CITIZENS' WATER ADVISORY COMMITTEE (CWAC)
Technical/Planning and Policy Subcommittee

Wednesday, January 27, 2016, 12:00 p.m.
Director's Conference Room
Tucson Water, 3rd Floor
310 W. Alameda Street, Tucson, Arizona

Legal Action Report

1. Roll Call/Call to Order
The meeting was called to order by Subcommittee Chair Mark Murphy, at 12:08 p.m. Those present and absent were:

Present:

Mark Murphy	Chairperson-Representative, Mayor
Mitch Basefsky	Representative, City Manager
Chuck Freitas	Representative, City Manager
Kelly Lee	Representative, Ward 6

Absent:

Brian Wong	Representative, City Manager
Placido dos Santos	Representative, City Manager

Tucson Water Staff Present:

Britt Klein	Water Administrator
Wally Wilson	Chief Hydrologist
Fernando Molina	Water Program Superintendent
Johanna Hernandez	Staff Assistant

Others Present:

Marc Campbell	SRP
Bud Foster	KOLD
Brian Bennett	KOLD
Paul Durrant	KOLD

2. Announcements – No action taken.

3. Call to Audience – No action taken.

4. Review & Approval of October 28, 2015 Legal Action Report and Meeting Minutes – Member Freitas motioned to approve the Legal Action Report and Meeting Minutes of October 28, 2015. Member Basefsky seconded. Motion passed unanimously by a voice-vote of 4-0.

5. Approval of 2016 Meeting Schedule – The Subcommittee considered the 2016 meeting schedule and decided not to make any changes to the current meeting schedule. Brief discussion was held on items

6. Subsidence in Tucson and Avra Basins – Tucson Water staff Wally Wilson presented a PowerPoint on subsidence mapping in the Tucson and Avra Valley groundwater basins. The general goal is to stop subsidence, though occasionally reversing subsidence can be achieved. The USGS has been monitoring subsidence since 1987 using vertical compaction GPS surveys, and extensometer data, both of which are physical installments. In 1993, ADWR began using InSAR data to map subsidence, which is then validated by the USGS methods. InSAR is

essentially a serious of satellites that utilize side scan radar in passes around the Earth, where subsequent passes are compared to earlier passes. The InSAR data up to 2015 reflect the rate of change reflecting subsidence is diminishing drastically. A USGS report spanning 1987-2005 includes GPS survey data that reflects actual subsidence change is less than 5 inches. The same USGS report includes extensometer data reflect that increasing water tables are significantly mitigating subsidence in certain areas (Marana, SAVSARP) and even resulted in some rebound. Some areas in the center of the City are not seeing as much mitigation of subsidence and compaction can be seen up to 6 inches. Renewable water supplies have significantly mitigated subsidence in the Tucson and Avra Valley groundwater basins through strategic recharge and pumping. While Tucson Water will be increasing pumpage in Pima Mine Road, the water levels in the area are rising so quickly that pumpage will not cause subsidence.

7. **Arizona's Desalination Efforts –** Marc Campbell, with the Salt River Project (SRP), presented a PowerPoint presentation on Seawater Desalination in Arizona. SRP's desalination project is a joint project with DWR and CAP. Desalination is important because additional renewable water resources are necessary to support additional population growth and economic development. Ocean water comprises 97.5% of water, and makes up the largest source of renewable water. Desalination costs are decreasing over time from $9.50 per 1K gallons to just under $3 per 1K gallons of water. A large part of the costs are associated with litigation related to desalination. The Middle East leads in desalination capacity. The US is just behind in capacity with 1200 desalination plants, comprised mostly of small-scale brackish treatment plants. Thermal distillation and membrane methods of desalination were reviewed, and emerging technologies were discussed. The Carlsbad Desalination plant was reviewed for an example. Desalination plants have an estimated 50-60 year lifespan, with the opportunity to upgrade/retrofit to extend the life of plants; plants can expect 60-70% fresh water recovery. Desalination projects have to be regional to account for the cost. Arizona's best options are to partner with California or with Mexico. Taking into consideration the scale, the legal aspects, and funding, a partnership with Mexico may present the best opportunity. A study and scenario of a possible desalination project in Rocky Point was reviewed. Currently, discussions of that possible project are being held at the federal level. Some consideration for the area are brine disposal and effects to endangered species. If Arizona started today, it would still be 20 years before a large-scale plant is operational.

8. **Future Meetings/Agenda Items –** See projected agenda for further information.

9. **Adjournment –** Meeting adjourned at 1:16 p.m.

Subsidence in Tucson and Avra Valley Basins

Technical, Planning, and Policy Subcommittee

January 27, 2016

Presented by: Wally Wilson

Subsidence mapping in the Tucson and Avra Valley Groundwater Basins

Interferometric Synthetic Aperture Radar (InSAR)

ADWR's Satellite Based Land Subsidence Monitoring Program

- Side looking radar imaging system
- Compares single pass over specific area with subsequent passes
- Can produce surface deformation with cm-scale vertical resolution

Vertical Compaction GPS and Extensometers

USGS Land Subsidence Monitoring Program

- Sub-cm GPS surveys compared between measurements
- Extensometer measurement on continuous basis

Land Subsidence Rate Maps:

The land subsidence rate maps show the rate of land subsidence per year (cm/yr). These maps are used to illustrate any changes in land subsidence rates over time. All the land subsidence rate maps utlize the same color scale.

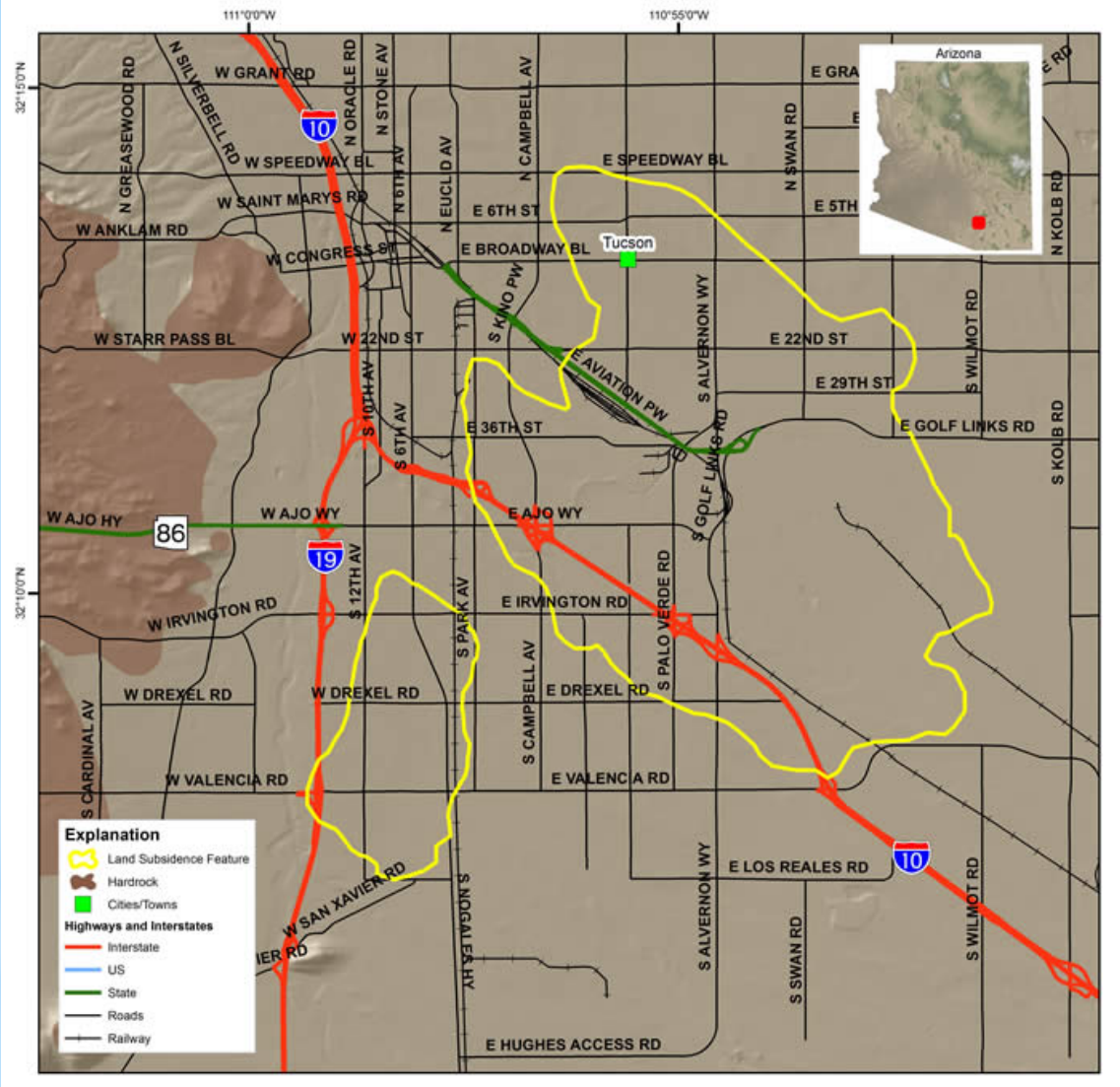
NOV-1993 to SEP-2000	FEB-2009 to JAN-2010	MAY-2012 to MAY-2014

Land Subsidence Maps:

The land subsidence maps show the total land subsidence (cm) over a specific period of time (1-year, 2-year, 4-year, etc). All the land subsidence maps utlize the same color scale.

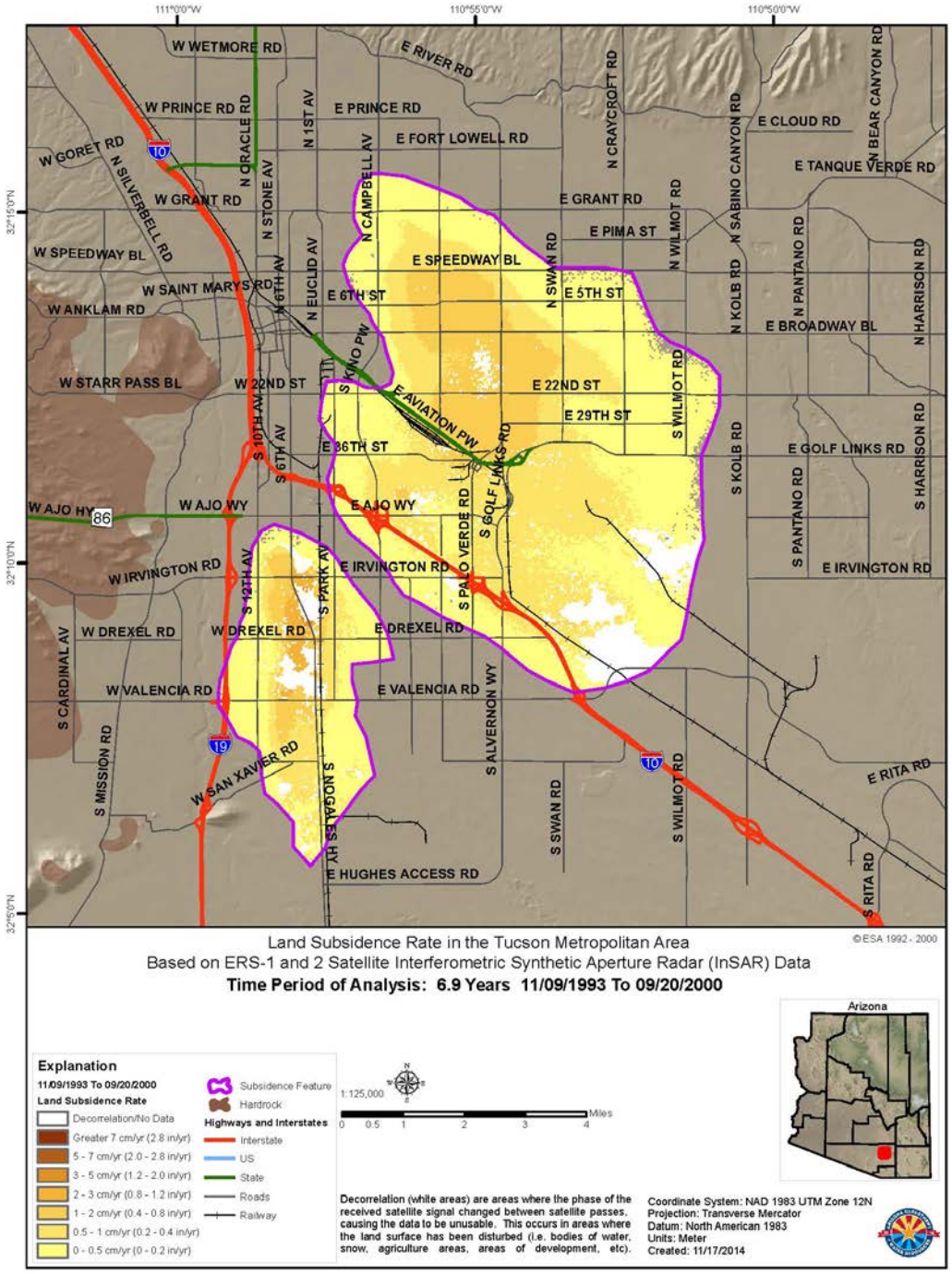
NOV-1993 to SEP-2000	FEB-2007 to MAR-2008	FEB-2008 to JAN-2010
FEB-2003 to JAN-2010	FEB-2007 to FEB-2009	FEB-2009 to JAN-2010
APR-2006 to APR-2008	FEB-2008 to FEB-2009	MAR-2008 to MAR-2011
MAY-2010 to APR-2012	APR-2011 to MAY-2012	APR-2011 to MAY-2013
MAY-2010 to APR-2013	MAY-2010 to MAY-2014	MAY-2012 to MAY-2014
APR-2013 to APR-2015	MAY-2010 to APR-2015	

http://www.azwater.gov/AzDWR/Hydrology/Geophysics/TucsonSubsidence.htm



InSAR Data

Extent of Imaged Features

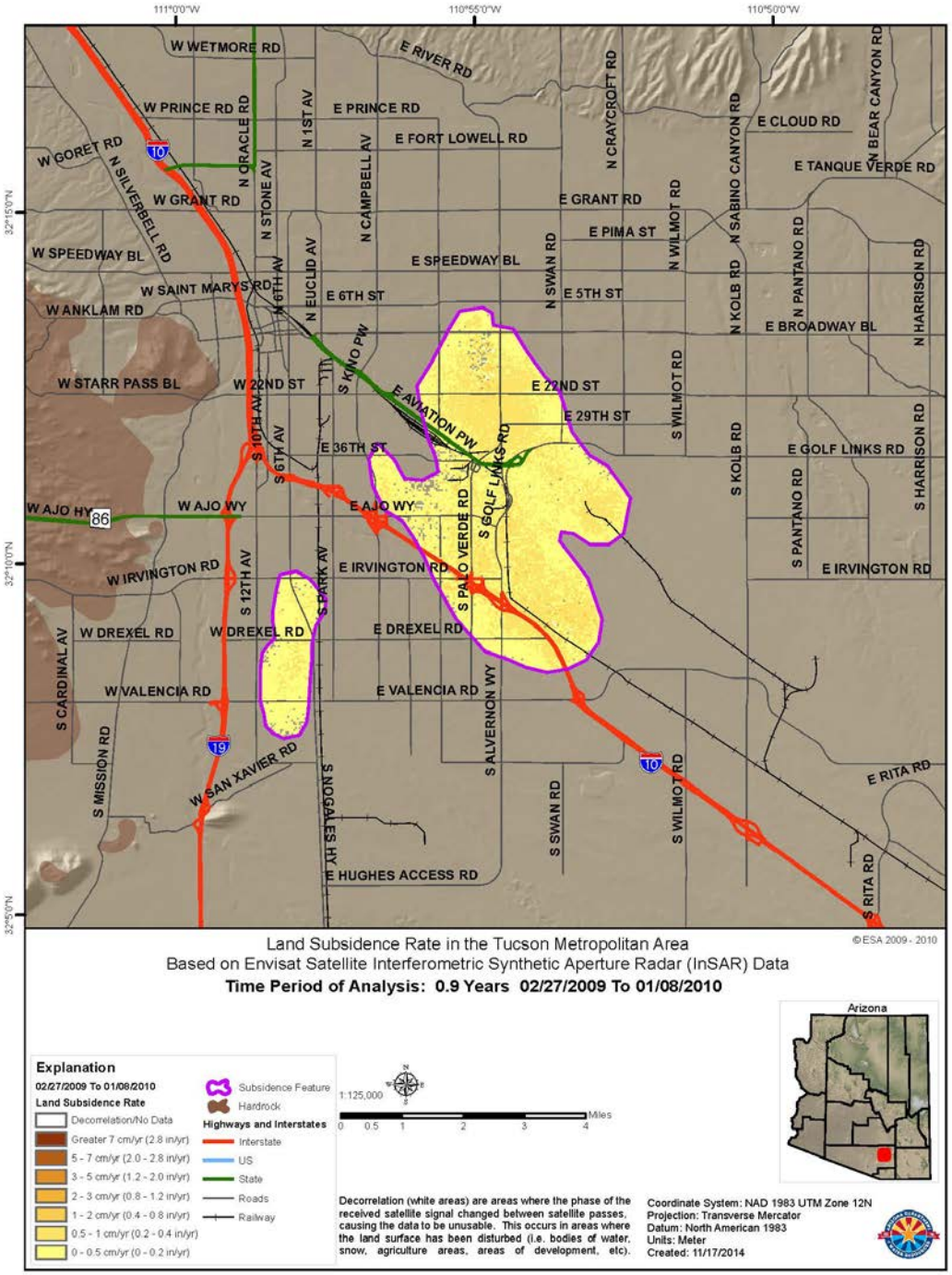


InSAR Data

1993 to 2000

6.9 year period

Maximum Rate: 0.8 to 1.6 in/yr

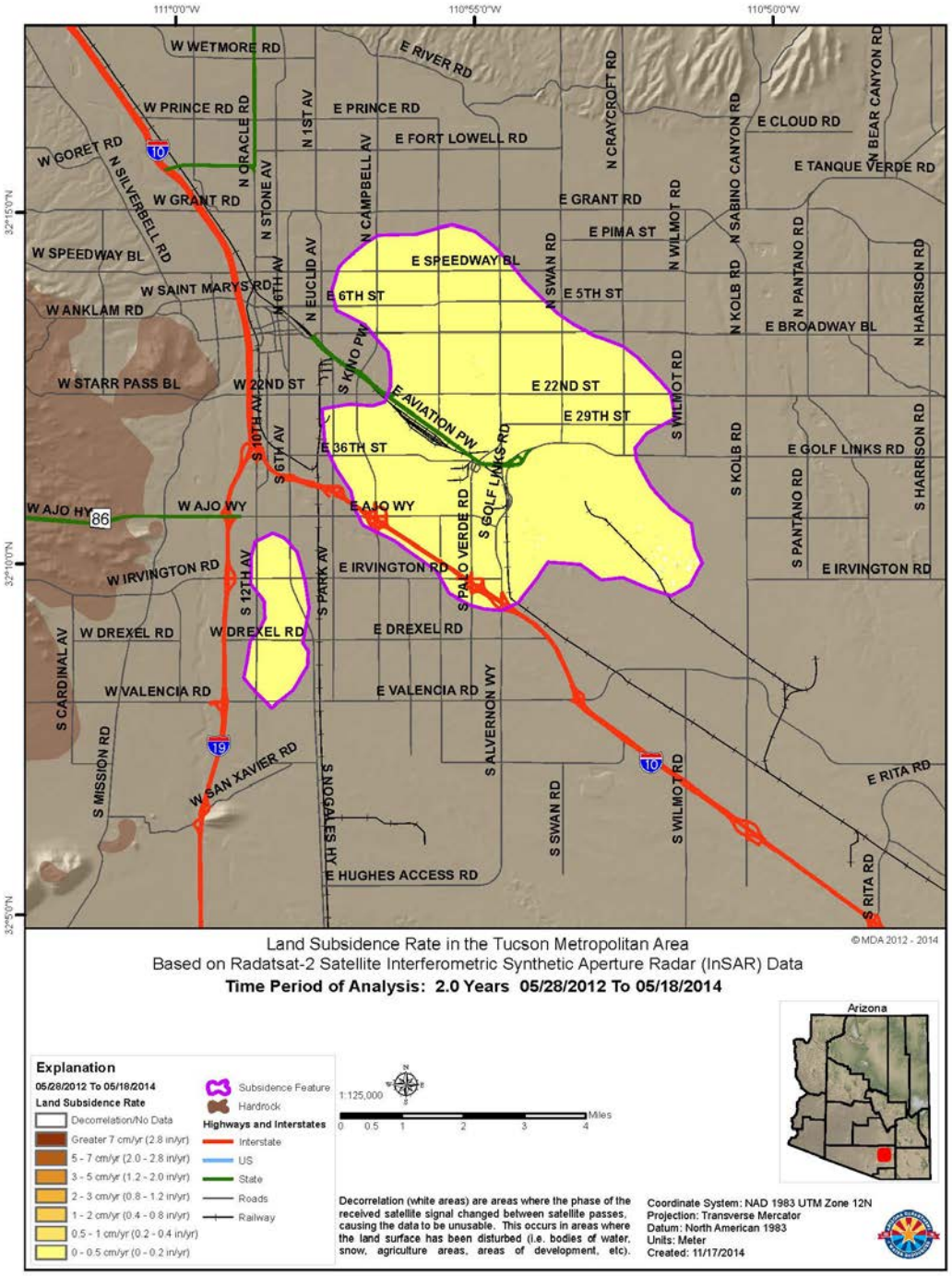


InSAR Data

2009 to 2010

0.9 year period

Maximum Rate: 0.4 to 0.8 in/yr



InSAR Data

2012 to 2014

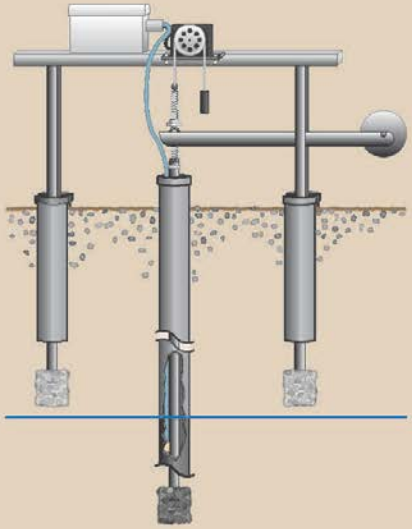
2.0 year period

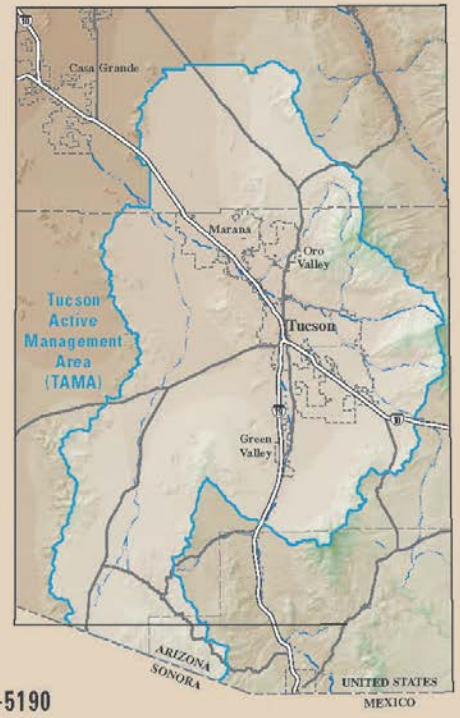
Maximum Rate: 0.0 to 0.4 in/yr

USGS
science for a changing world

Prepared in cooperation with the
ARIZONA DEPARTMENT OF WATER RESOURCES, CITY OF TUCSON WATER DEPARTMENT,
PIMA COUNTY, THE TOWN OF ORO VALLEY, THE TOWN OF MARANA, and the
METROPOLITAN DOMESTIC WATER IMPROVEMENT DISTRICT

Land Subsidence and Aquifer-System Compaction in the Tucson Active Management Area, South-Central Arizona, 1987–2005





Scientific Investigations Report 2007-5190

U.S. Department of the Interior
U.S. Geological Survey

USGS Report 1987 – 2005

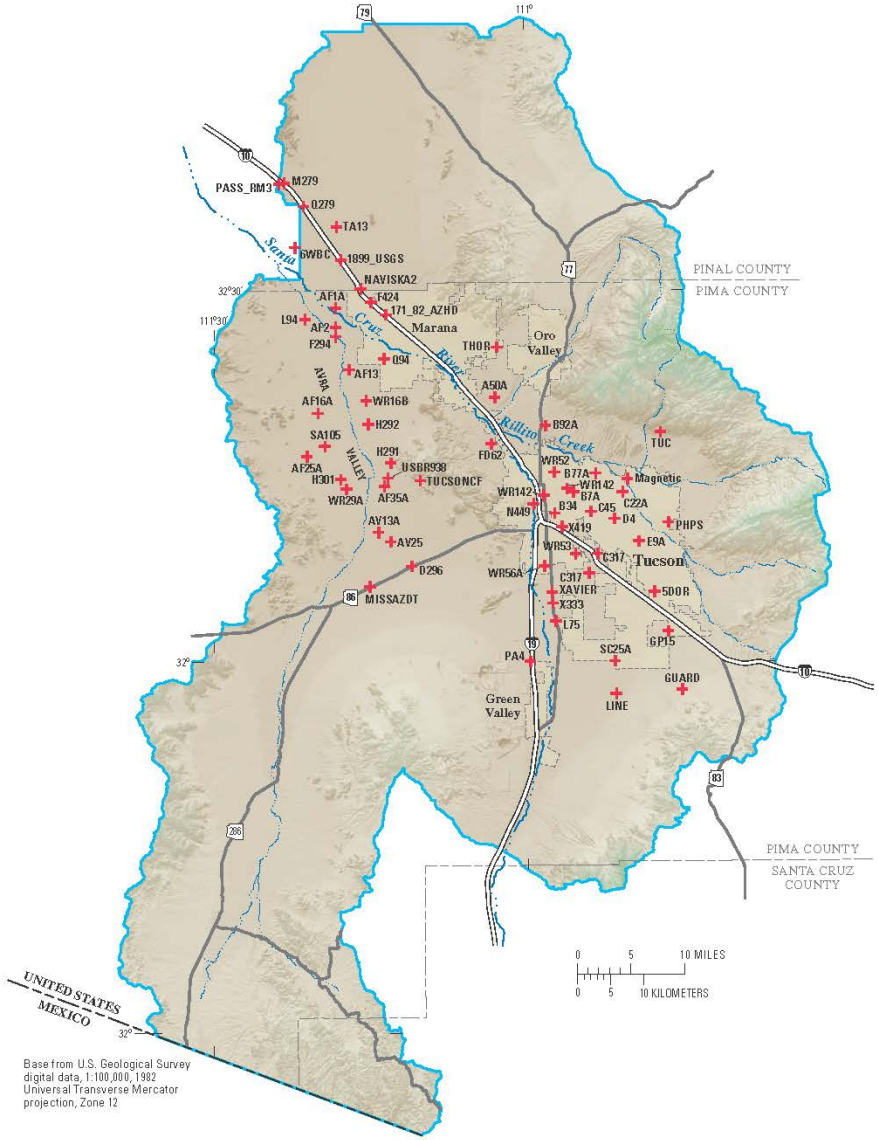


Figure 2. Long-term elevation-change monitoring stations in the Tucson Active Management Area.

USGS GPS Stations

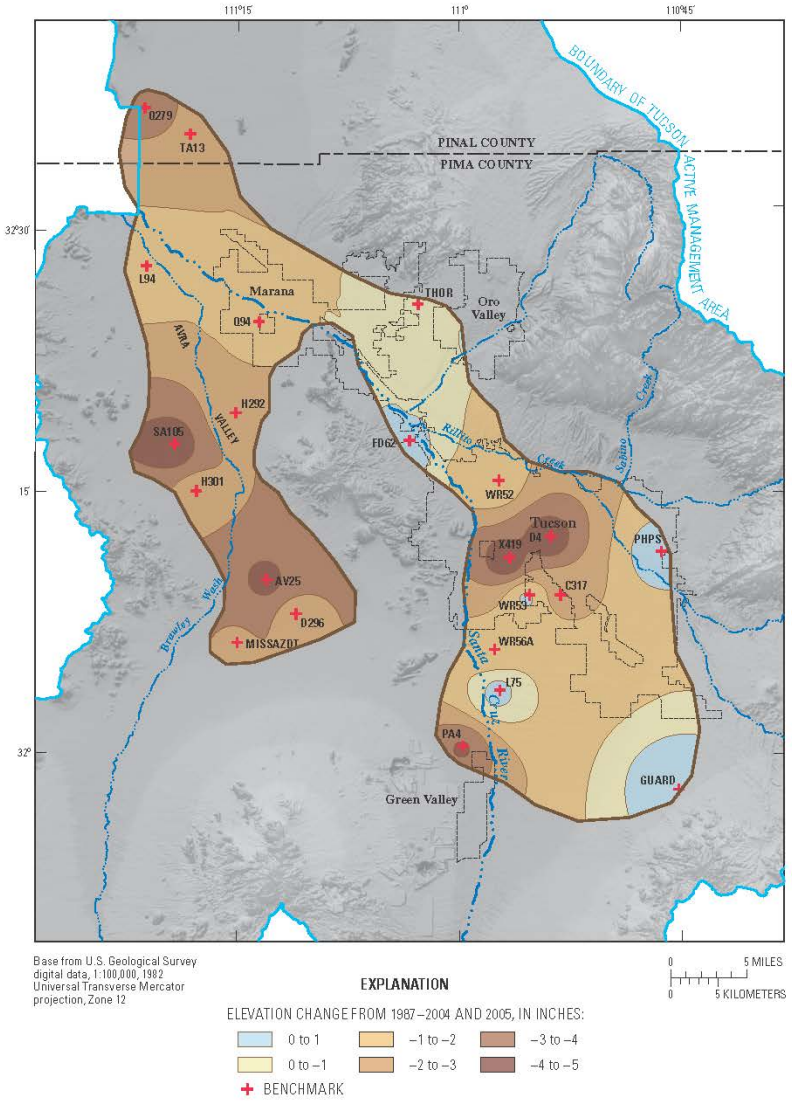


Figure 12. Land-surface elevation change in the Tucson Active Management Area from 1987 to 2004 and 2005.

GPS Comparison Land Subsidence
1987 to 2005
Range 0 – 5 inches

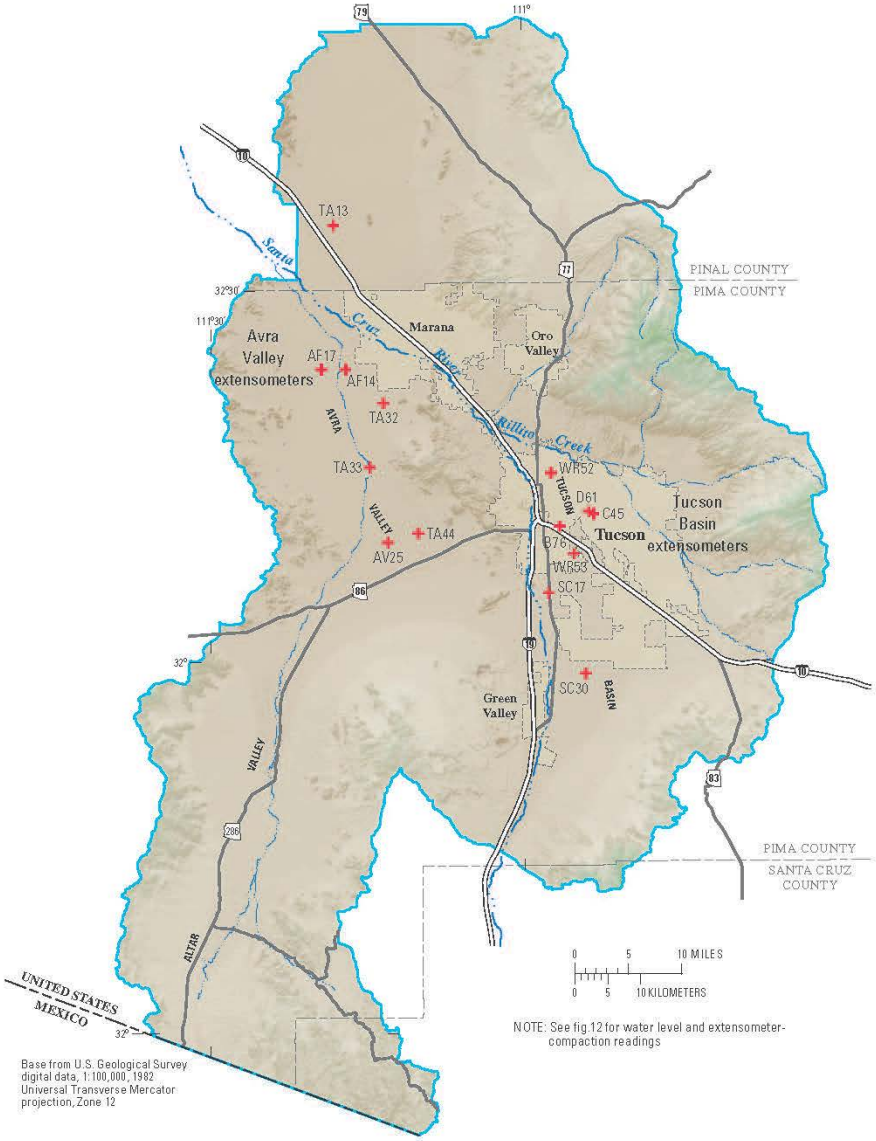
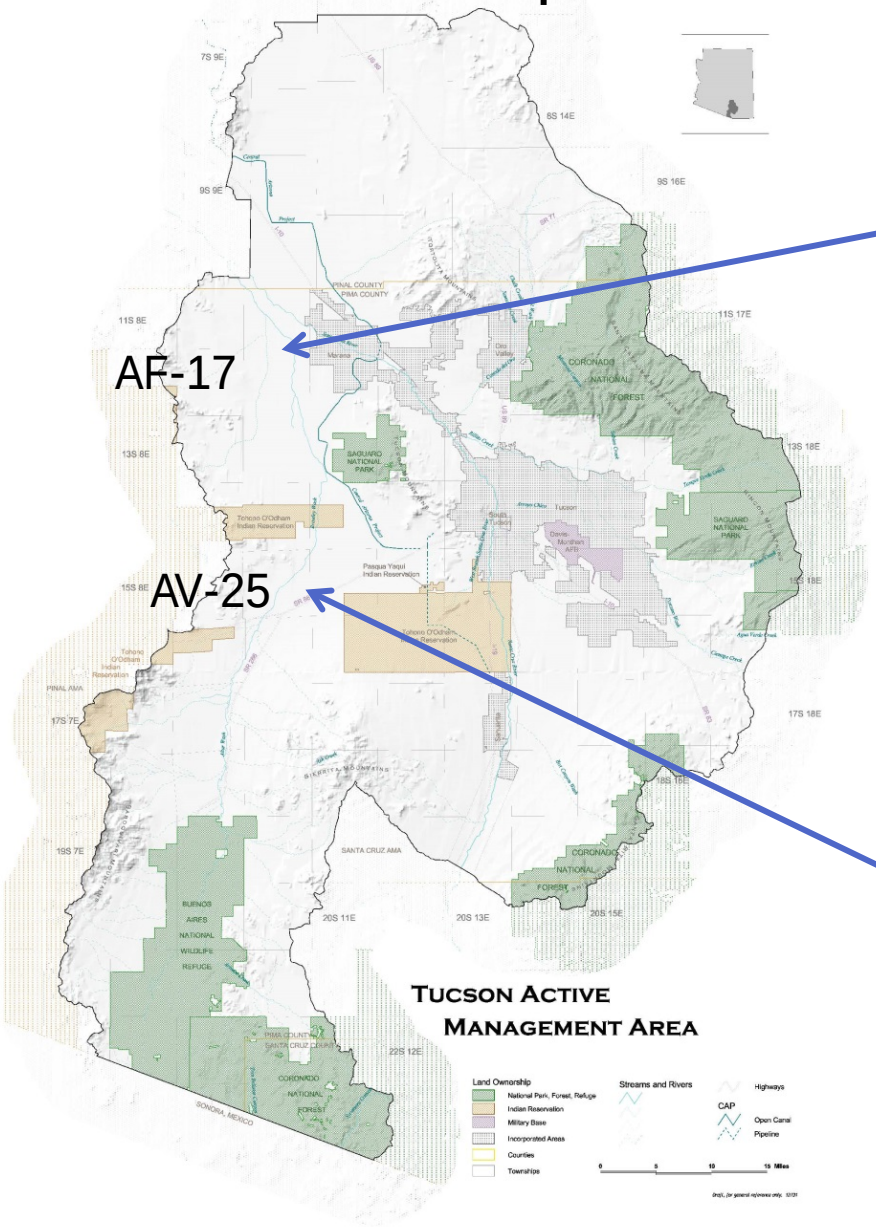
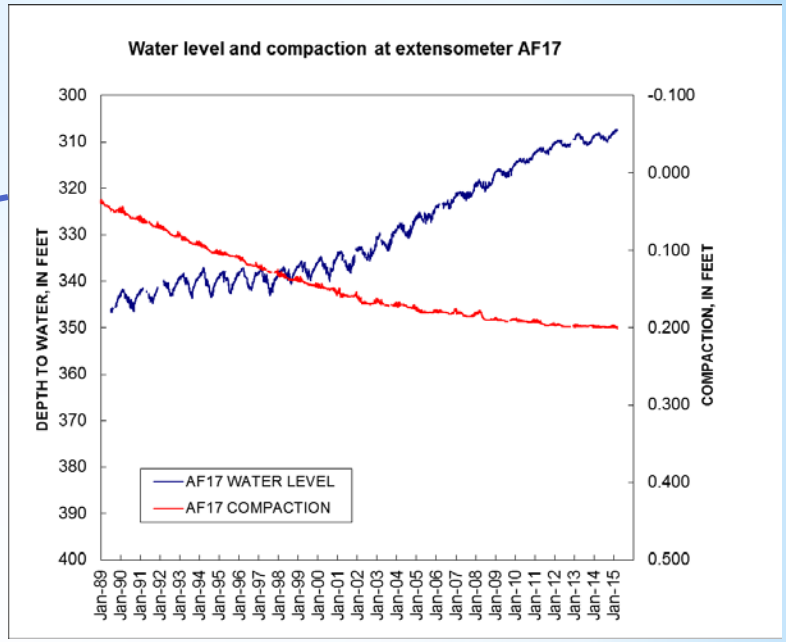


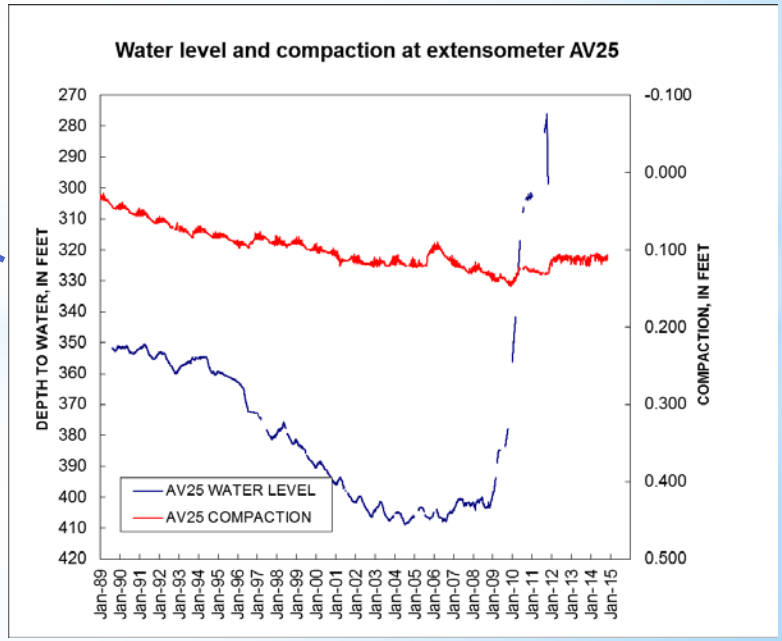
Figure 4. Tucson Active Management Area borehole extensometer stations.

USGS Extensometers

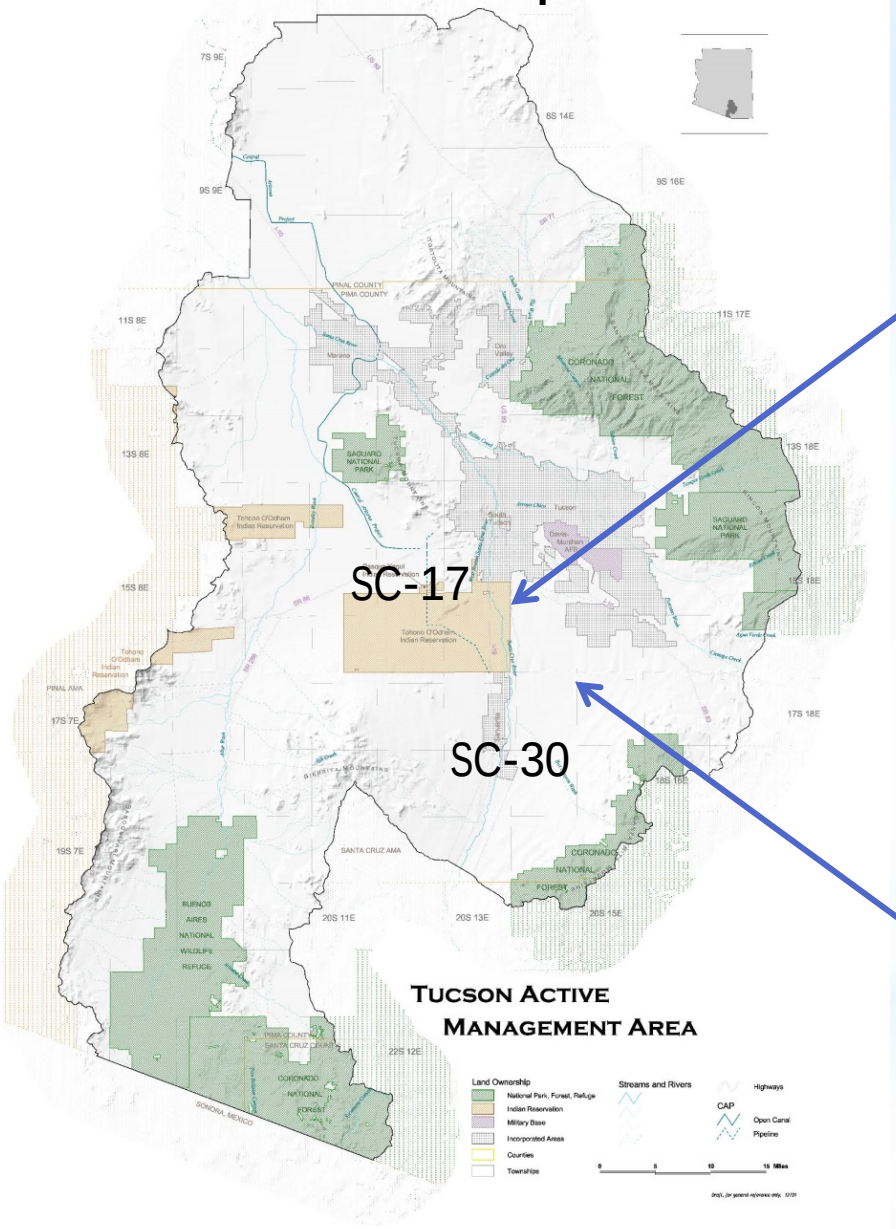
Cumulative Compaction

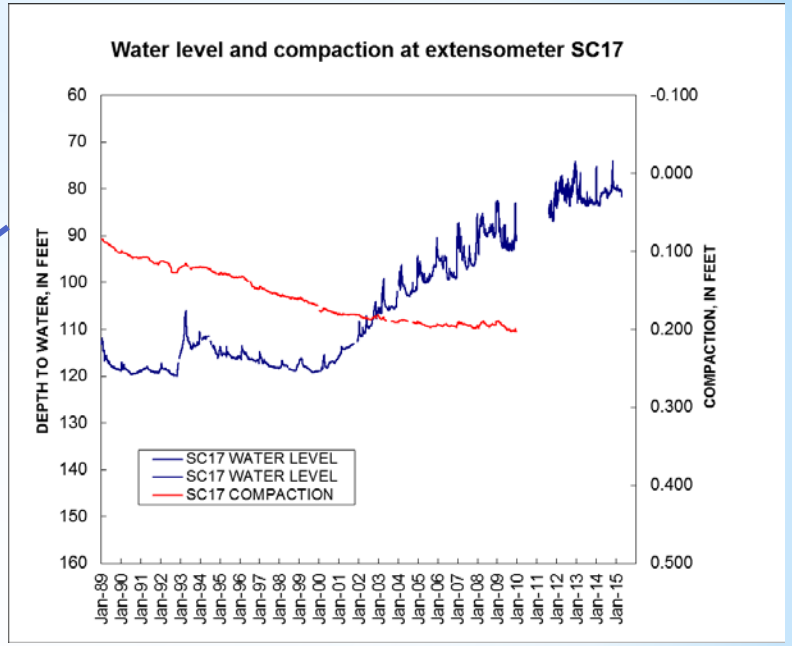


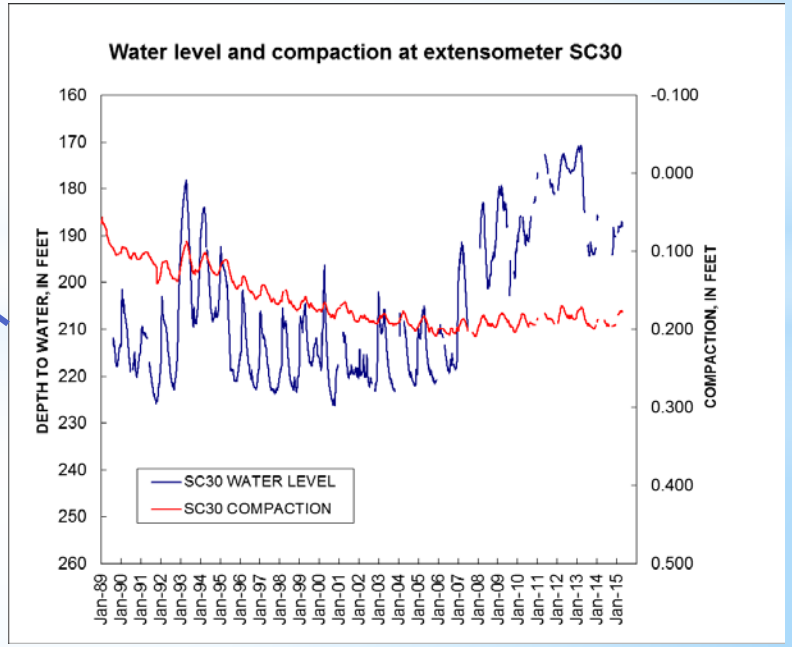




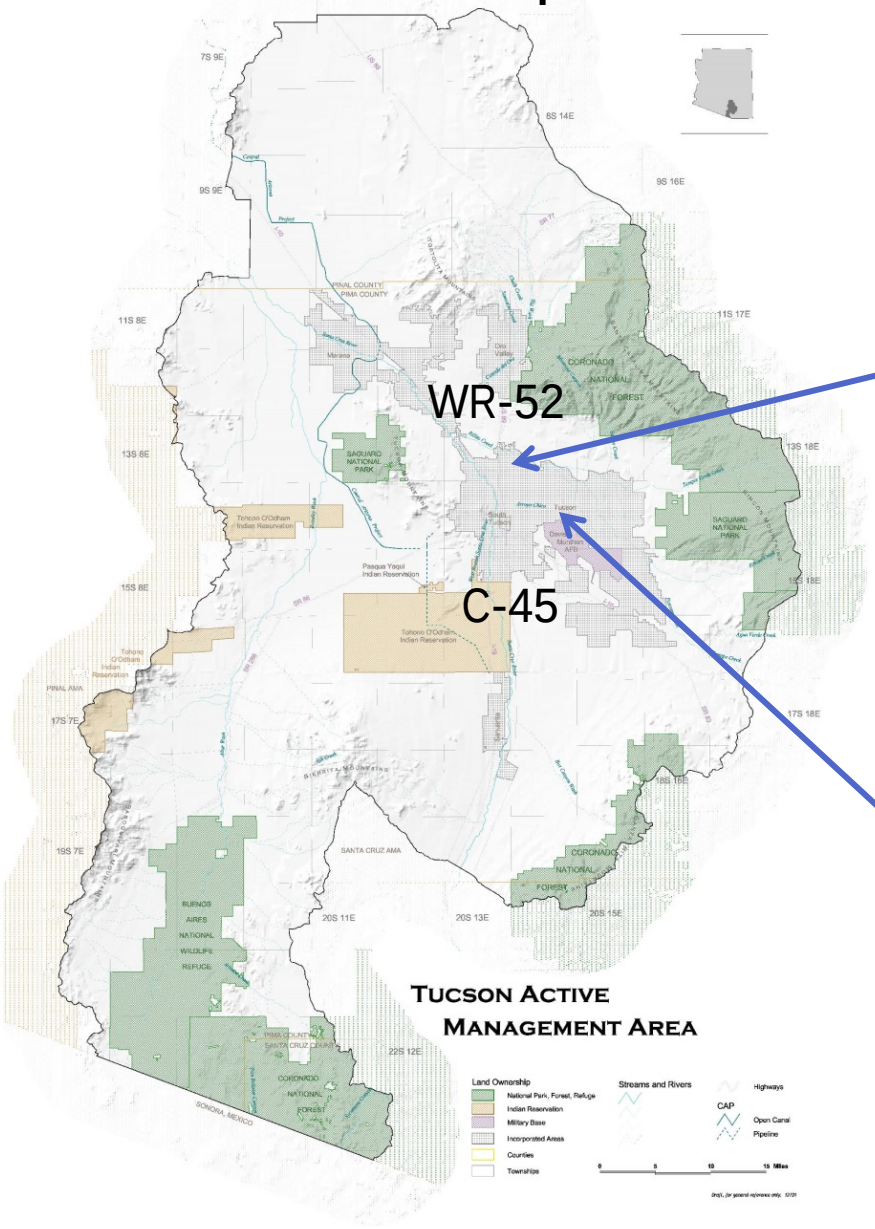
Cumulative Compaction

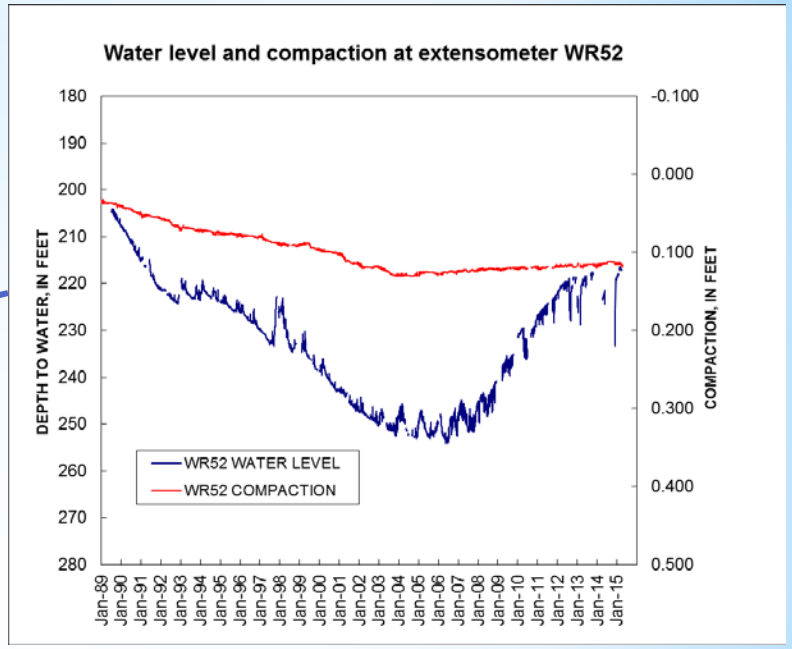


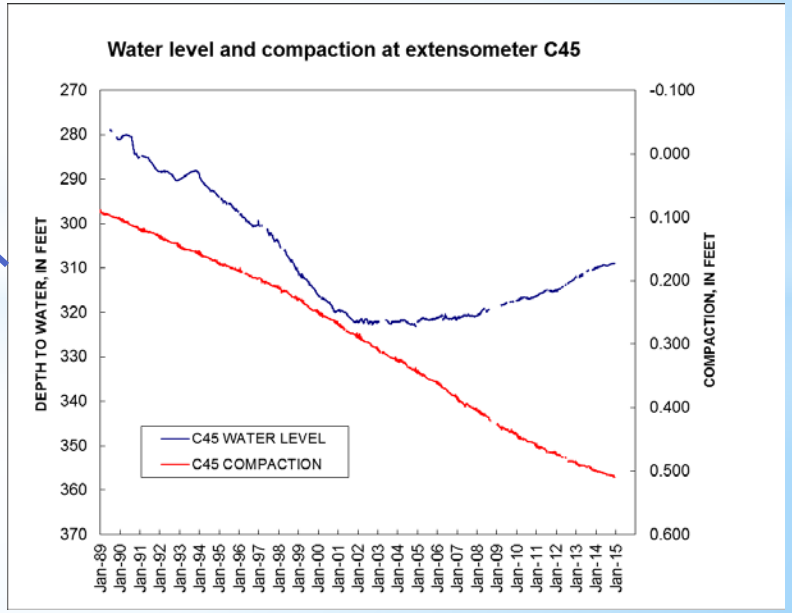




Cumulative Compaction







CONCLUSIONS

Transition to renewable water supply has greatly affected subsidence in the Tucson and Avra Valley Basins

Most areas in the basins have seen a decline or cessation of aquifer compaction

There are isolated areas that are still experiencing aquifer compaction

Lacking data in the South and Southeast portion of the Tucson Basin

Questions?

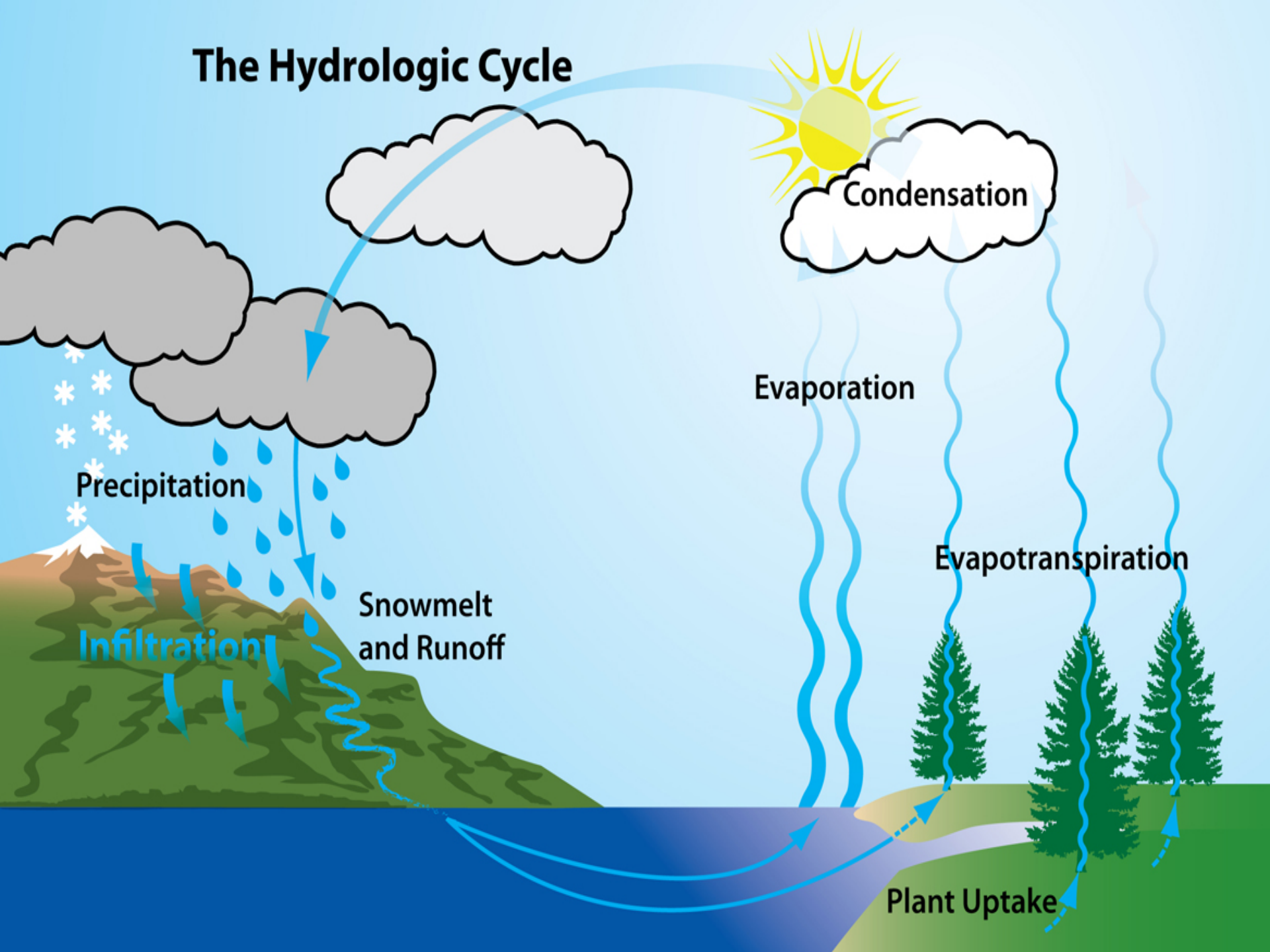
Seawater Desalination: Arizona's Next Bucket?

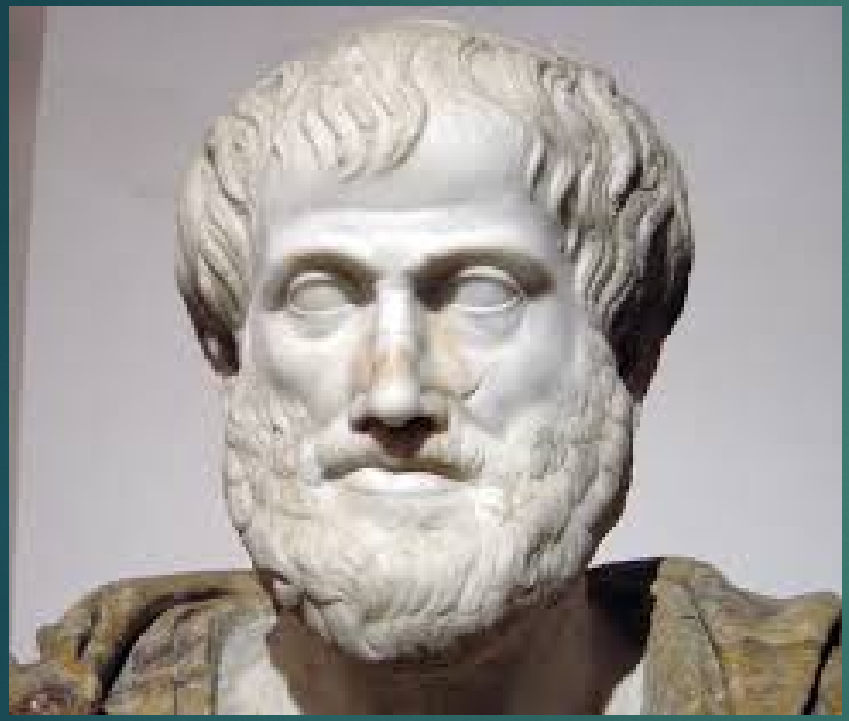
MARC CAMPBELL

JANUARY 27, 2015

"If we could produce fresh water from salt water at a low cost, that would indeed be a great service to humanity, and would dwarf any other scientific accomplishment."

President John F. Kennedy, 1962

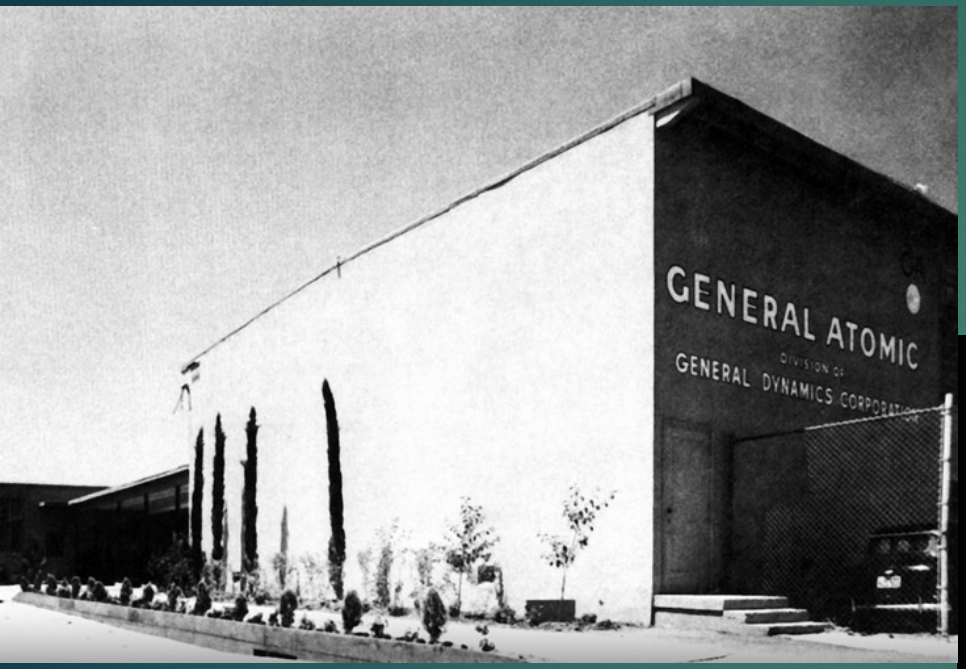

The Hydrologic Cycle
Condensation
Evaporation
Precipitation
Evapotranspiration
Snowmelt
and Runoff
Infiltration
Plant Uptake



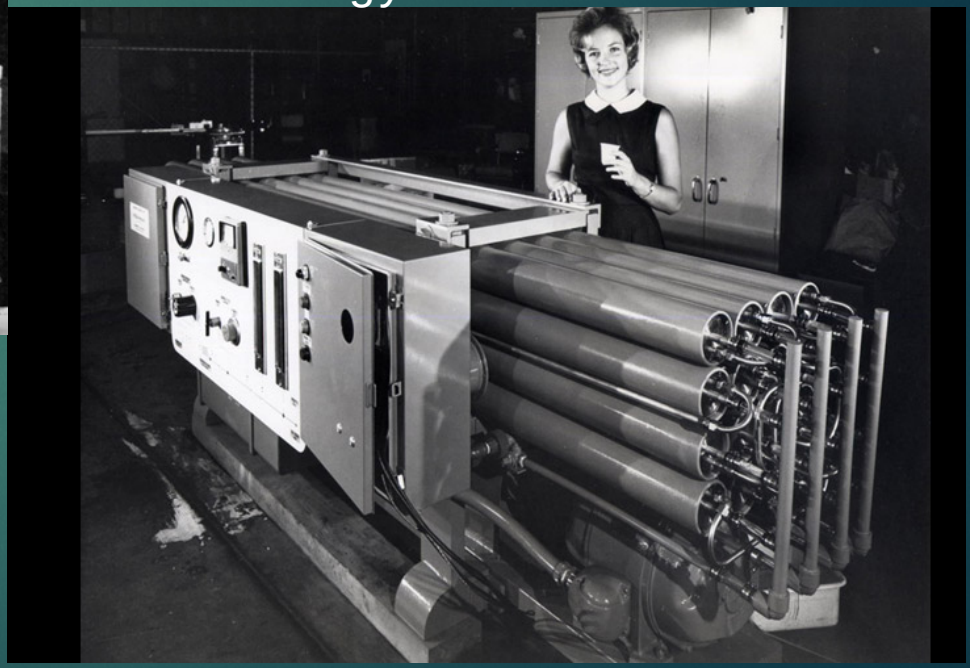
Aristotle

Pliny the Elder

Modern Advance of Desalination

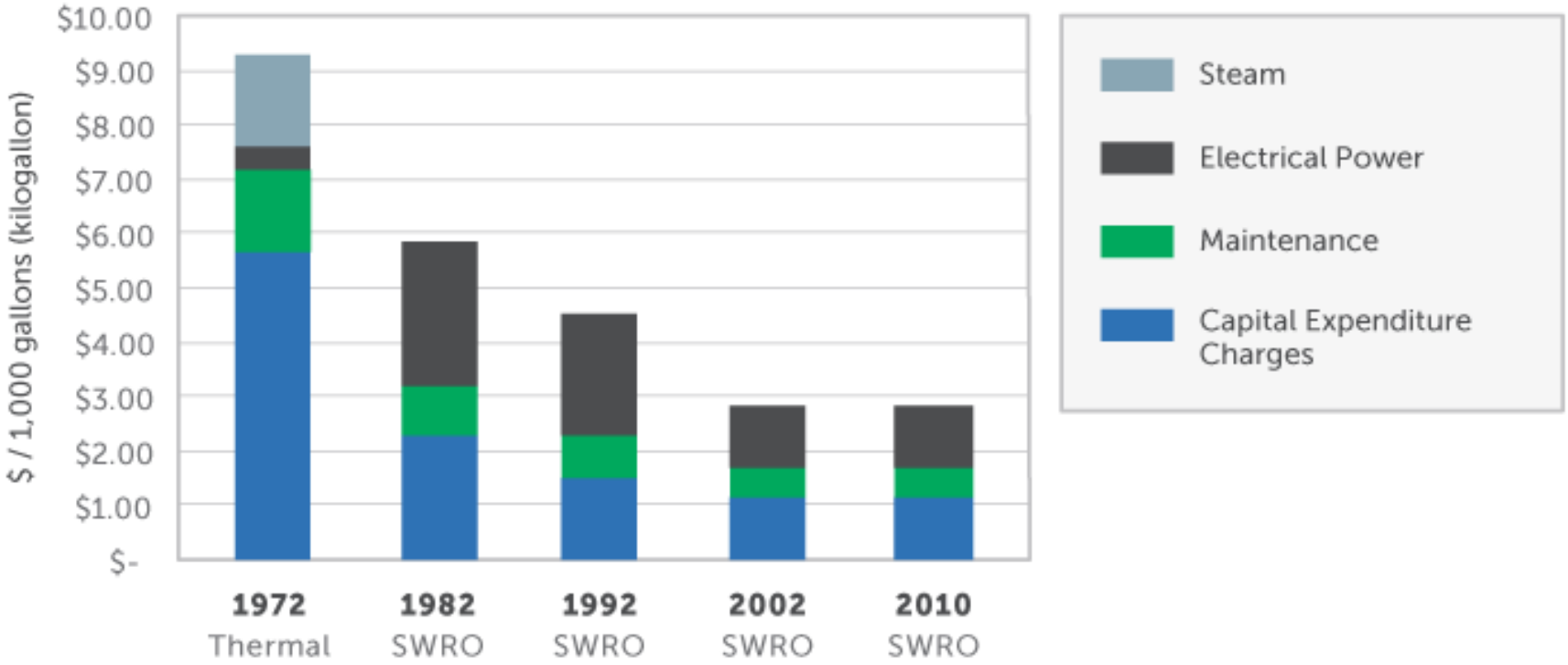


July 1955—General Dynamics creates their General Atomic Division for research and development in the peaceful use of atomic energy.

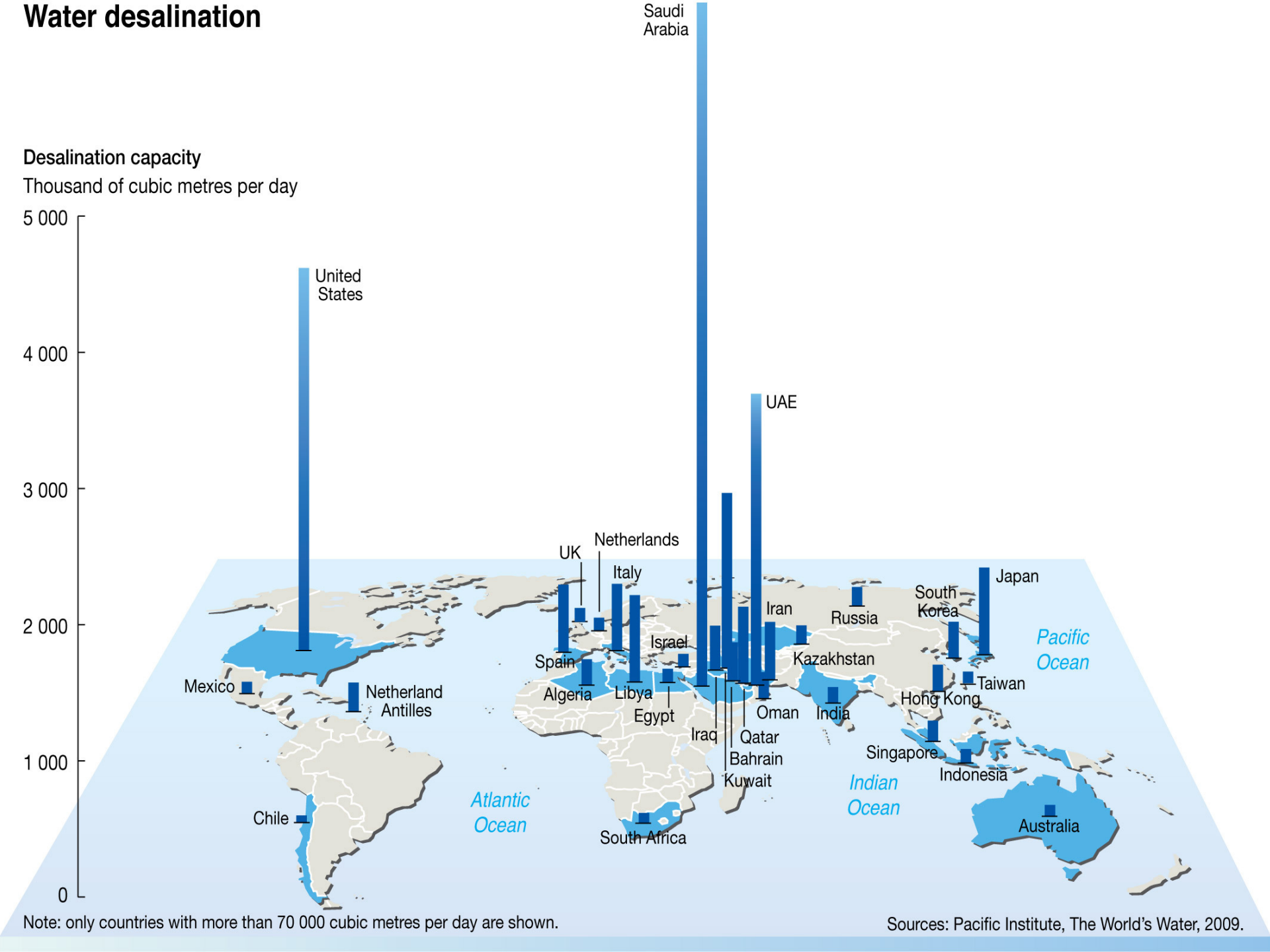


May 1962—The Department of the Interior's Office of Saline Water sponsors research at GA on reverse osmosis for saline water conversion.

Declining Cost of Desalination



Water desalination



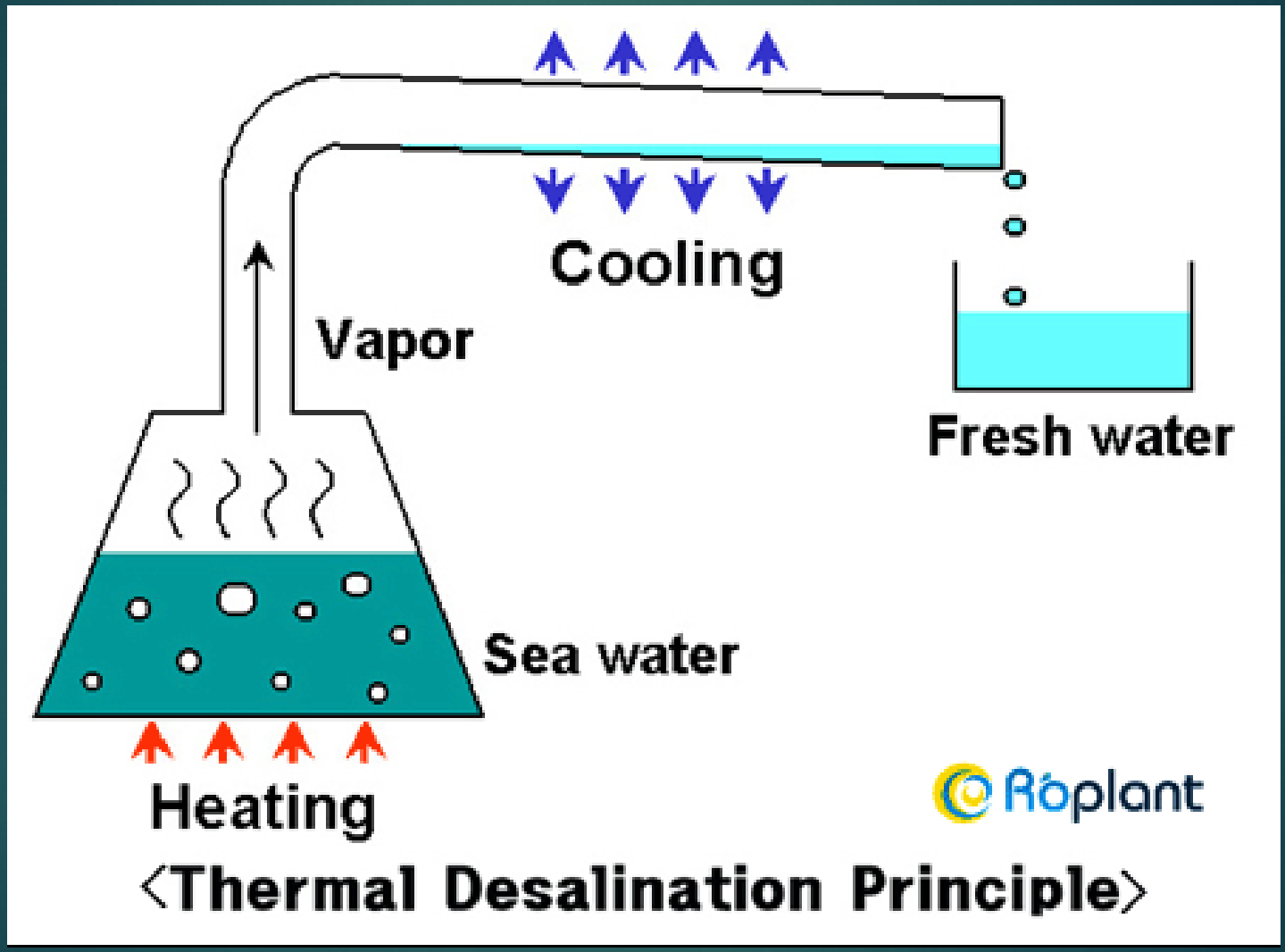
Note: only countries with more than 70 000 cubic metres per day are shown.

Sources: Pacific Institute, The World's Water, 2009.

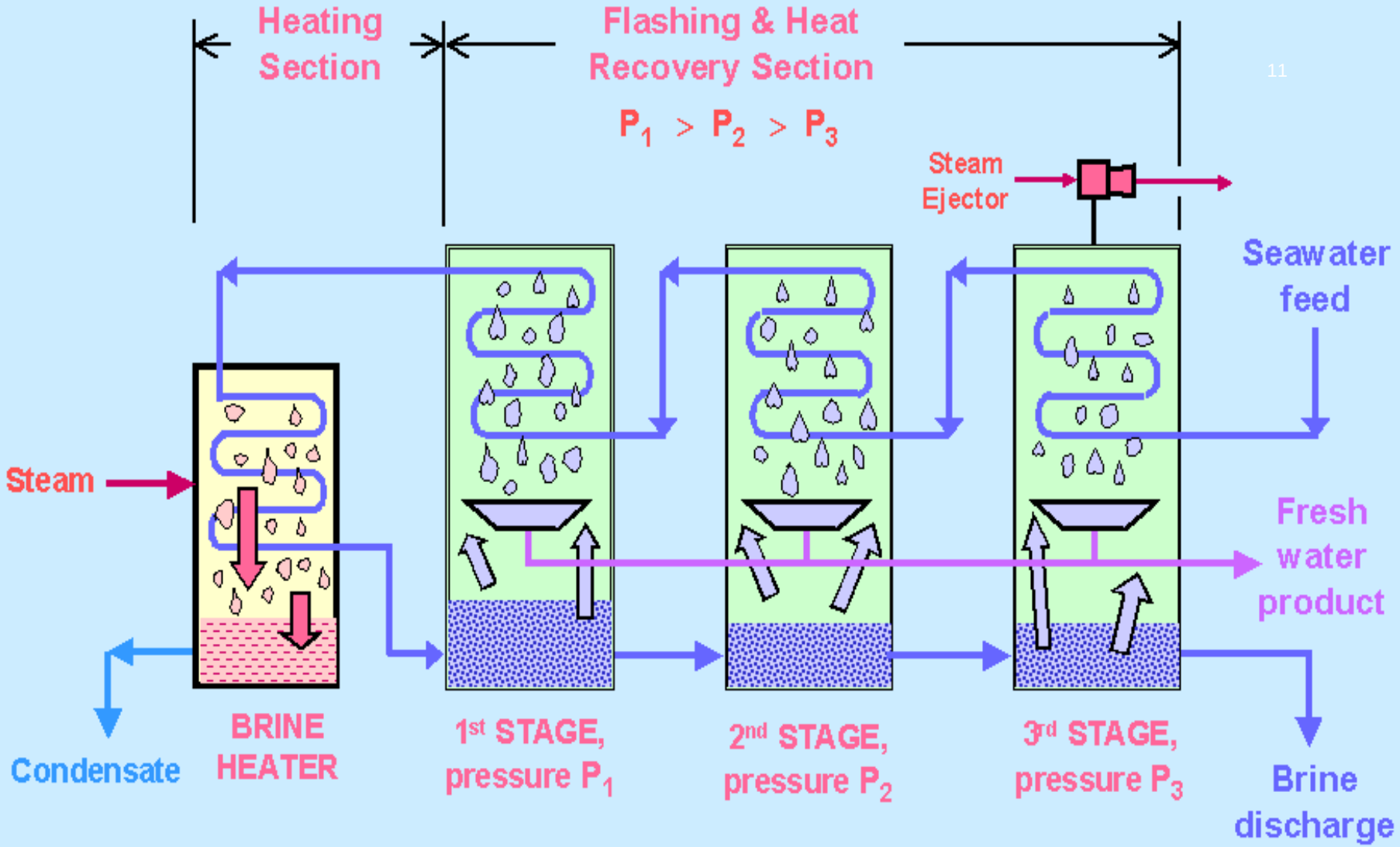
U.S. Desalination

Predominant Desalination Processes

- Thermal Distillation
  - Multi-effect distillation and multi-stage flash evaporation
  - Vapor Compression
- Membrane
  - Reverse Osmosis



〈Thermal Desalination Principle〉



MULTI-STAGE FLASH DISTILLATION (MSF)

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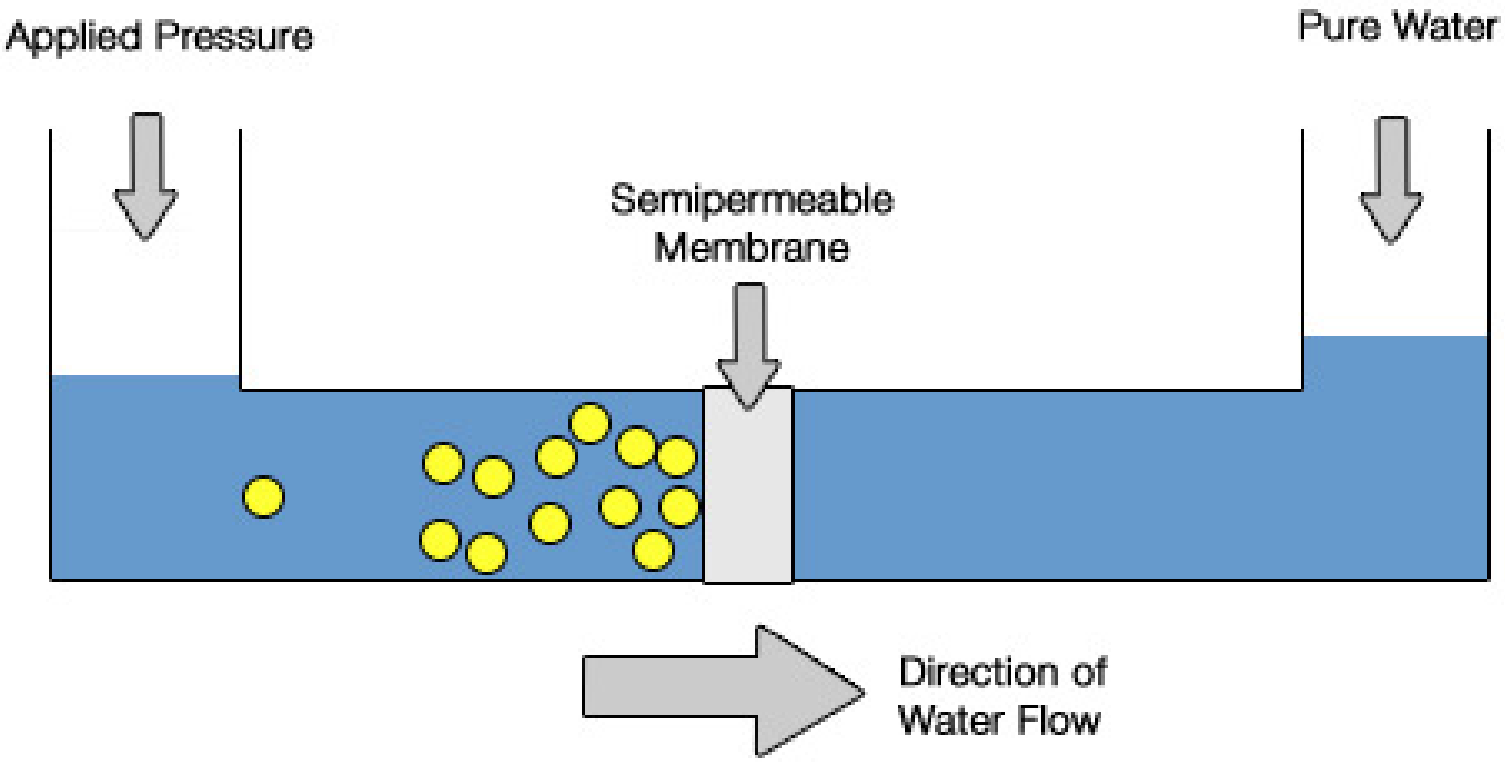
Reverse Osmosis

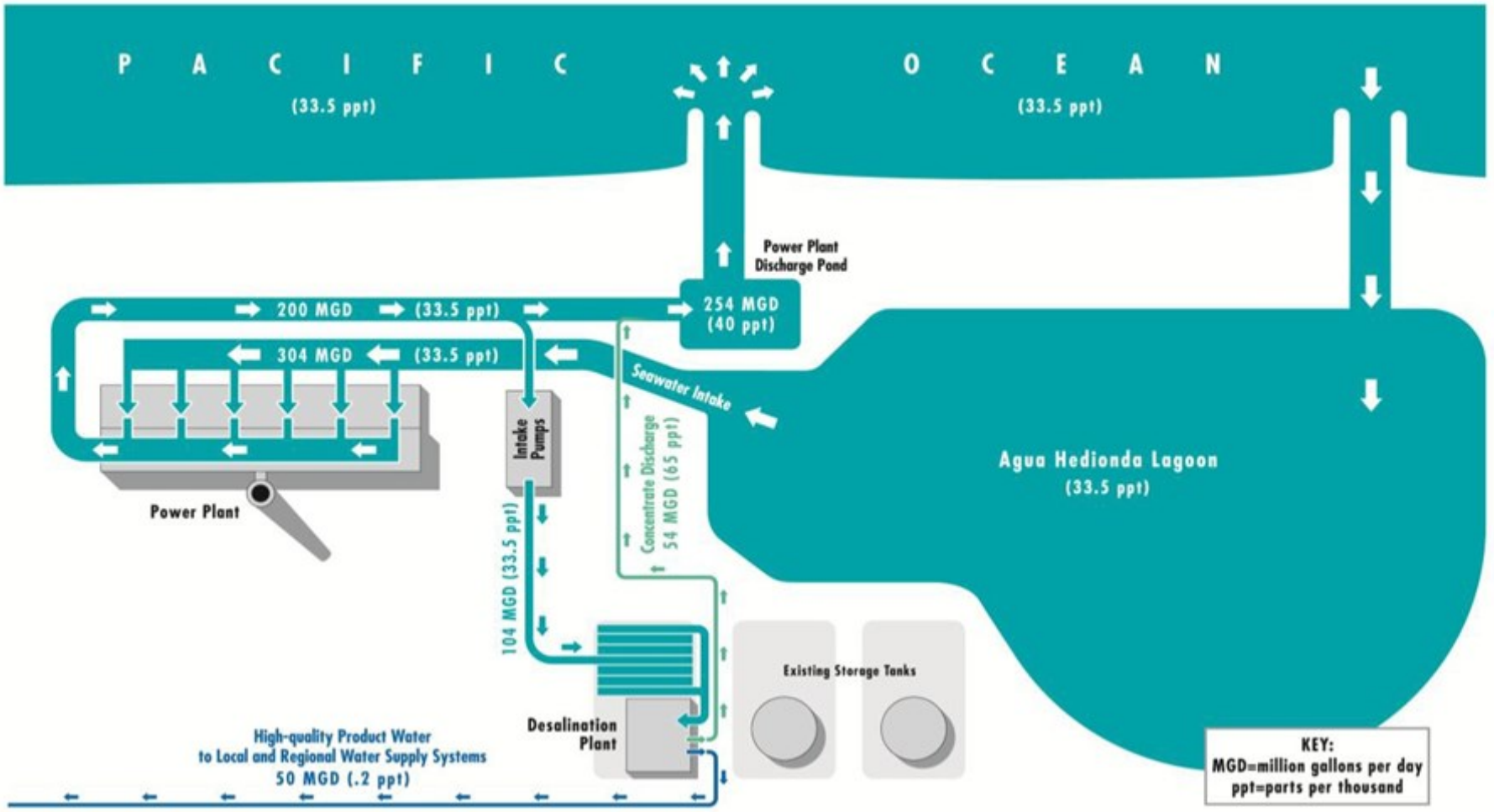


Emerging Technologies

- Forward Osmosis
- Semi-batch Reverse Osmosis
- Solar Desalination
- Flow-through Electrode Capacitive Desalination
- Membrane Solutions
  - Perforated Graphene
  - Bacteria Resistant

Carlsbad Plant

Water Intake and Production



Opportunities for Arizona

- Develop drought-proof water supply
- Continued economic development
- Regional partnerships

Arizona's Desalination Options

- Partner with California
  - Invest in coastal desalination plants
  - Exchange supplies for CA Colorado River water
- Partner with Mexico
  - Invest in desalination plant on Sea of Cortez/Pacific Ocean
  - Exchange supplies for portion of Mexico's Colorado River water or Yuma/CA ag water
  - Develop direct delivery to southern Arizona

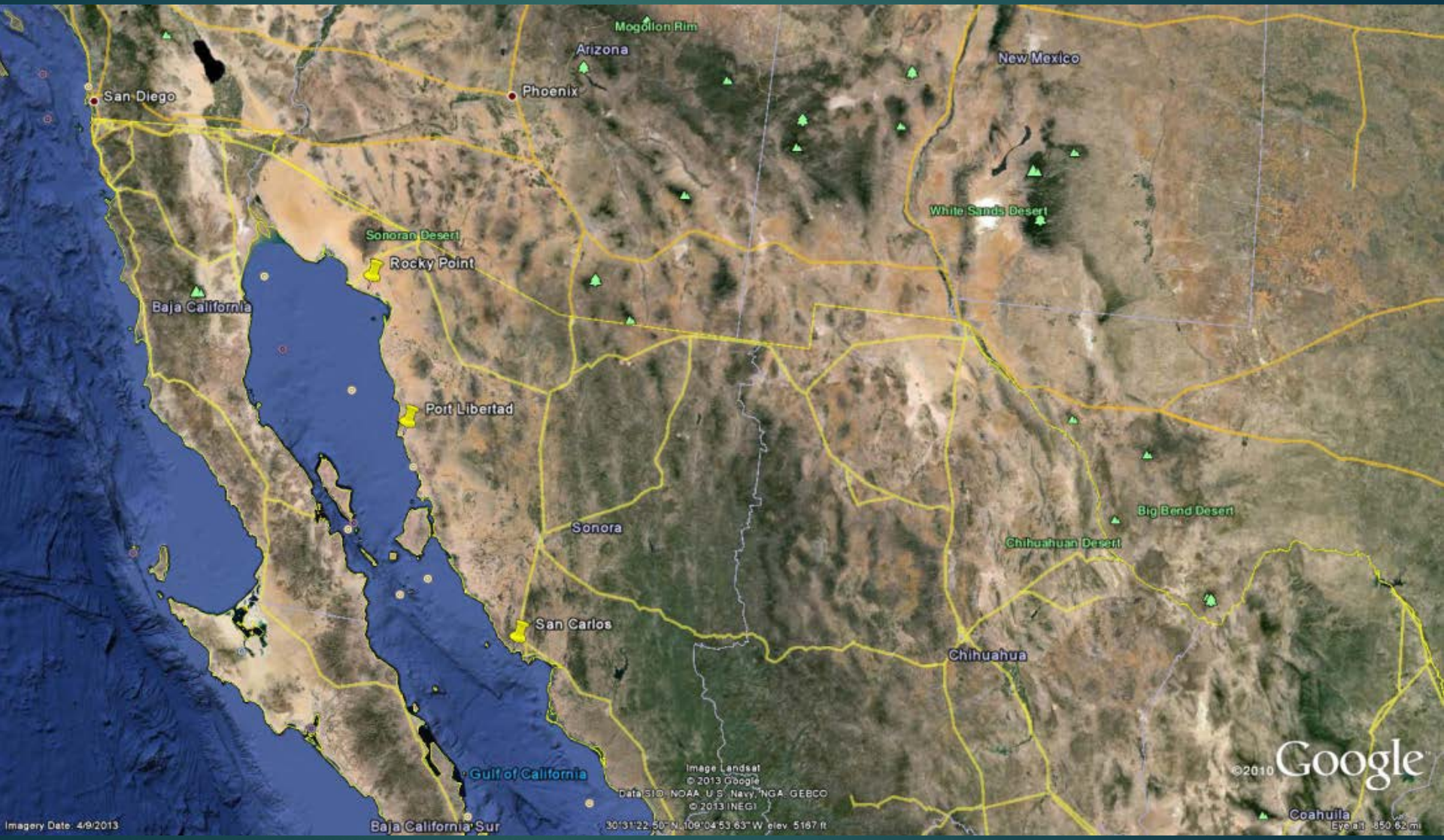
CalDesal

Alameda County Water
City of Oceanside
Delta Diablo Sanitation
Laguna Beach Water
Orange County Water
SDCWA
City of San Clemente
Moulton Niguel Water
Southern Nevada W.A.
Vallecitos Water
Zone 7 Water
AECOM
Avista Technologies
Carollo Engineers
DYK, Inc.
Malcolm Pirnie
Kiewit

California American Water
City of Santa Barbara
Eastern Municipal Water
Mesa Water District
Park Water Company
San Gabriel Co. Water
San Juan Capistrano
South Coast Water
Sweetwater Authority
Water Replenishment Dist
Acciona Agua Corp
AMTA
Bay Planning Coalition
CDM, Inc.
Energy Recovery, Inc.
HDR Engineering
Poseidon Water

California Domestic Water Co.
Contra Costa Water District
Irvine Ranch Water District
MWD
Municipal Dist. of Orange Co.
Santa Margarita Water District
Laguna Beach Co. Water
South Orange Co. Wastewater
Upper San Gabriel Valley
West Basin Municipal District
ACWA
American Membrane Technology
Black & Veatch
Dudek
ESA
IDE Americas
United Water

Binational Desalination



Previous Studies

- 6 studies in Sonora since 1999
  - From Puerto Peñasco to Guymas
- 2 most recent occurred in 2008-2009, focused on Puerto Peñasco
  - Study for future municipal supplies
    - Funded by USTDA ($369,000)
  - HDR conceptual study for Sonoran and Arizona
    - Funded by CAP and SRP

Puerto Peñasco HDR Study

- Deliver water to Arizona through Imperial Dam
- Create opportunities for various Colorado River users
- 2 scenarios
  - AZ-Sonora
  - Regional (MX, AZ, CA, NV)
- 170 miles conveyance
- 180 elevation gain

Puerto Peñasco HDR Study

Two scenarios and two alternatives for transmission:

1. AZ-Sonora (107 mgd)
   - 120,000 AF/Yr
   - 170 miles of pipeline (78-inch)
   - 4 pumping plants 6,000 hp
   - Energy requirements – 50MW
2. Regional (1,070 mgd)
   - 1.2 MAF/Yr
   - 143 miles of open canal
   - 25 miles of double pipeline (180-inch)
   - 5 pumping plants 15,000 hp
   - Energy requirements – 500MW

Where We Are Now

- Declaration of Cooperation between Sonora and AZ at Arizona-Mexico Commission Plenary June 2014
  - Cross-border investigation of desalination potential
- Conversation moved to federal level as part of U.S.-Mexico CO River discussions
- Monitoring outcome of Rosarito desal plant
- Hope to drive feasibility analysis back to state level with support of other interested parties

Environmental Considerations

Questions?

San Carlos, Mexico

Citizens' Water Advisory Committee
Technical Planning, Policy Subcommittee
Projected Agenda

Meeting Date/Agenda Items	Materials Deadline
February 24, 2016 • **Reclaimed Water System (agua caliente ponds)** • **WMG – Tools for Evaluation of RWH Benefits (TBD)**	**February 19, 2016**
March 23, 2016 • **Reclaimed Plant**	**March 18, 2016**

Future Agenda Items without a Date:
Antibiotic resistant genes in the Wastewater system
Conservation based rate structures