8.1 INTRODUCTION

The purpose of the Augmentation and Recharge Program (ARP) is to encourage the development, delivery, use, and storage of renewable water supplies now and in the future. The ARP, in combination with conservation program efforts, is intended to support achievement of the safe-yield management goal for the PRAMA. Increasing the use of renewable supplies to replace groundwater mining will have the biggest impact on achieving safe-yield in the PRAMA.

For purposes of this chapter, "augmentation" means increasing the availability and use of renewable water supplies, such as reclaimed water, in lieu of groundwater. "Recharge" means storage of excess water (non-groundwater) supplies for future use pursuant to the Underground Water Storage, Savings and Replenishment Act, A.R.S. § 45-801, *et seq*.

Although the PRAMA groundwater management goal of safe-yield applies to the AMA as a whole, the objectives of the ARP during the fourth management period reflect an increased awareness and improved understanding of the importance of water management on a sub-AMA scale. An AMA-wide safe-yield balance between supply and demand of groundwater does not address local concerns regarding groundwater level declines, physical availability issues, and poor groundwater quality, because it allows for substantially variable water level conditions throughout the AMA. The 4MP incorporates a localized focus on water management by taking these site-specific areas into consideration, and proposes solutions to the problems where possible.

8.2 THE ARP

The augmentation and recharge of renewable water resources is a principal mechanism by which the AMA can reach both safe-yield and site-specific goals. In the 4MP, ADWR will use the authorities available and potentially pursue additional authorities to facilitate and encourage the development, efficient use, and recharge of renewable water supplies for the AMA. Additionally, the ARP can be an effective tool to mitigate local water supply problems, depending on where storage and recovery activities occur.

Recharge is an important regulatory tool in the 4MP. While the development and direct use of renewable water supplies is an important component of AMA water management during the fourth management period, underground water storage provides a cost-effective means of storing water that is currently available to the AMA but that has no direct use.

8.2.1 Overview of Recharge and Recovery

Recharge statutes and management plan provisions provide regulations under which water may be stored and rights to recover that water may be accrued. The statutes and policies when read together, establish a number of objectives. These objectives include:

- To protect the general economy and welfare of the state by encouraging the use of renewable water supplies instead of groundwater, through a flexible and effective regulatory program for the underground storage, savings, and replenishment of water;

- To allow for the efficient and cost-effective management of water supplies by allowing the use of storage facilities for filtration and distribution of surface water instead of constructing surface water treatment plants and pipeline distribution systems;

- To further the conjunctive management of the water resources of this state to reduce the overdraft and achieve the management goals of the AMAs;

- To store water underground for seasonal peak demand use and for use during periods of shortage; and

- To augment the local water supply to allow future growth and development.

Since their inception in 1986, recharge and recovery have become increasingly flexible over time with regard to storage and recovery locations and the number and types of programs available. With the increased flexibility have come an increased complexity and the potential for recharge projects to aggravate, as well as mitigate, local water problems. High or low water tables, water quality, physical availability, and third party impacts are all problems that can be impacted positively or negatively by recharge facilities. Thus, the regulation of the program to maximize benefits and minimize harm is crucial to an effective program.

8.2.2 Primary Program Components

There are several key components of recharge and recovery. Rights to recover water may be exercised annually or long-term. Almost any water can be recovered within the same year in which it was stored. Stored water will be credited to a long-term storage account, which allows the account holder to recover the water at any point in the future, if certain conditions are met. These conditions greatly assist the achievement of water management goals by preventing an entity from storing water and earning long-term storage credits if the water could have been put to direct use. The statutes define what source water cannot be put to direct use, and therefore may be eligible to earn long-term storage credits. *See the definition of "Water that cannot reasonably be used directly" in* A.R.S. § 45-802.01.

No time limit exists on the right to recover long-term storage credits. Long-term storage credits may be assigned to another person if that person could meet the same provisions for earning credits as did the storer. In addition, once the water is recovered, it retains the same legal characteristics it had before storage.

The Underground Water Storage (UWS) Program is also the mechanism by which a groundwater replenishment district (GRD) replenishes water on behalf of its members. Currently, there is no GRD in the PRAMA.

Finally, in many cases, a certain percentage of the volume of water stored is made non-recoverable by statute to benefit the aquifer. These required non-recoverable volumes are called "cuts to the aquifer." The cuts apply to the storage of certain types of water for long-term storage credits. They do not apply to water that is stored and recovered annually. In the PRAMA, due to the type of recharge that has occurred and is projected to occur in the future, this particular offset to overdraft is minimal. During the historical period, there were only two years in which a cut to the aquifer occurred. In 2003 and 2004, a combined volume of less than 1,000 acre-feet was included as a cut to the aquifer.

Persons who elect to undertake recharge-related activities must obtain the necessary permits from ADWR. There are three recharge-related permit categories: (1) storage facility permits, composed of constructed or managed Underground Storage Facility (USF) permits and Groundwater Savings Facility (GSF) permits; (2) Water Storage (WS) permits; and (3) Recovery Well (RW) permits. For a detailed description of each of these permits, please see the *Water Demand and Supply Assessment 1985-2025, Prescott Active Management Area* (Assessment) on ADWR's website: http://www.azwater.gov/AzDWR/WaterManagement/Assessments/documents/PRAMAAssessmentVersion2.pdf .

8.3 PHYSICAL ASSESSMENT OF THE ACTIVE MANAGEMENT AREA

Attaining the safe-yield goal will not necessarily eliminate water supply problems facing the PRAMA water users such as localized groundwater declines and other physical availability problems. Varied physical conditions and resulting impacts to AMA residents demonstrate a need to develop enhanced aquifer management strategies during the fourth management period.

8.3.1 Groundwater Overdraft

Total water demand in the PRAMA was approximately 20,211 acre-feet in 2012. About 82 percent of this, 16,563 acre-feet, was met by groundwater. Groundwater overdraft in the PRAMA has persisted over the historical period of 1985 through 2012. Net natural and incidental recharge offset overdraft each year to varying degrees. Historically, years of high net natural recharge have resulted in surplus conditions, where net natural recharge was greater than the volume of groundwater withdrawn in the AMA and the AMA aquifers were replenished to some extent, however, in most years groundwater overdraft of between 10,000 and 20,000 acre-feet has occurred in the PRAMA. To date, the majority of recharge in PRAMA has been annual storage and recovery of surface water and storage of reclaimed water at constructed USFs; neither of these storage activities requires a cut to the aquifer.

The PRAMA population increased from less than 45,000 to nearly 121, 000 people between 1985 and 2012, representing an increase of more than 76,000 persons. Municipal groundwater demand increased 204 percent over this period, to 13,909 acre-feet in 2012. The statutory goal of safe-yield does not appear achievable in the PRAMA without additional supplies, cooperative regional water resource management and/or a combination of water management programs, policies, rules and incentives.

8.3.2 Consequences of Groundwater Overdraft

Sustained groundwater mining in the PRAMA could have negative consequences in addition to the loss of the resource. Lower water levels could reduce well productivity, increase pumping costs, further compromise riparian habitat, and reduce stream flows. As water levels are lowered, water in storage is reduced and water supplies become jeopardized. Although land subsidence has not previously occurred in the PRAMA, lowered water levels could potentially cause future land subsidence.

As described in Chapter 2, groundwater overdraft is reflected in groundwater level declines. In Chapter 2, Figure 2-4 shows historical water level changes between 1994 and 2010. During this time period, maximum water level declines of between 10 and 60 feet were observed; however, other areas within the AMA saw significant water level rises as water tables recovered, resulting from the shifting of pumping to other locations. Table 8-1 summarizes the water storage and recovery through the year 2012 at the AMA level and for each of the two groundwater subbasins in the PRAMA. Note that the figures shown in Table 8-1 are the volumes of water that entered the storage facilities and do not represent the volume of recharge credits earned. To calculate recharge credits, ADWR subtracts water losses such as evaporation and other losses, debits (for example, for exceeding the permitted capacity of the storage facility, should that occur), and any "cuts to the aquifer" (for storage of Central Arizona Project water or reclaimed water stored at a managed underground storage facility) prior to calculating the acre-feet of long-term storage credits earned.

8.3.2.1 Little Chino Subbasin

The majority of the water service area of the City of Prescott and the majority of the active, irrigated agricultural land are within the Little Chino Subbasin of the PRAMA. As of 2012, more than 59,000 acre-feet of water had been delivered to underground storage facilities in the Little Chino Subbasin. Of this volume, 77 percent was reclaimed water. The remaining 23 percent was surface water. No groundwater savings facilities have been permitted in the PRAMA to date.

Nearly all the recovery of stored water has occurred in the Little Chino Subbasin, mostly by the City of Prescott and the Chino Valley Irrigation District (CVID). The volumes of recovered water have been fairly

evenly split between surface water and reclaimed water. In addition to storing and annually recovering surface water, the City of Prescott stores reclaimed water, and through an agreement with the CVID, transfers long-term storage credits for reclaimed water to the CVID, which then recovers the water within the CVID for use by farms in the district. The City of Prescott has two wells located within the area of impact of storage of reclaimed water and has recovered reclaimed water within the area of impact in recent years.

8.3.2.2 Upper Agua Fria Subbasin

The Town of Prescott Valley is the primary user of water in the Upper Agua Fria Subbasin of the PRAMA. The Town of Prescott Valley is the only entity who has stored water in the Upper Agua Fria Subbasin to date. AMA population is fairly evenly divided between the two subbasins as is municipal water demand. However, less than 20 percent of the actively irrigated agricultural land is located within the Upper Agua Fria Subbasin.

By the end of 2012, more than 17,000 acre-feet of water had been delivered to be stored at USFs in the Upper Agua Fria Subbasin, but very little recovery of the stored water has occurred.

TABLE 8-1
SUMMARY OF WATER STORAGE AND RECOVERY, 1986 - 2012
PRAMA

	Subbasin	Little Chino	Upper Agua Fria	AMA TOTAL
Delivered to be Stored through 2012	USF Reclaimed	45,690	17,330	63,020
	USF Surface Water	13,329	0	13,329
	TOTAL STORED	**59,019**	**17,330**	**76,349**
Recovered through 2012	Reclaimed	17,872	25	17,897
	Surface Water	12,978	0	12,978
	TOTAL RECOVERED	**27,106**	**25**	**30,875**
Recovered Water in 2012	Reclaimed	1,414	0	1,414
	Surface Water	445	0	445
	Total	1,859	0	1,859
	Within 1 mile of any storage location	**421**	**0**	**421**
Recovered Water in 2005	Reclaimed	1,234	6	1,240
	Surface Water	1,547	0	1,547
	Total	2,781	6	2,787
	Within 1 mile of any storage location	**0**	**0**	**0**

8.4 ALTERNATIVE WATER SUPPLIES ASSESSMENT

Reclaimed water and surface water are renewable sources of water that can replace the use of groundwater in order to achieve the management goal of safe-yield by the year 2025. Reclaimed water is water that has been collected in sanitary sewers for subsequent treatment in a regulated sewage system, disposal plant or wastewater treatment facility (WWTF). Surface water is the waters of all sources, flowing in streams, canyons, ravines or other natural channels, or in definite underground channels, whether perennial or intermittent, floodwater, wastewater or surplus water, and of lakes, ponds and springs on the surface. The PRAMA has limited access to surface water supplies.

Renewable resources can be used directly or they can be stored in the ground and recovered in the future. While it is important to use renewable water sources efficiently, ADWR encourages the use of renewable water sources in place of groundwater because it reduces groundwater overdraft in an aquifer.

In addition to augmentation of the PRAMA's water supply with reclaimed water and surface water, a limited supply of imported groundwater may be available to the AMA. While imported groundwater is not a renewable water supply, it is a valuable alternative to groundwater pumped from within the PRAMA.

8.4.1 Reclaimed Water

ADWR estimates that about 6,000 acre-feet of reclaimed water was generated in the PRAMA in the year 2012, compared to about 4,600 acre-feet in 2000. The City of Prescott's Sundog and Airport wastewater treatment plants have been treating wastewater and subsequently recharging the reclaimed water into the Little Chino subbasin since the 1980s. Increased reclaimed water generation is attributable in part to increased population, but also to the construction of a new wastewater treatment plant in the Town of Prescott Valley which began operation in 1994. The new plant replaced the use of septic systems in major portions of the Prescott Valley area. Table 8-2 provides a summary of reclaimed water generation by the two wastewater treatment plants operated by the City of Prescott and the plant operated by the Town of Prescott Valley, while Figure 8-1 displays their locations, as well as the location of the Town of Chino Valley water reclamation facility, within the PRAMA. The locations of underground storage facilities are also shown in Figure 8-1. There are other smaller wastewater treatment plants operating within the PRAMA which are not shown on the map. As the PRAMA population increases new plants will likely be constructed and existing plants expanded.

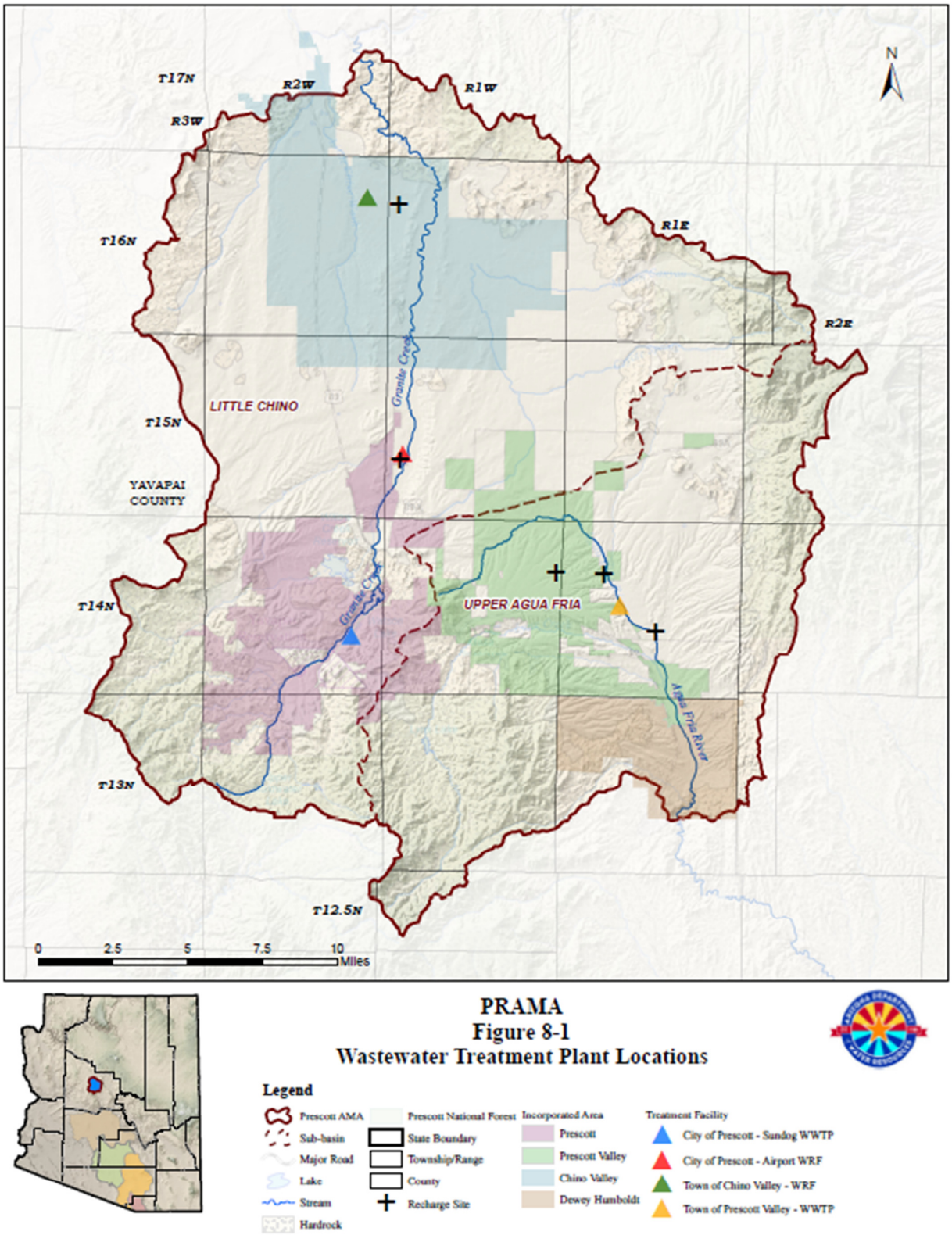
TABLE 8-2
ANNUAL WASTEWATER TREATMENT PLANT PRODUCTION (ACRE-FEET)
PRAMA

Year	Prescott Valley WWTF	Prescott WWTF (two facilities)
2002	1,771	3,538
2003	1,904	3,752
2004	1,837	4,083
2005	2,328	4,729
2006	2,550	3,853
2007	2,753	4,132
2008	2,687	4,488
2009	2,504	4,019
2010	2,639	4,417
2011	2,719	4,440
2012	2,712	3,915

Although there are many definitions for reclaimed water, the focus of this discussion is on the use of water generated from municipal WWTFs. Historically reclaimed water has been recognized as a valuable resource and has been used within the AMA for several years by the City of Prescott for turf and agricultural irrigation purposes.

The City of Prescott delivers reclaimed water directly to three golf courses and a sand and gravel operation. In the summer months, when turf watering needs are high, the City supplements the direct use reclaimed water with reclaimed water recovered within the area of impact of storage, which counts the same as direct use reclaimed water for turf-related facility conservation requirement compliance. Wastewater generated by the City is treated at the Sundog WWTF.

FIGURE 8-1
WASTEWATER TREATMENT PLANTS AND UWS FACILITIES
PRAMA



The Town of Prescott Valley currently delivers reclaimed water to refill lakes at Mountain Valley Park and to irrigate turf at Stoneridge Golf Course. As with the City of Prescott, the majority of the Town's reclaimed water is stored at USFs to generate long-term storage credits.

Three factors limit the ability to directly use all reclaimed water generated in the PRAMA. First, the quality of the reclaimed water is insufficient to directly introduce it into potable water supply systems. Direct use of reclaimed water, therefore, is currently limited to agricultural irrigation, turf watering, and some industrial applications. Second, reclaimed water demand for irrigation and turf watering purposes is seasonal; higher demand occurs in summer and lower demand in winter. Reclaimed water generation, however, is directly related to indoor water consumption which is relatively constant throughout the year. Third, over time, reclaimed water generation will exceed the demand for reclaimed water for irrigation and turf watering purposes.

8.4.2 Artificial Recharge

Artificial recharge allows reclaimed water to be stored during low demand periods and later recovered during high demand periods. Recharge also allows the possibility of indirect potable use of reclaimed water. The City of Prescott currently has a constructed USF permit for a reclaimed water recharge facility at Prescott Airport, which allows a maximum annual storage at the facility of 7,200 acre-feet. The City has two Water Storage permits for the storage of reclaimed water at the facility – one for long-term storage credits and one for non-recoverable water storage. No credits may be issued for the storage of non-recoverable water pursuant to A.R.S. §45-833.01 as the stored water does not retain its original legal characteristic, but instead becomes part of the available groundwater supply to the benefit of all AMA water users. The combined storage under both Water Storage permits is limited to 7,200 acre-feet per annum, which is the maximum annual storage volume allowed under the USF permit. All three permits expire on May 18, 2029. Recovery of the reclaimed water stored for long-term storage credits is allowed pursuant to a Recovery Well Permit issued to the City in January 1998, which allows the City to recover 1,600 acre-feet of recharged reclaimed water annually.

In May of 2012, the Town of Prescott Valley was issued an USF permit with maximum annual reclaimed water storage capacities at the In-Channel Site and North Plains Site of up to 1,200 acre-feet and 3,000 acre-feet, respectively. In addition, the Town has another facility that may store up to 5,150 acre-feet of reclaimed water. Long-term storage credits issued for the storage of reclaimed water represent a long-term alternative water source (subject to physical availability limitations) which could help offset the Town's dependence on groundwater. Presently, its WWTF has the capacity to treat 4,200 acre-feet of reclaimed water annually. Treated reclaimed water from this facility is currently discharged into the Agua Fria River, pursuant to a National Pollutant Discharge Elimination System (NPDES) permit.

The Town of Chino Valley has been issued a modified permit to store up to 1,120 acre-feet per year of reclaimed water at the Town's Old Home Manor constructed underground storage facility. The Town is actively pursuing increasing the number of sewer connections within its service area and connecting new subdivisions to its sewer system. The Town's WWTF has been expanded more than once since it was initially constructed. Further plant expansions are planned for the future.

Physical factors impacting recharge feasibility include: infiltration rates, available storage, and the existence and extent of lower permeability or impermeable layers in the vadose zone. In some urban areas of the PRAMA, there is insufficient space to develop recharge sites or land costs are too high for a project to be economically viable. There is potential for additional storage along Granite Creek, extending linearly north of the City of Prescott airport recharge facility for some distance. There is additional but less extensive potential for additional storage along the Agua Fria. (See ADWR's *Prescott AMA Groundwater Flow Model Update Report, 2013*).

8.4.3 Surface Water

The use of CAP water is not economically feasible in the PRAMA due to the distance of the AMA's water users from the CAP aqueduct. Recognizing this, the City of Prescott and the Yavapai-Prescott Indian Tribe sold their CAP allocations to develop a funding source for the acquisition of other alternative water supplies.

Historically, storm water runoff from Granite Creek and Willow Creek has been impounded at Watson Lake and Willow Lake. Until the late 1990's CVID diverted these waters to district lands for agricultural irrigation. The City of Prescott purchased these rights at that time, inheriting a pre-existing agreement between the CVID and Salt River Project (SRP) which stipulates that the City may only use the water (for annual storage and recovery) from the lakes between April 1 and November 30. If the City can amend this agreement with SRP it would allow the City greater water management flexibility, however, considerable legal complexities related to the use of water from Watson and Willow Lakes which would need to be overcome to allow a change in the use of this source water by the City of Prescott. The combined capacity of Watson and Willow Lakes is estimated to be roughly 11,000 acre-feet. The City expects to be able to annually store and recover about 1,500 acre-feet of surface water per year, however, since the year 2000, the City has averaged about 1,200 acre-feet of annual surface water recovery. Due to statutory requirements, when this water is stored, it must be recovered on or before the last day of the following month or within the same calendar year, whichever is earlier.

The City of Prescott has no plans to directly use the surface water from Watson and Willow Lakes at this time. The City also possesses surface water rights for Banning Creek (Goldwater Lake), the Hassayampa River, and along Del Rio Springs. Although base flows at Del Rio Springs are used to irrigate land both inside and outside of the PRAMA, the City could execute its water rights and begin using the flows at this site.

Future water exchanges involving surface water may be possible. Details of how this could occur have not yet been explored, but would likely involve some type of water exchange including surface water along the Verde River watershed, possibly from the Granite Creek drainage system, and stored water from Watson and Willow Lakes. Additionally, through severance and transfer of water rights to Lynx Lake, there exists about 500 acre-feet of surface water that could potentially be used annually as municipal water supply for the Town of Prescott Valley and/or for recreational purposes.

Table 8-3 illustrates the long-term storage credit balances (as of December 31, 2011) for entities located in the PRAMA.

TABLE 8-3
LONG-TERM STORAGE ACCOUNT CREDITS
PRAMA

Credits as of December 31, 2011			
LTSA HOLDER	**LTSA No.**	**Reclaimed Water**	**Surface Water**
Prescott	70-421123.0000	22,417	0.00
Prescott Valley	70-421124.0000	10,668	0.00
CVID	70-421125.0000	>1	0.00
North Nuggett	70-421126.0000	528	0.00
Chino Valley	70-421127.0000	693	0.00
TOTALS:		**34,306**	**0.00**

8.4.4 Imported Groundwater from the Big Chino Subbasin

Groundwater importation from the Big Chino Subbasin of the Verde River Groundwater Basin, which is located completely outside the AMA, is allowable per statute *(See A.R.S. § 45-555).* The Groundwater

Transportation Act reserved groundwater supplies in the Big Chino Subbasin for use in the PRAMA and authorized the transfer of those supplies across subbasin boundaries. The Groundwater Transportation Act allows municipalities in the PRAMA to withdraw groundwater in the Big Chino Subbasin to meet municipal and industrial demand under certain conditions. Private water companies are restricted from using this provision and, therefore, cannot directly acquire imported groundwater.

The City of Prescott has purchased land in the Big Chino Subbasin on which it intends to eventually construct a well field. The City and the Town of Prescott Valley have entered into an agreement to share imported Big Chino groundwater and the costs of importation. As of mid-year 2013, construction of Big Chino wells and a Big Chino pipeline has not begun. ADWR has projected the possible impact of importing Big Chino groundwater on the ability to achieve and maintain safe-yield in the PRAMA *(See Chapter 11).*

8.5 4MP AUGMENTATION PROGRAM GOALS AND OBJECTIVES

The ARP for the fourth management period is intended to move the PRAMA toward its goal of safe-yield and to enhance AMA water management by emphasizing the following objectives:

- Maximize the recharge of alternative water supplies, including reclaimed water, which cannot be used directly.
- Develop a regional recharge plan to coordinate storage and recovery of alternative water supplies in a manner consistent with the AMA's management goal and objectives, which also recognizes the importance of the recovery of stored water within the area of impact of underground storage.
- Expand the existing groundwater and surface water monitoring program for the PRAMA to facilitate effective implementation of regional water management strategies and the AMA's conservation and augmentation programs.
- Explore the benefit to the AMA of interregional water exchanges.
- Continue to research and identify augmentation measures for future implementation, including the study of legal, institutional, technical, environmental, and economic constraints that inhibit the development and use of alternative water supplies.
- Identify and assess the potential to develop alternative water supplies from outside the PRAMA.

The possibilities and need for augmentation during the fourth management period differ substantially among the five AMAs. During the fourth management period, ADWR will continue to assist water users in identifying and developing additional water supplies and maximize the use of existing alternative water supplies in meeting the PRAMA management goal. ADWR will also continue to work to develop avenues from which local water interests can work together to promote improved water resource management and secure the long-term availability of water supplies to support existing and new uses.

8.6 THE 4MP AUGMENTATION AND RECHARGE PROGRAM

ADWR is required to include in the 4MP "if feasible, a program for additional augmentation of the water supply of the active management area, including incentives for artificial groundwater recharge." A.R.S. § 45-567(A)(5). Pursuant to A.R.S. 45-561(2), "Augmentation means to supplement the water supply of an active management area and may include the importation of water into the active management area, storage of water or storage of water pursuant to chapter 3.1 of this title." The ARP must be consistent with this statute, but, as described in the introduction, for purposes of this chapter *augmentation* means increasing the

availability and use of renewable supplies such as reclaimed water in lieu of groundwater and *recharge* means storage of water pursuant to Title 45, Chapter 3.1, the Underground Water Storage, Savings and Replenishment Act. The ARP therefore includes provisions for maximizing the use of renewable supplies and for storage of renewable water.

The principal responsibility for developing water supplies and for storing that water for future uses lies with the PRAMA's water users. ADWR's responsibility under A.R.S. § 45-567(A)(5) is to design a program that encourages and facilitates the efforts of those water users. The program should particularly encourage augmentation and storage of water where groundwater supplies are limited. The ARP, however, must also allow ADWR to use the authorities granted by the Legislature to prevent unreasonable harm to third parties and to avoid aggravating existing local water supply problems.

The ARP for the 4MP contains the statutory requirements for storing and recovering water within an AMA. The key statutory provisions for storage facilities relate to hydrologic feasibility, A.R.S. § 45-811.01(C)(2); protection of land and other water users from unreasonable harm, A.R.S. § 45-811.01(C)(3); and avoidance of water quality impacts, A.R.S. § 45-811.01(C)(5). Although the Underground Water Storage, Savings and Replenishment Act contains statutory requirements for water storage and for recovery, it also includes requirements linking storage and recovery to the AMA's management plan and management goal. The provision that governs non-recoverable storage, found in A.R.S. § 45-833.01(A), includes a requirement that non-recoverable water storage must be consistent with the AMA's ARP. The provisions governing recovery are found in A.R.S. § 45-834.01. Those provisions allow stored water to be recovered outside the area of impact of the stored water only if certain conditions are met. One of the conditions is that the director must determine that recovery at the proposed location is consistent with the management plan and management goal of the AMA. A.R.S. § 45-834.01(A)(2)(b)(ii).

ADWR has developed the ARP for the 4MP based on the statutory authorities and tools available to address the goals and objectives identified in the previous section. The program components will be presented in the order listed.

8.6.1 Storage and Recovery Siting Criteria

The benefits to water management through the ARP depend on where the water is stored and recovered. Non-recoverable water storage is discussed in the next section.

For storage and recovery, unless stored water is recovered by the storer within the area of impact, the recovery is only allowed, "if the director determines that recovery at the proposed location is consistent with the management plan and achievement of the management goal for the active management area." A.R.S. § 45-834.01(A)(2)(b)(ii). Recovery of stored water *within* the area of impact of the stored water is always considered consistent with the management plan and management goal of the AMA.

Because the statute requires that recovery outside the area of impact be consistent with the AMA's management plan and management goal, the locations of storage and recovery of water are inherently linked. Both must be considered when determining whether the future recovery of stored water meets the requirement for consistency with the management plan and management goal of the AMA. It cannot be determined whether recovery outside the area of impact of storage is consistent with water management objectives of the AMA unless the storage location is also considered. Water management benefits to the AMA would depend greatly on whether water recovered from an existing recovery well was stored in a remote area of the AMA or in a large pumping center of the AMA. Therefore, the criteria to determine whether the recovery location is consistent with the management plan and goal for the AMA must also consider where water was stored.

The locations of storage and recovery are important factors in addressing local and regional supply problems, particularly in areas experiencing severe water level declines, subsidence, or other aquifer

management issues, and in attempting to balance the supplies in the AMAs during the fourth management period. For example, the future water supplies of the AMA may be diminished if water storage occurs in a remote location with no future demand for the stored water and recovery occurs outside the area of impact of storage. In addition, recovery outside the area of impact of water storage could aggravate problems if the area of recovery was experiencing rapidly dropping groundwater levels or if groundwater supplies were already fully committed under the Assured Water Supply (AWS) Program. On the other hand, if storage occurs in an area experiencing high water levels and recovery occurs away from the area of impact, the water storage will contribute to those high water levels. If dewatering is required as a *direct* result of water storage or savings, either the storage facility's operational plan should be adjusted to minimize impacts, which may include strategic recovery locations to mitigate impacts, or the storer may not be issued credits.

The 4MP criteria protect groundwater supplies already committed for an AWS Determination from an entity who wishes to recover water *outside* the area of impact.

The 4MP criteria also link future use benefits to determinations under the AWS Program. If storage occurs in an area that has a committed and projected demand through a Designation of Assured Water Supply or Certificate of Assured Water Supply, then it is deemed to contribute to groundwater supplies that will be used in the future. If the storage does not occur within such an area, the director must determine that the storage will otherwise be beneficial to the AMA if recovery is to occur outside the area of impact of the storage. If a storage facility is found not to meet these criteria, the permit will include a notice to potential water storers that recovery of the stored water will be allowed only within the area of impact of storage until such time that the director determines there is a demand for groundwater within the area of impact of the storage.

The requirement that recovery outside the area of impact of storage must be consistent with the AMA's management plan and management goal continues to be a requirement even after the recovery well permit has been issued. Thus, previously permitted recovery wells are subject to the criteria of the 4MP and future management plans. Recovery from within the area of impact is not required to meet management plan and management goal consistency requirements.

8.6.2 Criteria for Storage of Non-Recoverable Water

Pursuant to A.R.S. § 45-833.01(A),

> At the request of the applicant, the director may designate a water storage permit as storing non-recoverable water. If the water storage occurs within an active management area, the water storage permit may be designated in this manner only if the storage is consistent with the active management area's augmentation program.

The director may make this designation only upon application by a proposed water storer.

Only in few instances has this designation been applicable to date. In the second management period, non-recoverable storage occurred in association with certain augmentation grants that included storage of water to test the hydrologic feasibility of a recharge site. The City of Prescott City Charter speaks to the permanent recharge of reclaimed water generated by new development where future annexations are greater than or equal to 250 acres. The City of Prescott holds a non-recoverable water storage permit in addition to its other water storage permits. Under the 4MP, non-recoverable water storage may also occur as a result of an enforcement action associated with non-compliance of conservation requirements.

Water that is stored under a permit with this designation may not be recovered on an annual basis, may not be credited to a long-term storage account, and may not be used for replenishment purposes associated with a GRD. The same considerations discussed in the preceding section that shaped the criteria for recovery location have shaped the criteria for siting non-recoverable storage.

8.7 REGULATORY INCENTIVES

Provisions established in the Agricultural, Municipal, and Industrial Conservation Programs of this management plan provide incentives for water users to utilize renewable resources. The inclusion of renewable supply incentives is somewhat controversial due to the perception that encouraging the use of a renewable supply may result in an inefficient use of the supply. The Programs to increase the use of renewable water supplies should not be perceived as an alternative to conservation.

The Code (particularly through the AWS provisions) and the management plans require a long-term perspective on supply and demand. In the long term, efficient use of all water supplies is necessary. The distinctions that are now being made among sources of water, including incentives that allow increased use of certain renewable sources, may seem ill-advised in hindsight. It would be inappropriate not to build a conservation ethic into the structure of the PRAMA communities, even as they move towards the use of renewable supplies.

Achievement of the water management goals over the long term is only possible in the context of serious, long-term conservation efforts and increased utilization of renewable supplies. The debate is not between conservation and augmentation, but rather, whether the concept of "efficient use" can be integrated into the regulatory system and the community ethic. Matching the resources to the most appropriate demand will continue to require sophisticated management, including conjunctive management of groundwater, surface water, and reclaimed water. It is difficult to design incentives that are administratively workable without causing equity problems and weakening the conservation message that is crucial in protecting our resources for the future.

Table 8-2 lists the 4MP incentives to use alternative supplies. Because many of these incentives encourage use of alternative supplies at the expense of conservation, the incentives may need to be scaled back in the future to achieve safe-yield.

Although the need to include specialized incentives to address subregional conditions has been identified, the only regulatory tool to date for addressing localized areas of decline is the limitation on recovery of recharged water if it is recovered outside the area of impact of the stored water. The compliance approach described in Table 8-4 may result in encouraging recharge in specific locations to address local hydrologic concerns.

8.7.1 Enhanced Aquifer Management

As described in Chapter 2 and summarized in the physical assessment section of this chapter, certain areas within the AMA are experiencing water management problems that are more serious than in other areas of the AMA. These areas could continue to experience severe water management problems even if safe yield is achieved on an AMA-wide basis unless a more localized approach to water management is implemented. Therefore, ADWR will work to develop strategies to address the problems within its current legal authority. ADWR's efforts may include: (1) developing local/state partnerships; (2) identifying stakeholders; (3) identifying problems; (4) identifying groundwater pumping issues; (5) conducting hydrogeologic investigations as necessary; (6) examining new legislation and/or local ordinances to remove barriers to problem mitigation; (7) developing programs; and (8) creating incentives that contribute to a solution. This will be discussed further in Chapter 12.

8.8 CONCLUSION

The focus of this chapter has been on defining ADWR's role in augmenting the water supplies of the PRAMA for the fourth management period. The augmentation issues summarized in this chapter show that there is continuing need for active participation by ADWR in augmentation activities to facilitate achievement of the PRAMA's water management goal and objectives. An augmentation and recharge

program has been developed that will use regulatory incentives, technical and planning assistance, coordination and facilitation of cooperative efforts, resolution of legal and institutional barriers, financial assistance, and storage and recovery location criteria to enhance ADWR's ability to reduce reliance on PRAMA groundwater and encourage the use of alternative water supplies in the PRAMA. Strategies to address local water levels and the need for additional new water supplies will be explored by ADWR, with input from the PRAMA during the fourth management period to ensure that the PRAMA's management goal can be achieved.

TABLE 8-4
RENEWABLE WATER SUPPLY UTILIZATION INCENTIVES
PRAMA

Sector	Incentive
Municipal	Delivery of reclaimed water by a municipal water provider does not count against the gallons per capita per day (GPCD) requirement, unless the reclaimed water is stored in one location and recovered outside the area of impact. This is an incentive for municipal providers to invest in reclaimed water systems *(Chapter 5, section 703.A).*
Industrial	Reclaimed water use is discounted when calculating compliance with the annual allotment for a turf-related facility. For the 4MP, ADWR has retained the 40 percent discount that was included in the 3MP *(Chapter 6, section 6-1404(A)).* If 100 percent of the water used at a facility in a year is from a non-groundwater source, no compliance is required with the annual allotment for that year.
Industrial	Cooling Towers Cooling towers that beneficially reuse 100 percent of their blowdown water are exempt from meeting the blowdown concentration requirements *(Chapter 6, section 6-1702(B)(1)).* Cooling towers that convert to at least 50 percent reclaimed water are exempt from the blowdown concentration requirements for one full year. If it is shown that they cannot meet the requirements, amended blowdown concentration levels may be applied *(Chapter 6, section 6-1702)(B)(.2)).*
Agricultural	Pursuant to A.R.S. § 45-467, reclaimed water use cannot contribute to a farm exceeding its allotment in any year. In determining whether a farm exceeds its maximum annual groundwater allotment for a year, total water use, including groundwater, reclaimed water, and surface water, is counted and any reclaimed water used that year is subtracted from the amount of groundwater that otherwise would have exceeded the farm's allotment.

Alternative supplies are available for beneficial use within the PRAMA. Sources of reclaimed water, surface water, imported groundwater, and extinguished grandfathered rights for AWS determinations comprise a sufficient volume of supply to meet future growth based on current demand trends. However, the access to alternative water supplies is not equitably distributed throughout the PRAMA, and environmental issues have delayed the development of some water supplies within the state. The management challenge is to determine how alternative water supplies can be put to maximum beneficial use by water users within the PRAMA. This will also entail exploring how to connect large concentrations of domestic wells, which face a greater threat of well failures, with existing or new potable water delivery systems in an affordable manner.

8.9 AUGMENTATION AND RECHARGE REQUIREMENTS

8-901 Storage and Recovery Siting Criteria

During the fourth management period, for the purposes of A.R.S. § 45 834.01(A)(2)(b), recovery of stored water at a location is consistent with the management plan and achievement of the management goal for the active management area:

A. *If recovery will occur within the area of impact, regardless of whether the recovery well permit applicant was the storer of the water; or*

B. *If recovery will occur outside of the area of impact, all of the following three criteria are met:*

1. *The water storage that resulted in the right to recover water:*

   a. *Is contributing to groundwater supplies that are accessible to current groundwater users or that have been committed to establish a Designation, Certificate, or Analysis of Assured Water Supply pursuant to A.R.S. § 45-576 or rules adopted thereunder so long as the areas in which water is stored are not experiencing problems associated with shallow depth to water; or*

   b. *Is a component of a remedial action project under Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) or Title 49, Arizona Revised Statutes, and the director has determined that the remedial action will contribute to the objectives of this chapter or the achievement of the management goal for the active management area; or*

   c. *Is otherwise determined by the director to have contributed to the objectives of this chapter or the achievement of the management goal for the active management area.*

2. *Either:*

   a. *At the time of the application, the maximum projected depth to water at the location of the recovery well after 100 years does not exceed the general 100-year depth-to-static water level for the AMA specified by A.A.C. R12-15-716 after considering: (1) the maximum proposed withdrawals from the recovery well; (2) withdrawals for current, committed, and projected demands associated with determinations made under A.R.S. § 45-576 that are reliant on the water which the recovery well will withdraw; and (3) withdrawals for other current or projected demands that are reliant on the water which the recovery well will withdraw; or*

   b. *The recovery will be undertaken within the applicant's service area and the applicant is a municipal provider designated as having an assured water supply.*

3. *The recovery well is:*

   a. *Located in an area experiencing an average annual rate of decline that is less than 4.0 feet per year; or*

   b. *A component of a remedial action project under CERCLA or Title 49, Arizona Revised Statutes, and the director has determined that the remedial action will contribute to the*

objectives of this chapter or the achievement of the management goal for the active management area; or

c. *Likely to contribute to the water management objectives of the geographic area in which the well is located, as determined by the director.*

8-902 Criteria for Storage of Non-Recoverable Water

During the fourth management period, water storage that is designated as non-recoverable is consistent with the AMA's Augmentation and Underground Water StorageProgram if one of the following criteria is met:

The water storage:

1. *Is contributing to groundwater supplies that are accessible to current groundwater users or that have been committed to establish a Designation, Certificate, or Analysis of Assured Water Supply pursuant to A.R.S. § 45-576 or rules adopted thereunder so long as the areas in which water is stored are not experiencing problems associated with shallow depth to water; or*

2. *Is a component of a remedial action project under CERCLA or Title 49, Arizona Revised Statutes, and the director has determined that the remedial action will contribute to the objectives of this chapter or the achievement of the management goal for the active management area; or*

3. *Is otherwise determined by the director to contribute to the objectives of this chapter or the achievement of the management goal for the active management area.*

DRAFT

APPENDIX 8
DECLINE RATE METHODOLOGY

In evaluating an application for a proposed recovery well permit, ADWR considers many factors in determining consistency with the average water level decline rate siting criteria. The time frame for which the average is calculated may vary based on data availability and the hydrologic characteristics of the area. Major trends in precipitation, water supply utilization over time, hydrogeologic data, and the modeling of projected impacts may be factors in evaluating this rate. Other considerations may also be appropriate depending on the location of the proposed recovery well.

Typically, ADWR examines the historic static water level data for the period of record for wells located in the section in which the proposed recovery well is located and in the eight sections that surround the section where the proposed well is located. The specific area examined depends on the availability and quality of water level data and the hydrogeology of the area. Bedrock outcrops, large pumping centers, and other features may affect the determination of pertinent data. Generally, wells that are screened in the aquifer of concern and regularly monitored using consistent methods for static water level data are good reference points (such as ADWR's statewide monitoring or index wells). ADWR examines the well hydrographs (graphs of static water levels over time), and evaluates the slope of the curve for the period of interest. The slope indicates whether the static water level in the monitoring well has risen or fallen over time. A horizontal line on the hydrograph indicates that water levels remained stable over time. ADWR identifies what activities may have caused the groundwater changes over time to see whether the activity still exists or has been reduced, eliminated, or increased over time.

This approach provides more flexibility and protection of the groundwater resource than would be provided by a simplistic evaluation of decline rates calculated for all water level data within a set radius and during the entire period of record. For example, if a recovery well is proposed for an area which historically had a rapid decline in groundwater levels due to activities that no longer exist (e.g., retirement of agriculture after heavy agricultural use in the 1940s and 1950s), and if the proposed area is not at high risk for subsidence, the proposed recovery well might be deemed consistent with the average decline rate criteria by looking at the period of time after the historic change in use. Similarly, if water levels in the vicinity of the proposed recovery well were stable for decades, but recently a new use caused rapid rates of decline, the proposed recovery well may be deemed inconsistent with the criteria.

ADWR's groundwater models may be used to project future water levels and decline rates on a regional basis. Modeling may assist the permittee in evaluating recovery options. Where there are sufficient data, a model may give an indication of how long recovery within a region may remain permitted based on the current average decline rate criteria.

The most current procedures for establishing the average groundwater level decline rate in the vicinity of a proposed recovery well will be published in ADWR's Recovery Well Application Packet, however the general procedure is described below.

Decline Rate Procedure Description

To evaluate the four-foot decline criteria, ADWR will review water level data from all available, reliable sources of water level data in the vicinity of the proposed recovery well. Some sources include the ADWR GWSI database, water levels submitted with the recovery well application from the applicant, or other water level data available.

The entire period of record for each well in the vicinity of the proposed recovery well is plotted on a hydrograph. The entire period of record of measurements is often used in the evaluation; however, sometimes the hydrograph reveals a pronounced inflection in average slope of the hydrograph, indicating that the entire period of record may not be representative of current conditions. The inflection may be

attributed to conditions such as urbanization of previously irrigated acreage or the introduction of a new water source. The latest portion of the hydrograph that is most representative of current conditions, and will likely continue in the future, is then used in the analysis.

The average annual rate of decline for a given well is calculated by dividing the total change in water level for the selected period of record by the period of record, in years. The water level change for each well is averaged to arrive at an average water level change in the vicinity of the proposed recovery well. Care is taken to select wells for averaging near the proposed recovery well that are representative of nearby aquifer conditions.

DRAFT