Arizona Department of Water Resources
Tucson Active Management Area
Draft Fourth Management Plan

Water Resources Research Center

February 2, 2016

Jeff Tannler, Area Director
Statewide Active Management Areas

Groundwater Management Act (1980)

- **Created Arizona Department of Water Resources**
- **Goals of the Groundwater Management Act:**
  - Control severe groundwater depletion
  - Provide the means for allocating Arizona's limited groundwater resources to most effectively meet the state's changing water needs
  - Augment Arizona's groundwater supplies through development of additional water supplies
  - Preserve groundwater for use in drought

Groundwater Management

Active Management Areas (AMAs)

- *Phoenix*
- *Pinal*
- *Prescott*
- *Tucson*
- *Santa Cruz*

Irrigation Non-Expansion Areas (INAs)

- *Harquahala*
- *Douglas*
- *Joseph City*

Active Management Area Goals

Phoenix AMA:

- *To achieve safe-yield by the year 2025*

Pinal AMA:

- *To preserve agricultural economy for as long as feasible, while considering the need to preserve groundwater for future non-irrigation uses*

Prescott AMA:

- *To achieve safe-yield by the year 2025*

Tucson AMA:

- *To achieve safe-yield by the year 2025*

Santa Cruz AMA:

- *To maintain a safe-yield condition in the active management area and to prevent local water tables from experiencing long term declines*

Management Plans - AMAs

- **Each AMA subject to series of five plans up to year 2025**
- **Conservation requirements for Agricultural, Municipal, Industrial Sectors**
  - **Ag** – base program, BMP program
  - **Muni** – GPCD program, Non Per Capita program
  - **Industrial** – requirements for each type of use
- **Management plans are a tool toward achieving AMA Management Goal**

Management Plan Approach

- **1MP** – base programs; prescriptive conservation requirements
- **2MP** - added BMP programs for muni, ag; more restrictive conservation requirements
- **3MP** – refinement of conservation requirements and BMP programs, introduction of BMP program for dairies
- **4MP** – no substantial changes to conservation requirements; identify impediments to reaching management goal; identify possible solutions

Information Sources Reviewed

- Designations of Assured Water Supply
- Annual Water Withdrawal & Use Reports
- Tucson AMA Groundwater Flow Model
- Demand and Supply Assessment, Tucson AMA
- Residential Demand Study, Montgomery & Associates
- Pima Assoc. of Gov't Population Projections by Traffic Analysis Zone
- Central AZ Assoc. of Gov't Population Projections by Traffic Analysis Zone
- AZ Dept. of Administration Population Projections
- CAGRD Plan of Operation
- Pima County Effluent Generation and Utilization Reports
- US Bureau of Reclamation Colorado River Basin Study
- US EPA – "WaterSense" plumbing fixture flow rate information (http://www.epa.gov/watersense/products/index.html)

Tucson AMA Draft 4MP Chapters

- Chapter 1 – INTRODUCTION
- Chapter 2 – HYDROLOGY
- Chapter 3 – WATER DEMANDS & SUPPLY
- Chapter 4 – AGRICULTURAL CONSERVATION PROGRAM
- Chapter 5 – MUNICIPAL CONSERVATION PROGRAM
- Chapter 6 – INDUSTRIAL CONSERVATION PROGRAM
- Chapter 7 – WATER QUALITY
- Chapter 8 – AUGMENTATION & RECHARGE
- Chapter 9 – WATER MANAGEMENT ASSISTANCE
- Chapter 10 – IMPLEMENTATION OF 4MP
- Chapter 11 – PROJECTED WATER BUDGET
- Chapter 12 – WATER MANAGEMENT STRATEGY

Tucson AMA Draft 4MP
Chapter 1: INTRODUCTION

- AMA Challenges:
  - Maintaining the safe-yield goal
  - Utilization/availability of CAP supplies
  - Increased utilization of reclaimed water
  - Physical availability of GW within the AMA
  - Limitations on management plan authority

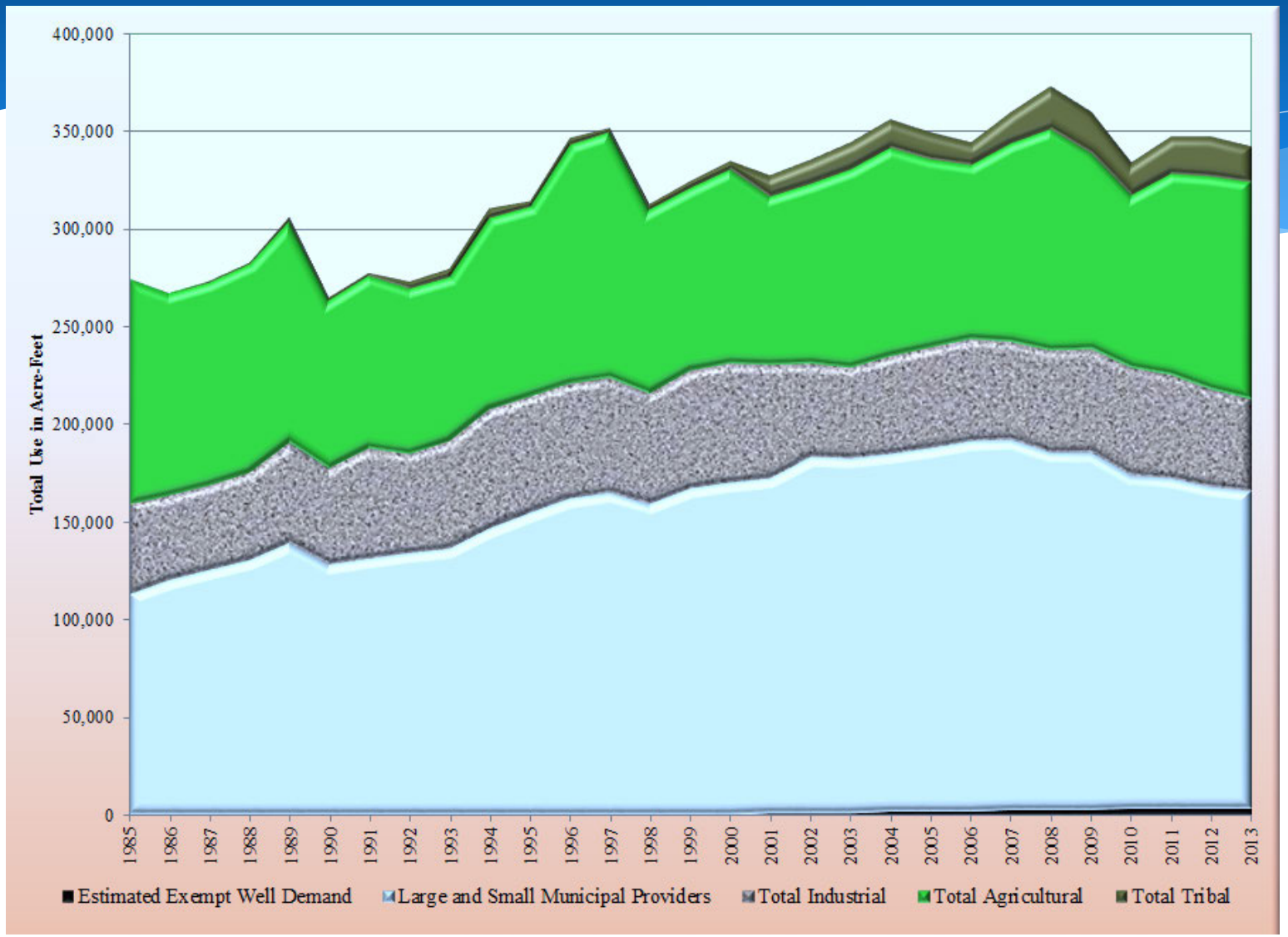
Tucson AMA Draft 4MP Chapter 2: HYDROLOGY

- Historically fluctuating annual precipitation amounts
- Prolonged drought since 1995 (officially since 1999)
- Most natural recharge enters along the tributaries and is highly seasonal and sporadic
- Reclaimed water discharge decreasing with decreasing GPCD
- Agricultural incidental recharge is declining with increased efficiency
- Increased artificial recharge and decreased pumping resulting in some areas of water level stabilization or rise, but LTS credits belong to storers
- Some areas of the AMA have experienced subsidence

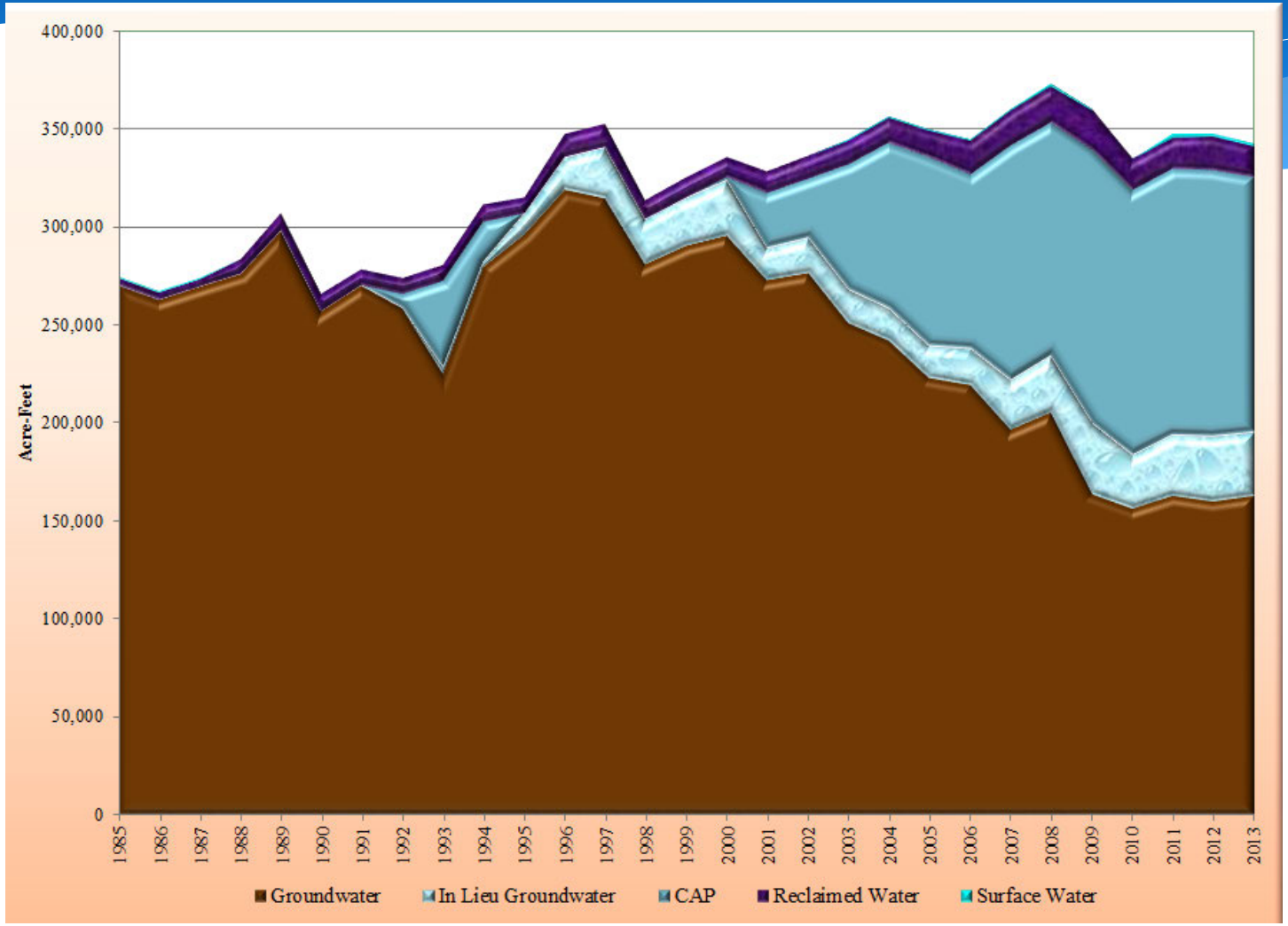
Tucson AMA Draft 4MP
Chapter 3: WATER DEMAND & SUPPLY

- Approx. 40% reduction in municipal GW demand 1985-2014
- Overall AMA groundwater demand decrease:
  - 1985 270,381 acre-feet
  - 2014 162,522 acre-feet
- AMA population estimates between Censuses are generally over- or under-estimated; Census recalibrates the population
- Aggregate large provider gallons per capita per day (GPCD) in the census years:
  - 1990 = 175 GPCD
  - 2000 = 182 GPCD
  - 2010 = 159 GPCD

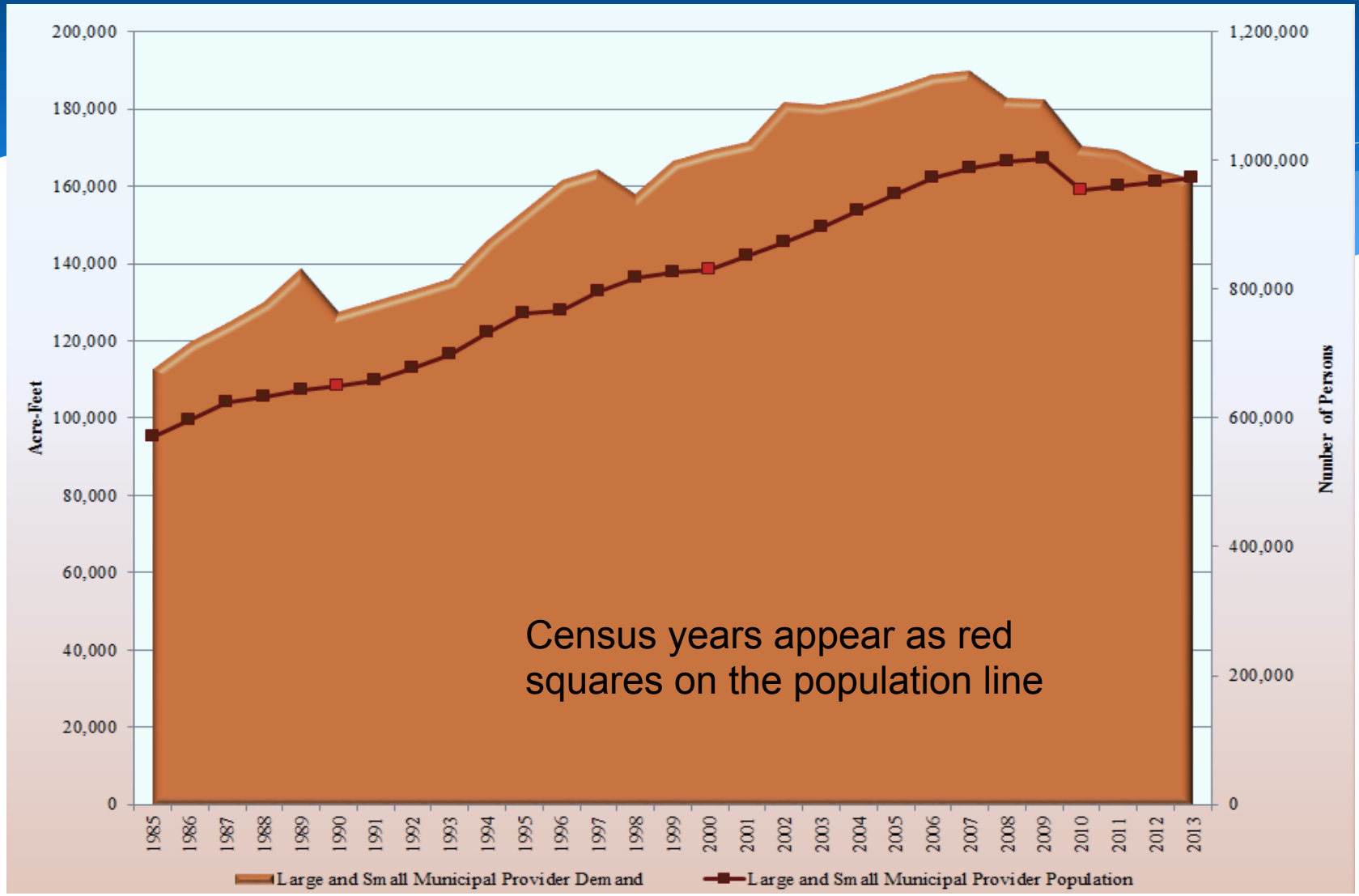
Tucson AMA Draft 4MP
Historical Water Demand by Sector



Tucson AMA Draft 4MP Historical Water Supplies Used



Tucson AMA Draft 4MP
Historical Municipal Demand & Total AMA Population



Tucson AMA Draft 4mp
Chapter 3: WATER DEMAND & SUPPLY

- Industrial Sector
  - Overall sector use is less than 30% of amount allotted
  - 2013 industrial demand was about 48,000 acre-feet
- Agricultural Sector
  - About 200 IGFRs >10 acres remaining
  - About 35,000 irrigation acres remaining with about 155,000 acre-feet of allotment
  - 2013 agricultural demand was about 111,000 acre-feet

Tucson AMA Draft 4MP
Chapter 3: WATER DEMAND & SUPPLY

- 23 IGFRs in Tucson AMA have been extinguished pursuant to the AWS Rules:
  - 1,270 acres out of production
  - 36,915 acre-feet of extinguishment credits
  - About 1,149 acre-feet of pledged extinguishment credits
  - Remaining 35,766 acre-feet of extinguishment credits remain unpledged

Tucson AMA Draft 4MP
Chapter 4: AGRICULTURAL

- **Conservation Program mostly unchanged from Third Management Plan (3MP)**
  - Irrigation district lost and unaccounted for requirements
- **Agricultural sector contribution to safe-yield**
  - prohibition on new acres coming into production
  - improved on-farm irrigation practices
  - reduction in irrigation acres due to retirement or development
  - some renewable supply use
- **No farms in the Best Management Practices (BMP) program in the Tucson AMA**

Agricultural Base Conservation Program

- **Annual allotment based on historical irrigated acres, water duty**
- **Flexibility Account**
  - Allows farmers to "bank" credits
  - Use less than allotment, earn credits for future use
- **Credits may be sold during 2nd year after earning**
- **Out of compliance when account is < -50% of allotment**
- **Currently, over 13 million acre-feet worth of flex credits registered.**

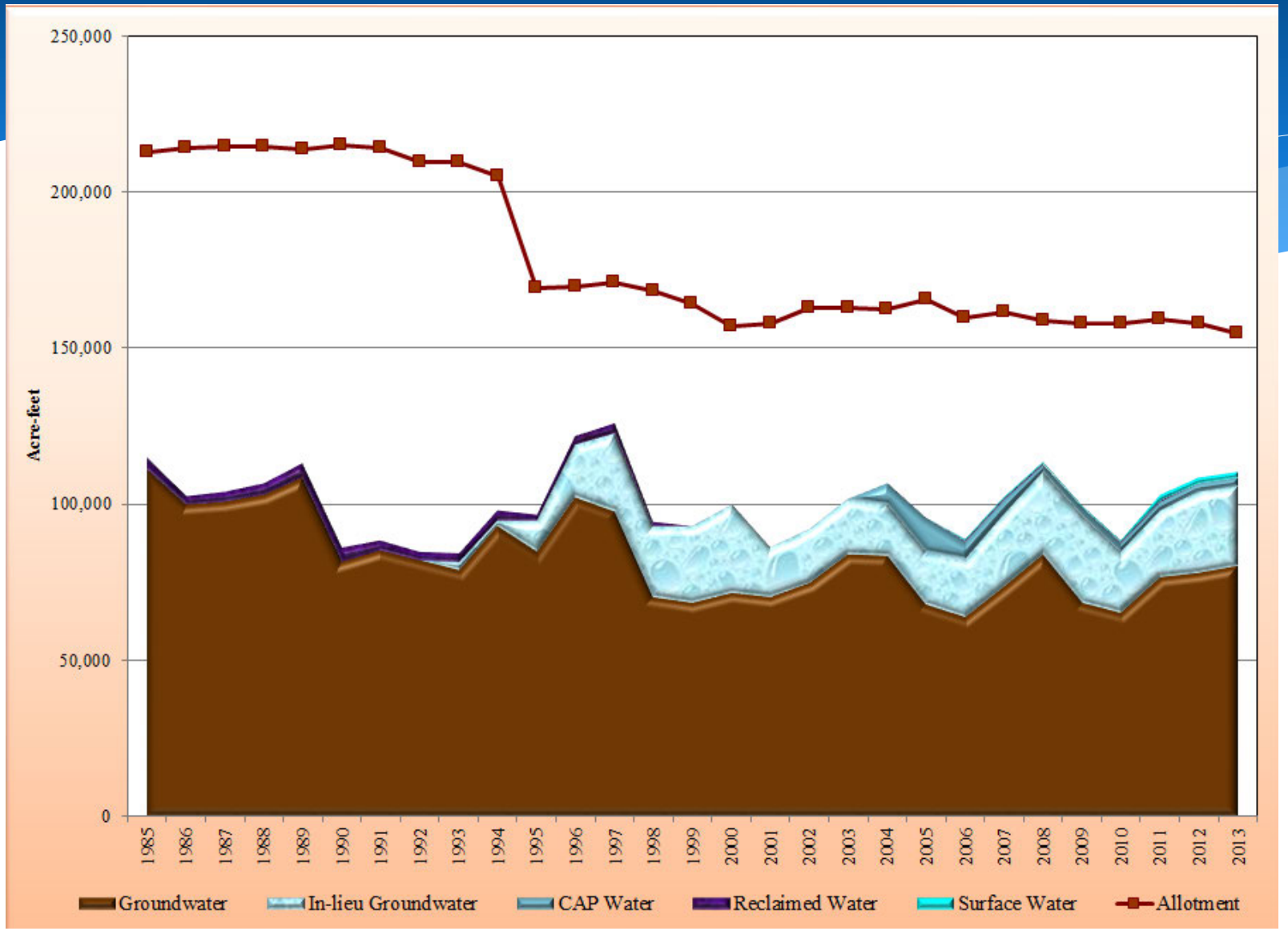
Agricultural Base Conservation Program

- **Assigned Irrigation Efficiency**
- **Efficiency of water application to crops**
- **Assigned Irrigation Efficiency has changed with time:**
  - First Management Period: 50%-70%
  - Second Management Period: 50%-85%
    - Several intermediate water duties
  - Third Management Period: 80%
  - Fourth Management Period: 80%

Agricultural Best Management Practices (BMP) Conservation Program

- **No allotment, no water duty, no flex account**
- **Measuring, annual reporting still required**
- **Different categories of BMPs:**
  - Water Conveyance Systems
  - Farm Irrigation Systems
  - Irrigation Water Management
  - Agronomic Management
- **Water savings at least equivalent to the Base Program**

Tucson AMA Draft 4MP
HISTORICAL AGRICULTURAL SECTOR DEMAND & SUPPLY

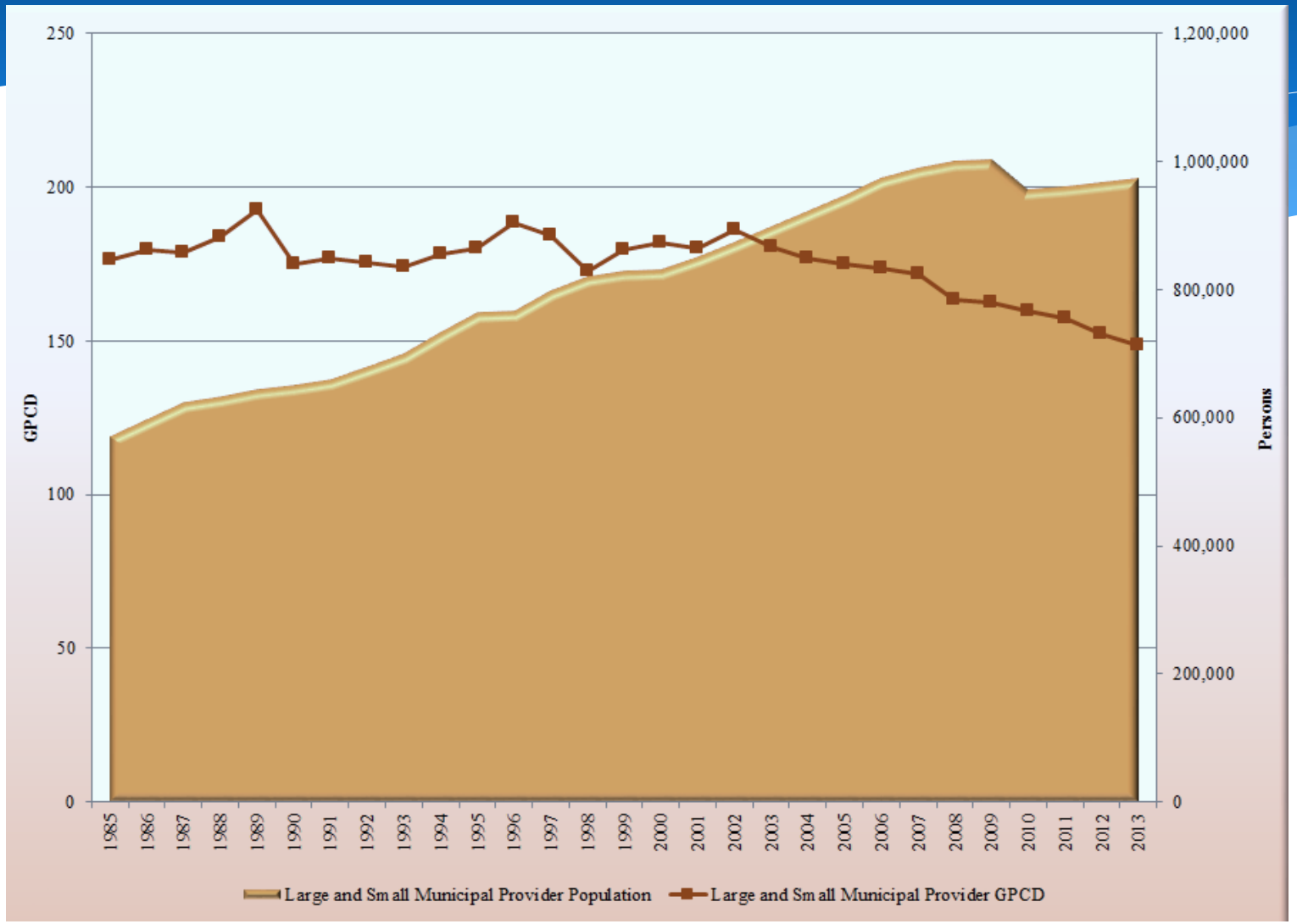


Tucson AMA Draft 4MP
Chapter 5: MUNICIPAL

- Muni program historical objectives: gradually reduce GPCD, encourage conservation, maximize efficient use of all water supplies
- Tucson AMA annual population growth averaged about 2.0% from 1985-2013
- As AMA population has increased, AMA overall average GPCD has decreased (assumed GPCD for exempt well population)

Tucson AMA Draft 4MP

HISTORICAL MUNICIPAL GPCD & POPULATION

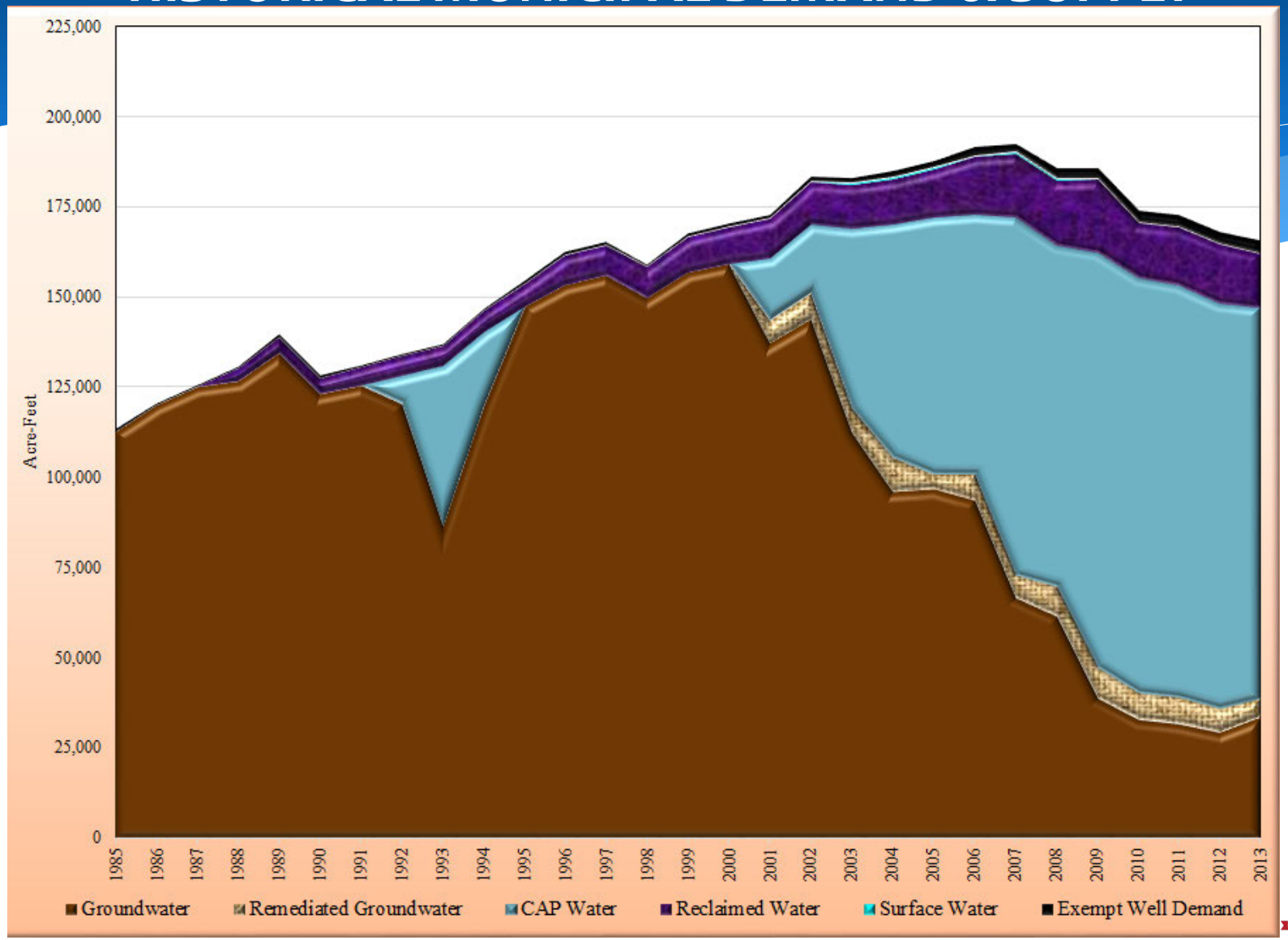


Tucson AMA Draft 4MP Chapter 5: MUNICIPAL

- **Continued efforts are needed to maintain safe-yield:**
  - Additional water conservation potential
  - Drought and shortage planning and strategy development
  - Increased use of reclaimed water
- **4MP Large Provider conservation plans include Total GPCD and the Non Per Capita Conservation Program (NPCCP)**
- **11 municipal providers in Tucson AMA with Designation of Assured Water Supply**

Tucson AMA Draft 4MP

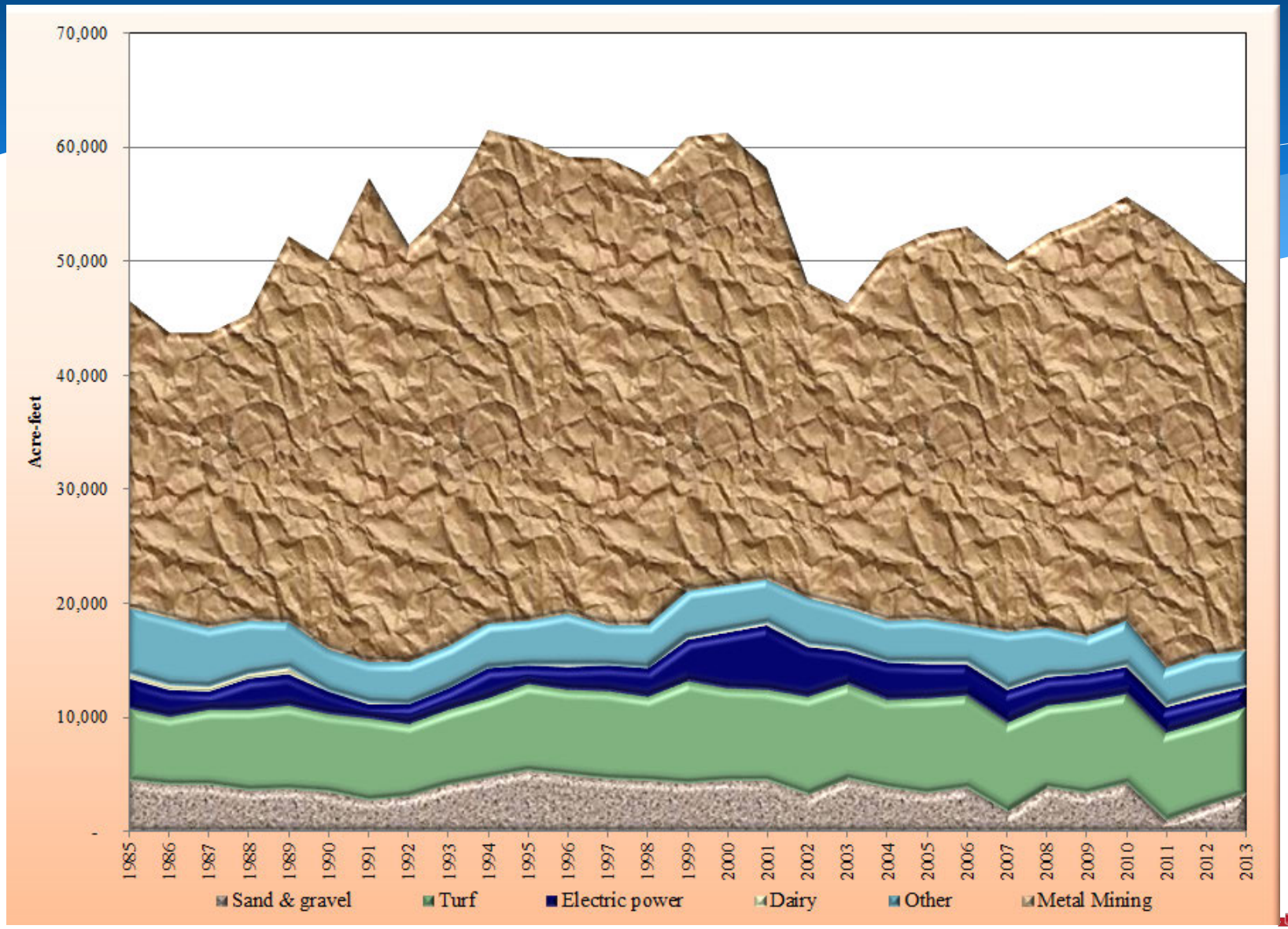
HISTORICAL MUNICIPAL DEMAND & SUPPLY



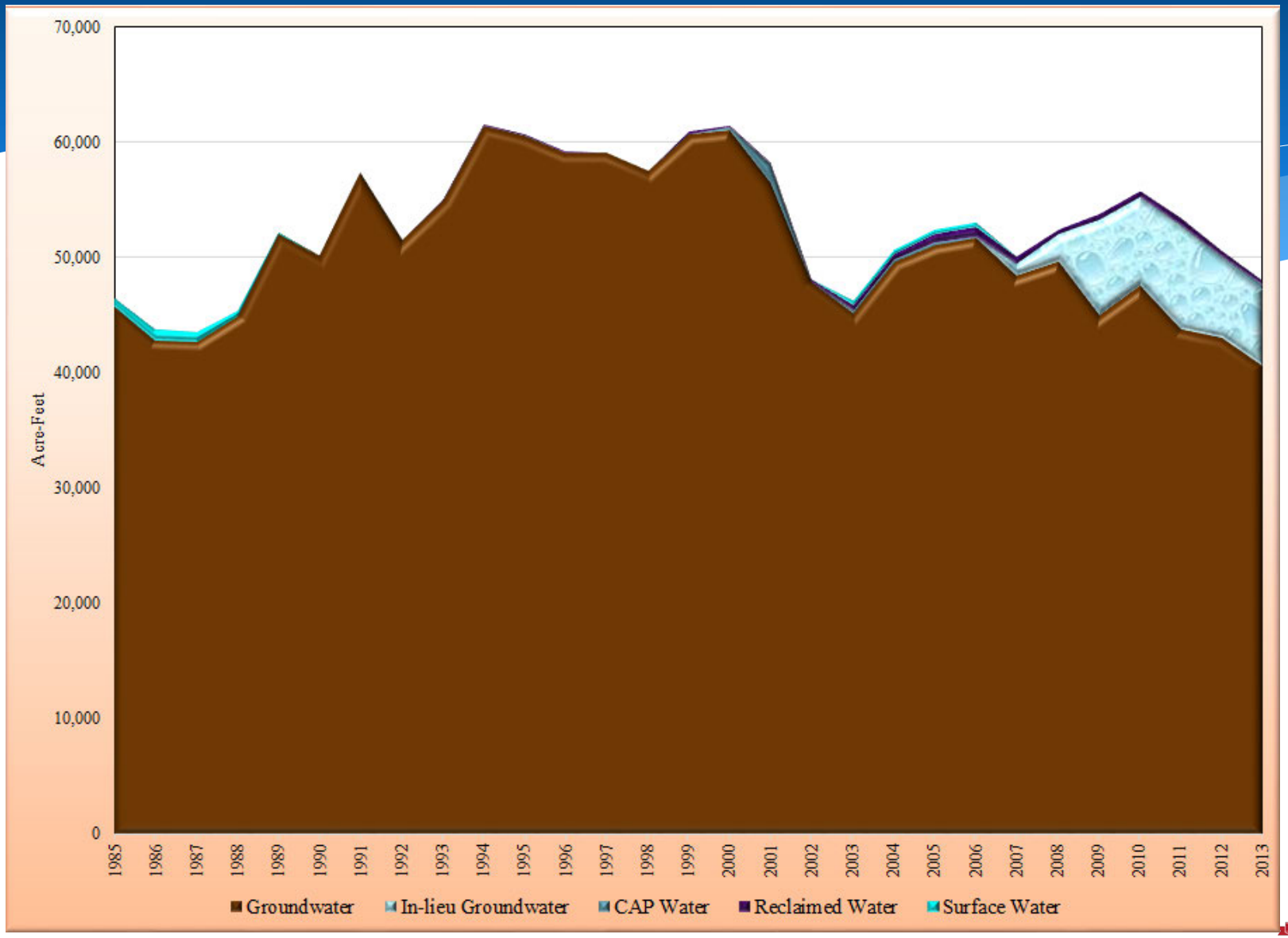
Tucson AMA Draft 4MP
Chapter 6: INDUSTRIAL

- **Program mostly unchanged from 3MP**
- **Historical objectives of industrial program:**
  - Move to highest level of water use efficiency economically attainable using the latest conservation technology
  - Efficient use of groundwater
  - Increased use of renewable supplies
- **Largest industrial use is mining; second largest sub-sector is turf**

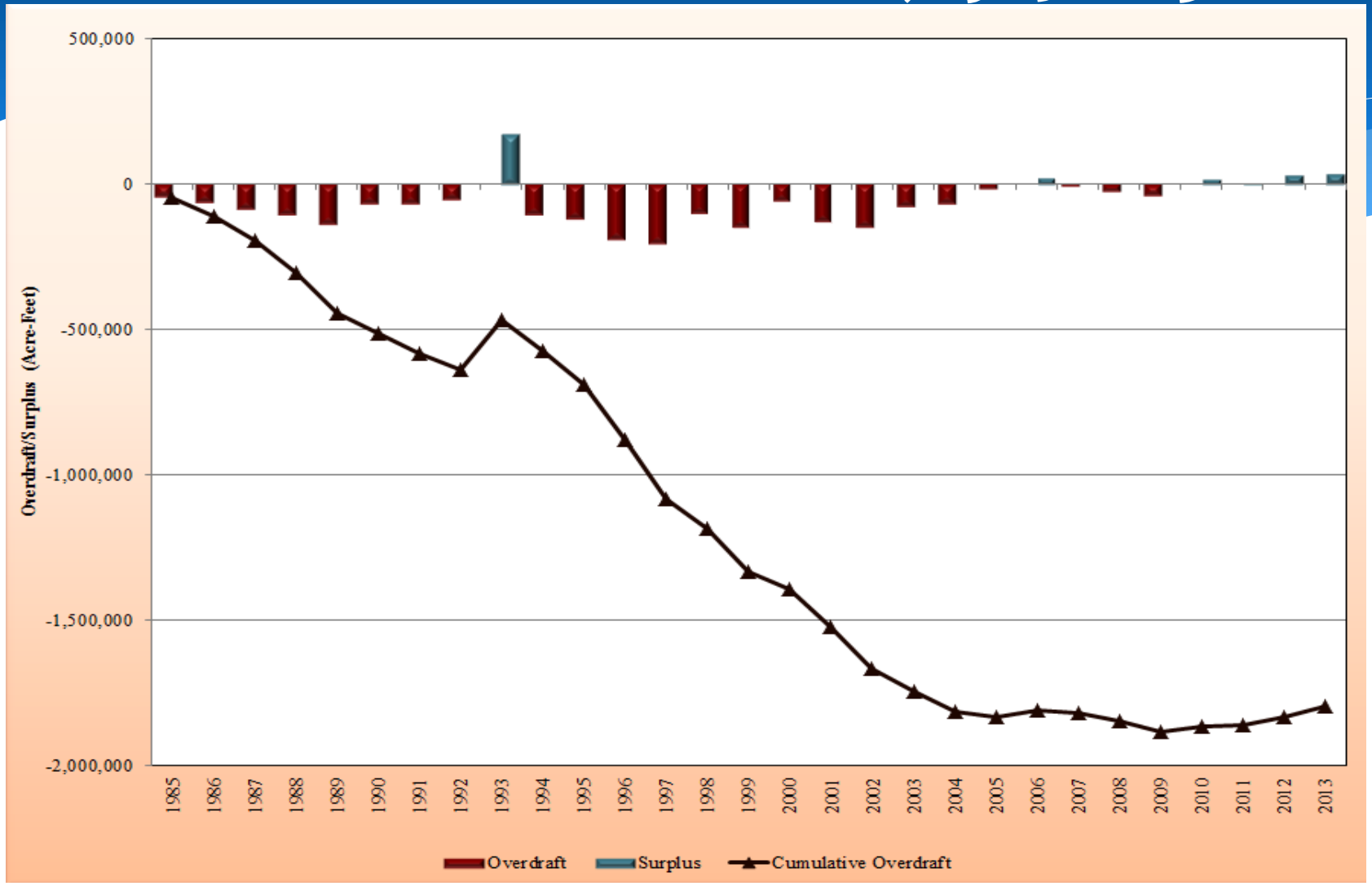
Tucson AMA Draft 4MP
HISTORICAL INDUSTRIAL DEMAND BY SUB-SECTOR



Tucson AMA Draft 4MP
HISTORICAL INDUSTRIAL DEMAND BY SOURCE OF SUPPLY



Tucson AMA Draft 4MP
HISTORICAL OVERDRAFT, 1985-2013



Tucson AMA Draft 4MP
Chapter 7: WATER QUALITY

- Seven (7) Water Quality Assurance Revolving Fund (WQARF) sites, one US EPA National Priorities List (NPL) site, and one Department of Defense (DOD) site in the TAMA
- TAMA groundwater withdrawals from wells within these identified areas have been discontinued or are in the process of being cleaned up through remedial activities.
- During the 4th management period, ADWR will continue to coordinate with ADEQ to monitor water levels, land subsidence, and other changes at remedial project sites

Tucson AMA Draft 4MP
Chapter 8: AUGMENTATION & RECHARGE

- **Program Objectives**
  - Encourage storage of renewable water supplies to support safe-yield
  - Increased use of renewable supplies and protection from renewable supply shortages
  - Utilize increased awareness and improved understanding of local conditions in water management approaches
- **Total water stored through 2013 = 2,847,316 acre-feet**
- **Total water recovered through 2013 = 1,221,038 acre-feet**
- **Storage concentrated in Avra Valley sub-basin**
- **Historical recovery more concentrated in Upper Santa Cruz sub-basin, (2013 recovery strongly concentrated in the Avra Valley sub-basin)**

Tucson AMA Draft 4MP
SUMMARY OF WATER STORAGE AND RECOVERY, 1986 - 2013

	Sub-basin	Avra Valley[1]	Upper Santa Cruz	AMA TOTAL
Delivered to be Stored through 2013	USF CAP	1,669,023	305,302	1,974,325
	USF Reclaimed	214,959	214,108	429,067
	USF Surface Water	957	0	957
	USF TOTAL	***1,884,939***	***519,410***	***2,404,349***
	GSF (CAP) TOTAL	***401,889***	***41,078***	***442,967***
	TOTAL DELIVERED TO BE STORED	**2,286,828**	**560,488**	**2,847,316**
Recovered through 2013	CAP	584,820	506,356	1,091,176
	Reclaimed	0	128,992	128,992
	Surface Water	870	0	870
	TOTAL RECOVERED	**585,690**	**635,348**	**1,221,038**
Recovered Water in 2013	CAP	67,061	41,942	109,003
	Reclaimed	0	8,018	8,018
	Surface Water	0	-	-
	Total	67,061	49,960	117,021
	Within 1 mile of any storage location	**34,949**	**5,814**	**40,763**
Recovered Water in 2005	CAP	24,617	46,344	70,960
	Reclaimed	-	5,358	5,358
	Surface Water	149	-	149
	Total	24,766	51,702	76,467
	Within 1 mile of any storage location	**7,372**	**4,655**	**12,027**

[1] Includes recharge projects that span both sub-basins.

Tucson AMA Draft 4MP
Chapter 8: AUGMENTATION & RECHARGE

- **Fourteen active USFs in the Tucson AMA as of 2013**
- **Seven active GSFs in the Tucson AMA as of 2013**
- **Total Long-Term Storage (LTS) credits as of 2013 more than one million acre-feet (CAP and reclaimed water)**
- **4th management period augmentation/recharge opportunities:**
  - Encourage replacement of groundwater use with renewable supplies
  - Improve groundwater conditions in areas experiencing greatest declines
  - Develop ideas for local aquifer management through storage/recovery
  - Maximize storage of CAP

Tucson AMA Draft 4MP
Chapter 9: WATER MANAGEMENT ASSISTANCE

- Purpose of Water Management Assistance Program (WMAP): Provide financial and technical resources to help water users develop and implement conservation programs, facilitate augmentation and renewable supply utilization, and collect hydrologic information
- Total monies collected since 1997 = $1,888,705
- Total collected in 2014 = $82,342
- Several projects funded during the third management period focusing on conservation, education, monitoring and researching conservation potential

Tucson AMA Draft 4MP
Chapter 10: IMPLEMENTATION

- Description of ADWR's process for implementing, determining compliance with, and enforcing the 4MP regulatory requirements.
- No substantive changes were made to Chapter 10

Tucson AMA Draft 4MP
Chapter 11: PROJECTED BUDGET

- **Two projected water supply/demand scenarios are included in Ch. 11:**
  - **Normal CAP Delivery Scenario**
    - Uses the May 22, 2015 CAP Delivery Schedule
  - **Tier 1 Shortage Scenario**
    - Assumes Tier 1 (320,000 af) CAP shortage each year from 2015 – 2040
- **In taking this approach, ADWR is not projecting nor predicting that there will be a Tier 1 shortage every year in the future**
- **The Tier 1 Shortage scenario is included to give an idea of the potential impact of an extended shortage on groundwater overdraft**

Tucson AMA Draft 4MP
Chapter 11: PROJECTED BUDGET

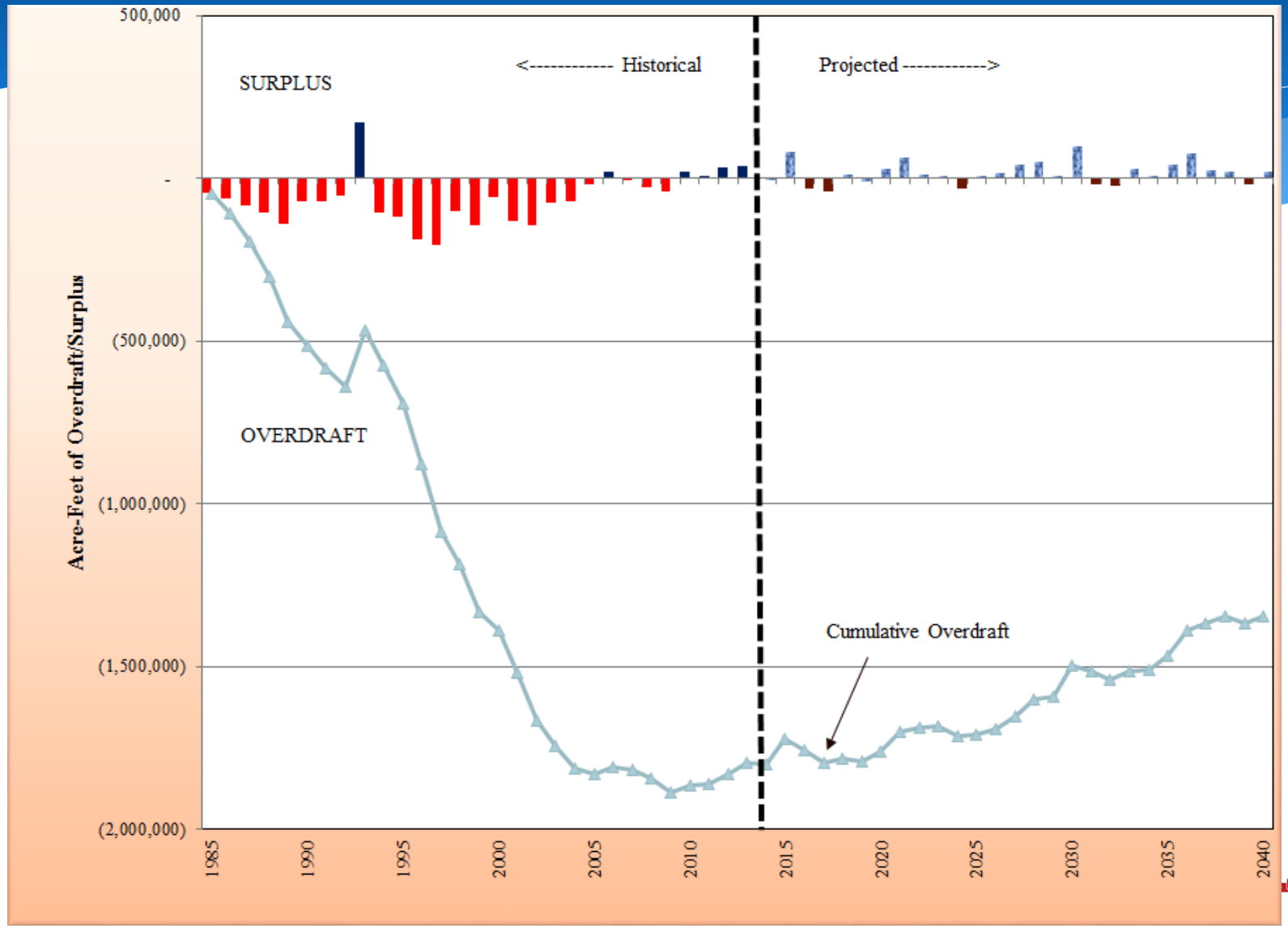
- **Demand/supply utilization assumptions common to both scenarios:**
  - Used projections by TAZ for Pinal and Pima Counties and ADOA projections for Santa Cruz County
  - Each large provider at their own historical GPCD trend
  - Most muni providers who can store/use CAP were assumed to do so
  - Ag and industrial projections adjusted based on longer historical trend (1985-2013)
  - Consulted with some sector representatives individually
- **Projection period from 2014 - 2040**

Tucson AMA Draft 4MP
Chapter 11: PROJECTED BUDGET

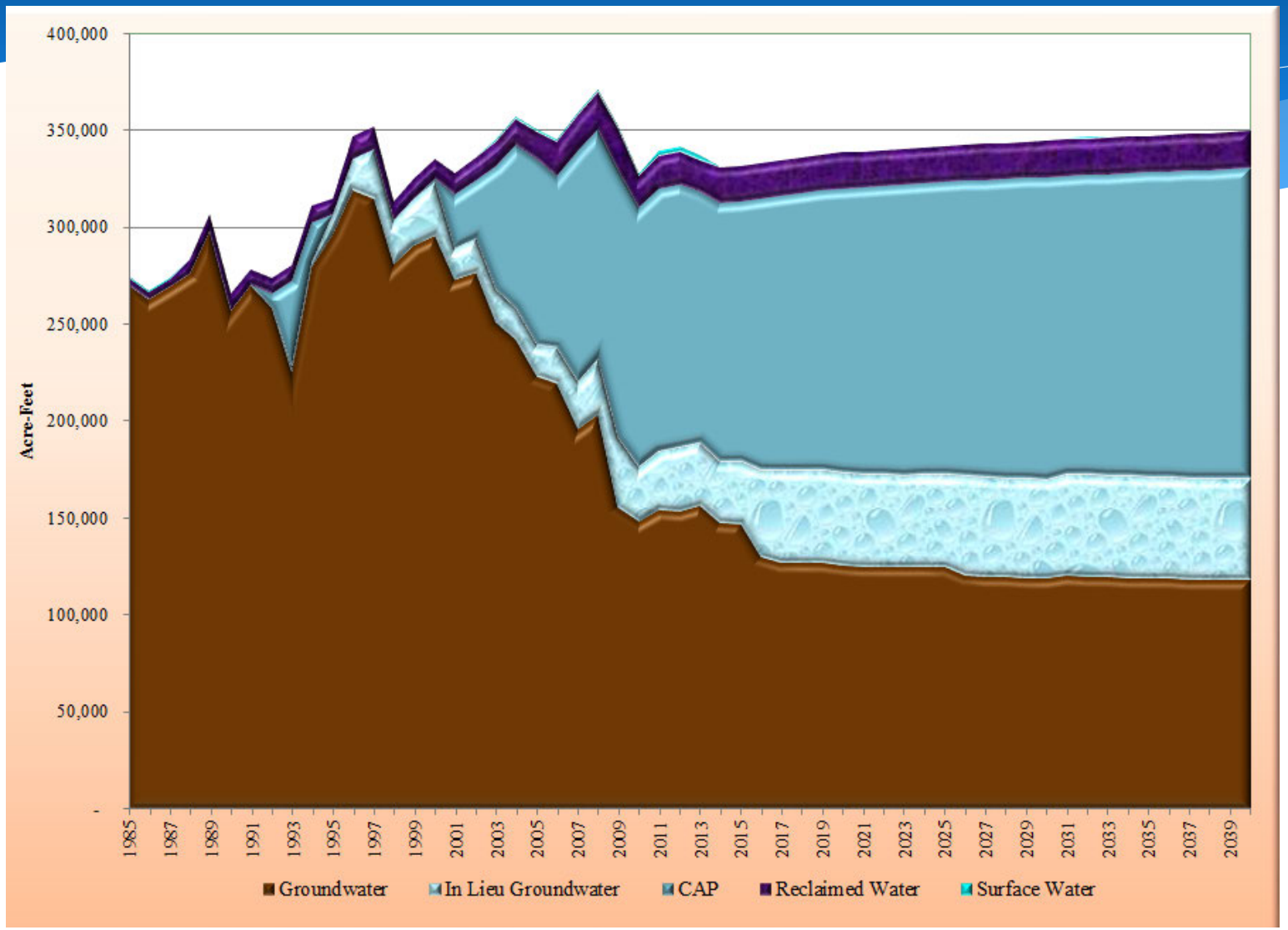
- **Natural system components**
  - Streambed recharge based on a portion of the historical record to mimic annual fluctuation in flood recharge
  - Incidental recharge is lagged 20 years
  - Groundwater inflow and outflow based on relationship with incidental and stream channel recharge
- **Any unused CAP is assumed to be stored, mostly at USFs**
- **Reclaimed water (effluent) storage increases**

Tucson AMA Draft 4MP
RESULTS OF FUTURE PROJECTION

Normal CAP delivery scenario



Tucson AMA Draft 4MP
PROJECTED SUPPLIES
Normal CAP delivery scenario



Tucson AMA Draft 4MP
Chapter 12: WATER MANAGEMENT STRATEGY

- **Challenges and Opportunities:**
  - Allowable Pumping
  - Location of underground storage vs. location of recovery
  - Groundwater Savings Facility capacity not being used
  - Limitations on Availability of New Recharge Sites
  - Water Quality Concerns
  - Conservation Alone Insufficient to Maintain Safe-yield
  - Reclaimed Re-Use
  - Susceptibility of CAP Supplies to Shortage
  - Infrastructure
  - Water Distribution and Wheeling Agreements
  - Limitation on Renewable Supplies
  - Jurisdictional and Water Policy Considerations

Tucson AMA Draft 4MP
Chapter 12: WATER MANAGEMENT STRATEGY

- **Possible Approaches:**
  - Look for opportunities to increase use of reclaimed water and CAP water and achieve additional demand reductions through conservation / increased water use efficiency in all three sectors
  - Work with local water users to increase augmentation, and transition from groundwater to renewable supply use

Review of Tucson AMA Draft 4MP

- Next Steps:
  - Written comments being reviewed
  - GUAC Recommendations
  - Promulgation process

Tucson AMA Draft 4MP

Questions?

jmtannler@azwater.gov