



12. WATER RESOURCES ELEMENT

The Verde Valley region is blessed by the Verde River and its tributaries: Sycamore Creek, Oak Creek, Wet and Dry Beaver Creeks, West Clear Creek and Fossil Creek. During the preparation of the General Plan, community residents expressed their strong desire that water resources be carefully protected. With proper stewardship, the community's water resources will be available for current and future generations.

A. VISION AND FOCUS

Water is a fundamental resource necessary to the support of all life. It is a critical component of urban development and essential to the support of community growth and land use, be it residential, commercial, industrial, agricultural, or recreation. The City of Cottonwood has a very real interest in guaranteeing the integrity of the community's water resources and is intent on taking the actions necessary to assure supplies for drinking water, fire flow and other non-potable uses essential to support the community's vision of prosperity.

The City intends to continue active participation in the Northern Arizona Municipal Water Users Association, Yavapai County Water Advisory Committee, the Verde Watershed Association, and other efforts designed to better understand and manage the water resources of the region. The City of Cottonwood and the Town of Clarkdale are actively investigating the acquisition of three private water companies serving the area in order to improve the planning, coordination and management of water resources and to improve fire protection capability.

B. RELATED LEGISLATION AND STUDIES

Arizona Revised Statutes (ARS §9-461.05.5) specifies that a general plan must have a Water Resources Element that addresses:

- (a) The currently available surface water, groundwater and effluent supplies. adequately served by the legally and physically available water supply or a plan to obtain additional necessary water supplies.
- (b) An analysis of how the future growth projected in the general plan will be

Much of the information included in this section is derived from the Verde River Watershed Study prepared by the Arizona Department of Water Resources, 2000. The Yavapai County Water Advisory Committee has recently completed a draft water budget for the Verde Valley and has been at work since 2000 on scientific studies of the Verde Valley's ground water resources.

C. REGIONAL SETTING

The Verde River basin covers approximately 5,500 square miles of Central Arizona and covers parts of Yavapai, Coconino and Gila counties. It extends from the Coconino Plateau in the north to the USGS gauging station on the Verde River below Tangle Creek in the south, and from the Juniper



and Santa Maria Mountains in the west to the Mogollon Rim in the east. The Verde River is a tributary of the Salt River and is part of the Colorado River System.

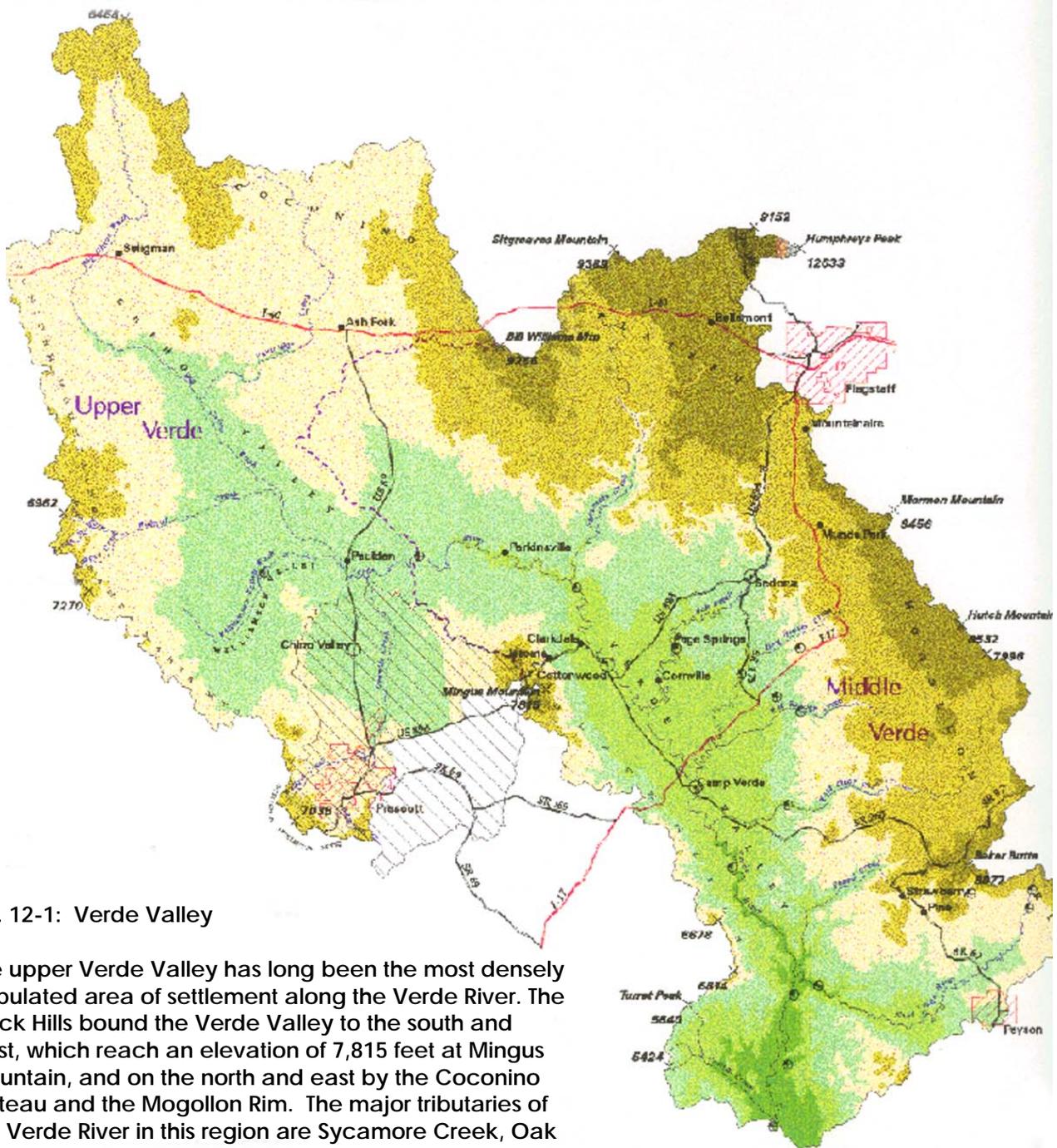


Fig. 12-1: Verde Valley

The upper Verde Valley has long been the most densely populated area of settlement along the Verde River. The Black Hills bound the Verde Valley to the south and west, which reach an elevation of 7,815 feet at Mingus Mountain, and on the north and east by the Coconino Plateau and the Mogollon Rim. The major tributaries of the Verde River in this region are Sycamore Creek, Oak Creek, Dry Beaver Creek, Wet Beaver Creek, West Clear Creek and Fossil Creek. All these waterways originate either on the Coconino Plateau or the Mogollon Rim. Evaporation and transpiration rates vary from year to year depending on temperatures, humidity and wind velocity. The average annual precipitation for Cottonwood, at an elevation of 3,300 feet, is 12.21 inches.

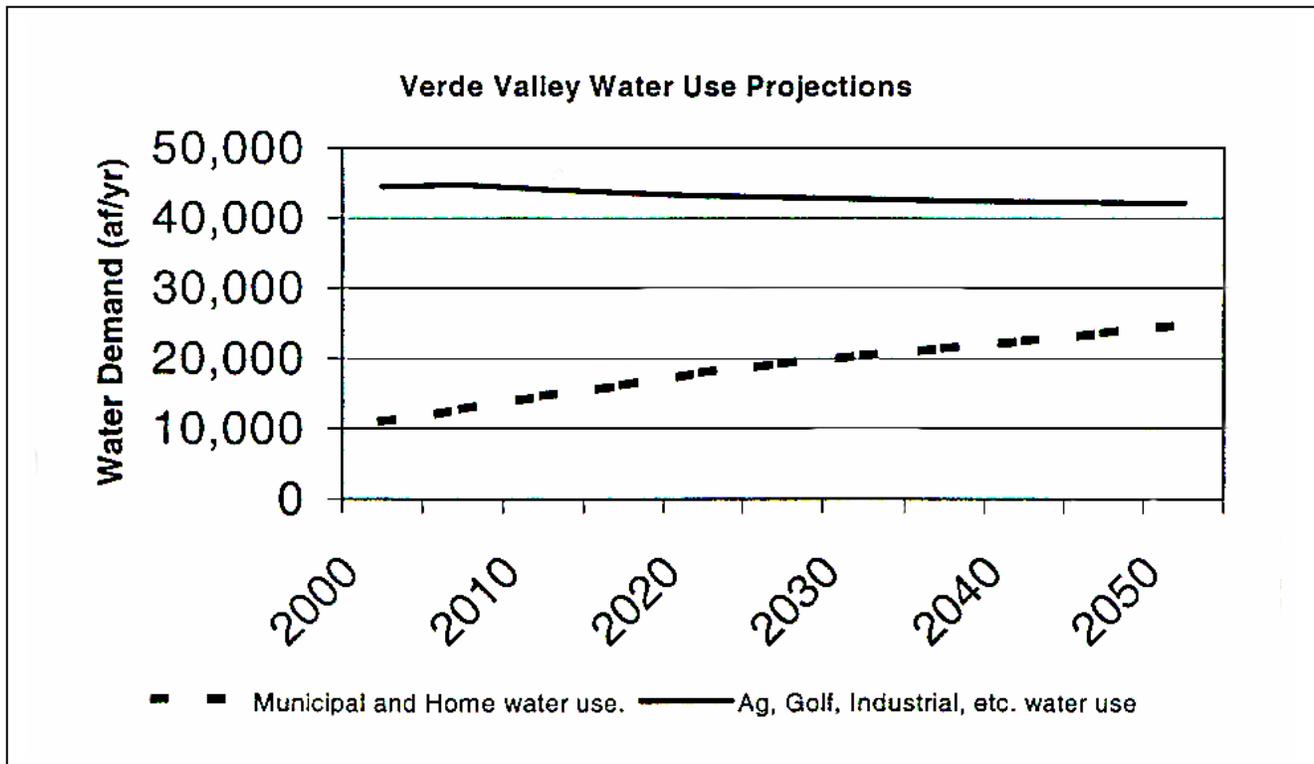


The City of Cottonwood overlies a series of low water yielding geolithic formations, including alluvial gravels, silts and clays from the Quaternary and Recent ages and the Tertiary Verde Formation. The Verde Formation includes consolidated sandstones, limestones, mudstones and claystones, but these rock types are not exposed on the surface within the corporate limits. However these units are in the subsurface within the corporate limits. Immediately to the west and northwest, a series of faults expose certain Paleozoic and Precambrian formations, but these rock types are not present within the corporate limits. To the north of the City are both Tertiary volcanic calderas (in Flagstaff) and basaltic flows (such as House Mountain, a "shield" volcano) and outcrops of Paleozoic sedimentary rocks typical of the Sedona and Jerome areas and the mountain front west of the Cottonwood area.

The surface water supplies along the Verde River and its tributaries are controlled by the Doctrine of Prior Appropriation and are utilized primarily for irrigation and agricultural purposes. These rights are presently being adjudicated but because of over allocation and the complex hydrogeologic relationship that exists between surface and groundwater this is a complex and controversial process.

The Doctrine of Reasonable Use governs groundwater supplies in the region. This Doctrine simply means one has the right to drill and develop a groundwater supply as long as the water is put to a "beneficial" use. Because the area is outside a State designated Active Management Area, there are few restrictions on well development. It is this Doctrine that applies to Cottonwood's water supplies.

TABLE 12.1





REGIONAL WATER USE AND DEMAND

The chart below, taken from the Draft Water Use Projections-Verde Valley, Arizona (April 2003)¹, shows the projected water demands in the Verde Valley by major water use categories – agriculture, golf courses, industrial and other demands compared to demands from the municipal and self-supplied residential sector. As demonstrated in the chart, there is predicted to be a small decline in the agricultural sector and a two-fold increase in the residential and municipal water use sector. This is closely related to the predicted population increase in the Verde Valley, from 61,284 at present to an estimated 153,000 in 2050.

Agricultural use was estimated at 34,375 acre-feet per year in 2000. Evaporation and transpiration has been estimated at 35,000 acre-feet per year in the Middle Verde (Verde Valley area) according to the Verde River Watershed Study. Industrial and domestic water uses are both estimated at about 10,000 acre-feet per year, currently.

The Northern Arizona Municipal Water Users Association recently completed Residential Water Demand Projections for the year 2050, building on work done by the Yavapai County Water Advisory Committee. These projections for the Verde Valley are summarized below.

TABLE 12.2 VERDE VALLEY WATER USERS

<u>Estimated Population</u>	<u>Per Capita Usage</u> (spcd)	<u>Total Residential Demand</u> (AF / YR)	<u>Local Sources</u> (AF / YR)	<u>Deficit</u> (AF / YR)
153,000	175	30,000	18,000	12,000

Based on these projections, the Verde Valley will need to locate and secure 12,000 additional acre-feet of water to meet residential needs in the year 2050. Possible solutions to this deficit include improved conservation and efficiency measures, new ground water

resources, importation of water into the region and the acquisition of surface water rights for conversion to municipal use in accordance with Arizona Water rights law.

¹ Yavapai County Water Advisory Committee and the U.S. Bureau of Reclamation.



RIGHT: The chart at right, derived from the Draft Water Use Projections, Verde Valley, Arizona (April, 2003), combines all water use demand, including residential, agricultural, industrial, golf courses and other uses by community. Communities with high agricultural use will obviously demonstrate the highest per capita water use.

Table 12.3: VERDE VALLEY WATER DEMAND (in Acre Feet)						
Place	<u>Year 2000</u>			<u>Year 2050</u>		
	Pop.	Acre Ft.	Per Capita g/p/d*	Pop.	Acre Ft.	Per Capita g/p/d*
Sedona	10,192	3,153	276	15,700	4,718	268
Big Park	5,245	2,409	410	6,317	2,786	393
Bridgeport	1,535	2,395	1,393	3,185	1,630	457
Camp Verde (incl. Y-A Nation)	9,814	19,796	1,801	31,490	22,444	636
Clarkdale	3,562	3,162	792	9,366	4,152	396
Cottonwood & Verde Village	19,794	5,635	254	35,014	7,837	200
Cornville	3,083	3,825	1,108	8,600	3,073	319
Jerome	596	280	419	953	448	420
Page Springs	599	6,208	9,252	1,418	6,292	3,961
Rimrock	3,349	1,903	507	10,579	2,756	233
<i>*gallons per person per day</i>						

WATER RESOURCES

Mean annual precipitation in the Verde Valley is between 10 and 20 inches and may exceed 30 inches along mountain slopes.

Surface water is all water in streams, rivers, lakes and ponds, as well as floodwaters and water flowing in underground channels. It is estimated that approximately 35,000 acre-feet per year of surface water is diverted from the Verde and its tributaries for irrigation purposes in the Verde Valley. As previously mentioned, surface water rights are being adjudicated throughout the Gila River system. Possible over-allocation and the complex hydrogeology of the Verde Valley make this a complex and controversial process.

Groundwater is that subsurface water below the water table level which is the top of the zone of totally saturated sediments and/or rocks. The Reasonable Use Doctrine has meant that one has the right to drill and develop

groundwater supplies as long as the water is put to beneficial use. Outside of the Active Management Areas, there are few restrictions on well development. As of April of 1999, ADWR's well registry indicated 9,630 wells in the Verde Valley area. At present, about 10,000 acre-feet per year of ground water are pumped for municipal and self-supplied residential use in the Verde Valley.

The Verde Valley has such a lack of data and understanding that even an approximation of groundwater in storage is not currently possible.

The City of Cottonwood and its partners in the Yavapai County Water Advisory Committee and the Verde Watershed Association have undertaken a series of scientific studies to determine the groundwater resources within the Verde Valley.



Reclaimed water is also considered a water resource. Septic recharge was estimated to be 2,120 acre-feet in 1996. The City of Cottonwood and other municipal wastewater treatment plants in the Verde Valley generate a

substantial amount of reclaimed water that can be used for recharge, irrigation and other potential uses. At full capacity, the Cottonwood Waste Water Treatment Plant will produce about 1,680 acre feet of reclaimed water per year.

D. LOCAL OVERVIEW

The City of Cottonwood is wholly dependent on groundwater to meet its potable water demands. The sources for the water are a number of wells that penetrate into the Verde Formation and in some cases into the shallow alluvium near the Verde River. While the Verde Formation supplies the source water, it is not known as a prolific water-bearing unit with large production wells in the area yielding a few hundred gallons of water per minute.

In contrast, more prolific wells in the region such as Chino Valley produce water at a rate of several thousand gallons per minute.

Three private water companies distribute water throughout the City. These companies are Clemenceau, Cordes Lakes and Cottonwood Water Works. A matrix comparing these companies is shown below.

The Arizona Corporation Commission regulates the activities of these companies, particularly those related to rate setting. The Arizona Department of Water Resources and the Arizona Department of Environmental Quality also regulate aspects of their operations.

	Custom ers	Annual Delivery (Af)	Storag e (Mg)	Wells
Clemenceau	236	241	0.335	3
Cordes Lks	3,634	1,327	0.912	15
Ctwd/W.W.	4,162	1,877	3.278	12
TOTALS	8032	3445	4.525	30

Af = acre-feet Mg = Million gallons

BELOW: The Yavapai County Water Advisory Committee, Draft Water Use Projections (April, 2003) indicate the following for Cottonwood and Verde Village.

	Year					
	2000	2010	2020	2030	2040	2050
Population Projection	19,794	23,024	26,151	29,958	32,611	35,014
Total Water Demand (acre-feet/yr)	5,635	6,279	6,923	7,441	7,586	7,837
Total potable water demand (incl. pvt. wells)	3,288	3,932	4,576	5,352	5,874	6,346
GPCD	148	152	156	159	161	162
Other uses (Ag, Indust, Golf, Reservoirs)	2,347	2,347	2,347	2,090	1,712	1,491



E. KEY ISSUES

1. Regional study of water supplies

Safe, dependable water resources are critical to the health and well being of current and future residents.

The City of Cottonwood is highly dependent on local groundwater sources that are produced by a fairly low yield geologic formation. The City is currently participating in a multi-year comprehensive hydrogeologic assessment of all available water resources in the Verde Valley. The City must continue to work with regional partners to complete the comprehensive assessment of water resources in the Verde Valley.

2. Development of additional resources

Except for minor ditch rights and reclaimed water, the City does not own any water sources or water delivery infrastructure. The City's best option may be the development of a municipal water system as a means to ensure continued development of water resources and the establishment of a sufficient distribution system.

3. Water quality.

The Environmental Planning element addresses water quality issues directly. Primary concerns include nitrate levels that may be affected by unregulated lot splitting, well drilling and septic disposal. The Federal Environmental Protection Agency has approved new arsenic standards, lowering the acceptable level from

50 parts per billion to 10 parts per billion, effective in 2006. This new standard will have a significant effect on municipal supply and cost factors. Other water quality issues pertain to the integrity of the watershed, waterways and riparian corridors. The City should closely regulate run off contaminants and encourage maintenance of vegetative buffers along stream channels that may help to filter pollutants.

4. Conservation and water reuse

The City must take measures to encourage efficient use of water at every opportunity, including water saving plumbing fixtures, household gray water systems, drip irrigation and drought resistant landscaping. Reclaimed water distribution systems are currently in place and being operated by the Cottonwood Waste Water Treatment Plant. There may be opportunities to make use of the reclaimed water to recharge groundwater aquifers. The treatment plant has been fitted for water trucks so that reclaimed water can be used for street sweeping / washing, dust proofing and fire protection.

5. Funding for water development

Water development requires a great deal of money. Most of the funding will come in the form of bonding. The City should develop a comprehensive funding strategy for water development and coordinate the strategy with the City's Capital Improvements Plan.



F. GOALS AND OBJECTIVES

GOAL WR-1 PROVIDE ADEQUATE WATER SUPPLIES FOR THE CITIZENS OF COTTONWOOD TO MEET EXISTING AND LONG TERM NEEDS.

OBJECTIVE 1.1 Support regional and statewide efforts to assure safe yield within the Verde Valley.

- 1.1.A Assist the Yavapai County Water Advisory Committee and the Verde Watershed Association in their continuing water study and monitoring programs and in developing a comprehensive water budget for the Verde Valley communities.
- 1.1.B Develop strict regulations to assure *safe-yield* concept is maintained.
- 1.1.C Upon completion of the regional water budget develop a water resources master plan for the City that inventories known sources of water and establishes a plan for future demand.
- 1.1.D Support legislation for the protection of local riparian habitats and water supplies.

OBJECTIVE 1.2 Maintain and improve water quality (see also Environmental Planning Element).

- 1.2.A Support monitoring of water quality data by federal, state and local agencies.
- 1.2.B Support additional water quality base line studies.
- 1.2.C Develop standards that prohibit development that adversely affects surface and groundwater quality.
- 1.2.D Identify sources of surface and ground water pollution and design methods for efficient clean up.
- 1.2.E Maintain buffers of natural vegetation along washes and riverside areas to help filter pollutants.
- 1.2.F Require hookups to municipal water and sewer systems.

OBJECTIVE 1.3 Protect and maintain riparian habitats along the Verde River (see also Environmental Planning Element).

- 1.3.A Monitor and maintain historical base flow levels in the river system.
- 1.3.B Develop standards that prohibit development that impairs riparian habitat or decreases river flows.



- 1.3.C Develop protective riverine corridors and buffers as part of land use planning and design review.
- 1.3.D Promote educational activities that protect and defend the sanctity of riparian habitats.



OBJECTIVE 1.4 Maintain and improve water supply.

- 1.4.A Develop a municipal water system.
- 1.4.B Support legislation related to municipal acquisitions, inter-basin transfers and districting options for augmenting water supplies.
- 1.4.C Encourage sub flow and aquifer recharge projects.
- 1.4.D Acquire surface water rights from agricultural land retirement and/or unused rights from irrigation districts.
- 1.4.E Consider acquiring water rights associated with State Trust properties east of the City.
- 1.4.F Upgrade distribution systems to provide for adequate supply and fire flows.
- 1.4.G Cooperate with other communities in regional groundwater exploration projects.

OBJECTIVE 1.5 Promote strict water conservation, recharge and reuse codes and programs.

- 1.5.A Prepare educational programs for schools, organizations and general public justifying the importance of water conservation programs.
- 1.5.B Amend codes to encourage water conservation measures.
- 1.5.C Promote xeriscaping and other outdoor conservation efforts.
- 1.5.D Develop a system of reclaimed water for open space, public recreation areas and other non-potable uses.
- 1.5.E Support a program of rebates as part of a municipal water system which encourages conversions to water saving fixtures.
- 1.5.F Explore storm water and house water reclamation, for use within residential areas.
- 1.5.G Research and develop water recharge projects to supplement groundwater and sub flow removals.
- 1.5.H Amend the Zoning Ordinance to prohibit golf course development that requires use of any potable water supplies.

OBJECTIVE 1.6 Develop funding for water development

- 1.6.A. Develop a funding plan to enable acquisition of private water companies, new water rights and upgrades to the supply and distribution system.
- 1.6.B Coordinate water related improvements and funding with the Capital Improvements Plan.



G. ACTION PLAN

WATER RESOURCES ELEMENT			
	DO-ITEM	AGENCY	TIMELINE
WR-1	PROVIDE ADEQUATE WATER SUPPLIES FOR THE CITIZENS OF COTTONWOOD TO MEET EXISTING AND LONG TERM NEEDS.		
1.1	Support regional and statewide efforts to assure safe yield within the Verde Valley.		
1.1.A	Assist the Yavapai County Water Advisory Committee and the Verde Watershed Association in their continuing water study and monitoring programs and in developing a comprehensive water budget for the Verde Valley communities.	Cottonwood City Management	On-going
1.1.B	Develop strict regulations to assure <i>safe-yield</i> concept is maintained	Cottonwood City Management	ST
1.1.C	Upon completion of the regional water budget, develop a water resources master plan for the City which inventories known sources of water and effluent and establishes a plan for future demand.	Cottonwood City Management	ST
1.1.D	Support legislation for the protection of local riparian habitats and water supplies	Cottonwood City Management	ST
1.2	Maintain and improve water quality (see also Environmental Planning Element).		
1.2.A	Support monitoring of water quality data by federal, state and local agencies	Cottonwood City Management	On-going
1.2.B	Support additional water quality base line studies	Cottonwood City Management	On-going
1.2.C	Develop standards which prohibit development that adversely affects surface and groundwater quality	Cottonwood Community Development	ST
1.2.D	Identify sources of surface and ground water pollution and design methods for efficient clean-up	Cottonwood City Management	ST
1.2.E	Maintain buffers of natural vegetation along washes and riverside areas to help filter pollutants.	Cottonwood Community Development	On-going
1.2.F	Require hookups to municipal water and sewer systems.	Cottonwood City Management	LT
1.3	Protect and maintain riparian habitats along the Verde River (see also Environmental Planning Element).		
1.3.A	Monitor and maintain historical base flow levels in the river system	Cottonwood City Management	On-going
1.3.B	Develop standards which prohibit development that impairs riparian habitat or decreases river flows	Cottonwood Community Development	ST
1.3.C	Develop protective riverine corridors and buffers as part of land use planning and design review.	Cottonwood Community Development	LT
1.3.D	Promote educational activities that protect and defend the sanctity of riparian habitats	Cottonwood Community Development	ST
1.4	Maintain and improve water supply.		
1.4.A	Develop a municipal water system.	Cottonwood City Management	ST
1.4.B	Support legislation related to municipal acquisitions, inter-basin transfers and districting options for augmenting water supplies.	Cottonwood City Management	On-going
1.4.C	Encourage sub flow and aquifer recharge projects.	Cottonwood City Management	On-going
1.4.D	Acquire surface water rights from agricultural land retirement and/or unused rights from irrigation districts.	Cottonwood City Management	LT



1.4.E	Consider acquiring water rights associated with State Trust properties east of the City.	Cottonwood City Management	LT
1.4.F	Upgrade distribution systems to provide for adequate supply and fire flows.	Cottonwood City Management	ST
1.4.G	Cooperate with other communities in regional groundwater exploration projects.	Cottonwood City Management	On-going
1.5	Promote strict water conservation, recharge and reuse codes and programs.		
1.5.A	Prepare educational programs for schools, organizations and general public justifying the importance of water conservation programs.	Cottonwood Community Development	ST
1.5.B	Amend codes to encourage water conservation measures.	Cottonwood Community Development	ST
1.5.C	Promote xeriscaping and other outdoor conservation efforts.	Cottonwood Community Development	ST
1.5.D	Develop a system of re-claimed water for open space, public recreation areas and other non-potable uses.	Cottonwood City Management	ST
1.5.E	Support a program of rebates as part of a municipal water system which encourages conversions to water saving fixtures.	Cottonwood City Management	LT
1.5.F	Explore storm water and house water reclamation, for use within residential areas.	Cottonwood City Management	LT
1.5.G	Research and develop water recharge projects to supplement groundwater and sub flow removals.	Cottonwood City Management	LT
1.5.H	Amend the Zoning Ordinance to prohibit golf course development that requires use of any potable water supplies.	Cottonwood Community Development	ST
1.6	Develop funding for water development		
1.6.A.	Develop a funding plan to enable acquisition of private water companies, new water rights and upgrades to the supply and distribution system.	Cottonwood City Management	ST
1.6.B	Coordinate water related improvements and funding with the Capital Improvements Plan.	Cottonwood City Management	ST