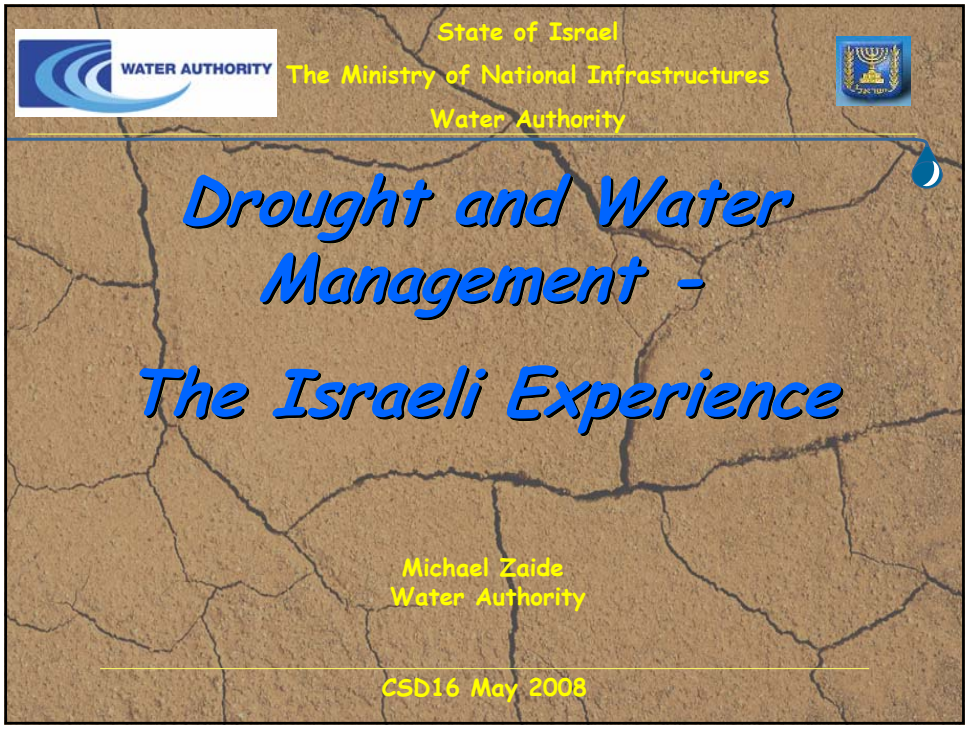

Learning center:
Efficient management of food production systems under water and land constraints
Israel Delegation to The CSD-16
United Nations Commission on Sustainable Development
NYC, May 2008


State of Israel
The Ministry of National Infrastructures
Water Authority
Drought and Water Management -
The Israeli Experience
Michael Zaide
Water Authority
CSD16 May 2008

Israel – General Data

- Middle East, Semi arid area
- Established 1948 (this year-60th birthday)
- Area: 20,770 km^2
- Regime: Democracy
- population 7.2 millions.
- Minorities 20%
- GDP 31,800 US$/Cap
- Agriculture 2% of the GDP
- Soon a member of the OECD

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Outline

- Background
- Water Crises
- Change of Policy
- Principles of management and planning
- Lessons from the Israeli experience

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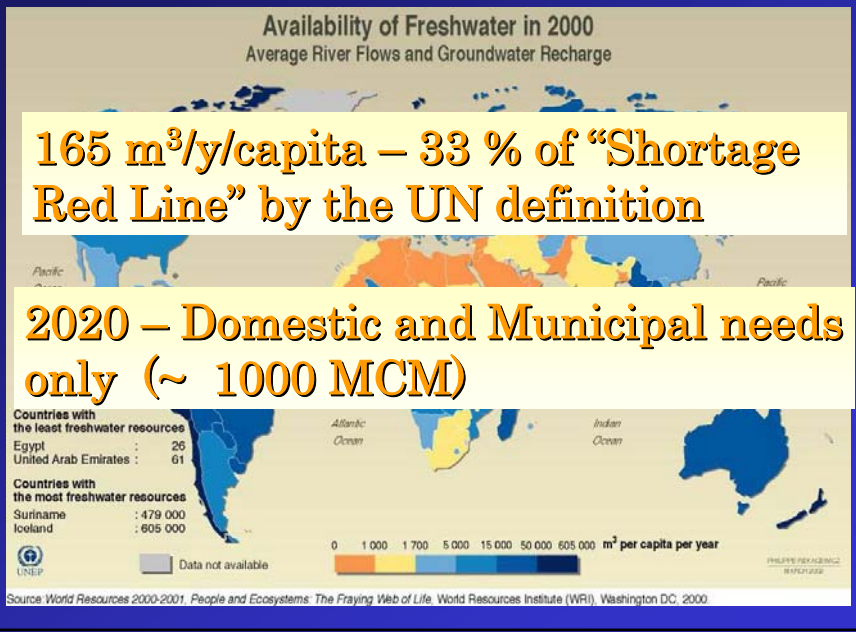
The Extent of Water



165 m^3/y/capita – 33 % of "Shortage Red Line" by the UN definition

2020 – Domestic and Municipal needs only (~ 1000 MCM)

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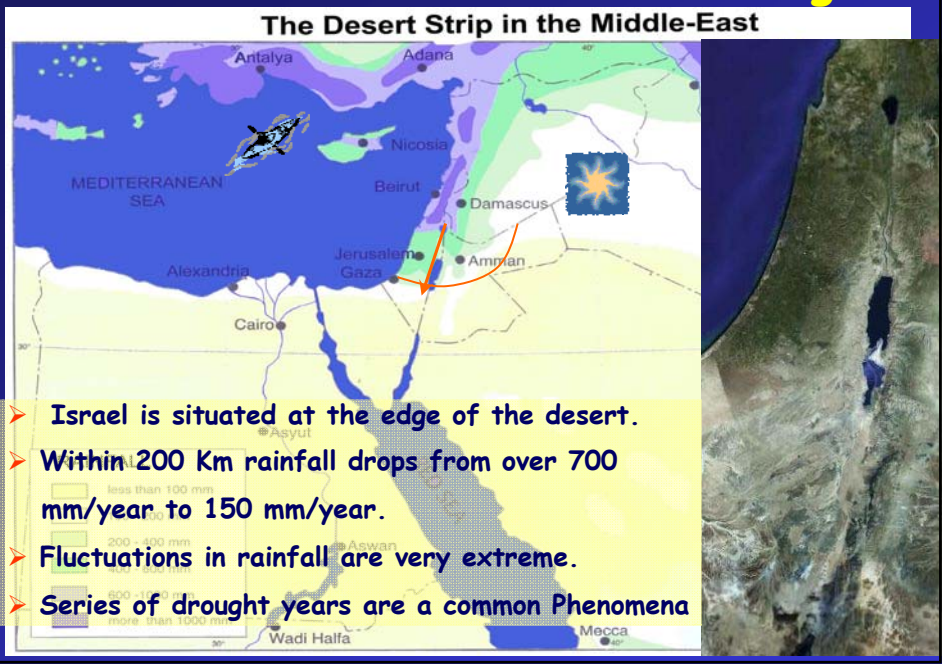
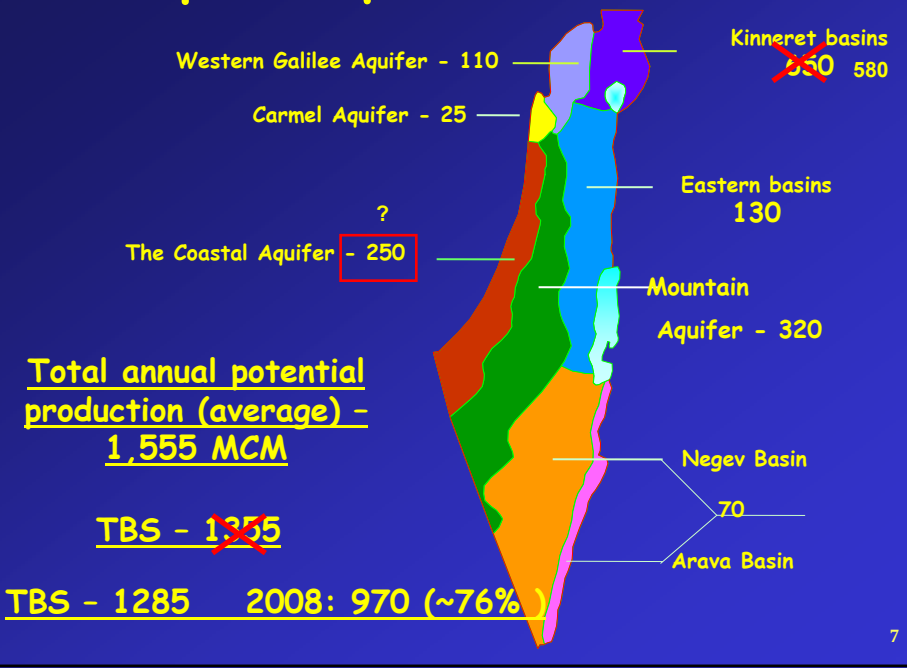
The Extent of Water Shortage



- Israel is situated at the edge of the desert.
- Within 200 Km rainfall drops from over 700 mm/year to 150 mm/year.
- Fluctuations in rainfall are very extreme.
- Series of drought years are a common Phenomena

Map of Aquifers in Israel



Total annual potential production (average) – 1,555 MCM

TBS – ~~1355~~

TBS – 1285 2008: 970 (~76%)

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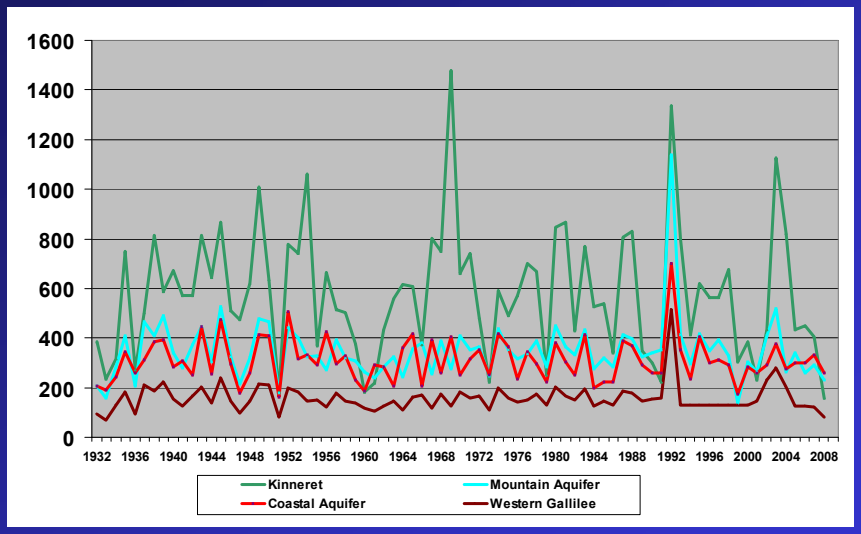
Replenishment Data 1932-2008



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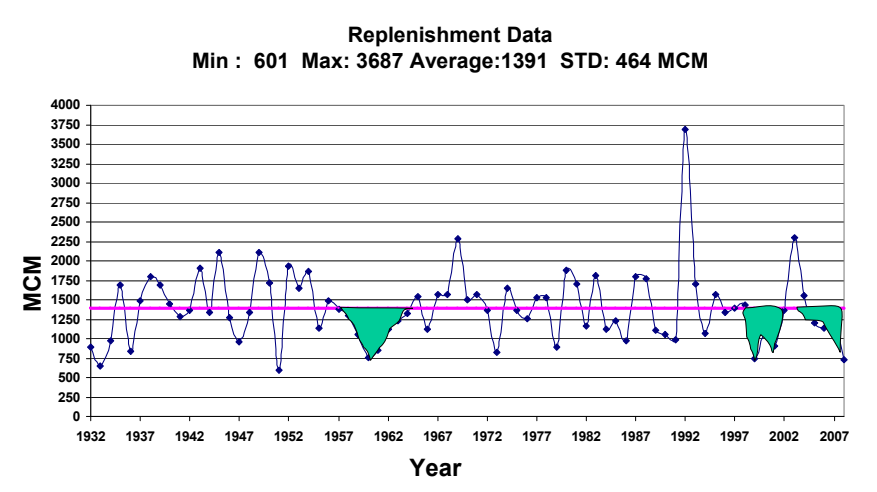
Replenishment Data

1932-2008



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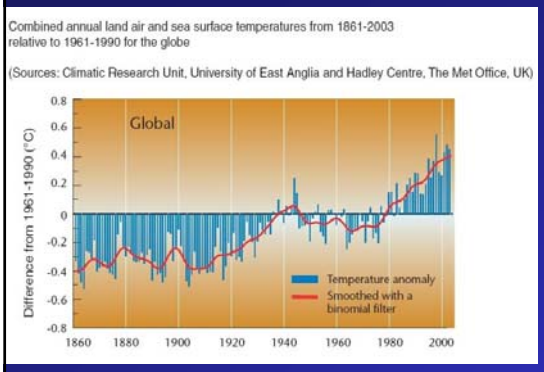
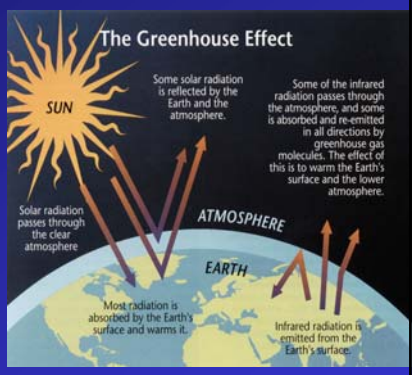
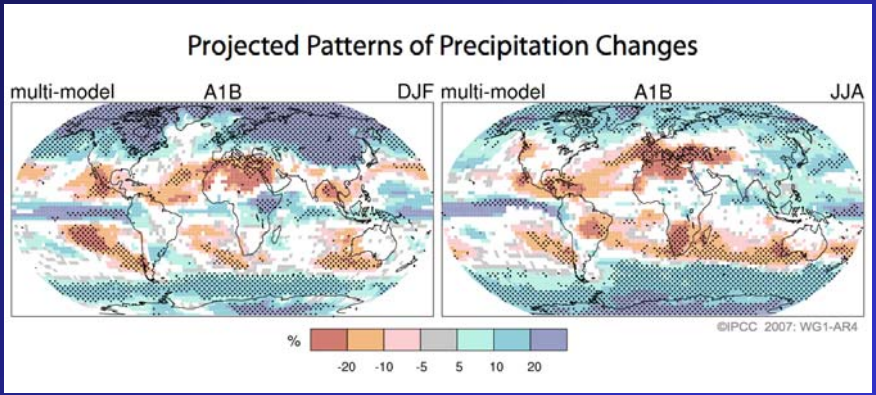
Climate Change





Source: Roger Braithwaite, University of Manchester (UK)

Projections of Future Changes in Climate



- Decrease in precipitation quantities.
- longer intermissions between rain events.
- Increase in uncertainty of annual replenishment volume of natural water resources.

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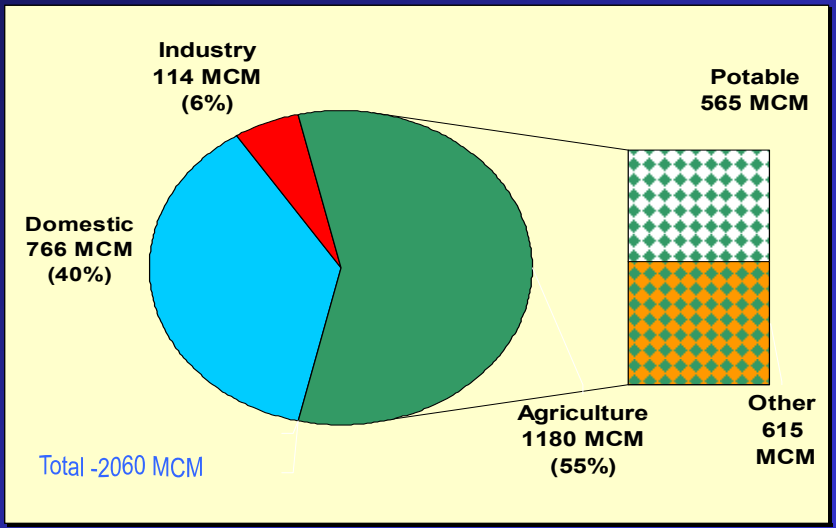
Water Demand per Sectors 2007



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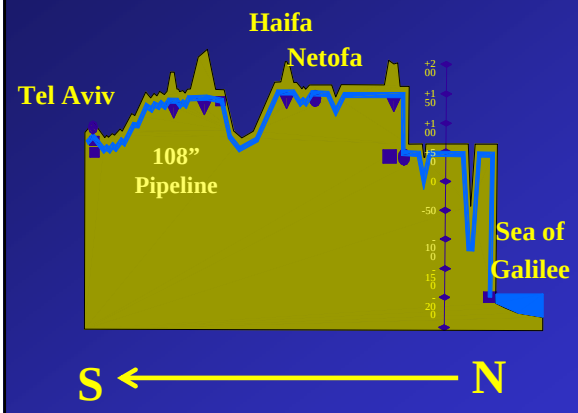
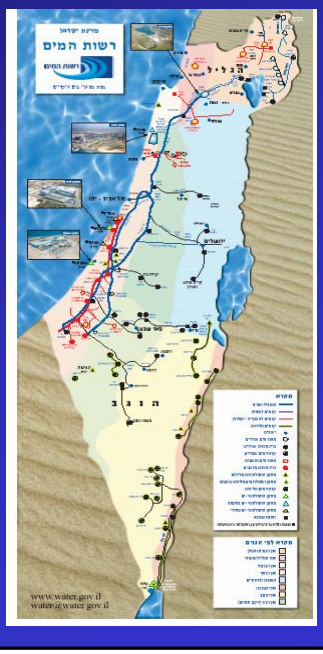
Main National Water Supply System





Wastewater Treatment in Israel:

- No. of large WWTP: 32
- Wastewater ~ 500 MCM/year
- 50% - secondary level
- 30% - tertiary level

The Jerusalem WWTP 2003

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Water Crises

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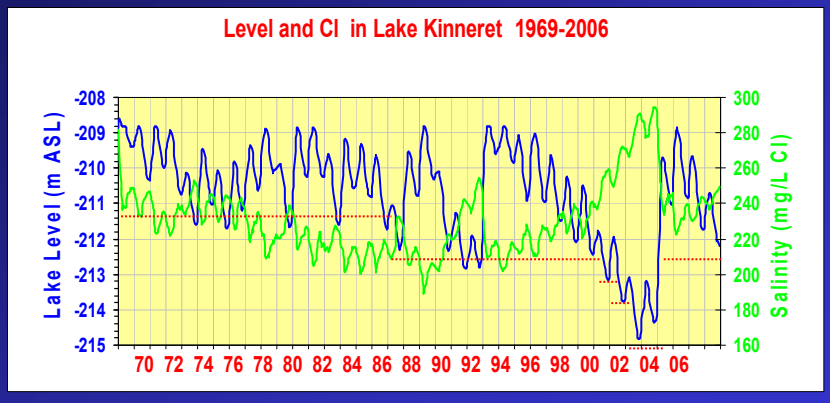
Lake Kinneret - Israel's main surface water source
Water level (1962 - 2006)



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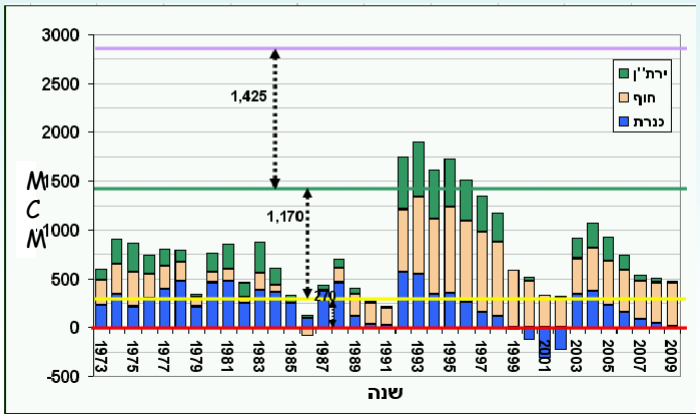
Water Volume in the TBS
MCM



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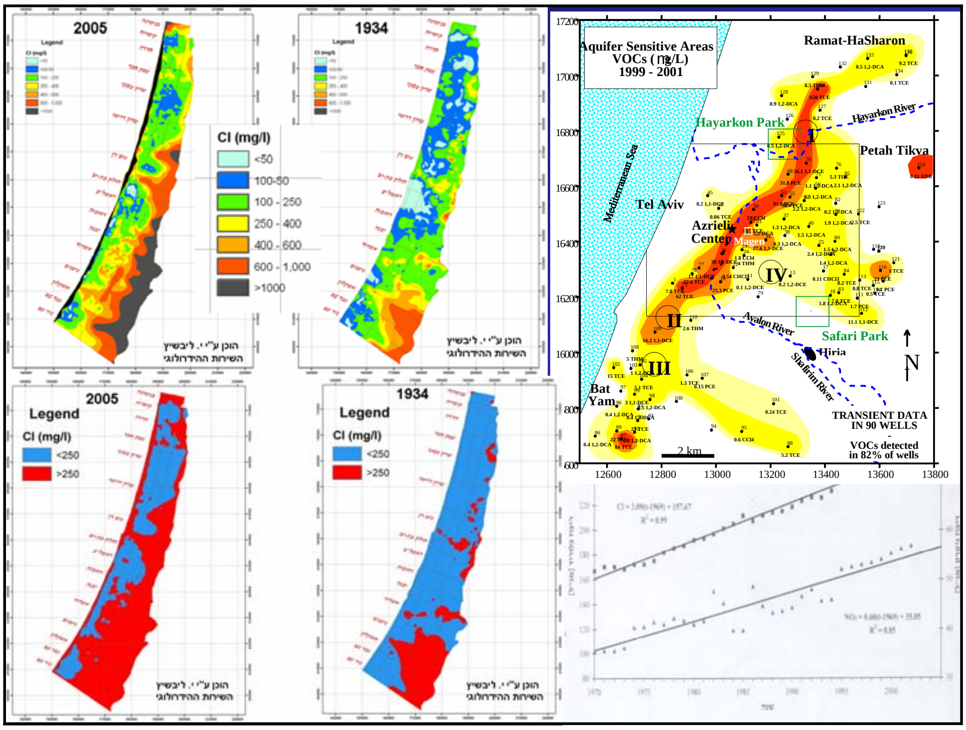

Water Crises

The main reasons:

- Consecutive years of drought in the region.
- Increased demand by population growth.
- Stretching the renewable water sources to the limit.
- Quality Deterioration of the natural sources.
- Lack of regulation tools.

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What has been done to cope with the water crises ?

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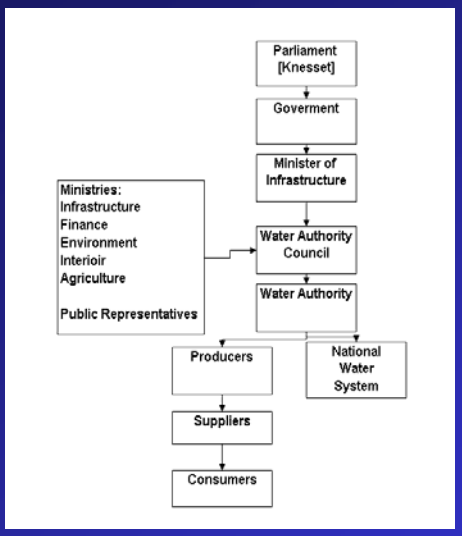
Water Authority



- Establishing the Water Authority (2007)
- Centralizing water management authorities from all ministries including the setting tariffs
- Management the hole coarse of the water cycle.

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Demand Management

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Domestic Tariffs

	Old Model	New Model
Tariff charged to the municipality	Average cost	Two tariffs: 1. First 3 MCM/month- ("resultant cost") 2. The rest- marginal cost
Tariffs charge to the Consumer:	3 progressive tariffs	Two tariffs

Agriculture Tariff also has being changed and was linked to the average cost (desalination cost included).

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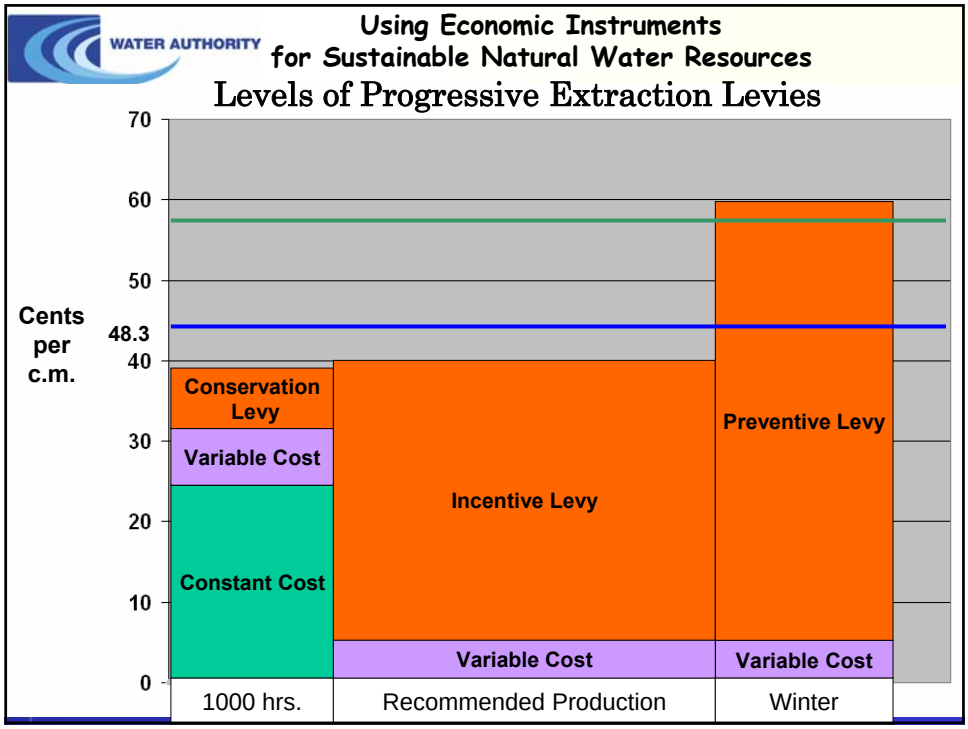
WATER AUTHORITY
Using Economic Instruments
for Sustainable Natural Water Resources
Levels of Progressive Extraction Levies
Cents per c.m.
70
60
50
48.3
40
30
20
10
0
Conservation Levy
Variable Cost
Constant Cost
Incentive Levy
Variable Cost
Preventive Levy
Variable Cost
1000 hrs.
Recommended Production
Winter


Changing Planning Concepts
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Potable Water Demand 2002-2010 MCM/ YEAR

	Domestic	Industry	Agriculture	Nature	Other	Total
2008	766	85	454	7	130	1442
2020	985	93	350	50	208	1686

Annual demand growth rate of
20 MCM/YEAR

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Sustainable Development Approach

- ~~"Walking on the Edge" Policy~~

- Adoption of sustainable approach to water resources management and development both for quantity & quality

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New Policy - Sustainable Approach

1. Restoring the reliability of the water supply system.
2. Recognition of Nature's right to water.
3. Rehabilitation of contaminated parts of the Coastal Aquifer.
4. Reclamation of wastewater.
5. Reduction of salinity in reclaimed wastewater.
6. Financial and technical water savings mechanisms.
7. Manufacturing water as one of the ways of promoting peace in the region.

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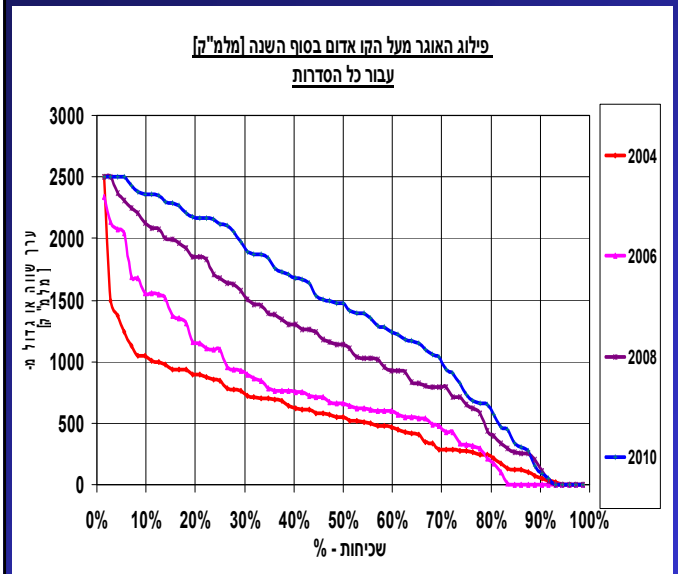
Probability Analysis

Natural Storage Rehabilitation



- Ensemble Forecasting
- Storage volume & yearly change
- Operational extraction
- Water loss
- Deficits
- Desalination
- Benefit- cost analysis

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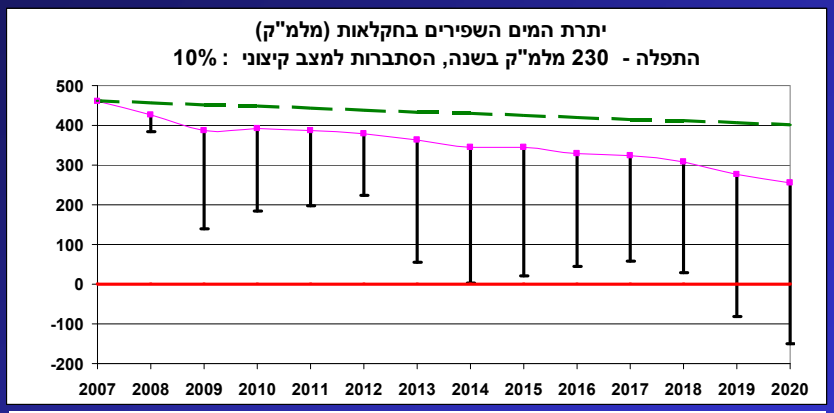
Probability Analysis

Water Supply Shortage



- Supply according to demand needed
- The capability to supply the water in average (Expectancy)
- Safety interval (for desired probability)
- Red line

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Risk Management

- Climate change : 10-20%
- water redundancy due to bilateral agreements
- Water quality deterioration
- Water Security
- Water demand (Standard of living)

- "Uncertainty factor" (0.85) in natural replenishment
- Building scenarios
- Implementing stringent limitations for water reliability standards

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Development Program

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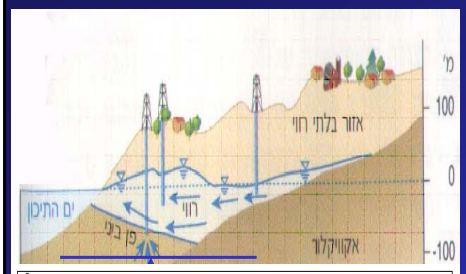
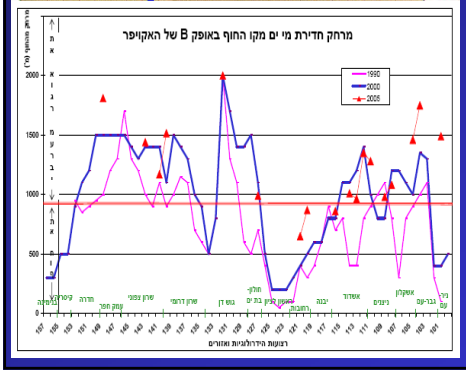
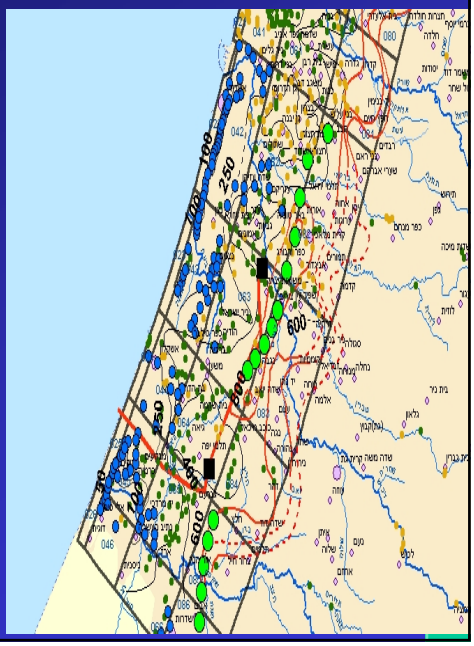
Rehabilitation of the Coastal Aquifer



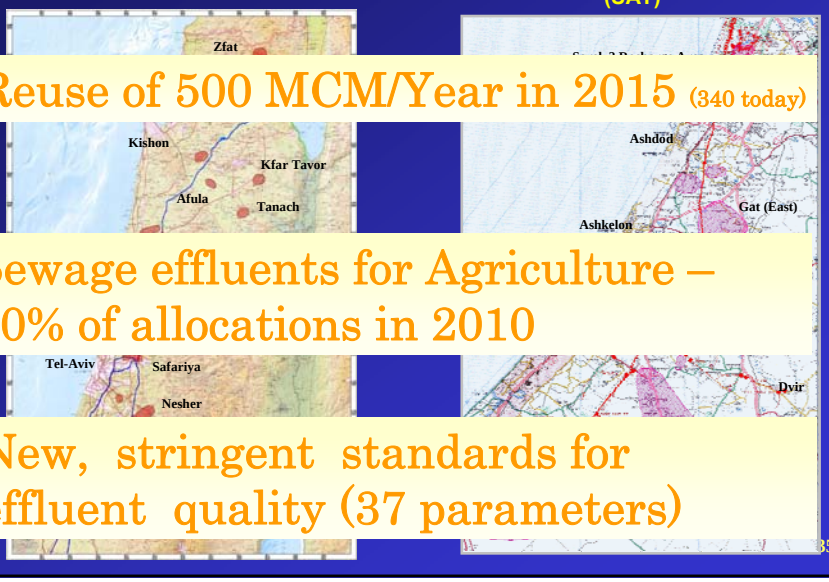




Reuse of All Sewage Effluents

Effluents Supply systems

Shafdan Water Project (SAT)



Reuse of 500 MCM/Year in 2015 (340 today)

Sewage effluents for Agriculture – 50% of allocations in 2010

New, stringent standards for effluent quality (37 parameters)

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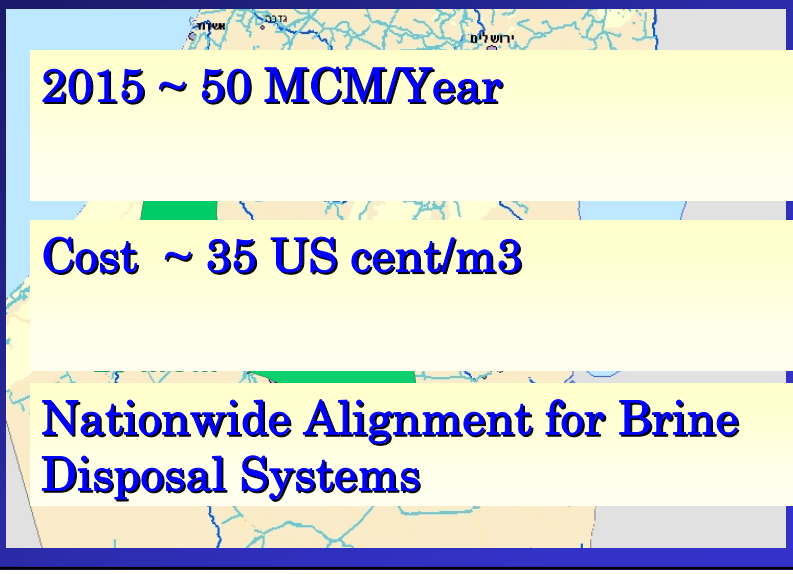
Brackish Water Desalination



2015 ~ 50 MCM/Year

Cost ~ 35 US cent/m3

Nationwide Alignment for Brine Disposal Systems

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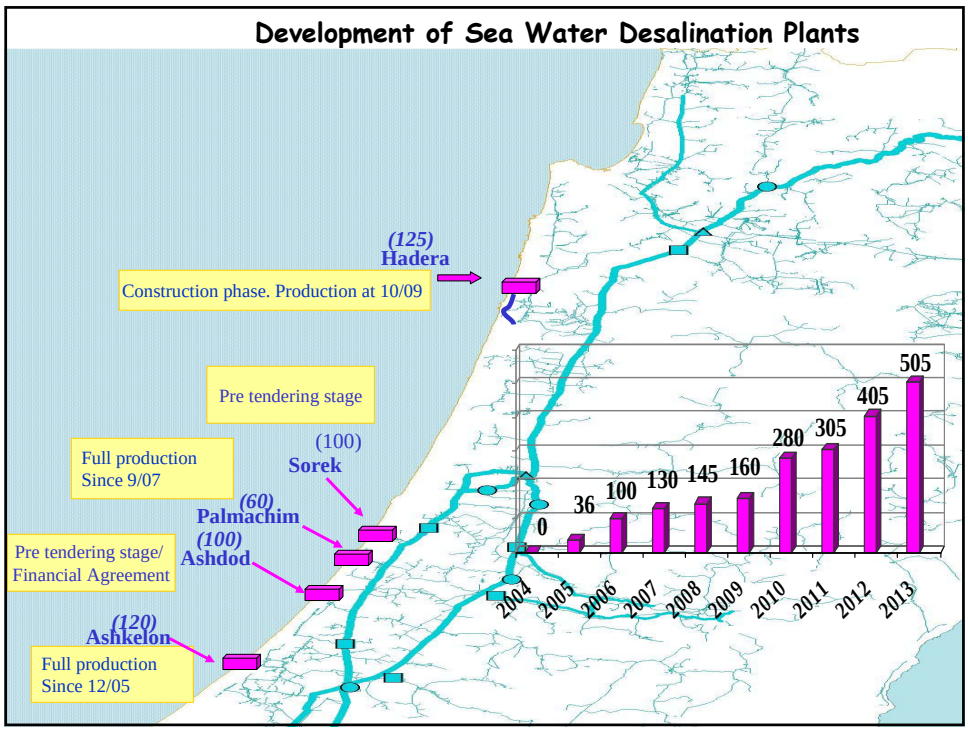
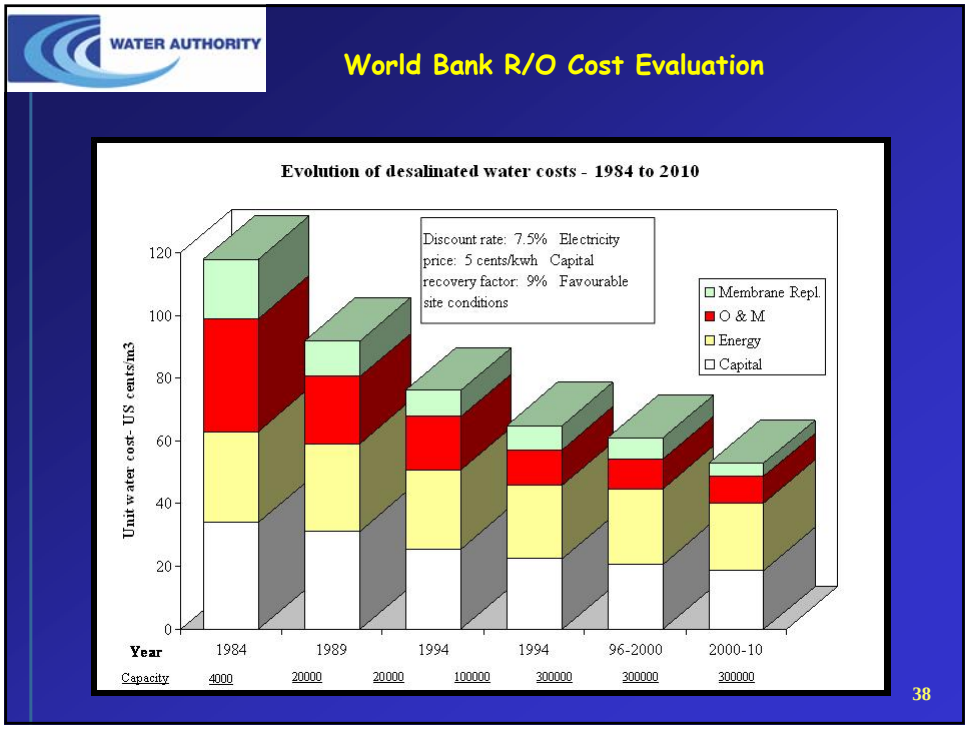
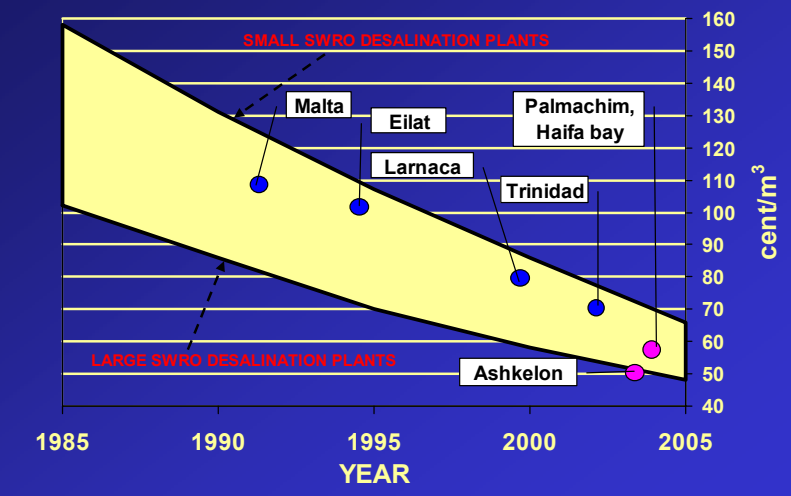

Development of Sea Water Desalination Plants
(125)
Hadera
Construction phase. Production at 10/09
Pre tendering stage
(100)
Sorek
Full production
Since 9/07
(60)
Palmachim
(100)
Ashdod
Pre tendering stage/
Financial Agreement
(120)
Ashkelon
Full production
Since 12/05
0
36
100
130
145
160
280
305
405
505
2004
2005
2006
2007
2008
2009
2010
2011
2012
2013


WATER AUTHORITY
World Bank R/O Cost Evaluation
Evolution of desalinated water costs - 1984 to 2010
Discount rate: 7.5% Electricity price: 5 cents/kwh Capital recovery factor: 9% Favourable site conditions
Membrane Repl.
O & M
Energy
Capital
Unit water cost- US cents/m3
120
100
80
60
40
20
0
Year
1984
1989
1994
1994
96-2000
2000-10
Capacity
4000
20000
20000
100000
300000
300000
300000
38

Desalinated Sea Water Cost Range



Source: ADAN

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Manufactured Water 2002 - 2015 MCM/Year

	2008	2009	2010	2011	2012	2013	2014	2015
Sea water desalination	140	160	280	300	400	500	700	700
Brackish water desal.	11	15	22	31	37	43	47	51
Water import	-	-	-	-	-	-	-	-
Additional amounts of potable water	151	175	302	331	437	543	747	751
Treated waste water	340	355	370	385	400	415	430	445

40% of total supply will be manufactured by 2010

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National Master Plan

Water Development Plan: required investments 2002 – 2010 (2015)

(Million US $)

• Desalination	1,600
• Sewage treatment & reuse systems	1,000
• Water supply systems	600
• Renovation & Improvements	800
TOTAL	**4,000**

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Some Lessons from the Israeli experience…

- A drought is a crisis but its also an opportunity for reforms.
- Water reliability is a policy. However, a plan should be prepared for a low probability scenario.
- Incorporating demand management measures has contributed to water consumption reduction.
- Reclamation is the best way to increase affordable water supply for agriculture.
- Desalination in large plants reduce costs effectively.

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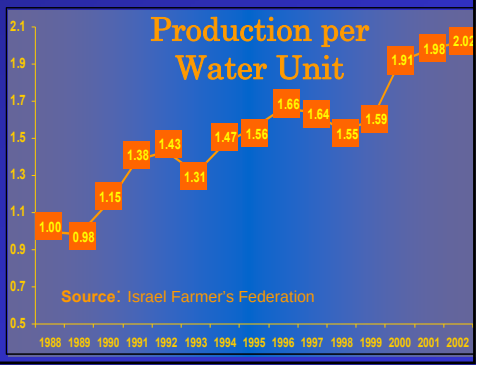
Some Lessons from the Israeli experience…

- Integrated system management should take into account and enable high level of mobilization for water.
- In order to prevent low levels of salinity in reclaimed water, desalinated water should be supplied as primary use (for domestic use).
- Enhancing private sector involvement has proven successful, however the state always needs to take responsibility for risks involved.
- Agriculture can become much more efficient than expected.



WATER AUTHORITY

Thank you !

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