Water Management in Israel

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The Bridge, Feb. 2018
Rainfall Distribution
National water carrier

Israel:
Area: 25,000 km²
Population: 8.5 millions
Climate: arid to semi arid, 5-35 °C
Range of Rainfall: 50 to 800 mm/year.
Average G.W. recharge: 1200 million m³/year.
Total consumption: 2000 million m³/year.
Domestic use: 90 m³/year/person.
GDP per person: 35,000$. 

Sea of Galilee (Kinneret)
National carrier 108°
Jerusalem
Haifa
Tel Aviv
Authorities of Water Sector in Israel

**Water Authority**
Regulator - Water Allocation, Development, Tariff, Planning

**Water production & Suppliers**
Mekorot Company
Local Authorities & Locals Corporation
Agriculture association

**Water quality control**
Health ministry
Environment ministry
Mekorot Company
Local Authority & Locals Corporation
### Water Balance In Israel

#### Demand (mcm/year)

<table>
<thead>
<tr>
<th>Total Demands</th>
<th>Water Depreciation</th>
<th>Jordan &amp; Palestinians</th>
<th>Nature</th>
<th>Agriculture</th>
<th>Industrial</th>
<th>Domestic</th>
<th>Consumption per capita</th>
<th>Population</th>
<th>Year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1918</td>
<td>36</td>
<td>112</td>
<td>24</td>
<td>945</td>
<td>86</td>
<td>715</td>
<td>87.3</td>
<td>8.2</td>
<td>2014</td>
</tr>
<tr>
<td>2330</td>
<td>43</td>
<td>196</td>
<td>49</td>
<td>1089</td>
<td>99</td>
<td>854</td>
<td>90.6</td>
<td>9.4</td>
<td>2020</td>
</tr>
<tr>
<td>2745</td>
<td>50</td>
<td>265</td>
<td>49</td>
<td>1215</td>
<td>110</td>
<td>1,056</td>
<td>90.5</td>
<td>11.7</td>
<td>2030</td>
</tr>
<tr>
<td>3562</td>
<td>64</td>
<td>398</td>
<td>49</td>
<td>1487</td>
<td>121</td>
<td>1,443</td>
<td>90.9</td>
<td>15.9</td>
<td>2050</td>
</tr>
</tbody>
</table>

#### Sources (mcm/year)

<table>
<thead>
<tr>
<th>Total Sources</th>
<th>Desalination seawater (present)</th>
<th>Desalination salty water</th>
<th>Treated sewage</th>
<th>Salty</th>
<th>Natural potable Resources</th>
<th>year</th>
</tr>
</thead>
<tbody>
<tr>
<td>1918</td>
<td>580</td>
<td>25</td>
<td>450</td>
<td>175</td>
<td>1000</td>
<td>2014</td>
</tr>
<tr>
<td>2330</td>
<td>712</td>
<td>50</td>
<td>573</td>
<td>150</td>
<td>845</td>
<td>2020</td>
</tr>
<tr>
<td>2745</td>
<td>1015</td>
<td>60</td>
<td>685</td>
<td>140</td>
<td>845</td>
<td>2030</td>
</tr>
<tr>
<td>3562</td>
<td>1587</td>
<td>70</td>
<td>930</td>
<td>130</td>
<td>845</td>
<td>2050</td>
</tr>
</tbody>
</table>

Zaide, 2017
**Natural Resources**

**Replenishment MCM/y**

- **Western Galilee**: 120
- **Carmel**: 30
- **Coastal Aquifer**: 270
- **Eastern Aquifers**:
  - Kineret: 420
  - Judean Aquifer: 310
  - Negev & Arava

**Total (average)**

1150 MCM/y

**No. of Production Boreholes 2013**

- **Total boreholes**: 1563
- **Kineret**: 102
- **Coastal Aquifer**: 72
- **Western Galilee**: 75
- **Carmel**: 89
- **Judean Aquifer**: 310
- **Negev & Arava**: 808
- **Total**: 189

*Gev I. 2016*
Main Water Supply System

- Haifa
- Sea of Galilee (Kinneret)
- National carrier 108"
- Tel Aviv
- Jerusalem
- Eshkol reservoir

National carrier - length section

Sea of Galilee 108"
Sea of Galilee Basin

Area 2730 km²

Elevation -210 m
Area 168 km²
Depth 46 m
Volume 4150 m³
Range of level -209 to -215 m
Average recharge 420 million m³
Climate change - Sea of Galilee water level (m)

-215

• Use of renewable energy - solar energy and wind.
Climate change

Sea of Galilee Total flow (million m3/year)
Natural Resources

production Cost $/m³

- Western Galilee: 0.45
- Carmel: 0.7
- Coastal Aquifer: 0.15
- Judean Aquifer: 0.3
- Eastern aquifers
- Negev & Arava

Average cost 0.35 $/m³

Ashkelon Sea water Desalination Plant

- Construction 2003-2005
- Operation since 2005
- Production 120 million m³/year
- Cost 1 $
Desalination of Seawater in Israel

Average cost 1 $/m³

Hadera (127) 400 288
Palmachim (90) 123 296
Ashdod (100) 145
Ashkelon (120) 103

Million m³/year

Tene A. 2012
Potential damage to water sources:

- High nitrogen concentration,
- High chloride concentration,
- Micro elements pollution,
- Hydrophobic feature that inhibit seepage and increase soil erosion.

Average cost $0.7/m$^3$.
GDP and Domestic water expense

- Consumption pre capita is: 90 m³/year.
- The Tariff is: 2.4 $/m³/person, 216$/year/person.
- GDP per person: 35,000 $.
- Relative expense for water per person: 0.6%.
- For family of five people: 3%.
Population & GDP (Gross domestic product) per person
Pre-feasibility study Integral Water Management Plan

Auroville and study area

‘Issues and Choices’

2007
Water Group Auroville
Gilles Boulicot Internal coordinator
Gilles Gigand
Kireet
Michael Boncke
Dirk Nagelschmidt
Ulrich Blass
Carel Thieme
Tency Baetens
Lucas Dengel
Jana
Maurice
Lata Iyer
Vani (Until April 2005)
Judith (From August 2005)
Walter Wagner (until April 2006)

International Advisory Committee
Dr. Israel Gev Head of Water Resources Planning, Water Planning Authority, Herzeliya, Israel
Drs. Jochen Kohler LGA Institute for Environmental Geology
Ir. Jeen Kootstra Consultant with Royal Haskoning, Nijmegen, The Netherlands External Coordinator
Dr. Sophie Violette University Pierre and Marie Curie, Paris, France
Drs. Carlo Schillinger LGA Institute for Environmental Geology
Grondwater – Present use

Aquifers used in/around Auroville:

- Cuddalore in east
- Kadaperikuppam in center
- Vanur in West

Groundwater used for all purpose (drinking, irrigation, gardening).

Abstraction 10 – 15 times recharge (Vanur 35 times)

Rapidly dropping groundwater levels in all aquifers

Noticeable effect in water quality
Auroville 1994
Results

**Figure 7.** Sap flux for *P. pterocarpum* between March and July 1994. Each square indicates daily sap flux.

**Figure 9.** $t_{\text{max}}$ values for *P. pterocarpum* in July 1994.

**Figure 8.** Sap flux for *A. auriculiformis* between March and July 1994.

**Figure 10.** $t_{\text{max}}$ values for *A. auriculiformis* in July 1994.
Summary

• A large part of the area in the region will continue to be used for agriculture in a considerable use of water resources.
• The population in the urban area will grow, and increase with the standard of living.
• Climate change is a fact that will influence on the requirement to find technology to produce water with low energy solution.

Find out your vision & adopt an integrative planning strategy:
• Integration of various water sources - Ground water & Runoff with Desalination of seawater, and Effluents.
• The runoff is a resource rather than a nuisance.
• Pollution sources must be eliminated.
Summary

- Exploitation groundwater as an operational storage for storing desalinated water or treated sewage.
- Use advanced technologies for sewage treatment and desalinate sea water, or salty water.
- Use of renewable energy - solar energy and wind.

- Strengthen professional involvement in the community.
- Strengthen public involvement in planning.
- Promote institutions of research and planning accompanied by professional and public committees.
Thank you