FINAL REPORT ON SAFE-YIELD IMPEDIMENTS, OPPORTUNITIES, AND STRATEGIC DIRECTIVE

PREPARED FOR:

PRESCOTT ACTIVE MANAGEMENT AREA GROUNDWATER USERS ADVISORY COUNCIL (GUAC)

BY:

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I. PREAMBLE

"The Groundwater Users Advisory Committee (GUAC) Safe-Yield Subcommittee's mission is to examine and identify the impediments and opportunities for achieving and thereafter maintaining a state of **safe-yield** (A.R.S. § 45-561(12)) in the Prescott **Active Management Area** (PrAMA) by 2025 and recommend a strategic directive to the GUAC no later than December 31, 2006" (Defined in III.B below). A Technical Advisory Committee composed of representatives from the subcommittee member's organizations or affiliations was established to assist in the completion of this strategic directive.

II. PURPOSE AND SCOPE

The 1980 Groundwater Management Act (GMA) established three pivotal components that influenced the creation of this document: 1) it established the safe-yield water management goal for the PrAMA. 2) it created the Arizona Department of Water Resources (ADWR) to manage the groundwater resources in the PrAMA according to state regulations in order to reach the safe-yield goal and 3) it established the GUAC to act as a local advisory board to assist and advise the Arizona Department of Water Resources (ADWR) in reaching the goal. In December 2005, the GUAC, fearing that the management programs established by the GMA may not be sufficient for attaining safe-yield, decided to assess the impediments and opportunities for reaching safe-yield and created the Safe-Yield Subcommittee to help with this task. This report seeks to clarify the impediments to reaching safe-yield and the opportunities that are available to assure the PrAMA reaches and thereafter maintains safe-yield by 2025.

This report is intended to document the obstacles to reaching safe-yield and provide a menu of possible approaches to overcoming those obstacles; it does not define a plan for reaching safe-yield in the PrAMA. Instead, the information in this report can form a basis for developing a safe-yield plan by a group comprised of affected stakeholders, the Arizona Department of Water Resources (ADWR) and potentially the Arizona State Legislature. In addition, concepts in this report may be integrated into the Prescott AMA Fourth Management Plan (4MP). Any integration into the 4MP or implementation of any recommendations of this report will require a technical, legal, and administrative analysis by ADWR or legislation for acceptance.

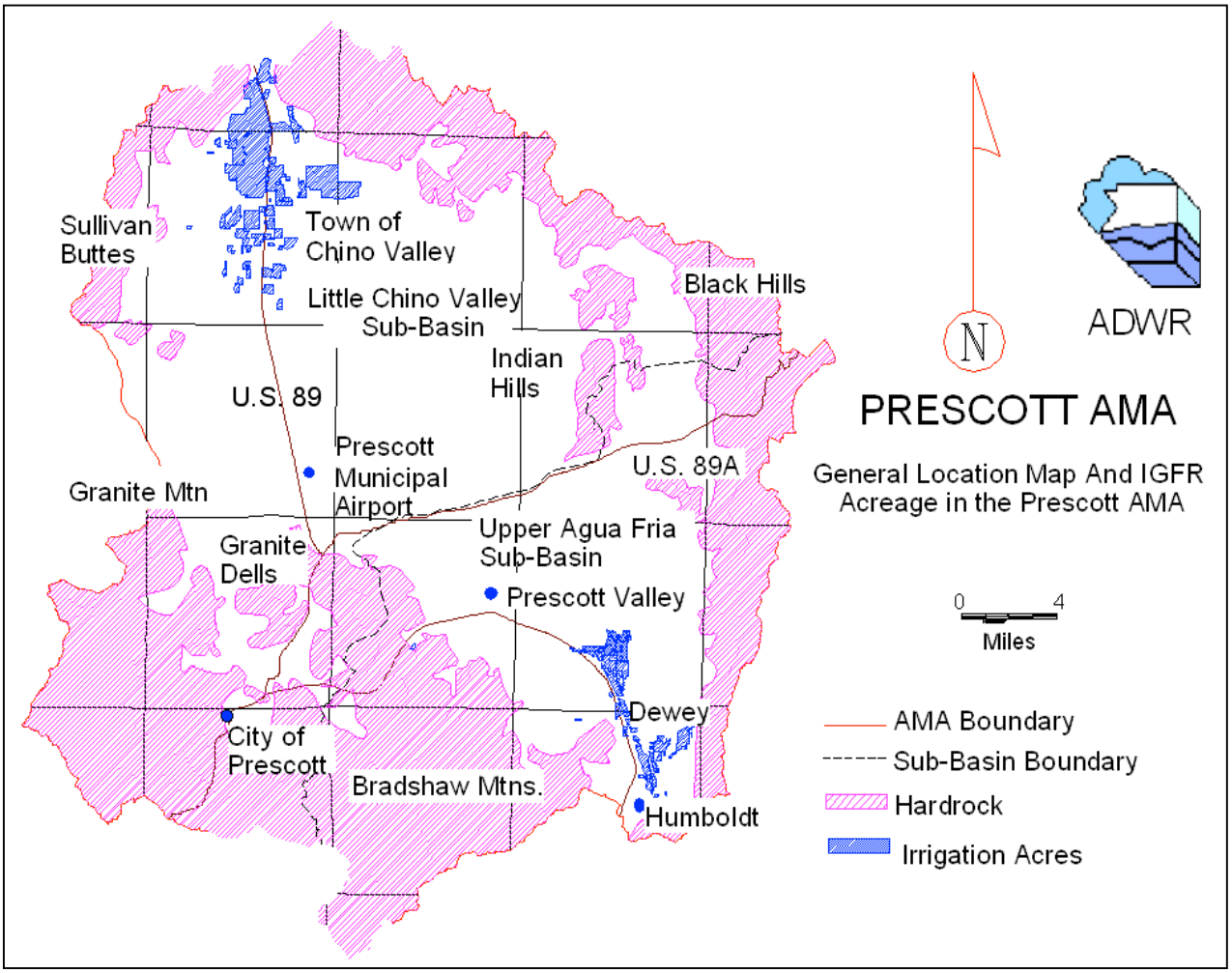
This report documents obstacles to reaching safe-yield and provides a menu of possible approaches to overcome these obstacles. It does not define a plan.

III. INTRODUCTION

Prior to the 1940s, water use in the Prescott area was primarily supplied by surface water impoundments and diversions. Irrigated agriculture in Chino Valley and Dewey was supplied by impoundments such as Watson and Willow Lakes, or direct diversions from Lynx Creek. The introduction of the high-capacity turbine pump in the 1940s gave farmers a way to supplement surface water supplies or to subjugate additional acreage to irrigation. These pumps and wells also provided the City of Prescott a more secure

supply than was available from the Goldwater Lakes. In the mid-1990s municipal water demands surpassed agriculture water demands as the primary groundwater user in the PrAMA. However, overall groundwater use in the region has not changed significantly since the 1960s.

Currently, the groundwater basins which range roughly from Walker to Chino Valley and from Prescott to Dewey provide most of the potable water demands for residents in the area. The aquifer system was designated an Active Management Area by the State of Arizona with the passage of the 1980 GMA. The 485 square-mile region encompasses the AMA groundwater basin and the Granite Creek and Upper Agua Fria River watersheds. The GMA recognized groundwater rights, initiated water use reporting and water conservation requirements, and established a goal for the PrAMA of reaching safe-yield by 2025. Lacking sufficient data to determine if the PrAMA was within safe-yield or not, ADWR put off enacting additional management requirements. In January of 1999, ADWR declared the PrAMA to be "out of safe-yield" based on a water budget analysis. At that time, the Assured Water Supply Rules came into effect, restricting access to groundwater for new subdivisions.



Initially, the municipal water providers in the PrAMA considered independent actions to meet their share of the safe-yield obligation. However, It became apparent that certain obstacles exist that will make achieving safe-yield throughout the PrAMA difficult if not impossible and that a collaborative effort would be required. In the fall of 2005, the

GUAC established a safe-yield subcommittee, comprised from among all groundwater user groups in the PrAMA to begin this collaborative effort and document safe-yield issues in this report.

The concepts presented in this report were created through a consensus-based process of the participating parties. The members of the subcommittee include duly-elected officials of the major jurisdictions and some local water interest groups from each of the following entities:

1. City of Prescott
2. Town of Prescott Valley
3. Town of Chino Valley
4. Town of Dewey-Humboldt
5. Yavapai Prescott Indian Tribe
6. Yavapai County
7. Private Water Companies
8. Citizens Water Advocacy Group

A. Current Conditions

Although the Assured Water Supply Rules restrict access to groundwater for post-1999 subdivision growth, approximately 32,000 residential units were approved just prior to the 1999 declaration that the PrAMA was "out of safe-yield" and were granted access to groundwater (approximately one-half are now developed). This action further exacerbated the groundwater overdraft in the PrAMA. These pre-1999 residential units are primarily supplied by the municipal water providers in the PrAMA. Although the groundwater overdraft within the PrAMA was once primarily the result of pumping by irrigated agriculture, the largest groundwater users are now municipal water providers.

The three municipal water providers in the PrAMA (Prescott, Prescott Valley and Chino Valley) have separately developed plans for addressing their proportionate share of the groundwater overdraft in order to help reach safe-yield. It is important to note that although these plans address the largest portion of the safe-yield equation, they do not address the entire groundwater overdraft problem in the PrAMA. Additionally, the municipalities' plans to reach safe-yield hinge on the ability to import additional water supply from the Big Chino Sub-basin – a project requiring infrastructure that is not yet complete.

Actions by municipal water providers in addition to expected declines in agricultural water use can eliminate most of our groundwater overdraft.

Agricultural water uses continue to pump a significant volume of groundwater but are steadily decreasing in the PrAMA as water rights are purchased for other uses. The conversion of agricultural water rights to a residential use reduces the allowable pumping to approximately one-tenth (1/10) of the original agricultural pumping (depending on year of the conversion and other factors as defined in Arizona Administrative Code Section 12-15 and session law). This process is

anticipated to continue without additional intervention and will virtually eliminate this sector of water use. It is anticipated that the agricultural water rights, once extinguished and converted to other uses, will attain safe-yield through the drastic reduction in allowable pumping.

Some obstacles to reaching safe-yield have been addressed - the focus of this report is on those obstacles that have not yet been addressed.

In developing this report, the GUAC has focused on the obstacles to reaching safe-yield that have not yet been addressed. It has been assumed that the plans of the municipal water providers (representing at least 58% of total pumping) and the continued decline in agricultural groundwater uses (representing 18% of total pumping) will be effective in addressing the largest share of the groundwater overdraft. Some oversight and coordination should be exercised to ensure that these elements will be successful.

B. Safe-Yield Defined

As defined by Statute, "Safe-yield is a groundwater management goal which attempts to achieve and thereafter maintain a *long-term balance* between the amount of groundwater withdrawn in an active management area and the annual amount of **natural** and **artificial recharge** in the active management area", (A.R.S. § 45-561 Section (12)). **Incidental recharge** is interpreted to be a component of artificial recharge. Throughout the remainder of this report, artificial recharge is used in the context of recharge that occurs as a result of intentional human activities (i.e. recharge projects), while incidental recharge is used in the context of recharge that results from unintentional human activities (i.e. excess water applied during irrigation). This is an important distinction since water that is artificially recharged maintains its original legal characteristic (effluent, surface water, etc.) while being stored in the aquifer and later withdrawn, while water that is incidentally recharged acquires the legal characteristic of groundwater. Since the safe-yield goal addresses groundwater conditions, artificial recharge must be considered separately.

As defined, safe-yield does not require that the water table be maintained at a level that would provide for natural outflows to springs, streams or other aquifers. Although the change in the water budget over the long term provides the most definitive measure of the achievement of safe-yield, water level measurements are required to provide an understanding of the factors that affect safe-yield. The safe-yield goal is a basin-wide balance where recharged water in one part of the PrAMA can offset groundwater levels in another portion of the PrAMA.

C. Importance of Achieving Safe-Yield

Safe-yield will maintain a long-term water supply for **all groundwater users** including individual well owners and water providers.

Overdraft of groundwater in the aquifers cannot continue forever. Continuous water level declines will eventually impact the ability of groundwater

users to physically and/or economically acquire groundwater. Shallow groundwater wells may go dry and/or have to be drilled deeper at considerable costs. A significant decline of the water table may cause the aquifer to compress and lead to land subsidence. Areas in the southern portion of Arizona are experiencing such subsidence. Land subsidence can result in significant damage to properties and structures and would permanently reduce aquifer storage and production capabilities within the compressed areas. If safe-yield is not achieved the area may face other significant economic damages. Without a secure water supply, businesses and industries may not be able to locate here, or expand here. Also, real estate values could be negatively affected.

Safe-yield, by definition, will eliminate continuing overdraft, minimize reduction in aquifer storage, and maintain a long-term water supply for all groundwater users in the PrAMA, including individual well owners and private and municipal water providers.

D. The Estimated Size of Groundwater Overdraft

ADWR periodically calculates **water budgets** for the PrAMA and publishes a PrAMA Hydrologic Monitoring Report Series. These reports show that for a number of years more water has been leaving the aquifer, naturally and through pumping, than has been recharged, naturally and artificially. This condition is referred to either as "out-of-safe-yield," "mining the aquifer" or "overdraft." In 2001, the overdraft was 11,510 AF[1], in 2002 it was 15,450 AF[2], and in 2003 it was 11,300 AF[3]. The large municipal water providers pumped approximately 58% of the total groundwater removed from the PrAMA in 2003, while agricultural users pumped 18%, private domestic wells pumped 14% and the remaining 10% was used by small providers, non-domestic exempt wells and commercial and industrial users (see Appendix A).

Although there is approximately 2.9 million AF of groundwater in storage (not all of which can be recovered through pumping), continuous overdraft will eventually deplete the aquifer. Actions are required that can positively affect the aquifer and ensure a continuous water supply for all groundwater users.

The Hydrologic Monitoring Reports also provide data on the elevation of the water table as measured in a large number of wells located throughout the PrAMA. The data show a decline over most of the aquifer, which is consistent with the water budget information. The overdraft reflects both natural discharges and groundwater withdrawals by pumping. As overdraft continues, groundwater levels will decline and wells will continue to go dry. It should be noted that changes in groundwater levels will occur from year to year, reflected by variations in the seasonality of flood events, precipitation, and drought which effect recharge. For example, the year 2002 was one of the driest on record,

[1] 2001 ADWR Prescott Active Management Area Hydrologic Monitoring Report
[2] 2002 ADWR Prescott Active Management Area Hydrologic Monitoring Report
[3] 2003 ADWR Prescott Active Management Area Hydrologic Monitoring Report

impacting the aquifer with little recharge and increased demand of water for landscaping and agriculture, while the wet winter of 2005 had the opposite effect.

IV. SAFE-YIELD PRINCIPLES

In order to address the politically and hydrologically complex topic of safe-yield, including the impediments and opportunities to achieving it, several basic agreed-upon principles form the foundation upon which this report is based:

A. All PrAMA Groundwater Users Should Share in the Goal of Reaching Safe-Yield

The 1980 GMA established the Prescott AMA and with it the goal of reaching safe-yield. However, management of groundwater resources has focused exclusively on the large groundwater users; primarily the municipal and private water providers and irrigators (regulated water users). Small exempt domestic, stock and industrial well users (primarily those pumping less than 35 gallons per minute) were excluded from most of the Code regulations under the concept that small users would not have a significant impact on the safe-yield goal (unregulated water users). In total, an estimated 9,400 wells now serve domestic needs and taken together would be the third largest residential groundwater user, constituting approximately 14% of total groundwater withdrawn in the PrAMA. For additional details regarding exempt wells in the Prescott AMA please refer to Appendix A.

Regulated water users cannot meet the safe-yield goal without the cooperation of the unregulated water users. Water users within the municipal water provider systems are paying for water delivery and wastewater collection and treatment infrastructure as well as a water resource development fee for reaching safe-yield. Groundwater users outside of these municipal service areas have also invested in water and wastewater infrastructure, but they are not currently required to offset their share of the overdraft. It would be unfair to place the full burden of reaching safe-yield, a benefit for all water users, only on those that receive their water from a regulated water provider.

B. All PrAMA Groundwater Users Should Agree on a Strategy to Share Safe-yield Groundwater

Access to groundwater in the PrAMA has been over-allocated, allowing the aquifer to be legally overdrafted. However, the total amount of groundwater that can be pumped (water stored in the aquifer through artificial recharge maintains its original legal classification and is not considered groundwater) and achieve safe-yield is equal to the sum of natural and incidental recharge and is referred to as **safe-yield groundwater**. If safe-yield is to be achieved, the safe-yield groundwater should be quantified and a strategy devised to share it among groundwater users. Currently, each user does not have a specific share, and

therefore does not know how much AMA groundwater they can pump and be in safe-yield.

Once each user or supplier knows how much net AMA groundwater they can pump, they will know the size of their share of the overdraft. They will then be better able to determine what they need to do to eliminate their share of the overdraft.

C. Alternative Water Supplies Should Be Developed for Water Demands That Exceed Safe-Yield Pumping

Although water resource planning in the PrAMA is more advanced than most rural areas in Arizona, the responsibility of sharing safe-yield goals and limiting overdraft places additional burdens on all water users. Quantifying and then developing the amount of alternative water necessary to fill shortfalls between demand and overdraft will provide water users with some of the tools necessary to help reach safe-yield.

V. IMPEDIMENTS TO ACHIEVING SAFE-YIELD

Following the guidance of the Safe-yield Principles discussed above, the GUAC has identified several issues that are impediments to reaching safe-yield within the PrAMA.

A. Over-Allocation of Groundwater Rights

To be in safe-yield, the annual amount of groundwater withdrawn averaged over a long term must not exceed the combined amount of natural, incidental, and artificial recharge. However, since the early 1980s, insufficient data about natural recharge and regulations (and/or lack of regulations in the GMA) have led to the over-allocation of groundwater supplies.

Natural recharge within the PrAMA varies from year to year depending on climatic conditions. Incidental recharge will vary as the activity that produces it varies. The primary activity for incidental recharge is agriculture, which may decrease significantly in the future.

Natural recharge occurs primarily along mountain front areas or along washes, rivers and creeks where snowmelt and long winter rains percolate through fractures and coarse materials to eventually reach the saturated aquifer system(s). The average annual amount of natural recharge is about 7,000 AF/yr[4]. Incidental recharge primarily occurs in conjunction with irrigated lands and canals and may occur in areas where high concentrations of septic tanks and leach fields occur. Currently an average annual estimate for natural and incidental recharge of approximately 10,000 AF/yr has been developed from various

[4] 2002 ADWR Hydrologic Modeling Report No. 12,

hydrologic models and reports within the PrAMA and is conceptually the withdrawal limit of safe-yield groundwater. Although this value has inherent uncertainties and assumptions it is useful for this report's discussion. It should be noted that a portion of the safe-yield groundwater (approximately 3,100 acre-feet/year) is derived from incidental recharge caused by agricultural irrigation (see footnote [4] on previous page). Since agricultural irrigation is expected to continue to decline, incidental recharge will also decline.

Water that is artificially recharged (through permitted recharge projects) maintains its legal characteristics and is not considered groundwater. Unless this artificial recharge is dedicated to the aquifer for the greater good of the PrAMA, the volume of artificial recharge cannot be counted toward the safe-yield water balance. Prescott, Prescott Valley and Chino Valley all currently operate artificial recharge systems to recharge effluent and surface water.

Current groundwater demand in the PrAMA is estimated to be 24,000 acre-feet per year - roughly twice that of the safe-yield limit (or more if only natural recharge is considered). This annual groundwater withdrawal represents vested groundwater rights that were granted by ADWR through regulatory processes established by the GMA. This presents a significant impediment to reaching safe-yield since all groundwater users are presumptively mining groundwater but are within their legal right to do so. To reach safe-yield, the groundwater users within the PrAMA will need to voluntarily reduce groundwater pumping to within safe-yield limits or replace the overdraft groundwater with another water source. Ultimately, groundwater users will have to apportion the volume of safe-yield groundwater among each other to determine the amount of groundwater water they can rely on and the amount of make-up water (through alternative water supplies and/or water conservation practices) that will be needed to replace overdraft groundwater withdrawals.

Currently there are no regulations in place that require groundwater users to share safe-yield groundwater. There are several proposed methods by which safe-yield groundwater could be shared among groundwater users within the PrAMA. These methods for calculating the amount of safe-yield groundwater potentially available by any one entity would be comprised of various individual components. Appendix B summarizes several methods that could be considered. They include approaches such as a PrAMA-wide approach, demographic approaches, a priority water list approach, zonal approaches and aquifer health approaches.

B. Exempt Wells

In general, wells pumping 35 gallons per minute or less in the PrAMA are exempt from groundwater regulations ("exempt wells"), including metering, water use reporting, and assured water supply and water conservation requirements. Concern about the administrative burden of regulating thousands of small wells and the belief that they would exert a negligible impact on the aquifer led the legislature to exempt this category of groundwater use from the 1980 GMA. As a result, users of exempt wells are not required to participate in reaching safe-yield, however, in the PrAMA the cumulative withdrawal from exempt wells is estimated to be the third largest groundwater withdrawal for residential uses (behind the City of Prescott and the Prescott Valley Water Systems) (see Appendix A). A person wishing to drill an exempt well is not required to demonstrate physical or legal availability of the water supply. Even though exempt wells do not provide any assurances of a long-term water supply their construction and use is often the least expensive alternative and avoids the regulatory requirements of other water supply options.

Without a way to help reach safe-yield, exempt well users will have no guarantee of a secure water supply.

According to ADWR, exempt domestic wells are estimated to pump approximately 14% of the total annual groundwater withdrawn in the PrAMA. In contrast, in the large AMAs around the state the proportion of water used by exempt wells is much smaller. For instance, in the Phoenix AMA the use by exempt wells is less than 1% of their total water use. So, while exempt wells may be a regional problem in certain small areas around the state, they are not considered one of the top water issues throughout the state. For that reason it may be better to seek a PrAMA solution rather than looking for statewide standards.

Exempt wells are generally unregulated with respect to requirements of the GMA; however, there are several provisions that do apply to exempt well owners:

1. Exempt wells may not pump more than 35 gallons per minute
2. If used for industrial purposes, they cannot pump more than 10 acre-feet per year
3. If used for irrigation, not more than 2 acres can be irrigated
4. Exempt wells cannot be drilled within 100 feet of a designated water provider's operating distribution system unless one of the criteria for an exemption is met
5. Dry lot subdivisions intending to drill exempt wells must obtain a certificate of assured water supply and demonstrate the physical and continuous availability of groundwater for 100 years (the depth to groundwater cannot exceed 400 feet)

There are now approximately 9,400 exempt wells in the PrAMA. If the number of exempt wells continues to increase at historic rates with no regulatory plans, the combined withdrawal could become the largest groundwater user within the PrAMA. The lack of comprehensive regulation of exempt wells is therefore one of the largest impediments to reaching safe-yield in the PrAMA.

C. *Insufficient Access to Alternative Water Supplies*

ADWR and others have concluded that even the most aggressive water conservation and water reuse program would not allow the PrAMA to reach safe-yield without augmenting the existing water supply. A similar situation existed in other active management areas and resulted in the construction of the Central Arizona Project (CAP). However, the remote location of the Prescott AMA in relation to the CAP makes it impractical to provide direct delivery of CAP supplies. There is no regional allocation of CAP water supplies or a regional coordination to develop alternative water supplies necessary to reach safe-yield. Currently, the Town of Prescott Valley and the City of Prescott are working together to transport the City of Prescott's allocated water from the Big Chino Water Ranch within the Big Chino Sub-basin, eighteen miles northwest of Paulden, into the PrAMA. The Town of Chino Valley is pursuing the transportation of water from historically irrigated acres (HIA) from the Big Chino Sub-basin near Paulden into the PrAMA.

However, other PrAMA users do not have legal access to external water supplies like the Big Chino Sub-basin. Because of a lack of legal authority, small water providers or exempt well owners cannot transport groundwater into the PrAMA. Furthermore, they are unlikely by themselves to possess the financial wherewithal to participate in water transportation projects due to the high costs of water right acquisitions and water transportation infrastructure.

D. *Uncertainty of Imported Alternative Water Supplies*

As stated earlier, the municipal water providers have legal access to water from the Big Chino Sub-basin and consider this water supply to be a significant portion of their plan to reach safe-yield. The infrastructure required to physically deliver this water to the PrAMA, however, has yet to be constructed and has been threatened with legal action. High costs of new imported water supplies may also become an impediment to reaching safe-yield. Until an alternative water supply can be made physically available for use within the PrAMA, the municipal water providers can not reach their proportionate share of safe-yield.

E. *Lack of Enforcement Mechanisms*

Although safe-yield is specified as a goal in the GMA, other components of the law over-allocated groundwater rights and underestimated potential impacts from exempt wells. Although conservation requirements and the Assured Water Supply Rules, which restrict access to groundwater for new subdivisions, are important tools, there are no written provisions establishing consequences for not reaching safe-yield. As such, safe-yield plans and compliance with them are largely voluntary at this time.

F. Incomplete Public Understanding

Actions to achieve safe-yield are likely to involve substantial costs or other burdens that the public will have to bear. These actions will consequently require substantial public support across the entire PrAMA. Although there is general support for achieving safe-yield, that support appears to be largely abstract. It is possible that much of the public does not completely understand the complexity of reaching safe-yield. A strategy to enhance and broaden public understanding and support has been lacking.

G. Lack of Legislative Strategy

To date, attempts to obtain legislation that would be beneficial to achieving safe-yield have been largely unsuccessful. Recommendations of the Governor's Groundwater Management Commission (2002) have largely been tabled and several initiatives introduced by rural legislators did not receive enough votes to pass. A satisfactory political strategy has been lacking.

VI. NEXT STEPS AND OPPORTUNITIES

Identifying the impediments to reaching safe-yield in the PrAMA provides a partial picture of the water resource challenges facing the region. The following section lists the opportunities for reaching safe-yields, and in many instances, itemizes additional considerations or data needs within a particular opportunity.

A. Stakeholder Process

The GUAC, and by extension the Safe-Yield Subcommittee, are limited by statute to a role as a local advisor to ADWR on PrAMA issues. As such, the GUAC can provide recommendations to the Governor or ADWR, but does not have the legal authority to act on many of the recommendations listed in this section. An action team comprised of the affected stakeholders may be required to continue with the required work on the other recommended next steps and opportunities. The stakeholders could then develop a best management strategy, agree to promote or implement specific actions and lobby the state legislature if deemed necessary. A stakeholder process should include representatives of all affected water users and providers in the PrAMA.

B. Natural and Incidental Recharge

A decision should be made on how to share the PrAMA's natural and incidental recharge. Some of the alternative methods of sharing (Appendix B) would be made more accurate if there was a more detailed analysis of the various components of natural and incidental recharge. Other alternative methods could

be done with little or no additional studies. The Safe-yield Subcommittee recommends using an approach that would utilize existing information for an initial allocation of safe-yield groundwater (consisting of either just the natural recharge or the natural and incidental recharge). Once additional information is available, adjustments to the allocation can be made.

C. Exempt Wells

This report does not suggest that exempt wells be restricted or removed.

Although an individual exempt well pumps an insignificant amount of groundwater, the combined pumping of all domestic exempt wells represents an estimated 14% of the total PrAMA groundwater withdrawals. It will be difficult to solve the safe-yield equation without their collaboration. It should be noted that this report does not suggest that existing exempt wells be restricted or removed, only that exempt well users attempt to meet safe-yield on a level that is equal to other water users in the PrAMA. People within municipal water service areas have the benefit of municipal organizations that assess water needs and develop plans and financial resources to meet safe-yield on their behalf. Exempt well owners do not enjoy the benefits of an alliance that will help individuals meet the safe-yield goal and provide a secure water supply. An organization capable of accomplishing this task could take the form of a special water district governed by a board.(See Section F. and Appendix C) This "special water district" could develop a revenues source from district-members (such as withdrawal or conservation fees) to offset groundwater uses by recharging the aquifer through a water augmentation project.

Exempt well owners should only participate in reaching safe-yield at the same proportionate level as other groundwater users in the PrAMA.

While a person who chooses to live in a new planned subdivision cannot, under state law, access groundwater supplies, a person who acquires property through a lot split and chooses to drill a new exempt well is allowed to access groundwater. The State's regulations, statutes, or rules regarding new exempt wells may require modifications such as:

1. Development of a new exempt well impact or annual fee structure based on any of the following:
    a) The amount of groundwater overdrafted from the well
    b) The seniority of the water use supplied by the well
    c) An equal cost for all exempt well uses regardless of use or seniority
2. Development of water augmentation, water conservation or other programs to be funded with exempt well fees
3. Development of appropriate water conservation requirements for new exempt well users
4. Development of additional assured water supply-type requirements for new "exempt" wells

5. A requirement for water meters and a program to monitor water use.

New exempt domestic wells are more prevalent in developments far from water or sewer service areas or in lot split areas occurring outside of municipal plan developments. This presents a challenge for water augmentation/recharge projects to provide services near the areas most impacted by exempt wells. Goals of a water augmentation or recharge project should be to maintain cost effectiveness and positively impact areas with groundwater declines. Additional concerns that will need to be addressed include:

1. Should requirements be imposed within areas of high concentrations of exempt wells to develop centralized wastewater treatment and recharge facilities?
2. Should waste water treatment systems with recharge/underground storage facilities be placed for optimum recharge?
3. Should guidelines be established for augmentation programs for low-density exempt well uses in scarce water resource areas?

Encouraging exempt well owners to convert their water and wastewater systems to a centralized provider may be practical in areas with a high concentration of wells. Centralized water and wastewater service could increase the security of the water supply and contribute to more efficient aquifer recharge. Although few financial tools are available for extending municipal water and sewer service to areas with exempt wells, some options might include:

1. Water Infrastructure Finance Authority (WIFA)
2. Community Facilities Districts (CFD)
3. Replenishment or Conservation districts
4. Local water construction or conservation impact fees

D. Develop Data on Exempt Well Uses

A clear and accurate accounting of groundwater pumped from exempt wells is necessary to determine the safe-yield condition of the aquifer. This can be accomplished by metering a statistically-significant sample of exempt wells through a volunteer program, or by imposing mandatory metering of all wells. Under a voluntary metering program participation could be enhanced by various means such as by adopting a two-tiered water use fee: 1) well owners with a meter could be charged based on actual water use and 2) well owners without a meter could be charged an annual fee that might be higher.

With continued growth throughout the PrAMA, it is anticipated that the number of exempt wells will increase significantly through the year 2025 and thereafter. Development served by exempt wells may outpace development served by regulated water providers, especially if alternative supplies required for growth in regulated water systems become more expensive or difficult to obtain.

E. Water Resource Planning

Although new state legislation (A.R.S. §45-342) requires that all water providers (small and large) develop water conservation, water supply and drought preparedness plans, water providers are not required to include plans for reaching safe-yield. Strong water conservation programs, developed in conjunction with long-term water supply plans, can achieve significant water savings per capita, and could help our AMA reach safe-yield. Methods such as tiered rates, incentives, regulations, and education need to be considered.

The larger water providers within the PrAMA have developed plans for meeting future water needs and for reaching an estimated share of safe-yield, but many other water users have not developed similar plans and probably do not posses the resources to do so. In keeping with the concept that all water users should share the responsibility of reaching safe-yield, all water uses and separate water supply plans should be incorporated into an AMA-wide water supply plan that can demonstrate both the ability to meet future water needs and reach and thereafter maintain the AMA-wide safe-yield goal.

F. Special Districts

A special district can provide a locally designed and controlled alliance to help reach safe-yield.

A special district and authority could provide a vehicle through which water users in the PrAMA could reach safe-yield. One of the obstacles envisioned by the GUAC is that many groundwater users in the PrAMA do not have the resources as individuals to develop water augmentation or conservation programs that can be robust enough to achieve their proportionate share of safe-yield. For example, it makes little sense to have approximately 10,000 water augmentation projects in the PrAMA - one for each exempt well user. However, working collaboratively, small water users could create a large-scale water augmentation project that can address safe-yield. Establishing a water conservation and augmentation district is one possible approach to developing that collaborative approach.

Groundwater districts can be incorporated into the safe-yield plan. District concepts for consideration to help achieve safe-yield might include:

1. Water augmentation
2. Water Conservation
3. Groundwater Replenishment
4. Natural or incidental recharge enhancement

Additional information about districts and authorities is provided in Appendix C.

G. Legislative Initiatives

If it is determined that a special district is needed, then state legislation would be required. The legislation could be simply based on establishing a district and giving the district necessary general powers. The district could be set up so it would only have the powers that are requested by our AMA's citizens and/or government representatives.

Other management tools that could be considered through legislation or by a district include:

1. Groundwater withdrawal or conservation fees and/or incentives for unregulated groundwater users
2. For septic systems - an impact fee, an annual assessment, or both. These funds would go to help ameliorate damages caused by septic systems on groundwater quality.
3. Implement assured water supply requirements
4. Implement well spacing requirements for all wells

An effective enforcement or incentive program will be a necessary part of any legislation. Any enhancements to statute will require state level enforcement (that could be delegated to local authorities). Any enhancements to county, municipal, or special districts will require local enforcement. Enforcement provisions could be included in a voluntary PrAMA-wide plan to achieve safe-yield. Such plan and enforcement provisions would require an agreement or contract among all parties.

Other legislative changes may be required to make additional water supplies legally available for transport to the PrAMA. Alternative water supplies potentially available for inter-basin groundwater or surface water transfers may include:

1. Colorado River
2. CAP allocation
3. Additional Big Chino water importation
4. Water from other groundwater basins
5. Severance and transfer of surface water rights

H. Alternative Water Supplies

1. Flood Retention, Detention and Recharge

Surface water that flows in PrAMA streams is generally considered to be fully appropriated – meaning that the rights to surface water belong to someone downstream. Slowing the release of flood waters would likely increase the amount of groundwater recharge, but would only be possible as long as there are no impacts to downstream water right holders. It may also be possible to purchase downstream water rights and transfer the water right to a location in the PrAMA. During some wet periods, such as

the winter of 2005, excess surface water is available (i.e. when all downstream rights are satisfied) and could be retained in reservoirs and/or recharged. Other options, such as demonstrating that additional runoff is created from streets and rooftops have been successful in creating flood water retention projects. Runoff that has not yet collected into streams and drainages is considered sheet flow and is non-appropriable, meaning that downstream water right owners can not claim it as a water source. Sheet flow collected from rooftops or other surfaces could also increase the available water supply.

2. Watershed Management

According to past studies by the U.S. Department of Agriculture and others, vegetation in the PrAMA can be managed for the purpose of increasing recharge. The PrAMA receives in excess of 450,000 acre-feet of water in the form of precipitation in an average year, but only around 10,000 acre-feet per year of that precipitation reaches the aquifer[5]. The remainder evaporates from land and water surfaces or is transpired by vegetation.

It is important to note that the Prescott National Forest, which surrounds the PrAMA, receives the most precipitation, creates most of the runoff and provides most of the recharge to the aquifer. The Prescott National Forest Reserve, consisting of about 16 square miles, was created in 1898 to protect the domestic watershed for the City of Prescott. Another petition by the Salt River Project (SRP) was filed in 1903 to protect the watershed above the Salt River Valley, thereby protecting the water source for SRP. The Prescott National Forest managers may be able to use this initial charter to return the forest to more natural hydrologic conditions, with the potential to increase recharge.

Past research projects located in and near the Prescott National Forest have successfully demonstrated that water yield can be significantly increased by implementing healthy watershed modification approaches.[6] These approaches entail returning watersheds to more natural functioning conditions such as reduced forest density or rebuilding native grasslands. They do not entail clear-cutting or desertification processes.

In most cases, the watershed modification successes were short-lived because of the lack of maintenance on the research watersheds. A program similar to the artificial recharge program administered by ADWR could be developed that will include maintenance of the watershed

[5] 2006, USGS, Hydrogeology of the Upper and Middle Verde River Watershed, Central Arizona, Scientific Investigations Report 2005-5198 by Blasch and others – estimate extrapolated to include the Upper Agua Fria portion of the PrAMA

[6] Markus B. Baker, Jr., Compiler, "History of Watershed Research in the Central Arizona Highlands", U.S. Department of Agriculture, Forest Service, Rocky Mountain Research Station, Research Paper RMRS-GTR-29, April 1999

Peter F. Ffolliott, David B, Thorud, "Vegetation Management for Increased Water Yield in Arizona", University of Arizona Agricultural Experiment Station, Technical Bulletin 215, no date

treatment methods as a condition of a permit that recognizes the water supply contribution of the watershed management project.

3. Regional Transportation of Alternative Water

Regional coordination for the transportation of alternative water and recharge is necessary to aid small water providers that rely exclusively on groundwater. With that in mind, the following questions should be considered:

a) If a small water provider is located near existing wastewater treatment and effluent recharge systems, should the small water provider be required to collect wastewater and participate in the centralized treatment and effluent recharge systems?
b) If a small water provider is not located next to a centralized wastewater treatment and effluent recharge systems, should the small water provider be required to develop its own wastewater collection, treatment and effluent recharge facility?
c) If small water providers are required to reduce their groundwater withdrawals to help reach safe-yield, should a mechanism be put in place to allow these small providers to trade or otherwise obtain water rights without building their own alternative water transportation pipelines?

It is unknown if sufficient alternative water is available for economical transport into the PrAMA. Each municipal transport agent should determine the quantity of water that may be available for importation.

4. Weather modification

The PrAMA, in conjunction with the State of Arizona and possibly other states within the Colorado watershed, may want to investigate the possibility of enhancing precipitation and water recharge through weather modification projects.

5. Importation

As the current growth in the PrAMA continue, additional sources of imported water will be necessary. It is therefore necessary to examine the potential sources and cost of imported water. An analysis of each new source should also outline the advantages and disadvantages of importation from each source, including determining if the expected cost is reasonable.

I. Quantification of Groundwater Supplies

Many of the past policy decisions that have been identified as impediments to reaching safe-yield were based on insufficient hydrologic information. ADWR and water users in the PrAMA should continue to improve the quality and quantity of hydrologic information. This will include expanding our knowledge about water use and recharge and developing improved geologic frameworks

and hydrologic models. It is clear, however, that we now have sufficient information to proceed with the next steps to develop and implement a plan to reach and maintain safe-yield.

The amount of recharge contributed by septic and leach field systems is unknown. ADWR does not include recharge from septic systems in its water budgets. The GUAC recommends that ADWR evaluate recharge from these systems. The study should include the potential to increase recharge and the effect such increases may have on water quality.

J. Public Education

Public confidence is essential to the success of any implemented plan(s) to reach safe-yield. It is crucial that the public understands the elements of the water resource management strategies and what is expected to be accomplished with each approach. The public should also understand why the action is necessary, and how each plan may impact them. It is therefore important that a proactive public outreach and education program be established to inform the citizens of the PrAMA about the importance of the safe-yield issues, solicit their feedback, and encourage their support and involvement.

VII. SUMMARY AND CONCLUSION

Annual groundwater withdrawals within the PrAMA exceed the groundwater that is replenished each year. While present plans to import additional water from the Big Chino Sub-Basin, increased conservation efforts, and increased recharge will help the PrAMA attain safe-yield, these projects will not accomplish that goal on their own. Ultimately, legislative changes and additional water management strategies will be required to obtain and maintain safe-yield.

Important to the impediments and opportunities for reaching safe-yield are the principles that guide the underlying concept. These principles include the idea that all groundwater users are responsible for reaching safe-yield in proportion to their share of the overdraft, that all groundwater users need to know how much groundwater they may use, and that alternative water supplies need to be developed to meet water demands that are in excess of the safe-yield volume.

A lack of regulations and/or regulations that were based on an inadequate understanding of hydrologic conditions have lead to the PrAMA aquifer being overdrafted. The 1980 GMA resulted in an initial over-allocation of groundwater rights and exempted some water users from regulations. Additionally, original concepts for augmenting groundwater supplies with CAP water proved intractable and resulted in a lack of sufficient quantities of alternative water supplies. Finally, the enforcement mechanisms established by the GMA are either insufficient or were put into place after they could be fully effective in reaching safe-yield. These situations exist today and are impediments to reaching safe-yield in the PrAMA.

Opportunities for overcoming these impediments exist in the form of voluntary and regulatory measures. Groundwater users could decide to voluntarily reduce groundwater demands and resist using their full groundwater allocation. Key to this solution is the ability to augment PrAMA groundwater supplies with another source of water. Various regulatory options exist that would allow exempt wells users to participate in reaching the safe-yield goal such as developing revenue to support a water augmentation project. Alternative water supplies can be developed from a number of sources, including flood recharge, watershed management and importing water from other areas. Finally, legal and institution hurdles can be overcome to develop better incentives and enforcement mechanisms.

Attaining the safe-yield goal will not come without costs, PrAMA water users must understand that if safe-yield is not reached and maintained there could be more significant costs. Without sufficient water, local economic activity will be severely affected and property values may decrease.

The plan to reach safe-yield must be adaptive and will evolve over time as new and more accurate information develops regarding groundwater uses, predicted increases, and recharge. If uses or recharge, or our understanding of them change over time, further adjustments may be required.

In order to implement a safe-yield plan, strong public support is required. The public must understand that legitimate private property rights can be adhered to while we protect our water supply. In order to assure continual water supplies for all water users, all water users must adhere to the same goal.

Summary font

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GLOSSARY

Acre-foot (AF)
A unit for measuring the volume of water. The amount of water needed to cover an acre of land one foot deep, equal to 325,851 gallons.

Active Management Area (AMA)
A geographic area that has been designated by the Arizona State Legislature as requiring active management of ground water withdrawals from pumping.

Artificial recharge
Water that is intentionally added to a groundwater aquifer due to human activities by means of a recharge project. Artificial recharge can be accomplished via injection wells, spreading basins, or in-stream projects. Water that is artificially recharged maintains its original legal classification (effluent, surface water, etc.) and is not considered groundwater when it is pumped back out of the aquifer. The legal definition of safe-yield considers incidental recharge as part of artificial recharge. Except when referring to the legal definition, this report will present incidental recharge separately from artificial recharge. (see also **incidental recharge, natural recharge, recharge**)

Incidental recharge
Water that is unintentionally added to a groundwater aquifer due to human activities, such as excess irrigation water applied to fields or water discharged as waste after being used. Water that is unintentionally recharge is classified as groundwater regardless of its original legal classification (effluent, surface water, etc.) The legal definition of safe-yield considers incidental recharge as part of artificial recharge. Except when referring to the legal definition, this report will present incidental recharge separately from artificial recharge.

Natural Recharge
Natural replenishment of an aquifer generally from snowmelt and storm runoff. (see also **recharge, artificial recharge, incidental recharge**)

Recharge (ground water)
The process involved in the absorption and addition of water to the zone of saturation; also, the amount of water added.

Safe-yield
A ground water management goal which attempts to achieve and thereafter maintain a long-term balance between the annual amount of groundwater withdrawn in an **Active Management Area** and the annual amount of **natural**, **incidenta**l and **artificial recharge** within a designated area.

Safe-yield groundwater
An amount of groundwater equal to the long-term average of natural and incidental recharge. Safe-yield groundwater along with artificial recharge is the maximum amount of water that can be withdrawn and meet safe-yield.

Shared safe-yield groundwater
The total of **natural recharge** and **incidental recharge, or just natural recharge** averaged over a long term that is shared through a consensual approach by all groundwater users in the **AMA**.

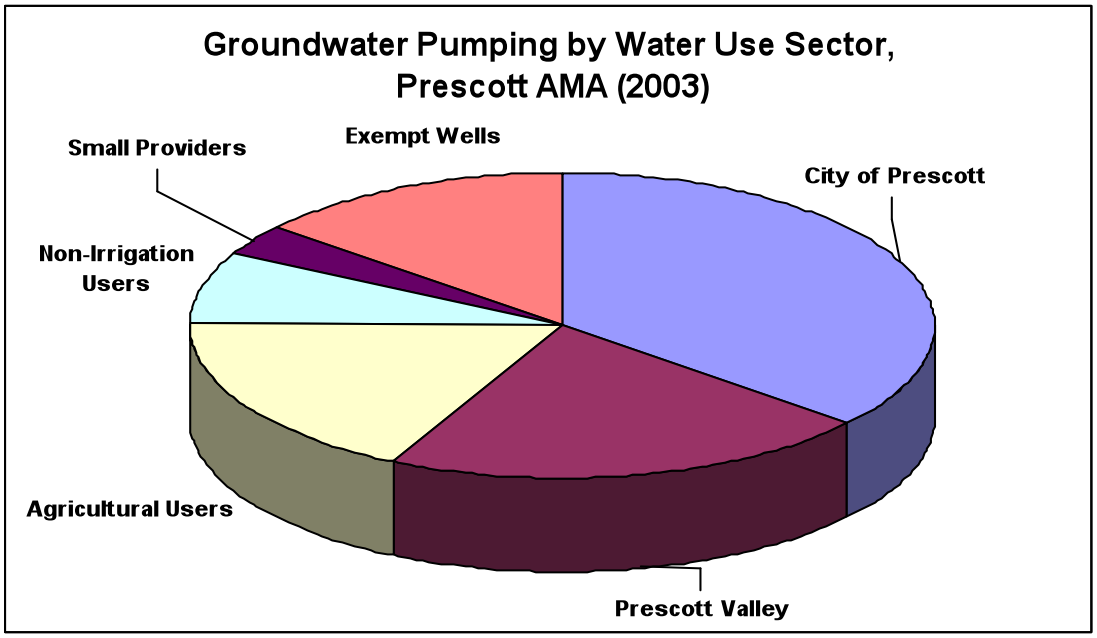
Water budget
An evaluation of all sources of supply and the corresponding discharges with respect to an aquifer or a drainage basin.

Appendix A – Groundwater Use in the PrAMA

Residential Water Use in the Prescott AMA (2004-2005 Time Period)

Water Provider Name	Number of Service Connections (Residential Units only)	Population (Based Upon 2.5 Person per Household)	Water Use (acre-feet/year) (Residential Units only)
City of Prescott	20,928	52,320	4,705.9
Prescott Valley Water Systems(1)	15,406	38,515	3,433.3
Exempt Domestic Wells	9,200-9,700 (2)	23,000-24,250	2,024-3,200 (3)
Private Water Companies (4)	4,352 (5)	10,880	965.0(5)
Total	49,886-50,386	124,715-125,965	11,128.2-12,304.2

(1) Prescott Valley Municipal System and Prescott Valley Water District
(2) Range based on 8/14/06 Safe-yield TAC Memo
(3) Estimated use per service connection ranges from 0.22 (average of other service providers) to 0.33 acre-feet per year
(4) Total values for all 19 Prescott AMA Private Water Companies
(5) Values for 2004 Calendar Year



Water Provider or Water Use Category	2003 reported Non-Exempt Pumping (1)	Percentage of Total Pumping
City of Prescott	8,152	36.0%
Prescott Valley	4,860	22.0%
Agricultural Users	4,037	18.0%
Other Users (2)	1,689	7.0%
Small Providers	784	3.0%
Exempt Domestic Wells (3)	3,135	14.0%
Total Pumping	22,657	

(1) Data from Prescott AMA 2003-2004 Hydrologic Monitoring Report
(2) Non-irrigation users (1,359 af) and non-domestic exempt wells (approx 1,000 wells @0.33 af/yr each)
(3) Exempt Domestic Well pumping estimated, 9,400 active domestic wells at estimated 0.33 af/yr each

Appendix B – Methods of Allocating Safe-yield Groundwater

A proposed method of reallocating safe-yield groundwater ("**shared safe-yield groundwater**") is through a voluntary process. This process could be comprised of individual components for calculating the amount of shared safe-yield groundwater that may be used by an entity. These components may include but are not limited to:

- An AMA-wide approach
    1. All users reduce groundwater pumping in equal proportions

- A demographic approach that factors population centers based on
    1. Current populations
    2. Populations in 1999 (the ADWR declaration of groundwater mining)
    3. Populations when groundwater mining was estimated to begin

- A priority water list approach consisting of various water uses
    1. Water use at 1999 (the ADWR declaration of groundwater mining)
    2. Conversion of water rights (IGFR, Type I, II) to assured water supplies
    3. Current versus future water rights

- A water auction approach for the sale of water
    1. Grandfathered rights
    2. Rights on historically irrigated acres (HIA)
    3. Retired or extinguished rights

Another proposed method of reallocating shared safe-yield groundwater is through a hydrologic approach to ensure critical natural recharge areas of the AMA are protected or enhanced to allow the maximum natural or incidental recharge to occur in perpetuity. These components may include but are not limited to:

- A hydrogeologic approach for recharge zones:
    1. Geographic access to stream alluvial
    2. Geographic access to the upper and lower aquifer units
    3. Geographic access to critical aquifer impacted areas
    4. Geographic access to groundwater depletion zones
    5. Geographic access to recharge water interception areas

- Aquifer Health Approach
    1. Utilize high-resolution zonal recharge models that would be developed and updated annually which monitor zonal recharge, aquifer replenishment and withdrawals, and provide an aquifer health indication.

- Recharge Incentive Programs
    1. Encourage natural and incidental recharge incentive programs for:
        a. Stream diversion and detention programs
        b. Catchments and retention programs
        c. Regional recharge programs
    2. Underground storage facility (USF) enhancements
    3. New recharge programs or existing recharge program enhancements

Appendix C – Summary of District and Authority Enabling Legislation

Boundaries of Districts/ Authorities

1. May be limited to unincorporated areas of a county.
2. Lands need not be contiguous.
3. May include areas in a city or town if the city or town consents.
4. A district or authority's boundaries may be limited to areas within an AMA
5. May limit the population of counties within a district or authority
6. May require that members of an authority receive water from specified sources
7. May require that the boundaries of the authority be coterminous with certain other boundaries (e.g., the boundaries of an AMA.)
8. May base boundaries on the service area of water providers within the district or hydrologic boundaries

Formation

1. The county board of supervisors may initiate proceedings to establish a district; or
2. A majority of persons owning real property in the proposed district may petition the board of supervisors to form a district.
3. Some statutes require that a district adopt a preliminary general plan
4. In the case of districts, the governing bodies generally must hold a hearing on a proposal to form a district or authority
5. Formation of a taxing districts requires an election in which all residents within the proposed district are eligible to vote
6. Some statues require that the district promote the public convenience, necessity or welfare
7. Generally, any city, town or irrigation district can request to be excluded from the district or authority
8. In the case of some authorities, formation can be effective as soon as a majority of municipal corporations in the county adopt resolutions approving it.

Governance

1. If the district is within a single county, either the county board of supervisors or a board of directors may govern. If multiple counties participate, a board of directors governs. Members of a board may be appointed or elected
2. In single county districts, the board of supervisors may appoint all members;
3. In some cases, the governing bodies of each city or town within an authority may appoint one or more members
4. Irrigation districts have the power to appoint board members for certain authorities
5. Statute may require that certain board members represent the interests of certain entities or groups, e.g., water providers within the authority.
6. Some authorities' statutes provide that members serve at the pleasure of the governing body that appoints them

Powers and Duties

State legislation currently grants districts or authorities the power to do one or more of the following:

1. Acquire, construct, maintain or repair waterworks for the delivery of water for domestic purposes.

2. Join with other persons or entities to create a multi-jurisdictional entity to further the acquisition, construction, operation or maintenance of water systems
3. Levy and collect taxes upon the real and personal property in the district to pay for general obligations of the district.
4. Enter into loan repayment agreement with WIFA
5. Impose fees, including user fees, hookup fees and lateral fees
6. File liens on property for nonpayment of user fees
7. Issue improvement bonds
8. Designate assessment districts that will benefit from, and be charged with the expense of improvements
9. Cooperate with other government agencies and political subdivisions, the federal government and Indian tribes to augment and conserve the authority's and its members' water
10. Act as a bargaining, negotiating or contracting agency at the request of an authority member
11. Acquire, hold, assign or otherwise dispose of water storage credits
12. Act as agent of any authority member for the acquisition, transportation, delivery, treatment or recharge of water
13. Acquire electricity or other forms of energy to transport water or operate the projects of the authority
14. Make grants to its members to fund water acquisition, reuse or conservation programs
15. Plan, construct operate, maintain and dismantle water augmentation projects (e.g., treatment, recharge. underground storage and recovery)
16. Acquire, hold, assign or otherwise dispose of water storage credit
17. Act as agent of any political subdivision for the acquisition, transportation, delivery, treatment or recharge of water
18. Negotiate, execute and perform contracts, including contracts for water exchanges and deliveries
19. Negotiate to acquire water and water rights to augment the water supply
20. Sell, lease, exchange, hold, sever, transfer or retire water rights
21. Negotiate and enter into agreements to use existing facilities to transport water to and within the county
22. Institute condemnation proceedings in accordance with state eminent domain law within the county in which it is authorized

Financing

1. For general obligations, the governing body may levy and collect taxes upon the real and personal property in the district
2. An authority can assess fees, including development impact fees, extraction fees, connection fees, user fees, replenishment fees and administrative fees against any operating unit or other person with which the authority has contracted to provide service
3. Districts established under title 48 can assess taxes upon the real and personal property in the district

List of Existing Districts and Authorities (Legislation):

Districts:

1. Groundwater Replenishment Districts (Title 48 Chapter 27)
2. Agricultural Improvement Districts (Title 48 Chapter 17)
3. Irrigation and Water Conservation Districts (Title 48 Chapter 19)
4. Irrigation Water Delivery Districts (Title 48 Chapter 20)
5. Multi-County Water Conservation Districts (Title 48 Chapter 22)
   Active Management Area Water District (Title 48 Chapter 28)
6. Domestic Water Improvement District (DWID) (A.R.S. §48-901 et seq.)
7. Community Facilities District (A.R.S. §48-701 through 48-708)
8. Multijurisdictional Water Facilities District (A.R.S.§48-5901 through 48-5931)

Authorities:

1. County Water Augmentation Authority (Title 45 Chapter 11)
2. County Water Authority (Title 45 Chapter 13)
3. Arizona Water Banking Authority (45 Chapter 14)