Botin Foundation – Madrid – July 1 2013

Israel's Water Master Plan V4 - 2012

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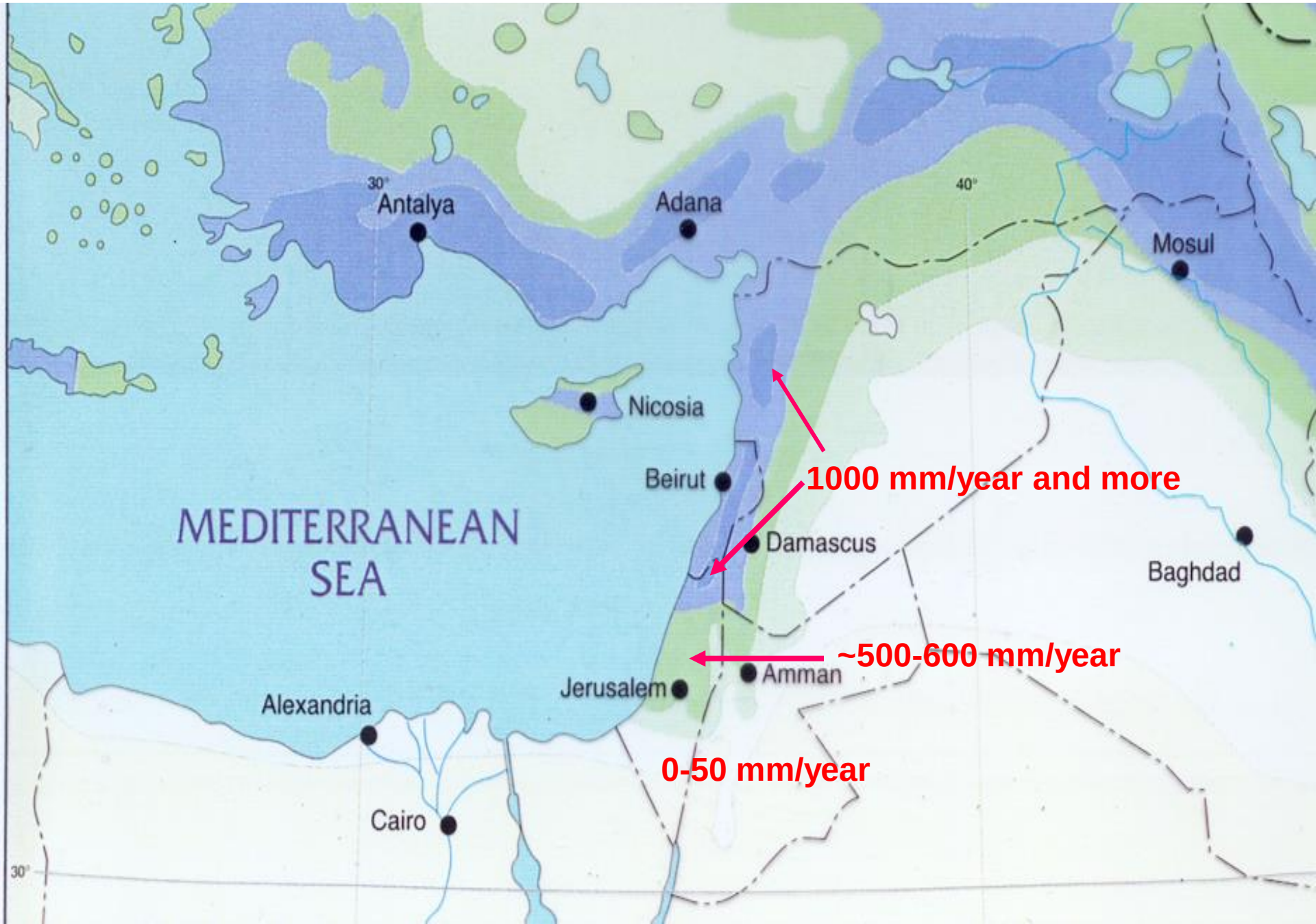
Outline

- Water situation in Israel
  - Basic information
  - Challenges → Pressures
  - Challenges → Responses
  - Israel's main failures and accomplishments
  - New 2012 Water Master Plan

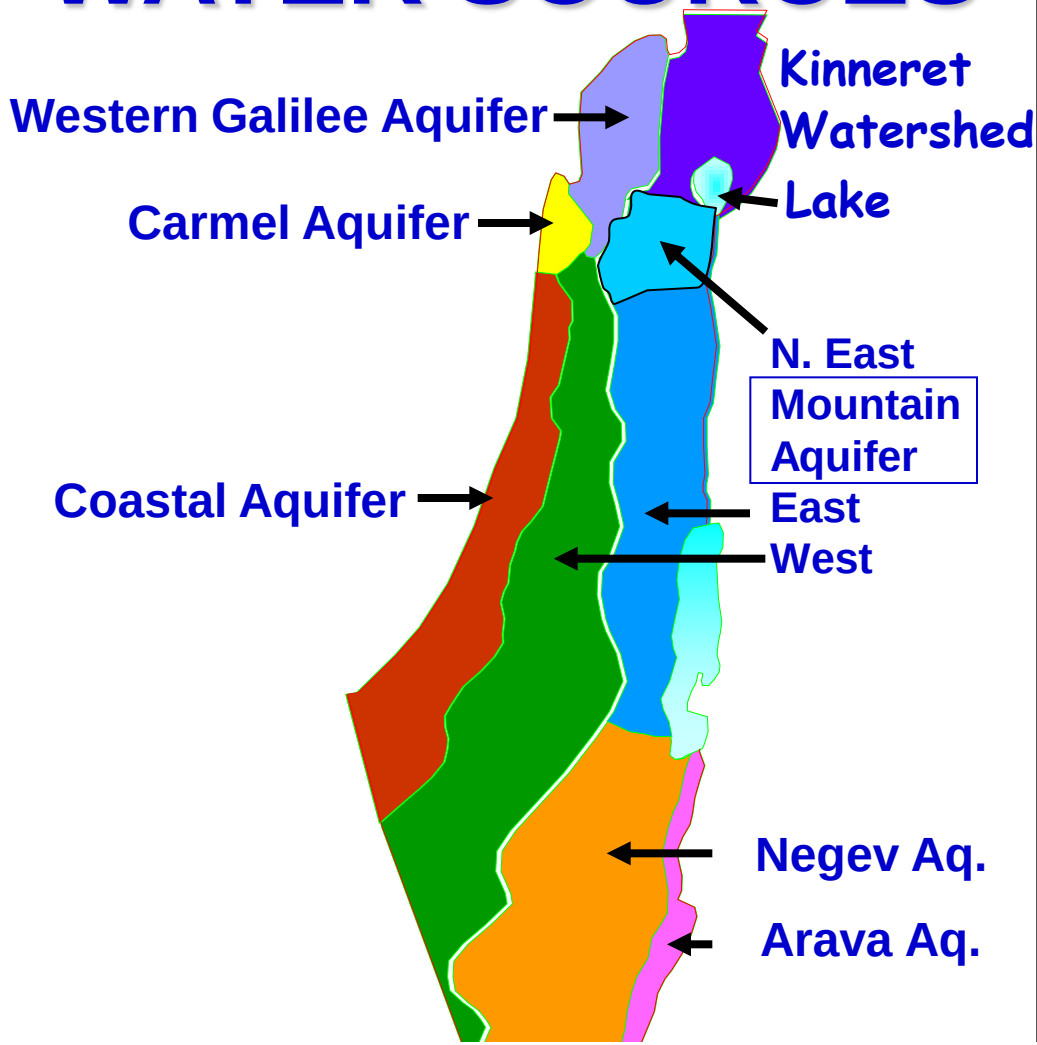
Israel's Water Situation: Data, Challenges, Responses

Similar challenges face other countries in our region and in several other regions, but the responses have to be adjusted to local conditions and capabilities

Rainfall Distribution in the Region



WATER SOURCES



Highly integrated national and regional systems

Average Annual Potential

~1,200 mcm/yr Israeli system

~1,700 mcm/yr Med to Jordan R.

- **Population:**
  - 2012 7.9 million +~0.3 Unaccounted
  - 2025 ~ 9 million
  - 2050 ~ 14 million
  - 150→86 m^3/capita/year
  - 2050 11-16 million

- **Total area:**
  21,000 square km
  The southern half is populated sparsely

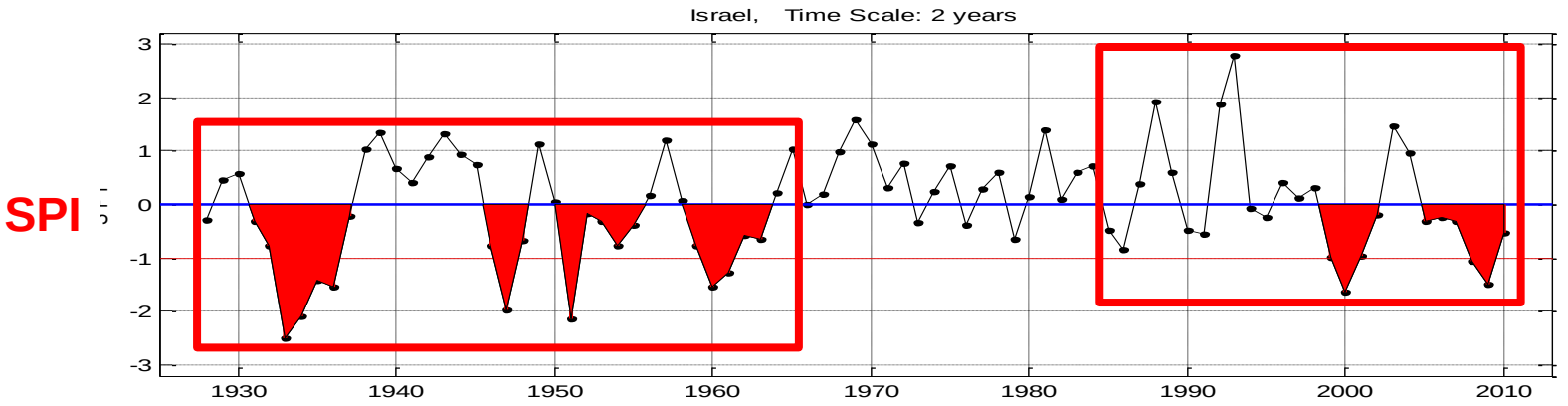
- **Irrigated area**
  ~2,000 square km
  ~10% of the total area

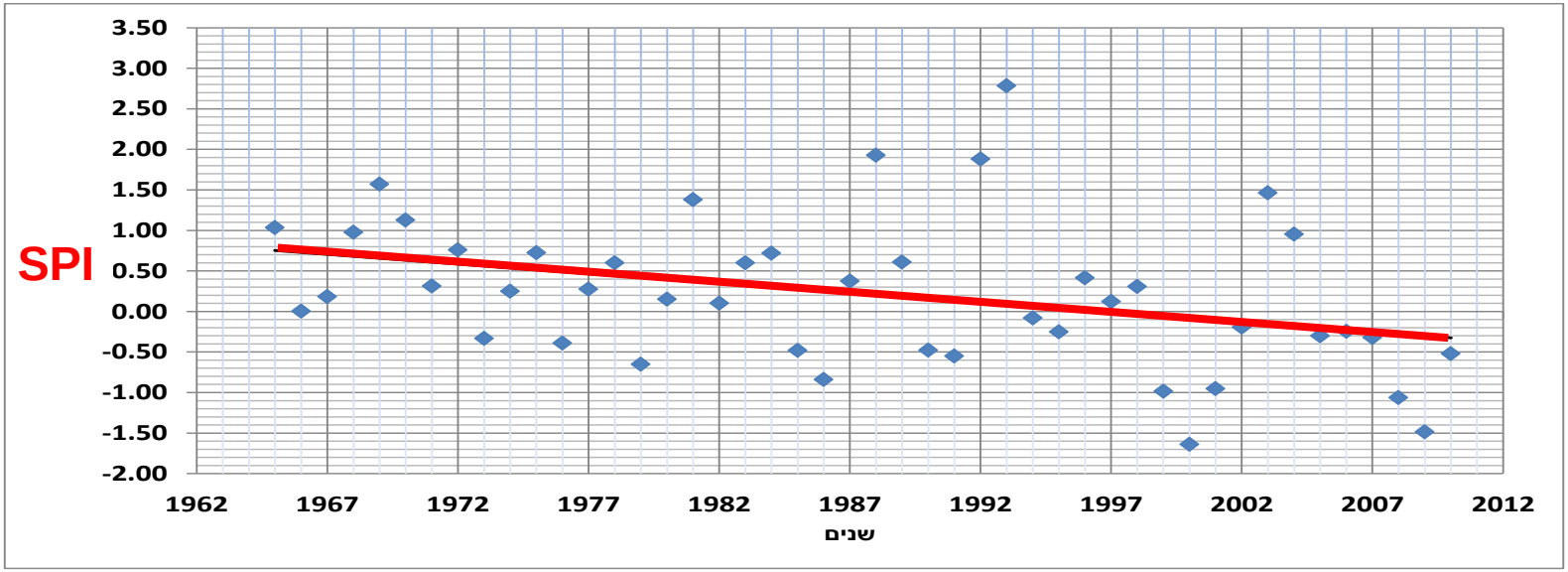
Source: Based on Ben Gurion University and Tahal Engineers, Israel Water Study for the World Bank, 1994.

Drought Index (Precipitation) for the National System

2-year backward moving average of the total precipitation

(Amir Givati, Meir Rom & Uri Shamir, IHS, March 2012)

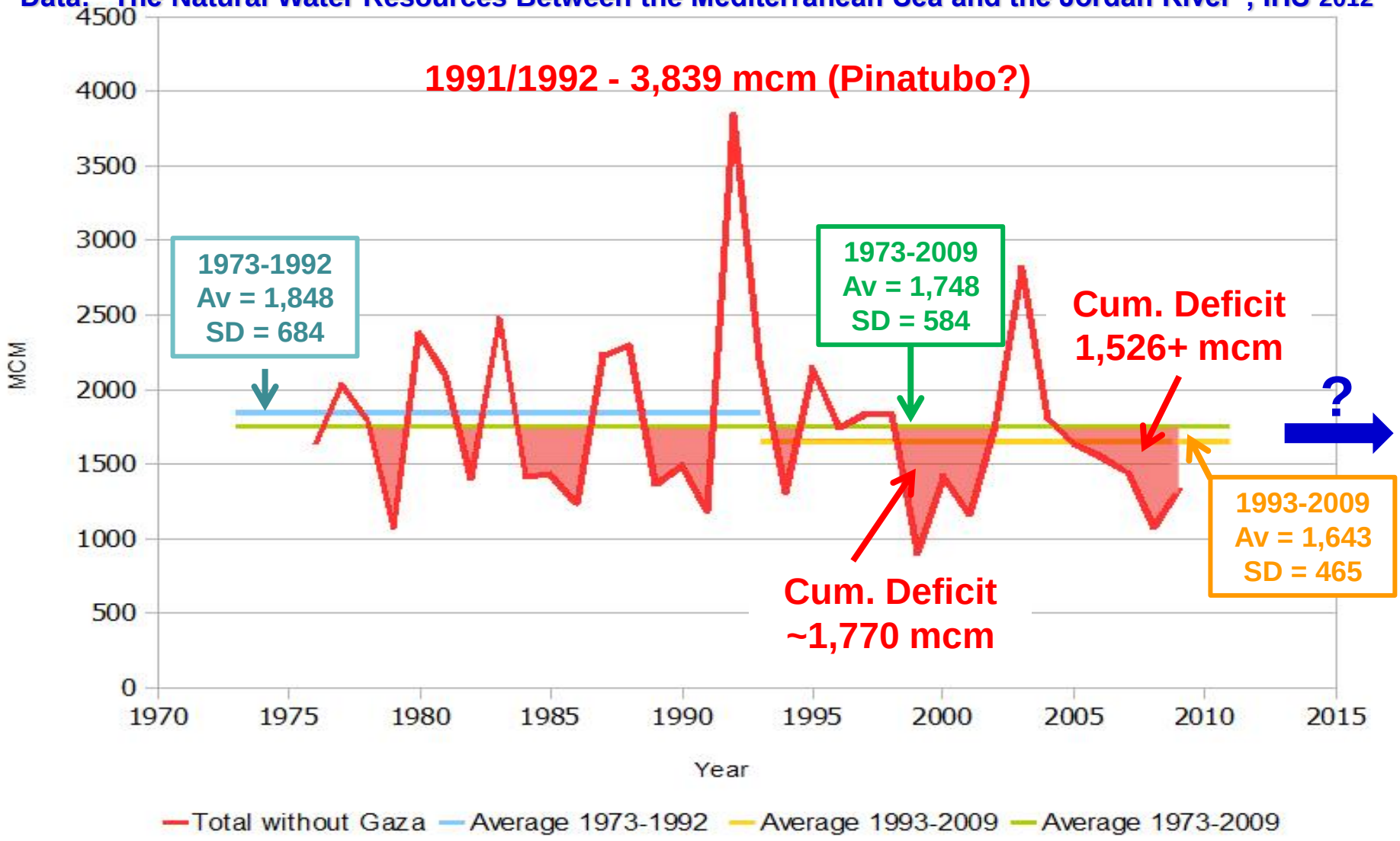




Natural Replenishment (mcm/year)

All Sources from Mediterranean Sea to Jordan River (exc. Gaza)

Data: "The Natural Water Resources Between the Mediterranean Sea and the Jordan River", IHS 2012



Uncertainties and Outcomes

- Sources of uncertainty: population (size and distribution), demands (urban, agriculture, nature, regional), hydrology (precipitation and recharge), performance of system components, costs and benefits, pricing, laws and regulations, politics, international conditions
- Desired outcomes: reliable supply of water quantity and quality, serve people, agriculture, protect species, efficiency, income, net benefit
- Negative outcomes: loss of service, shortages, loss of species, financial loss, loss of professional reputation, loss of political position

Coping with Uncertainties

- We recognize, we admit, and we allow that decisions (political/public as well as private) are taken with a subjective attitude (bias). This is partciularly true for decisions under uncertainty, which are difficult to grasp and to communicate, decisions whose consequences and uncertain.
- And still, we strive to provide the DMs and society with tools that expose the meanings of uncertainty and the consequences of making decisions under uncertainty, so decisions can be made "with open eyes", and have a good chance of resulting in minimum future regret (a possible definition of sustainability).

Challenges → Pressures

- Large hydrological variability and uncertainty with respect to future hydrology
- Possible impact of climate change
- Frequent change in Israeli politics and replacement of Ministers
- Uncertainty in the political and management domain can be the most difficult to deal with

Challenges → Pressures

- In the past >70% of fresh water were used by the (politically powerful) agricultural sector
- As long as water for agriculture was subsidized the Ministry of Treasury refused to allow desalination
- Population growth → urban demand for more potable water, now >50%
- Result: overuse of the sources

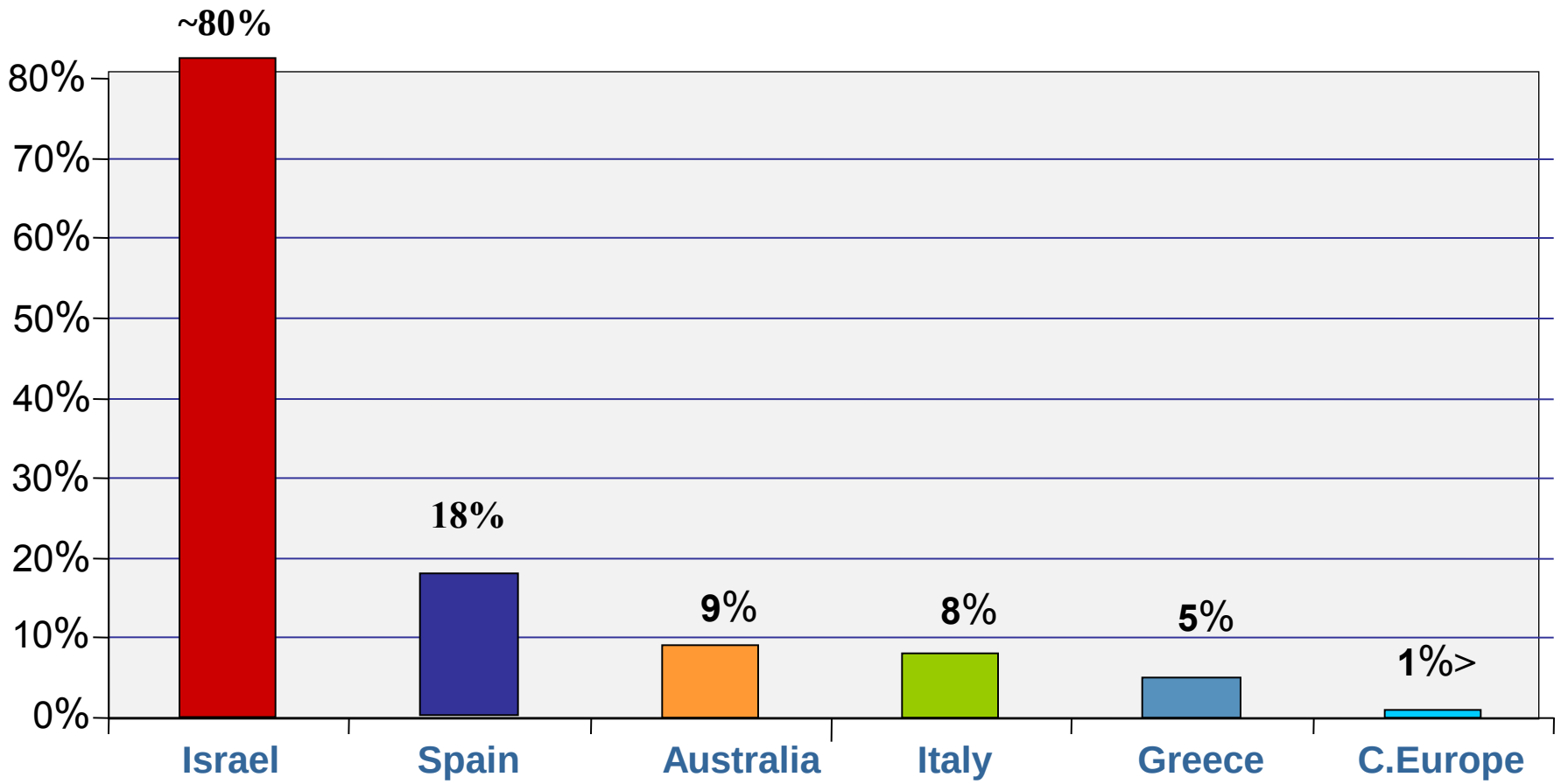
Challenges → Pressures

- Declining water quality in the sources caused by human activities and lower water levels
- Rising quality standards for water (we do have very good quality at the tap) and for treated wastewater
- Water agreements with our neighbors → potential reduction (?) of our share of the regional resources

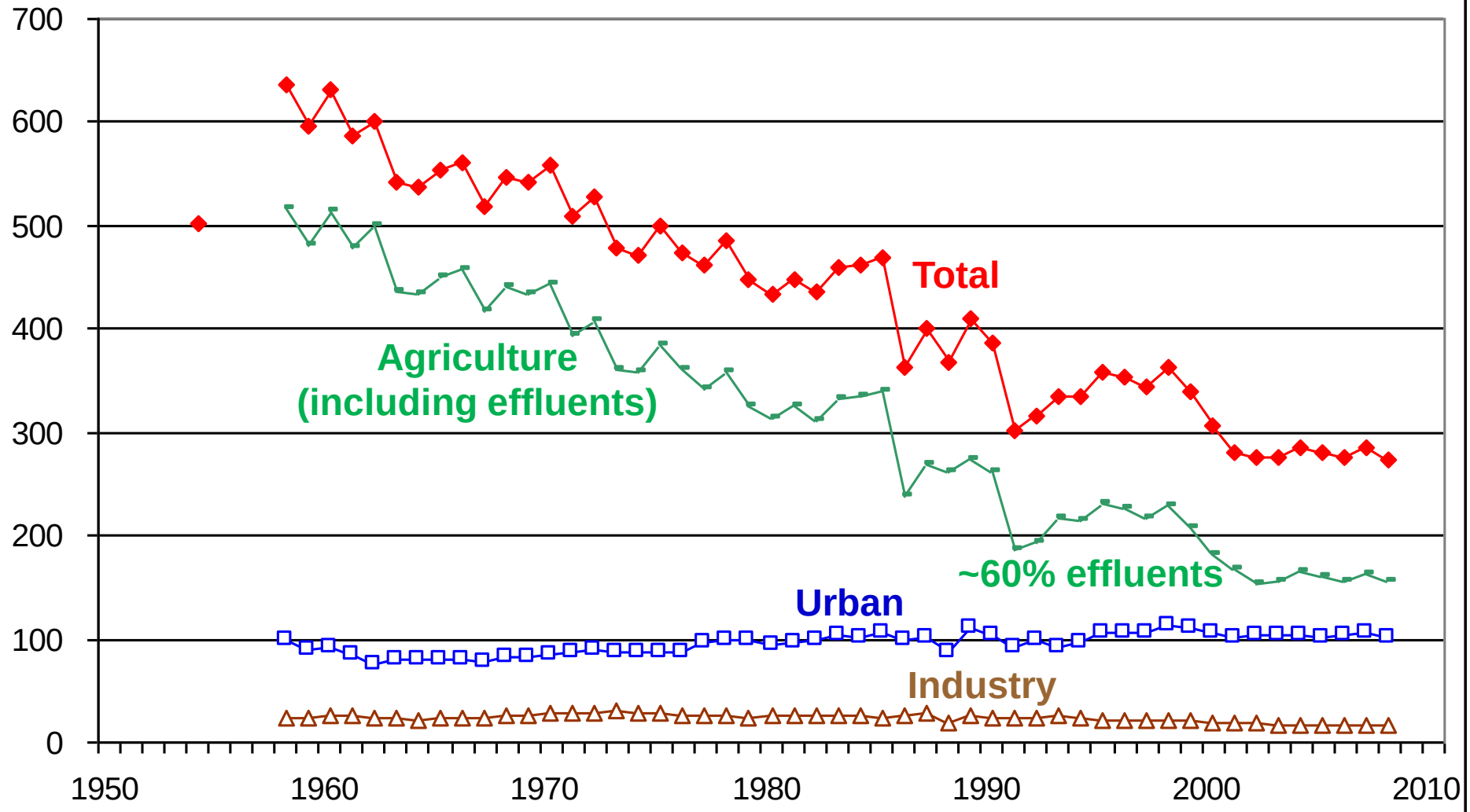
Challenges → Responses

- Reduced by more than 60%(!) fresh water supply for irrigation
- Replaced by sewage effluents, and water productivity has multiplied
- Water pricing moving towards full cost for all sectors (including agriculture)
- Water conservation in the urban sector through pricing, regulations, campaigns, education

Reuse of Sewage Effluents (% of sewage) (Sewage is ~80% of water used)



Water (incl. effluents) consumption, m^3/cap/year



From: Prof. Yoav Kislev

Urban Consumption (m^3/cap/year) 1996-2011 & 2012 est.

צריכה לנפש מגורים (,תאגידים/ברשויות המקומיות)-סה"כ צריכת המים למגורים וגינון פרטי ברשויות מקומיות לשנה מסוימת , מחולקת במספר התושבים ברשויות המקומיות באותה שנה

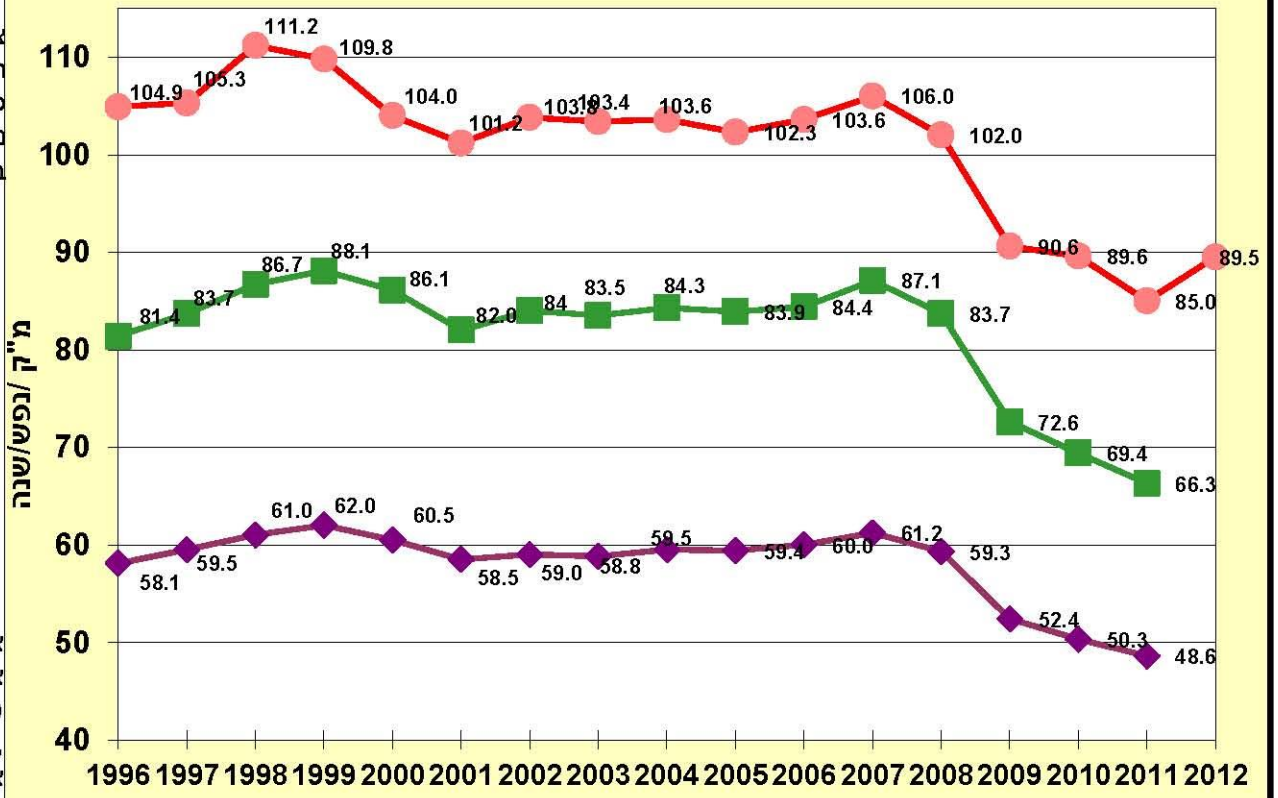
Private homes + gardens

צריכה לנפש עירונית (תאגידים/ברשויות המקומיות)-סה"כ צריכת המים ברשויות מקומיות למעט צריכה חקלאית ותעשייתית לשנה מסוימת , מחולקת במספר התושבים ברשויות המקומיות באותה שנה

Municipal areas (w/o Ag. & Ind.)

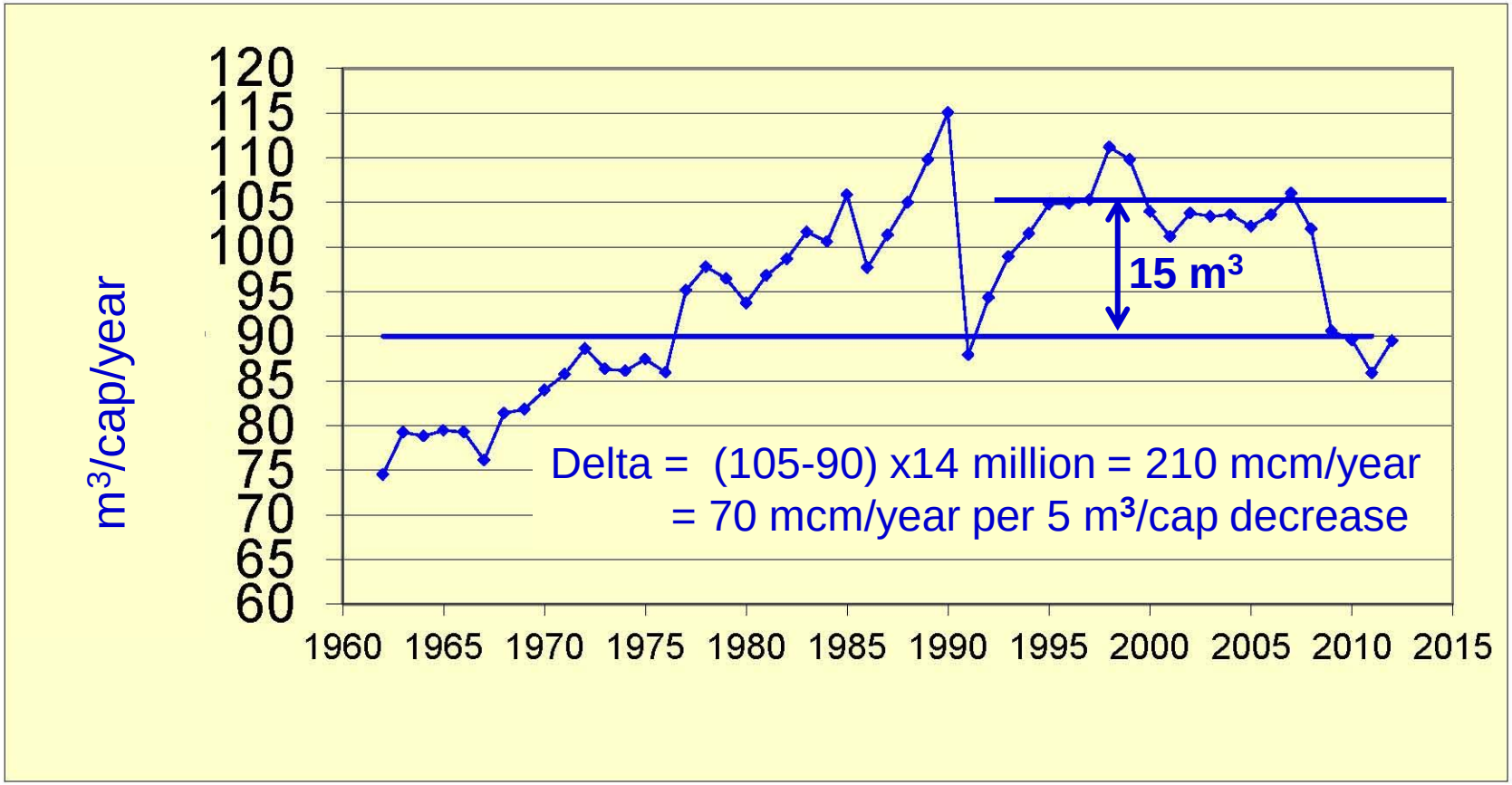
צריכה לנפש מגזר ביתי וציבורי (ארצי)-סה"כ צריכת המים לשנה מסוימת ,ברשויות מקומיות (עיריות ומועצות מקומיות) קיבוצים ,מושבים ,יישובים קהילתיים ,כפרי מיעוטים ,מחנות צה"ל , למעט צריכה חקלאית ותעשייתית מחולקת במספר התושבים במדינה באותה

Total settled sector



From: Sharon Nussbaum, IWA

Total Urban Consumption (m^3/cap/year) 1996-2011 & 2012 est.



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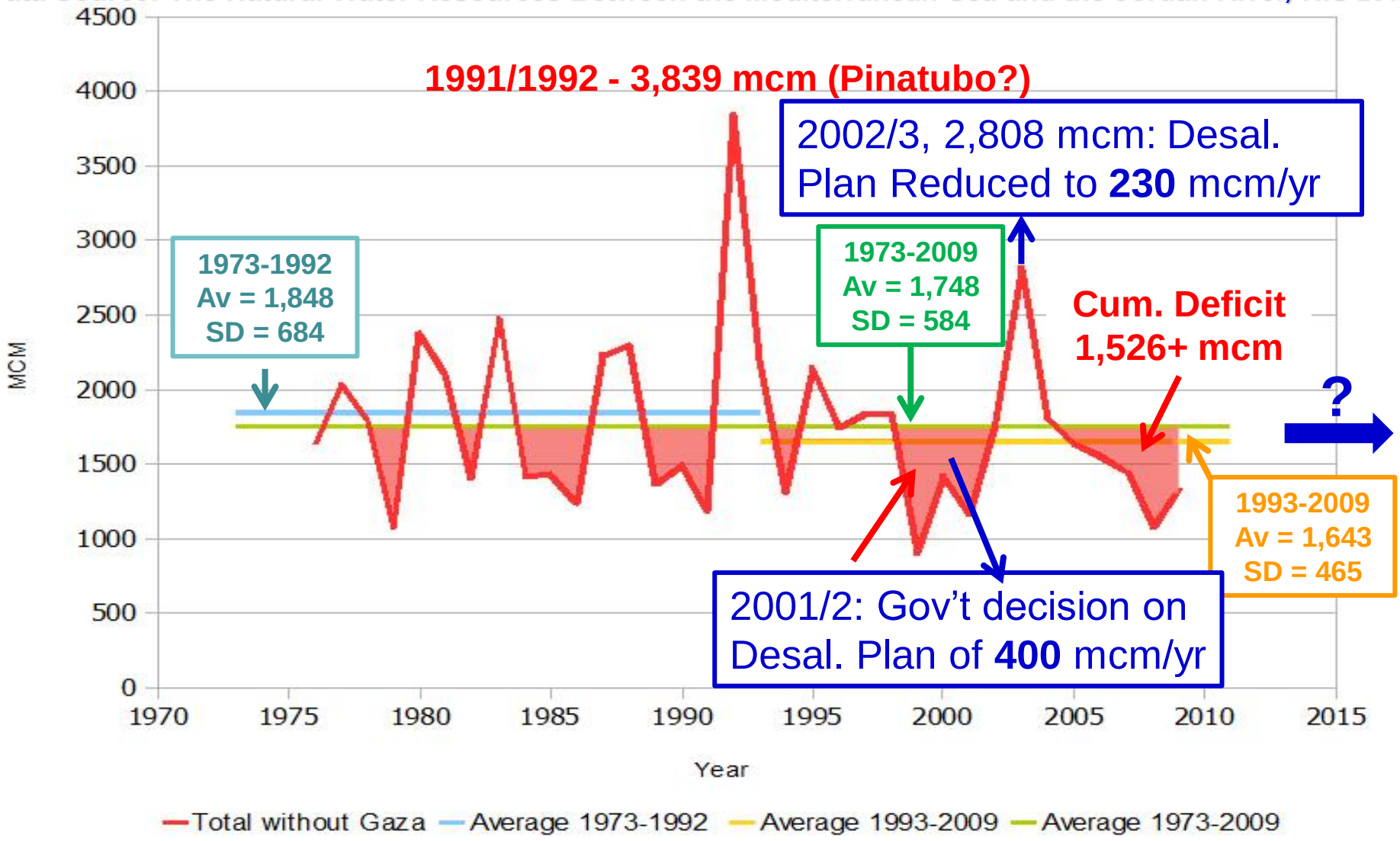
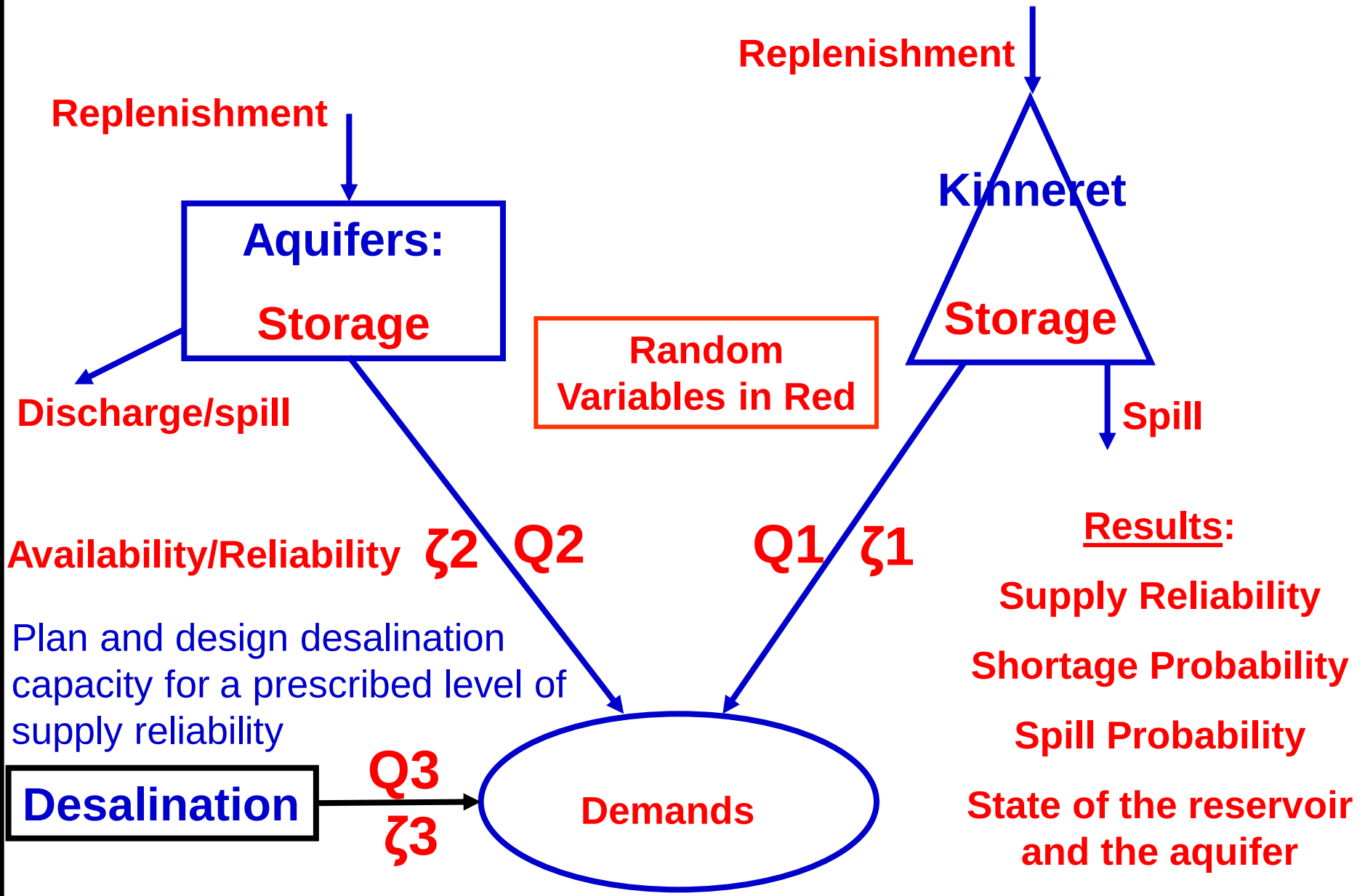
Natural Replenishment (mcm/year) & Desalination Plans

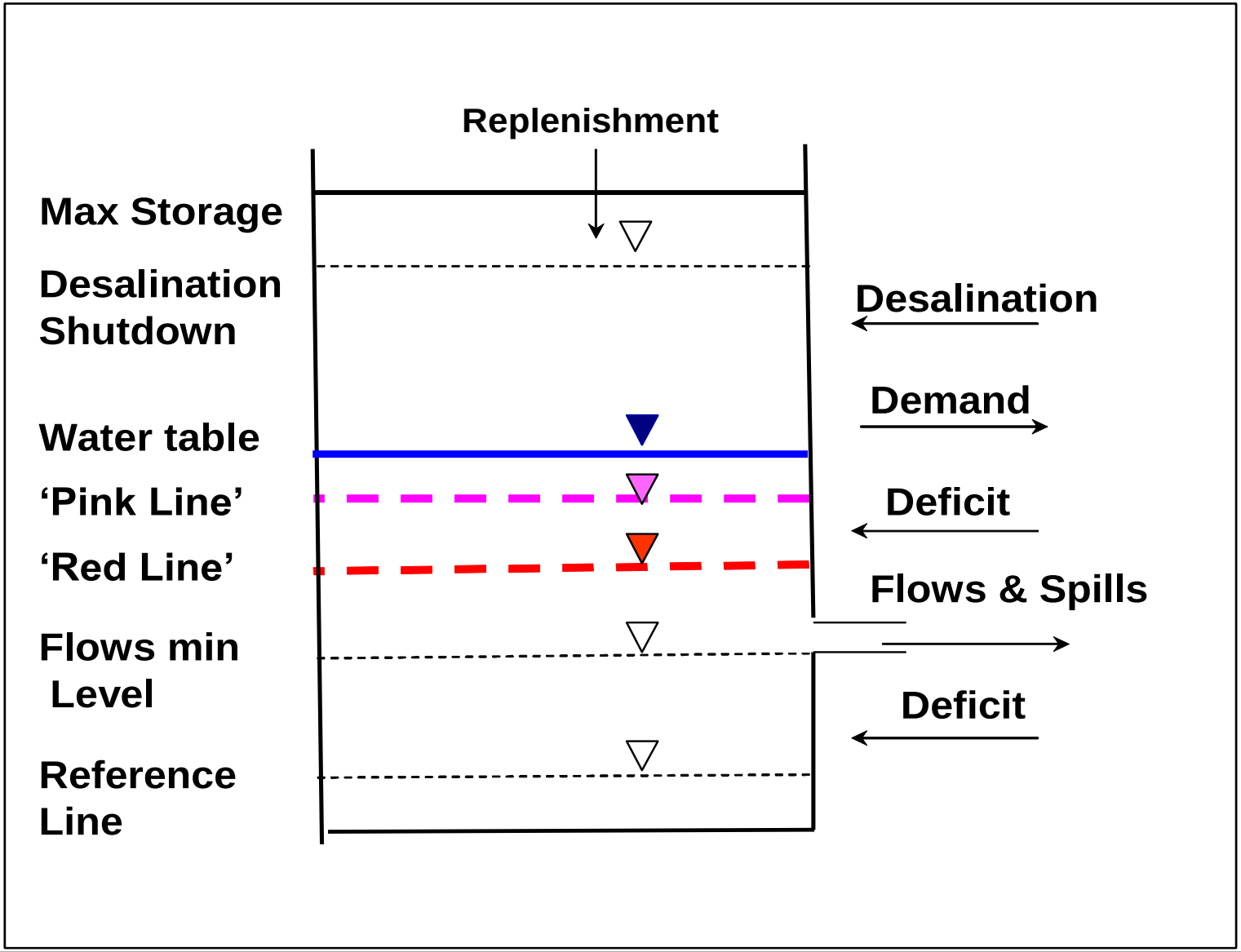
All Sources from Mediterranean Sea to Jordan River (exc. Gaza)

Data Source: The Natural Water Resources Between the Mediterranean Sea and the Jordan River, HIS 2012

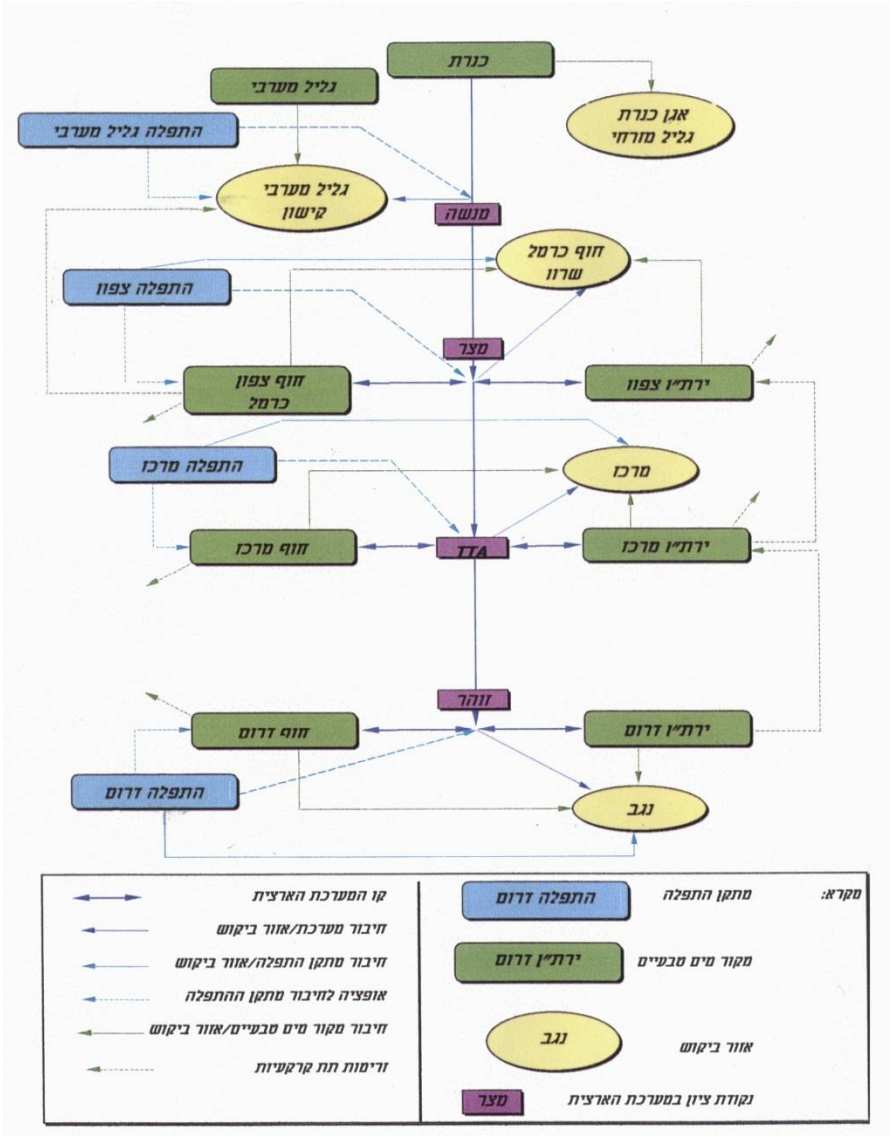



Replenishment
Replenishment
Kinneret
Aquifers:
Storage
Storage
Random
Variables in Red
Discharge/spill
Spill
Availability/Reliability
ζ2
Q2
Q1
ζ1
Results:
Supply Reliability
Shortage Probability
Spill Probability
State of the reservoir
and the aquifer
Plan and design desalination
capacity for a prescribed level of
supply reliability
Desalination
Q3
ζ3
Demands

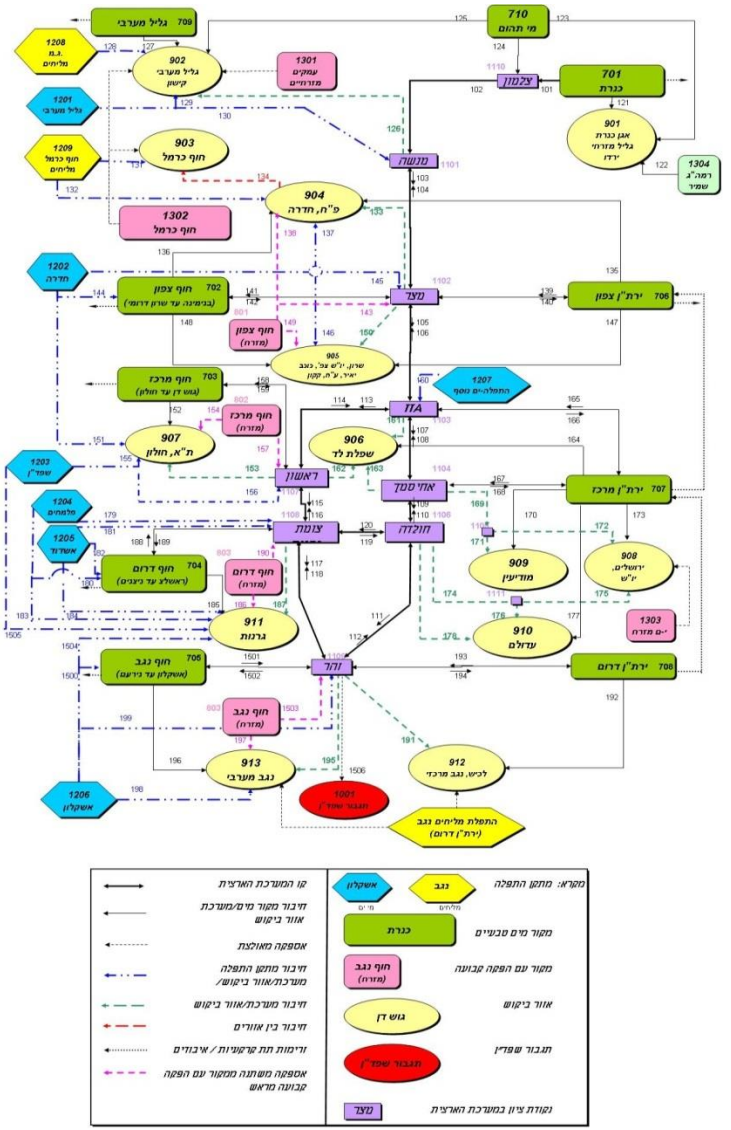
2012 Master Plan: Aggregate Model of the System



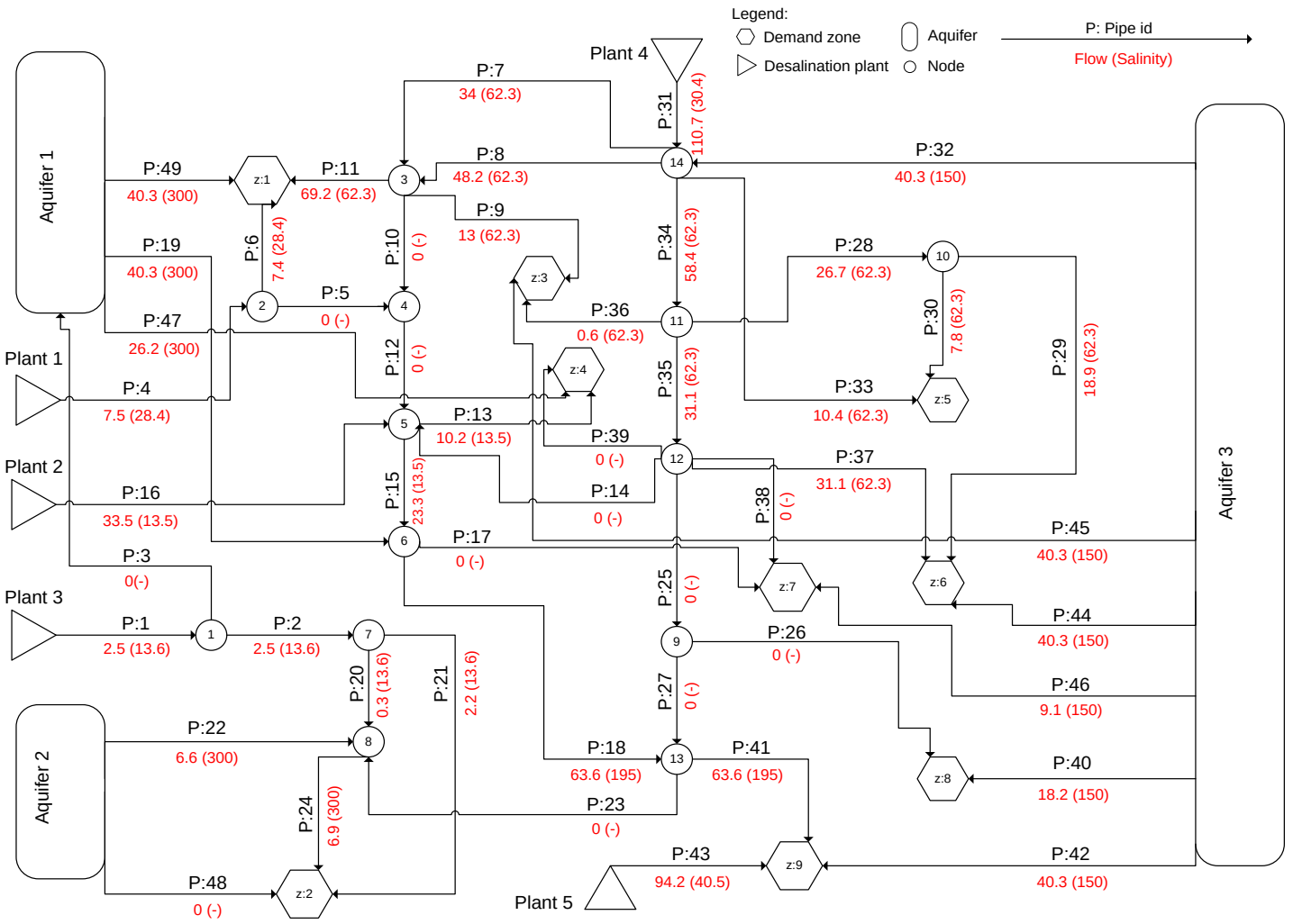
Three-Basin Model



Expanded Three-Basin Model



Central part of the INWSS



3 aquifers, 5 desalination plants, 9 consumer zones, 14 network nodes

15+15+27 = 57 mcm have been added to the three existing plants → total = 287 mcm/yr
25% of the natural replenishment (287/1,200)

Hadera: 100+ mcm/y since end of 2009

We offered the Palestinians to locate a 50-100 mcm plant at Hadera for the WB

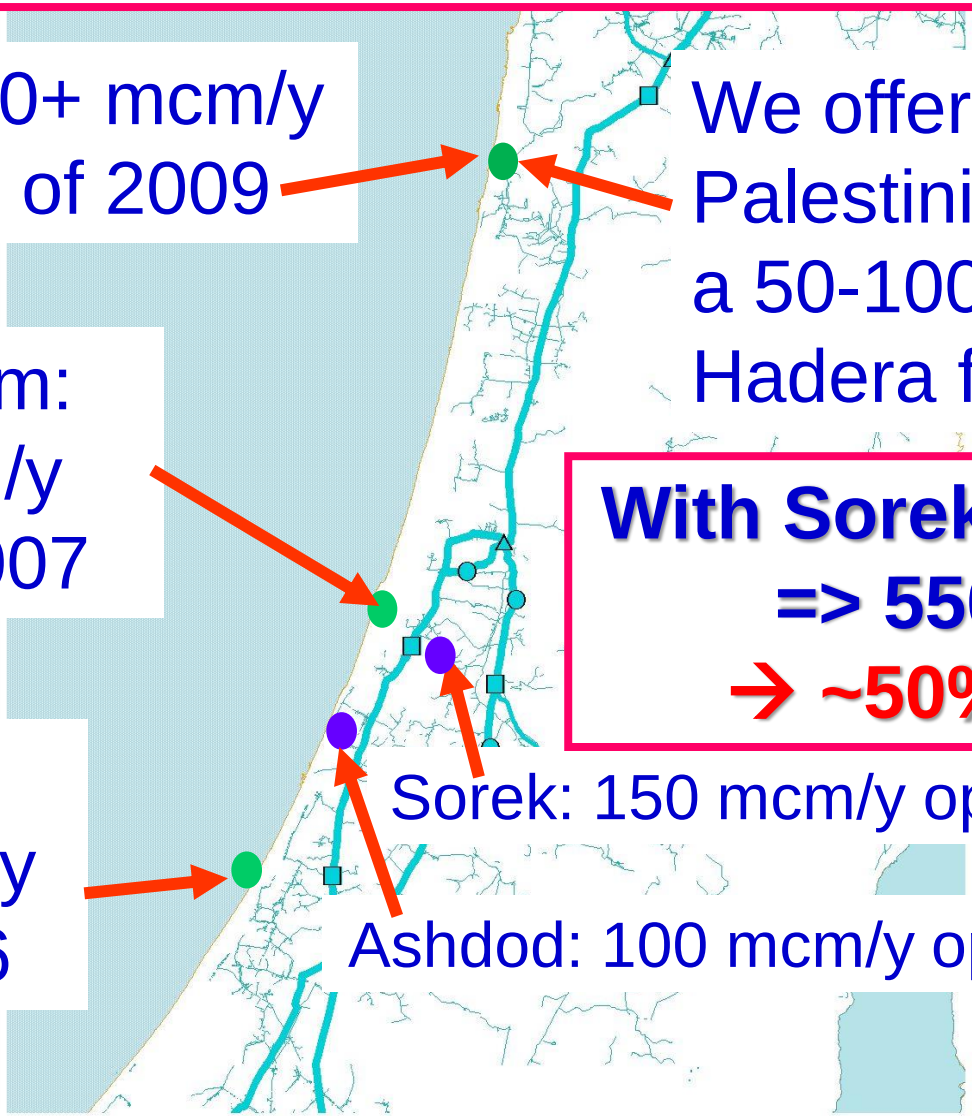
Palmachim: 30+ mcm/y since 6/2007

With Sorek and Ashdod => 550 mcm/y → ~50% of 1,200

Ashkelon: 100+ mcm/y since 2006

Sorek: 150 mcm/y operational in 2013

Ashdod: 100 mcm/y operational in 2013



Hadera Desalination Plant: 100→127 mcm/year
Operating since October 2009

Challenges → Responses

- Desalination of seawater (now ~300 mcm/yr in three large plants):
  - 550-600 mcm/year by 2013
  - 750 mcm/year by 2020 – decided, subject to continuous re-evaluation so as not to over-develop
- Desalination of saline groundwater:
  - → 50 mcm/year
- Sewage reclamation and reuse:
  - Expand: 300 →500 mcm/year

Israel's main failures

- Overuse of the natural sources
- Quality deterioration of the sources
- Delayed decisions on large scale desalination
- Late attention to urban water conservation
- Governance of national infrastructures: lack of coordination, slow statutory and budget processes

Israel's main accomplishments

- Integrated national water policy and central control, towards regulation
- Highly integrated water supply system
- Efficient water use in agriculture
- Urban demand management
- Reuse of sewage effluents
- Large scale sea-water desalination + desalination of brackish GW

A New Master Plan

Approved by the IWA Board:
V3 on 4.7.2011 & V4 on 9.8.2012

Being prepared for Consideration by the Government

Long-Term Master Plan for the National Water Sector
Part A - Policy Document
Version 4
August 2012

New Water Master Plan

- ~20 domains of policy, e.g., water and agriculture, water for nature, protecting natural sources, pricing, regulation
- ~ 5-25 components in each
- Several alternatives policies for each component, spanning a wide yet possible range
- A set of criteria and indices for evaluation
- Evaluation, synthesis, recommendations
- Consequences: budget, major actions, constraints, measures to overcome them
- Example: desalination = function (Reliability)

The National Balance – Basic Scenario

Population			Water Sources (mcm/year)							
Year	National pop. (m.)	Per capita consumption (cu.m. per capita)	Year	Natural freshwater (1)	Saline (direct consumption)	Treated wastewater (inc. Dan STP)	Desalination of saline waters	Desalination of sea water (2)	Required supplement (3)	Total supply
2010	7.6	100	2010	1,200	174	450	23	280	4	2,131
2020	9.1	99	2020	1,140	150	573	50	750	9	2,672
2030	10.9	98	2030	1,080	140	685	60	750	50	2,765
2050	15.6	95	2050	1,020	130	930	70	750	671	3,571

In 2008, an additional 46 mcm of floodwater was used that was not taken into account.

(1) Total average replenishment of natural freshwater, less losses for water with less than 400 mg. of chloride per liter.

(2) "Desalination of sea water" – according to the approved government decisions.

(3) "Required supplement" = the difference between total consumption of freshwater (bottom table) and total sources of freshwater.

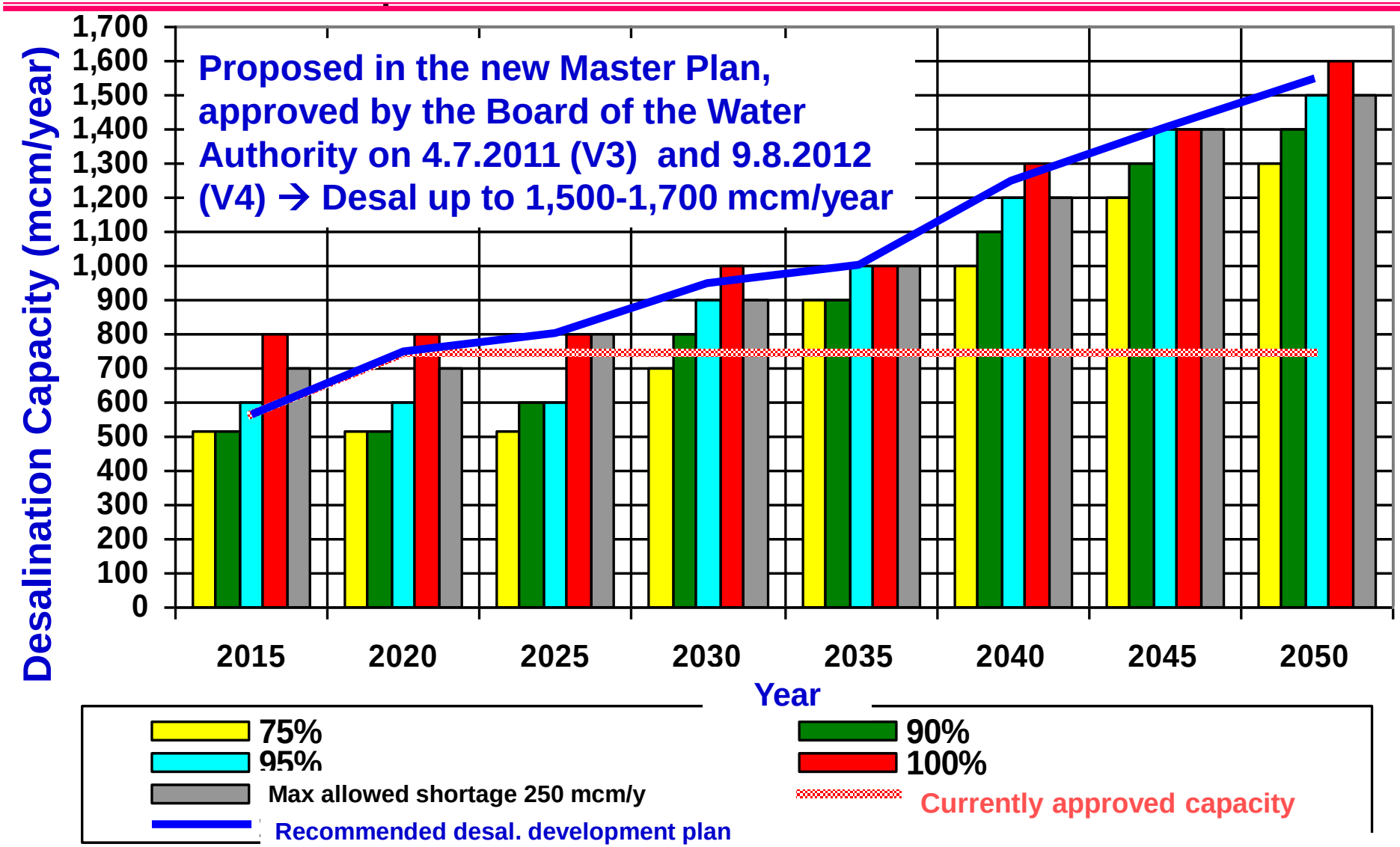
Year	Urban	Water Consumption (mcm/year)												
		Industry			Agriculture				Regional (1)	Reservoir storage recovry	Nature and landscape(2)		Unforeseeables	Total consumption
		Fresh-water	Saline	Total	Fresh-water (3)	Saline	Treated wastewater (+Dan STP)	Total						
2010	764	90	30	120	500	144	400	1,044	143	0	10	60	0	2,131
2020	902	95	30	124	490	120	528	1,138	143	200	50	95	70	2,672
2030	1,064	99	30	129	470	110	645	1,225	143	0	50	90	114	2,765
2050	1,482	108	30	138	450	100	900	1,450	143	0	50	80	278	3,571

(1) Regional consumption includes supply to the PA and Jordan.

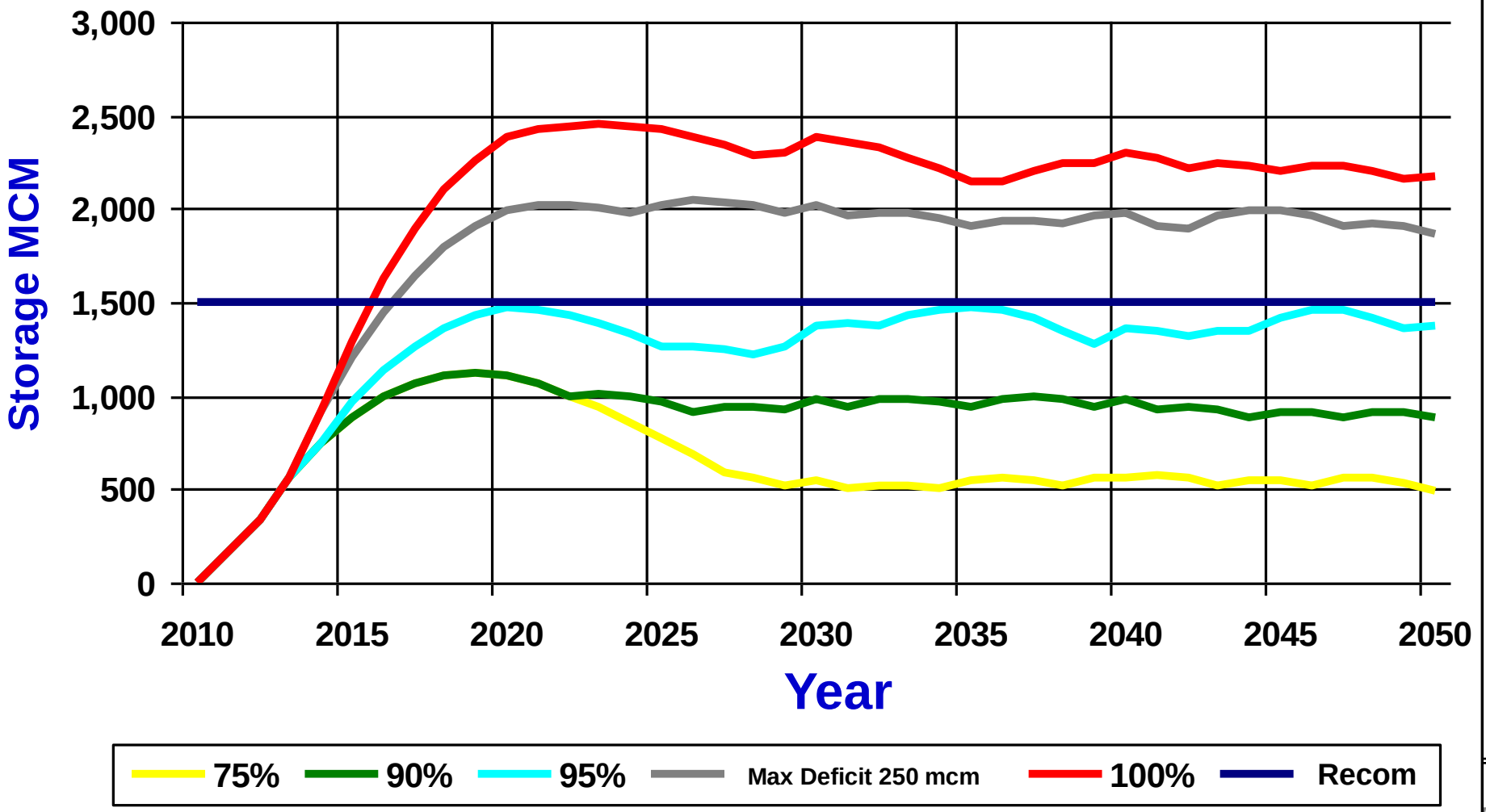
(2) Some of the treated wastewater used for nature and landscape is treated wastewater that is not actually used, and flows in ri verbeds.

(3) The decline in consumption of freshwater for agriculture is contingent on conversion to high quality treated wastewater, and a change in definitions of well protection radii.

Desalination Capacity Development, as function of Required Reliability



Expected value of storage above "Red Lines", as a function of Reliability With the Recommended Desalination Capacity Development Plan



What else?

- Management of the Kinneret and its watershed for ecological health, water supply, fisheries, recreation and tourism
- Protection and sustainable management of GW
- Grey water recycling
- Effluents advanced treatment → potable water quality
- Stormwater/Runoff management and Water Sensitive planning (WSP, LID) for increased benefits (recharge, use, landscaping, …) and reduced costs (flooding, erosion)
- The effects of climate change: serious, but less dramatic than the increasing population

Take Home Message

- Israel can meet the water needs of the increasing population to 2050 and beyond, at a reasonable cost [which I have not discussed explicitly].
- Many places in the world are facing mounting water challenges, so Israel's experience is relevant as an indication of what does and will happen, what can and should be done and what should be avoided, and what some of the responses and solutions might be.
- These solutions have to be adapted and adjusted in each country to the local physical, social, economic and political conditions.

Credits and Thanks

- Miki Zaide, Mo Provisor, Yosi Dreizin – Core Group of the Master Plan of the Israeli Water Authority (IWA)
- Directors of the IWA Uri Shani and Alex Kushnir, the Board of the IWA and the Minister of Energy and Water Uzi Landau
- Data from: IWA Planning Division, Hydrologic Service, Division of Regulation, Desalination Division

Thanks to Ramon Llamas, the Botin Foundation, and the Audience

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