SECOND MANAGEMENT PLAN

1990 - 2000

PRESCOTT
ACTIVE MANAGEMENT AREA

ARIZONA DEPARTMENT OF WATER RESOURCES
MANAGEMENT PLAN
FOR THE SECOND MANAGEMENT PERIOD
1990 - 2000

PRESCOTT
ACTIVE MANAGEMENT AREA

ARIZONA DEPARTMENT OF WATER RESOURCES
JANUARY 1991
February 1991

The Second Management Plan, adopted December 1989, is the second in a series of five management plans required by the 1980 Groundwater Management Code. This plan will guide water management efforts in the Prescott Active Management Area during the last decade of this century. The plan's requirements are designed to bring water users another step closer to achieving the water management goal of safe-yield by the year 2025.

The conservation programs for agricultural, municipal and industrial waters users, introduced in the First Management Plan, have been strengthened; and the water resources analysis of the Prescott Active Management Area has been revised. With the addition of two new programs -- water quality assessment and management, and water supply augmentation and reuse -- the Second Management Plan presents a more comprehensive water management strategy.

The plan's design and format has been modified in order to facilitate use by regulated water users, the general public, and the legal community. For example, all legally enforceable requirements are printed differently than, and set apart from, the explanatory text.

The Department of Water Resources appreciates the input received from the Groundwater Users' Advisory Council, technical advisory committees, the regulated water community, and the citizens of the Prescott Active Management Area. I strongly believe that public involvement is instrumental to the success of Arizona's water management efforts.

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INTRODUCTION
A. THE SECOND MANAGEMENT PLAN

The Groundwater Management Act of 1980 established the Department of Water Resources (DWR) to administer provisions set forth in the water management legislation. The Groundwater Code gives DWR broad authority over state water concerns and requires DWR to prepare a series of five groundwater management plans, that are progressively more stringent, for each of the state's four Active Management Areas, or AMAs. This Second Management Plan for the Prescott AMA addresses the 1990 to 2000 period, and is intended to be a comprehensive approach to water resources management.

The Second Management Plan is comprised of three primary components: 1) mandatory water conservation requirements for agricultural, municipal, and industrial groundwater users and groundwater distribution systems; 2) a groundwater quality assessment and management program; and 3) a water supply augmentation and reuse program. The plan includes the following chapters:

Chapter 1 - Introduction
Chapter 2 - Water Resources Analysis
Chapter 3 - Water Quality Assessment and Management Program
Chapter 4 - Agricultural Conservation Program
Chapter 5 - Municipal Conservation Program
Chapter 6 - Industrial Conservation Program
Chapter 7 - Augmentation and Reuse Program
Chapter 8 - Plan Implementation
Chapter 9 - Conclusions and Future Directions

The Second Management Plan contains a great deal of information on water use characteristics, water supply and demand projections, water quality, water supply augmentation strategies, and includes the Department's management approach to these issues. This information is provided to explain the plan's development, educate water users, and provide information useful in developing future water management policies for the Prescott AMA.

Legally enforceable conservation requirements for groundwater users and distribution systems are included in Chapters 4, 5, and 6. These requirements are printed in italics for easy reference and are located at the ends of Chapters 4 and 5, and after each industrial water use sector in Chapter 6.

It should be noted that water users may apply for an administrative review if they feel their conservation requirements have been calculated incorrectly or if extraordinary circumstances exist. If users feel they require more time to comply with a requirement, they may apply for a variance. Further discussion of variances and administrative reviews is contained in Chapter 8.

This chapter provides a framework for the Second Management Plan through a discussion of the following topics:

- Arizona's Groundwater Management Problem
- Overview of the Groundwater Code
- The Prescott AMA Water Management Approach
- Management Principles
- Prescott AMA Management Goal and Objectives
- Program Implementation
- Balanced Approach
1. **Severability Clause**

If any provision or part or term of a provision of this Management Plan for the second management period for the Prescott Active Management Area is held by the courts to be illegal or in conflict with any law of the State of Arizona or the United States of America, the validity of the remaining provisions or portions of provisions shall not be affected. The remaining provisions or portions of provisions of the plan shall be construed and enforced as if the plan did not contain the particular provision or part or term of a provision held illegal or in conflict with law.

B. **ARIZONA'S GROUNDWATER MANAGEMENT PROBLEM**

On a long-term average basis, groundwater withdrawals in central and southern Arizona have exceeded recharge by approximately two million acre-feet per year. Groundwater overdrafting has resulted in the lowering of groundwater levels by as much as 600 feet in some areas. Furthermore, in some locations, groundwater depletion has made it economically infeasible to pump water for some uses and has caused a lowering of the land surface and water quality problems. These trends, if allowed to continue, would be disastrous for Arizona's expanding population and economy.

C. **OVERVIEW OF THE GROUNDWATER CODE**

Arizona's Groundwater Code was enacted in 1980 to address the groundwater overdraft problem occurring in several areas of the state. The primary objectives of the Code are: 1) to control the severe overdraft occurring in some parts of the state, and 2) to provide the means for allocating Arizona's limited groundwater resources to most effectively meet the state's changing water needs.
where a predominantly agricultural economy exists, the goal is to allow the development of non-irrigation water uses, extend the life of the agricultural economy for as long as feasible, and preserve water supplies for future non-agricultural uses.

The Code limits withdrawals of groundwater within Active Management Areas to holders of groundwater rights and permits, except for withdrawals from small non-irrigation wells. These water rights and other key features of the Code are discussed in Appendix 1. Readers who are not familiar with the different types of groundwater rights established by the Code are encouraged to read this appendix.

D. THE PRESCOTT AMA WATER MANAGEMENT APPROACH

The Groundwater Code directs the Department of Water Resources to develop for each Active Management Area a series of five water management plans covering the period from 1980 to 2025. The Code and management plan provisions and requirements apply to entities that pump groundwater, or distribute or use groundwater or commingled water (a mixture of groundwater and other types of water).

The First Management Plan for the Prescott AMA was the first step toward a comprehensive and effective water management program. The plan initiated conservation programs and focused attention on important water management issues. The Second Management Plan not only continues the water conservation efforts of the first plan, but also establishes an overall management strategy for the 1990s which will identify water management problems and develop appropriate solutions.

The Second Management Plan expands upon the agricultural, municipal, and industrial conservation programs of the First Management Plan. Two additional programs required by statute are included in this plan: 1) a program to promote water supply augmentation, and 2) a groundwater quality assessment and management program.

1. Plan Development

The Second Management Plan was developed in many phases. First, a detailed plan of study was prepared which outlined data collection and analysis needs in each program area. Research was then conducted by Department staff and consultants with expertise in specific program areas. Water conservation targets and water management programs were then drafted based on these research findings. The proposed requirements and programs were reviewed extensively by advisory groups and public interest organizations, and then revised to produce the draft Second Management Plan which was promulgated on May 16, 1988.

Public comments on the draft plan were received during two formal hearings, held on June 22, 1988 and July 6, 1988, and written comments were received until June 29, 1988. After reviewing all of the received comments, the Department made changes to some of the conservation requirements and management programs and adopted the modified plan on October 28, 1988. A number of requests for review or rehearing of the modified plan were filed pursuant to the Department's procedural rules, and a rehearing for specific requirements and program elements was held on January 23, 1989. Publication of this document followed a final order of adoption, effective December 15, 1989, which included revisions to some of the requirements and programs based on the requests for review and the rehearing.

2. Public Participation

Public input has played an important role in the development of this plan. The
Groundwater Code established a five-member Groundwater Users Advisory Council for each Active Management Area. The Department met with the councils throughout the planning process to obtain their opinions and recommendations on components of the Second Management Plan. Council meetings were open to the public, and interested groups and individuals made their views known to Department staff in this forum. The councils commented on this plan, as required by law, prior to promulgation.

The Department also consulted with numerous advisory groups and committees, comprised of technically-oriented representatives of various water resources organizations and special interest groups. Public comment was obtained throughout the planning process during presentations and workshops given by Department staff to clubs, civic organizations, and the general public. The Department distributes its quarterly newsletter, "Water Planning News," to individuals and organizations interested in Arizona water issues to inform them of the Department's planning activities and research findings.

E. MANAGEMENT PRINCIPLES

The Groundwater Code provides the Department with many management tools that vary in their flexibility and approach. Because the Code is not only comprehensive, but also complex, general management principles are needed to guide program development and evaluate water management alternatives. The Department will strive to develop programs for the 1990s using a water management philosophy based the following principles:

• Effective water management must include both water supply and demand management programs. Comprehensive supply and demand management allows the flexibility needed to address changing water resources issues. Supply management includes substitution of renewable water sources for non-renewable groundwater resources. Demand management, which includes water conservation efforts, allows available water supplies to serve more users or extend over a longer period of time.

• Groundwater right holders must be an integral part of the management structure. All water users are required to reduce water use to the extent deemed reasonable through the Department's analysis of conservation potential. Right holders are the most familiar with their individual needs and ability to respond to water resources issues. They should play a major role in program development and implementation.

• Public education on water matters and public involvement in management program development are essential to sustaining a strong and effective water management effort.

• Water management efforts should consider economic impacts and feasibility. Attaining the Active Management Area goal will require public and private expenditures. Water management programs, however, should be based on sound economic planning principals.

• Exchanges and transfers of water and water rights are important tools for allocating supplies in response to changing water use patterns. Public policy should allow and encourage the transportation of water from areas of resource surplus to areas of resource deficit.

• Water management efforts should be consistent with and enhance the quality of life in the community. Conservation practices and the substitution of renewable water supplies for non-renewable groundwater will provide a secure future for all water users in the Active Management Areas. Many conservation investments will reduce costs, reduce
labor, and increase aesthetic amenities for water users. Social values, public health, and environmental quality considerations must be recognized.

- **Water management programs should provide a stable institutional structure that brings certainty to water resource issues.** Water right holders must implement long-range plans. This can only be accomplished within a structure that provides regulatory stability. Management programs must be clear and free of ambiguity.

**F. PRESCOTT AMA MANAGEMENT GOAL AND OBJECTIVES**

**1. Management Goal**

The management goal of the Prescott AMA is to reach safe-yield of the area’s groundwater resources by 2025 or earlier. The Groundwater Code defines safe-yield as "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 groundwater recharge in the active management area." (A.R.S. § 45-561.7) It is important to note that safe-yield allows groundwater pumpage.

The Department has further interpreted safe-yield to be the amount of groundwater that can be withdrawn without causing long-term aquifer depletions and water level declines. This amount is the total of natural groundwater recharge, net groundwater inflow to Active Management Area aquifers, recharge incidental to water use, and artificial recharge.

Annual water budgets like those found in Chapter 2 of this plan can be used to estimate the amount of safe-yield withdrawals based on water supply and demand in the Active Management Area. After water budget estimates indicate groundwater withdrawals have been reduced to safe-yield levels, groundwater levels within the Active Management Area will need to be monitored to ensure that safe-yield is maintained.

The amount of groundwater that can be withdrawn and still maintain safe-yield will not be a fixed amount; it will vary based primarily on annual variations in artificial recharge credits, incidental recharge, and natural recharge. If long-term water level trends show declining water tables, groundwater withdrawals would have to be reduced and the safe-yield estimate adjusted accordingly. If water levels rise beyond the degree expected due to variations in natural recharge, groundwater withdrawals could be increased. These withdrawal adjustments could be made at five or ten-year intervals to ensure long-term groundwater level stability.

**2. Objectives**

The Department's Second Management Plan water management programs are designed to attain the Active Management Area water management goal of safe-yield by January 1, 2025. The Department will attain this goal by working toward the following program objectives:

- Set water conservation requirements which will require additional reasonable water conservation efforts by all groundwater users. The requirements will consider public acceptance, and evaluate economic, technical, health, and environmental constraints.

- Provide monetary and staff assistance to implement water conservation in all water use sectors. This program will include training programs, educational materials, and grants to assist water conservation efforts.

- Create incentives and regulations to encourage direct use and recharge of treated sewage effluent.
• Fund water supply augmentation and recharge projects designed to increase the Prescott AMA's dependable water supplies. These projects may include research, demonstration, or operational projects.

• Inform the public and the Arizona legislature about water demands, supplies, and groundwater overdraft in the Prescott AMA.

• Suggest the most appropriate management actions to encourage the development, exchange, and transportation of renewable water supplies.

G. PROGRAM IMPLEMENTATION

The Department uses its authority, management principles, goals, and objectives to guide program development. Programs are implemented using the following four primary mechanisms: rules, management plans, administrative action, and public information/participation.

1. Rules

Rules are used to supplement and interpret the procedures and criteria contained in the Groundwater Code. Rules provide certainty and clarity to the management process, and help define the basic management framework.

2. Management Plans

The Department's groundwater management plans are similar to rules in that they add needed detail to the provisions of the Code. However, plans are more flexible and are tailored to meet the needs and objectives of the Active Management Areas. The plans also contain conservation requirements which apply to specific persons rather than on a general basis.

3. Administrative Action

Administrative action is the Department's most discretionary water management tool. The following activities are examples of administrative action.

• Developing Memorandums of Understanding with other water management agencies to implement water management programs

• Working with the Arizona legislature and water users to draft new legislation

• Developing and disseminating water resources data

• Issuing water use permits and water rights certificates

• Enforcing the provisions of the Groundwater Code and management plans

• Informing the public regarding these provisions

4. Public Information/Participation

The Department's water management programs require and encourage public discussion and comment. Public education and technical assistance programs will help water users and providers meet the Department's program requirements during the 1990s.

H. BALANCED APPROACH

The Department's overall principles, goals, and objectives provide a balanced approach to water management in the next decade. Programs will be developed in cooperation with the water community. With community support, the Department can respond to changing water issues and needs while maintaining a regulatory program that ensures a dependable water supply for Arizona's future.
WATER RESOURCES ANALYSIS
A. INTRODUCTION

This chapter describes current and projected water resources availability and use in the Prescott Active Management Area (AMA). The following topics are discussed in the order listed:

- Background Characteristics of the Prescott AMA
  - Water Use History
  - Demographic and Economic Characteristics
  - Governmental and Institutional Setting
  - Geography and Hydrology

- Inventory and Projection of Water Resources Conditions
  - Water Budget Analysis
  - Water Demands
  - Water Supplies
  - Groundwater Overdraft

A. BACKGROUND CHARACTERISTICS OF THE PRESCOTT AMA

The Prescott AMA covers 485 square miles in central Yavapai County and is comprised of the Little Chino (LIC) and Upper Agua Fria (UAF) groundwater sub-basins. The Prescott AMA is illustrated in Figure 2-A. The LIC sub-basin includes the Chino Valley, Lonesome Valley, and Prescott areas; the major drainages include Granite Creek, Big Draw, and Chino Creek, all of which join the Verde River near Paulden. The UAF sub-basin includes the Prescott Valley, Humboldt, Dewey, Lynx Creek, and Coyote Spring areas.

Geographic factors affecting the Prescott AMA’s water supplies and water demands are summarized below:

- Annual precipitation - 12 to 18 inches
- Average daily January minimum and maximum temperatures - 22° F, 57° F
- Average daily July minimum and maximum temperatures - 50° F, 89° F
- Average growing season - 160 days
- Elevation range - 4,400 to 7,800 feet above mean sea level
- Natural vegetation varies from high desert grasslands to coniferous forests

1. Water Use History

Water resources in the Prescott AMA have been developed and used since the early 1890s. The Chino Valley Irrigation District constructed storage reservoirs on Granite Creek in 1914, and Willow Creek in 1937, to provide agricultural irrigation water in the Chino Valley area. Development of irrigated agriculture occurred in the UAF sub-basin during the 1950s and 1960s. Irrigated agriculture remains the largest water user in the AMA, but in recent years rapid population growth and industrial development have resulted in significant increases in municipal and industrial water use.

2. Demographic and Economic Characteristics

The Prescott AMA’s population has grown rapidly in recent years. The 1985 special census indicated that the population of the Prescott AMA was 43,900. Incorporated cities and their 1985 populations include Prescott (21,390), Prescott Valley (5,600), Chino Valley (3,840), Dewey (1,000), and Humboldt (720). Population in the unincorporated areas of the AMA totaled 11,350 in 1985. The Arizona Department of Economic Security (DES) projects that 128,400 people will reside in the AMA by the year 2025.
Figure 2-A
Groundwater Sub-Basins
Prescott Active Management Area

March, 1988
Arizona Department of Water Resources
The area's economy is now based primarily on government, services and trade. In 1985, these three economic sectors accounted for 19 percent, 17 percent and 20 percent, respectively, of total employment in Yavapai County. DES projections indicate that these sectors will continue to provide the primary employment base through 2010.

3. Governmental and Institutional Setting

Water management in the Prescott AMA area is performed by a number of government entities. Local, county, regional, state, and federal agencies are involved in planning and zoning, flood control, water planning, wastewater management, and water quality management. Recent trends in zoning regulations and other related activities reflect an increasing local awareness of water use and water quality concerns.

The Northern Arizona Council of Governments, a regional body overseeing the interests of northern Arizona's communities, reviews the Prescott AMA's activities within the context of the larger, regional perspective.

In addition to the Department of Water Resources' water management efforts at the state level, the Department of Environmental Quality develops and enforces water quality guidelines. The Arizona Corporation Commission regulates activities of private water companies.

Federal water management activities include the Prescott National Forest's management efforts and the U.S. Environmental Protection Agency's Superfund and National Pollution Discharge Elimination System permit programs. In addition, the U.S. Geological Survey works in conjunction with the Department of Water Resources in the collection and analysis of hydrologic data.

4. Groundwater Resources

Groundwater in the Prescott AMA occurs under both confined (artesian) and unconfined conditions. Where groundwater movement is restricted by one or more layers of low permeability, the aquifer is confined under a pressure significantly greater than atmospheric pressure. In contrast, an unconfined aquifer has an upper surface (water table) which is free to fluctuate under atmospheric pressure.

Water levels in the LIC sub-basin range from a few feet above the land surface (in flowing artesian wells) in the northern part of the sub-basin to over 500 feet below the surface near Granite Dells. Figure 2-B shows the 1987 water level elevations of the main unconfined aquifer in the Prescott AMA. Near the Town of Chino Valley, water level declines as much as 75 feet were observed between 1940 and 1982, primarily due to agricultural use. Water levels northwest of Granite Dells have not changed significantly since 1940. Between 1983 and 1987, water levels in the Prescott area have remained fairly constant.

In the Little Chino Valley area, where a perched aquifer exists, groundwater levels in the upper perched aquifer have declined in recent years because of decreased irrigation-related recharge. Irrigation pumping from a lower confined aquifer has declined, along with recharge to the unconfined aquifer above.

In the Prescott Valley and Dewey areas (UAF sub-basin), water levels rose in some wells between one and twenty feet between 1983 and 1987. These rises are attributed primarily to above normal precipitation levels since the late 1970s.

5. Surface Water Resources

Surface water in the Prescott AMA occurs as intermittent streamflow (major streams remain dry for long periods each year). The primary streams are Bannon,
Figure 2-B
Depth to Water
Prescott Active Management Area
Granite, Willow, and Lynx Creeks. Bannon Creek flows are impounded by the City of Prescott at Goldwater Lakes. The City's Goldwater Lakes surface water treatment facility provides approximately 5 to 10 percent of municipal water supplies. Flows from springs occur in the upper reaches of many drainages and in reaches where Granite Creek, the Agua Fria River, and Little Chino Creek cross the Prescott AMA boundary.

C. INVENTORY AND PROJECTION OF WATER DEMANDS AND SUPPLIES

1. Water Budget Analysis

The Department used a water budget analysis to evaluate the current and projected imbalance between water demands and renewable water supplies, and progress toward meeting the Prescott AMA's goal of safe-yield. It is important to note that many variables and assumptions were used to calculate each component of the water budgets. Water demand and supply conditions in 1985 were used as a "baseline" in both of the water budget scenarios presented in this chapter. The Department considers the water demand and supply projections presented in this plan as the conditions most likely to occur in the future.

In the water budget, overdraft is calculated by subtracting the sum of annual dependable water supplies (including surface water and natural groundwater recharge), incidental groundwater recharge, and effluent use from the total annual water demand. Individual entries in the budgets are discussed in the following sections.

The projections shown in Table 2-A assume that baseline water demand and supply patterns continue through 2025. However, the projections incorporate modifications to account for population increases and a reduction in irrigated acreage in response to development pressures. Table 2-B illustrates the effects of Second Management Plan conservation programs and receipt of Central Arizona Project allocations on groundwater overdraft.

2. Water Demands

a. Municipal Water Demand

Municipal demands include all water provided by cities, towns, and private water companies. Population and per capita water use are the two primary factors which influence municipal demand. Population in the Prescott AMA increased from 36,000 in 1980 to 43,900 in 1985. By 2025, the Arizona Department of Economic Security projects that the AMA's population will reach 128,400.

Per capita water use within the City of Prescott service area (the AMA's largest water provider) decreased from the estimated 1980 rate of 141 gallons per capita per day (GPCD) to 120 GPCD in 1985. This reduction is attributed largely to the City's water system leak detection and repair program, and the success of conservation programs directed at residential water use. For the second management period, the Department has set a total GPCD requirement of 120 GPCD for all large providers in the Prescott AMA.

In 1985, municipal use comprised approximately 16 percent of total water use. By 2025, municipal use is projected to account for almost 50 percent of total water use. Projected changes in water demand characteristics in the Prescott AMA, with and without Second Management Plan conservation programs, are shown graphically in Figures 2-C and 2-D.

b. Agricultural Water Demand

Following the passage of the Groundwater Code in 1980, the Department certified approximately 6,100 acres of land as
having irrigation grandfathered rights in the Prescott AMA. In addition to lands having groundwater rights, about 2,500 acres of agricultural land in the Chino Valley Irrigation District have surface water rights. However, only 600 acres of land within the district receive surface water pursuant to those rights.

In 1985, agricultural water use accounted for approximately 63 percent of total water use. During the 1980 to 1985 period, approximately 60 acres of irrigated land were removed from agricultural production each year through either development and conversion to Type 1 Non-irrigation Grandfathered Rights or non-production due primarily to economic factors. The Department anticipates this conversion rate of 60 acres per year to continue through 2025. Under Second Management Plan conservation requirements, the average irrigation efficiency in the Prescott AMA will increase to about 75 percent by the year 2000 from 50 percent in 1985.

By the year 2025, increased efficiencies and reductions in irrigated acreage are projected to reduce agricultural water demand to approximately 5,400 acre-feet per year. Agricultural demand should comprise only 20 percent of total water demand in the Prescott AMA in 2025.

c. Industrial Water Demand

Industrial demand in the water budgets presented in this chapter includes all water obtained from non-irrigation grandfathered rights and groundwater withdrawal permits. In addition, golf course demands supplied by effluent are included in the industrial demand category.

In 1985, industrial demands were 1,600 acre-feet, which accounted for five percent of total water use. For projection years, the Department has assumed full use of existing non-irrigation grandfathered rights. In addition, two new golf courses are now planned for development in the Prescott AMA by the year 2000. Industrial water demands are projected to increase to 3,300 acre-feet per year by 2025 and comprise about 12 percent of total water use.

d. Exempt Wells and Other Demands

"Exempt wells" are wells having a pump with a maximum capacity of not more than thirty-five gallons per minute and which withdraw groundwater for non-irrigation use. (A.R.S. § 45-454.A and B) Currently, there are approximately 4,000 exempt wells in the Prescott AMA used primarily for domestic purposes. The number of exempt wells will increase in the future. However, it is difficult to predict the proportion of population growth that will be served by private wells rather than municipal providers. For the purpose of estimating future overdraft, exempt well demands were held constant for projection years, and all water demands for new population growth is included under the municipal demand category.

Other demands include evaporation losses from Watson and Granite Lakes. These demands are projected to remain at the current level of approximately 2,200 acre-feet per year.

3. Water Supplies

a. Surface Water

Net surface water inflows are accounted for by totalizing all surface water inflows available for direct use and subtracting all outflows. The difference is the net surface water inflow. The net surface water inflow during the 1985 base year represented 2.3 percent of the total demand. It is projected that in the year 2025, this source of supply will represent 2.4 percent of the demand.
## TABLE 2-A

**WATER DEMAND AND SUPPLY - BASELINE AND PROJECTIONS 1985-2025**

**ASSUMING CONSERVATION AND CAP WATER**

**PRESCOTT AMA**

<table>
<thead>
<tr>
<th></th>
<th>1985</th>
<th>1990</th>
<th>2000</th>
<th>2025</th>
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<tbody>
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<td>43,900</td>
<td>52,200</td>
<td>69,700</td>
<td>128,400</td>
</tr>
<tr>
<td>Irrigated Acres</td>
<td>4,000</td>
<td>3,700</td>
<td>3,100</td>
<td>1,600</td>
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</table>

### Water Demands (1000s acre-feet)

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<th>1985</th>
<th>1990</th>
<th>2000</th>
<th>2025</th>
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<tr>
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<td>17.8</td>
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<td>5.4</td>
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<tr>
<td>Municipal</td>
<td>5.3</td>
<td>5.4</td>
<td>7.8</td>
<td>15.7</td>
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<tr>
<td>Industrial</td>
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<td>2.4</td>
<td>3.3</td>
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<tr>
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<td>2.0</td>
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<tr>
<td>Other Demands</td>
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<td>2.2</td>
<td>2.2</td>
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<tr>
<td><strong>Total Demands</strong></td>
<td>30.3</td>
<td>29.8</td>
<td>25.2</td>
<td>28.6</td>
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</table>

### Water Supplies (1000s acre-feet)

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<th>1985</th>
<th>1990</th>
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<th>2025</th>
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<tr>
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<td>0.7</td>
<td>0.7</td>
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<td>7.0</td>
<td>7.0</td>
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<tr>
<td>Incidental &amp; Artificial Recharge</td>
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<td>9.6</td>
<td>4.6</td>
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</tr>
<tr>
<td>Effluent - Direct Use</td>
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<td>1.8</td>
<td>4.7</td>
<td>5.7</td>
</tr>
<tr>
<td>Central Arizona Project</td>
<td>---</td>
<td>---</td>
<td>7.6</td>
<td>7.6</td>
</tr>
<tr>
<td><strong>Mined Groundwater (Overdraft)</strong></td>
<td>11.7</td>
<td>10.7</td>
<td>0.6</td>
<td>-1.1⁴</td>
</tr>
<tr>
<td><strong>Total Supplies</strong></td>
<td>30.3</td>
<td>29.8</td>
<td>25.2</td>
<td>28.6</td>
</tr>
</tbody>
</table>

---

1 Baseline water demand and supply values as reported or measured except agricultural demands which were reduced to adjust for 500 acres that were irrigated because owners were apprehensive about losing irrigation grandfathered rights because of non-use. The Department has since ruled that rights cannot be lost due to non-use.

2 Exempt well demands held constant for projection years. All future population growth included under municipal category.

3 Surface water inflow less artesian water outflow at Del Rio Springs.

4 Negative number indicates recharge to aquifer.
## TABLE 2-B

WATER DEMAND AND SUPPLY – BASELINE AND PROJECTIONS 1985-2025
WITHOUT CONSERVATION AND CAP WATER

### PRESCOTT AMA

<table>
<thead>
<tr>
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<th>1985</th>
<th>1990</th>
<th>2000</th>
<th>2025</th>
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</thead>
<tbody>
<tr>
<td>Population</td>
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<td>52,200</td>
<td>69,700</td>
<td>128,400</td>
</tr>
<tr>
<td>Irrigated Acres</td>
<td>4,000</td>
<td>3,700</td>
<td>3,100</td>
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<td><strong>Water Demands</strong> (1000s acre-feet)</td>
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<td>8.1</td>
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<tr>
<td>Municipal</td>
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<td>5.4</td>
<td>7.8</td>
<td>15.7</td>
</tr>
<tr>
<td>Industrial</td>
<td>1.6</td>
<td>2.4</td>
<td>3.3</td>
<td>3.3</td>
</tr>
<tr>
<td>Exempt Wells</td>
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<td>2.0</td>
<td>2.0</td>
<td>2.0</td>
</tr>
<tr>
<td>Other Demands</td>
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<td>2.2</td>
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<tr>
<td><strong>Total Demands</strong></td>
<td>30.3</td>
<td>29.8</td>
<td>30.2</td>
<td>31.3</td>
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<tr>
<td><strong>Water Supplies</strong> (1000s acre-feet)</td>
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<tr>
<td>Net Surface Water Inflow</td>
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<td>0.7</td>
<td>0.7</td>
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<tr>
<td>Net Natural Recharge</td>
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<td>7.0</td>
<td>7.0</td>
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<tr>
<td>Incidental &amp; Artificial Recharge</td>
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<tr>
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<td>1.8</td>
<td>4.7</td>
<td>5.7</td>
</tr>
<tr>
<td>Central Arizona Project</td>
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<td>---</td>
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<td>---</td>
</tr>
<tr>
<td><strong>Mined Groundwater (Overdraft)</strong></td>
<td>11.7</td>
<td>10.7</td>
<td>9.2</td>
<td>7.0</td>
</tr>
<tr>
<td><strong>Total Supplies</strong></td>
<td>30.3</td>
<td>29.8</td>
<td>30.2</td>
<td>31.3</td>
</tr>
</tbody>
</table>

1 Baseline water demand and supply values as reported or measured except agricultural demands which were reduced to adjust for 500 acres that were irrigated because owners were apprehensive about losing irrigation grandfathered rights because of non-use. The Department has since ruled that rights cannot be lost due to non-use.

2 Exempt well demands held constant for projection years. All future population growth included under municipal category.

3 Surface water inflow less artesian water outflow at Del Rio Springs.
FIGURE 2-C

CHARACTERISTICS OF WATER DEMAND WITH SECOND MANAGEMENT PLAN CONSERVATION

PRESCOTT AMA

1000 AF

1985 1990 2000 2025

- LOSSES
- MUNICIPAL & INDUSTRIAL USE
- AGRICULTURAL USE
FIGURE 2-D

CHARACTERISTICS OF WATER DEMAND WITHOUT SECOND MANAGEMENT PLAN CONSERVATION

PRESCOTT AMA

1000 AF

<table>
<thead>
<tr>
<th>Year</th>
<th>LOSSES</th>
<th>MUNICIPAL &amp; INDUSTRIAL USE</th>
<th>AGRICULTURAL USE</th>
</tr>
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<td>1985</td>
<td></td>
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<td>2025</td>
<td></td>
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</tbody>
</table>
b. Natural Recharge

Net natural recharge is defined as naturally occurring additions to groundwater storage from precipitation and groundwater flow into the basin, less groundwater flow out of the basin. The net natural recharge occurring during the 1985 base year represented 23.1 percent of the total demand. It is projected that in year 2025 this source of supply will represent 24.5 percent of the total demand.

c. Incidental and Artificial Recharge

Incidental recharge is the volume of water which is not depleted in satisfying a demand and which is returned to the groundwater aquifer. It includes deep percolation from irrigation, water from septic tank leach fields, tailing ponds, deep percolation from unlined canals, recharge pits, etc. The net incidental recharge occurring during the 1985 base year represented 32.7 percent of the total demand. It is projected that in the year 2025 this source of supply will represent 30.4 percent of the total demand.

In 1988 the City of Prescott completed construction of an artificial groundwater recharge facility and began recharging treated effluent. The volume of treated effluent is parallel to the volume of water previously recharged through deep percolation in the Chino Valley Irrigation District canal system. The City of Prescott has made application to the Department to convert the recharge project to a storage and recovery project. Assuming this action occurs, the City of Prescott will receive credit for the volume of water recharged to the Little Chino aquifer system. The Prescott AMA water budgets, illustrated in Tables 2-A and 2-B, assume this conversion after 2000.

d. Effluent

Effluent will become an increasingly important water source for both direct use and artificial recharge in the Prescott AMA. In 1985, effluent generated by the City of Prescott's wastewater treatment plants was utilized by farmers in the Chino Valley Irrigation District and by the City of Prescott at Antelope Hills golf course. Prescott is now recharging much of the effluent at a site east of the municipal airport and is continuing to supply effluent to the golf course.

Plans for additional wastewater treatment facilities and effluent use are being developed by other Prescott AMA communities. The Prescott Country Club is planning to construct a treatment plant and use the effluent to irrigate the existing golf course. Effluent generated by a plant planned by the Town of Prescott Valley would be used to irrigate agricultural lands owned by the Fain Land and Cattle Company. The Town of Chino Valley also has plans for a treatment plant and effluent use on agricultural lands.

The Department's projection for the Prescott AMA assumes full utilization of effluent in the future. By the year 2025, direct effluent use is projected to be 5,700 acre-feet per year, or over 20 percent of the AMA's annual water demand. Artificial recharge of high quality effluent could increase this figure significantly. Maximum use of effluent resources is essential if safe-yield is to be achieved without the implementation of more strict water conservation measures in later management periods. Projected changes in the characteristics of the Prescott AMA's water supply, with and without Second Management Plan conservation programs and CAP water deliveries, are shown in Figures 2-E and 2-F. These graphs illustrate the importance of CAP water deliveries and effluent use in attaining safe-yield by 2025.
e. Central Arizona Project

The City of Prescott has a Central Arizona Project (CAP) allocation of 7,127 acre-feet per year, and the Yavapai-Prescott Indian Community's allocation is 500 acre-feet per year. The City of Prescott is currently proposing to exchange its CAP allocation with a downstream water user possessing rights to Verde River water, enabling the transfer of water from the Verde River headwaters to the Prescott area. The implementation of such an exchange is vitally important to achieving safe-yield by 2025.

If this type of exchange is not possible, additional water supplies equivalent to the AMA's CAP allocation will be needed to achieve safe-yield without more stringent conservation requirements in later management periods. The CAP water issue and alternative water supply sources are discussed in Chapter 7, the Augmentation and Reuse Program.

4. Groundwater Overdraft

The imbalance between groundwater withdrawals and recharge to the aquifer within the Active Management Area is referred to as groundwater overdraft. To achieve the Prescott AMA goal of safe-yield, overdrafting, or mining, of groundwater must be discontinued.

The estimated overdraft in the Prescott AMA for 1985 was 11,700 acre-feet. Mined groundwater supplied approximately 39 percent of the Active Management Area's water demands in 1985. It should be noted that this estimate, derived from reported 1985 water use and improved measurements of surface and groundwater inflows and outflows, is significantly higher than the 1980 overdraft estimate of 8,600 acre-feet presented in the First Management Plan. This increase in the estimated overdraft is due primarily to more accurate measurements of basin outflows at Del Rio Springs at the headwaters of the Verde River. In addition, new and more accurate information on natural recharge in southwestern alluvial basins was published by the U.S. Geological Survey in 1986.

Table 2-A indicates that the achievement of Second Management Plan conservation requirements and the use of Central Arizona Project water allocations is projected to eliminate overdraft by 2025, creating a situation where about 1,100 acre-feet of groundwater recharge occurs annually. However, without this plan's programs in place and CAP water, overdraft is projected to remain as high as 7,000 acre-feet per year in 2025 (Table 2-B). The difference between these two scenarios emphasizes the importance of Second Management Plan conservation requirements and the receipt of CAP water (via an exchange agreement) allocated to the city of Prescott and the Yavapai-Prescott Indian Community.

5. Conclusion—Future Water Demand

The water management programs contained in this plan will significantly influence the progress made toward safe-yield in the Prescott AMA. However, it should be noted that control of some factors influencing future water demands, such as energy cost, are beyond the scope of these programs.

Economic conditions within the major water use sectors will strongly influence future water use patterns. In the agricultural sector, the projected retirement of irrigation grandfathered rights could be affected by fluctuations in crop prices, or changes in urban growth patterns.

Future municipal and industrial water uses will also vary due to outside factors, but are not as sensitive to other influences as water use within the agricultural sector. Industrial demands could increase significantly if large industrial facilities were to locate in the Prescott AMA. Such facilities would probably obtain water through the purchase of Type 1 or Type 2 Non-irrigation Grandfathered Rights.
FIGURE 2-E

CHARACTERISTICS OF WATER SUPPLY
ASSUMING CENTRAL ARIZONA PROJECT ALLOCATION

PRESCOTT AMA

1000 AF

1985 1990 2000 2025

MINED GROUNDWATER (OVERDRAFT)
INCIDENTAL RECHARGE & EFFLUENT USE
DEPENDABLE SUPPLY
FIGURE 2-F

CHARACTERISTICS OF WATER SUPPLY
WITHOUT CENTRAL ARIZONA PROJECT ALLOCATION

PRESCOTT AMA

1000 AF

1985 1990 2000 2025

MINED GROUNDWATER (OVERDRAFT)
INCIDENTAL RECHARGE & EFFLUENT USE
DEPENDABLE SUPPLY
GROUNDWATER QUALITY ASSESSMENT AND MANAGEMENT PROGRAM
A. INTRODUCTION

In order to meet the water needs of the Prescott Active Management Area (AMA), groundwater reserves must not only be of sufficient quantity, they must also be of a quality suitable for the intended uses. Groundwater quality and quantity are interrelated, and both issues must be addressed to effectively manage the region's water resources. Protecting and managing groundwater quality will maximize the amount of usable water.

This chapter presents the Groundwater Quality Assessment and Management Program for the Prescott AMA for the second management period. The results of the assessment completed by the Department of Water Resources (DWR) are presented first, followed by the description of the management program. The format of this chapter is:

- Introduction
- Overview of Groundwater Quality in the Prescott AMA - Program Summary
- Statutory Provisions
- Minerals and Chemicals in Water
- Groundwater Quality Assessment
  - Assessment Goal and Objective
  - Assessment Methodology
  - Groundwater Quality by Parameter in the Prescott AMA
  - Future Data Collection and Management
  - Quality of Other Water Sources in the Prescott AMA
  - Treatment and Mitigation of Water Quality Problems
- Groundwater Quality Management Program
  - Program Goal, Objectives, and Management Strategies
  - Interrelationships between Water Quality and Quantity
  - Interagency Cooperation in Water Quality Management
  - Water Quality Management Actions
  - Possible Incentives for the Use of Poor Quality Water

B. OVERVIEW OF GROUNDWATER QUALITY IN THE PRESCOTT AMA - PROGRAM SUMMARY

Groundwater quality in the Prescott AMA is generally excellent. However, federal and state drinking water standards are sometimes exceeded for total dissolved solids, organics, sulfate, nitrate, and metals. Volatile organic compounds (VOCs) and pesticides were not detected in the groundwater of the Active Management Area as of 1987. However, only limited sampling for VOCs and pesticides were done.

Historic groundwater quality data for the Prescott AMA is scarce. However, when historic data is compared with more recent data, little change in groundwater quality is evident. Water quality in the mountain areas on the perimeter of the Active Management Area was also evaluated. Water quality in these areas is also excellent, having characteristics similar to water of the alluvial sediments in the central portions of the Active Management Area.

The goal of DWR's Groundwater Quality Management Program is to manage the quality of Arizona's groundwater in order to maximize the quantity of water available for beneficial use. Key components of the program outlined in this chapter include:

- A commitment by DWR to adopt new rules to protect and manage groundwater quality. Rules will be added during the second management period in the following program areas:
- Assured Water Supply
- Well Construction and Licensing of Well Drillers
- Well Spacing/Impact Analysis
- Groundwater Withdrawal Permits
- Recharge Project and Underground Storage and Recovery Project Permits

• A commitment to update the groundwater quality assessment and maps every three years. In coordination with the Department of Environmental Quality's (DEQ's) groundwater monitoring strategy, DWR will increase groundwater quality data in known groundwater quality problem areas, and expand collection efforts in areas where insufficient data currently exists.

• A commitment to research, during the second management period, potential incentives for the use of poor quality groundwater. These incentives may require statutory changes or may be implemented through the management plan's conservation requirements.

C. STATUTORY PROVISIONS

Both DWR and DEQ have the authority to regulate water quality. (A.R.S. §§ 45-105.A.1 and 49-104.A.8) The Groundwater Code states: "The Director of DWR] may formulate plans and develop programs for the practical and economical development, management, conservation and use of surface water, groundwater and the watersheds in this state, including the management of water quantity and quality." (A.R.S. § 45-105.A.1) The Code also specifies that for the second management period, DWR must include an assessment of groundwater quality in the Second Management Plan. (A.R.S. § 45-565.A.6) This assessment and any proposed groundwater quality program, and any water quality considerations in developing or implementing the plan, must be done in cooperation with DEQ. (A.R.S. §§ 45-565.A.6, 45-573) In addition, if DWR proposes a program for groundwater quality protection, the program must be submitted to the Arizona Legislature for any necessary enabling legislation or coordination with existing programs of DEQ. (A.R.S. § 45-565.A.6)

The Environmental Quality Act of 1986 established DEQ and created a strong and comprehensive water quality management structure. (A.R.S. § 49-101, et seq.) DEQ holds the primary responsibility for water quality protection in Arizona, and has implemented and enforced numerous programs to protect the environment and the public health. A summary of the Environmental Quality Act is contained in Appendix 3-A.

D. MINERALS AND CHEMICALS IN WATER

Many minerals and chemicals can be dissolved or mixed in water. These substances may be introduced from a number of sources, including the natural occurrence of salts and minerals, and pollutants caused by human activities. Not all minerals and chemicals present in water are harmful. Each substance may have a different effect, depending upon the concentration of the substance, length of exposure, amount ingested, and the proposed use of the water. Although the presence of some chemical constituents in water can be beneficial, higher concentrations of the same constituents may cause undesirable health, aesthetic or economic effects. Moderate levels of fluoride, for example, are known to reduce the incidence of tooth decay; but high levels may cause discoloration and mottling of teeth. Water with high fluoride concentrations, however, may be suitable for many industrial and agricultural uses. The possible effects of each chemical must be evaluated in light of the concentrations
present and the proposed use of the water.

The water quality parameters addressed in this assessment were selected in part because, at certain concentrations, they can decrease the number of ways in which water can be used. Not all of the substances have been shown to cause long-term health effects. In addition, it is not possible to equate the chemical constituents discussed here according to their detrimental effects. For example, the effects of sulfate are very different from the effects of pesticides in water. Some of the known effects of the parameters included in the assessment are summarized later in this chapter.

E. GROUNDWATER QUALITY ASSESSMENT

1. Assessment Goal and Objective

The goal of DWR's Groundwater Quality Assessment is to provide the information base needed to incorporate water quality considerations into water management programs. A series of maps were generated by DWR hydrologists displaying the presence of selected organic compounds and inorganic substances.

The maps included in this chapter summarize the results of DWR's groundwater quality assessment for the Prescott AMA. The maps were created with information compiled from a variety of data sources, and with technical support from DEQ. Additional information will be periodically collected for updates of the Prescott AMA's water quality conditions for long-range water quality planning purposes. These maps will assist DWR in identifying areas that may require special well construction or well spacing requirements to protect groundwater from degradation. The maps can also be compared to maps of land use, projected urban growth, wildlife ranges, and many other subjects for the purpose of analyzing long-range water planning requirements and objectives.

2. Assessment Methodology

a. Parameter Selection

The large number of potential biological, chemical and radiological constituents in groundwater made it impossible to address all possible constituents or contaminants. DWR, in cooperation with DEQ, selected six water quality parameters to be studied. Selection was based not only on the parameter's effect on water use, but also on the amount of available data. The criterion of sufficient data was included because of the time constraints associated with the production of this management plan. The six parameters selected were: total dissolved solids, sulfate, nitrate, metals, pesticides, and volatile organic compounds.

Each of these parameters affects potential water uses in different ways. For example, water contaminated with volatile organic compounds may be unfit for human consumption, but suitable for some types of agricultural irrigation. The section entitled "Groundwater Quality by Parameter," in this chapter discusses how elevated concentrations of each parameter affect domestic, industrial and agricultural water uses.

Parameter concentrations are expressed in this report as milligrams per liter (mg/l) and micrograms per liter (ug/l). One milligram per liter is equal to one thousand micrograms per liter. Milligrams per liter are essentially equivalent to parts per million (ppm) at concentration levels less than 10,000 mg/l. Micrograms per liter are essentially equivalent to parts per billion (ppb).
b. Data Sources

Most of the data used in this assessment are from published reports prior to 1987 and from the STORET (STOrage and RETrieval) system maintained by the U.S. Environmental Protection Agency (EPA). STORET contains groundwater data collected by several local, state (e.g., DEQ) and federal agencies. An attempt was made to use data collected after 1980 for two reasons: 1) analytical techniques used in recent years are the most accurate and 2) recent data is the most representative of current conditions. Older information was used in some areas for which no recent data was available. VOC data came from a variety of sources, including DEQ.

STORET information was used to confirm published data and fill in data gaps. Data from the U.S. Geological Survey's WATSTORE (WAter STOrage and RETrieval) database, DWR's GWSI (Groundwater Site Information) system, consultant reports, and other data sources were also used for areas where STORET data was not available. VOC data came from a variety of sources, including DEQ.

c. Water Quality Standards Used in this Analysis

Six types of standards were used to evaluate groundwater quality in the four Active Management Areas. An explanation of each of these appears in Appendix 3-B. The two types of standards most commonly discussed are Primary Maximum Contaminant Levels (Pri-MCLs) and Secondary Maximum Contaminant Levels (SMCLs). Pri-MCLs are enforceable health-based limits for contaminants in drinking water. SMCLs are based on aesthetic considerations such as taste and odor. SMCLs are non-enforceable guidelines for substances in drinking water. However, health implications may exist for these substances at a very high concentrations.

3. Groundwater Quality by Parameter in the Prescott AMA

a. Total Dissolved Solids

Total dissolved (TDS) is a measure of dissolved compounds in water. Components of TDS include inorganic compounds such as calcium, magnesium, sodium, sulfate, bicarbonate, chloride, and silica. TDS is a general indicator of water quality, but is not a final measure of suitability for a specific water use. In most areas, the prevalent components of TDS are derived naturally, as groundwater can dissolve certain minerals present in aquifers. TDS concentrations can also be elevated by human activities such as agriculture, mining, and discharges from wastewater treatment facilities.

1) Domestic/Municipal Use

An EPA SMCL of 500 mg/l has been established for TDS because higher concentrations have adverse taste effects which may cause consumers to use other water sources. High TDS concentrations, resulting in scaling and mineral accumulation, have also been shown to have an adverse economic impact on water distribution systems and household plumbing and appliances. Water having TDS levels higher than 500 mg/l may not be palatable or quench thirst for those persons unaccustomed to the water. However, no permanent harmful effects have been observed. Water in Arizona is generally higher in TDS than water sources in many other areas of the country.

People in many Arizona communities such as Yuma, Parker and Gila Bend are accustomed to drinking water which exceeds 500 mg/l TDS. It should be noted that the EPA standard is based on nationwide water quality characteristics.
2) **Industrial Use**

The concentration of TDS that limits water use varies widely among industries. A few industries require water so pure that they must treat almost any source of water to obtain the necessary quality. The semiconductor industry is such an example. Other industries, such as sand and gravel operations, can use water with very high TDS concentrations.

3) **Agricultural Use**

The TDS concentration in water used for agricultural irrigation in the Prescott AMA typically ranges from 200 to 500 mg/l. The use of special irrigation practices or the selection of salt-resistant crops is required only if the TDS concentration is between 1,500 and 3,000 mg/l. Water with a TDS concentration over 3,000 mg/l is unsuitable for irrigation.

Livestock can tolerate water with relatively high TDS concentrations. Levels of over 10,000 mg/l have been reported to have few ill effects, particularly if a tolerance is developed over time. However, TDS levels less than 2,500 mg/l are more satisfactory for watering livestock.

4) **Total Dissolved Solids in Groundwater**

TDS concentrations in both groundwater subbasins of the Prescott AMA are generally low, ranging from less than 130 mg/l to over 800 mg/l. Most readings are in the 200 to 400 mg/l range. Concentrations are highest in the northwestern part of the Active Management Area and lowest in the central and northeastern areas of the Active Management Area. Near Del Rio Springs, TDS concentrations in the underlying regional aquifer are somewhat lower than concentrations in the perched aquifer system.

b. **Sulfate**

Sulfate can be a natural inorganic constituent of groundwater originating from the natural dissolution of minerals in aquifers. Elevated concentrations can also result from the leaching of industrial wastes and agricultural fertilizers. High sulfate concentrations are often found in aquifers underlying current or historic agricultural lands, copper mining areas, and areas of mineralization.

1) **Domestic/Municipal Use**

There are three reasons for limiting the concentration of sulfate in drinking water:

1) sulfate can be tasted, which may cause consumers to use other water sources, 2) water containing high levels of sulfate tends to form hard scales in boilers and heat exchanger, and 3) high intake rates can cause laxative effects. The laxative effect diminishes over time with continued use, as individuals become accustomed to sulfate. Infants appear to be more sensitive to these effects than adults; however, adverse effects have been associated with sulfate exposure over a lifetime at the concentrations commonly present in water.

The EPA SMCL for sulfate is 250 mg/l. This drinking water limit was set because of taste considerations. Some people can detect sulfate at concentrations of 250 mg/l, yet most people cannot taste it until concentrations reach 400 to 500 mg/l.

2) **Industrial Use**

The diverse nature of industrial water requirements creates specific needs for different industries. Taste considerations
associated with sulfate can limit some industrial uses, including several food and beverage processes. Sulfate concentrations in excess of 150 mg/l may have a corrosive effect on concrete. Elevated sulfate concentrations can also lead to scale formation in evaporative cooling systems.

3) Agricultural Use

High sulfate concentrations in groundwater do not commonly limit agricultural water uses. Concentrations above 600 mg/l may, however, require special irrigation practices. A maximum sulfate concentration of 500 mg/l is recommended for livestock watering.

4) Sulfate in Groundwater

Sulfate concentrations in the groundwater of the Prescott AMA are low, never exceeding the EPA SMCL standard of 250 mg/l. Sulfate concentrations range from less than 5 mg/l to 85 mg/l, with most readings in the 10 to 25 mg/l range. Concentrations are highest in the northwestern portion of the Active Management Area and lowest in the central portion.

c. Nitrate

Low concentrations of nitrate in groundwater may originate from natural sources such as organic acids. Higher nitrate concentrations are usually linked to industrial sources, sewage treatment plants, septic tanks and leach fields, or agricultural fertilizers.

Over the years, nitrate values have been reported in two different ways. Older laboratory results were reported as milligrams per liter of nitrate (as NO₃). Currently, laboratories report results as milligrams per liter of nitrate as (NO₃ or N.) All nitrate levels have been reported as NO₃ in this assessment.

1) Domestic/Municipal Use

The EPA Pri-MCL for nitrate is 45 mg/l. This limit is based on a link between high nitrate concentrations and infant methemoglobinemia (blue baby syndrome). Adults can tolerate higher levels of nitrate, although water containing more than several hundred milligrams per liter can cause gastrointestinal irritation.

2) Industrial Use

High nitrate concentrations limit water use by a number of industries, particularly food and beverage processors. Nitrate is converted to nitrite of nitric acid during some industrial processes. Both of these nitrogen compounds are more harmful to people than nitrate. Because of these potential conversion processes, water with nitrate concentrations greater than 15 to 30 mg/l is generally unacceptable for use by the food and beverage industry.

3) Agricultural Use

Nitrate stimulates plant growth and is regarded as a desirable constituent in irrigation water. For this reason, treated sewage effluent is often sought as a source of irrigation water. Nitrogen fertilizer application rates may be reduced or eliminated if irrigation water contains high concentrations of nitrate. Nitrites may be harmful to livestock at concentrations exceeding several thousand milligrams per liter.
4) Nitrate in Groundwater

Nitrate concentrations in the groundwater of the Prescott AMA are low, never exceeding the EPA Pri-MCL standard of 45 mg/l. Nitrate concentrations range from less than 1 mg/l to 27 mg/l, with most readings in the 5 to 15 mg/l range. Concentrations are slightly higher in the area of perched groundwater near Del Rio Springs and are lowest in the central and southern portions of the Active Management Area.

d. Metals

The EPA has assigned Pri-MCLs for eight metals occurring in drinking water: arsenic, barium, cadmium, chromium, lead, mercury, selenium, and silver. This assessment includes all eight metals. High concentrations of metals in groundwater are typically associated with landfills and industrial wastes. Elevated concentrations of some metals, however, may naturally occur in some aquifers. Although boron is not a metal, it has also been addressed in the assessment because of limitations on agricultural water use.

1) Domestic/Municipal Use

The health effects associated with exposure to metals in drinking water are varied and quite complex. Each metal has its own distinctive effects, which vary significantly with the chemical form, exposure time, amount consumed, and concentration present. Some metals such as selenium and chromium are known to be essential to human nutrition or are beneficial at certain concentrations. Other metals, such as lead, have no known beneficial effects on human or animal development. The Pri-MCLs for each of the metals included in this assessment are listed in Table 3-A. Some of the major health effects associated with human exposure to metals are summarized below:

- **Arsenic** appears to be an essential dietary trace element, yet exposure to excessive concentrations through ingestion may cause arsenic to accumulate in the human body, causing fatigue and loss of energy. Chronic exposure to high concentrations of arsenic may result in skin cancer or lung cancer.

- **Barium** does not appear to be harmful to humans in small doses. Although Barium is not readily absorbed when ingested, concentrations may cause toxic effects on the heart, blood vessels and nervous system. Acute barium toxicity is associated with increased blood pressure and nerve damage.

- **Cadmium**: Acute exposure to excessive concentrations of cadmium may cause nausea, vomiting, diarrhea, muscular cramps, and salivation. The critical target organ of chronic exposure to cadmium is the kidney. Individuals deficient in zinc or calcium may be more susceptible to the toxic effects of cadmium.

- **Chromium** occurs in several molecular forms. Trivalent chromium is considered to be an essential dietary trace element for human health and is relatively harmless in small concentrations. Hexavalent chromium, however, may be carcinogenic in excessive concentrations when ingested; and chronic exposure is known to produce kidney and liver damage and internal hemorrhage. Long-term exposure to elevated levels of hexavalent chromium may affect blood pressure, blood sugar, and cholesterol levels.
Lead is not considered to be beneficial to human health in any concentration. Chronic exposure to low concentrations of lead (e.g., through a contaminated water supply) may cause lead to accumulate in bones and tissues, and to interfere with the formation of red blood cells. The central nervous system is primarily affected, especially in developing fetuses and children under six years of age. Exposure to excessive concentrations may cause serious poisoning and possibly death.

Mercury occurs in both inorganic and organic forms. Exposure to low levels of mercury in the inorganic form is basically harmless to humans. Prolonged ingestion of mercury in the organic form, however, may result in kidney damage, mental health deterioration, and other toxic effects.

Selenium is considered an essential trace element. However, ingestion of excessive concentrations of selenium may be toxic or carcinogenic to humans. Chronic exposure to selenium by inhalation or ingestion can result in central nervous system damage, gastrointestinal disturbances, and dermatitis.

Silver: Long-term exposure to excessive concentrations of silver can cause a permanent blue-gray discoloration of the skin, mucous membranes, and the eyes. Considered a cosmetic condition, exposure to silver is not known to be associated with adverse health affects.

2) Industrial Use

Limitations imposed on industrial water use by high concentrations of metals vary considerably by contaminant and the type of industrial process.

3) Agricultural Use

High concentrations of some metals in water may be toxic to plants. Toxic levels vary considerably, depending on the contaminant and the type of plant.

4) Metals in Groundwater

Metal concentrations in the groundwater of the Prescott AMA are low and were not known to exceed federal or state health-based standards as of 1987. (Metal concentrations were not mapped because of insufficient data.)

e. Pesticides

Pesticides are most often detected in groundwater underlying agricultural areas. In this assessment, the term "pesticides" refers collectively to the myriad of chemicals used as insecticides, rodenticides and herbicides. Pesticides can be leached by the percolation of irrigation water downward to the aquifer. Groundwater contamination may also occur as a result of improper disposal to pesticides in landfills or elsewhere. Health-based standards have been assigned to the pesticides evaluated.

1) Domestic/Municipal Use

Numerous chemical preparations are available to control insects, rodents and weeds. Each of these substances produces specific health effects, and when present with other organic substances, may produce different or possibly more severe effects. Pesticide contamination can restrict
the use of groundwater for domestic purposes.

2) Industrial Use

The presence of pesticides can restrict some industrial water uses. Animal-based industries, for example, cannot use water with elevated concentrations of pesticides because some of these substances accumulate in living tissue as they pass through the food chain. Some pesticides are volatile in nature and may be harmful if inhaled, further restricting some industrial uses of pesticide-tainted water.

3) Agricultural Use

Pesticides that are used by the agricultural sector are not applied to all crops at any one time. Some of the chemicals serve specialized purposes such as attacking insect larvae or particular types of weeds that infest a certain crop. The bioaccumulative nature of some pesticides may prevent the use of the chemical on edible crops.

The use of water contaminated with pesticides for agricultural purposes is not a simple matter. The presence and concentrations of pesticides in groundwater must be evaluated on a case-by-case basis to determine if the water can safely be applied to crops or be used for other agricultural water uses.

4) Pesticides in Groundwater

Pesticides have not been detected in the groundwater of the Prescott AMA. The absence of pesticide contamination may be due to relatively non-intensive farming practices. There has been limited sampling for these compounds in the region.

f. Volatile Organic Compounds

Volatile organic compounds (VOCs) such as trichloroethylene (TCE) and tetrachloroethylene (PCE), are synthetic organic chemicals commonly associated with specialized industrial processes. VOCs are present in or are used for the manufacturing of many substances including degreasers, solvents, plastics, paint, varnish, finish removers, detergent, medicine, and gasoline. When found in groundwater, VOCs are usually associated with industrial waste disposal of chemicals. The thirteen VOCs listed in Appendix 3-C include the most common compounds which have been detected in Arizona's groundwater. These VOCs have been assigned health-based drinking water standards.

1) Domestic/Municipal Use

The health effects associated with VOCs in drinking water are complex and vary with the types of compounds and concentrations present. Some VOCs are suspected carcinogens while others have been associated with damage to internal organs.

2) Industrial Use

Potential industrial applications of water containing VOCs must be examined on an individual basis.

3) Agricultural Use

The potential uses of water contaminated with VOCs for agricultural applications must be evaluated on a case-by-case basis.

4) Volatile Organic Compounds in Groundwater

VOCs have been detected in the groundwater of the Prescott AMA. The low level of VOC contamination is probably due to the relatively low level of industrial development in the
Active Management Area. VOCs in non-industrial areas may be due to septic tank discharge of household chemicals. It may also be related, in part, to limited sampling for these compounds.

4. Future Data Collection and Management

DWR will continue to collect data on groundwater quality in the Prescott AMA in support of water quality management programs. Data collection will be done in cooperation with DEQ and local agencies. Additional water quality parameters may be evaluated in the future. Data collection will be guided by the information requirements of DWR’s water management programs. Of particular importance will be those activities that affect groundwater quality, such as areas of future urbanization, landfills, and industrial land use. The objectives of supplemental data collection efforts are to monitor groundwater quality protection efforts and to identify areas of poor quality groundwater where special management efforts are needed. Supplemental data collection efforts to support DWR’s management programs will begin in 1990. Data collection efforts will be conducted in cooperation with DEQ monitoring programs.

5. Quality of Other Water Sources in the Prescott AMA

Groundwater is the predominant source of water for agricultural, municipal and industrial water uses in the Prescott AMA. Other water sources that may be used directly, or that may influence the quality of groundwater due to deep percolation, include surface water and treated sewage effluent.

a. Surface Water

The primary sources of surface water in the Prescott AMA are Granite Creek and the Agua Fria River. The quality of surface water in the AMA is very good; all parameters are within federal and state drinking water standards. Representative water quality data for Granite Creek, above the City of Prescott’s Main (Sundog) Wastewater Treatment Plant (WWTP) is summarized in Table 3-A.

b. Effluent

Effluent discharged from municipal wastewater treatment plants is a significant source of water. Although not suitable for human consumption, secondary effluent is suitable for a number of alternative uses. Effluent may contain relatively high concentrations of total dissolved solids, nitrate, sulfate, and metals. A chemical analysis of effluent discharged from the Sundog WWTP shows high levels of nitrate only. Representative water quality for effluent released from this facility is summarized in Table 3-A.

6. Treatment and Mitigation of Water Quality Problems

Water quality problems can be corrected. A wide variety of water treatment and management techniques are available to water managers to improve the quality of water, if necessary, so that deliveries meet the quality requirements of the proposed use. Public water suppliers are aware of these techniques and work to ensure that their deliveries meet primary drinking water standards.

Many water treatment methods can improve the quality of water. No single treatment method is capable of removing all potential mineral constituents or contaminants which could be present in water. Some methods may remove contaminants which are harmful to health while other methods primarily improve the water’s aesthetic quality. Some constituents, additionally, cause beneficial health effects and may be desirable in water. Appropriate
### TABLE 3-A

**REPRESENTATIVE WATER QUALITY OF NON-GROUNDWATER SOURCES**

**PRESCOTT AMA**

(concentrations in milligrams per liter)

<table>
<thead>
<tr>
<th>Parameter/Constituent</th>
<th>Surface Water</th>
<th>Effluent</th>
<th>Applicable Standard 4</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>TDS</td>
<td>260</td>
<td>425</td>
<td>500*</td>
</tr>
<tr>
<td>Nitrate</td>
<td>0.10</td>
<td>89</td>
<td>45</td>
</tr>
<tr>
<td>Sulfate</td>
<td>--</td>
<td>37</td>
<td>250*</td>
</tr>
<tr>
<td>Arsenic</td>
<td>--</td>
<td>&lt;0.010</td>
<td>0.05</td>
</tr>
<tr>
<td>Barium</td>
<td>--</td>
<td>&lt;0.010</td>
<td>1.0</td>
</tr>
<tr>
<td>Boron</td>
<td>--</td>
<td>&lt;0.30</td>
<td>0.01</td>
</tr>
<tr>
<td>Chromium</td>
<td>--</td>
<td>&lt;0.010</td>
<td>0.05</td>
</tr>
<tr>
<td>Lead</td>
<td>--</td>
<td>&lt;0.010</td>
<td>0.05</td>
</tr>
<tr>
<td>Mercury</td>
<td>--</td>
<td>&lt;0.0002</td>
<td>0.002</td>
</tr>
<tr>
<td>Selenium</td>
<td>--</td>
<td>&lt;0.050</td>
<td>0.01</td>
</tr>
<tr>
<td>Silver</td>
<td>--</td>
<td>&lt;0.010</td>
<td>0.05</td>
</tr>
</tbody>
</table>


3 Total Nitrogen levels in effluent may be considerably higher than the level of N03 alone.

4 Values (except those marked with an asterisk) are Pri-MCLs. Standards shown for TDS and sulfate are SMCLs.

- Treatment methods must be selected based upon an evaluation of several factors, including: 1) the quality of the raw water, 2) the quality requirements of the proposed uses, 3) the capability and limitations of water treatment methods, and 4) the financial cost of the treatment methods. Air stripping, for example, is used for removing volatile organic compounds which may be present in groundwater as a result of industrial pollution. Disinfection is the appropriate treatment method for controlling biological contaminants such as bacteria and viruses. In some cases, a combination of treatment methods may be necessary. Other types of water management techniques may also be applied to affect
the quality of water withdrawals and deliveries. Special well construction standards, water blending, and water exchanges are examples of management techniques commonly used by water providers.

Groundwater contamination is usually limited in its vertical extent within aquifers. Special well construction techniques can often ensure that water is withdrawn from aquifer levels at which water meets required quality standards. Blending water of different qualities is sometimes done to produce water which is of an intermediate quality but still meets standards. Water exchanges may also be made to match water quality with appropriate uses. In these exchanges, lower quality water may be traded to industrial and agricultural users for potable water which could be distributed for municipal use.

These are only a few of the water quality management techniques available to water managers. The long-term availability of a dependable and safe water supply requires the efficient use of water resources. In order to accomplish this, water quality and water quantity must be conjunctively managed.

F. GROUNDWATER QUALITY MANAGEMENT PROGRAM

1. Program Goal, Objectives, and Management Strategies

The goal of the Prescott AMA Groundwater Quality Management Program is to manage the quality of the Active Management Area’s groundwater to maximize the quantity of water available for beneficial use. This goal must be consistent with the overall goal of safe-yield. The program is designed to meet the following objectives:

- Protect groundwater quality from degradation
- Collect groundwater quality data on a continual basis
- Identify areas of poor quality groundwater
- Correct existing groundwater quality problems

DWR will achieve these objectives by implementing the following management strategies is coordination with DEQ, consistent with A.R.S. § 45-573:

- Prevent the introduction of contaminants to the aquifer
- Prevent or minimize the migration of poor quality groundwater
- Monitor groundwater quality trends
- Encourage the beneficial use of poor quality groundwater
- In cooperation with DEQ, oversee remedial actions to correct groundwater contamination
- Cooperate with other water quality management agencies

The program presented in this chapter is designed to increase the effectiveness of DWR’s water management efforts by incorporating water quality concerns into existing programs.

2. Interrelationship between Water Quality and Quantity

Water quality and quantity issues are interrelated in a number of ways. The interrelationships listed below emphasize the need for comprehensive, integrated water management programs that address water quality and quantity issues.

- Contamination can decrease the number of ways in which water can be used. For example, large areas historically used for intensive
agriculture are often underlain by non-potable water. Urbanization of agricultural lands can change the water quality needs of these areas. Some poor quality waters may be suitable for farming but are unsuitable for municipal uses without treatment.

• Natural recharge, artificial recharge, and groundwater pumping can affect the vertical and lateral migration of poor quality groundwater.

• Improper siting, construction, or operation of wells or recharge facilities can cause the migration of poor quality groundwater or result in the withdrawal of water from contaminated portions of the aquifer.

• Groundwater pollution is often an incidental by-product of municipal, industrial, or agricultural water use. Water conservation, at times, may serve as a groundwater quality management device by reducing incidental groundwater recharge and the downward movement of contaminants.

3. Interagency Cooperation in Water Quality Management

The difference in the scope of water quality programs administered by DWR and DEQ is a result of the statutory mandates of the agencies. DWR’s primary responsibility is water quantity in Arizona. DEQ has primary responsibility for water quality in Arizona. Because of the many interrelationships between water quantity and quality, the programs developed by each agency require coordination to achieve their goals.

The two most significant Arizona statutes that establish goals for groundwater protection are the Groundwater Management Code (Code) (1980) and the Environmental Quality Act (1986). The Code gives DWR broad authority to develop water quality protection programs in cooperation with DEQ. The Environmental Quality Act gives DEQ detailed authority over groundwater quality and identifies specific areas requiring coordination with DWR, such as DEQ and DWR joint authority to conduct feasibility studies and remedial investigations relating to groundwater quality protection. In response to the Code, the Environmental Quality Act, and other legislation summarized by DEQ in the "State of Arizona Groundwater Protection Strategy" (1989), DWR and DEQ have implemented a cooperative approach to groundwater quality protection in Arizona.

The Code established DWR to administer its provisions. The purpose of DWR is to:

"1. Focus the responsibility for water management and administration of water-related programs within this state.

2. Stabilize the use of water resources, particularly groundwater resources, in this state according to management practices, procedures, standards and plans provided for by statute.

3. Compile and maintain information which is necessary for intelligent management, administration, and planning for water resources and programs." (Laws 1980, 4th S.S., Ch. 1, § 171)

The Director of DWR may:

• Formulate plans and develop programs for the practical and economical development, management, conservation and use of surface water, groundwater and the watersheds in this state, including the management of water quantity and quality. (A.R.S. § 45-105.A.1)

• Collect and investigate information upon and devise plans for the development, conservation and
utilization of all waterways, water-
sheds, surface water, groundwater and
groundwater basins in this state and of all related matters and subjects,
including but not limited to water quality maintenance. (A.R.S. § 45-105.A.3)

• Acquire, hold and dispose of property, including land, rights-of-way, water
and water rights, as necessary or convenient for the performance of the
groundwater and water quality manage-
ment functions of the Department. (A.R.S. § 45-105.A.5)

• Conduct feasibility studies and remedial investigations relating to
groundwater quality. (A.R.S. § 45-105.A.16)

The Environmental Quality Act
established DEQ to consolidate and focus responsibility for environmental manage-
ment efforts for the purpose of pro-
tecting the public health, welfare and the environment. DEQ is designated as the
agency for this state for all purposes of
the Clean Water Act, the Resource
Conservation and Recovery Act, and the
Safe Drinking Water Act. (A.R.S. § 49-202.A) In addition, DEQ has joint
authority with DWR to conduct feasibility studies and remedial investigations relating
to groundwater quality. (A.R.S. § 49-202.B) DEQ promotes, coordinates,
and enforces water quality protection and enhancement efforts, provides for pollution
abatement and prevention, promotes the restoration of degraded water, and
protects groundwater quality for the highest beneficial use. DEQ's mandate
includes the following major programs:

• The setting of aquifer and surface water quality standards

• An aquifer protection permitting program to prevent degradation of aquifers, including Best Management Practices for agricultural activities

• Remedial action programs to restore degraded aquifers

• A program to prevent pesticide contamination of groundwater

• Regulation of public water supply systems

• Statewide water quality monitoring and development of a water quality database

Major DEQ programs, including, but not limited to, the National Pollutant
Discharge Elimination System, the Nonpoint Source Control program, the
Aquifer Protection Permit program, and the Underground Storage Tank program,
have been listed and summarized by DEQ in the groundwater protection strategy.

To avoid duplication of effort and to
increase the effectiveness of each agency, DWR and DEQ have entered into
an agreement clearly defining the management responsibilities of both
agencies. The agreement, or Memorandum of Understanding (MOU),
formalizes the framework for the cooperative management of groundwater quality. The MOU will require constant exchange of information and ideas to ensure that a balance is maintained in the management of water quality and quantity. An interagency policy committee and a technical committee were established to provide forums for the coordination of agency programs. Key features of the MOU include:

• The creation of a joint program for the collection and management of water quality and quantity data

• A commitment to keep each agency informed of activities affecting the statutory responsibilities of the other agency

• The establishment of a process for delineating agency responsibilities in remedial action projects
• The coordination of permit reviews
• A commitment to keep the other agency informed of all water resource management issues being considered as the subject of rulemaking. Each agency will allow the other adequate time in which to review and comment on all such issues and associated documents before filing the proposed rules with the Secretary of State.

DEQ and DWR administer programs which apply throughout the state, but local agencies also implement water quality programs. In some instances, these programs may be more thorough or stringent than those at the state level. Coordination with local entities such as cities, counties, universities, and regional councils of government is necessary to efficiently disseminate information. Interagency cooperation and coordination is vital to create cohesive water management programs which minimize data gaps and duplicated efforts. DWR is committed to cooperating with local entities.

4. **Water Quality Management Actions**

The following sections outline key areas of DWR's proposed water quality management programs. In accordance with A.R.S. § 45-565.A.6, if the Department proposes a water quality program, the program must be submitted to the legislature for any necessary enabling legislation or coordination with the existing programs of DEQ. Most of DWR's proposed water quality program consists of rule changes which do not require enabling legislation. Any proposed rules affecting water quality will be coordinated with DEQ. However, implementation of proposed incentives for use of poor quality water may require DWR to seek legislative amendments. DWR will cooperate with DEQ in developing and implementing its groundwater quality management program. (A.R.S. § 45-573)

DWR intends to adopt new or additional rules in five program areas:

- Assured Water Supply
- Well Construction and Licensing of Well Drillers
- Well Spacing/Impact Analysis
- Groundwater Withdrawal Permits
- Recharge Projects and Underground Storage and Recovery Projects

DWR also intends to research potential incentives for poor quality water use for implementation during the second management period. These incentives may be implemented with statutory or rule changes. The following sections describe each of the intended changes. DWR will attempt to follow this proposed program as closely as possible. However, some aspects of the proposed program may be altered to achieve the water management goals of the Active Management Area. The proposed program and any proposed changes will be coordinated with DEQ.

a. **Definitions**

In this chapter, unless the context indicates otherwise:

1) "Poor quality groundwater" means groundwater which the Director of DWR, in consultation with DEQ, determines to have limited current or potential beneficial use due to chemical, biological, or radiological characteristics and costs associated with its use.

2) "Adverse impact from migration of poor quality groundwater" means the entry of poor quality groundwater into an existing well, another aquifer, part of the same aquifer which does not contain poor quality groundwater, or any surface water, in amounts or concentrations such that the current or future usability of the affected water is or will be impaired.
The Groundwater Code includes a provision which, in cooperation with the Department of Real Estate, prohibits the sale or lease of subdivided or unsubdivided lands inside the Active Management Areas if an assured water supply cannot be demonstrated. (A.R.S. § 45-576.A) An assured water supply is the presence of sufficient water of adequate quality to continuously satisfy the needs of the proposed use for at least 100 years. The projected water use must be consistent with the management plan and achievement of the Active Management Area's management goal, and financial capability must be demonstrated to construct the delivery system and any necessary treatment works. (A.R.S. § 45-576.L)

Those proposing to sell or lease subdivided or unsubdivided lands must, prior to submitting the plat for approval, obtain a Certificate of Assured Water Supply from DWR unless the property is located within an area previously designated by DWR as having an assured water supply.

1) Current Guidelines

Under the criteria now used to determine an assured water supply, DWR's review of water quality is limited to the prospective water provider's compliance with state primary drinking water standards.

Instructions now given to applicants for Certificates of Assured Water Supply indicate that effluent may be considered as a source of water as long as the application includes plans for its collection, treatment, and delivery. DWR encourages appropriate uses of effluent and poor quality groundwater which are consistent with DEQ's regulations (e.g., Wastewater Reuse Permit Program)

2) Planned Rules

a) Applicants for Certificates of Assured Water Supply will be required to identify areas of poor quality groundwater within or adjacent to the area under consideration.

b) Applicants may be required to assess the possibility of adverse impacts from the migration of poor quality water. Water use associated with the issuance of a Certificate of Assured Water Supply must not cause significant adverse impacts from the migration of poor quality water.

c) Applicants may, at the direction of the Director of DWR, be required to address the present and future availability of poor quality groundwater and effluent, and describe any plans to put such waters to beneficial use.

c. Well Construction Requirements and Licensing of Well Drillers

If not constructed, sealed or abandoned properly, wells can act as conduits for contaminant flow. Poor quality water and pollutants can flow from the surface to an aquifer, or from one aquifer to another. In addition to posing a potential threat to water users, improperly constructed wells can result in groundwater quality degradation.

DWR's minimum well construction requirements are designed to minimize the potential for contaminant flow created when wells are constructed or abandoned. The standards not only protect the environment, they also protect public health by lessening the likelihood of inadvertent withdrawals of poor quality water from new wells.

1) Current Rules

a) Well Construction Requirements.

The well construction rules set forth
• The coordination of permit reviews

• A commitment to keep the other agency informed of all water resource management issues being considered as the subject of rulemaking. Each agency will allow the other adequate time in which to review and comment on all such issues and associated documents before filing the proposed rules with the Secretary of State.

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2) Planned Rules

a) Applicants for Certificates of Assured Water Supply will be required to identify areas of poor quality groundwater within or adjacent to the area under consideration.

b) Applicants may be required to assess the possibility of adverse impacts from the migration of poor quality water. Water use associated with the issuance of a Certificate of Assured Water Supply must not cause significant adverse impacts from the migration of poor quality water.

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DWR's minimum well construction requirements are designed to minimize the potential for contaminant flow created when wells are constructed or abandoned. The standards not only protect the environment, they also protect public health by lessening the likelihood of inadvertent withdrawals of poor quality water from new wells.

1) Current Rules

a) Well Construction Requirements.

The well construction rules set forth
in the DWR's Administrative Rules and Regulations are summarized below.

- Minimum Well Construction Requirements prevent entry of fluids at and near the surface and minimize the possibilities of migration and inadvertent withdrawal of poor quality groundwater. These requirements also prohibit the use of hazardous materials in the construction of wells.

- Well Abandonment Requirements minimize the potential for entry and migration of pollutants and poor quality waters.

- Disposal Site Restriction prevents the use of wells as disposal sites for any material which may pollute groundwater.

- Minimum Distances to Potential Sources of Pollutants reduce the potential for contamination of groundwater by surface pollutants and leachates.

- Special Standards may be required by DWR if the minimum well construction requirements do not adequately protect the aquifer or other water users.

- Open wells must be capped with a water-tight steel plate.

b) Licensing of Well Drillers

Construction, modification, abandonment or repair of all wells in Arizona must be performed by a driller licensed by DWR. The licensing procedure includes the administration of several written examinations to test the applicant's knowledge of state regulations, hydrologic concepts, and well construction principles and practices.

2) Planned Rules

a) DWR will develop and impose more stringent well construction requirements to prevent and mitigate groundwater contamination. When necessary, specific well construction requirements will be developed for areas of poor quality water to minimize adverse impacts.

b) DWR will develop and furnish educational materials on water quality and groundwater quality protection to all applicants for well driller's licenses. An examination on these subjects will be required of all applicants as part of the licensing procedure.

d. Well Spacing/Impact Analysis

1) Current Guidelines

Studies to evaluate the impacts on existing wells are required for proposed new non-exempt wells and replacement non-exempt wells located in the Active Management Areas. (See Appendix 1 for definition of non-exempt wells.) DWR conducts the impact studies for wells with a maximum discharge rate of 500 gallons per minute (gpm) or less. For wells with a maximum discharge rate exceeding 500 gpm, the permit applicant must submit a hydrological study of projected water level declines due to the operation of the proposed well. The study must also assess adverse impacts from the migration of poor quality water. The well permit application may be rejected if DWR determines that the proposed well would cause unreasonable adverse impacts on surrounding wells, additional regional land subsidence, or migration of poor quality water.
2) Planned Rules

a) For wells with a pumping capacity greater than 500 gpm, applicants will be required to submit an evaluation of the well's effect on the migration of poor quality water or the withdrawal of poor quality water within the proposed well's radius of influence.

b) DWR will evaluate the hydrologic study described above and may issue a well drilling permit if the new well's impact on water quality is consistent with the management plan, and will not cause unreasonable damage to surrounding land or water users, or adverse impacts from the migration of poor quality water.

c) A permit, if issued, may stipulate water quality and water level monitoring, well construction standards, collection of data on the rate and time of pumping, and the length of time for which the permit is valid.

e. Groundwater Withdrawal Permits

1) Current Statutes

The Groundwater Code describes seven types of groundwater withdrawal permits available from DWR and lists the criteria and conditions for the issuance of each. (A.R.S. § 45-512) The seven types of permits are:

- Dewatering
- Mineral Extraction and Metallurgical Processing
- General Industrial Use
- Poor Quality Groundwater
- Temporary (for dewatering and electrical power generation)
- Drainage
- Hydrologic Testing

DWR administers permits in accordance with statutory mandate. (A.R.S. § 45-512 et seq.) Rules do not currently exist for issuing withdrawal permits.

Water quality considerations are most extensive under the poor quality groundwater withdrawal permit process. DWR may issue such a permit if the water withdrawn has no other beneficial use at the present time, and the withdrawal is consistent with the management plan. (A.R.S. § 45-516.A) DWR can impose conditions of operation and monitoring on this type of permit and has done so in the past.

Water quality considerations for general industrial use and mineral extraction and metallurgical processing permits allow DWR to require the use of surface water or effluent of adequate quality if the cost of such water does not exceed the cost of groundwater by 25 percent. (A.R.S. §§ 45-514.3 and 45-515.2) Temporary dewatering permits must be consistent with the management plan and must not cause harm to other groundwater users. (A.R.S. § 45-518) Hydrologic testing permits must not cause harm to other users. (A.R.S. § 45-519.01)

2) Planned Rules

DWR plans to adopt rules regulating applications for all withdrawal permits. The rules will establish when a permit is consistent with the management plan, and when a permit will lead to adverse impacts from the migration of poor quality water. Consistency with the management plan, for the purposes of this discussion, is defined as being consistent with the goals, objectives, and strategies set forth in this chapter. In addition, permit issuance will be coordinated with DEQ to ensure
consistency with the provisions of the Environmental Quality Act.

DWR requires all applicants for a permit to withdraw groundwater at a rate of more than 500 gpm to submit a hydrologic study addressing the proposed withdrawal's consistency with the management plan, possible adverse impacts, and any other information the Director may require for each type of withdrawal permit. DWR should be contacted before the study begins for assistance in study design.

DWR will evaluate the study and may issue the permit, require additional analysis and information, or stipulate conditions for operations and monitoring.

a) Poor Quality Groundwater Withdrawals Permits

Appropriate uses of poor quality groundwater conserve the existing supply of potable groundwater. Poor quality groundwater withdrawal permits are designed to allow the withdrawal of water which, because of its quality, has no other beneficial use at the present time. Proposed withdrawals of groundwater associated with a poor quality groundwater withdrawal permit must be consistent with the goals of the management plan and are subject to review and permit issuance by DEQ.

To increase appropriate uses of poor quality groundwater during the second management period, DWR will continue to assess the feasibility of poor quality water use within the Active Management Area. DWR's groundwater quality monitoring program, discussed later in this chapter, will help determine the location, size, shape, and quality of known bodies of poor quality groundwater.

b) Dewatering Permits

Applicants for dewatering permits will be required to submit a hydrologic study when the proposed withdrawal rate is greater than 500 gpm or the withdrawal period will exceed 60 days. The study must demonstrate the withdrawal is consistent with the management plan and will not cause significant adverse impacts from the migration of poor quality water. Plans to mitigate any adverse impacts must also be included in the study.

DWR will evaluate the study and may issue or deny the permit, or require additional data and analysis. Conditions may be set on the permit regarding pumping rate, pumping periods and duration, life of the permit, monitoring, and remedial or mitigation efforts to avoid adverse impacts from the migration of poor quality groundwater.

f. Recharge Projects and Underground Storage and Recovery Projects

1) Current Guidelines

Recharge projects and underground storage and recovery projects are effective water management tools. Recharge projects, however, may have significant water quality impacts which must be evaluated before implementation.

Builders of recharge projects and underground storage and recovery projects must obtain permits from both DWR and DEQ prior to construction. DWR may deny a permit if a project causes unreasonable harm to land or other water users within the project's area of hydrologic impact. (A.R.S. §§ 45-652.B.5 and 45-804.B.4) In order to receive a DEQ aquifer protection permit, builders of both types of projects must complete a comprehensive evaluation of
potential water quality impacts. A more detailed discussion of DWR's siting criteria for recharge projects and underground storage and recovery projects is included in Chapter 7, the Augmentation and Reuse Program.

2) Planned Rules

DWR will adopt rules for recharge projects and underground storage and recovery projects. Rules having direct water quality implications are discussed below.

a) Categorial Exclusion

Certain activities that result in recharge which is clearly incidental to their primary function will not be permitted as recharge projects or underground storage and recovery projects. These activities include septic tank systems, source water treatment works, dry wells constructed solely to meet flood control ordinances, mine tailings ponds, agricultural practices including unlined irrigation delivery systems, sand and gravel operations, and lakes (unless the lake is clearly operated and designed to maximize recharge efficiency). These excluded facilities, however, may be subject the DEQ's strict discharge control requirements (best available demonstrated control technology).

b) Area of Hydrologic Impact

DWR will develop a method to determine a project's area of hydrologic impact. Any potential water quantity and water quality impacts are assessed by DWR and DEQ hydrologists to determine whether "unreasonable harm to land or other users" will occur. (A.R.S. §§ 45-652.B.5 and 45-804.B.4)

g) Groundwater Quality Monitoring and Assessment

An objective of DWR's groundwater quality monitoring program is to identify areas of poor quality groundwater where special management efforts are needed. DWR proposes to develop rules that may set special well construction, well spacing or operation requirements. Rules may also be developed to require beneficial uses of poor quality water in these areas and allow designation of such areas by the Director, or upon request by the public.

DWR will continue its ongoing groundwater quality data collection program. Supplemental data collection efforts, which will begin in 1990, will focus on the following areas:

- Regions for which limited information is available
- Areas of projected urbanization
- Areas around landfills and industrial facilities that may affect groundwater quality
- Areas of intensive agriculture
- Additional water quality parameters

Data collection will be done in cooperation with DEQ. Results of any groundwater sampling will be submitted to DEQ for inclusion in a statewide database. (A.R.S. § 49-255.B) Every three years, DWR will update the groundwater quality assessment for each Active Management Area.

5. Possible Incentives for the Use of Poor Quality Water

During the second management period, DWR will research the possibility of offering incentives to encourage the withdrawal and use of poor quality groundwater. An incentive program could have significant merit, but assurance of success and predictability of results must exist prior to implementation. The
potential effects of these incentives are complex and should be well understood to avoid adverse impacts.

The cost of remedial actions to correct and mitigate groundwater quality problems can be enormous. Taxpayers often carry the bulk of the financial burden for studying, planning, and implementing remedial actions through federal, state and local funding. An increasing share of the cost of remedial actions is being assumed by those parties determined to be responsible for the contamination. However, in some situations, poor quality groundwater can be put to beneficial use without any detrimental affects. Some water treatment prior to use may be necessary, but in many instances, water can be used directly without treatment.

The appropriate use of poor quality groundwater can perform two important water management functions simultaneously. By promoting the use of poor quality groundwater in agriculture and industries, existing potable supplies can be reserved for municipal use. The withdrawal and use of poor quality groundwater can also serve to cleanup groundwater contamination sites. This single management strategy preserves the maximum amount of groundwater for the highest beneficial use and corrects or mitigates existing groundwater quality problems.

DWR's poor quality withdrawal permits are the institutional mechanism by which water users and providers can withdraw poor quality groundwater. DWR may provide incentives in order to encourage the preferential use of poor quality groundwater in lieu of potable groundwater. Regulatory and economic incentives will be considered, in addition to providing technical assistance to those entities interested in utilizing poor quality water. Implementation of any proposed incentives may require DWR to seek legislative amendments.

Before approving poor quality groundwater withdrawal permits or granting incentives, DWR will ensure that proposed uses of poor quality groundwater have no significant health or environmental side-effects. Because environmental and public health issues are involved, approval of all such proposals by DEQ will be necessary. Decisions on whether water should be withdrawn or left in storage require an analysis of the intended water use, the location of use, the quantity of water and its quality.

Encouraging the beneficial use of poor quality groundwater will create the opportunity for voluntary participation in remedial actions that mitigate or avoid adverse impacts from migration of poor quality waters. This policy, however, would not exonerate or exclude any person or potentially responsible party from remedial action provisions or requirements under the Arizona Environmental Quality Act, the Comprehensive Environmental Response Compensation and Liability Act, the Safe Drinking Water Act, the Clean Water Act, or any other provision or law to which they must be subject. Any responsible party identified by DEQ shall not receive any incentives offered as part of this program.
AGRICULTURAL
CONSERVATION PROGRAM
A. INTRODUCTION

Water conservation practiced by agricultural water users in the Prescott AMA benefits the individual farm unit and is important in achieving groundwater management goals for the second management period. Reduction in agricultural groundwater withdrawals will help to stabilize water level decline rates, reduce the need to deepen existing wells, and reserve water supplies for the region's growing population. This chapter describes the agricultural water conservation program for the Prescott AMA. The following topics are discussed in the order listed:

- Program Summary
- Statutory Provisions
- Agricultural Water Use in the Prescott AMA
- Components of the Agricultural Conservation Program
- Agricultural Conservation Requirements

B. PROGRAM SUMMARY

The Department's economic and engineering studies, completed in preparation of this management plan, show that it is feasible for most farm units in the Prescott AMA to install sprinkler irrigation systems. This type of irrigation system can be operated at an efficiency of 75 percent with efficient irrigation water management practices. This means, for example, that if the consumptive use of a crop is 3.0 acre-feet per acre, then 4.0 acre-feet per acre would need to be applied to the field. The average irrigation water duty for the Prescott AMA will be reduced from 4.8 acre-feet per acre in 1988 to 3.5 acre-feet per acre in 2000. The total annual allotment will be reduced from 29,049 acre-feet to 21,421 acre-feet, or 26 percent.

Observations of farming practices in the Prescott AMA support the validity of these conservation requirements. Between 1980 and 1986, approximately 300 acres of land in the Active Management Area were converted to sprinkler irrigation systems. The percentage of sprinkler irrigation systems increased from 20 to 27 percent of the total irrigated acreage. Farmers were willing to make these investments in irrigation system improvements because the improvements resulted in water savings, crop yield increases, and increased profits. These investments occurred even though interest rates were relatively high and the economy was in a recession.

C. STATUTORY PROVISIONS

The Groundwater Code limits irrigation uses of water in the four AMAs by prohibiting the development of new irrigated acreage, requiring compliance with irrigation water duties and maximum annual groundwater allotments, and requiring the Director to establish delivery system conservation requirements for entities that distribute groundwater. There are presently no entities that distribute groundwater for irrigation in the Prescott AMA.

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 for a non-irrigation use, were issued a Certificate of Irrigation Grandfathered right by the Department. Each certificate describes the certified "irrigation acres." Only these acres may be irrigated with groundwater. (A.R.S. § 452.A) The Code makes four exceptions to the prohibition of new irrigated land:

- New acreage may be substituted for existing acreage to facilitate the
delivery and use of Central Arizona Project water. (A.R.S. § 45-452.B)

• State universities may irrigate new acreage not to exceed a total of 320 acres of land (A.R.S. § 45-452.H)

• Existing acreage damaged by flood water may be replaced with new acreage. (A.R.S. § 45-465.01)

• Existing farms that are irregular in shape may consolidate the acreage by substituting new acres in order to improve irrigation efficiency. (A.R.S. § 45-465.02)

Each person who had a Certificate of Irrigation Grandfathered right was issued an irrigation water duty and a maximum annual groundwater allotment for the farm unit during the first management period. The irrigation water duty was calculated as the quantity of water reasonably required to irrigate the crops historically grown on the farm unit. The maximum annual groundwater allotment was calculated by multiplying the irrigation water duty by the water duty acres. These acres are the highest number of acres in the farm legally irrigated during any one year in the five years preceding January 1, 1980.

In the Prescott AMA, a farm unit is usually the acreage described on a Certificate of Irrigation Grandfathered right. The maximum annual groundwater allotment may be used to irrigate all or a portion of the irrigation acres.

The Code directs the Department to establish a new irrigation water duty for the second management period. This procedure is described as follows:

"Establish a new irrigation water duty for each farm unit to be reached by the end of the second management period and may establish one or more intermediate water duties to be reached at specified intervals during the second management period. The irrigation water duty and any intermediate water duties shall be calculated 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 required to amortize conservation investments and financing costs." (A.R.S. § 45-565.A.1)

Irrigation water duties for the second management period were based on efficiencies achievable using a sprinkler irrigation system. In the Prescott AMA, the installation of this type of system is typically completed for the entire irrigated acreage at one time. Calculation of irrigation water duties and maximum annual groundwater allotments is discussed in detail in Section E of this chapter.

D. AGRICULTURAL WATER USE IN THE PRESCOTT AMA

Under the First Management Plan, 174 Certificates of Irrigation Grandfathered Rights were issued. These certificates permitted the irrigation of 6,521 acres. Due to numerous conveyances and transfers of rights to new owners, which sometimes splits a farm into two or more smaller farms the number of certificates issued or pending issuance had increased to 191 by December 1987. Irrigation acreage, however, had decreased to 6,124 acres because some irrigation grandfathered rights had been retired or transferred to non-irrigation rights.

Based on annual reports of measured water use in the Prescott AMA, the total irrigation water use in 1985 was 19,200 acre-feet. The volume of water allotted annually for the first
management period was 29,049 acre-feet. Farms choosing not to irrigate portions of their total acreage account for the balance of unused water.

Farm size in the Prescott AMA ranges from two acres to over 700 acres. The average farm size is 34 acres. Table 4-A shows the farm size distribution and the percentage of total irrigation acreage in each size category.

The Prescott AMA encompasses the Little Chino sub-basin and the Upper Agua Fria sub-basin. Figure 4-A shows the lands in the Prescott AMA by sub-basin with irrigation grandfathered rights. Both sub-basins contain lands that are irrigated with surface water or groundwater, or a combination of surface and groundwater.

In the Little Chino sub-basin, the Chino Valley Irrigation District (CVID) can deliver surface water to 2,458 decreed acres. One-third of the acreage served surface water by the CVID also holds groundwater irrigation rights. However, the CVID neither holds any groundwater rights nor delivers groundwater.

In the Upper Agua Fria sub-basin, some of the irrigation grandfathered right holders also hold rights to divert surface water from Lynx Creek, a tributary to the Agua Fria River. There is, however, no irrigation district in the Upper Agua Fria sub-basin. Table 4-B summarizes the irrigated acreage of the Prescott AMA by sub-basin and water rights.

a. Crops Grown

Historically, the crops grown in the Prescott AMA have varied from low water use vegetable crops to high water use irrigated pasture. The primary crops grown are pastures grasses, alfalfa, and small grains. These crops have typically depended on a local market, but outside markets are now being developed on a small scale for low water use specialty crops. Sweet corn acreage, although comparatively small, is anticipated to increase proportionally with the population.
Figure 4-A
Irrigation Grandfathered Rights
Prescott Active Management Area

March, 1988
Arizona Department of Water Resources
b. Soils

The irrigated soils of the Prescott AMA differ between the Upper Agua Fria and Little Chino sub-basins. The majority of irrigated lands in the Upper Agua Fria sub-basin are deep, well-drained soils of the Lynx series. The irrigated lands of the Little Chino sub-basin generally consist of shallow soils underlain by a zone of heavy lime accumulation or a cemented lime hardpan.

c. Irrigation Systems

The type of irrigation system found in an agricultural area is determined by factors such as water costs, labor availability, soil characteristics, and regional economics. The availability of inexpensive irrigation water and a lack of contractors specializing in agricultural water conservation has been a deterrent to the implementation of the more sophisticated irrigation systems found in southern Arizona's agricultural areas. Land leveling, an irrigation conservation strategy often used in Maricopa and Pinal counties, is not a viable alternative for farms in the Prescott AMA.

Irrigated farmlands of the Prescott AMA were predominantly flood/furrow irrigation systems on steep sloping fields until recent years. Significant increases in the cost of energy to pump groundwater and the water conservation requirements of the first management period have resulted in the implementation of more efficient irrigation systems. The most common irrigation system improvement made in the Active Management Area is the conversion from a flood/furrow slope irrigation system to a sprinkler irrigation system.

d. Future Changes in Agriculture

Increasing water costs, rising land values, and growing development pressures will affect agriculture in the Prescott AMA during the 1990s. Residential and industrial development are predicted to progressively replace agricultural land uses. In response to
this, average farm size will decrease as land possessing irrigation grandfathered rights is sub-divided.

Low water use/high value crops on smaller acreages are already replacing the less profitable high water use forage crops traditionally grown on larger acreages. In addition, field configurations are being altered to accommodate sprinkler irrigation systems, resulting in a decrease in field size and the number of acres being irrigated. The Department anticipates these trends to continue through the second management period. Approximately 60 acres of irrigated land are expected to go out of production each year. This assumption is reflected in the projection of agricultural water demands discussed in Chapter 2.

E. COMPONENTS OF THE AGRICULTURAL CONSERVATION PROGRAM

The Agricultural Conservation Program for the second management period establishes a new irrigation water duty and a maximum annual groundwater allotment for each farm unit. Irrigation water duties for the second management period are generally less than those for the first management period. After adoption of this management plan, the Department notified each person who holds a Certificate of Irrigation Grandfathered Right of the irrigation water duties and maximum annual groundwater allotments.

Each person receiving a notice must comply with the irrigation water duties as measured by the maximum annual groundwater allotments by the date in the notice. Compliance with the final irrigation water duty is required by January 1, 2000. All persons must remain in compliance with the applicable irrigation water duty and maximum annual groundwater allotment until the compliance date of any subsequent requirements in the Third Management Plan.

When a Certificate of Irrigation Grandfathered Right is conveyed to a new right holder, the new owner receives a maximum annual groundwater allotment that is proportional to the number of irrigation acres conveyed. For example, if a right holder sells 75 percent of his or her irrigation acres, the new owner will receive a maximum annual groundwater allotment that is 75 percent of the original owner's total allotment. The original owner would retain an allotment that is 25 percent of the maximum annual groundwater allotment for the original certificate.

Any person seeking additional time to comply with an irrigation water duty may apply for a variance within ninety days from the date of the notice of the water duty. The Code allows right holders who believe their water duty has been calculated incorrectly to seek an administrative review within ninety days from the date of the first notice of the irrigation water duties. A right holder may also apply for an administrative review beyond the 90-day period based on extraordinary circumstances not in existence when they received their first notice. Extraordinary circumstances are further discussed in Chapter 8.

1. Determination of Irrigation Water Duties and Maximum Annual Groundwater Allocations

The irrigation water duty is the primary component of the Agricultural Conservation Program. It is the variable which determines the maximum annual groundwater allotment for the irrigation acres in a farm. The following sections describe how the Department determines intermediate and final irrigation water duties and maximum annual groundwater allotments.
a. Calculation of Irrigation Water Duties

The irrigation water duty is the quantity of water reasonably required annually to irrigate the crops historically grown in a farm unit from 1975 through 1979. These crops were verified and established for each farm unit during preparation of the First Management Plan. The Department calculated the irrigation water duty (duties) for each farm unit using the following equation:

\[
\text{Irrigation Water Duty} = \frac{\text{Total Irrigation Requirement}}{\text{Total Planted Acres} \times \text{Assigned Irrigation Efficiency}}
\]

The numerator (top half) of the equation is equal to the average irrigation requirement for the crops grown in the farm unit from 1975 through 1979. For the Second Management Plan, the assigned irrigation efficiencies assume the maximum feasible level of conservation for each farm unit. Each component of the equation is discussed below.

1) Total Irrigation Requirement

The total irrigation requirement (TIR) for each farm unit equals the total amount of water needed to satisfy from 1975 through 1979: (i) the sum of the irrigation requirements for the crops historically grown. For each crop, the irrigation requirement (IR) consists of the amount of water which is needed to meet: the consumptive use (CU) requirement of the crop, plus any other needs (ON) requirement 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 equation:

\[
\text{IR} = \text{CU} + \text{ON} + \text{LA} - \text{EP}
\]

b) Consumptive Use Requirement

For the first management period, the crops historically grown were verified and determined for each farm unit. The Department evaluated the consumptive use requirements for the crops historically grown to determine if the scientific estimates of these requirements were appropriate. The consumptive use requirement of a crop includes the amount of water used in transpiration and building of plant tissue, and evaporated from adjacent soil during the growing season.

For the second management period, the consumptive use requirements of a few of the crops historically grown in the Prescott AMA, including vegetable crops, were modified because of elevation adjustments and differences between experimental plots and field conditions. Generally, consumptive use requirements for these crops increased, but in no case did the increase exceed 0.47 acre-feet per acre. Appendix 4 lists the consumptive use requirement for each crop historically grown in the Prescott AMA.

c) Other Needs Requirement

Water required by certain crops for purposes other than consumptive use is referred to as "other needs." Some vegetable crops, for example, need additional water for germination and quality control. For the second management period, no crops currently grown in the Prescott AMA were identified as needing additional water for other needs.

c) Leaching Allowance

In some situations, a crop's irrigation requirement may need to include an additional amount of water for
leaching, or deep percolation, purposes. This leaching allowance is needed to prevent salts from accumulating in the crop root zone when high levels of dissolved salts are present in the irrigation water. If the salts in the soil are not leached beyond the root zone, soil salinity will eventually become high enough to inhibit plant growth and yields.

For the second management period, the Department reviewed the procedure used to calculate the leaching allowance for a crop. The procedure was modified to reflect the findings of this review. This procedure is shown by the following equation:

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

Where:
- \( LA \) = Leaching allowance for the crop
- \( AE \) = Assigned irrigation efficiency for the farm unit
- \( CU \) = Consumptive use requirement of the crop
- \( EC_w \) = Electrical conductivity of the irrigation water, expressed in millimhos per centimeter
- \( EC_e \) = Tolerance of the crop to soil salinity in electrical conductivity of the soil saturation extract, expressed in millimhos per centimeter

For the second management period, the \( EC_w \) value determined for the water supply of the applicable "area of similar farming conditions" was used to calculate the leaching allowance included in each farm unit's total irrigation requirement. Most irrigation water in the Prescott AMA is of adequate quality and does not require additional leaching allowances. However, if a holder of an irrigation grandfathered right for the second management period has a water supply with an \( EC_w \) value greater than 1.5 millimhos per centimeter (a concentration of approximately 1,000 milligrams per liter of total dissolved solids), the right holder may apply to the Department for an administrative review within ninety days of the notice of conservation requirement.

d) Effective Precipitation

Effective precipitation is defined to be that portion of the annual precipitation available to meet a crop's water needs. The Department included effective precipitation in determining each farm unit's total irrigation requirement for the second management period. (Refer to Appendix 4)

2) Total Planted Acres

The total planted acres are the sum of the acres planted during the period, 1975 through 1979. Acres that were double-cropped are counted only once in the determination of total planted acres. The Department verified the total planted acres for each farm unit as it existed prior to the adoption of in the First Management Plan.

If a portion of a farm unit's irrigation acres are conveyed to a new owner, a proportion of the total planted acres equal to the proportion of irrigation acres conveyed are used to calculate the
irrigation water duty for the new owner's Certificate of Irrigation Grandfathered Right.

3) Irrigation Efficiency

Irrigation efficiency is a measure of the general effectiveness of water application. The effectiveness is a function of many variables, including evaporation loss, soil intake rate, land slope, water application technologies, and irrigation management practices. When calculating irrigation efficiencies, the Department also included reasonable on-farm water losses for typical irrigation distribution systems. The Department defines irrigation efficiency as:

\[ IE = \frac{\text{Total Irrigation Requirement}}{\text{Total Volume of Water Applied}} \]

The Department assigned an irrigation efficiency to each farm unit in the Prescott AMA for the second management period. Although holders of irrigation grandfathered rights will not be required to invest in new irrigation systems, irrigation water duties for most farm units are calculated with the assumption that this level of conservation will be attained by 2000. Irrigation efficiencies were determined in accordance with the Code's mandate to assume 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. (A.R.S. § 45-565.A.1)

4) Areas of Similar Farming Conditions

The Department undertook an intensive study to determine what constituted maximum conservation for farm units within "areas of similar farming conditions" (ASFCs). ASFCs were based on criteria having an effect on prudent long-term farm management practices: 1) water costs, 2) crop types, 3) soil characteristics, and 4) farm unit size. Two ASFCs were identified in the Prescott AMA.

Due to the homogeneity of the irrigated areas in the Prescott AMA, the only criterion applicable for defining ASFCs is water cost as water costs typically influence irrigation management decisions. Because the cost of surface water delivered within the Chino Valley Irrigation District (CVID) is significantly less than pumped groundwater, the primary criterion for determination of ASFCs was access to CVID water. Thirty-five farm units were identified as holding both irrigation grandfathered rights and CVID shares.

5) Prudent Long-term Farm Management Practices

Prudent long-term farm management practices were determined by the Department to be management practices commonly used on farms in the Prescott AMA which have proven to be economically feasible. The Department surveyed each ASFC in December 1985 to inventory the types of irrigation systems in place. This survey was conducted in a manner that ensured a high degree of accuracy.

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. Table 4-C describes irrigation efficiencies expected from each type of irrigation system when managed properly.
TABLE 4-C
IRRIGATION SYSTEMS AND EXPECTED IRRIGATION EFFICIENCIES
PRESCOTT AMA

<table>
<thead>
<tr>
<th>TYPE OF IRRIGATION SYSTEM</th>
<th>EXPECTED IRRIGATION EFFICIENCY</th>
</tr>
</thead>
<tbody>
<tr>
<td>Slope(^1) - without pumpback system</td>
<td>50%</td>
</tr>
<tr>
<td>Slope - with pumpback system</td>
<td>70%</td>
</tr>
<tr>
<td>Sprinkler</td>
<td>75%</td>
</tr>
<tr>
<td>Trickle</td>
<td>85%</td>
</tr>
<tr>
<td>Level Basin(^2)</td>
<td>85%</td>
</tr>
</tbody>
</table>

\(^1\) Slope is a graded furrow or graded border flood irrigation system. The slope, or grade, may vary from 0.05% to 1%.

\(^2\) Level Basin is a level furrow or level border flood irrigation system. The slope may vary from flat to 0.2 foot over the entire length of the field. These systems have limited application in the Prescott AMA.

The Department has worked closely with the USDA Soil Conservation Service Field Office in Prescott to evaluate irrigation systems used in the Active Management Area. Based on these evaluations and data from interviews with system operators, 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 Department could not estimate the irrigation efficiency of trickle irrigation systems under all conditions because of a lack of reliable field data. Available information indicates that properly managed systems can achieve a very high irrigation efficiency. However, due to lack of sufficient data, trickle irrigation systems are not considered an alternative to historical irrigation systems during the second management period. The Department does recognize that trickle irrigation systems can attain high irrigation efficiencies and encourages use of this system.
Level basin irrigation systems can be managed to achieve high irrigation efficiencies. Due to soil limitations in the Prescott AMA, these systems are not a feasible alternative to historical irrigation systems for most farm units. The Department recognizes that these systems can achieve high irrigation efficiencies and encourages their use 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. If good irrigation water management practices are used, this system can achieve an irrigation efficiency equal to the sprinkler irrigation system.

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 irrigation 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 in all ASFCs is a prudent long-term farm conservation practice.

6) Irrigation Water Management

The Department found that the failure of irrigation systems to achieve the expected irrigation efficiencies shown in Table 4-C is most often not due to physical limitations in the design of the irrigation systems, but in the manner in which they are managed. For example, if a level basin system is irrigated as if the field were still sloping, then the result is a significantly lower irrigation efficiency than that which is expected for the type of irrigation system.

Correct management of an irrigation system includes the use of the following proven practices: 1) regulating the timing and rate of each water application with regard to the design limitations of the irrigation system, 2) monitoring evapotranspiration or soil moisture in order to accurately determine when to irrigate and how much water to apply, and 3) maintaining the components of the irrigation system in order to achieve optimum performance. If these irrigation water management practices are utilized, the expected irrigation efficiencies shown in Table 4-C can be attained on a consistent basis, with little or no difficulty.

7) Economic Analysis of Irrigation System Improvements

The Department analyzed the economic feasibility of investing in irrigation system improvements for field crop farms units in each ASFC. For the purpose of the economic analysis it was determined that field crop farm units in the Prescott AMA could be represented by three crops: alfalfa, pasture grasses, and small grains. Economists from DWR and the USDA designed "crop budgets" to calculate annual production costs and gross revenues for these three crops for each type of irrigation system shown in Table 4-C, except trickle irrigation.

In conjunction with the crop budgets, a computer-generated spreadsheet, known as the "Whole Farm Analysis" (WFA), was designed to model a representative farm unit for each ASFC. The WFA spreadsheet served as a tool in analyzing the economic feasibility of irrigation systems assumed to be improvements.
for the representative farm unit. The types of irrigation systems in place on the representative farm unit were determined from the data collected in the Department's irrigation system 1985 survey. The acreage of the three field crops grown on the representative farm unit was a typical mix for the area in 1985. This was called the "before" situation.

The Department assumed the number of irrigated acres not already equipped with sprinkler irrigation systems could be improved by 2000. The WFA spreadsheet was then used to calculate water savings, production costs, and gross revenues for the farm unit after the assumed irrigation system improvements were made (the "after" situation). The difference between the net returns in the before situation and those in the after situation represented the benefits of the assumed investments in irrigation system improvements.

Because decisions to invest in irrigation system improvements are affected by many factors, ranges of the most critical factors were analyzed with the WFA spreadsheet. The variables tested were: 1) water costs, 2) crop prices and yields, 3) interest rates, and 4) loan period. For each of these variables, the values tested were determined by the Department's studies and were reviewed extensively by local farmers and other experts.

Except under conditions of extreme economic hardship, benefits exceeded amortized costs of the irrigation system improvement. The Department determined from these studies that the installation of sprinkler irrigation systems is economically feasible for field crop farm units in the Prescott AMA.

b. Calculation of Maximum Annual Groundwater Allotments

For each farm within a farm unit, the maximum annual groundwater allotment is determined by multiplying the irrigation water duty by the water duty acres. Water duty acres are the highest number of acres in a farm that were legally irrigated in any one year during the period 1975 through 1979. The Department verified the number of water duty acres for each farm, as determined prior to adoption of the First Management Plan. The Code requires that the maximum annual groundwater allotment be reduced over time with increasingly stringent conservation requirements.

c. Calculation of Intermediate and Final Irrigation Water Duties and Maximum Annual Water Allotments

The Groundwater Code allows the establishment of intermediate irrigation water duties from 1990 through 1999. (A.R.S. § 45-565.A.1) Intermediate water duties will encourage farmers to make incremental investments during the ten year period, so that final water duties will be attained by 2000.

The Department calculated the intermediate water duty and maximum annual groundwater allotment using the formulas described in Section a, above.

8) Assigned Irrigation Efficiencies

The Department determined the maximum conservation level economically feasible for each ASFC based on the economic and engineering studies described. After the assigned irrigation efficiency was determined for each ASFC, the irrigation water duty was calculated for each farm unit. Table 4-D shows the assigned irrigation efficiency and average irrigation water duty assigned to each ASFC for the year 2000.
TABLE 4-D

ASSIGNED IRRIGATION EFFICIENCIES AND AVERAGE IRRIGATION WATER DUTIES FOR AREAS OF SIMILAR FARMING CONDITIONS-2000

PRESCOTT AMA

<table>
<thead>
<tr>
<th>AREA OF SIMILAR FARMING CONDITIONS</th>
<th>ASSIGNED IRRIGATION EFFICIENCY</th>
<th>AVERAGE IRRIGATION WATER DUTY (acre-feet per acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>75%</td>
<td>3.53</td>
</tr>
<tr>
<td>2</td>
<td>75%</td>
<td>3.55</td>
</tr>
</tbody>
</table>

The Department established an intermediate water duty for calendar year 1992 because of changes in the consumptive use and other needs requirements for some crops, and the change in the procedure used to calculate leaching allowances.

d. Farm Flexibility Account

The Groundwater Code permits agricultural water users to borrow or bank groundwater from year to year to allow for varying climatic and market conditions (A.R.S. § 45-467). The Department maintains an operating flexibility account for each farm. If a farmer uses less than the farm's maximum annual groundwater allotment during an accounting period (usually a calendar year), a credit is registered to the account for any water not used which would have been groundwater. If more surface water and groundwater than the allotment is used during an accounting period, a debit is registered to the account for the amount of groundwater used, up to the amount of the excess.

A farmer may borrow from the farm's flexibility account no more than 50 percent of a farm's maximum annual groundwater allotment. At any time, the farmer may use groundwater in an amount equal to the credit balance in the farm's flexibility account. The Department has developed rules describing the procedures for maintaining flexibility accounts.

To encourage the maximum use of effluent during the second management period, the Department will count each acre-foot of effluent used for agricultural irrigation as 0.9 acre-foot of water for purposes of farm flexibility accounting.

2. Monitoring and Reporting of Agricultural Water Use

In order for the Department to monitor compliance with irrigation water duties and maximum annual groundwater allotments, and to calculate flexibility accounts, holders of irrigation grandfathered rights, as well as irrigation districts and private water companies which distribute groundwater for irrigation use, are required by the Code and the Second Management Plan to report their total amount of water withdrawn, diverted, or received by them annually. The Second Management Plan places additional reporting requirements on irrigation districts and private water companies which, as of
January 1, 1990, distribute 20 percent or more of their total water deliveries for irrigation use. This information, which includes total lost and unaccounted for water, is required by the Department to maintain accurate water use records for right holders served by irrigation districts and private water companies.
F. AGRICULTURAL CONSERVATION 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 this Chapter, unless the context otherwise requires, shall have the following meanings:

1. "Canal" means a waterway constructed for the purpose of transporting water to a point of delivery, including main canals and lateral canals.

2. "Farm" means an area of irrigated land under the same ownership which is served by a water distribution system common to the irrigated land and to which can be applied common conservation, water measurement and water counting procedures.

3. "Farm unit" means one or more farms which are irrigated with groundwater and which are contiguous or in proximity to each other with similar soil conditions, crops and cropping patterns.


5. "Irrigation distribution system" means 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" means the amount of water in acre-feet per acre that is reasonable to apply to irrigated land in a farm unit during the accounting period, as determined by the Director pursuant to A.R.S. §§ 45-564 through 45-568.

7. "Lost water" means 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 similar or dissimilar causes.

8. "Maximum annual groundwater allotment" means the quantity of water in acre-feet obtained by multiplying the water duty acres for a farm within a farm unit by an intermediate or final irrigation water duty for the farm unit.

9. "Total quantity of lost and unaccounted for water" means 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" means the highest number of acres in a farm, taking land rotation into account, which were legally irrigated during any one year in the five years preceding January 1, 1980.
4-102. Conservation Requirements for Holders of Irrigation Grandfathered Rights

A. The number of irrigation acres, the number of water duty acres, and the intermediate and final irrigation water duties and maximum annual groundwater allotments assigned for each Certificate of Irrigation Grandfathered Right in the Prescott Active Management Area are set forth in Supplement I, which is attached hereto and is also available for inspection and copying at the Department of Water Resources office in Prescott.

B. For the calendar years 1992 through 1999, each person who is entitled to use groundwater pursuant to a Certificate of Irrigation Grandfathered Right shall comply with the first intermediate irrigation water duty and the first intermediate maximum annual groundwater allotment assigned for the right in Supplement I. For the calendar year 2000, and for each calendar year thereafter until the first compliance date for any irrigation groundwater duty or maximum annual groundwater allotment assigned for the person's Certificate of Irrigation Grandfathered Right under the Management Plan for the Prescott Active Management Area for the Third Management Period, 2000 to 2010 ("Third Management Plan"), each such person shall comply with the final irrigation water duty and the final maximum annual groundwater allotment assigned for the right in Supplement I.

C. A person who is entitled to use groundwater pursuant to a Certificate of Irrigation Grandfathered Right may use the maximum annual groundwater allotment assigned for the right to irrigate only the irrigation acres to which the right is appurtenant.

D. A person who is entitled to use groundwater pursuant to a Certificate of Irrigation Grandfathered Right shall not use water for irrigation purposes in an amount which exceeds the maximum annual groundwater allotment assigned for the right for that calendar year, except as provided by the flexibility account provisions of A.R.S. § 45-467, any rules adopted by the Director pursuant thereto, and Subsection E below.

E. Effluent Adjustment

For purposes of calculating credits and debits to the operating flexibility account assigned to a farm pursuant to A.R.S. § 45-467, each acre-foot of effluent physically applied to the farm's irrigation acres shall be considered as 0.9 acre-foot of water used by the farm for irrigation purposes.

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, 1990, distribute 20 percent or more of their total water deliveries for irrigation use.
B. Conservation Requirements

By January 1, 2000, or upon commencement of operation, whichever is later, and continuing thereafter until the first compliance date for any substitute requirement in the Third 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 irrigation water 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 ten 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, 1990, distribute 20 percent or more of their total water deliveries for irrigation use.

B. Monitoring and Reporting Requirements

For calendar year 1992, and for each calendar year thereafter until the compliance date for any substitute requirement in the Third Management Plan, each irrigation district and each private water company 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.
MUNICIPAL
CONSERVATION PROGRAM
A. INTRODUCTION

This chapter presents the municipal water conservation program for the Prescott AMA. The following topics are discussed in the order listed.

- Program Summary
- Statutory Provisions
- Municipal Water Use in the Prescott AMA
- Municipal Conservation Program Approach
- Municipal Conservation Requirements
- Assured Water Supply Program

B. PROGRAM SUMMARY

The Municipal Conservation Program for the second management period consists of three regulatory alternatives for large water providers. The Department has assigned each large provider in the Prescott AMA a total gallons per capita per day (GPCD) water use requirement. In addition, providers have been given individual water user requirements for turf-related facilities, public road right-of-ways, and new large cooling towers.

Providers have the option of applying for an Alternative Conservation Program in lieu of the Total GPCD Program. The Alternative Conservation Program consists of a groundwater use limitation requirement, a residential GPCD conservation requirement, individual user requirements, special requirements for the provider including conditions of new water service, and a non-residential conservation requirement. The Alternative Conservation Program gives providers added flexibility in meeting their conservation requirements. However, the Department will assign this program only if a provider demonstrates that the level of water use efficiency will be equivalent to that resulting from the Total GPCD Program.

In addition, certain providers may be designated as institutional providers if they supply more than 90 percent of their deliveries to institutions. The institutional provider program includes a residential gallons per capita per day requirement as well as other mandatory conservation requirements.

C. STATUTORY PROVISIONS

The Groundwater Code requires the Department to include a conservation program for municipal uses in its management plans for the Active Management Areas. The Department developed a Municipal Conservation Program in the First Management Plan according to the Code's mandate to "require reasonable reductions in per capita use and such other conservation measures as may be appropriate for individual users." (A.R.S. § 45-564.A.2)

In the Second Management Plan, the Code instructs the Department to "require additional reasonable reductions in per capita use to those required in the first management period and use of such other conservation measures as may be appropriate for individual users." (A.R.S. § 45-565.A.2) The Code also requires the Department to establish reasonable conservation requirements for small municipal providers. (A.R.S. § 45-565.A.3)

Municipal use includes "all non-irrigation uses of water supplied by a city, town, private water company or irrigation district." (A.R.S. § 45-561.6) The Second Management Plan must include "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. § 45-565.A.4)
MUNICIPAL WATER USE IN THE
PRESCOTT AMA

A municipal water provider is a city, town, private water company, or irrigation district which distributes water for non-irrigation uses. All municipal providers in the Prescott AMA currently deliver treated water to residential and non-residential customers for interior and exterior use. In other Active Management Area's, some municipal providers are also delivering untreated water primarily for residential and non-residential landscape use. This chapter includes requirements for both types of providers, although untreated water is currently not being delivered in the Prescott AMA.

In accordance with the legislative mandate in A.R.S. § 45-561.8, municipal providers in the Prescott AMA have been divided into two categories based on the service area population and volume of water served. Large providers serve 500 or more people or supply 100 or more acre-feet of water per year. Small providers include municipal providers serving less than 500 people and supplying less than 100 acre-feet of water per year for non-irrigation purposes.

It should be noted that the definition of large provider in the Prescott AMA has been changed since the Department's release of the First Management Plan in 1984. At that time, a provider having more than 50 active service connections was considered a large provider. The status of several providers has therefore changed for the second management period.

In addition, municipal providers may be classified as institutional providers. Institutional providers are large providers supplying more than 90 percent of their total non-irrigation deliveries to specific non-residential users. Providers classified as "special providers" in the first management period may apply for the status of institutional provider.

A portion of the municipal water use in the Active Management Area is not supplied by municipal water providers. There are over 4,000 private domestic water wells throughout the Prescott Active Management Area.

1. Large Providers

As of December 1987, there were three large municipal water providers in the Prescott AMA. The City of Prescott, the Shamrock Water Company, and the Triangle Development Corporation serve most of the Active Management Area's residents. Figure 5-A shows the service areas for the Prescott AMA's large municipal providers.

Municipal water use in Prescott AMA communities is very different from water use in the metropolitan areas to the south. Residential customers comprise the largest group of water users throughout the Active Management Area. Because of the area's temperate climate and residents' preference for natural landscaping, outside water use is a small fraction of total residential consumption.

In the past, water use in the Prescott AMA was characterized by seasonal fluctuations largely due to population increases during the summer months. However, in recent years, municipal providers reported that more residential customers are permanent.

The City of Prescott, the largest water provider in the Prescott AMA, delivers water to Prescott residents, several residential areas outside the city limits, an area in Chino Valley, and the Yavapai-Prescott Indian Reservation. Residential customers used over two-thirds of the City's annual water deliveries in 1985. Interior water uses accounted for over 70 percent of that residential use, which was approximately 50 gallons per capita per day (GPCD).
Non-residential water use includes all commercial, institutional, recreational, and manufacturing activities. Prescott water records show that non-residential water use more than doubles from winter months to summer months. The increase is primarily attributed to peak watering demands for turfed areas -- schools, parks, golf courses, and common areas. Antelope Hills Golf Course, the City's largest turf-related facility, satisfies 90 percent of its water needs with effluent or reclaimed wastewater. Water use by restaurants and motels also peaks in response to summer visitors.

Total water use (residential and non-residential) in the Prescott service area in 1985 was approximately 120 GPCD. This rate is less than the conservation requirement of 133 GPCD established in the First Management Plan (1984). At that time, water use by the City of Prescott was estimated to be 141 GPCD.

The Shamrock Water Company provides water to the Town of Prescott Valley, the Prescott Country Club, and several adjacent residential areas. In 1985, residential water deliveries comprised 77 percent of Shamrock's total water deliveries. Non-residential water use included manufacturing and commercial activity, and was slightly less than 15 percent of total deliveries. Based on water sales records for fiscal year 1987, summer water use was almost twice the water use during the winter months. This increase was caused by outside watering and summer tourism.

Shamrock's per capita water use rate in 1985 was approximately 80 GPCD. This rate is less than the estimated 1980 rate of 85 GPCD and is well below the conservation requirement of 130 GPCD set in the First Management Plan. Water use in the future is projected to be similar to existing patterns.

The Triangle Development Corporation serves residential water customers exclusively in the Diamond Valley area, southwest of Prescott Valley. Water use for 1983 was estimated to be 77 GPCD. A conservation requirement of 130 GPCD was set in the First Management Plan.

2. Future Municipal Water Uses

Municipal water use characteristics in the second management period are likely to remain similar to those in the first management period. Population growth is anticipated as residential development continues and the tourism industry expands. By 2000, the population of the City of Prescott and its suburbs is projected to be over 47,000. The Towns of Chino Valley and Prescott Valley are expected to double their 1985 populations to 7,700 and 11,000, respectively. The population of the entire Active Management Area is projected to about 70,000 by the end of the second management period. New commercial and industrial water uses are inevitable as the Prescott AMA attracts new residents and increasing numbers of tourists.

The impact of private domestic water use by individual wells is also expected to increase as residential areas continue to develop outside of municipal provider service areas. However, the number of new wells that will be developed is difficult to predict.

3. Small Providers

As of December 1987, there were eleven municipal providers in the Prescott AMA classified as small providers. Several of these are expecting an increase in service area population sometime during the second management period and may, therefore, transition to the large provider classification. Many of the small providers serve residential customers in Chino Valley, Dewey and Humboldt. A few small providers are located near Prescott. Over the years, several small water companies have been absorbed into Prescott's municipal system. Figure 5-A
MUNICIPAL CONSERVATION PROGRAM

Figure 5-A
Municipal Water Providers
Prescott Active Management Area

March, 1988
Arizona Department of Water Resources
identifies the location of the Active Management Area's small providers.

4. Institutional Providers

For the first management period, special providers were defined as entities supplying more than 60 percent of their total non-irrigation deliveries to non-residential uses, and whose water use pattern could not be adequately characterized by a total water use rate (GPCD). Special providers were assigned mandatory conservation requirements, including a maximum residential water use rate.

The Arizona Laborers Joint Training Center in Chino Valley is the only facility in the AMA designated as a special provider during the first management period. Water is used for instructional purposes, student lodging, and a small number of residences. This water use is expected to continue through the second management period.

For the second management period, the classification of special provider is replaced by the institutional provider classification. Providers must supply 90 percent of their non-irrigation deliveries to specific non-residential users in order to receive this status. Institutional providers are entities such as schools, prisons, and government installations served by privately-owned wells. Residential water use occurs, but it is different from typical use by single family and multifamily dwellings.

5. Untreated Water Providers

The Department has defined municipal untreated water providers as providers delivering untreated (or unchlorinated) water for non-irrigation uses through a distribution system separate and distinct from that used to deliver treated water. Agricultural untreated water providers deliver untreated water for both irrigation and non-irrigation uses through a common distribution system. All deliveries of untreated water to irrigation grandfathered rights are considered deliveries for irrigation uses. All water deliveries to lands without irrigation grandfathered rights are considered non-irrigation uses. The most common non-irrigation use is the watering of lawns and pastures.

As of December, 1987, there were no providers in the Prescott AMA which could be classified as either a municipal untreated water provider or an agricultural untreated water provider.

E. MUNICIPAL CONSERVATION PROGRAM APPROACH

1. First Management Plan Approach

The approach used to determine the conservation potential for municipal providers in the First Management Plan was limited by the lack of accurate municipal water use data. This initial planning effort used available data and was designed to establish and analyze water use patterns, determine potential water savings, and set conservation requirements that could reduce municipal water use significantly.

Based on an analysis of conservation measures, it was determined that there was a direct relationship between a provider's water use rate (GPCD) and water use patterns, and its conservation potential. As a result, large providers were placed into three categories in the First Management Plan, based on their water use rate, for the purpose of assigning conservation requirements. "Low per capita providers" were large municipal providers whose 1980 water use rate was 130 GPCD or less. Large providers in this category were not required to reduce their water use rate during the first management period. "Medium per capita providers" were large municipal providers whose 1980 water use...
rate was between 130 and 160 GPCD. The Department's analysis indicated that these providers generally had the potential to reduce their water use rate by at least six percent during the first management period. "High per capita providers" were large municipal providers whose 1980 water use rate exceeded 160 GPCD. High per capita users were required to reduce their water use rate by 12 percent during the first management period. (There were no providers in the Prescott AMA that were in this last category.)

In addition, municipal providers were responsible for meeting the following conservation requirements for the first management period. The priority of each requirement depended on the nature of water use in the service area and characteristics of the distribution system.

- Limitations on the amount of water served to turf-related facilities
- Restrictions on serving groundwater to highway median strips, right-of-ways, and rest areas along public roads or highways
- A limitation on distribution system losses (10 percent)
- Various monitoring and reporting requirements

2. Second Management Plan Approach

For the Second Management Plan, a comprehensive data collection effort enabled the Department to thoroughly assess the water use characteristics within the service area of each water provider, and the Prescott AMA as a whole. Both large and small providers were asked to describe their distribution system in terms of population served, types of water uses, and plans (if any) for the future.

Large providers were asked to submit water use data for the baseline year (1985) for separate user categories. Department personnel worked with the municipal providers to prepare a summary of service area characteristics. The following information was requested from each large provider.

- Service area population (active service connections x average residents per household)
- Residential and non-residential land uses
- Single family and multifamily housing units
- Water use by land use sector
- New land uses
- Water system improvements
- Water conservation programs

Water use patterns for residential and non-residential uses were identified from water account records. Provider representatives commented on the anticipated future water use and potential expansion of water service areas.

A "provider profile" was prepared for the City of Prescott, the largest municipal provider in the Active Management Area. The profile summarized 1985 water use and addressed the success of Prescott's conservation efforts. Prescott concurred with the data presented in the profile.

Using the provider profile, the Department determined that total water use in 1985 was 15 percent less than total water use in 1980, the First Management Plan baseline year. Total water use in 1985, the Second Management Plan baseline year, was 120 GPCD, which was less than the First Management Plan conservation requirement of 133 GPCD.
Both of the other large providers, the Shamrock Water Company and the Triangle Development Corporation, had 1985 water use rates well below their First Management Plan conservation requirement of 130 GPCD. These providers serve primarily residential customers, which accounted for their low water use rates.

According to the water supply and demand projections prepared for the Prescott AMA Water Resources Analysis (Chapter 2), an overall Active Management Area maximum water use rate of 120 GPCD would be instrumental in achieving safe-yield by 2025, assuming the full use of available effluent and CAP allocations (to the City of Prescott and the Yavapai-Prescott Indian Community) in conjunction with the satisfaction of conservation requirements outlined in the Agricultural and Industrial Conservation Programs, Chapter 5 and 6, respectively. These additional water supplies would ensure that no additional conservation would be required in future management periods.

The Department has therefore set a Prescott AMA-wide conservation requirement of 120 GPCD for all municipal providers during the second management period. This satisfies the Groundwater Code's mandate to require a "reasonable reduction" in total water use by municipal providers for the second management period.

Beginning with calendar year 1995, the City of Prescott will be responsible for maintaining the total water use of 120 GPCD that was achieved during 1985. This is a ten percent reduction from the conservation requirement rate set in the First Management Plan. All other existing and new large municipal providers will have a maximum water use rate of 120 GPCD beginning with calendar year 1995, which is a 7.7 percent reduction from the First Management Plan maximum rate.

Table 5-A summarizes the conservation requirements for large providers in the Prescott AMA.

Should more stringent water conservation requirements be necessary in later management periods, the Department can utilize a "conservation potential analysis" that was developed to determine conservation programs suited to the water use characteristics of individual service areas. This computer-assigned program can create "conservation scenarios" that assign specific conservation measures to each user category to reduce total water use. Each conservation measure can be evaluated in terms of potential water savings, historical use, reliability, and costs to both the provider and the water user. The analysis was used to help determine reasonable conservation requirements for water providers in the Phoenix, Pinal and Tucson Active Management Areas.

The Department recognizes that total GPCD requirements may not be appropriate or equitable for providers with rapidly changing water use patterns. Therefore, municipal water providers may choose between the Total GPCD Program and an Alternative Conservation Program for the second management period. The Alternative Conservation Program must result in a level of water use efficiency that is equivalent to that of the Total GPCD Program, but gives providers flexibility in determining how to meet their water conservation requirements.

An underlying assumption of both municipal conservation programs is that water providers should move toward increased use of renewable water supplies and decreased use of mined groundwater during the second management period. The Department will re-evaluate the assured water supply designation of a city or town with a CAP allocation in 2001. The importance of the assured water supply program is discussed in more detail in Section F of this chapter.
TABLE 5-A
SUMMARY OF LARGE PROVIDER CONSERVATION REQUIREMENTS
PRESCOTT AMA

<table>
<thead>
<tr>
<th>Municipal Provider</th>
<th>FMP Maximum GPCD</th>
<th>SMP Maximum Rate</th>
<th>SMP Reduction from FMP Max. GPCD</th>
</tr>
</thead>
<tbody>
<tr>
<td>City of Prescott</td>
<td>133</td>
<td>120</td>
<td>120</td>
</tr>
<tr>
<td>Shamrock Water Co.</td>
<td>130</td>
<td>80</td>
<td>120</td>
</tr>
<tr>
<td>Triangle Dev. Corp.</td>
<td>130</td>
<td>77</td>
<td>120</td>
</tr>
<tr>
<td>New Large Providers</td>
<td>---</td>
<td>---</td>
<td>120</td>
</tr>
</tbody>
</table>

1 First Management Plan
2 Second Management Plan

3. Individual User Requirements

Although the total GPCD requirement is comprised of many requirements for individual water use categories, the provider's sole responsibility for the second management period will be to achieve the total GPCD requirement of 120 GPCD beginning with calendar year 1995.

The Department has set additional conservation requirements for specific individual users within a service area. These individual users are water users served by a municipal system which have high water use rates and significant conservation potential. In the First Management Plan, turf-related facilities, large artificial water bodies, and public right-of-ways were given individual user requirements.

For the Second Management Plan, the individual user requirements of the First Management Plan were re-evaluated to determine their appropriateness. In addition, the Department evaluated the following water use sectors to determine whether individual user requirements were needed: Electronics manufacturing facilities, heating and cooling water use, sanitary and kitchen use, food processing facilities, and construction water use.

As a result of this analysis, individual user requirements were retained and strengthened for turf-related facilities and right-of-way landscaping, and added for new large cooling towers. Requirements for turf-related facilities and new large cooling towers served by large municipal providers are identical to those described in the Industrial Conservation Program (Chapter 6). The individual user requirement restricting
water use in artificial water bodies in the First Management Plan is not included in the Second Management Plan because it has been superseded by the passage of Senate Bill 1200 in 1987, known as the "Lakes Bill." (A.R.S. § 45-131, et seq.)

Monitoring and reporting requirements for water providers have been expanded for the second management period. Providers must collect monthly water use data by water use category and submit the data to the Department. Water use information for certain types of individual water users must also be submitted.

4. Summary of Municipal Conservation Program for Large Providers

The Department has established three regulatory programs for large municipal providers for the second management period. Municipal providers regulated as large municipal providers in the Second Management Plan shall be initially assigned to a Total GPCD Program, but may apply to the Alternative Conservation Program or request to be classified as an institutional provider. These programs apply to all large providers, including existing providers, new providers, and those providers that consolidate their service areas during the second management period.

a. Total GPCD Program

1) Total GPCD Requirement

Each large provider has been assigned a total GPCD requirement based on the Department's analysis of its conservation potential. The new total GPCD requirement must be met beginning with calendar year 1995.

2) Individual User Requirements

Individual user requirements were retained and strengthened for turf-related facilities and public road right-of-ways. In addition, new large cooling towers were assigned conservation requirements.

b. Alternative Conservation Program

A total water use rate (GPCD) is an accurate water use indicator for many providers. However, in service areas with rapidly changing water use patterns, the total GPCD requirement may not be the most appropriate type of conservation requirement. Because the GPCD requirement is based on an assumed ratio of residential to non-residential water use, any significant deviation from this ratio could affect a provider's ability to attain the requirement by the compliance date. Providers may, therefore, request to be assigned to the Alternative Conservation Program for the second management period.

The Department has designed the Alternative Conservation Program to meet two primary objectives: 1) to provide increased flexibility not afforded by the Total GPCD Program, and 2) to achieve a comparable level of water use efficiency as the Total GPCD Program. The Alternative Conservation Program consists of the following requirements that must be met by the provider:

- Groundwater use limitation
- Residential GPCD requirement
- Individual user requirements
- Non-residential requirements

Each of these Alternative Conservation Program requirements is summarized below.

1) Groundwater Use Limitation Requirement

Existing providers must limit groundwater use to the highest annual use during the period 1980 to 1989 by
permanently extinguishing grandfathered groundwater rights, by using non-groundwater supplies, or by withdrawing groundwater outside of the Prescott AMA.

2) Residential GPCD Requirement

The annual residential GPCD requirement is comprised of individual GPCD requirements for existing residential users, new single family users, and new multifamily users and, therefore, reflects the growth in each residential sector. The annual residential GPCD requirement for the Prescott AMA's existing large municipal providers is found in Appendix 5-A. The Department will determine compliance with the residential GPCD requirement on an annual basis.

3) Individual User Requirements

Individual user requirements under the Alternative Conservation Program are identical to those required under the Total GPCD Program.

4) Non-residential Requirements

Like individual user requirements, non-residential requirements prescribe actions that must be taken by the provider. Providers choosing the Alternative Conservation Program must implement the following conditions of new service:

- All new non-residential users, except hotels and motels, must limit water-intensive landscaping to no more than 20 percent of the landscapable area over 20,000 square feet.

- All new model homes must limit water-intensive landscaping to 10 percent of the landscapable area. High-efficiency irrigation systems and low-flow interior plumbing are required.

- All new non-residential customers with an estimated demand exceeding 10 acre-feet annually except construction users must submit a water conservation plan to the provider. The plan must identify all water uses anticipated by the customer and the water conservation measures to be used for each use. The conservation measures selected must be the latest commercially available conservation technology consistent with reasonable economic return. A copy of each conservation plan must be submitted to the Department along with the provider's annual report.

The Department may approve a substitute conservation requirement applicable to a category of user described above if the requirement is as effective in limiting water use as the condition of new service.

c. Provider Application for the Alternative Conservation Program

Each large provider has received an official conservation notice from the Department informing it of its total GPCD requirement. The requirements of the Alternative Conservation Program are described in the notice. The total GPCD requirement remains in effect until the Department approves the providers request to change to the Alternative Conservation Program.
A provider may apply for the Alternative Conservation Program in the following manner: A provider may request the Alternative Program anytime during the second management period but no later than the first compliance date for any substitute requirement in the Third Management Plan.

To obtain the Department's approval, the provider must show it will limit its groundwater withdrawals within the Prescott Active Management Area during the second management period to the highest annual groundwater use during the period from 1980 through 1989. The provider must indicate that it will achieve this limitation on groundwater use by permanently retiring an amount of groundwater use by grandfathered right-holders equivalent to the amount of groundwater used by the provider in excess of the limitation, by using non-groundwater supplies (including CAP allotments) or by using groundwater withdrawn from outside the Prescott AMA.

The Department will use the provider's application for the Alternative Conservation Program to monitor progress by the provider and to determine the type of technical assistance that the Department might provide. Each year, along with the Annual Water Withdrawal and Use Report, the municipal provider will be required to submit an Alternative Conservation Program progress report describing programs carried out, costs incurred, water saved, and any difficulties encountered. This information will allow the Department to determine the level of each provider's conservation effort and monitor the provider's progress in reducing groundwater use.

As part of the application to the Alternative Conservation Program, providers must submit to the Department a comprehensive water supply and demand analysis, a plan to limit groundwater withdrawals, a description of existing and proposed conservation programs and measures, and a water augmentation plan. To be accepted, the provider's application must be approved by its governing body.

The application must demonstrate the provider will offset expansions of the non-residential demand with new water supplies other than groundwater mined from within the Prescott AMA. Toward this end, the application must include the following information:

- Existing water demands by water use category within the service area (including residential, commercial, industrial, and institutional) and distribution system losses.

- Future water demands by each major water use category. Providers must project water demands for 1990, 2000, 2010, 2020, and 2025, assuming applicable First and Second Management Plan conservation requirements, Northern Arizona Council of Governments adopted population projections, and any other accepted projections of residential growth within the service area.

- Water supplies by source for each projection year, including surface water by source (e.g., CAP allocation, surface water rights acquisition, etc.), groundwater, effluent, artificial recharge, and augmentation activities.

- Water conservation plan. The provider must describe all existing conservation programs as well as those programs designed to meet the conservation requirements outlined in the Second Management Plan. The conservation plan must include an analysis of water rate structures as an effective conservation measure. The plan must also include the provider's conservation plans for all existing non-residential customers and must describe how the...
provider will ensure conservation by new non-residential customers who use less than 10 acre-feet of water per year. In addition, the conservation plan must include a schedule for implementation of all conservation programs.

- Water augmentation plan. The provider must describe augmentation programs which will be implemented within the service area. The provider's role in programs operated in conjunction with a regional augmentation effort must also be described. The augmentation plan must also include an estimate of the amount of "new" water available, a description of the affected users, an implementation schedule, and program costs.

d. New Large Providers

All new large providers, including small providers that become large providers during the second management period, will initially be assigned to the Total GPCD Program. The new large provider will have six years to achieve compliance so that unusual water use patterns caused by construction water demand or other reasons will not affect the ability of the new provider to comply.

A new large provider may apply for the Alternative Conservation Program in accordance with the provisions of the Alternative Conservation Program provisions. Before a new large provider will be assigned to the Alternative Conservation Program, the provider must demonstrate that it will limit its use of groundwater withdrawn from within the Prescott AMA to no more than 50 percent of the lesser of a total usage of 120 GPCD or the total quantity of water from all sources used in a year. The provider can achieve this by permanently retiring a requisite amount of groundwater use by grandfathered rightholders, by using non-groundwater supplies, or by using groundwater withdrawn outside of the Prescott AMA.

e. Institutional Providers

The Total GPCD Program and the Alternative Conservation Program provide most municipal providers with a flexible regulatory package. However, the Department has a third program for "institutional providers". This provision allows municipal providers who supply 90 percent or more of their total water deliveries to prisons, military installations, air parks, health care facilities, schools, or other facilities deemed to be institutions, to apply for designation as an institutional provider. If approved, mandatory conservation requirements will be assigned to the provider. The Department will grant institutional provider status only if the Total GPCD Program is not appropriate and the provider demonstrates that it cannot limit its groundwater use, retire groundwater rights, or use other alternative sources as required by the Alternative Conservation Program.

f. Consolidation of Large Providers

Two or more large providers that consolidate their service areas will require an adjustment to their conservation requirements. The Department will recalculate a single total GPCD requirement on a prorated basis and assign the merged provider to the Total GPCD Program. The merged provider may apply for the Alternative Conservation Program.

g. Consolidation of a Large and Small Provider

A large and a small provider that consolidate their service areas will require an adjustment to their individual conservation requirements. The Department will assign the merged provider to the Total GPCD Program. The merged provider may apply for the Alternative Conservation Program.
h. Flexibility Account

In consideration of the impacts of weather conditions and other external factors which may cause annual variations in water use, both municipal conservation programs offered for the second management period includes a flexibility accounting provision (introduced in the First Management Plan as "three-year averaging") for use in determining compliance with conservation requirements.

The flexibility account allows a provider to exceed its per capita requirement within certain limits. The provider may debit his flexibility account to an amount equal to 10 GPCD if the provider is regulated under the Total GPCD Program, or 7 GPCD if the provider is regulated under the Alternative Conservation Program. If usage exceeds this maximum negative account balance, the provider will be out of compliance for the amount in excess of the limit. Conversely, in years of usage below the provider's target, the provider can accrue credits equal to the amount under target up to a maximum positive account balance of 30 GPCD for the Total GPCD Program or 21 GPCD for the Alternative Conservation Program. This credit balance can then be drawn from in dry, hot years.

The flexibility account applies to all large providers including new large providers and providers that consolidate their service areas.

i. Distribution System Requirements

Most existing service connections on municipal systems must be metered by January 1, 1992. All new service connections must be metered at the time water service is provided.

The Second Management Plan requires that lost and unaccounted for water from distribution systems of large providers may not exceed 10 percent on an annual or three-year average basis.

j. Monitoring and Reporting Requirements

The monitoring and reporting requirements introduced in the First Management Plan have been retained for the second management period. Additional monitoring and reporting will be required, including monthly water use by water use sector, and turf-related facility and cooling tower water use information for municipal providers responsible for complying with conservation requirements for those uses.

Providers assigned to the Alternative Conservation Program must submit to the Department a yearly status report on the water management plan and copies of conservation plans submitted to providers by water users.

4. Program Development - Small Providers

The conservation requirements previously discussed in this chapter are designed for large municipal providers. Small municipal providers (those providers serving less than 500 people or delivering less than 100 acre-feet of water per year) are addressed in a different manner. Although the First Management Plan called for reductions in water use (GPCD) by small providers similar to those required of large providers, the Second Management Plan conservation requirements for small providers are more general in nature.

In shifting its approach, the Department recognizes that: 1) Small providers are often unable to carry out the types of conservation programs expected of large providers, 2) Small providers would occupy a disproportionate amount of staff time to administer the GPCD requirements, and 3) the eleven small providers in the Prescott AMA already use very little water.

In addition to general conservation requirements, small providers will be responsible for all individual user
requirements, some monitoring and reporting requirements, and a distribution system requirement which limits lost and unaccounted for water to fifteen percent on an annual or three-year average basis.

F. ASSURED WATER SUPPLY PROGRAM

1. Introduction

The Groundwater Code requires those persons proposing to offer subdivided or unsubdivided land, as defined in A.R.S. § 32-2101, for sale or lease in an Active Management Area to demonstrate to the Department that an assured water supply exists for the proposed development. (A.R.S. § 45-576) The Code defines an assured water supply as:

1. Sufficient groundwater or surface water of adequate quality will be continuously available to satisfy the water needs of the proposed use for at least one hundred years.

2. The projected water use is consistent with the management plan and achievement of the management goal for the active management area.

3. The financial capability has been demonstrated to construct the delivery system and any treatment works necessary to make the supply of water available for the proposed use." (A.R.S. § 45-576.L)

The purpose of this section is to outline the relationship between the Second Management Plan and the Assured Water Supply Program. It is also intended to provide guidance regarding the re-evaluation of assured water supply determinations for municipal service areas with CAP allocations.

The responsibility for demonstrating an assured water supply rests with the developer of the property. A developer must demonstrate that an assured water supply exists before the county, town, or city can approve the subdivision plat, and before the Arizona Department of Real Estate can issue a public report.

There are three ways to demonstrate an assured water supply. First, the developer may demonstrate that it has entered into a service agreement with a city or town having a contract for CAP water. These providers have service areas deemed to have an assured water supply through December 31, 2000.

Second, the developer can arrange for service from a "designated water provider." This is a city, town, or private water company other than a deemed provider that the Department of Water Resources has determined as having a service area with an assured water supply. If a development is to be served by a city or town whose service area is deemed to have an assured water supply or a city, town, or private water company whose service area is designated by the Department as having an assured water supply and water will be supplied from the service area, the developer need not apply for a Certificate of Assured Water Supply.

The third way to demonstrate an assured water supply is for the developer to obtain a Certificate of Assured Water Supply from the Department. The ability to obtain a Certificate depends on the availability of the water supply which will serve the proposed uses.

An application for a Certificate must be submitted to the Department with a hydrologic study which demonstrates that the water supply is physically available. The developer is issued a Certificate of Assured Water Supply for the subdivision if the application meets all of the appropriate criteria.
2. Assured Water Supply Criteria

The Department has established standards by which assured water supply certificates are issued. These are standards for quantity, quality, and dependability of the proposed water supply. The review process not only evaluates whether sufficient quantities of adequate quality water will be available for 100 years, but also reviews financial capability to construct a delivery system (if applicable) and consistency of the proposed water uses with both the management plan and the water management goal for the Prescott AMA. Certificates of Assured Water Supply will not be issued to developments or parts of developments which include 1000 units or more that cannot reasonably be expected to be completed within ten years.

3. Re-evaluation of Municipal Designations after 2000

The Groundwater Code allows for the service areas of cities and towns with CAP allocations to be "deemed" as having an assured water supply until December 31, 2000. These service areas of municipalities with CAP subcontracts were determined as having an assured water supply based on the presumption that a sufficient supply of CAP water would be available to provide for the service area demands. This determination is subject to review by the Department after December 31, 2000. Cities and towns deemed as a result of their CAP allocations will then be required to demonstrate that their service areas have an assured water supply.

4. The Relationship between Management Plans and Assured Water Supply

The Groundwater Code provides a clear mandate for each municipal provider to wisely manage its water resources in anticipation of this re-evaluation. Municipalities wishing to obtain an assured water supply designation beyond 2000 should begin developing and implementing a comprehensive water planning and management program which may include, but is not limited to, the following elements.

- Withdrawal Management Program - Groundwater withdrawals should be reduced to eliminate groundwater overdraft.
- Demand Management Program - Conservation programs should be implemented. These may include public education efforts, conditions of service, conservation-oriented rate structures, technical assistance to water users, and ordinances.
- Supply Management Program - Providers should develop water augmentation alternatives, reclaimed water systems, and water quality protection programs.

It is currently an issue as to whether failure to meet the conservation requirements of the Second Management Plan will automatically jeopardize a provider's ability to be redesignated as having a service area with an assured water supply. However, consistency with the management plan will be considered in evaluating all applications for an assured water supply. Failure to implement comprehensive water demand management programs may make it more difficult for a provider to prove that continued growth in its service area will be consistent with the management plan.
G. MUNICIPAL CONSERVATION REQUIREMENTS

5-101. 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 this Chapter, unless the context otherwise requires, shall have the following meanings:

1. "Body of water" means a body of water or interconnected bodies of water in an active management area, including a lake, pond, lagoon or swimming pool, that has a surface area greater than twelve thousand three hundred and twenty square feet and that is filled or refilled primarily for landscape, scenic or recreational purposes. A body of water that is used incidentally for landscape, scenic, or recreational purposes is deemed not to be filled or refilled for landscape, scenic or recreational purposes.

2. "Canal" means a waterway constructed for the purpose of transporting water to a point of delivery, including main canals and lateral canals.

3. "Common area" means a recreational or open space area or areas maintained for the benefit of the residents of a housing development which is owned and operated as a single integrated facility.

4. "Construction use" means a use of water for construction purposes, including the use of water for dust control, compaction and preparation of building materials on construction sites.

5. "Construction user" means a person who uses water for construction use.

6. "Existing large provider" means a large provider that was in operation and was serving water on or before January 1, 1990.

7. "Existing non-residential customer" means a non-residential customer to whom a municipal provider served water on or before January 1, 1990.

8. "Existing 1990 service area population" means the service area population of a municipal provider as of July 1, 1990, as determined by the Director according to law.

9. "Extinguish" means, for the Alternative Conservation Program's groundwater use limitation requirement, to cause a grandfathered groundwater right to cease to exist through a formal process established by the Director.

10. "Housing unit" means a group of rooms or a single room occupied as separate living quarters. Housing unit includes a single family home, a patio home, a townhouse, a condominium, an apartment, a permanently setup mobile home or a unit in a multifamily complex. Housing unit does not include a mobile home in an overnight or limited-stay mobile home park or a unit in a campground, motel, hotel, or other temporary lodging facility. A housing unit may be occupied by a family, a family and unrelated persons living together, two or more unrelated persons living together, or by one person.
11. "Individual user" means a person receiving water from a municipal provider for non-irrigation uses to which specific conservation requirements apply, including turf-related facilities, new large cooling users and landscaped public rights-of-way.

12. "Landscapable area" means the entire area of a lot less any areas covered by structures, parking lots or roads.

13. "Large provider" means a municipal provider serving water to 500 or more people or supplying 100 acre-feet or more of water during a calendar year, and which is not a large untreated water provider.

14. "Large untreated water provider" means a municipal provider serving untreated water to 500 or more people or supplying 100 acre-feet or more of untreated water during a calendar year.

15. "Lost and unaccounted for water" means the total quantity of water from any source, including effluent only if it is recovered effluent, withdrawn, diverted or received by a municipal provider during a calendar year less the total quantity of authorized deliveries of water from any source, including effluent only if it is recovered effluent, made by the municipal provider during the calendar year that are metered deliveries or deliveries that the municipal provider accounts for by a generally accepted method of estimating water use.

16. "Lost water" means water from any source, including effluent only if it is recovered effluent, that enters a municipal distribution system and is lost from the system during transportation or distribution due to seepage, evaporation, leaks, breaks, phreatophyte use or other similar or dissimilar causes.

17. "Multifamily housing unit" means a mobile home in a mobile home park and any permanent housing unit having one or more common walls with another housing unit located in a multifamily residential structure, and includes a unit in a duplex, triplex, fourplex, condominium development, townhome development, or apartment complex.

18. "Municipal distribution system" means a system of pipes, canals or other works which are owned and operated by a municipal provider to collect, store, treat or deliver water for non-irrigation use.

19. "Municipal provider" means a city, town, private water company or irrigation district that supplies water for non-irrigation use.

20. "New individual user" means an individual user that begins to use water served by a municipal provider after January 1, 1990.

21. "New large cooling user" means a non-residential facility with a total cooling tower capacity in excess of 250 tons, that begins to use water served by a municipal provider after January 1, 1990.
22. "New large landscape user" means a non-residential facility that applies water to a water-intensive landscaped area in excess of 10,000 square feet which either has landscaping planted and maintained after January 1, 1990 or bodies of water, other than bodies of water used primarily for swimming purposes, filled and maintained after January 1, 1990, or both. A new large landscape user does not include a turf-related facility, such as a school, park, cemetery, golf course or common area of a housing development.

23. "New large provider" means a large provider that begins serving water after January 1, 1990, or a small provider that becomes a large provider after January 1, 1990.

24. "New multifamily population" means the portion of the service area population of a municipal provider that resides in multifamily housing units and that begins receiving water from the municipal provider after July 1, 1990.


26. "New single family population" means the portion of the service area population of a municipal provider that resides in single family housing units and that begins receiving water from the municipal provider after July 1, 1990.

27. "Non-residential customer" means a person who is supplied water by a municipal provider for a non-residential use.

28. "Non-residential use" means a non-irrigation use of water other than a residential use.

29. "Outdoor watering" means the application of water from any source, including effluent, to grow landscaping plants.

30. "Previous year's new multifamily population" means the new multifamily population of a municipal provider as of July 1 of the preceding calendar year.

31. "Previous year's new single family population" means the new single family population of a municipal provider as of July 1 of the preceding calendar year.

32. "Recovered effluent" means effluent that has been stored pursuant to an underground storage and recovery permit and recovered outside the area of hydrologic impact. The area of hydrologic impact, as projected on the land surface, is the areal extent of the migration of water stored pursuant to an underground storage and recovery project under Chapter 3, Title 45 of the Arizona Revised Statutes.

33. "Residential GPCD" means the gallons of water per capita per day for all residential uses supplied by a municipal provider.
34. "Residential use" means a non-irrigation use of water related to the activities of a housing unit or units, including exterior water use.

35. "Service area population" means the number of people residing in housing units connected to distribution lines maintained by the municipal provider within the service area of the municipal provider which are being served as of July 1 of the applicable reporting year.

36. "Service connection" means a coupling of a municipal provider's distribution system and its customer's water system.

37. "Single family housing unit" means a detached dwelling, including mobile homes not in mobile home parks.

38. "Small provider" means a municipal provider serving less than 500 people and supplying less than 100 acre-feet of water during a calendar year.

39. "Total GPCD" means the total gallons of water per capita per day for all non-irrigation uses supplied by a municipal provider.

40. "Turf-related facility" means a school, park, cemetery, golf course or common area of a housing development that applies water from any source, including effluent, to a water-intensive landscaped area of ten or more acres, including, but not limited to, those facilities listed in Appendix 6-A.

41. "Turf-related watering" means the application of water from any source, including effluent, to a water-intensive landscaped area on the grounds of a turf-related facility.

42. "Untreated water" means water which is not treated or disinfected for drinking purposes.

43. "Water-intensive landscaped area" means, for the calendar year in question, an area of land that is watered with a permanent water application system and planted primarily with plants not listed in Appendix 6-B, and the total surface area of all bodies of water filled or refilled with water from any source, including effluent, that are an integral part of the landscaped area. Bodies of water used primarily of swimming purposes are not an integral part of a landscaped area.

5-102. Large Providers – Conservation Programs

A. Each large provider shall comply with the Total Gallons Per Capita Per Day ("GPCD") Program in accordance with Section 5-103, unless the provider has applied for and the Director has approved the provider for the Alternative Conservation Program or for designation as an institutional provider. If a large provider is accepted into the Alternative Conservation Program or is designated as an institutional provider, the provider shall continue to comply with its total GPCD requirement until the first compliance date assigned by the Director for the provider under the Alternative Conservation Program or as an institutional provider.
B. A large provider may apply for the Alternative Conservation Program as described in Section 5-104. If the Director approves the application, the large provider shall comply with the requirements of the Alternative Conservation Program.

C. A large provider may apply for designation as an institutional provider pursuant to Section 5-110. If the Director approves the application, the large provider shall comply with the institutional provider requirements assigned by the Director.

D. A large provider, including a small provider which has become a large provider, a merged large provider, a new large provider, an institutional provider and any other large provider, shall comply with individual user requirements, distribution system requirements, and applicable monitoring and reporting requirements as prescribed in Sections 5-112, 5-113 and 5-114.

E. A large untreated water provider shall comply with the requirements of Section 5-111.

5-103. Large Provider Total Gallons per Capita per Day Program

A. Total GPCD Requirement

Unless accepted into the Alternative Conservation Program or designated as an institutional provider:

1. For the calendar years 1992 through 1994, each existing large provider shall withdraw, divert or receive water from any source, including effluent only if it is recovered effluent, for non-irrigation use at or below its first intermediate total GPCD requirement as assigned in Appendix 5-A.

2. For the calendar years 1995 through 1999, each existing large provider shall withdraw, divert or receive water from any source, including effluent only if it is recovered effluent, for non-irrigation use at or below its second intermediate total GPCD requirement as assigned in Appendix 5-A.

3. For the calendar year 2000, and for each calendar year thereafter until the first compliance date for any substitute total GPCD requirement in the Third Management Plan, each existing large provider shall withdraw, divert or receive water from any source, including effluent only if it is recovered effluent, for non-irrigation use at or below its final total GPCD requirement as assigned in Appendix 5-A.

B. Compliance with Total GPCD Requirement

The Director shall determine if an existing large provider is in compliance with its total GPCD requirement for a calendar year pursuant to the flexibility account provisions in Section 5-105, using the large provider's service area population as calculated in Subsection C below.
C. Calculation of Large Provider's Service Area Population

The Director shall calculate the service area population of a large provider for each calendar year as follows, unless the Director has approved an alternative methodology for calculating the large provider's service area population prior to the calendar year in question:

1. Determine the number of single family housing units and multifamily housing units added to the large provider's distribution system between July 1 of the previous calendar year and July 1 of the calendar year in question, less any units removed from the system during that period.

2. Adjust these totals by the respective average annual vacancy rate for single family housing units and multifamily housing units as calculated from the most recent census or other approved source of information.

3. Multiply the adjusted number of single family housing units calculated in 2 above by the average number of persons per occupied single family housing unit as calculated in accordance with the most recent census or other approved source of information.

4. Multiply the adjusted number of multifamily housing units calculated in 2 above by the average number of persons per occupied multifamily housing unit as calculated in accordance with the most recent census or other approved source of information.

5. Add the results of 3 and 4 to the provider's respective previous year's new single family population and previous year's new multifamily population. The sums are the provider's new single family population and new multifamily population.

6. Add the provider's new single family population and new multifamily population to the provider's existing 1990 service area population. The sum is the large provider's service area population for the calendar year.

5-104. Alternative Conservation Program

A. Application for Alternative Conservation Program

Only large providers may apply for the Alternative Conservation Program. To be eligible for the Alternative Conservation Program, a large provider must submit an application on a form prescribed and furnished by the Director no later than the first compliance date for any total or residential GPCD requirement in the Third Management Plan. A large provider may apply for an administrative review pursuant to A.R.S. § 45-575 or for a variance pursuant to A.R.S. § 45-574 in addition to applying for the Alternative Conservation Program. The provider's completed application for the Alternative
Conservation Program must be approved by the provider's governing body, and must include the following:

1. A plan to limit the provider's overall groundwater withdrawals as required by Subsection B.1.a below.

2. An assessment and projection of water demand for the years 1990, 2000, 2010, 2020 and 2025 for the following water use sectors served by the large provider: single family residential uses, multifamily residential uses, commercial uses, industrial uses, turf-related facilities, government uses, construction uses, and any other uses.

3. A description and projection of the large provider's water supplies through the calendar year 2025, with a special emphasis on the large provider's water supplies for the calendar years 1990 through 2000.

4. A description and evaluation of the large provider's existing conservation programs.

5. A discussion of all conservation measures to be instituted by the large provider by the calendar year 2000, including an analysis and discussion of the implementation of conservation-oriented rate structuring. The discussion shall also include the large provider's conservation plans for: a) all existing non-residential customers, and b) all new non-residential customers using less than ten acre-feet of water per year.

6. The large provider's schedule for implementation of all conservation measures proposed in 5 above.

7. The large provider's water augmentation plan, including a schedule for the implementation of proposed water augmentation measures.

B. Alternative Conservation Program Requirements

1. Groundwater Use Limitation Requirement

   a. Requirement

   By a compliance date agreed upon by the Director and a large provider regulated under the Alternative Conservation Program, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan, the provider shall limit its annual use of groundwater withdrawn from within the Prescott Active Management Area to its largest legal groundwater use during any one calendar year from calendar year 1980 through calendar year 1989. The provider shall achieve this requirement by permanently extinguishing or causing to be permanently extinguished grandfathered rights to groundwater as described in paragraph b below, or by substituting non-groundwater supplies or groundwater withdrawn from outside the Prescott Active Management Area for groundwater withdrawn from within the Prescott Active Management Area, or by a combination of these methods.
b. Extermination of Groundwater Uses Associated with Grandfathered Rights

1) Applicability

Only irrigation grandfathered rights, Type 1 non-irrigation grandfathered rights and Type 2 non-irrigation grandfathered rights, as described in A.R.S. §§ 45-462 through 45-465, may be extinguished to meet the groundwater use limitation requirement. The provider shall not receive credit toward the achievement of the groundwater use limitation requirement for the extermination of either a Type 2 non-irrigation grandfathered right used for electrical energy generation or mineral extraction or processing purposes, or a Type 1 or Type 2 non-irrigation grandfathered right owned or previously owned by a municipal provider and used or previously used to serve the municipal provider's service area.

2) Annual Credits

The Director shall determine the amount of annual credit a provider obtains for extinguishing grandfathered rights to groundwater as follows:

a) For each irrigation grandfathered right extinguished or caused to be extinguished by the provider, the annual credit shall be the lesser of:

(1) The number of water duty acres in the farm to which the right is appurtenant multiplied by 3.0 acre-feet of water, less any debits, in acre-feet, in the farm's operating flexibility account at the time the right is extinguished, or

(2) The maximum annual groundwater allotment assigned for the irrigation grandfathered right for the calendar year in which it is extinguished, as calculated pursuant to A.R.S. § 45-465.B and Chapter 4 of the Second Management Plan, less any debits, in acre-feet, in the farm's operating flexibility account at the time the right is extinguished.

b) For each Type 1 non-irrigation grandfathered right or portion of such right extinguished or caused to be extinguished by the provider, the annual credit shall be the full amount, in acre-feet, of the certificated Type 1 non-irrigation grandfathered right, or a proportional amount thereof if only a portion of the right is extinguished.

c) For each Type 2 non-irrigation grandfathered right extinguished or caused to be extinguished by the provider, the annual credit shall be the full amount, in acre-feet, of the certificated Type 2 non-irrigation grandfathered right.
3) **Proof of Extinguishment**

In order for a large provider to obtain an annual credit for extinguishing or causing to be extinguished a grandfathered right to groundwater, the holder of the grandfathered right must deliver the Certificate of Grandfathered Right to the Director before the calendar year in which the credit will be used, request that the grandfathered right be extinguished, and direct that the large provider receive the annual credit. Only one large provider may receive annual credit for any one portion of a grandfathered right which has been extinguished.

c. **Compliance**

The Director shall determine whether a large provider is in compliance with its groundwater use limitation requirement in a calendar year as follows:

1) Add together the amount of annual credits received by the provider for extinguishing grandfathered rights to groundwater after January 1, 1990, as determined by the Director pursuant to Subsection B.1.b.2) above.

2) Calculate the total volume of groundwater, in acre-feet, which the large provider withdrew, diverted or received during the calendar year from within the Prescott Active Management Area for use within the provider's service area.

3) Subtract the sum calculated in 1) above from the volume calculated in 2) above.

4) A large provider is in compliance with its groundwater use limitation requirement if the difference calculated in 3) above is equal to or less than the largest volume of groundwater legally withdrawn, diverted or received by the provider from within the Prescott Active Management Area for use within its service area during any one calendar year between 1980 and 1989, inclusive. Annual credits which are not needed by the provider to comply with its groundwater use limitation requirement in one calendar year shall not carry forward to any following calendar year.

2. **Residential GPCD Requirement**

a. **Requirement**

Beginning with the calendar year agreed upon by the Director and a large provider regulated under the Alternative Conservation Program, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan the provider shall serve water, including effluent only if it is recovered effluent, for residential use during the calendar year at or below its residential GPCD requirement for the year. The Director shall calculate the residential GPCD requirement for a large provider regulated under the Alternative Conservation Program for each calendar year as follows:
1) Determine the provider's existing 1990 service area population.

2) Determine the provider's new single family population and new multifamily population pursuant to Section 5-103.C.1 through 5, unless the Director approves an alternative methodology for calculating the large provider's new single family population and new multifamily population prior to the calendar year.

3) Multiply the provider's existing 1990 service area population by the GPCD rate for existing residential users assigned to the provider for the calendar year in Appendix 5-B. Multiply the provider's new single family population by the GPCD rate for new single family users assigned to the provider for the calendar year in Appendix 5-B. Multiply the provider's new multifamily population by the GPCD rate for new multifamily users assigned to the provider for the calendar year in Appendix 5-B. Add the three products, and then divide the sum by the sum of the provider's existing 1990 service area population, new single family population and new multifamily population. The quotient is the provider's residential GPCD requirement for the given calendar year.

b. Compliance with Residential GPCD Requirement

The Director shall determine if a large provider regulated under the Alternative Conservation Program is in compliance with its residential GPCD requirement pursuant to the flexibility account provisions in Section 5-105.

3. Non-residential Requirement

a. Conditions for the Establishment of New Service

1) Except as provided for in 2) below, by a compliance date agreed upon by the Director and a large provider regulated under the Alternative Conservation Program, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan, the large provider shall implement conditions for the establishment of service requiring:

a) All new non-residential customers, other than construction users, with an estimated annual water demand of ten acre-feet or more to submit a conservation plan identifying the anticipated types of water uses and demonstrating the use of the latest commercially available conservation technologies for both interior and exterior water uses consistent with reasonable economic return. The provider shall review each plan and shall require the new non-residential customer to use the latest commercially available conservation technology for both interior and exterior water use consistent with reasonable economic return. Any new non-residential customer aggrieved by a conservation requirement imposed by a municipal provider hereunder may appeal to the Director for relief therefrom no later than 30 days after receiving notice of the requirement.
b) All model homes to use high efficiency outdoor watering systems where an outdoor watering system is present, and to install low water use interior plumbing.

c) All model homes to limit their water-intensive landscaped area to ten percent of the landscapable area and to locate any water-intensive landscaped area immediately adjacent to the model home.

d) New large landscape users, excluding motels and hotels, to limit their water-intensive landscaped area to no more than 20 percent of the landscapable area in excess of 10,000 square feet.

e) New large landscape users which are motels or hotels to limit their water-intensive landscaped area to no more than 20 percent of the landscapable area in excess of 20,000 square feet.

2) The Director may approve a substitute conservation requirement applicable to the same category of user described in 1)a) through e) above, if the requirement is as effective or more effective in limiting water use than the prescribed condition of new service.

3) If a user violates a condition of service or substitute conservation requirement as established pursuant to this Section, the provider shall take appropriate action to enforce the condition of service agreement or substitute conservation requirement.

b. Non-Residential User Conservation Programs

By a compliance date agreed upon by the Director and a provider regulated under the Alternative Conservation Program, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan, the provider shall implement conservation programs for all new non-residential customers using less than ten acre-feet of water per year and all existing non-residential customers, as described in the provider’s application for the Alternative Conservation Program approved by the Director.

5-105. Compliance with Total GPCD Requirement and Residential GPCD Requirement - Flexibility Account

A. Total GPCD Program Flexibility Account

The Director shall determine if a large provider regulated under the Total Gallons Per Capita Per Day Program is in compliance with its annual total GPCD requirement through the maintenance of a flexibility account for the provider which shall operate as follows:

1. Each large provider regulated under the Total Gallons Per Capita Per Day Program shall be assigned a flexibility account with a beginning balance of zero gallons of water.
2. At the end of each calendar year in which the large provider withdraws, diverts or receives groundwater for non-irrigation use, beginning with the calendar year 1992, or the calendar year in which the provider first becomes a large provider, whichever is later, the Director shall adjust the provider's flexibility account as follows:

a. Subtract the total gallons of water from any source, including effluent only if it is recovered effluent, withdrawn, diverted or received by the provider during the calendar year for non-irrigation use from the amount of water the provider could legally withdraw, divert or receive during the calendar year for non-irrigation use, as calculated in paragraph d below.

b. If the result in paragraph a above is negative, debit the flexibility account by this volume.

c. If the result in paragraph a above is positive, credit the flexibility account by this volume.

d. The amount of water which a large provider regulated under the Total Gallons Per Capita Per Day Program can legally withdraw, divert or receive for non-irrigation use during a calendar year is calculated by multiplying the provider's total GPCD requirement for the calendar year by the provider's service area population for the year as calculated pursuant to Section 5-103.C, and then multiplying the product by the number of days in the calendar year.

3. The balance in the provider's account to be carried forward to the following calendar year shall be determined pursuant to Subsection C below, and the provider's compliance status for the calendar year shall be determined pursuant to Subsection F below.

B. Alternative Conservation Program Flexibility Account

The Director shall determine if a large provider regulated under the Alternative Conservation Program is in compliance with its annual residential GPCD requirement through the maintenance of a flexibility account for the provider which shall operate as follows:

1. Each large provider regulated under the Alternative Conservation Program shall be assigned a flexibility account with a beginning balance to be calculated by the Director based on the ending balance in the provider's flexibility account while the provider was regulated under the Total Gallons Per Capita Per Day Program.

2. At the end of each calendar year in which the large provider delivers groundwater for residential use, beginning with the calendar year agreed upon by the Director and the provider, the Director shall adjust the provider's flexibility account balance as follows:

a. Subtract the total gallons of water from any source, including effluent only if it is recovered effluent, withdrawn, diverted or received and delivered by the provider for residential use during the calendar year.
from the amount of water the provider could legally withdraw, divert or receive and deliver for residential use during the calendar year, as calculated in paragraph d below.

b. If the result in paragraph a above is negative, debit the flexibility account by this volume.

c. If the result in paragraph a above is positive, credit the flexibility account by this volume.

d. The amount of water which a large provider regulated under the Alternative Conservation Program can legally withdraw, divert or receive and deliver for residential use during a calendar year is calculated by multiplying the provider's residential GPCD requirement for the calendar year by the provider's service area population for the year as calculated pursuant to Section 5-103.C, and then multiplying the product by the number of days in the calendar year.

C. Account Balance to be Carried Forward

The account balance existing in a large provider's flexibility account at the end of a calendar year, after the adjustment provided for in Subsection A or B is made, shall carry forward to the following calendar year subject to the following limitations:

1. If the account balance is a positive number and exceeds the maximum positive account balance allowed in the provider's flexibility account for the calendar year as calculated in Subsection D below, the balance carried forward shall equal the maximum positive account balance allowed in the provider's flexibility account for that year.

2. If the account balance is a negative number and exceeds the maximum negative account balance allowed in the provider's flexibility account for the calendar year as calculated in Subsection E below, the balance carried forward shall equal the maximum negative account balance allowed in the provider's flexibility account for that year or for the following calendar year, whichever is less.

D. Maximum Positive Account Balance

The maximum positive account balance allowed in the flexibility account of a large provider regulated under the Total Gallons Per Capita Per Day Program shall be calculated by multiplying the provider's service area population for the calendar year by a GPCD rate of 30, and then multiplying that product by the number of days in the calendar year. The maximum positive account balance allowed in the flexibility account of a large provider regulated under the Alternative Conservation Program shall be calculated by multiplying the provider's service area population for the calendar by a GPCD rate of 21, and then multiplying that product by the number of days in the calendar year.
E. **Maximum Negative Account Balance**

The maximum negative account balance allowed in the flexibility account of a large provider regulated under the Total Gallons Per Capita Per Day Program shall be calculated by multiplying the provider's service area population for the calendar by a GPCD rate of -10, and then multiplying that product by the number of days in the calendar year. The maximum negative account balance allowed in the flexibility account of a large provider regulated under the Alternative Conservation Program shall be calculated by multiplying the provider's service area population for the calendar year by a GPCD rate of -7, and then multiplying that product by the number of days in the calendar year.

F. **Compliance Status**

If an adjustment to a provider's flexibility account at the end of a calendar year as provided for in Subsection A or B causes the account to have a negative account balance which exceeds the maximum negative account balance allowed in the provider's flexibility account for the year as calculated in Subsection E, the provider shall be out of compliance for that calendar year in an amount of water equal to the difference between the provider's flexibility account balance and the maximum negative account balance allowed in the provider's account for the year.

5-106. **Conservation Requirements for Small Providers**

A. By January 1, 1992, or upon commencement of operation, whichever is later, and until the first compliance date for any substitute requirements in the Third Management Plan, each small provider shall adopt and implement a program to achieve the following goals:

1. Minimize waste of all water supplies.
2. Maximize efficiency in outdoor watering.
3. Encourage reuse of water supplies.
4. Reduce its total GPCD usage.

B. A small provider shall comply with all individual user requirements, distribution system requirements, and applicable monitoring and reporting requirements as prescribed in Sections 5-112, 5-113, and 5-114.

5-107. **Consolidation of Large Providers**

A. **Notification**

If two or more large providers consolidate, the merged provider shall notify the Department of the merger within 30 days after consolidation of water services.

B. **Regulation of Merged Provider**

Upon the consolidation of two large providers, the merged provider shall be regulated under the Total GPCD Program described in Section 5-103, unless the merged provider applies and is accepted for regulation under the Alternative
Conservation Program described in Section 5-104. For the year of merger, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan, a merged provider regulated under the Total GPCD Program shall comply with the Total GPCD Program requirements set forth in Section 5-103, except that the merged provider's first intermediate, second intermediate and final total GPCD requirements for the years designated in Section 5-103.A shall be calculated pursuant to Subsection C below. The merged provider may apply for the Alternative Conservation Program in accordance with the procedures established in Section 5-104.A. If the merged provider is accepted for regulation under the Alternative Conservation Program, its annual residential GPCD requirement shall be calculated pursuant to Subsection D below.

C. Calculation of Total GPCD Requirement

1. The Director shall calculate the merged provider's first intermediate total GPCD requirement as follows:

a. Multiply each former large provider's first intermediate total GPCD requirement as assigned in Appendix 5-A by each former large provider's respective service area population as of July 1 of the calendar year of merger, as calculated pursuant to Section 5-103.C.

b. Add the two products from paragraph a above, and then divide the sum by the sum of the former large providers' service area populations as of July 1 of the calendar year of merger. The quotient is the merged provider's first intermediate total GPCD requirement.

2. The Director shall calculate the merged provider's second intermediate total GPCD requirement as follows:

a. Multiply each former large provider's second intermediate total GPCD requirement as assigned in Appendix 5-A by each former large provider's respective service area population as of July 1 of the calendar year of merger, as calculated pursuant to Section 5-103.C.

b. Add the two products from paragraph a above, and then divide the sum by the sum of the former large providers' service area populations as of July 1 of the calendar year of merger. The quotient is the merged provider's second intermediate total GPCD requirement.

3. The Director shall calculate the merged provider's final total GPCD requirement as follows:

a. Multiply each former large provider's final total GPCD requirement as assigned in Appendix 5-A by each former large provider's respective service area population as of July 1 of the calendar year of merger, as calculated pursuant to Section 5-103.C.

b. Add the two products from paragraph a above, and then divide the sum by the sum of the former large providers' service area populations as of July 1 of the calendar year of merger. The quotient is the merged provider's final total GPCD requirement.
D. Calculation of Alternative Conservation Program Residential GPCD Requirement

If a merged provider is accepted for regulation under the Alternative Conservation Program, the Director shall calculate the merged provider's residential GPCD requirement for each calendar year as follows:

1. Multiply the merged provider's existing 1990 service area population by a residential GPCD rate of 71.

2. Multiply the merged provider's new single family population as calculated pursuant to Section 5-103.C.1 through 5 by a residential GPCD rate of 85.

3. Multiply the merged provider's new multifamily population as determined pursuant to Section 5-103.C.1 through 5 by the residential GPCD rate of 60.

4. Add the three products from 1, 2 and 3 above, and then divide the sum by the sum of the merged provider's exiting 1990 service area population, new single family population and new multifamily population. The quotient is the merged provider's residential GPCD requirement for the calendar year.

E. Compliance with Total GPCD Requirement and Residential GPCD Requirement

The Director shall determine if a merged provider regulated under the Total GPCD Program is in compliance with its total GPCD requirement, and whether a merged provider regulated under the Alternative Conservation Program is in compliance with its residential GPCD requirement, pursuant to the flexibility account provisions in Section 5-105. The beginning balance of the flexibility account of a merged provider regulated under the Total GPCD Program shall equal the sum of the balances in each former large provider's flexibility account at the time of the merger. For purposes of determining the merged provider's compliance with its total GPCD requirement for the year of the merger, the Director shall consider the total gallons of water from any source, including effluent only if it is recovered effluent, withdrawn, diverted or received by both former large providers and the merged provider for non-irrigation use during the calendar year.

5-108. Consolidation of a Large and Small Provider

A. Notification

If a large and small provider merge, the merged provider shall notify the Department of the merger 30 thirty days after consolidation of water services.

B. Regulation of Merged Provider

Upon the consolidation of a large and small provider, the merged provider shall be regulated under the Total GPCD Program described in Section 5-103, unless the merged provider applies and is accepted for regulation under the Alternative Conservation Program described in Section 5-104. For the year of
merger, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan, a merged provider regulated under the Total GPCD Program shall comply with the Total GPCD Program requirements set forth in Section 5-103, except that the merged provider's first intermediate, second intermediate and final total GPCD requirements for the calendar years designated in Section 5-103.A shall be calculated pursuant to Subsection C below. The merged provider may apply for regulation under the Alternative Conservation Program in accordance with the procedures established in Section 5-104.A. If the merged provider is accepted for regulation under the Alternative Conservation Program, its annual residential GPCD requirement shall be calculated pursuant to Subsection D below.

C. Calculation of Total GPCD Requirement

1. The Director shall calculate the merged provider's first intermediate total GPCD requirement as follows:

   a. Determine the total gallons of water from any source, including effluent only if it is recovered effluent, withdrawn, diverted or received by the former small provider for non-irrigation purposes during the calendar year prior to the merger.

   b. Determine the small provider's service area population as of July 1 of the calendar year prior to the merger pursuant to the method described in Section 5-103.C.

   c. Divide the total gallons of water withdrawn, diverted or received by the former small provider as calculated in paragraph a above by the former small provider's service area population for the calendar year prior to the merger as calculated in paragraph b above, and then divide the result by the number of days in the calendar year prior to the merger. The quotient is the former small provider's total GPCD usage for the calendar year prior to the merger.

   d. Multiply the former large provider's first intermediate total GPCD requirement as assigned in Appendix 5-A by the former large provider's service area population as of July 1 of the calendar year of the merger as determined pursuant to Section 5-103.C.

   e. Multiply the former small provider's total GPCD usage for the calendar year prior to the merger as calculated in paragraph c above by the former small provider's service area population as of July 1 of the calendar year of the merger as determined pursuant to Section 5-103.C.

   f. Add the products calculated in paragraphs d and e above, and then divide the sum by the sum of the former small and large providers' service area populations as of July 1 of the calendar year of the merger. The result is the merged provider's first intermediate total GPCD requirement.

2. The Director shall calculate the merged provider's second intermediate total GPCD requirement as follows:
a. Multiply the former large provider's second intermediate total GPCD requirement as assigned in Appendix 5-A by the former large provider's service area population as of July 1 of the calendar year of the merger.

b. Multiply the former small provider's total GPCD usage for the calendar year prior to the merger as calculated in 1.c above by the former small provider's service area population as of July 1 of the calendar year of the merger.

c. Add the products calculated in paragraphs a and b above, and then divide the sum by the sum of the former small and large providers' service area populations as of July 1 of the calendar year of the merger. The result is the merged provider's second intermediate total GPCD requirement.

3. The Director shall calculate the merged provider's final total GPCD requirement as follows:

a. Multiply the former large provider's final total GPCD requirement as assigned in Appendix 5-A by the former large provider's service area population as of July 1 of the calendar year of the merger.

b. Multiply the former small provider's total GPCD usage for the calendar year prior to the merger as calculated in 1.c above by the former small provider's service area population as of July 1 of the calendar year of the merger.

c. Add the products calculated in paragraphs a and b above, and then divide the sum by the sum of the former small and large providers' service area populations as of July 1 of the calendar year of the merger. The result is the merged provider's final total GPCD requirement.

D. Calculation of Alternative Conservation Program Residential GPCD Requirement

The Director shall determine the annual residential GPCD requirement for a merged provider accepted for regulation under the Alternative Conservation Program in a manner consistent with the determination of a merged provider's residential GPCD requirement under Section 5-107.D, but modified as to the former small provider consistent with the method for determining the merged provider's total GPCD requirement under Subsection C above.

E. Compliance with Total GPCD Requirement and Residential GPCD Requirement.

The Director shall determine if a merged provider regulated under the Total GPCD Program is in compliance with its total GPCD requirement, and whether a merged provider regulated under the Alternative Conservation Program is in compliance with its residential GPCD requirement, pursuant to the flexibility account provisions in Section 5-105. The beginning balance of the flexibility account of a merged provider regulated under the Total GPCD Program shall equal the balance in the former large provider's flexibility account at the time of the merger. For purposes of determining the merged provider's compliance with its total GPCD requirement for the year of the merger, the Director shall
consider the total gallons of water from any source, including effluent only if it is recovered effluent, withdrawn, diverted or received by the former large provider, the former small provider and the merged provider for non-irrigation use during the calendar year.

5-109. Conservation Requirements for New Large Providers

A. Total GPCD Program

1. A new large provider shall be assigned to the Total GPCD Program and shall comply with an annual total GPCD requirement of 120 no later than the sixth full calendar year after commencing service as a new large provider, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan.

2. The Director shall determine if a new large provider is in compliance with its annual total GPCD requirement pursuant to the flexibility account provisions in Section 5-105.

B. Alternative Conservation Program

1. Application

A new large provider may apply for regulation under the Alternative Conservation Program in accordance with Section 5-104.A.

2. Substitute Groundwater Use Limitation Requirement

A new large provider accepted into the Alternative Conservation Program is exempt from complying with the groundwater use limitation requirement as described in Section 5-104.B.1.a, but shall instead comply with the following groundwater use limitation requirement:

a. Requirement

Upon a compliance date agreed upon by the Director and a new large provider regulated under the Alternative Conservation Program, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan, the new large provider shall limit its annual use of groundwater withdrawn from within the Prescott Active Management Area to no more than 50 percent of the lesser of:

1) the total quantity of water from any source, including effluent only if it is recovered effluent, withdrawn, diverted or received by the provider during the calendar year, or

2) a quantity of water calculated by multiplying the provider's service area population for the calendar year, as determined pursuant to Section 5-103.C, by a GPCD rate of 120, and then multiplying that product by the number of days in the calendar year.
The provider shall achieve this requirement by permanently extinguishing or causing to be permanently extinguished grandfathered rights to groundwater pursuant to Section 5-104.B.1.b, or by substituting non-groundwater supplies or groundwater withdrawn from outside the Prescott Active Management Area for groundwater withdrawn from within the Prescott Active Management Area, or by a combination of these methods.

b. Compliance with Groundwater Use Limitation Requirement

The Director shall determine whether a new large provider is in compliance with its groundwater use limitation requirement in a calendar year as follows:

1) Add together the amount of annual credits received by the provider for extinguishing grandfathered rights to groundwater, as determined by the Director pursuant to Section 5-104.B.1.b.2).

2) Calculate the total volume of groundwater, in acre-feet, which the new large provider withdrew, diverted or received during the calendar year from within the Prescott Active Management Area for use within the provider's service area.

3) Subtract the sum calculated in 1) above from the volume calculated in 2) above.

4) A new large provider is in compliance with its groundwater use limitation requirement if the difference calculated in 3) above is no more than 50 percent of the lesser of:

   a) the total quantity of water from any source, including effluent only if it is recovered effluent, withdrawn, diverted or received by the provider during the calendar year, or

   b) a quantity of water calculated by multiplying the provider's service area population for the calendar year, as determined pursuant to Section 5-103.C, by a GPCD rate of 120, and then multiplying that product by the number of days in the calendar year.

3. Annual Residential GPCD Requirement

a. Requirement

A new large provider regulated under the Alternative Conservation Program shall comply with an annual residential GPCD requirement for each calendar year as described in Section 5-104.B.2.a.

b. Calculation of Annual Residential GPCD Requirement

The Director shall calculate the annual residential GPCD requirement for a new large provider regulated under the Alternative Conservation Program for each calendar year as follows:
1) Determine the large provider's new single family population and new multifamily population in accordance with Section 5-103.C.1 through 5, unless the Director approves an alternative methodology for calculating the large provider's new single family population and new multifamily population prior to the calendar year in question.

2) Multiply the provider's new single family population by the residential GPCD rate of 85. Multiply the provider's new multifamily population by the residential GPCD rate of 60. Add the two products, and then divide the sum by the sum of the provider's new single family population and new multifamily population. The quotient is the new large provider's residential GPCD requirement for the given calendar year.

c. Compliance with Annual Residential GPCD Requirement

The Director shall determine if a new large provider regulated under the Alternative Conservation Program is in compliance with its annual residential GPCD requirement pursuant the flexibility account provisions in Section 5-105.

d. Conditions for the Establishment of New Service

A new large provider shall impose conditions for the establishment of service in accordance with the provisions of Section 5-104.B.3.a.

e. New Non-residential Conservation Programs

A new large provider shall implement conservation programs for its non-residential customers using less than ten acre-feet of water per year in accordance with Section 5-104.B.3.b.

5-110. Conservation Requirements for Institutional Providers

A. The First Management Plan category of special provider is eliminated for the Second Management Period.

B. If a large provider operates primarily for the purpose of serving water to institutions, including prisons, hospitals, military installations, airparks and schools, and supplies or expects to supply more than 90 percent of its total non-irrigation deliveries to one or more of these institutions, the provider may apply to the Director at any time after January 1, 1990 for designation as an institutional provider. The Director may deem a facility other than one of those listed above as an institution if its water use characteristics are similar to the types of institutions listed above.

C. A large provider which was a special provider under the First Management Plan, and which wishes to be designated as an institutional provider under the Second Management Plan, may submit an application to the Director for designation as an institutional provider. The Director will evaluate the application in accordance with Subsection B above.
D. A large provider applying for designation as an institutional provider shall apply on a form prescribed and furnished by the Director. The large provider shall provide information of sufficient detail to allow the Director to evaluate the provider's conservation potential and to establish appropriate conservation requirements for the provider.

E. The Director may approve the application of a large provider to be designated as an institutional provider if the provider meets the criteria in Subsection B above, and does not qualify for the Alternative Conservation Program.

F. Each municipal provider designated as an institutional provider shall be assigned mandatory conservation requirements and monitoring and reporting requirements, including a maximum residential GPCD requirement and appropriate conservation measures for non-residential uses. The institutional provider shall comply with the assigned conservation requirements by the date specified by the Director, and shall remain in compliance with those requirements for each calendar year thereafter until the first compliance date for any substitute requirements in the Third Management Plan.

5-111. Conservation Requirements for Large Untreated Water Providers

A. GPCD Requirement

For the calendar year 1995, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan, a large untreated water provider shall serve no more water from any source, including effluent, than its GPCD requirement for the calendar year as calculated in Subsection B below.

B. Calculation of GPCD Requirement

The Director shall calculate a large untreated water provider's GPCD requirement for a calendar year as follows:

1. Determine the number of gross acres of land to which the large untreated water provider delivers water during the calendar year. Gross acres do not include those acres regulated under Subsection D below.

2. Multiply the number of gross acres determined in 1 above by an average annual application rate of 4.0 acre-feet of water per gross acre. Multiply the product times 325,851 gallons per acre-foot, and then divide that product by the number of days in the calendar year. Divide the quotient by the population served by the provider. The result is the provider's GPCD requirement for the calendar year.

C. Compliance

The Director shall calculate the GPCD usage of a large untreated water provider for each calendar year by dividing the total gallons of water from any source, including effluent, that the provider served at its delivery points during the calendar year by the population served by the provider, and then dividing
the quotient by the number of days in the calendar year. A large untreated water provider is in compliance with its GPCD requirement for a calendar year if:

1. The provider's GPCD usage for that calendar year does not exceed the provider's GPCD requirement for the calendar year as calculated in Subsection B above, or,

2. The provider's three-year average GPCD usage for that calendar year and the two preceding calendar years is equal to or less than the three-year average GPCD requirement for that calendar year and the two preceding calendar years.

D. Individual User Requirements

For the calendar year 1995, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan, a large untreated water provider shall comply with the individual user requirements described in Section 5-112.

E. Distribution System Requirements

By January 1, 2000, and continuing thereafter until the first compliance date for any substitute requirement in the Third Management Plan, a large untreated water provider shall either:

1. Line all canals used to deliver water to the provider's delivery points with a material that allows no more lost water than a well-maintained concrete lining, and maintain such lining to minimize its lost and unaccounted for water, or

2. Operate and maintain its distribution system to reduce lost and unaccounted for water at or below ten percent of the total quantity of water from any source, including effluent, withdrawn, diverted or received by the provider on an annual or three-year average basis.

F. Monitoring and Reporting Requirements

For the calendar year 1992, and for each calendar year thereafter until the the first compliance date for any substitute requirement in the Third Management Plan, a large untreated water provider shall report in its annual report required by A.R.S. § 345-632:

1. The total quantity of water by source, including effluent, withdrawn, diverted or received by the provider during the reporting year, as separately measured at each delivery point on the provider's distribution system with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.

2. The population served by the provider during the calendar year and the number of gross acres to which it delivered water during the year.
3. The provider's total quantity of lost and unaccounted for water during the calendar year.

4. The percentage of the total quantity of water from any source, including effluent, withdrawn, diverted or received by the provider during the calendar year that is lost and unaccounted for water.

5-112. Individual User Requirements for Municipal Providers and Individual Users

A. Individual User Requirements

For the calendar year 1992, or upon commencement of service of water, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan, the municipal provider or individual user responsible for compliance with the individual user requirements pursuant to Subsection B below shall:

1. Serve water to, or use water within, a turf related facility only in accordance with Sections 6-202 through 6-205 of the Industrial Chapter of the Second Management Plan, and shall comply with the monitoring and reporting requirements set forth in Section 6-206 of the Industrial Chapter, as though the individual user were an industrial user. The person responsible for compliance shall also comply with the requirements contained in Sections 6-102, 6-105 and 6-106 of the Industrial Chapter, if applicable, as though the individual user were an industrial user.

2. Serve or use water for the purpose of watering landscaping plants planted on or after January 1, 1987 within any publicly owned right-of-way of a highway, street, road, sidewalk, curb or shoulder which is used for travel in any ordinary mode, including pedestrian travel, only if the plants are listed in Appendix 6-B. The Director may waive this requirement upon request from the municipal provider or individual user if a waiver of this requirement is in the public interest. This requirement does not apply to any portion of a residential lot that extends into a publicly owned right-of-way.

3. Serve water to, or use water within, a new large cooling user only if the facility complies with all applicable conservation requirements contained in Sections 6-102, 6-103 and 6-104 of the Industrial Chapter of the Second Management Plan as though the facility were an industrial user. The person responsible for compliance shall also comply with the applicable monitoring and reporting requirements contained in Section 6-106 of the Industrial Chapter as though the individual user were an industrial user.

B. Responsibility for Compliance with Individual User Requirements

1. A municipal provider shall be responsible for compliance with an individual user requirement for an existing individual user unless the municipal provider has identified the existing individual user to the Director on a form provided by the Department and received by the Director no later than 90 days before the adoption of the Second Management Plan, as provided in A.R.S. § 45-565.B.1.
2. A municipal provider shall be responsible for compliance with an individual user requirement for a new individual user unless the municipal provider identifies the new individual user to the Director on a form provided by the Department and received by the Director either:

   a. within 90 days after the municipal provider begins serving water to the new individual user, or

   b. at least 90 days before the end of the calendar year preceding the first calendar year in which the municipal provider is not responsible for compliance with the individual user requirement for the individual user.

3. An existing individual user that has been given written notice of an individual user requirement by the Director shall be responsible for compliance with the individual user requirement beginning January 1, 1992.

4. A new individual user that has been given written notice of an individual user requirement by the Director shall be responsible for compliance with the individual user requirement beginning with the calendar year in which the individual user received the written notice from the Director if the municipal provider that serves the individual user identified the user to the Director as provided for in 2.a above. If the municipal provider that serves the new individual user identified the user to the Director as provided for in 2.b above, the new individual user shall comply with the individual user requirement beginning January 1 of the calendar year following the calendar year in which the user received the written notice from the Director.

5. For purposes of this Subsection only, the term "new individual user" shall mean an individual user to whom a municipal provider begins serving water after the adoption of the Second Management Plan.

C. Notification of New Individual User by Municipal Provider

Beginning January 1, 1992, and continuing thereafter until the first compliance date for any substitute requirement in the Third Management Plan, a municipal provider shall notify a new individual user in writing of its individual user requirements as set forth in Subsection A above before commencement of service of water to the individual user.

D. Individual Users that are Turf-Related Facilities - 1990 and 1991

For the calendar years 1990 and 1991, an individual user shall not use water within a turf-related facility in an amount which exceeds the facility's maximum annual water allotment for the year as calculated pursuant to Appendix 5-C.
5-113. Conservation Requirements for Municipal Distribution Systems

For the calendar year 2000, or the calendar year in which the provider commences operation, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan:

1. A large provider shall not operate a distribution system in a manner such that lost and unaccounted for water exceeds ten percent of the total quantity of water from any source, including effluent only if it is recovered effluent, withdrawn, diverted or received by the large provider on an annual or three-year average basis.

2. A small provider shall not operate its distribution system in a manner such that lost and unaccounted for water exceeds 15 percent of the total quantity of water from any source, including effluent only if it is recovered effluent, withdrawn, diverted or received by the small provider on an annual or three-year average basis.

5-114. Monitoring and Reporting Requirements for Municipal Providers and Individual Users

A. Except as provided for in Subsection B below, for the calendar year 1992, or the calendar year in which the provider commences operation, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan:

1. A large provider shall separately measure and report in its annual reports required by A.R.S. §§ 45-468 and 45-632, the total quantity of water from any source, including effluent, delivered each month for: a) irrigation use; b) residential uses by category, including single family and multifamily; and c) non-residential uses by category, including turf-related facility uses, commercial uses, industrial uses, government uses, construction uses and

2. A municipal provider shall report the following in its annual report required by A.R.S. § 45-632:
   a. The total quantity of water from any source, including effluent only if it is recovered effluent, withdrawn, diverted or received by the provider for non-irrigation use during the reporting year, as separately measured with a measuring device in accordance with 5 below. If the municipal provider withdraws, diverts or receives water during the reporting year for both irrigation and non-irrigation use, the amount of water withdrawn, diverted or received by the provider for non-irrigation use shall be proportional to the amount of water delivered by the provider for non-irrigation use during the reporting year.
   b. The total quantity of water from any source, including effluent, withdrawn, diverted or received by the provider for irrigation use during the reporting year.
c. The number of single family housing units added to the provider's service area from July 1 of the previous calendar year to July 1 of the reporting year.

d. The number of multifamily housing units added to the provider's service area from July 1 of the previous calendar year to July 1 of the reporting year.

e. The total number of single family housing units and multifamily housing units served by the provider as of July 1, 1990.

f. The number of single family housing units and the number of multifamily housing units added to the provider's service area between July 1, 1990 and July 1 of the reporting year.

g. The provider's total quantity of lost and unaccounted for water during the calendar year.

h. The percentage of the total quantity of water from any source, including effluent only if it is recovered effluent, withdrawn, diverted or received by the provider during the calendar year that is lost and unaccounted for water.

3. No later than March 31 of each year, a large provider regulated under the Alternative Conservation Program shall file with the Director, for the previous calendar year:

   a. a status report describing progress in implementing the provider's programs proposed in its application, specifically including the provider's proposed conservation plan and augmentation plan.

   b. copies of all conservation plans the provider has received from customers using more than ten acre-feet of water.

   c. a list of new non-residential customers, excluding construction users, with an annual water use exceeding ten acre-feet.

4. A large provider shall meter water deliveries to all service connections on its municipal distribution system, except connections to fire services, dwelling units in individual multifamily units, mobile homes in a mobile home park with a master meter, and construction users.

5. A municipal provider shall make all water use measurements using measuring devices in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.

6. An individual user shall meet the monitoring and reporting requirements prescribed in the Industrial Chapter as though the individual user were an industrial user.

B. For the calendar years 1990 and 1991, an individual user that is a turf-related facility shall comply with the monitoring and reporting requirements prescribed in Appendix 5-C.
INDUSTRIAL
CONSERVATION PROGRAM
A. INTRODUCTION

This chapter presents the Department’s conservation program for industrial water users that do not receive water from a city, town, or private water company. There are few industrial water users in the Prescott AMA that do not receive water from a municipal provider. However, all non-irrigation water users meeting the qualifications in their use sector are subject to the guidelines and requirements set forth in this chapter.

B. PROGRAM SUMMARY

The Department’s studies indicate that there is significant water conservation potential in several major water-using industries in the Active Management Areas. General industrial use requirements apply to water use characteristics common to all industrial users and include a diverse collection of industries that are not addressed in the four primary categories. The Department has set specific conservation requirements for the second management period for the following industrial water use categories (listed in the order they appear in this chapter):

- All Industrial Users
- Turf-Related Facilities
- Dairy Operations
- Cattle Feedlot Operations
- Sand and Gravel Facilities

Although the turf-related facilities sector is the only industrial sector currently operating in the Prescott AMA, conservation requirements for turf-related facilities and other industrial users are discussed in this chapter. Requirements for dairies, cattle feedlots, and sand and gravel facilities are applicable if a new industrial use in these sectors occurs in the AMA during the second management period.

C. STATUTORY PROVISIONS

The Groundwater Code requires the management plan to include a program for industrial and municipal conservation. The Department must:

"Establish additional conservation requirements for all non-irrigation uses of groundwater to be achieved by the end of the second management period and may establish intermediate conservation requirements to be achieved at specified intervals during the second management period. For industrial uses including industrial uses within the exterior boundaries of the service area of a city, town, private water company or irrigation district, the program shall require the use of or establish conservation requirements based on the use of the latest commercially available conservation technology consistent with reasonable economic return." (A.R.S. § 45-565.A.2)

The Code defines an industrial use of water as "a non-irrigation use of water not supplied by a city, town or private water company, including animal industry use and expanded animal industry use." (A.R.S. § 45-561.2) Industrial facilities supplied by their own wells are classified as industrial users.

D. CHARACTERISTICS OF INDUSTRIAL WATER USE IN THE PRESCOTT AMA

Persons regulated as industrial users withdraw or receive groundwater pursuant to a Type 1 or Type 2 non-irrigation grandfathered right, or a groundwater withdrawal permit. Groundwater supplied to a commercial
or industrial user by a city, town, or private water company is a "municipal" rather than "industrial" use. The Municipal Conservation Program in Chapter 5, however, establishes conservation requirements for turf facilities and other classes of non-residential users served by municipal providers that are similar in nature to those contained in this chapter. In the Prescott AMA, these types of industrial users are the exception.

Table 6-A shows 1985 allotments and estimated or reported water use for industrial users in the Prescott AMA. In 1985, 1,480 acre-feet of water was used by these use sectors. Table 6-A does not identify the many industrial water users which receive water from the Active Management Area's large municipal providers and are not classified as industrial users. These water users are typically described as "individual users" served by municipal providers. In 1985, commercial and industrial water use in the city of Prescott and Shamrock Water Company service areas accounted for approximately 650 acre-feet of water. Water use was primarily related to industrial processes, sanitary and kitchen uses, cooling, construction, nurseries, institutional facilities, landscaping, and stock watering.

E. **ALL INDUSTRIAL USERS**

This section outlines conservation requirements for all industrial water users. Many of the industrial facilities regulated by this section are the same types of water users as those regulated as non-residential users on municipal systems. The requirements detailed in this section apply whether or not an industrial facility is regulated under subsequent sections of this chapter. An industrial user, therefore, may have to comply with the requirements in more than one section of this chapter. For example, a dairy operation which has a new landscaped area exceeding 10,000 square feet would need to meet the landscaping requirements in this section, and would be subject to regulation under Section G of this chapter which deals specifically with dairy operations. This section also applies to certain facilities which, because of their small size, are excluded from regulation under the requirements detailed for specific industrial sectors.

1. **Water Use Characteristics**

Conservation requirements in this section are divided into three categories: 1) industrial uses, 2) cooling towers, and 3) landscaping. Industrial water use, other than that regulated under subsequent sections of this chapter, accounts for a small percentage of the total groundwater withdrawals by industries in the Prescott AMA. This water use is primarily related to cooling, landscaping, sanitary and kitchen requirements, and water used in industrial processes. Many types of commercial and manufacturing water uses are included in this category, as well as construction uses, nurseries, stockwatering operations, and institutional uses such as hospitals and schools.

2. **Conservation Potential**

Because of the similarities between most "industrial users" and non-residential users on municipal systems, the two categories were combined for an analysis of conservation potential. The Department inventoried all non-residential water users who received more than 20 acre-feet from municipal systems and analyzed their conservation potential. All non-irrigation Grandfathered Rights and groundwater withdrawal permits were also reviewed. From this analysis, the Department identified the following
TABLE 6-A

INDUSTRIAL WATER USE IN THE PRESCOTT AMA - 1985

(acre-feet/year)

<table>
<thead>
<tr>
<th>Turf-Related Facilities</th>
<th>Allotment</th>
<th>Estimated Water Use</th>
</tr>
</thead>
<tbody>
<tr>
<td>• Served by a municipal provider</td>
<td>1,468</td>
<td>425</td>
</tr>
<tr>
<td>• Withdrawal permit</td>
<td>469</td>
<td>312</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other Industrial Users</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>• Type 1 grandfathered right</td>
<td>217</td>
</tr>
<tr>
<td>• Type 2 grandfathered right</td>
<td>3,935</td>
</tr>
</tbody>
</table>

| Totals                   | 6,089    | 1,480 |

general water uses for further study: heating and cooling, sanitary and kitchen facilities, and commercial landscaping. Most of the water used by large nonresidential users, such as health care facilities, resorts, restaurants, office buildings, shopping malls, laundries, and bottling plants, is included in these categories. In addition, the Department identified the following specific industries for further study: dairy operations, electronics plants, and turf-related facilities. Turf-related facilities and dairy operations are addressed in Sections F and G, respectively, of this chapter.

a. Identification of Conservation Potential

The Department contracted with consultants to describe water use patterns and to determine the conservation potential in the landscaping, heating and cooling, and sanitary and kitchen sectors. Site visits, phone surveys, and an extensive literature review were conducted to develop a detailed assessment of water use patterns. A report on the latest commercially available conservation technologies and practices for each sector, including a feasibility assessment for each practice, was also prepared.

From this information, the Department determined that significant conservation potential exists in the cooling and commercial landscaping sectors. The conservation potential associated with sanitary and kitchen uses appeared to be limited to the use of low-flow plumbing fixtures.

In the electronics sector, most of the potential water savings associated with electronics plants is associated with cooling and landscaping conservation techniques.

b. Conservation Techniques

Water use patterns for industries are extremely diverse, and conservation potential varies depending on the type of use. Certain water-using activities, however, are common to many industries and can be easily managed to ensure efficient water use. The Department's evaluation of industrial water uses indicates that appreciable water
conservation can be achieved through careful management of cooling towers and landscaped areas. The following are recommended techniques for achieving water conservation in these applications:

- Reusing or recycling of water
- Avoiding single pass-through of water used for cooling, unless the water is reused
- Using low-flow plumbing devices
- Conducting employee water conservation education programs
- Developing site-specific water conservation plans for large facilities

1) Cooling Towers

Cooling towers are used for space cooling in large malls, office buildings, institutions, and manufacturing operations. Water conservation opportunities associated with cooling tower operations are limited to reducing the amount of water which is "blown down" (replaced) from the tower to prevent the accumulation of minerals and other contaminants, such as calcium and silica, in the recirculating water. Water is periodically replaced so that contaminants are maintained at tolerable levels and damaging corrosion, scale, and fouling are avoided.

Water losses from blowdown are normally a direct function of the concentration ratio. The amount of blowdown decreases as the concentration ratio increases. However, replacement, or "make-up", water sources in Arizona are relatively high in total dissolved solids and hardness, both of which contribute to scale formation. When comparing the water use efficiency in cooling towers, cycles of concentration should not be the sole criterion because the quality of replacement water varies.

The water use efficiency of most cooling towers could be increased by improved management. The installation of flow meters for replacement water and blowdown enables tower operators to adjust tower water consumption with tower performance. It should be noted that meters are not successful without continual operator attention. An additional advantage of metering replacement and blowdown water is the ability to determine water losses due to evaporation.

Many cooling tower recirculating water systems release blowdown water automatically when the concentration of total dissolved solids in the water reaches a pre-set level (this is known as "batch process"). In many cases, significant volumes of water are lost using this type of system. An alternative is to provide continuous blowdown and replacement flows, thus constantly maintaining the water quality at the desired level. The cost of upgrading to this type of system is modest for most cooling towers. It has been estimated that 10 to 20 percent of the total water used in large cooling towers can be saved by increasing the concentration ratio and converting to a continuous feed replacement/blowdown process.

2) Landscaped Areas

Water use associated with landscaping is directly related to the size of the landscaped area, the types of vegetation, and the efficiency of the irrigation method used. Although low water use residential landscaping is common in Prescott, significant water use is associated with the landscaping of large commercial and institutional facilities.
A variety of sources were used to assess the water savings associated with water-efficient landscaping designs. A consultant was hired to determine the water savings and costs associated with low water use design alternatives. Based on the results of the study, alternative landscapes were designed to achieve a visual effect similar to the effect achieved using standard water-intensive designs.

The study indicated that significant reductions in water use can be achieved using the following techniques:

- Improving water application efficiency through proper irrigation scheduling, use of more sophisticated control systems, conversion to drip irrigation, and grouping plants with similar water needs

- Reducing the size and perimeter of turfed areas and limiting their placement to functional use areas and areas of high visual impact

- Using drought-resistant plant species adapted to the desert

- Using proper planting, fertilization, and maintenance techniques

- Grading sites to direct rainfall into planted areas

- Avoiding the use of water-intensive plants within public rights-of-way and at rest areas

Attractive landscapes can be maintained solely with rainfall, resulting in a 100 percent water savings. However, a lush, colorful, low water use landscape, watered by a permanent drip irrigation system, is considered more desirable for commercial and industrial landscape applications. This type of landscape results in water savings of 50 to 75 percent of the amount used by a well-maintained turf (water-intensive) landscape.
3. Conservation Requirements for All Industrial Users

6-101. 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 6-101 through 6-106 of this Chapter, unless the context otherwise requires, shall have the following meanings:

1. "Industrial process water" means water which is used by an industrial user in the creation or manufacture of a product, including water used for sanitary waste disposal, but not water used for cooling and cleaning purposes.

2. "Industrial use" means a non-irrigation use of water not supplied by a city, town or private water company, including animal industry use and expanded animal industry use.

3. "Industrial user" means a person who uses water for industrial uses. Industrial users include new large landscape users and new large cooling users.

4. "Landscapable area" means the entire area of the lot less any areas covered by structures, parking lots or roads.

5. "Large-scale power plant" means an industrial user that produces or is designed to produce more than 25 megawatts of electricity.


7. "New large cooling user" means an industrial facility with a total cooling tower capacity in excess of 250 tons that begins operation after January 1, 1990. A new large cooling user does not include a large-scale power plant that utilizes cooling towers for dissipating heat.

8. "New large landscape user" means a non-residential facility that applies water to a water-intensive landscaped area in excess of 10,000 square feet which either has landscaping planted and maintained after January 1, 1990 or bodies of water, other than bodies of water used primarily for swimming purposes, filled and maintained after January 1, 1990, or both. Schools, parks, cemeteries, golf courses and common areas of housing developments are excluded from this definition.

9. "Single pass cooling or heating" means the use of water without recirculation to increase or decrease the temperature of equipment, a stored liquid or a confined air space.

10. "Water-intensive landscaped area" means, for the calendar year in question, an area of land that is watered with a permanent water application system and planted primarily with plants not listed in Appendix 5-D, and the total water surface area of all bodies of water filled or refilled with water from
6-102. Conservation Requirements for All Industrial Users

By January 1, 1992, or upon commencement of operation, whichever occurs later, and continuing thereafter until the first compliance date for any substitute requirement in the Third Management Plan, each industrial user shall:

1. Avoid waste; use only the amount of water from any source, including effluent, reasonably required for each industrial use; and make diligent efforts to recycle water;

2. Not use water for non-residential single-pass cooling or heating purposes unless the water is reused for other purposes; and

3. Use low-flow plumbing devices to the maximum extent feasible.

6-103. Additional Conservation Requirements for New Industrial Users

A. All new industrial users with an annual industrial use exceeding 100 acre-feet shall submit a water conservation plan to the Director in which the new industrial user shall:

1. Specify the level of water conservation that can be achieved assuming the use of the latest commercially available conservation technology consistent with reasonable economic return;

2. Identify water uses and conservation opportunities within the facility, addressing water used for the following categories as appropriate: landscaping; space cooling; process-related water use, including recycling; and sanitary and kitchen uses;

3. Describe an ongoing water conservation education program for employees; and

4. Include an implementation schedule.

B. If a new industrial user is required to submit a conservation plan under another section of this Chapter, the new industrial user may combine that plan with the plan required in Subsection A above and submit a single conservation plan to the Director.

6-104. Additional Conservation Requirements for New Large Cooling Users

A. Conservation Requirements

For the first calendar year after commencing operation, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan, a new large cooling user shall:
1. Achieve a ratio of concentration that results in blowdown water being discharged at an average annual minimum of 2000 milligrams per liter of total dissolved solids (mg/l TDS);

2. Use non-groundwater make-up water sources where available and of suitable quality; and

3. Develop and implement a water conservation plan which maximizes efficiency of water use at the facility through conservation techniques and management practices.

B. Exemption

The requirements listed in Subsection A.1 and 2 above are waived if the facility reuses 100 percent of its blowdown water.

6-105. Additional Conservation Requirements for New Large Landscape Users

For the first calendar year of operation, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan, all new large landscape users, except hotels and motels, shall limit their water-intensive landscaped area to no more than 20 percent of the landscapable area in excess of 10,000 square feet. New large landscape users that are hotels or motels shall limit their water-intensive landscaped area to no more than 20 percent of the landscapable area in excess of 20,000 square feet. This requirement is waived if the new large landscape user applies water which is 100 percent wastewater generated at the facility.

6-106. Monitoring and Reporting Requirements

A. New Large Cooling Users

Beginning with the calendar year 1992, or the calendar year in which operations commence, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan, each new large cooling user, except as provided for in Subsection C below, shall measure with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq., and report in its annual report required by A.R.S. § 45-632, the following:

1. The quantity of water which was used for replacement ("make-up") water on a monthly basis during the reporting year;

2. The quantity of water which was blown down on a monthly basis during the reporting year; and

3. The average milligrams per liter of total dissolved solids in replacement and blowdown water on a monthly basis during the reporting year.
B. All Industrial Users

Beginning with the calendar year 1992, or the calendar year in which operations commence, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan, each industrial user, including a new large landscape user and a new large cooling user, shall, except as provided for in Subsection C below, report the following information in its annual report required by A.R.S. § 45-632:

1. The quantity of water from any source, including effluent, used for industrial process purposes during the reporting year, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.

2. The quantity of water from any source, including effluent, used for landscape watering purposes during the reporting year, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.

3. The quantity of water from any source, including effluent, used during the reporting year for purposes other than the purposes listed in 1 and 2 above, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.

4. An estimate of the quantity of wastewater generated during the reporting year.

5. An estimate of the quantity of wastewater recycled during the reporting year.

6. A description of the primary purposes for which water from any source, including effluent, is used.

C. Exemption

An industrial user that uses water pursuant to a Type 1 or Type 2 non-irrigation grandfathered right which is in the amount of ten acre-feet or less per year, or a groundwater withdrawal permit which is in the amount of ten acre-feet or less per year, is exempt from the requirements set forth in Subsections A and B above, unless the industrial user holds more than one such right or permit in the aggregate amount of more than ten acre-feet per year and withdraws more than ten acre-feet of water during the calendar year pursuant to those rights or permits from a single well.
F. TURF-RELATED FACILITIES

Turf-related facilities include municipal and industrial users applying water to ten or more acres of water-intensive landscaping in the following categories: golf courses, parks and recreational facilities, school grounds, cemeteries, and common areas of housing developments.

Turf watering is considered to be a non-irrigation use because, "irrigation," as defined in the Code, includes only water used to produce crops for sale or consumption.

Turf-related facilities regulated in this chapter obtain their water pursuant to grandfathered rights or permits. In addition, a significant proportion of turf facilities are served by municipal water providers. Consequently, conservation requirements for turf-related facilities set in this chapter are also applicable to facilities served by municipal providers through the provisions of the Municipal Conservation Program (Chapter 5).

There is a direct relationship between the number of turf acres and the water use of a facility. Turf-related facilities in the Prescott AMA contain a total of approximately 300 acres of turf. This number is projected to increase significantly during the second management period because several new 18-hole golf courses are proposed.

Lakes are an integral part of some turf-related facilities and may include ponds and other water features. There are approximately 7 surface acres of lakes at the two Prescott AMA golf courses. Water requirements for lakes are high because evaporation from water bodies averages 5.5 acre-feet per acre per year. Unlined or improperly sealed lakes may have significantly higher water requirements because large quantities of water may be lost through seepage.

The term "water use efficiency" refers to the relationship between plant water needs and the amount actually applied. Turf-related watering is normally expressed in terms of acre-feet per acre per year. The variety of grass most commonly used in the Active Management Area is bluegrass. Bluegrass has a net irrigation requirement consumptive use minus effective rainfall) of 3.65
acre-feet per acre per year. The recommended application rate for bluegrass in the Prescott area is 4.9 acre-feet per acre, assuming a 75 percent application efficiency.

The Department has assumed the use of the latest commercially available and economically feasible conservation technologies and practices in setting the application rates for turf-related facilities, including: 1) the use of weather-based irrigation scheduling and water budgeting, 2) accurate, well-designed sprinkler heads and computerized control mechanisms, and 3) PVC lake liners.

In developing the conservation requirements for this plan, the Department has recognized that all turf-related facilities are faced with budget, soil, and weather constraints. Each facility type, however, has distinct characteristics affecting water use patterns and conservation potential. Water use efficiency may vary among facilities with similar acreage and vegetation due to differences in facility use, water application systems, and management practices. The following section summarizes the conditions that have been considered for each type of turf-related facility.

b. Types of Turf-Related Facilities

1) Golf Courses

As of January 1, 1991, there were two 18-hole golf courses in the Prescott AMA. Prescott's Antelope Hills golf course facility, including a driving range and a 3.7 acre lake, is approximately 120 acres. The course at the Prescott Country Club is 142 acres, including three lakes with a total surface area of approximately 3 acres. Both facilities use bluegrass turf, which has a growing season of March through December. However, both courses are played year-round.

Construction of two new golf courses in the Prescott AMA has begun. Plans for two additional 18-hole golf courses have been discussed. Locations of these proposed turf-related facilities are uncertain. Development is likely to occur during the second management period.

Golf course water application systems are often more sophisticated than those at other turf-related facilities. Most have a system with a control panel and field satellites that can override the central controller. The trend is toward computerized controllers and more flexibility in operating sprinkler heads. The newest systems incorporate weather stations to assist in scheduling water applications. Most courses apply water to greens and tees with spray heads, while larger turf areas are watered with large radius heads.

The use of reclaimed water for watering large turf-related facilities in the Prescott AMA is expected to increase during the second management period. Presently only during the summer months is potable water required to supplement the supply of reclaimed water. The use of effluent for a new golf course or a possible expansion of the existing Antelope Hills facility is likely.

Future plans at the Prescott Country Club include the construction of a water reclamation facility. Processed wastewater from the country club residential development would decrease the facility's dependence on groundwater. The completion of the proposed reclamation facility is possible during the second management period.
2) Cemeteries

The Veterans Administration (VA) National Cemetery is the only cemetery larger than ten acres in the Prescott AMA. Designated gravesites at the VA cemetery are near full utilization, and an expansion of the existing facility is possible. The conservation requirements set forth in this chapter for turf-related facilities apply to the 37-acre site.

There are numerous cemeteries smaller than 10 acres throughout the Active Management Area. Many are supplied with water from exempt private wells. Bluegrass is most common at these facilities, but cemeteries without lush turf also exist. Water requirements are similar to those of golf courses.

Cemeteries have several unique characteristics that affect water conservation potential. Cemeteries are developed in stages and are committed to maintaining grave sites in perpetuity in a manner acceptable to the public. Internment activities also cause problems in irrigation scheduling. Cemeteries promote an image of a quiet, cool resting place, so turf appearance is very important.

Because cemeteries are developed in sections, the water application system is installed as new areas are opened. The irrigation system in older areas is often quite different from the system in more recently developed sections. The result is often a complex control system that is difficult to manage.

3) Schools & Parks

Turfed areas in parks, school grounds, and ball fields are important to the communities in the Prescott AMA.

All of these turfed areas are smaller than 10 acres. These small facilities use water supplied by municipal providers or Type 2 Non-irrigation Grandfathered Rights. Bluegrass is the turf species most commonly maintained at these facilities.

There are approximately 50 acres of turf in small facilities in Prescott and Prescott Valley. Public parks and schools maintain turf primarily for active playing surfaces and community activities. Prescott's playing fields are maintained year-round and many of the schools' sports facilities are used jointly for school activities and municipal athletic programs.

2. Approach Used to Develop Conservation Requirements

Development of the Second Management Plan conservation requirements involved extensive data collection regarding water use patterns in Arizona and the conservation options available to turf-related facility managers. The Department relied heavily on input from the Turf Advisory Committees in the Tucson and Phoenix areas. Conservation requirements in the Prescott area differ from southern desert areas due to climate conditions and the adaptability of the grass species used. The advisory committees included golf course and cemetery superintendents, turf irrigation specialists, extension agents, and golf course designers.

The Department hired a consultant to analyze the water conservation practices currently in use in the turf industry and the potential for future water conservation. The study evaluated technologies, including management practices and design alternatives, associated with water conservation. The consultant advisory committees concluded that a combination of good management and
the latest irrigation systems was effective in reducing water use. The use of specific irrigation systems alone was not the primary determinant of efficient water use.

Due to the widely varying characteristics of turf-related facilities identified by the consultant, the Department has chosen not to require specific conservation techniques wherever possible. Instead, turf-related facilities are given a maximum annual water allotment based on the use of such techniques. The allotment approach allows the manager to consider the characteristics of the facility, evaluate the alternatives, and decide how to use the annual allotment most effectively, based on the facility's needs. In setting the annual water allotments, the following information was considered:

- Consumptive use requirements of the grass species most frequently grown
- Water application efficiency achievable with currently available technologies
- Evaporative losses from lakes based on pond evaporation data
- Management practices and technologies currently in place
- Conservation potential associated with additional technologies, practices, and design alternatives
- Germination requirements for establishing new turf

Based on analysis of this information, the Department determined that an annual application rate which is reasonable for turf areas in the Prescott AMA is 4.9 acre-feet per acre.

Irrigated low water use plants, requiring some watering, are often used to landscape part of turf-related facilities.

The Department's analysis indicated that an annual application of 1.5 acre-feet per acre for low water use plants for all facilities is reasonable.

The use of artificial lakes for regulatory water storage is appropriate for large turf-related facilities such as golf courses. The Department's studies indicate that a 3 to 5 day water supply is adequate in the event of well breakdowns or reductions in municipal water service. If properly lined, losses associated with lakes are limited to evaporation. The Department determined that an annual application rate of 5.5 acre-feet per acre to replace lake evaporation is reasonable.

The Department encourages the use of effluent or poor quality water supplies and creative designs to reduce water use. The conservation requirements in this chapter provide incentives for effluent use and recognize that additional allotments may be needed to leach salts through the root zone for other technical problems.

3. Turf Conservation Program Summary

a. Maximum Annual Water Allotment

The turf conservation program for the second management period is based on a maximum annual water allotment, beginning in 1992, for each facility. The total acreage of turf and lakes is multiplied by the application rate and the evaporative loss rate, respectively, to determine the allotment. For existing facilities, this limit will be based on the historic acreage of turf, lakes, and low water use landscaping. Table 6-B summarizes the application rates used to calculate the annual water allotment for turf-related facilities during the second management period. The maximum annual water allotment for the existing turf-related facility having a grandfathered right in the Prescott AMA is identified in Appendix 6.
TABLE 6-B

ANNUAL APPLICATION RATES FOR TURF-RELATED FACILITIES

PRESCOTT AMA

<table>
<thead>
<tr>
<th>TYPE OF USE</th>
<th>APPLICABLE RATE(^1) (acre-feet per acre)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Turf</td>
<td>4.9</td>
</tr>
<tr>
<td>New Turf</td>
<td>5.7</td>
</tr>
<tr>
<td>Artificial Lakes</td>
<td>5.5</td>
</tr>
<tr>
<td>Low Water Use Landscaping</td>
<td>1.5</td>
</tr>
</tbody>
</table>

\(^1\) For 1992 and each year thereafter until the first compliance date for any substitute requirement in the Third Management Plan.

New golf courses in the Prescott AMA will receive their annual allotments based on the same formula used for other turf-related facilities, up to a maximum water use cap of 25.3 acre-feet per hole. This cap is based on 5 acres of turf and 0.15 acres of lake per hole. Five acres of turf at 4.9 acre-feet per acre plus 0.15 acre of lake at 5.5 acre-feet per acre results in the per hole cap of 25.3 acre-feet. All turf-related watering using non-effluent sources on new golf courses must stay within this allotment, including watering of low water use landscaping (except in the case of newly planted turf).

It should be noted that although the allotment is calculated on a per acre basis, the allotment may be used anywhere on the facility at the discretion of the manager. Additions of acreage to existing or new golf courses will not result in an increase in the maximum annual allotment unless new regulation golf holes are added. If new holes are added, the expanded area will receive an allotment as if it was a new facility, with a maximum of 25.3 acre-feet per hole.

The allotment for schools, parks, and cemeteries will continue to be calculated using a formula in which turf acreage is multiplied by the appropriate application rate (see Table 6-B). The approach used for these facilities allows for additional water for any expansion of turfed area.

There is a disincentive regarding the use of potable water in new lakes in golf courses. Facilities using 100 percent effluent in their lakes have no maximum allotment because lake acreage is not limited. The application rate of 5.5 acre-feet per acre for evaporation losses still applies, however.

b. Effluent Use Incentive

Effluent is an ideal water source for turf because of its nutrient characteristics. Studies have shown that as long as the turf manager take effluent's higher nutrient and soluble salt content into account, high quality turf can be grown.

In light of effluent's compatibility with turf, an effluent use incentive has been developed. While a facility's allotment

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does not change, effluent is accounted for at a reduced rate for the purpose of determining compliance with the annual allotment. A turf-related facility that uses effluent to meet 50 to 89 percent of its annual allotment or actual use (whichever is less) shall have each acre-foot of effluent counted as 0.85 acre-foot of water. Each acre-foot of effluent will be counted as 0.80 acre-foot of water if the amount of effluent used is equal to or greater than 90 percent of the facility’s annual allotment or actual use (whichever is less).

In addition to the incentive, facilities using effluent may apply to the Director for a modification of their allotment to allow for leaching of salts below the root zone or to compensate for other technical difficulties associated with the use of effluent.

c. Reduction of Turfed Acreage Incentive

Conservation requirements for the second management period also provide an incentive to reduce turfed acreage. The annual water allotment for existing turf-related facilities is based on the maximum area of turf and lakes developed at each facility during the first management period. If turfed acreage or lakes are removed, the allotment does not decrease. Golf courses, schools, parks, cemeteries, and common areas of housing developments are encouraged to minimize the areas landscaped with water-intensive plants and lakes.

d. Revegetation Adjustment

A revegetation adjustment to the annual allotment may be necessary if the turf-related facility wants to establish low water use plants. Up to 1.5 acre-feet per acre of additional water may be included in the annual allotment for a maximum of three calendar years. The revegetation adjustment must be applied for by the facility, with the quantity and duration of the adjustment to be determined by the Department.

e. Artificial Lake Fill and Refill Adjustments

A golf course may apply to the Department for a one-time adjustment to its allotment to fill new artificial lakes for regulatory storage. Any turf-related facility which drains an artificial lake to install a lake liner or to otherwise reduce water losses from the lake may apply to the Department for a one-time adjustment to its allotment to refill the lake.

f. Additional Conservation Requirements

A conservation plan will be required from all new turf-related facilities. The plan must outline the practices and technologies the facility will use to reduce its water use.

New schools, parks, and common areas are required to construct and maintain their facilities so that areas landscaped with water intensive plants are minimized.

New cemeteries are prohibited from landscaping more than 75 percent of their facilities with plants that are not low water use plants.

g. Monitoring and Reporting Requirements

The Second Management Plan includes additional monitoring and reporting requirements for turf-related facilities. The Department intends to notice new turf-related facilities of their conservation requirements prior to commencing operations. All water use by a turf-related facility will be assumed to be for landscape watering purposes unless non-landscape water is metered separately. This provision encourages facilities to install meters to ensure that landscape watering is
accurately reported. Turf-related facilities may apply to the Department for an administrative review if separate meters are not feasible.

**h. Inclusion of Common Areas of Housing Developments**

The maximum annual allotment provisions of this plan apply to the common areas of housing developments. However, there are no existing housing developments having more than 10 acres of water intensive landscaping in common areas.

**i. Conservation Assistance Program**

A conservation assistance program will be developed to help facility managers meet their water conservation requirements. Potential elements of this program include:

- Field assistance program providing weather-based water application scheduling, annual water budgeting, and technical assistance regarding conservation technologies and practices
- Educational materials and presentations to inform user groups
- Direct support for research resulting in water conservation
- Awards program to recognize outstanding conservation efforts
4. Additional Conservation Requirements for Turf-Related Facilities

6-201. 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 6-201 through 6-206 of this Chapter, unless the context otherwise requires, shall have the following meanings:

1. "Body of water" means a body of water or interconnected bodies of water in an active management area, including a lake, pond, lagoon, or swimming pool, that has a surface area greater than twelve thousand three hundred and twenty square feet and that is filled or refilled primarily for landscape, scenic, or recreational purposes. A body of water that is used incidentally for landscape, scenic, or recreational purposes is deemed not to be filled or refilled for landscape, scenic or recreational purposes.

2. "Common area" means a recreational or open space area or areas maintained for the benefit of the residents of a housing development which is owned and operated as a single integrated facility.

3. "Contiguous" means in contact at any point along a boundary, or part of the same master planned community. Two parcels of land are contiguous even if they are separated by one or more of the following: a road, easement or right-of-way.

4. "Existing turf-related facility" means a turf-related facility that was either in operation as of December 26, 1984, or substantially commenced as of December 26, 1984, and includes any expanded or modified portion of such a facility.

5. "Hole" means a component of a golf course consisting at a minimum of a tee and a green. A driving range is not a hole.

6. "Landscape watering" means the application of water from any source, including effluent, by a turf-related facility to a water-intensive landscaped area, a low water use landscaped area and revegetation acres.

7. "Low water use landscaped area" means an area of land of at least one acre, which is planted in identifiable areas of a turf-related facility, watered by a permanent water application system and planted primarily with plants listed in Appendix 5-D. The vegetative covering at maturity of a low water use landscaped area, as calculated by the Director, must cover at least 50 percent of the area.

8. "New turf-related facility" means a turf-related facility that was neither in operation as of December 26, 1984 nor substantially commenced as of December 26, 1984.

9. "Newly turfed area" means an area of land planted during the calendar year in question with a grass species requiring additional water for germination.
and the establishment of the grass species. Newly turfed area does not include an area covered with a grass species during the preceding calendar year that has been overseeded or reseeded with a grass species during the calendar year in question.

10. "Overseeded area" means an area of land planted during the calendar year in question with a cool season grass species that grows over dormant warm season grasses in the winter period.

11. "Revegetation acres" means acreage contiguous to a turf-related facility that has been approved by the Director as qualifying for a revegetation allotment adjustment.

12. "Substantially commenced as of December 26, 1984" means, with regard to the construction of a turf-related facility, that the owner or operator of the facility had obtained all pre-construction permits and approvals required by federal, state or local governments for the facility by December 26, 1984, or had made a substantial capital investment in the physical on-site construction of the facility by December 26, 1984.

13. "Substantially expanded or modified" means an expansion or modification of a turf-related facility that results in an increase in the area of land within the facility to which water is applied for landscape watering.

14. "Total operating facility area" means an area of land being used for cemetery-related purposes, including any area of land covered by grave markers or by cemetery-related buildings, walks, pathways and landscaping, but not including roads, parking lots and any areas of land being held for future expansion of the cemetery.

15. "Total water surface area" means the total surface area of all bodies of water that are an integral part of the water-intensive landscaped area of a turf-related facility. Bodies of water used primarily for swimming purposes are not an integral part of the water-intensive landscaped area of a turf-related facility.

16. "Turfed acres" means an area of land within a turf-related facility that is watered with a permanent water application system and planted primarily with plants not listed in Appendix 5-D.

17. "Turf-related facility" means a school, park, cemetery, golf course or common area of a housing development that applies water from any source, including effluent, to a water-intensive landscaped area of ten or more acres, including, but not limited to, those facilities listed in Appendix 6.

18. "Water-intensive landscaped area" means, for the calendar year in question, the area of land within a turf-related facility that is watered with a permanent water application system and planted primarily with plants not listed in Appendix 5-D, and the total water surface area of the facility.
6-202. Conservation Requirements for Turf-Related Facilities

Beginning with calendar year 1992, or the first calendar year in which the facility applies water to its water-intensive landscaped area, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan, a turf-related facility shall not use an amount of water during a calendar year which exceeds its maximum annual water allotment for the year as calculated pursuant to Section 6-203 using the applicable application rates specified in Table A. A turf-related facility's compliance with its maximum annual water allotment for a calendar year shall be determined pursuant to Section 6-204.

6-203. Calculation of Maximum Annual Water Allotment for Turf-Related Facilities

A. New And Existing Turf-Related Facilities that are Not Golf Courses

The Director shall calculate the maximum annual water allotment for a new or existing turf-related facility that is not a golf course by determining the number of acres in existence within the facility during the calendar year in each of the categories listed in Table A, and then multiplying the number of acres in each category by the applicable application rate for each category as set forth in Table A. The sum of the products, plus any adjustments allowed pursuant to Subsection D below, is the facility's maximum annual water allotment for the calendar year.

B. Existing Turf-Related Facilities that are Golf Courses

The Director shall calculate the maximum annual water allotment for an existing turf-related facility that is a golf course by determining the number of acres in existence within the facility during the calendar year in each of the categories listed in Table A, and then multiplying the number of acres in each category by the applicable application rate for each category as set forth in Table A. The sum of the products, plus any adjustments allowed pursuant to Subsection D below, is the facility's maximum annual water allotment for the year, subject to the following limitations:

1. In determining the number of acres of total water surface area in existence within the facility during the calendar year, the total surface area of all bodies of water not entirely filled with effluent which are located within any portion of the facility substantially expanded or modified after December 26, 1984 shall be limited to an area calculated by multiplying the number of holes present within that portion of the facility during the year by 0.14 acre per hole.

2. In no event shall the allotment for any portion of the facility that was substantially expanded or modified after December 26, 1984, and within which no new holes were added within newly turfed area during the year, exceed an amount calculated by multiplying the number of holes present within that portion of the facility during the year by 25.3 acre-feet of water per hole.
3. In no event shall the allotment for any portion of the facility that was substantially expanded or modified after December 26, 1984, and within which one or more new holes were added within newly turfed area during the year, exceed an amount calculated by multiplying the number of new holes added within the newly turfed area by 29.3 acre-feet of water per hole, then multiplying all other holes present within that portion of the facility during the year by 25.3 acre-feet of water per hole, and then adding the two products together.

C. New Turf-Related Facilities that are Golf Courses

The Director shall calculate the maximum annual water allotment for a new turf-related facility that is a golf course by determining the number of acres in existence within the facility during the calendar year in each of the categories listed in Table A, and then multiplying the number of acres in each category by the applicable application rate for each category as set forth in Table A. The sum of the products, plus any adjustments allowed pursuant to Subsection D below, is the facility's maximum annual water allotment for the calendar year, subject to the following limitations:

1. In determining the number of acres of total water surface area in existence within the facility during the year, the total surface area of all bodies of water not filled entirely with effluent shall be limited to an area calculated by multiplying the number of holes present within the facility during the year by 0.14 acre per hole.

2. In no event shall the maximum annual water allotment for a new turf-related facility that is a golf course and within which no new holes were added within newly turfed area during the year exceed an amount calculated by multiplying the number of holes present within the facility during the year by 25.3 acre-feet of water per hole.

3. In no event shall the maximum annual water allotment for a new turf-related facility that is a golf course and within which one or more new holes were added within newly turfed area during the year exceed an amount calculated by multiplying the number of new holes added within the newly turfed area during the year by 29.3 acre-feet of water per hole, then multiplying the number of all other holes present within the facility during the year by 25.3 acre-feet of water per hole, and then adding the two products together.

D. Allotment Adjustments

1. Revegetation Adjustment

A turf-related facility may apply to the Director for an allotment adjustment to revegetate disturbed areas around the facility. The Director may allow up to an additional 1.5 acre-feet of water per revegetation acre for up to three years if the following conditions apply:

a. The plants which are planted within the revegetation acres are listed in Appendix 5-D, or were adapted to natural site conditions prior to construction;
b. The area to be irrigated exceeds one acre and can be distinguished as an area of revegetation; and

c. The turf-related facility measures and reports all of the water applied to revegetation acres as part of the total water use of the facility.

2. Body of Water Fill and Refill Adjustment

a. A turf-related facility that is a recreational facility open to the public and owned or operated by the United States, this State, a city or town, a flood control district established under Title 48, Chapter 21, Arizona Revised Statutes, or a multi-county conservation district established under Title 48, Chapter 22, Arizona Revised Statutes, may apply to the Director in writing for a one-time body of water fill allotment adjustment equal to the volume of water needed to fill any bodies of water within the facility.

b. A turf-related facility that is a golf course, and that adds a body of water to the facility for regulatory storage purposes after January 1, 1990, may apply to the Director in writing for a one-time body of water fill allotment adjustment equal to the volume of water used for regulatory storage within the facility.

c. Any turf-related facility may apply to the Director in writing for a one-time body of water refill allotment adjustment in an amount determined by the Director to be necessary to reduce water losses from the body of water.

3. Effluent Allotment Adjustment

For purposes of determining a turf-related facility's compliance with its maximum annual water allotment, the Director shall count each acre-foot of effluent used by the facility for landscape watering purposes during the calendar year as 0.85 acre-foot of water if the total amount of effluent used by the facility for landscape watering purposes during the year is between 50 percent and 89 percent of either the facility's maximum annual water allotment for the year or the amount of water actually used by the facility for landscape watering purposes during the year, whichever is less. The Director shall count each acre-foot of effluent used by the facility for landscape watering purposes during the year as 0.8 acre-foot of water if the total amount of effluent used by the facility for landscape watering purposes during the year is equal to or greater than 90 percent of either the facility's maximum annual water allotment for the year or the amount of water actually used by the facility for landscape watering purposes during the year, whichever is less.

4. Removed Acreage Adjustment

An existing turf-related facility that removes acres of water-intensive landscaped area from any portion of the facility that was not substantially expanded or modified after December 26, 1984, shall receive an additional allotment equal to the allotment the acres would have received pursuant to
the Second Management Plan if they had not been removed, provided that the acres were given a water allotment in the First Management Plan or the Second Management Plan.

5. Leaching Allotment Adjustment

A turf-related facility may apply for an additional allotment for leaching purposes. If the Director approves an additional allotment for leaching purposes, the Director shall calculate the additional allotment as follows:

\[
\text{Additional Leaching Allotment} = \left( \frac{1}{1 - \frac{\text{EC}_w}{\text{EC}_e \times 0.75}} \right) \times \text{CU}
\]

Where:

\[
\text{EC}_w = \text{Electrical conductivity of water used}
\]

\[
\text{EC}_e = \text{Tolerance of the grass species grown to the soil salinity in electrical conductivity of the soil saturation extract}
\]

\[
\text{CU} = \text{Consumptive use requirement for the grass species grown}
\]

E. Nothing in this Section shall be construed to authorize a turf-related facility to use more water from any source than the facility is entitled to use pursuant to any groundwater or appropriable water rights held by the facility. Nor shall this Section be construed to authorize a turf-related facility to use water from any source, including effluent, in any manner that violates Chapter 1 or Chapter 2 of Title 45, Arizona Revised Statutes.

6-204. Compliance with Maximum Annual Water Allotment

A turf-related facility is in compliance with its maximum annual water allotment for a given calendar year if the Director determines that either of the following applies:

1. The amount of water from any source, including effluent, used by the facility for landscape watering purposes during the calendar year does not exceed the facility's maximum annual water allotment for that year, or

2. The amount of water from any source, including effluent, used by the facility for landscape watering purposes during the calendar year and the preceding two calendar years does not exceed the sum of the maximum annual water allotments for those three years.
6-205. Additional Conservation Requirements for New Turf-Related Facilities

A new turf-related facility shall comply with the following additional conservation requirements, as applicable:

A. Conservation plan

By January 1, 1992, or six months after the facility commences operation, whichever is later, a new turf-related facility shall prepare, and maintain until the first compliance date for any applicable conservation requirement in the Third Management Plan, an accurate and detailed description of the conservation technologies, including management practices, that the facility uses in the delivery of water for landscape watering purposes.

B. Schools, Parks and Common Areas of Housing Developments

Upon commencement of operation, a new turf-related facility that is a school, park or common area shall design, construct and maintain its grounds in such a manner as to minimize the water-intensive landscaped area of the facility consistent with the use and enjoyment of the facility. As appropriate, the school, park or common area shall limit its water-intensive landscaped area used for recreation.

C. Cemeteries

Beginning January 1, 1992, or upon commencement of operation, whichever is later, a new turf-related facility that is a cemetery shall not landscape more than 75 percent of its total operating facility with plants not listed in Appendix 5-D.

6-206. Monitoring and Reporting Requirements

A. For the calendar year 1992, or the calendar year in which the facility commences operations, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan, a turf-related facility shall report in its annual report required by A.R.S. 45-632:

1. The total quantity of water by source, including effluent, withdrawn, diverted or received by the facility during the reporting year for landscape watering purposes, as measured with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.

2. The number of acres of newly turfed area within the facility during the reporting year.

3. The number of acres of total water surface area within the facility during the reporting year.

4. The number of acres of revegetation acres within the facility during the reporting year.
5. The number of acres of low water use landscaped area within the facility during the reporting year.

6. The number of acres of turfed acres within the facility during the reporting year, not including newly turfed area.

7. The quantity of water used to fill or refill a body of water within the facility during the reporting year.

8. The number of acres of overseeded area within the facility during the reporting year.

9. If the facility is a golf course, the number of holes added within newly turfed area during the reporting year.

B. An existing turf-related facility that is a golf course and that was substantially expanded or modified after December 26, 1984, shall report the information required in Subsection A above separately for the expanded or modified portion of the facility.

C. A turf-related facility shall estimate and report in its annual reports required by A.R.S. § 45-632, the quantity of water from any source, including effluent, used for each purpose other than landscape watering purposes. Any water used by the facility that is not measured separately from the water used for landscape watering purposes shall be counted by the Director as water used by the facility for landscape watering for purposes of calculating the facility's compliance with its maximum annual water allotment.
**TABLE A**

**APPLICATION RATES FOR TURF-RELATED FACILITIES**

**PRESCOTT AMA**

(acre-feet per acre per calendar year)

<table>
<thead>
<tr>
<th>Application Rate - Turfed Acres Including Newly Turfed Area</th>
<th>1992 - TMP¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Facilities</td>
<td>4.9</td>
</tr>
</tbody>
</table>

| Additional Application Rate For Newly Turfed Area          |
|-----------------------------------------------------------|------------|
| All Facilities                                            | 0.8        |

<table>
<thead>
<tr>
<th>Application Rate - Total Water Surface Area</th>
<th>1992 - TMP¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Facilities</td>
<td>5.5</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Application Rate - Low Water Use Landscaped Area</th>
<th>1992 - TMP¹</th>
</tr>
</thead>
<tbody>
<tr>
<td>All Facilities</td>
<td>1.5</td>
</tr>
</tbody>
</table>

¹ TMP means the first compliance date for any substitute requirement in the Third Management Plan
G. DAIRY OPERATIONS

As of January 1, 1991, there were no operating dairies in the Prescott AMA. Should a dairy operation be established during the second management period, the facility must comply with the conservation requirements contained in this section.

To determine conservation requirements for dairy operations, the Department conducted a study to identify dairy water use patterns, processes, and associated water use. Several dairies were visited during the study. Experts from the University of Arizona reviewed and supplemented the study, and had significant input to the conservation requirements outlined in this section.

1. Water Use Characteristics

The majority of water use at dairies occurs in the following categories: animal drinking needs, udder washing, barn clean-up, and animal cooling.

a. Drinking Needs

A lactating cow drinks an average of 30 gallons of water per day, with some seasonal variation. A replacement animal, non-lactating animal or mature dry cow drinks an average of 15 gallons per day.

b. Other Water Uses during the Milking Cycle

The first step in the milking cycle at most dairies is moving the cows into a holding pen, where the udders are washed before milking. Irrigation sprinklers are located in a grid pattern on the floor of the pen and turned on to wash the udders. The cows may be cooled during udder washing to enhance milk production. The animals are then moved to the milking parlor for milking and then returned to the corral area. Each time the cycle is completed, the holding pen and parlor areas must be cleaned, milk lines washed, and manure removed.

There are a number of dairy management decisions which affect water use. For example, cows may be milked either two or three times daily. Each time the milking cycle is repeated, water is used to wash the udders, clean the barn, and at some dairies, cool the cows. Dairy managers evaluate the benefits of milking two or three times per day based upon parlor and corral capacity, milk yield, staffing, and other economic factors. If economic factors and facilities permit, most dairies will milk three times daily. In the past, most dairies milked three times a day. However, this practice has been discontinued at many dairies, and future milking practices will be dictated more by economic factors. Approximately 30 percent of Arizona's dairies currently milk three times per day.

Animal cooling to reduce heat stress and enhance milk production is another optional management practice. Cooling may be done either in the holding pen corral, at the parlor exit, or along the fenceline feeding area, when temperatures exceed 85 to 90 degrees Fahrenheit. Approximately 30 percent of Arizona dairies cool their cows during some portion of the milking cycle. Most dairy managers cool only the highest producing cows or those that have recently calved. Lactating cows are often cooled at only one or two of the possible locations. Cooling practices have developed in Arizona over the past decade and are projected to increase during the next decade.

The last dairy management practice which significantly affects water use is whether replacement animals and non-lactating animals are housed on or off-site. Dairies keep lactating and mature dry cows on-site at a ratio that remains relatively constant throughout the year,
with some variation due to weather. A separate, more variable management decision is whether replacement calves, heifers and non-lactating animals (such as horses) are kept on-site. Typically, if replacement animals are housed on-site, replacement animals plus the mature dry cows equal the number of lactating cows. Some dairy managers prefer to purchase replacement animals as needed or raise the animals in cooler climates until they near calving age. Approximately 33 percent of Arizona dairies raise their replacement animals off-site.

Water needs for both replacement animals and mature dry cows are much less than those of lactating animals because their water use consists only of drinking water and minor clean-up use. Drinking requirements for mature dry cows and replacement animals are 15 gallons per day. Non-lactating animals were assumed to have the same drinking requirements as mature dry cows and replacement animals.

The amount of water required by a dairy depends upon the number of cows and non-lactating animals housed at the dairy, herd composition, and dairy management practices. Table 6-C summarizes daily water needs for each dairy process, assuming use of appropriate water conservation technology and practices. The water needs listed are based upon the following assumptions: 1) milking is done three times per day per lactating animal, and 2) cooling is done during the milking cycle for at least a portion of the herd.

Total water use for lactating cows, assuming conservation, is 105 gallons per animal per day. Mature dry cow, replacement animals and non-lactating animals require 20 gallons per animal per day. Maximum annual water allotments for dairies during the second management period will be determined using these per animal water use needs. A dairy operation must be in compliance with its maximum annual allotment by 2000.

Upon application, the Department may approve an additional allocation of water for a dairy operation above its maximum annual water allotment if the dairy operation demonstrates that one or more of the following conditions exist:

- Milking is being done more than three times daily
- Technologies which are designed to achieve industry health and sanitation objectives, such as the recommended pre-milking sanitation method, are being used
- Animal cooling technologies designed to increase milk production are being used

2. Water Conservation Potential

The dairy industry can conserve water in the udder washing process and by recycling waste water. The udder washing process has the greatest conservation potential for the dairy operations studied. The typical udder washing cycle consists of a one minute washing, a three minute break, followed by a two minute washing. At many dairies, more water is used in the udder washing process during the summer months, though no increase is warranted for sanitation reasons. Summer water use can easily be reduced with little or no additional management or equipment costs.

Although proper management is the best way to control water waste in the udder washing process, the use of automatic timers can contribute to significant water savings if used properly. Another management practice which can be easily implemented to reduce water needs for udder washing is regular and frequent washing of the corral walkway areas.
TABLE 6-C
WATER USE FOR DAIRY OPERATIONS
(gallons per animal per day)

<table>
<thead>
<tr>
<th>Type of Use</th>
<th>Lactating Animal</th>
<th>Replacement Animal</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drinking needs</td>
<td>30</td>
<td>15</td>
</tr>
<tr>
<td>Udder washing-based upon 72 min/day @ 8 GPM; 16 cows per spray head. Varies w/no. of milkings per day - assumes three milkings.</td>
<td>35</td>
<td>0</td>
</tr>
<tr>
<td>Barn clean-up and sanitizing. Varies w/no. of milkings per day - assumes three milkings.</td>
<td>20</td>
<td>0</td>
</tr>
<tr>
<td>Animal cooling - management option, site-specific</td>
<td>10</td>
<td>0</td>
</tr>
<tr>
<td>Calf barn - clean-up</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Milk cooling tower (if present)</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>5</td>
<td>0</td>
</tr>
<tr>
<td><strong>Totals</strong></td>
<td><strong>105</strong></td>
<td><strong>20</strong></td>
</tr>
</tbody>
</table>

Periods of extreme weather may influence dairy water use. Wet periods, resulting in muddy corrals, may require longer udder washing cycles or increased washing of corral walkways and milking areas. To account for the impact of weather on dairy water use, the Department has included a three-year averaging provision in the maximum annual water allotments for the second management period.

Dairy operations can also achieve significant water conservation by recycling their waste water. Milk cooling using vacuum pumps produces discharged water which can be captured and used in the udder washing cycle. At some dairies, this water can be captured a second time and used to wash corral walkways.

Recycling offers the dairy manager several benefits: lower water costs, less wastewater to dispose of, less free-standing water, drier conditions, and cleaner cows. Recycling should be evaluated and implemented wherever feasible in new dairies.
3. Additional Conservation Requirements for Dairy Operations

6-301. 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 6-301 through 6-305 of this Chapter, unless the context otherwise requires, shall have the following meanings:

1. "Calf" means a dairy animal ranging in age from one day to five months old.

2. "Dairy cow" means a dairy animal from which milk production is intended for use or sale for human consumption, or a dairy animal that is kept for raising replacement dairy animals.

3. "Dairy operation" means a dairy cow operation that houses an average of 100 or more lactating cows during a calendar year as calculated in Section 6-302.B.1.

4. "Heifer" means a female dairy animal that has never calved.

5. "Lactating cow" means any cow that has calved at least once and is producing milk.

6. "Mature dry cow" means any cow that has calved at least once and is not producing milk.

7. "Non-lactating animal" means a steer, horse or other large stock animal not otherwise defined in this Section, that is present on-site at a dairy operation and watered through the use of the dairy operation's watering system.

8. "Replacement animals" means heifers and calves which are present on-site at a dairy operation.

6-302. Conservation Requirements for Dairy Operations

A. Maximum Annual Water Allotment

For the calendar year 2000, and for each calendar year thereafter until the first compliance date for any substitute maximum annual water allotment requirement in the Third Management Plan, a dairy operation shall not use water during a calendar year in an amount which exceeds its maximum annual water allotment for the year as calculated in Subsection B below.

B. Calculation of Maximum Annual Water Allotment

The Director shall determine a dairy operation's maximum annual water allotment for a calendar year as follows:
1. Calculate the number of lactating cows, mature dry cows, non-lactating animals and replacement animals which are present at the dairy operation during the calendar year. The Director shall calculate the number of lactating cows, mature dry cows, non-lactating animals and replacement animals as follows:

   a. At the end of each month during the calendar year, determine the total number of animals present at the dairy operation in each of the following categories: lactating cows, mature dry cows, non-lactating animals and replacement animals.

   b. For each category of animal, add together the total number of such animals present at the dairy operation on the last day of each month during the year in question, and then divide the result by 12. The quotient is the average daily number of lactating cows, mature dry cows, non-lactating animals and replacement animals kept at the dairy operation during the calendar year.

2. Calculate the dairy operation's maximum annual water allotment for the drinking and sanitation needs of the operation for the calendar year in question as follows:

   a. Multiply the average daily number of lactating cows kept at the dairy operation by the maximum annual water allotment of 105 gallons per animal per day (GAD), and then convert to acre-feet per year as follows:

   \[
   C_L \times \frac{105 \text{ GAD}}{325,851 \text{ g/af}} \times \frac{\text{d/yr}}{} = \text{Maximum annual water allotment for lactating cows (acre-feet per year)}
   \]

   Where:
   
   \(C_L\) = Average daily number of lactating cows
   
   \(GAD\) = Gallons per animal per day
   
   \(g/af\) = Gallons per acre-foot
   
   \(d/yr\) = Days in the year

   The result is the dairy operation's maximum annual water allotment for lactating cows for the calendar year in question.

   b. Add together the average daily number of mature dry cows, non-lactating animals and replacement animals kept at the dairy site, then multiply the sum by the maximum annual water allotment of 20 gallons per animal per day (GAD), and then convert to acre-feet per year as follows:

   \[
   C_{MNR} \times \frac{20 \text{ GAD}}{325,851 \text{ g/af}} \times \frac{\text{d/yr}}{} = \text{Maximum annual water allotment for mature dry cows, non-lactating animals and replacement animals (acre-feet per year)}
   \]
Where:  \( C_{\text{MNR}} \) = Average daily number of mature dry cows, non-lactating animals and replacement animals  
\( GAD \) = Gallons per animal per day  
\( g/af \) = Gallons per acre-foot  
\( d/yr \) = Days per year

The result is the dairy operation's maximum annual water allotment for mature dry cows, non-lactating animals and replacement animals for the calendar year in question.

c. Add the dairy operation's maximum annual water allotment for mature dry cows, non-lactating animals and replacement animals for the calendar year as calculated in paragraph b above to the dairy operation's maximum annual water allotment for lactating cows for the calendar year as calculated in paragraph a above. The sum is the maximum annual water allotment for the dairy operation for the calendar year in question.

3. Nothing in this Section shall be construed to authorize a dairy operation to use more water from any source, including effluent, than the operation is entitled to use pursuant to any groundwater or appropriable water right held by the operation. Nor shall this Section be construed to authorize a dairy operation to use water from any source, including effluent, in any manner that violates Chapter 1 or Chapter 2 of Title 45, Arizona Revised Statutes.

6-303. Compliance with Maximum Annual Water Allotment

A dairy operation is in compliance for a calendar year with its maximum annual water allotment if the Director determines that either of the following applies:

1. The dairy operation's water use for that calendar year is equal to or less than its maximum annual water allotment for the calendar year, or

2. The dairy operation's three-year average water use for that calendar year and the preceding two calendar years is equal to or less than its three-year average maximum annual water allotment for that calendar year and the preceding two calendar years.

6-304. Alternative Conservation Program

Upon application by a dairy operation, the Director may approve an additional allocation of water for the dairy operation consistent with industry health and sanitation objectives if the dairy operation requires more than its maximum annual water allotment because the dairy operation milks more than three times daily; uses technologies which achieve industry health and sanitation objectives, such as the recommended pre-milking sanitation method; or uses technologies for cooling lactating cows which are designed to increase milk production.
6-305. Monitoring and Reporting Requirements

For the calendar year 1992, or the calendar year in which the dairy commences operation, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute monitoring and reporting requirements in the Third Management Plan, each dairy operation shall:

1. Measure and report in its annual report required by A.R.S. § 45-632, the total quantity of water from any source, including effluent, withdrawn, diverted or received during the reporting year for use by the dairy operation. The measurements shall be made with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.

2. Estimate and report in its annual report required by A.R.S. § 45-632, deliveries of water during the calendar year to any uses other than the dairy operation from the well or wells which serve the dairy operation.

3. Calculate and report in its annual report required by A.R.S. § 45-632, the total number of lactating cows, mature dry cows, non-lactating animals and replacement animals which were present on-site at the dairy operation on the last day of each month during the calendar year.
H. CATTLE FEEDLOT OPERATIONS

As of January 1, 1991, there were no operating cattle feedlots in the Prescott AMA. Should a feedlot be established during the second management period, the facility must comply with the conservation requirements presented in this chapter.

1. Water Use Characteristic

Cattle feedlot operations use water for the following purposes: livestock drinking water, dust control, feed mixing and processing, environmental controls, health controls, fire protection, and losses due to evaporation.

The conservation requirements for cattle feedlot operations outlined in this management plan include a maximum annual water allotment for each facility based on specific conservation technologies. These requirements are unchanged from those included in the First Management Plan. During preparation of the First Management Plan, representatives of feedlot owners and operators in the Pinal AMA reviewed the equation used to determine the maximum annual water allotment for a feedlot. In addition, the University of Arizona College of Agriculture and W.F. Welchert, an expert on cattle feedlot operations, verified that the equation which was developed for determining maximum annual water allotments allocates a reasonable amount of water to cattle feedlots.

The equation is based on the number of gallons of water reasonably required per animal per day (GAD). To determine this amount, three components of cattle feedlot water use were considered: 1) cattle drinking water requirements, 2) dust control watering requirements, and 3) other uses. The amount of water required for each component varies with the number of cattle processed by the feedlot. Cattle drinking water requirements include water intake, water spilled while drinking, and evaporation losses from watering tanks. Drinking water requirements are estimated to be 15 GAD. Dust control watering requires approximately 10 GAD. Other uses, including water used for feed mixing, health and environmental controls, system losses, and fire protection total 5 GAD. Total water requirements for a cattle feedlot operation are 30 GAD (0.034 acre-feet per animal per year).

2. Water Conservation Potential

The only water use process having a significant conservation potential is dust control watering. Cattle feedlots control dust by applying water to the land surface using either a mobile tank and a large gun sprinkler, portable water lines with small nozzles, or a permanently installed sprinkler system. Each of these methods provides satisfactory dust control if water coverage is adequate and enough water is applied. Overall management of the system is the most important factor in efficient dust control watering. Correct management techniques include removing excess manure to less than two inches in depth and increasing the number of cattle per pen to increase pen moisture. Dust can also be controlled by utilizing a durable surface on roads between pens and in other areas of the facilities. Both of these management practices reduce dust, thereby reducing the need to apply water.

Some conservation potential also exists for cattle feedlot operations in the areas of landscape watering and water system losses. No significant water savings can be achieved in the area of cattle drinking water needs.
3. Additional Conservation Requirements for Cattle Feedlot Operations

6-401. 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 6-401 through 6-403 of this Chapter, unless the context otherwise requires, shall have the following meanings:

1. "Beef cattle" means cattle or calves fed primarily for meat production.
2. "Cattle feedlot operation" means a beef cattle feedlot or feedyard that feeds 100 or more beef cattle during the applicable calendar year.

6-402. Conservation Requirements for Cattle Feedlot Operations

A. Maximum Annual Water Allotment

For the calendar year 2000, and for each calendar year thereafter until the first compliance date for any substitute maximum annual water allotment requirement in the Third Management Plan, a cattle feedlot operation shall not use water during a calendar year in an amount which exceeds its maximum annual water allotment for the year as calculated pursuant to Subsection B below.

B. Calculation of Maximum Annual Water Allotment

The Director shall determine a cattle feedlot operation's maximum annual water allotment for a calendar year as follows:

1. Calculate the average daily number of beef cattle kept at the cattle feedlot operation during the calendar year in question as follows:
   a. Determine the total number of beef cattle present at the cattle feedlot operation on the last day of each month during the calendar year.
   b. Add together the total number of beef cattle present at the cattle feedlot operation on the last day of each month during the calendar year in question, and then divide the sum by 12. The quotient is the average daily number of beef cattle kept at the cattle feedlot operation during the calendar year.

2. Multiply the average daily number of beef cattle kept at the cattle feedlot operation during the calendar year by the water allotment of 30 gallons per animal per day (GAD), and then convert to acre-feet per year as follows:

\[
CB \times \frac{30 \text{ GAD}}{325,851 \text{ g/af}} \times \text{d/yr} = \text{Maximum annual water allotment for the cattle feedlot operation (acre-feet/year)}
\]
Where:  \( C_B = \) Average daily number of beef cattle kept at the cattle feedlot operation
\( GAD = \) Gallons per animal per day
\( g/af = \) Gallons per acre-foot
\( d/yr = \) Days in the year

C. Compliance with Maximum Annual Water Allotment

A cattle feedlot operation is in compliance with its maximum annual water allotment for the year if the Director determines that either of the following applies:

1. The water use by the cattle feedlot operation for that calendar year is equal to or less than the operation's maximum annual water allotment for the calendar year, or

2. The three-year average water use by the cattle feedlot operation for that calendar year and the preceding two calendar years is equal to or less than the operation's three-year average maximum annual water allotment for that calendar year and the two preceding calendar years.

D. Nothing in this Section shall be construed to authorize a cattle feedlot operation to use more water from any source, including effluent, than the operation is entitled to use pursuant to any groundwater or appropriable water right held by the operation. Nor shall this Section be construed to authorize a cattle feedlot operation to use water from any source, including effluent, in any manner that violates Chapter 1 or Chapter 2 of Title 45, Arizona Revised Statutes.

6-403. Monitoring and Reporting Requirements

For the calendar year 1992, or the calendar year in which operations commence, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan, a cattle feedlot operation shall:

1. Measure and report in its annual report required by A.R.S. § 45-632, the total quantity of water from any source, including effluent, withdrawn, diverted or received during the reporting year for use by the cattle feedlot operation. The measurements shall be made with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq.

2. Calculate and report in its annual report required by A.R.S. § 45-632, the total number of beef cattle present at the cattle feedlot operation on the last day of each month during the calendar year.
I. SAND AND GRAVEL FACILITIES

As of January 1, 1991, there were no sand and gravel facilities in the Prescott AMA with water use from any source, including effluent, in excess of 100 acre-feet of water per year. Should an existing or new sand and gravel facility use more than 100 acre-feet of water per year during the second management period, the facility must comply with the conservation requirements presented in this chapter.

1. Water Use Characteristics

Sand and gravel facilities mine unconsolidated stream deposits to produce construction materials. The mined material or aggregate must be sorted according to particle size and washed to remove fine-grained particles. Aggregate washing accounts for the bulk of water use by sand and gravel producers. In addition to using water for washing material, water is used: 1) to produce ready-mix concrete, bricks, blocks and asphalt; 2) to control dust; 3) to wash vehicles; and 4) for domestic purposes. Figure 6-A displays a water flow diagram for a typical sand and gravel facility.

2. Conservation Potential

Most sand and gravel facility managers recycle wash water using excavated pits called disposal ponds. Sediment-laden wash water is pumped or diverted into a pit or series of pits where sediment is allowed to settle out. After clarification, the water is recycled to the plant and used to wash more material. The recycled water can also be pumped from the pond for dust control, truck washing, or other clean-up activities.

An alternative method of recycling wash water is the use of mechanical devices called clarifiers. A clarifier is an apparatus which quickens the settling of solids without creating the need for a large disposal pond. Chemical flocculants are usually used in conjunction with clarifiers to further enhance the removal of solid particles from the wash water. The use of clarifiers is more water-efficient than the use of disposal ponds, but mechanical clarifiers are very expensive and may, in some situations, not eliminate the need for a disposal pond. Clarifiers are used by a small number of sand and gravel operations to meet specific water recycling needs.

Recycled water is not used for mixing concrete because using non-potable water in the mixture may result in a product of inferior strength and quality. Aggregate used in the concrete, however, can be washed with non-potable water without affecting concrete strength. The water conservation potential of sand and gravel operations varies because of differences in geology, availability and cost of land and water, product demand and price, and other factors. It may therefore be economically feasible to use the latest commercially available conservation technology at some facilities but not at others.

3. Summary of Conservation Requirements

a. Recycling of Wash Water

A requirement to recycle wash water using disposal ponds or clarifiers was set forth in the First Management Plan. This requirement ensures that sand and gravel facilities reduce their primary water use. The First Management Plan requirements are carried over into the second management period because they improve water use efficiency and can be applied at all sand and gravel operations.

Sand and gravel producers can achieve the greatest water savings by applying the most appropriate conservation methods for their facility. Some
facilities may be able to decrease the disposal pond surface area. Others may find it economical to use clarifiers. In order to identify the most economical conservation methods for each facility, sand and gravel producers will be required during the second management period to evaluate specific water-saving methods and submit to the Department a conservation plan.

b. Conservation Plan

The conservation plan to improve water use efficiency during the second management period must be submitted to the Director by December 31, 1992, or at least six months prior to commencing production at a new facility, whichever is later.

Sand and gravel facility managers are required to evaluate the use of specific conservation methods in the conservation plan. However, operators may select the most appropriate conservation methods for implementation at their facility. The Department encourages operators to evaluate any water conservation methods not
specified in the requirements that may be appropriate at a particular facility.

The implementation of some water conservation practices or technologies can result in increased profits. The Department encourages sand and gravel operators to analyze conservation methods to identify those which will result in a positive economic return. In order to identify profitable conservation measures, facility managers should perform a cost-benefit analysis of each potential method. However, managers are not required to submit the economic analysis as part of the conservation plan. The following potential costs and savings should be calculated in the economic analysis.

- Labor (including planning, construction, operation, maintenance and management time)
- Equipment (values amortized over the projected life of the equipment)
- Land value (including value of mineral reserves)
- Water costs (including pumping costs, well maintenance, withdrawal taxes)
- Chemicals and raw materials
- Fuel or energy costs
- Sewage disposal costs
- Changes in revenue caused by changing production rate, minimizing down-time, or increasing the size of reserves

Water use comparisons should be based on historical records or best available estimates. Evaporative losses in the Prescott AMA are approximately 5.5 acre-feet per year for each surface acre of water.
4. Additional Conservation Requirements for Sand and Gravel Facilities

6-501. Definitions

In addition to the definitions set forth in Chapters 1 and 2 of the Title 45 of the Arizona Revised Statutes, the following words and phrases used in Sections 6-501 through 6-504 of this Chapter, unless the context otherwise requires, shall have the following meanings:

1. "Sand and gravel facility" means an industrial facility that produces sand and gravel and uses more than 100 acre-feet of water from any source, including effluent, per calendar year. For purposes of this definition, the annual water use shall include all water from any source, including effluent, used or projected to be used within or by the sand and gravel facility regardless of the nature of the use.

2. "Wash water" means water used for washing or sorting sand, gravel, or other aggregates.

6-502. Conservation Requirements

Except as provided in Section 6-503, a sand and gravel facility shall comply with the following conservation requirements by December 31, 1992, or upon commencement of operation, whichever occurs later, and shall remain in compliance with these requirements during each calendar year thereafter until the first compliance date for any substitute requirements in the Third Management Plan:

1. If sufficient land area for construction and operation of disposal ponds is available at a reasonable price, a sand and gravel facility shall construct disposal ponds. The sand and gravel facility shall discharge into the disposal ponds all wash water and all water used for wet scrubbers at asphalt plants. The facility shall equip each disposal pond with a barge pump or sump pump of sufficient capacity, together with any necessary additional equipment, to assure the maximum reclamation of wash water. The facility shall reclaim and reuse the wash water for any purpose related to the facility's operation.

2. If sufficient land area for the construction and operation of disposal ponds is not available at a reasonable price, a sand and gravel facility shall use clarifiers for reclaiming wash water. The clarifiers shall be designed and operated by the sand and gravel facility to assure the maximum reclamation of water. The facility shall reclaim and reuse the wash water for any purpose related to the facility's operation.

3. A sand and gravel facility shall divert, to the maximum extent feasible, all runoff from clean-up operations and all drainage from sand and gravel piles to ponds or clarifiers for reclamation. The facility shall equip each pond with a barge pump or sump pump of sufficient capacity, together with any necessary additional equipment, to assure the maximum feasible reclamation of the pond water. The facility shall reclaim and reuse the pond water for any purpose related to the facility's operation.
4. A sand and gravel facility shall submit to the Director not later than December 31, 1992, or at least three months prior to commencing production, whichever is later, a plan to improve the efficiency of water use by the facility. The plan shall be based upon a feasibility study of the latest commercially available conservation technology and management techniques consistent with reasonable economic return. The feasibility study shall include a complete and accurate economic analysis of implementing the following techniques or technologies at the facility:

a. Disposal pond surface area reduction;
b. Clarifiers for recycling wash water;
c. Road binders to reduce water for road dust suppression; and
d. Availability and use of effluent and poor quality groundwater.

The facility may prepare a plan proposing additional conservation methods. The plan shall indicate the best estimate of water savings to be incurred by implementation of those conservation technologies and other techniques which the sand and gravel operator has addressed in the feasibility study. The plan must also include a schedule for implementation of the techniques and technologies described in the plan.

6-503. Alternative Conservation Program

A sand and gravel facility may apply to the Director to use conservation technologies other than those prescribed in Section 6-502. The Director may approve the use of alternative conservation technologies if the Director determines that both of the following apply:

1. The owner or operator of the sand and gravel facility has filed with the Director a detailed description of the proposed alternative technologies and the water savings that can be achieved by the use of those technologies, and

2. The owner or operator of the sand and gravel facility has demonstrated to the satisfaction of the Director that the alternative conservation technologies will result in a water savings equal to or greater than the savings that would be achieved by the conservation requirements prescribed in Section 6-502.

6-504. Monitoring and Reporting Requirements

For the calendar year 1992, or the calendar year in which the facility commences operation, whichever is later, and for each calendar year thereafter until the first compliance date for any substitute requirement in the Third Management Plan, each sand and gravel facility shall:

1. Measure, with a measuring device in accordance with the Department's measuring device rules, A.A.C. R12-15-901, et seq., and report in its annual report required by A.R.S. § 45-632, the following:
a. The quantity of water reclaimed from disposal ponds or clarifiers during the reporting year.

b. The quantity of water from any source, including effluent, supplied to the wash plant during the reporting year.

c. The quantity of water from any source, including effluent, supplied to the asphalt plant during the reporting year.

2. Measure and report in its annual report required by A.R.S. § 45-632, the following for each facility:

a. The aggregate surface area of any disposal ponds.

b. The average depth of any disposal ponds.

c. The estimated quantity of water from any source, including effluent, used during the calendar year for:

1) Industrial process purposes. Water used for industrial process purposes includes water used for sanitary waste disposal but does not include water for cooling and cleaning purposes.

2) Non-domestic cooling purposes.

3) Non-domestic cleaning purposes.

4) Road dust control.

5) Landscape watering.

6) Other purposes.

d. The tonnage of material washed during the reporting year.
AUGMENTATION AND REUSE PROGRAM
A. INTRODUCTION

The Water Resources Analysis (Chapter 2) highlights the importance of a water supply augmentation and reuse program for the Prescott AMA. The analysis indicates the efficient use of available water supplies is an integral part of achieving safe-yield but alone is insufficient in eliminating groundwater overdraft. Water users must develop new water supplies, including the full utilization of available effluent. The Augmentation and Reuse Program is designed to increase the use of renewable water supplies to reduce the Active Management Area's dependence on groundwater.

Good water management requires facilities to store developed water supplies since surface water supplies tend to be available in the winter and spring months when the water demand is low. Sometimes water must be stored in wet cycles so that the water demand can be met during times of drought. The Augmentation and Reuse Program, therefore, includes provisions to incorporate artificial groundwater recharge in plans for water supply development. The following topics are discussed in the order listed:

• Program Summary
• Statutory Provisions
• Program Goals and Objectives
• The Department's Role in Augmentation
• The Augmentation and Reuse Program
• Augmentation Research and Development Priorities
• Artificial Groundwater Recharge
• Water Reuse -- Effluent
• Central Arizona Project
• Analysis of Augmentation Measures
• Conclusion

B. PROGRAM SUMMARY

The Groundwater Code requires the Department to include a water supply augmentation program in the Second Management Plan. The intent of the Augmentation and Reuse Program presented in this chapter is to address the potential development of additional water supplies and maximize the use of renewable water resources to help attain the Prescott AMA's goal of safe-yield by 2025.

The Department evaluated several water supply augmentation, delivery, and storage opportunities in the development of this program. The augmentation and reuse strategies deemed feasible for statewide implementation during the 1990s were selected for in-depth study and discussion. Several of these alternatives, however, have limited applications in and for the Prescott AMA.

The Groundwater Code establishes an augmentation and conservation assistance fund to finance augmentation and conservation assistance programs for the benefit of the Active Management Area. The fund, comprised primarily of fees levied on groundwater withdrawals, will be used for augmentation purposes to:
1) provide funds for augmentation projects and studies initiated and conducted by the Department, and
2) provide cost-sharing grants to entities for augmentation activities.

The Department will also provide technical assistance to water users implementing augmentation projects to facilitate augmentation efforts in the Prescott AMA. Department staff will:
1) review and provide input to studies and project proposals, 2) promote the exchange of information between parties implementing augmentation projects, 3) continue to investigate augmentation measures for future implementation, 4) contract with private consultants for augmentation studies, and 5) issue
permits for recharge projects and underground storage and recovery projects.

C. STATUTORY PROVISIONS

The Groundwater Code contains many provisions enabling the Department to develop water supply augmentation programs. The Code requires that the Department include in the Second Management Plan for each Active Management Area a water supply augmentation program and incentives for artificial groundwater recharge. (A.R.S. § 45-565.A.5) The Code defines augmentation as supplementing the water supply of an Active Management Area, including importation of water into the Active Management Area, water storage, and artificial groundwater recharge. (A.R.S. § 45-561.1)

To provide funds for implementing the program, the Code established an augmentation fund consisting of monies collected from groundwater withdrawal fees, excess administration and enforcement fees, and application and surcharge fees collected for temporary use of groundwater in artificial lakes. (A.R.S. §§ 45-615.1 [1980], 45-611.2 [1980], 45-612.C [1980], and 45-133.C and D [1987]) These fees must be used to finance augmentation programs benefitting the Active Management Area in which they are collected. (A.R.S. § 45-613 [1980])

In 1990, the legislature amended the Code to require the Department to include in the Second Management Plan for each Active Management Area a program for conservation assistance to water users within the Active Management Area. (A.R.S. § 45-565.F, as amended by laws 1990, Ch. 320, Sec.2) To provide monies for the conservation assistance programs, the legislature further amended the Code to change the augmentation fund to an "augmentation and conservation assistance fund." (A.R.S. § 45-615.1, as amended by laws 1990, Ch. 320, Sec.9) Monies for the fund are to come from the same sources as those which funded the augmentation fund, and are to be used for both augmentation of the Active Management Area's water supply and conservation assistance to water users within the Active Management Area. Addition of a conservation assistance program to the Second Management Plan will require modification of the plan following a public hearing, pursuant to A.R.S. § 45-572.A. The Department intends to hold a public hearing on the modification in 1991, and enter an order of modification later that year.

The Code states that an amount not greater than two dollars per acre-foot per year shall be levied for augmentation of the water supply of the Active Management Area and conservation assistance to water users within the Active Management Area. (A.R.S. § 45-611.2) The initial fee for augmentation will be levied in 1990, the first year in which the augmentation program is developed and implemented as part of the management plan for the Active Management Area. (See A.R.S. § 45-611.2 [1984], amended by Laws 1990, Ch. 320, Sec. 5) Beginning in 1991 a fee for both augmentation and conservation assistance will be levied.

D. PROGRAM GOALS AND OBJECTIVES

The possibilities and need for augmentation differ substantially among the state's four Active Management Areas. The goal of the Prescott AMA augmentation and reuse program is to develop additional water supplies and maximize the use of renewable water supplies for the purpose of attaining safe-yield in the Active Management Area. To attain this goal, the Department will work toward the following objectives:
PRESCOTT AMA SECOND MANAGEMENT PLAN

- Maximize the use of Central Arizona Project water allocated to the Active Management Area
- Maximize the controlled recharge and underground storage and recovery of effluent which cannot be used directly
- Generate additional water supplies within the state and maximize their benefit to the Active Management Area by effecting inter-basin water transfers and exchanges
- Resolve technical, institutional, legal, and environmental constraints inhibiting the development and beneficial use of alternative water supplies
- Research and identify augmentation measures for future implementation

E. THE DEPARTMENT'S ROLE IN AUGMENTATION

The Department will take a lead role in identifying, facilitating, and coordinating augmentation activities within the Active Management Areas. The Prescott AMA Groundwater User's Advisory Council (GUAC) will also play a role in prioritizing and evaluating activities. The Department will provide planning support, technical support, and financial assistance to entities wishing to implement augmentation projects during the second management period.

Specifically, the Department will:

- Research, identify, and prioritize augmentation activities appropriate for implementation
- Coordinate activities and promote the exchange of information between parties implementing augmentation projects or conducting research related to increasing water supplies in the Active Management Area
- Provide technical assistance by reviewing and providing input to project proposals, research and feasibility study proposals, study results, project operations, and data interpretation
- Provide financial assistance to entities implementing augmentation projects or studies that contribute to Active Management Area's water management goals
- Facilitate, to the greatest extent possible, the permitting of artificial groundwater recharge projects and underground storage and recovery projects

F. THE AUGMENTATION AND REUSE PROGRAM

The Department will be an active participant in water supply augmentation during the second management period. The principle responsibility for developing water supplies, however, will remain with the region's water users. The Augmentation and Reuse Program includes five main elements designed to assist water users in developing new water supplies:

- Regulatory Incentives
- Technical Assistance
- Coordination and Facilitation of Efforts
- Resolution of Institutional and Legal Barriers
- Augmentation and Conservation Assistance Fund

1. Regulatory Incentives

Provisions established in the Agricultural, Municipal, and Industrial Conservation Programs of this management plan provide incentives for water users to implement augmentation and reuse measures.
2. **Technical Assistance**

The Department will support augmentation project construction, planning, and research activities during the second management period. Technical assistance will be provided to water users in assessing the need for augmentation projects, determining project feasibility, and reviewing project impacts. Department staff will participate in oversight committees, provide data, and review planning and feasibility study reports. To facilitate research projects, the Department will assist users by initiating research activities, assisting in study design, providing data, reviewing results, and disseminating information.

3. **Coordination and Facilitation of Efforts**

Many augmentation activities will require the participation of a variety of interest groups. Cooperative efforts among many governmental agencies, water users, and other groups will allow the development of larger, more effective projects and studies. The Department will work with organizations inside and outside the Prescott AMA to coordinate and facilitate augmentation activities. Examples of these facilities include: 1) basin-wide management studies, 2) analysis of watershed management research, 3) participation in the development of artificial groundwater recharge projects, 4) research on the impacts of effluent use, 5) promoting the use of the Central Arizona Project allocations, and 6) assessments of weather modification feasibility.

4. **Resolution of Institutional and Legal Barriers**

The summaries of the augmentation and reuse alternatives presented in this chapter identify a number of legal and institutional issues that must be resolved before augmentation projects can be undertaken on a large scale. Examples of the problems identified include:

- Questions regarding ownership of rights to augmented water supplies, or "new water"
- Questions regarding liability for potential damages resulting from augmentation programs
- Department rules or specific provisions of the Groundwater Code which may provide disincentives for water supply augmentation efforts

The Department will work with interested parties in the Prescott AMA and statewide to draft rules and to propose legislation that will resolve these and other legal and institutional problems.

5. **The Augmentation and Conservation Assistance Fund**

a. **Collection of Fees**

The Groundwater Code allows an augmentation and conservation assistance fee on groundwater withdrawals of up to $2.00 per acre-foot per year. These fees, excess payments of administration and enforcement fees, and the fees for interim use of groundwater in artificial lakes are the basis of the augmentation and conservation assistance fund. Monies in the fund designated for augmentation will be used to provide: 1) funds for augmentation projects and studies initiated or conducted by the Department, and 2) cost-sharing grants for augmentation projects and studies initiated or conducted by others. Table 7-A uses estimates of groundwater pumpage in 1990, 2000, and 2025 to illustrate the revenues which could be generated each year with alternative augmentation and conservation assistance fee levels in the Prescott AMA. The table does not include augmentation...
TABLE 7-A

ESTIMATED ANNUAL REVENUES BASED ON VARIABLE AUGMENTATION AND CONSERVATION ASSISTANCE FEES

PREScott ama

<table>
<thead>
<tr>
<th>Year</th>
<th>$0.50/ac-ft</th>
<th>$1.00/ac-ft</th>
<th>$1.50/ac-ft</th>
<th>$2.00/ac-ft</th>
</tr>
</thead>
<tbody>
<tr>
<td>1990</td>
<td>$12,500</td>
<td>$25,000</td>
<td>$37,500</td>
<td>$50,000</td>
</tr>
<tr>
<td>2000</td>
<td>$10,500</td>
<td>$21,000</td>
<td>$31,500</td>
<td>$42,000</td>
</tr>
<tr>
<td>2025</td>
<td>$12,300</td>
<td>$24,500</td>
<td>$36,900</td>
<td>$49,200</td>
</tr>
</tbody>
</table>

and conservation assistance funds generated by sources other than the groundwater withdrawal fee.

The Director may begin levying an augmentation fee in the first year in which an augmentation program is developed and implemented as part of the management plan of an Active Management Area. Because the date the Director implements an augmentation program will coincide with the beginning of the second management period, the Department will begin collecting an augmentation fee for the calendar year 1990. The Director will also begin to distribute any excess administration and enforcement fees to the augmentation fund for the calendar year 1990. The Director will begin levying a reasonable application fee for permits for the interim use of groundwater in artificial lakes upon receipt of permit applications. Application fees will be remitted to the augmentation fund.

b. Fund Allocation

1) Fund Categories

The Director will allocate augmentation monies from the augmentation and conservation assistance fund between two categories. Category I includes construction and implementation projects. This category includes projects whose primary goal is to directly increase water supplies or water storage. Secondary goals may include the demonstration of technologies and data collection. Category I also includes pilot and demonstration projects. Augmentation funds disbursed for this category will be used to help purchase water rights, construct facilities, and finance other activities which increase water supplies.

Category II includes planning, research, and feasibility studies. In Category II, funding will be used to determine which augmentation activities are suitable for future construction and implementation projects. The following types of studies will be eligible for augmentation fund monies in this category: studies designed to assess the feasibility of new technologies, studies designed to identify future sites for augmentation projects, studies designed to resolve institutional issues, and studies...
designed to facilitate future augmentation activities.

2) Method of Allocating Funds

During each year, a maximum of 80 percent of the available augmentation monies from the augmentation and conservation assistance fund may be spent on construction and implementation projects (Category I), and a maximum of 40 percent may be used to fund planning and feasibility studies (Category II). This is intended, in part, to prevent either category from consuming all of the available funds.

3) Fund Reversions

Any funds not distributed during the calendar year shall revert to the augmentation and conservation assistance fund for redistribution during the following calendar year.

4) Project Selection

The technical, economic, and/or institutional viability of various augmentation measures may change significantly during the second management period. In light of this, it is impractical at this time to detail the types of projects or studies that merit augmentation funding. The alternative is to develop a fund allocation process which is flexible yet politically and publicly responsive. This is accomplished by placing emphasis on the role of the Prescott AMA GUAC in fund allocation. Regularly scheduled GUAC meetings provide an excellent forum for public review and comment on projects and studies proposed for funding. The annual GUAC review process can also easily adapt to changing circumstances or priorities.

The Department will initially determine the general types of projects that it will fund during the calendar year, (e.g., weather modification, watershed management). The Department will coordinate this decision with water users in the Active Management Area to identify augmentation projects that will maximize potential augmentation of the region’s water supply.

After the Department establishes its overall augmentation priorities for the calendar year, it will accept proposals for specific projects. Each proposal will be evaluated at two levels. The Prescott AMA GUAC will evaluate and grade submitted proposals as to relative merit and recommend projects for funding to the Director. The Director will consider the GUAC recommendations and to what extent the project proposals meet the established criteria. Evaluation criteria include but are not limited to the following:

- Compatibility with current Department programs and policies, and consistency with the management plan goal
- Identification and description of potential economic, environmental, and social impacts
- Application of benefits derived from the proposed project to the entire Active Management Area
- Compliance with applicable federal, state, and local regulations
- Technical feasibility and timely realization of additional water supplies
- Promotion of efficient use of additional water supplies

Proposals will be coordinated with other Arizona agencies and organizations with water quality authority, such as the Department of...
Environmental Quality, by a review and comment process to ensure awareness of the project and allow adequate time to assess any impact the proposed project may have on existing programs (e.g., aquifer protection permits).

Once a project has been selected to receive augmentation monies, the method which will be used to allocate monies for the project will depend on the type of entity chosen to implement the project. If the project is to be implemented by a private entity, the Department will either allocate the money through a grant to the entity proposing the project, or seek bids from private contractors under the provisions of the Arizona Procurement Code. (A.R.S. §41-2501, et seq.) If bids are sought, the bids will be evaluated by the Department after consultation with the Prescott AMA GUAC. A contract will then be executed with the person whose bid meets the applicable contract guidelines.

If the project is to be implemented by a public agency, board or commission, the Department will either allocate the money through a grant to the agency, board or commission, or execute an intergovernmental agreement pursuant to A.R.S. §11-952.

If the project is to be implemented by the Department, monies will be withdrawn from the augmentation and conservation assistance fund for payment of the costs of the project as they accrue.

5) Funding Modifications

The Director may modify the funding allocation if the following are true:

- Projects in one of the two categories will benefit from an increase in funding, and
- Projects currently proposed in the other category are not of sufficient merit to warrant funding.

The Director must hold a hearing pursuant to A.R.S. §§ 45-570 and 45-572 prior to any modification.

G. AUGMENTATION RESEARCH AND DEVELOPMENT PRIORITIES FOR THE PRESCOTTAMA

The augmentation alternatives discussed in this chapter differ greatly from each other with regard to: 1) direct applicability in the Prescott AMA, 2) proven status of the technology, and 3) immediate need to be addressed. The Department used these considerations to establish priorities for augmentation efforts in the Prescott AMA during the second management period.

Of the augmentation and reuse options considered for the second management period, the Department will focus initially on the following strategies:

- Maximize the controlled subsurface storage and recovery of effluent which cannot be used directly
- Facilitate the implementation of Central Arizona Project (CAP) water allocations to the City of Prescott and the Yavapai Prescott Indian community
- If CAP allocations cannot be obtained, provide augmentation funds to research and promote the development of alternative water supplies, such as inter-basin water transfers

Augmentation priorities must be flexible enough to respond to changing circumstances during the planning period. Changes in the constraints affecting water supply augmentation measures may cause some measures, including those not presented in this plan, to become more viable. The Department recognizes this
possibility and has deliberately structured the Augmentation and Reuse Program, described in the following sections, to accommodate the future development of augmentation strategies not listed as a priority in this discussion.

**H. ARTIFICIAL GROUNDWATER RECHARGE**

As used in this chapter, the terms "artificial groundwater recharge" and "recharge" will refer to both a "recharge project" as defined in A.R.S. § 45-651.5, and an "underground storage and recovery project" as defined in A.R.S. § 45-802.6, unless the context otherwise requires.

Recharge allows developed water supplies to be stored during periods of low demand and recovered later during peak demand periods. Recharge also allows the possibility of indirect potable use of effluent because of the following considerations: 1) the ability of advanced wastewater treatment systems to produce water of a quality close to drinking water standards, 2) the additional filtering and cleansing properties recharge offers by percolating water through the subsurface, and 3) the blending and dilution that occur when the recharged water mixes with the underlying groundwater.

**1. Concerns Regarding Artificial Groundwater Recharge**

In pursuing effluent recharge objectives, careful consideration must be given to the possible negative impacts of recharge projects. A facility's siting, design, operation, and monitoring plan will determine whether the project contributes to water quantity and quality management objectives or results in adverse impacts (discussed below).

Potential impacts can be grouped into three general categories: 1) water quality degradation, 2) negative impacts on areas adjacent to the recharge site, and 3) increased flooding or stream channel erosion.

**a. Water Quality Degradation**

There are four major water quality concerns related to recharge facilities. First, some of the source waters for recharge, including effluent and urban storm water runoff, do not meet drinking water standards. The introduction of such waters into the subsurface must be carefully managed. Recharge methods that introduce water directly to the aquifer, such as injection wells, do not take advantage of the natural cleansing properties of the subsurface and are of particular concern. (Injection wells are not being used at the City of Prescott recharge facility.) In addition, facilities located too close to drinking water production wells may create water quality problems. Siting criteria used by the Department to evaluate potential recharge sites are discussed in a following section.

The second water quality concern relates to the groundwater mound created by artificial recharge. Improperly located recharge facilities (ones located immediately upgradient from a contaminant plume) can accelerate the migration of a contaminant plume.

The third concern is the possible leaching of contaminants to the water table as a result of present or historical land uses at or near the recharge site. This concern is important because landfills are located in or near stream channels (some of the best recharge areas). Special design considerations are warranted for recharge projects located near landfills.

The final water quality concern related to recharge facilities involves interagency coordination. The Department must coordinate with the Department of Environmental Quality (DEQ) through DEQ programs such as the aquifer protection permit program.
b. **Impacts on Adjacent Land Uses**

Artificial groundwater recharge facilities in urban areas can create conflicts with adjacent land uses. The design, landscaping, and operation of a recharge facility determine whether the project improves or degrades an area's aesthetic qualities. In addition, excessive detention times in recharge or sedimentation basins may enable mosquitoes and other insects to breed in the basins.

c. **Flooding Impacts**

Stream channels have highly efficient natural recharge characteristics, but their use for artificial recharge raises two flood control concerns. First, artificial recharge adds to the groundwater mounding already present from the natural recharge process. Long-term artificial recharge operations in some areas could cause local groundwater tables to rise within a few feet of the streambed. Without adequate water storage space in the unsaturated zone to accommodate natural recharge, runoff events could be forced to stay within the drainage channel, contributing to downstream flooding and erosion. This phenomenon is known as "rejected recharge." One solution to this problem is constructing recovery wells in the area to maintain an adequate unsaturated zone.

Second, recharge projects located off-channel that utilize in-channel diversion structures may obstruct water flow, causing localized flooding. A facility design which includes stream channel widening at and near the point of diversion can mitigate this problem. Projects located within the floodway or floodplain should be coordinated with the local flood control district.

2. **Siting Criteria for Artificial Groundwater Recharge Projects**

Legislation was enacted in 1986 which removed many barriers to implementing artificial recharge projects. (A.R.S. §§ 45-651, et seq. and 45-801, et seq.) Prior to 1986, an entity storing water underground had no enforceable right to recover water and no legal protection from nearby groundwater users withdrawing stored water. Major provisions of the legislation include:

- Establishment of two project categories: (1) recharge projects, and (2) underground storage and recovery projects
- Establishment of an underground storage accounting process clearly quantifying the amount of water stored and recovered
- Determination that the recovered water has the same legal identity as its original source
- Protection of the stored water from recovery by others
- Establishment of a permitting process, administered by the Department, including permit review criteria

Key permit criteria related to the siting of recharge projects and underground storage and recovery projects are discussed below.

a. **Recharge Projects**

Recharge projects must satisfy certain criteria in order to be permitted by the Department. A key criterion for projects located within Active Management Areas is that the Director must determine that "the project is not inconsistent with the active management area's augmentation program." (A.R.S. § 45-652.B.4) Recharge projects
located in any of the following areas are deemed to be inconsistent with the augmentation program:

- In remote or isolated areas where benefits of recharge would not be realized by a significant magnitude of groundwater use

- In a location that would promote the migration of a contaminant plume or poor quality groundwater area, unless the project is part of a sanctioned corrective management program of the Department of Water Resources/Department of Environmental Quality (DWR/DEQ)

- In a localized area of high groundwater levels with the potential to create drainage problems (e.g., agricultural, septic tank, leach field)

b. Underground Storage and Recovery Projects

Underground storage and recovery projects must satisfy criteria similar to those for recharge projects. However, a key distinction involves the location of the recovery activity. Only cities, towns, private water companies and irrigation districts in Active Management Areas may recover water outside the area of hydrologic impact of the project. Furthermore, the water must be recovered within the service area of the city, town private water company or irrigation district, and the Director must determine that the project "is consistent with the management plan and achievement of the management goal for the active management area." (A.R.S. § 45-807.A.1(b))

An underground storage and recovery project must meet at least one of the storage location criteria and at least one of the recovery location criteria listed below in order for the project to be deemed consistent with the management plan and achievement of the management goal for the Active Management Area.

If the project contributes to water management objectives but does not satisfy the location conditions, the Director may, in limited situations, deem the project to be consistent with the management plan and achievement of the management goal.

1) Storage Location Criteria

- In such a location or operated in such a manner as to contribute to groundwater supplies which are currently being used or could be used in the future so long as the areas which are recharged are not experiencing problems associated with a shallow depth to water

- In such a location or operated in such a manner as to contribute to a DWR/DEQ or U.S. Environmental Protection Agency (EPA) sanctioned corrective management program for a contaminant plume or poor groundwater quality area

2) Recovery Location Criteria

- In an area which would remove and use poor quality water (as defined in Chapter 3) as part of a DWR/DEQ or EPA sanctioned water quality management program

- In such a location or designed in such a manner as to contribute to a DWR/DEQ or EPA sanctioned corrective management program for a contaminant plume or poor groundwater quality area

- In an area experiencing a long-term annual rate of decline in the water table that is less than 4 feet per year
3. Future Directions

Artificial groundwater recharge is a feasible method to store water developed through augmentation activities. Through recharge, water users will be able to maximize their use of available water and match that use with periods when the water is most needed. During the second management period, the Department will work toward the following objectives:

- Continue research into artificial groundwater recharge technologies and related aspects of recharge
- Provide support to interested users wishing to develop artificial recharge projects
- Implement, and refine as needed, rules for recharge projects and underground storage and recovery projects

1. WATER REUSE—EFFLUENT

Although the Groundwater Code defines effluent in broad terms (A.R.S. § 45-402.6), the focus of this discussion is on treated municipal wastewater. It is important to further develop this resource during the second management period because the full utilization of effluent is necessary to reduce groundwater withdrawals in the Active Management Area. Effluent use efforts focus on: 1) increasing direct use, and 2) increasing controlled recharge of effluent which cannot be used directly. Direct use of effluent is centered on turf and agricultural irrigation, although other direct use possibilities exist. Provisions of this plan designed to encourage effluent use are discussed in the Agricultural, Municipal, and Industrial Conservation Programs.

1. Effluent Generation In the Prescott AMA

Currently, approximately 4,000 acre-feet of effluent is generated each year by wastewater treatment plants in the Prescott AMA. Projections indicate that by the year 2025, effluent production could increase to over 16,000 acre-feet per year.

As of April 1988, there were two wastewater treatment plants (WWTPs) in the Prescott AMA, both operated by the City of Prescott. Effluent discharged from Prescott's Main WWTP and not delivered to the Chino Valley Irrigation District (CVID) is used for turf watering at the city-owned Antelope Hills Golf Course. Nearly 90 percent of the water required to maintain the golf course is supplied by effluent. The City of Prescott has constructed facilities to recharge effluent that is not used directly for irrigation purposes. (Section H in this chapter discuss artificial recharge in more detail.)

Other communities in the Active Management Area are in various stages of providing centralized sewage treatment. The balance of the region's wastewater is processed by small septic systems and regulated by the Yavapai County Health Department. All treatment plant proposals include plans to use effluent. At least one new treatment facility will be operating sometime during the second management period.

The Prescott Country Club (a major residential subdivision and golf course) and the Town of Prescott Valley have plans for constructing new wastewater treatment facilities. The Prescott Country Club has applied to the Department of Environmental Quality for a discharge permit for the proposed plant.

When the Town of Chino Valley constructs its proposed sewage treatment facility, it is anticipated that the effluent
may be used to irrigate 800 acres of agricultural land owned by the town which is now irrigated with groundwater. Plans for this facility are in the preliminary stage. It is unlikely that the facility will be constructed before 2000.

2. Direct Use of Effluent

Three factors will limit the ability to directly use all effluent generated during the second management period. First, the quality of effluent produced in the Prescott AMA is insufficient to introduce into a potable water supply system. Direct use is therefore limited to turf watering, agricultural irrigation, and industrial applications. Second, users of effluent for irrigation have peak summer water demands and low winter demands. However, effluent production is directly related to indoor water consumption and is therefore relatively constant throughout the year. Third, over time, effluent generation will exceed the demand for effluent for irrigation purposes.

3. Artificial Groundwater Recharge with Effluent

For many years, a portion of the effluent discharged from Prescott's Main (Sundog) and Airport WWTPs was released to Granite Creek. Effluent mixed with surface water was stored in Watson Lake and transported to the Chino Valley Irrigation District for agricultural irrigation.

In 1985, the Arizona Department of Health Services designated Granite Creek as a full-body contact stream. The City of Prescott was notified that the water quality in Granite Creek did not meet state standards. Subsequent action by the U.S. Environmental Protection Agency required the City of Prescott to either stop discharging effluent into Watson Lake or upgrade the quality of water being discharged. The City of Prescott has ceased the discharge of effluent into Watson Lake and has obtained necessary permits from the Department of Water Resources and the Department of Environmental Quality to recharge the effluent through the use of infiltration basins. Prescott's recharge project is anticipated to recharge approximately 3,000 acre-feet annually to the Little Chino aquifer system. Plans to modify the sites as an underground storage and recovery project are currently under development.

4. Future Directions

Reclaimed water is an important and growing water resource in the Prescott AMA. The Department will support the increased use of effluent through artificial groundwater recharge. During the second management period, the Department will work toward the following objectives:

- Encourage the direct use of effluent by agricultural, municipal, and industrial users
- Provide augmentation funds for effluent recharge projects
- Identify institutional barriers to effluent use and work to resolve constraints
- Facilitate the permitting of effluent recharge projects that are consistent with the Prescott AMA's water management goals
- Provide planning and technical assistance to entities interested in implementing direct use and effluent recharge projects

3. CENTRAL ARIZONA PROJECT

The Central Arizona Project (CAP) is a water delivery system designed to transport Colorado River water to cities, industries, farms, and Indian communities in the Gila River Basin. The CAP is
FIGURE 7-A
CENTRAL ARIZONA PROJECT
Arizona's primary water supply augmentation project during the second management period. The CAP will deliver approximately 1.6 million acre-feet of water annually to users in central and southern Arizona. Figure 7-A depicts the location of the CAP aqueduct.

Although the City of Prescott and the Yavapai-Prescott Indian Community have signed letters of intent to contract for annual allocations of 7,127 and 500 acre-feet, respectively, the logistics of receiving the water dictate the use of a water exchange with a water user who has direct access to the CAP aqueduct.

At one time the City of Prescott proposed to divert water from the Verde River and transport it by pipeline to a pumping station near the Chino Valley Well Field. Analysis of the proposed diversion indicated potential negative environmental impacts. An alternative diversion site currently below the confluence of the Verde River with Sycamore Creek was also discussed and rejected.

K. ANALYSIS OF AUGMENTATION MEASURES

In addition to assessing artificial groundwater recharge and effluent use options, the Department conducted in-depth studies of four augmentation measures that could be implemented during the second management period. The measures identified were:

- Increasing the efficient use of storm water runoff
- Importing water from outside the Active Management Area (inter-basin transfers)
- Developing watershed management strategies to increase water yields
- Using weather modification to increase precipitation

The studies identified the approximate quantity of water potentially available, relative costs of the additional water, constraints on the development of new water supplies, and the role of the Department in future water supply development. The Department recognizes that these measures do not represent all water supply development options available to the Prescott AMA during the second management period. The application of each augmentation measure for the Prescott AMA is summarized in the following sections.

1. Storm Water Runoff

The Department evaluated the augmentation potential of storm water runoff from small drainages in the Prescott AMA. Table 7-B indicates the storage capacity of the major retention reservoirs in each sub-basin. In the Little Chino Sub-basin, the majority of runoff is contained in Watson Lake, Willow Creek, and Bottleneck Wash Reservoirs. These waters are then released for irrigation of agricultural lands in Chino Valley. Other runoff waters are relatively insignificant in volume and generally contribute to the natural groundwater recharge in the Active Management Area. Occasionally, small amounts of storm water runoff flow out of the Little Chino Sub-basin and enter the Verde River system.

In the Upper Agua Fria Sub-basin, storm water flows occur in the watersheds which form the headwaters of the Agua Fria River system. Lynx Creek is the largest of these watersheds. Lynx Lake impounds runoff water, which is then diverted into several retention reservoirs. These impounded waters are used for recreation, wildlife, and irrigation.
2. Water Importation (Water Transfers)

In this chapter, the terms "water importation" and "water transfers" will refer to both the severance and transfer of surface water rights, and the transportation of groundwater between sub-basins or away from a basin or Active Management Area.

The Groundwater Code allows entities to withdraw groundwater and transport it for use in another sub-basin or away from an Active Management Area. (A.R.S. §§ 45-542 and 45-543) Water importation, or an inter-basin water transfer, is a potential source of additional water in the Prescott AMA. Both the Big Chino Basin to the north and Skull Valley in the Bill Williams River Basin to the west are potential source areas for water transfers to the Prescott AMA. Importation of water from outside sources could help in reducing groundwater overdraft and obtaining assured water supply designations in 2001.

In recent years, water transfers to the state's metropolitan areas have become politically controversial because of concerns regarding the potential impacts of transfers in rural communities. The Department, at the direction of the Joint Legislative Committee on Groundwater and Surface Water Exportation, completed a study in December of 1987 (Final Water Transfer Study, Phase III Report) to evaluate water transfer impacts. The following sections briefly summarize current statutory constraints on water transfers, and potential impacts to rural areas.

a. Current Constraints

Several constraints now affect where water transfers will occur and the amount of water that may be transferred from an area. The Groundwater Code allows up to 3.0 acre-feet per acre of groundwater to be withdrawn from retired irrigated land pursuant to a Type 1 Non-Irrigation Grandfathered Right and transported to another sub-basin within an Active Management Area or away from an Active Management Area without payment of damages. (A.R.S. § 45-542.C) Outside of Active Management Areas, the Code makes entities liable for payment of damages to other water users if tangible

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**TABLE 7-B**

**RESERVOIR CAPACITIES**

**PRESCOTT AMA**

<table>
<thead>
<tr>
<th>Sub-basin</th>
<th>Reservoir</th>
<th>Storage Capacity (ac-ft)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Little Chino</td>
<td>Bottleneck Wash</td>
<td>--</td>
</tr>
<tr>
<td>Little Chino</td>
<td>Watson Lake</td>
<td>4,700</td>
</tr>
<tr>
<td>Little Chino</td>
<td>Willow Creek</td>
<td>6,100</td>
</tr>
<tr>
<td>Upper Agua Fria</td>
<td>Lynx Lake</td>
<td>1,470</td>
</tr>
</tbody>
</table>
injury can be demonstrated from transporting groundwater between sub-basins or away from a basin. (A.R.S. § 45-544)

Transfers of surface water within Arizona are regulated by state statutes that control changes in the four major characteristics of a surface water right: 1) source of supply, 2) point of diversion, 3) place of use, and 4) purpose of use. Although approval by the Director is required to change the place of use and purpose of use of a surface water right, the statutes do not create significant barriers to surface water transfers from basins outside the Active Management Areas.

Transfers of Colorado River water to the Active Management Areas are subject to the jurisdiction of the U.S. Secretary of the Interior. Any modifications to existing contracts which allocate the bulk of Arizona's Colorado River entitlement would have to be approved by the Secretary. To date, the Secretary has approved two sever and transfer actions of Colorado River water contracts. It is unlikely that the Secretary will block future transfers, provided there are no negative third party effects.

b. Potential Impacts

The Water Transfer Study identified the potential hydrologic, economic, and environmental impacts of water transfers in rural communities. The following discussion summarizes these potential impacts.

1) Hydrologic Impacts

The Water Transfer Study indicated that the hydrologic impacts of transfers would vary markedly depending on the area. The transfer of Colorado River water, a renewable resource, would have a nominal hydrologic impact within the present use area. The primary impact would probably be a small change in water quality downstream.

Impacts from groundwater withdrawals and transportation would vary widely among different areas and according to the volumes of water transported. In basins in which groundwater withdrawals are now minimal, increased pumping for water exportation would probably result in accelerated water level declines and increased potential for land subsidence and earth fissures. In basins in which agricultural lands would be retired to provide water for exportation, there would likely be no acceleration of water level declines if pumping levels remained at or below agricultural withdrawal rates. The study indicated that groundwater withdrawals from concentrated areas would cause more severe hydrologic impacts than pumping from dispersed areas.

2) Economic Impacts

The magnitude of socioeconomic and fiscal impacts would vary according to an area's size and the degree of diversification of economic activity. The study indicated that extensive removal of irrigated acreage in all areas would result in a decrease in employment, tax revenues, and economic activity associated with the agricultural base that would not be easily absorbed by other economic sectors.

The projected impacts, on an absolute basis, are expected to be more severe in areas supporting a more diverse economy. Absolute impacts, in terms of total tax revenue lost, would be greater in diversified economies because of the multiplier effects related to lost employment and tax revenues. However, projected socioeconomic impacts in smaller, less diversified areas may be large relative to the existing economic profile.
In addition, secondary tax revenues associated with bonding capacity would be affected to the extent that tax rates will have to be increased to maintain a viable bonding program.

3) Environmental Impacts

Retired agricultural lands require maintenance to prevent problems associated with noxious weeds, dust, and other undesirable effects to adjacent lands remaining in agricultural production. Any retirement of productive land would result in these effects if preventive measures are not taken.

4) Other Impacts

The effect of decreased local water supplies on the ability of rural areas to grow economically was not specifically analyzed in the Water Transfer Study. This issue was the primary concern raised during public meetings held to discuss the transfer issue. If economic growth was dependent only on available water supplies, an evaluation of water transfer impacts would have been relatively easy to accomplish. However, economic development is driven by numerous factors other than an abundant local water supply.

Arizona's mining industry provides an example of how development often occurs in areas with limited water supplies. The mines have rarely had adequate water supplies adjacent to ore bodies, but have taken steps to bring water to the mine sites. However, in areas where there are competing uses for water supplies, any water transfers large enough to cause a severe depletion of the water supply could affect the area's development potential.

c. Future Directions

During the second management period, the Department will continue to research the issues regarding inter-basin water transfers, including the potential hydrologic, economic and environmental impacts on Arizona's rural communities, and ways to mitigate these impacts. The Arizona Legislature may, in the future, impose additional restrictions on water transfers to protect rural communities from potential impacts. These restrictions may determine whether inter-basin transfers remain a viable augmentation strategy for the Active Management Areas.

3. Watershed Management

The concept of increasing water yields from Arizona's mountain watersheds was first proposed in the Barr Report in 1956. During the 1960s and 1970s, the U.S. Forest Service used several small experimental watersheds in Arizona to evaluate potential water yield increases through watershed management.

In recent years, the use of watershed management to increase water yields has been included in forest management plans for lands in Arizona which are managed by the U.S. Forest Service. These forest plans reflect the importance of considering improved water yields as an aspect of multiple-use planning for National Forest lands. The Department can play an important role in developing cooperation and coordination with other governmental agencies involved in watershed management efforts.

a. Management Techniques

Small watershed studies indicate that water yields can be increased through watershed management in the chaparral, ponderosa pine, and mixed conifer vegetation zones. Management techniques vary for each vegetation type, but the concept is the same: reduce
evapotranspiration losses through vegetation conversion. In the chaparral zone, brush and low-growing trees are replaced by grasses. Ponderosa pine and mixed conifer lands are thinned or cut in patches and strips to reduce plant water use.

b. Suitable lands

There are about 7.4 million acres of Arizona lands in these three vegetation zones: 2.8 million acres of chaparral, 4.3 million acres of ponderosa pine, and 0.31 million acres of mixed conifer. Seventy percent of this acreage is managed by the Forest Service. Most of the land is located north of Phoenix, within the Salt and Verde River watersheds.

Much of this land, however, cannot be managed for increased water yields because of constraints such as wilderness designations, steep slopes, low precipitation, and other institutional or physical factors. The Forest Service has estimated that about 2.8 million acres of its lands are suitable for watershed management when these additional constraints are considered. However, other multiple-use considerations such as grazing, recreation, and wildlife habitat may take precedence over managing National Forest lands for increased water yields.

c. Additional Water Available

Potential water yield increases from Arizona's National Forests have been estimated by applying the results of small watershed studies to the 2.8 million acres of land identified as suitable for watershed management. Table 7-C shows the range of potential water yield increases for each vegetation zone from the state's National Forest lands. The ranges represent various levels of watershed management due to different management constraints. The total estimated water yield from vegetation zones identified to be suitable for watershed management in the state ranges from 43,000 to 107,000 acre-feet annually. It should be recognized that this range is dependent on the full treatment of all three vegetation zones. Since it is unlikely that all feasible areas would be fully treated, the range indicated should be considered a maximum. The Department would need to take an extremely active role in encouraging the Forest Service and other land management agencies, as well as water users in the

<table>
<thead>
<tr>
<th>Vegetation Zone</th>
<th>Increases from Management</th>
<th>Ponderosa Pine</th>
<th>Mixed Conifer</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stallard Ponderosa Pine Mixed Conifer Total</td>
<td>25,000</td>
<td>15,000</td>
<td>3,000</td>
<td>43,000</td>
</tr>
<tr>
<td>to to to to to to to to</td>
<td>70,000</td>
<td>30,000</td>
<td>7,000</td>
<td>107,000</td>
</tr>
</tbody>
</table>

* Adapted from Solomon & Schmidt, U.S. Forest Service, 1981
state, to implement programs before these water yield increases could be achieved.

d. Prescott AMA Applications

Direct application of watershed management techniques in the Prescott AMA is limited. Approximately 35 percent of the 340,000 acres of chaparral in the Prescott National Forest are within the Granite Creek, Big Chino Wash, Upper Agua Fria, and the Santa Maria River. Granite Creek is the only watershed draining to the Active Management Area. However, watershed management efforts could potentially augment the water supply of the Prescott AMA indirectly through the management of nearby watersheds. Water transfers or exchanges would be necessary if water yield improvement efforts were implemented in other drainages.

e. Institutional Factors

Ownership of additional water obtained through watershed management has not yet been established by Arizona's courts. Questions regarding water ownership must be resolved before it is possible to fully assess the feasibility of watershed management as a water supply augmentation strategy.

Legal uncertainties also exist regarding potential liability if flooding were to occur downstream of lands managed for water yield increases. Questions remain regarding legally acceptable documentation on the effects of watershed management. It has not been determined whether hydrologic models will be accepted as evidence of streamflow changes. In addition, there are uncertainties regarding whether additional water generated would be measurable, given the limits imposed by natural variability and the accuracy of stream flow measurements.

f. Economic Considerations

Economic considerations regarding watershed management have not been fully evaluated to date. A comprehensive cost-benefit analysis of this augmentation measure should include an evaluation of:

- Treatment costs
- On-site impacts from vegetation conversion
- Impacts to the stream system from increased flows
- Water transmission losses
- Non-point source impacts on surface water quality through programs such as the DEQ non-point source program
- Costs related to storage and delivery of increased runoff from management activities
- Costs to mitigate environmental impacts
- Benefits of increased water supplies

Some costs and benefits of watershed management have been identified by researchers, but no monetary value has been determined for many factors. Cost-benefit assessments were based on small-watershed studies (10 to 2,000 acres) and extrapolated to larger watersheds. Factors affecting project costs or benefits include effects on wildlife, water quality, soil erosion, livestock, timber production, aesthetic values, fire hazards, and hydroelectric power generation. Initial research by the Forest Service indicates a positive net benefit, but some of the aforementioned factors were not considered.
g. **Current Forest Service Projects in Arizona**

Three of Arizona's National Forests—the Apache-Sitgreaves, the Coconino, and the Tonto—have evaluated watershed management as part of their planning process. The Tonto National Forest has also included watershed management objectives in its 50-year forest plan. The plan calls for management of up to 20,000 acres of chaparral lands annually, depending on available funding and other management constraints.

h. **Future Directions**

Watershed management is still being analyzed as a feasible augmentation measure for Arizona. During the second management period, the Department will continue to encourage land management agencies in the state, such as the Forest Service, the U.S. Bureau of Land Management, and the Arizona State Land Department, to include watershed management in their planning activities.

Because the treatable area of chaparral within the Prescott AMA is limited, management of watersheds outside of the Active Management Area poses additional considerations involving water transfers and exchanges. The actual amount of water that could potentially reach users in the Prescott AMA has not yet been determined.

To further analyze the potential for implementing watershed management activities in the state, the Department is currently working through the U.S. Department of Agriculture's Field Advisory Committee, (FAC) comprised of representatives from the U.S. Soil Conservation Service, the U.S. Forest Service, the Salt River Project, and the Department of Water Resources. Figure 7-5 illustrates the area currently being evaluated by the FAC in the Arizona Water Resources Study for future watershed management applications.

The following questions and constraints will be examined through this committee and subsequent studies.

- Water ownership questions
- Legal/institutional issues
- Total costs of watershed management
- Benefits to local areas and water users in the Active Management Areas
- Environmental impacts and mitigation of those impacts
- Necessity for storage and flood control facilities
- Impacts on other land uses such as recreation, forage, and wildlife habitat
- Additional research needed for any potential application of watershed management as a water supply augmentation strategy

5. **Weather Modification**

Weather modification has been cited as one of the most promising water supply augmentation options for the future, yet it is the one measure studied for the second management period that has the most uncertainty and the greatest need for additional research. Since the late 1940s, researchers have investigated weather patterns in Arizona's mountainous regions to determine whether it is possible to increase precipitation and resulting streamflows. Recent studies of winter cloud formation processes and precipitation patterns over the mountains of central Arizona have revealed sufficient information to conclude that the Department should continue to study weather modification as an augmentation measure.
Figure 7-B

VEGETATIVE ZONE
- Ponderosa Pine
- Mixed Conifer
- Chaparral

STUDY WATERSHEDS
- LITTLE COLORADO RIVER 02
- BILL WILLIAMS RIVER 03
- UPPER GILA RIVER 04
- SALT & VERDE RIVERS 06
- AGUA FRIA & HASSAYAMPA RIVERS 07

Study Area: Arizona Water Resources Study
a. Concepts - Study Methods

The seeding of winter clouds to increase precipitation over Arizona's mountains has been under investigations since 1986. Cloud seeding involves the introduction of condensation nuclei, usually silver iodide or dry ice, to certain types of cloud formations to encourage water vapor to accumulate on the nuclei and fall as snow. Initial research by the U.S. Bureau of Reclamation (USBR) indicated that it may be feasible to treat winter storm clouds over the Mogollon Rim area, Chiricahua Mountains, and Mule Mountains. In cooperation with USBR, the Department has evaluated the feasibility of cloud seeding to increase the water yield from the Salt and Verde River watersheds in the Mogollon Rim area. Information collected from field investigations, conducted from mid-January to mid-March in both 1987 and 1988, has shown that a reasonable frequency of seedable winter clouds exists over these watersheds, and that these clouds contain a considerable amount of excess water which can be converted into precipitation.

b. Additional Water Available

Given the prevailing weather patterns and efficiency of treatments, USBR estimated that snowpack in the Mogollon Rim area could be increased by up to 15 percent in an average year. However, there is a substantial body of scientific literature which questions whether water yields from weather modification activities are significant and dependable. To identify the actual quantity and quality of water available to water users in years when the water is needed, further research will be necessary.

c. Prescott AMA Applications

Like watershed management, direct application of weather modification within the Prescott AMA is limited. USBR studies did not identify

mountainous areas in or adjacent to the Active Management Area as those with a high potential for cloud seeding projects. However, application to basins outside the Active Management Area may yield water that could be imported through transfers or exchanges. Further analysis of potential treatment sites is necessary to determine the feasibility and appropriateness of such a program.

d. Environmental Impacts

The potential environmental effects of cloud seeding in Arizona have not been studied extensively. Studies conducted elsewhere, however, have been used to project short and long-term impacts. These studies have focused on three types of impacts: 1) physical effects from chemicals in the seeding material, 2) impacts from increases in precipitation on ecosystems and communities, and 3) changes in streamflow and flow regime. Therefore, before initiating a full-scale cloud seeding program in Arizona, short-term pilot programs should be conducted to adequately assess the potential environmental effects of weather modification.

e. Economic Considerations

Any water yield increases from cloud seeding programs would occur during snowmelt runoff in the spring. Additional water, therefore, would flow through the Salt and Verde Rivers at a time when natural streamflows are at their highest. In all but the driest periods, increased reservoir storage capacity would be necessary before water yield increases to downstream users could be realized. If weather modification research indicates that substantial water yield increases are possible, additional research will be needed regarding streamflow increases before it will be possible to estimate the costs of water storage and delivery.

Cost estimates for weather modification programs are highly variable, depending
on: 1) the criteria used for estimating the number of weather patterns suitable for cloud seeding, 2) the relative use of ground and aircraft seeding, 3) the extent of weather monitoring required, and 4) the extent of environmental monitoring needed. USBR estimates the cost of basin-wide weather modification activities in the Colorado River basin would range from $5.00 to $10.00 per acre-foot, not including storage or delivery costs. Additional research will be needed regarding streamflow increases in response to treatment scenarios before it is possible to estimate the costs of water storage and delivery.

g. Future Directions

There are a number of unresolved questions regarding the feasibility of weather modification as a means to augment water supplies for the Active Management Areas. The focus of the Department's efforts during the second management period will be to address the following:

- Potential water yield increases to water users in the Active Management Areas from various locations, technologies, and treatments
- Environmental impacts
- Legal and institutional problems
- Potential funding sources for large-scale weather modification programs
- Impacts on downstream storage and flood control plans

f. Institutional Factors

Since the outcome of a successful weather modification program would be increased surface water yield from the Salt and Verde River watersheds, allocation of this "new water" would need to be thoroughly addressed with respect to Arizona surface water law. The standard criteria used in evaluating surface water use is to evaluate the impacts that a proposed action may have on vested rights. As a result, any weather modification program would have to include a participation of all major water users affected by the program. At this time, it appears that a negotiated allocation of any new water would have to take place.

These problems suggest studies are needed to determine: 1) groups impacted by weather modification, 2) water yield increases associated with the program, and 3) relative allocation of costs and benefits among participants and impacted groups. Ultimately, the state courts or the Arizona Legislature will need to resolve the legal issues for which precedents do not exist.

I. CONCLUSION

The Department has identified and evaluated potential application of various augmentation schemes for the Prescott AMA. Many of the alternatives discussed in this chapter have limited application for this region. The Department will continue to examine additional augmentation and reuse strategies in an effort to achieve the Active Management Area's goal of safe-yield.
PLAN IMPLEMENTATION
A. INTRODUCTION

This chapter describes how the water conservation requirements in this management plan are implemented, steps water users must take to comply with the Groundwater Code and management plan provisions, and how the Department works to ensure compliance with the plan's requirements. The following topics are discussed in the order listed:

- Notice of Conservation Requirement - Compliance Dates
- Variance and Administrative Review Process
- Plan Modification Procedures
- Groundwater Use Monitoring and Reporting Requirements
- Monitoring and Audit Procedures
- Enforcement Approach

Compliance with agricultural, municipal, and industrial conservation requirements is vital to attaining the Prescott Active Management Area's water management goal of safe-yield. When necessary, the Department will use the Groundwater Code's statutory authority to ensure the success of Second Management Plan conservation programs. The Department's enforcement approach and procedures are discussed in Section G of this chapter.

B. NOTICE OF CONSERVATION REQUIREMENT - COMPLIANCE DATES

Within thirty days after the final adoption of the Second Management Plan, affected water providers, distributors, and users were mailed a certified letter with written notice of their intermediate and final irrigation water duties or conservation requirements. Where conservation requirements in one chapter of the plan are referred to in another chapter, both chapters' requirements were contained in the notice.

The Department will again serve written notice to a provider, distributor, or user of their intermediate or final conservation requirements two years prior to the compliance date of the requirement. If a compliance date covers a period of one calendar year ending upon December 31 of that year, the Department will provide notice two years prior to January 1 of that calendar year. If any intermediate requirements begin January 1, 1992, the Department will include a specific notice of those requirements in the same mailing containing the initial notice of all requirements. When a right to withdraw groundwater is sold or conveyed, the new owner will receive written notice of the applicable requirements.

Until the first intermediate compliance date (or final compliance date if there is no intermediate requirement) is reached, the person noticed must continue to meet all applicable First Management Plan requirements. In this chapter, "person" means "an individual, public or private corporation, company, partnership, firm, association, society, estate, trust, any other private organization or enterprise, the United States, and any state, territory or country or a governmental entity, political subdivision or municipal corporation organized under or subject to the constitution and laws of this state." (A.R.S. § 45-402.24) Any intermediate requirements are superseded by later intermediate requirements or final requirements upon reaching the applicable compliance dates. Persons noticed of final requirements must continue to meet those requirements until any subsequent Third Management Plan requirements.
C. VARIANCE AND ADMINISTRATIVE REVIEW PROCESS

Persons receiving a notice of Second Management Plan conservation requirements or irrigation water duties may apply for a variance or administrative review. An application for administrative review may be made at any time during the second management period. An application for a variance must be made within 90 days of the date of notice of the water duty or conservation requirement.

1. **Variances**

A variance provides additional time to achieve specific water duties or conservation requirements. The Director may grant a variance for up to five years, if the applicant demonstrates that compelling economic circumstances prohibit the attainment of the water duty or conservation requirement by the date specified in the notice. Persons granted a variance must meet the water duties or conservation requirements by the dates specified in the variance. In the interim, they must comply with applicable requirements.

2. **Administrative Reviews**

An aggrieved person may apply for administrative review at any time. If the person applies for administrative review within 90 days after the initial written notice for a Second Management Plan water duty or conservation requirement, the Director shall determine whether an error or omission was made in calculating the person's water duty or conservation requirement. The Director may also consider other unusual circumstances requiring a change in the water duty or conservation requirement.

If a person applies for an administrative review more than 90 days after their initial Second Management Plan notice, the person must prove that extraordinary circumstances, not in existence as of the date of the notice, make it unreasonable to comply with the water duty or conservation requirement.

Extraordinary circumstances not in existence as of the date of notice for municipal providers may include, but are not necessarily limited to, the following:

- Smaller service area populations than were projected in the procedure used to determine the total gallons per capita per day (GPCD) requirement
- A lower actual value of persons per household than was projected in determining the total GPCD requirement
- A higher actual ratio of single family dwelling units to multifamily dwelling units than was projected in determining the total GPCD requirement
- A small provider transitioning to a large provider with a predetermined new large provider total GPCD requirement which is not consistent with the provider's existing water use patterns

Extraordinary circumstances not in existence as of the date of notice for irrigation grandfathered right holders may include, but are not necessarily limited to, the following:

- Less favorable economic conditions than were projected in determining the irrigation water duty
- Changes in water quality altering water application rates

Extraordinary circumstances not in existence as of the date of notice for industrial users may include, but are not necessarily limited to, the following:
• Changes in technology and economics that affect the economic return of the facility

• Changes in federal, state and local regulations which prevent compliance with conservation requirements

• Changes in water quality

D. PLAN MODIFICATION PROCEDURES

The Second Management Plan does not include the modification provisions which were in the First Management Plan. (Under the First Management Plan, a municipal water provider could obtain a modification to its total GPCD requirement under certain conditions.) Now, modifications may only be made through A.R.S. § 45-572. Under this statutory provision, the Director may modify elements of the management plan whereby the irrigation water duties or conservation requirements for an entire category of users is affected. The Director may also modify an individual water duty or conservation requirement if it is determined that extraordinary circumstances justify the modification. Unlike either the variance or administrative review, the Director must conduct a public hearing prior to modifying the management plan.

E. GROUNDWATER USE MONITORING AND REPORTING REQUIREMENTS

The Groundwater Code contains a number of provisions which enable the Department to acquire needed information on water use and to evaluate compliance with the Code and Department rules, permits, and management plans. The water use monitoring and reporting requirements summarized below are also designed to provide water users with the data needed to assess their progress in attaining conservation requirements.

1. Measuring Devices

The Code requires persons withdrawing groundwater from non-exempt wells in Active Management Areas or Irrigation Non-expansion Areas to use water measuring devices approved by the Director. (A.R.S. § 45-604) Some small non-irrigation users, however, are exempt from the measuring device requirements. The Department has adopted rules requiring the use of an approved device, or combination of devices and methods, for measuring rates of groundwater withdrawal which allow the calculation of the total annual volume of groundwater withdrawn. (A.A.C. R12-15-901 et seq.) Persons subject to the measuring device requirement must maintain the accuracy of the device within specified standards.

2. Records and Annual Reports

The Code requires persons who own or lease a right to withdraw, receive or use groundwater in an Active Management Area to file an Annual Water Withdrawal and Use Report with the Director for each right they hold. (A.R.S. § 45-632) Those persons using water which has been transported from an Active Management Area must also file an annual report. All persons required to file annual reports must maintain current and accurate records of the water withdrawn, delivered, received, and used.

Persons withdrawing groundwater from exempt wells and most non-irrigation customers of cities, towns, private water companies, and irrigation districts are exempt from record keeping and reporting requirements. Persons receiving water pursuant to a groundwater withdrawal permit and persons assigned and noticed of individual user requirements must meet the record keeping and reporting requirements.

The Code specifies the minimum content of annual reports and authorizes the
Director to require additional information. The reports must be in the form prescribed by the Director, and must contain a sworn statement or certification that the reported information is true and correct according to the best belief and knowledge of the person filing the report. Reports must be maintained on a calendar year basis and filed with the Department no later than March 31 of each year for the preceding calendar year.

The Code contains other reporting requirements. Each person delivering a combination of surface water and groundwater, whether commingled or otherwise, for use by cities, towns, private water companies, industries, agriculture, or other users, must provide the Department with an annual accounting of all surface water and all groundwater delivered to each class of user and to each farm. (A.R.S. § 45-468)

The following sections briefly outline reporting requirements for different types of water users. The Department furnishes detailed instructions to each water user regarding their reporting requirements.

a. Irrigation Grandfathered Right Holders

An annual report detailing the total amount of water used from all sources must be submitted for each irrigation grandfathered right. Right holders who own their own wells must document the method by which they calculated their groundwater withdrawals. For those receiving all of their water from an irrigation district or other irrigation water delivery entity, either the individual or the entity may submit the report. Persons with more than one irrigation grandfathered right must submit an annual report for each right.

b. Irrigation Water Delivery Entities

Cities, towns, private water companies, and irrigation districts delivering water to irrigation grandfathered right holders must measure and report their total annual withdrawals from their wells. These entities must also report the amount of surface water and the amount of groundwater delivered to each of their irrigation customers. The Agricultural Conservation Program in Chapter 4 of this plan sets forth additional reporting requirements.

c. Municipal Water Providers

Each municipal provider must report its total groundwater and surface water deliveries. The Municipal Conservation Program in Chapter 5 of this plan sets forth additional reporting requirements.

d. Industrial Water Users

Industrial users include persons withdrawing water pursuant to a Type 1 or Type 2 non-irrigation grandfathered right or a groundwater withdrawal permit. Each industrial water user must report its total annual groundwater pumpage. The Industrial Conservation Program in Chapter 6 of this plan sets forth additional reporting requirements.

e. Recharge, Storage and Recovery

Monitoring and reporting requirements for both recharge and underground storage and recovery projects are prescribed in permits issued by the Department of Water Resources and the Department of Environmental Quality.

Holders of recharge permits are required to file an annual report which includes the following information:

- The quantity of water from each source used for recharge under the permit for that year.
• The number of days during the year that the recharge project was in operation.

• Such other information as the Director may reasonably require

Holders of underground storage and recovery permits are required to file an annual report which includes the following:

• The quantity of water from each source stored pursuant to the permit for that year

• The registration number and location of each well used to recover stored water

• The quantity of fuel or electricity consumed by the pump for each well during the year

• The quantity of each type of stored water recovered by each well during the year

• The names of any persons, other than non-irrigation customers of municipal providers, to whom the recovered water was delivered during the year; the quantity of recovered water delivered to each such person; and the uses to which the recovered water was applied

• Specific monitoring and reporting requirements as stated in the permit

f. Individual Users

Individual users are defined as turf-related facilities, new large cooling users, and landscaped public rights-of-way served by municipal providers. Those individual users which have conservation requirements which are "substantially identical" to those contained in the Industrial Conservation Program (Chapter 6) for industrial users (turf-related facilities and new large cooling users) are responsible for filing annual reports with the Department. The information which must be reported is outlined in Chapter 6. Either the municipal provider or the individual user may be responsible for filing the annual report, depending on who was notified of the conservation requirements.

F. MONITORING AND AUDIT PROCEDURES

The Groundwater Code allows the Department to enter property where facilities for the withdrawal, transportation, or use of groundwater are located (A.R.S. § 45-633) to:

• Inspect facilities subject to Code provisions

• Obtain data or access to records relating to the withdrawal, use or transportation of groundwater

• Determine compliance with the Code

The Department will give persons reasonable notice of inspections or investigations unless there is reason to believe that such notice would frustrate enforcement or where entry is sought solely to inspect a measuring device. The Department will audit the records of a sufficient number of persons to ensure overall compliance with the Code within the Prescott AMA.

1. Measuring Devices

The Department systematically monitors compliance with the measuring device requirements. Before all field visits, the Department contacts well owners to ask for their cooperation and presence during the inspection. Standardized procedures and equipment are used to test the accuracy of measuring devices. The Department checks a significant percentage of the wells in the Prescott AMA each year.
2. **Irrigated Acreage Monitoring**

The Department monitors irrigated acreage and irrigation water use in the Prescott AMA using annual reports, U.S. Agricultural Stabilization and Conservation Service crop records, energy records, aerial photography, and satellite-based remote sensing data. These procedures are also used both to detect illegal irrigation and to determine the accuracy of annual water use reports. The Department investigates any discrepancies which are identified.

3. **Audits**

The Department conducts audits of annual reports by water users to check the accuracy of the reports. An audit is a detailed review by Department staff of the water use records which must be kept by each person required to file an annual report. Each year, the Department audits a significant number of annual reports to ensure overall compliance with the Groundwater Code and the management plan for the Prescott AMA.

G. **ENFORCEMENT APPROACH**

Most entities and individuals comply with the requirements of the Groundwater Code and management plans when they understand what is expected of them. In the past, most violations have been due to ignorance of Code or management plan provisions, or unintentional mistakes, rather than deliberate refusals to comply. Because of the public’s willingness to comply, the Department will emphasize public education and information in its enforcement efforts. However, the Code does allow the Director to seek civil and criminal penalties for violations. The Department will use these powers when necessary to ensure the attainment of the Prescott AMA water management goal.

1. **The Role of Education**

The Department educates water users in several ways to help them meet their irrigation water duties or conservation requirements. First, conservation requirements and methods for reducing water use are explained to affected users. Conservation assistance programs are being designed to encourage specific water-saving approaches in each water use sector. Second, the Department attempts to inform water users of impending violations when they are discovered. Pre-violation notices make users aware of potential problems so that corrective action can take place before violations occur. Third, those persons in violation of the management plan are given additional assistance in designing conservation programs to meet their needs.

2. **Determination of Compliance**

The mandatory conservation program contained in the Second Management Plan is designed to achieve reductions in groundwater withdrawals. Consequently, persons given notice of water duties and conservation requirements established in the plan are required to comply with those duties and requirements only in those years in which they withdraw, distribute or receive groundwater. The following discussion explains how compliance with maximum annual water allotments and total GPCD requirements is determined in those years in which a person withdraws, distributes, or uses groundwater.

Compliance by a person with a maximum annual water allotment or total GPCD requirement is generally determined by comparing the total amount of water used by the person during the year with the amount of water the person was entitled to use during the year as measured by the allotment or total GPCD requirement. Use of water by the person in an amount which exceeds the allotment or total
GPCD requirement does not necessarily mean that the person is out of compliance for that year, however. To account for weather variations or other factors which may result in the use of more water in some years than others, operating flexibility accounts have been established for farms and municipal providers which allow them to either borrow or bank water from year to year subject to certain limits.

Flexibility accounts for farms are established pursuant to statute. (A.R.S. § 45-467) If the total amount of water, other than spill water, used by a farm during a year is less than its maximum annual groundwater allotment, the farm's flexibility account is credited with the amount of groundwater saved. If the total amount of water, other than spill water (see A.A.C. R12-15-1001.9), used by a farm during a year exceeds its maximum annual groundwater allotment, the farm's flexibility account is debited by the amount of groundwater used, up to the amount of the excess. A farm is out of compliance with its maximum annual groundwater allotment if its use of water during a year causes its flexibility account to be in arrears in an amount which exceeds fifty percent of its maximum annual groundwater allotment.

Flexibility accounts for municipal providers are established pursuant to Section 5-105 of the Second Management Plan. If the total amount of water, other than spill water and effluent which is not recovered effluent, used by a municipal provider in a year is less than the amount of water the provider was legally entitled to use in the year, as measured by its total GPCD requirement, the provider's flexibility account is credited with the difference, up to a maximum positive account balance of 30 GPCD. If the total amount of water, other than spill water and effluent which is not recovered effluent, used by a municipal provider in a year exceeds the amount of water it was legally entitled to use in the year, its flexibility account is debited with the difference, up to a maximum negative account balance of -10 GPCD. A provider is out of compliance with its GPCD requirement in any year in which its flexibility account is debited by an amount of water which causes the account balance to exceed the maximum negative account balance allowed in the account.

If a debit to a municipal provider's flexibility account causes the provider to be out of compliance with its total GPCD requirement, the extent of the provider's non-compliance is determined by the amount of groundwater used during the year. Although water from all sources, other than spill water and effluent which is not recovered effluent, used by the provider during the year is counted when determining the provider's compliance with its total GPCD requirement, groundwater is counted last.

This is consistent with the intent of the Groundwater Code that other available sources of water be used before groundwater is used. It also allows the Department to determine whether, and to what extent, the provider has failed to reasonably reduce its per capita use of groundwater. If the total amount of water used by the provider during the year exceeds the amount of water determined to be reasonably necessary for its use, as reflected in its total GPCD requirement, the provider has failed to conserve the groundwater included in the excess.

The process of counting groundwater last is called "stacking," because the groundwater is added to (or "stacked" on) the other sources of water used by the provider during the year before comparing the amount of water used with the provider's total GPCD requirement. This process is also used when determining compliance by a farm with its maximum annual groundwater allotment.
Because groundwater use is counted last, the amount of water debited to a provider's account will be comprised at least partially of groundwater, with the groundwater again stacked on top of any other sources of water present. If the debit causes the account balance to exceed the maximum negative account balance, the provider is out of compliance for the year by the amount of groundwater included in the debit, up to the excess.

Turf-related facilities, dairy operations and cattle feedlot operations are subject to maximum annual water allotments. Compliance by such entities with their maximum annual water allotments is determined by comparing their total water use during a year with their maximum annual water allotment for the year. As in the case of municipal providers, groundwater used by the entity during the year is counted last. Therefore, if the amount of water used by the entity during the year exceeds its allotment, the entity will be out of compliance by the amount of groundwater included in the excess.

Although flexibility accounts have not been established for turf-related facilities, dairy operations, and cattle feedlot operations, the Department has included a three-year averaging provision in the plan to allow them to exceed their allotment in one year and make up the difference with water saved in prior years. Under this provision, the entity will be in compliance in a year in which its water use exceeds its allotment if the amount of water used by the entity during that year and the previous two years does not exceed the sum of its allotments for the three years.

Certain types of water users that receive water from municipal providers must comply with conservation requirements during the second management period if they are given written notice of those requirements by the Department. Those users include turf-related facilities, publically owned rights-of-way, and new large cooling towers. Whether, and to what extent, such entities have used groundwater during a year depends on the distribution system through which they receive water, and their provider's system of accounting for its deliveries.

If a municipal provider delivers a single source of water to such a user through a distinct distribution system, all of the water received by the user from the provider will be considered to have been from that source of water. However, if the provider delivers water to the user through a distribution system through which it delivers a combination of groundwater and other sources of water, the Department will assume that the water delivered to the user was comprised of the same sources of water, and in the same proportion, as the provider's total deliveries through the system during the year. This assumption will not be made if the provider can establish, to the satisfaction of the Department, that the water actually delivered to the user was from a single source, or was from several sources in a proportion different to that of the provider's total deliveries.

3. The Enforcement Process

When the Department's monitoring program identifies a potential violation or when a person complains about the activities of another, an investigation will be conducted to obtain the facts and determine an appropriate course of action.

An investigation will usually involve a field inspection by Department staff after notice to the potential violator. The Department may also request the individual to produce relevant records for audit. Based upon the investigation, the Department will determine whether there has been a violation and, if so, what course of action to take.
Where the violation is minor, unintentional, and does not require corrective action, the Department may bring the compliance action to a close upon discontinuance of the violation. With more serious violations, where there is reason to believe a person is violating or has violated a Code, permit, rule, or management plan provision, a hearing may be held during which the person may show cause why they should not be ordered to cease and desist from the violation. (A.R.S. § 45-634)

Following a hearing, the Director may issue a cease and desist order, seek civil penalties, or take other actions. The Code authorizes civil penalties of up to $10,000 per day for violations directly related to the illegal withdrawal, transportation, or use of groundwater.

Extremely serious cases may also be referred for criminal prosecution if persons knowingly violate or refuse to comply with the Code, or a permit, rule, or order issued or adopted under the Code.

4. Determination of Penalties

An important objective of the compliance program is to be as equitable and reasonable as possible in imposing penalties on violators. The Department will strive to set penalties that fit the severity of water conservation violations.

The Department's policy is that deliberate violations are more serious than unintentional ones. Each Active Management Area office will keep records of educational efforts and aid provided to water users, and will evaluate the degree to which a violator tried to comply with their conservation requirements. Those persons who have active water conservation programs and who still do not achieve compliance may be treated differently from those persons who have not made a strong effort toward meeting their conservation requirements.

Flagrant violations with high public visibility will receive prompt and relatively strict corrective action from the Department. Repeat offenders will receive more severe penalties than first-time violators.
CONCLUSIONS
AND
FUTURE DIRECTIONS
A. INTRODUCTION
The Department conducted a comprehensive assessment of water supplies, demands, and conservation potential for the Second Management Plan. The development of this plan has led to several conclusions regarding the ability of these programs to reduce groundwater overdraft and future efforts needed to achieve safe-yield. This chapter summarizes these conclusions, and the water management programs comprising this plan.

B. GENERAL CONCLUSIONS

- During the second management period, groundwater overdraft in the Prescott AMA can be reduced by approximately 21 percent through the importation of Central Arizona Project exchange water, continued conservation efforts by all water users, and full utilization of effluent. By 2025, the Department projects that overdraft can be eliminated through the implementation of Second Management Plan conservation programs, urbanization of agricultural land, and water supply augmentation measures.

- The water conservation requirements in this plan are economically reasonable investments. Proven conservation technology exists to reduce water use in many water use sectors by as much as 20 to 25 percent without major changes in water use patterns, lifestyle, or profitability of industrial water users.

- Safe-yield can only be achieved through continued conservation efforts and increased water supply augmentation. Augmentation efforts could increase renewable water supplies and lessen the need for additional conservation measures beyond those contained in this plan.

- More detailed water use information is needed in the future from all use sectors to determine how water can be used more efficiently.

- Groundwater quality data and the influence of water quality on water management programs in Arizona are not yet well defined. Groundwater quality assessments are needed on a continuing basis to provide the data needed for effective management of the Active Management Area’s groundwater resources.

The water management programs developed for this plan are based on the above findings and conclusions. Additional assumptions used to develop these programs, and conclusions regarding specific programs are discussed in the following sections.

C. SECOND MANAGEMENT PERIOD CONSERVATION PROGRAMS

1. Standards of Reasonableness

All conservation requirements in this plan have been analyzed to determine if they are reasonable expectations for water users. The criteria and assumptions used for most water use sectors to determine if requirements are reasonable included: 1) the cost of implementing conservation measures, 2) the use of proven conservation technology, 3) the use of readily available technology, and 4) the length of time necessary to implement the technology. Using these criteria, the Department established conservation requirements that will not constrain agricultural production, industrial development and population growth through the year 2000.

a. Agricultural Water Conservation Requirements

The Second Management Plan’s agricultural water conservation
requirements assume that farmer's will use the most feasible and effective water conservation measures and devices available. The plan's requirements are based on the use of economically feasible, proven technology. These conservation measures should reduce the total irrigation demand in the Prescott AMA by 20 to 25 percent. It will be extremely difficult for farmers to achieve higher irrigation efficiencies in the future. Even if irrigators can obtain higher efficiencies, the amount of additional water saved would be very small in comparison to total water use in the Active Management Area.

b. Municipal Water Conservation

Developing effective and equitable water conservation programs for municipal water users requires an analysis of many issues. In any large municipal system their are many categories of users, each with different water use characteristics and conservation potential. Implementing effective water conservation therefore involves a complicated effort of education, regulation, monitoring and enforcement.

Arizona's population increased over 20 percent from 1980 to 1987, and is projected to grow by over 50 percent between 1987 and 2000. The Department's research indicates that the most effective and least costly conservation measures are those installed on new facilities and homes. Conservation savings for all new development during the next decade will result in significant reductions in the overall water use rate by 2000.

Second Management Plan conservation requirements for new development assume the minimum reasonable water use rates for interior and exterior use. Low water use landscape designs, consistent with aesthetic standards in the community, are assumed and encouraged by the municipal water conservation program. Existing urban water users will also be expected to reduce water consumption using retrofitting devices that are technically feasible and economically reasonable.

c. Industrial Water Conservation

The Department's studies indicate that significant water savings are possible for many industries and facilities. Accurate water use measurements are a prerequisite to reducing industrial water use. Better water system management and new water use monitoring and control equipment are needed to reduce water use in many industrial use sectors. At many facilities, state-of-the art technologies are already in place to control water waste. Most of these conservation measures are very cost-effective.

The Second Management Plan's industrial conservation requirements focus on new facilities because water savings are the least expensive and have the greatest potential at these facilities. The water savings that will result from this program are difficult to estimate because accurate water use information is not available for many facilities. However, similar conservation measures in other states (e.g., Kansas) have been estimated to reduce water use by over 20 percent.

d. WATER USE MONITORING AND REPORTING REQUIREMENTS

Adequate water use information does not currently exist for several use sectors to allow an accurate determination of conservation potential and the development of conservation programs. More detailed data for most water use sectors would enable the Department to work with water users in the development of effective conservation programs in future management periods.
The plan's water use monitoring and reporting requirements are designed to fill many of the data gaps identified during research for the plan. These requirements are an important part of DWR's water management program. Water use information collected during the 1990s will provide the building blocks for the conservation and management programs of future management periods.

E. EFFLUENT USE

The maximum use of effluent could reduce groundwater pumpage in the Prescott AMA significantly during the 1990s. Effluent is considered a valuable resource for agricultural and turf irrigation, industrial use, artificial groundwater recharge, and other uses. The conservation requirements in this plan include several incentives to encourage water providers and users to utilize available effluent resources. Though extensive effluent use is not required by the Second Management Plan, the Department's groundwater overdraft projections assume that all effluent generated in the Active Management Area will either be used directly or be artificially recharged. Full utilization of effluent is essential if safe-yield is to be achieved without more stringent conservation requirements in later management periods.

F. THE ROLE OF ADDITIONAL WATER SUPPLIES

The use of surface water, a renewable resource, could reduce groundwater pumpage to the degree that additional water conservation beyond the programs contained in this plan is not necessary to achieve safe-yield. The Department will, therefore, pursue a policy during the 1990s to encourage the use of Central Arizona Project allocations within the Active Management Area, other water supply augmentation strategies, and effluent use. Implementation of this policy may require changes in the Groundwater Code.

The Department's policies and programs will be developed in cooperation with all groundwater users in the Prescott AMA, and will include water supply augmentation strategies to bring additional water into the Active Management Area. Augmentation strategies could include increasing flows through watershed management and implementing water exchanges.

G. CONSERVATION ASSISTANCE PROGRAMS

Good water management can achieve significant water savings for many municipal and industrial users. However, the most effective and least expensive water conservation techniques are not being implemented by all water users. To facilitate conservation efforts by water users and help them achieve Second Management Plan conservation requirements, the Department will develop cooperative training programs, seminars, and other educational and research programs.

The Department also plans to develop model water conservation plans for use by municipal providers needing assistance to implement conservation programs. This model program will include water consumer educational materials, model conservation ordinances, and a list of information resources.

The Department feels it is important to continuously monitor progress toward achieving water conservation goals. During the Second Management Period, DWR will collect information to assess the reasonableness of the conservation programs and of any assumptions made in developing the programs. The Department will act as a clearing-house for information related to the effectiveness
of various water conservation programs, sharing information with water users, assuming there are no objections from the water users providing the information. Results of these monitoring efforts will be discussed with the Groundwater Users Advisory Council.

A water conservation assistance program has already been initiated in the Pinal AMA. This cooperative program involving the Department and local Natural Resource Conservation Districts is providing training to farmers in irrigation water management. Similar programs are planned for the Phoenix and Tucson AMAs.

H. GROUNDWATER QUALITY MANAGEMENT

Water quality constraints could, in the future, limit the amount of groundwater available for use in the Active Management Area. Groundwater quality management will therefore become an increasingly important part of DWR's overall water management program during the second management period. Continued coordination with the Department of Environmental Quality will be essential in this effort. DWR will update its groundwater quality assessment for the Active Management Area every three years, focusing additional data collection efforts in problem areas and regions lacking adequate data.

The plan also outlines changes to several DWR programs having significant groundwater quality impacts. These changes, to be implemented as rules during the second management period, will help ensure that water quality concerns are adequately addressed by the Department's water management programs. When appropriate, the Department, in cooperation with DEQ, will seek legislation necessary to implement its water quality program.

I. FUTURE MANAGEMENT PLANS

The water conservation and management programs in this plan are projected to eliminate groundwater overdraft in the Prescott AMA by the year 2025. However, should future water demand and supply characteristics differ from those projected in this plan, additional conservation measures may be needed in future management periods.

In the third management period, the Groundwater Code allows the Department to reduce the highest 25 percent of the irrigation water duties of farm units within a sub-basin to the average of the middle 50 percent of the water duties within the sub-basin.

The Department may also collect annual groundwater withdrawal fees of up to $2.00 per acre-foot to purchase and retire agricultural land beginning in 2006. However, the purchase and retirement of agricultural lands by the state and reduction of the highest irrigation water duties may be avoided if the plan's conservation goals are met and effluent is used to the greatest extent possible.

More stringent municipal water conservation requirements may be needed in future management periods to assure long-term dependable supplies for existing water users. In addition, the Groundwater Code's assured water supply provisions (discussed in Section G of Chapter 5) may require new developments to obtain renewable water supplies prior to the subdivision and sale of land.

The need for additional water use restrictions in future management periods will be determined by the level of overdraft within the AMA and the availability of additional water supplies.
J. UNCERTAINTY REGARDING SURFACE WATER RIGHTS

The Arizona Superior Court is now determining the water rights of most of the state's water users in general adjudications. These proceedings are being conducted under the General Adjudication of Water Rights statute passed by the Arizona Legislature in 1979. For the first time, the court will comprehensively identify and rank the priority of all water rights, including those of the federal government and the Indian communities.

A primary goal of the adjudications is to quantify the water rights of the federal government and Arizona's Indian communities. The federal government and the Indians hold federal reserved rights, which are different from rights held under state law. Until federal reserved rights are quantified, few water users in the state can be certain of their rights because Indian reserved rights, in particular, have very early priority dates.

The groundwater overdraft projections made in this management plan are based on water supplies available to right holders according to the court decrees and permits now in force. The ongoing adjudication process creates a degree of uncertainty for water management planning in the Active Management Areas.

The federal reserved rights water claims are much larger than the current uses of water on Indian lands. If a large amount of water is granted to senior priority Indian communities or other federal lands, less water will be available for lower priority users. If the court's decisions during the adjudications alter these water rights significantly, future groundwater withdrawals in the Active Management Areas could be larger than projected. Later management plans would then have to address this situation with more stringent conservation requirements and increased augmentation efforts.

K. THE IMPORTANCE OF THE SECOND MANAGEMENT PLAN

The Second Management Plan is designed to achieve increased groundwater conservation and provide incentives for the development and use of alternative water supplies. Fulfillment of the plan's goals is imperative to achieve safe-yield. The ability of water providers to demonstrate assured water supplies for future uses will also depend heavily upon the success of the Second Management Plan.
A. GROUNDWATER CODE PROVISIONS

This Appendix provides a brief summary of the provisions of the Arizona Groundwater Code. Readers should refer to Arizona Revised Statutes §§ 45-401 through 45-635 for more information. Important provisions and requirements of the Code include:

- Establishment of rights to withdraw groundwater
- A ban on new irrigated acreage in Active Management Areas (AMAs) and Irrigation Non-Expansion Areas (INAs)
- A prohibition in AMAs against the sale of subdivided or unsubdivided land without an assured water supply (i.e., a water supply of sufficient quantity and quality to meet the needs of the development for 100 years)
- Statewide well registration
- Well construction standards, and well spacing and well impact requirements
- Licensing of well drillers
- Annual reporting of groundwater withdrawals and uses in AMAs and INAs
- Use of approved water measuring devices for all wells subject to annual reporting requirements in AMAs and INAs

The Code also includes provisions that regulate the transportation of groundwater from the point of withdrawal to another location. A person with the right to withdraw groundwater may, in most cases, transport water within a sub-basin without payment of damages.

The Code requires the Director to impose an annual withdrawal fee on all persons withdrawing groundwater from non-exempt wells within AMAs. The groundwater withdrawal fee is comprised of an administration and enforcement fee, an augmentation and conservation assistance fee, and a grandfathered right purchase and retirement fee. The maximum amount the Director can levy for these three fees is purchase and $1.00, $2.00, and $2.00 respectively per acre-foot. Consequently the groundwater withdrawal fee may not exceed $5.00 per acre-foot. This money is used to finance part of the costs of administering and enforcing the law, to fund projects for augmenting water supplies and, if necessary, beginning in the year 2006, to purchase and retire grandfathered rights.
B. RIGHTS TO WITHDRAW GROUNDWATER IN AMAs

This section summarizes the four types of rights created by the Groundwater Code to withdraw groundwater in AMAs. The summary necessarily omits many of the details and restrictions contained in the Code.

1. Exempt Withdrawals

Withdrawals of groundwater for non-irrigation uses from a well with a pump capacity of not more than thirty-five gallons per minute are exempt from many provisions of the Code, including water measurement and annual reporting. These wells are called exempt wells. Exempt wells drilled on or after April 28, 1983 have a further restriction: withdrawals from these wells for uses other than domestic uses, including the irrigation of less than two acres of land, and stockwatering may not exceed ten acre-feet per year. Exempt wells, drilled prior to April 28, 1983, are not so restricted. Wells that do not meet all applicable criteria are considered non-exempt and groundwater withdrawals are authorized by the groundwater rights described below.

2. Grandfathered Rights

Persons who pumped or received groundwater from non-exempt wells prior to June 12, 1980, were eligible for a certificate of grandfathered right (GFR). Cities, towns, private water companies, and irrigation districts withdraw and use groundwater based on "service area rights." GFRs and service area rights are explained below.

There are three types of GFRs: 1) Irrigation GFRs, 2) Type 1 Non-Irrigation GFRs, and 3) Type 2 Non-Irrigation GFRs. Persons who wish to irrigate more then two acres of land within an AMA must have an irrigation GFR. Generally, Irrigation GFRs were granted to land irrigated between January 1, 1975, and January 1, 1980, for the purpose of growing plants for sale, human consumption, or for livestock or poultry feed.

An Irrigation GFR gives the holder the right to irrigate land with groundwater but does not specify the amount of water that may be used on the irrigated acreage. The Department’s groundwater management plans specify the amount. The water allocations to individual Irrigation GFR holders for the second management period are on file and may be reviewed at the respective AMA office. Generally, Irrigation GFRs may not be transferred to another location.

Type 1 Non-Irrigation GFRs apply to farmland retired from irrigation after January 1, 1965, in anticipation of a specific non-irrigation use. A Type 1 GFR generally allows a right-holder to pump three acre-feet of groundwater per acre per year from the retired land. Type 1 GFRs may not be transferred to another location, although water pumped from the original location may be transported to a new location for a non-irrigation use subject to certain restrictions.

Type 2 Non-Irrigation GFRs apply to non-irrigation withdrawals of groundwater in existence as of June 12, 1980. Generally, rights equal the maximum amount of water withdrawn and used for non-irrigation purposes in any one of the five years prior to June 12, 1980. Type 2 GFRs may be transferred to new locations within an AMA.
A person without the required history of groundwater use may obtain the right to withdraw and use groundwater by leasing or purchasing a GFR. Both the lease and purchase of GFRs, however, are subject to restrictions. As of December, 1990, there were 215 Certificates of Grandfathered Water Right within the Prescott AMA.

3. Service Area Rights

Cities, towns, private water companies and irrigation districts have service area rights to withdraw and transport groundwater. A city, town or private water company has the right to withdraw as much groundwater from within its service area as it needs to serve the residents and landowners within the area, subject to the conservation requirements imposed in the management plan. The Code defines the service area of a city, town or private water company as the area of land actually served by the entity and any additional areas that contain an operating distribution system owned by the entity and used primarily for the delivery of non-irrigation water.

Irrigation districts that were withdrawing and delivering groundwater, as of January 1, 1977, also have the right, with some restrictions, to serve landowners within their service areas. The service areas of these irrigation districts include the area of land within the districts' boundary actually being served water by the district at any time during the five years prior to June 12, 1980. Areas within a district's boundaries, as of June 12, 1980, that contain an operating distribution system are also included in its service area. Irrigation districts that were not withdrawing and delivering groundwater, as of January 1, 1977, have more limited rights to withdraw groundwater.

The Code does not provide for the quantification of service area rights but does place limitations on withdrawals by cities, towns, private water companies and irrigation districts (service entities). Service entities that deliver water for non-irrigation use must meet the conservation requirements of the municipal conservation program. Persons receiving groundwater from service entities for irrigation of two or more acres must have Irrigation GFRs. In addition, holders of Irrigation GFRs must meet the conservation requirements specified in the agricultural conservation program.

Irrigation and municipal service entities must comply with the distribution system requirements specified in the Municipal and Agricultural Conservation Programs. Conservation requirements for irrigation districts and municipal providers districts are described in Chapters 4 and 5, respectively.

The Code restricts extensions of service areas by service entities. Cities, towns and private water companies may not extend their service areas primarily for the purpose of 1) including a well field within the service area, 2) furnishing disproportionately large amounts of water to a large water use (e.g., a large industry), unless the use is consistent with the management plan and approved by the Director, or 3) including irrigation acres within the boundaries of the service area to eliminate a farmer's right to convey an Irrigation GFR for a non-irrigation use. Furthermore, a city, town or private water company may not extend its service area to serve irrigation water. In most cases, an irrigation district may not extend its service area.
4. **Groundwater Withdrawal Permits**

Those not eligible for GFRs or service area rights and who require more water than what may be withdrawn from an exempt well may apply for the right to withdraw and use groundwater for non-irrigation uses through a groundwater withdrawal permit. If the criteria for a withdrawal permit are met, the Director may issue a permit for new or expanded non-irrigation uses of groundwater. Groundwater withdrawal permits specify limits on the duration and amount of withdrawals. There are seven types of groundwater withdrawal permits.

- Dewatering permits
- Mineral extraction and metallurgical processing permits
- General industrial use permits
- Poor quality groundwater withdrawal permits
- Temporary permits for dewatering or for electric power generation
- Drainage water withdrawal permits
- Hydrologic testing permits

5. **Recharge and Storage and Recovery Permits**

In 1986, the Arizona Legislature passed House Bill 2209 which regulates the underground storage of water and establishes a permit system for wells used to retrieve stored water. This legislation also amended the Groundwater Code to allow projects intended to recharge Arizona’s groundwater aquifers. Recharge projects are usually designed and operated by government agencies and large industries. Anyone wishing to undertake a storage/recovery project or a recharge project should contact DWR for more information regarding permits and requirements.

6. **Restrictions on Artificial Lakes**

The regulation of artificial water bodies in the First Management Plan has been expanded by the passage of Senate Bill 1200 in 1987, known as the "Lakes Bill." This legislation eliminates the need for lake requirements in the Second Management Plan other than those pertaining to turf-related facilities (Chapter 6). The use of groundwater in water bodies is permitted under the following conditions:

- If the body of water was filled before January 1, 1987
- If a substantial capital investment was made in developing the body of water prior to January 1, 1987
- On an interim or emergency basis for up to 5 years until effluent is available. A special permit from DWR is required until effluent is available.
- If the body of water is an integral part of a golf course which complies with applicable conservation requirements for turf-related facilities.
- If the body of water is located within a recreational facility open to the public and owned or operated by a government entity.

Other new large lakes can only be developed with non-potable sources of water such as effluent or stormwater runoff. Water bodies with surface areas of 12,320 square feet or smaller are not subject to these restrictions. Two or more bodies of water connected at or below the land surface are considered to be one body of water.
The following describes components of the Environmental Quality Act of 1986, including responsibilities directed to the state agency created by legislation, the Arizona Department of Environmental Quality (DEQ).

- DEQ was established, effective July 1987, to administer state programs for water quality, air quality, solid waste and hazardous waste. Responsibilities of the former Department of Health Services' Division of Environmental Health Services were transferred to DEQ.

- Responsibilities for pesticide control were placed in four agencies: the Commission of Agriculture and Horticulture, the Department of Environmental Quality, the Industrial Commission, and the current Department of Health Services.

- Broad authorities were established for the management, control and regulation of sources which may impact water quality, including point and nonpoint sources of pollution into surface and ground waters, regulated agricultural activities, underground injection control, and other activities which may impact aquifer water quality.

- An aquifer protection permit program was established, which requires discharging facilities, except for groundwater recharge and underground storage and recovery projects, to use the "best available demonstrated control technology" to reduce the discharge to the greatest extent possible.

- A comprehensive remedial action program, the Water Quality Assurance Revolving Fund, was established with a dedicated revenue source to investigate, assess, mitigate, abate, and clean up groundwater pollution from past activities.

- Water conservation or augmentation shall be considered in aquifer protection permit determinations and remedial actions.

- DEQ was required: to adopt numeric toxic standards for surface waters, to adopt aquifer water quality standards, to define aquifer boundaries, and to establish aquifer use reclassification procedures. Arizona's aquifers were initially classified and protected for drinking water use.

- Criminal penalties and expanded civil penalties were prescribed for violations of State groundwater quality statutes.

- Citizens were authorized to sue any person who fails to comply with state water quality laws.

- No person may intimidate, threaten, coerce, terminate, or discriminate against any person because that person filed a complaint or exercised any right pertaining to the protection of water quality.

- Advisory groups were established for the development of water quality standards, aquifer boundaries and best management practices for concentrated animal feeding operations and the application of nitrogen fertilizers.
• The State Department of Administration was authorized to staff an Administrative Law Judge to hear contested compliance orders and to staff a Technical Appeals Board to hear appeals on contested permits or permit conditions.

• Liability for the contamination of waters of the state from hazardous substances shall be strict, joint, several, and retroactive.

• The public has the right to know information pertaining to the existence and concentration of chemical constituents of any pollutant discharged which might potentially impact upon drinking water supplies.

• A pesticide contamination prevention program was authorized. Pesticide registrants were required to submit information on the physical and chemical characteristics that describe the "environmental fate" of the pesticide's active ingredients; DEQ was required to establish allowable threshold values for "environmental fate" characteristics. DEQ has developed and maintains a list of all pesticides that have the potential to pollute groundwater; these pesticides are subject to specific monitoring and reporting requirements. Pesticide registrations may be cancelled if necessary.

• Annual reports were required on 1) pesticides, 2) well sampling activities, and 3) violations and enforcement of water quality and hazardous waste laws. A report is also required every five years on pollutant levels in aquifers and the effects of regulation and best management practices.

• The Environmental Quality Act required that numerous sets of rules be adopted to carry out the purposes of the Act.
APPENDIX 3-B

SUMMARY OF WATER QUALITY STANDARDS

The following is a summary of federal and state drinking water standards, health-based guidelines, and agricultural guidelines. One or more of the standards has been established for each of the water quality parameters addressed in the Water Quality Assessment and Management Program, discussed in Chapter 3.

1. U.S. EPA Maximum Contaminant Level Goals (EPA MCLGs)

EPA MCLGs are developed by the Environmental Protection Agency's Office of Drinking Water as the first step toward promulgation of Primary Maximum Contaminant Levels (Pri-MCLs). Prior to the Safe Drinking Water Act Amendments of 1986, these levels had been referred to as Recommended Maximum Contaminant Levels. MCLGs are non-enforceable, health-based standards derived from toxicological data that includes appropriate factors for public safety.

2. U.S. EPA Primary Maximum Contaminant Levels (EPA Pri-MCLs)

EPA Pri-MCLs are federally enforceable limits for contaminants in drinking water established by the EPA Office of Drinking Water under the authority of the Safe Drinking Water Act. MCLs are set as close to MCLGs as is feasible, considering the best analytical and treatment techniques available and the costs of these techniques.


EPA SMCLs are non-enforceable EPA guidelines for contaminants in drinking water. These regulations control contaminants that primarily affect the aesthetic qualities and public acceptance of drinking water. However, health implications may also exist at considerably higher concentrations of these contaminants.


EPA NAWQC are promulgated under the authority of the Clean Water Act. The standards are not mandatory, but states may adopt them as enforceable standards to protect the beneficial uses of surface water bodies. Three criteria are of concern for each priority pollutant: the protection of freshwater aquatic life, saltwater aquatic life, and human health. The table in Appendix 3-C shows the human health standard for selected constituents.

5. Arizona Primary Maximum Contaminant Levels (AZ Pri-MCLs)

AZ Pri-MCLs are enforceable state standards for contaminants in community and noncommunity water supplies. These standards were established by the Arizona Environmental Quality Act, as amended in 1987. The Arizona Department of Environmental Quality (DEQ) is responsible for enforcement of these standards statewide, except in Maricopa and Pima counties where the state delegates a portion of its enforcement authority.
**APPENDIX 3-C**

**DRINKING WATER STANDARDS AND GUIDELINES FOR SELECTED PARAMETERS**

**DECEMBER 29, 1987**

**INTRODUCTION, INSTRUCTIONS AND WARNING**

This Drinking Water Standards and Guidelines Table is a compendium of standards, criteria, and guidelines for selected chemical contaminants which have been found in groundwater in the State of Arizona. The descriptions of each type of standard or guideline are included in the Water Quality Assessment and Management Program (Chapter 3). In order to make the table a manageable size, very few explanations for the levels are included. Because of this, and the fact that the background documentation and knowledge of the derivation of any particular number is critical to the proper use of the number, this table should not be used as a sole source of information. The appropriate reference material or governmental agency responsible for establishing the standards and guidelines should be consulted to determine whether or not the value being considered is applicable to the particular situation. Not following the suggested procedure could result in the selection of an inaccurate or meaningless number for the intended purpose.

All reporting units for each parameter are the same as listed in the units column unless otherwise noted next to the number.

**CATEGORIES OF STANDARDS AND GUIDELINES**

The following are the different categories of standards and guidelines shown in the table:

- **EPA MCLG** = United States Environmental Protection Agency (EPA), Maximum Contaminant Level Goal
- **EPA PRI-MCL** = United States Environmental Protection Agency (EPA), Primary Maximum Contaminant Level
- **EPA SMCL** = United States Environmental Protection Agency (EPA), Secondary Maximum Contaminant Level
- **EPA NAWQC** = United States Environmental Protection Agency (EPA), National Ambient Water Quality Criteria
- **AZ PRI-MCL** = Arizona, Primary Maximum Contaminant Level
- **C** = Carcinogen - A substance or agent producing or inciting cancer.
- **NC** = Noncarcinogen - A substance or agent not known to produce or incite cancer.
- **COMMUNITY** = A public water system which regularly serves at least 15 service connections or 25 residents on a year round basis.
- **NON-COMMUNITY** = A public water system which serves at least 15 service connections or 25 residents on less than a year round basis.

**SYMBOLS USED THROUGHOUT THE TABLE**

- * Enforceable Standard
- + Non-enforceable Standard or Guideline
- mg/l parts per million (ppm)
- ug/l parts per billion (ppb)
- ng/l parts per trillion (ppt)

For additional information regarding EPA and Arizona standards and guidelines contact:

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<thead>
<tr>
<th>United States Environmental Protection Agency</th>
<th>Arizona Department of Environmental Quality</th>
</tr>
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<tr>
<td>Criteria and Standards Division</td>
<td>Office of Water Quality</td>
</tr>
<tr>
<td>Office of Drinking Water (W-550 D)</td>
<td>ATTN: Jon Dahl, Manager - Safe Drinking Water Unit</td>
</tr>
<tr>
<td>401 M. Street, S. W.</td>
<td>2005 North Central, Room 304</td>
</tr>
<tr>
<td>Washington, D.C. 20460</td>
<td>Phoenix, AZ 85004</td>
</tr>
<tr>
<td>(202)382-7575</td>
<td>(602)257-2201</td>
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<th>EPA MCL (NON-COMM.)</th>
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<th>EPA SECONDARY MCL (COMMUNITY)</th>
<th>EPA SECONDARY MCL (NON-COMM.)</th>
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200
## DRINKING WATER STANDARDS AND GUIDELINES FOR SELECTED PARAMETERS (cont.)

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<th>EPA PRI-MCL MCLG</th>
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<td>Alpha-BHC</td>
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<td>.71 mg/l (c)</td>
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### APPENDIX 4

**CONSUMPTIVE USE OF WATER BY CROPS AND EFFECTIVE PRECIPITATION**

**PRES S COTT AMA**

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<td>1.55</td>
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<td>EFFECTIVE PRECIPITATION</td>
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<tr>
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<td>MISCELLANEOUS CROPS</td>
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<td>(Mendel and Scotch Pine)</td>
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<td></td>
</tr>
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## APPENDIX 5-A

TOTAL GPCD REQUIREMENTS FOR LARGE PROVIDERS

PRESCOTT AMA

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<thead>
<tr>
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<tr>
<td>Triangle Dev't Corp.</td>
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¹ First compliance date for any substitute GPCD requirement in the Third Management Plan (TMP).
# APPENDIX 5-B

## ALTERNATIVE CONSERVATION PROGRAM REQUIREMENTS FOR LARGE PROVIDERS

**Prescott AMA**

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<thead>
<tr>
<th>Provider</th>
<th>Intermediate Requirement FCD(^1) - 1999</th>
<th>Final Requirement 2000 - TMP(^2)</th>
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<td>Triangle Dev't Corp.</td>
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<td>85</td>
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<tr>
<td>New Providers</td>
<td>-</td>
<td>85</td>
</tr>
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</table>

1. First compliance date as agreed upon by the Director and the provider.
2. First compliance date for any substitute GPCD requirement in the Third Management Plan (TMP).
3. New single family residential rate.
4. New multifamily residential rate.
APPENDIX 5-C

CONSERVATION REQUIREMENTS FOR INDIVIDUAL USERS THAT ARE TURF-RELATED FACILITIES - CALENDAR YEARS 1990 AND 1991

A. 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 this Appendix, unless the context otherwise requires, shall have the following meanings:

1. "Contiguous" means in contact at any point along a boundary. Two parcels of land are contiguous if they are separated by only one or more of the following: a road, highway, easement or right-of-way.

2. "First Management Plan existing turf-related facility" means:
   a. A turf-related facility that, as of December 26, 1984, was in operation or had obtained all preconstruction permits and approvals required by federal, state or local governments, or for which substantial capital investment had been made in the physical on-site construction of the facility in the twelve months prior to December 26, 1984.
   b. An expansion or modification of a turf-related facility that qualifies as a First Management Plan existing turf-related facility under paragraph a of this definition, if that expansion or modification increased the area of land to which water is applied for turf-related watering purposes and was substantially commenced as of December 26, 1984. An expansion or modification was substantially commenced if the owner or operator of the facility obtained all preconstruction permits or approvals required by federal, state or local governments for that expansion or modification or made a substantial capital investment in the physical on-site construction of the expansion or modification in the twelve months prior to December 26, 1984.

3. "Landscape watering" means the application of water to grow landscaping plants.

4. "Lanscaping plant" means any member of the kingdom Plantae, including any tree, shrub, vine, herb, flower, succulent, groundcover or grass species, that grows or has been planted out-of-doors and is used for landscaping purpose.

5. "First Management Plan new turf-related facility" means:
   a. A turf-related facility that does not qualify as a First Management Plan existing turf-related facility.
   b. An expansion or modification of a turf-related facility that qualifies as a First Management Plan new turf-related facility under paragraph a of this definition, if that expansion or modification increased the area of land to which water is applied for turf-related watering purposes.
c. An expansion or modification of a First Management Plan existing turf-related facility, if that expansion or modification increased the area of land to which water is applied for turf-related watering purposes and was not substantially commenced as of December 26, 1984.

6. "Newly turfed area" means the area of land newly planted during the calendar year in question with a grass species that requires additional water for germination and establishment. Newly turfed area does not include an area covered with a grass species during the preceding calendar year that has been overseeded or reseeded with a grass species during the calendar year in question.

7. "Total landscaped area" means:

a. With respect to a First Management Plan existing turf-related facility or a First Management Plan new turf-related facility, except as provided in paragraph b of this definition, the area of land to which water from any source is legally applied for landscape watering purposes during the calendar year in question.

b. With respect to a First Management Plan existing turf-related facility in operation as of December 26, 1984, whichever of the following is greater:

1) The largest area of land to which water from any source was legally applied for landscape watering purposes during any one year from January 1, 1980 through December 31, 1984.

2) The area of land to which water from any source is legally applied for landscape watering purposes during the calendar year in question.

8. "Total water surface area" means the total surface area of all bodies of water from any source, including lakes, ponds and lagoons, that are an integral part of the landscaped area of a turf-related facility. Bodies of water used primarily for swimming purposes are not an integral part of the landscaped area of a turf-related facility.

9. "Turf-related facility" means an industrial user that applies water from any source to ten or more acres of land for turf-related watering purposes.

10. "Turf-related watering" means the application of water from any source to grow landscaping plants on the grounds of a turf-related facility and the use of water from any source to fill or refill any bodies of water, including lakes, ponds or lagoons, that are an integral part of the landscaped area of a turf-related facility. Bodies of water used primarily for swimming purposes are not an integral part of the landscaped area of a turf-related facility.

11. "Turfed acreage" means the total area of land planted with grass species or with plants not listed on the Low Water Using Plant List for the Prescott Active Management Area for the First Management Period, adopted by the Director and filed in the Department.
B. Conservation Requirements for First Management Plan Existing Turf-related Facilities

Except as provided in Section F of this Appendix, an individual user that is a First Management Plan existing turf-related facility shall comply with the following conservation requirements:

For the calendar years 1990 and 1991, a First Management Plan existing turf-related facility shall not use an amount of water which exceeds its maximum annual water allotment for the year. The maximum annual water allotment shall be calculated pursuant to Section D of this Appendix, and compliance with the maximum annual water allotment shall be determined pursuant to Section E of this Appendix.

C. Conservation Requirements for First Management Plan New Turf-Related Facilities

Except as provided in Section F of this Appendix, an individual user that is a First Management Plan new turf-related facility shall comply with the following conservation requirements:

For the calendar years 1990 and 1991, a First Management Plan new turf-related facility shall not use an amount of water during a calendar year which exceeds its maximum annual water allotment for the calendar year. The maximum annual water allotment for the calendar year shall be calculated pursuant to Section D of this Appendix, and compliance with the maximum annual water allotment shall be determined pursuant to Section E of this Appendix.

D. Calculation of Maximum Annual Water Allotment

1. The maximum annual water allotment for a First Management Plan existing turf-related facility for a calendar year shall be calculated as follows:

   a. Determine the total landscaped area of the facility and the newly turfed area of the facility. Subtract the newly turfed area from the total landscaped area. Multiply the result by the water application rate of 5.2 acre-feet per acre.

   b. Multiply the newly turfed area of the facility by the water application rate of 6.2 acre-feet per acre.

   c. Determine the total water surface area of the facility. Multiply the total water surface area by the water application rate of 5.5 acre-feet per acre.

   d. The sum of the results of the calculations in paragraphs a, b and c above is the maximum annual water allotment for the facility for the calendar year.

2. Except as provided in Section D.3 of this Appendix, the maximum annual water allotment for a First Management Plan new turf-related facility for a calendar year shall be calculated as follows:

   a. Determine the total landscaped area of the facility and the newly turfed area of the facility. Subtract the newly turfed area from the total landscaped area. Multiply the result by the water application rate of 4.8 acre-feet per acre.
b. Multiply the newly turfed area of the facility by the water application rate of 5.8 acre-feet per acre.

c. Determine the total water surface area of the facility and the water surface area of any body or bodies of water filled and refilled with effluent. Subtract the water surface area of any body or bodies of water filled and refilled with effluent from the total water surface area. Multiply the result by the water application rate of 4.8 acre-feet per acre.

d. Multiply the water surface area of any body or bodies of water filled and refilled with effluent by the water application rate of 5.5 acre-feet per acre.

e. The sum of the results of the calculations in paragraphs a, b, c and d above is the maximum annual water allotment for the facility for the calendar year.

3. The maximum annual water allotment for a golf course that qualifies as a First Management Plan new turf-related facility and has a total landscaped area in excess of the result obtained by multiplying the number of regulation holes by five acres shall be determined for a calendar year as follows:

a. Multiply the number of regulation holes by five acres. Subtract from that result the newly turfed area of the facility. Multiply the result by the water application rate of 4.8 acre-feet per acre.

b. Multiply the newly turfed area of the facility by the water application rate of 5.8 acre-feet per acre. In no case shall the allotment for the newly turfed area exceed the result obtained by the following formula: Multiply the number of regulation holes by five acres and multiply that result by the water application rate of 5.8 acre-feet per acre.

c. Determine the water surface area of any body or bodies of water filled and refilled with effluent. Multiply that water surface area by the water application rate of 5.5 acre-feet per acre.

d. The sum of the results of the calculations in paragraphs a, b and c above is the maximum annual water allotment for the golf course for the calendar year.

4. Where a turf-related facility consists of a First Management Plan existing turf-related facility and a First Management Plan new turf-related facility that are contiguous, under one ownership, and operated as one facility, the facility may combine the maximum annual water allotment for the First Management Plan existing turf-related facility and the maximum annual water allotment for the First Management Plan new turf-related facility and may apply all or a portion of the aggregate maximum annual water allotment to any part of the facility.

5. Nothing in this Appendix shall be construed to authorize a turf-related facility to use more water from any source than that facility is entitled to use pursuant to any groundwater or appropriable water right held by the facility. Nor shall this Appendix be construed to authorize a turf-related facility to use water from any source in any manner that violates Chapter 1 or Chapter 2 of Title 45, Arizona Revised Statutes.
E. Compliance with Maximum Annual Water Allotment

A turf-related facility is in compliance for the calendar year 1990 or 1991 with its maximum annual water allotment for the year if the Director determines that either of the following applies:

1. The aggregate amount of water from any source used by the facility for turf-related watering purposes during the calendar year does not exceed its maximum annual water allotment for that year, or

2. The aggregate amount of water from any source used by the facility for turf-related watering purposes during that calendar year and the preceding two calendar years does not exceed the sum of the facility's maximum annual water allotments for those three years.

F. Alternative Conservation Program

A First Management Plan existing turf-related facility or a First Management Plan new turf-related facility that is or will be using effluent may apply to the Director for a modification of a water application rate. The Director may approve a modification of a water application rate if the owner or operator of the facility demonstrates to the satisfaction of the Director that technical difficulties caused by the use of effluent justify a modification.

G. Monitoring and Reporting Requirements

1. For the calendar years 1990 and 1991, each First Management Plan existing turf-related facility and each First Management Plan new turf-related facility shall measure and report in its annual report required by A.R.S. § 45-632:
   a. The total quantity of water from any source withdrawn, diverted or received annually for turf-related watering purposes. The measurements shall be made with a measuring device in accordance with the Department’s measuring device rules, A.A.C. R12-15-901, et seq.
   b. The total landscaped area of the facility.
   c. The newly turfed area of the facility.
   d. The total water surface area of the facility.

2. For the calendar years 1990 and 1991, each First Management Plan new turf-related facility shall measure and report in its annual report required by A.R.S. § 45-632 the water surface area of any body or bodies of water filled and refilled with effluent.

3. For the calendar years 1990 and 1991, each First Management Plan existing turf-related facility and each First Management Plan new turf-related facility shall estimate and report in its annual report required by A.R.S. § 45-632 the watering purposes.
APPENDIX 5-D

LOW WATER USE PLANT LIST

PRESCOTT AMA

The Low Water Use Plant List for the Prescott Active Management Area is filed in the Department's Prescott AMA Office. A copy of the list effective as of the date of this plan follows in this Appendix. Since the list may be amended using the procedure described below, a current list is available upon request from the Prescott AMA Office or from the Department's public information officer in Phoenix.

PROCEDURE FOR MODIFICATION OF LOW WATER USE PLANT LIST FOR THE PRESCOTT AMA

A. A person who seeks to add a plant or plants to the Low Water Use Plant List for the Prescott AMA or to delete a plant or plants from the list may apply at any time to the Director for a modification of the list. The application shall be made on a form prescribed and furnished by the Director.

B. The Director shall review each request for a modification of the Low Water Use Plant List. The Director may request additional information from the applicant and may seek information from other sources as may be necessary to determine whether the list should be modified.

C. If the Director approves the addition of a plant to the Low Water Use Plant List, the Director shall place the plant on a supplemental list that shall be considered an addendum to the Low Water Use Plant List. The supplemental list shall be available upon request from the Department's Public Information Officer or the office of the Prescott AMA.

D. If the Director approves the deletion of a plant from the Low Water Use Plant List, the Director shall delete the plant from the list.

E. The Director shall conduct an annual review of the Low Water Use Plant List and issue a modified plant list no later than January 15 of the following year. As a result of the review, the Director may add plants to the list, delete plants from the list or both.
LOW WATER USE PLANT LIST
PRESCOTT ACTIVE MANAGEMENT AREA

This list was compiled by the Department in cooperation with experts from the Desert Botanical Garden, Arizona Department of Transportation and various nurserymen and landscape specialists from the Prescott AMA. Individuals wishing to add low water use plants to this list or delete plants from the list may submit information to the Director of Water Resources for consideration. The Director will amend the list as appropriate.

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<thead>
<tr>
<th>Botanical Name</th>
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<td>Chrysothamnus spp.</td>
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<td>Cotoneaster conguestra</td>
<td>Pyrenees Cotoneaster</td>
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<td>Cotoneaster horizontalis</td>
<td>Creeping Cotoneaster</td>
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<td>Cotoneaster divaricata</td>
<td>Spreading Cotoneaster</td>
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<td>Red-osifer Dogwood</td>
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<td>Pyrancantha coccinea lalandii</td>
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<td>and coccinea pauciflora</td>
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<td>Rhus trilobata</td>
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<td>Anglojap and Hicks Yew</td>
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<td>Yucca glauca</td>
<td>Small Soapwood</td>
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Low Water Use Plant List (cont.)

PERENNIAL, BULB, ANNUALS

(Common and/or Botanical Names Not Specified)

Achillea
Agave
Anacyclus depressus
Baptisia australis
Bearded Iris
Cleome spinosa
Coreopsis
Cortaderia selloana
Cosmos
Echeveria
Erigonum
Euphorbia
Gaillardia
Kniphofia livaria
Liatris
Linum
Marrubium vulgare
Narcissus
Oenothera berlandieri
Pholmis fruticosa
Portulaca grandiflora
Sedum
Tithonia rotundifolia
Verbena
Vine Wisteria
Yucca
APPENDIX 6

MAXIMUM ANNUAL WATER ALLOTMENT FOR TURF-RELATED FACILITIES

PRESCOTT AMA

(acre-feet)

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<tr>
<th>Name of Facility</th>
<th>1991-1998</th>
<th>1999-TMP¹</th>
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</thead>
<tbody>
<tr>
<td>Antelope Hills Golf Course²</td>
<td>564</td>
<td>564</td>
</tr>
<tr>
<td>Prescott Country Club Golf Course³</td>
<td>653</td>
<td>653</td>
</tr>
<tr>
<td>Veterans Administration²</td>
<td>181</td>
<td>181</td>
</tr>
<tr>
<td>(cemetery and grounds)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

¹ Until any subsequent Third Management Plan requirements
² Grandfathered right or withdrawal permit
³ Served by municipal provider