City of Austin
Water and Wastewater Utility

Water Distribution System Long-Range Planning Guide

February 1994

Produced by Systems Analysis and Planning Services Divisions

WATER DISTRIBUTION SYSTEM LONG-RANGE PLANNING GUIDE

TABLE OF CONTENTS

WATER DISTRIBUTION SYSTEM LONG-RANGE PLANNING GUIDE
TABLE OF CONTENTS

WATER DISTRIBUTION SYSTEM LONG-RANGE PLANNING GUIDE
LIST OF FIGURES

WATER DISTRIBUTION SYSTEM LONG-RANGE PLANNING GUIDE
LIST OF FIGURES

WATER DISTRIBUTION SYSTEM LONG-RANGE PLANNING GUIDE

SUMMARY

A NEW PLANNING TOOL

The Water and Wastewater Utility's Systems Analysis and Planning Services Divisions have produced this Water Distribution System Long-Range Planning (LRP) Guide to serve as a road map to the facilities that may be needed over the next 45 years. The Guide is a working document for use within the Utility and by others who have an interest in future facility plans.

The Utility views this Guide as an initial baseline plan that covers three types of information:

- The what, when, where and size of facilities needed in the future, including cost estimates and a description of how the systems will operate.
- An outer network or "urban grid" plan that provides a context for subdivision-level development.
- Discussion of major issues, such as, Integrated Water Resources Planning, including environmental concerns, and new regulations that will shape the future of Utility needs and services.

The LRP team has completed the facilities planning portion of the Guide that keys on demand versus capacity relationships. The team is continuing work to flesh out other vital planning elements, including environmental and regulatory considerations. Discussion of these issues brings out some of the complex factors central to ensuring quality utility management and service. The Guide covers investments in new and expanded facilities only and does not include rehabilitation, maintenance or replacement needs.

The LRP team used population growth and distribution projections developed by the City Planning and Development Department as basic input in our analysis. We performed distribution system network analyses to develop ways to meet projected service needs. We then selected the most cost-effective projects to formulate a recommended program of facilities development in keeping with the "compact city" concept which assumes progressive expansion of urban and suburban growth patterns. The LRP team consulted at several points with those who will be using the Guide in order to produce a customer-oriented document.

SUMMARY OF MAJOR PLANNING ISSUES

The key findings of the long-range planning effort can be briefly stated in terms of major planning issues that are expected to have the greatest bearing on Austin's investment in new infrastructure in the coming years. These are the issues that will determine the extent to which the Utility is able to allocate resources to achieve customer service objectives, particularly in terms of the fundamental questions of capacity utilization, environmental protection and rate stability.

These key issues are highlighted below:

Ullrich Water Treatment Plant (WTP) and Transmission Main Capacity

Near term demand projections show that by 1998 we will need more water from Ullrich WTP than can currently be treated. Ullrich is the only existing plant that has space for capacity expansion. Projects to expand Ullrich have been under way for some time. However, the final size of the expansion (and magnitude of funding) has not been set due to issues associated with meeting provisions of proposed new Safe Drinking Water Act Rules in a cost-effective manner.

The existing transmission mains originating from Ullrich are near their capacity. Therefore, a new Ullrich Medium Service Transmission Main and a major upgrade of the Medium Service Pump Station will be required to move the treated water from the expanded plant into the system to satisfy customer needs. The Utility should continue active pursuit of the engineering and financial issues associated with these near-term projects.

Continued Operation of the Green WTP and the Safe Drinking Water Act

In 1924, the City of Austin constructed one of the first water treatment plants in Texas. This facility, now called the Thomas C. Green Water Treatment Plant, has been updated and expanded over the years. Green operates on a small site, north of Town Lake in downtown Austin, that limits opportunities for upgrading treatment processes.

The Safe Drinking Water Act (SDWA) enacted by Congress in 1974 directed the Environmental Protection Agency to establish minimum national drinking water standards. Numerous rules have been adopted, and the City has met all requirements to date. A proposed SDWA rule called Phase II of the Disinfection/Disinfection By-Products (D/DBP) Rule appears at this time to be the most likely of the newly evolving regulations to require significant changes in the way our water is treated. The intent of the proposed rule is to minimize the health risk associated with compounds that may form when chlorine is used for disinfection in the treatment process. The requirements for the Phase II D/DBP Rule are expected to be finalized in 1998 after more study is performed on disinfection by-products as an integral part of negotiating the final rule.

If the adopted Phase II D/DBP rule (or any other new regulation) requires expensive, space-consuming modifications, the aging Green WTP may need to be retired soon after the year 2000. This would hasten the time when Water Treatment Plant 4 is needed.

Integrated Water Resources Planning (IWRP)

At a time when a larger segment of the public is becoming interested in infrastructure planning, the water and wastewater industry is moving to more comprehensive planning processes that more fully incorporate public involvement, demand management, and a broad array of supply side alternatives. This LRP Guide is one of the Utility's first steps in moving to IWRP as a standard business practice. The facility planning issues brought forward in the Guide highlight the need to incorporate financial planning into the Utility's IWRP efforts.

Increased conservation and reuse offer the potential for water and wastewater plant expansion deferral savings. Savings in the purchase of raw water from the Lower Colorado River Authority are also possible. A 1990 City Council resolution established conservation goals and reuse study objectives for the community. The Utility and the Environmental and Conservation Services Department have proactive roles in exploring how these practices can play a part in achieving the least-cost infrastructure plan for the future.

Timing of Water Treatment Plant 4 (WTP 4)

Construction of WTP 4 in response to rising demand and/or to replace the Green WTP is the largest cost identified in the Guide. The new plant, with its pump stations and transmission mains, accounts for approximately half of the expenditures for new capacity anticipated over the next 45 years.

The Guide assumes that WTP 4 will be constructed at the existing site near the intersection of RM 2222 and RM 620. This site was purchased in the mid-1980s. It is surrounded by proposed Balcones Canyonlands Conservation Plan (BCCP) land acquisition area. The proposed BCCP arrangements to date will provide for the plant and the routing of transmission mains out of the facility. However, depending upon final BCCP arrangements, other sites for WTP 4 may need to be considered.

The timing of WTP 4 will be dependent on rising demands and availability of capacity at existing plants. Increased conservation and reuse—key components of Integrated Water Resources Planning—offer the potential for deferral of the facility beyond the year 2018 timing based on the "current trend" demand projections.

Water Supply and Water Rights

The City of Austin currently has adjudicated municipal water rights that are projected to meet demand for about 45 years based on current trends in our usage patterns. The City is currently participating in the Trans-Texas Project—a component of the Texas Water Plan—to identify and evaluate water supply options to meet our needs through the year 2050.

The Guide recommends taking even a longer-term view in planning for water supply needs. Competition for water and potential interbasin transfers could significantly increase the cost of water supplies that are critical to the community's long-term vitality. Our efforts in the water supply area should include:

- Diligent pursuit of water supplies for Austin's long-term future.
- Innovative pursuit of the benefits of conservation and reuse.
- Taking a proactive role in protecting the quality of our water resources.

INTRODUCTION TO THE SYSTEM

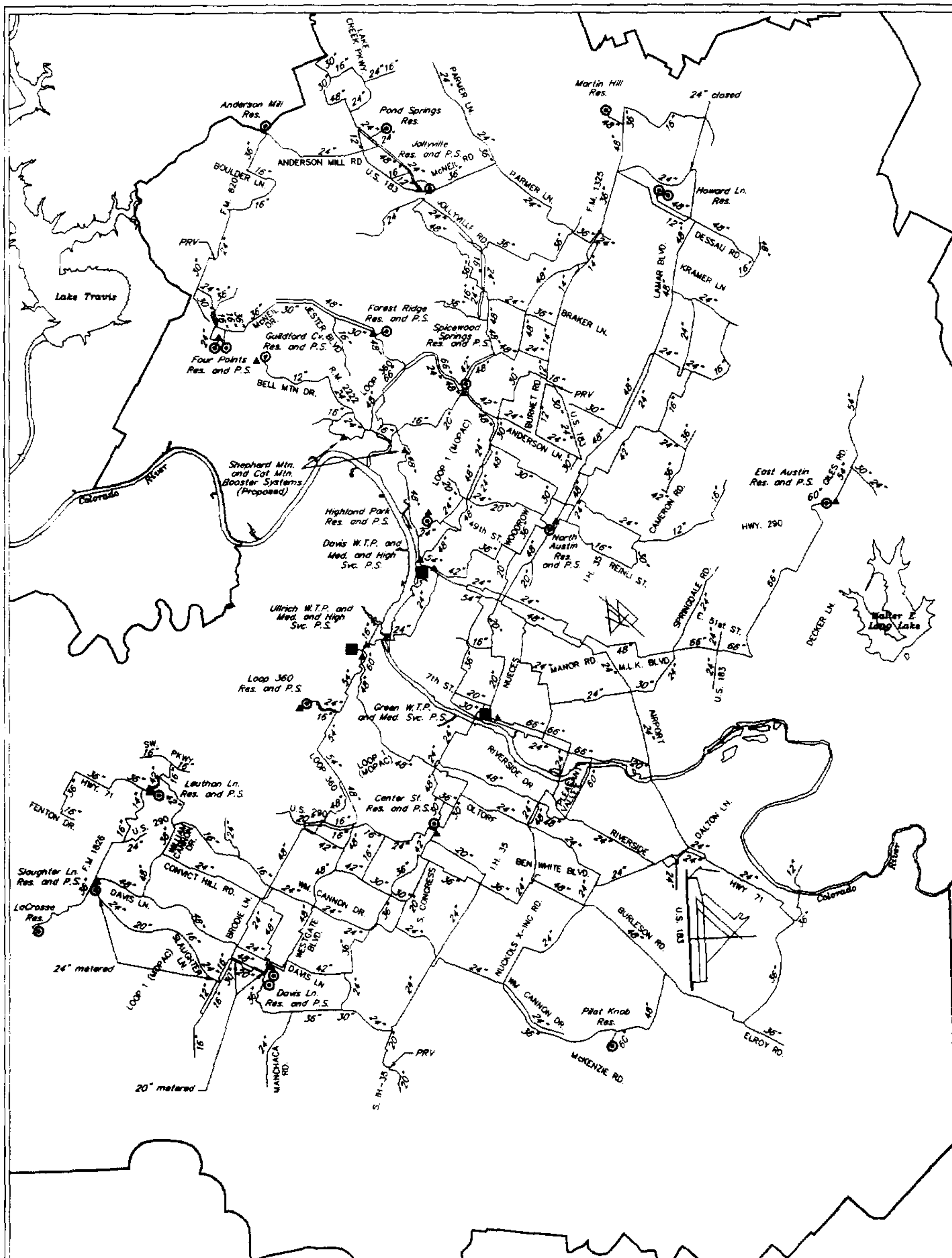
The existing system is an integrated water distribution network consisting of 7 major pressure zones and many smaller zones. Pressure zones and major facilities (existing and future) are shown on the Water System Plan Map at the end of the Summary. The entire system is supplied by 3 water treatment plants that draw from the Colorado River and have 225 MGD of combined rated treatment capacity. The system includes 15 major pump stations and 17 major reservoirs that distribute water through more than 3,000 miles of pipe.

The service area (defined as the Impact Fee Area) covers 488 square miles. The system serves about 570,000 people through 148,000 connections, including more than 20 wholesale water providers. Figure S-1, Existing System Map, shows major Utility water distribution facilities. The "existing" system includes several CIP projects scheduled to be completed in the next two to three years. These projects are listed in Chapter 5 in the Guide and are shown on the Water System Plan Map with a distinctive line type.

WATER DISTRIBUTION SYSTEM LONG-RANGE PLANNING GUIDE
LIST OF TABLES

WATER DISTRIBUTION SYSTEM LONG-RANGE PLANNING GUIDE

LIST OF TABLES



- Ⅰ Flow/Pressure Control Station (F.C.S./P.C.S.)
- ■ Water Treatment Plant
- ▲ Pump Station
- ◉ Reservoir

N

0 11,000'

—— Existing Main

—— Long-Range Water Planning Boundary

Note: The Existing System includes some future projects scheduled for completion in the near term. Table 5-2 in the Guide provides a listing of these improvements.

Recommendations in this figure are based on the policies and data available as of January 1994

City of Austin
Water & Wastewater Utility
Water Distribution System
Long-Range Planning Guide
February 1994

Existing System

Figure S-1

Produced by Systems Analysis and Planning Services Divisions

The magnitude and timing of needed facilities presented in the Guide are based on so called "current trend" demand projections. These are projections based on historical data. For the maximum day demand projection there is a confidence limit added. To analyze timing effects of aggressive demand management on major facilities, raw water purchase from LCRA, and longevity of water rights, we projected two "demand reduction scenarios". Figure S-2, Average Day Demand With Effects Of Aggressive Demand Management, shows the three average day demand projection curves used in this guide. Figure S-3, Maximum Day Demand With Effects Of Aggressive Demand Management, shows similar curves for projected maximum day demands. The maximum day demand projections are especially important since they determine the timing of new water treatment plant capacity.

On both figures, the "current trend" is considered a baseline demand scenario. The first demand reduction curve (Scenario A) corresponds to 1990 City Council Resolution water use reduction goals of 10 percent total system maximum day demand reduction by the year 2000 and 5 percent average day demand reduction. The 10 percent maximum day goal equates to reducing projected year 2000 consumption from 230 MGD to 207 MGD in terms of the maximum day trend line with 95 percent confidence interval that is used to analyze the effects of conservation on facility timing. Tracking of this goal must be done using the maximum day trend line without confidence interval. (See Figure 2-2 in Chapter 2.)

For this projection line, the targeted goal amounts to reducing the expected demand value for the trend line in year 2000 from 206 MGD to 185 MGD. (In terms of gallons per capita per day, this equates to a maximum day reduction from 325 gpcd to 292 gpcd.) The 5 percent average day goal in Scenario A equates to reducing average day demand in year 2000 from 125 MGD to 119 MGD (from 197 gpcd to 188 gpcd).

A more stringent demand reduction scenario has also been projected to show the possible impacts of continued aggressive conservation. Demand Reduction Scenario B entails an <u>additional</u> 10 percent reduction of maximum day demand and an <u>additional</u> 5 percent reduction of average day demand between the year 2000 and the year 2020.

Average Day Demand with Effects of Aggressive Demand Management

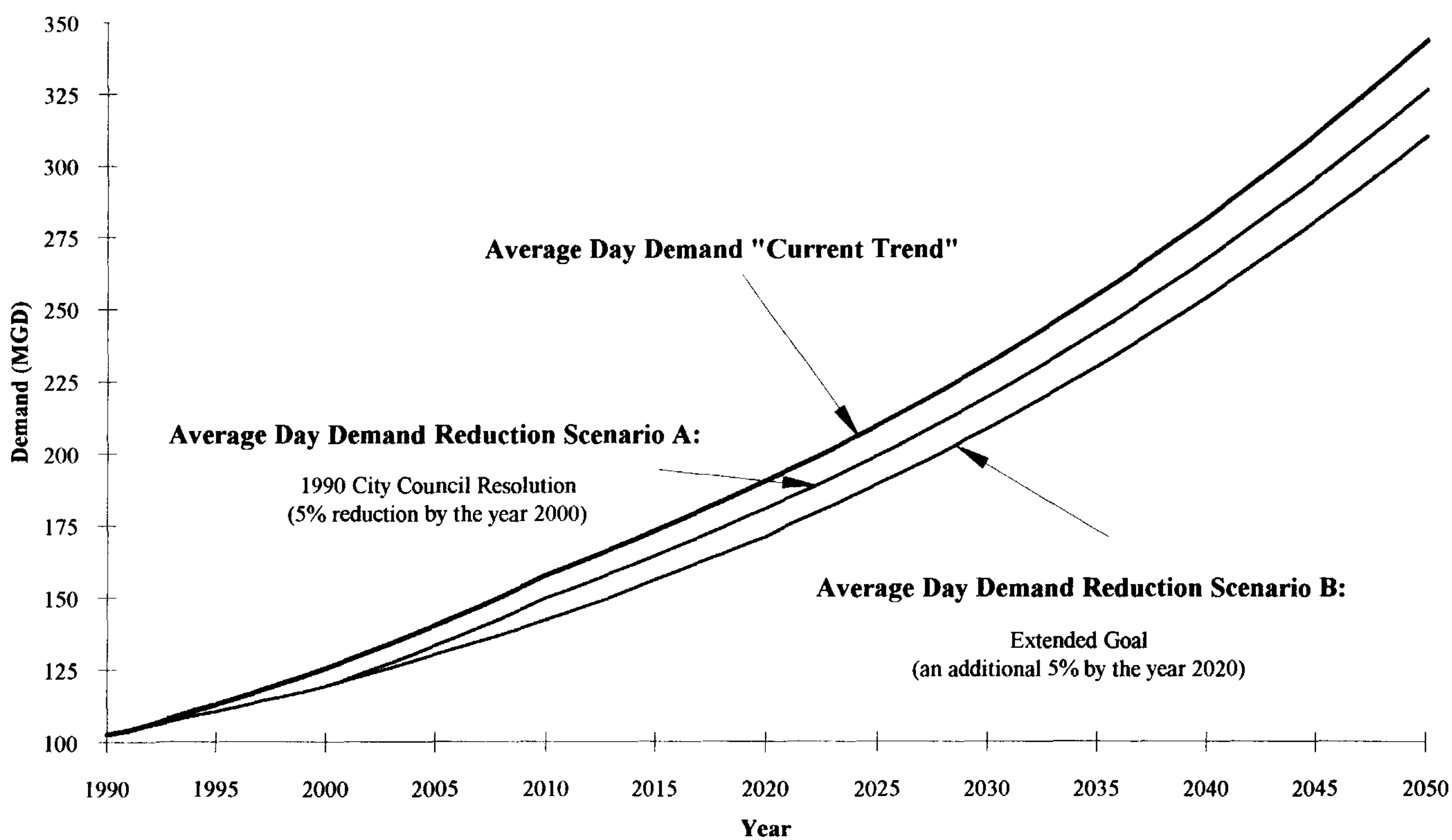


Figure S-2

Maximum Day Demand with Effects of Aggressive Demand Management

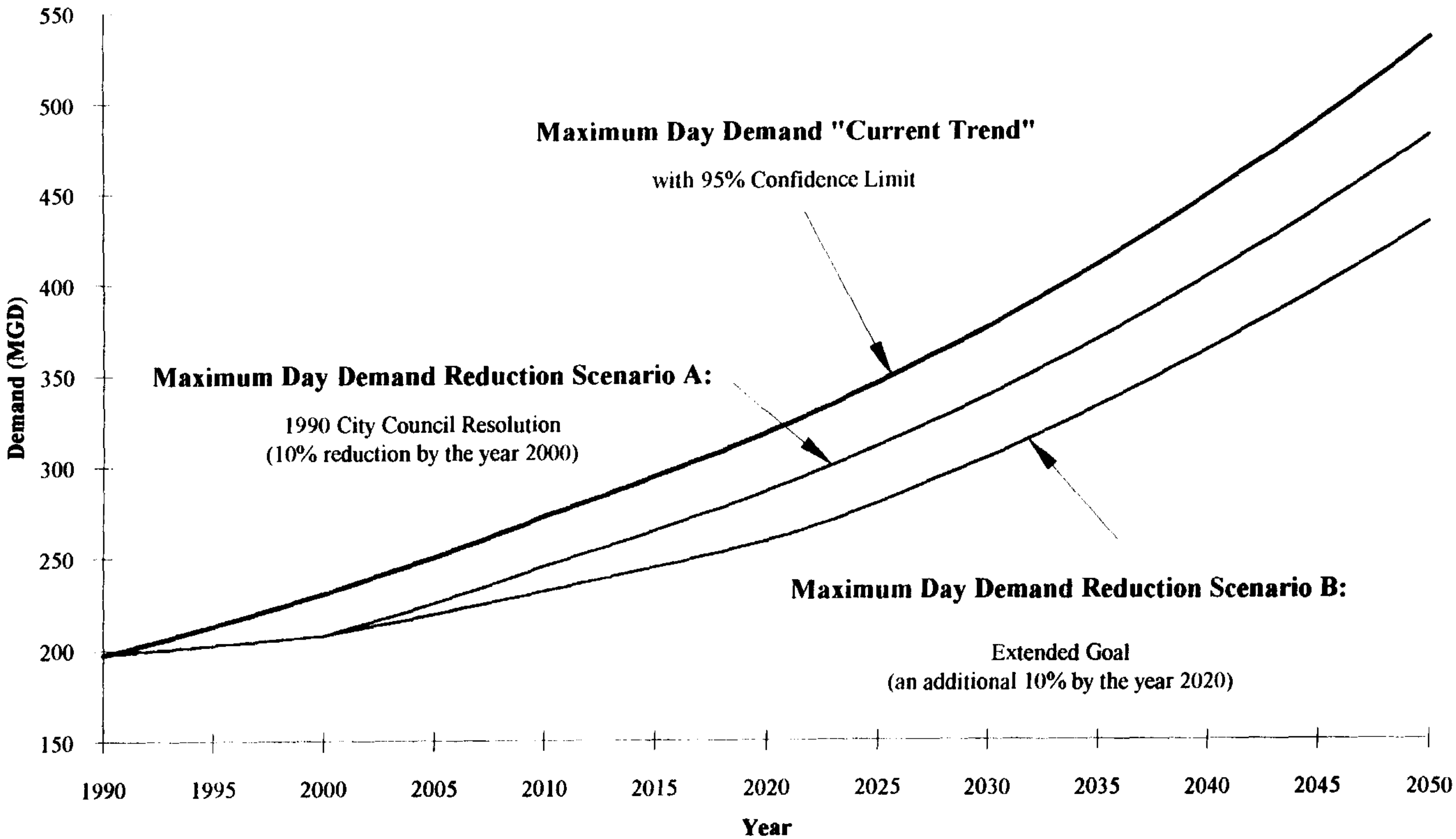


Figure S-3

FACTORS SHAPING OUR INFRASTRUCTURE FUTURE

In general, three influences will shape the future needs for facilities: growth in demand, environmental and public health regulations, and technology. A variety of issues related to these factors must be taken into account to understand the long-range management challenges.

The four main long-term potential cost drivers identified in the Guide are:

- Construction of WTP 4 and its associated facilities in response to rising demand and/or to replace the Green WTP; this effort alone requires an investment of more than $170 million—about half of the total for all new CIP improvements projected to be needed to the year 2037.
- Establishment of new Safe Drinking Water Act rules that could force expensive changes in treatment facilities or accelerate the schedule for construction of new facilities.
- Implementation of demand management practices that could push the need for major facilities further out in time as compared to current trends.
- Reaching the limit of existing water rights and the need to secure other sources of supply in a competitive environment.

Growth

The LRP team, using City Planning and Development Department projections, forecasts a population increase in the Utility's service area from 570,000 today to about 1.35 million in 2037. By then, the Utility's served population is projected to be slightly larger than either San Antonio or the City of Dallas proper is today. Projecting water use from current trends, this implies an increase in average-day water demand from about 105 MGD today to 261 MGD in 2037.

A review of the Water System Plan Map in the map pocket at the end of this Summary shows how we have provided for both adequate capacity at the core of the system and an outer network or "urban grid" that will distribute water from the core to subdivision-level developments.

As population projections and development distribution patterns are updated, the Long-Range Planning team will update this Guide.

Integrated Water Resources Planning

Integrated Water Resources Planning (IWRP) is the name given to the City's unified approach encompassing water conservation, water reuse, and the water conservation rate structure efforts. The Utility and the Environmental and Conservation Services Department are working together to pursue opportunities for better water resources management in these areas. The IWRP approach is important because demand reduction can translate into deferral of major facility investments. This guide itself is also a component of the IWRP concept. IWRP is an innovative comprehensive planning approach that keys on several main principles:

- Cost effectiveness
- Balancing both supply-side management and demand-side management alternatives
- Public involvement
- Inclusion of all direct and indirect costs and benefits of a comprehensive set of elements: including demand management, supply management, environmental impacts, water rights, risk management, reliability, and alternative systems.

Demand-side management refers to steps that reduce water use and/or beneficially change water use patterns. The City of Austin is currently implementing or is in the process of implementing a number of efforts/programs to promote demand-side management. These include: public education, water saving ordinances, rebate and incentive programs, and water conservation rates.

Supply-side management covers efforts that improve water supply capacity. On the supply side, the City of Austin is currently involved in or considering the following: Utility infrastructure programs, water reuse projects, water audits, water system reliability assessments, and other alternative supply options.

All facilities timing recommendations in this Guide are triggered by demand reaching certain levels, not by calendar dates. If significant demand reductions can be achieved, the recommended facilities can be postponed to later years.

If the system meets the targets set by the City Council of 10 percent maximum-day and 5 percent average-day demand reductions, some of the major investments identified in this Guide can be deferred for 6 or more years. These investment postponements represent a combined net present value of more than $20 million.

Even more aggressive targets of an additional 10 percent maximum-day and 5 percent average-day demand reduction by the year 2020 could result in doubling both the time of major facility deferral and the associated savings. In this case, pushing plant expansions out 12 years would mean deferral savings with a net present value of $39 million. These facility deferral benefits must be weighed against the costs associated with achieving lower than projected growth in demand. Moreover, investments in conservation which promise capacity deferral benefits should be evaluated against other available investments or actions as suggested by IWRP.

Water Supply and Water Rights

Water supplies from the City's currently held water rights (293,703 acre-feet) are projected to meet demand to the year 2037. Conservation could extend the longevity of existing water rights beyond the year 2037 date indicated by current trends. Competition for water and potential interbasin transfers could drive up the cost of supply for Austin over the long run.

The Guide recommends continuing to participate in the Trans-Texas Project and taking a pro-active stance in providing for water supply needs beyond the current planning horizon. As part of the project, HDR Engineering, Inc. has been hired to study Austin's existing water rights and the availability of firm supply; identify Austin's water rights transfer options; and identify and evaluate water supply alternatives for Austin.

Other Capital Costs

The Utility should broaden the base of planning in future years. Major costs vital to utility management do not currently fall into the facilities category, yet must be balanced with new facilities needs. Examples include:

- New technologies (e.g. aquifer storage and recovery, water recycling, facility performance improvements).
- Regulatory compliance.
- Rehabilitation and maintenance to prolong the life or enhance the performance of existing systems.
- Utility relocation for transportation projects.

Local Environmental Considerations

A growing body of local environmental regulations and plans affect facilities planning. Also, community environmental concerns often focus on specific projects. We are seeking to include public involvement in facility planning as a part of Integrated Water Resources Planning. The Utility is working with the City's Environmental and Conservation Services Department and others to address these issues earlier and more effectively in the planning process.

IMPROVEMENTS AND COST ESTIMATES BY TIME PERIOD

Guide Format

The Guide divides the planning period into 5 segments. The Guide provides snapshots of the system in each of the following years:

- The year 2000, showing facilities that will be required by this date.
- 2010, showing facilities that are projected to be added between 2000 and 2010 assuming "current trend" demand projections.
- 2017, which represents the maximum use of the existing treatment plants immediately before the addition of Water Treatment Plant 4 (WTP 4) with

"current trend" demands. With effective conservation, this may be represented by a later date.

- 2018, the projected date for putting WTP 4 on line. WTP 4 will result in substantial changes in the way the system operates.
- 2037, the year "current trend" projections indicate that demand will rise to use all of the water available from currently held water rights. As stated elsewhere in the Guide, this date can be postponed with effective conservation.

Each "snapshot" is accompanied by a listing of the projects analysis indicates will be required to be in service by the snapshot year, together with a cost estimate of each project in 1993 dollars.

The Urban Grid and Special Service Area Concepts

In addition to determining the largest improvements needed at the core of the system, the LRP team used two concepts to provide a more detailed view of the future system.

The first of these is development of an "urban grid". This grid is an outer network of 16-inch and 24-inch mains that will ensure an urban level of service (including fire suppression) throughout the service area. Urban grid facilities differ from major improvements in that their timing, sizing and location is dependent on location-specific development. Urban grid mains will often be built during the development process and not as part of a Capital Improvements Program (CIP) process. Chapter 5 contains urban grid cost estimates for each pressure zone for the entire planning period. The system total for all pressure zones is approximately $115 million in estimated urban grid costs through the entire planning period.

All points in the planning area not within currently developed areas are within 1 mile of a potential future urban grid connection. See the Water System Plan map at the end of this summary or the individual pressure zone maps at the end of the Guide for representation of the urban grid network.

A second way that the LRP team provided more detail to the picture of the long-term system is by identifying special service areas. These areas will require special attention to provide adequate service because they lie above or below the normal service elevations of their pressure zone, are not contiguous to the pressure zone, or have other unusual characteristics. Pressure boosting or reduction facilities for special service areas will need to be engineered as part of the development process. The Water System Plan map and pressure zone maps show almost 250 of these areas.

Summary of Facilities Improvements

The following pages contain summaries of the major projects recommended in each planning time period, together with tables of cost estimates and maps. Discussion of these projects and how they affect system operations appears in Chapters 4 and 5 of this Guide. Methods for determining capacity requirements and costs are presented in Chapter 2.

The three basic assumptions driving our planning analysis are:

- The existing treatment plants can be expanded only to 305 MGD due to site limitations.
- WTP 4 should be operational once the existing plants reach capacity. This baseline assumption is needed to set the "current trend" framework for planning. Many factors such as the Safe Drinking Water Act, the Balcones Canyonlands Conservation Plan, and the community's conservation achievements could alter WTP 4 siting, timing, and sizing.
- Year 2037 forms the planning horizon since it corresponds to the projected full use of Austin's water rights. However, it should be noted, a later date may represent the planning horizon with aggressive conservation assumptions.

Figure S-4, Treatment Plant Expansion Timing And Demand With Effects Of Aggressive Demand Management, shows how demand is met by expanding existing and building new treatment facilities. The figure also shows the potential for postponements under the two aggressive demand reduction scenarios described previously.

Treatment Plant Expansion Timing and Demand with Effects of Aggressive Demand Management

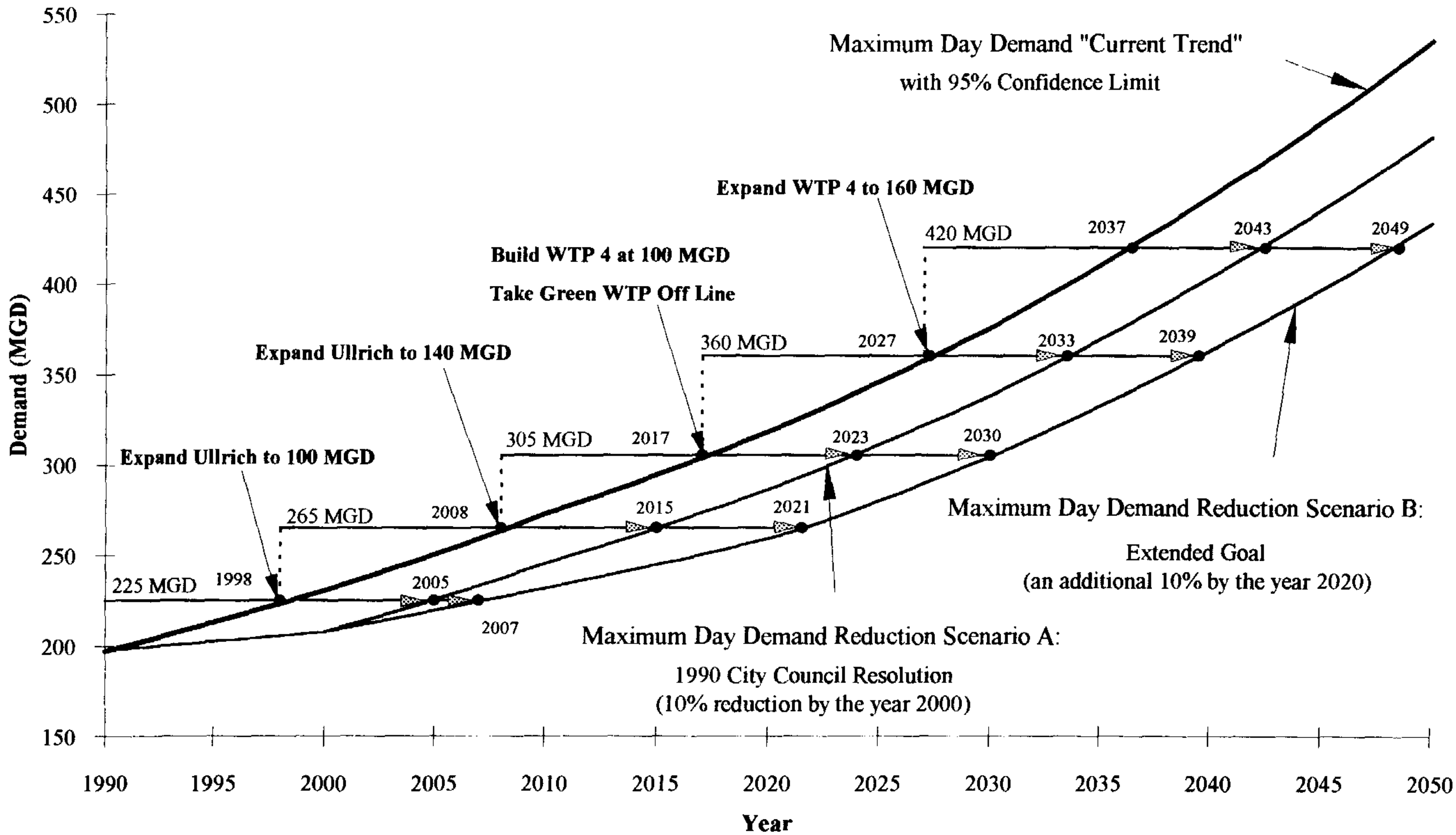


Figure S-4

The timing of construction of Water Treatment Plant 4 (WTP 4) and potential impacts of demand management on the demand curve composes the biggest single facility planning issue facing the Utility. WTP 4 and the associated distribution facilities that make it functional amount to about half of the $340 million total cost for all new CIP facilities projected to be needed during the 45-year planning horizon. If conservation or other measures slow the growth in demand, WTP 4 may be deferred beyond the currently anticipated 2017 date. On the other hand, increasingly stringent regulations may limit the use of some existing plants and accelerate the need for WTP 4 service.

A second major facility planning issue is the timing of the Ullrich Medium Service Transmission Main. Projections indicate more water will be needed from the Ullrich WTP to meet system demands, including north of the river, long before WTP 4 is added to the system. This has prompted the recommendation to build the $12.6 million Ullrich Medium Service Transmission Main before the year 2000. Building the transmission main is the key to using the expanded Ullrich WTP capacity that will be available when existing plant improvement CIP projects are completed.

Figure S-5, Estimated CIP Improvements Costs, summarizes projected spending over the entire planning horizon. Major expenditures—primarily for WTP 4 and its associated facilities—are looming about 25 years in the future.

A Comparison of Water and Wastewater Improvement Costs

Water infrastructure costs are half the cost of wastewater facilities presented in the Utility's Wastewater Long-Range Planning Guide. The difference may be attributed to five factors:

- CIP projects in the 1980s built more of the water major facilities needed for future capacity than they did wastewater.
- In the case of wastewater, existing core area interceptors typically must be replaced to increase capacity, where as in the water system, the majority of new mains act as additions to the existing system capacity.

Estimated CIP Improvements Costs

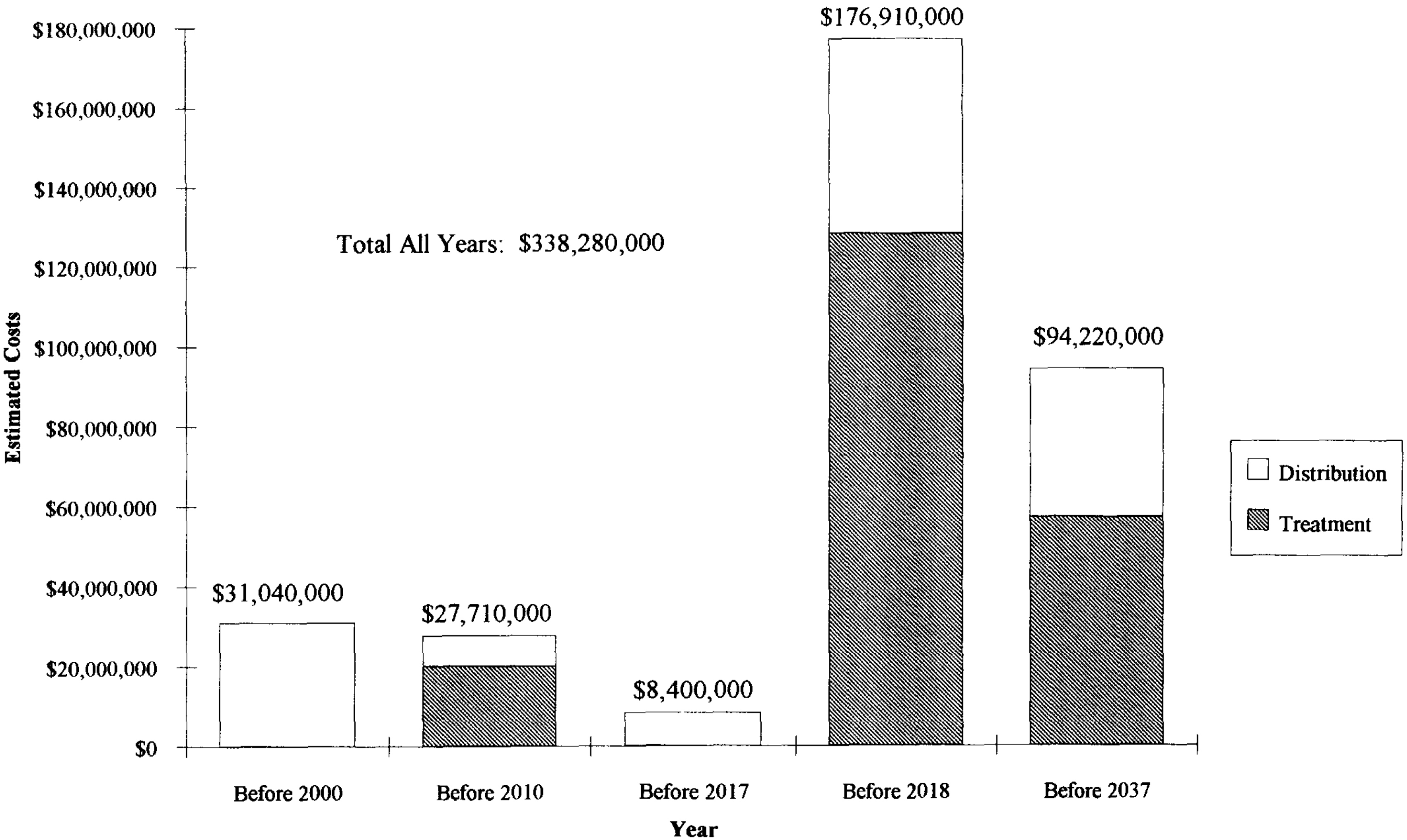


Figure S-5

- Water lines are more readily located away from sensitive environmental features. The cost of complying with recent Comprehensive Watershed Ordinance requirements for special design and construction of wastewater lines in sensitive environmental zones (Critical Water Quality Zones) accounts for about $70 million of the wastewater total.
- Wastewater facility plan costs include numerous 24-inch and smaller interceptors and lift station relief lines to extend gravity service to the periphery of the planning area. Water plan cost tables do not include the $115 million associated with the smaller "urban grid" lines because of the uncertainty of timing, sizing, location and type of funding of specific lines.
- Treatment plant costs are also higher for the wastewater system. Over the planning period the water plan identified the need for 200 MGD at a cost of $205 million and the wastewater plan identified 149 MGD of new capacity for a total cost of approximately $363 million.

Improvements Recommended Before the Year 2000

Highlights of improvements for this time period are:

- Ullrich Medium Service Transmission Main and Pump Station Upgrade
  The existing transmission mains originating from Ullrich are very near their maximum capacity. The new main and pump station will be needed to move water from Ullrich to meet projected demand.

- South Loop 360 Pressure Zone
  The creation of a new pressure zone with a pump station and elevated reservoir will be required to improve existing service, eliminate operations and maintenance problems, and provide for projected growth.

- 16- and 24-inch Transmission Mains
  Several mains are recommended that will raise the level of service to existing customers, provide for anticipated growth and increase system reliability.

Table S-1 shows a summary listing of all CIP Improvements Projects recommended before the year 2000 with the corresponding cost estimates.

Figure S-6 shows the location of the facilities.

Table S-1

COST ESTIMATES FOR CIP IMPROVEMENTS RECOMMENDED BEFORE THE YEAR 2000

WATER TREATMENT FACILITIES		Capacity	Total Cost
None †			0

TRANSMISSION MAINS	Zone	Diameter	Total Cost
FAR SOUTHEAST AREA IMPROVEMENTS	Central	16 & 24-inch	2,497,040
HIGHWAY 183 INTERCONNECTOR	Central	24-inch	1,461,252
ULLRICH MEDIUM SERVICE TM	Central	54-inch	12,600,000
LOST CREEK TM	S Loop 360	16-inch	546,750
PINNACLE ROAD DISCHARGE TM	S Loop 360	24-inch	959,040
PFLUGERVILLE EXIT TM	NWA	16 & 24-inch	1,649,310
SOUTH MOPAC TM	SWA	24-inch	2,236,650
SOUTHWEST A LOOP TM	SWA	16-inch	1,275,300
SOUTHWEST PARKWAY TM	SWB	16-inch	1,263,600
TOTAL TRANSMISSION MAINS			*$24,488,942*

PUMP STATIONS	Zone	Capacity	Total Cost
ULLRICH MEDIUM SERVICE PS UPGRADE	Central	100 MGD/60 MGD	3,414,530
PINNACLE ROAD PS	S Loop 360	5.5 MGD	905,558
LEUTHAN LANE PS UPGRADE	SWB	5.9 MGD	304,845
TOTAL PUMP STATIONS			*$4,624,933*

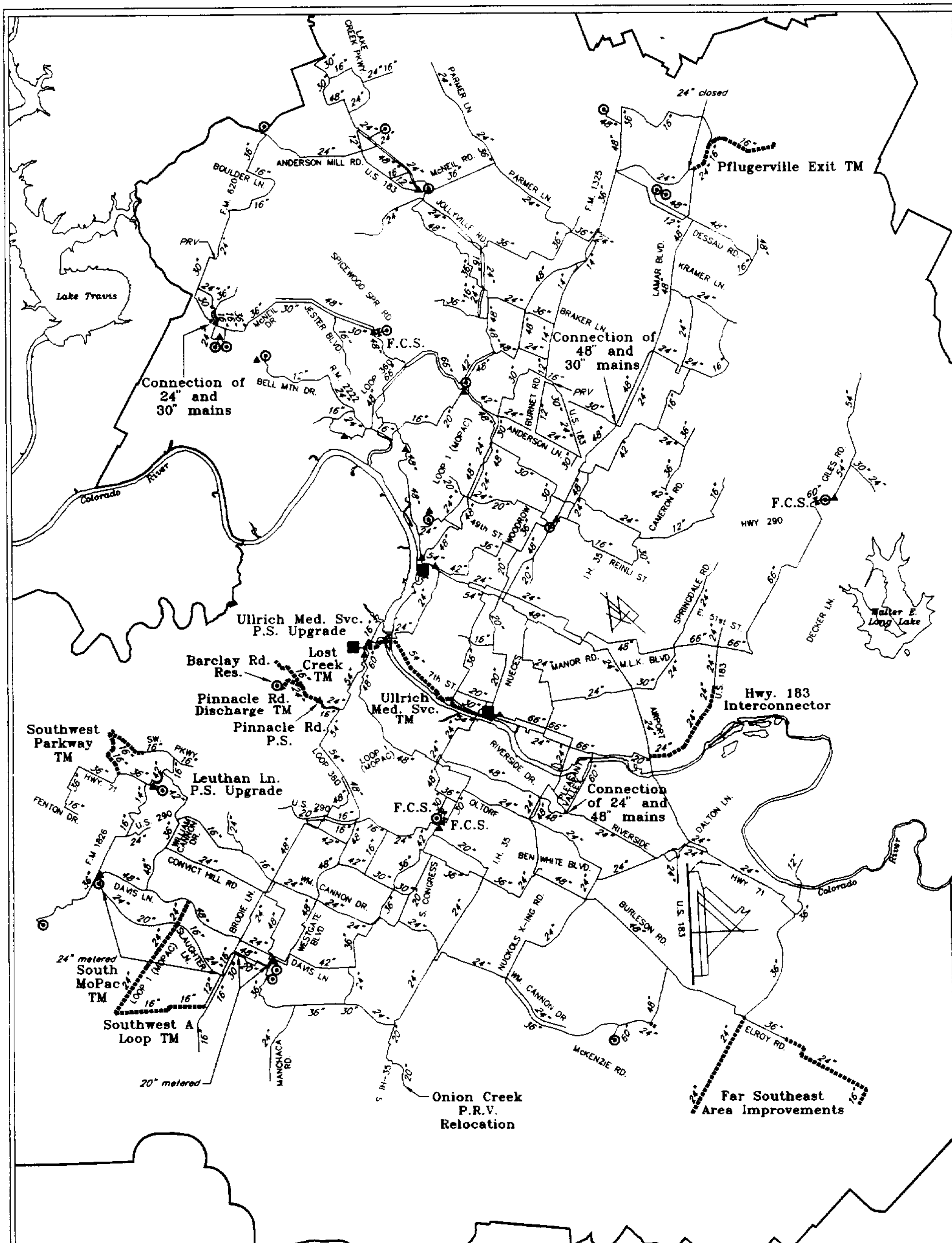
RESERVOIRS	Zone	Capacity	Total Cost
BARCLAY ROAD RES	S Loop 360	1 MG	1,161,000
PINNACLE ROAD SUCTION RES*	S Loop 360	0.2 MG	160,728
TOTAL RESERVOIRS			*$1,321,728*

* Note, a suction tank at the Pinnacle Road Pump Station may not be needed

MISCELLANEOUS	Zone	Total Cost
Connection of 24 & 48 at Riverside & Pleasant Valley	Central	50,000
Flow Control Stations (FCS) at Center Street Res	Central	200,000
Flow Control Station (FCS) at East Austin Res	Central	50,000
Connection of 48 & 30 at Lamar & Peyton Gin	North	50,000
Relocation of Onion Creek PRV	South	50,000
Boundary Adjustments: PRVS, Valves, & Connections	S Loop 360	100,000
Flow Control Station (FCS) at Forest Ridge Res	NWA	50,000
Connection of 24 & 30 at Riverplace and RM 2222	NWC	50,000
TOTAL MISCELLANEOUS		*$600,000*

TOTAL ALL IMPROVEMENTS	**$31,035,603**

† Costs for upgrading Ullrich WTP to 100 MGD are not included in this table.



Flow/Pressure Control Station (F.C.S./P.C.S.)
Water Treatment Plant
Pump Station
Reservoir

Existing Main

Capital Improvement Project Main Recommended before 2000

Long-Range Water Planning Boundary

City of Austin
Water & Wastewater Utility
Water Distribution System
Long-Range Planning Guide
February 1994

Water Investment Plan Map
2000 System

Recommendations in this figure are based on the policies and data available as of January 1994

Figure S-6

Produced by Systems Analyses and Planning Services Divisions

Improvements Recommended Between Year 2000 and 2010

Highlights of improvements are:

- Ullrich Treatment Plant
  The expansion of treatment plant capacity will be required to meet projected demands.

- Far South Pressure Zone
  This project will be required to serve new customers. The project will require transmission mains, a pump station and an elevated storage reservoir.

Table S-2 shows a summary listing of all CIP Improvements Projects recommended before the year 2010 with the corresponding cost estimates.

Figure S-7 shows the location of the facilities.

Table S-2

COST ESTIMATES FOR CIP IMPROVEMENTS RECOMMENDED BETWEEN THE YEAR 2000 AND 2010

WATER TREATMENT FACILITIES		Capacity	Total Cost
ULLRICH WTP UPGRADE		from 100 to 140 mgd	20,000,000
TOTAL WATER TREATMENT FACILITIES			*$20,000,000*

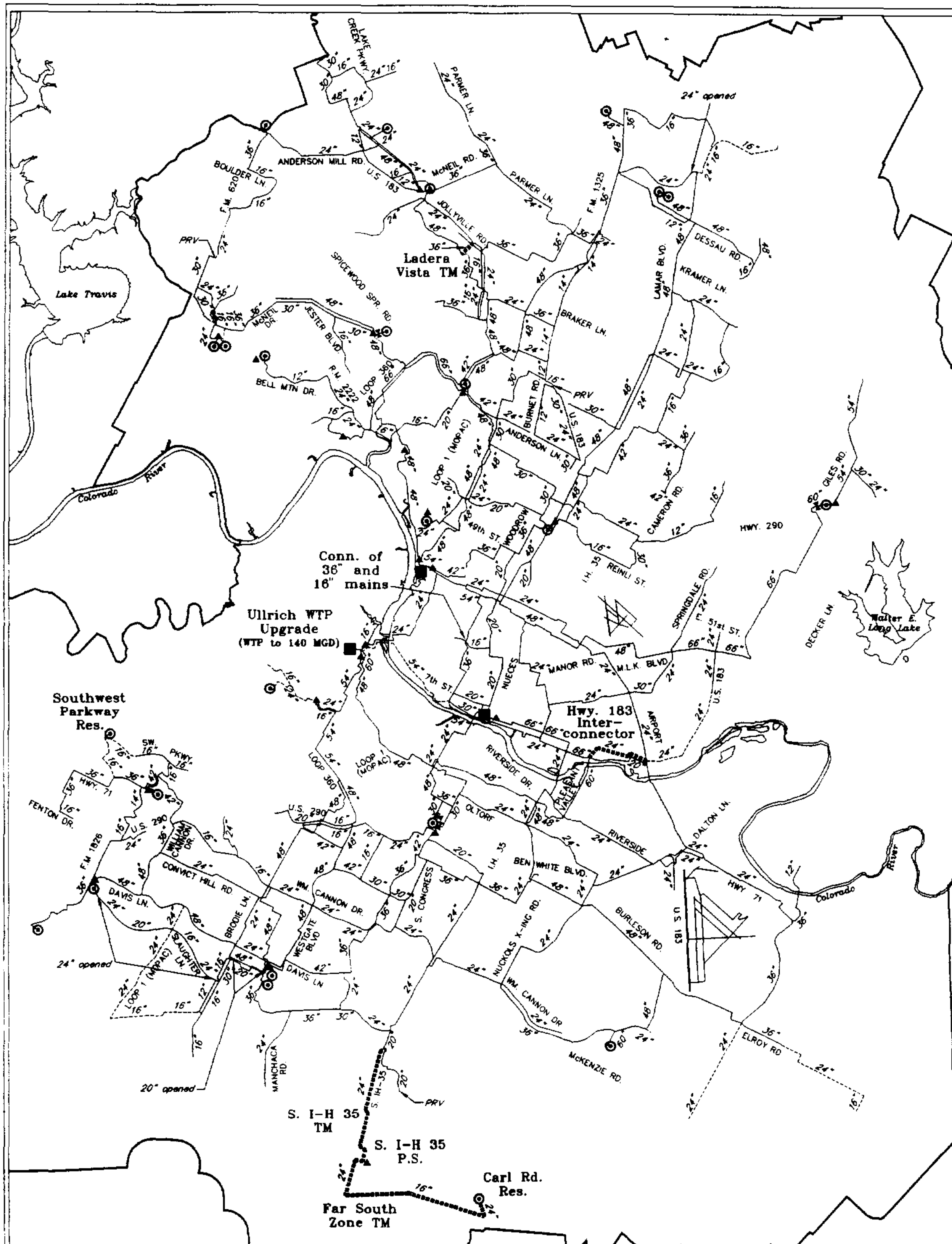
TRANSMISSION MAINS	Zone	Diameter	Total Cost
HIGHWAY 183 INTERCONNECTOR (REMAINDER)	Central	24-inch	937,040
SOUTH INTERSTATE 35 TM	South	24-inch	1,511,640
FAR SOUTH ZONE TM	Far South	16 & 24-inch	1,998,880
LADERA VISTA TM	NWA	36-inch	397,800
TOTAL TRANSMISSION MAINS			*$4,845,360*

PUMP STATIONS	Zone	Capacity	Total Cost
SOUTH INTERSTATE 35 PS	Far South	3.6 MGD	539,565
TOTAL PUMP STATIONS			*$539,565*

RESERVOIRS	Zone	Capacity	Total Cost
CARL ROAD RES	Far South	1 MG	1,118,000
SOUTHWEST PARKWAY RES	SWB	1 MG	1,161,000
TOTAL RESERVOIRS			*$2,279,000*

MISCELLANEOUS	Zone		Total Cost
Connection of 36 & 16 on West 24th	Central		50,000
TOTAL MISCELLANEOUS			*$50,000*

TOTAL ALL IMPROVEMENTS **$27,713,925**



- Ⅰ Flow/Pressure Control Station (F.C.S./P.C.S.)
- ■ Water Treatment Plant
- ▲ Pump Station
- ⊙ Reservoir
- ——— Existing Main
- - - - Capital Improvement Project Main Recommended before 2000
- ■■■■ Capital Improvement Project Main Recommended between 2000 and 2010
- ——— Long-Range Water Planning Boundary

N

0 11,000'

City of Austin
Water & Wastewater Utility
Water Distribution System
Long-Range Planning Guide
February 1994

Water Investment Plan Map
2010 System

Recommendations in this figure are based on the policies and data available as of January 1994.

Figure S-7

Produced by Systems Analysis and Planning Services Divisions

Improvements Recommended Between Year 2010 and 2017

Highlights of improvements during this period are:

- Central Business District Transmission Main
  This project will be required to move water from the Green WTP and the terminus of the Ullrich Medium Service Transmission Main to meet projected demands in the northern portions of the system.

- Lost Horizon Transmission Main
  This project will be required to increase transmission main capacity from the Spicewood Springs Pump Station to the Jollyville Reservoir.

- Davis High Service Pump Station
  This upgrade will be required to keep the Spicewood Springs Reservoir full. This reservoir will be the source of supply to the rest of the Northwest Pressure Zones.

Table S-3 shows a summary listing of all CIP Improvements Projects recommended before the year 2017 with the corresponding cost estimates.

Figure S-8 shows the location of the facilities.

Table S-3

COST ESTIMATES FOR CIP IMPROVEMENTS RECOMMENDED BETWEEN THE YEAR 2010 AND 2017

WATER TREATMENT FACILITIES		Capacity	Total Cost
None			0

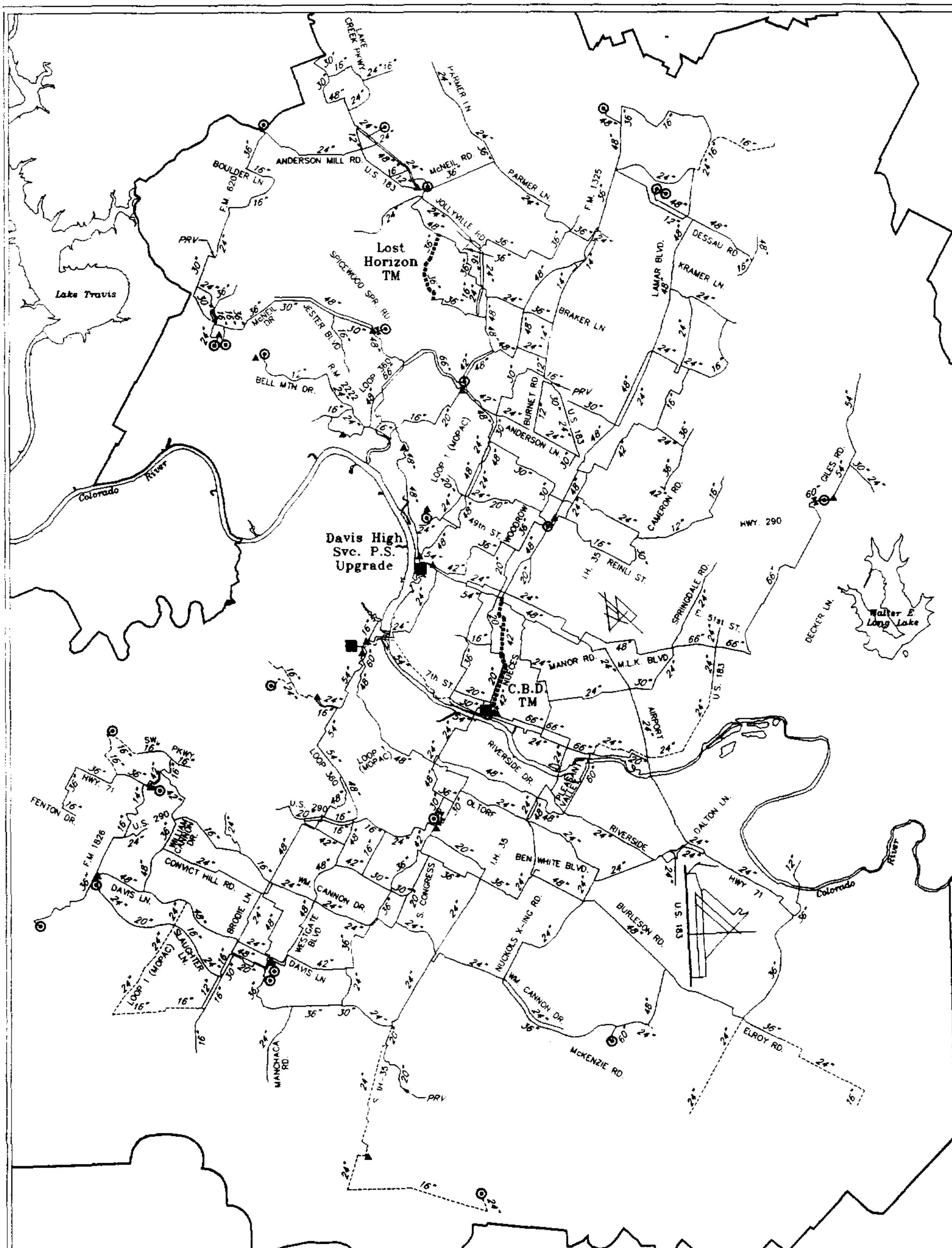
TRANSMISSION MAINS	Zone	Diameter	Total Cost
CENTRAL BUSINESS DISTRICT (CBD) TM	Central	42-inch	5,733,000
LOST HORIZON TM	NWA	36-inch	1,721,250
TOTAL TRANSMISSION MAINS			*$7,454,250*

PUMP STATIONS	Zone	Capacity	Total Cost
DAVIS HIGH SERVICE PS UPGRADE	North	16.4 MGD	948,340
TOTAL PUMP STATIONS			*$948,340*

RESERVOIRS	Zone	Capacity	Total Cost
None			0

MISCELLANEOUS	Zone	Total Cost
None		0

TOTAL ALL IMPROVEMENTS **$8,402,590**



X	Flow/Pressure Control Station (F.C.S./P.C.S.)
■	Water Treatment Plant
▲	Pump Station
⊙	Reservoir
——	Existing Main
- - -	Capital Improvement Project Main Recommended before 2010
▪▪▪▪	Capital Improvement Project Main Recommended between 2010 and 2017 (Pre-WTP 4)
——	Long-Range Water Planning Boundary

N

0 11,000'

City of Austin
Water & Wastewater Utility
Water Distribution System
Long-Range Planning Guide
February 1994

Water Investment Plan Map
2017 System

Recommendations in this figure are based on the policies and data available as of January 1994

Figure S-8

Produced by Systems Analysis and Planning Services Divisions

Improvements Recommended Between The Year 2017 and 2018

Highlights of improvements are:

- <u>WTP 4 and Associated Pump Stations</u>
  These projects will be required because more treatment capacity will be needed to serve projected growth in the system. The existing plants will be at their maximum capacities. It is assumed that Green WTP (on-line in 1925) will have outlived its usefulness. With some equipment nearing 100 years of age, it may not be able to efficiently meet increasingly stringent treatment requirements. These projects will allow for the decommissioning of Green WTP.

- <u>Transmission Mains Associated with WTP 4</u>
  All of the NWA Transmission Mains will be required to move water from WTP 4 to the rest of the system. They will allow WTP 4 to be integrated into the system.

- <u>Davis Medium Service TM</u>
  This main will be required to move more water in the Central Pressure Zone to replace water previously supplied from the decommissioned Green WTP.

- <u>Howard Lane Pressure Control Station</u>
  This facility will be required to supply WTP 4 water to the North Pressure Zone system.

Table S-4 shows a summary listing of all CIP Improvements Projects recommended before the year 2018 with the corresponding cost estimates.

Figure S-9 shows the location of the facilities.

Table S-4

COST ESTIMATES FOR CIP IMPROVEMENTS RECOMMENDED BETWEEN THE YEAR 2017 AND 2018

WATER TREATMENT FACILITIES		Capacity	Total Cost
WATER TREATMENT PLANT 4		100 MGD	128,000,000
TOTAL WATER TREATMENT PLANTS			***$128,000,000***

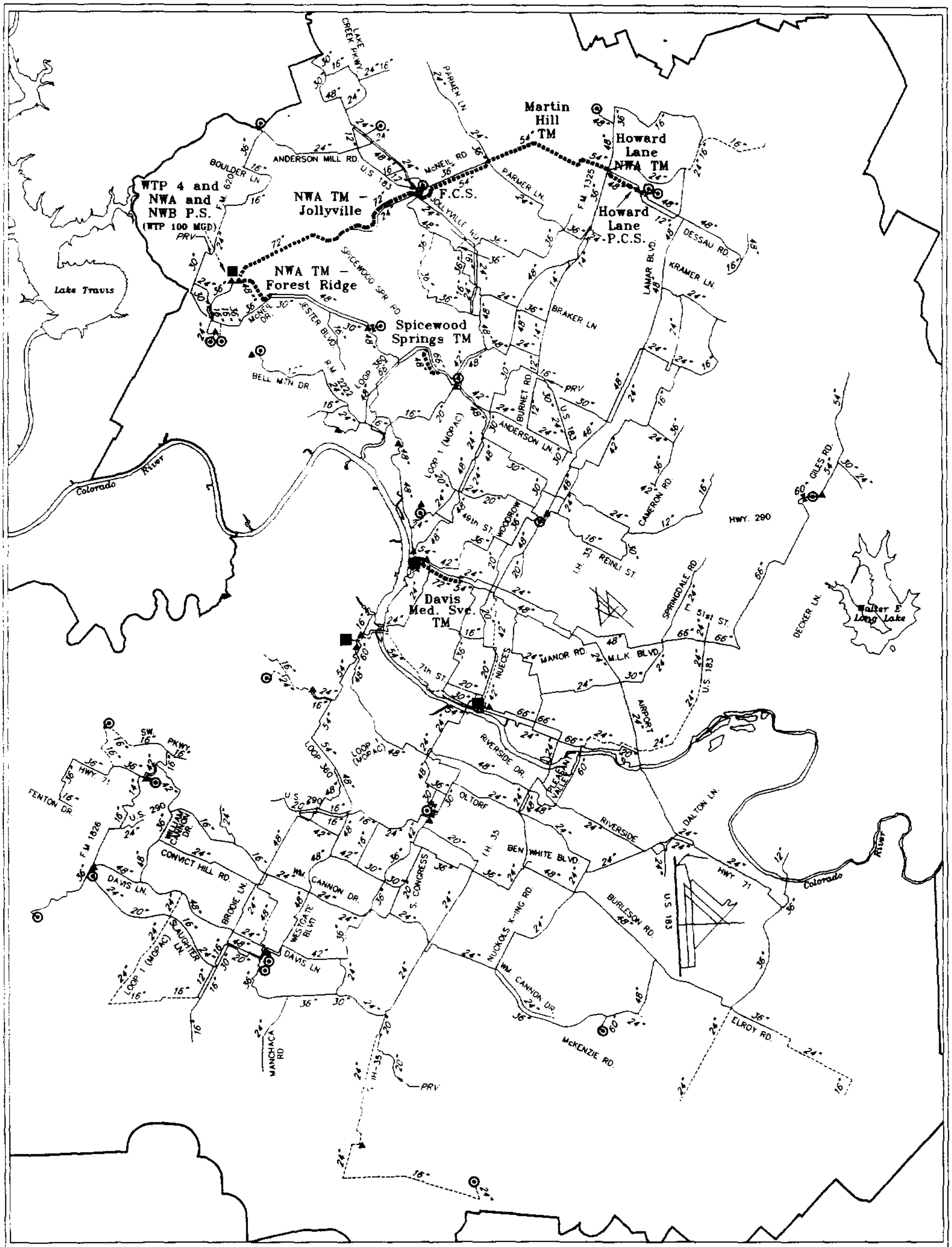
TRANSMISSION MAINS	Zone	Diameter	Total Cost
DAVIS MEDIUM SERVICE TM	Central	72-inch	4,143,750
SPICEWOOD SPRINGS TM (EAST)	NWA	48-inch	1,012,500
WTP 4 NWA DISCHARGE TM - FOREST RIDGE	NWA	48-inch	2,700,000
WTP 4 NWA DISCHARGE TM - JOLLYVILLE	NWA	72-inch	21,802,500
MARTIN HILL TM	NWA	54-inch	9,517,500
HOWARD LANE NWA TM	NWA	48-inch	1,625,000
TOTAL TRANSMISSION MAINS			*$40,801,250*

PUMP STATIONS	Zone	Capacity	Total Cost
WTP 4 NWA PS	NWA	120 MGD	6,794,263
WTP 4 NWB PS	NWB	7 MGD	960,976
TOTAL PUMP STATIONS			*$7,755,240*

RESERVOIRS	Zone	Capacity	Total Cost
None			0

MISCELLANEOUS	Zone		Total Cost
HOWARD LANE PRESSURE CONTROL STATION (PCS)	North		300,000
Flow Control Station (FCS) at Jollyville Res	NWA		50,000
TOTAL MISCELLANEOUS			*$350,000*

TOTAL ALL IMPROVEMENTS **$176,906,490**



I	Flow/Pressure Control Station (F.C.S./P.C.S.)
■	Water Treatment Plant
▲	Pump Station
⊙	Reservoir
——	Existing Main
- - - -	Capital Improvement Project Main Recommended before 2017
■■■■	Capital Improvement Project Main Recommended between 2017 and 2018 (Post-WTP 4)
——	Long-Range Water Planning Boundary

N

0 11,000'

City of Austin
Water & Wastewater Utility
Water Distribution System
Long-Range Planning Guide
February 1994

Water Investment Plan Map
2018 System

Recommendations in this figure are based on the policies and data available as of January 1994.

Figure S–9

Produced by Systems Analysis and Planning Services Divisions

Improvements Recommended Between the Year 2018 and 2037

Highlights of improvements are:

- WTP 4 and NWA Pump Station Upgrades
  These plant improvements will be required to meet projected demand.

- Spicewood Springs TM (West) and WTP 4 NWB Pump Station Discharge TM
  These mains will be needed to move the increased WTP 4 capacity into the system.

- Spicewood Pressure Control Station (PCS) and North Pressure Zone TM
  These two projects are recommended to distribute additional water from the expanded WTP 4 into the North Pressure Zone where needed.

- Central Pressure Zone TMs
  A number of mains will be needed in the Central Zone to meet increasing demands and operational needs without Green WTP in the system.

Table S-5 shows a summary listing of all CIP Improvements Projects recommended before the year 2037 with the corresponding cost estimates.

Figure S-10 shows the location of the facilities.

Table S-5

COST ESTIMATES FOR CIP IMPROVEMENTS RECOMMENDED BETWEEN THE YEAR 2018 AND 2037

WATER TREATMENT FACILITIES		Capacity	Total Cost
WATER TREATMENT PLANT 4 UPGRADE		from 100 to 160 MGD	57,000,000
TOTAL WATER TREATMENT PLANTS			*$57,000,000*

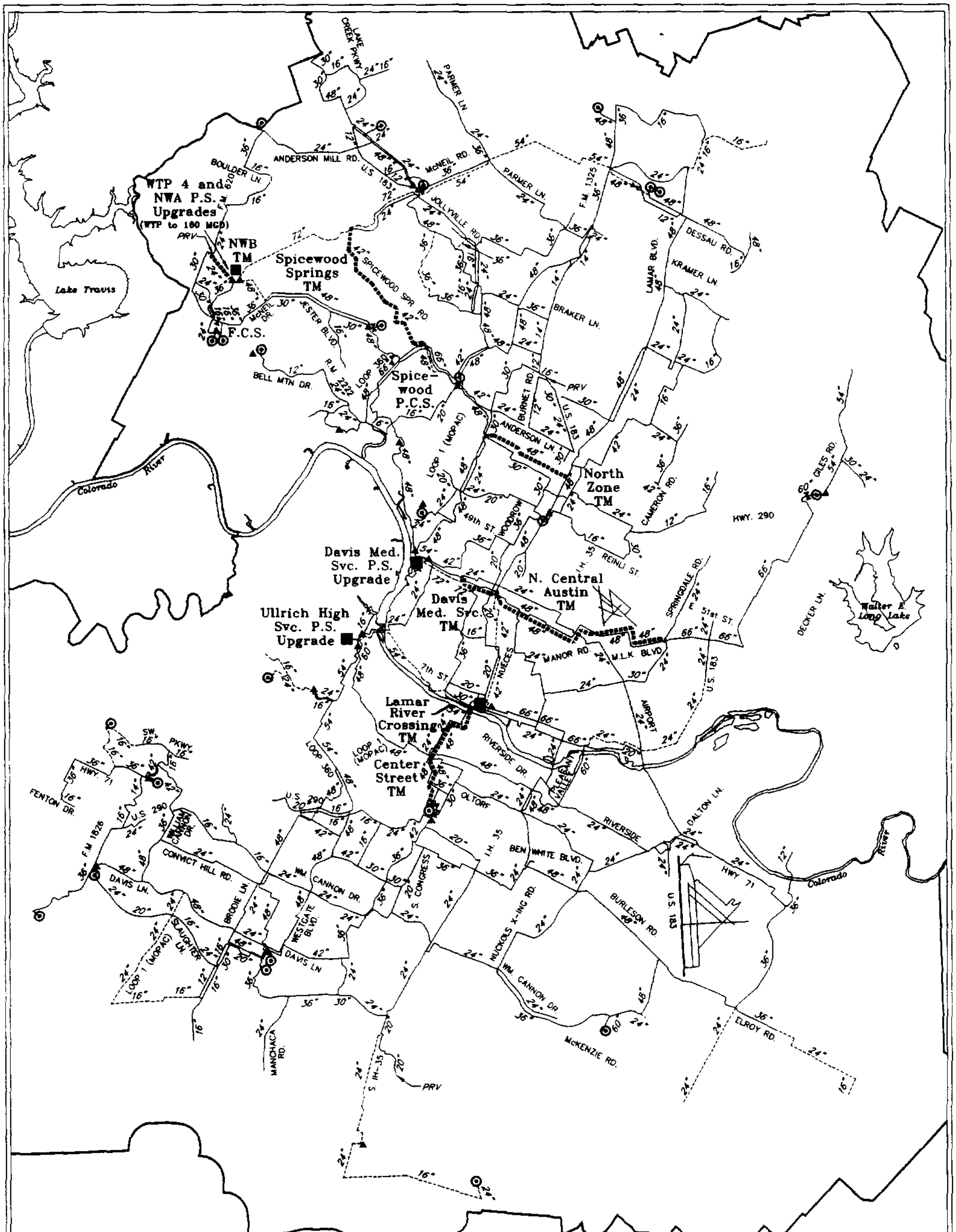
TRANSMISSION MAINS	Zone	Diameter	Total Cost
CENTER STREET TM	Central	48-inch	3,656,250
DAVIS MEDIUM SERVICE TM (REMAINDER)	Central	72-inch	4,143,750
LAMAR RIVER CROSSING TM	Central	48-inch	4,300,000
NORTH CENTRAL AUSTIN TM	Central	48-inch	10,205,000
NORTH ZONE TM	North	48-inch	4,225,000
SPICEWOOD SPRINGS TM (WEST)	NWA	42-inch	5,244,750
WTP 4 NWB PS DISCHARGE TM	NWB	24-inch	1,123,875
TOTAL TRANSMISSION MAINS			*$32,898,625*

PUMP STATIONS	Zone	Capacity	Total Cost
DAVIS MEDIUM SERVICE PS UPGRADE	Central	34.1 MGD	1,327,773
ULLRICH HIGH SERVICE PS UPGRADE	South	28.8 MGD	1,149,843
WTP 4 NWA PS UPGRADE	NWA	60 MGD	1,496,257
TOTAL PUMP STATIONS			*$3,973,873*

RESERVOIRS	Zone	Capacity	Total Cost
None			0

MISCELLANEOUS	Zone		Total Cost
SPICEWOOD PRESSURE CONTROL STATION (PCS)	North		300,000
Four Points Flow Control Station (FCS)	NWB		50,000
TOTAL MISCELLANEOUS			*$350,000*

TOTAL ALL IMPROVEMENTS	**$94,222,498**



N

0 11,000'

- Flow/Pressure Control Station (F.C.S./P.C.S.)
- Water Treatment Plant
- Pump Station
- Reservoir
- Existing Main
- Capital Improvement Project Main Recommended before 2018
- Capital Improvement Project Main Recommended between 2018 and 2037
- Long-Range Water Planning Boundary

City of Austin
Water & Wastewater Utility
Water Distribution System
Long-Range Planning Guide
February 1994

Water Investment Plan Map
2037 System

Recommendations in this figure are based on the policies and data available as of January 1994.

Figure S-10

Produced by Systems Analysis and Planning Services Divisions

CHAPTER 1

INTRODUCTION

1.1 ABOUT THIS DOCUMENT

In 1990, the Water and Wastewater Utility charged its Systems Analysis and Planning Services Divisions with reworking the patchwork of previous planning efforts into an orderly, cost-effective plan. This Water Distribution System Long-Range Planning Guide (called the Water LRP Guide) is a product of that effort.

The Water LRP Guide is designed to serve three basic purposes:

- It indicates what new facilities will be needed during the planning period, what size they should be, and when and where they should be built in order to meet growing demand.
- It provides guidelines and a context for subdivision-level development through use of an urban grid concept.
- It discusses other factors like Integrated Water Resources Planning that shape long-term costs and management challenges.

This document provides an engineering context for utility planning and capital investment decisions. It is referred to as a "planning guide" in recognition of the complex issues that will affect facilities needs, but are beyond the scope of the current planning effort. Further consideration of these related issues will be needed before some recommended facility investments are made. As yet undetermined trends with regard to regulatory requirements and new-paradigm infrastructure alternatives like wastewater reuse and aquifer storage/recovery are factors that warrant more study and public discussion. The Guide is therefore a working document that the Utility will update and adapt to reflect new knowledge and policy direction.

The Water LRP Guide begins by analyzing the trends that are driving infrastructure needs and then makes recommendations for addressing those needs. Continued growth in population and employment projected by the Austin Planning and Development Department is the primary driver of the plan. Increasingly stringent regulatory and environmental requirements shape the facilities plans to a lesser extent.

Along with an introduction to Integrated Water Resources Planning, the principle products of the Water LRP Guide are the descriptions, cost estimates, and schedules of the specific facilities that the planning process indicates will be needed.

The Water LRP Guide is of necessity limited in scope. It deals primarily with major facilities. It does not, for example, present a plan for managing the water supply. No forecast is made of costs associated with compliance with anticipated changes in Federal regulations. The Guide does not cover planning for facility maintenance, rehabilitation, and replacement. CIP costs such as laboratory facilities are not addressed in detail. Organizational and process alternatives for enhancing infrastructure management were not a part of this project. Cost information presented in the Guide is an important element in financial planning, but does not represent a financial plan.

In the past, the Utility commissioned consultants to prepare master plans on a regular basis. The most recent was the 1986 Water and Wastewater Utility Interim Plan by Engineering Science, Inc. By doing the Water LRP Guide project internally, the City benefits in a number of ways, because the Guide:

- Better integrates the staff's knowledge of the system into the planning process.
- Develops our in-house modeling capabilities to improve both planning and system analysis.
- Strengthens the link between planning and operations.
- More effectively links subdivision-level development and major facility planning.
- Develops the Utility's ability to respond to emerging planning issues.

- Leaves the Utility with an adaptable planning tool that it can continue to use to re-study areas and projects as conditions, projections, and policies change.

The consulting firm of CH2M HILL supplied oversight in the preparation of this plan. Through oversight workshops, we identified areas that needed improvement and discovered new ways of looking at utility planning topics. The oversight workshop process enhanced our effort to produce a planning guide that puts the interests of the users at the forefront.

1.2 PLANNING FRAMEWORK, ASSUMPTIONS AND OBJECTIVES

e employed the compact city concept to define the area where the Utility intends to take a lead role and responsibility in water and wastewater planning.

Three basic assumptions formed a superstructure for the engineering planning analysis. First is that our existing plants are expandable to a limit of 305 MGD due to site limitations. Second is that once our existing plants are expanded to their limits, Water Treatment Plant 4 (WTP 4) should be brought on line to add more capacity. Finally, planning was carried to a year 2037 horizon because that corresponds to the full use of Austin's Colorado River water rights based on our demand projections.

In general, the Water LRP Guide focuses on capacity utilization and the hydraulic performance of the system. It addresses the most cost-effective alternatives to achieve the desired balance in demand/capacity relationships for the treatment plants, pump stations, reservoirs, and mains that make up the water distribution system.

The term "recommended project" is used in the Guide to convey that a particular project satisfies the demand/capacity analysis criteria outlined in Chapter 2. A recommended project reflects the professional judgment of the project team as to the best way to satisfy the objectives and planning performance indicators discussed in this chapter. Individual studies of recommended projects will provide more detailed analysis. The Water LRP Guide puts these studies in context.

Because it keys on current trends in demand growth, regulations, environmental constraints, and water industry technology, the Guide serves as a "baseline" facility plan. The multitude of factors affecting facility needs also means many "what if" questions arise. We look forward to tackling these questions once the more basic building blocks of the baseline plan have been evaluated.

The Utility plans to update the Water LRP Guide periodically. Trends that drive the long-range plan for major facilities will be monitored. Among these are growth rates and distribution, conservation, regulations, environmental policies, new technologies, and financial trends. New growth projections are expected from the Planning and Development Department this year. The Utility's Strategic Business Planning process will help crystallize emerging issues to the point where the appropriate resources are directed to new planning projects.

Primary Objectives

Six main objectives set the framework for the planning effort:

Objective 1: Major Facility Identification, Timing, Sizing and Cost. Determine major facilities needed in the future to meet growth in demand and determine the magnitude and approximate timing of investment in these new facilities. Provide a context for financial planning and the CIP. The Guide Summary and Chapters 4 and 5 present this information.

Objective 2: Efficient, Reliable Operations. Address key operational aspects of future demand conditions and new distribution system facilities, including system reliability. Hydraulic modeling of future demands provides insight into how the distribution system will operate. This information is presented in Chapter 5. Chapter 8 covers system reliability.

Objective 3: Context for New Development. Determine where the current pressure zone configuration will not be able to serve new development without pressure boosting or pressure reduction modifications. Determine an efficient pipe network for mid-size lines that will provide an urban level of service (typified by 3500-gpm fire flow capability) for newly developing areas in the planning area.

Chapter 5 and accompanying maps address this objective using the concepts of "special service areas" and "urban grid lines".

Objective 4: Environmental Issues Identification. Identify key environmental issues and chart the methodology by which these issues will be addressed. The baseline plan focuses more on understanding than on resolving these issues. We are devising the picture of facility needs and a process for working with environmental issues before tackling individual projects. Chapter 6 addresses this topic.

Objective 5: Address Key Factors Shaping the Future. Highlight such areas as Integrated Water Resources Planning (includes conservation and recycling), Safe Drinking Water Act requirements, and the status of water rights. These topics, which will play an important role in strategic planning, are covered in Chapters 3, 4 and 7.

Objective 6: Meet Customer Requirements. Present long-range planning information in a manner that best meets the needs of the users of the plan (in both content and format). In line with the City's BASICS management philosophy, we have made every effort to tailor the planning effort to the needs of our customers. We invite comments and feedback on the Guide.

1.3 THE TOTAL QUALITY MANAGEMENT CONTEXT

The Utility's Mission and Strategic Planning

The Austin Water and Wastewater Utility is committed to our mission:

> We will protect our community's public health and environment by effective management of our water resources. We will:
>
> > Provide a safe, reliable supply of water for community purposes and fire suppression;
> >
> > Provide treatment of wastewater in an environmentally responsible manner; and

> Emphasize cost-efficiency, continuous improvement and promote conservation.

Our mission provides the context for strategic planning. The present planning effort was born out of one of the City's 1990-91 Management Plan goals for living within our means:

> We will live within our means by planning strategically and monitoring consistently to improve quality, productivity and efficiency.

The Water LRP Guide is an important step in the Utility's strategic planning process. It lays the groundwork for decisions that must be made to dedicate the resources required to meet Austin's future major facilities needs.

Link to Strategic Choices

In the June 1993 Strategic Choices report, the City Manager refers to Austin as an emerging city-state, a major player in a global economy. She addresses the forces affecting the health and vitality of Austin, the Council's priority areas for action, and the strategic choices before us. The strategic choices selected to address the physical development of the City have a bearing on the Utility's long-range planning. These were stated in the report as follows:

- We can change our annexation policy.
- We can review our zoning laws to encourage mixed use development (as a key to being a "compact city").
- We can develop regional economic alliances for the sharing of revenues and tax base.
- We can be active participants in regional planning such as Austin Transportation Study and the Capital Metro Light Rail Plan.
- We can be strategic in our investment in infrastructure, including telecommunications infrastructure.

In the economic sphere, four of the ten strategic choices identified in the report have the greatest bearing on the Utility's long-range thinking. These were stated as follows:

- Make strategic investment through the budget and the Capital Improvements Plan.
- Invest in the workforce.
- Re-think city government. (BASICS is an example.)
- Explore new government structures. (Examples are interlocal and regional agreements for infrastructure planning, regional authorities and special districts, sharing of economic development revenues and tax bases, and city-county consolidations.)

Clearly, infrastructure maintenance and facility planning are important to the vision of Austin's future. This emphasis on sound infrastructure planning is the link between the City's vision for the future and the Water LRP Guide. In BASICS or Total Quality Management (TQM) terms the question of quality customer service then becomes "how good is the plan?"

Performance Indicators

In a workshop with our oversight consultant we established facility planning performance indicators we will use to evaluate our work in the coming months and years as the planning process continues. They are listed below.

- Identify and correctly portray trends that drive the need for infrastructure improvements.
- Engineer smart solutions that satisfy the needs.
- Reap the benefits of the TQM problem-solving process.
- Reap the benefits of cost-effectiveness analysis.
- Reap the benefits of Integrated Resources Planning.
- Satisfy design criteria (includes regulatory aspects).

- Satisfy facility operations requirements.
- Satisfy environmental requirements.
- Schedule facilities for CIP budgeting and construction.
- Cost improvements for CIP budgeting and financial planning.
- Provide context for subdivision level facility development.
- Define planning drivers that serve as update indicators.
- Convey information to plan users that is accurate and usable in a manner that is readable.
- Provide mechanisms for public/customer input and feedback so that the Utility plan is transformed into the community plan.

Public Involvement

Public involvement is the key to turning these plans into reality. Today, water industry officials are one of many voices in the debate on water quality, environmental risk, and costs versus benefits of treatment and waste disposal methods. Regulatory standards, public perceptions of what constitute environmentally desirable policies and the role of elected officials are subject to constant change. In the July 1993 AWWA Journal, American Water Works Association Executive Director John B. Mannion clearly states that to develop genuine community decisions, industry professionals must listen better and try harder to understand what the public is thinking and feeling about water issues.

The Utility will embark on a program of public involvement as the logical next step in turning this baseline plan into the community action plan. Two principles will guide this effort. One is to obtain early input from viewpoints outside the Utility. The other is to continuously monitor major shifts in public opinion and modify plans accordingly. We believe this is the path to an effective infrastructure development process.

CHAPTER 2

PLANNING ELEMENTS AND METHODOLOGY

This chapter lays out the assumptions and methodology that were used in developing the Water LRP Guide, including those used for modeling and decision-making. Chapter 2 also includes a listing of other utility providers presently serving areas within or adjacent to the planning area and shows which of these providers the LRP team assumes will be absorbed into the City's utility service area.

2.1 PLANNING AREA DEFINITION

The long-range planning boundary (see Figure 2-1, Water Planning Area Map) is an interpretation of a "natural" limit to the City's ability and willingness to extend services during the next 40 to 50 years. The boundaries were established based on City Planning and Development Department allocations of growth, topographic and jurisdictional barriers, proximity of other service providers, and the professional judgment of the LRP team.

The planning area boundaries used for this analysis reflect a "compact service area" consistent with the goals endorsed by the City Council aimed at minimizing urban sprawl. In support of the 1993 Strategic Choices document, the LRP team recognizes that annexation and the provision of water and wastewater utilities must work hand-in-hand to integrate developing suburban areas into the Austin community. Under Texas law, the ability to provide water and wastewater services has been closely linked to the ability of cities to annex.

In most areas, water and wastewater service boundaries are the same. They diverge in a few places where water service is anticipated, but wastewater service is not.

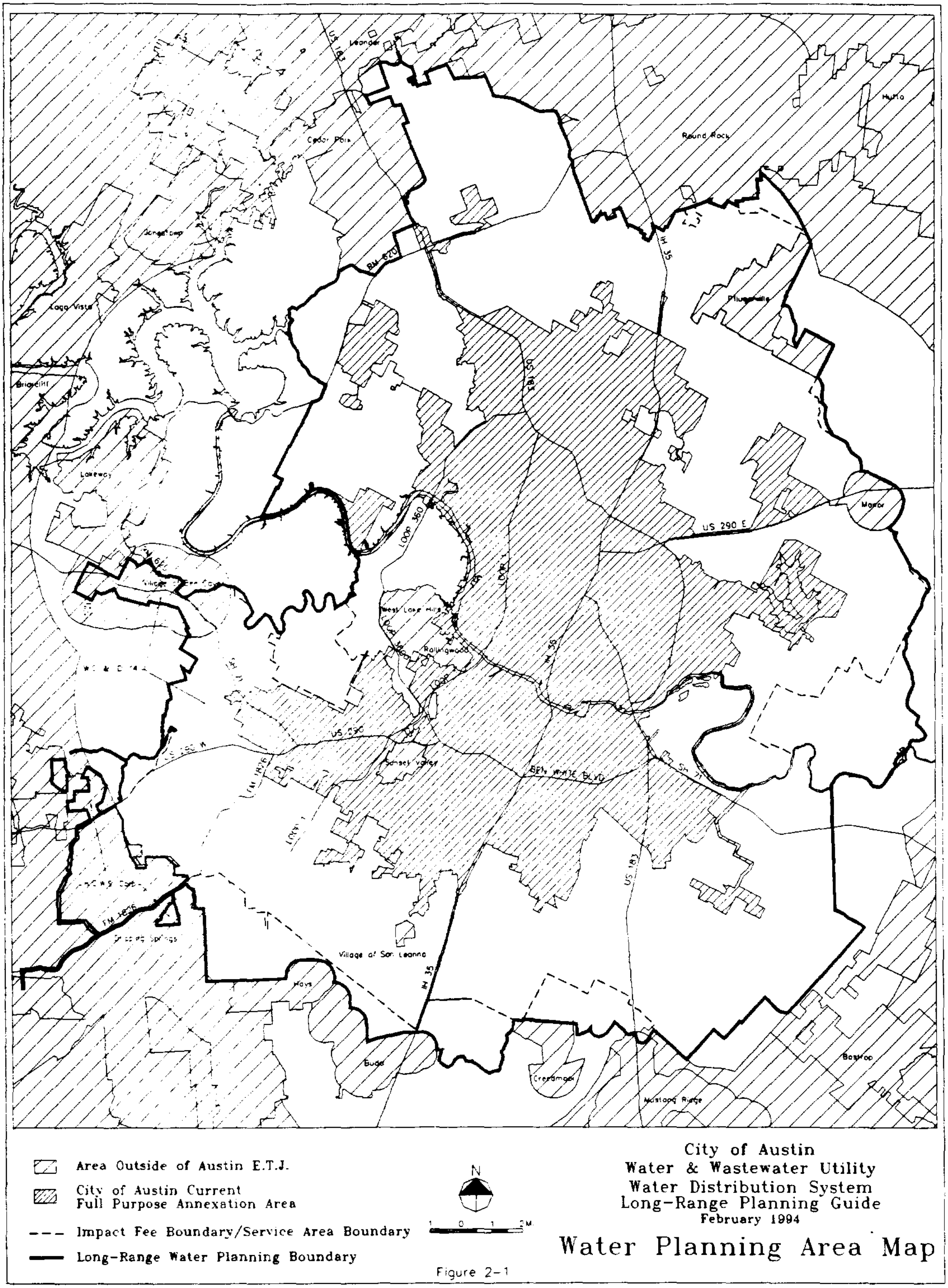

Leander
Cedar Park
Round Rock
Hutto
Jonestown
Lago Vista
Pflugerville
Briarcliff
Lakeway
Manor
US 290 E
West Lake Hills
Rollingwood
US 290
Sunset Valley
BEN WHITE BLVD
IH 35
US 183
LOOP 360
LOOP 1
RM 620
FM 1826
SH 71
US 183
Village of San Leanna
Hays
Buda
Creedmoor
Mustang Ridge
Bastrop
Area Outside of Austin E.T.J.
City of Austin Current Full Purpose Annexation Area
Impact Fee Boundary/Service Area Boundary
Long-Range Water Planning Boundary
N
City of Austin
Water & Wastewater Utility
Water Distribution System
Long-Range Planning Guide
February 1994
Water Planning Area Map

Figure 2-1

The "natural" limits of the planning area are bounded by:

- Other Cities' ETJs. With the exception of several small communities already encompassed by Austin's ETJ, the planning team's assumption that the service area and the City boundaries will one day be identical is consistent with Strategic Choices. These limiting ETJs include the Cities of Round Rock, Leander, Cedar Park, Dripping Springs, Hays and Buda.

- Self-sufficient water districts with contracts with the Lower Colorado River Authority (LCRA). The LRP team assumed that these districts will remain independent of Austin. These include WCIDs 17, 18, 20 and 21. WCID 19 had also been in this category until the Barton Creek Community Plan Agreement of July 9, 1993 caused this property to be included in the planning area.

- Areas to the west that would be extremely difficult for the City to serve cost-effectively. Much of this area is now designated for purchase as greenbelt and habitat preserve in the Balcones Canyonlands Conservation Plan and the Barton Creek Preserve. This includes the Cypress Creek area and the upper Barton Creek basin.

- Watersheds to the east that are so remote from existing City facilities, have so little projected demand, and would require such massive new systems that we consider city investment unlikely in the next 40 to 50 years. The basis for drawing the line in the east is the ridge line separating the Gilleland Creek basin from the Wilbarger Creek basin. In 1988, LCRA indicated its interest in becoming the service provider for the Wilbarger Basin when it released a feasibility study for providing a regional wastewater system to an area that includes the Wilbarger watershed.

Several water supply corporations (WSCs) with certificates of convenience and necessity (CCNs) are not considered long-term limiting factors to the City's ability to provide service to new development. This includes Manville WSC, Aqua WSC and Creedmore-Maha WSC. These entities have not demonstrated an ability to provide urban levels of service, including fire flow for multi-family, commercial, industrial and institutional/educational uses. In the past, the service boundaries of such entities have tended to shrink whenever urban/suburban levels of development occur.

The long-term planning boundary also encompasses existing and/or anticipated wholesale customers for the planning horizon. For water service this includes WCIDs 10 and 14, Hill Country WSC, and the Loop 360/Westlake peninsula.

Some of the facility maps in the LRP Guide show an intermediate boundary within the planning area. This boundary approximates an area where the City expected to have service available by the year 2000. From June 1990 through 1992, this boundary was also used as the City's Impact Fee Service Area Boundary. Currently, the Impact Fee Service Area Boundary more closely resembles the long-term planning boundary.

This intermediate boundary should not be construed as a development-limiting boundary and is meant only to provide a target for projecting service demands to design a reasonable short-term facility plan and perform financial analysis within the context of the long-range plan.

The long-term planning boundary may also be subject to change due to new conditions or policies. A good example of this is Barton Creek Properties (BCP), which until the summer of 1993 had been excluded from the planning boundary under the assumption that WCID 19 or its successor districts would maintain service. The July 9, 1993 Barton Creek Community Plan Agreement caused BCP to be combined with the Lantana tract and added to the planning area for the analysis performed for this Guide. However, in November 1993 the BCP negotiations ended and the agreement terminated. At this writing, the question of service to BCP is still undecided.

2.2 OTHER UTILITY SERVICE PROVIDERS

Many entities other than the City of Austin provide water service within or adjacent to the service area defined in this Guide. As the City has grown, it has typically absorbed most of the entities operating near major Utility facilities. For planning and modeling purposes, the LRP team reviewed current non-City providers and made assumptions regarding if and when their service areas might be absorbed. These decisions were made only to aid in the projection of demand and hydraulic analysis. These assumptions do not represent city policy nor are they a statement of intent. Table 2-1, Assumptions About Other Service Providers, shows the LRP team's assumptions regarding areas to be served and when service might begin.

The tentative and changing nature of these assumptions is illustrated by the example of BCP. Initial work for this Guide assumed that the BCP would not be served in the planning period. Late in the secondary modeling analysis, BCP was added to the service area and modeled as a wholesale customer throughout the planning period. Although the BCP agreement is no longer in effect, BCP was hydraulically modeled as a wholesale customer for the Guide and remains presented as such in our analytical results.

Historically, neighboring Water Control and Improvements Districts (WCIDs) and Water Supply Corporations (WSCs) were founded to provide a rural level of service. As development intensifies over time, a suburban or urban level of service is required. Traditionally, the increased level of service is provided by the Utility after negotiation with the initial service provider. For example, WCID 12 was acquired by the City of Austin in September of 1986. Also, the Garden Valley Water Supply Corporation became a wholesale customer of the Utility in 1993. The Guide assumes that the Garden Valley WSC customers will become City of Austin retail customers by the year 2010.

2.3 "CURRENT TREND" DEMAND PROJECTION METHODOLOGY

This section covers topics relating to water system demand projections and the timing of key demand/capacity events, demand forecasting methods and magnitudes, timing, peaking factors, diurnal demand variations, and minimum-month demands are discussed.

Table 2-1
Assumptions About Other Service Providers

ENTITY	SERVICE ASSUMPTION*
ANDERSON MILL MUD I Formally Williamson Co. MUD I	Retail Service by 2010
AQUA WATER SUPPLY S.E. Travis Co.	Future Retail Service
AUSTIN COLONY SUBDIVISION	Future Retail Service
AUSTIN MUDS I - III Harris Branch Formally N. Travis Co. MUDS	Existing Retail Service
BARTON CREEK PROPERTIES	Wholesale Service All Years
BEAR CREEK MUD	Future Retail Service
BRANCH CREEK ESTATES	Retail Service by 2010
BRUSHY CREEK - SOUTHERN SECTION Formerly W. Co. MUD II	Wholesale Service by 2010
CEDAR PARK, CITY OF	Emergency Service Only
CIRCLE C MUDS I-IV	Retail Service by 2010
CREEDMOOR-MAHA	Future Retail Service
DECKER CREEK MUDS I-V Dissolved by TNRCC September 29, 1993	Future Retail Service
FERN BLUFF MUD	Wholesale Service by 2010
GARDEN VALLEY WSC Subdivision off FM 973	Retail Service by 2010
GLENLAKE	Future Retail Service
HIGH VALLEY WSC	Future Retail Service
HILL COUNTRY UTILITIES Lamplight Village	Future Retail Service
HILL COUNTRY WSC Southwest Travis Co.	Wholesale Service All Years
LAKE AUSTIN LOOP 360 PENINSULA Davenport MUD and Others	Wholesale Service by 2010
LOST CREEK MUD	Retail Service by 2010
McKNOWVILLE RM 1826 Well System	Future Retail Service
MANOR, CITY OF	Wholesale Service by 2010
MANVILLE WSC N.E. Area	Future Retail Service
MAPLE RUN AT AUSTIN MUD	Retail Service by 2010

*Service assumptions in this table were made only for use in hydraulic analysis. The assumptions do not represent city policy nor are they a statement of intent.

Table 2-1 (continued)
Assumptions About Other Service Providers

ENTITY	SERVICE ASSUMPTION*
MARSHA WATER SUPPLY CORP.	Retail Service by 2010
MOORE'S CROSSING MUD	Existing Retail Service
NORTH AUSTIN MUD I Milwood	Retail Service by 2010
NORTHTOWN MUD N.E. Area	Retail Service by 2010
NORTH TRAVIS COUNTY MUD 5	Future Retail Service
NORTHWEST AUSTIN MUDS I & II Canyon Creek	Existing Retail Service
NORTHWEST TRAVIS COUNTY MUD I	Retail Service by 2010
NORTHWEST TRAVIS COUNTY MUD II Spicewood Area	Retail Service by 2010
PFLUGERVILLE, CITY OF	Wholesale Service by 2010
RIVERPLACE MUD	Wholesale Service by 2010
ROLLINGWOOD, CITY OF	Wholesale Service All Years
SAN LEANNA, CITY OF	Wholesale Service by 2010
SHADY HOLLOW MUD	Retail Service by 2010
SOUTHLAND OAKS MUD	Retail Service by 2010
SPRINGWOODS MUD Hunters Chase and Springwoods	Retail Service by 2010
SUNSET VALLEY, CITY OF	Wholesale Service All Years
TANGLEWOOD FOREST MUD	Retail Service by 2010
T. P. INVEST JOINT VENTURE Formerly Orion WSC	Future Retail Service
VILLAGE AT WESTERN OAKS MUD	Retail Service by 2010
WCID No. 10	Wholesale Service All Years
WCID No. 14	Wholesale Service All Years
WELLS BRANCH MUD	Retail Service by 2010
WILLIAMSON/TRAVIS CO. MUD 2 Never Created by the Texas Water Commission	Future Retail Service
WINDERMERE UTILITY COMPANY The Eastern Part	Wholesale Service by 2010
WINDERMERE UTILITY COMPANY The Western Part	Future Retail Service

*Service assumptions in this table were made only for use in hydraulic analysis. The assumptions do not represent city policy nor are they a statement of intent.

"Current Trend" Demand Summary

The LRP team based its demand projections on City of Austin Planning and Development Department projections and spatial allocations of population and employment.

Two critical planning periods are defined by the total capacity of all existing water treatment plants when they have been fully expanded and by the limit imposed by full use of existing water rights. Our analysis indicates that "current trend" maximum-day demand will rise to full treatment plant capacity (305 MGD) around the year 2017; thus the recommendation to put WTP 4 into service by 2017. The long-term planning horizon is reached at about the year 2037, when "current trend" average-day demand rises to an estimated 261 MGD, fully using all existing water rights (293,703 acre-feet/year).

Table 2-2, Summary of Total System "Current Trend" Demand, and Figure 2-2, Total System "Current Trend" Demand, show this data in tabular and graphical form, respectively.

TABLE 2-2

SUMMARY OF TOTAL SYSTEM "CURRENT TREND" DEMAND

Year	Average-Day Demand	Peaking Factor	Maximum-Day Demand
2000	125 MGD	1.84	230 MGD
2010	158 MGD	1.73	273 MGD
2017	182 MGD	1.68	305 MGD
2037	261 MGD	1.60	418 MGD

Demand projections—not inflexible time periods—trigger recommendations for additional facilities projects. Thus, if demand is lower than projected, facilities plans will be pushed back to later years. By the same token, higher than expected demand would accelerate the proposed schedule of improvements.

The LRP team statistically trended future peaking factors, which decline over time. This is discussed in more detail later in this chapter.

Total System "Current Trend" Demand

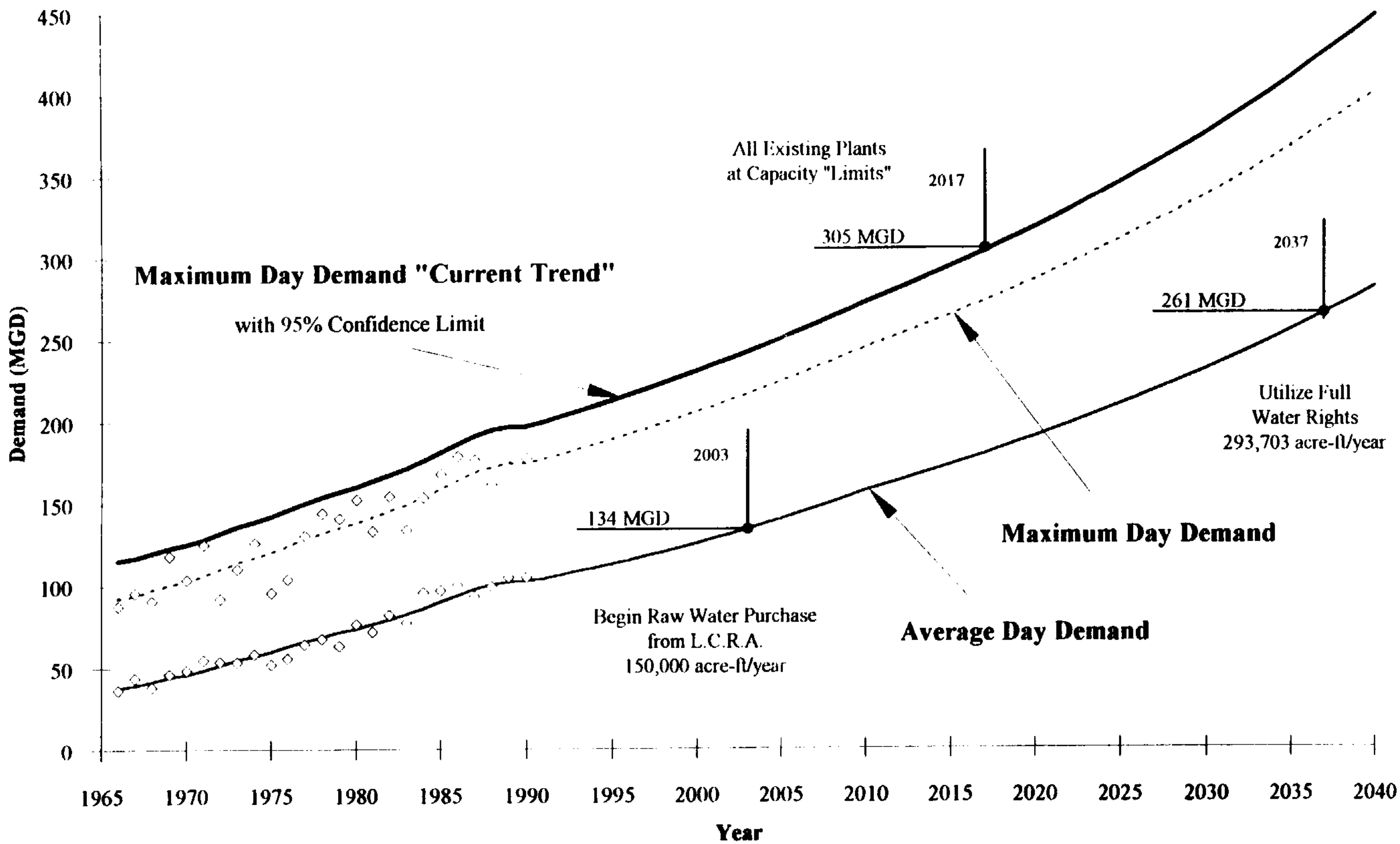


Figure 2-2

Table 2-3, Demand Projection Elements, gives a summary of elements involved in projecting total system demand and generating demand for modeling purposes.

Forecasting Methods

The LRP team based demand projections on the two independent variables that are most readily available and most reliable: population and employment. The LRP team's analysis used the City Planning and Development Department's population and employment projections, including their spatial allocations (to the traffic serial zone level). These represent the best "official" numbers for the City and its ETJ. These estimates are widely accepted by other cities and jurisdictions for planning purposes.

The Planning and Development Department's planning horizon is the year 2020. The LRP team extrapolated the 2020 projections to our own planning horizon of year 2037 and beyond by applying the same growth rate predicted for the decade of 2010 to 2020. We also carried the spatial allocation process to more detailed levels than traffic serial zones to appropriately match the water infrastructure.

Figure 2-3, Projection Of Population And Employment Growth By Planning Sector, shows a spatial allocation of the population and employment projections. The population and employment projections are shown in Table 2-4, Population and Employment Projections.

TABLE 2-4

POPULATION AND EMPLOYMENT PROJECTIONS

Year	Population	Employees
2000	633,144	377,081
2010	810,341	485,380
2017	934,345	568,125
2037	1,352,189	854,185

TABLE 2-3

DEMAND PROJECTION ELEMENTS

- Collected historical population data from 1966 to 1991 and projected population for each year to the year 2050.
- Collected historical average day and maximum day pumpage data from 1966 to 1991.
- Using linear regression, defined the average day trend line as a function of population for 1966 to 1991. With population estimates, extrapolated this line to the year 2050.
- Repeated this procedure using the maximum day demand data.
- Calculated the maximum day 95% one-tail confidence limit trend line for the 1966 to 2050 period. The one-tail test is applied to one side of the statistical curve. In this case, the high range is selected. This produces an upper limit such that there is a 5% chance that maximum day pumpage will exceed the limit.
- Calculated the total system maximum day to average day peaking factor for each year through 2050 as:
    a) the ratio of the trended maximum day to trended average day pumpage.
    b) the ratio of the maximum day with 95% confidence limit to average day pumpage.
- Based on unit flows and the population and employment projections, calculated the average day demand for each pressure zone for the years 1990 to 2050. Pressure zone demands are summed for the total average day system demand for each year (this curve is plotted on Figure 2-2).
- Using the total system average day demand and the peaking factors, calculated and plotted maximum day demand and the maximum day with 95% confidence limit demand for each year (Figure 2-2).
- Using hourly usage data collected for each zone and the peaking factor, determine the diurnal variations for average day and maximum day demand in each zone. Each hour of the average and maximum demand day is expressed as the ratio of hourly demand to the zone's average daily demand.
- Allocate the average day demand in each pressure zone for the years 2000, 2010, 2017, and 2037 to appropriate nodes in the hydraulic system models.

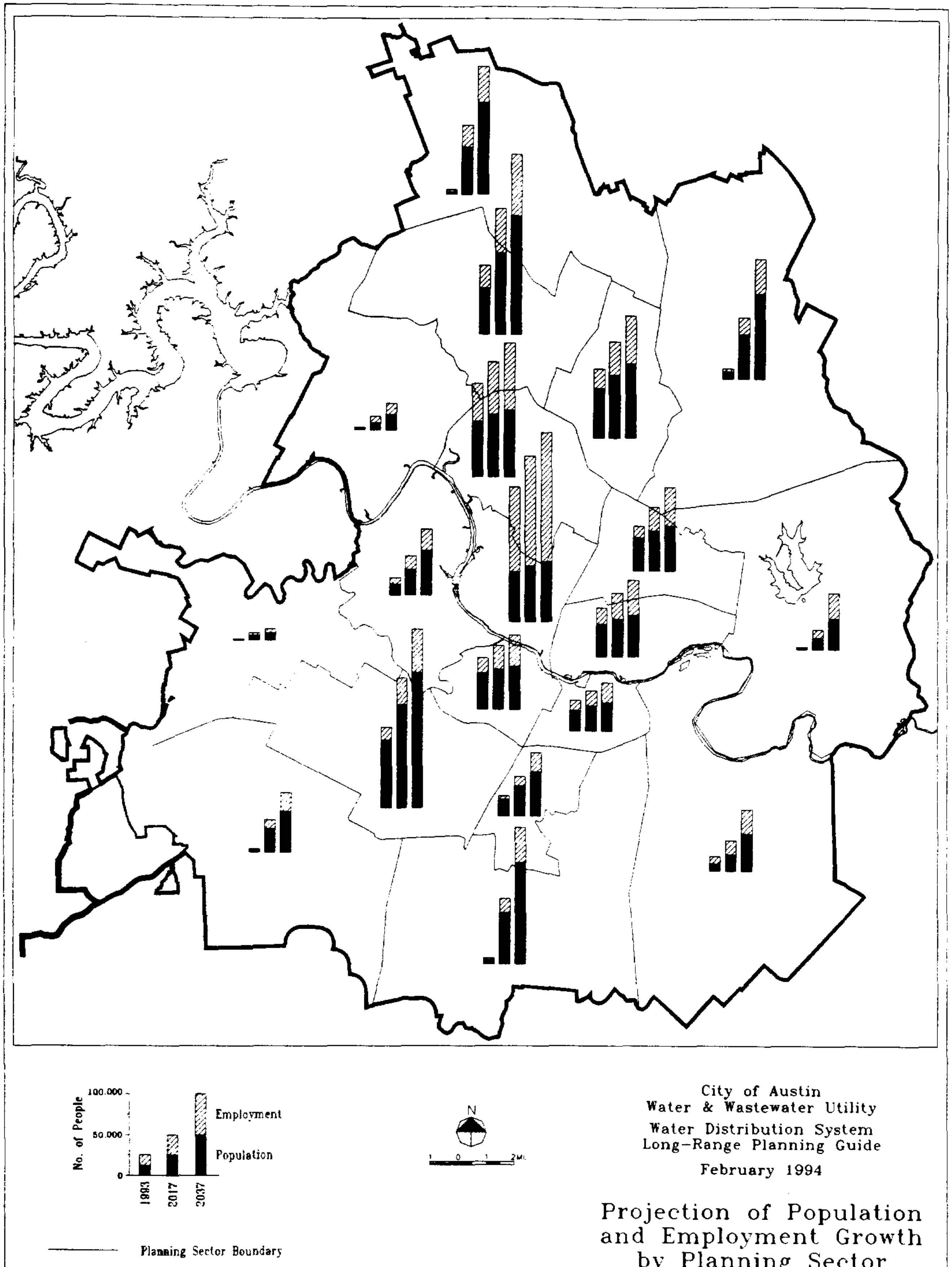

100,000
50,000
0
No. of People
Employment
Population
1993
2017
2037
N
1 0 1 2MI.
Planning Sector Boundary
Long-Range Planning Boundary
City of Austin
Water & Wastewater Utility
Water Distribution System
Long-Range Planning Guide
February 1994
Projection of Population and Employment Growth by Planning Sector

Figure 2-3

For pressure zone level (and smaller area) forecasts, we used unit water usage figures to calculate demand from population and employment. The average daily residential figures vary by Census Tract, and were obtained in the 1980s from customer consumption data. In our projections, the differences among tracts diminish over time, with all tracts moving toward the city-wide mean.

The average daily nonresidential demand per employee figures were calculated in the late 1980s. They are based on estimates of the number of employees by industry type and standard water usage tables for various types of industries and commercial uses. These figures vary by pressure zone. Demand projections for some large commercial customers were adjusted on the basis of usage records and individual company forecasts.

The LRP team used historical records and trending, regression analysis, and confidence limit calculations to estimate the total water system demand on an annual basis. We compared these projections to totals from pressure-zone- level and smaller scale forecasts (described above).

Total System "Current Trend" Demand Projections

Total system "current trend" demand projections are shown on Figure 2-2, Total System "Current Trend" Demand. The figure shows the average-day projection and the maximum-day projection with and without a 95 percent (one-tail) statistical confidence limit. The 95 percent confidence limit was chosen as a conservative estimate of demand that properly accounts for drought conditions and short periods of rapid growth. These forecasts were used to estimate the timing of key events.

Table 2-5, "Current Trend" Demand Projection Summary, shows the various types of demand by pressure zone and planning year. These basic data were used in first-round primary total system model. Pressure zone level adjustments were made for the second round (more detailed) modeling.

Table 2-5

"CURRENT TREND" DEMAND PROJECTION SUMMARY

PRESSURE ZONE	YEAR 2000 Average Day (MGD)	YEAR 2000 Peaking Factor	YEAR 2000 Maximum Day (MGD)	YEAR 2000 Minimum Day (MGD)	YEAR 2010 Average Day (MGD)	YEAR 2010 Peaking Factor	YEAR 2010 Maximum Day (MGD)	YEAR 2010 Minimum Day (MGD)
CENTRAL	54.5	1.72	93.7	43.6	62.1	1.61	99.9	49.6
NORTH	24.7	1.90	46.9	19.7	28.9	1.78	51.4	23.1
SOUTH	16.8	1.83	30.8	13.5	24.4	1.71	41.7	19.5
NWA	17.2	1.99	34.3	13.8	25.4	1.87	47.5	20.3
SWA	3.8	2.01	7.6	3.0	5.3	1.88	9.9	4.2
NWB (with NWC)	6.3	2.05	13.0	5.1	8.4	1.92	16.2	6.7
SWB	2.0	2.05	4.2	1.6	3.1	1.92	5.9	2.5
TOTAL SYSTEM	125.4	1.84	230.4	100.3	157.5	1.73	272.6	126.0

PRESSURE ZONE	PRE-WTP 4 (YEAR 2017) Average Day (MGD)	PRE-WTP 4 (YEAR 2017) Peaking Factor	PRE-WTP 4 (YEAR 2017) Maximum Day (MGD)	PRE-WTP 4 (YEAR 2017) Minimum Day (MGD)	WATER RIGHTS (YEAR 2037) Average Day (MGD)	WATER RIGHTS (YEAR 2037) Peaking Factor	WATER RIGHTS (YEAR 2037) Maximum Day (MGD)	WATER RIGHTS (YEAR 2037) Minimum Day (MGD)
CENTRAL	68.6	1.56	107.0	54.9	91.9	1.48	136.0	73.5
NORTH	31.8	1.72	54.7	25.4	43.3	1.63	70.6	34.6
SOUTH	29.3	1.66	48.7	23.5	46.3	1.58	73.2	37.0
NWA	30.9	1.81	55.9	24.7	47.2	1.72	81.2	37.8
SWA	6.7	1.83	12.3	5.4	10.3	1.73	17.9	8.3
NWB (with NWC)	10.2	1.86	18.9	8.1	15.2	1.77	27.0	12.2
SWB	4.1	1.86	7.6	3.3	7.0	1.77	12.4	5.6
TOTAL SYSTEM	181.6	1.68	305.1	145.3	261.3	1.60	418.2	209.0

Timing of Key Demand/Capacity-Driven Events

The planning and analysis processes for the water system are driven by two key demand/capacity-based events:

- When existing water treatment plants have been fully utilized and expanded to the limits of their sites (305 MGD), WTP 4 will be needed to treat additional supplies. See Chapter 4 for a detailed discussion.
- When demand requires full use of existing adjudicated water rights (261 MGD or 293,703 acre/feet/year), additional—and as yet unidentified—sources of supply will be necessary. (See Chapter 7 for a discussion of related issues.)

These planning horizons and analyses do not target specific time frames, but rather specific conditions. The LRP team's effort has been focused on determining cost-effective ways to operate the system in response to various demand levels, regardless of when these levels are reached.

The timeline also shows that the City of Austin could be required to begin paying for raw water from the Colorado River in the year 2003. This corresponds to the year that 134 MGD demand (150,000 acre-feet/year) meets the "current trend" average-day demand line. The point is shown on the average-day demand curve on Figure 2-2, Total System "Current Trend" Demand. Using the same method, we estimate adjudicated water rights (261 MGD or 293,703 acre-feet/year) may be fully utilized around 2037, as shown on Figure 2-2, Total System "Current Trend" Demand.

Many factors affect the shape and magnitudes of the curves. Major influences include growth in population and employment, weather effects, peaking factors, supply and demand management, and changes in the service area boundary. Actions that alter these factors can change the timing and sizing of facilities.

Peaking Factors

Figure 2-4, Peaking Factors, shows the ratio of average-day to maximum-day demand. Based on historical statistical trends and data analysis, the system-wide peaking factor continues to fall over time. These system-wide confidence-limit peaking factor values start at 3.05 in 1966 (the actual peaking factor that year was 2.41) and slope downward to 1.84 in 2000, 1.73 in 2010, 1.68 in 2017, and 1.60 in the year 2037. Note that over the last 5 years—a relatively wet, mild weather period—the actual system-wide peaking factor has averaged 1.67.

The downward trend is expected to continue. First, as the city grows, it will become more diverse. A more heterogeneous employment and population base will cause the system water-use pattern to flatten. For example, as a city grows there are often more businesses using water around the clock and evenly throughout the year. Secondly, Integrated Water Resources Planning including demand management programs should tend to reduce the peaking factor. Along that same line, broader use of off-peak watering, such as with automatic sprinkler systems, will tend to reduce peak-period use.

At present, the maximum-hour peaking factor varies by pressure zone and usually occurs around 8 p.m.

Diurnal Variations

The LRP team used dynamic models of the system(s). Typically, we represented a future maximum-demand 24-hour day. These dynamic runs represent changing system hydraulic conditions throughout the day. In preparing this Guide, the team created diurnal curves representing typical hourly water use in each pressure zone and generated curves for both maximum-day and average-day conditions.

Minimum-Month Demand

We analyzed minimum usage models of the zones to assess operational flexibility under low-flow conditions. We used a "minimum-month" level of demand for a dynamic 24-hour day. Analysis of usage data since 1980 showed that February is the typical minimum usage month. The average minimum-month demand is about 80 percent of average-day demand. Thus, we used the base average-day demand set with the average-day diurnal curve and multiplied by a uniform 0.8 factor. Table 2-6, Minimum-Month Demand, shows the results.

Peaking Factors

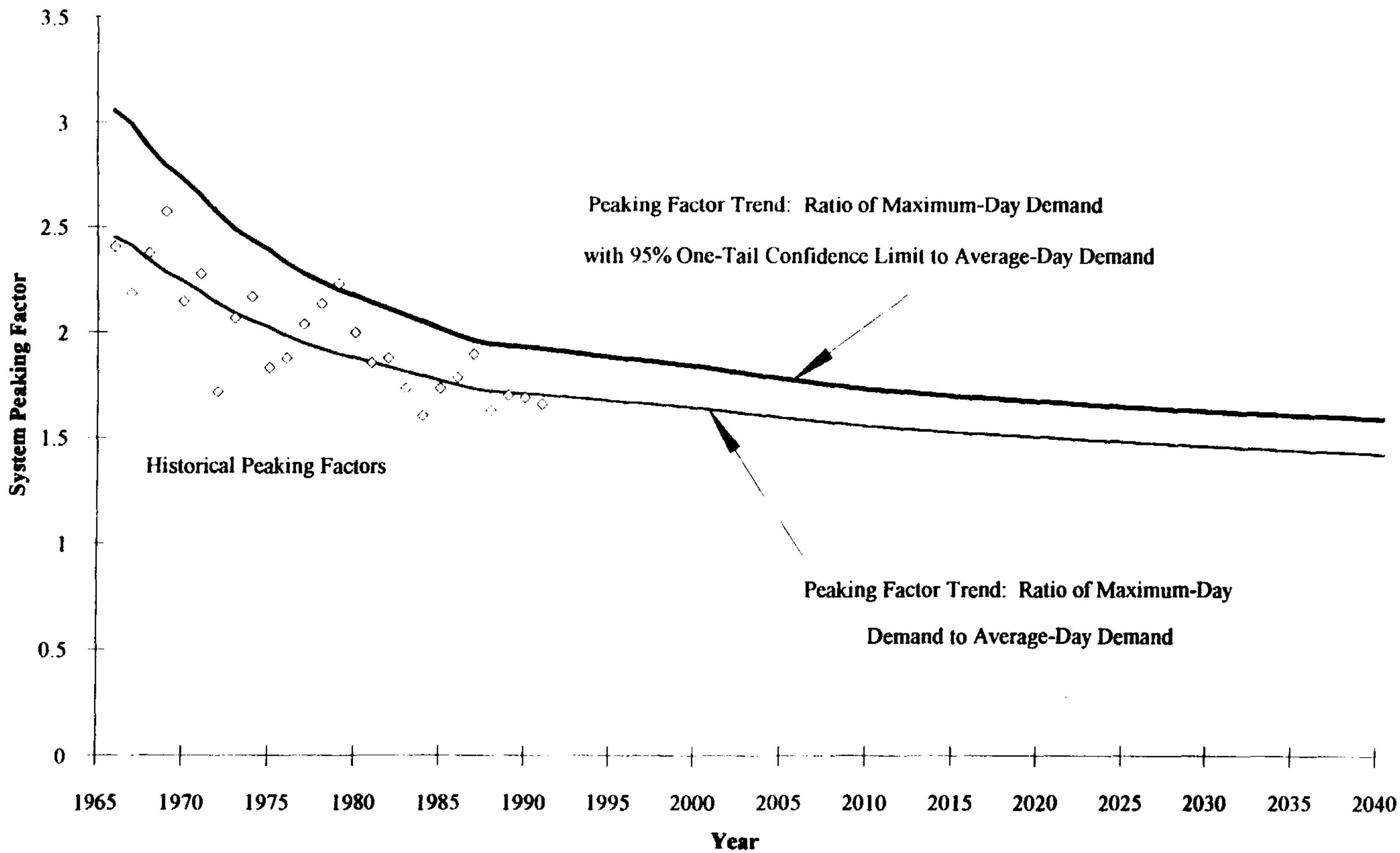


Figure 2-4

TABLE 2-6

MINIMUM-MONTH DEMAND

Year	Minimum-Month Demand
2000	100 MGD
2010	126 MGD
2017	145 MGD
2037	209 MGD

As the Utility updates this Guide, data will be adjusted to reflect changing trends, new population and employment projections, effects of demand management programs, and other factors affecting probable future demand and peaking levels.

2.4 DESIGN STANDARDS AND MODELING METHODOLOGY

This section describes the methodology used for modeling and devising projects to improve the water system. Information on operating and engineering design criteria appears immediately below. Information concerning computer modeling methodology follows.

Operating Criteria

Working with the Operations Division, the LRP team has gathered information on pump and reservoir operating limits for both normal (35 psi minimum pressure) and emergency (20 psi minimum pressure) conditions. This information appears in Tables 2-7, Reservoir Capacities and Normal Operation Limits, 2-8, Reservoir Capacities and Emergency Operation Limits, and 2-9, Pump Station Capacities and Discharge Pressure Limits. Pump discharge pressure limits are aimed at a desired upper pressure in a zone and are generally a function of the head and efficiency relationships of existing pumps. Reservoir low-level limits are aimed at maintaining minimum pressure in the system and providing adequate pump suction pressures.

Table 2-7

RESERVOIR CAPACITIES AND NORMAL OPERATION LIMITS

RESERVOIR	PRESSURE ZONE	STORAGE CAPACITY (MG)		RESERVOIR BOTTOM	NORMAL OPERATION LEVEL (FT)			
					MINIMUM		MAXIMUM	
		Total	Effective	Elev (FT)	Depth (ft)	HGL (ft)	Depth (ft)	HGL (ft)
NORTH AUSTIN	Central	10	8	708	8	716	12	720
EAST AUSTIN	Central	12	7	663	40	703	57	720
CENTER STREET	Central	8	6	665	35	700	55	720
PILOT KNOB	Central	10	9	680	28	708	40	720
HOWARD LANE (1 and 2)	North	20	20	829	15	844	31	860
SPICEWOOD SPRINGS	North	10	8	847	6	853	13	860
DAVIS LANE 1	South	10	5	810	30	840	50	860
DAVIS LANE 2	South	10	5	805	35	840	55	860
FOREST RIDGE	NWA	3	1	935	50	985	80	1015
JOLLYVILLE	NWA	11	6	949	40	989	66	1015
MARTIN HILL	NWA	34	14	931	50	981	84	1015
LEUTHAN LANE	SWA	3	3	980	20	1000	35	1015
SLAUGHTER LANE	SWA	6	6	980	25	1005	35	1015
FOUR POINTS GROUND	NWB	7	7	1087	25	1112	43	1130
POND SPRINGS	NWB	3	3	1090	25	1115	40	1130
ANDERSON MILL	NWB	3	3	1091	24	1115	39	1130
LACROSSE	SWB	2	2	1105	15	1120	35	1140
FOUR POINTS ELEVATED	NWC	1	1	1195	20	1215	35	1230
DAVIS WTP CLEARWELLS		15	NA					
GREEN WTP CLEARWELLS		4	NA					
ULLRICH WTP CLEARWELLS		20	NA					
TOTAL		202	114					

	Population	Connections @3 cap/con	State Storage Requirement Total (MG)	Effective (MG)
"Pre-WTP 4" (2017)	926,326	308,775	62	31
"Water Rights" (2037)	1,352,189	450,730	90	45

Table 2-8

RESERVOIR CAPACITIES AND EMERGENCY OPERATION LIMITS

RESERVOIR	PRESSURE ZONE	STORAGE CAPACITY (MG)		RESERVOIR BOTTOM	EMERGENCY OPERATION LEVEL (FT)			
					MINIMUM NO PUMPS		MINIMUM W/ PUMPS	
		Total	Effective	Elev (FT)	Depth (ft)	HGL (ft)	Depth (ft)	HGL (ft)
NORTH AUSTIN	Central	10	8	708	5	713	5	713
EAST AUSTIN	Central	12	7	663	40	703	40	703
CENTER STREET	Central	8	6	665	25	690	25	690
PILOT KNOB	Central	10	9	680	10	690	NA	NA
HOWARD LANE (1 and 2)	North	20	20	829	6	835	NA	NA
SPICEWOOD SPRINGS	North	10	8	847	1	848	1	848
DAVIS LANE 1	South	10	5	810	5	815	5	815
DAVIS LANE 2	South	10	5	805	10	815	10	815
FOREST RIDGE	NWA	3	1	935	25	960	25	960
JOLLYVILLE	NWA	11	6	949	11	960	11	960
MARTIN HILL	NWA	34	14	931	29	960	NA	NA
LEUTHAN LANE	SWA	3	3	980	10	990	16	996
SLAUGHTER LANE	SWA	6	6	980	10	990	20	1000
FOUR POINTS GROUND	NWB	7	7	1087	8	1095	8	1095
POND SPRINGS	NWB	3	3	1090	5	1095	NA	NA
ANDERSON MILL	NWB	3	3	1091	4	1095	NA	NA
LACROSSE	SWB	2	2	1105	5	1110	NA	NA
FOUR POINTS ELEVATED	NWC	1	1	1195	5	1200	NA	NA
DAVIS WTP CLEARWELLS		15	NA					
GREEN WTP CLEARWELLS		4	NA					
ULLRICH WTP CLEARWELLS		20	NA					
TOTAL		202	114					

Table 2-9

PUMP STATION CAPACITIES AND DISCHARGE PRESSURE LIMITS

PUMP STATION	PRESSURE ZONE	PUMP STATION CAPACITY (MGD)		DISCHARGE GAGE	MAXIMUM DISCHARGE LIMITS			
					NORMAL		EMERGENCY	
		Total	Firm	Elev (FT)	Pressure (psi)	HGL (ft)	Pressure (psi)	HGL (ft)
DAVIS WTP MED. SERV.	Central	121	101	555	90	763	100	786
GREEN WTP MED. SERV.	Central	73	56	446	142	774	142	774
ULLRICH WTP MED. SERV.	Central	95	63	623	75	796	85	819
DAVIS WTP HIGH SERV.	North	90	73	539	162	913	188	973
EAST AUSTIN	North	70	54	661	103	899	120	938
NORTH AUSTIN	North	115	95	711	90	919	105	954
CENTER STREET	South	60	45	672	110	926	115	938
ULLRICH WTP HIGH SERV.	South	85	56	649	115	915	119	925
SPICEWOOD SPRINGS	NWA	99	85	847	90	1055	100	1078
DAVIS LANE	SWA	106	77	815	100	1046	100	1046
FOREST RIDGE	NWB	13	7	940	95	1159	105	1183
JOLLYVILLE	NWB	87	72	944	110	1198	120	1221
LEUTHAN LANE	SWB	3	1	984	84	1178	84	1178
SLAUGHTER LANE	SWB	32	22	969	90	1177	90	1177
FOUR POINTS	NWC	11	5	1098	57	1230	57	1230
TOTAL		1060	812					

Hydraulic Design Criteria

The State of Texas "Rules and Regulations for Public Water Systems" form the umbrella of design requirements that govern the performance of the water distribution system. The specific criteria used in preparing this Guide are outlined below.

PRESSURE CRITERIA

Facilities are recommended and sized to assist in satisfying the 35 psi State minimum pressure standard for normal operations and 20 psi minimum pressure for maximum day plus fire flow and emergency conditions at all points of connection (meters). The LRP team used 50 psi minimum pressure for areas targeted for creation of new pressure zones. A maximum pressure limit of 115 psi is used to target areas that may be suitable for a pressure-reduced sub-zone. The City Plumbing Code requires customers to use pressure-reducing valves on their side of the meter to reduce system pressure down to 80 psi where necessary.

FIRE FLOW

The LRP team used the standards from the City's Fire Protection Criteria Manual. When actual fire flow for a project is undetermined (i.e., before buildings are designed), the fire flow must meet or exceed the standards outlined in Table 2-10, Fire Flow Requirements.

TABLE 2-10

FIRE FLOW REQUIREMENTS

Building Use	Minimum Water Supply	Duration
Residential, Single Family	1000 gpm	2 hours
Residential, Multi-family	3500 gpm	3 hours
Retail	3500 gpm	3 hours
Storage	3500 gpm	3 hours
Industrial	3500 gpm	3 hours

The 3500-gpm three-hour duration flow is used as the design standard. The less stringent residential standard is not appropriate for major facility planning in an urban system.

WATER TRANSMISSION MAINS

The Utility's past C-factor testing and model calibration results show that generally Austin's Hazen-Williams C-factor values range from 80 to 120. For this Guide, unless calibration work has indicated otherwise, the team gave pre-1984 mains a C-factor of 80, and gave mains constructed in 1984 and later a value of 100. The Davis and Ullrich Treatment Plants will soon add recarbonation to the treatment process. The recarbonation and the lowering of the pH of the water should reduce scale and thereby increase capacity in transmission mains over that previously experienced. This may allow the use of higher C-factors in Austin in the future.

Relationships among pipe size, the energy required for pumping and the slope of the hydraulic grade line generally conform to typical engineering design practice. Velocities under maximum demand conditions are in the 1 to 10 feet per second range. Corresponding headloss is in the range of 1 to 5 feet per 1000 feet of pipe.

STORAGE RESERVOIRS

State criteria for surface water supplies require a total storage capacity of 200 gallons per connection and an elevated storage of 100 gallons per connection. The number of connections may be estimated by dividing population by 3 people per connection.

Additional ground storage, pumping capacity, or auxiliary power may be substituted for elevated storage volume in excess of 5 million gallons with the approval of the Texas Natural Resource Conservation Commission.

As noted on Table 2-7, Reservoir Capacities and Normal Operation Limits, Austin's existing storage exceeds the State requirement throughout the planning period on a total system basis. Given the flexibility in the State requirement, new storage tanks needed to achieve the system pressure criteria stated above will be sized by comparing the state criteria with a performance design basis. The performance basis is tank volume designed for equalization of the difference between maximum-day and maximum-hour flow, with a specified volume added for fire flow and other emergencies such as pump station outage.

PUMP STATIONS

State criteria for surface water systems require that each pressure zone shall have two or more pumps that have a total capacity of 2.0 gpm per connection or that have a total capacity of at least 1,000 gpm and the ability to meet peak-hour demands with the largest pump out of service. For systems that provide elevated storage of 200 gallons per connection, two pumps with a minimum combined capacity of 0.6 gpm per connection are required. This criteria will be evaluated along with the performance design basis described above for storage tanks.

TREATMENT PLANTS

State criteria for surface water supplies require a treatment plant capacity of 0.6 gpm per connection under normal rated design flow. It is the practice of the Utility to size treatment plants based on maximum-day demand. The maximum-day demand forecast with confidence interval equates to 0.75 gpm per connection in 1993, declining to 0.64 gpm per connection in year 2037.

Primary Modeling

Systems Analysis Division personnel performed all modeling using WADSY (April 1988 version). WADSY is a digital computer program for the analysis of WAter Distribution SYstems developed by Metcalf & Eddy Inc.

The LRP team constructed a skeletonized model of all seven major pressure zones in the system in order to test the overall operation of the system in one model. The primary model was calibrated to accurately reflect actual system performance for July 19, 1989. Building on the calibrated model, the near-term baseline model was formed by including projects to be completed within the next two or three years. The maps show these projects as already complete or "existing" facilities. (Table 5-2 in this Guide provides a listing of these improvements.)

Systems Analysis then constructed a series of maximum-day models to test peak system demands in the years of interest as follows:

- Year 2000
- Year 2010
- Pre-WTP 4 (2017)

- Post-WTP 4 (2018)
- Water Rights (2037)

The team analyzed several models for each time frame which reflected different potential infrastructure alternatives that met system performance criteria. We used this data and professional judgment to arrive at a consensus on the preferred operating strategy and recommended projects that met objectives cost-effectively.

The team analyzed a series of minimum-month models (80 percent of average-day demands) for all planning periods. These models tested the system to determine if a reasonable operating strategy could be found that met criteria and provided adequate turnover in the reservoirs. Particular attention was given to those reservoirs that do not have pump stations that draw water from the reservoir.

Secondary Modeling

The team constructed a series of more detailed individual pressure zone models to use in this phase of analysis. The planning periods and demand conditions chosen for secondary analysis were:

- Year 2000 maximum-day demand
- Year 2000 minimum-month demand
- Year 2010 maximum-day demand
- Pre-WTP 4 (Year 2017) maximum-day demand
- Pre-WTP 4 (Year 2017) with fire flows
- Post-WTP 4 (Year 2018) maximum-day demand
- Post-WTP 4 (Year 2018) minimum-month demand

The team used a 40 psi minimum pressure criterion in initial models. We felt that this added safety factor would ensure meeting the 35 psi minimum. Areas that did not meet the 40 psi criterion were then examined in more detail to test the 35 psi minimum.

The team began by modeling the year 2017 system. The team also analyzed other planning period models in an iterative process. Each modeler explored different operating strategies, alignments and sizing for projects in the zone. If pumpage into the zone or transfers out of the zone were changed from the basic primary operating strategy, the modeler conferred with adjacent zone modelers to assure that the changed operating strategy did not adversely impact the adjacent zone.

URBAN GRID METHODOLOGY

Urban grids were added to baseline models of all the major pressure zones. Demands were assigned to points on the grid. The urban grid pipe network is targeted to deliver 3500 gpm fire flow throughout the system with a 20 psi minimum service pressure using the following criteria:

- All points in the service area must be within 1 mile of an urban grid source, which is generally a looped pipe network.
- A single 24-inch main was assumed to run from the source grid to a development in the service area.
- The source grid must have a hydraulic grade line equal to or greater than 46.2 feet (20 psi) plus the elevation of the controlling high point in the area plus the friction loss resulting in a 24-inch pipe flowing 3500 gpm from the source to the controlling high point.

In certain small areas a single 16-inch dead-end line can be used if it meets the criteria. It is assumed that smaller pipes will make a local grid that will allow circulation of water and add reliability.

In general, urban grid pipes larger than 16 inches in diameter will be located nearer the interior of the system. In some cases a 24-inch main is shown near the extremities of the system. These pipes may not be required if the area develops as residential or if the local distribution system connecting with the urban grid can make up the required fire flow.

MAXIMUM-DAY MODELING

The team studied the primary modeling results and determined pumpage from a zone for each pump station for the 24 hours in the simulation. They used primary model pumpage as a transfer demand node in each secondary model.

The models ran for a full 24-hour day, beginning at noon. A check was made comparing modeled demands to the target for each time period for each zone. An independent member of the team checked each zone model for baseline model connectivity and compliance of the modeled urban grid with locations previously agreed to.

The modeling analysis began at the year 2017. Earlier preliminary cost-effectiveness analysis had suggested that any pipe needed in earlier years would probably be built at the size needed at least 20 years into the future. The secondary models were initially set up like the primary models where appropriate in terms of operating strategies and anticipated infrastructure improvements.

Next, the team ran an iterative series of models that considered the most cost-effective way to meet minimum hydraulic grade line criteria for normal conditions (maximum-day and minimum-month) and to meet a minimum of 20 psi criteria anywhere within the zone under a fire flow condition.

FIRE FLOW MODELING

Fire flow models were run for 3 full hours, with all reservoirs starting at one-half their normal operational range. Diurnal multipliers equal to each zone's average maximum-day peaking factor were modeled for each hour of the simulation. Modelers checked transfers from the zone in the simulation to assure that the transfers were at least equal to average maximum-day values. Normal pump station discharge pressures and reservoir minimum limits were used as standards for the fire flow test. If additional pumpage was needed in a zone for fire flow conditions, it was not provided until the second hour of the simulation.

MINIMUM-MONTH MODELING

Secondary minimum-month models were analyzed for the year 2000 and 2018 systems. This process was basically the same as for the minimum-month primary modeling discussed previously in this chapter.

2.5 COST ESTIMATING METHODOLOGY

Infrastructure Costs

All cost estimates shown in this Guide are expressed in 1993 dollars. No attempt has been made to predict inflation rates, changes in project requirements or new technologies that may affect future infrastructure costs.

Table 2-11, Cost Estimating Formulas, shows the basis for cost estimates used in this Guide. These methods have been used by the Utility Systems Planning Division for several years in developing planning-level estimates for the Capital Improvements Program (CIP). The methodology originated in 1988 through the availability of data from many projects that had been bid or completed in the early and mid-1980s.

Simplified Cost-Effectiveness Analysis

A few special issues such as the cost of supplying WTP 4 (Lake Travis) water to the North Pressure Zone as compared to Lake Austin water and the cost/benefit of energy recovery from NWA water introduced into the North Pressure Zone have been addressed in other studies and were revisited for this Guide. Energy, operations, and maintenance costs versus new infrastructure costs were analyzed in some cases.

The typical analysis performed for the Guide considered the cost of a series of transmission main timing and sizing alternatives. This sometimes compared different series of projects or the combination of an initial project of smaller size with a second parallel main to be added in the future.

The analysis used a real discount rate of 3 percent, recently confirmed as appropriate by the Utility Finance Manager. The cost of operation of the transmission facilities is not considered. Additionally, salvage value or an average useful life of a transmission main is not considered, as their useful life could extend well beyond planning horizons used when analyzing initial project costs of alternative systems. Therefore, the analysis becomes a present worth analysis based upon current estimated project costs and 3 percent real compound interest factors.

TABLE 2-11

COST ESTIMATING FORMULAS
September 1993

PUMP STATIONS

$C = 22{,}000\ (Q)^{0.75}\ (h)^{0.4}$ Where, C = construction cost, dollars
Q = rated capacity, MGD
h = rated head, ft

RESERVOIRS

Elevated: $C = 860{,}000\ (V)^{0.7}$ Where, C = construction cost, dollars
V = total tank volume, million gallons

Ground: $C = 350{,}000\ (V)^{0.67}$ Where, C = construction cost, dollars
V = total tank volume, million gallons

TRANSMISSION MAINS

Pipe Diameter	Unit Cost ($/LFt)			
	Soft Rock		Hard Rock	
(in)	Open Cut	Tunnel	Open Cut	Tunnel
16	55	110	90	180
24	68	136	111	222
30	83	166	141	282
36	97	194	170	340
42	130	260	210	420
48	154	308	250	500
54	203	406	300	600
60	242	484	345	690
66	275	550	385	770
72	310	620	425	850

MULTIPLIERS

The following multipliers account for engineering, easements, contingencies, etc.

New Pump Stations, Reservoirs &Transmission Mains

Standard Projects: $C_{total} = (C)(1.3)$

Projects in Difficult Terrain (i.e., special habitat areas, river crossings, greenbelts):

$C_{total} = (C)(1.35)$

Additions to Pump Stations: $C_{total} = (C)(0.5)$

TREATMENT PLANTS No multipliers are used; the engineering costs, etc., are already included.

WTP 4 (for a plant size in the 100 MGD range):
C = 950,000 (T) + (Cost of Intake & Tunnel) C = total treatment plant cost, dollars
T = treatment capacity, MGD
Cost of Intake & Tunnel = $ 33 Million

Ullrich WTP Expansion (100 MGD to 140 MGD) = $ 20 million
(estimate by Facility Engineering Division, Sept. 1993)

Cost-Effectiveness Analysis Criteria

Cost-effectiveness analysis yields a recommended selection of the best facility planning option in the context of the Utility's mission of providing safe, reliable service in a cost-efficient manner. The analysis criterion is the lowest life-cycle cost, taking into account the time value of money, economies of scale, the trade-off between operating and capital costs, and non-pecuniary factors, for options that otherwise satisfy performance objectives.

For specific considerations of these costs for individual projects, contact the Systems Analysis Division of the Water and Wastewater Utility.

CHAPTER 3

INTEGRATED WATER RESOURCES PLANNING

The City of Austin Water and Wastewater Utility is beginning to view long-term water system planning in a new way. In the water utility industry sector, there is an emerging planning approach referred to as Integrated Water Resources Planning (IWRP). For the City of Austin, the IWRP structure is proving helpful in synthesizing today's issues into a broad-scope water utility planning context. IWRP is a concept into which water conservation, water reuse, and the water conservation rate structure can be factored to make more comprehensive planning decisions. This chapter discusses this concept, its components, and potential impacts and benefits. Further discussion of impacts and benefits in terms of plant expansion timing can be found in Chapter 4.

3.1 IWRP CONCEPTS

The key concepts of Integrated Water Resources Planning are:

- Balancing both supply-side management and demand-side management alternatives
- Public involvement
- Cost effectiveness
- Inclusion of all direct and indirect costs and benefits of a comprehensive set of elements including demand management, supply management, environmental impacts, water rights, risk management, reliability, and alternative systems.

This guide itself is a flexible component of this comprehensive planning approach. It is a baseline facilities plan from which we can make decisions and develop comparisons. The recommended facilities plans presented in the Guide are designed to meet specific flow conditions. In general, decisions to recommend these plans are made on a supply-side cost-effectiveness basis.

Depending on the success of the City's aggressive demand-side management activities, the timing of needed facilities may change significantly. Since the facilities plans are designed to supply given flows in the system, not given time frames, lowering of the demand projection curves will act to postpone the timing of the need for planned facilities. This is an obvious benefit.

Reductions in different types of water use create a variety of benefits directly related to facilities costs. Typically benefits result from deferral of major investments. Although slowing the growth in demand is a major factor in enabling the City to postpone large outlays, in some cases reliability and operational flexibility considerations may override strict demand/capacity timing of system improvement projects.

In practical terms, within the framework of this Guide, reducing maximum-day consumption postpones the need for major water treatment and distribution facilities. "Demand Reduction Scenario" facilities timing benefits are discussed in more detail below and in Chapter 4. In a similar manner, reducing average-day demand postpones the time at which the City must make raw water purchases from Lower Colorado River Authority (LCRA) and the time at which the City reaches the limits of its adjudicated water rights.

Integrated Water Resources Planning is a planning process approach into which many influences can be incorporated. The American Water Works Association "White Paper on Integrated Resource Planning in the Water Industry" (December 1993) provides this definition:

> Integrated resource planning is a comprehensive approach to evaluating supply-side and demand-side resource alternatives with respect to explicitly defined and often conflicting objectives. IRP encompasses least-cost planning, but is broader in its emphasis as an open and participatory decision-making process, the use of planning scenarios that incorporate uncertainties, externalities, and long term community needs, and consideration of the multiple institutions concerned with water resources and the competing policy goals among them.

Within this concept, least cost analysis considers both supply-side and demand-side options equally to meet future water needs. In other words, in developing cost effective alternatives for meeting projected growth in demand, we no longer assume the demand forecast is fixed. We must examine other supply-side options too. The traditional approach limits options to more traditional cost effectiveness analysis comparing various traditional facilities options. IWRP brings in the idea that demand management and alternative supply options should be considered equally. IWRP also involves environmental considerations, public involvement, community-based decision making, risk considerations, and Total Quality Management.

Demand-side management refers to steps that reduce water use and/or beneficially change water use patterns. The City of Austin is currently implementing or in the process of implementing a number of efforts/programs aimed at achieving this end. These include: public education, water saving ordinances, water audits, rebate and incentive programs, and water conservation rates.

Supply-side management covers efforts that improve water supply capacity. On the supply-side, the City of Austin is currently involved in or considering the following: Utility infrastructure programs, water reuse projects, water system reliability assessment, and other alternative supply options (including aquifer storage and recovery technology).

Externalities refer to costs associated with providing water service that are not usually taken into account in least cost utility planning. They tend to be associated with such factors as environmental impacts. Examples are the value of the use of land for environmental habitat, temporary disruption of habitat, and the value of water allowed to stay in the Colorado River unused. IWRP provides a forum in which to consider these often difficult to estimate values.

3.2 BACKGROUND

The 1986 Water Conservation Emergency Plan

In the mid-1980s the City of Austin instituted a Water Conservation Emergency Plan (Ordinance No. 860703-K, passed and approved July 3, 1986). The plan was instituted to relieve stress mainly on over-burdened water and wastewater treatment facilities. During that time, system demands were increasing rapidly due to an Austin growth boom period and infrastructure improvements were unable to stay ahead of demand.

Every year from May 1 through September 30, the Water Conservation Emergency Plan is in effect. The plan is a mechanism by which the City can influence the maximum beneficial use of its water resources. It is a dual purpose plan. On one level, the City uses the ordinance as a vehicle to implement a yearly voluntary water conservation program which raises public awareness about voluntary conservation. On another level, it is a plan that allows the City to impose mandatory controls on water use when demand threatens to exceed capacity.

The 1990 Council Resolution

On December 6, 1990, the City of Austin adopted a Council Resolution to develop and implement a long-range water quality protection plan. In it the Council established the following water use reduction objectives to be achieved by the year 2000:

- Reduce projected maximum-day water demand by 10 percent.
- Reduce projected average-per capita daily consumption by 5 percent.

Quantity-wise, the goals translate to 20 MGD reduction in maximum day demand and 6 MGD reduction in average-day demand. This demand reduction goal is represented graphically as later in this chapter (shown as Demand Reduction Scenario A on the charts in Section 3.4). To achieve these objectives, the Environmental and Conservation Services Department (ECSD) and the Utility are employing IWRP to incorporate both supply and demand-side management aspects of water provision.

Note that there are several ways to interpret the water use reduction goals. The Resolution objective for average demand is expressed in terms of per capita usage. Currently, the Utility and ECSD are interpreting the goals as targeting reduction in total system water use. The total system demand target is calculated as a percentage to be shaved off of the projected demand curves.

In the case of maximum day water demand projection, the LRP team uses a demand curve that includes a 95 percent one-tail test confidence limit for planning purposes as discussed in Chapters 2 and 4. Note that the maximum day demand reduction goal of 20 MGD, discussed above, is calculated from the maximum day demand projections that does not include an added confidence limit.

The Resolution includes the following programs to be implemented by the City:

- Public water conservation education/awareness campaign.
- Enforcement and promotion of plumbing code standards.
- Development and implementation of a long-range master plan for beneficial reuse of "reclaimed" water for non-potable purposes.
- Active participation in development and implementation of a landscape water management program.
- Consider revision of the Austin landscape ordinance to place more emphasis on water conservation.

The City is actively engaged in all of these areas.

3.3 IWRP COMPONENTS

A number of established and emerging components fit into the Integrated Water Resources Planning structure. Namely:

- Conservation Programs and Water Saving Ordinances
- the Water Reuse Plan
- the Water Conservation Rate Structure
- the Water Distribution System Long-Range Planning Guide
- Utility Infrastructure Programs

Each of these components is discussed below. The Trans-Texas Water Program, South Central Texas Study Project and Reliability Task Force also fit into this comprehensive planning approach and are discussed in Chapters 7 and 8 respectively.

Conservation Programs (and Water Saving Ordinances)

Currently, the Environmental and Conservation Services Department (ECSD) is implementing water saving programs in the following areas:

- Public education
- Rebate and incentive programs
- Water saving ordinances

The "City of Austin Water Conservation Plan" report (March 1993 - Montgomery Watson) identified a number of potential water saving programs to achieve positive benefits by water use reduction. Of these, ECSD is currently implementing:

- Xeriscape Public Information Program
- Xeriscape It: residential rebate program for installing water efficient landscape materials
- Dowser Dan Elementary School Program: an education theatrical program for first through fourth grades.
- Efficient Irrigation Program: an audit and rebate program for underground irrigation systems for residential and commercial customers
- 1.6 GPF Toilet Replacement Rebate Program for residential, commercial, and multi-family users
- Indoor Water Audits for residential, commercial, and industrial customers
- City Facilities: plumbing retrofit and Xeriscape landscaping

Table 3-1, Recommended Program Water Savings, from the Water Conservation Plan, provides estimates of water savings associated with measures of the recommended program.

TABLE 3-1

RECOMMENDED PROGRAM WATER SAVINGS

Program Element	1995 Avg, (MGD)	1995 Peak Day (MGD)	2000 Avg. (MGD)	2000 Peak Day (MGD)
Landscape Retrofit	0.04	0.14	0.10	0.36
Irrigation Efficiency Audits/Retrofit	0.46	1.61	1.22	4.29
New Xeriscape Incentive	0.04	0.13	0.10	0.36
Large Landscape Irrigation Audits/Retrofit	0.15	0.52	0.39	1.37
Residential Home Water Audit and Retrofit	0.12	0.21	0.32	1.90
Commercial/Industrial Audits and Rebate	0.69	1.40	1.86	3.74
Manufacturing Audits and Rebate	0.43	0.63	1.15	1.68
City Building Retrofit, Interior	0.01	0.01	0.03	0.03
1.6 GPF Toilet Replacement Program	1.67	1.67	4.47	4.47
School Education	NA	NA	NA	NA
Commercial Landscape Ordinance	0.05	0.09	0.14	0.25
Plumbing Code	0.72	0.72	1.70	1.70
TOTAL WATER SAVINGS	4.38	7.13	11.48	20.15

Source: Water Conservation Plan, Montgomery Watson, 1993

The Water Conservation Plan found that—given the nature of some of the program effects—if the maximum-day goal of 10 percent reduction is made, then the 5 percent average-day reduction target will also be met. This is because one of the most significant programs, toilet replacement, has its greatest impact on reducing average-day demand. In addition to many other programs, the Water Conservation Plan proposes to replace over 15,000 toilets per year from 1993 to the year 2000 to meet the resolution goals. ECSD reports that we are currently replacing far fewer than 15,000 per year because they do not currently have the budget for rebates to replace 15,000 per year. In Fiscal Year 1993-1994 ECSD estimates 3,000 toilets will be replaced.

The recommended programs shown in Table 3-1 could achieve the 10 percent goal of 20 MGD peak day demand reduction. However, current funding levels for programs are well below what would be needed to reach this level of conservation by the year 2000. By using the IWRP approach, investments in other demand and supply management areas such as those discussed in this chapter will reduce the need for any one program to make a large impact on water use reduction in order to increase the likelihood of reaching water use reduction goals. IWRP can be used to decide which aspects of demand and supply management constitute the best investment mix.

The City of Austin also has several ordinances that help reduce water use. They include:

- Plumbing Code Revisions
- Water Conservation Emergency Plan
- Commercial Landscape Ordinance (to be revised)
- Water Waste Ordinance (proposed)

Water Reuse Plan

The Water and Wastewater Utility has both studied and initiated recycling activities over the past few years. The March 1992 CH2M Hill report entitled "City of Austin Master Planning for Recycled Water" supports the 1990 City Council resolution. Currently, a few major projects are in progress and a wide variety of options have been identified. Only non-potable uses for recycled water have been proposed. The Utility is not actively pursuing potable reuse options at the present time. This is because not all questions regarding health effects of recycled water have been answered. However, the LRP team expects continuing evaluation and development of the cost-effectiveness and acceptability of recycling alternatives to lead to an increasing role for recycled wastewater, or reclaimed water, in Austin's water supply over the long term.

At present, the following recycling activities are in progress:

- Use of treated effluent for on-site process and irrigation purposes at Wastewater Treatment Plants (WWTPs):
    - Govalle WWTP (on-site reuse)
    - Hornsby Bend Sludge Treatment Facility (process water supplied by reuse line from South Austin Regional WWTP)
    - South Austin Regional WWTP (on-site reuse)
    - Walnut Creek WWTP (on-site reuse)
- Irrigation of the golf course on the former Bergstrom Air Force Base Site. There is also a potential to use the line for irrigation, toilet flushing, and process water at the new airport facility. The "Bergstrom" line originates at the South Austin Regional WWTP.
- Irrigation of the Jimmy Clay Golf Course and soon the Spikerush Golf Course (under construction). There will be an opportunity to develop additional use by serving industrial customers in the Burleson/Ben White Corridor. This line also originates at the South Austin Regional WWTP.

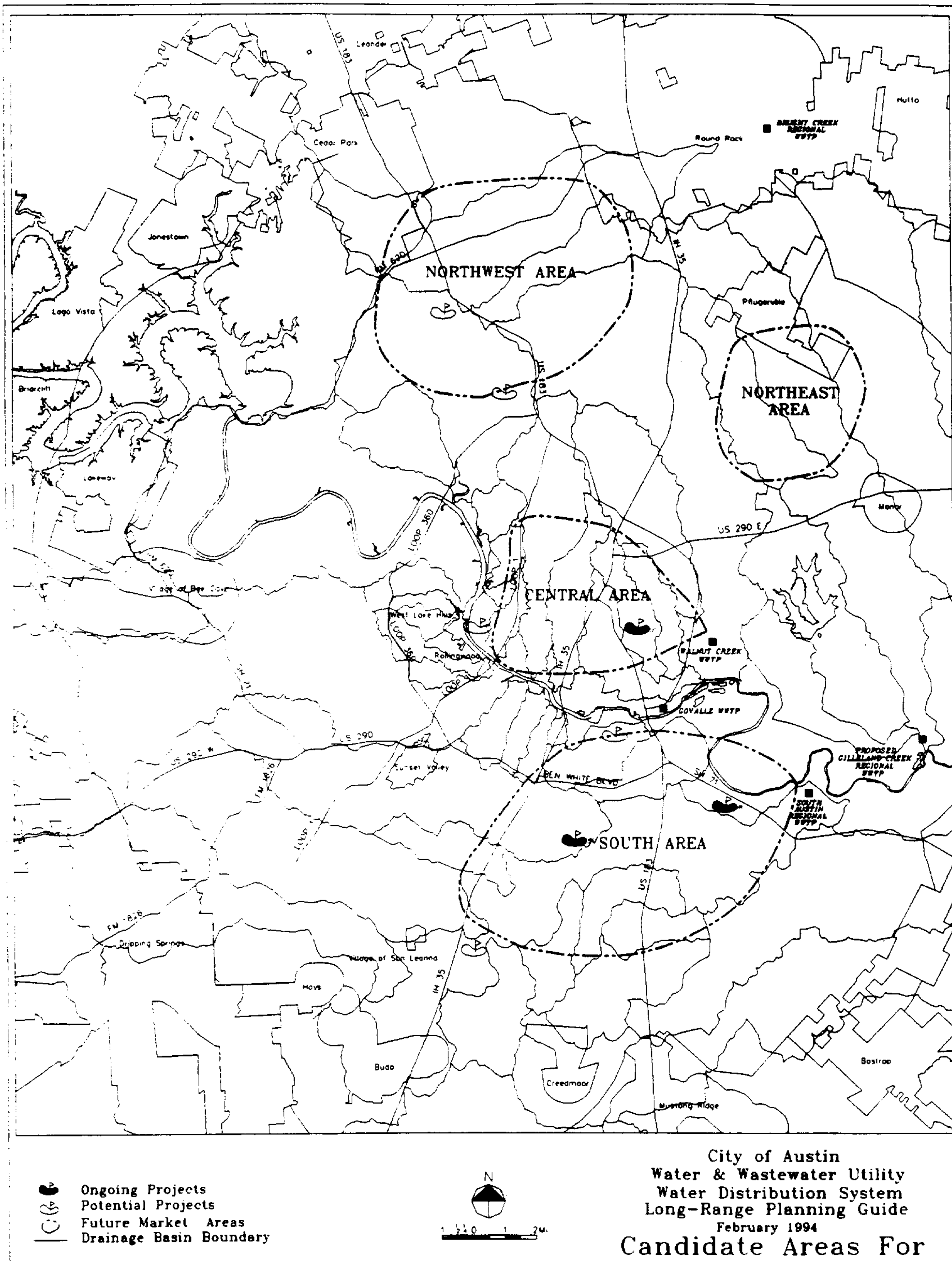
Currently, design of facilities for conveying recycled water from the Walnut Creek WWTP for irrigation of the Morris-Williams Golf Course is scheduled to take place in October 1994. There will be an opportunity to use the recycled water elsewhere for irrigation and possible industrial use at and near the existing municipal airport site.

The 1992 "Master Planning for Recycled Water" identified potential long-term water reuse projects and costs. The proposed recycling projects would lead to use of 8 to 10 MGD of recycled water. The report made recommendations and identified potential long-term water reuse candidates, including:

- Central Reuse System - developing a pipeline to provide irrigation water for the Morris-Williams Golf Course, with the potential to expand the system to neighboring businesses such as Tracor and Motorola and eventually extend lines west to serve Lions Golf Course and neighboring users.
- South Reuse System - developing a system similar to the one mentioned above serving the South side of the city, including the former Bergstrom Air Force Base and the Ben White Corridor.
- Establishing a Conservation and Reuse Demonstration House for public education purposes.
- Substituting recycled water for Colorado River water at Lake Walter E. Long for Decker Power Plant cooling water.
- Exploring pricing, market development, economic development, and grant funding aspects of recycling.
- Northwest and Northeast Wastewater System Studies - may involve "water factory" concept in which, to some extent, water is used, recycled, and used again all in the same general area.
- Develop Public Information and Water Quality Monitoring Programs

Figure 3-1, Candidate Areas For Water Recycling Map, shows the general locations and areas of some existing and proposed projects.

Water factories may become more cost-effective when the City must begin purchasing water from the Lower Colorado River Authority (currently estimated to begin in the year 2002). These "factories" typically consist of package treatment facilities located beside a major interceptor. The factory "taps" some of the large interceptor flow during months of heavy irrigation, treats the water and discharges it to a nearby user. The remaining wastewater in the interceptor continues on to the WWTP. Water factory sludge and filtrate are returned to the interceptor.



City of Austin
Water & Wastewater Utility
Water Distribution System
Long-Range Planning Guide
February 1994

Candidate Areas For Water Recycling Map

Figure 3-1

By reclaiming water near the site of its intended use, water conveyance costs are kept to a minimum. This concept is in keeping with the Texas Natural Resource Conservation Commission (TNRCC) regional management of wastewater treatment facilities because operation of the factories remains within the Utility. Figure 3-1 depicts the future market areas suggested in the Master Planning for Recycled Water Report where some of these water factories could be located.

PUBLIC ACCEPTANCE

Among the critical concerns regarding water recycling is public acceptance of potential uses. Generally, the more indirect the use, the more acceptable it is. For example, the public is accustomed to and accepts the reuse that occurs when upstream users discharge treated effluent into a surface water source used by a downstream user. Irrigation of golf courses, parks and highway medians is also widely accepted when the reliability of the wastewater treatment system and prevention of excess run-off is assured.

More direct forms of reuse such as aquifer recharge or direct connection to a water plant have been found to be much less acceptable. To date these less acceptable uses have not been considered by the Utility, since a variety of opportunities for landscape irrigation and industrial/commercial use are available.

Despite the focus on more acceptable forms of reuse, public education is likely to be required to assure acceptance. Research indicates that increased knowledge about the reasons for reuse and its applications increases public acceptance.

Water Conservation Rate Structure

The water conservation rate structure has been developed in conjunction with the Utility's Cost of Service Study. The City Council approved the rate structure in November 1993. The new residential rate structure will go into effect in April/May of 1994. It is an inclining block residential rate mechanism by which water customers pay higher rates for water use above a certain threshold. This structure is expected to mainly reduce residential landscape watering and summer water use. The water savings associated with this component are currently unknown. However, the Utility plans to quantify the affects once the structure is in place. It will be interesting to see if the structure has long term water use reduction benefits.

Similar structures may be applied to other customers categories in the future.

Water Distribution System Long-Range Planning Guide

This guide is a component of the Utility's broad-scoped Integrated Water Resources Planning effort. It is a baseline facilities plan from which we can make decisions and develop comparisons. The Guide is an "in-house" document making it easier to update and revise as effects of IWRP come to light.

The recommended facilities presented in the plan are designed to meet a specific flow criteria. Depending on the results of demand-side management efforts, the timing of needed facilities may change significantly. Since the facilities plans are designed to supply given flows in the system, not given time frames, lowering of the demand projection curves will act to postpone the timing of the need for planned facilities.

Utility Infrastructure Programs

The City of Austin has a number of on-going efforts that improve water supply capacity. The main programs are as follows:

- leak detection and repair
- line maintenance and rehabilitation
- leak credit program for customer leak repairs
- meter repair and replacement

3.4 IWRP BENEFITS

Some of the main benefits of IWRP are listed below:

- Provides for least cost improvements to meet needs
- In some cases allows for postponement of major investments

- Increases environmental sensitivity
- System flexibility is increased
- Increases potential for public acceptance
- Increases reliability and efficiency
- Reduces risk by calling for smaller scale investments
- Avoids depletion of water supplies

Reductions in different types of use create a variety of benefits directly related to facilities costs. Typically, benefits result from deferral of major investments. Regarding near term major facilities requirements, the stage is fairly well set. However, in the longer range, given time and the right level of acceptance, the benefits of the IWRP approach are expected to materialize.

Maximum-Day-Demand-Driven Benefits

As described in Chapter 2, the LRP team estimated the timing of maximum-day-demand-driven improvements with a view to ensuring that water supplies will be available when needed. We use the maximum-day with 95 percent confidence limit total system demand figures. These estimates, referred to as "current trend", are made using historical data and population and employment projections.

From the maximum-day 95 percent confidence limit demand baseline, we drew a new curve showing the total system effect of a 10 percent reduction in projected maximum-day demand (Maximum Day Demand Reduction Scenario A, 1990 City Council Resolution Goal). We also projected a more aggressive Maximum Day Demand Reduction Scenario B, which shows an additional 10 percent reduction of maximum-day demand by the year 2020. Figure 3-2, Maximum Day Demand With Effects Of Aggressive Demand Management, shows these demand projection curves.

Maximum Day Demand with Effects of Aggressive Demand Management

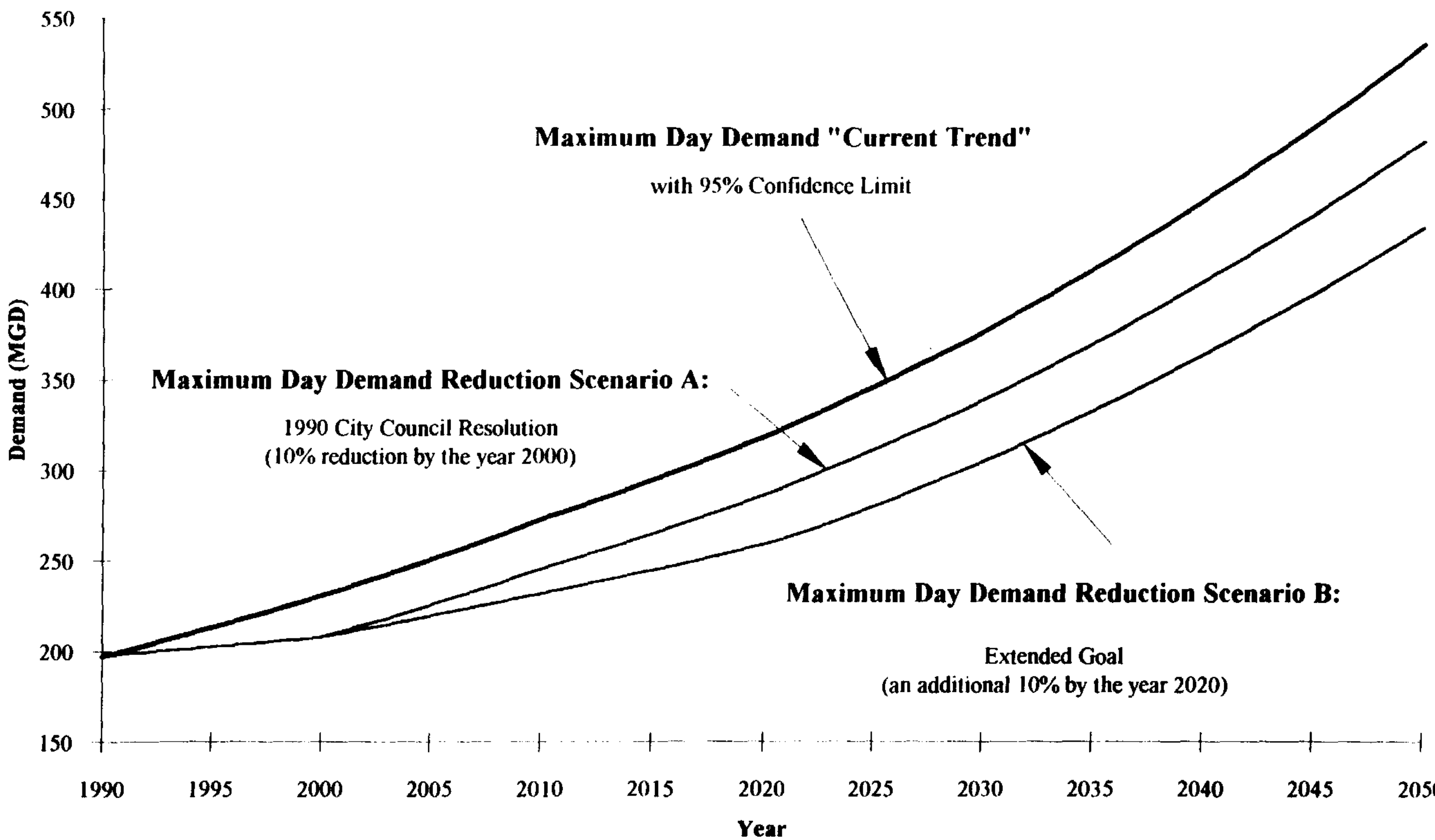


Figure 3-2

Raw Water Purchase and Water Rights Timing and Demand with Effects of Aggressive Demand Management

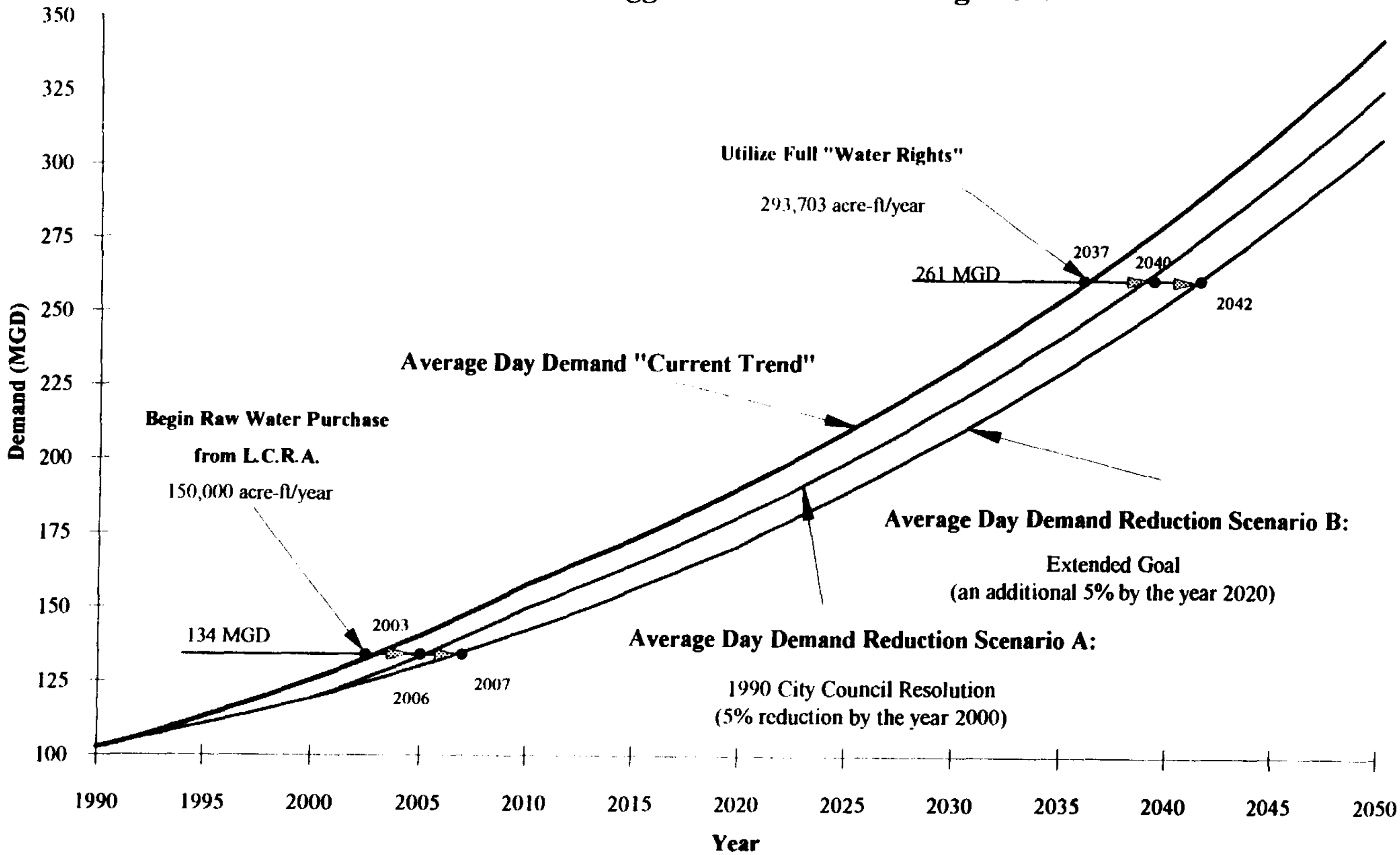


Figure 3-3

By lowering the demand curve, the timing of the need for facilities changes. Since water treatment plants are designed for maximum day demand conditions, lowering the maximum day demand curve makes it possible to postpone the need for such facilities. These benefits are discussed in more detail in Chapter 4, Treatment Facilities Plans.

Average-Day-Demand-Driven Benefits

Reducing average-day demand postpones the time at which the City must make raw water purchases from Lower Colorado River Authority and the time at which the City reaches the limits of its adjudicated water rights. All types of demand management aid in reducing system energy and operation costs and reduce water bills for water conservation program participants.

Figure 3-3, Raw Water Purchase And Water Rights Timing And Demand With Effects Of Aggressive Demand Management, illustrates the "current trend" average-day demand projection. In addition, two aggressive demand reduction scenarios are shown. There is an average-day demand curve with the 5 percent water conservation target curve (Average Day Demand Reduction Scenario A, 1990 City Council Resolution Goal). Also, there is an Average Day Demand Reduction Scenario B (an extended goal) curve showing an additional 5 percent water use reduction by the year 2020.

Figure 3-3 shows that if the Average Day Demand Reduction Scenario A (1990 City Council Resolution Goal of 5 percent reduction by the year 2000) target is met:

- The estimated year the City will be required to begin raw water purchases from the LCRA could be postponed from the year 2003 to 2006 (a 3-year deferral).
- The projected year the system will reach the limits of the City's adjudicated water rights could be postponed from the year 2037 to 2040 (a 3-year deferral).

Assuming the first goal is met by the year 2000, Figure 3-3 shows that if the additional 5 percent demand reduction by the year 2020 target is met:

Raw Water Purchase and Water Rights Timing and Demand with Effects of Aggressive Demand Management

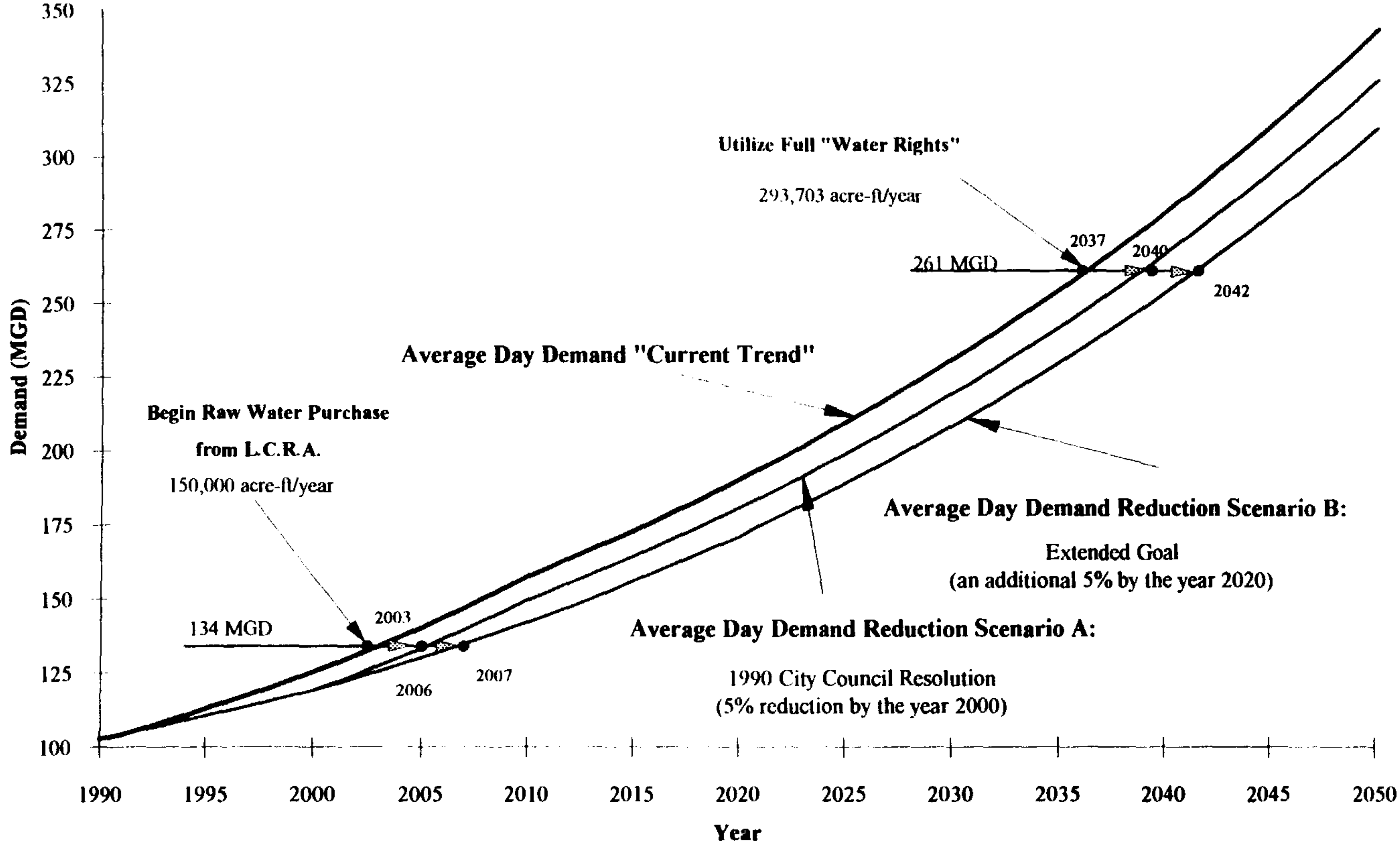


Figure 3-3

- The estimated year the City will be required to begin raw water purchases from the LCRA could be postponed from the year 2003 to 2007 (a 4-year deferral).
- The projected year the system will reach the limits of the City's adjudicated water rights could be postponed from the year 2037 to 2042 (a 5-year deferral).

To illustrate the value of the deferral of raw water purchases, we estimated the amount the Utility will be required to spend on raw water purchases through the year 2017. These calculations assume a cost of raw water of $105/acre-ft: the current LCRA rate, which is anticipated to remain in effect until 1999. In accordance with the terms stipulated in the Comprehensive Water Settlement Agreement Between the City of Austin and the LCRA (December 10, 1987), the cost of raw water was calculated based on the amount of water used each year above the 150,000 acre-ft/year (134 MGD average day) "limit". As a point of interest, the LCRA often uses $200/acre-ft in their long-range conservation planning analyses to reflect the cost of developing new water supplies.

For each of the demand reduction scenarios, the average annual savings in the 15 year period from 2003 to 2017 were calculated. Average Day Demand Reduction Scenario A (1990 Council Resolution Goal) results in an average savings of $1.1 million per year over the "current trend" payments. Scenario B (Extended Goal) results in an average savings of $1.7 million per year as compared to "current trend". As these dollar amounts show, reductions in average day demand associated with demand management offer the potential for significant savings during the planning period.

3.5 MONITORING IWRP SUCCESS

The LRP team has taken an approach that focuses on the timing of key facility events (major projects), triggered by demand reaching a given level. As events shift on the time line, the Utility can adjust facility needs timing accordingly. As regards demand management, therefore, the proof will be measured reductions of demand. That is, if usage data show a slowing of demand growth, future issues of this Planning Guide will reflect that success. The LRP team uses "current trend" and can adjust projections to reflect a changing reality.Until an historical data set is collected, it will be difficult to quantify the system impacts of water demand management programs. Effects of changes in the plumbing code requiring installation of low-flow toilets and shower heads, etc. and xeriscape programs will also need to be analyzed as data becomes available. ECSD is working to establish meaningful measures of conservation program effectiveness.

Austin has some demand monitoring instrumentation in place, since it formed part of the cost-of-service rate study implemented in 1991. This provides an opportunity to target programs to measurable relatively homogeneous user type areas. This data will be used to monitor consumption patterns and demand management effects.

CHAPTER 4

TREATMENT FACILITIES PLANS

Chapter 4 discusses the long-range program recommended by the LRP team for upgrading and expanding treatment facilities to meet demand and comply with regulations. It includes:

- Recommended timing for treatment plant expansions and the corresponding cost estimates.
- Discussion of the impact of aggressive demand management (IWRP) on treatment plant expansion timing (including economic analysis)
- Information on what is involved in bringing Water Treatment Plant 4 and its associated distribution facilities through the design and construction process and into the system.
- Confirmation that winter treatment plant capacity is adequate to allow down-time for maintenance.
- An overview of sludge disposal practices.
- Discussion of the implications of the Safe Drinking Water Act (SDWA) Amendments.

4.1 TREATMENT PLANT EXPANSION TIMING

"Current Trend" Timing

The provision of treatment plant capacity should prove challenging in light of provisions of the Safe Drinking Water Act and site limitations of existing facilities. Upgrades to the treatment facilities will meet Americans with Disabilities Act requirements. Compliance with Occupational Safety and Health Administration regulations may soon be required as a result of pending legislation in the United States Congress. The Engineering Division is proposing to create a Utility Water Treatment Task Force to address all of the complicated treatment plant issues. The LRP Guide team supports the creation of this Task Force.

The City currently operates 3 water treatment plants (WTPs)—Davis, Green, and Ullrich—with a total combined treatment capacity of 225 MGD.

The Davis WTP (120 MGD) occupies a site that limits expansion or major upgrade of processes. This plant is expected to continue functioning at its current capacity throughout the 45-year planning period.

The Green WTP (45 MGD) operates on a site that limits any major expansion or upgrading of treatment processes. Its capacity will eventually be replaced by WTP 4. If the 1998 requirements for the Safe Drinking Water Act (SDWA) Phase II Disinfection/Disinfection By-Products (D/DBP) Rule require expensive space-consuming modifications, the aging Green WTP may need to be replaced by the year 2002. Without the restrictions of this proposed rule, it could continue in service until WTP 4 comes on line (about 2017).

The Ullrich WTP (60 MGD) can be expanded. As demand approaches current capacity limits, the LRP Guide team assumed the Ullrich plant would first be expanded to 100 MGD. The 100 MGD capacity was based on existing CIP projects defined prior to promulgation of the D/DBP Rule. We anticipate the expansion will be needed in the relatively near future (by 1998). Our estimates indicate that the plant will need to be expanded again in about 2008, this time to 140 MGD which is considered to be the limit of its site.

The proposed WTP 4 represents the largest water system investment of the planning period. Together with its associated mains and facilities, WTP 4 will require an investment of $173 million—about half of the total new CIP investment for the 45-year period. WTP 4 will also change the operating strategy for a large part of the system. The LRP team recommends an initial capacity of 100 MGD by the year 2018, with expansion to 160 MGD by the year 2028.

Figure 4-1, Treatment Plant Expansion Timing With "Current Trend" Demand, shows how and when rising demand is projected to trigger the need for the recommended improvements. Table 4-1, Treatment CIP Improvements and Cost Estimates, outlines the corresponding costs. CIP expenditures total $205 million for the 45-year period.

As implied above, growth in demand is the primary factor creating the need for new investment in treatment capacity, although increasingly stringent regulations may also play a role. Each of the recommended major projects provides an increment of capacity sufficient to meet increases in demand for approximately ten years.

If Green WTP is taken off line, due to SDWA regulations, Ullrich WTP needs to be expanded to 140 MGD before Green WTP is decommissioned. Without Green, and with Davis at 120 MGD and Ullrich at 140 MGD, system treatment capacity totals 260 MGD. The maximum-day demand, with the 95 percent confidence limit, reaches 259 MGD in the year 2007. Therefore, WTP 4 would be needed by the year 2008 (9 years earlier than otherwise projected).

Figure 4-1 shows the 225-MGD capacity line meeting the maximum-day 95 percent confidence limit demand line just after the year 1998. Given that Ullrich WTP is the only expandable existing plant and that we are recommending the addition of the Ullrich Medium Service Transmission Main before the year 2000, upgrade of Ullrich WTP is the logical first step to increase treatment capacity. We feel that this capacity will also provide reliability and flexibility of operation in the near term, particularly when SDWA related construction is occurring.

The expansion of Ullrich to 100 MGD has been taken as part of the baseline set of facilities referred to as "existing" in this Guide and our analysis indicates that an expansion should be accomplished by 1998. Projects to expand Ullrich have been under construction for some time. However, the size of the expansion and magnitude of funding have not been determined largely due to issues still under consideration associated with the not yet adopted SDWA Disinfection/Disinfection By-Products Rule.

Treatment Plant Expansion Timing with "Current Trend" Demand

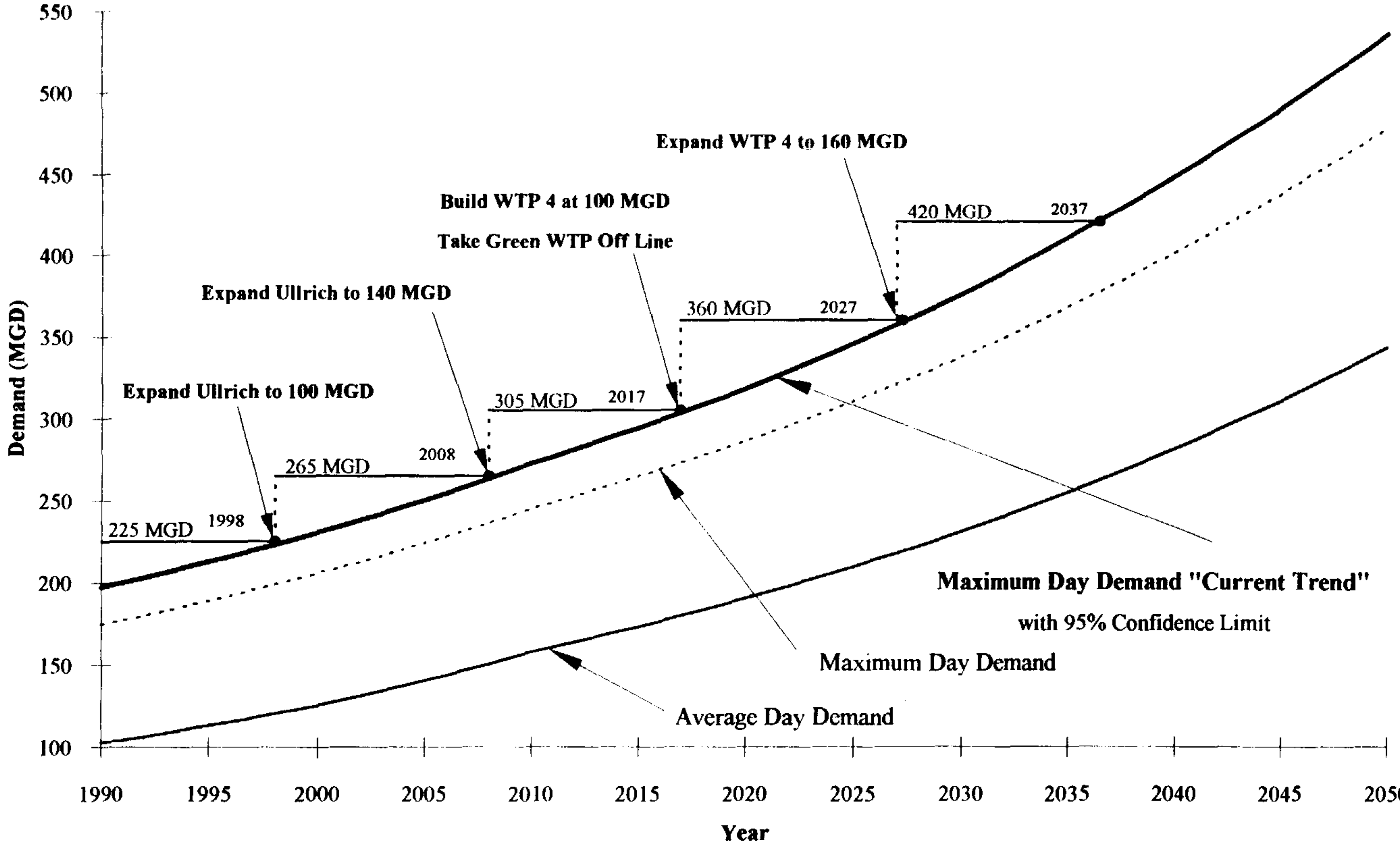


Figure 4-1

Table 4-1

TREATMENT CIP IMPROVEMENTS AND COST ESTIMATES

TREATMENT Description	Treatment Capacity (MGD)	Total Cost Estimate (dollars)	Recommended Before Year
ULLRICH WTP UPGRADE	100 to 140	20,000,000	2010 (2008)
WATER TREATMENT PLANT 4	100	128,000,000	2018
WATER TREATMENT PLANT 4 UPGRADE	100 to 160	57,000,000	2037
TOTAL TREATMENT		***$205,000,000***	

TOTAL WTP CIP IMPROVEMENTS

YEAR 2000	$0
YEAR 2010	$20,000,000
YEAR 2017	$0
YEAR 2018	$128,000,000
YEAR 2037	$57,000,000
TOTAL	$205,000,000

Note: Costs for upgrading Ullrich WTP to 100 MGD are not included in this table.

The 265-MGD capacity line meets the demand line just after the year 2008. This triggers expanding the Ullrich WTP to 140 MGD, which is now assumed to be the effective maximum treatment capacity at the Ullrich site. This $20-million improvement will bring the total system treatment capacity to 305 MGD.

The 305-MGD capacity line intersects the demand line just after the year 2017. Since our recommendations would have resulted in the existing sites having been expanded to their maximum limits, a new water treatment plant would be needed at that time. The Utility has already invested in a new plant site and planning and engineering for a fourth plant and associated facilities. The LRP team assumed the Utility would proceed with the proposed WTP 4 facility at the existing site near the intersection of RM 2222 and RM 620 (the Four Points area).

In 2017, Green WTP will be over 90 years old and may encounter increasing difficulty in meeting SDWA requirements. The LRP team recommends that WTP 4 be designed with enough capacity to allow the retirement of Green. Therefore, the Guide recommends designing WTP 4 at a treatment capacity of 100 MGD for the first phase. This treatment capacity addition (minus the Green WTP) brings total capacity to 360 MGD.

The first phase of the plant is currently estimated at about $128 million (see Table 4-1). The associated distribution facilities cost estimates amount to about $45 million for a combined total project cost of $173 million before the year 2018.

The 360-MGD capacity meets the demand line in the year 2027; at this time a WTP 4 treatment capacity upgrade is needed. We recommend an additional 60 MGD at WTP 4 to supply the system through the year 2037 time horizon. This will bring the system total to 420 MGD. The 60 MGD expansion will cost an estimated $57 million. Additional information on WTP 4 appears later in this chapter.

Impacts of Aggressive Demand Management on Treatment Plant Expansion Timing

As discussed in Chapter 3, aggressive demand-side management has the potential to be of great benefit by allowing the postponement of major facilities investments. Figure 4-2, Treatment Plant Expansion Timing And Demand With Effects Of Aggressive Demand Management, shows the two "demand reduction scenario" curves. The figure shows the timing of key treatment plant expansion events under the different demand reduction scenarios.

In this section the deferral timing and economic impact are discussed for each of the following three treatment plant expansion projects:

- The Ullrich WTP Expansion from 100 to 140 MGD
- The Initial Construction of WTP 4 (at 100 MGD) and associated distribution facilities
- The Expansion of WTP 4 from 100 MGD to 160 MGD with associated distribution facilities

Note that the Ullrich WTP expansion from 60 MGD to 100 MGD is also shown on the figure. In the judgment of the LRP team, there is insufficient data on changing usage patterns to justify postponing the Ullrich expansion based on conservation goals being met in the short term. Therefore, prudent planning suggests that the 1998 completion target be used. Also, in the broad scheme covered by this long-range planning Guide, the project is not anticipated to be a major scale investment due to the existing infrastructure in place at the plant. Therefore, the timing and economic impact of the Ullrich Expansion to 100 MGD is not discussed here.

Note that the economic analysis simply shows the benefit of the capital investment deferral. This is only one part of the Integrated Water Resources Planning economic picture. To paint the full picture of the benefits of these deferrals, the loss of revenue, the costs of programs to reduce demands, and the operations and maintenance costs would need to be weighed against the cumulative value of the deferrals. Other less tangible costs and benefits related to environmental impacts, risk management, and reliability would ideally be factored in as well.

Treatment Plant Expansion Timing and Demand with Effects of Aggressive Demand Management

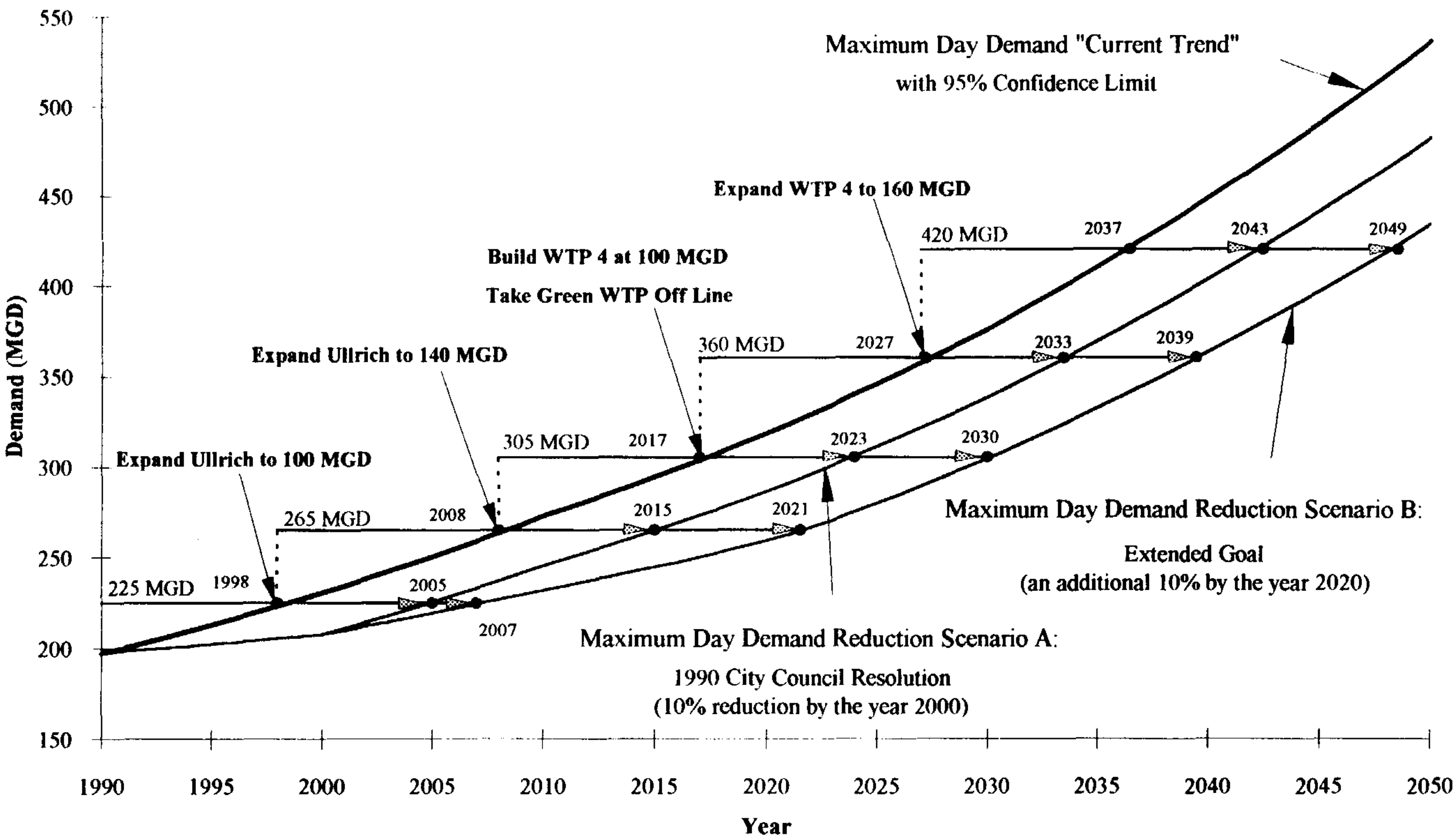


Figure 4-2

THE ULLRICH WTP EXPANSION FROM 100 TO 140 MGD

Based on "Current Trend" demand projection, this project is needed in the year 2008. The cost estimate in 1993 dollars is $20 million. Assuming a three year design and construction schedule, the roughly estimated "current trend" project cash flow is as follows:

Year	Cash Amount	
2006	$4 million	(20%)
2007	$8 million	(40%)
2008	$8 million	(40%)
	$20 million	(100%)

As shown on Figure 4-2, the curve for Maximum Day Demand Reduction Scenario A (1990 City Council Goal of 10 percent reduction by the year 2000) indicates the project can be postponed 7 years (from year 2008 to 2015). Therefore, the cash flow for this timing would be over the period of year 2013 to 2015.

As shown on Figure 4-2, the curve for Maximum Day Demand Reduction Scenario B (Extended Goal of an additional 10 percent by the year 2020) indicates the project can be postponed 13 years (from year 2008 to 2021). Therefore, the cash flow for this timing would be over the period of year 2019 to 2021.

The following shows the results of a net present value analysis for the Ullrich WTP expansion (100 to 140 MGD) project showing the value of project deferral (using a 3 percent real discount rate):

	Total Outlays 1993 Dollars	NPV of Outlays 1993 Dollars	NPV of Deferral Savings
Current Trend:	$20 million	$12.8 million	$0.0 million
Scenario A:	$20 million	$10.4 million	$2.4 million
Scenario B:	$20 million	$ 8.7 million	$4.1 million

Source: Utilities Finance Division, Water and Wastewater Utility, January 1994

Note that Scenario A provides $2.4 million in net present value of deferral savings over "current trend" while Scenario B provides $4.1 million.

THE INITIAL CONSTRUCTION OF WTP 4 (AT 100 MGD) AND ASSOCIATED DISTRIBUTION FACILITIES.

Based on "current trend" demand projection, this project is needed in the year 2017. The cost estimate in 1993 dollars is $173 million. Assuming a five year design and construction schedule, the roughly estimated "current trend" project cash flow is as follows:

Year	Cash Amount	
2013	$17.3 million	(10%)
2014	$17.3 million	(10%)
2015	$43.3 million	(25%)
2016	$51.9 million	(30%)
2017	$43.2 million	(25%)
	$173.0 million	(100%)

As shown on Figure 4-2, the curve for Maximum Day Demand Reduction Scenario A (1990 City Council Goal of 10 percent by the year 2000) indicates the project can be postponed 6 years (from year 2017 to 2023). Therefore, the cash flow for this timing would be over the period of year 2019 to 2023.

As shown on Figure 4-2, the curve for Maximum Day Demand Reduction Scenario B (Extended Goal of an additional 10 percent by the year 2020) indicates the project can be postponed 13 years (from year 2017 to 2030). Therefore, the cash flow for this timing would be over the period of year 2026 to 2030.

The following shows the results of a net present value analysis for the WTP 4 (at 100 MGD) project with associated distribution facilities showing the value of project deferral (using a 3 percent real discount rate):

	Total Outlays 1993 Dollars	NPV of Outlays 1993 Dollars	NPV of Deferral Savings
Current Trend:	$173 million	$86.4 million	$ 0.0 million
Scenario A:	$173 million	$72.4 million	$14.0 million
Scenario B:	$173 million	$58.9 million	$27.6 million

Source: Utilities Finance Division, Water and Wastewater Utility, January 1994

Note that Scenario A provides \$14.0 million in net present value of deferral savings over "current trend" while Scenario B provides \$27.6 million.

THE EXPANSION OF WTP 4 FROM 100 MGD TO 160 MGD
WITH ASSOCIATED DISTRIBUTION FACILITIES

Based on the "current trend" demand projection, this project is needed in the year 2027. The cost estimate in 1993 dollars is \$69 million. Assuming a three year design and construction schedule, the roughly estimated "current trend" project cash flow is as follows:

Year	Cash Amount	
2025	\$13.8 million	(20%)
2026	\$27.6 million	(40%)
2027	\$27.6 million	(40%)
	\$69.0 million	(100%)

As shown on Figure 4-2, the curve for Maximum Day Demand Reduction Scenario A (1990 City Council Goal of 10 percent by the year 2000) indicates the project can be postponed 6 years (from year 2027 to 2033). Therefore, the cash flow for this timing would be over the period of year 2031 to 2033.

As shown on Figure 4-2, the curve for Maximum Day Demand Reduction Scenario B (Extended Goal of an additional 10 percent by the year 2020) indicates the project can be postponed 12 years (from year 2027 to 2039). Therefore, the cash flow for this timing would be over the period of year 2037 to 2039.

The following shows the results of a net present value analysis for the expansion of WTP 4 (100 to 160 MGD) project with associated distribution facilities showing the value of project deferral (using a 3 percent real discount rate):

	Total Outlays 1993 Dollars	NPV of Outlays 1993 Dollars	NPV of Deferral Savings
Current Trend:	$69 million	$25.1 million	$0.0 million
Demand Reduction Scenario A:	$69 million	$21.0 million	$4.1 million
Demand Reduction Scenario B:	$69 million	$17.6 million	$7.5 million

Source: Utilities Finance Division, Water and Wastewater Utility, January 1994

Note that Scenario A provides $4.1 million in net present value of deferral savings over "current trend" while Scenario B provides $7.5 million.

SUMMARY

The cumulative net present value of deferral savings for Demand Reduction Scenario A is about $21 million and for Scenario B about $39 million as Figure 4-3 illustrates (compare Net Present Value of Outlays). When this benefit is weighed against the various direct and indirect costs and other benefits of achieving these postponements, it will likely be cost effective to make significant investments toward achieving demand reductions.

However, while the outlook for success in causing significant demand reductions is improving, we need to be prudent in planning facilities at this time. Until our observations confirm that our demand reduction efforts significantly affect actual water usage, we should continue to plan for current trends. As we observe new evidence of demand reduction, we will change our investment plans to reflect new trends in usage brought about by aggressive demand management.

Net Present Value of Treatment Plant Expansion Project Deferrals

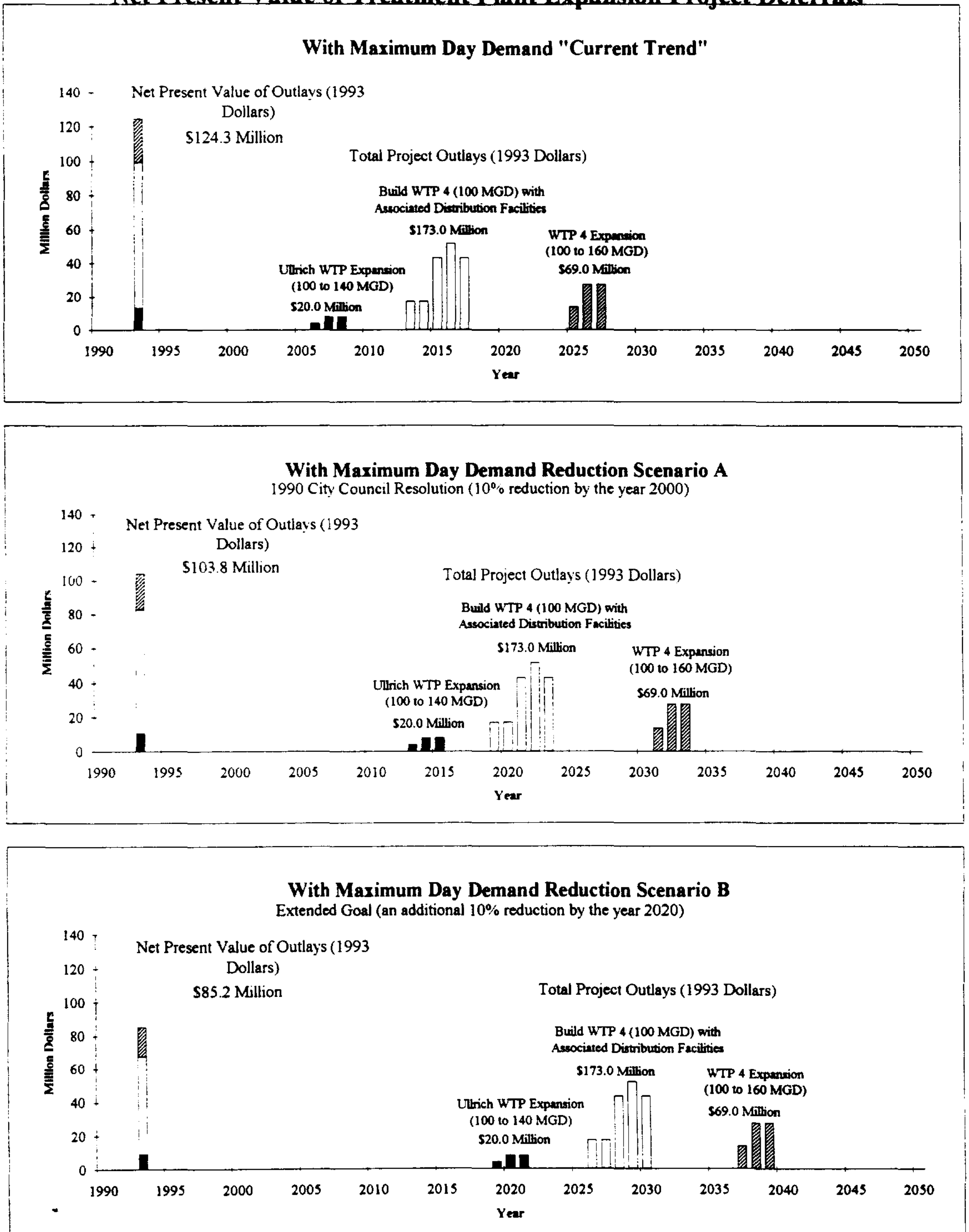


Figure 4-3

4.2 WATER TREATMENT PLANT 4 (WTP 4)

Water Treatment Plant 4 has special significance in long-range planning both because its operation will change the system operating strategy and because of the large investment it represents.

WTP 4 was designed in the early 1980s when growth projections were high. Plans for the plant have been on hold since 1989. For detailed information concerning WTP 4, refer to the SITE SELECTION AND PRELIMINARY DESIGN REPORT: WATER TREATMENT PLANT NUMBER 4 by Lake Travis Consultants, April 1985.

Capacity

We recommend WTP 4 have an initial treatment capacity of 100 MGD. This will provide capacity to allow retirement of the Green WTP and will add about a 10-year increment of supply. Second-phase improvements to bring WTP 4 to 160 MGD are projected to be needed by the year 2028.

The 1987 LCRA agreement stipulates that the capacity of the WTP 4 intake pumps will be limited to 150 MGD. There is a discrepancy between the agreement and the 160-MGD capacity that this Guide suggests will be needed.

Location

The Guide assumes that WTP 4 will be constructed at the existing site near the intersection of RM 2222 and RM 620 (near the Four Points area). This site was purchased in the mid-1980s. It is essentially surrounded by proposed Balcones Canyonlands Conservation Plan (BCCP) land acquisition area. As of this writing, the proposed BCCP arrangement will provide for the location of the plant and transmission main routing out of the facility. However, depending upon the final BCCP arrangements, other sites for WTP 4 may need to be considered. Chapter 6 provides more information on BCCP issues.

Operations

With WTP 4 providing just under one-third of total system demand, the system operation scheme will change. The LRP team recommends keeping operation strategies in the South and Southwest Pressure Zones similar to those of the existing system. Adjustments will be required in the Central Zone, however, to accommodate the absence of the Green WTP and the presence of WTP 4.

The Ullrich and Davis Plants will supply the demands of the Central, South, and Southwest Pressure Zones. They will also supply a portion of the North Pressure Zone. WTP 4 will supply the Northwest Pressure Zones and a portion of the North Pressure Zone. With this operation strategy, Spicewood Springs PS will no longer be needed to routinely move water to the northwest. Instead, water will be moved from the northwest toward the center of the system.

In a balanced maximum-day operations scenario, Davis could contribute 100 MGD, Ullrich 120 MGD and WTP 4 85 MGD (each at 85 percent of capacity), serving a total system demand of 305 MGD. With WTP 4, new system operating strategies will become available.

We recommend supplying WTP 4 water to the North Pressure Zone initially through a Pressure Control Station (PCS) at the Howard Lane Reservoirs. Later, we recommend adding a second WTP 4 water supply point to the North Zone near Spicewood Springs Road and Loop 360 (Spicewood PCS).

Associated Distribution Facilities

Many associated distribution facilities will be needed to integrate WTP 4 into the system. Pump stations will be required to pump the water from the plant into the system. Large transmission mains will be needed to move the pumped water from the plant into the various pressure zones where needed.

The following is a list of facilities associated with WTP 4:

- Water Treatment Plant 4
- Spicewood Springs TM

- WTP 4 NWA PS Discharge TM - Forest Ridge
- WTP 4 NWA PS Discharge TM - Jollyville
- Martin Hill TM
- Howard Lane NWA TM
- WTP 4 NWA Pump Station
- WTP 4 NWB Pump Station
- Howard Lane Pressure Control Station (PCS)
- Flow Control Station/Valve (FCS) at Jollyville Reservoir
- WTP 4 Upgrade
- North Zone TM
- WTP 4 NWB PS Discharge TM
- WTP 4 NWA PS Upgrade
- Spicewood Springs Pressure Control Station (PCS)
- Flow Control Station/Valve (FCS) at Four Points

4.3 WINTER CAPACITY DURING MAINTENANCE

The LRP team reviewed winter treatment plant capacity to establish the system's ability to meet winter demand while some facilities are off line for maintenance. Two of the three plants have routine maintenance scheduled during the winter that reduces the amount of water available to be pumped into the system.

The Davis WTP routinely has three of its conventional sedimentation basins scheduled for maintenance at a time. Some of the basins may be out of service throughout the entire off-season. Therefore, the Davis WTP capacity will vary from 80 to 120 MGD depending upon how many basins are down. For the purpose of this analysis, the Davis WTP winter capacity was established as 80 MGD.

The Green WTP has two conventional sedimentation basins. One of the basins is rated at 15 MGD and the other is rated at 30 MGD. Routinely, a Green basin would be down for approximately two months. Therefore the Green WTP is rated at 15 MGD for winter operation.

The Ullrich WTP is and will continue to be equipped with up-flow solid contact clarifiers. The maintenance schedule on these clarifiers is no different in the winter than in the summer. Additionally, Ullrich is planned to have a standby clarifier available at all times. Therefore, the Ullrich WTP winter capacity is the same as its maximum-day capacity.

We compared the winter treatment capacity of the plants to the average-day demand for each planning period. This is a conservative approach, since demand in many winter months falls below average-day demand. For example, during February demand is typically about 80 percent of average-day usage. Also, the Davis WTP and the Green WTP may have more capacity available at times than their rated winter operating capacity. Table 4-2, Winter Treatment Plant Capacities, shows the relationship between winter capacities and average-day demand.

TABLE 4-2

WINTER TREATMENT PLANT CAPACITIES

Year	2000	2010	2017
Davis Capacity	80 MGD	80 MGD	80 MGD
Green Capacity	15 MGD	15 MGD	15 MGD
Ullrich Capacity	100 MGD	140 MGD	140 MGD
Total Capacity	195 MGD	235 MGD	235 MGD
Average Day Demand	136 MGD	168 MGD	182 MGD
Excess Winter Capacity	59 MGD	67 MGD	53 MGD

The Utility should enjoy a healthy winter demand versus winter capacity relationship throughout the life of the Green WTP. Design and operational considerations for WTP 4 should continue this relationship. System infrastructure that will meet maximum-day demand will be sufficient to transfer treated water in the winter to the individual pressure zones.

4.4 WATER TREATMENT PLANT SLUDGE DISPOSAL

The water treatment sludges produced are primarily calcium carbonate with a high magnesium hydroxide content. The sludges contain much of the original suspended and colloid material contained in the raw water supply plus the chemical added to produce coagulation.

The sludge is essentially composed of relatively inert material. The recent changes in coagulation chemicals to a lesser dosage of lime and higher dosage of ferrous sulfate may slightly alter the quality of sludge produced. However, the relatively inert nature of the sludge should be retained even with these changes in chemicals and dosages. The sludges should continue to be monitored to ensure this inert quality.

Sludge is dewatered at each of the existing water treatment plants by use of centrifuges to produce solid concentrations in the sludge of about 35 to 50 percent. These existing sludges are trucked to the City of Austin Shaw Lane facility in Southeast Travis County. The Shaw Lane disposal facility is an old gravel pit that is being reclaimed for beneficial use by using the inert solids from the water treatment sludge to fill the pit. The City of Austin has a TNRCC permit for this purpose.

The sludge from WTP 4 will be used for the same purpose at a gravel pit located in lower Williamson County near Leander. Sludge is proposed to be transported by use of a slurry pipeline rather than by truck. This is a more efficient method in which the sludge solids are pumped to the site and the carrier water (supernatant) is returned to the water treatment plant for recovery and use. This saves on sludge processing and transportation.

The sludge disposal facilities at each existing water treatment plant have been or are being upgraded by current projects to provide sludge treatment capacities, which match their water treatment capacities. The problems with trucking sludge have been and are primarily due to conditions caused by the truck traffic in residential areas. This problem is being addressed by choice of trucking routes, time of delivery and public education.

By putting the water treatment plant sludges to beneficial use in reclaiming abandoned gravel pits, the City of Austin has solved the issue of disposal in an enlightened manner. The Utility will continue to monitor sludge quality and regulatory trends. This current method of final disposal appears to be the method of choice, and the gravel pits appear to have capacity throughout the planning period.

4.5 COMPLIANCE WITH SAFE DRINKING WATER ACT (SDWA) AMENDMENTS

Among the many regulations governing water system planning, the most significant and rapidly changing are those covered by the Safe Drinking Water Act (SDWA). This section outlines the key features of SDWA requirements now in force and discusses trends and probable new requirements that affect the planning process. The City's record of compliance with these rules is also stated.

The City of Austin's record of SDWA compliance includes:

- The City has complied with all provisions of the Act in effect in January of 1993. This includes compliance with the Lead and Copper Rule.
- Compliance with the Surface Water Treatment Rule was achieved on July 1, 1993. Meeting this rule required major simultaneous construction projects at our three treatment plants.

Based on initial Utility review, the second stage of the Disinfection By-Product Rule may prove challenging. The proposed rule should be available in March of 1994, and the Utility will evaluate its impact in detail at that time.

One important aspect of SDWA regulations is the requirement of public notification when provisions are violated. The mandated notifications vary depending on the severity and potential consequences of the violation. For example, a serious violation of the Total Coliform Rule suggests public health concerns. This violation triggers immediate public notification via the broadcast media, while others require print media public notification. The Utility has never been involved in a violation that incurred the notification requirement.

SDWA History

The Safe Drinking Water Act (SDWA) enacted by Congress in 1974 directed the Environmental Protection Agency (EPA) to establish minimum national drinking water standards. It stipulated that the states be responsible for implementing and enforcing these regulations. Every public water supply serving at least 15 service connections or 25 or more people must ensure that its water meets the minimum standards established by the Act. Drinking water standards, or maximum contaminant levels (MCLs), became effective for 26 parameters which included turbidity, 10 inorganic contaminants, 6 pesticides, and total coliform.

In 1986, Congress passed amendments known as the Safe Drinking Water Act Amendments of 1986, which accelerated EPA's regulations of contaminants, banned all future use of lead pipe and lead solder in public drinking water systems, and streamlined the enforcement procedures to ensure compliance.

The 1986 Amendments gave EPA three years to set standards for 83 contaminants and monitoring requirements for an additional 150 to 200 unregulated parameters in five sets of regulations. These drinking water standards not only establish MCLs but also the best available technologies (BATS) that are capable of meeting the standards.

As part of the SDWA, a number of rules and regulations have been developed to achieve SDWA goals. These rules and regulations include those listed below.

Disinfection/Disinfection By-Products Rule (Phase VI A)

This Rule is currently the one that will pose the most serious challenges to the City's system. The Rule is being negotiated to establish requirements on the use of disinfectants and the permissible levels of disinfection by-products. On September 10, 1992, the Disinfection/Disinfection By-Product (D/DBP) Rule was signed. Concurrently, the EPA created an Advisory Committee to negotiate proposed Rules by March 1994.

To date, three proposed rules have been agreed to: Information Collection Rule (ICR), D/DBP Rule, and Enhanced Surface Water Treatment Rule (ESWTR).

The D/DBP Rule will be divided into two stages. The first stage would establish MCLs for total trihalomethanes (TTHMs) and total haloacetic acids (THAAs) at 80 and 60 parts per billion (ppb) respectively. MCLs would be established for bromate and chlorite. Maximum residual disinfection levels (MRDLs) would be proposed for chlorine at 4 milligrams per liter (mg/l) as free chlorine, for chloramines at 4 mg/l measured as total chlorine, and 0.8 mg/l for chlorine dioxide. Stage 1 will require many large (greater than 100,000 people) systems using conventional treatment to initiate enhanced coagulation for the removal of disinfection by-product precursors.

The second stage of the D/DBP Rule would propose TTHM and THAA levels of 40 and 30 ppb respectively, but would remain open until a second regulatory negotiation in 1998. The second negotiation would be based on data from the ICR rule, health effects, occurrence and exposure data.

With the City's present treatment process we can meet the Stage 1 proposed limits and can demonstrate enhanced coagulation. However, for the Stage 2 proposed regulations various treatment alternatives need to be evaluated with the pilot plant studies to determine further effects on compliance with this rule. This is a major concern at the Green WTP where space for major process changes is at a premium.

Total Coliform Rule

The Total Coliform Rule was finalized on June 29, 1989. Requirements include a written sample siting plan, a monthly maximum contaminant level of no more than 5 percent coliform positive samples per month from the distribution sample sites (221 sample sites for the City of Austin), three specified repeat samples on any positive sample and fecal coliform testing on each total coliform positive sample.

The City of Austin met the compliance date of December 31, 1990 and has had no violations to date.

Surface Water Treatment Rule

This was finalized on June 29, 1989. Regulations became effective in December 1990, with a phased-in implementation period and full compliance required by July 1993. Requirements include turbidity of <0.5 NTU in 95 percent of four-hour measurements of water entering the distribution system; treatment techniques requirements must achieve at least a 4-log reduction (99.99 percent inactivation) of viruses; and continuous monitoring of concentration of disinfectant entering the distribution system from each plant with residual disinfectant in the system not to be undetectable in more than 5 percent of samples taken in a month for any 2 consecutive months. All public water systems using surface water are required to disinfect and may be required to install filtration depending on source quality.

The City of Austin met compliance on July 1, 1993 by the addition of free chlorine at the raw water intakes of each plant to provide the required viral and partial Giardia inactivation. Additional Giardia removal credit is given based on the removal of turbidity provided by the treatment process.

Lead and Copper Rule

This Rule was finalized May 1991, establishing an action level for treatment of 0.015 mg/L for lead and 1.3 mg/L for copper in more than 10 percent of household taps sampled. The 90^{th} percentile of the City of Austin's compliance samples collected and analyzed for both the first and second round of samples were under 5 parts per billion (ppb). Consequently, the Utility has demonstrated effective corrosion control. Water Quality Parameter sample results will continue to be collected and reported quarterly from 10 distribution sample site locations as part of the reduced monitoring program.

Phase II Rule

The National Primary Drinking Water Regulation for 30 synthetic organic chemicals (SOCs) and 8 inorganic chemicals (IOCs) was finalized December 31, 1990. The rule includes monitoring, reporting and public notification requirements for the SOCs and IOCs. Also included are monitoring requirements for approximately 110 additional "unregulated" contaminants.

Compliance sample results of March 1993 for nitrate/nitrite were 0.21-0.23/<0.01-0.01 ppm which is well below the maximum contaminant levels of 10/1 parts per million. Compliance monitoring for Phase II and Phase V contaminants began August, 1993.

In the future annual samples will be required for cadmium, chromium, mercury, selenium, and barium. One sample every 9 years will be required for asbestos and one annual sample for nitrite. For Austin's system four quarterly samples will be required for nitrate initially and then one annual sample thereafter. Quarterly samples for one year will be required for the 18 Volatile Organic Compounds (VOCs) and annual samples after one year of no detection. For the 17 pesticides and PCBs, quarterly samples are needed every three years. After one round of no detection, monitoring requirements will be reduced to two samples per year every three years.

Radionuclide Rule Phase III

The City of Austin Water and Wastewater Utility will not be affected by the MCLs established for naturally occurring radon, radium-226, and radium-228, since they are not a problem for this area. The new MCL of 20 pCi/L for gross alpha and beta particle emitters presents no problem; the levels from our water plants are below that level.

Phase V Rule

This rule, finalized in May 1992, regulates 24 contaminants which include nine pesticides, six inorganic chemicals (IOCs), three volatile organic chemicals (VOCs), and six synthetic organic chemicals (SOCs).

Compliance monitoring for the Phase V contaminants began for large systems in Texas in August 1993.

Information Collection Rule

The ICR is intended to develop information for future regulation of D/DBPs and provide input to the Enhanced Surface Water Treatment Rule. It is also intended to provide data for development of a Stage 2 D/DBP Rule. Systems serving more than 10,000 people will be required to monitor raw water for microbial contaminants and water quality parameters as well as finished water for disinfection by-products and operational parameters. Monitoring for systems serving more than 100,000 people for microbial, Giardia, Cryptosporidium, total coliforms, fecal coliforms or E. Coli and enteroviruses, must be completed by March 1997.

Enhanced Surface Water Treatment Rule

The Enhanced Surface Water Treatment Rule (ESWTR) is intended to insure that the present microbial protection provided by the Surface Water Treatment Rule is adequate, and that microbial protection is not compromised by control of disinfection by-products in the D/DBP rule. The final proposed ESWTR—expected in December 1998—will establish a baseline for systems serving fewer than 10,000 and update the baseline for larger systems if needed.

Phase VI B: Additional SOCs & IOCs

This rule, to be proposed in Spring of 1994, will select contaminants from the Drinking Water Priority List along with those from the D/DBP rule, to make up the 25 contaminants required to be regulated every three years.

CHAPTER 5

DISTRIBUTION SYSTEMS FACILITIES PLANS

This chapter shows the projects that our analysis indicates will be needed by pressure zone and time period. Pressure zone maps are in the map pockets at the end of the Guide. Summaries of zone projects with cost estimates are included in the pressure zone facility plan sections (Sections 5.4 through 5.10). Operating strategies and improvements are described for each planning period, including detailed information on near-term investments. Planning for a distribution grid to provide an urban level of service and the special needs of areas that are above or below the normal service elevation or not contiguous to major pressure zones are discussed under headings at the beginning of this chapter.

This chapter does not present alternatives considered while developing the recommended plans or documentation of computer simulations. Additional information on these subjects is available from the Utility's Systems Analysis Division.

5.1 THE URBAN GRID CONCEPT FOR SUBDIVISION-LEVEL DEVELOPMENT

In addition to planning for major facilities improvements, the LRP team established plans for the outer network of the distribution system. This network or "urban grid" is designed to provide urban level fire suppression capability, pressure and capacity over the long term. It consists of 16-inch and 24-inch lines that may be built as part of the development process rather than as CIP projects. The exact location, timing and sizing of urban grid lines will depend on location-specific development activity.

Urban grid improvement costs are expected to approximate $115 million through the entire planning period. Table 5-1, Urban Grid Cost Estimates, below presents estimated development costs for urban grid on an individual pressure zone basis. These costs are the combined total of expected grid before the year 2000 and after the year 2000 that would serve the planning area until the year 2037. These numbers are total cost estimates for each pressure zone and take into account differing construction methodologies and conditions, engineering costs, and contingencies. The majority of the lines modeled as urban grid are 16-inch with a substantial amount of 24-inch diameter lines.

TABLE 5-1

URBAN GRID COST ESTIMATES

Pressure Zone	Total Cost
Central	38,041,244
North	9,990,338
South	14,367,795
Far South	2,266,550
Northwest A	18,124,470
Southwest A	11,611,080
Northwest B	16,936,690
Southwest B	4,139,070
Total Cost	$115,477,237

The urban grid mains are shown on the Water System Plan Map and the individual Pressure Zone maps.

The urban grid has the following characteristics:

- The urban grid network provides 3500 gpm of fire suppression capability.
- Urban grid mains generally follow existing or proposed transportation corridors.
- All property in the service area is within one mile of an urban grid main.
- Urban grid mains will often be built during the development process and at the developer's expense.

The key finding of the urban grid analysis is that several areas of the system will require 24-inch-diameter rather than 16-inch-diameter mains to meet urban level of service criteria. The section in Chapter 2 on " Design Standards and Modeling Methodology" provides more detail on urban grid criteria.

Special characteristics of the urban grid in each pressure zone, if any, are included in the discussion of the pressure zones that follow.

5.2 SPECIAL SERVICE AREAS

A second new concept is that of Special Service Areas (SSAs). They are areas not readily served by the standard configuration of pressure zones. SSAs will require special attention to provide service at required levels. The individual Pressure Zone maps contained in this chapter show these as hatched areas. The seven pressure zone maps show a total of 248 Special Service Areas. Each hatched SSA or SSA cluster has a reference number and a letter tag. The letter designates which one of the four following categories the special service area belongs to:

- **A** These SSAs are **Above** the key upper topographic contour elevation of the pressure zone. These are high ground areas (e.g., hills) within or adjacent to the pressure zone area. Typically, service above the zone's hydraulic grade line level is needed for adequate service. Pressure enhancement options include localized booster pumping, connection to higher hydraulic grade line pressure zone, service by another suitable water supply entity, and creation of a new pressure zone (reduced off of a higher hydraulic grade line zone or boosted off of a lower hydraulic grade line zone).

- **B** These SSAs are **Below** the key lower topographic contour elevation of the pressure zone. They are low lying areas (e.g., valleys) within or adjacent to the zone. Typically these areas will require conversion to a lower pressure zone or pressure reduction to individual customers or small areas. Creation of a new larger scale reduced pressure zone area (reduced off of a higher hydraulic grade line zone or boosted off of a lower hydraulic grade line zone) may be appropriate.

- **NC** These SSAs are **Non-Contiguous** to the pressure zone. They are isolated areas with elevations in the zone's typical topographic range. Isolation occurs due to the presence of political boundaries, other entities, other pressure zones, environmentally sensitive areas, etc. Possible service options include an extension from an existing pressure zone, new pressure zone creation, and service by another water supply entity.

- **S** These are nonstandard SSAs. They represent special cases not covered by the A, B, and NC categories. A total of only 8 areas are in this S category. These include certain MUDs, the proposed Brushy Creek Reduced Pressure

Zone area, some nonstandard areas too distant from the pressure zone's established network, and a special low topography case. These are explained in the discussion of individual pressure zones that follows.

Out of these four categories, one is particularly challenging to address properly. These are the future service areas identified with an "A" which are areas Above the key upper topographic contour for the pressure zone. These areas will have pressures below standards unless special provisions are made to supplement the normal zone pressure. In undeveloped areas, solutions for proper service to these areas should be implemented before development is allowed to occur.

5.3 THE EXISTING SYSTEM

The existing system is an integrated water distribution network consisting of seven major pressure zones and numerous smaller zones. The entire system is supplied by three water treatment plants all drawing from the Colorado River. The combined rated treatment capacity is 225 MGD. There are 15 major pump stations and 17 major reservoirs that distribute water through over 3,000 miles of pipe. The pump stations total 812 MGD firm pumping capacity and 1060 MGD total pumping capacity. The reservoirs constitute 115 million gallons of effective storage capacity and 202 million gallons of total storage capacity including plant clearwells. The service area (also the Impact Fee Area) covers roughly 488 square miles.

The system now serves about 570,000 people through 148,000 connections, including more than 20 wholesale water customers. In the last year the total system pumpage averaged about 105 MGD, with maximum day pumpage ranging to almost 190 MGD.

The "existing" system as shown on the maps and referred to in this planning guide, includes several current CIP projects scheduled for completion in the near term. Table 5-2, Current CIP Projects Considered As Part of the Existing System, lists the name and current status of each project in this category.

TABLE 5-2

CURRENT CIP PROJECTS CONSIDERED AS PART OF THE EXISTING SYSTEM

Project Name	Current Status
Anderson Mill Transmission Main	Design
Cat Mountain Pump Station	Design
Jollyville Transmission Main (remainder)	Design
RM 2222 Transmission Main	Construction
Shepherd Mountain Pump Station	Design
Slaughter Lane Transmission Main	Construction
South/Southwest A Boundary Change	Study
Southwest A/SWB Boundary Change	Study

The varying terrain in the Austin service area requires that the water system be divided into different pressure zones. A zone is an area of similar land elevations with facilities chosen to meet minimum pressure criteria while keeping maximum pressures within reasonable limits.

Figure 5-1 shows the existing and recommended pressure zone boundaries. Figure 5-2 is a hydraulic profile schematic showing major facilities in a zone, their relationship to each other and key topographic contour elevations. The Water System Plan Map (in the map pocket in the Summary) provides more detailed information concerning the location of the pressure zones and the major facilities in each. The remainder of this chapter provides discussion concerning operations and improvements by pressure zone. At the end of this report are detailed maps for each pressure zone. These maps include "predicted performance indicators" to provide modeling analysis results of the hydraulic characteristics of the pump stations, reservoirs, selected mains, and points in the zone systems.

Pressure Zone Boundaries

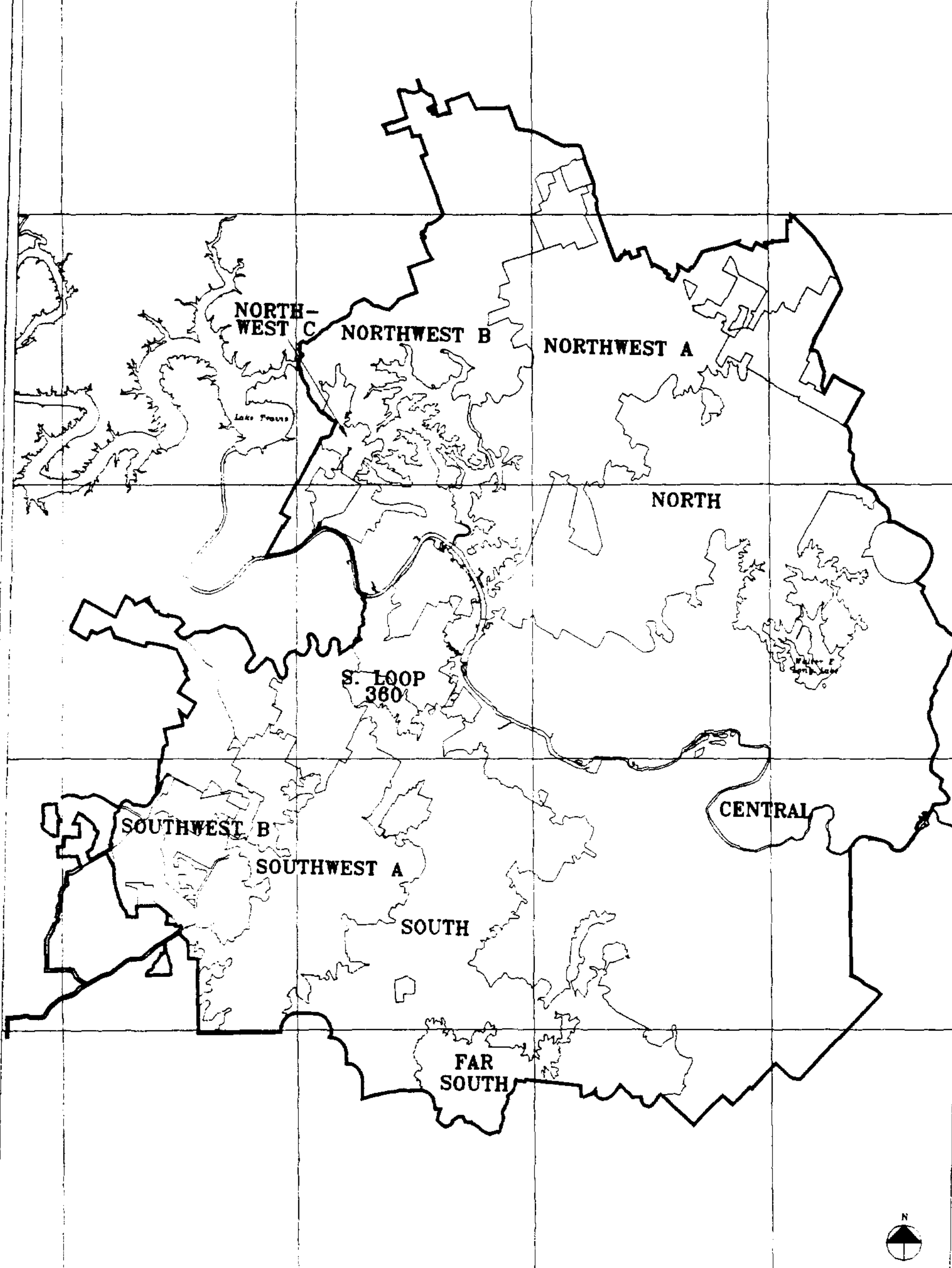
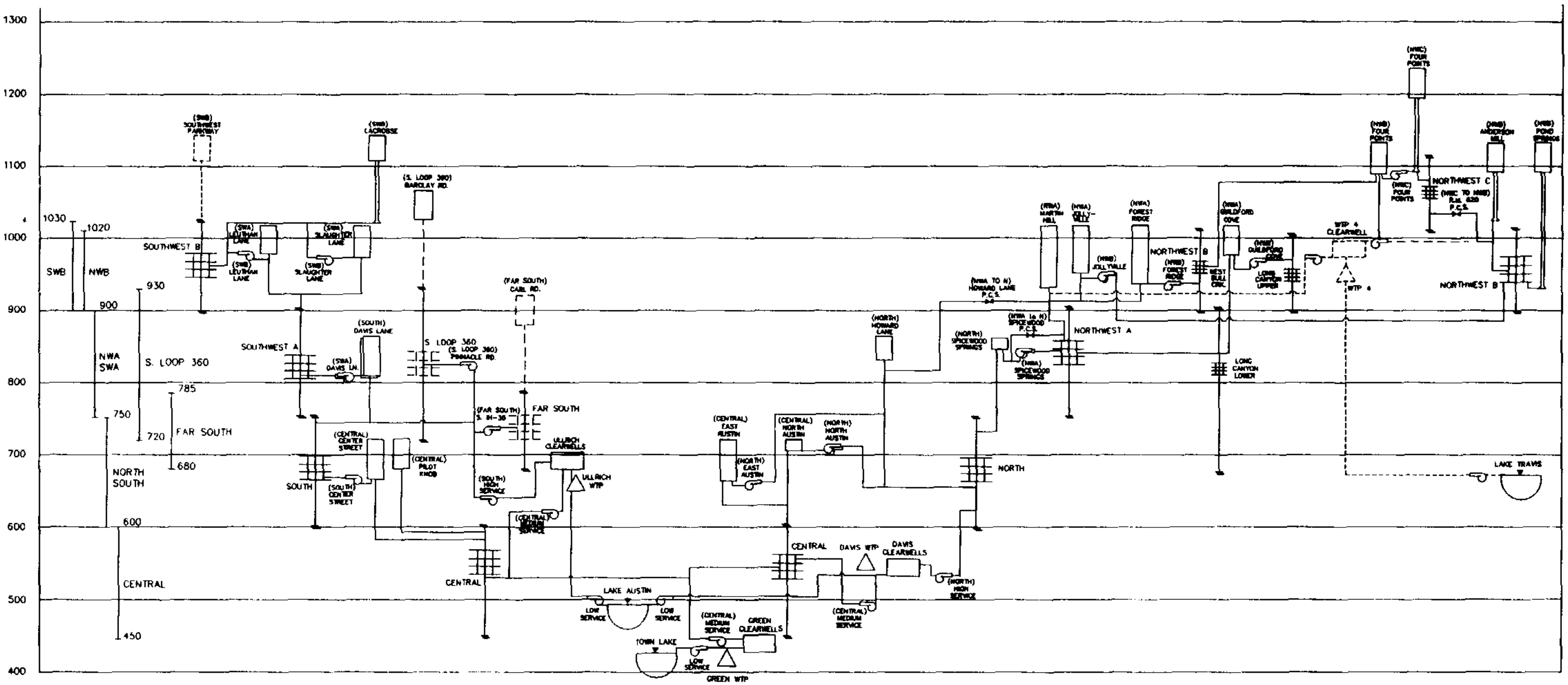


Figure 5-1



NOMINAL RESERVOIR OVERFLOWS	
Central Pressure Zone:	720'
North/South Pressure Zones:	860'
Northwest A/Southwest A Pressure Zones:	1015'
Northwest B Pressure Zone:	1130'
Southwest B Pressure Zone:	1140'
Northwest C Pressure Zone:	1230'
S. Loop 360 Pressure Zone:	1066'
Far South Pressure Zone:	921'

- △ Water Treatment Plant
- ⋈ Pressure Control Station
- Pump Station
- ▯ Reservoir
- ---- Future Facilities
- Distribution Grid
- Upper Key Topographic Contour Elevation
- Lower Key Topographic Contour Elevation

City of Austin
Water & Wastewater Utility
Water Distribution System
Long-Range Planning Guide
February 1994

Schematic Hydraulic Profile

No Horizontal Scale

Produced by Systems Analysis and Planning Services Divisions

Figure 5-2

5.4 CENTRAL PRESSURE ZONE

The Central Pressure Zone supplies central and eastern portions of the service area, including the Central Business District. The zone will serve Manor to the northeast and as far southeast as the Travis/Bastrop County Line. The zone generally serves a topographic contour range of 600 feet and below. The scope of the following Central Pressure Zone Discussion includes:

- General Description
- Projects, Cost Estimates and Timing
- Operations and Improvements
- Special Service Areas

The Water System Plan Map (in the Summary) shows major components of the zone and the relationship of the Central Pressure Zone to the entire system. The Central Pressure Zone Map (in the map pocket at the end of this report) shows more detail in the zone and provides performance indicators for key zone facilities. Table 5-3 provides detailed cost estimate information for recommended system improvements.

General Description

The Central Pressure Zone is currently the largest pressure zone in terms of demand and land area and will remain as the largest zone in the system throughout the planning period. The Central Pressure Zone requires facilities to transport water to adjacent pressure zones. The zone presents a challenge in developing an operating strategy due to the variety of facilities and options available for facility use.

Table 5-3

CENTRAL PRESSURE ZONE CIP IMPROVEMENTS AND COST ESTIMATES

TRANSMISSION MAINS Description	Pipe Diameter (inches)	Pipe Length (LF)	Construction Unit Cost [$/LF]	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
CENTER STREET TM						
End of Lamar RC to Center St. open cut	48	6750	250	1.3	2,193,750	
End of Lamar RC to Center St. tunnel	48	2250	500	1.3	1,462,500	
					3,656,250	2037
CENTRAL BUSINESS DISTRICT (CBD) TM						
From Green to North Lamar open cut	42	7000	210	1.3	1,911,000	
From Green to North Lamar tunnel	42	7000	420	1.3	3,822,000	
					5,733,000	2017
DAVIS MEDIUM SERVICE TM						
From Davis to MoPac open cut	72	2500	425	1.3	1,381,250	2018
From Davis to MoPac tunnel	72	2500	850	1.3	2,762,500	2018
From MoPac to Lamar open cut	72	2500	425	1.3	1,381,250	2037
From MoPac to Lamar tunnel	72	2500	850	1.3	2,762,500	2037
					8,287,500	
FAR SOUTHEAST AREA IMPROVEMENTS						
Highway 183 at Scenic Loop open cut	24	650	68	1.3	57,460	
Highway 183 at Scenic Loop bore	24	150	136	1.3	26,520	
Highway 183 at Scenic Loop connection	24	1	25000	1.3	32,500	
Elroy Road from existing 36-in open cut	24	11700	68	1.3	1,034,280	
Old Elroy Loop open cut	16	2200	55	1.3	157,300	
Elroy FM 973 open cut	24	13450	68	1.3	1,188,980	
					2,497,040	2000
HIGHWAY 183 INTERCONNECTOR						
End of exist. 24 to Airport Blvd. open cut	24	8270	68	1.3	731,068	2000
End of exist 24 inch to Airport Blvd. bore	24	4130	136	1.3	730,184	2000
Airport Blvd. to Pleasant Valley open cut	24	5300	68	1.3	468,520	2010
Airport Blvd. to Pleasant Valley bore	24	2650	136	1.3	468,520	2010
					2,398,292	
LAMAR RIVER CROSSING TM						
Open cut	48	7000	250	1.3	2,275,000	
Tunnel	48	3000	500	1.35	2,025,000	
					4,300,000	2037
NORTH CENTRAL AUSTIN TM						
Hard Rock open cut	48	8000	250	1.3	2,600,000	
Hard Rock tunnel	48	4000	500	1.3	2,600,000	
Soft Rock open cut	48	15000	154	1.3	3,003,000	
Soft Rock tunnel	48	5000	308	1.3	2,002,000	
					10,205,000	2037

Table 5-3

CENTRAL PRESSURE ZONE CIP IMPROVEMENTS AND COST ESTIMATES (CONTINUED)

TRANSMISSION MAINS (CONTINUED)

ULLRICH MEDIUM SERVICE TM						
Ullrich to Mo Pac open cut	54	7000	300	1.35	2,835,000	
Ullrich to Mo Pac tunnel	54	7000	600	1.35	5,670,000	
Mo Pac to Green open cut	54	3500	300	1.3	1,365,000	
Mo Pac to Green tunnel	54	3500	600	1.3	2,730,000	
					12,600,000	2000
TOTAL MAINS					*$49,677,082*	

PUMP STATIONS

Description	Flow (MGD)	Head (feet)	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
DAVIS MEDIUM SERVICE PS UPGRADE	34.1	214	0.5	1,327,773	2037
ULLRICH MEDIUM SERVICE PS UPGRADE					
Higher Head Pumps	100	100	0.5	2,194,799	
Lower Head Pumps	60	60	0.5	1,219,731	
				3,414,530	2000
TOTAL PUMP STATIONS				*$4,742,303*	

MISCELLANEOUS

Description	Total Cost Estimate (dollars)	Recommended Before Year
Connection of 24 & 48 at Riverside & Pleasant Valley	50,000	2000
Connection of 36 & 16 on West 24th	50,000	2010
Flow Control Stations (FCS) at Center Street Res	200,000	2000
Flow Control Station (FCS) at East Austin Res	50,000	2000
TOTAL MISCELLANEOUS	*$350,000*	

TOTAL CENTRAL ZONE IMPROVEMENTS

YEAR 2000	$20,272,822
YEAR 2010	$987,040
YEAR 2017	$5,733,000
YEAR 2018	$4,143,750
YEAR 2037	$23,632,773
TOTAL	$54,769,385

The zone receives water from all three existing treatment plants and contains four major reservoirs. Three of the reservoirs provide pump suction storage for transfer of water into the next higher pressure zone while also providing equalization storage. Different pumping combinations into adjacent higher zones can change Central Pressure Zone operation and performance. River crossing mains offer options in transferring water across Town Lake and the Colorado River, impacting Green WTP and Ullrich WTP Medium Service Pump Station operations. Additionally, other system valve settings can isolate any or all of the three medium service pump stations from each other, if so desired.

Historically, the Central Pressure Zone has often been operated as two separate pressure zones, the North Central and the South Central. The zone was separated into sections by operating with all or the majority of the river crossings closed. This Guide recommends that the Central Pressure Zone be operated as one system. Integrated operation of the Central Pressure Zone will maximize the use of current infrastructure and minimize future facilities investment.

Year 2000 Operations and Improvements

We explored a variety of operating strategies for year 2000 Central Pressure Zone operations. The recommended strategy requires the construction of the **Ullrich WTP 54-inch Medium Service Transmission Main** (described below) and new pumps for the **Ullrich Medium Service Pump Station**. With the Ullrich improvements, the Green WTP is required to operate only at the 30-MGD level under maximum-day conditions.

Highlights of the maximum-day operations are as follows. The system will be operated with all river crossings open, although the Pleasant Valley River Crossing will be throttled to a 24-inch equivalent pipe size. The Center Street Reservoir fill lines will be throttled and the East Austin Reservoir inlet/outlet will also be throttled. The East Austin and Pilot Knob Reservoirs will fluctuate at least 7 feet during maximum-day operation. The East Austin fluctuation will be achieved with a constant valve setting of a 14-inch equivalent pipe (simulating a throttling valve) on the inlet/outlet main to the reservoir.

The year 2000 minimum-month operating strategies do not require additional major facilities. Proper fluctuation of the East Austin Reservoir was not achieved in this model. However, we assumed that the reservoir could be operated as it is today—on a fill-and-draw basis—to allow for proper water quality in the reservoir. We recommend that a check valve be installed at the East Austin Reservoir. The check valve will allow water to automatically flow into the system when needed.

The Guide recommends two other major projects for the zone by the year 2000. The first is a major segment of the **Highway 183 24-inch Interconnector Transmission Main** (see below). The Highway 183 project provides for basic system reliability in an industrial/commercial corridor. Major distribution system improvements in the **Far Southeast Area** of the zone are recommended. These improvements upgrade the existing system to meet basic standards and set the framework to provide for future urban growth in the area.

<u>ULLRICH MEDIUM SERVICE TRANSMISSION MAIN AND PUMP STATION IMPROVEMENTS</u>

We recommend building the entire **Ullrich Medium Service Transmission Main** by the year 2000. On a strict demand/capacity basis, portions of the main will be needed soon after year 2000, and all portions will be required by year 2010. Completion of this line and Ullrich WTP pump station improvements are the principle facilities that will allow the system to deliver 140 MGD from Ullrich WTP.

Year 2000 maximum day operations without the main would require Davis WTP to operate at its capacity of 120 MGD and the Green WTP to operate at its capacity of 45 MGD. Ullrich WTP would also be used at near its capacity under this scenario. Therefore, anything more than a minor problem at any plant or in a major transmission main from the plants could result in a service outage for customers.

We also recommend the upgrade of the **Ullrich Medium Service Pump Station** by the year 2000. More capacity will be needed at the station by year 2010. The existing pumps were selected to operate into a system with only the existing 48-inch Medium Service Transmission Main. The construction of the new **54-inch Ullrich Medium Service Transmission Main** will drastically alter the pressure head conditions at which the pump station will deliver water in the future. This will require changes in both low head and high head pumps at the station.

The **Ullrich Medium Service Transmission Main** should be constructed from the Ullrich WTP to the existing 66-inch Green WTP Medium Service Transmission Main. Demands North of Lake Austin and Town Lake will comprise nearly two-thirds of total system demand throughout the planning period. The northern alignment would also utilize more existing infrastructure than a southern alignment. The northern alignment would also provide a second major river crossing in the system to provide flexibility of operation and reliability in case of a system emergency.

The LRP team recommends that the preliminary engineering, design and permitting for this project begin soon. The project will pose engineering and technical challenges that will require broad Utility consensus and public involvement. Construction time for the main and lead time on the pump station equipment will probably require two to three years before the project is operational. In all, the project will probably require four to five years from inception to completion.

HIGHWAY 183 INTERCONNECTOR TRANSMISSION MAIN

We recommend building a major portion of the **Highway 183 Interconnector 24-inch Transmission Main** by year 2000. On a demand/capacity basis the entire main will be needed by year 2010. The portion of the main from Airport Boulevard north to its connection with the existing section of the Highway 183 Interconnector will be a vital link for reliable service to the Highway 183/Ed Bluestein Industrial Corridor.

Major customers and employment centers such as Motorola East, National Linen Service and Tracor occupy this corridor. Computer simulations performed in support of developing reliability criteria show this area is vulnerable to outages.

Computer simulations were performed with the year 2000 maximum-day model that deleted the existing portion of the Highway 183 Interconnector from the model to represent a break in the existing main or the loss of the 66-inch East Austin Transmission Main in Martin Luther King Boulevard to which the Highway 183 main connects.

The simulations predicted an immediate loss of service to customers in the area which includes Tracor and Motorola East. Simulations made with the existing main deleted from the model but with the recommended **Highway 183 Interconnector Transmission Main** in service predicted system service pressure reduced only about 10 percent from normal operating levels.

FAR SOUTHEAST AREA IMPROVEMENTS

The LRP team recommends constructing three transmission main projects in this portion of the zone. The two larger projects are in the Elroy area. The City acquired this service area and infrastructure from Water Control and Improvement District 12 in September 1986. WCID 12 customers became retail customers at that time.

Computer simulations for the area were performed utilizing the year 2000 maximum-day model. Initial simulations were performed with just the existing 6-inch and 8-inch mains in the model.

The simulations predicted virtually no pressure at key topographic contours in the entire FM 973, FM 812, and Elroy Road area. The recommended transmission main projects would solve this problem. The mains should be 24-inches in diameter except for a portion of the system in Elroy Road which should be 16-inches in diameter.

One more improvement in this area is recommended before year 2000. A 24-inch main should be constructed in the area of the Highway 183 intersection with Scenic Drive and FM 812. The main should begin at the existing 48-inch Pilot Knob Transmission Main and continue to the east side of Highway 183. The project will supply urban levels of water for fire suppression to the commercial intersection.

SMALLER-SCALE PROJECTS

Three smaller-scale CIP projects are also recommended by year 2000. Remote control motorized valves should be installed on the two Center Street Reservoir Fill lines to allow for throttling of the reservoir. A 48-inch main in Pleasant Valley Road should be connected to a 24-inch main in Riverside Drive. This connection will provide increased normal operating pressure and increased reliability to the area south of this connection. Major customers in this area include AMD and Sematech. A check valve should be installed at the East Austin Reservoir. This will allow water in the reservoir to automatically flow into the system when the reservoir fill valve is closed during fill-and-draw operation.

Year 2010 Operations and Improvements

The year 2010 operating strategy will be a continuation of operations established by year 2000. The Green WTP contribute 34 MGD in maximum-day computer simulations performed for this time period. Operations will be normalized at the East Austin Reservoir, because pumpage from the reservoir should be sufficient to provide turnover for water quality requirements. The Pilot Knob Reservoir will fluctuate, but its proper operation appears no easier to achieve than in previous years.

The Ullrich WTP will require expansion to 140 MGD by year 2008. The remainder of the **Highway 183 Interconnector Transmission Main** will be needed by year 2010. We also recommend connecting an existing 36-inch transmission main to an existing 16-inch main in West 24th Street.

Year 2017 Operations and Improvements

The year 2017 Central Pressure Zone operating strategy will be a continuation of previous years' operating strategy. All treatment plants must contribute at their maximum capacities. Operation will require building the **42-inch Central Business District Transmission Main** in the period from 2010 to 2017. This main will be needed to transport water to northern portions of the zone and lower discharge pressures at all of the treatment plants medium service pump stations.

Year 2018 Operations and Improvements

In 2018, the Green WTP could be decommissioned when WTP 4 comes on line. Two major operating strategy changes would compensate for the lost capacity input from Green WTP into the Central Pressure Zone. First, the Davis WTP should contribute more into the Central Pressure Zone than in previous years. Second, transfers from the North Austin Reservoir into the North Pressure Zone will be significantly reduced from those in the prior decade.

These operational changes will require the construction of the first portion of the **72-inch Davis Medium Service Transmission Main** to move more water into the zone while keeping discharge pressures within limits. The North Austin Reservoir fill lines will be throttled slightly to prevent overflow of the reservoir. The LRP team assumed that two existing remote control motorized valves at the North Austin Reservoir site will perform the throttling function.

Year 2037 Operations and Improvements

The year 2037 Central Pressure Zone operating strategy will continue that established in 2018. The major operating change in the zone will be that the Davis WTP will contribute its total 120 MGD capacity into the Central Pressure Zone. By this time, the Davis WTP will no longer contribute flow directly to the North Pressure Zone through the Davis WTP High Service Pump Station. Instead, the majority of the North Pressure Zone demand will be supplied by WTP 4 via two pressure control stations discussed later in the chapter. Some water will still be supplied to the North Pressure Zone through the North and East Austin Pump Stations.

The **Davis WTP Medium Service Pump Station** will require an upgrade from 101 MGD to 135 MGD to meet maximum-hour needs. We propose exploring the option of converting the Davis WTP High Service Pump Station to a medium service pump station.

Major transmission mains will be required to distribute the 120 MGD from Davis WTP to the proper locations in the zone.

Transmission mains required are the:

- Remaining portion of the **72-inch Davis WTP Medium Service Transmission Main**.
- **48-inch North Central Austin Transmission Main**.
- New **48-inch Lamar River Crossing Transmission Main**.
- **48-inch Center Street Transmission Main**.

Special Service Areas

The Central Pressure Zone has 39 areas identified as Special Service Areas. These areas are shown on The Central Pressure Zone Map contained in the map pocket at the end of the Guide. Two Special Service Areas are discussed in more detail below.

<u>SSA IB</u>

This area is adjacent to Town Lake and the Colorado River. The individual customers or subdivisions in this area should be pressure reduced, not the Urban Grid transmission system. If the entire area is pressure reduced, larger mains will be required than those shown. The larger mains would be required because the pressure reducing valves would separate the northern portions of the grid from the southern mains preventing the entire system from working as a unit.

<u>SSA 24A</u>

The West Rim Pump Station is proposed for this area to provide improved service to existing customers. The project will be funded from current revenues under the category of System Improvements To Meet Minimum Standards. The City is in the process of real estate acquisition for this project.

5.5 NORTH PRESSURE ZONE

The North Pressure Zone serves most of the northeast part of the City and parts of the north and northwest. It is adjacent to the Central and the NWA Pressure Zones. The zone serves a topographical contour range from 600 feet to 750 feet. The scope of the following North Pressure Zone discussion includes:

- Zone operating strategies.
- Estimated costs for recommended system improvements.

The Water System Plan Map (in the Summary) shows major components of the zone and the relationship of the North Pressure Zone to the entire system. The North Pressure Zone Map (in the map pocket at the end of the Guide) shows more detail in the zone and provides performance indicators for key zone facilities. Table 5-4 provides detailed cost estimate information for recommended system improvements.

General Description

The North Pressure Zone system is fed primarily by the Davis High Service Pump Station and the North Austin Pump Station. The Davis High Service Pump Station provides boosted water from the clearwell source located at the Davis Water Treatment Plant. The North Austin Pump Station boosts Central Pressure Zone water up to the required hydraulic grade line for the North zone. The East Austin Pump Station and Reservoir supply a section of the North Pressure Zone, but demand on this side of the zone has so far been minimal.

The area east of IH-35 did not develop to the extent anticipated after construction of the East Austin Pump Station and Reservoir. Many of the distribution system improvements required to connect the area to the rest of the zone never occurred. As a result the East Austin Pump Station is poorly connected to the rest of the zone. Demand in this area is not expected to increase enough to warrant construction of larger transmission mains.

Table 5-4

NORTH PRESSURE ZONE CIP IMPROVEMENTS AND COST ESTIMATES

TRANSMISSION MAINS Description	Pipe Diameter (inches)	Pipe Length (LF)	Construction Unit Cost [$/LF]	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
NORTH ZONE TM						
Hard Rock open cut	48	9000	250	1.3	2,925,000	
Hard Rock tunnel	48	2000	500	1.3	1,300,000	
					4,225,000	2037
TOTAL MAINS					*$4,225,000*	

PUMP STATIONS Description	Flow (MGD)	Head (feet)	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
DAVIS HIGH SERVICE PS UPGRADE	16.4	364	0.5	948,340	2017
TOTAL PUMP STATIONS				*$948,340*	

MISCELLANEOUS Description	Total Cost Estimate (dollars)	Recommended Before Year
Connection of 48 & 30 at Lamar & Peyton Gin	50,000	2000
HOWARD LANE PRESSURE CONTROL STATION (PCS)	300,000	2018
SPICEWOOD PRESSURE CONTROL STATION (PCS)	300,000	2037
TOTAL MISCELLANEOUS	*$650,000*	

TOTAL NORTH ZONE IMPROVEMENTS		
	Year 2000	$50,000
	Year 2010	$0
	Year 2017	$948,340
	Year 2018	$300,000
	Year 2037	$4,525,000
	TOTAL	$5,823,340

The Utility has historically closed valves on several east-west lines to keep the Spicewood Springs Reservoir full enough to supply Northwest area demands while allowing the Howard Lane Reservoirs to fluctuate. This has been a somewhat seasonal operation driven by demand. These valves are often called "the wall of valves".

We examined operating strategies with these valves open, closed and throttled. Results show that it will be easier to maintain higher levels at the Spicewood Springs Reservoir with some combination of these valves closed. The system can operate with the valves open, and we recommend this strategy, because it will increase reliability. However, if conditions of inadequate fluctuation at the Howard Lane Reservoir or insufficient quantity to the Spicewood Springs Reservoir occur, the system can still operate as it has in the past.

Several of the east-west transmission mains running between approximately Braker Lane and Rutherford Lane are connected only to the 24-inch main which parallels the Lamar Blvd. 48-inch main. Modeling shows that this area would be better served by connecting with the stronger 48-inch main.

The recommended Peyton Gin Road connection would serve this purpose, connecting the 30-inch main along Peyton Gin with the 48-inch Lamar Blvd. transmission main. This will provide more use of the 48-inch main and ease demand on the 24-inch main, which currently connects to the 30-inch main.

Year 2000 Operations and Improvements

The service area for the year 2000 strategy is shown on the North Pressure Zone map in the map pocket. No new major facilities will be added for this near-term operating condition. Local demand for new growth in this time period can be adequately distributed through 16-inch urban grid lines, and existing pumps have the capacity to serve the area.

Low demand in the east part of this zone will continue to result in the East Austin Pump Station operating significantly below its design capacity. The model shows that only one small 3,500-gpm pump can be used. Neither of the two existing 10,000-gpm or two 10,700-gpm pumps will be needed in this time period. The 48-inch Northeast Austin Transmission Main proposed in the 1980s would have linked this part of the zone with the 48-inch main east of the Howard Lane Reservoirs. Lower demands now expected for this area will require only a 16-inch main. Future reliability analysis will address the need for better connection of the East Austin Pump Station to the rest of the North Zone.

Both the Howard Lane and the Spicewood Springs Reservoirs will fluctuate more than 6 feet during a 24-hour period. Operators have in the past had to open and close valves at Howard Lane Reservoirs and change pumps at the North Austin Pump Station to achieve desired fluctuation and turnover in this reservoir.

The Davis High Service Pump Station will be used to feed the Spicewood Springs Reservoir and Spicewood Springs Pump Station. The North Austin Pump Station and the Howard Lane Reservoirs will work together to supply demand. Our preferred operation strategy calls for cutting back pumpage at North Austin Pump Station and letting Howard Lane supply more demand during peak hours of the diurnal cycle. This operating procedure will allow the reservoir to fluctuate more than if the North Austin Pump Station were providing higher pumpage.

The LRP team also considered appropriate operating strategies for year 2000 minimum-month demand levels. While operating pressures were within the desired levels, there will be reservoir fluctuation problems. In particular, Howard Lane Reservoir will not fluctuate and during the 24-hour cycle will probably require valve operation to assure adequate turnover. Utility staff currently employ this method as needed, in order to keep the chlorine residuals at the desired levels.

Year 2010 Operations and Improvements

Operations in the year 2010 operating period will be similar to those in year 2000. No major system improvements will be needed under the proposed operating strategy. Local demand from new growth in this time period will be supplied through 16-inch urban grid lines.

The LRP team made the planning assumption that the City of Pflugerville and the area known as the Loop 360 Peninsula will have begun to receive service from the North Pressure Zone by year 2010. (These areas are now served by others.)

The Loop 360 Peninsula area could be served by other nearby zones, however the proximity of the 48-inch main from the Davis High Service Pump Station makes it the most practical service connection. In addition, demand will continue to grow as the service area expands.

By the year 2010, only one of the small pumps at the East Austin Pump Station will continue to be an adequate supply to meet maximum-day demand. The Davis High Service Pump Station will operate at its firm capacity to provide adequate volume to the Spicewood Springs Reservoir and Pump Station. Approximately 67 MGD will be supplied by the Davis High Service Pump Station according to our maximum-day simulation. The Howard Lane Reservoirs will fluctuate about 6 feet.

Year 2017 Operations and Improvements

Year 2017 North Pressure Zone operating strategy will require the purchase of one additional 16.4-MGD pump and station modifications at **Davis High Service Pump Station**. This purchase will be necessary to prevent Davis High Service Pump Station from operating beyond its firm capacity. Demand in this zone will increase and the actual operation will be enhanced by better reservoir fluctuation.

The operating strategy modeled assumed the previously mentioned "wall of valves" will be open. This differs from the primary modeling which was simulated with the North Austin Pump Station and the **Davis High Service Pump Station** partially isolated by closing the valves. Again, if conditions of inadequate fluctuation of the Howard Lane Reservoir or insufficient quantity to the Spicewood Springs Reservoir occur, the system could still be separated by valves to achieve the desired conditions, as is often done presently.

Year 2018 Operations and Improvements

The operating strategy for the North Pressure Zone will change for this time period due to zone-to-zone transfer changes recommended when WTP 4 and the proposed **Howard Lane Pressure Control Station** come on line. With this change, the NWA Pressure Zone will transfer water into the North Pressure Zone instead of the other way around as presently occurs. WTP 4 is discussed in detail in Chapter

4 of this guide. The LRP team recommends scaling back significantly the Davis High Service Pump Station to allow for increased medium service pumpage, because WTP 4 will supply the previous Davis High Service demands in the North zone. Under maximum-day demands, Davis High Service pumpage will be reduced to only about 7 MGD.

We will be able to operate the North Pressure Zone in this manner through use of a pressure control station (PCS) located near the Howard Lane Reservoirs. A 48-inch main from the Northwest A Pressure Zone will extend to the point of connection near the reservoirs. The North Austin Pump Station will not provide as much as it has in the past. Large amounts of water will be supplied by WTP 4, and much less will need to be pumped up from lower to higher pressure zones.

Year 2037 Operations and Improvements

Davis WTP pumpage will all be medium service into the Central Zone and will no longer supply the North Pressure Zone in the year 2037 scenario. An additional water source from the Northwest A Pressure Zone will be needed for this 2037 operating strategy. This new **Spicewood PCS** will be located near the intersection of the existing 66-inch Loop 360 North Zone line and the existing Forest Ridge 48-inch Northwest A transmission main. No new transmission main will be needed to make this connection.

Approximately 11,000 linear feet of 48-inch transmission main, the **North Zone TM**, will be needed to better distribute flow from the new pressure control station across the zone. The proposed routing of this line is shown on the North Pressure Zone map and roughly follows a Greenlawn Parkway alignment connecting the Lamar Boulevard 48-inch main to the MoPac 48-inch main.

5.6 SOUTH, SOUTH LOOP 360 AND FAR SOUTH PRESSURE ZONES

The South Pressure Zone is located adjacent to the Central Zone and, like the North Zone, it generally serves a topographic contour range from 600 feet to 750 feet. The scope of the following South Pressure Zone discussion includes:

- Zone operating strategies.
- Infrastructure investments and scheduling.
- Details of the expanded and improved South Loop 360 Zone.
- Details of the Far South Zone, a new pressure boosted zone.
- Description of the various Special Service Areas.

The Water System Plan Map (in the Summary) shows major components of the zone and the relationship of the South Pressure Zone to the entire system. The South Pressure Zone Map (in the map pocket at the end of this report) shows more detail in the zone and provides performance indicators for key zone facilities. Table 5-5 provides detailed cost estimate information for recommended system improvements.

General Description

Currently and for the entire planning period, the South Pressure Zone is served by two pump stations. The Ullrich WTP High Service Pump Station pumps water from the treatment plant clearwells. The Center Street Pump Station transfers water into the South Zone from the Central Pressure Zone.

Water from these two pump stations is consumed or stored in the two 10 million gallon reservoirs at Davis Lane. These interconnected reservoirs supply equalization storage for the South Pressure Zone, and they provide storage for the Davis Lane Pump Station to supply water for the Southwest A Zone.

Table 5-5

SOUTH PRESSURE ZONE CIP IMPROVEMENTS AND COST ESTIMATES

TRANSMISSION MAINS Description	Pipe Diameter (inches)	Pipe Length (LF)	Construction Unit Cost ($/LF)	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
SOUTH INTERSTATE 35 TM	24	8,500	68	1.3	751,400	
	24	4,300	136	1.3	760,240	
					1,511,640	2010
Rehabilitation: (Future Study)						
54- inch Ullrich WTP High Service TM					unknown	
TOTAL MAINS					*$1,511,640*	

PUMP STATIONS Description	Flow (MGD)	Head (feet)	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
ULLRICH HIGH SERVICE PS UPGRADE	28.8	205	0.5	1,149,843	2037
TOTAL PUMP STATIONS				*$1,149,843*	

MISCELLANEOUS Description	Total Cost Estimate (dollars)	Recommended Before Year
Relocation of Onion Creek PRV	50,000	2000
TOTAL MISCELLANEOUS	*$50,000*	

TOTAL SOUTH ZONE IMPROVEMENTS		
	YEAR 2000	$50,000
	YEAR 2010	$1,511,640
	YEAR 2017	$0
	YEAR 2018	$0
	YEAR 2037	$1,149,843
	TOTAL	$2,711,483

In addition to this transfer of water into the Southwest A Zone, two other transfers of water out of the South Pressure Zone should be mentioned. They occur at the Eberhart Reservoir and Pump Station and the Loop 360 Reservoir and Pump Station.

The current CIP calls for the Eberhart Reservoir and Pump Station to be decommissioned as a part of a project to phase out the Southwest B 1068 Pressure Zone in the next two to three years. The facilities are in operation as this Guide is being written. The Eberhart Reservoir has an overflow of 820 feet. It is filled by use of a motorized valve and is used only as pump suction storage for the Eberhart Pump Station. The pump station transfers water to the Oak Hill Southwest B Zone in a 16-inch discharge line in William Cannon. With decommissioning, a section of the 16-inch discharge line can be converted to a South Pressure Zone pipe by connecting it to a parallel 24-inch line at Emerald Forest and also at Manchaca Road.

The Loop 360 Reservoir and Pump Station is located near Camp Craft Road. Both Lost Creek and the Woods of Westlake are supplied with treated water from the fill-and-draw ground storage tank. The Lost Creek MUD pumps water from this reservoir to its own ground storage tanks, while the Woods of Westlake is served by a hydropneumatic system.

For modeling purposes, the LRP team assumed that the 24-inch CIP transmission main in Manchaca, south of Slaughter Lane, will be in operation. In addition, the 54-inch Ullrich WTP High Service Transmission Main is currently being studied as a part of the C-Factor Testing Program. A low carrying capacity has been observed in the field. In the hydraulic modeling analysis this was represented by an abnormally low C-Factor relative to the age of this pipe. Specifically, the Ullrich High Service Transmission Main was modeled with a C-Factor of 75 for the planning periods through year 2018. This corresponds to the calibrated value in the total distribution systems primary model.

Consideration should be given to the fact that partial blockage or scale build-up resulting in a low C-Factor in this 54-inch transmission main will be accompanied by an increase in the cost of electrical energy used for pumping in the zone. As more water is pumped, this cost will increase. Rehabilitation to increase the carrying capacity in the line would probably be beneficial.

Year 2000 Operations and Improvements

The year 2000 South Pressure Zone operating strategy will work much the same as in preceding years.

Under year 2000 maximum-day demand conditions, the South Pressure Zone will require approximately 47.4 MGD for water consumption and transfers out of the zone. In the model, the bulk of this demand (42.8 MGD) was provided by the Ullrich WTP High Service Pump Station. The Center Street Pump Station supplied only 4.4 MGD, with the Davis Lane Reservoirs contributing the balance. However, construction of the recommended Ullrich Medium Service Transmission Main in the Central Zone will provide more water at the Center Street Reservoir. Therefore, larger pumps could be used at the Center Street Pump Station.

We recommend that the Pinnacle Road Improvements CIP project be completed by the year 2000. This project would add a number of new facilities, and it would create a new pressure zone, the South Loop 360 Pressure Zone. The South Loop 360 Zone is discussed later in this section.

Also by this time, the pressure reducing valve on the Onion Creek 20-inch line should have been relocated. In this way the Utility could make better use of the 20-inch transmission main for supplying the developing customer base to the east of IH-35.

Year 2010 Operations and Improvements

The model indicates that under year 2010 maximum-day demand conditions, the Ullrich WTP High Service Pump Station will pump 43.3 MGD at firm capacity. The Center Street Pump Station will supply 15 MGD and still have additional pumping capability. It will be limited not by the number of available pumps, but rather by the Central Pressure Zone transfer of water into the Center Street Reservoir. The Davis Lane Reservoirs will operate routinely, reaching a maximum hydraulic grade line of 855 feet and a minimum hydraulic grade line of 839 feet. With the expanded service area and in order to maintain reasonable pressures, the hydraulic grade line of the Davis Lane Reservoirs should remain above 838 feet.

The South Pressure Zone geographical planning area will have almost doubled by the year 2010. (See South Pressure Zone Map). Providing an urban level of service to the areas remote from major facilities will require special attention. The relationship between the hydraulic grade line of the Davis Lane Reservoirs, head loss in pipes, and the topography of the area will make it impractical to serve all of this expanded area with South Pressure Zone water.

To serve up to the 750-foot contour near the southern boundary would require the construction of 72-inch diameter transmission mains and would require the Davis Lane Reservoirs to remain virtually full. While hydropneumatic systems could be used, they do not normally provide the urban levels of service, nor will they provide the greatest degree of reliability for many customers. Instead, a new South boosted pressure zone, the Far South Pressure Zone, is proposed. The LRP team recommends that this zone be established by year 2010.

To do this, two projects will be needed to serve the expanded service area. They are the 24-inch **South IH-35 Transmission Main** and the Far South Zone Improvements (see map). Details of the Far South Zone Improvements are delineated later in this section under the heading "Creating the Far South Pressure Zone."

Years 2017 and 2018 Operations and Improvements

The South Pressure Zone operating strategies for years 2017 and 2018 will be a continuation of operations established for 2010. To meet maximum-day demands for these time frames, the model showed the Ullrich WTP High Service Pump Station contributing at firm capacity (approximately 43 MGD) and that Center Street will pump approximately 23 MGD below its firm capacity. Note that WTP 4 operation will have little direct effect on the South Pressure Zone.

Year 2037 Operations and Improvements

The individual zones were not modeled for this time period. Instead, the total distribution major facilities model, also know as the primary model, was used.

This analysis indicated that by the year 2037, **Ullrich WTP High Service Pump Station** should be upgraded. The LRP team assumed an additional 28.8 MGD pump will be added to match the two large existing pumps. Also, in modeling the year 2037, the C-Factor in the 54-inch Ullrich WTP High Service Transmission Main was raised to 95 (from the 75 value in the calibrated existing systems primary model). This was done to represent the rehabilitation of the line correcting its low carrying capacity. No other major capital expenditures should be needed for the year 2037.

Special Service Areas

The South Pressure Zone has 24 areas identified as Special Service Areas. These areas are shown on The South Pressure Zone Map contained in the map pocket at the end of the Guide.

There are four Special Service Areas (4S, 5S, 6S, and 24S) that merit discussion. They all have elevations above 730 feet. All are far from any major facility. In these cases modeling indicated that the relationship between the hydraulic grade line of the Davis Lane Reservoirs, head loss in pipes and the topography of the locality will make it impractical to provide an urban level of service with the South Pressure Zone. Any service above this elevation must come from either the SWA Pressure Zone or special provisions must be made to supplement the South Zone pressure.

Creating the South Loop 360 Pressure Zone

The proposed South Loop 360 Pressure Zone will be on the western edge of the South Pressure Zone (see the map inset on the South Pressure Zone Map). The area is roughly west of Walsh Tarlton Lane and surrounded by the Barton Creek Greenbelt, Lost Creek MUD, and WCID 10. We identified several year 2000 projects that will be required to create this new pressure zone.

The South Loop 360 Pressure Zone will:

- Relieve the existing overloaded Loop 360 Pump Station facility (a small suction tank, two independent sets of pumps, and a hydropneumatic tank).
- Increase the level of service to customers by improving pressure, reliability, and fire flow capacity.
- Provide for limited new growth in the area.

- Eliminate the existing Loop 360 Pump Station facility operation and maintenance problem.
- Increase system reliability.

Table 5-6 shows the proposed CIP improvement projects with cost estimates.

PRESSURE ZONE AREA

The new South Loop 360 Pressure Zone is defined by topographic, political, and environmental boundaries. To define the lower topographic boundary, we determined that the South Pressure Zone can reasonably serve with 50 psi or greater at an elevation of up to 720 feet. We assumed that the new zone would be practically confined to the west side of Walsh Tarlton Lane. The zone will extend from the 720-foot contour and Walsh Tarlton Lane west through a mostly residential corridor surrounded by WCID 10, the Barton Creek Greenbelt, and the Lost Creek MUD.

The area cannot easily be hooked up with the SWA Pressure Zone mainly because the Barton Creek Greenbelt lies between the two zones.

Some of the customers in this area are now served by the South Pressure Zone at a pressure of less than 50 psi. We are proposing to move them from the lower hydraulic grade line of the South Zone to the higher hydraulic grade line of the South Loop 360 Pressure Zone. Hundreds of customers to be switched from the South Zone to the South Loop 360 zone will require either subdivision or individual pressure reducing valves (PRVs) to keep pressure to a maximum of 80 psi after the pressure zone switch.

SERVICE PRESSURE RANGE

To conform to anticipated future pressure ranges, the LRP team set as a target for this zone to supply water at 50 to 115 psi. This may be difficult, since there is 300 feet of topographic change (from about 720 to 1003 feet). With a normal operating hydraulic grade line of 1046 to 1066 feet, areas above 930 feet (marked Special Service Area 2A on the map) will need pressure boosting. Areas below 800 feet require PRVs.

Table 5-6

SOUTH LOOP 360 PRESSURE ZONE CIP IMPROVEMENTS AND COST ESTIMATES

TRANSMISSION MAINS

Description	Pipe Diameter (inches)	Pipe Length (LF)	Construction Unit Cost ($/LF)	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
LOST CREEK TM	16	4500	90	1.35	546,750	2000
PINNACLE ROAD DISCHARGE TM	24	6400	111	1.35	959,040	2000
TOTAL MAINS					*$1,505,790*	

PUMP STATIONS

Description	Flow (MGD)	Head (feet)	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
PINNACLE ROAD PS	5.5	210	1.35	905,558	2000
TOTAL PUMP STATIONS				*$905,558*	

RESERVOIRS

Description	Volume (MG)	Design Type: Elevated or Ground	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
BARCLAY ROAD RES	1	Elevated	1.35	1,161,000	2000
PINNACLE ROAD SUCTION RES*	0.2	Ground	1.35	160,728	2000
TOTAL RESERVOIRS				*$1,321,728*	

* Note, a suction tank at the Pinnacle Road Pump Station may not be needed

MISCELLANEOUS

Description	Total Cost Estimate (dollars)	Recommended Before Year
Boundary Adjustments: PRVs, Valves, & Connections	100,000	2000
TOTAL MISCELLANEOUS	*$100,000*	

TOTAL SOUTH LOOP 360 ZONE CIP IMPROVEMENTS

YEAR 2000	$3,833,076
YEAR 2010	$0
YEAR 2017	$0
YEAR 2018	$0
TOTAL	$3,833,076

Zone was not modeled under Year 2037 demand conditions

DEMAND DEFINITION

The modeled maximum-day demand projection for the Year 2000 is 4.9 MGD, for Year 2010, 4.9 MGD, and for 2017, 5.0 MGD. Total demand will remain fairly steady through the secondary modeling horizon of 2017/18. The slight growth that occurs will be offset by the declining peaking factor. Demand previously attributed to land in the proposed BCCP land acquisition area (for example, the Parkstone Development area) has been shifted elsewhere in the system. BCCP lands are assumed to have zero demand.

LOST CREEK CUSTOMERS

The LRP team assumed that Lost Creek MUD will be a wholesale customer in the year 2000 and that the area will be converted to retail service by 2010. Currently, the Lost Creek MUD is about 95 percent "built out", and we assumed that demand would remain the same after it is converted to retail service. In other words, we are proposing to simply remove the meter and take over operation and maintenance of existing facilities. As the plans for annexation are developed, this proposed approach should be studied in more detail.

The existing Lost Creek MUD system consists of a small hydropneumatic boosted zone, a main zone that floats off of two side-by-side ground storage tanks, and a reduced pressure zone. Two ground storage tanks totaling 1.25 MG in capacity) are filled by the Lost Creek pumps located at the small existing City of Austin Loop 360 Pump Station. Our analysis assumed Lost Creek MUD's peak demand will be a constant 2,100 gpm though the secondary modeling horizon (2017/18). This is consistent with currently projected development levels supplied by the MUD.

WCID 10 CUSTOMERS

The LRP team assumed WCID 10 will be a wholesale customer through the secondary modeling horizon of 2018. Based on topography analysis and findings of previous network analyses, half of the WCID 10 demand was loaded on the South Loop 360 Pressure Zone for the years 2000, 2010, and 2017. (Since we were unsure if WCID 10 would tie a major portion of their system to the South Loop 360 feed, 100 percent of WCID 10 demand was loaded also on the Central Pressure Zone for the years 2000 and 2010 and 50 percent of the demand for the year 2017.)

PINNACLE ROAD PUMP STATION

The Utility's Engineering Division recently acquired a suitable pump station site near the corner of Pinnacle and Allen Roads. Two adequate suction lines flank the site. There is a 16-inch main on the south side and a 24-inch main on the north side of the site to serve as suction pipes for the pump station. Because there are two reasonably sized suction lines and the pressure in the lines at the pump suction is greater than 20 psi under all modeled conditions, a suction tank will probably not be needed. However, the cost estimates include a small suction tank at the site. The cost estimate also includes a miscellaneous item for South/South Loop 360 Pressure Zone conversion costs such as valve installation, connections, and PRV installations associated with adjusting the South Pressure Zone boundary.

Based on the modeled demand conditions, a 5.5 MGD **Pinnacle Road Pump Station** will be needed by year 2000. Eventually the pump station may be upgraded to 9.2 MGD based on demand estimates for the planning horizon beyond 2017. These pump station capacities should work with the proposed discharge side reservoir (Barclay Road Reservoir) at a one-million-gallon capacity. Modeling shows that the pump station and reservoir operated together will meet operations criteria under all conditions, including a maximum-day power outage scenario, maximum-day plus fire flow, peak-hour, and minimum-month demand.

BARCLAY ROAD RESERVOIR

After examining many options for a reservoir on the discharge side of the Pinnacle Road Pump Station, we sized the **Barclay Road Reservoir** at 1 million gallons. The City has recently completed the Barclay Road Reservoir site acquisition (see South Loop 360 Pressure Zone inset map on the South Pressure Zone map for approximate location). The 1 million-gallon size will supply fire flow plus flow equalization through the year 2017. A one-million-gallon tank will also be adequate through the year 2037 if the Pinnacle Road Pump Station is upgraded from 5.5 MGD to 9.2 MGD. The 24-inch transmission main needed to connect the pump station and the reservoir can carry the additional flow.

There are a couple of high spots in the pressure zone area. One is by the modeled reservoir site off Barclay Road (up to about 930 feet in elevation). One is in a small area (1003 feet at its peak) adjacent to the northern boundary of Lost Creek MUD (also a reservoir site candidate). Since the second high spot is somewhat disconnected from the main part of the zone and since it is adjacent to the Lost Creek boosted hydropneumatic system, we designated the second high spot a Special Service Area (SSA 2A) and used 930 as the upper topographic elevation of the new pressure zone.

To maintain 50 psi at the 930-foot contour, the tank should not drop below 1046 feet. Since the standard catalog tank in the one-million-gallon size range will have a 40-foot operating range, half of the operating range could be for normal operation and the other half for emergencies. Therefore, the tank overflow should be at 1066. It should drop to 1046 on a routine basis and can go to 1026 for emergencies. In the 1026 feet level condition, customers would receive 20 psi or greater, if the network line sizes are adequate to supply peak day plus fire flow demand with acceptable headloss.

PINNACLE ROAD AND LOST CREEK MAINS

The network modeling analysis shows that the **Pinnacle Road Discharge Main** connecting the proposed pump station and reservoir should be 24-inches in diameter.

With replacement of the existing Loop 360 Pump Station, maintaining service levels to existing customers may pose a problem. In the Lost Creek system, the Utility will be replacing the two Lost Creek pumps with service from the new pump station at Pinnacle Road. Since Lost Creek is currently supplied with a hydraulic grade line of around 1085 feet, the new zone normal operating hydraulic grade line level of 1046 to 1066 feet will not be adequate to replace the old feed unless other improvements are made.

A 12-inch line now fills the Lost Creek MUD tanks, which operate between 987 and 992 feet. Today, maximum demand reaches 2,100 gpm, a significant amount of water to flow through a long single 12-inch line. With the new system, the **Lost Creek Transmission Main** (4,500 linear feet of 16-inch line parallel to the existing 12-inch supply line) will be needed to reduce the headloss. The parallel water line is needed to sufficiently to maintain the tank levels at the Lost Creek MUD reservoirs with the new hydraulic grade line level of the system feeding the tanks.

We are planning to install a flow control/altitude valve in the main Lost Creek service line to supply the Lost Creek system. The valve will be needed to control inflow and outflow of the existing ground storage tanks.

COST ESTIMATES AND SCHEDULING

As shown on Table 5-6, a total of $3.8 million will be required to establish a new South Loop 360 pressure zone. The individual projects are:

- **Lost Creek TM**
- **Pinnacle Road Discharge TM**
- **Pinnacle Road Pump Station**
- **Barclay Road Reservoir**
- **Pinnacle Road Suction Reservoir** (if necessary)
- **Miscellaneous Boundary Adjustments and Valves**

The LRP team supports beginning these projects as soon as possible. The Engineering Division is in the process of hiring a consultant for this group of projects.

SPECIAL SERVICE AREAS

The South Loop 360 Pressure Zone inset map on the South Pressure Zone map shows 3 hatched Special Service Areas (SSAs).

Special Service Area 2A is a small hill within the pressure zone area. Pressure above the South Loop 360 Pressure Zone level will be needed for adequate service. One realistic possibility for service is the Lost Creek boosted hydropneumatic system.

SSA 3S is the Lost Creek MUD system. We assumed the existing MUD system to be adequate for future service in the nearly built-out MUD area.

Creating the Far South Pressure Zone

By the year 2010 there is also a need to create another new zone in the South. As previously mentioned, the current south system will be unable to provide an urban level of service to some areas of the South Pressure Zone. The LRP team recommends creating a new Far South Zone for this purpose. While the South Zone can supply water to the new zone, it cannot adequately serve the area without pressure enhancement. The new zone will be located south of the Onion Creek community. It will include the South IH-35 area and extends east just beyond Carl Road. The Planning Area Boundary defines the southern limit (see the South Pressure Zone Map).

Forming the new zone will be accomplished with the construction of the following Far South Zone Improvements:

- **Far South Transmission Main** - 24,500 linear feet of 16-inch and 24-inch mains.
- 3.6-MGD **South IH-35 Pump Station**.
- 1-million-gallon **Carl Road Reservoir**.

This sizing of facilities is projected to be adequate to meet demand through the year 2037. Table 5-7 provides detailed cost estimate information for recommended system improvements.

PRESSURE ZONE AREA

The primary line of demarcation between the South and the Far South Pressure Zones will be the 680-foot topographical contour line. At about this elevation the South Pressure Zone can provide a minimum service pressure of 50 psi.

SERVICE PRESSURE RANGE

As with the South Loop 360 Zone, the LRP team set a target service pressure range of 50 psi to 115 psi for this zone. Establishing the zone with a normal operating hydraulic grade line ranging from 901 feet to 921 feet will provide the target pressure range for most of the Far South Zone. However, pressure reducing valves would be necessary along Rinard Creek where the elevation falls as low as 610 feet.

DEMAND DEFINITION FOR THE FAR SOUTH ZONE

Between the year 2010 to year 2037, average-day demand will more than triple from .7 MGD to 2.2 MGD. For years 2010, 2017 and 2037, the maximum-day demands were projected to be 1.2 MGD, 1.7 MGD and 3.4 MGD, respectively.

Table 5-7

FAR SOUTH PRESSURE ZONE CIP IMPROVEMENTS AND COST ESTIMATES

TRANSMISSION MAINS Description	Pipe Diameter (inches)	Pipe Length (LF)	Construction Unit Cost ($/LF)	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
FAR SOUTH ZONE TM	24	4,300	68	1.3	380,120	2010
	24	1,400	136	1.3	247,520	2010
	16	17,200	55	1.3	1,229,800	2010
	24	1600	68	1.3	141,440	2010
					1,998,880	
TOTAL MAINS					*$1,998,880*	

PUMP STATIONS Description	Flow (MGD)	Head (feet)	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
SOUTH INTERSTATE 35 PS	3.6	140	1.3	539,565	2010
TOTAL PUMP STATIONS				*$539,565*	

RESERVOIRS Description	Volume (MG)	Design Type: Elevated or Ground	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
CARL ROAD RES	1	Elevated	1.3	1,118,000	2010
TOTAL RESERVOIRS				*$1,118,000*	

TOTAL FAR SOUTH ZONE CIP IMPROVEMENTS		
	YEAR 2000	$0
	YEAR 2010	$3,656,445
	YEAR 2017	$0
	YEAR 2018	$0
	TOTAL	$3,656,445

Zone was not modeled under Year 2037 demand conditions

SOUTH INTERSTATE 35 PUMP STATION

The proposed **South Interstate 35 Pump Station** was modeled at a location on the northern edge of the zone near IH-35. It will be fed by another proposed CIP project, the 24-inch **South IH-35 Transmission Main**. In addition, analysis included the potential for two other 16-inch urban grid lines to provide a backup suction source for the pump station. Modeling of a line break in the 24-inch transmission main showed that these 16-inch lines will have sufficient capacity to provide water at more than 20 psi. Thus, a tank on the suction side of the pump station will not be needed. This conclusion should be revisited as the need for the Far South Pressure Zone develops and more information is available on the actual pipe configuration.

Energy costs should also be considered if a tank on the suction side of the pump station is deemed necessary. Operating costs may make a small elevated tank more cost- effective than a ground storage tank to supply the pump station.

The pump station was sized and modeled to provide the anticipated maximum-day water demands of 2037. Thus, the recommended pump station will operate at a uniform 3.6 MGD throughout the 2037 maximum day depending on a million-gallon elevated storage tank on the discharge side to handle the hour-to-hour variations. Modeling indicates that by working together, the **South IH-35 Pump Station** and the **Carl Road Reservoir** will be able to supply demand for maximum-day, peak-hour, and maximum-day with fire flow over all the planning periods.

CARL ROAD RESERVOIR

As stated, we assumed that an elevated reservoir will be operating on the discharge side of the pump station. For modeling purposes, the LRP team located the reservoir on a hilltop west of Carl Road. In addition to giving operational flexibility, elevated storage in this zone will increase system reliability, normalize pressures, and reduce the need for large main sizes. Analysis suggests the **Carl Road Reservoir** should be a 1-million-gallon elevated storage tank.

The **Carl Road Reservoir** was modeled with a total operating depth of 40 feet. The normal operating range would be the upper 20 feet, resulting in a normal hydraulic grade line of 901 feet to 921 feet. A hydraulic grade line of 901 feet will allow the highest point in the zone (785 feet) to be supplied a minimum of 50 psi water during normal operations. In the event of an emergency, the reservoir would have an additional 20 feet of storage that provides water at 20 psi or greater throughout the zone. This will greatly increase system reliability.

An additional measure of reliability can be added by using South Pressure Zone water to feed the area directly in the event of an emergency. For example, the South Pressure Zone was modeled as a backup water source in the event of a power outage to the pump station. Provided there will be a direct connection with a check valve that bypasses the pump station, the South Pressure Zone can be used to supply many of the customers in the Far South Zone with water at 20 psi in an emergency.

<u>FAR SOUTH ZONE TRANSMISSION MAIN AND URBAN GRID</u>

The computer analysis indicated the need for the **Far South Zone Transmission Main**. It will be 7,300 linear feet of 24-inch and 17,200 linear feet of 16-inch pipe to provide the transmission capacity from the pump station to the reservoir. In addition, the 16-inch urban level grid was modeled. It would extend to the extremities of the zone and would complete a loop that will provide proper pressure and fire flow to the localized areas.

5.7 NORTHWEST A PRESSURE ZONE

The Northwest A (NWA) Pressure Zone is a large zone located between the North and Northwest B Pressure Zones. It extends from Lake Austin past Pflugerville and from Round Rock to Mount Barker. The zone generally serves a topographic range of 750 feet to 900 feet. The following section includes discussion on:

- Zone operating strategies (including how WTP 4 facilities relate to this zone).
- Infrastructure investments, timing, and cost estimates.
- Information on Special Service Areas.

The Water System Plan map (in the map pocket in the Summary) shows the major components of the zone and how it fits with the rest of the system. Table 5-8 shows the CIP investment projects with cost estimates. The pressure zone map is located at the end of this report in a map pocket. The NWA Pressure Zone map shows more detail than the Water System Plan map and the modeling results on performance indicators for key facilities.

General Description

Today the Spicewood Springs Pump Station supplies virtually all of the Northwest Area demand. The small Highland Park Pump Station augments supply to the Mount Barker area under high demand, including emergency conditions.

The Spicewood Springs Pump Station is the single pump station supplying a significant portion of the service area. It appears first on Table 8-2, Vital Few Facility Outage Events. Since a large portion of the City is fed by a single source, service may be vulnerable to a major outage (especially electrical). There are, however, 21 million gallons of effective storage within the NWA zone. Using this stored water helps to maintain acceptable service during pump station outages.

Table 5-8

NWA PRESSURE ZONE CIP IMPROVEMENTS AND COST ESTIMATES

TRANSMISSION MAINS Description	Pipe Diameter (inches)	Pipe Length (LF)	Construction Unit Cost ($/LF)	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
PFLUGERVILLE EXIT TM						
Main section that parallels RM 1825	16	12000	90	1.3	1,404,000	
Short end that connects to Wells Branch Pkwy	24	1700	111	1.3	245,310	
					1,649,310	2000
LADERA VISTA TM	36	1800	170	1.3	397,800	2010
LOST HORIZON TM	36	7500	170	1.35	1,721,250	2017
SPICEWOOD SPRINGS TM						
from Loop 360 east to existing 48-inch parallel						
to existing 24-inch section of line (Eastern Section)	48	3000	250	1.35	1,012,500	2018
from Loop 360 west to WTP 4 NWA PS						
discharge 72-inch line (Western Section)	42	18500	210	1.35	5,244,750	2037
					6,257,250	
WTP 4 NWA DISCHARGE TM - FOREST RIDGE	48	4000	500	1.35	2,700,000	2018
WTP 4 NWA DISCHARGE TM - JOLLYVILLE						
Section from WTP to SS Road - Tunnel	72	14000	850	1.35	16,065,000	
Section along SS Rd to Jollyville - Open Cut	72	10000	425	1.35	5,737,500	
					21,802,500	2018
MARTIN HILL TM	54	23500	300	1.35	9,517,500	2018
HOWARD LANE NWA TM	48	5000	250	1.3	1,625,000	2018
TOTAL MAINS					*$45,670,610*	

Table 5-8

NWA PRESSURE ZONE CIP IMPROVEMENTS AND COST ESTIMATES (CONTINUED)

PUMP STATIONS

Description	Flow (MGD)	Head (feet)	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
WTP 4 NWA PS	120	100	1.35	6,794,263	2018
WTP 4 NWA PS UPGRADE	60	100	0.5	1,496,257	2037
TOTAL PUMP STATIONS				*$8,290,520*	

MISCELLANEOUS

Description	Total Cost Estimate (dollars)	Recommended Before Year
Flow Control Station (FCS) at Forest Ridge Res	50,000	2000
Flow Control Station (FCS) at Jollyville Res	50,000	2018
TOTAL MISCELLANEOUS	*$100,000*	

TOTAL NWA ZONE CIP IMPROVEMENTS		
	YEAR 2000	$1,699,310
	YEAR 2010	$397,800
	YEAR 2017	$1,721,250
	YEAR 2018	$43,501,763
	YEAR 2037	$6,741,007
	TOTAL	$54,061,130

The three main NWA Pressure Zone reservoirs, Forest Ridge, Jollyville, and Martin Hill, provide emergency and equalization storage. The Forest Ridge and Jollyville Reservoirs serve as suction tanks for Northwest B Zone Pump Stations. The Forest Ridge Pump Station pumps out of the tank to the West Bull Creek NWB Pressure Zone system. The Jollyville Pump Station pumps to the main NWB Pressure Zone system along US 183.

There are several small pressure zones within or adjacent to the NWA Pressure Zone. The Anderson Lane Reduced Pressure Area is fed by a pressure reducing valve at US 183. The Guildford Cove hydropneumatic system serves a portion of the Long Canyon Subdivision.

The Cat and Shepherd Mountain booster systems are scheduled to be constructed in the near future. They will serve high spots within the NWA Pressure Zone. There are many small reduced pressure zones and pockets in the low lying areas served by the NWA Zone. These are concentrated in the hilly western portion of the zone, especially near Bull and West Bull Creeks.

The current operation method for the NWA zone generally consists of pumping from Spicewood Springs Pump Station to maintain pressures and reservoir levels within specified limits. Pumping rates for reservoir fill-and-draw cycles are set based on tracked usage patterns. Each reservoir has a motorized valve (in addition to other valves) that allows for valving tanks off when necessary. However, in general, with the exception of Forest Ridge, the reservoir valves remain open to the NWA system.

The Forest Ridge Reservoir is nearby and well connected to the Spicewood Springs Pump Station. The configuration creates a situation where the Forest Ridge Reservoir must often be valved off to avoid over-filling. When the reservoir is valved off from the NWA system, the Forest Ridge Pump Station can continue to pump out of the tank to the West Bull Creek NWB Pressure Zone.

Year 2000 Operations and Improvements

For the year 2000, we modeled the system assuming continued use of current operating methods. The existing Spicewood Springs Pump Station will continue to supply virtually all of the Northwest Area demand. The small Highland Park

Pump Station will continue to operate and the Forest Ridge, Jollyville, and Martin Hill Reservoirs will be used. Analysis indicates the existing pumping and storage capacity will be sufficient to serve the year 2000 demands.

We checked the system for the minimum-month demand condition in 2000 and found no obvious operations problems.

Due to growing demand, in the year 2000, more transmission main capacity will be needed in the Pflugerville Exit area. The system modeling analysis shows that a 24/16-inch **Pflugerville Exit Transmission Main** along RM 1825 will be needed (see pressure zone map).

This pipe will reinforce the existing distribution network and provide capacity to serve the projected year 2000 demands and beyond in the northeast section of the zone. A number of existing retail and wholesale customers in the area will benefit.

A small valve installation CIP project will be needed at Forest Ridge Reservoir. Currently, the tank water cannot flow into the NWA system unless the motorized valve is open. If the valve were equipped with a check valve bypass, the reservoir would automatically backflow (providing water to the area) if the hydraulic grade line in the area dropped below the tank level. This project, recommended by the year 2000, would improve service, operations, and reliability.

We considered decommissioning the Highland Park Reservoir and Pump Station. Analysis showed it to be more cost-effective to continue to operate and maintain the facility rather than retire it.

Year 2010 Operations and Improvements

Operations in 2010 will continue basically the same as in the year 2000. The analysis shows the existing pumping and storage capacity will be sufficient to serve 2010 demands.

We identified a need in 2010 for the **Ladera Vista Transmission Main** project to connect the existing 24-inch line in Jollyville Road to the 36-inch line in Danwood Drive. This line will improve reliability and provide transmission main grid looping.

Year 2017 Operations and Improvements

Operations in the year 2017 will continue basically unchanged from the previous years. The existing pumping and storage capacity will be sufficient to serve 2017 demands.

The year 2017 (pre-WTP 4) system modeling analysis indicated the need for more transmission capacity from Spicewood Springs Pump Station to Jollyville Reservoir. This need could be satisfied via the **Lost Horizon Transmission Main** connecting the existing 36-inch line in the Great Hills area to the Danwood Drive TM at Oak Knoll Drive.

Year 2018 Operations and Improvements

Once WTP 4 comes on line (2018), Northwest A Pressure Zone operations will change. The **NWA Pump Station at WTP 4** will be the main plant capacity discharge facility. It will become the main source of supply for the NWA Pressure Zone. Operations will continue to focus on meeting demands, maintaining reservoir levels and supplying pressures within specified limits.

A check of the system for the minimum-month demand condition in 2018 found no obvious operations problems.

For the 2018 maximum-day demand scenario, we used the WTP 4 NWA Pump Station to serve NWA Pressure Zone system demand, the Main NWB Pressure Zone system demand (through the Jollyville Pump Station), and a portion of the North Pressure Zone demand through the Howard Lane Pressure Control Station. The Spicewood Springs Pump Station was not used in that scenario. The Howard Lane Pressure Control Station was used to supply water to the North Pressure Zone.

Based on strict demand/capacity relationships, the Spicewood Springs facility will not be needed to supply the Northwest Pressure Zones once WTP 4 is on line. However, there may be times of the year when using Spicewood Springs Pump

Station would be a preferred operating strategy. Reliability considerations may also help justify keeping the pump station in service. At this point, the LRP team makes no recommendation regarding Spicewood Springs Pump Station when WTP 4 comes on line.

WTP 4 will trigger the need for many NWA Pressure Zone CIP improvements, including a pump station, a valve, and several transmission mains. These projects will cost an estimated $45 million and are discussed in more detail below. The 6 major NWA projects related to WTP 4 for the year 2018 are:

- **NWA Pump Station at WTP 4**
- **WTP 4 NWA Discharge TM - Forest Ridge**
- **WTP 4 NWA Discharge TM - Jollyville**
- **Martin Hill TM**
- **Spicewood Springs TM (the eastern section)**
- **Howard Lane NWA TM (Howard Lane PCS Supply Main).**

The **NWA Pump Station at WTP 4** will connect to two NWA discharge mains. It will be used to fill the Jollyville and Martin Hill Reservoirs through the 72-inch main discharge pipe. The pump station will supply a direct feed to the NWA Pressure Zone system and will also supply the Jollyville PS that pumps to the main NWB Pressure Zone. The Forest Ridge Reservoir (if needed) could be filled directly from the 48-inch main. The NWA Pressure Zone Pump Station 48-inch TM could supply the Forest Ridge Pump Station if the facility is used once the NWB WTP 4 Pump Station is on line. The NWA Pump Station at WTP 4 will also supply water to the Howard Lane Pressure Control Station near the North Pressure Zone Howard Lane Reservoirs.

At the Jollyville Reservoir, we foresee the need for a check valve installation for Jollyville Reservoir backflow for times when the two existing motorized butterfly valves are closed. This would only be needed beginning in 2018, because prior to that the motorized butterfly valves at the Jollyville Reservoir are little used. The tank is almost always open to the NWA system in the event the system needs the Jollyville Reservoir water to backflow to serve NWA demand.

Year 2037 Operations and Improvements

The operating strategy for the year 2037 NWA Pressure Zone system will be similar to the year 2018 operating strategy. An additional supply point to the North Pressure Zone is recommended near the intersection of Spicewood Springs Road and Loop 360.

Primary-level modeling showed the need for a WTP 4 NWA PS Station upgrade and the **Spicewood Springs TM (the western section)**. The line is a 42-inch main that will be needed to move additional **WTP 4 NWA Pump Station** water, some of which will be needed at the Spicewood Pressure Control Station, into the system.

Special Service Areas

The NWA Pressure Zone map shows the hatched Special Service Areas (SSAs). In total, there are 41 NWA SSAs; all fall into the standard categories explained near the beginning of this chapter. Six particularly noteworthy SSAs are discussed below.

In Special Service Areas 4A and 5A, customers are currently served with NWA water. Two NWA variable speed booster pump station projects, funded by the CIP, have been designed to solve the low pressure service problems in these areas. The pump stations are the Shepherd Mountain Pump Station (for 4A) and the Cat Mountain Pump Station (for 5A).

Special Service Areas 7A and 14A contain customers currently served with NWA Water. This is a marginal pressure area with customers near 35 psi minimum under some conditions. The area needs to be studied in detail including field testing. The Systems Analysis Division recently proposed a new project called the Greystone Upgrade to address water service to this area.

Areas 23B and 24B include development currently served with NWA Reduced Pressure Water. This is the recently created "Anderson Lane Reduced Pressure Area", which is fed by a single PRV near US 183. Modeling results confirm that check valves and a pressure relief valve are needed for reliability and to increase fire flow capacity in the area.

Areas 23B and 24B include development currently served with NWA Reduced Pressure Water. This is the recently created "Anderson Lane Reduced Pressure Area", which is fed by a single PRV near US 183. Modeling results confirm that check valves and a pressure relief valve are needed for reliability and to increase fire flow capacity in the area.

5.8 SOUTHWEST A PRESSURE ZONE

The Southwest A (SWA) Pressure Zone is a medium-sized zone located between the South and Southwest B Pressure Zones. It extends roughly from Barton Creek to the Hays Extraterritorial Jurisdiction (ETJ) and from Oak Hill to Manchaca Road. The zone generally serves a topographic range of 750 feet to 900 feet. The following section includes discussion on:

- Zone operating strategies.
- Infrastructure investments, timing, and cost estimates.
- Information on Special Service Areas.

The Water System Plan map (in the map pocket in the Summary) shows the major components of the zone and how it fits with the rest of the system. Table 5-9 shows the CIP investment projects with cost estimates. The pressure zone map is located in a map pocket at the end of this report. The SWA Pressure Zone map shows more detail than the Water System Plan map and the modeling results on performance indicators for key facilities.

General Description

Currently, the Davis Lane Pump Station supplies virtually all of the SWA demand. The pump station serves SWA system demand and fills the Leuthan Lane and Slaughter Lane Reservoirs. From those reservoirs, water is pumped on to serve the SWB Pressure Zone system. The two SWA Pressure Zone reservoirs are used to provide emergency and equalization storage. The current operation strategy for the SWA zone consists of pumping from the Davis Lane Pump Station to maintain pressures and reservoir levels within specified limits.

The firm pumping capacity of the Davis Lane Pump Station is 62.6 MGD, with the potential to go to a firm capacity of 77.0 MGD with an impeller change on the two largest capacity pumps. The pump station's firm capacity (at 77 MGD) is more than twice the projected year 2037 SWA maximum-day demand of 30.3 MGD.

Table 5-9

SWA PRESSURE ZONE CIP IMPROVEMENTS AND COST ESTIMATES

TRANSMISSION MAINS Description	Pipe Diameter (inches)	Pipe Length (LF)	Construction Unit Cost ($/LF)	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
SOUTH MOPAC TM	24	15500	111	1.3	2,236,650	2000
SOUTHWEST A LOOP TM	16	10900	90	1.3	1,275,300	2000
TOTAL MAINS					*$3,511,950*	

TOTAL SWA ZONE CIP IMPROVEMENTS		
	YEAR 2000	$3,511,950
	YEAR 2010	$0
	YEAR 2017	$0
	YEAR 2018	$0
	YEAR 2037	$0
	TOTAL	$3,511,950

The Davis Lane Pump Station is the single pump station supplying a fair-sized portion of the entire service area. It appears fifth on Table 8-2, Vital Few Facility Outage Events. Like the case of the Spicewood Springs Pump Station serving the Northwest, a sizable portion of the City is being fed by a single source, making service vulnerable to major outage (especially electrical). There are, however, about 9 million gallons of effective storage within the SWA zone, which increases the length of time customers receive acceptable service levels during a pump station outage.

A CIP project (SWA/SWB and SWA/South Pressure Zone Boundary Adjustments) has already been created to carry out boundary adjustments needed in this area. The project eliminates the SWB (1068 Hydraulic Grade Line) Pressure Zone. Therefore, the LRP team also assumed elimination of the Eberhart-Motorola Pump Station and the Oak Hill Reservoir. For the "existing system" we assumed the Hill Meadow, Oak Hill, and Travis Country Pump Stations are all retired. The project includes valve adjustments, connections, valve installations, facility decommissions, and PRV installations. This is assumed to be completed by the year 2000. We refer to the resulting system as the baseline or "existing" system.

Year 2000 Operations and Improvements

For the year 2000 we modeled the system assuming continued use of current operating methods. During the year 2000 planning period, the system will continue to be fed through the Davis Lane Pump Station facility. The analysis indicates the existing pumping and storage capacity will be sufficient to serve the year 2000 demands.

Few improvements will be needed in the pressure zone. However, the LRP team recommends installing a transmission main along South MoPac and a line to loop the South MoPac line back to the existing system along Brodie Lane. These projects are referred to as the **South MoPac (24-inch) TM** and the **Southwest A Loop (16-inch) TM**. These improvements are recommended before the year 2000 to increase the level of existing service, provide for projected growth, and increase reliability.

The **South MoPac TM** will connect the 48-inch Davis Lane SWA TM (see Southwest A Pressure Zone Map in the map pocket). From there it will follow MoPac to the south. At some point (to be determined by detailed study), the line should be extended to the east to connect back to Brodie Lane.

The **Southwest A Loop TM** will reinforce the system serving the developing Brodie Lane corridor from Slaughter Lane to Shady Hollow. A planning-level report detailing limitations of existing system capacity in the developing Brodie Lane area is available.

A check of minimum-month demands for the zone revealed no significant operational problems.

Year 2010 through 2037 Operations and Improvements

No additional operational changes and/or additional improvements are projected through the year 2037 planning horizon. Note that SWA Pressure Zone operations will not be affected by WTP 4 coming on line (in the year 2018).

5.9 NORTHWEST B AND NORTHWEST C PRESSURE ZONES

The Northwest B (NWB) and Northwest C (NWC) Pressure Zones form the northwest extent of the system. There are actually two NWB Pressure Zones, which will eventually be linked via the NWC Pressure Zone. The medium-sized main NWB Pressure Zone extends from Parmer Lane to Lake Travis and from the Leander and Cedar Park ETJs to around McNeil Road and US 183. The small West Bull Creek NWB Pressure Zone includes Jester Estates and the non-contiguous Guildford Cove Hydropneumatic System. The NWB zones generally serve a topographic range of 900 feet to 1020 feet. The small Northwest C Pressure Zone is on the Jollyville Plateau centered roughly at RM 620 and RM 2222. The NWC zone serves elevations from about 1020 feet to 1110 feet. The following section includes discussion of:

- Zone operating strategies.
- Infrastructure investments, timing, and cost estimates.
- Information on Urban Grid and Special Service Areas, including the new NWB Brushy Creek Reduced Zone.

The NWB Pressure Zones will be discussed first followed by the NWC Pressure Zone discussion.

The Water System Plan map (in the map pocket in the Summary) shows the major components of the zones and how they relate to each other and with the rest of the system. Tables 5-10 and 5-11 show the CIP investment projects with cost estimates for the NWB and NWC Pressure Zones. The NWB Pressure Zone map, located in a map pocket at the end of the Guide, includes the map of the NWC Pressure Zone as an inset. The map contains more detail than the Water System Plan map and the modeling results on performance indicators for key facilities.

Table 5-10

NWB PRESSURE ZONE CIP IMPROVEMENTS AND COST ESTIMATES

TRANSMISSION MAINS

Description	Pipe Diameter (inches)	Pipe Length (LF)	Construction Unit Cost ($/LF)	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
WTP 4 NWB PS DISCHARGE TM						
WTP 4 to RM 620 tunnel BCCP Section	24	2000	222	1.35	599,400	
WTP 4 to RM 620 open cut	24	3500	111	1.35	524,475	
					1,123,875	2037
TOTAL MAINS					*$1,123,875*	

PUMP STATIONS

Description	Flow (MGD)	Head (feet)	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
WTP 4 NWB PS	7	155	1.35	960,976	2018
TOTAL PUMP STATIONS				*$960,976*	

MISCELLANEOUS

Description	Total Cost Estimate (dollars)	Recommended Before Year
Four Points Flow Control Station (FCS)	50,000	2037
TOTAL MISCELLANEOUS	*$50,000*	

TOTAL NWB ZONE CIP IMPROVEMENTS

YEAR 2000	$50,000
YEAR 2010	$0
YEAR 2017	$0
YEAR 2018	$960,976
YEAR 2037	$1,123,875
TOTAL	$2,134,851

Table 5-11

NWC PRESSURE ZONE CIP IMPROVEMENTS AND COST ESTIMATES

MISCELLANEOUS Description	Total Cost Estimate (dollars)	Recommended Before Year
Connection of 24 & 30 at Riverplace and RM 2222	50,000	2000
TOTAL MISCELLANEOUS	*$50,000*	

TOTAL NWC ZONE CIP IMPROVEMENTS		
	YEAR 2000	$50,000
	YEAR 2010	$0
	YEAR 2017	$0
	YEAR 2018	$0
	YEAR 2037	$0
	TOTAL	$50,000

General Description

The Utility is now in the process of building three major short-term CIP improvement projects in the NWB Pressure Zone system. They are the Jollyville TM, the Anderson Mill TM, and the US 183 Utility Relocations projects. We assumed these projects would be completed by the Year 2000 (therefore, they appear on the map as "existing" system components).

Currently, the main NWB Pressure Zone is served by the Jollyville Pump Station. There are two main NWB Pressure Zone reservoirs, Pond Springs and Anderson Mill. These elevated reservoirs are used to provide emergency and equalization storage.

The current operation method for the main NWB Pressure Zone generally consists of pumping from the Jollyville Pump Station to maintain pressures and reservoir levels within specified limits. Pumping rates for reservoir fill-and-draw cycles are set based on tracked usage patterns.

The Jollyville Pump Station has a firm capacity of 72.3 MGD. The projected maximum-day demand for both NWB zones and the NWC zone in the year 2037 is about 27 MGD.

The Forest Ridge Pump Station serves the West Bull Creek NWB Pressure Zone, to the Four Points Ground Storage Reservoir. The operating strategy for this part of the zone is the same as for the main part of the zone.

Demand on the West Bull Creek NWB Pressure Zone is very low. In addition to serving Jester Estates, the zone supplies the NWC Pressure Zone at the Four Points Ground Storage Reservoir. During low demand periods, there are long periods when the Forest Ridge Pump Station is off while the Four Points Ground Reservoir level is in draw mode feeding demand.

The Four Points Pump Station serves the NWC Pressure Zone. It pumps to the Four Points Elevated Reservoir which is on the same site. The operating strategy is the same as the NWB Zones.

NWB Year 2000 Operations and Improvements

Demand/capacity analysis shows that there is plenty of NWB storage and pumping capacity for the year 2000 period. Beginning in the year 2000, the NWB Pressure Zones and the NWC Pressure Zone will work together as an integrated system. The West Bull Creek NWB system will be linked to the NWC system via the existing Four Points Reservoirs and Pump Station facilities. The NWC system is linked to the main NWB Pressure Zone system via an existing Pressure Control Station (i.e., PRV) adjacent to RM 620. The Water System Plan map and the NWB Pressure Zone map shows the NWB and NWC Pressure Zone system configuration.

For the year 2000 we modeled the system assuming continued use of current operating methods. The existing Jollyville Pump Station will continue to supply the main pressure zone area and the Forest Ridge Pump Station will feed the West Bull Creek area. From the year 2000 on, the NWB to NWC Pressure Control Station (PCS) could open to feed the "Canyon Creek" service area and possibly beyond (depending on demand conditions) in the event that the main NWB feed to the area is interrupted.

No major CIP improvements are anticipated for this time period in the NWB Pressure Zones. However, major improvements could occur in the Brushy Creek area as part of the urban grid development (addressed later).

We checked the system for the minimum-month demand condition in 2000 and found no obvious operation problems.

NWB Year 2010 to 2017 Operations and Improvements

Operations in the period from 2010 through 2017 will continue basically the same as in the year 2000. The analysis shows the existing pumping and storage capacity should be sufficient to serve at least year 2017 demands.

No major CIP improvements are anticipated for these time periods in the NWB Pressure Zones.

NWB Year 2018 Operations and Improvements

Even when WTP 4 is on line (2018), the LRP team proposes little change in the zone's operation strategies. At that time we propose adding the **WTP 4 NWB Pump Station.**

In our preferred operation scenario, we propose installing a 7-MGD firm capacity (sized based on 2037 demands) NWB Pump Station at WTP 4. Initially, the pump station will pump only to the Four Points Reservoir and the NWB West Bull Creek Pressure Zone system and supply suction to the NWC Pump Station at Four Points. The pump station should be connected to the existing 36-inch main in Riverplace Boulevard. The Four Points Pump Station will still pump water to the NWC Pressure Zone drawing from the Four Points Ground Storage Reservoir.

During the initial phases of new plant operation, we recommend keeping the more than adequately sized Jollyville PS as the primary feed to the main NWB Pressure Zone. Therefore, the WTP 4 NWA Pump Station will pump to the existing Jollyville Reservoir, and from there water could be pumped into the main NWB Pressure Zone just as it is today.

Reliability will be enhanced if the WTP 4 NWB Pump Station (independent of the NWA Pump Station) is built when the plant is first constructed. It will not be needed based solely on the demand/capacity relationship of the NWC and NWB West Bull Creek area and the Forest Ridge Pump Station and Four Points Reservoir. However, we feel that it makes sense to construct the NWB pump station with the initial plant construction. If NWB does not pump out of WTP 4, the discharge transmission mains out of the WTP 4 NWA Pump Station would need to be enlarged to carry the extra flow to be pumped back to the NWB Pressure Zone.

By the time WTP 4 comes on line, the Forest Ridge Pump Station facility will be fairly old (around 30 years old). However, there may be reasons such as reliability and operational flexibility to keep it on line.

We checked the system for the minimum-month demand condition in 2018 and found no obvious operation problems.

NWB Year 2037 Improvements

In 2037, the systems will still work much the same as in the year 2018, except that we propose linking the WTP 4 NWB Pump Station to the main NWB Pressure Zone. The **WTP 4 NWB Pump Station Discharge TM** will consist of a line connecting the pump station to the existing 24-inch Canyon Creek line. The new line will tie in to the reduced pressure side of the NWC to NWB Pressure Control Station adjacent to RM 620.

With this connection, we recommend the installation of a flow control valve. The valve will be needed in the 36-inch NWB RM 2222 line between the pump station and the Four Points Ground Storage Reservoir and will make pump station and reservoir operation more flexible. Once the Four Points Ground Storage Reservoir fills, the valve could be closed. Once closed, the reservoir would continue to feed the NWC Pump Station and the NWB West Bull Creek system. At the same time the Four Points Reservoir section will be valved off, the WTP 4 NWB Pump Station could be used to pump to the main NWB zone.

NWB Urban Grid

CREATING THE BRUSHY CREEK REDUCED ZONE

We explored options for providing service to the large portion of the service area north of RM 620 in the Brushy Creek area. The area is generally north of RM 620 and east of US 183 and is bounded by Cedar Park, Leander, and Round Rock ETJs (see the Pressure Zone map). Ground elevations range from about 970 to 760 feet (a 210-foot range). These elevations fall within the NWA and NWB Pressure Zone key service topographic elevations. The area's maximum-day demand will be roughly 1 MGD in the year 2000, 4.4 MGD in the year 2010, and 5.4 MGD in the year 2017.

We found it difficult to supply NWA water to all of the land in the "NWA topography". There are long distances (6 miles to the center of the "NWA area") from existing NWA reservoirs. Also, the area is well on the other side of the reservoirs from the main pump station; the Spicewood Springs Pump Station is more than 10 miles away. Another factor is the natural NWB ridge jutting eastward to the Brushy Creek MUD Wholesale Service Customer boundary. The ridge and the political boundaries in the area tend to isolate the entire Brushy Creek area from the rest of the NWA zone.

A reasonably cost-effective service option consists of supplying the area partly from the NWB Pressure Zone and partly through a new NWB Reduced Pressure Zone. The decision was made after we compared the costs of lost energy versus costs of facilities required to supply the area with NWA water.

The hatched area marked Special Service Area 33S on the pressure zone map shows the extent of the proposed Brushy Creek Reduced Pressure Zone area. This service plan consists of a 24-inch NWB and NWB Reduced Pressure Zone pipeline network with two main Pressure Control Stations. The Brushy Creek Reduced Pressure Zone is designed to supply pressures of about 50 psi to 115 psi. Pressures in this range will be achieved with a hydraulic grade line setting of about 1030 feet at the Pressure Control Stations.

Initially, we see the need for a 24-inch line along Brushy Creek Road fed by the southern Pressure Control Station. After the year 2000, as the area develops farther to the north, more grid lines and the second PRV will be needed. At this time, we see the entire Brushy Creek Reduced Pressure Zone as being in the category of Urban Grid, not part of the CIP.

Later, as the network is looped into the northern PCS, two PCS will feed the system. In the event that one of the feeds is interrupted, the other feed will be capable of supplying water at 20 psi or greater to the reduced pressure zone at least through the Year 2018 time frame.

NWB Special Service Areas

The NWB Pressure Zone map shows a total of 44 hatched Special Service Areas (SSAs). All but two fall into the standard categories explained near the beginning of this chapter. Three particularly noteworthy SSAs are discussed below.

The 33S SSA is the Brushy Creek Reduced Pressure Zone; refer to the NWB Urban Grid discussion.

Special Service Area 35A is a high spot adjacent to the Anderson Mill MUD near Anderson Mill Road and RM 620. On first pass, it appears that the adjacent Anderson Mill MUD Tanglebriar Reservoir system, with an 1150 to 1170 ft. operating hydraulic grade line, has adequate pressure and capacity to serve this "high spot". In the short-term it is a possible candidate for out-of-district service.

Special Service Area 44S is the Anderson Mill MUD. The MUD is nearly "built out". Upon annexation (assumed to be after the year 2000, see Table 2-1, Assumptions About Other Service Providers), it appears feasible to remove the meters, open key NWB valves, and take over operating the system basically "as is". About half of the MUD is served by a NWB system (like our NWB system). The other half is served by an 1170-foot hydraulic grade line overflow system.

NWC Year 2000 Operations and Improvements

The demand/capacity analysis showed plenty of NWC storage and pumping capacity for the year 2000 period. We modeled the system assuming continued use of current operating methods. The existing Four Points Pump Station will continue to supply the demand working in conjunction with the elevated reservoir.

The only project proposed for the NWC Pressure Zone is a full-size connection between the existing 30-inch line in RM 2222 and the 24-inch and 16-inch lines at Riverplace Boulevard and RM 2222. This connection, recommended by the year 2000, creates a strong loop that increases the reliability and flexibility of the main NWC pipeline network.

We plan further study of the potential for installing a check valve at the NWC to NWB Pressure Control Valve Station near RM 620. In an emergency, water could flow from the NWB Pressure Zone into the low-lying areas of the NWC Pressure Zone. If, in an emergency condition, most of the NWC zone is severed from the Four Points Reservoir and Pump Station facilities, at least some customers could receive pressures in excess of 20 psi.

We checked the system for the minimum-month demand condition in 2000 and found no apparent operation problems.

NWC Year 2010 to 2037 Operations and Improvements

The firm capacity of the NWC Four Points Pump Station significantly exceeds the projected 2018 NWC system demand. No major CIP improvements are anticipated for these time periods in the NWC Pressure Zone.

5.10 SOUTHWEST B PRESSURE ZONE

The Southwest B (SWB) Pressure Zone is a small zone on the southwestern edge of the system. It extends from Southwest Parkway to the Hays ETJ and from Oak Hill to Mowinkle Drive. The zone supplies two large wholesale customers greatly expanding the area served by City of Austin water. The zone generally serves a topographic range of 900 feet to 1030 feet. The following section includes discussion on:

- Zone operating strategies.
- Infrastructure investments, timing, and cost estimates.
- Information on Urban Grid and Special Service Areas.

The Water System Plan map (in the map pocket in the Summary) shows the major components of the zone and how it fits with the rest of the system. Table 5-12 contains a listing of the CIP investment projects with cost estimates. The Pressure Zone map (in a map pocket) are located at the end of this report. The SWB Pressure Zone map shows more detail than the Water System Plan map and the modeling results on performance indicators for key facilities.

General Description

Currently, the existing Slaughter Lane and Leuthan Lane Pump Stations supply SWB Pressure Zone demand. The pump stations pump to the LaCrosse Reservoir, which is used to smooth pump station operation and provide emergency and equalization storage.

The current operation strategy of the SWB zone system generally consists of pumping from the Slaughter Lane and Leuthan Lane Pump Stations to maintain system pressures and the reservoir level within specified limits.

Table 5-12

SWB PRESSURE ZONE CIP IMPROVEMENTS AND COST ESTIMATES

TRANSMISSION MAINS Description	Pipe Diameter (inches)	Pipe Length (LF)	Construction Unit Cost ($/LF)	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
SOUTHWEST PARKWAY TM	16	10400	90	1.35	1,263,600	2000
TOTAL MAINS					*$1,263,600*	

PUMP STATIONS Description	Flow (MGD)	Head (feet)	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
LEUTHAN LANE PS UPGRADE	5.9	145	0.5	304,845	2000
TOTAL PUMP STATIONS				*$304,845*	

RESERVOIRS Description	Volume (MG)	Design Type: Elevated or Ground	Multiplier	Total Cost Estimate (dollars)	Recommended Before Year
SOUTHWEST PARKWAY RES	1	Elevated	1.35	1,161,000	2010
TOTAL RESERVOIRS				*$1,161,000*	

TOTAL SWB ZONE CIP IMPROVEMENTS		
	YEAR 2000	$1,568,445
	YEAR 2010	$1,161,000
	YEAR 2017	$0
	YEAR 2018	$0
	YEAR 2037	$0
	TOTAL	$2,729,445

The firm pumping capacity of the Slaughter Lane Pump Station is currently 21.6 MGD. The other SWB pump station, Leuthan Lane, has a firm pumping capacity of 1.2 MGD. Generally, the Slaughter Lane Pump Station serves the southern part of the zone, and the Leuthan Lane Pump Station serves the northern part. The two sections are linked by a 36/24/16-inch single series of mains. The two service areas are somewhat separated by the SWA Pressure Zone and wholesale customers.

Two major wholesale customers are now served by the zone. The Hill Country Water Supply and WCID 14 wholesale customers for the most part, shape the western extent of the zone. These customers are supplied through meters, and re-pump into their distribution systems.

A CIP project (SWA/SWB and SWA South Pressure Zone Boundary Adjustments) has already been created to carry out boundary adjustments needed in this area. Refer to the General Description of the SWA Pressure Zone for more information.

Year 2000 Operations and Improvements

For the year 2000 we assumed the system will continue to be fed through the Slaughter Lane and Leuthan Lane Pump Station facilities. The pump stations serve SWB system and wholesale customer demand and fill the LaCrosse Reservoir.

The LRP team analysis indicates that two year 2000 CIP improvements projects are needed. The **Southwest Parkway Transmission Main** (16-inch) and **Leuthan Lane Pump Station** capacity upgrade (to 5.9 MGD) will be needed to serve increasing demands, mainly in the northern part of the system. They are needed to provide a reliable grid that is capable of providing 3500 gpm to commercial development slated for the area such as were proposed in the Barton Creek Properties development. The **Southwest Parkway TM** will be a link along Travis Cook Road and Old Bee Caves Road connecting the existing 36-inch Windmill Run TM to Southwest Parkway area lines.

A check of minimum-month demands for the zone revealed no significant operational problems.

Year 2010 Operations and Improvements

Performance and operational criteria indicate the proposed **Southwest Parkway Reservoir** will be needed by the year 2010. As demand continues to increase, the northern section of the service area will need more storage. By the year 2010, the lines that link the two areas will not be adequate to maintain desired operation and performance characteristics. Storage improves operations and increases reliability in the zone.

The analysis for this Guide was performed when there was a strong possibility the Barton Creek Properties (BCP)/Uplands area would be a major wholesale customer for the SWA and SWB Pressure Zones. This analysis indicates that the recommended **Southwest Parkway Reservoir** will be required to serve the Barton Creek Properties (BCP)/Uplands area. With the BCP wholesale customer as a service assumption, we anticipated moving the timing of the Southwest Parkway Reservoir up to the year 2000. Therefore, the package of improvements, the reservoir, pump station upgrade, and transmission main, could be installed together as a working unit.

Now that negotiations between the City of Austin, the environmental community, and Barton Creek Properties have stopped, these facilities may not be needed as soon as previously anticipated. Additional analysis will need to be done in the future to adjust long-range water system plans to the changing development conditions in the area.

Year 2017 through Year 2037 Operations and Improvements

No operational changes and/or additional improvements will be needed through the year 2037 planning horizon. Note that SWB Pressure Zone operations will not be affected by WTP 4 coming on line in the year 2018.

Urban Grid

One of the urban grid lines that would enhance SWB operations is a link between the existing 36-inch TM at US 290 and RM 1826 and the 16-inch end of the existing Windmill Run TM at Fenton Drive. There is an existing CIP project for this line, the Highway 290 West TM. However, the timing for the need of this main is not well defined at this time.

Special Service Areas

The SWB Pressure Zone map shows the hatched Special Service Areas (SSAs). In total, there are 32 SWB SSAs. They all fall into the standard categories explained near the beginning of this chapter. Two noteworthy SSAs are discussed below.

Special Service Area 11A consists of two small high spots adjacent to RM 1826. The one on the west side of RM 1826 is the currently served high spot at Lewis Mountain Ranch. Pressure at the customer meter in this area will run below 35 psi under some conditions. Private individual hydropneumatic systems will be used to augment pressure in this area.

Area 27A is an existing served area high spot. Currently, there is an item in the Water System Improvements to Meet Minimum Standards CIP Project called Fenton Drive Hydropneumatic System. This project has been set up to address this problem area. Another viable option for addressing this Special Service Area would be to connect to the WCID 14 system. The Systems Analysis Division will study improvements to this area in the future.

line, the Highway 290 West TM. However, the timing for the need of this main is not well defined at this time.

Special Service Areas

The SWB Pressure Zone map shows the hatched Special Service Areas (SSAs). In total, there are 32 SWB SSAs. They all fall into the standard categories explained near the beginning of this chapter. Two noteworthy SSAs are discussed below.

Special Service Area 11A consists of two small high spots adjacent to RM 1826. The one on the west side of RM 1826 is the currently served high spot at Lewis Mountain Ranch. Pressure at the customer meter in this area will run below 35 psi under some conditions. Private individual hydropneumatic systems will be used to augment pressure in this area.

Area 27A is an existing served area high spot. Currently, there is an item in the Water System Improvements to Meet Minimum Standards CIP Project called Fenton Drive Hydropneumatic System. This project has been set up to address this problem area. Another viable option for addressing this Special Service Area would be to connect to the WCID 14 system. The Systems Analysis Division will study improvements to this area in the future.

CHAPTER 6

ENVIRONMENTAL CONSIDERATIONS

The Utility recognizes that protecting Austin's unique environment is a fundamental part of our mission. In the past, State and Federal regulations—particularly the Clean Water Act and its control of water pollution—provided most of the criteria the Utility followed in managing the physical environment. In recent years, however, local regulations and concerns have begun to play a larger role.

Chapter 4 addresses the impact of the Safe Drinking Water Act on the facilities planning process. The local policy instruments that govern Utility environmental considerations in facility planning are outlined below.

6.1 LOCAL ENVIRONMENTAL REGULATIONS

Comprehensive Watershed Ordinance (CWO)

The CWO protects ground water, surface water, and natural areas by mandating reductions in density, structural water quality controls, provisions for critical water quality zones and water quality buffer zones, setbacks from Critical Environmental Features, and development of standards for construction over the Northern Edwards Aquifer. To control development density, the ordinance limits allowable impervious cover using a "net site area" approach. Utility projects, like all projects, must satisfy the Site Plan Requirements of the Land Development Code to get a permit for construction.

Development density aspects of the CWO are incorporated in demand projections used in the Guide. The main impact of the CWO on water facility planning is avoidance of Critical Environmental Features and use of erosion and sediment control devices and certain construction methods to protect water quality during the construction process.

Endangered Species Survey Ordinance

Austin enacted an endangered species ordinance to work in tandem with the U.S. Endangered Species Act. It requires the developer of a project to do a survey of the project area for existing or potential endangered species habitat. Impacts on facility planning are discussed under the Balcones Canyonland Conservation Plan, later in this chapter.

Edwards Aquifer Rules

Rules governing protection of the Edwards Aquifer in Hays, Travis, and Williamson Counties were promulgated by the Texas Water Commission in 1989. Related to use of the aquifer for water supply, the rules are designed to control water pollution in the recharge zone. Water utility construction is not a regulated activity under the Edwards Aquifer Rules.

Save Our Springs (SOS) Ordinance

In 1992, the SOS Ordinance was adopted to protect the water quality of Barton Springs. The ordinance sets a 15 percent limit on impervious cover in the Southern Edwards Aquifer Recharge Zone, less than that allowed by the CWO. (Eanes and Dry Creek and the area draining directly to Town Lake are excluded.) The ordinance also limits impervious cover in areas adjacent to the recharge zone. In addition, the SOS ordinance mandates no increase in pollutant loading for 13 water quality parameters. Details for implementing the ordinance are as yet unpublished. Its greatest impact on water and wastewater facility planning is expected to be changes to the demand projections used in the Guide.

SOS ordinance impacts (lower development density) may affect the timing and sizing of recommended projects in the Southwest A and Southwest B Pressure Zones. This includes the **Leuthan Lane Pump Station Upgrade**, the **South MoPac TM**, the **Southwest A Loop TM**, and the **Southwest Parkway TM** that are slated for construction before the year 2000. It also applies to the new South Loop 360 Pressure Zone improvements, the **Pinnacle Road Pump Station and Discharge TM**, the **Lost Creek TM**, and the **Barclay Reservoir**. SOS implementation details along with a City Council decision on service to Barton

Creek Properties should be available in time to include SOS impact analysis in the preliminary engineering studies for these projects.

6.2 BALCONES CANYONLANDS CONSERVATION PLAN (BCCP)

The BCCP is an innovative plan to meet the terms of the U.S. Endangered Species Act, which prohibits destruction of the habitat of endangered species. It is a joint effort by the City, Travis County, LCRA and community groups to create an orderly development process that complies with the Act by setting aside designated tracts of land for endangered species habitat. The plan—which has not yet been adopted—involves 34,000 acres of habitat land. Habitat areas where land purchases are planned appear on the Water System Plan map and the individual pressure zone maps. Ratification of the plan hinges on funding for the acquisition of BCCP land.

At the time the LRP team made demand projections for this Guide, the tracts of land that were candidates for habitat set-asides were not yet identified. Since voters approved the bonds for purchase of most of these tracts, we adjusted the spatial demand projection accordingly, assuming no development in these areas.

One of the key impacts of BCCP on facility planning is the reservation of corridors for future utility construction. It should be noted that provisions have been made for the projects recommended by this Guide that are located in the BCCP candidate purchase areas.

For example, much of the WTP 4 site and the transmission main routes leading to and from it are on golden cheek warbler habitat. These facilities are expected to be the key to providing the capacity Austin needs 20 years from now, or sooner if new federal requirements limit use of Green WTP. The BCCP plan as now formulated provides a mechanism for satisfying the Endangered Species Act for these projects. Should the plan not be approved, a new plan to balance environmental habitat needs with our future drinking water needs would have to be devised. Utility planning must remain open to the possibility that habitat considerations could make the use of the WTP 4 site infeasible.

6.3 ADDRESSING ENVIRONMENTAL ISSUES

The Utility is working to identify an efficient way to better integrate environmental considerations into the facilities planning and implementation process.

The Utility's Environmental and Regulatory Support Division provides a mechanism for bringing general environmental policy issues into facility planning. Project-specific issues have often not been addressed until the CIP process, sometimes as late as the first set of project drawings. We believe that we can and should move identifying Critical Environmental Features and Critical Water Quality Zone Requirements further forward in the planning process as one step in this direction. In general, however, a more pro-active approach to addressing community environmental concerns must be developed.

The Utility is exploring the possibility of working more closely with the Environmental and Conservation Services Department (ECSD) to identify project-specific environmental issues in the planning phase. This would enable us to begin to address them before the design phase in the CIP. In addressing these issues in the planning phase, we are seeking to link Integrated Water Resources Planning and public involvement efforts into a single process.

CHAPTER 7

WATER SUPPLY AND WATER RIGHTS

Austin's adjudicated municipal water rights from the Colorado River system total 293,703 acre-feet per year. Of this amount, 272,403 acre-feet may be diverted from either Lake Austin or Town Lake (or Lake Travis as provided below). While the City has certificates for diversion of water for other uses—such as industrial, irrigation, recreation, and hydroelectric generation—this section deals only with water rights for municipal purposes.

The current annual raw water demand of the Austin water system is about 120,000 acre-feet (about 105 MGD average). The LRP team's analysis indicates that the currently held rights to Colorado River water for municipal supply will be adequate to meet demand until about the year 2037. However, the City is obligated to pay the LCRA for water in excess of 150,000 acre-feet/year. The system may reach this level of demand shortly after the year 2003. (Refer to Figure 2-2 in Chapter 2.)

Our demand projections indicate that system demands could begin to exceed Austin's water rights in the year 2037 (in about 45 years). The condition at which Austin fully uses its existing water rights marks the planning horizon for the Water LRP Guide, rather than a projected calendar year.

The payment required for amounts over 150,000 acre-feet/year and the long-term 293,000-acre-foot limit on existing water rights focus attention on the need to conserve and to manage the growth in demand. In addition to delaying the construction date of major facilities such as WTP 4, postponing the need for more expensive water—especially for developing other more costly sources of supply—will represent major savings for Austin water customers over the long term.

7.1 WATER RIGHTS HISTORY AND STATUS

The State's 1988 adjudication of Austin's municipal water rights was based on the December 1987 Comprehensive Water Settlement Agreement with LCRA, which was confirmed by final judgment and decree of the State District Court of Bell

County in April of 1988. Pursuant to that agreement, up to 170,000 acre feet of Austin's allocation may be diverted from Lake Travis. In addition to the 272,403 acre-feet that may be diverted from the Highland Lakes, Austin has a certificate to divert another 20,300 acre-feet for municipal purposes from the Colorado River below Longhorn Dam. Several of the City's certificates of adjudication were consolidated in 1991. At that time, 1,000 acre-feet of Austin's municipal water rights were temporarily converted to irrigation (for park land). An apparent clerical error resulted in subtracting this amount twice from the total, so that the combined certificate shows only 271,403 acre-feet, including the temporary irrigation amount.

The 1987 settlement with LCRA and subsequent State adjudication expanded Austin's previous water rights by 86,000 acre-feet.

One important feature of the 1987 LCRA agreement is that the City will begin paying LCRA, at the rate established by the LCRA Board of Directors, for all water diversions that exceed 150,000 acre-feet under the combined certificate noted above.

The 1987 LCRA agreement allows the City to divert municipal water from Lake Travis as well as from Lake Austin and Town Lake. However, diversions from Lake Travis are limited to 170,000 acre-feet per year, and the raw water pumping facilities are limited to 150 MGD. (170,000 acre-feet is roughly equal to 150 MGD times 365 days.) The annual figure is adequate for the planning horizon, but maximum-day demand projections indicate that the 150 MGD single-day pumping limit will not be adequate to meet system requirements at maximum day during the latter years of the planning period.

The City is participating in the Trans-Texas Water Program, South Central Texas Study, to evaluate its water needs through the year 2050. This study was initiated in 1992 for the purpose of evaluating the feasibility of moving water from areas with abundant water to areas where there is not enough water in order to sustain economic development and public well-being.

The Trans-Texas Water Program is a component of the Texas Water Plan maintained by the Texas Water Development Board (TWDB). It is managed by a Policy Management Committee composed of representation from TWDB, Texas

Natural Resources Conservation Commission, and Texas Parks and Wildlife Department, as well as the local and regional participants. These participants include Austin, Bexar Metropolitan Water District, Brazos River Authority, Corpus Christi, Edwards Underground Water District, Guadalupe-Blanco River Authority, Houston, Lavaca-Navidad River Authority, Lower Colorado River Authority, Nueces River Authority, Sabine River Authority, San Antonio River Authority, San Antonio Water System, and San Jacinto River Authority.

The City of Austin entered the study in 1993 with an amendment to the work plan to allow a portion of the study to concentrate on the specific water needs of Austin. The Trans-Texas Water Program is now broken into three parallel studies according to region: South Central, which includes the Cities of Austin and Corpus Christi; West Central, which includes San Antonio; and Southeast, which encompasses Houston and a large area north and east of the Colorado River. The consultant conducting the study for the South Central area is HDR Engineering, Inc. This project is to study Austin's existing water rights and the availability of firm supply; identify Austin's water rights transfer options; and identify and evaluate water supply alternatives for Austin.

7.2 EXAMPLE PLANNING ACTIVITIES FROM OTHER CITIES

The oversight consultant for the long-range planning process indicated that other cities in the West are very active in water supply planning, acquisition and protection.

Major Western cities, such as Denver and Tucson, are doing the following:

- Using time periods of up to 100 years for purposes of water source planning and securing water supplies.
- Maintaining sizable working groups, including attorneys, dedicated solely to water supply maintenance and acquisitions.
- Engaging in frequent court and administrative processes to protect and expand water supplies.

- Assuming aggressive, leadership roles in water planning, regional activities, legislation and litigation.

Being in an environment where water scarcity is relatively greater, other Western cities have learned that adequate water supplies are critical to a community's long-term viability.

7.3 RECOMMENDATIONS

The LRP team recommends the following actions to improve the City's prospects for maintaining adequate, low-cost water supplies well into the future:

- Continue active involvement in the Trans-Texas Project. This may become an important vehicle for protecting and expanding Austin's water resources.
- Expand the planning horizon for water supplies beyond the time frame of this planning guide, and investigate options for meeting even longer term water needs.
- Begin making provisions to secure additional future water reserves from the Colorado River, by contract with LCRA and/or through other means.
- Move to check threats of massive interbasin transfers of Colorado River water to other entities in the market for new supplies, such as San Antonio and Corpus Christi, in order to protect this water resource for Austin's long-term needs.
- Seek to move the point of diversion of the 20,300 acre-feet of water rights now located below Longhorn Dam to a location upstream, preferably Lake Austin.
- Consider increasing the 150-MGD limit on raw water pumping capacity from Lake Travis when the LCRA agreement is amended or extended in the future.
- Take an active role in protecting the <u>quality</u> of Austin's water sources, including proactive controls for basins draining to the Highland Lakes.
- Create a specialized work group in the City with responsibility for water source planning, the protection of existing water rights and water sources,

the exploration and pursuit of the best opportunities for additional water rights, and all related regional coordination and planning efforts. This group should include adequate legal assistance.

CHAPTER 8

SYSTEM RELIABILITY

This chapter discusses the Utility's current efforts to analyze and improve water system reliability. Activities and methods of the Reliability Task Force, which was established in 1992, receive special attention.

Reliability in the supply of water is an important element of the Utility's mission. In terms of major facility planning, reliability refers to the measures taken to prevent large numbers of customers from experiencing poor or no service due to a facility outages. In the 1970s and early 1980s the City experienced occasional facility outages that resulted in more than 1000 customers being adversely affected. In one instance, construction blasting for relocation of a 42-inch water line at Spicewood Springs Road (during building of MoPac Loop 1) caused a line break that left much of the North Pressure Zone below 20 psi or totally without water for 12 to 16 hours.

Inadequate service has also occurred for other reasons that do not fall under the definition of reliability. For example, in the summers of 1984, 1985, and 1986, Utility customers experienced mandatory water conservation. This situation was brought about by the growth in demand outstripping the available capacity in the system. This was a demand versus capacity imbalance, relating to normal operating criteria, not a reliability question. Reliability refers to an emergency operating condition resulting from facility outages, and in these cases outages were not involved.

The big CIP programs of the mid 1980s added new facilities and more capacity, increasing system reliability. For example, adequate service has been maintained to customers in the NWA Pressure Zone although power outages have caused the Spicewood Springs Pump Station to be out of service as much as half a day at a time during the past decade. This was accomplished by using water stored in reservoirs to maintain pressures very near the normal lower limit of 35 psi.

State design criteria mandate a good measure of system reliability, primarily through reservoir storage and equipment redundancy requirements. Capacity provided to meet high summer demands is much greater than is needed in other times of the year. An outage during less stringent demand periods can often be compensated for by using the capacity available in other facilities. These conditions explain how water service has been maintained on the few occasions when Ullrich WTP or Davis WTP has been off line.

Establishing appropriate reliability criteria is a difficult task. Information on the subject is scarce, probably because of the differences in communities, both in terms of distribution system configuration and ability to afford the higher costs of back-up facilities. AWWA recently surveyed cities to ask about their reliability criteria as a first step to creating a methodology for standard practice in the water industry. No results have been reported as of the writing of this Guide.

Defining the appropriate level of reliability hinges on determining the probability of events like flooding, power outages, pipe breaks, hazardous material spills into the water supply, or contamination by pathogens. For many of these events, few historical records and little statistical data exist for establishing their probability of occurrence.

8.1 THE RELIABILITY TASK FORCE

The Utility created a Reliability Task Force in 1992 to establish distribution system reliability criteria for Austin. Work is in the analysis phase. The process the task force is using to work from the AS IS reliability condition to a DESIRED condition follows the steps shown on Table 8-1, Reliability Analysis Process.

The first step is to identify the "vital few" facility outage events for initial analysis. The Task Force relied on the experience and judgment of Operations and Engineering Divisions personnel to identify where the water distribution system is most vulnerable. We targeted conditions where we might expect one or more failures in a 20-year period that could cause more than 1 percent of Utility customers to drop below 20 psi in water pressure. The top ten facility outage conditions for further study are listed on Table 8-2, Vital Few Facility Outage Events.

TABLE 8-1

RELIABILITY ANALYSIS PROCESS

Step 1. Identify the vital few facility outage events believed to pose the greatest risk of an undesired level of service in terms of:

- frequency of occurrence of a particular facility outage.
- number of customers affected at different demand (min., avg., and max. day).
- duration of emergency (down time).

Step 2. Analyze the AS IS reliability condition for each facility outage:

- assess failure modes.
- use the computer model to estimate the number of customers affected.
- investigate different outage causes and frequency of occurrence.

Step 3. Postulate low, medium, and high candidate levels for DESIRED reliability conditions for each facility in terms of the parameters stated in Step 1.

Step 4. Create, analyze, and estimate costs of facility and operating alternatives that improve each facility from the AS IS conditions to the candidate DESIRED reliability conditions.

Step 5. Get customer input on the alternative levels of DESIRED reliability and costs, as well as demand management options that would minimize investment in new facilities.

Step 6. Select the reliability criteria that meet customer requirements. (Note that they may be specific to each facility.)

Table 8-2
VITAL FEW FACILITY OUTAGE EVENTS
"AS IS" RELIABILITY ANALYSIS
YEAR 2000 DEMAND LEVEL

Capability of System to Meet Stated Demand
(Percent of total system customers below
20 psi with listed facility out of service)

Facility	Essential Needs (min-month)	Landscape Sustenance (avg-day)	All Needs (max-week)
1. Spicewood PS and TM	--	--	--
2. Ullrich PS and TM			
High Service	0	--	--
Medium Service	0	--	--
3. Jollyville PS and TM	--	--	--
4. Davis PS and TM			
High Service	--	--	--
Medium Service	--	--	--
5. Davis Lane PS and TM	--	--	--
6. Loop 360 PS and TM	1%	1%	1%
7. N. Austin PS and TM	--	--	--
8. Ullrich WTP			
50% outage	0	0	5%
100% outage	0	5%	56%
9. Green WTP			
50% outage	--	--	--
100% outage	--	--	--
10. Davis WTP			
50% outage	--	--	--
100% outage	--	--	--

Note: "--" indicates modeling analysis not completed.

The total population served is projected to be 633,144 with 377,081 employees by the year 2000.

8.2 PRELIMINARY RELIABILITY ANALYSIS RESULTS

The first test of system reliability with the pipe network model was an analysis of plant and pump station outages. Maximum-day 1990 demands were modeled for 24 hours in the case of plant outages and 12 hours in the case of pump station outages. No operations changes were made to minimize problems.

In the 1990 simulations, the system maintained a minimum 20 psi for most major facility outages. The exceptions were failures caused by the loss of Davis Medium Service (MS) Pump Station (PS), Jollyville Pump Station and the Loop 360 and Guildford Cove Hydropneumatic Pump Stations. For loss of the Davis MS PS, service pressures dropped to 20 psi in 8 hours in the upper elevations of the North Central Pressure Zone. For loss of the Jollyville PS, pressures drop below 20 psi in 7 hours at Anderson Mill Road and Taterwood. The Spicewood Springs Pump Station (the only feed to the northwest part of the City) met criteria, but included the assumption that the proposed Cat Mountain and Shepherd Mountain booster pump stations were in service.

The Reliability Task Force is using year 2000 demands to define the next steps toward achieving greater system reliability. As a test case, modeling was done with Ullrich WTP out of service. For year 2000 Ullrich WTP was assumed to have a capacity of 100 MGD based on the existing CIP projects defined prior to promulgation of the Disinfection/Disinfection By-Products Rule. The modeling results showed that under a maximum-week demand level only 5 percent of total system customers were below 20 psi for a 50 percent outage condition at Ullrich. For a 100 percent outage under maximum-week demands, 56 percent of customers were below 20 psi. For demand levels below average-day, less than 5 percent of customers were affected by Ullrich WTP being off line. These results are included in Table 8-2.

The Ullrich WTP modeling points up an opportunity for demand management. If customers cut consumption in an emergency during a maximum week, the number of people without water could be drastically reduced. Total loss of Ullrich during peak-maximum usage is a low probability event and so may be better mitigated through demand management, rather than expensive back-up facilities. After doing a failure mode assessment for Ullrich WTP, the Task Force will decide if work on alternatives to achieve a better reliability condition is warranted. (Refer to Table 8-1, Steps 3 and 4 for analyzing a DESIRED reliability condition.)

To understand how many customers would be affected by the loss of a particular facility and how often , it is important to have an understanding of the failures that are most likely to occur. This is termed a failure mode assessment. Members of the Task Force met with Davis WTP operations staff in August 1993 to determine ways in which the plant is vulnerable to being unable to supply water to its customers. Summarized results of this assessment are presented in Table 8-3, Failure Mode Assessment Summary.

8.3 CONCLUSIONS

System reliability analysis conducted in 1990 confirmed that capacity reserves in Austin's three water treatment plants, combined with emergency water storage in elevated reservoirs in excess of state requirements, makes the Austin system relatively reliable.

Analysis of the "vital few" reliability events being studied by the Reliability Task Force will reveal more about how reliable the system is in terms of the number of customers that could be affected, for how long, and how often. By looking at the infrastructure investments required to lessen the effects of the loss of a major facility, the Utility will be better equipped to develop options for setting reliability criteria for the distribution system.

The public involvement process and the CIP process will be the vehicles for making reliability criteria decisions. In some cases infrastructure alternatives will be weighed against demand management approaches. Knowing the level of reliability our customers want to invest in, we can begin taking the steps necessary to meet the criteria.

TABLE 8-3

FAILURE MODE ASSESSMENT SUMMARY
DAVIS WATER TREATMENT PLANT

Failure Mode	Resulting Level of Plant Outage
1. Loss of Lakeshore Substation	100%
2. Loss of Warren Substation	100%
3. Loss of In-plant Substation	100%
4. Mechanical Equipment Failure	
* recycle line	undefined
* PS discharge headers	50%
* PS discharge TMs and valves	50%
* chlorine solution line	100%
* filter backwash line	100%
* filter channel to clearwell and valves	100%
5. Supply Quality Unacceptable	
* Loop 360 traffic accident	100%
* boating accident near intake	100%
* RM 2222 at Bull Creek accident	100%
* tributary stream spill	100%
* upstream spill or accidents	100%
6. Other Possible Causes of Outage	
* tornado	undefined
* dam break	undefined
* flood	undefined
* fire	undefined
* phone line outage	undefined

TABLE 8-3

FAILURE MODE ASSESSMENT SUMMARY
DAVIS WATER TREATMENT PLANT

Failure Mode	Resulting Level of Plant Outage
1. Loss of Lakeshore Substation	100%
2. Loss of Warren Substation	100%
3. Loss of In-plant Substation	100%
4. Mechanical Equipment Failure	
* recycle line	undefined
* PS discharge headers	50%
* PS discharge TMs and valves	50%
* chlorine solution line	100%
* filter backwash line	100%
* filter channel to clearwell and valves	100%
5. Supply Quality Unacceptable	
* Loop 360 traffic accident	100%
* boating accident near intake	100%
* RM 2222 at Bull Creek accident	100%
* tributary stream spill	100%
* upstream spill or accidents	100%
6. Other Possible Causes of Outage	
* tornado	undefined
* dam break	undefined
* flood	undefined
* fire	undefined
* phone line outage	undefined

CHAPTER 9

LINKS TO THE CIP

This chapter addresses how near-term CIP projects and long-term capital needs for items not categorized as major facilities relate to the LRP Guide.

9.1 THE CURRENT CAPITAL IMPROVEMENTS PROGRAM

Because the first time period on the Guide's timeline is the period up to the year 2000, long-range plans are closely linked to the current 6-year CIP process.

With the exception of the Southwest Parkway Transmission Main and minor operations-related improvements, every project the LRP team found will be needed by the year 2000 is in the current CIP. However, our analysis also shows that about 20 projects now in the CIP will not be needed before the year 2000. These projects have been postponed primarily because the growth projections used in the Guide are lower than those of previous planning studies. Further reliability analysis could lead to assigning higher priority to some of these projects.

9.2 OTHER CAPITAL COSTS

The Utility has, to date, managed maintenance, replacement and rehabilitation activities separately from the facilities planning process, as has been standard practice throughout the water industry. In drawing up the LRP Guide, we recognize that a broader view of strategic planning for the Utility includes planning and prioritizing spending for both new and existing facilities. We therefore have included mention of these capital costs to acknowledge that a complete review of long-range needs would take these topics into account.

Of special interest are such issues as spending on regulatory compliance which is not ordinarily thought of as "providing water". This represents a substantial investment which is central to good facilities management. Other than the major CIP facilities needed to meet growth in demand, and operations related improvements, the major cost categories that come into play in overall planning for the Utility are:

- Utility relocation for transportation projects
- Rehabilitation and replacement
- Service to annexed areas
- Service extension reimbursement for urban grid lines
- New technologies
- SDWA and other regulatory compliance.

While dealing with these issues is beyond the scope of this Guide, the LRP team recommends that future planning efforts be directed toward integrating them into the planning process.

CHAPTER 10

TECHNICAL REFERENCE AND PROJECT TEAM INFORMATION

This chapter provides a listing of materials and the names of LRP project team members (Table 10-1, Project Team Members) for the reference of those interested in further information about the Water LRP Guide.

The LRP team drew on many technical resources and has produced several documents in the course of developing this Guide. This information is too voluminous to be included in the Guide itself, but is available at the Water and Wastewater Utility offices.

To access this information or for answers to questions about the Guide, contact the Planning Services and Systems Analysis Divisions located on the 7th floor of the Waller Creek Center. Waller Creek Center is at 625 E. 10th Street. The mailing address is P.O. Box 1088, Austin, Texas 78767-8859. Our office telephone number is 512-322-3600 and our fax number is 512-322-2842.

Examples of the types of information available include:

- Primary Water Distribution System Model Calibration, November 1990.
- Baseline Water Distribution System Reliability Model Results, December 1990.
- Long Range Water Plan Primary Modeling and Operating Strategies Austinplan Demand Projections, September 1991.
- Water Long Range Plan Demand Data, Detailed Demand Spreadsheets and Diurnal Usage Information, September 1992.
- Numerous Methodology Documents that provide more detail than provided in this Guide.
- Water Demand Node Maps.

- Electronic Copies of all models used in the analysis for this Guide (and many others).
- Model Maps.
- Paper copies of documentation of the models.
- Numerous special studies that investigated localized portions of the system that advanced our knowledge of how to analyze the system for this Guide.
- Report of the Reliability Task Force for the period January 1992 through March 1993.

TABLE 10-1

PROJECT TEAM MEMBERS

City of Austin

Randy Goss	Director, Executive Sponsor
Gene Gardner	Project Manager and Analyst (Central Pressure Zone)
Janet Atkinson	Analyst (South Pressure Zone)
Jeff Fox	Analyst (North Pressure Zone)
Teresa Lutes	Analyst (Northwest, Southwest, and South Loop 360 Zones)
Philip Campman	Planner (Cartography)
Steve Harsch	Analytical/Technical Support
Frances Wyrick	Administration/Word Processing
Jeannie Wiginton	SDWA Assistance
Adrian Rosas	Technical Assistant
Randy Alexis	Manager, Planning Services (Demand Projections)
Craig Bell	Manager, Planning, Analysis and Mapping
Tom Ellison	Manager, Systems Analysis
Cathy Harrington	Assistant Director, Administration and Planning

Consultant Oversight

Susan Booth	Susan Kane Booth
Joe Jenkins	CH2M Hill
Elaine Jones	CH2M Hill, Project Editor
David Lewis	CH2M Hill
Ken Miller	CH2M Hill
Gene Suhr	CH2M Hill

Water Distribution System Long-Range Planning Guide

Contract #91-483-589

The following maps are not attached to this report. They are located in the official file and may be copied upon request.

1. Water System Plan Map
2. Central Pressure Zone
3. South Pressure Zone
4. Northwest A Pressure Zone
5. Northwest B Pressure
6. Southwest A Pressure Zone
7. Southwest B Pressure Zone

Please contact Research and Planning Fund Grants Management Division at (512) 463-7926 for copies.