

AN ORDINANCE AMENDING CHAPTER 18, "MOTOR VEHICLES AND TRAFFIC", OF THE ABILENE MUNICIPAL CODE, BY AMENDING CERTAIN SECTIONS AS SET OUT BELOW; PROVIDING A SEVERABILITY CLAUSE; AND DECLARING A PENALTY.

BE IT ORDAINED BY THE CITY COUNCIL OF THE CITY OF ABILENE, TEXAS:

PART 1: That Chapter 18, "Motor Vehicles and Traffic", of the Abilene Municipal Code be amended as set out in Exhibit "A", attached hereto and made a part of this ordinance for all purposes.

PART 2: That if any provision or any section of this ordinance shall be held to be void or unconstitutional, such holding shall in no way effect the validity of the remaining provisions or sections of this ordinance, which shall remain in full force and effect.

PART 3: That any person, firm or corporation violating any of the provisions of this chapter shall be deemed guilty of a misdemeanor, and upon conviction thereof shall be punished by a fine of not more than Two Hundred Dollars (\$200.00). Each day such violation shall continue or be permitted to continue, shall be deemed a separate offense. Said Ordinance, being a penal ordinance, becomes effective ten (10) days after its publication in the newspaper, as provided by Section 19 of the Charter of the City of Abilene.


PASSED ON FIRST READING this 22nd day of May, A. D., 1986.

PASSED ON SECOND AND FINAL READING this 12th day of June, A. D., 1986.

ATTEST:

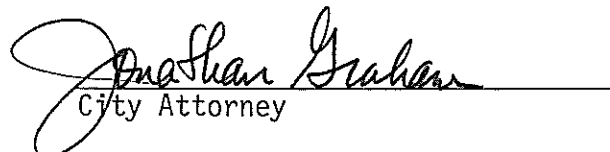


City Secretary



Mayor

Approved:



City Attorney

Exhibit "A"

Section 18-293. Parking prohibited - At all times.

ADD:

<u>Street</u>	<u>Side</u>	<u>Extent</u>
Compere Blvd	Both	From Hickory St. west a distance of 40 feet.
Compere Blvd	Both	From Simmons Ave. east a distance of 40 feet.

Section 18-294. Parking prohibited - During certain hours.

ADD:

6:00 a.m. to 7:00 a.m.; 9:00 a.m. to 10:00 a.m.; and 3:00 p.m. to 4:00 p.m.:

<u>Street</u>	<u>Side</u>	<u>Extent</u>
Compere Blvd	North	From Hickory St. to Simmons Ave.
Compere Blvd	South	From Hickory St. West a distance of 380'
Simmons Ave	East	From N. 21st St. to Compere Blvd.
Simmons Ave	West	From N. 21st St. to the alley south of N. 20th St.

ABILENE'S
WATER
MANAGEMENT PLAN

*Approved
Revised
6-12-86*

CITY OF ABILENE
CONSIDERED BY
CITY COUNCIL

MAY 22 1986
6-12-86

APPROVED DENIED

ORD # *44-1986*

RES # *April*

SIGNED: *Patricia Patton*

SUMMARY

Water Management Plan

In February 1985, the City Council appointed a Water Conservation Advisory Committee to assist city personnel in revisions to the Water Conservation Ordinance.

In April 1985, the revised Water Conservation Ordinance was presented to City Council and accepted as the Drought Contingency Plan. At this time, the Water Advisory Committee also proposed the development of a total Water Management Plan for the City of Abilene.

The Water Conservation Advisory Committee started meeting in October 1985 and has continued to meet on a regular basis until the completion of the Water Management Plan.

The Water Management Plan includes an overview of the city's water resources, and a detailed background on the city's water utility system. Also discussed are the anticipated population growth and the water/wastewater requirements associated with this growth. The Water Management Plan also lists Supply Management Programs, where the utility conserves water, and Demand Management Programs, where the user conserves water.

The Drought Contingency Plan has again been revised to be part of the Water Management Plan. The two major changes were:

First, omitting Voluntary Stages 1 and 2. Voluntary conservation practices will now be part of the on-going education program and is addressed under demand management, and,

Secondly, A) prohibiting water to run 75 feet from the downgrade of the property line, and B) prohibiting restaurants from serving water unless requested, will be enforced when the Drought Contingency Plan is implemented and not on a year-round basis as previously done. These practices will be encouraged on a voluntary basis as part of the City's education program.

The Drought Contingency Plan would now be utilized only when emergency water situations occur, and mandatory water restrictions were required.

TABLE OF CONTENTS

- I. INTRODUCTION
- II. OVERVIEW OF WATER RESOURCES
- III. WATER UTILITY SYSTEM
 - Water Treatment
 - Water Distribution
 - Wastewater Treatment
- IV. PROJECTIONS
 - Population
 - Water Requirements
 - Wastewater Requirements
- V. LONG-RANGE MANAGEMENT ISSUES
 - Hubbard Creek Lake
 - Stacy Dam Project
 - Water Reuse and Recycling
- VI. WATER MANAGEMENT PROGRAMS
- VII. SUMMARY

TABLE OF FIGURES

- Figure 3-1 Annual Water Usage
- Figure 3-2 Abilene Water Use Profile
- Figure 3-3 Peak Day Usage
- Figure 3-4 Projected Water Treatment Expansions
- Figure 3-5 Wastewater Flows 1975-85
- Figure 3-6 Abilene Wastewater Flow Profile
- Figure 3-7 Wastewater Treatment Plant Expansions
- Figure 4-1 Projected Annual Water Usage
- Figure 6-1 Single Family Home Water Use
- Figure 6-2 Detailed Water Use Breakdown
- Figure 6-3 Retrofitted Homes
- Figure 6-4 Projected New Construction

APPENDIX

Appendix A - Drought Contingency Plan (Ordinance # 44-1986)

Appendix B - Pressure Plane Map

Appendix C - Abilene Water Resources (Map)

Appendix D - Key: Assumptions

ABILENE'S WATER MANAGEMENT PLAN

INTRODUCTION & BACKGROUND

The goal of Abilene's Water Management Plan is to provide a basis for city policy regarding the development, management, conservation, and protection of water resources for Abilene. Private and public interests are identified and considered equitably in the plan.

This plan provides for the orderly development and management of Abilene's water resources so that quality water will be available to the city in sufficient quantity at a reasonable price.

In addressing the water management issues in Abilene, these questions were considered:

Is the present supply of water sufficient and secure? Have future water needs been adequately assessed? Have plans been made to meet future needs? Is the present delivery system adequate? Have plans been made to meet future delivery? Are the treatment facilities adequate in supplying safe water? Do wastewater treatment facilities sufficiently handle present needs and do they comply with citizen expectation as well as state and federal laws? Are additional facilities being planned to handle wastewater flows that will increase with population growth? Has flood protection been provided?

The answers to these questions and others are part of the Abilene Water Management Plan. Since Abilene cannot depend on abundant rainfall, water management and planning are particularly important to the preservation of its quality of life.

The objectives of the Water Management Plan are:

1. To plan, develop, operate, and maintain adequate water acquisition, storage, conveyance, treatment, and wastewater treatment facilities.
2. To reduce the quantity of water used without categorically eliminating any uses of water.

3. To accomplish water conservation through the installation of equipment and the adoption of practices that result in the most efficient initial use of available water.

The Water Utility Department is responsible for the overall supervision and inspection of water and wastewater operations in the City of Abilene, including: providing safe water, collecting all wastewaters discharged to sanitary sewer systems, and transporting and treating all wastewater.

All divisions of the Water Utility Department will participate in the implementation and monitoring of the Water Management Plan. The Water Administration Division has primary responsibility for water management and for consumer demand management programs. Water Distribution, Treatment and Production Divisions operate and maintain the utility system, and manage utility system development programs.

OVERVIEW OF WATER RESOURCES

Under Texas law, surface water--that which is found in rivers, streams and lakes--is considered a public resource owned and managed by the State of Texas for public benefit. Legal rights to use "state water" are acquired by obtaining a permit to take or divert state water, provided the water is put to beneficial use. The City of Abilene receives its water supply from Fort Phantom Hill Lake, Lake Abilene and Hubbard Creek Lake. Lake Kirby provides water for irrigation purposes.

The amount of water that the City may use is defined by permits and various contracts. The quantities of water under each of the permits, as determined by the Texas Water Commission, are:

- o Permit No. 253; September 7, 1918; Lake Abilene. Under this permit, authorization was given to construct a dam to create a reservoir of 11,868 acre-feet capacity and annual use of 1675 acre-feet per year (af/yr) of water for municipal purposes.
- o Permit No. 1051; October 10, 1927; Lake Kirby. Amended May 1978 (1051-A). Authorized construction of dam on Cedar Creek to impound 8,500 acre feet, of which 1120 af/yr is used strictly for golf course irrigation purposes.

- o Permit No. 1249; June 17, 1937; Fort Phantom Hill Lake. Amended October 1969 (1249-A). Allowed the construction of a 73,690 acre-foot capacity reservoir on Big Elm Creek known as Fort Phantom Hill reservoir. This permit allows the right to divert and use 30,690 af/yr, of which 20,690 for municipal purposes and 10,000 is for industrial purposes.
- o Permit No. 1481; August 3, 1949; Clear Fork Diversion. Amended several times (1481-C). Allows the use of excess water, not to exceed 30,000 af/yr, from the Clear Fork of the Brazos River, to be stored in Fort Phantom Hill Reservoir.
- o Permit No. 1726; November 1, 1954; Deadman Creek Diversion. Rights recognized under this permit granted the City of Abilene the right to construct a small dam across Deadman Creek and to divert 3,000 af/yr through a diversion channel into Fort Phantom Hill Reservoir if quality and/or quantity permits.

The city also has additional water available from a small well located in Abilene State Park. There is no permit required and this water is used to meet small contractual commitments and for municipal water during drought situations.

In 1955, the West Central Texas Municipal Water District was created, comprised of the cities of Abilene, Albany, Anson and Breckenridge. Its purpose is to provide the member cities a water source for municipal, domestic, industrial, and mining use, as well as to provide treatment and processing of the water, and transportation of water to member cities.

In September 1959, the City of Abilene entered into a contract with the Water District, allowing the City to receive 17,362 af/yr from Hubbard Creek Lake. Due to changing power costs and a decision to keep water rates as low as possible, this contract has been amended on five different occasions, but the basic terms and gallons per day have remained intact.

The most recent amendment to the Water District contract, made in August of 1985, allows the City to obtain maximum benefit of water from Hubbard Creek Lake in conjunction with a coordinated water use program developed in 1982. To obtain maximum water from Hubbard, a second pipeline and additional pumping capacity will be required.

In a referendum on August 10, 1985, Abilene voters gave overwhelming support to the proposal that the City of Abilene join with the West Central Texas Municipal Water District,

the Colorado River Municipal Water District, and several other West Texas cities to build Stacy Reservoir near Coleman, Texas. It is estimated that this reservoir would contribute to meeting Abilene's water needs beyond the year 2000. Cities and water districts entered the final agreement on September 5, 1985. Provisions of the agreement that allow the City of Abilene the rights to Stacy water are:

- o The City of Abilene will own the rights for 16.54% of the safe yield of Stacy Reservoir, not to exceed 15,000 af/yr. The safe yield will be calculated by the engineers of the Colorado River Municipal Water District (CRMWD).
- o The City of Abilene will have the opportunity, if water is available, to purchase additional amounts of water from the lake.
- o The project will be financed by CRMWD; the bonds will be secured by contract with the City of Abilene.
- o In the event of a critical shortage of water at the Stacy Reservoir, the Board of Directors of CRMWD will determine how each city's share will be affected by that critical shortage.
- o The City of Abilene will be responsible for the transportation of the water it uses from Stacy Reservoir.

Without water from Stacy, the amount of water available to the city for municipal and industrial use is 49,997 af/yr, allowing the city to provide 45.0 million gallons a day (MGD). Depending on seasonal demands and the amount of water received from Hubbard, the cost of water ranges from \$1.22 to \$1.37 per thousand gallons, based on 1984-85 water usage and expenditures.

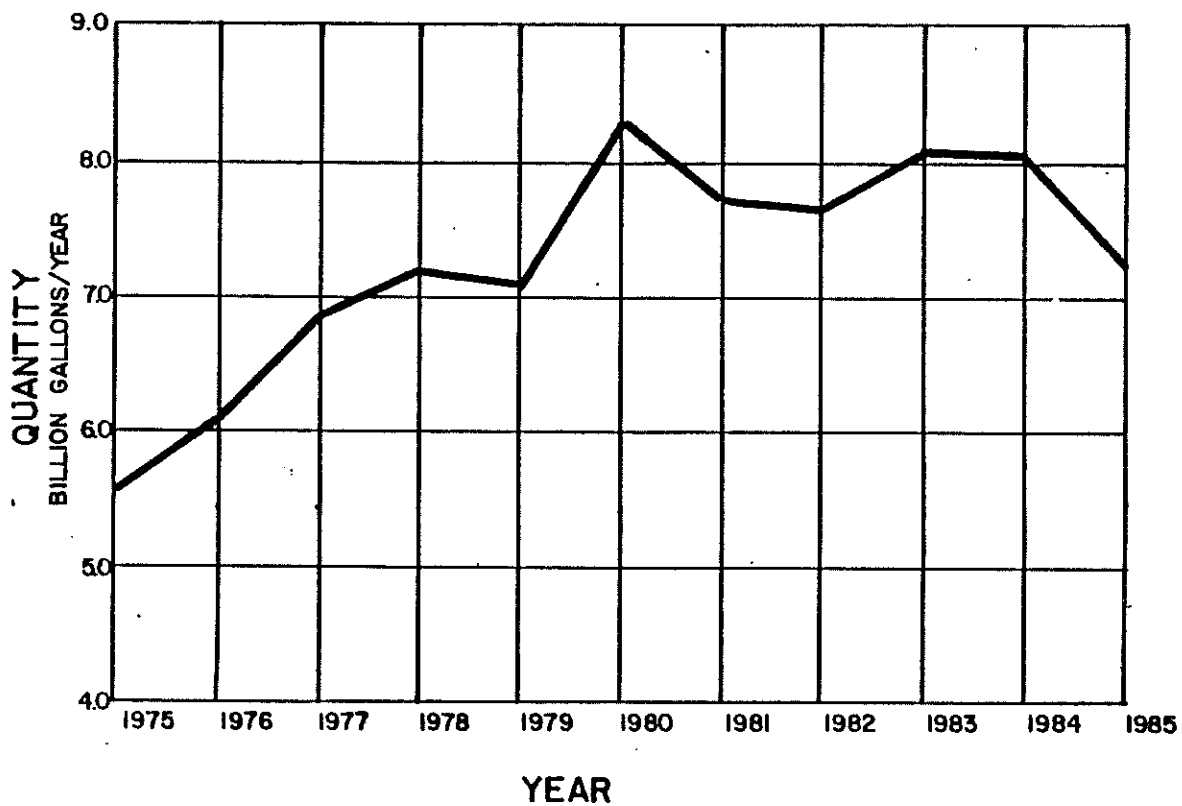
WATER UTILITY SYSTEM

The City of Abilene supplies treated water to residential and commercial customers within the incorporated limits of the city. The city also has agreements to sell water to eight water supply corporations and to Dyess Air Force Base.

Abilene's water utility service requirements have grown consistently for the past decade. Since 1975, the demand for water has grown at an annual rate of 2.44%, taking into account variations for weather conditions.

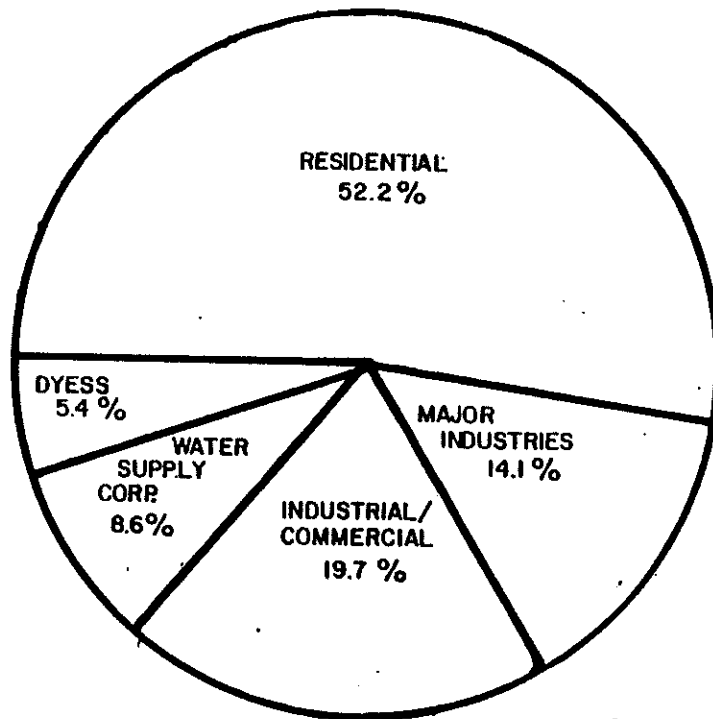
Figure 3-1 depicts annual water demands from 1975 through 1985.

Figure 3-1
ANNUAL WATER USAGE
1975-1985



The number of customers served by the water utility system has increased over the past decade. During fiscal year 1974-75, approximately 27,355 residential and commercial customers were served by the utility. In fiscal year 1984-85, 34,000 residential and commercial customers were served. Based on the average water usage billed during fiscal year 1984-85, the percentage of total annual usage by customer class is depicted in Figure 3-2.

Figure 3-2
ABILENE WATER USE PROFILE
AVERAGE USAGE :: 21 MGD



The demand for water can be divided into two key components: base water use and summer water use. Base water use generally occurs within homes and businesses at a relatively constant rate throughout the year. Base use is measured during the months of October through May when outdoor water use is normally minimal. Currently, base water use in Abilene averages 15 million gallons per day (MGD).

Summer water use is the usage above base water used during the months of June through September. Generally, this is outdoor use, particularly lawn watering. Summer water use is highly variable due to weather conditions. During fiscal year 1984-85, 53 percent of annual water demand was base water use in the eight months from October through May, while the remaining 47 percent of annual water demand was summer use in the four month period of June through September.

Annual water demand is not consistent because of varying weather conditions. During an extended dry, hot period, water consumption will be greater primarily due to increased lawn watering.

Peak day water demands also increased between 1970 and 1985. Figure 3-3 shows the trend in peak day water pumpage during this period, with projections through the year 2000.

WATER TREATMENT

The city's Water Treatment System consists of three treatment plants having a maximum capacity of 52 mgd. The water treatment plants have a combined treated water storage of 13 million gallons. The three water treatment plants are Northeast Water Treatment Plant and Grimes Water Treatment Plant, which take water from Fort Phantom Lake and Hubbard Creek Lake; and the Abilene Treatment Plant, which takes water from Lake Abilene and the Abilene State Park well. There are no major expansions currently underway at any of the three existing water treatment plants.

Figure 3-4 depicts the relationship between planned peak load treatment capacity and projected peak day water demands without conservation. Historically, water treatment capacity has been designed to meet peak load. If the existing water conservation program maintains a 1.89 ratio of peak day use to average day use, it will be necessary for the city to increase its water treatment capacity in the year 1998 in order to meet peak day demands. Without conservation, this same expansion will be needed by 1991 to accommodate the projected requirements.

WATER DISTRIBUTION

The water distribution system provides economical and compatible facilities that are capable of furnishing sufficient water at suitable pressures. Elements of the system include high service pumping facilities, ground storage tanks, elevated storage tanks, and the distribution system network of pipelines.

After the water is processed at the treatment plants and tested for purity, it is stored in ground storage tanks or pumped into the water distribution system which consists of approximately 700 miles of water mains in varying diameters buried underneath streets and alleys. The distribution network is laid out in a continuous looped system to circulate water.

The City of Abilene has a 7.5 million gallons semi-elevated storage tank, a renovated Kirby pump station with a 2 million gallon ground storage tank, and the following four elevated storage tanks:

Buffalo Gap Road	1,000,000 gal. capacity
South 19th & Highland	1,500,000 gal. capacity
Hartford Street	2,000,000 gal. capacity
Elmdale	500,000 gal. capacity

The combined capacity of these storage tanks is 14.5 million gallons. Due to the elevation of these tanks, the pressure on the distribution system remains fairly constant, around 50 pounds per square inch.

Pumping stations are located strategically throughout the city to maintain uniform pressure levels and fill elevated tanks during the night.

The distribution system is divided into a high level and a low level pressure plane (See Appendix B), along east-west lines. The area south of this line, where the average elevation is higher, requires about 20 pounds additional pressure to maintain adequate service.

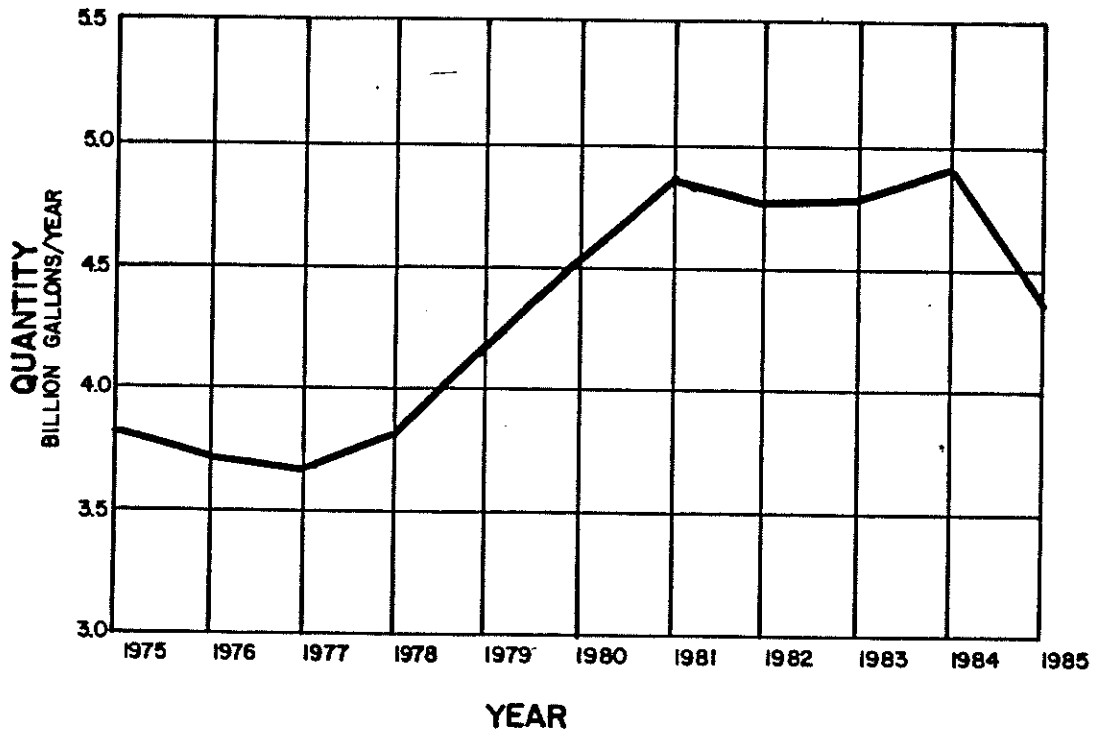
WASTEWATER TREATMENT

The Wastewater Utility Division treats all sanitary waste from the City of Abilene. It monitors all wastes that enter the collection system, particularly that of certain industries, in order to prevent problems in the wastewater treatment process.

The wastewater collection system is a network of approximately 500 miles of collection lines. Wastewater flows by gravity into the Buck Creek Pump Station, which has a pumping capacity of approximately 24 mgd. The emergency storage basin has a capacity of approximately 23 million gallons. Wastewater is metered and pumped five miles to the wastewater treatment plant where it receives physical and biological treatment to remove suspended and dissolved organic solids. The modified activated sludge plant has a permitted 13.4 MGD capacity.

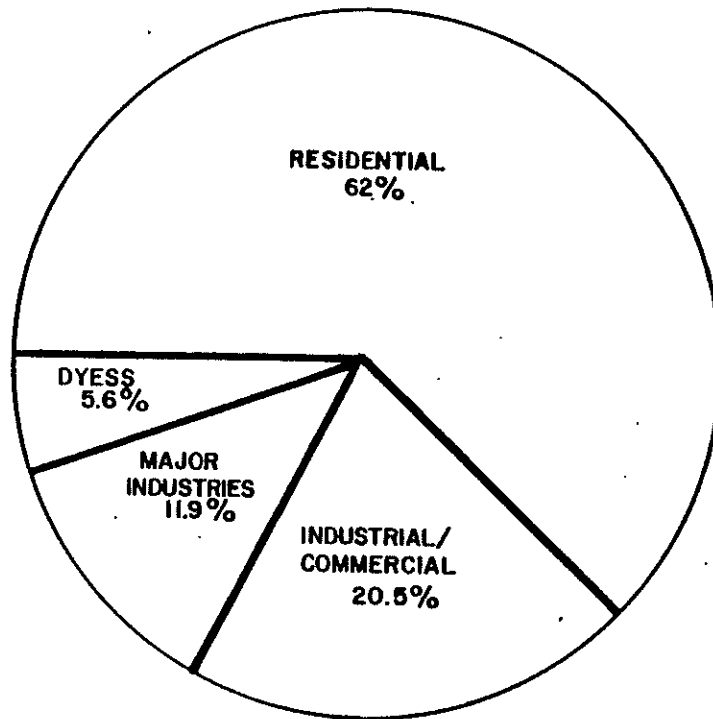
Since 1975, wastewater flows have grown at a compound rate of 4.3 percent. Figure 3-5 depicts the wastewater flows from 1975 through 1985. A significant decrease in 1985 can be attributed to reduced water consumption, the loss of major industries in Abilene, the effects of the industrial waste program, and the more accurate measurement of wastewater flows.

Figure 3-5
WASTEWATER FLOWS
1975-1985



The total number of customers served by the wastewater utility system has increased over the past decade. During fiscal year 1984-85, approximately 34,000 residential and commercial customers were served by the utility; in 1974-75, this figure was approximately 26,000. The percentage of total wastewater flows by customer class is depicted in Figure 3-6.

Figure 3-6
ABILENE WASTEWATER FLOW PROFILE
AVERAGE FLOW :: 12.7 MGD



Renovations and expansions were made to the wastewater treatment facility in fiscal year 1984-85, so that average daily flows now equal 80% of the permitted wastewater treatment capacity. As depicted in Figure 3-7, total wastewater treatment capacity will need to be increased by 1989, assuming demand management programs are not implemented. Note that in 1980-83, the requirements exceeded the capacity. During this period, 4 MGD were diverted to oxidation ponds for irrigation. Measurement of inflow was also inaccurate during this period.

On March 23, 1982, the City Council adopted the New Industrial Waste Ordinance and User Charge System. The Industrial Waste Program has two major objectives: to prevent toxic chemicals from reaching water resources; and to provide education and assistance for local industries to reduce their waste output level. Under this program, waste samples are taken from 21 industries to verify compliance. The Industrial Waste Officer enforces pretreatment standards, with enforcement measures including misdemeanor fines and/or injunctions.

PROJECTIONS-POPULATION AND WATER/WASTEWATER REQUIREMENTS

Total annual water usage and peak day water demands can be expected to increase with continued population and economic growth. Figure 4-1 depicts the projected growth in annual water usage from 1975 through 2000. These projections are based on population growth and data supplied from a 1985 updated analysis of Abilene's municipal water system.

POPULATION

The projected population growth pattern in an area provides a basis for estimating future water requirements. Between 1983 and 2000, Abilene's total population is projected to grow at a rate of 1.0 percent per year, from 106,700 to 126,011. Most of this population growth is projected to occur in the southern part of the city. The population in the southern part of Abilene, between the year 1983 and 2000 is expected to increase by 3.4 percent per year, from 26,227 to 46,127. In the year 2000, it is projected that 36.6 percent of Abilene's population will live in the middle and third pressure planes (See Appendix B).

WATER REQUIREMENTS

Peak day water demands are more difficult to project because of variability in weather. Also, increases in demand have been limited in recent years by both voluntary and mandatory conservation measures. Figure 3-3 (Page 7) presents high and low projections of peak day demand through the year 2000, based on the 1985 Municipal Water System Analysis. The high projection, based on a 2.4 ratio of peak day use to average day use, was typical before the water conservation program was introduced. The low projection, assuming continued water conservation, is a 1.89 ratio of peak day use to average day use.

An average of 15 miles of new water mains are added annually to the water distribution system. As the city grows to the south, not only will further expansion be required, but also a third level major pressure plane will be needed to maintain proper service and adequate water pressures (See Appendix B).

Several key improvements are required to enable the system to supply the projected year 2000 water requirements. Phase I improvements are needed before 1990 and include the following:

1. Construction of a 500,000 gallon elevated storage tank on Highway 707 near Highway 83/84.
2. Construction of a 24-inch pipeline from the 42-inch main near the Northeast Water Treatment Plant to the new Maple Street Pump Station.
3. Construction of the new Maple Street Pump Station with an initial rated capacity of 4.0 MGD serving the middle pressure plane.
4. Construction of 2 million gallons of ground storage at the new Maple Street Pump Station.
5. Construction of a 16-inch pipeline along Highway 83/84 from the new elevated storage tank to Waldrop Lane.
6. Construction of a 12-inch pipeline along Highway 707 from the new elevated storage tank to an existing 12-inch pipeline.
7. Modification of the distribution system to separate the existing upper pressure plane into the middle and third pressure planes.

Phase II improvements, projected to be needed between 1990 and the year 2000, include:

1. Expansion of the Maple Street Pump Station to a rated capacity of 12.0 MGD serving the middle pressure plane and 4.0 MGD serving the third pressure plane.
2. Construction of an additional 2 million gallons of ground storage at the Maple Street Pump Station.
3. Construction of a 20-inch pipeline from the Maple Street Pump Station to Highway 707.
4. Construction of a 16-inch pipeline along Highway 707 from Highway 83/84 to Oldham Lane.
5. Replacement or modification of the existing pumps at the Kirby Pump Station to allow pumping against 40 feet of additional head.
6. Construction of a 1.0 million gallon storage tank in the southeast section of the third pressure plane.
7. Construction of an additional 16,100 feet of 12-inch pipeline to serve new development in the middle and third pressure planes.

The projected construction cost of the proposed improvements listed in Phase I is estimated to be \$4,680,000 and in Phase II is estimated to be \$7,080,000 (1985 dollars).

WASTEWATER REQUIREMENTS

Although wastewater flow for the next decade is expected to increase, flow reduction from conservation programs will reduce operating costs and the need for capital improvements. Figure 3-7 (Page 10b) illustrates the projected increase in annual wastewater flows through the year 2000.

LONG-RANGE MANAGEMENT ISSUES

This section briefly discusses long-range water resources issues and presents the recommended strategies for addressing:

- o Water supply availability; and
- o Water reuse and recycling.

HUBBARD CREEK LAKE

In the summer of 1985, the City of Abilene determined that a second pipeline from Hubbard Creek Lake was needed to avoid restrictions during a drought situation.

The second pipeline could be in place as early as 1987, or as late as 1990, depending upon the demand and availability of present water resources. The plans for this pipeline have already been developed and implementation could begin quickly. Water Administration will continuously monitor Abilene's water conditions, and present recommendations to the City Council as required.

STACY RESERVOIR PROJECT

With the approval of the Stacy Reservoir Project in 1985, (See Page 4), Abilene has an additional source of water which is projected to be available after 1995. The City of Abilene will receive 16.54% of the safe yield, not to exceed 15,000 af/yr. In return, Abilene will pay 16.54% of construction, annual maintenance and lake administration costs. 1985 estimates place total lake construction costs at \$68 million, making Abilene's share about \$11 million. The project is to be financed by revenue bonds issued by the Colorado River Municipal Water District.

Abilene's share of Stacy's costs will be paid through water rates. Abilene must also construct its own pipeline and pump station at an anticipated cost of \$35 million.

Abilene can draw water from Stacy as soon as there is a sufficient amount impounded. Engineers have said water quality from Stacy will be inferior to Lake Fort Phantom Hill, but will be of equal quality to Hubbard Creek Lake. It is anticipated that this reservoir would contribute to meeting Abilene's water needs beyond the year 2000.

WATER REUSE AND RECYCLING

The potential for water reuse and recycling as an approach to reducing future water demands and extending available water supplies is substantial. Potential applications of reuse and recycling technology exist for every major water use sector (residential, commercial, industrial, and public).

Reclaimed wastewater is used for irrigation of parks, golf courses, and farmland throughout the United States. Generally, use of reclaimed wastewater is considered a method of wastewater disposal. However, reclaimed wastewater can be a substitute for high-quality potable water supplies in seasonal, landscape-related uses.

On February 14, 1985, the City Council authorized the staff to proceed to develop a small pilot project (1-2 MGD) for an advanced wastewater treatment facility. Some of the necessary steps include:

- a) Begin a systematic process of getting full information to the public on the acceptable use of wastewater as a water source.
- b) Obtain advice and assistance from a law firm with recognized water rights expertise.
- c) Contact the Brazos River Authority to seek their cooperation and support.
- d) Contact the Texas Department of Water Resources for advice regarding necessary water rights.
- e) Obtain the water rights as required.
- f) Obtain permit from Texas Department of Water Resources for a small scale pilot project and seek funding from state and federal sources.

The Council in June 1985 instructed the staff to pursue the feasibility of developing wastewater reuse as a viable long-range water project for the City of Abilene.

A formal proposal for a research project in wastewater reuse, costing an estimated \$348,718, has been approved by the Technical Advisory Committee of the Texas Water Development Board. The project would address health concerns, public acceptance, and surface water impacts from wastewater return. The committee will recommend that the state provide one-half of the cost of the research project, \$174,359, although it is anticipated that the money will not be available during the current biennium.

The proposed research project is Part One of a three-phase program to develop the first water reclamation and reuse project in West Texas. Part Two would include design, construction, operation, and evaluation of a 0.5 to 1.0 MGD demonstration plant. Part Three would be the construction of a full-scale water reclamation plant.

The outcome of the research project would be determination of acceptable water quality standards for the reclaimed wastewater discharge as a supplemental potable water supply and as supplemental water supply to Lake Fort Phantom Hill. Available water treatment technologies to achieve these standards would be evaluated and incorporated into the design of a preliminary process demonstration plant. Public awareness and acceptance programs would be developed.

Working with City of Abilene staff would be consultants and engineers, as well as a public advisory committee and a technical advisory committee.

WATER MANAGEMENT

Once implemented, a water management program is a one-day-at-a-time effort to keep maximum daily water demands within the peak load capacity of the water utility system. The reason for reducing this demand is to ensure adequate water utility service to all areas of Abilene; to preserve essential fire-fighting capabilities; and to protect water treatment and distribution facilities from stress-related damage. Both supply management, when the utility conserves water, and demand management, when the user conserves water, are needed.

Supply management programs, such as water conservation retrofits and leak detection and repair, will reduce total annual water use as well as contribute to reductions in peak day demands. To effectively reduce peak day water demands, more emphasis must be placed on demand management. Public information and education programs designed to encourage low water use landscaping and water conserving landscape maintenance will be important.

Benefits from a successful long-term effort to reduce peak water demands include:

- o Allowing for a greater emphasis on long-term water distribution system improvements;
- o Reducing inefficient and costly energy consumption caused by severe peak demands;
- o Allowing for a delay in major facility expansions, beyond those already anticipated to meet existing and near-term conditions; and
- o Saving money for the utility customer by a rate schedule that reflects decreased debt service requirements, and reduced operations and maintenance expenses.

SUPPLY MANAGEMENT PROGRAMS

Supply management is designed to improve efficiency and reduce waste within the production and delivery system. Supply management is used to achieve these conservation goals:

- o long-term use reduction;
- o average or peak use reduction; and
- o low or high percentage reduction

Some basic programs of supply management are: metering, leak detection and repairs, watershed management, and evaporation suppression.

METERING

This program enables the city to keep an accurate account of water use and bill accordingly. The City of Abilene presently completes the meter reading task manually. In 1986, the city will convert to electronic meter reading, which is expected to increase productivity and decrease errors.

LEAK DETECTION & REPAIRS

This program is designed to systematically inspect water distribution mains to locate water leaks for repair. The national average for unaccounted water is 12%, with 5% being excellent. Abilene's water utility estimates that 5% to 7% of the annual water pumpage is unaccounted for due to leaks, equipment failures, metering problems or unauthorized connections.

WATERSHED MANAGEMENT

Watershed Management, which includes the Industrial Waste Program and floodwater management, involves the monitoring of all area waters which are part of or flow into the city's water supply. Periodic random samples are taken from area lakes, streams, and creeks, and are sent to local and state facilities to ensure that standards are being met. Abilene occupies a relatively unique geographical position in that the city lies within the drainage area which provides the water source. This presents three distinct areas of concern:

1. A recommended method to reduce potential flooding in Abilene is detention (temporary storage of stormwater released into creek or channel at a controlled rate) of runoff upstream. Detention would significantly reduce the amount of water reaching storage at Fort Phantom Hill Lake due to evaporation and ground inflow.
2. Population growth close to creeks and channels limits the city's ability to reduce flood potential, increase water supply, and protect citizens. Clean, relatively straight, obstruction-free creeks and channels are needed to increase flow to Fort Phantom Hill Lake and reduce the flood potential in populated areas.
3. The existence of a large, diverse populated area within the water source drainage basin indicates a strong potential for inadvertent water pollution from industrial dumping, transportation accidents, wastewater pipeline leaks, oilfield mishaps, or natural disasters.

These concerns for the water supply encompass the total City Administration and the population as a whole. We must be constantly vigilant to assure the integrity of this precious resource for now and in the future.

EVAPORATION SUPPRESSION

Covering of open storage reservoirs minimizes the loss of water through evaporation. The City of Abilene does not presently participate in a program of this nature.

DEMAND MANAGEMENT

Demand management requests that the user conserve within his/her home or business. These programs can be used to achieve any type of conservation goal. The advantages of demand management programs are:

- o versatility
- o some are inexpensive
- o some do not require a lot of labor
- o some can be implemented very quickly

There are three types of demand management programs:

Pricing: changing the water rate to encourage users to conserve by saving money and water;

Regulation: issuing a restriction on the use of water, encouraging users to conserve by complying with the law/regulations, including the Drought Contingency Plan and Plumbing Code Requirements;

Education: informing users of the need to conserve; emphasizing that conservation will help the City of Abilene solve problems and help users save money; including the public information and education programs, XERISCAPE, Water Saver's Kit distribution, Action Audits, and Commercial/Industrial programs.

Criteria for development of the following water demand management programs were cost-effectiveness, equity, implementability, achievable savings, and integration with existing conservation programs.

PRICING

Water pricing policy has been used by numerous water utilities throughout the United States as a mechanism for encouraging water consumers to conserve. Overall, studies have not been conclusive about the effectiveness of pricing as a conservation incentive. Generally, results have been that price has little influence on interior water use, although it could lead to reduction of outdoor watering.

The City of Abilene has an inverted rate structure for water service. All utility customers are charged a minimum monthly charge, which varies with meter size, for the first 2,000 gallons of water used. The consumer is then charged for each additional 1,000 gallons of water used. This structure does not address the need to decrease water demand during the summer peak demand period, nor does it reflect the signifi-

cant difference in the cost of treating and distributing water during the summer due to higher energy costs, or consider variation in costs of providing water service to utility customers with different water demand characteristics.

The Water Utility Department is investigating alternative water rate structures that incorporate marginal cost pricing concepts. Marginal costs are the additional production costs associated with each incremental unit of production. Short-run marginal costs would include energy and chemicals; long-run marginal costs would include the costs of expanding production capacity and operating costs of the added capacity. Rate alternatives are:

Seasonal rates - An across-the-board higher rate charged during the summer peak demand period.

Excess use rate - Uniform commodity rates are charged for a base allotment of water, with a higher commodity rate charged for use in excess of the base allotment.

Rate design will be planned by City Administration and Water Utility Department using these criteria;

Cost-recovery - Water rate structures must be designed to generate sufficient revenues to meet the costs associated with providing water service.

Equity - A new water rate structure should reflect an equitable allocation of costs within and among customer classes.

Acceptability - A new water rate structure should be acceptable to water consumers and easy to understand. Consumer understanding and acceptance of the rationale underlying a conservation-oriented water rate structure is essential.

Implementability - A new rate structure should not require a drastic change from current utility billing practices.

Recommended water rate structure modifications will be presented to the City Council for considerations.

REGULATION

Water customers of the City of Abilene would be required by law to comply with these regulations as implemented. As new contracts are negotiated with water supply corporations, water conservation provisions will be included since the city has no regulatory authority to enforce regulations outside of the city limits.

The following two programs are regulatory in nature:

- 1) Drought Contingency Plan
- 2) Plumbing Code Requirements

Drought Contingency Plan

The fundamental objectives of the Drought Contingency Plan (Appendix A) are to:

- 1) Decrease the magnitude of seasonal peaks;
- 2) Eliminate the waste of water;
- 3) Decrease daily consumption to levels consistent with available water supplies during drought periods;
- 4) Provide safe and uniformly adequate level of service;
- 5) Ensuring adequate water flows for firefighting.

In 1983, Abilene's water conservation program, consisting mainly of extensive public education, was developed and implemented. During the summer of 1984, the Water Conservation Ordinance was adopted due to severe drought conditions throughout Central Texas. Mandatory water use restrictions (Stage 3) were in effect from July through September. Stricter conditions (Stage 4) were enforced September through January 1985. During this period, data clearly indicates that the Water Conservation Ordinance was effective in reducing peak water demands. In 1985, the Water Conservation Ordinance was revised and renamed the Drought Contingency Plan, in which Stage 2, voluntary conservation, was in effect. The Drought Contingency Plan was designed to reduce summer water use during critical peak demand periods. The plan defines successive water conservation stages, each geared to water supply emergency conditions of increasing severity. Stages 1 and 2 address voluntary restrictions, while stages 3, 4, and 5 address mandatory water restrictions.

In May 1986, the Drought Contingency Plan (Appendix A) was again revised to be part of the Water Management Plan. The major change was the deletion of Voluntary Stages 1 and 2. The City of Abilene still requests that all customers of the utility system voluntarily limit the amount of water used to that amount necessary.

The Drought Contingency Plan will be implemented in accordance with the triggering events defined in the ordinance, and/or upon recommendation of the Director of Water Utilities and the City Manager. Stages 1, 2, and 3 specify successively more stringent mandatory restrictions on certain outdoor watering uses, particularly landscape water uses. Violations of mandatory water use restrictions are punishable by fines up to \$1,000.

Because implementation of mandatory water use restrictions is contingent upon the occurrence of triggering events, the costs and benefits associated with Plan implementation are difficult to predict and quantify. The direct costs and the effectiveness of the Plan will vary from year to year depending on the level of reduction required. Since voluntary conservation will be requested annually, certain administrative costs will be relatively constant. These costs are considered to be a part of the total costs for the city public information and education program.

Plumbing Code Requirements

Proposed plumbing code requirements prescribe water conservation standards for plumbing fixtures on new residential, commercial and public buildings. The Water Utility Department will provide assistance to the Building Inspections Department to develop inspection procedures and train inspectors. When the Plumbing Code is implemented, the Water Utility Department will also sponsor workshops for developers and builders to provide information on code requirements.

The current Plumbing Code does not specify fixture performance. The following standard fixtures are required in many new buildings throughout the United States.

Tank-type toilets	3.5 gallons per flush
Flush-valve type toilets	3.0 gallons per flush
Tank-type urinals	3.0 gallons per flush
Flush-valve type urinals	1.0 gallons per flush
Showerheads	3.0 gallons per minute
Lavatory & kitchen faucets	2.75 gallons per minute

A recent HUD study of residential water use reports water savings of 15.2 gallons per person per day in a new residence equipped with plumbing fixtures that meet code requirements. No similar estimates of water-savings are currently available for non-residential buildings.

The proposed City of Abilene code requirements for water conservation will be modeled on similar code requirements that have been adopted by cities and states throughout the country. Plumbing fixtures that meet or exceed code requirements are widely available at no greater cost than the old less efficient fixtures.

The City staff, with assistance from the Water Conservation Advisory Committee, will prepare guidelines and proposed revisions for the existing plumbing code.

EDUCATION

One of the most widely accepted techniques for reducing water consumption is through education and public information programs. This technique allows conservation to be obtained through voluntary response. Education and public information programs increase the community's awareness of the actual problem. Below is a summary of the existing and proposed educational programs for the City of Abilene:

Public Information & Education Programs

The Water Utility Department will continue developing public information and education programs aimed at bringing about voluntary changes in water use habits and encouraging consumer participation in other city-sponsored water conservation programs. Information and education programs are oriented toward both general and specific audiences. A variety of communication and marketing techniques are being utilized.

The success of the City's proposed water demand strategies is largely dependent upon the widespread use of water conservation technologies and the voluntary adoption of water conservation practices. A sustained public information and education program is integral to the entire water demand management strategy. Increasing consumer awareness of the need for and benefits of water conservation will complement and reinforce other policies and programs. In some cases, widespread public acceptance may be a prerequisite to the implementation of particular policies and programs.

Existing projects include:

Publication and distribution of brochures and literature on water conservation;

Neighborhood Water Awareness (presentations to neighborhood civic, social and professional organizations);

Development of public service announcements;

Water Saver's Hotline (by which consumers can get information on water conservation);

Watch For Water Wasters (by which consumers can report, anonymously, those wasting water).

Proposed projects include:

Advertisements in newspapers, local magazines, journals and newsletters;

Development and presentation of audio-visual program;

Water conservation exhibits;

Development and introduction of Abilene's specific water conservation curriculum in area public schools;

Workshops and seminars.

The Water Utility Department encourages water conservation on a continuous basis. The following are some voluntary guidelines that should be adhered to:

- 1). All restaurants should refrain from serving water to customers except when water is requested by the customer.
- 2). The following uses of water are defined as a "waste of water" and customers are encouraged to prevent their occurrence:
 - allowing water to run off through a gutter ditch or drain for more than 75 feet from the downgrade property line at any time for any reason
 - failure to repair a controllable leak
 - watering when raining
- 3). Lawns, gardens, landscaped areas, trees, shrubs or other plants should be irrigated only as reasonably required, and only then between 1:00 a.m. to 10:00 a.m. and 9:00 p.m. to 12:00 midnight.
- 4). Automobiles, trucks, trailers, boats, airplanes and other types of mobile equipment should not be washed more than once a week. Such washing should be done with a five (5) gallon container, or a hand-held hose equipped with a quick shut-off nozzle for quick rinses.

Other voluntary techniques can be found in the brochure "Easy Steps to Help Conserve Water and Save Money", distributed by the Water Utility Office.

The effects of public information and education programs on future water demands are difficult to predict. Combined with other demand management programs, it is expected to help keep peak day demands in line with water resources available and to delay future plant expansions.

XERISCAPE

Low Water Demand Landscaping (Proposed Program)

The XERISCAPE Program is a low water landscaping concept originally developed by the City of Denver, Colorado, as one component of its water conservation program. When implemented by water customers and the landscaping industry, it can reduce seasonal water use. The basis for the XERISCAPE program are these seven principles of water-efficient landscaping:

- Good planning and design;
- Soil improvement;
- Reduced turf area;
- Larger mulch areas;
- Use of low water demand plants;
- Efficient irrigation; and
- Good maintenance.

The program is equally applicable to landscaping in new and existing development.

Implementation of the XERISCAPE Program will begin in fiscal year 1986-87 with the publication of a consumer guidebook explaining XERISCAPE. Other activities and projects will include:

- o Public workshops on XERISCAPE topics;
- o Presentations to inform local landscape and nurserymen of XERISCAPE concepts;
- o Installation of a demonstration garden at a high exposure area;
- o XERISCAPE design competition for parks, universities, and Dyess Air Force Base, and awards program for residential and commercial landscaping that demonstrate XERISCAPE principles;
- o Presentation to various builders and realtors to promote the application of XERISCAPE principles in new residential and commercial development;
- o Plant-tagging program to assist consumers in identifying low water demand plants;
- o Technical assistance on low water demand landscaping to utility customers.

An ad hoc XERISCAPE Advisory Committee will be organized to facilitate private sector participation in the program. XERISCAPE has been endorsed by the Texas Department of Agriculture, the Texas Association of Nurserymen, the Texas Association of Landscape Contractors, the Texas Turf Irrigation Association, and the National Wildflower Research Center.

Potential water savings resulting from the adoption of XERISCAPE principles are substantial. Low cost or no cost maintenance practices that reduce water waste can reduce irrigation requirements by 20 to 30 percent. Planting low water demand plants, reducing turf areas, increasing mulch areas, and using high efficiency irrigation equipment can reduce irrigation requirements by 50 percent. Individual consumers also benefit from reduced need for fertilizers and pesticides, and from less time and labor spent on landscape maintenance.

Residential Water Conservation Retrofit Program
Kit Distribution (Proposed Program)

Residents of the City of Abilene would be given the opportunity to receive a free Water Saver's Kit. The kit would contain low-flow showerheads, toilet dams, dye tablets for detecting toilet leaks, installation instructions and brochures on water conservation. Kits would be made available to water supply corporations for minimal charge. Delivery and installation assistance would be provided on request to senior or disabled citizens. In conjunction with kit distribution, the staff would introduce water education in area public schools.

It is estimated that interior water use in a typical single family residence is 89 gallons per capita per day (gcd). Replacement of old, less efficient showerheads with low flow showerheads (3.0 gallons per minute or less) will reduce water use for showering by 7.2 gcd. Installation of toilet dams is estimated to reduce water use for toilet flushing by 3.0 gcd. Based on occupancy of 2.6 persons per household, annual water savings of approximately 9,600 gallons per household can be expected as a result of plumbing fixture retrofits.

It is expected that a total of 6,000 single family residences and 1,100 multi-family residences could receive a Water Saver's Kit through distribution during the first year of implementation. Current planning projects the distribution of 28,400 kits in the succeeding four years.

Low Income Housing Conservation Retrofit Program
Action Audit (Proposed Program)

The Water Utility Department would identify low income-housing to receive a water audit, leak survey, and installation of low-flow showerheads and toilet dams. Currently, the City Housing Office lists 475 units of low income housing.

It is proposed that water conservation devices be installed in a total of 95 low income housing units during the first year of implementation.

City Building Retrofit Program (Proposed Program)

A program to reduce interior water use in City owned facilities by installing retrofit devices in existing plumbing fixtures will be implemented. This program will provide data on the cost-effectiveness of plumbing retrofits in commercial and institutional facilities. Other candidates for retrofits would also include Dyess Air Force Base, the Abilene Independent School District, Abilene State School, other facilities operated by the federal and state government, the three institutions of higher learning, commercial office buildings and retail shopping centers.

Commercial/Industrial (Proposed Program)

The Water Utility Department would identify local commercial establishments, especially those using more than 50 thousand gallons a month. These facilities would be given general suggestions on how to reduce consumption, such as:

- o Install automatic bleed controls and increase cycles of concentration on cooling towers to maximum but safe levels.
- o Boilers should be operated at maximum safe level of solids concentration. Excessive slowdown should be prevented.
- o Pumps with mechanical shaft seals should be installed in lieu of packing gland type pumps.
- o Swimming pools should be backwashed as necessary, automatic backwash systems should be set accordingly.
- o Use air-cooled ice machines.
- o Consider installing energy and water efficient air conditioning equipment.
- o Recycle water where feasible, i.e., car washes, laundries.
- o Check water supply for leaks and turn off any unnecessary flows, and adjust flows to reduce discharge of water.

In addition, conservation techniques utilized in residences and in landscaping would be recommended.

PROGRAM EFFECTIVENESS

This section summarizes water use reductions and economic benefits associated with demand management programs.

WATER USE REDUCTIONS

The City of Abilene provided water utility service to approximately 31,000 residential housing units during fiscal year 1984-85. Since there are no existing plumbing code requirements for water conserving fixtures, all of these units are candidates for plumbing fixture retrofits that would reduce interior water use.

Based on water usage records for the City of Abilene, it is estimated that households not equipped with water conserving plumbing fixtures use approximately 182 gallons per capita (gcd) from October through May and 254 gcd during the months of June through September. Figure 6-1 illustrates a single family home interior and exterior water use.

Figure 6-1

SINGLE FAMILY HOME WATER USE

AVERAGE USE :: 182 gcd

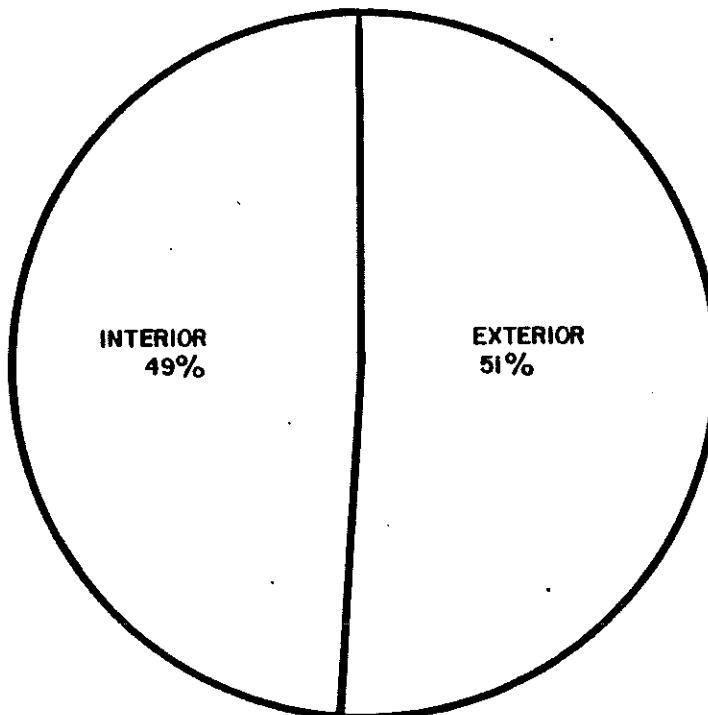
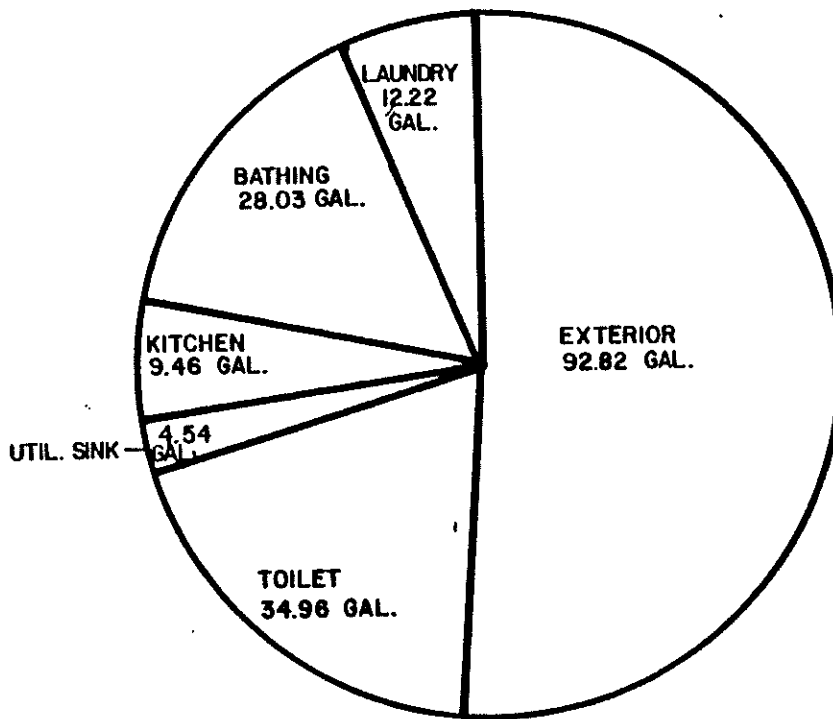


Figure 6-2 shows an interior water use in a typical non-conserving single-family residence. This water use profile is based on national average data, adjusted for the Abilene area.

Figure 6-2
HOME WATER USE
DETAILED WATER USE BREAKDOWN
AVERAGE USE :: 182 gpd

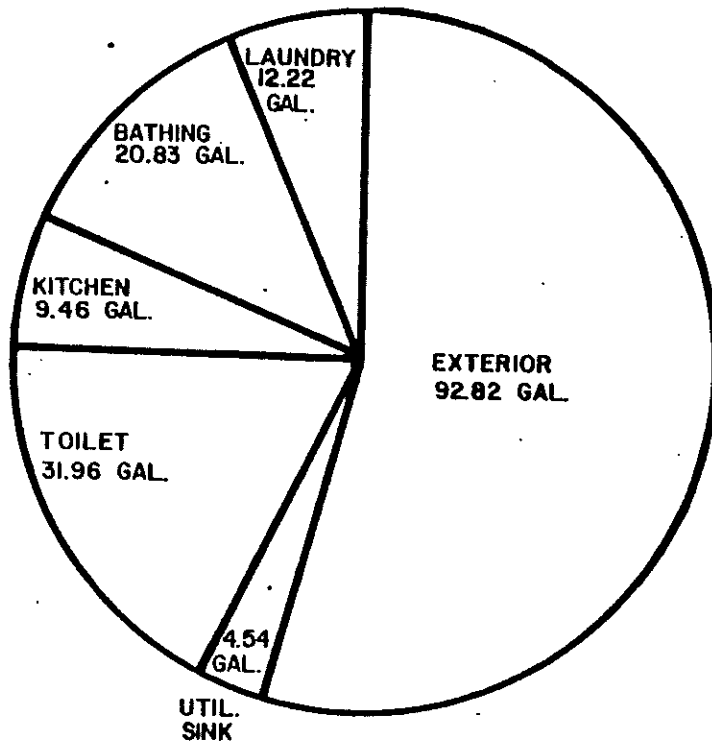


Residential waste disposal (toilet flushing) and bathing accounts for nearly 63 percent of the total interior water usage. Because of the relatively large percentage of water used for toilets and showers, the most cost-effective plumbing retrofits involve replacing inefficient showerheads with low-flow heads (3 gallons per minute or less) and the installation of toilet tank displacement devices that reduce

the amount of water used per flush. Based on recent government data, low-flow showerheads are estimated to reduce water use for showering by 7.2 gcd. Installation of toilet-tank devices (toilet dams) is estimated to reduce water use by 3.0 gcd. Total water savings of 10.2 gcd, or 13 percent of interior water use, can therefore be expected from low-cost plumbing fixture retrofits. In addition to water savings, retrofits also result in corresponding reductions in wastewater flow.

Figure 6-3 depicts the water use profile following retrofits.

Figure 6-3
HOME WATER USE
RETROFITTED HOMES
AVERAGE USE :: 171.8 gcd



Two residential water conservation retrofit programs are proposed for implementation.

Kit Distribution, Single & Multi-family - Utility customers of the City will be notified by direct mail that WATER-SAVER'S KITS (low-flow showerheads, toilet dams, toilet dye tablets) will be available at "depot" distribution centers. Device installation is by the consumer.

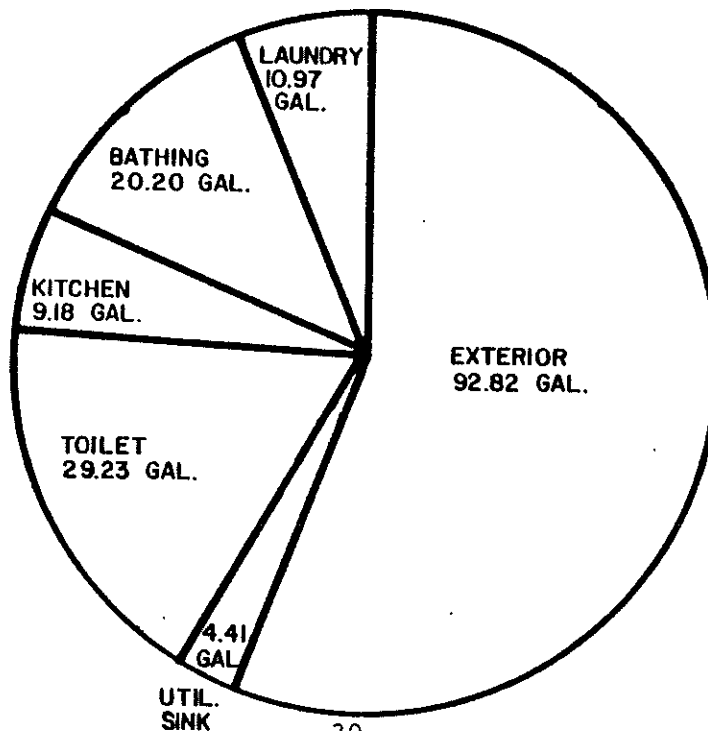
Action Audit - Targeted low-income housing will receive a water audit, leak survey, and installation of low-flow showerheads and toilet dams.

Water conservation devices should be installed in approximately 7,200 single and multi-family housing units in the first year of implementation.

New housing also presents an opportunity to achieve reduction in interior water use and wastewater flows through the installation of water-conserving plumbing fixtures and appliances at the time of construction. It is proposed that new residential housing be required to comply with water conservation standards to be set forth in the Uniform Plumbing Code. The standards, as depicted on Page 21, are identical to those adopted by cities and states throughout the country.

Figure 6-4 depicts the water use profile for a newly constructed home in compliance with the plumbing code standards. Recommended plumbing fixtures are widely available and will not add to the cost of a new home.

Figure 6-4.
HOME WATER USE
PROJECTED NEW CONSTRUCTION
AVERAGE USE :: 166.8 gpd



Additional reductions in interior water usage can be achieved with water-efficient appliances and advanced water-conserving plumbing fixtures. Based on data from the HUD study, water-efficient clothes washers save approximately 1.7 gcd, while water-efficient dishwashers save 1.0 gcd. Most major appliance manufacturers offer water and energy-conserving models. It is likely that many new homes in Abilene will include water-efficient appliances.

Further reductions in interior water use can be achieved in new residential housing by installing advanced water-conserving plumbing fixtures. There are a number of toilets available which use considerably less water than a standard low-volume flush toilet. Common types use 5.0 gallons per flush, while others are available that use less than 2.0 gallons per flush. Estimated water savings reported in the HUD study for ultra low flush toilets (1.5 gallons per flush) is 16.0 gcd. Unfortunately, ultra low flush toilets are more expensive than the standard models. Because of the added expense of these fixtures, widespread use is not envisioned unless economic incentives or new plumbing codes are required.

ECONOMIC BENEFITS

Following are examples of the projected impacts of some of the demand management programs in terms of total water savings, reductions in peak water demands, and reduction in average daily wastewater flows.

It should be noted that the calculations of water savings, reduction in peak water demands, and reduction of wastewater flows are based on established methodologies and assumptions. (See Appendix D). Every effort was made to make these calculations conservatively.

The projected water savings and/or estimated costs for a first year planning period are:

<u>Item</u>	<u>Plumbing Code Requirements</u>	<u>Action Audits</u>	<u>Kit Distribution</u>
Annual Water Savings	13.7 mg	919,600 gals.	48.1 mg
Peak Water Demand Reduction (mg)	.04	-	.1
Avg. WW Flow Reduction (MGD)	.04	-	.1
Est. Annual Cost (\$1000)	-	2.0	59.6
Annual Benefit (\$1000)			
Consumer Water	17.0	1.2	62.1
Benefit/Cost Ratios	N/A	.6	1.0

Economic benefits accrue directly to the consumer in the form of reduced charges for use of water, wastewater treatment, and energy. The City of Abilene also benefits because of reduced need for energy and chemicals to distribute and treat water and wastewater. Benefits, in the form of water savings, continue long after the costs of these programs have been offset by savings.

SUMMARY

Providing a basis for city policy regarding the development, management, conservation, and protection of water resources for Abilene is the goal of the Abilene Water Management Plan. To achieve success both in near-term and long-range water management strategies, the city must continue planning, development and evaluation of its programs. By monitoring, measuring and reporting the reductions in water use and wastewater flows, the programs should gain public confidence and the support that is needed to continue. Good water management policies will mean that quality water will continue to be available in sufficient quantity and at a reasonable price to the citizens of Abilene.

APPENDIX A