drip irrigation (85%)
- Sprinkler (1%)
- Virojet (5%)
- Others (4%)
Adassia Diversion Weir on Yarmouk River
تصرف نهر اليرموك السنوي للفترة: 1981 – 2012 (مليون متر مكعب)
تدفق نهر اليرموك للفترة الصيفية للأعوام 1981 – 2012 (مليون متر مكعب)
Percentage of Irrigation allocation VS the water consumption in Jordan

Year
Demand Management for Irrigation Water in JV

- Public awareness, stakeholders dialogue and extension.
- New water resources.
  - Reuse (TWW)
  - Desalination
- Rehabilitation the old (existing) infrastructure
- Improve the efficiency.
  - JVA Network level
  - On-farm level
- Private sector participation.
- Review of water tariff
Public awareness and stakeholders dialogue.

- To increase the awareness of individuals (farmers) and institution (WUA’S) in ways and mechanism of water consumption and the use of available quantities according to the required needs and maintain water resources.
- Realize the irrigation sector by the reality of water and the challenges faced by the sector and create their role in facing these challenges and supports water sector.
- Raising knowledge level among farmer with ways, means and tools that are used to maintain and rational use of water in irrigation and reduce of wasting or polluting it.
- Provide farmers with information related to irrigation at the appropriate times.
- Provide farmers with required information of how to use reuse water in agriculture.
Means of awareness-raising

- Seminars and brain stormy
- Workshops/conferences
- Awareness materials (flyers, posters, videos, etc)
- Exhibitions
- Public awareness events
- Visitors' days
- Field days
- International Tours
- Media (newspaps, radio, TV)
- Websites and other internet-based tools
New water resources.

• Extension and improved operation of existing wastewater treatment plants (180 MCM/a total capacity) to make their effluents safe to use for irrigation

• Construction of new wastewater treatment plants (110 MCM/a capacity)

• Construction of a seawater desalinization plant of 80-100 MCM/a capacity at Aqaba
إعادة استخدام المياه المعالجة في شمال وادي الأردن

<table>
<thead>
<tr>
<th>Stage</th>
<th>Potential Irrigation Area</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>53,500 du.</td>
</tr>
<tr>
<td>II</td>
<td>out of command</td>
</tr>
</tbody>
</table>
### National Water Supply and Consumptive Use (MCM), by Sector, 2009

<table>
<thead>
<tr>
<th>Sector</th>
<th>Domestic</th>
<th>Industrial</th>
<th>irrigation</th>
<th>Livestock</th>
<th>Total</th>
<th>Share</th>
</tr>
</thead>
<tbody>
<tr>
<td>Surface</td>
<td>93.9</td>
<td>3.1</td>
<td>153.4</td>
<td>7.0</td>
<td>257.4</td>
<td>29.5%</td>
</tr>
<tr>
<td>Ground</td>
<td>214.7</td>
<td>33.0</td>
<td>245.8</td>
<td>0.9</td>
<td>494.3</td>
<td>56.8%</td>
</tr>
<tr>
<td>Treated WW</td>
<td>0.0</td>
<td>1.2</td>
<td>101.2</td>
<td>0.0</td>
<td>102.4</td>
<td>11.8%</td>
</tr>
<tr>
<td>Brackish</td>
<td>17.0</td>
<td>0.0</td>
<td>0.0</td>
<td>0.0</td>
<td>17.0</td>
<td>2.0%</td>
</tr>
<tr>
<td><strong>Total Used</strong></td>
<td><strong>325.6</strong></td>
<td><strong>37.3</strong></td>
<td><strong>500.3</strong></td>
<td><strong>7.9</strong></td>
<td><strong>871.0</strong></td>
<td><strong>100%</strong></td>
</tr>
<tr>
<td><strong>Share</strong></td>
<td>37.3%</td>
<td>4.3%</td>
<td>57.4%</td>
<td>0.9%</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*With treated wastewater*
## Irrigation Use in JV(MCM), 2000-2010

<table>
<thead>
<tr>
<th>Year</th>
<th>Surface</th>
<th>Ground</th>
<th>TWW</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2000</td>
<td>75.10</td>
<td>8.08</td>
<td>78.52</td>
<td>161.70</td>
</tr>
<tr>
<td>2001</td>
<td>53.13</td>
<td>8.94</td>
<td>49.44</td>
<td>111.50</td>
</tr>
<tr>
<td>2002</td>
<td>53.23</td>
<td>13.90</td>
<td>61.01</td>
<td>128.13</td>
</tr>
<tr>
<td>2003</td>
<td>72.52</td>
<td>10.98</td>
<td>88.90</td>
<td>172.41</td>
</tr>
<tr>
<td>2004</td>
<td>79.47</td>
<td>12.94</td>
<td>93.72</td>
<td>186.13</td>
</tr>
<tr>
<td>2005</td>
<td>64.53</td>
<td>14.45</td>
<td>90.49</td>
<td>169.48</td>
</tr>
<tr>
<td>2006</td>
<td>32.82</td>
<td>15.60</td>
<td>81.86</td>
<td>130.29</td>
</tr>
<tr>
<td>2007</td>
<td>56.25</td>
<td>14.32</td>
<td>79.38</td>
<td>149.95</td>
</tr>
<tr>
<td>2008</td>
<td>48.45</td>
<td>13.59</td>
<td>78.51</td>
<td>140.55</td>
</tr>
<tr>
<td>2009</td>
<td>49.39</td>
<td>12.84</td>
<td>65.84</td>
<td>128.07</td>
</tr>
<tr>
<td>2010</td>
<td>49.98</td>
<td>12.46</td>
<td>82.04</td>
<td>144.48</td>
</tr>
</tbody>
</table>

**Percentage (2010)**

<p>| | | | | |</p>
<table>
<thead>
<tr>
<th></th>
<th></th>
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<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>34%</td>
<td>9%</td>
<td>57%</td>
<td>100%</td>
<td></td>
</tr>
</tbody>
</table>
Rehabilitation of old existing infrastructure

- The existing distribution systems was constructed since more than 25 years.
- The estimated cost of rehabilitation is about 70 MJD.
- JVA planned to complete all rehabilitation at the end of 2017.
Improve of efficiency

Irrigation Water Management

Water Efficiency

JVA network Efficiency 85%

On-Farm Efficiency 55% – 60%
1- JVA level (From source to the FU)

- A network rehabilitated and major maintenance
- New operation procedures
- Monitoring Performance with Indicators based on water meter
- Improved communication between JVA and farmers/WUA

2- On-farm level

- Optimized on-farm irrigation techniques
- Extension service (demonstration farms, expertise, brochures, etc.)
- Subsidies to farmers
WMIS Architecture

Control Center

Main SCADA

NGD

MGD

SGD

SO1

SO2

SO3

SO4

SO5

SO6

SO7

SO8

SO9

SO10

Gate

Sub SCADA

Network
Upstream Sensor

Check gate on

KAC
The lack of basin-wide cooperation has not prevented riparians from entering into bilateral water sharing agreements.

**Bilateral Agreements on Jordan River Basin**

   - Joint Water Committee for investment of Yarmouk River Basin
   - Joint technical Committee

   - Joint Water Committee
   - Joint technical Committee
Private sector participation (WUA’s) in the JV

- WUAs are cooperative civil voluntary non-profit organizations that are managed by the farmers.

The main objective of the WUAs is: Sustainable management of irrigation water resources in the JV through farmers participation.

On the governmental level (JVA):

Maintaining the infrastructure and optimal irrigation water use.

On the farmers level:

Improvement of the level of provided services.
Water User Associations (WUA)

Objective: Sustainable management of Irrigation water resources in the Jordan Valley through farmer participation.

1. Confidence Building  
   2001 - 2003

2. WUA Establish  
   2003 - 2006

3. Task Transfer  
   2006 - 2009

4. WUA Sustaining  
   2009 - Up-to-date

Achievements and Results

- More efficient of retail water distribution.
- More uniformity in water flow.
- More stabilized network water pressure.
- Decrease illegal water use (penalties).
- Decrease maintenance cases.
- More trust and cooperation between farmers them self and between JVA and farmers.
Irrigation Water Tariff in JV

<table>
<thead>
<tr>
<th>FILS/CM</th>
<th>Consumption cm/month</th>
</tr>
</thead>
<tbody>
<tr>
<td>8</td>
<td>0 - 2500</td>
</tr>
<tr>
<td>15</td>
<td>2501-3500</td>
</tr>
<tr>
<td>20</td>
<td>3501-4500</td>
</tr>
<tr>
<td>35</td>
<td>more than 4500</td>
</tr>
</tbody>
</table>

**Graph:**
- **2014:**
  - 20 FILS/CM
  - 30 FILS/CM
  - 45 FILS/CM
- **2015:**
  - 35 FILS/CM
  - 50 FILS/CM
- **2016:**
  - 60 FILS/CM
  - 70 FILS/CM
- **2017:**
  - 80 FILS/CM
  - 90 FILS/CM

**Tariff Rates:**
- 2014:
  - شريحة 1 (91%)
  - شريحة 2 (5%)
  - شريحة 3 (2.5%)
  - شريحة 4 (1.5%)

- 2015:
  - شريحة 1 (95%)
  - شريحة 2 (73%)
  - شريحة 3 (50%)
  - شريحة 4 (35%)

- 2016:
  - شريحة 1 (80%)
  - شريحة 2 (60%)
  - شريحة 3 (50%)
  - شريحة 4 (45%)

- 2017:
  - شريحة 1 (90%)
  - شريحة 2 (70%)
  - شريحة 3 (60%)
  - شريحة 4 (50%)
Water quality Monitoring

- Thirteen fully-automated monitoring stations are located on the Yarmouk, and Zarqa Rivers, King Abdullah Canal and at the inlet and outlet of King Talal Dam.

- Three measuring sets are:
  - Temperature, pH, EC, turbidity and DO
  - T-N and T-P.
  - COD.