OVERVIEW OF THE DRAFT FOURTH MANAGEMENT PLAN FOR THE TUCSON AMA

Tucson Groundwater Users Advisory Council

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

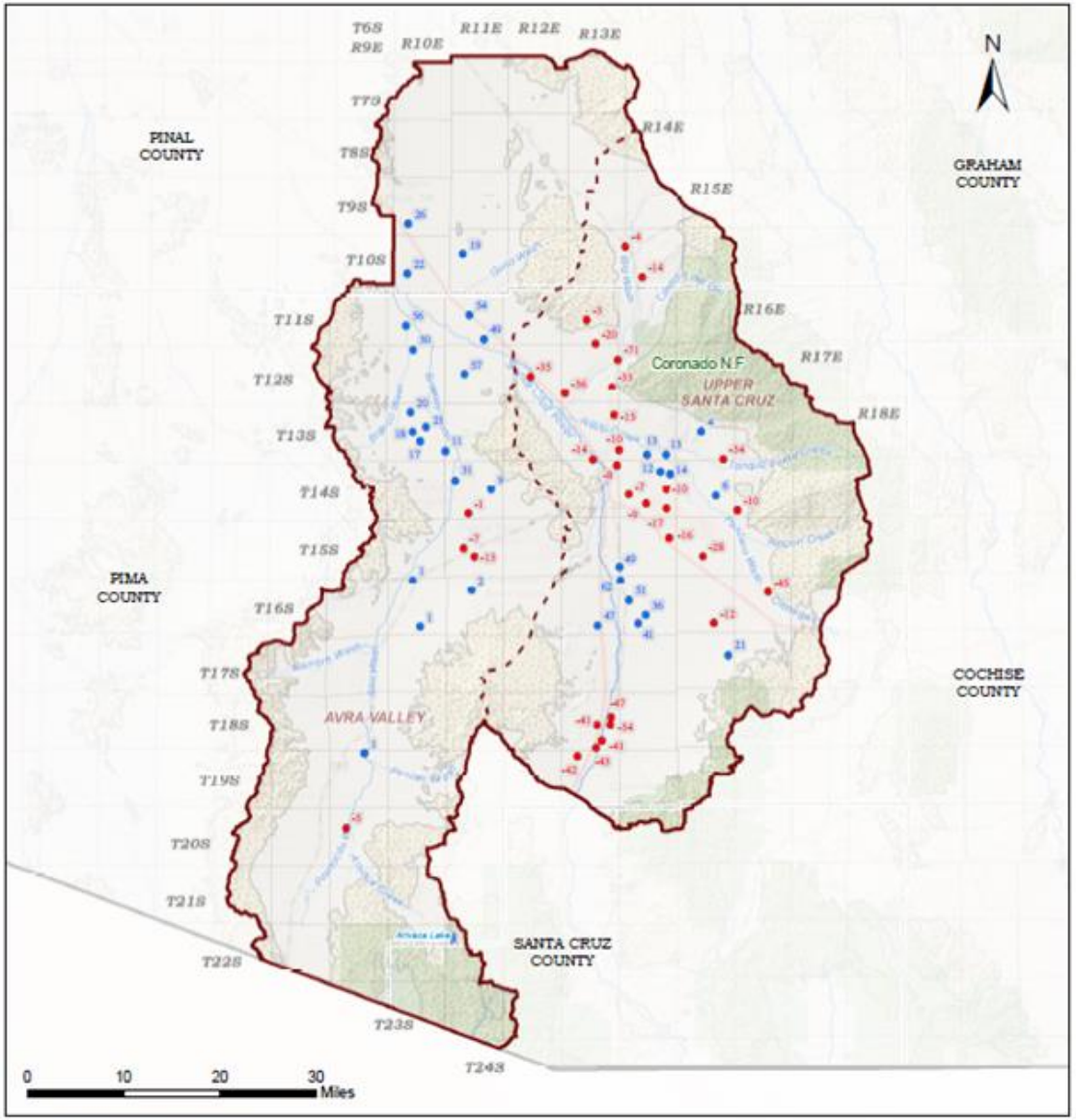
- Chapter 1 – INTRODUCTION
- Chapter 2 – HYDROLOGY
- Chapter 3 – WATER DEMANDS & SUPPLY
- Chapter 4 – AGRICULTURAL CONSERVATION PROGRAM
- Chapter 5 – MUNICIPAL CONSERVATION PROGRAM
- Chapter 6 – INDUSTRIAL CONSERVATION PROGRAM
- Chapter 7 – WATER QUALITY
- Chapter 8 – AUGMENTATION & RECHARGE
- Chapter 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 experiencing subsidence



Water Level Change
2000-2010

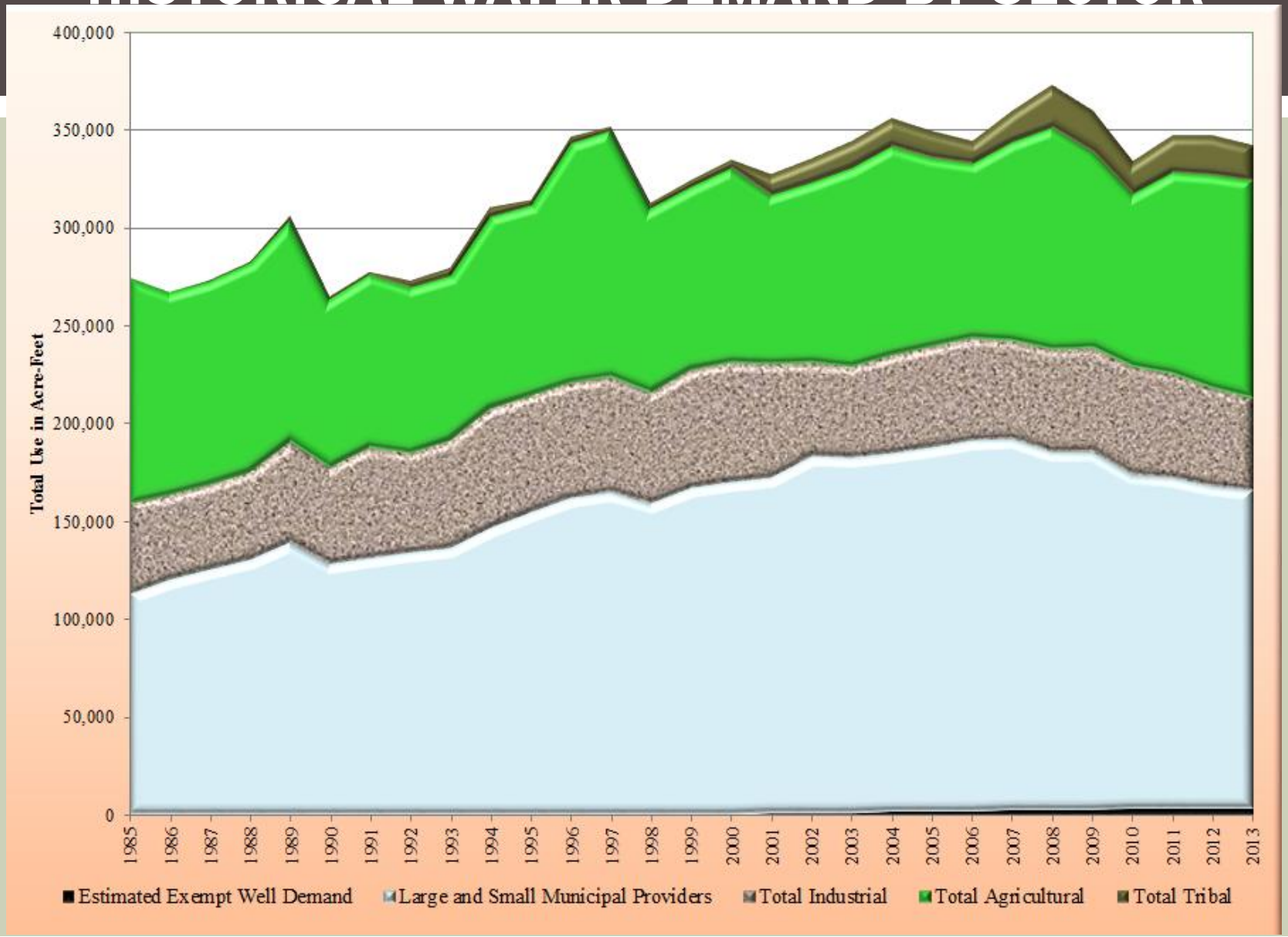
Tucson AMA

- Tucson AMA
- Sub-basin
- Hardrock
- County
- Lake
- Stream
- Major Road
- Interstate Hwy
- Positive WL Change
- Negative WL Change

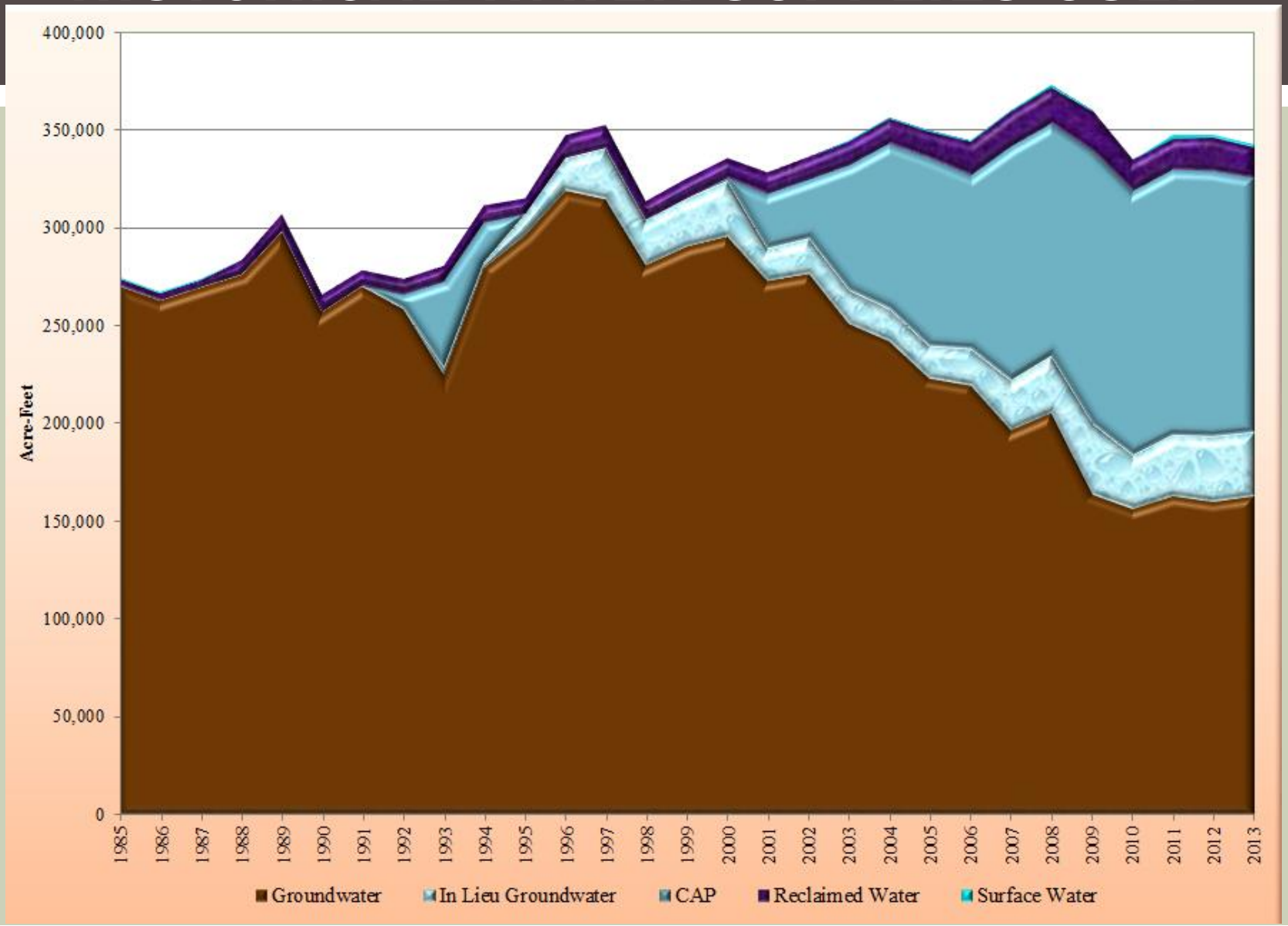
TUCSON AMA DRAFT 4MP
CHAPTER 3: WATER DEMAND & SUPPLY

- Municipal groundwater demand in 2013 about one-third the 1985 volume
- 2007-2013 municipal demand has been lower than from 1995-2006
- 2013 municipal demand was 161,916 acre-feet
- Overall AMA groundwater demand decreased from a high of 318,857 acre-feet in 1996 to 163,410 acre-feet in 2013
- AMA population estimates between Censuses are generally over- or under-estimated; Census recalibrates the population
- Looking at the aggregate large provider gallons per capita per day (GPCD) in the Census years:
  - 1990 = 175 GPCD
  - 2000 = 182 GPCD
  - 2010 = 159 GPCD

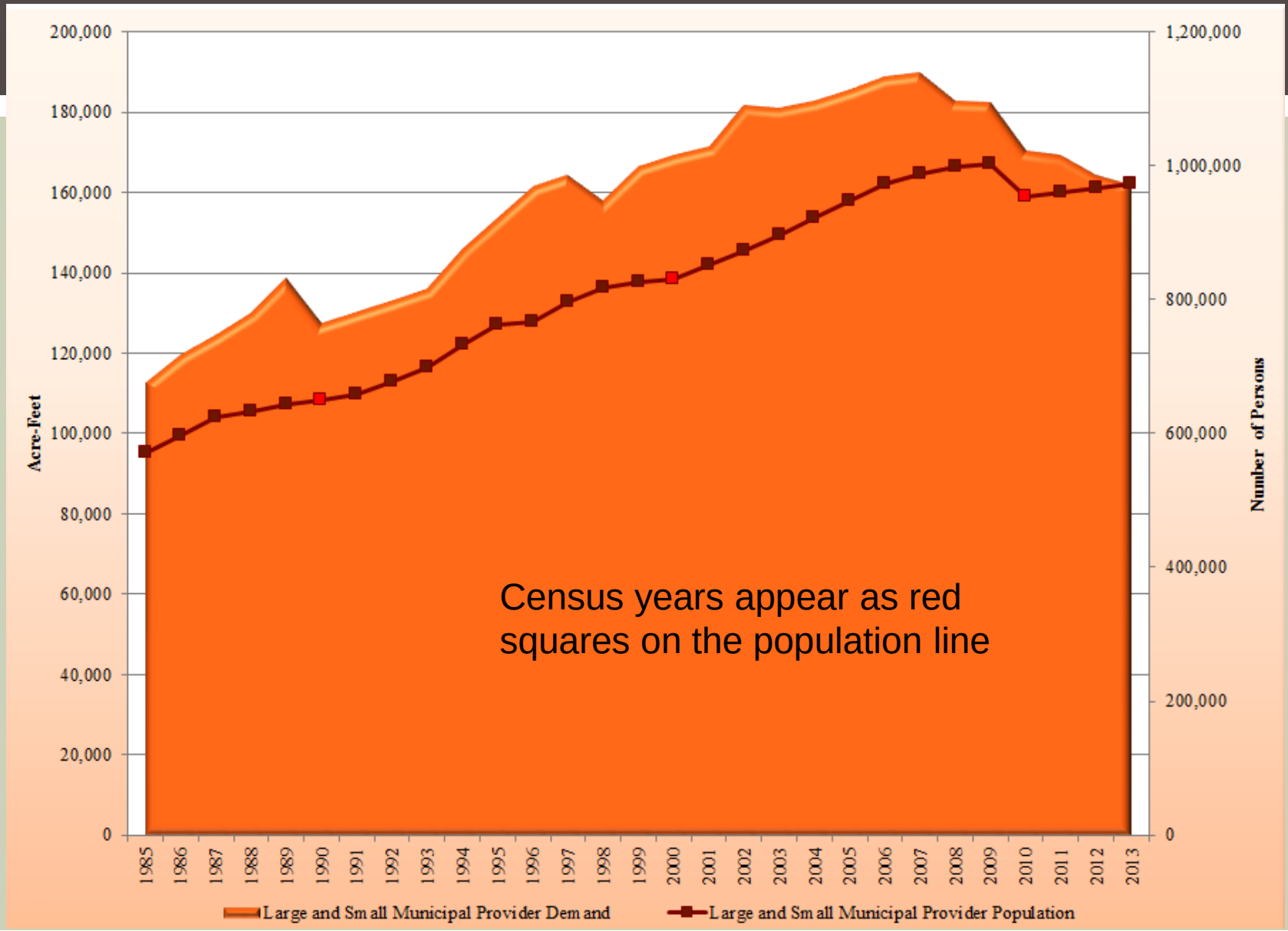
TUCSON AMA DRAFT 4MP HISTORICAL WATER DEMAND BY SECTOR



TUCSON AMA DRAFT 4MP HISTORICAL WATER SUPPLIES USED



TUCSON AMA DRAFT 4MP
HISTORICAL MUNICIPAL DEMAND & TOTAL AMA POPULATION



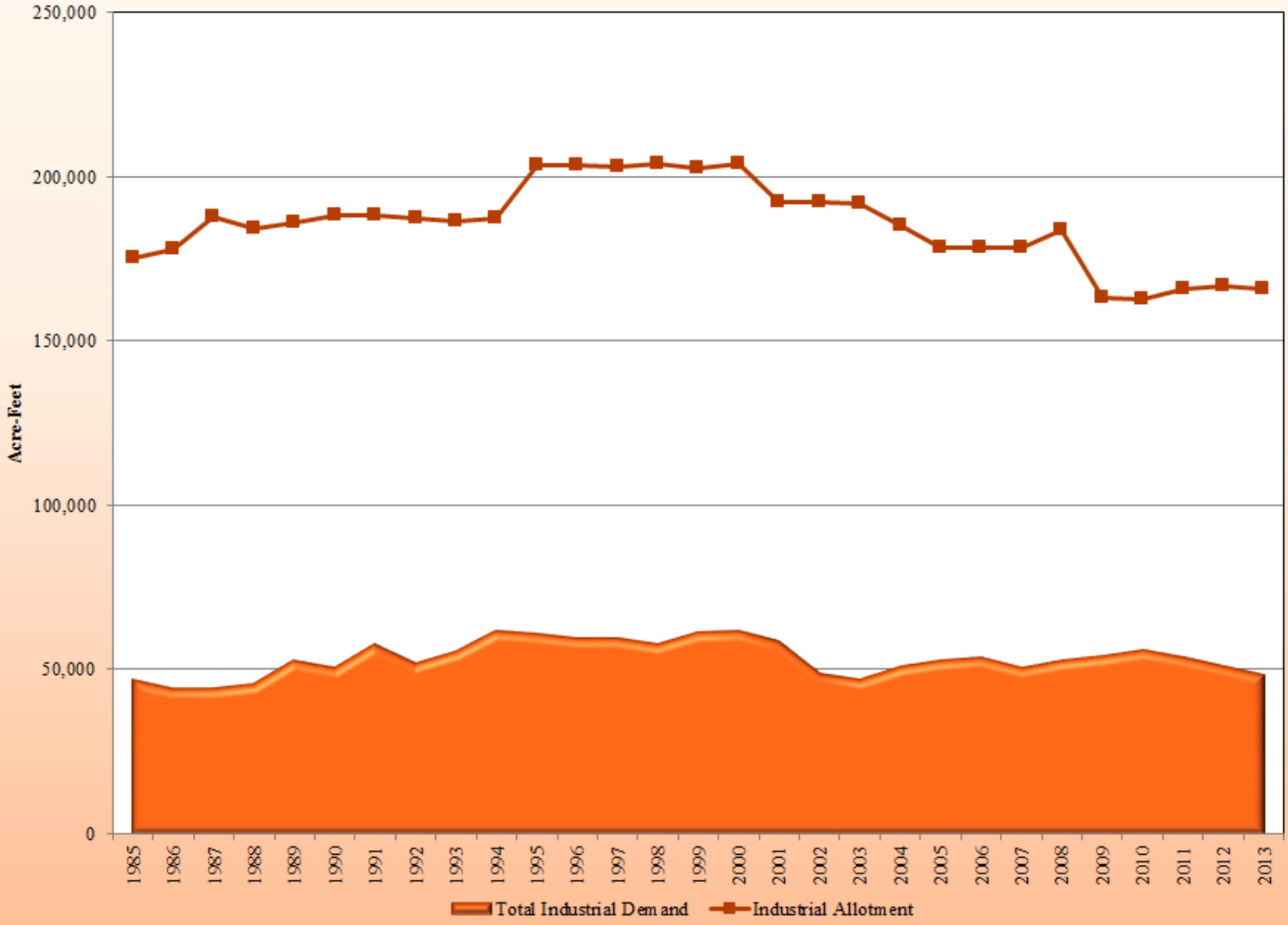
TUCSON AMA DRAFT 4MP CHAPTER 3: WATER DEMAND & SUPPLY

- Industrial Sector
  - Using less than 30% of Industrial allotment
  - Used about 48,000 acre-feet in 2013
- Agricultural Sector
  - About 200 IGFRs >10 acres remaining
  - About 35,000 irrigation acres remaining with about 155,000 acre-feet of allotment
  - In 2013, agricultural demand was about 111,000 acre-feet

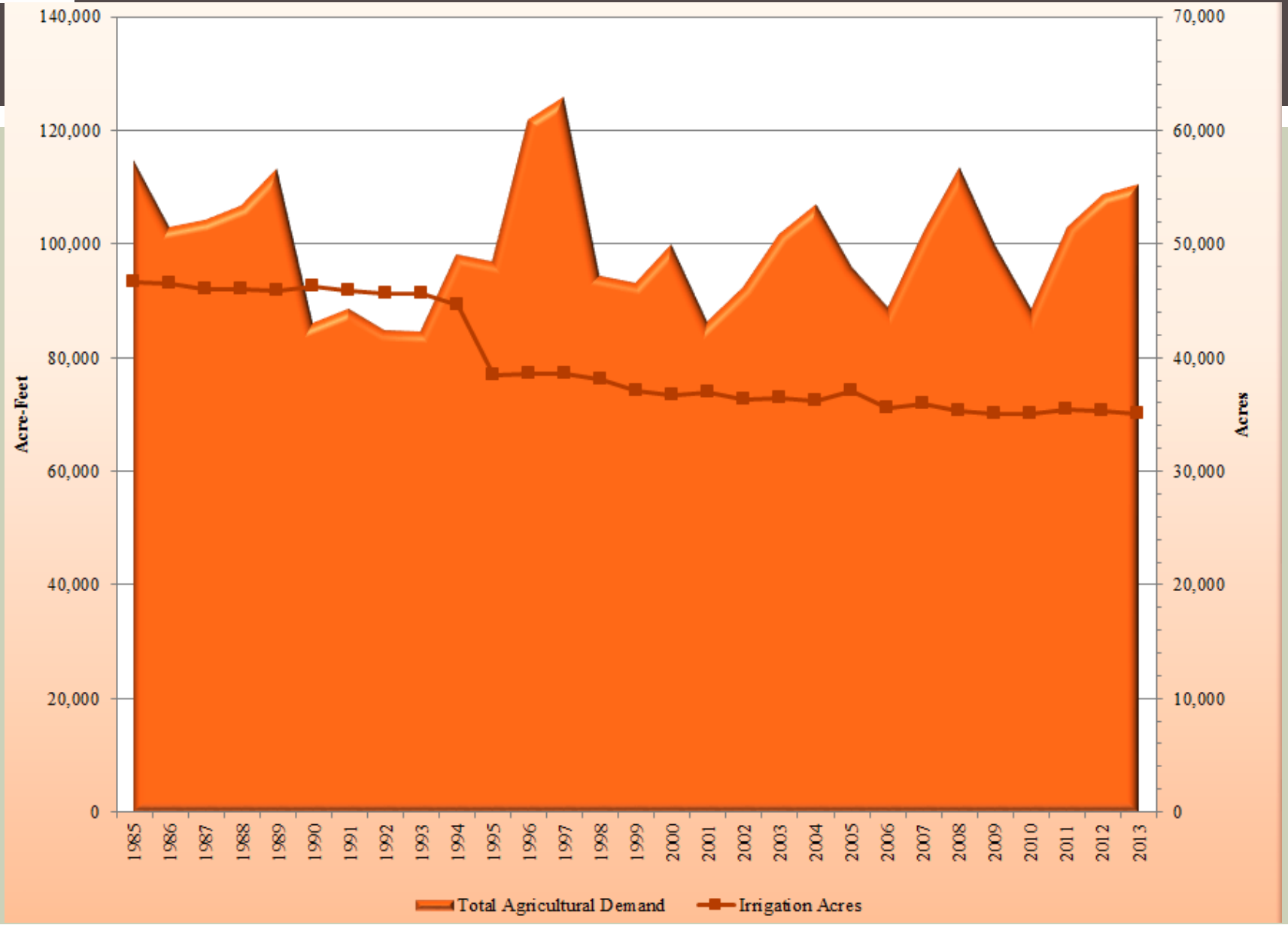
TUCSON AMA DRAFT 4MP
CHAPTER 3: WATER DEMAND & SUPPLY

- 23 IGFRs in TAMA 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
HISTORICAL INDUSTRIAL DEMAND AND ALLOTMENT



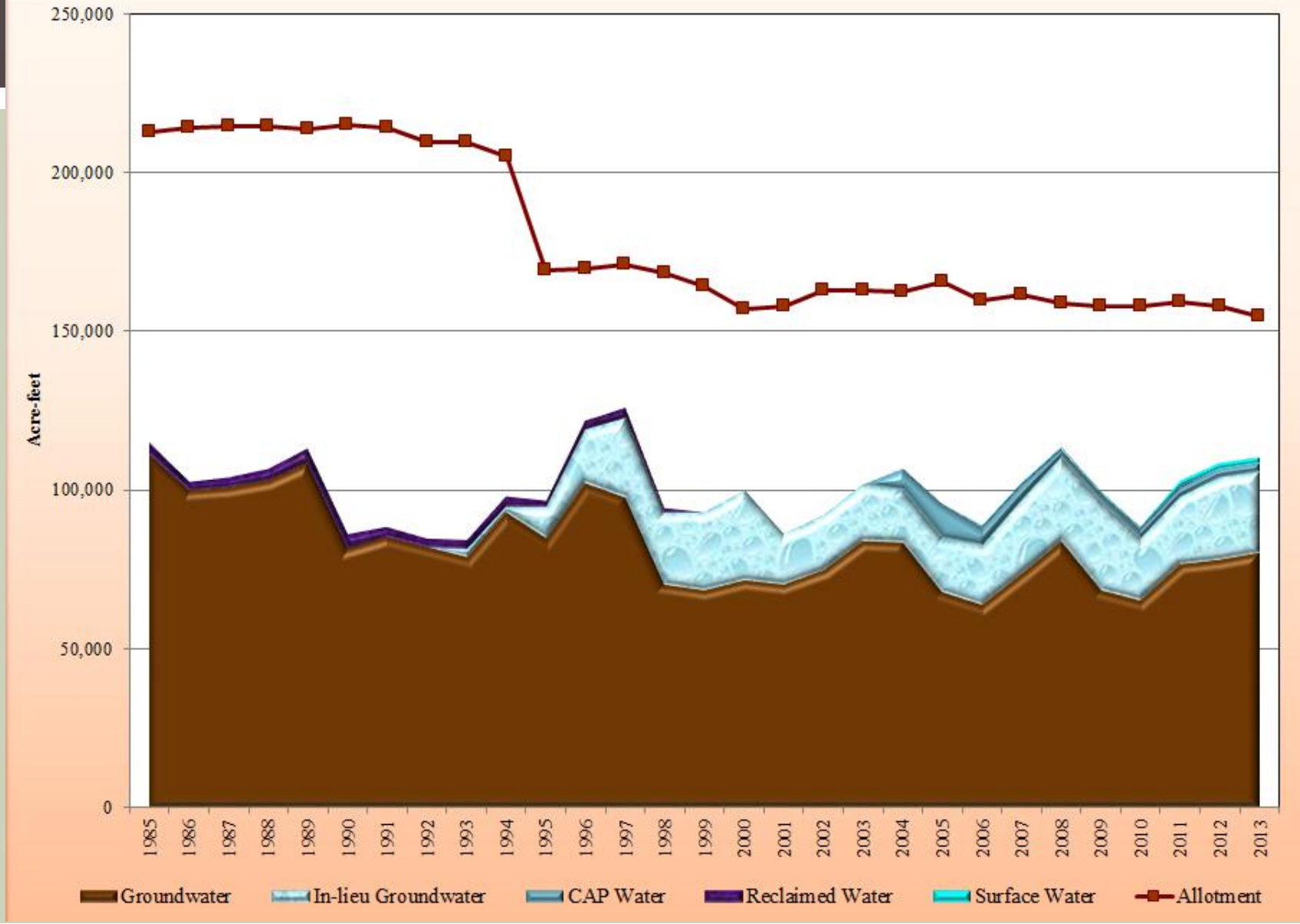
TUCSON AMA DRAFT 4MP
HISTORICAL AGRICULTURAL DEMAND & IRRIGATION ACRES



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

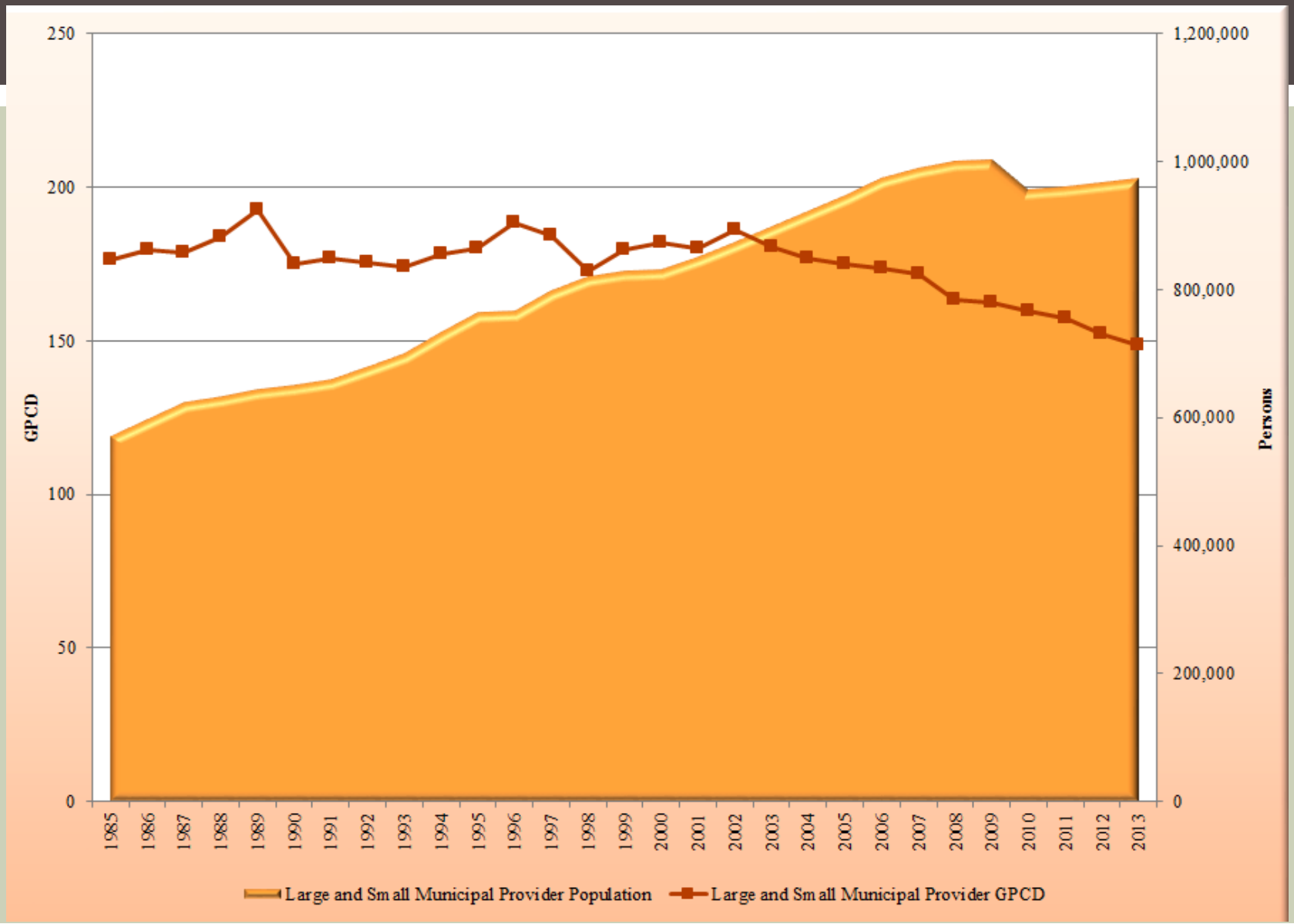
TUCSON AMA DRAFT 4MP
HISTORICAL AGRICULTURAL SECTOR DEMAND & SUPPLY



TUCSON AMA DRAFT 4MP CHAPTER 5: MUNICIPAL

- Historical objective of municipal program to gradually reduce GPCD, encourage conservation, maximize efficient use of all water supplies
- ADWR continuing efforts to meet water management challenges and improve progress towards safe-yield. ADWR goals include:
  - Encouraging equitable distribution of water through long-range planning
  - Encouraging cooperative regional efforts
  - Providing technical assistance
  - Providing public education materials
  - Administering regulatory programs
- In the TAMA, 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)

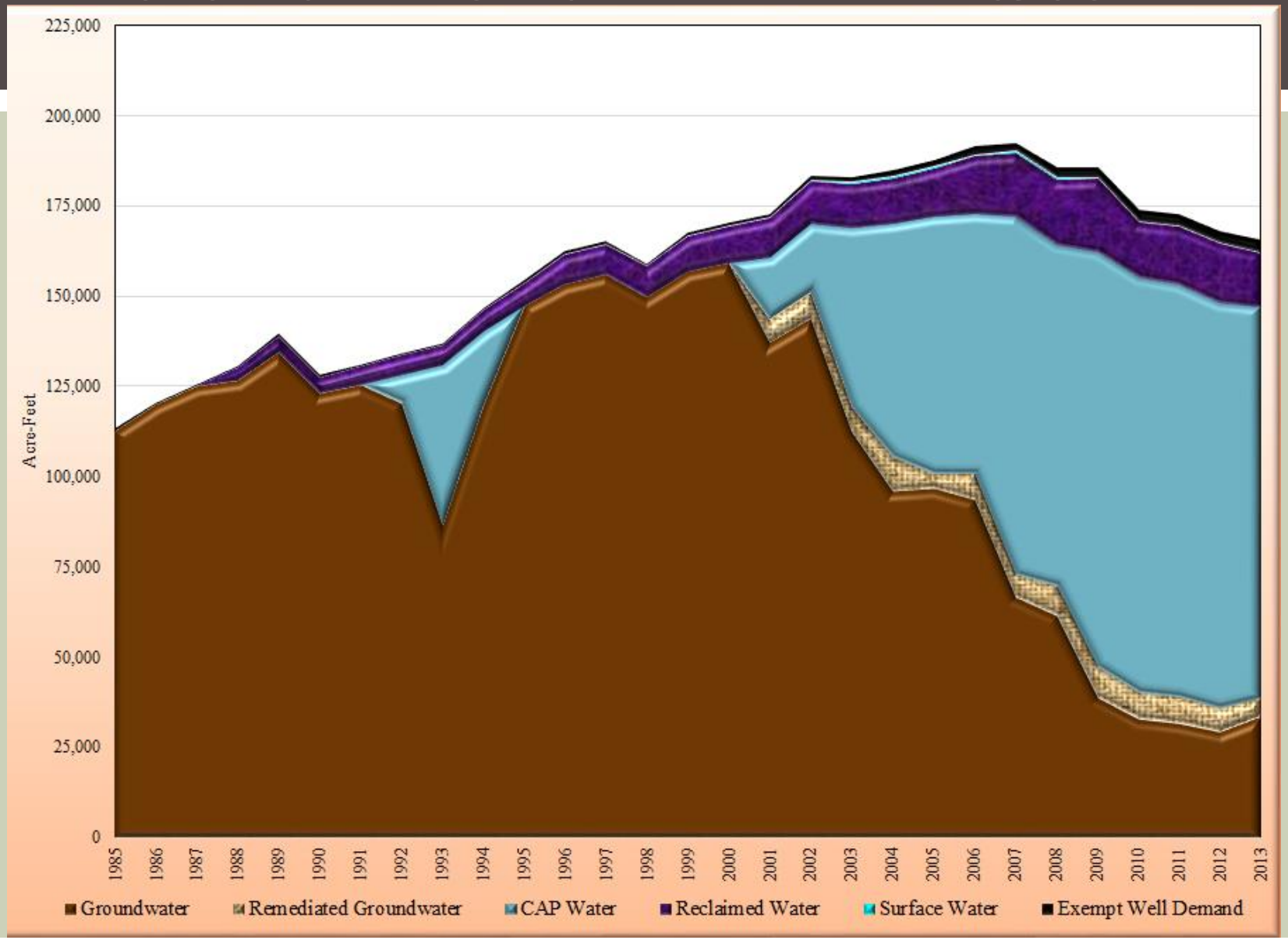
TUCSON AMA DRAFT 4MP
HISTORICAL MUNICIPAL GPCD & POPULATION



TUCSON AMA DRAFT 4MP CHAPTER 5: MUNICIPAL

- Additional efforts are needed to maintain safe-yield:
  - Additional water conservation potential
  - Drought and shortage planning and strategy development
  - Increased use of reclaimed water
- Only Total GPCD and the Non Per Capita Conservation Program (NPCCP) for the 4MP for large providers
  - Providers with DAWS in the NPCCP will initially be noticed under the Total GPCD for the 4MP and will be able to opt back into the NPCCP after initial noticing
  - Total GPCD Program one target for the whole fourth management period = 2000-2009 median minus 1 SD
    - Eleven providers hold DAWS in TAMA; nine are active

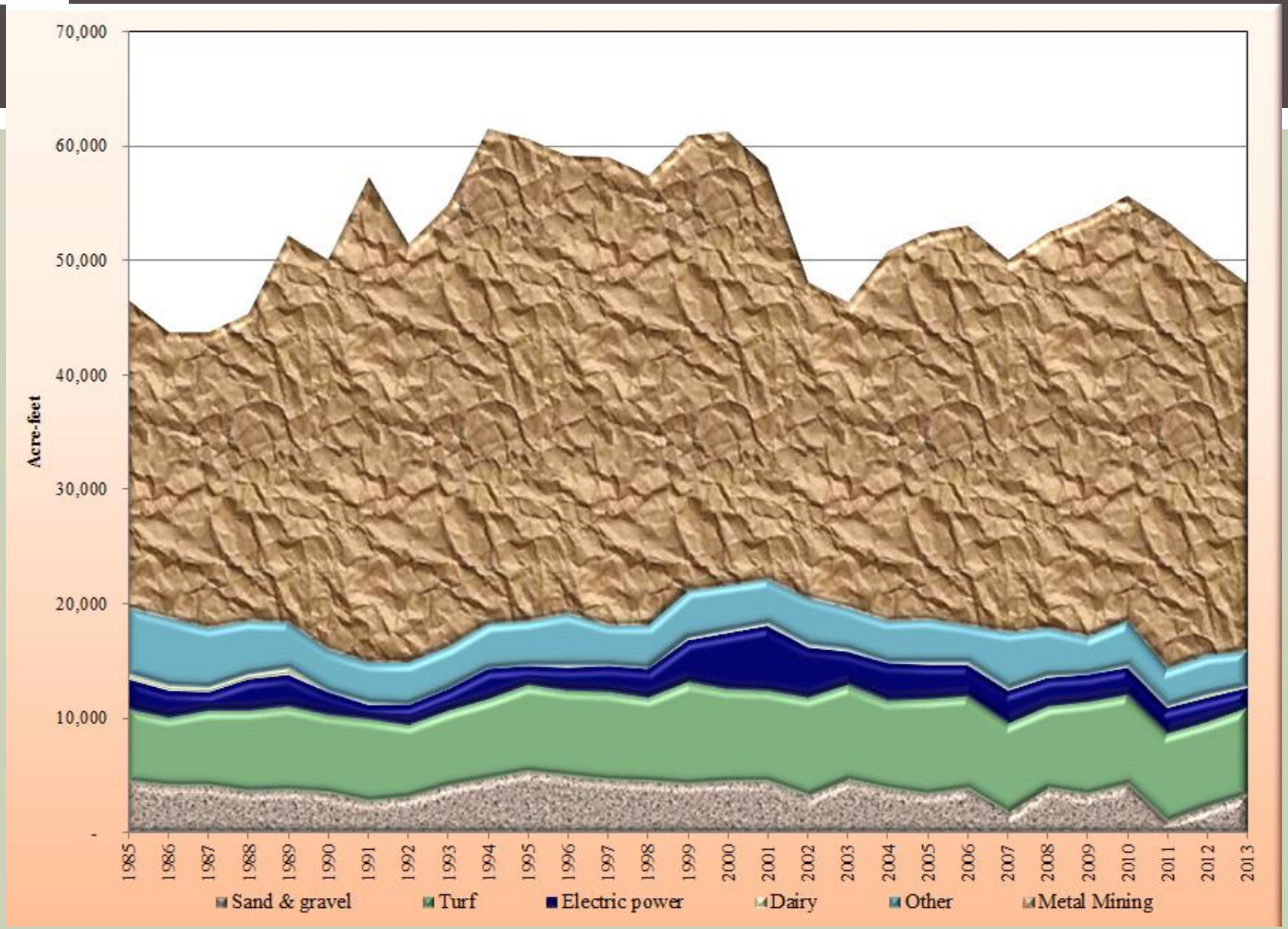
TUCSON AMA DRAFT 4MP
HISTORICAL MUNICIPAL DEMAND & SUPPLY



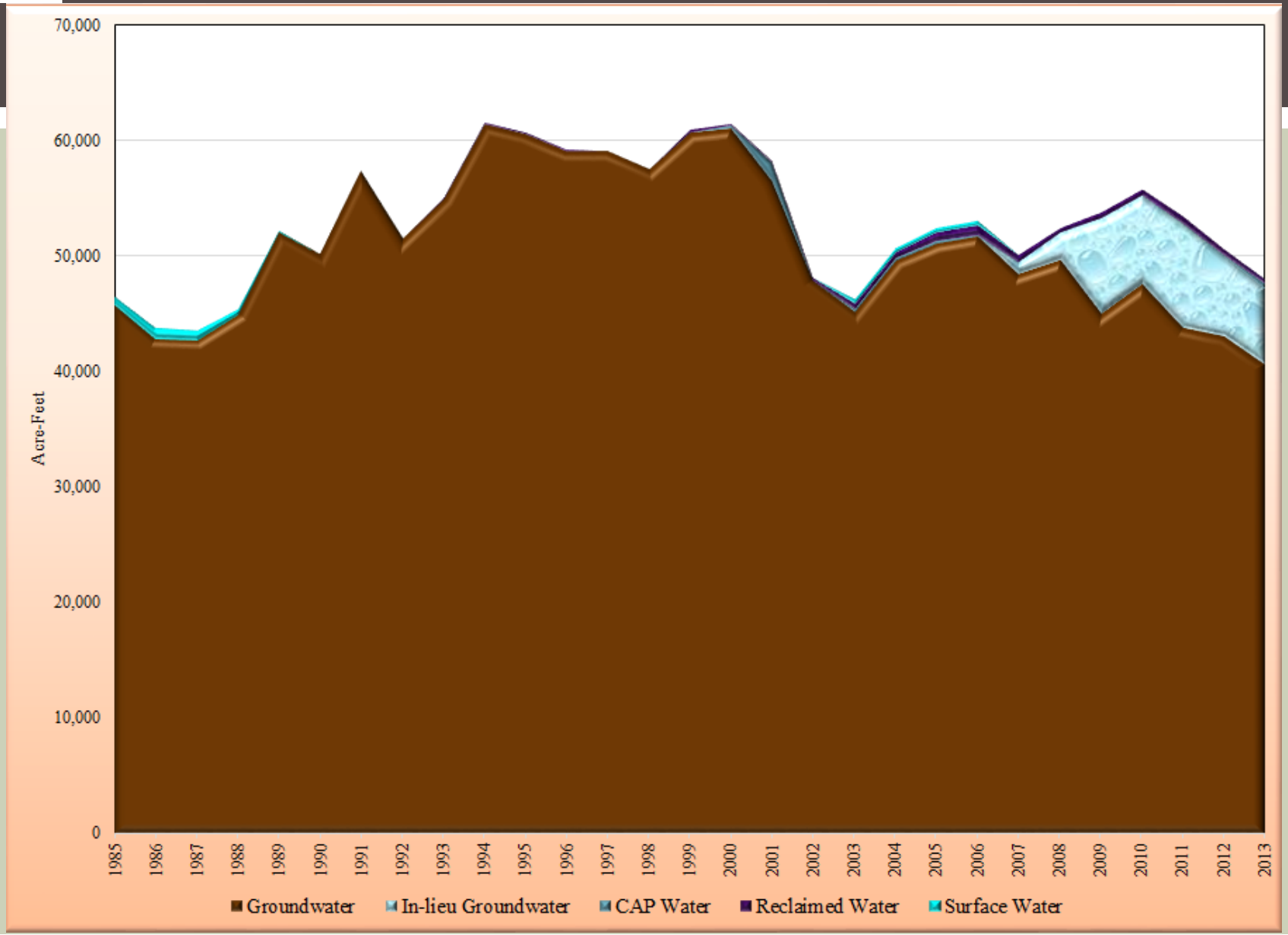
TUCSON AMA DRAFT 4MP CHAPTER 6: INDUSTRIAL

- 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

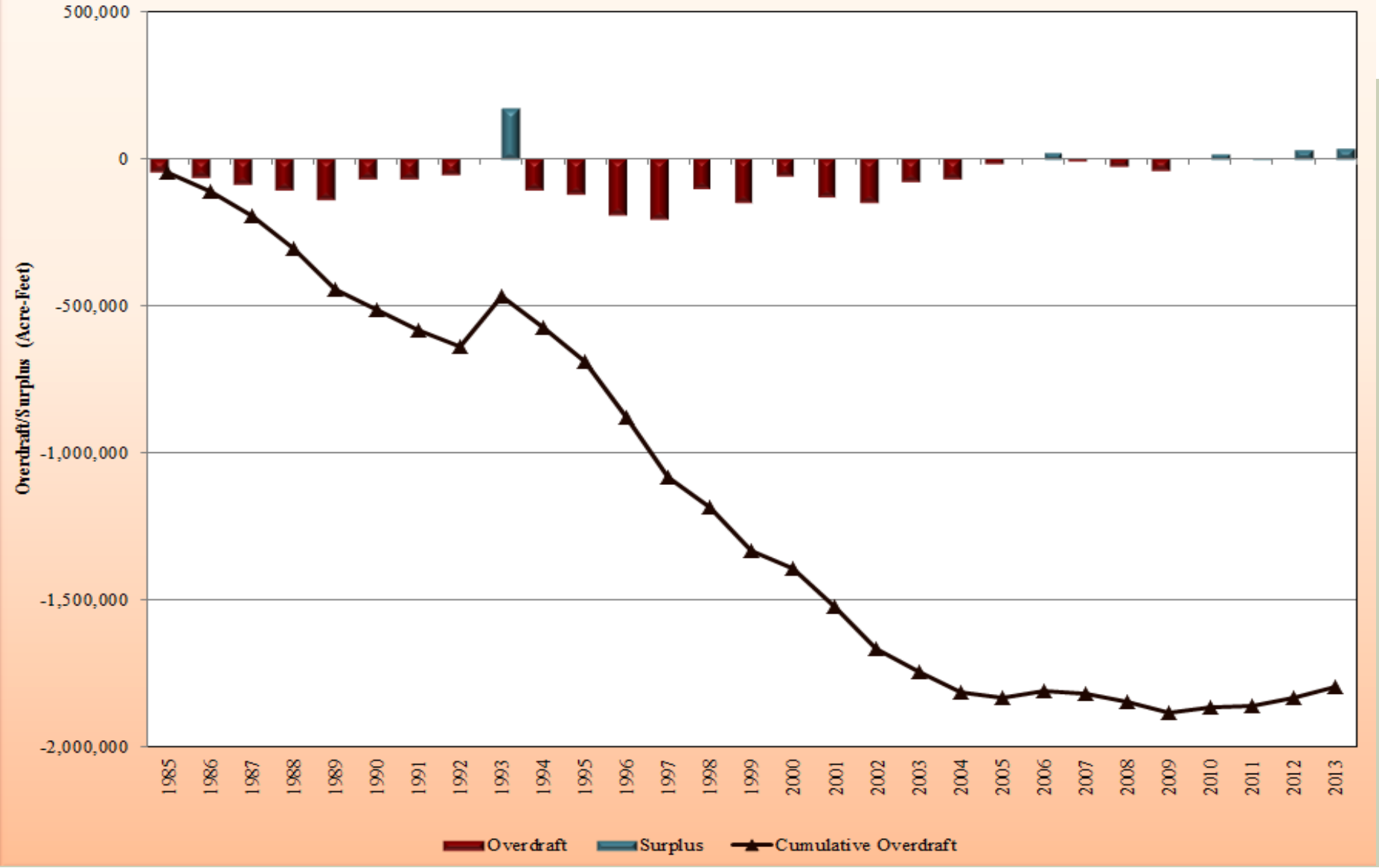
TUCSON AMA DRAFT 4MP
HISTORICAL INDUSTRIAL DEMAND BY SUB-SECTOR



TUCSON AMA DRAFT 4MP
HISTORICAL INDUSTRIAL DEMAND BY SOURCE OF SUPPLY



TUCSON AMA DRAFT 4MP HISTORICAL OVERDRAFT, 1985-2013



TUCSON AMA DRAFT 4MP
HISTORICAL WATER DEMAND BY SECTOR

Year	Municipal Demand	Estimated Demand from Exempt Wells	Industrial Demand	Agricultural Demand	Tribal Demand	*TOTAL AMA DEMAND*	Renewable Supplies to Meet Demand[1]	Ground-water to Meet Demand	Offsets to GW Pumping[2]	*OVERDRAFT*
1985	112,655	425	46,616	114,879	72	*274,647*	4,266	**277,545**	231,046	*(46,500)*
1986	119,974	436	43,834	102,910	75	*267,229*	4,032	**270,118**	207,293	*(62,825)*
1987	124,837	447	43,704	104,294	810	*274,092*	4,354	**275,849**	189,543	*(86,306)*
1988	129,971	458	45,419	106,676	902	*283,427*	7,416	**280,043**	172,583	*(107,460)*
1989	138,850	470	52,168	113,326	2,091	*306,905*	8,959	**300,459**	160,926	*(139,533)*
1990	127,454	482	50,121	86,217	1,516	*265,791*	8,665	**259,854**	189,866	*(69,988)*
1991	130,482	495	57,337	88,508	1,557	*278,380*	8,178	**274,588**	203,790	*(70,798)*
1992	133,431	507	51,490	84,837	3,800	*274,065*	15,885	**263,879**	208,024	*(55,856)*
1993	136,164	520	54,964	84,499	4,349	*280,497*	52,106	**238,898**	411,263	***172,365***
1994	146,037	534	61,442	98,246	4,786	*311,045*	29,414	**289,239**	182,942	*(106,297)*
1995	153,740	547	60,589	96,943	3,089	*314,909*	8,415	**313,857**	195,965	*(117,892)*
1996	161,466	562	59,137	121,834	3,566	*346,564*	11,047	**339,252**	151,484	*(187,769)*
1997	164,338	576	59,046	125,819	2,210	*351,990*	11,789	**342,349**	137,358	*(204,990)*
1998	158,235	591	57,440	94,394	2,988	*313,647*	9,702	**307,756**	207,220	*(100,536)*
1999	166,575	606	60,831	93,071	3,675	*324,757*	10,055	**317,642**	171,519	*(146,123)*
2000	169,242	621	61,269	100,006	3,960	*335,099*	11,277	**326,251**	266,740	*(59,511)*
2001	171,588	854	58,191	86,331	11,240	*328,204*	39,172	**284,547**	153,899	*(130,647)*
2002	181,860	1,087	48,157	92,308	12,508	*335,921*	41,929	**287,745**	142,562	*(145,183)*
2003	181,248	1,320	46,364	101,643	14,341	*344,916*	76,620	**262,457**	186,424	*(76,033)*
2004	182,810	1,554	50,765	106,963	14,259	*356,351*	98,102	**250,025**	178,926	*(71,099)*
2005	185,565	1,787	52,423	95,848	14,306	*349,928*	110,435	**239,720**	221,429	*(18,290)*
2006	188,977	2,020	53,084	88,973	11,619	*344,672*	106,528	**236,586**	258,288	***21,702***
2007	189,893	2,253	50,049	102,124	15,649	*359,968*	138,434	**219,000**	211,749	*(7,251)*
2008	182,750	2,486	52,466	113,630	21,646	*372,977*	138,294	**230,032**	203,497	*(26,535)*
2009	182,464	2,719	53,802	99,738	21,418	*360,141*	160,289	**192,270**	151,318	*(40,952)*
2010	170,571	3,124	55,701	88,586	16,797	*334,777*	150,795	**178,554**	197,133	***18,579***
2011	169,285	3,202	53,374	103,104	18,748	*347,712*	153,903	**189,196**	194,743	***5,547***
2012	164,481	3,282	50,638	108,847	20,517	*347,764*	154,180	**189,955**	220,664	***30,709***
2013	161,916	3,364	48,020	110,669	18,903	*342,873*	147,559	**194,237**	230,204	***35,967***

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 fourth 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
  - Increase 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 TAMA as of 2013
- Seven active GSFs in the TAMA as of 2013
- Total Long-Term Storage (LTS) credits as of 2013 more than one million acre-feet (CAP and reclaimed water)
- Fourth 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

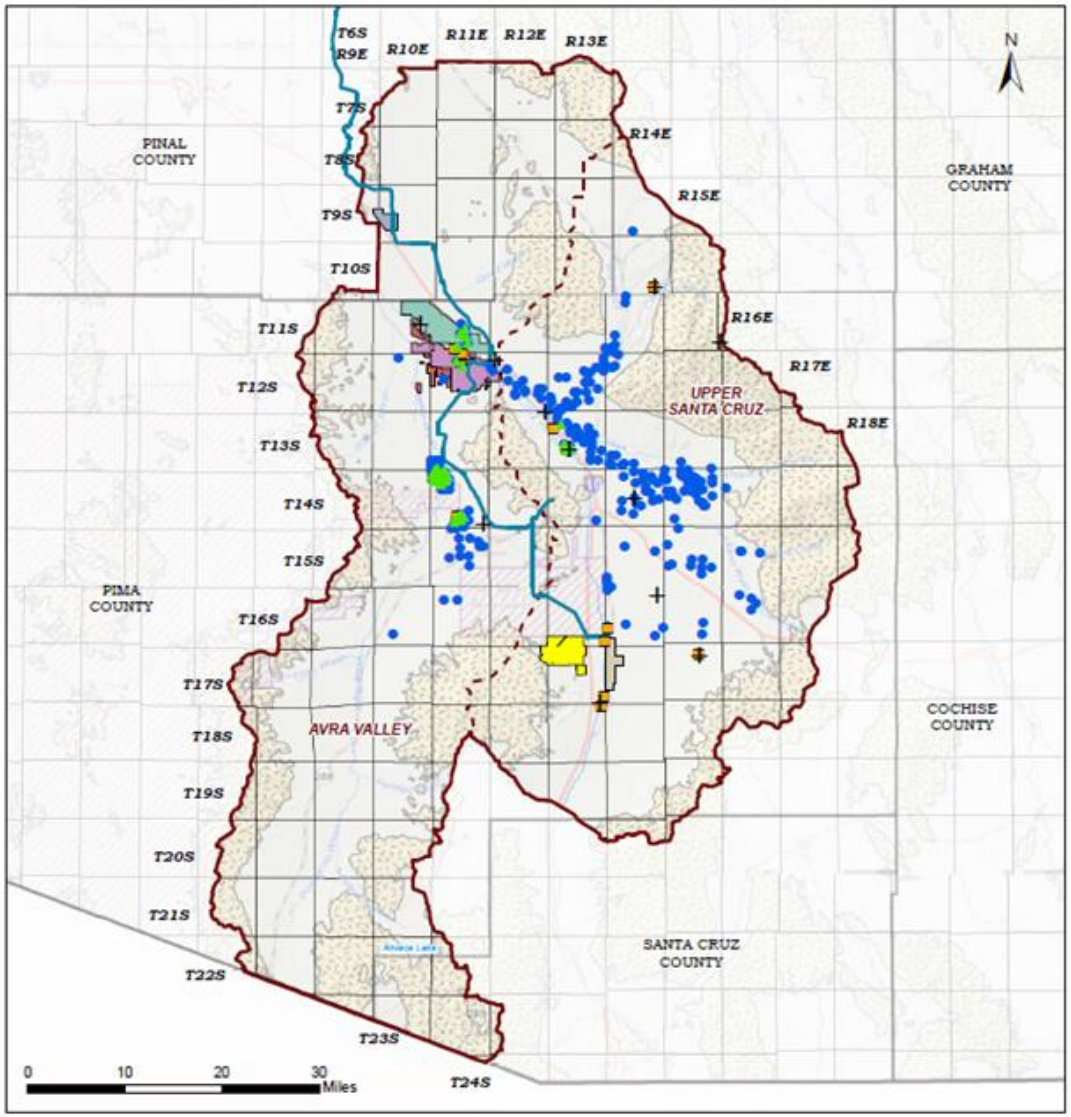


Figure 8-1
Locations of Recharge and Recovery 2013
TAMA

- Tucson AMA
- Sub-basin
- City or Town
- Indian Reservations
- Major Road
- Interstate Highway
- Lake
- Stream
- CAP canal
- Hardrock
- Park or Forest
- Military
- State Boundary
- Township/Range
- County
- 2013 Recovery Wells Used
- Recovery Wells Used Within AOI
- Underground Storage Facility
- Wastewater Treatment Facilities

Groundwater Savings Facilities
- ASARCO Mission Mine
- BKW / Milewide
- BKW Farms
- Cortaro Marana I.D.
- FICO
- Kai - Avra
- Kai Farms - Red Rock

TUCSON AMA DRAFT 4MP
CHAPTER 9: WATER MANAGEMENT ASSISTANCE

- Purpose of Water Management Assistance Program (WMAP) is to 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
  - the 3MP preface moved to an appendix in chapter 10
  - the preface from the 3MP describes the "stacking" procedure for compliance

TUCSON AMA DRAFT 4MP CHAPTER 11: PROJECTED BUDGET

- Two projected water supply/demand scenarios are included in Chapter 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

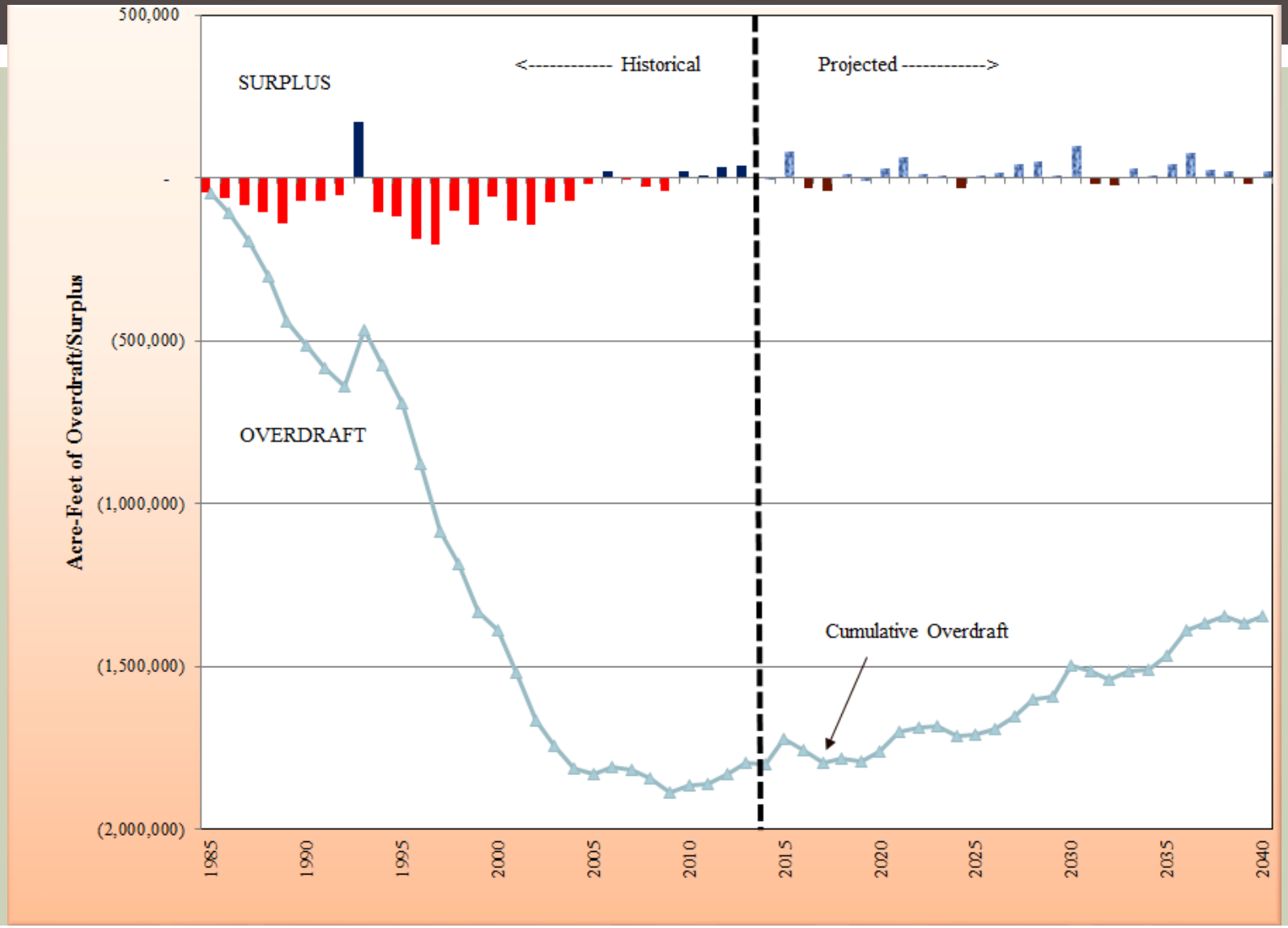
TUCSON AMA DRAFT 4MP CHAPTER 11: PROJECTED BUDGET

- 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 municipal providers who can store/use CAP, do so
  - Ag and industrial projections adjusted based on longer historical trend (1985-2013)
  - Conferred with some sector representatives individually
- Projection period from 2014 - 2040

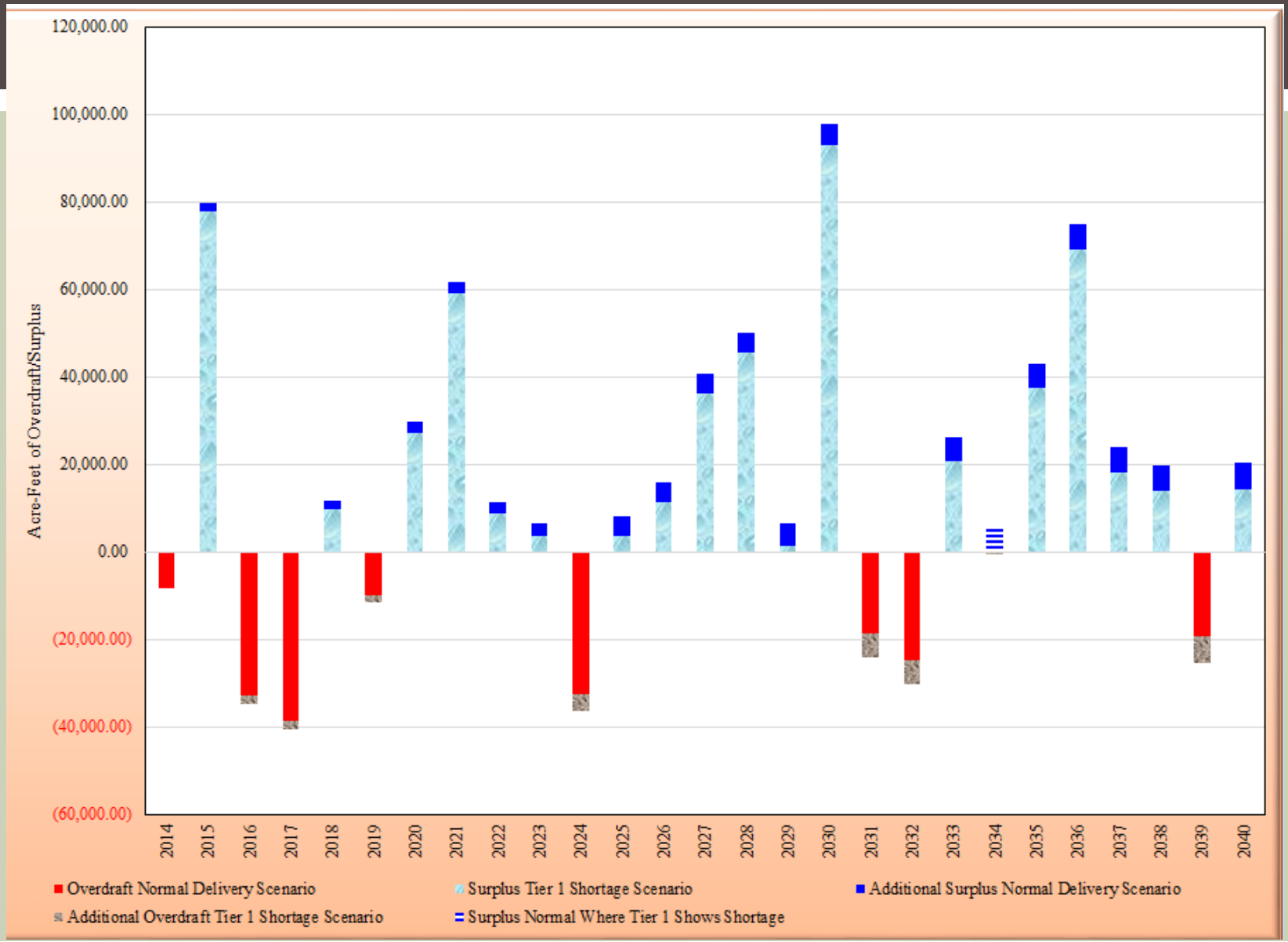
TUCSON AMA DRAFT 4MP CHAPTER 11: WATER BUDGETS

- 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

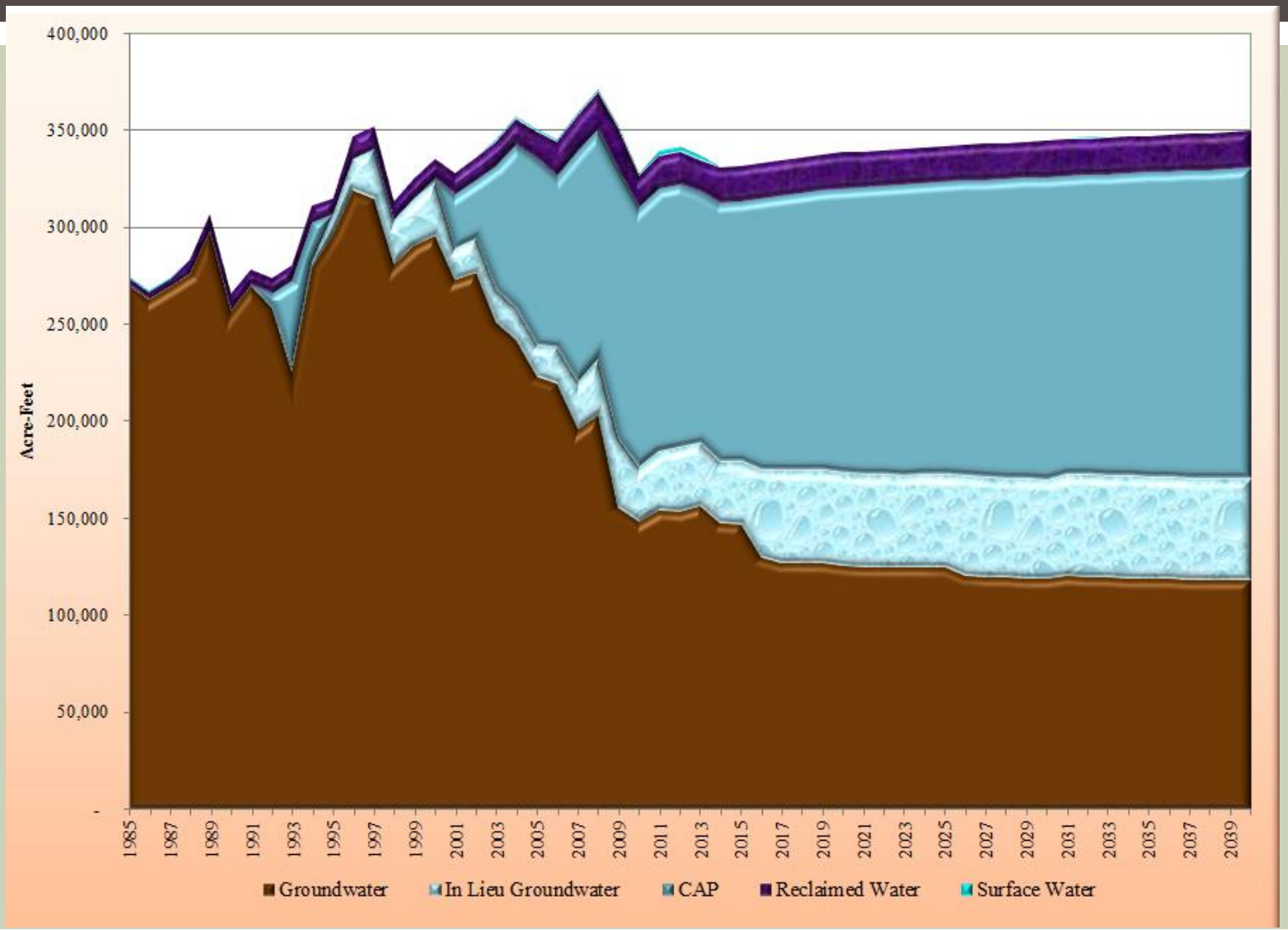


TUCSON AMA DRAFT 4MP
COMPARISON OF PROJECTION SCENARIOS



TUCSON AMA DRAFT 4MP PROJECTED SUPPLIES

NORMAL CAP DELIVERY SCENARIO



TUCSON AMA DRAFT 4MP
CHAPTER 12: WATER MANAGEMENT STRATEGY

- Challenges:
  - 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 TAMA DRAFT 4MP:

- TAMA DRAFT 4MP
  - Supplied hard copies to GUAC members today
  - Posted to ADWR's website
  - ADWR is requesting written comments by December 31, 2015
  - Electronically to jmtannler@azwater.gov
  - Hard copy to Jeff Tannler, AMA Director, ADWR
- ADWR will review and summarize comments received
- ADWR present comment summary at subsequent GUAC
- Promulgation will occur after ADWR makes changes to the draft plan

QUESTIONS:

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