

# **CAGRD Mid-Plan Review: Enrollment, Demand and Obligation**

**CAGRD & Underground Storage Committee**

**October 20, 2011**

## PREFACE

**O**n October 31, 2005, the Director of the Arizona Department of Water Resources determined that the CAGR D's second Plan of Operation was consistent with the achievement of the management goals of the Phoenix, Pinal and Tucson Active Management Areas. That action was the culmination of a large-scale effort that involved virtually every department within CAP, an extensive stakeholder process, and regulatory review.

The half-dozen years that followed were some of the most tumultuous in modern U.S. history, and the housing sector in Arizona has been particularly affected. In the face of that unprecedented volatility, some of the assumptions that went into the Plan have proven more durable than others.

This report provides an update on the status of the CAGR D's enrollment, demand and obligation. The Plan has many other components, (e.g., finances, water supply acquisition, canal capacity, etc.) but most of those depend, at least in part, on the timing and volume of enrollment, demand and obligation. This report is also intended to help meet CAWCD's strategic objective to "Review CAGR D status as compared to projections in the Plan of Operation often enough to provide comfort to the Board, staff, stakeholders and legislators."<sup>1</sup>

The report is organized to address three questions: What did we think would happen? What has happened? What do we think will happen next?

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<sup>1</sup> 2010 CAWCD Board of Directors Strategic Plan, Key Results Area: Replenishment, Strategic Issue: CAGR D Management and Oversight.

# Chapter 1

## "227"

*"CAGR D estimates that its total annual replenishment obligation for current members and those that are projected to enroll through 2015 will reach about 227,000 acre-feet by 2035"*

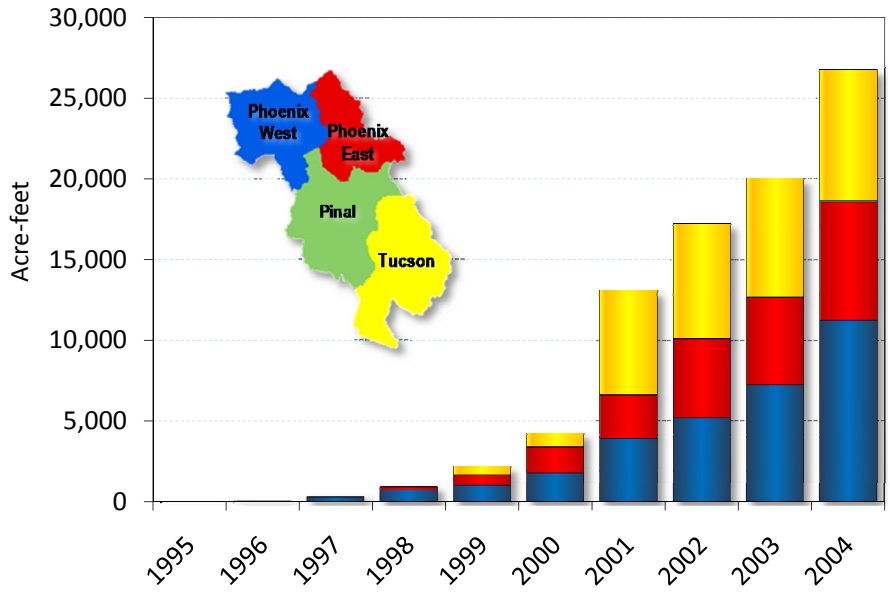
–Central Arizona Groundwater Replenishment District: Plan of Operation,  
November 8, 2004

The CAGR D's current Plan of Operation is comprised of 173 pages of text, charts, maps and tables, but out of all of that, one thing stands out—227,000 acre-feet of obligation.<sup>2</sup> That number has been seared into the collective consciousness of the water community, and has been embraced by CAGR D critics and advocates alike. "227" has become a kind of Rorschach test about the CAGR D itself—proof to some that it is a large part of the problem; proof to others that it is a large part of the solution. But whatever one's view, the obligation number made it hard to escape the conclusion that the CAGR D is a big deal.

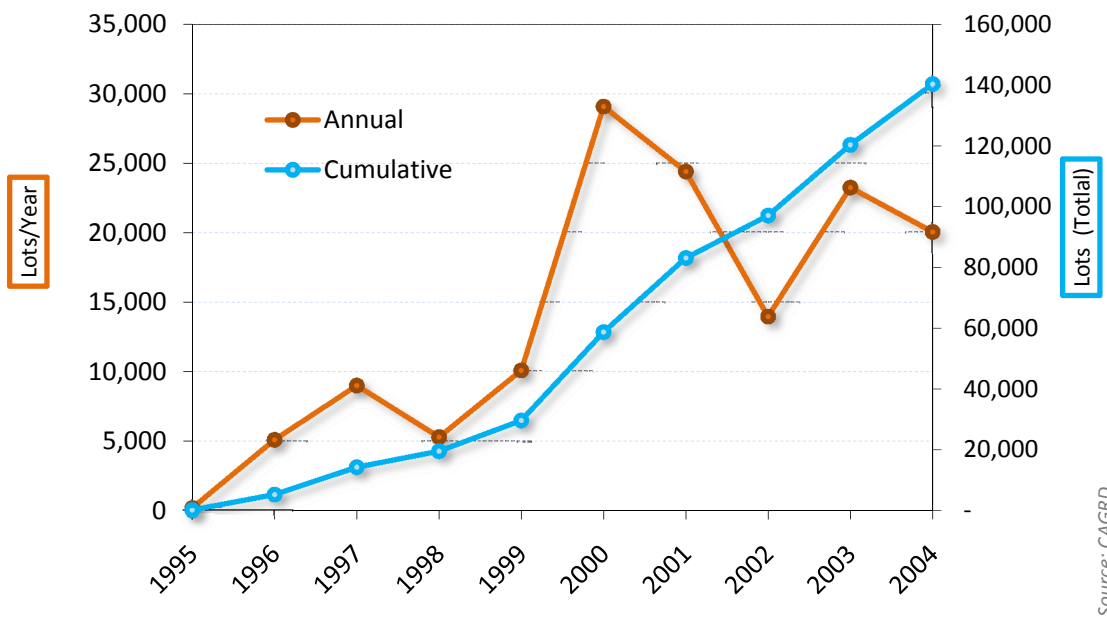
Today, a little more than half-way through the Plan period, it appears unlikely that the CAGR D's replenishment obligation for members enrolled through 2015 will reach 227,000 acre-feet by 2035. Even so, it is useful to understand how that number was arrived at, and to put it (and the rest of the 173 pages) into context.

As the Plan was being prepared in 2003 and 2004, there was a relatively short period of actual data that could form the basis of key assumptions for the Plan.<sup>3</sup> The State's Assured Water Supply Rules went into effect in 1995, but CAGR D activity was modest for the first few years, in part because some developers had obtained plat approvals in anticipation of the AWS Rules. However, by the year 2000 obligation started to grow, and there was more than a five-fold increase in obligation between 2000 and 2004 (Figure 1). While the absolute numbers were still relatively modest, and some of the obligation reflected particular annual reporting arrangements,<sup>4</sup> the increase was drawing notice.

**Figure 1: Replenishment Obligation ,  
to 2004**



**Figure 2: Member Land Enrollment, to 2004**

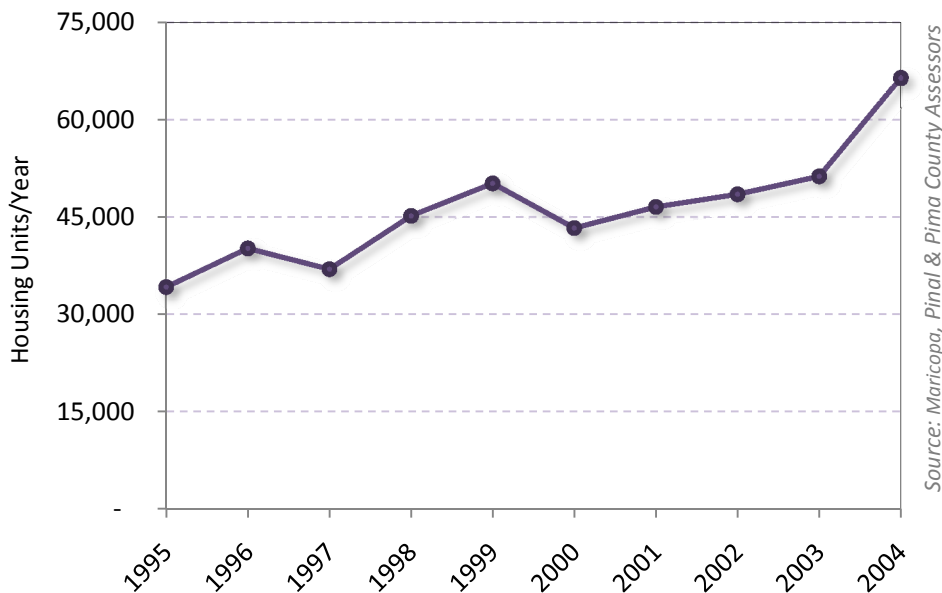


Source: CAGR D

The rapid increase in obligation was matched by a marked increase in Member Land enrollment (Figure 2). The surge in enrollment in 2000 and 2001 was attributed to the Growing Smarter legislation and proposed growth initiatives, but there was a discernable upward trend overall as well.<sup>5</sup> Residential construction activity in Maricopa, Pinal and Pima counties was also generally increasing, with the annual rate exceeding 50,000 units in 2004 (Figure 3).<sup>6</sup>

As those overall construction rates increased, so did the proportion of that

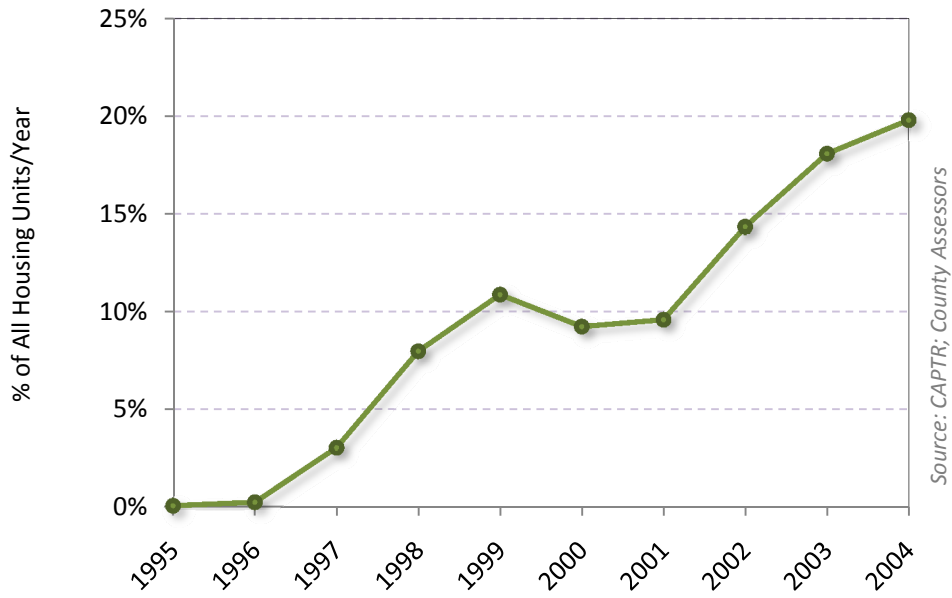
**Figure 3: Tri-County Residential Construction, to 2004**



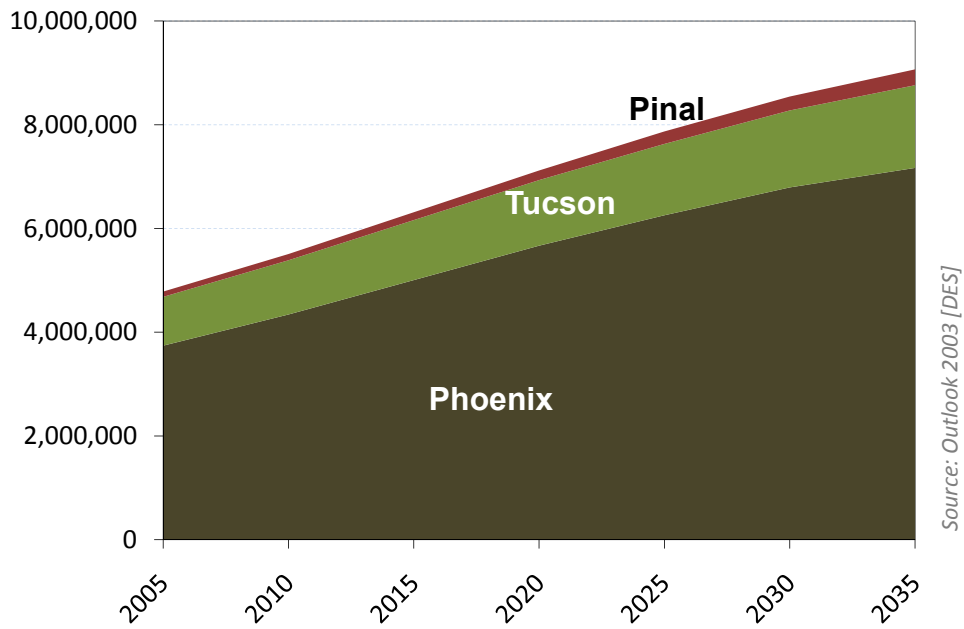
construction that was associated with Member Lands (Figure 4). By 2004, fully one-fifth of the residential units constructed in CAP's service area were associated with Member Lands, and the trajectory on that trend was strongly upwards.

The primary driver of the construction activity was the State's rapid population growth. The 2000 Census pegged Arizona's population at more than 5.1 million, making it the 20<sup>th</sup> largest State; up nine places from just two decades earlier.<sup>7</sup> Between 2003 and 2004, Arizona was the second fastest growing State (after Nevada) at 3.4%, which was a full 0.9% faster than number three Utah.

**Figure 4: Proportion of Residential Construction in Member Lands, to 2004**

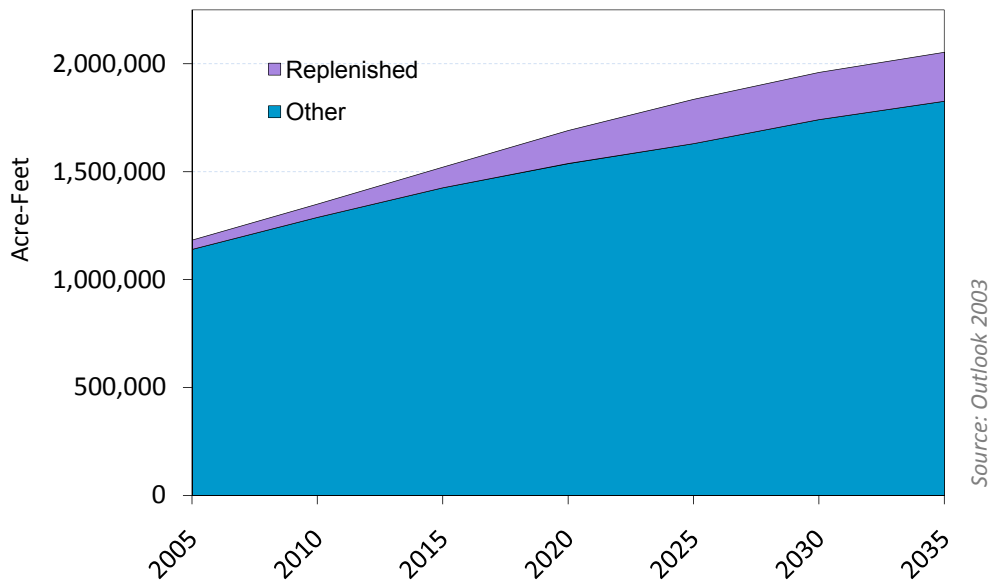


**Figure 5: Total Projected Population, by AMA**



National demographic and migration trends fueled growth in the Sunbelt, and population projections generated by the Census, the State and local agencies all showed robust growth into the future. The Maricopa Association of Governments projected that CAP's service area population would surpass nine million by 2035 (Figure 5), and all of those people were going to need water.

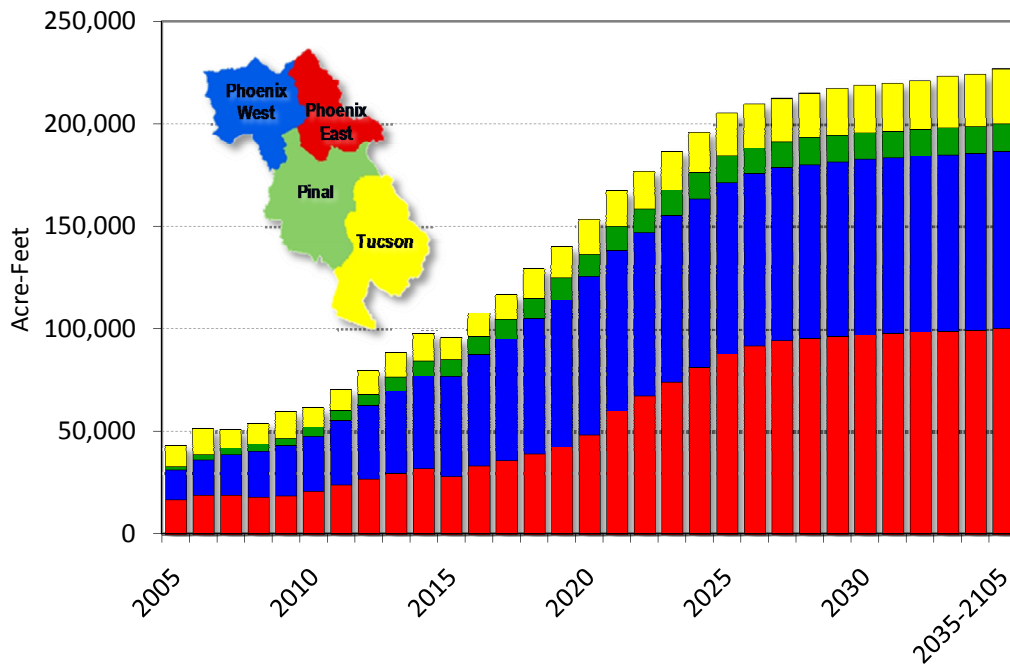
**Figure 6: Total Projected Municipal Demand, and CAGR D Replenishment**



In aggregate, there is a strong association between population and water use in the municipal sector (which includes both public and private water utilities), and the Plan projected an overall increase in municipal demand of some 870,000 acre-feet by 2035, including the 227,000 acre-feet that would be replenished (Figure 6). However, the relationship between population and demand is influenced by a range of demographic, economic, social and geographic factors. Accounting for these factors is particularly important for CAGR D planning because replenishment requirements vary. For instance, even if two homes have identical use, they will have dramatically different replenishment requirements if one is in the Phoenix AMA and the other in the Pinal AMA. There is also significant variation in water use rates among water providers and subdivisions, so while aggregate numbers are sufficient for many kinds of planning, CAGR D planning requires a higher level of detail.

In the lead-up to the public phases of the Plan of Operation, CAP staff, in collaboration with the Maricopa Association of Governments, undertook a large-scale planning effort that included extensive data gathering and modeling. This work—known as "Outlook"—generated a range of data products, but a core purpose was to estimate the volume and timing of excess groundwater use that would be reported to the CAGR by Member Service Areas and Member Lands. In the process, one of the CAGR's most critical operational tools (the "CAPTR" database) was created to manage Member Land data and the associated parcels.

**Figure 7: Projected Obligation, by AMA/Region**

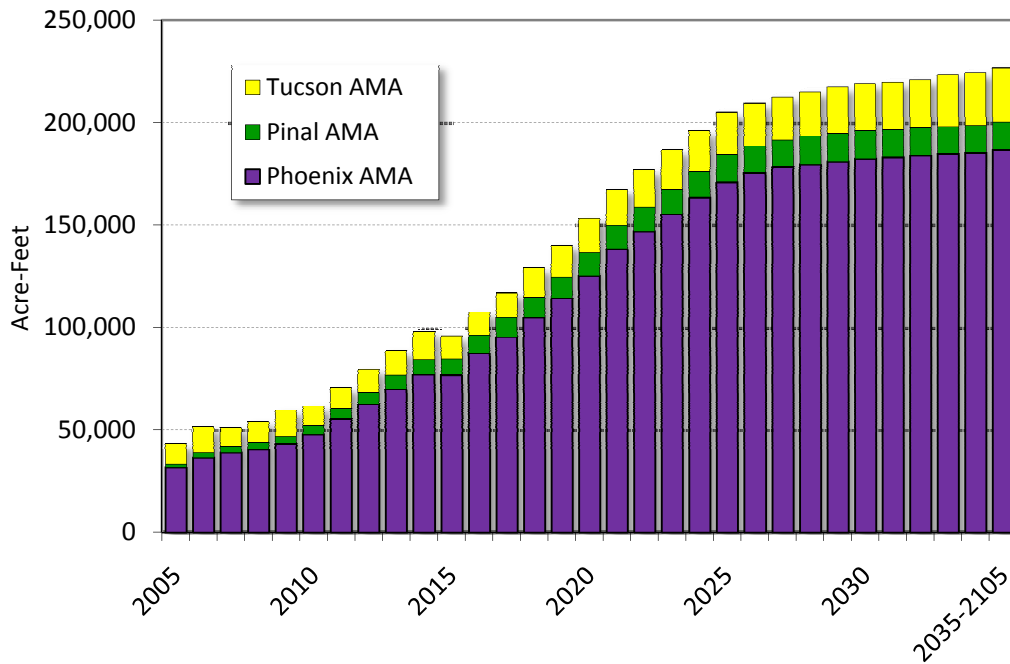


The Plan itself has an extensive discussion of the assumptions and methods that went into the Outlook work, and there was a supplemental technical report issued on CD-ROM that goes into even greater detail.<sup>8</sup> However, in its most distilled form the primary process involved projecting population and housing units for individual water providers and subdivisions; determining water demand conversion factors at those same levels of geography; estimating how much of the resulting demand will be groundwater-based; and then estimating how much of that groundwater will be reported to the CAGR for replenishment. One of the products generated from that work is the now iconic graph showing projected obligation building up to 227,000 acre-feet (Figure 7).



Figure 7 has now become a standard part of any presentation on the CAGR, and it shows projected obligation associated with activity through the end of the Plan period. This includes MLs enrolled through 2015, and MSA obligation through end of Designation period (or DAWS/MSA cap). Dividing the Phoenix AMA into East and West reflects the statutory provision which encourages replenishment to match the obligation incurred in those two regions. The chart also shows a small dip in obligation in 2015, which is due to the expiration of mandatory two-thirds reporting of Excess groundwater for Member Lands, and a planning assumption that remaining groundwater allowances would be used in a way that would temporarily suppress obligation.

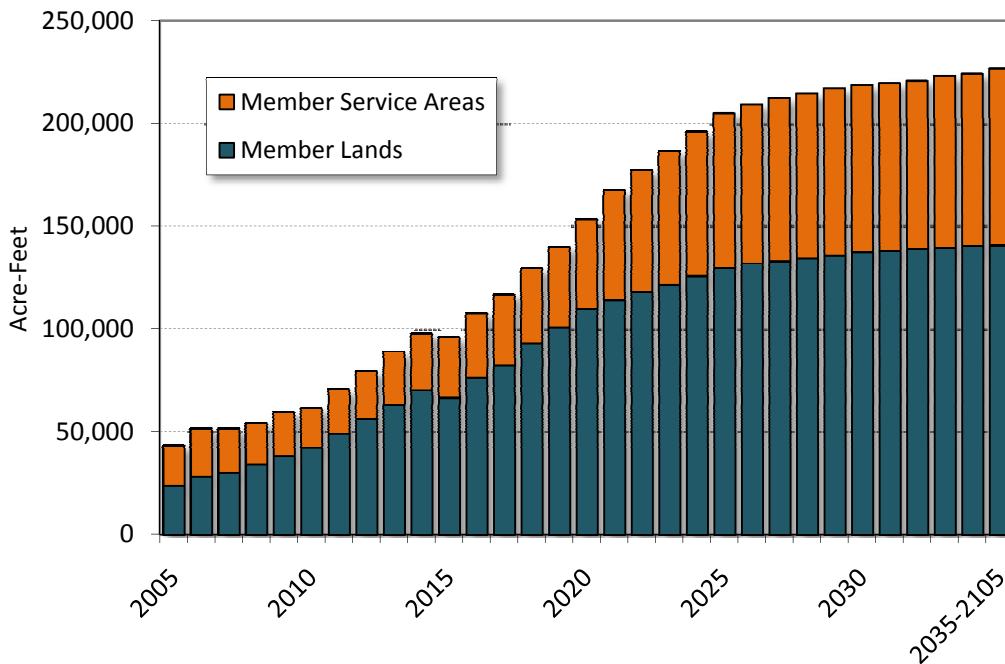
**Figure 8: Projected Obligation, by AMA**



The next variation of the chart (Figure 8) simply makes it a bit easier to see how much of the obligation was projected to occur in the Phoenix AMA (82% in 2035). There are three reasons for this; 1.) 77% of the population in the CAP service area resides in the Phoenix AMA,<sup>9</sup> 2.) obligation in the Pinal AMA is suppressed because of a much more generous groundwater allowance, and 3.) most of the population in the Tucson AMA is served by water providers that are still growing into their CAP allocations, so overall reliance on the CAGR is lower.

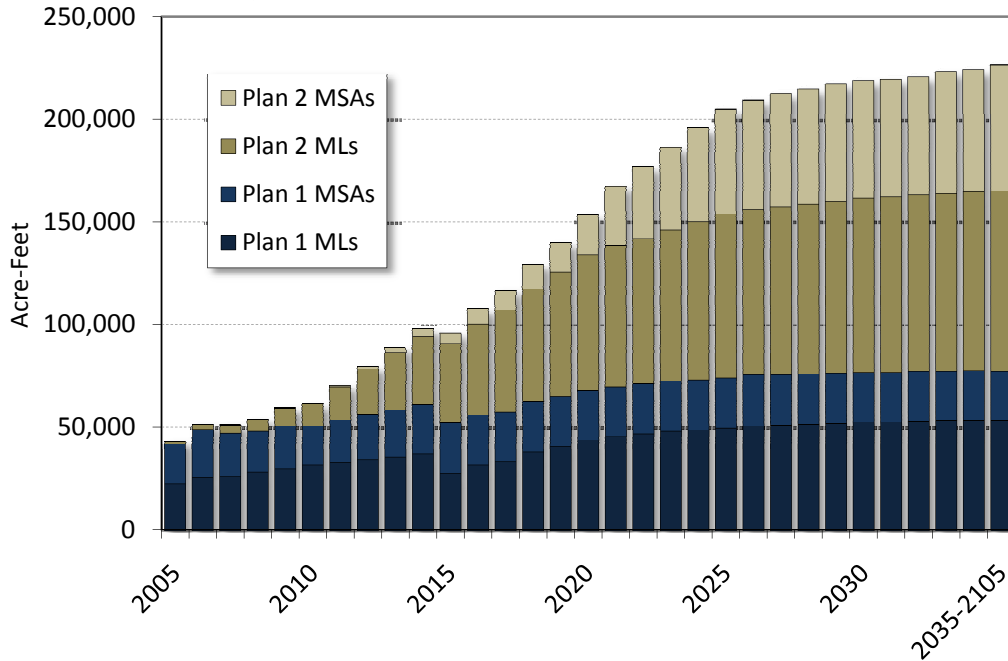
Charting the projected obligation by Member type (Figure 9) points out how much of the 227,000 acre-feet was associated with MSAs (86,200AF; 38%), and helps illuminate some important differences in the timing and magnitude of obligation. The post-2015 increase in Member Land obligation reflects the time it takes for subdivisions that were enrolled through 2015 to build out.<sup>10</sup> But for Member Service Areas, some of the increase is a result of subdivisions that are platted after 2015, but before the expiration of the Member's Designation of Assured Supply. The fact that designations can span into (or even past) the next Plan period means that those demands (and obligation) have to be considered in the current Plan, and they were.

**Figure 9: Projected Obligation, by Member Type**



The final version of the build-up chart (Figure 10) differentiates the obligation by which Plan it was incurred under. This makes the point that there is carryover demand/obligation from one plan period to the next, and that the additional increment of obligation in the new Plan period starts out modestly, but then builds. Put another way, the bulk of the projected obligation incurred under the current Plan was expected to come to fruition after 2015. The need to account for the lag-time between construction, demand and obligation has become even more important as recent trends in housing activity have shifted obligation even further out in time.

**Figure 10: Projected Obligation, by Plan Of Operation Under Which Enrollment Occurred**




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**Chapter 1 Bottom Line:** *The assumptions that went into the Plan of Operation were based on the best available data, stakeholder input and analysis of trends which, at the time, pointed in one direction—up.*

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## Chapter 1 Endnotes

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<sup>2</sup> More precisely, 226,800 acre-feet, per Table 3.6 in the Plan of Operation

<sup>3</sup> Note that key water use data are reported to ADWR and CAGR D on an annual basis, and are not required to be submitted until March 31<sup>st</sup> of the following year.

<sup>4</sup> Notably, the City of Tucson's member Service Area agreement required it to report 5,000 acre-feet of obligation per year. The City transferred long-term storage credits to the CAGR D to satisfy that obligation.

<sup>5</sup> The Member Land enrollment tables and charts in the Plan of Operation listed the year based on the application date; current CAGR D practice, and this report, summarize on the basis of when the Member Agreement and Declaration are recorded. As a consequence, Figure 2 in this report is less "spiky" than the corresponding chart (Figure 2.4) in the Plan.

<sup>6</sup> The construction information in this report is based on parcel data maintained and provided by the Assessors for Maricopa, Pinal and Pima Counties. CAP maintains a unified GIS layer and tabular data for those 2+ million parcels, including attributes of all residential parcels. This provides a consistent dataset for planning and analysis, but the housing unit counts are not identical, and generally slightly lower, than the permit-based data used in the Plan of Operation.

<sup>7</sup> U.S. Census Bureau ([www.census.gov/population/www/cen2000/maps/respop.html](http://www.census.gov/population/www/cen2000/maps/respop.html) and [www.census.gov/compendia/statab/2012/tables/12s0014.pdf](http://www.census.gov/compendia/statab/2012/tables/12s0014.pdf))

<sup>8</sup> Central Arizona Project and Maricopa Association of Governments Information Center, 2004. *Outlook 2003: Municipal Demand Projections for CAWCD's Service Area Assuming Historic Data Through January 2003*, [CD-ROM], Phoenix, AZ.

<sup>9</sup> Based on estimated population (2006) by the Arizona Department of Water Resources, in the *AMA Assessments*.

<sup>10</sup> The Maricopa Association of Governments evaluated the rate and amount of time it takes for subdivisions to build-out once construction has been initiated. These "velocity curves," which vary based on the subdivision size, were incorporated into the projections in the Plan.

## Chapter 2

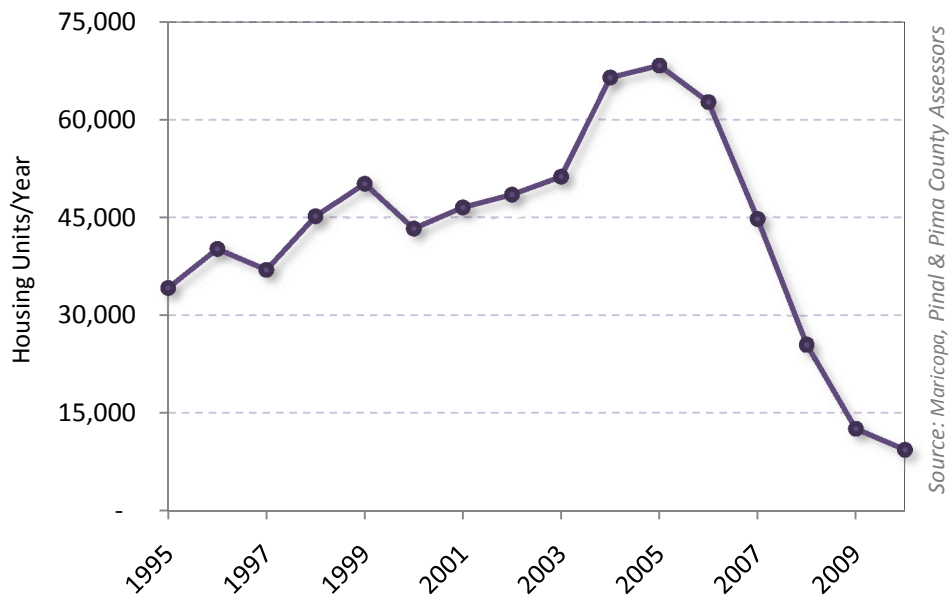
### "KINGDA KA"

*"[T]he hydraulic launch mechanism accelerates the train from 0 to 128 miles per hour in 3.5 seconds, pulling about 1.67 G. The train climbs the main tower...then descends 418 feet straight down through a 270-degree right-hand spiral."*

—Description of *Kingda Ka*, the world's tallest rollercoaster, in Jackson, New Jersey

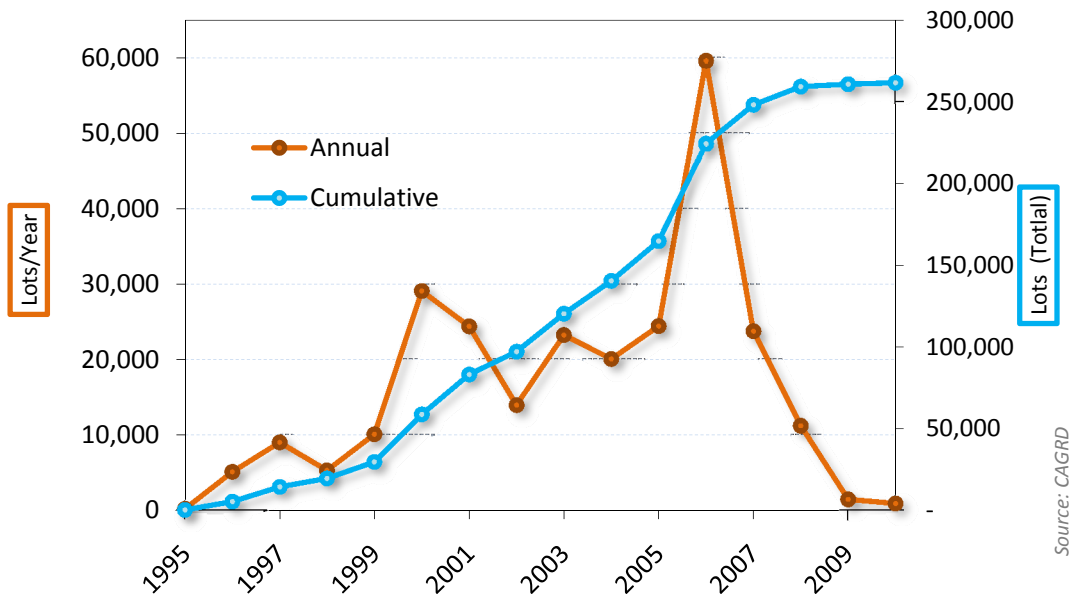
Comparing Arizona's housing market to a rollercoaster ride is a shop-worn cliché, but not even the mighty *Kingda Ka* can compare with the rise and precipitous fall of the housing market in the past six years (Figure 11). The climb and terrifying drop have had profound and wide-ranging effects on Arizona's physical, political and economic landscape, and the CAGR and its members were sitting in the front row.

**Figure 11: Tri-County Residential Construction, to 2010**



Immediately following adoption of the Plan, the concern was not about activity grinding to a halt, rather it appeared that the enrollment and demand projections might be too low. The already high pace of home construction accelerated further, and rapidly rising home prices led many buyers to "drive-to-qualify" at the outer fringes of the urban area. Large tracts of desert and agricultural land suddenly became economically viable for residential development, and affordable financing, speculation and questionable lending standards helped things along. There were cautionary signs—a divergence in the ratio of jobs to homes, an increase in investor-owned properties, and steady declines in the affordability indices—but growth had its own momentum.<sup>11</sup>

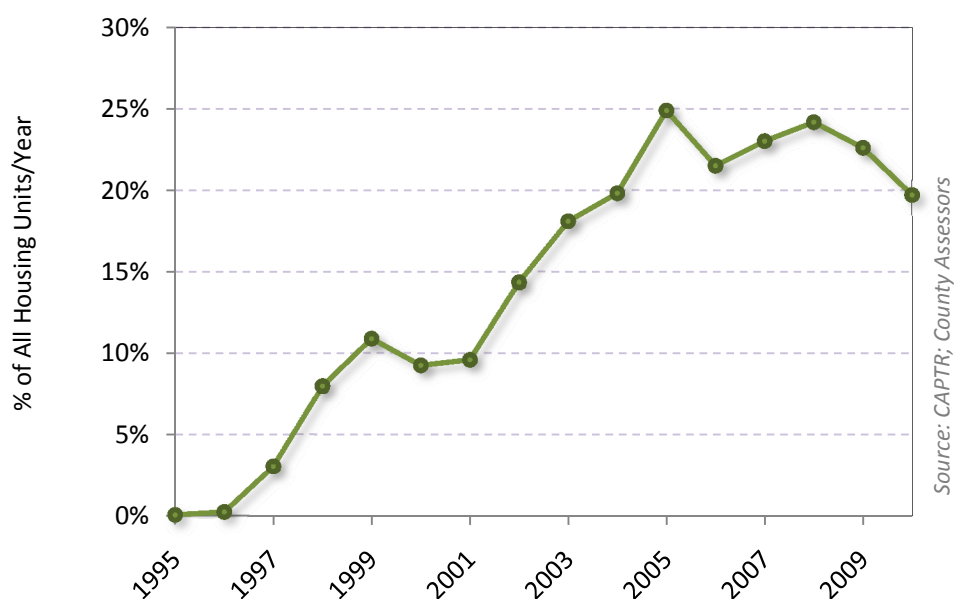
**Figure 12: Member Land Enrollment, to 2010**



In addition to general overheating of the housing market, in 2006 the CAGRD saw another large policy-driven spike in enrollment like the one in 2000 (Figure 12). The 2006 increase was particularly pronounced in the Pinal AMA where a pending change in the Assured Water Supply Rules created a strong incentive to enroll before 2007.<sup>12</sup> The 23,833 Member Land lots that were enrolled in 2006 in the Pinal AMA constituted a 579% increase over the previous year.

Even with the frenetic pace of construction, the ratio of enrollment to constructed units worsened, and the backlog of not-yet-built subdivisions grew. As it turned out, 2006 wasn't just a year of unusually high enrollment, it was the apex of overall housing and economic activity; the top of the rollercoaster had

**Figure 13: Proportion of Residential Construction in Member Lands, to 2010**

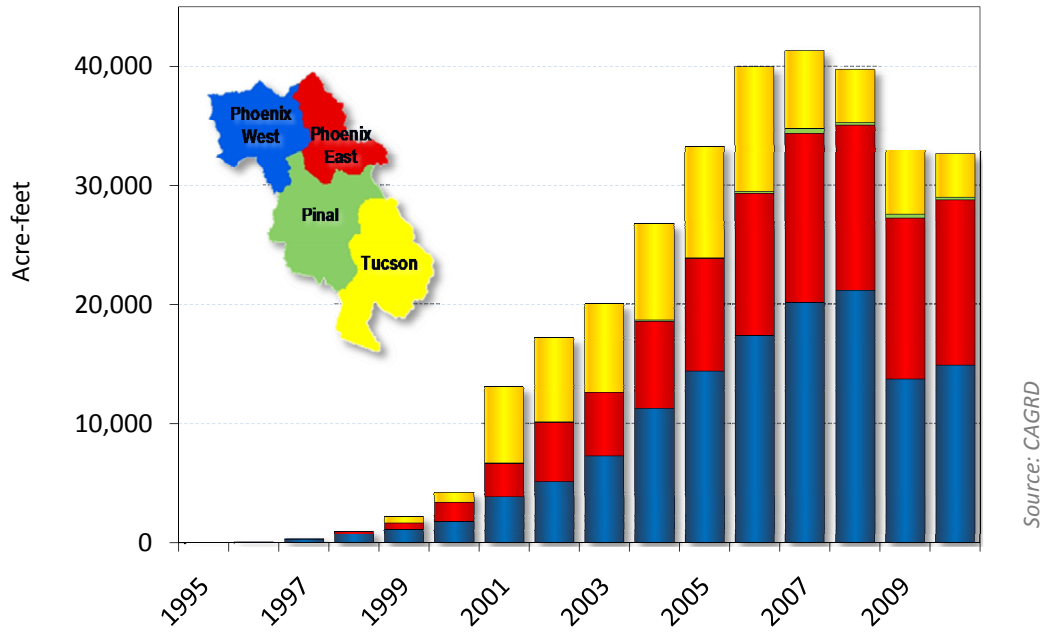


been reached. Consider, for example, that in 2006 Arizona held the number two spot in national job growth, but by 2009 it fell to 49<sup>th</sup>.<sup>13</sup> It is not hard to find other depressing statistics—foreclosures, vacancy rates, underwater loans—that confirm the wreckage.<sup>14</sup>

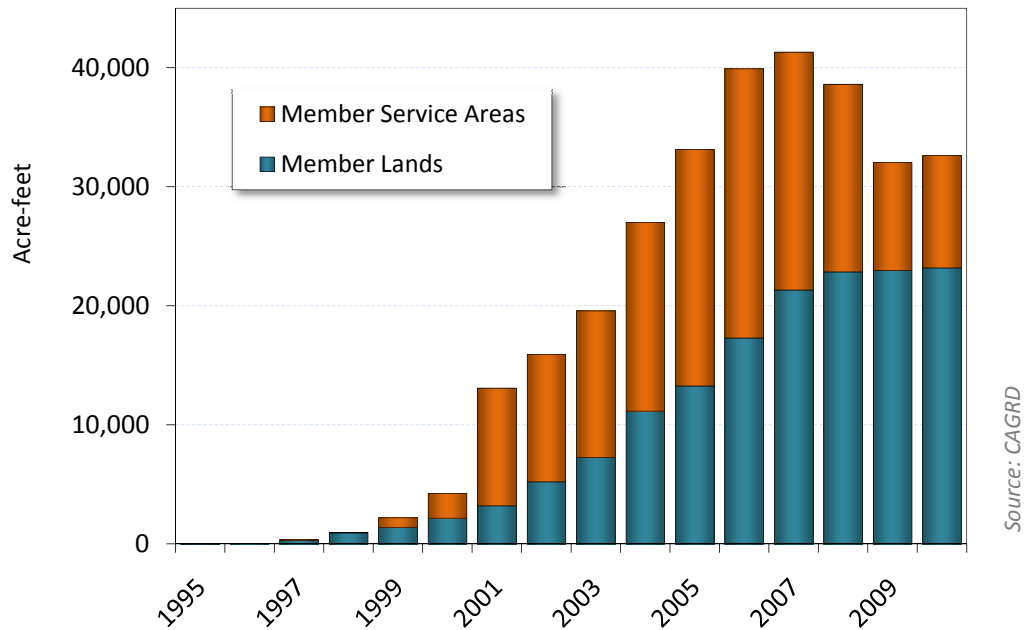
One phenomenon that appears to have been relatively unaffected by the rollercoaster ride is the proportion of overall residential construction associated with Member Lands (Figure 13). The comparative stability of that measure after 2003—between 20% to 25%—even though the amount of construction varied enormously, hints at the possibility of some underlying equilibrium point.

The CAGR's annual replenishment obligation hit a peak in 2007, at just over 40,000 acre-feet (Figure 14). The decline since then is partially explained by the reduced obligation in Tucson,<sup>15</sup> but the cause of the reduction is clearer when viewed by membership type (Figure 15). As one would expect, Member Land obligation leveled-off as construction activity decreased. Figure 15 makes it clear that the overall drop in obligation is a result of Member Service Areas.

**Figure 14: Replenishment Obligation, to 2010**

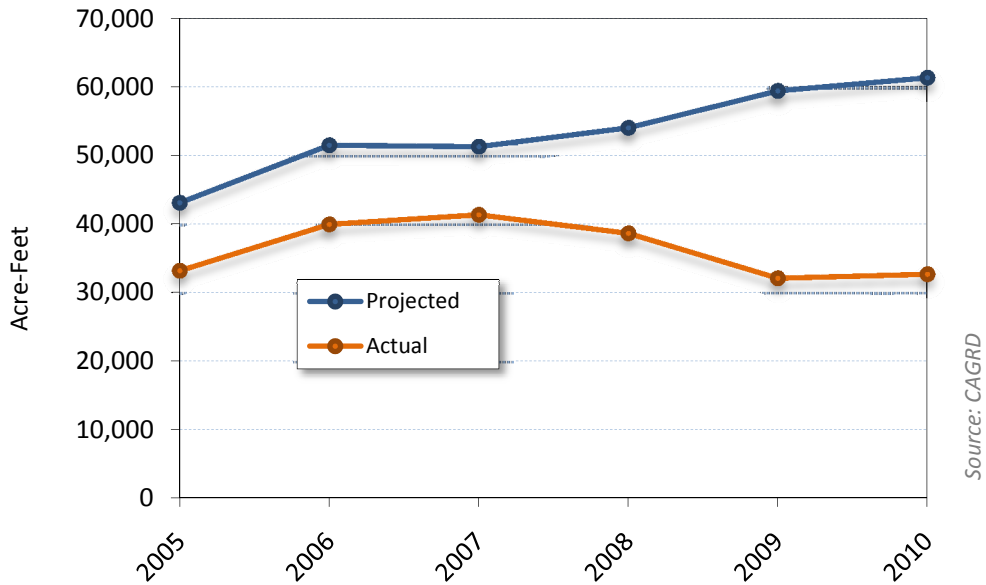


**Figure 15: Replenishment Obligation, by Member Type, to 2010**





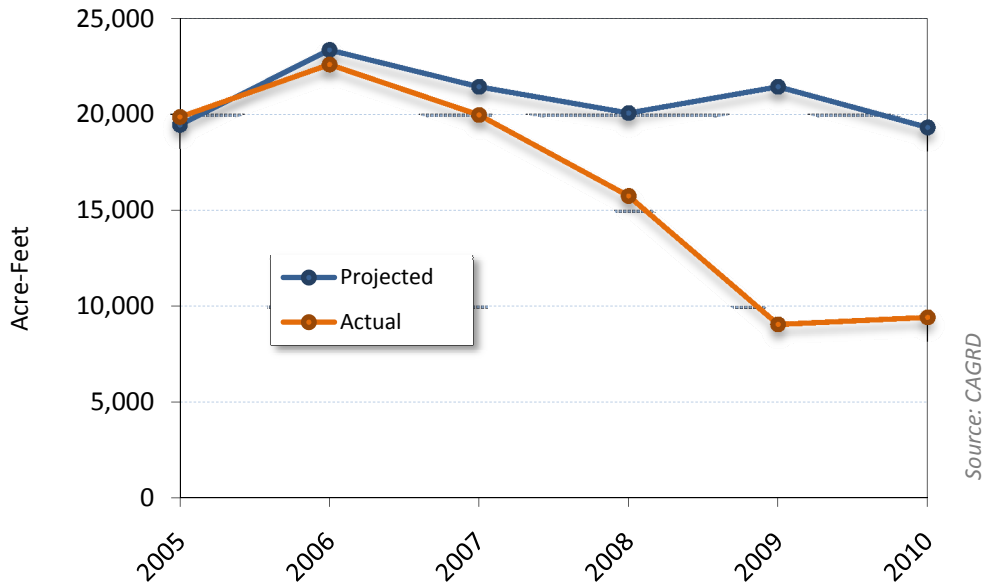
**Figure 16: Projected vs. Actual Obligation for All Members**



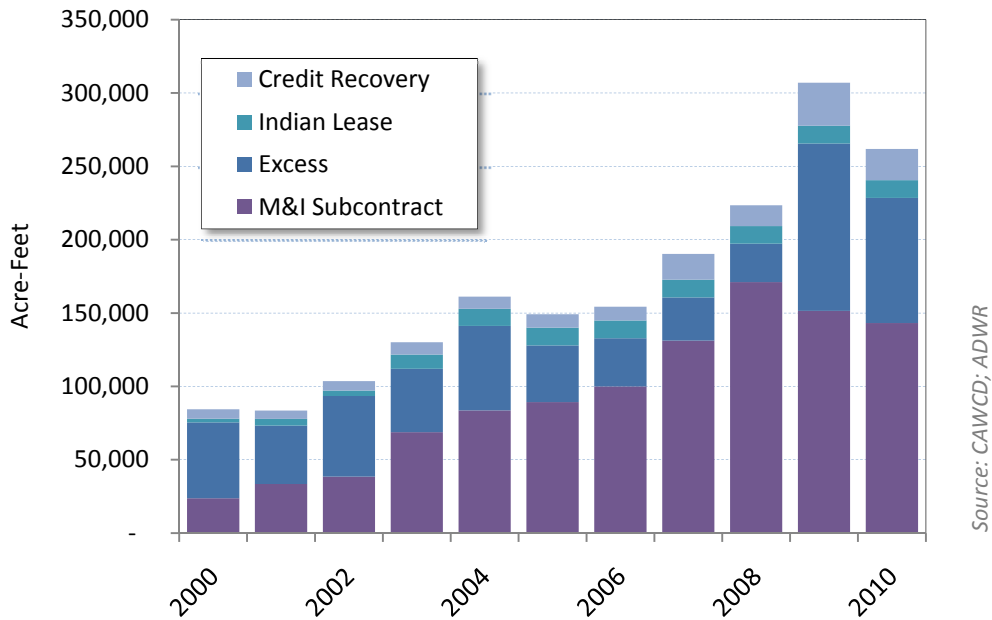
As Figure 17 shows, the Plan had anticipated a modest reduction in Member Service Area obligation after 2006, but the difference between projected and actual has increased. Part of the explanation comes from an examination of the use of CAP water by the currently enrolled Member Service Areas (Figure 18). The chart shows not only that water providers used their M&I CAP subcontracts, which was largely anticipated, but that use of Excess CAP has been substantial.

For several Member Service Areas, the use of Excess CAP is part of an overall strategy to reduce or eliminate the amount of groundwater that must be replenished by the CAGR D. Since Member Service Areas have to collect the revenue for CAGR D replenishment from their customers through their water rates, these water providers have a direct incentive to reduce the cost of compliance with the Assured Water Supply provisions. Water providers that are able to obtain Recovery Well permits from ADWR for their production wells can often greatly reduce their costs by performing Annual Storage and Recovery, or through recovery of Long-Term Storage Credits.<sup>16</sup>

**Figure 17: Projected vs. Actual Obligation for Member Service Areas**

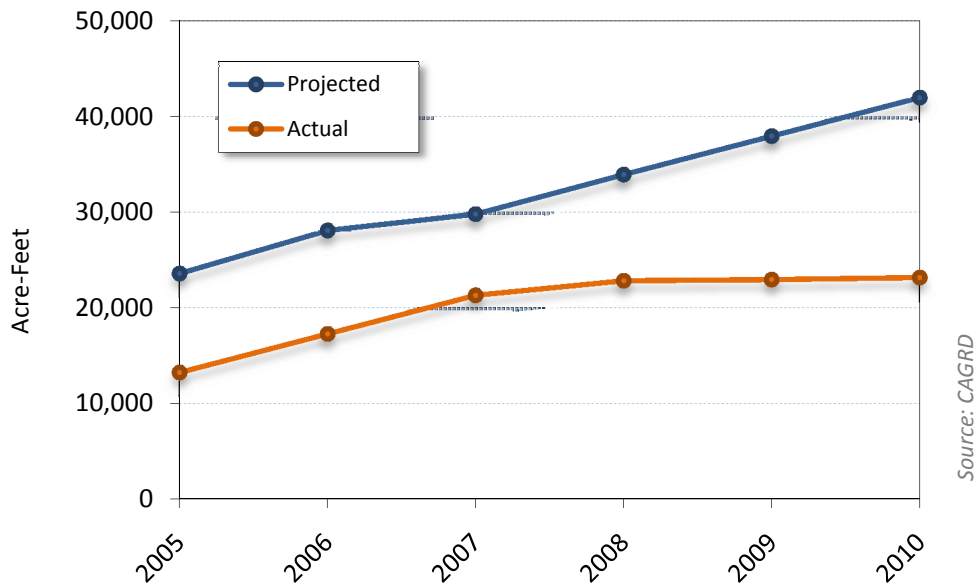


**Figure 18: CAP Utilization by Current Member Service Areas**

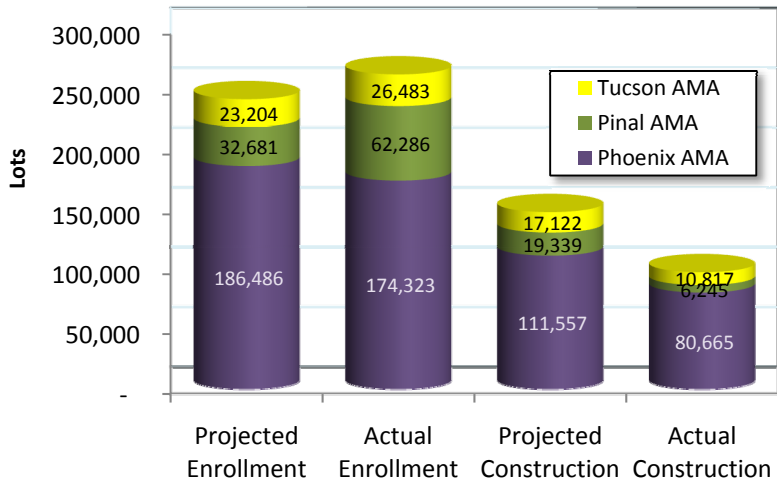


For Member Lands, the obligation projections in the Plan have been more consistently overestimated (Figure 19). There are several underlying factors, but the predominant one is related to the overall level of construction activity. As previously noted, the total Member Land enrollment has exceeded projections (Figure 20), but that is primarily due to the Pinal AMA. Since construction has not occurred as rapidly as anticipated, the total demand, groundwater demand, and obligation have also lagged.

**Figure 19: Projected vs. Actual Obligation for Member Lands**

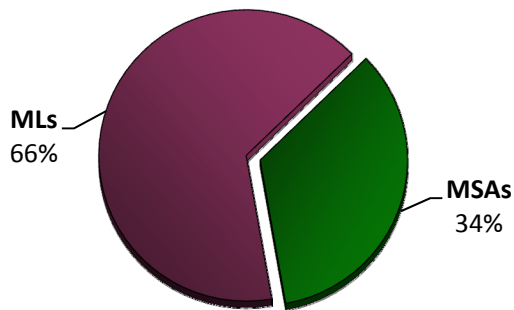


**Figure 20: Member Land Enrollment and Construction, 2010**



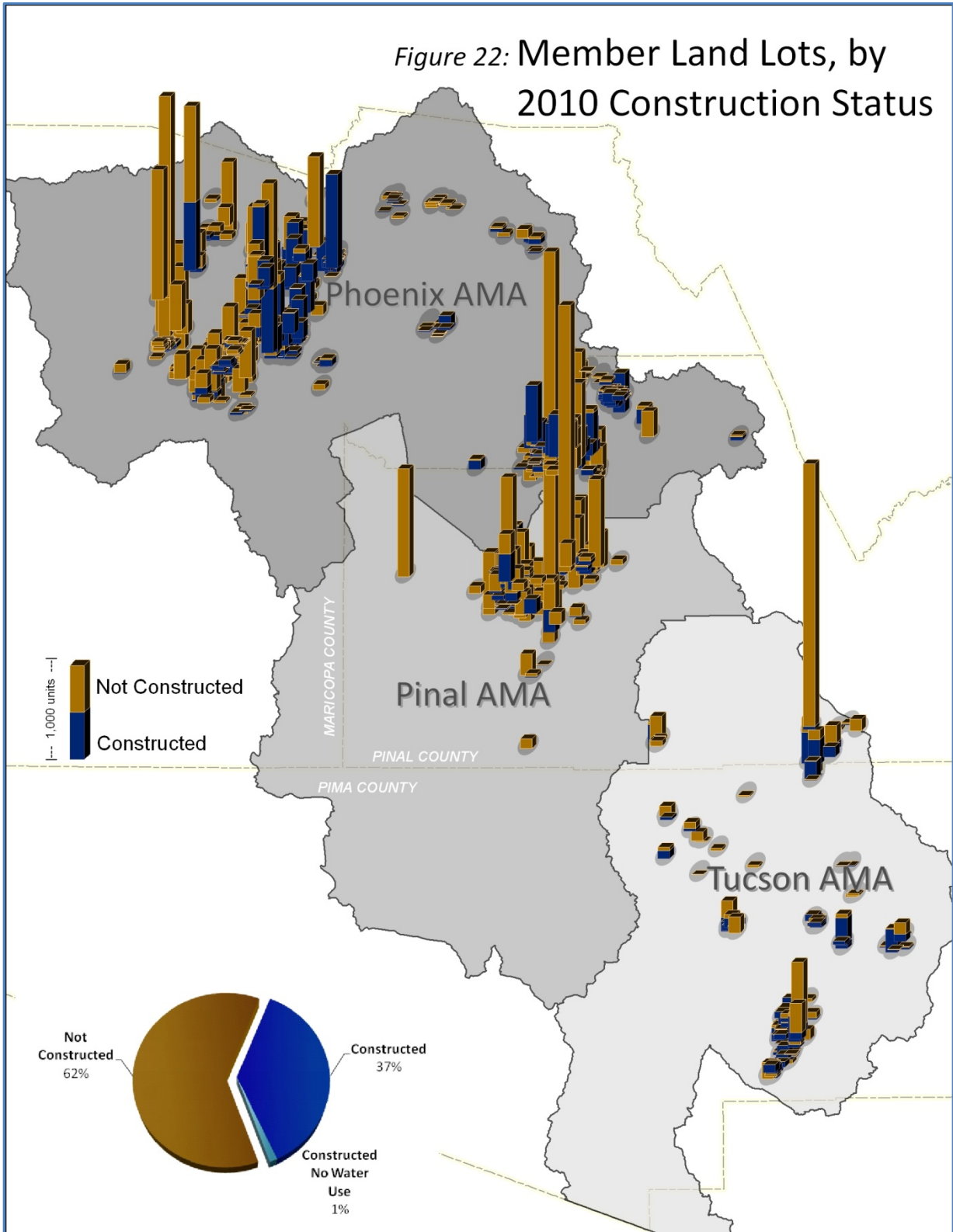
Source: CAGR; County Assessors

**Figure 21: 2010 Obligation Overestimation, by Member Type**



Source: CAGR

Figure 22: Member Land Lots, by 2010 Construction Status



The large backlog of enrolled, but not-yet-built Member Land lots accounts for the bulk of the current overestimation (Figure 21). The spatial distribution of those unconstructed lots (Figure 22) begins to reveal how far removed from the urban center many of these subdivisions are, and how large some of the proposed developments are. As discussed in the next chapter, projecting when (or if) these Member Lands will be built is one of the main planning challenges facing the CAGR. In addition, even though Figure 21 shows that Member Service Areas account for a smaller proportion of the total 2010 obligation estimation than Member Lands, the ability of Member Service Areas to avoid reporting excess groundwater to the CAGR (including through de-enrollment) suggests that in the longer term the overestimation of MSA obligation will grow.

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**Chapter 2 Bottom Line:** *The rise and fall of the housing market since 2005 has dealt a harsh blow to a number of the assumptions in the Plan of Operation. In particular, the obligation has not increased as expected, and CAGR now has a larger-than-anticipated overhang of enrolled, but not yet constructed lots.*

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## Chapter 2 Endnotes

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<sup>11</sup> The sharp rise in median home prices beginning in 2004 also offered one of the clearest indications that something out of the ordinary was happening.

[www.jparsons.net/housingbubble/phoenix.html](http://www.jparsons.net/housingbubble/phoenix.html)

<sup>12</sup> The Pinal AMA is not a safe yield AMA, so the 1995 Assured Water Supply Rules included generous allowable groundwater allowances that greatly reduce or eliminate the need for replenishment. The 2007 change made the requirement for new subdivisions closer to what it is in the Phoenix and Tucson AMAs.

<sup>13</sup> Elliott D. Pollack & Company, based on U.S. Bureau of Labor Statistics

<sup>14</sup> The Urban Land Institute's "Influx/Outflux: Metropolitan Phoenix" report from November 2009 provides a comprehensive, and quite readable account of the trends, and along with some key findings from leading experts. The full report, and a summary version, are available at:

[www.uli.org/ResearchAndPublications/CenterfortheWest/ResearchArchives/Reports.aspx](http://www.uli.org/ResearchAndPublications/CenterfortheWest/ResearchArchives/Reports.aspx)

<sup>15</sup> See Chapter 1, Endnote 4

<sup>16</sup> Information on the regulatory requirements can be found at ADWR:

[www.azwater.gov/AzDWR/WaterManagement/Recharge/](http://www.azwater.gov/AzDWR/WaterManagement/Recharge/)

## Chapter 3

### "MAYBE NEVER"

*"For now, he said, the couple were planning to sit tight in Maricopa until the market turned, even if it took another five years . Someday, they hoped, they would be able to recover what they'd lost."*

*–The Boomtown Mirage, by Samantha Shapiro, New York Times Magazine,  
April 6, 2008*

The housing market in Arizona has experienced previous cycles of boom and bust, and there is reason to believe that at some point there will be a rebound from the current situation. However, the severity of the collapse has greatly increased uncertainty in the housing sector, and as a result, uncertainty for the CAGR. Steps have been taken to improve the capacity of the CAGR to deal with that uncertainty, but the planning and analytical challenge is large, and remains a work-in-progress.

Many factors at the national, regional and local level have to improve before robust housing construction returns to Central Arizona. That could take a very long time, but some care should be taken to avoid 'momentum bias'—the tendency to over-project when things are booming, and under-project when things are low. Arizona still has a number of characteristics that tend to favor long-term growth. Those factors include the ninth lowest median age in the U.S., the fourth highest fertility rate,<sup>17</sup> a once-again attractive affordability index,<sup>18</sup> pent-up demand from doubled-up households,<sup>19</sup> ample zoned and platted land, and (mostly) favorable weather.<sup>20</sup> Moreover, because housing construction is labor-intensive, it can create a certain amount of its own momentum. It is an oversimplification, but once housing activity gets going it generates direct jobs, which generates demand for other goods and services, which creates jobs, which attracts newcomers, which fuels demand for housing, which keeps the cycle going.<sup>21</sup>

For planning purposes, the housing sector question is considered in three parts:



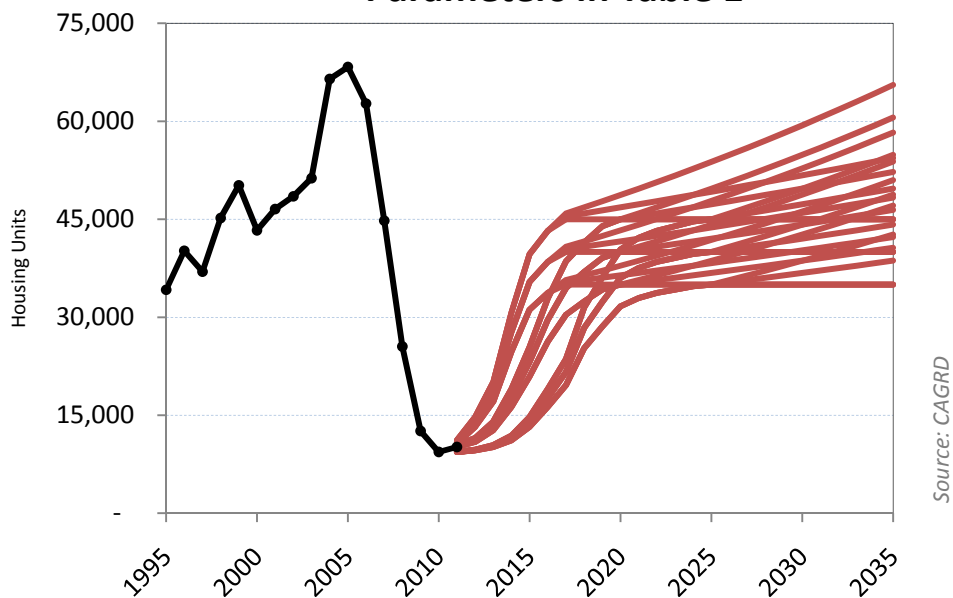
1. How long it will take to get back to a more "ordinary" (i.e., population-driven) level of housing activity?
2. What will that level be?
3. What rate of growth will occur thereafter?

Three different initial values were selected for each of these (Table 1).

Parameter	Value #1	Value #2	Value #3
Duration of recovery period	Short (~5 years)	Medium (~10 years)	Long (~15 years)
Level of "ordinary" activity	35,000 units/yr	40,000 units/yr	45,000 units/yr
Post-recovery growth	0%	1%	2%

The duration of the recovery period is the subject of considerable debate among experts. Many predictions of a "V-Shaped" recovery<sup>22</sup> have given way to talk of lost decades<sup>23</sup> and bulldozing foreclosed homes.<sup>24</sup> The duration parameters were chosen to encompass a wide range of plausible outcomes. The values for "Level of 'ordinary' activity" and "Post-recovery growth" have been set more narrowly, but even so, the 27 combinations generated from these parameters begin to convey how broad the range of outcomes can be (Figure 23).

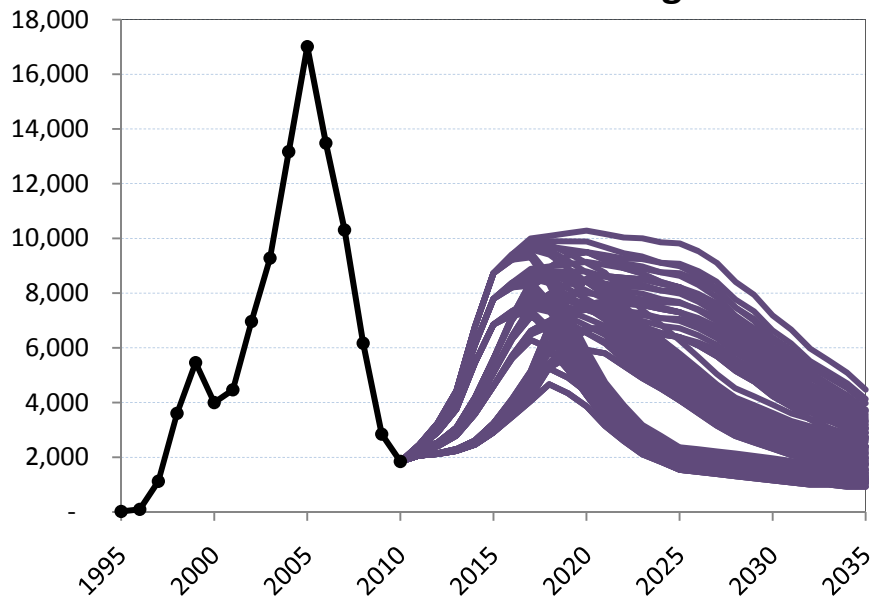
**Figure 23: Tri-County Construction Based On Parameters in Table 1**



## Member Lands

The next step for CAGR Member Land planning is to estimate how much of the overall construction will be associated with Member Lands. The approach used for the Plan of Operation relied heavily on disaggregating official county-level population and housing projections. Though it was a defensible approach, it offered limited ability to consider alternative outcomes. CAP is currently updating this approach to more explicitly couple the aggregate housing unit assumptions with the spatial distribution of those units.<sup>25</sup> In the meantime, Member Land construction can be approximated by making some broad construction assumptions.

**Figure 24: Scenarios for Construction of Member Lands Enrolled Through 2015**



The results of applying three different Member Land construction assumption sets are shown in Figure 24.<sup>26</sup> The chart illustrates how even a small number of factors can generate a large number (and very broad range) of outcomes. For policy and decision-making purposes it is usually necessary to extract a much smaller subset of outcomes for evaluation, but the ability to analyze the larger set can help evaluate uncertainty and strengthen the basis of those decisions.

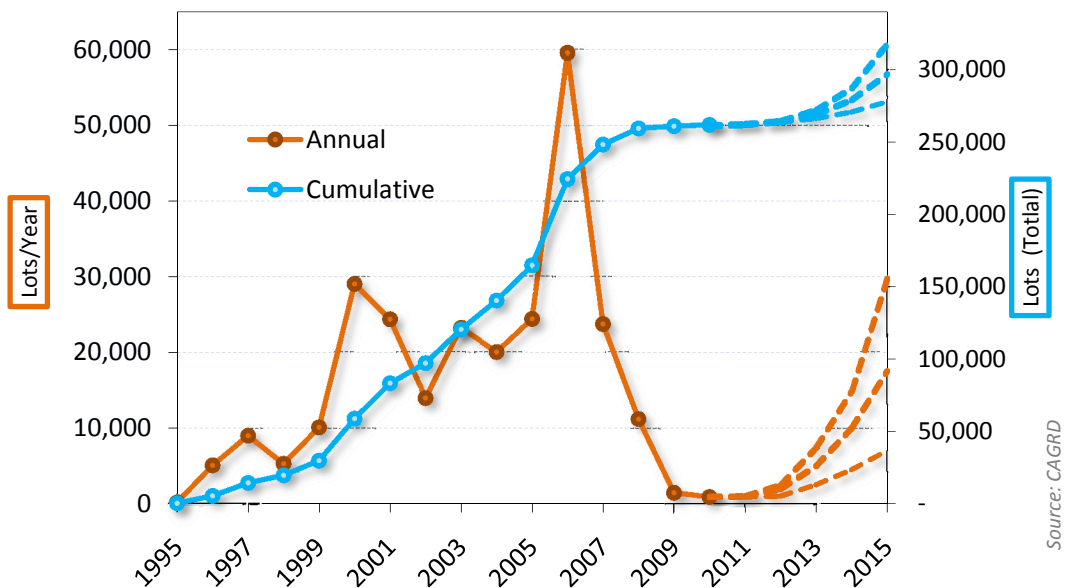
The process then involves converting the projected housing units into demand, and then calculating how much of that will result in CAGR obligation, by year,

for each Member Land. To accomplish this, the CAGR D uses the "Short-Term Outlook" model that was first developed to support the Plan of Operation, and has since been updated to add functionality and to account for operational and policy changes (e.g., the 2007 Pinal AMA rules). Outlook uses data in the CAGR D's operational database (CAPTR), including the hundreds of thousands of parcel water use records, to develop demand estimates for planned subdivisions based on fully constructed subdivisions that have stable water use.

Outlook generates good quality estimates of Member Land build-out demand and obligation (and results improve with each year of water use data), and new capabilities are being tested that incorporate projected construction rates like those shown in Figure 24. Work is also underway to implement a construction likelihood classification scheme for each Member Land—"Now"; "Later"; "Much Later"; and "Maybe Never." So far, the approach looks promising, and is particularly useful for evaluating the impact of subdivisions in the Pinal AMA, where the number of enrolled lots is large, but the projected CAGR D obligation is small.

In addition to Member Land construction, demand and obligation, it is also necessary to make projections of enrollment through the end of the current Plan. While there is a general association between enrollment and housing construction activity, there have also been enrollment spikes for policy reasons.

**Figure 25: Member Land Enrollment Scenarios**



The generally depressed housing economy and the implementation of Annual Membership Dues may reduce the magnitude of a spike before 2015, but a rush to enroll prior to the next Plan is certainly a possibility (Figure 25).

Table 2 shows an example of the initial results of the Member Land demand and obligation projections. The assumptions in this example are middle-of-the-road, and indicate that the 2035 Member Land obligation is notably below the 140,500 acre-feet projected in the Plan. Part of the difference is due to a lower overall level of enrollment (297,200 units in this projection; 342,000 in the Plan), and the fact that the updated modeling shows 50,200 units that are enrolled but not built. If these "Maybe Nevers" are actually constructed, they could be expected to add another 18,100 acre-feet of obligation (total=107,300 acre-feet).

<b>Table 2: Preliminary Member Land Modeling Results: Moderate Scenario</b>					
Moderate Enrollment Spike; Medium-Paced Housing Recovery; Housing Stabilized @ 40k; 1% Housing Growth Thereafter; Mostly Existing ML Post-2015 Construction					
	<b>2010</b>	<b>2015</b>	<b>2025</b>	<b>2035</b>	<b>Beyond</b>
<b>Constructed Units</b>	99,800	116,500	194,900	247,100	297,200
<b>Unconstructed Units</b>	161,900	180,800	102,300	50,200	0
<b>Groundwater Demand</b>	35,500	45,200	86,200	121,300	146,000
<b>Obligation</b>	23,200	24,900	63,400	89,200	107,300

Table 3 uses the same level of enrollment, but a slower, and lower rate of recovery in the housing market. The effect on obligation and 2035 unconstructed lots is pronounced; nearly half of the lots remain unconstructed, and obligation is only 56,000 acre-feet.

<b>Table 3: Preliminary Member Land Modeling Results: Lower &amp; Slower Scenario</b>					
Moderate Enrollment Spike; Long Housing Recovery; Housing Stabilized @ 35k; 1% Housing Growth Thereafter; Mostly Existing ML Post-2015 Construction					
	<b>2010</b>	<b>2015</b>	<b>2025</b>	<b>2035</b>	<b>Beyond</b>
<b>Constructed Units</b>	99,800	111,600	143,200	155,300	297,200
<b>Unconstructed Units</b>	161,900	185,700	154,000	142,000	0
<b>Groundwater Demand</b>	35,500	43,300	63,300	76,300	146,000
<b>Obligation</b>	23,200	23,800	46,600	56,000	107,300

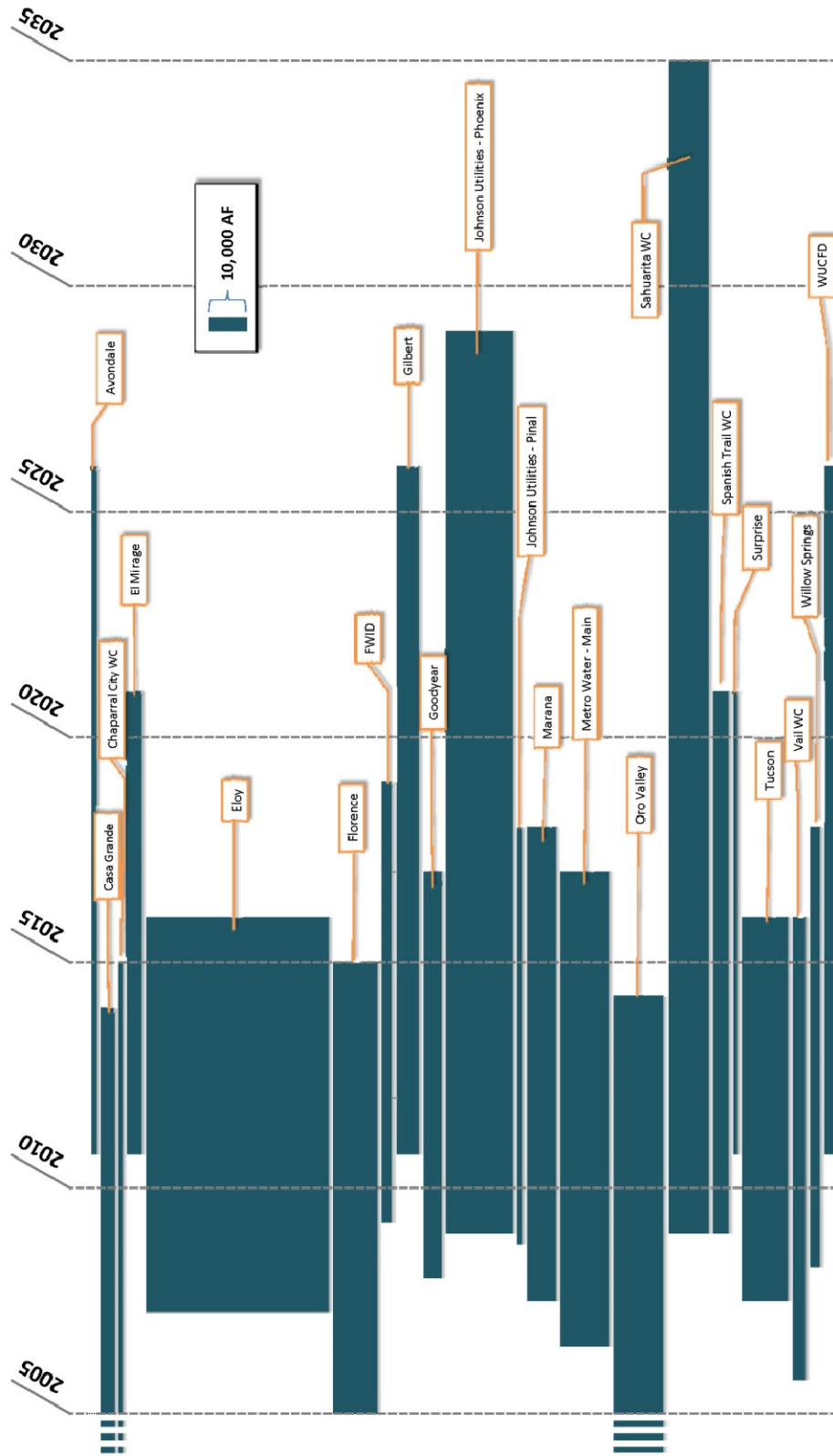
In another scenario (Table 4) there is a larger spike in enrollment, and the housing market returns very quickly. This combination results in obligation growing more quickly, and reaching a higher level in 2035 (94,700 AF), though there is still a substantial portion of the obligation that occurs sometime after 2035 (assuming the units are actually constructed).

<b>Table 4: Preliminary Member Land Modeling Results: Faster &amp; Higher Scenario</b>					
Large Enrollment Spike; Fast Housing Recovery; Housing Stabilized @ 40k; 1% Housing Growth Thereafter; Mostly Existing ML Post-2015 Construction					
	<b>2010</b>	<b>2015</b>	<b>2025</b>	<b>2035</b>	<b>Beyond</b>
<b>Constructed Units</b>	99,800	123,300	208,200	262,500	317,700
<b>Unconstructed Units</b>	161,900	194,500	109,500	55,300	0
<b>Groundwater Demand</b>	35,500	47,800	92,100	128,900	156,000
<b>Obligation</b>	23,200	26,300	67,700	94,700	114,700

### **Member Service Areas**

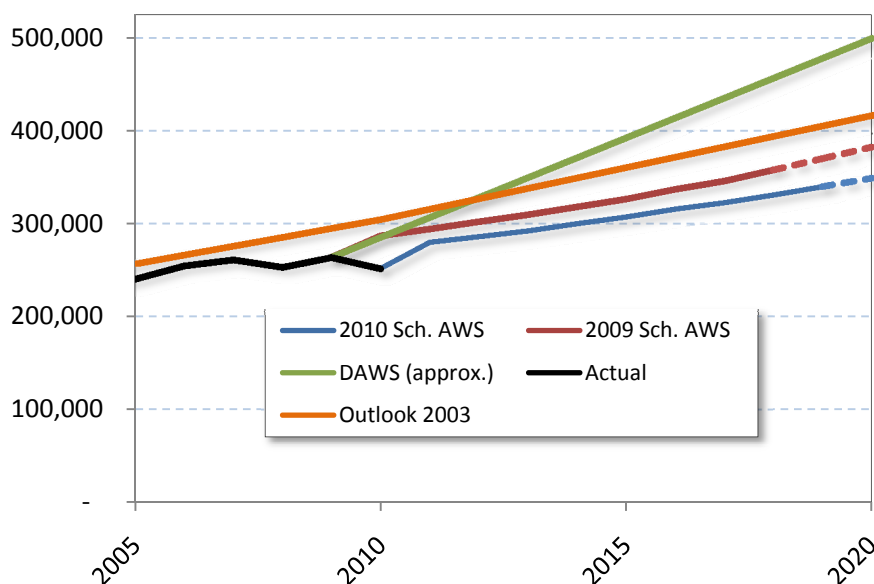
Projections of replenishment obligation for Member Service Areas are challenging to develop because these water providers have differing reliance on the CAGR. The CAGR is currently responsible for more than 175,000 acre-feet of groundwater in Designations of Assured Supply issued by ADWR (Figure 26). However, the overwhelming proportion of that is not expected to result in an actual annual replenishment obligation, and is more akin to a regulatory insurance policy. Indeed, some of the approved volumes are greatly in excess of the realistic demand projections (e.g., Eloy),<sup>27</sup> and others used groundwater as the basis of their Designation, but have CAP subcontracts that will be used in lieu of reporting to the CAGR (e.g., Metro Water).<sup>28</sup> ADWR is also now issuing Designations for longer than its previous custom of a maximum of ten years.<sup>29</sup> The practical effect of this change to designation length on the CAGR is not entirely clear, though it does reduce the frequency in which the assumptions in the Designation are revisited.

**Figure 26: Volume and Duration of Excess Groundwater in Designations of Assured Water Supply for Current Member Service Areas**



Considerable work went into the Member Service Area projections in the Plan of Operation, but the basic methodology was relatively straightforward: estimate the total demand by water provider, subtract the known or expected renewable supplies, account for groundwater supplies that do not require replenishment, and assume the remainder (if any) is reported as excess groundwater to the CAGR. That same basic approach that was used earlier this year to estimate the statutory "CAGR Reliance" factor for Annual Membership Dues. In that case, the demand projections were based on the "Schedule AWS" submitted to ADWR as part of the municipal water providers' annual reporting requirements.

**Figure 27: Demand Projections For Currently Enrolled MSAs**



Based on a comparison of projections (Figure 27), the Schedule AWS data appear to provide a more realistic basis for estimating MSA demands than the projections in the Designations of Assured Supply,<sup>30</sup> though even the Schedule AWS values are high given recent water use trends.

When more realistic overall demand growth rates are used, the approach taken with Annual Membership Dues can provide a reasonable starting point for estimating long-term CAGR reliance. However, the analysis of overestimation in Chapter 2 points to at least one serious limitation in the overall approach—the use of non-permanent supplies, particularly excess CAP water, to avoid reliance

on the CAGR. To arrive at more realistic year-to-year projections, an "avoidance adjustment" needs to be applied to the main supply calculations to acknowledge that Member Service Areas will find ways to reduce their water supply cost and CAGR reliance.

Table 5 summarizes the results of an analysis that used the Schedule AWS data, some extrapolation, and a 30% downward adjustment to account for the use of temporary supplies.

<b>Table 5: Member Service Area Projection</b>				
Schedule AWS; 1.5% extrapolated growth; 30% avoidance factor				
	<b>2010</b>	<b>2015</b>	<b>2025</b>	<b>2035</b>
<b>Total Demand</b>	255,000	310,000	377,000	439,000
<b>Obligation</b>	6,544	10,300	25,300	47,300

**Total Obligation**

The estimates of 2035 replenishment obligation contained in this report are not particularly robust—a number of very coarse assumptions have been made—but they are at least *illustrative*. The Member Service Area estimate of 47,300 AF, plus the Member Land "Moderate" scenario of 89,200 sums to a ballpark answer of 136,500 acre-feet (plus an additional 18,100 acre-feet of potential Member Land obligation after 2035). Obviously this is substantially less than the Plan of Operation estimate of 227,000 acre-feet. However, 136,500 AF is still a lot of water, and the CAGR is still a big deal.

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**Chapter 3 Bottom Line:** New challenges have been added to an already complex set of CAGR planning and analytical tasks. It is clear that CAGR's ultimate obligation under the current Plan of Operation could be in the range of 30% lower than originally projected. It is also clear that the obligations will ramp up more slowly than projected, and that the 2035 obligation may be closer to 136,500 acre-feet than 227,000.

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## Chapter 3 Endnotes

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<sup>17</sup> Based on data from the 2010 Census, [www.census.gov/prod/cen2010/briefs/c2010br-03.pdf](http://www.census.gov/prod/cen2010/briefs/c2010br-03.pdf) and <http://www.census.gov/compendia/statab/2011/tables/11s0082.pdf>

<sup>18</sup> Arizona State University Realty Studies, [http://realty.wpcarey.asu.edu/arec/market\\_update.html](http://realty.wpcarey.asu.edu/arec/market_update.html)

<sup>19</sup> David Johnson, US Census Bureau, September 13, 2011, *Households Doubling Up*, [blogs.census.gov/censusblog/2011/09/households-doubling-up.html](http://blogs.census.gov/censusblog/2011/09/households-doubling-up.html)

<sup>20</sup> Mike Sakal, September 2, 2011. *Feeling the heat? August 2011 breaks Arizona high temperature record*. East Valley Tribune, [www.eastvalleytribune.com/arizona/article\\_e9bcef0a-d5b6-11e0-a61a-001cc4c002e0.html](http://www.eastvalleytribune.com/arizona/article_e9bcef0a-d5b6-11e0-a61a-001cc4c002e0.html)

<sup>21</sup> Bureau of Labor Statistics data for 2007 show that Arizona's proportion of jobs in construction was 54% higher than the national average. [www.bls.gov/oes/2007/may/oes\\_az.htm](http://www.bls.gov/oes/2007/may/oes_az.htm)

<sup>22</sup> Forecasts from the University of Arizona's Economic and Business Research Center have tended to be on the optimistic end of the spectrum, but even their recent population projections were released under the heading "Expectations Lowered for the Longer Term." [azeconomy.eller.arizona.edu/AZE11q3/expectations\\_lowered\\_long\\_term.asp](http://azeconomy.eller.arizona.edu/AZE11q3/expectations_lowered_long_term.asp)

<sup>23</sup> Chris Isidore, June 8, 2011. *America's Own 'Lost Decade.'* CNNMoney, [money.cnn.com/2011/06/08/news/economy/economy\\_debt\\_unemployment/index.htm](http://money.cnn.com/2011/06/08/news/economy/economy_debt_unemployment/index.htm)

<sup>24</sup> Daniel Indiviglio, July 30, 2011. *Why Are Banks Bulldozing Foreclosures?* In *The Atlantic*, [www.theatlantic.com/business/archive/2011/07/why-are-banks-bulldozing-foreclosures/242784/](http://www.theatlantic.com/business/archive/2011/07/why-are-banks-bulldozing-foreclosures/242784/)

<sup>25</sup> This capability, which will allow a wider range of scenarios to be considered, is being developed to support the CAGR as well as a number of CAP's other planning needs within its service area.

<sup>26</sup> A uniform 22% ML construction rate is applied through 2015 (based on the "stabilized" ratio observed in Figure 13). The post-2015 ratio diminishes through time as more of the construction is associated with post 2015 subdivisions. Figure 24 shows three different scenarios for post-2015 construction.

<sup>27</sup> Eloy's demand projections were controversial when they were submitted to ADWR, but they did reflect some of the highly aggressive Pinal County growth projections that were in existence at the time. The potential impact to the CAGR is substantially mitigated by the Pinal AMA's generous groundwater allowances.

<sup>28</sup> A CAP M&I subcontract meets the Assured Water Supply requirement of 100-year legal and physical availability, but water providers that do not have a reliable way to put it to use (e.g., a treatment plant or guaranteed share of a recharge project) are not able to satisfy the "continuous availability" provision of the AWS Rules. A number of MSAs, including most in the Tucson AMA (other than Tucson Water), fall into this category.

<sup>29</sup> Unlike Certificates of Assured Water Supply in which the 100-year supply evaluation is done only once, Designations of Assured Water Supply have time and volume limits that require periodic review. In that respect, a water provider that maintains its Designation must demonstrate a rolling 100-year water supply.

<sup>30</sup> There are provisions of the Annual Membership statute that create an economic incentive for Member Service Areas to produce realistic projections. The downward adjustment between 2009 and 2010 reporting years was partially attributed to water providers taking a closer look at their individual projections.