COLLEGE OF AGRICULTURE & LIFE SCIENCES
COOPERATIVE EXTENSION

WATER RESOURCES RESEARCH CENTER

Desalination in Israel

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MSSC 2018 Annual Salinity Summit
February 8, 2018

wrrc.arizona.edu

GREATER DEPTH, BROADER PERSPECTIVE FOR A CLEAR WATER FUTURE

We tackle key water policy and management issues, empower informed decision-making, and enrich understanding through engagement, education, and applied research.

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2006

Public Policy Review

by Sharon Megdal

Visit Shows Israel Faces Similar Water Management Issues as Arizona

I traveled to Israel this summer to present a paper at a conference and to meet with researchers and other water professionals to learn about Israeli water management and policy. My perception was that, while quite a bit of Arizona-Israeli collaboration on technical water issues seemed to have occurred, less had taken place in the social science and policy arenas. I hoped to build upon recent col-

nation. I explained that desalination along coastal California has the potential to enable landlocked Arizona to gain more Colorado River water. Israel, like the United States, has long considered seawater desalination. Repeated droughts there have prompted a program to construct several plants over a five-year period to eventually deliver 315 million cubic meters of freshwater. With construction having begun in 2003, the plant in Ashkelon was built through a public-private partnership as a build-operate

in 2005, the plant produc

2009

ARIZONA WATER RESOURCE

Volume 17, Number 4 *Fall 2009*

Arizona, Middle East Water Issues Focus of WRRC Workshop

Arizona, Israel, Palestinian Territories Share Common Concerns

AZIP Arizona-Israeli-Palestinian Water Management & Policy Workshop

The Arizona-Israeli-Palestinian Water Management and Policy Workshop (AzIP for short), a Water Resources Research Center project that was two and a half years in the planning, focused on critical water issues of the three arid and semi-arid

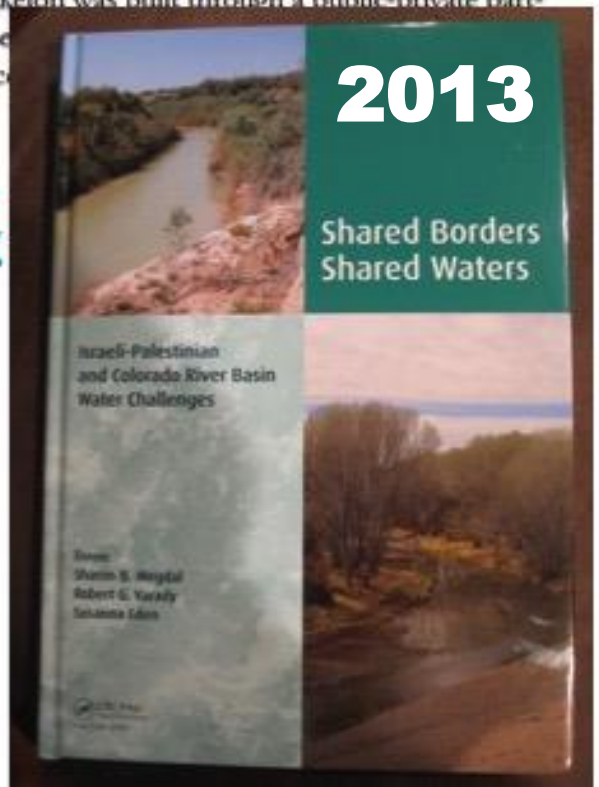
Complicating their task are the formidable political issues that trouble the waters, and much else in the Middle East. Arizona water affairs, too, are marked by the need to consider and negotiate the claims of sovereign entities, specifically neighboring Mexico and Indian nations. Arizona fortunately does not have to contend with the worrisome, highly-charged political climate prevailing in the Middle East.

It is hoped that the workshop will pay a long-term benefit by promoting peace. By working together to identify research needs and developing an international, collaborative research program, workshop

Special Workshop Edition of Newsletter

This issue of the *Arizona Water Resource* newsletter provides information about the Arizona, Israeli, and Palestinian Water Management and Policy Workshop. (See page 8 for workshop agenda.) Additional information about the workshop is available at the WRRC web site.

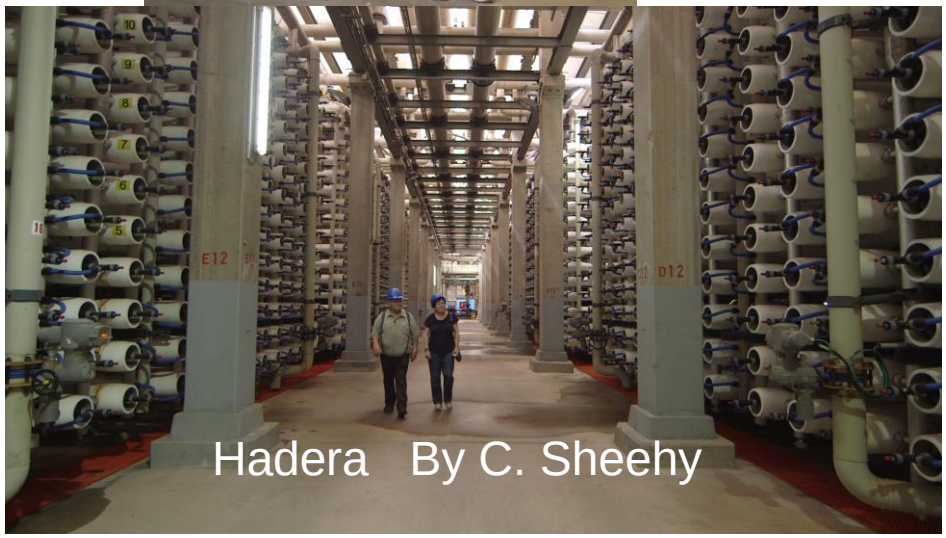
2013



2015

BeyondtheMirage.org
Filming done October 2015


Sorek


Hadera By C. Sheehy


Palmachim

2016


Sorek Desalination Plant, November 20, 2016

Public Policy Review

Bridging Through Water

by Sharon B. Megdal

November 20, our day in Israel, included visiting the Yad Hanna Wastewater Treatment Plant, which is located just on the Israel side of the Green Line and wall separating the West Bank and Israel. Treating the wastewater from the West Bank

2017

Public Policy Review

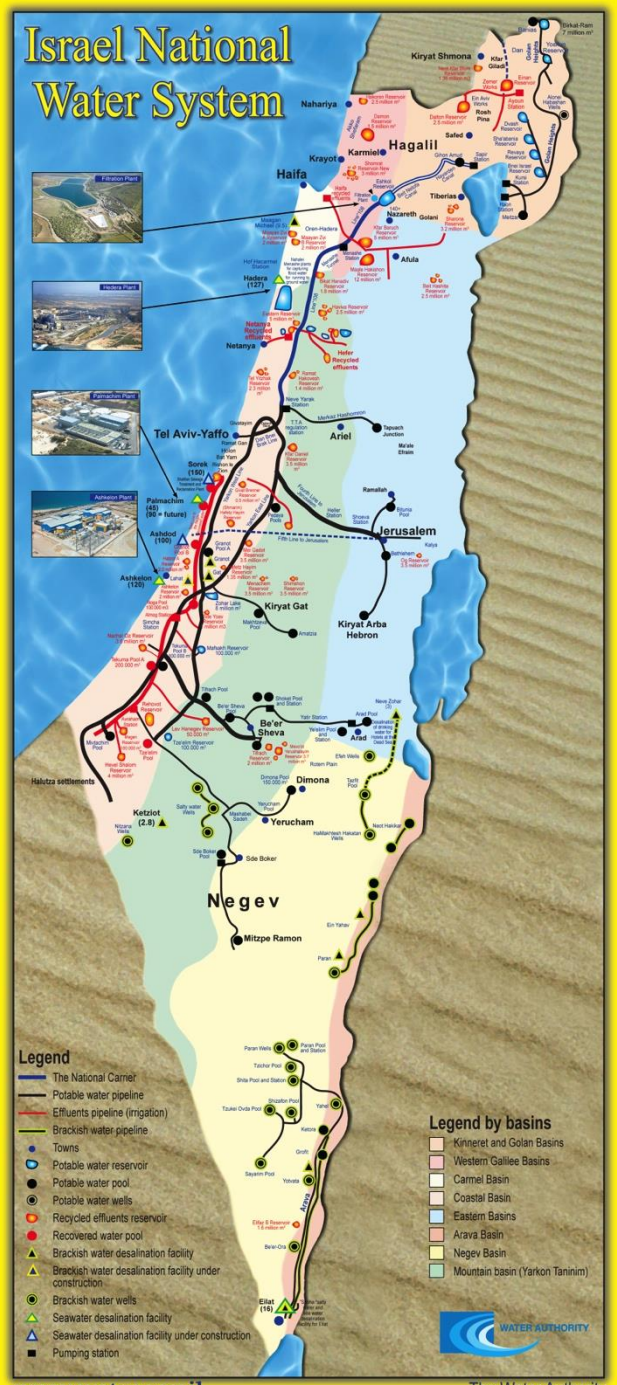
Photos, clockwise from top left: View of reception area for Cutting-Edge Solutions to Wicked Water Problems conference; Conference co-chairs Dror Avisar and Sharon B. Megdal; Sorek Desalination Plant field trip participants; Panel at Sept. 12 WATEC conference; Central Arizona Project Board members Jennifer Brown and Mark Taylor with Sharon B. Megdal.

Photographers: Gefen Ronen Eliraz, Jennifer Brown, and Michelle Baruch

Comparing Experiences and Lessons Learned: The September 2017 International Conference on Cutting-Edge Solutions to Wicked Water Problems

climate, the imbalance between growing demands for water relative to supplies, and transboundary water and wastewater challenges, including pollution. Different regions face different problems, but the pathways to solutions often have common or similar elements. Israel is well known for its leadership in deployment of desalination technology, drip irrigation, and water reclamation, which has enabled it to address the scarcity of natural freshwater resources.


Beirut
بيروت
Damascus
دمشق
Tyre
صور
Al-Qisa
قيسيا
M5
110
Haifa
10
25
Tel Aviv-Yafo
Amman
عمان
10
5
30
Jerusalem
40
15
65
Be'er Sheva
Jordan
Israel
5
65
5
16
Eilat
5
مخمية الطيبي


Israel National Water System
Kiryat Shmona
Nahariya
Hagalil
Karmiel
Krayot
Haifa
Tiberias
Nazareth
Golani
Afula
Hadera (127)
Netanya
Tel Aviv-Yaffo
Ariel
Palmachim (65) (90 = future)
Ashdod (100)
Ashkelon (120)
Jerusalem
Kiryat Gat
Kiryat Arba Hebron
Be'er Sheva
Dimona
Yeruchem
Ketziot (2.8)
Sde Boker
Negev
Mitzpe Ramon
Eilat (16)
Legend
The National Carrier
Potable water pipeline
Effluents pipeline (irrigation)
Brackish water pipeline
Towns
Potable water reservoir
Potable water pool
Potable water wells
Recycled effluents reservoir
Recovered water pool
Brackish water desalination facility
Brackish water desalination facility under construction
Brackish water wells
Seawater desalination facility
Seawater desalination facility under construction
Pumping station
Legend by basins
Kinneret and Golan Basins
Western Galilee Basins
Carmel Basin
Coastal Basin
Eastern Basins
Arava Basin
Negev Basin
Mountain basin (Yarkon Taninim)
WATER AUTHORITY
www.water.gov.il
The Water Authority

Centralized authorities

- Israel Water Authority (changed to Authority from Commission in 2006)
  - Has significant powers for planning, water allocations, and rates
- High degree of reuse of water, mostly by agriculture
- Has deployed desalination technology, both seawater and brackish water
- Has been a leader in public-private partnerships
- Strong national identity with water
- Has addressed scarcity while preserving a vibrant agricultural sector

“Replumbing” the System

Main Policy Points and Recommendations
Administering the National Freshwater System

State of Israel
WATER AUTHORITY

- The national water system will be administered in a centralized and integrated manner.
- The Sea of Galilee will be designated primarily for use in northern Israel.
- Supply to the center of the country will be based on desalination plants, as a supplementary source to natural water sources.
- High supply reliability in the central, regional and local supply systems (aiming to establish: looped systems, a number of consumer connections from a range of water sources, storage, etc.)

Master Plan for the National Water Sector

Main Points of the Policy Paper

Israel has water and wastewater master plans

State of Israel

WATER AUTHORITY

Main Core Issues

1. Water balance, analysis under uncertainty (scenarios)
2. Management of the potable water system
3. Management of sewage and treated wastewater
4. Management of natural water sources
5. Water quality
6. Demand management
7. Urban water management
8. Water and agriculture
9. Management of drainage and runoff water
10. Water and energy
11. Environment and water for nature

5

August 2012 Israel Water Master Plan, p. 54

Table 1 – The National Water Balance – Basic Scenario

Population		
Year	National popn. (millions)	Per capita consumption (cu.m. per capita per year)
2010	7.6	100
2020	9.1	99
2030	10.9	98
2050	15.6	95

Water Sources (mcm/year)							
Year	Natural freshwater (1)	Brackish (direct consumption)	Treated wastewater (incl. Dan Region STP)	Desalination of brackish waters	Desalination of sea water (2)	Additional Required (3)	Total supply *
2010	1,200	174	450	23	280	4	2,131
2020	1,140	150	573	50	750	9	2,672
2030	1,080	140	685	60	750	50	2,765
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" – 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 *	Reservoir storage recovery	Nature and landscape**		Unforeseeable	Total consumption
		Fresh-water	Brackish	Total	Fresh-water ***	Brackish	Treated wastewater (incl. Dan Region STP)	Total			Fresh-water	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

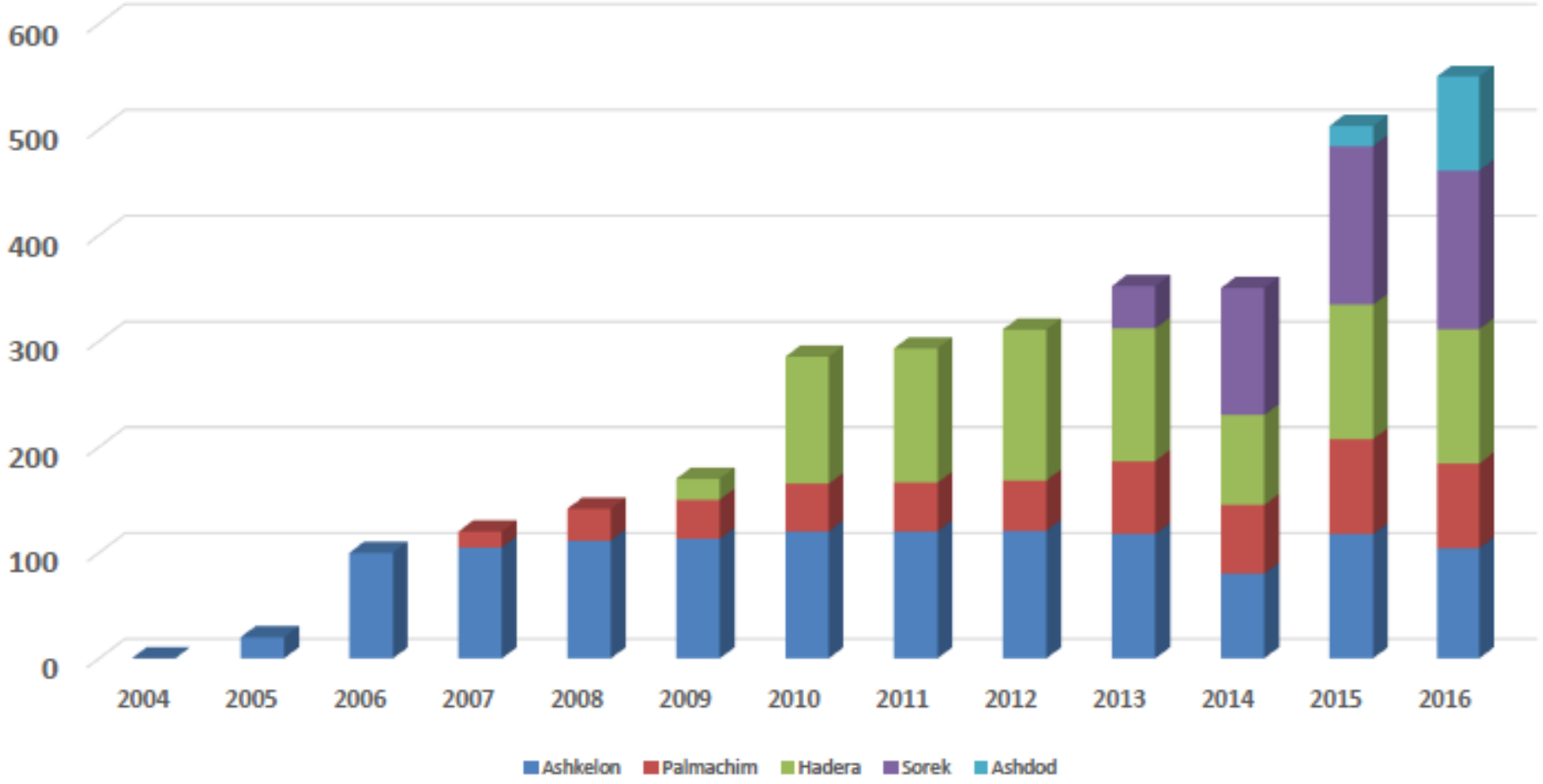
* Regional consumption includes supplies to the PA and Jordan.

** Some of the treated wastewater used for nature and landscape is treated wastewater that is not actually used, and flows in riverbeds.

*** 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.

WATER AUTHORITY
ISRAEL

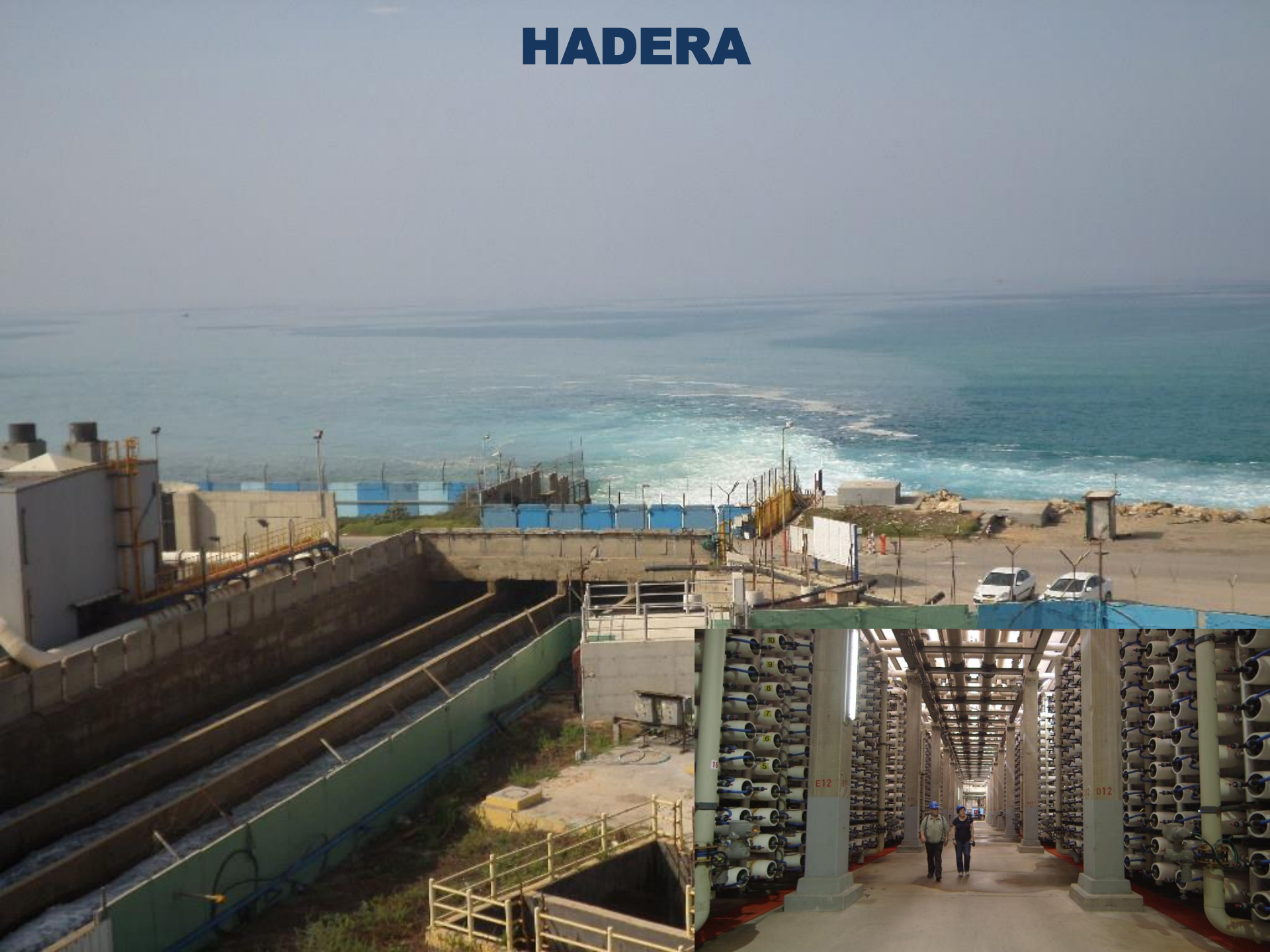
SWRO Facilities - Annual Production

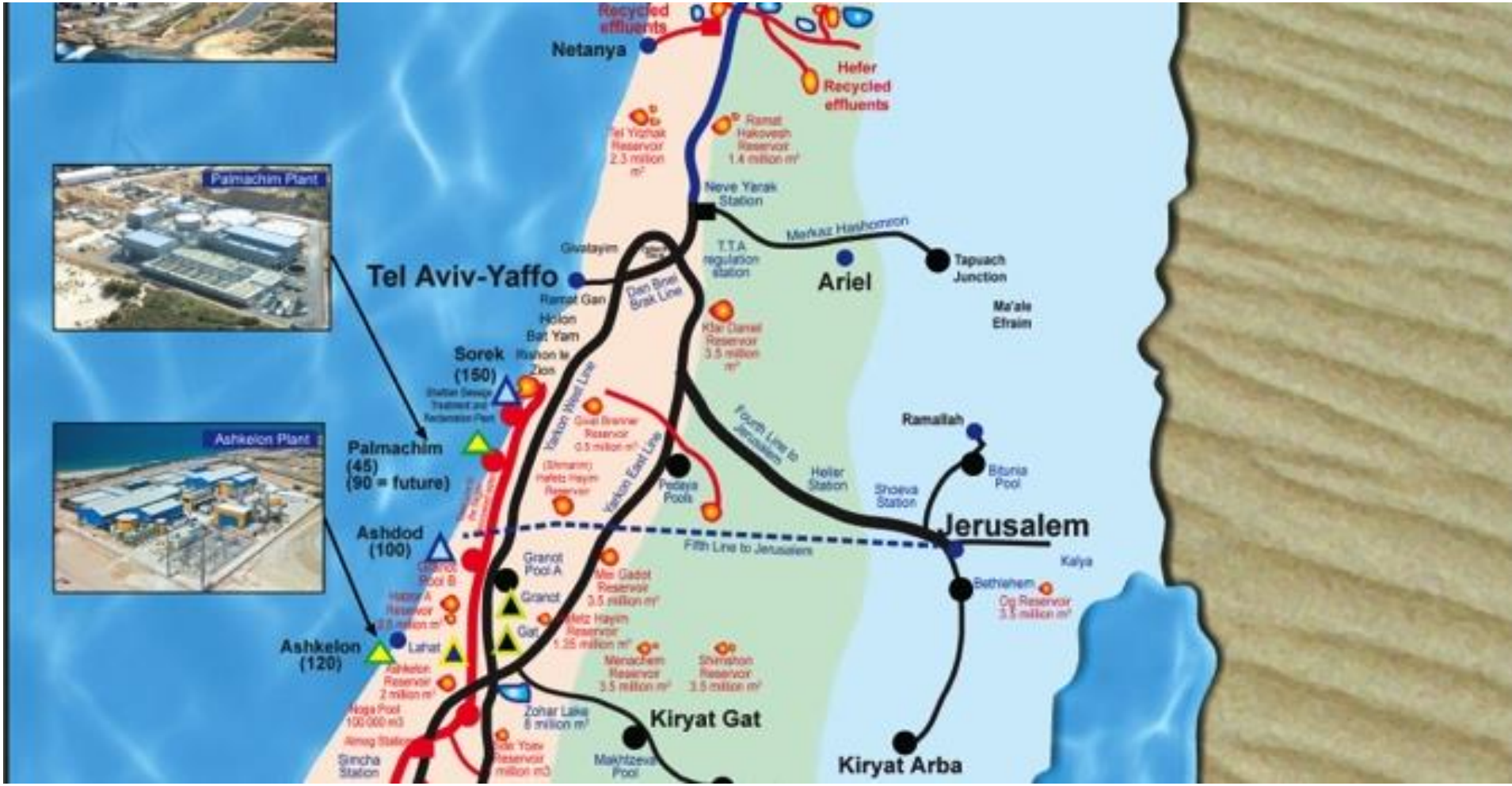


* 2016 – Projected data


Israel National Water System
Filtration Plant
Hedera Plant
Kiryat Shmona
Kfar Giladi
Banias
Birkat-Ram 7 million m³
Dan
Golan Heights
Zemer Works
Einan Reservoir
Ayoun Station
Alonei Habashan Wells
Nahariya
Hakeren Reservoir 2.5 million m³
Ein Aviv Works
Rosh Pina
Dalton Reservoir 2.5 million m³
Akko Shefaram
Damon Reservoir 1.5 million m³
Dvash Reservoir
Safed
Sha'abania Reservoir
Hagalil
Karmiel
Krayot
Revaya Reservoir
Bnei Israel Reservoir
Kursi Station
Sapir Station
Haifa
Shomrat Reservoir-New 3 million m³
Eshkol Reservoir
Haifa recycled effluents
Filtration Plant
Beit Netofa Canal
Hayarden Canal
Tiberias
Haon Station
Meitzar
Line 108
Nazareth
Golani
Sharona Reservoir 3.2 million m³
Maagan Michael (9.5)
Oren-Hadera
Kfar Baruch Reservoir 5 million m³
Maayan Zvi B Reservoir 2 million m³
Menashe Station
Afula
Hof Hacarmel Station
Menashe Tunnel
Maale Hakishon Reservoir 12 million m³
Hadera (127)
Bikat Hanadiv Reservoir 1.8 million m³
Beit Hashita Reservoir 2.5 million m³
Haviva Reservoir 2.5 million m³
Eastern Reservoir 5 million m³
Netanya Recycled effluents
Netanya
Hefer Recycled

HADERA




Palmachim Plant
Ashkelon Plant
Recycled effluents
Netanya
Hefer Recycled effluents
Tel Yitzhak Reservoir 2.3 million m³
Ramat Hakovesh Reservoir 1.4 million m³
Neve Yarak Station
Merkaz Hashomron
T.T.A regulation station
Ariel
Tapuach Junction
Ma'ale Efraim
Tel Aviv-Yaffo
Givatayim
Ramat Gan
Holon
Bat Yam
Rishon le Zion
Dan Shafdan Sorek Line
Kfar Daniel Reservoir 3.5 million m³
Sorek (150)
Shafdan Sewage Treatment and Reclamation Plant
Yarkon West Line
Givat Brenner Reservoir 0.5 million m³
Yarkon East Line
Fourth Line to Jerusalem
Ramallah
Palmachim (45) (90 = future)
(Shmarim) Hafetz Hayim Reservoir
Pedaya Pools
Heller Station
Shoeva Station
Bituna Pool
Ashdod (100)
Fifth Line to Jerusalem
Jerusalem
Kalya
Granot Pool A
Granot
Gat
Metz Hayim Reservoir 1.25 million m³
Mei Gadot Reservoir 3.5 million m³
Bethlehem
Og Reservoir 3.5 million m³
Ashkelon (120)
Lahat
Ashkelon Reservoir 2 million m³
Menachem Reservoir 3.5 million m³
Shimshon Reservoir 3.5 million m³
Zohar Lake 8 million m³
Kiryat Gat
Kiryat Arba
Simcha Station
Makhtzevet Pool

SOREK

http://www.water-technology.net/projects/sorek-desalination-plant/

PALMACHIM

By C. Sheehy

ASHDOD

http://www.battus.co/portfolio-item/ashdod-desalination-plant/

Ashdod Desalina

The Ashdod desalination plant

GLOBES
ISRAEL'S BUSINESS ARENA

Ashdod desalination plant repair costs spiral

2 Aug, 2017 17:33 Sonia Gorodeisky and Amiram Barkat

The state wants the faults corrected urgently, due to concern about a severe water crisis resulting from four straight drought years.

ASHKELON

Ashkelon Desalination Plant

An award-winning, milestone plant for the desalination industry

When completed, The Ashkelon reverse osmosis desalination plant was by far the world's largest and most advanced desalination plant. With a huge capacity of up to 330,000 m3/day and with extremely high efficiency levels, the Ashkelon desalination plant achieved one of the world's lowest ever prices for desalinated water. In 2010, due to the unmatched success of the plant, it was expanded by nearly 20% to 392,000 m3/day, providing clean water for more than a million people.

Overview

Capacity: 396,000 m^3/day

Technology: Reverse Osmosis (RO)

Project Type: Build-Operate-Transfer (BOT)

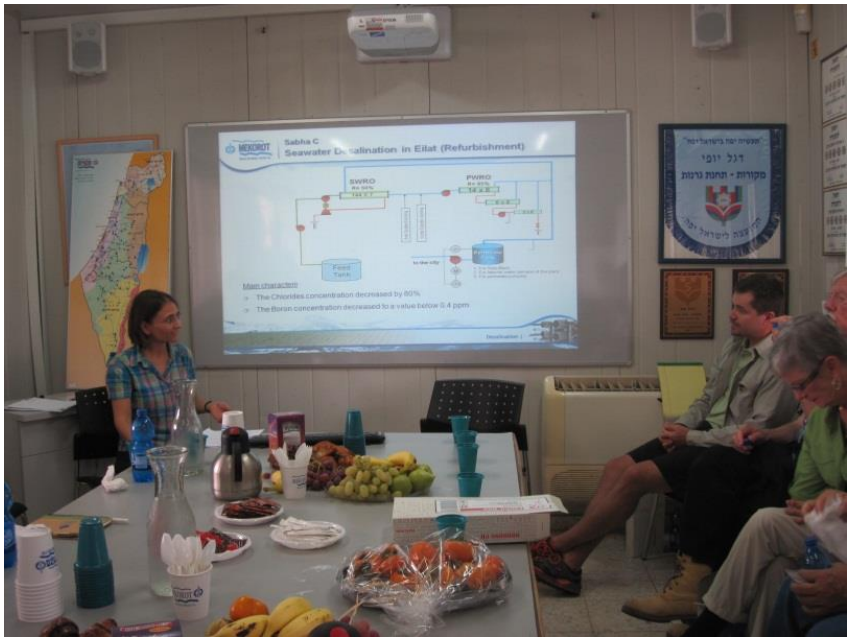
Location: Ashkelon, Israel

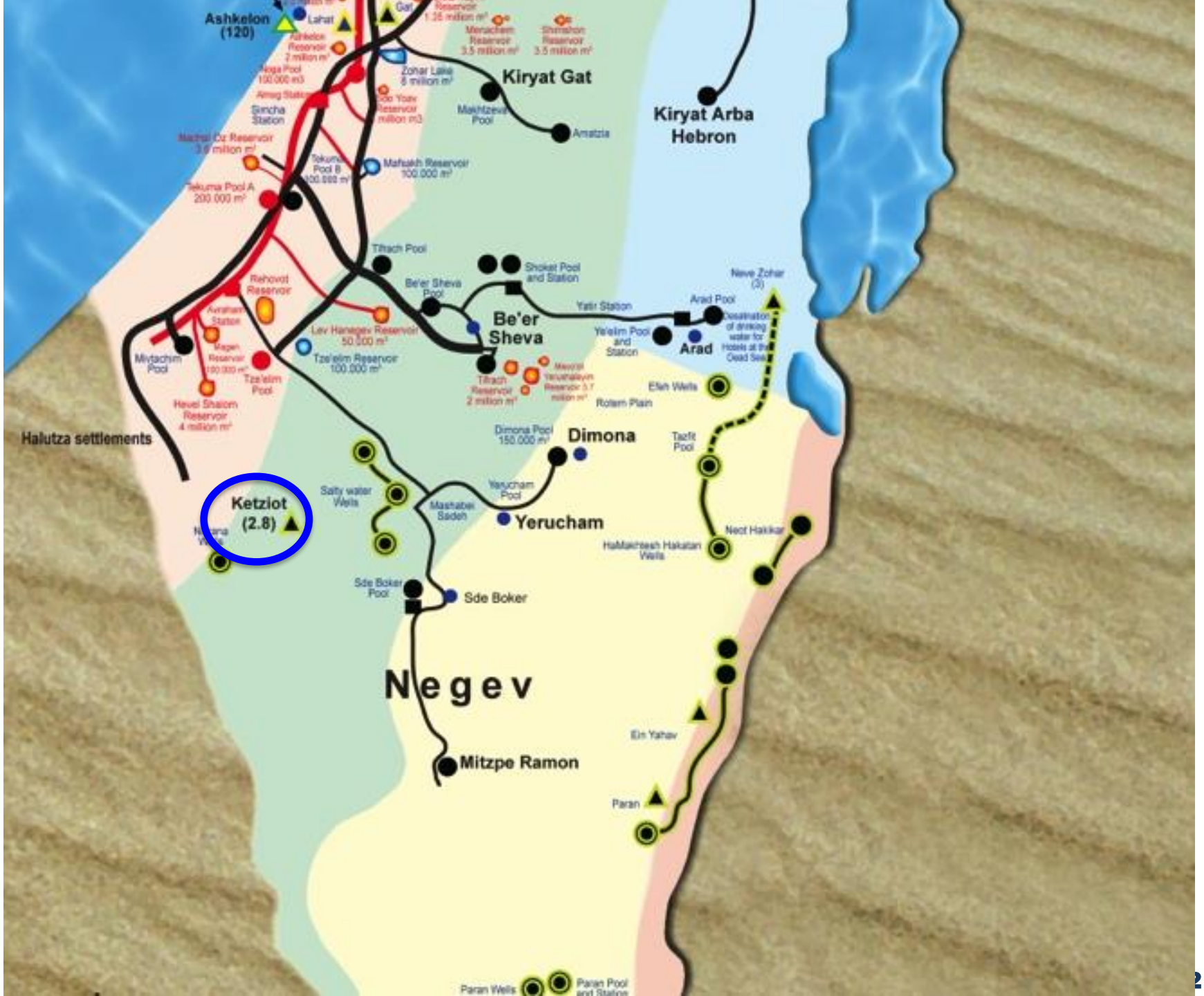
Footprint: 70,000 m2 (350m x 200m)

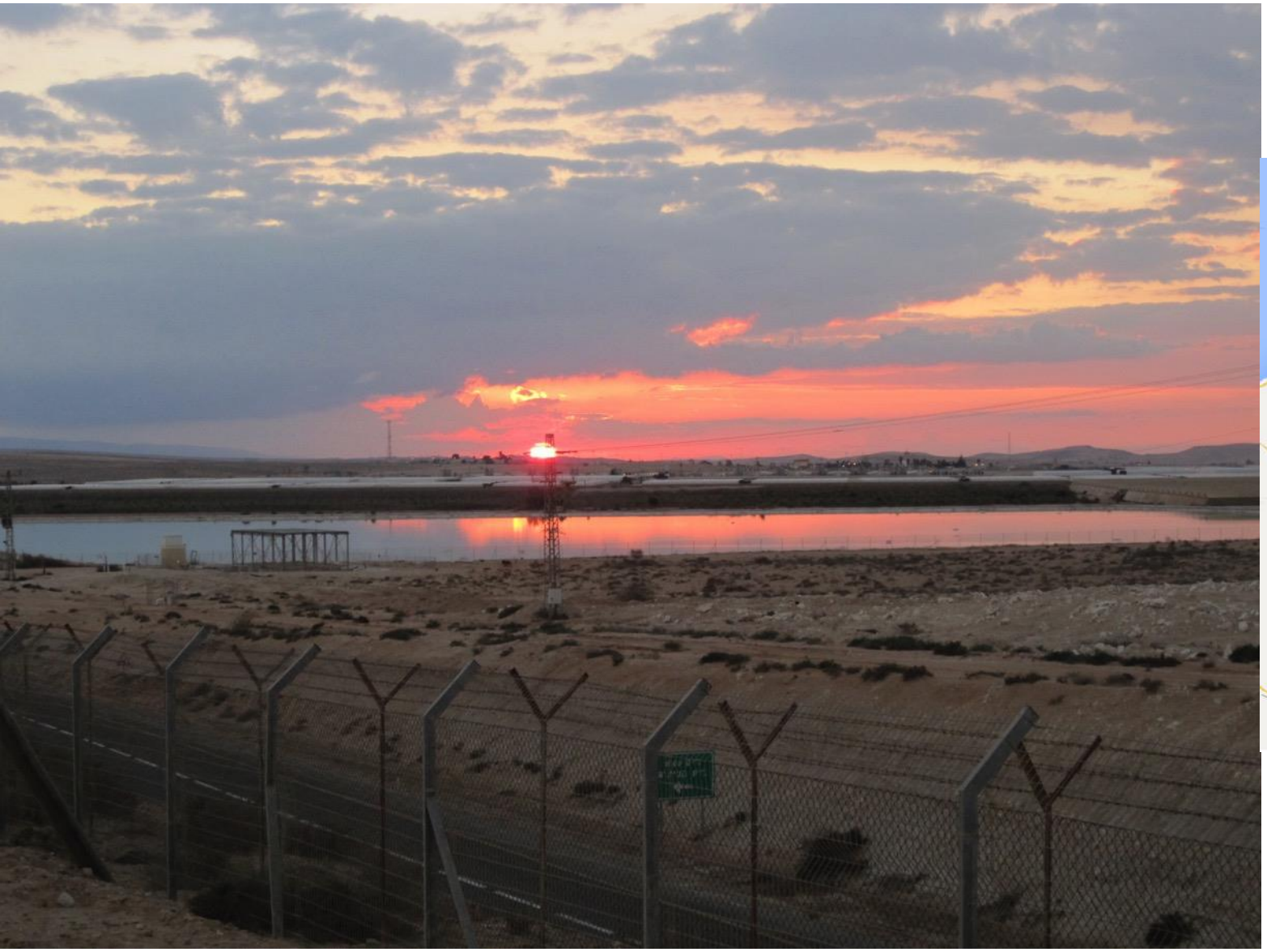
Commission Date: 2005

Brackish Water Desal – Granot Brine goes to the Mediterranean

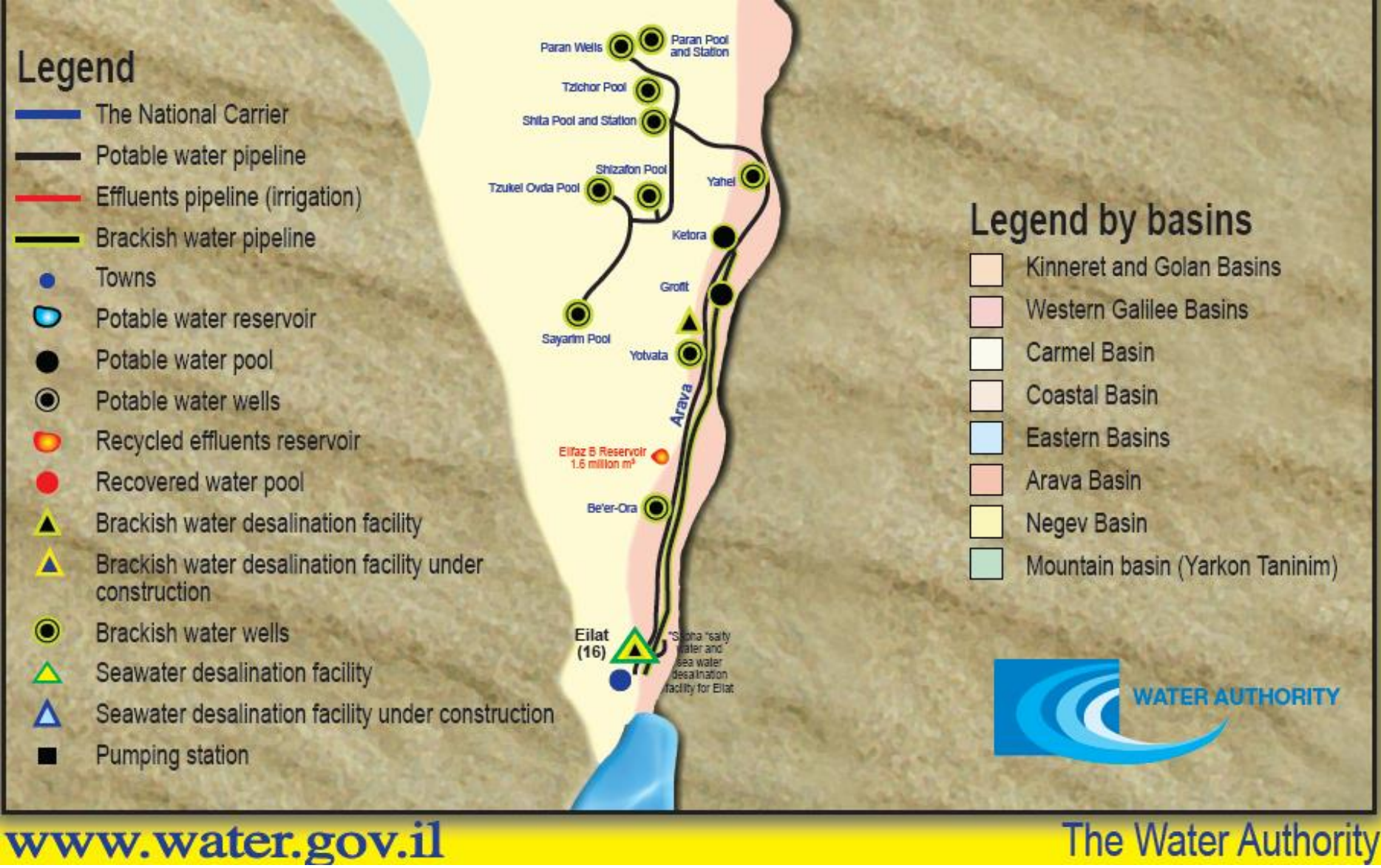
Granot Brackish Water Desal Plant




Ashkelon
(120)
Lahat
Gat
Menachem Reservoir
3.5 million m³
Shimshon Reservoir
3.5 million m³
Zohar Lake
6 million m³
Kiryat Gat
Makhtzeva Pool
Amatzia
Kiryat Arba
Hebron
Sincha Station
Mafsakh Reservoir
100,000 m³
Tekuma Pool A
200,000 m³
Tifrach Pool
Shoket Pool and Station
Be'er Sheva Pool
Be'er Sheva
Yatir Station
Arad Pool
Arad
Neve Zohar (3)
Rehovot Reservoir
Lev Haneqev Reservoir
50,000 m³
Tze'elim Reservoir
100,000 m³
Mivtachim Pool
Tze'elim Pool
Tifrach Reservoir
2 million m³
Ye'elim Pool and Station
Efeh Wells
Rotem Plain
Halutza settlements
Dimona Pool
150,000 m³
Dimona
Tazfit Pool
Ketziot
(2.8)
Salty water Wells
Mashabei Sadeh
Yerucham Pool
Yerucham
Neot Hakikar
HaMakhtesh Hakatan Wells
Sde Boker Pool
Sde Boker
Negev
Ein Yahav
Mitzpe Ramon
Paran
Paran Wells
Paran Pool and Station



Brine Evaporation Ponds
Kzi'ot Brackish Water Desal Plant



Red Sea Desalination in Jordan and related water exchange


LEBANON
SYRIA
IRAQ
Mediterranean Sea
GOLAN HEIGHTS
(disputed; occupied by Israel)
WEST BANK*
GAZA STRIP*
Dead Sea
(-408 m)
JORDAN
ISRAEL
EGYPT
SAUDI ARABIA
Gulf of Aqaba
Sur
Qiryat Shemona
Nahariyya
Zefat
Acre
Qiryat Yam
Haifa
Tiberias
Nazareth
Umm el Fahm
Hadera
Ar Ramtha
Irbid
Janin
Tulkarm
Netanya
Nabulus
Al Mafraq
Jarash
Petah Tiqwa
Tel Aviv-Yafo
As Salt
Az Zarqa'
Ar Rusayfah
Rishon LeZiyyon
Ram Allah
Jericho
'Amman
Ashdod
Jerusalem
Ashqelon
Bethlehem
Ma'daba
Qiryat Gat
Gaza
Hebron
Ofaqim
Ah Zahiriyah
Khan Yunus
Rafah
'Arad
Al Karak
Beersheba
Al 'Arish
Dimona
At Tafilah
Ma'an
Eilat
Al 'Aqabah
34°
36°
38°
40°
32°
30°
* The Gaza Strip and the West Bank are disputed territories occupied by Israel. Some parts are autonomously governed by the Palestinian Authority. The final status of these territories has yet to be determined.
Jordan, Israel, Gaza Strip, West Bank
0 50 100 150 200
Kilometers
© World Sites Atlas (sitesatlas.com)

Red Sea-Dead Sea Project (RSDS Project)

- The Project aims at producing 65 MCM/year of Desalinated Water and discharging 235 MCM/year of Mixed Water to the Dead Sea.
- The 235 MCM/year discharge to the Dead Sea is a mix of Brine Water from the Desalination Plant with Red Sea Water.
- Of the 65 MCM/year of Desalinated Water produced, 30 MCM/year is to be supplied to the Jordanian Delivery Point and 35 MCM/year to the Border Delivery Point.

Source: Document provided by Oded Fixler, Israel Ministry of Regional Cooperation

- Plus exchange (sale) of other water to the north of Israel to Jordan; also water to be provided to the Palestinian Authority

Summary Points

- Obvious differences between the regions, particularly with respect to land availability, legal and regulatory framework, and politics
- Israel has overcome many obstacles and “problems”
  - Drought a key driver
- Role of the private sector in financing
- There are significant opportunities to “compare notes” when looking for solutions to water management challenges
- Addressing water issues across borders is of importance
- I have many contacts there, some of whom come to the US quite often
- Opportunities to travel there

Thank you!

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