Water Resources Research Center

College of Agriculture and Life Sciences, The University of Arizona

Water Planning for the Tucson Region

Arizona Chapter of the American Society of Farm Managers and Rural Appraisers

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WaterSustainability The University of Arizona

Abstract

Scenarios for meeting the rapidly growing water demands of the Tucson region are presented. Groundwater regulations, recharge, conservation, effluent, renewable water supplies, regional cooperation and cost considerations are discussed.
The methodology can be applied to othe regions of the state. The study shows that, although there are sufficient water supplies to accommodate growth, the cost of using some of them is not quantified and there are many issues that require resolution prior to utilization of all the supplies.

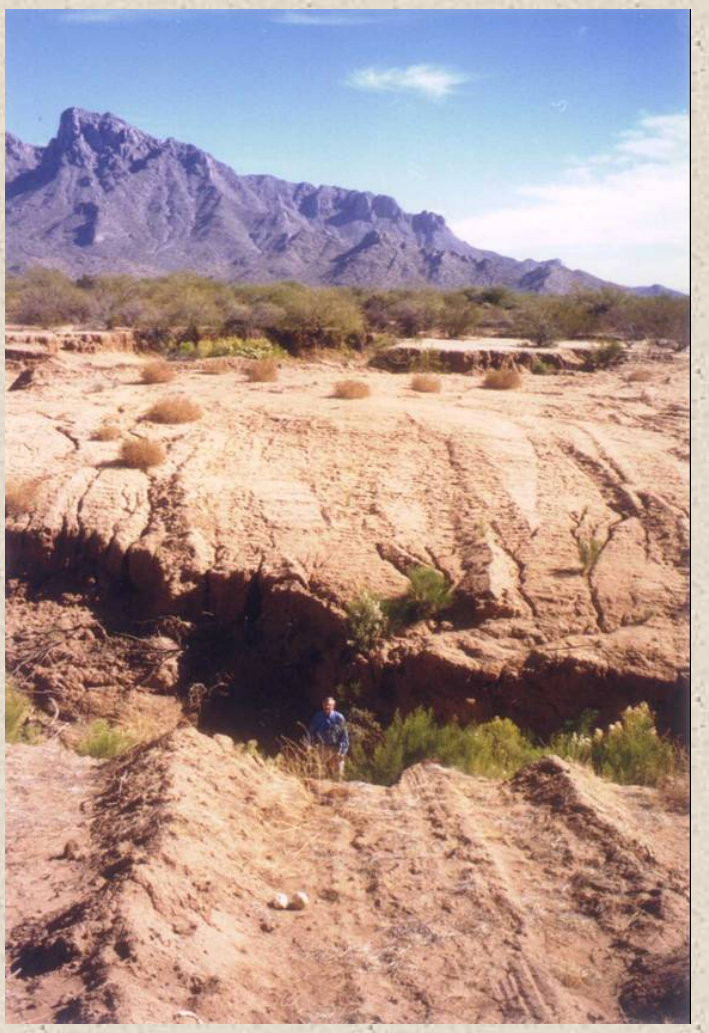
Water Resource Planning in the Tucson Region – Providing Context

- Study released July 2006: *Water Resource Availability for the Tucson Metropolitan Area*

  Available www.cals.arizona.edu/azwater
- Explanation of water management
  - Assured Water Supply Rules
  - Role of CAP water and recharge
  - The Central Arizona Groundwater Replenishment DistrictRegional management considerations
- Water Availability Scenarios Work Sheet, with sensitivity analysis
- Where is the next bucket of water?

Growth in People and Economic Activity Resulted in Groundwater Overdraft Problem in some parts of Arizona

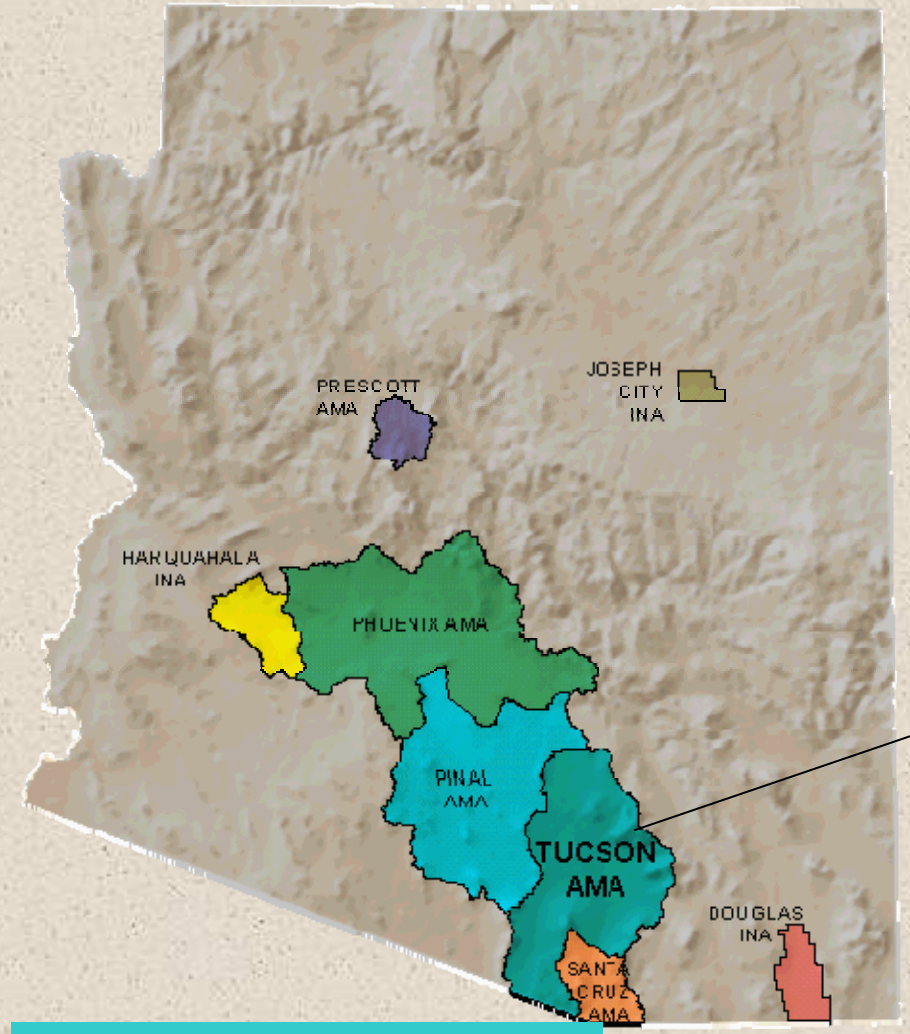
- Groundwater pumped from aquifers faster than it is replenished by nature
- Problem: declining water tables, with numerous associated implications: water quality, cost of pumping, land subsidence and fissuring.

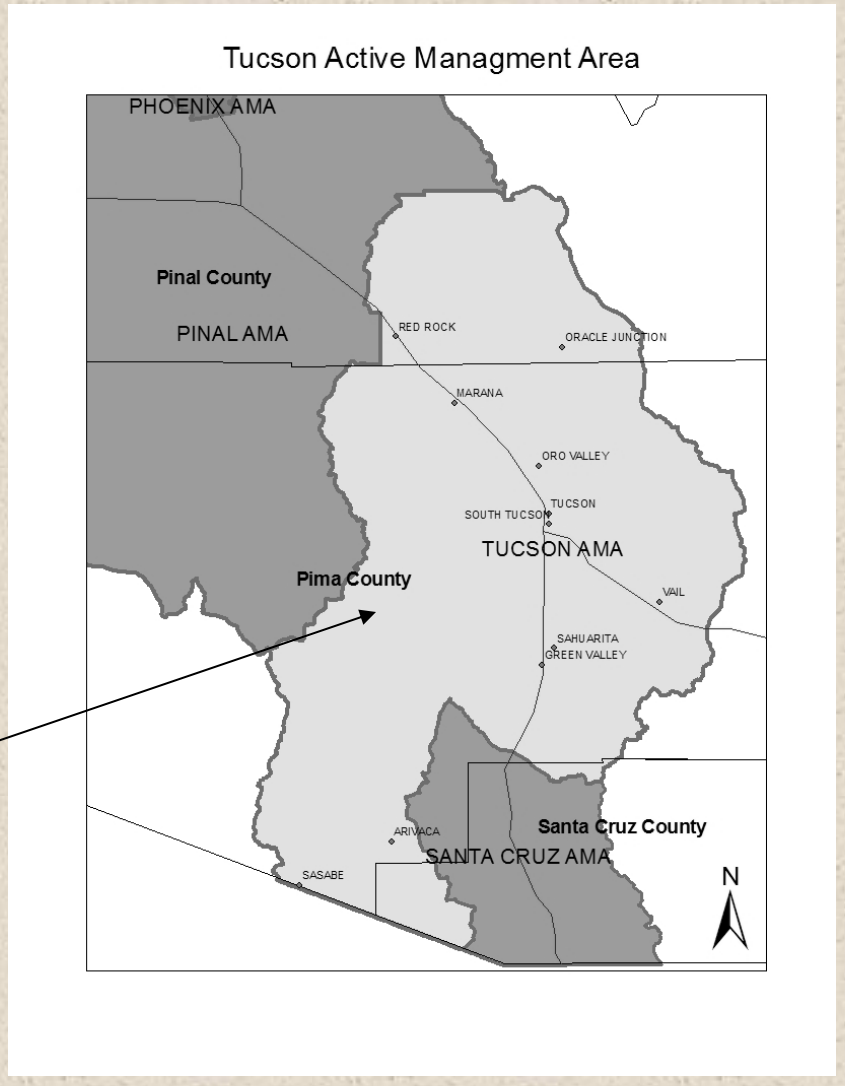


State's Response: 1980 State of Arizona Groundwater Management Act (GMA)

- Established areas where groundwater management was required – **Active Management Areas**, each with a statutory **management goal**
- GMA required the adoption of **Assured Water Supply Rules**, which require municipal growth to depend primarily on renewable supplies.
- **Conservation** programs for each water using sector and management plans are developed by the Arizona Department of Water Resources every 10 years.
- **No expansion of agricultural land** beyond what was irrigated during the late 1970s.
- Statutes and Management Plans establish regulatory framework, but the decisions how to meet the regulations are made by the water user/water supplier.

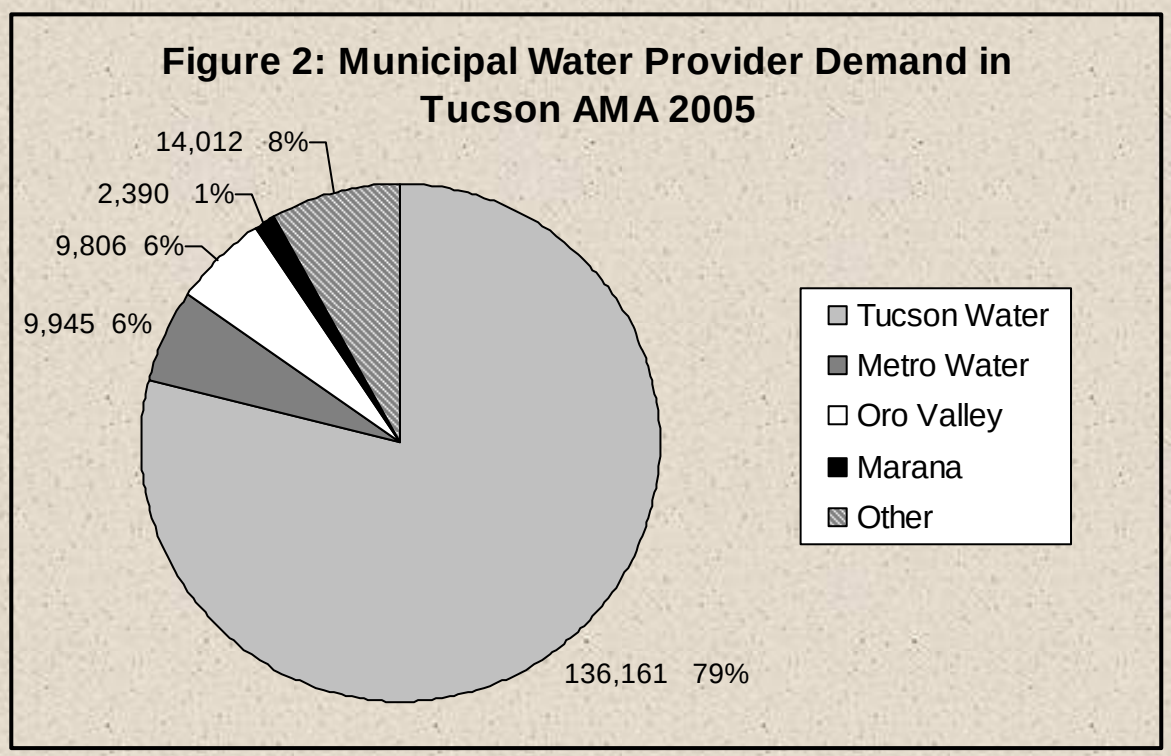
Active Management Areas in Arizona





Note: Management goals may differ by AMA

Relative Size of Large Water Providers in the Tucson Region



Total water demanded in 2005 was 172,314 AF. (Figures for Marana, Metro Water and Other are projections for 2005) Figures for Tucson Water and Oro Valley are actual use.

Source: CAGRD Plan of Operation November 2004 and Communication with Tucson Water and Oro Valley.

Water Budget Calculations

Table 4: Water Scenarios Based on Third Management Plan			
	1998	2003	2025
Municipal Sector (Includes Exempt Wells)			
Total Demand	163,198	185,199	247,100
Total Supply	163,198	185,199	247,100
Groundwater	153,535	124,113	63,000
CAP	200	50,998	146,400
Effluent	9,463	9,811	37,700
Surface Water	0	277	0
Agricultural Sector			
Total Demand	94,809	102,959	54,200
Total Supply	94,809	102,959	54,200
Groundwater	70,882	85,617	41,200
Groundwater (in lieu)	22,947	17,342	10,000
CAP	0	0	0
Effluent	980	0	3,000
Industrial Sector			
Total Demand	57,544	47,430	75,400
Total Supply	57,544	47,430	75,400
Groundwater	56,844	45,721	70,700
CAP	0	160	0
Effluent	700	1,549	4,700
Indian			
Total Demand	100	14,196	16,000
Total Supply	100	14,196	16,000
Groundwater	100	788	200
CAP	0	13,408	15,800
Effluent	0	0	0
Other Demand Riparian	3,705	3,705	3,705
Total Demand	**315,651**	**349,784**	**392,700**
Total Groundwater Use	**308,013**	**277,286**	**188,805**
(Less) Net Natural Recharge	62,045	62,045	62,045
(Less) Net Incidental Recharge	81,972	43,257	32,516
(Less) Cuts to the Aquifer	2,341	8,362	45,200
Total Overdraft	**161,655**	**163,622**	**49,044**
Net Artificial Recharge	22,688	56,919	13,500

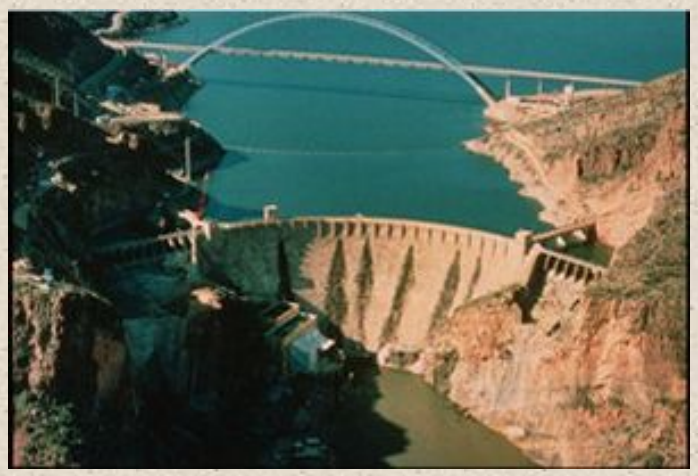
The Assured Water Supply Rules

- AWS Rules adopted in 1995
- Designation versus certification
- Use of renewable supplies
  - Direct versus indirect use
  - Can utilize groundwater to serve new growth if the groundwater is replenished
  - Membership in the Central Arizona Groundwater Replenishment District (CAGRD)
- Water suppliers and developers must plan for future growth.
- Need for additional water supplies.

Importance of Renewable Supplies and Dams to Arizona

- Central Arizona Project
- Salt River Project

Hoover Dam

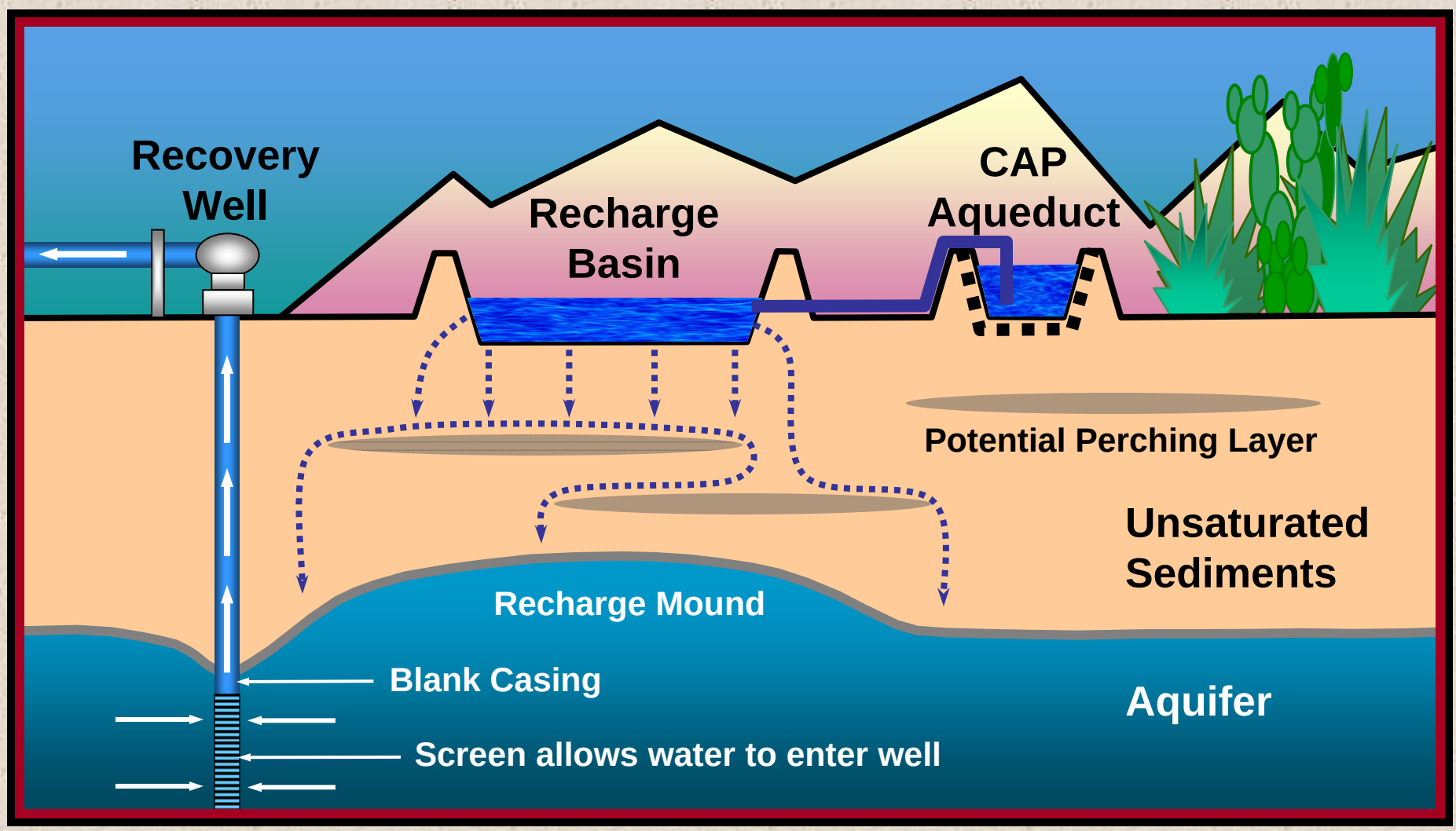


Roosevelt Dam

Photos courtesy of CAP and SRP

Importance of Recharge

Photo courtesy of Tucson Water

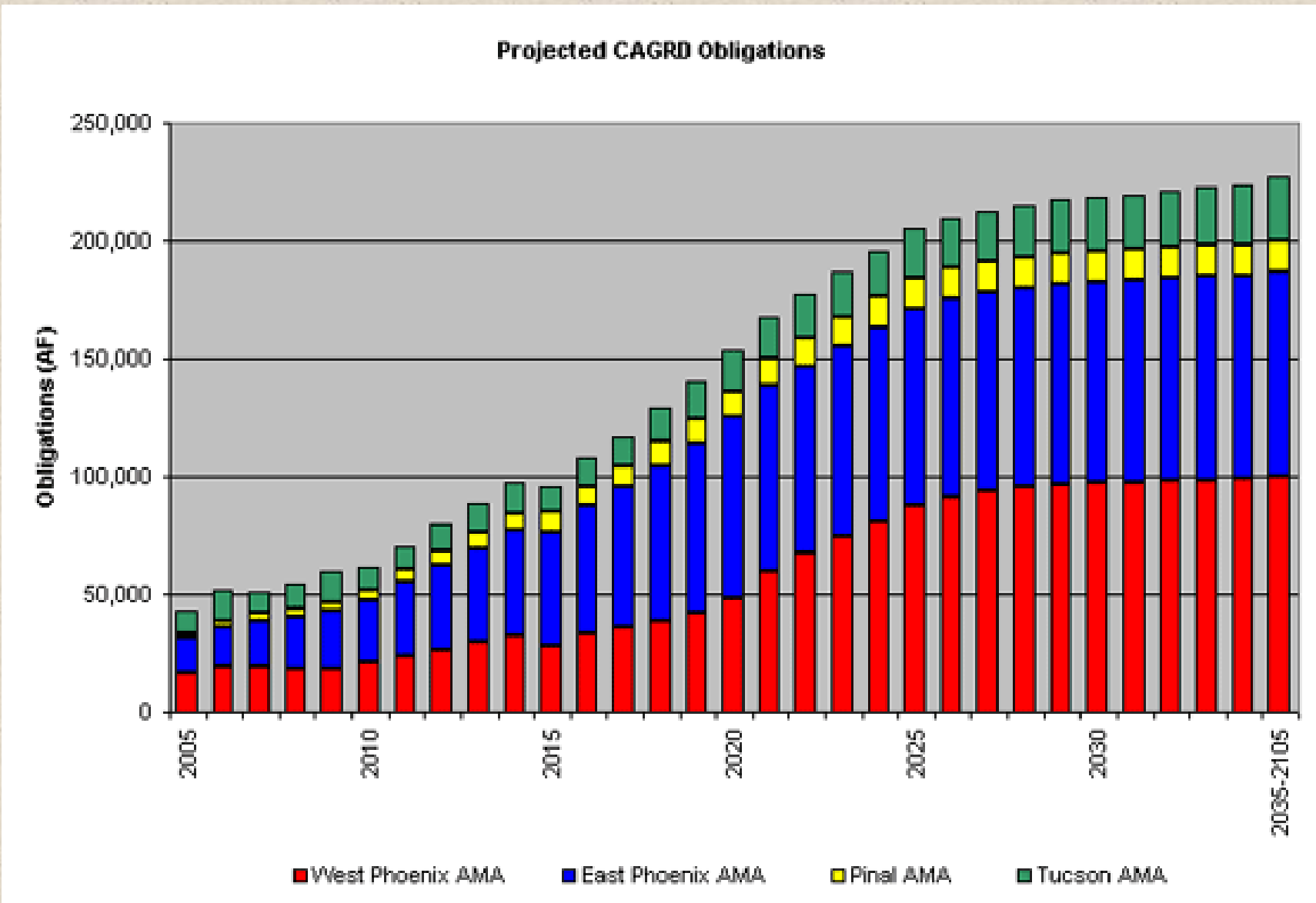


Graphic courtesy of Tucson Water

CAGRD

- Created in 1993 so that there would be a mechanism for compliance with AWS Rules
- Has grown beyond expectations
- 2004 Plan of Operation shows projected Replenishment Obligation for the Tucson AMA of 26,700 af annually by 2035
- Projected replenishment obligation for all three CAGRD counties is about 227,000 af annually
- Will have to obtain water supplies to meet this obligation, which may grow larger.
- Paper on CAGRD available at www.cals.arizona.edu/azwater/

CAGRD


Projected CAGRD Obligations
Obligations (AF)
250,000
200,000
150,000
100,000
50,000
0
2005
2010
2015
2020
2025
2030
2035-2105
West Phoenix AMA
East Phoenix AMA
Pinal AMA
Tucson AMA

Illustrative Scenarios to quantify the population that can be served by known water supplies

- For 2030
- Comparison of population that can be served to PAG population projection of approximately 1.5 million people
- These calculations are meant to be illustrative only. They are based on many assumptions and are not intended to be forecasts or projections.
- See Notes to Worksheet in Report
- Mechanisms to utilize all these supplies are not in place
- **In addition, the worksheet scenarios do not quantify the public investments required to actually utilize the identified water sources. Additional public investments may be required to utilize the resources.**

Scenarios Worksheet from Report

2030 Scenarios Worksheet[*]	M&I + DOI Effluent + Higher GPCD	Half (M&I + DOI) Effluent + Higher GPCD		M&I + DOI Effluent + Lower GPCD	Half (M&I + DOI) Effluent + Lower GPCD
See Notes for Assumptions	Year 2030	Year 2030		Year 2030	Year 2030
PAG Pima County Population Projection[1]	1,496,045	1,496,045		1,496,045	1,496,045
Estimated 2005 Population = 916,026					
Water Supplies/Sources in Acre Feet					
CAGRD with Tucson Water[2]	35,600	35,600		35,600	35,600
Allowable GW[3]	41,100	41,100		41,100	41,100
Exempt Well GW[4]	4,000	4,000		4,000	4,000
Undesignated GW[5]	22,000	22,000		22,000	22,000
Effluent[6]	67,409	33,705		67,409	33,705
Effluent DOI[7]	28,200	14,100		28,200	14,100
Municipal & Industrial CAP[8]	195,810	195,810		195,810	195,810
Total Annual Supply in Acre Feet[9]	394,119	346,315		394,119	346,315
Total Annual Supply in Gallons[10]	128,424,070,269	112,846,926,140		128,424,070,269	112,846,926,140
Assumed Total GPCD[11]	165	165		150	150
Water Per Person per annum[12]	60225	60225		54750	54750
Scenario Population[13]	2,132,405	1,873,756		2,345,645	2,061,131
Scenario Population less Projected Population[14]	636,360	377,711		849,600	565,086
Ratio of Scenario Population to Projected Pop[15]	1.43	1.25		1.57	1.38

Sensitivity Analysis

Table 8: Ratio of Scenario Population to Projected Population	Full Use M&I and DOI Effluent	Half Use M&I and DOI Effluent
Base Scenario with a GPCD of 150 (Taken from Table 7)	1.57	1.38
Base Scenario with a GPCD of 165 (Taken from Table 7)	1.43	1.25
Base Scenario with a GPCD of 175 (All Other Calculations Same as Table 7)	1.34	1.18
10% Increase in PAG 2030 Pop. and a GPCD of 175 (All Other Calculations Same as Table 7)	1.22	1.07
No State Land CAP (14,000 af) with a GPCD of 165 (All Other Calculations Same as Table 7)	1.37	1.20
No State Land CAP (14,000 af) with a GPCD of 150 (All Other Calculations Same as Table 7)	1.51	1.32

Water Supplies Appear of Sufficient Quantity, for a while, but issues remain

- Will there be direct delivery of CAP water?
- Will Arizona's ability to take direct delivery of CAP water be increased due to cost-effective desalination of seawater
- How will effluent be utilized?
  - Costs
  - Perception
- To what extent will there be reliance on the CAGRD
  - Will the CAGRD compete and/or supplement?
- Time horizon for AWS Designations is 100 years
- Other parts of the state dealing with the same issues
- How much will conservation be a factor?

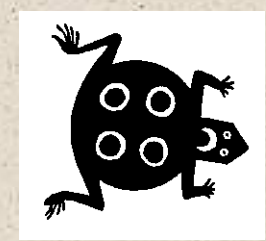
Contributions of the Study

- Explained how water regulations affect the utilization of water supplies, especially groundwater
- Engaged the business community and broader community in discussion of future water resource availability
- Has resulted in some actions and improved understanding of long-range water planning.

Concluding Remarks

- When the well's dry, we know the worth of water. – *Benjamin Franklin, Poor Richard's Almanac, 1746*

•The frog does not drink up the pond in which he lives. – *American Indian Proverb*



Questions/Discussion

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