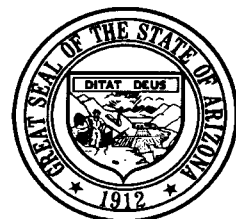


# II

## *Regulatory Programs*

- Chapter 4      Agricultural Conservation Program
- Chapter 5      Municipal Conservation Program
- Chapter 6      Industrial Conservation Program
- Chapter 7      Groundwater Quality Management Program
- Chapter 8      Augmentation and Recharge Program
- Chapter 9      Water Management Assistance Program
- Chapter 10     Plan Implementation



# Preface

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Section I provided an overview of the Arizona Department of Water Resources' (Department) statutory authority and management objectives, and described the physical, climatic, demographic, and water use characteristics of the active management area (AMA). Long-term water level declines, land subsidence, and water quality problems, coupled with current and projected groundwater over-drafting estimates, provide compelling justification for the development of progressive and responsible water management programs.

This section of the Third Management Plan is entitled "Regulatory Programs" because the programs described are required of groundwater users or are preconditions to obtaining certain permits or financial assistance. The regulatory chapters that follow describe specific requirements for groundwater users within the AMA. Programs contained in this section include mandatory conservation requirements, criteria for demonstrating consistency with the management plan by applicants for Certificates of Assured Water Supply, additional programs designed to encourage the use of renewable water sources, recharge program eligibility and operational criteria, criteria for obtaining financial assistance for water management programs, and plan implementation activities, including the Department's compliance and enforcement program.

Chapters 4, 5, and 6 contain the agricultural, municipal, and industrial conservation programs, respectively. Chapter 7 discusses the Department's groundwater quality management program and provides an assessment of water quality within the AMA. Chapter 8 describes the Department's augmentation and recharge program, and Chapter 9 discusses the Department's water management assistance program. Finally, Chapter 10 outlines the Department's policies and procedures for implementation of the Plan.

The regulatory programs are based on a philosophy developed by the Department over the course of the last two management periods. In the first management period, the Department focused on the conservation of groundwater as its primary management goal. In the second management period, the Department continued to enhance the conservation programs, but also implemented a program for the augmentation of water supplies, which included incentives for the increased use of renewable supplies. In the third management period, the Department's focus is on both conservation of groundwater and augmentation of water supplies. The Department's regulatory philosophy is based on its overall water management goals for the management plans: the conservation of groundwater through the efficient use of all water sources and the augmentation of water supplies to ensure a long-term, secure water supply.

The safe-yield goal and the overall mission statement of the Department are guiding concepts in the agency's activities. An understanding of the basic framework of the regulatory programs requires knowledge of the components of the safe-yield goal and the Department's compliance approach. The framework is described below.

- **The AMA Management Goal: Safe-yield**

"Safe-yield" by January 1, 2025 is the management goal of the Prescott AMA. "Safe-yield" is defined by statute to mean:

[A] groundwater 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 and artificial recharge in the active management area. A.R.S. § 45-561 (12).

The statute specifies that safe-yield is “a long-term balance.” Thus, the hydrologic conditions in the AMA cannot simply be viewed in the short-term, but rather must be viewed over a longer period of time. Further, establishing a “balance” is more complicated than comparing the total amount of groundwater withdrawals for the AMA to the amount of recharge occurring in the area in a given year.

In analyzing whether an AMA is at a safe-yield condition, the Department considers the following factors which impact groundwater levels and water in storage:

1. Groundwater pumpage: Annual pumpage volumes from the AMA’s aquifers are considered in the safe-yield calculation. Withdrawals in association with irrigation grandfathered rights, non-irrigation grandfathered rights, groundwater withdrawal permits, and undesignated municipal providers are calculated as debits to the groundwater system. Also considered in the safe-yield calculation as a debit to the system is the volume of groundwater allowed through the Assured Water Supply Program for each designation and Certificate of Assured Water Supply issued prior to 2025. The Department concluded in the development of the Assured Water Supply Rules that a limited quantity of the groundwater in storage could be allocated as a portion of the allowable water supply for each applicant. This groundwater can be used at any time in the 100 year period; however, it is expected that this allowance will be used in the early years while other supplies are being developed.

2. Groundwater underflow: Groundwater underflow from the AMA is a naturally occurring outflow from the AMA’s aquifers. It is a loss to groundwater in storage because it is no longer available for use in the AMA. For example, groundwater flows out of the Prescott AMA into the Big Chino groundwater subbasin.

While some may contend that these natural losses could be captured for use, and therefore should not be counted as a loss, the physical capture of groundwater leaving the AMA would be very difficult, if not impossible. Until the technology and infrastructure actually exist to locate and capture these outflows, they must be treated as a loss to the system.

3. Groundwater discharge to baseflow of surface water systems: Groundwater discharges to Del Rio Springs and the Agua Fria River are a loss to the groundwater system of the AMA. Even if these waters are captured by surface water right holders and used within the AMA, the groundwater that exits the system is a loss to the groundwater budget for the AMA.
4. Net natural recharge: Net natural recharge in a given year is the volume of water that naturally recharges the groundwater supply minus the natural depletions to the groundwater supply over the course of that year. The components of net natural recharge that increase the groundwater supply are stream channel infiltration, mountain front recharge, and groundwater inflow into the AMA. The components that naturally deplete the groundwater supply are groundwater outflow out of the AMA and water loss due to evapotranspiration. Infiltration of treated effluent discharged to surface water channels is not a component of net natural recharge.
5. Incidental recharge: Incidental recharge originates as groundwater or surface water which percolates down to the water table during and after its use for human activity. In the Prescott AMA, the volume of incidental recharge is largely dependent on the quantity of municipal effluent discharged into stream channels, and the volume and efficiency of agricultural and mining water use. It should be noted that incidental recharge that occurs

during the use of the water may not be permitted as an underground storage activity under the state's Underground Water Storage (UWS) Program. Water that is treated after its use for municipal purposes, becomes effluent, and is released into a natural streambed, however, is specifically recognized by the UWS Program as eligible to become a managed underground storage activity. *See A.R.S. §§ 45-801.01 et seq.* As is more fully explained below, storage credits that are accrued through an effluent discharge that has been permitted as a managed storage facility cannot be counted as a contribution to safe-yield.

6. Artificial recharge: Under the state's UWS Program, A.R.S. §§ 45-801.01 *et seq.*, persons may undertake recharge projects to purposely add water to an aquifer without the right to withdraw it in the future. However, artificial recharge is commonly used as a storage mechanism to accrue credits with the expectation of future recovery. Stored water for which credits have been issued cannot be counted as a contribution to safe-yield, because it is already allocated to the water storer. Therefore, this type of water has no impact on the safe-yield volume; however, it does result in a temporary increase in groundwater in storage.

Not all water stored under the UWS Program can be recovered. The volume of recharge which is allocated permanently to the aquifer, or the "cut to the aquifer" that results from generation of certain types of recharge credits does benefit the aquifer and is a component of the safe-yield groundwater supply. In addition, any non-recoverable storage that is conducted under the UWS Program in a given year can be included in the safe-yield volume for that year. Recharge credits that are generated and then subsequently extinguished prior to use are also a component of the safe-yield supply.

The volume of groundwater that can be withdrawn while maintaining a safe-yield condition in the AMA is not a fixed amount; it will change due to annual variations in incidental, natural, and artificial recharge, as well as other factors listed above. The groundwater system is in a state of "overdraft" as long as groundwater withdrawals exceed the sum of the naturally and incidentally recharged volumes plus the portion of the artificially recharged volume that will not be withdrawn later as storage credits.

Because water level changes are direct indicators of changes in groundwater storage, they are the measured data which support the other factors of the safe-yield analysis. However, changes in water levels are expected to continue even after achievement of safe-yield, as stored credits are recovered and entities with assured water supply designations utilize their groundwater allotments. An AMA that is at safe-yield should not experience broad-ranging, significant, and continuing declines in average water levels after adjustments are made for the factors just described. Therefore, water levels are considered in making the safe-yield determination.

- **Total Water Use Conservation Requirements and "Stacking"**

With the wide array of water resources available in Arizona as an alternative to groundwater, including surface water, effluent and remediated groundwater, the Department attempts to provide incentives that will promote use of these alternative supplies whenever and wherever possible. At the same time, we recognize that groundwater is often a very accessible and inexpensive source of supply, whereas the alternative sources can be expensive and difficult to access. The Department also recognizes that groundwater is our state's "emergency" supply, and it must be available for use whenever the other alternatives run short. Groundwater is particularly valuable as a long-term drought supply, to buffer the effect of changes in surface water availability. In order to maximize the supply of groundwater, and ensure sufficient supplies of water, all sources must be utilized efficiently.

For these reasons, the Department believes that it is both impractical and unwise to consider groundwater use as the only measure of regulatory compliance. The level of groundwater use that is reasonable is relative to the amount of water used from other sources. To ensure that groundwater users make reasonable use of groundwater, and to encourage efficiency and flexibility in the use of alternative supplies, the regulatory strategy includes evaluation of the total water use of each water user and provider, and setting conservation requirements based upon that total water use. In keeping with the Department's statutory obligations and limitations, however, the conservation requirements of the management plan only apply if groundwater is used.

The Department's regulatory program is, therefore, structured around the concept of "stacking" different types of water, by type, in a compliance hierarchy, with groundwater on top. If a total water use conservation requirement is exceeded by a user of groundwater, the amount of the violation of that requirement will be measured by the amount of groundwater used in excess of the regulatory requirements. This strategy will ensure that if groundwater is being used, it is being used as wisely and efficiently as economically possible. This system also provides the flexibility needed by most users of commingled supplies, allowing groundwater to be used as needed to supplement alternative sources.

- **Flexibility in the Components of the Regulatory Plan**

The Department recognizes that water use varies by year and locality. Therefore, the Department has provided maximum flexibility when administering the regulatory provisions of the management plan. For example, most regulatory provisions include a basic program, with one or more alternative programs designed to meet special circumstances. The basic program is generally designed to place simple numerical limits on water use, leaving the means of achieving those limits wholly up to the water user or provider. The alternative programs tend to remove numerical limits in favor of specific conservation measures more suitable to the water user.

Another component of regulatory flexibility is the establishment of "flexibility accounts" for most allotment-based requirements. These accounts generally allow water users to borrow or bank water from one year to the next in order to overcome the variation in use caused by weather or other unforeseen circumstances. Flexibility accounts are mandated by statute for agricultural users, and the Department has used this example to incorporate flexibility accounting into municipal and industrial programs as well.

- **Administrative Review and Variance of Conservation Requirements**

Even with the general flexibility of the regulatory programs, the Groundwater Code (Code) recognizes that certain individual conservation requirements may pose hardship in certain circumstances. To allow relief in these situations, the Code provides for an administrative review and variance process. The emphasis in this process is on the impact of a particular conservation requirement as it is applied to an individual water user. Administrative review and variance are fact-intensive inquiries which may result in some regulatory relief and are considered on a case-by-case basis.

- **Accounting for Water Use**

Many water providers deliver a mix of water types. In order to determine compliance with conservation requirements, the Department must adopt a set of policies for commingled systems. The Department is continuing to develop policies for "volumetric" accounting.

Generally, a water provider delivering different types of water through a commingled system cannot determine which type of water a customer actually received. Therefore, the provider is generally asked to account for all deliveries to its customers on a volumetric as opposed to molecular basis. This allows the provider to compute the percentage of each type of water delivered in a given year, and apply that same percentage to the water delivered to each customer, regardless of the type of water actually received by the customer. This volumetric accounting policy works well for most providers, because of its simplicity and certainty. Individual circumstances may warrant individual consideration, however, and the Department is constantly reviewing its policies on volumetric accounting to recognize necessary exceptions. Generally speaking, however, the Department does not recognize accounting which shows a concentration of deliveries of certain types of water to certain users if the delivery system is physically commingled.

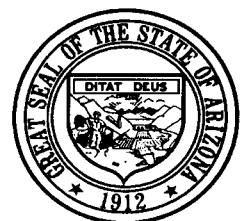
- **Enforcement**

An effective conservation plan requires effective enforcement. The Department is given wide ranging enforcement authority in the statutes to ensure that all water users are contributing their share to the overall goal of groundwater conservation and augmentation of water supplies. While the statutes allow the imposition of substantial monetary penalties for violating either water use limitations or conservation requirements, the Department is also given considerable discretion in how that enforcement program will be managed. Overall, the Department's philosophy has been that the ability to correct management deficiencies and save groundwater is more important than collecting monetary penalties. Therefore, most of the Department's regulatory efforts to date have involved voluntary "consent orders" where the water user in violation agrees to adopt conservation measures, guarantee future compliance, or otherwise mitigate the impact of the violation on the state's groundwater resources in exchange for a waiver or reduction of the civil penalties. This approach has worked well in the past, and has been particularly useful in making the transition from a state where groundwater use was essentially unregulated to a state where water regulation has become a fact of everyday life.

In the third management period, the Department will continue its policy of reviewing each suspected violation on an individual basis. The Department will also continue its policy of working with any water user in violation of the groundwater laws to make certain that all the surrounding circumstances are understood and to explore alternative means by which the problem might be solved. In some cases, however, violations are not matters of inadvertence or misunderstanding, but are repeat offenses or voluntary decisions based on economic considerations, lack of planning, or careless disregard for the resource. During the third management period, the Department will strive to identify these latter types of violations and pursue stringent civil penalties. By so doing, the Department intends to bring greater equity and fairness to the common goal of saving our groundwater supply. Alternative mechanisms to achieve compliance while encouraging achievement of local water management goals will also be explored.

The foregoing synopsis of the Department's regulatory approach is intended to assist the reader in understanding the reasons behind the mandatory conservation requirements in the following regulatory chapters. In addition, we have included a Plan Implementation Chapter which gives more definitive explanation to many of the administrative policies and procedures introduced here. Finally, it has always been the Department's policy to offer assistance to anyone seeking to better understand or comply with the conservation requirements imposed by the management plans, or the requirements of the Groundwater Code. The AMA offices, or the Department's central office in Phoenix, can provide valuable support on most water management issues.

*Agricultural Conservation Program*



## 4.1 INTRODUCTION

The Agricultural Conservation Program for the Third Management Plan has been developed to contribute to the achievement of the safe-yield goal by the year 2025 for the Prescott Active Management Area (AMA). The agricultural sector's contribution to meeting the Prescott AMA's safe-yield goal is expected to come from a combination of improved on-farm water management practices, the use of renewable water supplies, and the reduction of irrigated acreage due to urban and industrial development.

As discussed in Chapter 3, agriculture is responsible for about one third of the total annual water use in the Prescott AMA. In 1997, a total of 7,572 acre-feet of water was used for agricultural irrigation purposes. Most of this water came from groundwater sources. Other sources of water used for agricultural irrigation include treated effluent and surface water.

Under the Groundwater Code (Code), only land associated with a Certificate of Irrigation Grandfathered Right can be legally irrigated with groundwater within an AMA. A.R.S. § 45-465. These certificates were issued by the Arizona Department of Water Resources (Department) based on crops and acreage planted from the years 1975 to 1980. Land not irrigated during this time period may not be irrigated with any water unless one of the exceptions stated in the Code applies. A.R.S. § 45-452.

For each IGFR, the Department establishes a maximum annual groundwater allotment based on certain statutory criteria. The Agricultural Conservation Program for the third management period is based on the final maximum conservation levels established for each IGFR in the second management period. A description of the Agricultural Conservation Program is detailed in this chapter.

In addition to the regulatory conservation program, the Department will continue to encourage the efficient use of renewable water supplies by the agricultural sector through other water resource management methods. During the third management period, effluent reuse and water management assistance funds will contribute to the water management activities in the Prescott AMA.

There were two inherent assumptions regarding the agricultural sector when the Code was developed. These assumptions were: (1) agricultural water use would gradually be replaced by municipal and industrial uses; and (2) agricultural water use would become more efficient over time. These assumptions should be kept in mind when reading the details related to the development of current and future Agricultural Conservation Program requirements.

In this chapter, the following topics are discussed in the order listed:

- Statutory Provisions
- Irrigation Water Duties and Maximum Annual Groundwater Allotments
- Agricultural Conservation Program Development
- Agricultural Conservation Program Components
- Compliance with Agricultural Conservation Requirements
- Non-regulatory Water Resource Management Strategies
- Future Directions
- Agricultural Conservation Requirements and Monitoring and Reporting Requirements



## **4.2 STATUTORY PROVISIONS**

The Code limits the use of groundwater for irrigation purposes in AMAs in several ways. These statutory provisions are described below.

### **4.2.1 Third Management Plan**

A.R.S. § 45-566 requires the director to follow established guidelines in developing management plans for the third management period (the year 2000 to 2010). For the agricultural sector, in the plan for each AMA, the director:

- Shall establish an irrigation water duty for each farm unit to be reached by the end of the third management period. A.R.S. § 45-566(A)(1).
- May establish one or more intermediate water duties to be reached at specified intervals during the third management period. A.R.S. § 45-566(A)(1).
- Shall calculate the irrigation water duty or intermediate water duties as the quantity of water reasonably required to irrigate the crops historically grown in the farm unit and shall assume the maximum conservation consistent with prudent long-term farm management practices within areas of similar farming conditions, considering the time to amortize conservation investments and financing costs. A.R.S. § 45-566(A)(1).
- After computing the irrigation water duties or intermediate water duties, may adjust the highest 25 percent of the water duties within an area of similar farming condition by reducing each water duty in an amount up to 10 percent, except that in making the adjustment, no water duty may be reduced to an amount less than the highest water duty within the lowest 75 percent of the water duties computed within an area of similar farming condition. A.R.S. § 45-566(A)(1).
- Shall grant an exemption from the irrigation water duties at any time during the third management period if an applicant can demonstrate to the director's satisfaction that the applicant's farm unit meets specific hydrologic conditions regarding water logging or basin outflow. A.R.S. § 45-566(D).
- Shall establish additional economically reasonable conservation requirements for the distribution of groundwater by cities, towns, private water companies and irrigation districts within their service areas. A.R.S. § 45-566(A)(5).

### **4.2.2 New Irrigated Lands Prohibited**

Under A.R.S. § 45-452, only acres of land which were legally irrigated at any time from January 1, 1975 through January 1, 1980, which are capable of being irrigated, and which have not been retired from irrigation or conveyed for a non-irrigation use, may be irrigated with any water unless one of the following exceptions apply:

- Surface water may be used pursuant to decreed or appropriative rights established before June 12, 1980. A.R.S. § 45-452(A).
- Existing acreage irrigated with surface water may be replaced with new acreage if the surface water right is severed and transferred to the new acreage. A.R.S. § 45-172.

- State universities may irrigate new acreage not to exceed a total of 320 acres of land with not more than five acre-feet of groundwater per acre per year. A.R.S. § 45-452(I).
- Correctional facilities under the jurisdiction of the state department of corrections may irrigate new acreage not to exceed a total of ten acres of land with not more than four and one-half acre-feet of water per acre per year for the purpose of producing plants for consumption by inmates as part of a prisoner work program. A.R.S. § 45-452(J).
- Existing acreage damaged by floodwaters may be replaced with new acreage. A.R.S. § 45-465.01.
- Existing acreage which has a condition that limits irrigation efficiency may be replaced with new acreage. A.R.S. § 45-465.02.

#### **4.2.3 Maximum Annual Groundwater Allotments**

Under A.R.S. § 45-465, the maximum annual groundwater allotment for each IGFR is determined by multiplying the irrigation water duty by the water duty acres. The irrigation water duty is the annual amount of water in acre-feet per acre that is reasonable to apply to irrigated land to produce the crops historically grown (1975 to 1980) divided by an assigned irrigation efficiency. Water duty acres are the highest number of acres in a farm, taking land rotation into account, that were legally irrigated during any one year from 1975 to 1980. The maximum annual groundwater allotment may be used to irrigate any or all of the irrigation acres in the farm unit. Irrigation acres are the acres in the farm which were legally irrigated at any time from 1975 to 1980.

#### **4.2.4 Flexibility Account Provisions**

To provide farmers with sufficient flexibility to address varying climatic conditions and to take advantage of changing agricultural market conditions, the Code requires the director to establish a flexibility (flex) account for each farm that receives a maximum annual groundwater allotment. A.R.S. § 45-467. In 1987, the Department began implementing these provisions in the Prescott AMA.

Under the flex account statute, a farmer may accumulate both flex account credits and debits. If a right holder uses water during a year in excess of the farm's maximum annual groundwater allotment, the flex account is debited. A negative balance that exceeds 50 percent of the annual allotment results in a violation of the conservation requirement. If a right holder uses less water during a year than the farm's maximum annual groundwater allotment, the flex account is credited. Accrued flex account credits are not limited, can be used at any time in future years, and may be used to offset a debit. In addition, under certain conditions right holders may transfer flex account credits accumulated during the preceding calendar year from one IGFR to another. A.R.S. § 45-467(O).

#### **4.2.5 Small Irrigation Grandfathered Rights**

In 1994, legislation was passed that deregulated small IGFRs. A small IGFR is defined as an IGFR with ten or fewer irrigation acres that is not part of an integrated farming operation. Under A.R.S. §§ 45-563.02 and 45-632(D), small IGFRs are not required to report annual water use or to comply with water duty limitations. Small IGFRs comprise over half of the IGFRs in the Prescott AMA but account for only about 2 percent of the total water use.

### **4.3 IRRIGATION WATER DUTIES AND MAXIMUM ANNUAL GROUNDWATER ALLOTMENTS**

The irrigation water duty is the primary component of the Agricultural Conservation Program and is one of the variables that determines the maximum annual groundwater allotment for each IGFR. The following sections describe how the Department determines water duties and maximum annual groundwater allotments.

#### **4.3.1 Calculation of Irrigation Water Duties**

The irrigation water duty is the quantity of water reasonably required per acre to annually irrigate the crops historically grown in a farm unit from 1975 to 1980. The crops historically grown for each farm unit were verified and established during the first management period. The Department calculates the irrigation water duty for each IGFR using the following formula:

$$\text{Irrigation Water Duty} = \frac{\text{Total Irrigation Requirement Per Acre}}{\text{Assigned Irrigation Efficiency}}$$

In this formula, the irrigation water duty is calculated by dividing the total water requirements to produce the crops historically grown by an assigned irrigation efficiency. Each component of the formula is discussed below.

##### **4.3.1.1 Assigned Irrigation Efficiencies**

Irrigation efficiency is a measure of the overall effectiveness of water application during a crop season. The effectiveness is a function of many variables including evaporation loss, soil intake rate, water application rates, irrigation system type, crop type, and irrigation water management practices.

The assigned irrigation efficiency presumes a benchmark value which is determined for each management period in accordance with statutory provisions. For the Third Management Plan, the assigned irrigation efficiency assumes the maximum economically feasible levels of conservation that each right holder is expected to achieve within areas of similar farming conditions. The assigned irrigation efficiency for the Third Management Plan takes into account the prudent farm management practices that have been used and the on-farm seasonal irrigation efficiencies that have been achieved during the second management period. The on-farm seasonal irrigation efficiency is determined by dividing the amount of water required by a crop by the total quantity of water actually applied to that crop during one growing season.

##### **4.3.1.2 Total Irrigation Requirement**

The total irrigation requirement for each farm unit equals the amount of water needed annually to satisfy the sum of the irrigation requirements for all of the crops historically grown. For each crop, the irrigation requirement (IR) consists of the amount of water needed to meet: the consumptive use (CU) requirement of the crop, plus any other needs (ON) that the crop may have, plus any needed leaching allowance (LA), less the amount of any effective precipitation (EP). This concept is shown by the following equation:

$$IR = CU + ON + LA - EP$$

The components of the total irrigation requirement equation are discussed below.

#### 4.3.1.2.1 Consumptive Use

The consumptive use requirement of a crop is the amount of water used in transpiration and building of plant tissue together with the amount of water evaporated from adjacent soil during the growing season. Crop consumptive use values are based on accepted scientific methods and commonly used values for the Prescott AMA. Appendix 4 lists the consumptive use requirement for each crop historically grown in the Prescott AMA during the years 1975 to 1980 based on the data currently available.

#### 4.3.1.2.2 Other Needs

Water required by certain crops for purposes other than consumptive use is referred to as “other needs” water. The Department makes adjustments for those crops that have “other needs.” For the third management period, no crops grown in the Prescott AMA were identified as needing additional water for other needs.

#### 4.3.1.2.3 Leaching Allowance

In some situations, a crop may require additional water for leaching or deep percolation. A leaching allowance may be necessary to prevent salts from accumulating in the crop root zone when high levels of total dissolved solids (TDS) are present in the irrigation water. If the accumulated salts in the soil profile are not leached below the root zone, soil salinity will increase and eventually inhibit plant growth and yields.

The procedure used to calculate the leaching allowance for a crop is shown by the following equation:

$$LA = \frac{AE}{0.75} \left[ CU \left[ \frac{1}{1 - \frac{EC_w}{5EC_e - EC_w}} - 1 \right] \right]$$

Where:

LA	=	leaching allowance for the crop
AE	=	assigned irrigation efficiency for the farm unit
CU	=	consumptive use requirement of the crop
EC <sub>w</sub>	=	electrical conductivity of the irrigation water (expressed in millimhos per centimeter)
EC <sub>e</sub>	=	tolerance of the crop to soil salinity in electrical conductivity of the soil saturation extract (expressed in millimhos per centimeter)

Most irrigation water in the Prescott AMA is of adequate quality for irrigation purposes. Consequently, the Department did not include any leaching allowances in the calculation of irrigation requirements for crops grown in the Prescott AMA. If, however, a particular irrigation water supply has an EC<sub>w</sub> value greater than 1.5 millimhos per centimeter (a concentration of approximately 1,000 milligrams per liter of TDS), the right holder may apply to the Department for an administrative review as discussed in Chapter 10.

#### 4.3.1.2.4 Effective Precipitation

Effective precipitation is defined as the amount of precipitation occurring before and during the growing season that is available for plant growth. Because precipitation in the Prescott AMA is substantial during most years, an effective precipitation value was added to the total irrigation requirement. Consumptive use

values for crops grown in the Prescott AMA, including values for effective precipitation, can be found in Appendix 4.

#### **4.3.2 Calculation of Maximum Annual Groundwater Allotments**

The maximum annual groundwater allotment for each IGFR is determined by multiplying the irrigation water duty by the water duty acres. These calculations are governed by A.R.S. § 45-465. (See section 4.2.3).

### **4.4 AGRICULTURAL CONSERVATION PROGRAM DEVELOPMENT**

#### **4.4.1 First Management Plan Development**

In the First Management Plan, each right holder was assigned an irrigation water duty and a maximum annual groundwater allotment. As required by A.R.S. § 45-564, the irrigation water duty was calculated as the “quantity of water reasonably required to irrigate the crops historically grown in a farm unit [assuming] conservation methods being used in the state which would be reasonable for the farm unit including lined ditches, pump-back systems, land leveling and efficient application practices, but not including a change from flood irrigation to drip irrigation or sprinkler irrigation.” Based on this statutory language, the Department calculated the irrigation water duties and maximum annual groundwater allotments with assigned irrigation efficiency in the Prescott AMA of 50 percent.

#### **4.4.2 Second Management Plan Development**

In the Second Management Plan, each right holder was assigned a new irrigation water duty and a new maximum annual groundwater allotment to be reached by the end of the second management period. For the Second Management Plan, the irrigation water duty was based on different factors than those considered in the First Management Plan. Under A.R.S. § 45-565, the director was required to establish a new irrigation water duty for each farm unit “calculated as the quantity of water reasonably required to irrigate the crops historically grown in the farm unit [assuming] the maximum conservation consistent with prudent long-term farm management practices within areas of similar farming conditions, considering the time required to amortize conservation investments and financing costs.”

The Department determined that for non-limiting soil conditions in the Prescott AMA, a seasonal irrigation efficiency of 75 percent represented maximum conservation and that this level of efficiency could be attained by using sprinkler irrigation systems and proper irrigation water management techniques. The Department also concluded through analysis of on-farm conditions that existing irrigation systems could be economically converted to more efficient sprinkler irrigation systems largely due to the reduced water usage associated with improved sprinkler irrigation systems.

The agricultural conservation program requirements implemented through the Second Management Plan for most farms have an assigned irrigation water duty based on a 75 percent seasonal irrigation efficiency. This efficiency requirement is effective in the year 2000.

Under A.R.S. § 45-574, a right holder requiring additional time to comply with an intermediate or final water duty and maximum annual groundwater allotment due to economic circumstances may file an application for a variance to obtain up to five additional years to comply with the assigned water duty. During the second management period, the Department did not grant a right holder’s application for a variance if the right holder was able to comply with the water duty and groundwater allotment through the use of existing accrued flex account credits during the five-year period after the water duty and allotment became effective (see section 4.4.4.6).

Under A.R.S. § 45-575(A), a right holder may seek a permanent adjustment of an irrigation water duty and annual allotment by filing an application for administrative review. Administrative review may be requested based on unique circumstances and technical errors made in establishing the conservation requirements for a specific IGFR. During the second management period the Prescott AMA received two requests for administrative review. One request was withdrawn by the applicant and the other was canceled by the AMA when the lands were developed as a subdivision.

#### **4.4.3 Agricultural Consultant Studies**

During the second management period many central Arizona farmers and farm groups challenged the Department's final water duties and maximum annual groundwater allotments that will become effective in the year 2000. Although these groups agreed that an 85 percent irrigation efficiency was technically achievable on most farms in the Phoenix, Pinal, and Tucson AMAs, they argued that the crop yield increases assumed for level irrigation systems did not represent the typical farms and that a maximum groundwater allotment based on an 85 percent assigned irrigation efficiency was not economically feasible.

In response to the concerns expressed by the farming community, legislation was passed in 1991 which instructed the director to evaluate the irrigation water duties established under the Second Management Plan, and to determine if the management plans should be modified. Laws 1991, Ch. 211, § 32. To assist in this evaluation, the director formed an Agricultural Technical Advisory Committee (AGTAC), whose membership included representatives from the agricultural sector statewide, as well as from city, state, and federal agencies. As a result of AGTAC recommendations, the 1991 legislation was amended in 1994. Laws 1994, Ch. 203, § 43. The consulting firm of CH2M Hill was selected to perform an agricultural study which consisted of two distinct parts. Part 1 of the study evaluated the irrigation water duties established during the second management period for the Phoenix, Pinal, and Tucson AMAs and Part 2 of the study reviewed alternative agricultural conservation programs.

The results of the study indicated that it would not be economically feasible to convert sloping irrigation systems to level basin irrigation systems (level irrigation systems) without an increase in crop yields and/or water costs. Since level irrigation systems were associated with maximum conservation, it was assumed that it was not economically feasible to achieve an 85 percent seasonal irrigation efficiency. The consultant recommended that the maximum level of conservation that is economically feasible should be based on a 75 percent seasonal irrigation efficiency, which is consistent with "standards of the industry" for a well-managed slope irrigation system. "Standards of the industry" are considered to be irrigation system engineering design criteria used for a well-managed slope irrigation system with a tail water recovery system or a modified slope irrigation system. However, due to soil limitations in the Prescott AMA, level irrigation systems were not found to be a feasible alternative to historical irrigation systems for most farm units, although their use is encouraged where applicable.

Slope irrigation systems using a tail water recovery reservoir and pumpback system have application in the Prescott AMA, but have a lower expected irrigation efficiency than the sprinkler irrigation system. An irrigation efficiency of 75 percent is attainable when a properly managed sprinkler irrigation system is used.

#### **4.4.4 Prudent Practices**

One of the factors the Department considered during the development of the Third Management Plan Agricultural Conservation Program was the use of prudent practices by farmers during the second management period. The Department's observations indicate that these practices have resulted in reduced water usage.

The Department determined that prudent long term farm management practices (prudent practices) were management practices commonly used on farms in the Prescott AMA that are economically feasible. The Department surveyed each AMA in December 1985 to inventory the types of irrigation systems in place. The Department did extensive research on the irrigation efficiencies that can be achieved with each type of irrigation system. Conclusions were based on accepted agricultural engineering standards and from case studies of irrigation systems in place. The Department determined that the implementation of sprinkler irrigation systems can increase the average irrigation efficiency in the Prescott AMA from 57 percent to 76 percent.

To establish conservation requirements which assumed an investment in irrigation system improvements, the Department addressed three concerns: (1) effective installation of irrigation system improvements on all farms, (2) economic feasibility of irrigation system improvements, and (3) potential water savings that could be expected from irrigation system improvements. The irrigation efficiencies attainable with sprinkler irrigation systems are applicable to all crops historically grown in the Prescott AMA. The Department has determined that a reasonable expectation for the irrigation efficiency of a properly managed sprinkler irrigation system used in the normal crop rotation is 75 percent.

The Department performed economic studies to determine the investment costs and benefits of installing a sprinkler system. The studies also compared the cash flow over operating expenses for other systems in use in the Prescott AMA. This research indicated that conversion from the historical irrigation systems to sprinkler irrigation systems is a prudent long-term farm conservation practice.

In the Second Management Plan, prudent long-term farm management practices were defined by the Department to be “those management practices commonly used on central Arizona farms that do not result in unreasonable economic hardship and, in fact, have proven to be economically feasible in most cases.” These prudent practices, which are discussed in more detail below, include the use of deficit irrigation, improved crop varieties, land fallowing, flex account management, and other economic factors. As urbanization in the Prescott AMA replaces agricultural land with development, it may prove to be more economically feasible to incorporate the prudent practices described below than to invest in the installation of sprinkler irrigation systems as a means of water conservation.

#### **4.4.4.1 On-Farm Physical Improvements**

Many farmers have continued to make on-farm physical improvements to their irrigation systems during the second management period to maximize water use efficiencies. Irrigation system improvements have included the conversion of slope irrigation systems to more efficient systems such as modified slope and level irrigation systems. Some farms have converted to low pressure sprinkler systems and trickle irrigation systems. Other physical improvements include applying soil amendments such as organic matter, disking plant stubble into the soil, and/or producing green manure crops. These improvements are typically performed by farmers to enhance soil conditions and water holding capacities.

#### **4.4.4.2 Irrigation Water Management Practices**

The use of proper irrigation water management practices during the second management period has enabled farmers to apply enough irrigation water to optimize crop growth while avoiding water loss. These practices involve not only applying the proper amount of water, but also irrigating at the precise time to ensure adequate soil water moisture for plant growth. It was established in the Second Management Plan and has been generally accepted in the agricultural community that the use of good irrigation water management practices can increase irrigation efficiencies.

#### **4.4.4.3 Improved Crop Varieties**

The planting of improved crop varieties with lower consumptive use requirements is another prudent practice which may enable farmers to conserve water through fewer irrigation applications. Improved crop varieties have also decreased production costs. Generally, these crops have shown a higher resistance to insect problems and disease, as well as having lower fertilizer requirements, increased yields, reduced labor demands, and reduced water requirements.

#### **4.4.4.4 Deficit Irrigation**

Deficit irrigation is the intentional practice of reducing the number of irrigations to lower crop production costs (e.g. water, fertilizer, pesticides) while achieving acceptable yields. Deficit irrigation can be managed successfully to reduce crop water demand or allow a farmer with a limited water supply to irrigate more acreage.

#### **4.4.4.5 Land Fallowing**

Land fallowing is the practice of not planting all or a portion of a farm for a period of time. It is practiced by many farmers, primarily through crop rotation. Farmers may also decide to fallow land for other purposes such as soil recovery and the installation of irrigation system improvements. Land fallowing reduces the acreage irrigated on a farm and typically results in reduced water use.

#### **4.4.4.6 Flexibility Account Credits**

An additional factor which the Department considered in the development of the Third Management Plan Agricultural Conservation Program was the excessive number of flex account credits that have accumulated since 1987. This accumulation of flex account credits indicates that many right holders have been using less water than their maximum annual groundwater allotments.

Under A.R.S. § 45-467, a right holder may accumulate either credits or debits depending upon the amount of water the right holder actually used compared to the maximum annual groundwater allotment. If a right holder uses less water than the maximum annual groundwater allotment, the amount of water not used which would have been groundwater is registered as a flex account credit. If a right holder uses more groundwater than the farm's annual groundwater allotment, debits accrue.

Even though flex account credit accumulations vary in quantity by IGFR, right holders who have exceeded their maximum annual groundwater allotment typically have had an adequate accumulation of flex account credits to compensate for any accrued debits. Some irrigation right holders have also purchased flex account credits from other right holders to maintain a positive flex account balance. However, a small percentage of right holders in the Prescott AMA have accumulated flex account debits.

For a variety of reasons, approximately 158,000 acre-feet of flex account credits have accumulated in the Prescott AMA from 1987 through 1997. The accumulation of flex account credits is a function of the amount of groundwater allotted and the amount of agricultural water used. The amount of water used is affected by many factors including improvements made to irrigation systems, the use of irrigation water management practices, the use of drought tolerant and shorter season crops, deficit irrigation, land fallowing, effective precipitation, and climatic conditions. Other significant factors which contribute to lower farm water use include non-irrigation due to land speculation, participation in federal price support programs, and other economic reasons such as the inability to obtain favorable financing for on-farm operations, and commodity demand due to local and world market conditions. Each of these factors, independently or in combination with one another, have contributed to the accumulation of flex account credits.



The accrual of flex account credits is at least in part a function of the statutory method for calculating water duties. Under A.R.S. § 45-465, the Department must calculate the water duty and the maximum annual groundwater allotment based on the crops grown and acres planted from the years 1975 to 1980. The maximum annual groundwater allotment is determined based on the water duty acres, which are the largest number of acres, taking land rotation into account, legally irrigated in any one year from 1975 to 1980. If the total irrigation requirements of the crops actually grown in a given year are less than the total irrigation requirements of the crops historically grown, or if fewer acres than the water duty acres are planted, the water duty calculation will result in more water being allotted than is actually needed and flex account credits will accrue.

The average crop consumptive use values used by the Department in the formula for the water duty calculation also contribute to the accumulation of flex account credits (see section 4.3.1). Some crops have lower consumptive use requirements and need fewer irrigations than the varieties historically grown. Because updated crop consumptive use values for new crop varieties have not been scientifically determined for the Prescott area, the Department has continued to use the average consumptive use values previously established and accepted by the agricultural community. Thus even right holders who irrigate improved crop varieties similar to the types of crops and acreage historically grown are likely to accrue flex account credits.

The large accumulation of flex account credits, together with the ability to purchase credits if needed, has provided right holders with additional alternatives regarding farm management and irrigation system improvement decisions. For example, a decision may be based on the cost to apply a conservation practice versus the cost to purchase flex account credits. The Department has observed that some right holders buy flex account credits instead of making the on-farm physical improvements necessary to meet conservation requirements. The ability to accumulate and to buy and sell flex account credits enables right holders to exceed the farm's annual groundwater allotment while remaining in compliance with their Agricultural Conservation Program requirements.

These changes appear to have been influenced primarily by market conditions and federal price support programs, such as the 1996 Federal Agriculture Improvement and Reform Act. However, these factors may change in the future. The implementation of the Second Management Plan second intermediate water duties in 1995 may also have contributed to the decreased accumulation and increased use of flex account credits.

#### **4.4.5 Third Management Plan**

As in the First Management Plan and the Second Management Plan, the annual groundwater allotment for the Third Management Plan is calculated by multiplying the water duty by the water duty acres for each IGFR. As in the Second Management Plan, the water duty for each IGFR is based upon the quantity of water reasonably required to irrigate the crops historically grown in the farm unit assuming the maximum level of conservation which is economically feasible within areas of similar farming conditions. The assigned irrigation efficiencies used in the water duty calculations for the Third Management Plan are based on the analyses and investigations conducted by the Department.

### **4.5 AGRICULTURAL CONSERVATION PROGRAM**

The following section describes the Agricultural Conservation Program for the Third Management Plan which consists of two main parts: the Agricultural Conservation Program and the Irrigation Distribution Systems Conservation requirements.

#### **4.5.1 Agricultural Conservation Program**

Based on the consultant's studies and the Department's additional data and analyses, the Department has concluded that the Second Management Plan final conservation requirements will provide a sufficient quantity of water for most farmers to grow the crops historically grown from 1975 to 1980 while achieving the maximum level of conservation required for the third management period by A.R.S. § 45-566. Under the Third Management Plan Agricultural Conservation Program, the Second Management Plan final conservation requirements are carried forward for the entire third management period beginning with calendar year 2002. Intermediate water duties will not be established.

As under the Second Management Plan, for the Third Management Plan Agricultural Conservation Program the Department determined the maximum annual groundwater allotment by multiplying the farm's water duty by the farm's water duty acres. See section 4.3. In the Agricultural Conservation Program, the Department calculated the water duty for most IGFRs within ASFCs by using a 75 percent assigned irrigation efficiency, which is the same as that used for the final water duty under the Second Management Plan. For a description of the ASFCs in the Prescott AMA see Chapter 3, section 3.1.3. Under the Third Management Plan, the right holder is expected to meet the maximum annual groundwater allotment based on a 75 percent irrigation efficiency by using the prudent practices described above in section 4.4.4. Right holders who have received Second Management Plan administrative review adjustments based on limiting soils and/or established orchards will continue to receive those adjustments during the third management period.

Under A.R.S. § 45-566(A)(1), the Department is authorized to reduce the highest 25 percent of the water duties within an ASFC by an amount up to 10 percent. A reduction of this nature in the Prescott AMA would decrease groundwater allotments by only about 26 acre-feet, which represents less than 0.1 percent of the total farm allotments. For this reason, the Department did not implement this provision.

Projections of current cropping patterns indicate that implementing the Second Management Plan final water duties for the Third Management Plan Agricultural Conservation Program would result in most farms remaining within their maximum annual groundwater allotments. Accumulations of flex account credits are expected to continue, but may be at a slower rate. Of the few farms that might experience problems, most could rely on their existing flex account credits to remain in compliance with their conservation requirements. Only approximately 150 IGFRs in all five AMAs (less than 3 percent of all IGFRs), are projected to exhaust their flex account credits by the end of the third management period. Most of these right holders would likely purchase flex account credits to remain in compliance.

#### **4.5.2 Irrigation Distribution Systems Conservation Requirements**

For the third management period, the director is required to establish "additional economically reasonable conservation requirements for the distribution of groundwater by cities, towns, private water companies and irrigation districts within their service areas." A.R.S. § 45-566(A)(5). The same conservation requirements were part of the Second Management Plan. A.R.S. § 45-565 (A)(5).

In the Second Management Plan, private water companies and irrigation districts which distributed 20 percent or more of their total water deliveries for irrigation use by January 1, 1990, were required to reduce their irrigation distribution system lost and unaccounted for water either by lining all their canals or by operating their delivery systems so that the total quantity of lost and unaccounted for water is 10 percent or less of the total quantity of water withdrawn, diverted, or received during a year. This requirement becomes effective upon commencement of operation or by January 1, 2000, whichever is later. A Department review of the conservation practices of the largest irrigation districts has shown that the Second Management Plan distribution system conservation requirements are being achieved by most districts.

For the Third Management Plan, the irrigation distribution system conservation requirements established by the Second Management Plan will continue to apply to irrigation districts and private water companies which, as of January 1, 2000, distribute 20 percent or more of their total water deliveries for irrigation use. These irrigation districts and private water companies will be required to reduce their irrigation distribution system lost and unaccounted for water either by lining all their canals or by operating their delivery systems so that the total quantity of lost and unaccounted for water is 10 percent or less of the total quantity of water withdrawn, diverted, or received during a year. This requirement becomes effective upon the commencement of operation or by January 1, 2002, whichever is later.

If a private water company or irrigation district has economic circumstances that prevent timely compliance with the irrigation distribution system conservation requirements, a variance of up to five years may be requested as provided by A.R.S. § 45-574. Information submitted in support of the variance request must include a complete water loss reduction plan, prepared by a registered civil engineer, which contains:

- A complete construction design document that shows specifications for repairing or modifying the irrigation distribution system. The document must include material specifications, proposed design specifications, installation and construction specifications, and any other engineering information or specifications necessary to complete the proposed rehabilitation of the distribution system.
- A detailed list of engineering costs and the proposed investment options designed to pay for the system improvements.
- The final completion date for the rehabilitation.
- If applicable, a system operating guide to reduce lost and unaccounted for water to a minimum. This guide may be modified as the rehabilitation progresses.

The procedures for obtaining a variance are described in Chapter 10, section 10.3.1.

#### **4.5.3 Program Summary**

The Agricultural Conservation Program for the Third Management Plan consists of two parts, each of which is designed to achieve the water resource management goal for the Prescott AMA. As in the Second Management Plan, the Department developed an Agricultural Conservation Program under which the water duties and maximum annual groundwater allotments are calculated for each IGFR within ASFCs based upon certain assigned irrigation efficiencies. The final water duties assigned in the Second Management Plan are being carried forward into the Third Management Plan based on assigned irrigation efficiencies of 75 percent for most farms. For the Third Management Plan, the Department also developed Irrigation Distribution Systems Conservation requirements which are essentially identical to those established for the Second Management Plan.

#### **4.6 COMPLIANCE WITH AGRICULTURAL CONSERVATION REQUIREMENTS**

After final adoption of the Third Management Plan, the Department will notify each person entitled to withdraw, receive, or deliver groundwater under an IGFR of the water duty and maximum annual groundwater allotment for the farm unit under the Agricultural Conservation Program. Each person receiving a notice must comply with these conservation requirements by the date stated in the notice and must remain in compliance until the effective date of subsequent requirements in the Fourth Management Plan. The notification procedures, reporting requirements, and opportunities to obtain a variance from, or

administrative review of, an individual water duty and maximum annual groundwater allotment are described in Chapter 10, section 10.3.1 and 10.3.2.

#### **4.7 NON-REGULATORY WATER RESOURCE MANAGEMENT STRATEGIES**

In addition to the Agricultural Conservation Program, there are other water resource management options that are available to achieve the water management goal for the Prescott AMA. These options are described below.

##### **4.7.1 Effluent**

In 1991, the legislature amended A.R.S. § 45-467 to exclude effluent from consideration in determining the amount of any debit to be registered to a farm's flex account. Laws 1991, Ch. 112, § 3. Under this amendment, a person using groundwater on a farm pursuant to an IGFR may use an unlimited amount of effluent on the farm without any debit being registered to the farm's flex account as a result of the effluent use. This amendment created an incentive for the use of effluent.

During the third management period, the Department will study alternatives to increase the use of effluent. In the past, effluent utilization for agricultural irrigation has been limited mostly by the lack of necessary infrastructure. Other requirements, such as the wastewater reuse rules adopted by the Arizona Department of Environmental Quality, have limited the types of crops which can be irrigated solely with effluent.

##### **4.7.2 Conservation Assistance Program**

The use of Conservation Assistance Program monies to fund programs designed to assist the agricultural sector in the conservation of groundwater resources is expected to extend into the third management period. The Department will continue to encourage programs which promote efficient agricultural water use.

Much effort has been made by the Department to collect accurate water use data and cropped acreage data that enable Department staff to plan for the long term goals of the AMA. In addition to analyzing annual water use reports submitted by right holders each year, the AMA staff travel throughout the area, meeting with farmers and ranchers and discussing water needs and farm management practices. They have been willing to take an active role in ensuring that an adequate supply of irrigation water is available to meet the needs of the community. The Department staff has been better able to understand, through becoming involved with the community, the direction of water conservation practices for the AMA in the future. The Conservation Assistance Program is described more fully in Chapter 9.

#### **4.8 FUTURE DIRECTIONS**

To achieve the goal of safe-yield in the Prescott AMA, reductions in agricultural groundwater use need to continue. The increased use of renewable water supplies to replace groundwater use, combined with demand reduction efforts to enhance on-farm irrigation water management practices, are key factors in meeting this water resource management goal.

During the third management period, the Department will continue to provide the agricultural sector with technical and conservation planning assistance to reduce reliance on groundwater supplies. The Department will evaluate incentives for and encourage the increased use of effluent. In addition, the Department will facilitate agreements to provide alternative water sources to the agricultural sector.

To enhance the Department's water conservation efforts, the Department will investigate the need for the development of additional alternative agricultural conservation programs during the third management

period with limitations on flex account credit accruals. One of the main issues confronting the Department has been the excessive accumulation of flex account credits. Because of these accumulations, most right holders may exceed their farm's maximum annual groundwater allotment and yet continue to be in compliance with the farm's conservation requirements. During the third management period, the Department will examine whether alternative programs with limitations on flex account credits should be developed as authorized by the 1998 legislation. Two possible alternative programs that will be evaluated during the third management period include a cropped acreage program and a best management practices (BMP) program. These programs may provide a farmer the ability to grow crops that more closely reflect current market demands.

In addition, the Department will support funding for conservation, education, and the use of renewable supplies in order to achieve the water management goal for the Prescott AMA. These monies may be used to assist farmers with irrigation water management practices and for the infrastructure to convey renewable water supplies to farms.

The Department will also continue to monitor crop and water use patterns during the third management period to evaluate agriculture's contribution to achieving the Prescott AMA's safe-yield goal, and the impacts of Department programs on farming operations. Urbanization impacts on agriculture as well as water use trends due to agricultural market conditions will be evaluated for future planning needs.

The Agricultural Conservation Program for the Third Management Plan is a step toward achieving the water resource management goal of safe-yield for the Prescott AMA. During the third management period, this program will continue to be evaluated for its effectiveness in achieving this goal.

**4.9            AGRICULTURAL CONSERVATION REQUIREMENTS AND MONITORING AND REPORTING REQUIREMENTS**

**4-101.    *Definitions***

*In addition to the definitions set forth in Chapters 1 and 2 of Title 45 of the Arizona Revised Statutes, the following words and phrases used in sections 4-101 through 4-105 of this chapter shall have the meanings set forth below, unless the context otherwise requires:*

1.    *“Canal” is defined as a waterway constructed for the purpose of transporting water to a point of delivery, including main canals and lateral canals.*
2.    *“Farm” is defined under A.R.S. § 45-402.*
3.    *“Farm Unit” is defined under A.R.S. § 45-402.*
4.    *“Irrigation Acre” is defined under A.R.S. § 45-402.*
5.    *“Irrigation Distribution System” is defined as a system of canals, flumes, pipes, or other works which are owned or operated by an irrigation district or private water company and used to deliver water for irrigation use.*
6.    *“Irrigation Water Duty” is defined under A.R.S. § 45-566 which, for the Third Management Plan, is the total irrigation requirement to produce the crops historically grown divided by the assigned irrigation efficiency.*
7.    *“Lost Water” is defined as water from any source, including effluent, which enters an irrigation distribution system and is lost from the system during transportation or distribution due to seepage, evaporation, leaks, breaks, phreatophyte use, or other causes.*
8.    *“Maximum Annual Groundwater Allotment” is defined as the maximum amount of groundwater which may be used per year for the irrigation of each irrigation acre in the farm which is calculated pursuant to A.R.S. § 45-465.*
9.    *“Total Quantity of Lost and Unaccounted for Water” is defined as the total quantity of water from any source, including effluent, withdrawn, diverted, or received by an irrigation district or private water company during a calendar year less the total deliveries of water from any source, including effluent, made by the irrigation district or private water company during the calendar year that are measured or estimated based on a generally accepted method of estimating water use.*
10.    *“Water Duty Acres” is defined under A.R.S. § 45-461.*

**4-102.    *Agricultural Conservation Program Requirements***

*The owner of a Certificate of Irrigation Grandfathered Right (IGFR) and any person who is entitled to use groundwater pursuant to that IGFR shall comply with this section.*

- A.    *The IGFR owner and any person entitled to use groundwater pursuant to that IGFR shall comply with the irrigation water duty and maximum annual groundwater allotment assigned for the IGFR beginning in calendar year 2002, and during each calendar year thereafter, until the first compliance date for any substitute conservation requirement established in the*

management plan for the Prescott AMA for the fourth management period (Fourth Management Plan). The irrigation acres, water duty acres, irrigation water duty, and maximum annual groundwater allotment for each IGFR in the Prescott AMA are set forth in the document entitled Supplement I to the Third Management Plan, which is incorporated herein by reference and which is available for inspection and copying at the Arizona Department of Water Resources' office in Prescott, Arizona.

- B.** The IGFR owner and any person entitled to use groundwater under that IGFR may use the maximum annual groundwater allotment assigned for the right in Supplement I to irrigate only the irrigation acres to which the right is appurtenant.
- C.** The IGFR owner and any person entitled to use groundwater under that IGFR shall not use water for irrigation purposes during a calendar year in an amount which exceeds the maximum annual groundwater allotment assigned to the right in Supplement I, except as provided by the flexibility account provisions of A.R.S. § 45-467 and any rules adopted by the director.

#### **4-103. Conservation Requirements for Irrigation Distribution Systems**

##### **A. Applicability**

The irrigation distribution system conservation requirements set forth in subsection B below apply to irrigation districts and private water companies which, as of January 1, 2000, distribute 20 percent or more of their total water deliveries for irrigation use.

##### **B. Conservation Requirements**

By January 1, 2002 or upon commencement of operation, whichever is later, and continuing thereafter until the first compliance date of any substitute requirement in the Fourth Management Plan, each irrigation district and private water company owning or operating an irrigation distribution system shall either:

1. Line all canals used to deliver water for irrigation use with a material that allows no more lost water than a well-maintained concrete lining, or
2. Operate and maintain its distribution system so that the total quantity of lost and unaccounted for water is 10 percent or less of the total quantity of water from any source, including effluent, withdrawn, diverted, or received by the irrigation district or private water company on either a calendar year basis or a three-year average basis based on that calendar year and the two preceding calendar years.

#### **4-104. Monitoring and Reporting Requirements for Irrigation Districts and Private Water Companies**

##### **A. Applicability**

The monitoring and reporting requirements set forth in subsection B below apply to irrigation districts and private water companies which, as of January 1, 2000, distribute 20 percent or more of their total water deliveries for irrigation use.

**B. Monitoring and Reporting Requirements**

*For calendar year 2002 and for each calendar year thereafter until the compliance date for any substitute requirement in the Fourth Management Plan, each irrigation district and private water company owning or operating an irrigation distribution system shall submit in its annual report required by A.R.S. § 45-632, the following information as it applies to the irrigation district or private water company:*

- 1. A map showing the irrigation distribution system, including those portions which have lined canals and those portions which have unlined canals, unless a current map is on file with the Department.*
- 2. The number of miles of lined canals and the number of miles of unlined canals in the irrigation distribution system.*
- 3. The total quantity of water from any source, including effluent, which was withdrawn, diverted, or received by the irrigation district or private water company during the calendar year.*
- 4. The total quantity of water from any source, including effluent, delivered by the irrigation district or private water company to all water users during the calendar year.*
- 5. An estimate of the irrigation district's or private water company's total quantity of lost and unaccounted for water for the calendar year. This quantity shall be determined by a generally accepted engineering method.*



**APPENDIX 4**  
**CONSUMPTIVE USE OF WATER BY CROPS AND EFFECTIVE PRECIPITATION**  
**PRESCOTT ACTIVE MANAGEMENT AREA**

Crop	Consumptive Use		Effective Precipitation (inches/acre)
	acre-inches	acre-feet	
Grain Crops			
Barley	23.0	1.92	6.6
Oats, for Grain	26.0	2.17	3.7
Sorghum, Grain	22.0	1.83	4.8
Wheat, Winter	23.0	1.92	6.6
Pinto Beans	15.7	1.31	6.1
Corn, Grain	24.0	2.00	6.6
Forage Crops			
Alfalfa	41.0	3.42	7.2
Clover	37.0	3.08	7.2
Corn, Ensilage	22.0	1.83	4.8
Oats, for Hay	20.0	1.67	3.7
Sorghum, Ensilage	21.0	1.75	6.6
Sudan/Sudex Grass	18.0	1.50	6.6
Permanent Pasture (fescue or tall wheat grass)	51.0	4.25	7.2
Native Pasture	18.0	1.50	7.2
Vegetable Crops			
Beets, Table	25.4	2.12	3.7
Carrots	15.8	1.31	3.7
Chili Peppers	32.7	2.72	6.1
Corn, Sweet	18.6	1.55	4.8
Cucumbers	19.4	1.61	6.1
Garlic	25.4	2.12	6.1
Onions, Dry	22.1	1.84	6.1
Onions, Green	16.6	1.39	3.7
Potatoes	23.1	1.92	6.1

**APPENDIX 4**  
**CONSUMPTIVE USE OF WATER BY CROPS AND EFFECTIVE PRECIPITATION**  
**PRESCOTT ACTIVE MANAGEMENT AREA**

Crop	Consumptive Use		Effective Precipitation (inches/acre)
	acre-inches	acre-feet	
Tomatoes	25.4	2.12	6.1
Truck Crops	22.5	1.87	6.1
<b>Fruit Crops</b>			
Apricots	32.0	2.67	7.2
Peaches	32.0	2.67	7.2
Plums	32.0	2.67	7.2
Cherries	37.0	3.08	7.2
Apples	37.0	3.08	7.2
Grapes	29.0	2.42	7.2
<b>Miscellaneous Crops</b>			
Christmas Trees-Nursery Stock (Mondel and Scotch Pine)	27.0	2.25	7.2
Cut Flowers	22.1	1.84	

Sources: Consumptive Use of Water by Major Crops in the Southwestern United States, Conservation Research Report #29, Agricultural Research Service, United States Department of Agriculture (1982).

FAO Irrigation and Drainage Paper #24, Food and Agriculture Organization of the United Nations (revised 1977).