UTILITIES DEPARTMENT

City of Las Cruces

NEW MEXICO

Water and Wastewater System Master Plan Update

FINAL

CDM

Contents

Water Transmission and Distribution System Model Evaluation

Wastewater Collection System Evaluation

Wastewater Treatment Facilities

Water System Capital Improvement Program

Wastewater System Capital Improvement Program

Appendices

Tables

Figures

Section 1
Overview

1.0 Introduction

This section describes the purpose and organization of the Master Plan Update, the existing planning documents used in preparing the Update, the master planning area, and the planning timeframe.

1.1 Purpose and Organization of Master Plan

This Update revises the City's 1995 Water and Wastewater System Master Plan Update prepared by Montgomery Watson, 1995 to bring it up to date. Since that time, the City has experienced significant growth in the residential sector. The goal of a water and wastewater master plan is to identify and recommend the best program for managing the water and wastewater systems' development and growth in the planning area for the future. This Update identifies needed water and wastewater capital improvements and their costs and an implementation schedule from 2005 to the year 2025, broken into five-year increments.

The Update is organized as follows:

Section 1: Overview – This section provides a general description of the purpose and organization of the Update; an identification of existing planning documents utilized preparing the Update; a description of the water and wastewater master planning area and the planning period for this Update.

Section 2: Water and Wastewater Master Planning Process –Section 2 describes the planning and forecasting methods, the master planning process, and planning principles in general.

Section 3: Existing Water System – This section identifies the existing water service areas and pressure zones, existing water system infrastructure, surrounding water systems and other water purveyors located adjacent to the service areas.

Section 4: Existing Wastewater System – This portion of the Update identifies the existing wastewater collection system service area, existing wastewater collection and treatment facility infrastructure, and current per capita wastewater contribution rates.

Section 5: Water and Wastewater Flow Projections –Section 5 presents the estimated future water and wastewater flow projections based on growth in water and wastewater service area coverage, population and land use.

Section 6: Water System Evaluation –The Update presents an evaluation of the water transmission and distribution system in this section. Existing water demands and projected water demands developed in Section 5 are computer modeled to evaluate the water system for the current and future capacity of the transmission, distribution, and storage system. Where capacity is inadequate, recommendations for expansion, additional storage capacity and associated infrastructure improvements are made.

<u>Section 7</u>: Wastewater Collection System Evaluation – Section 7 presents an evaluation of the wastewater collection system. Existing wastewater flows presented in Section 4 and wastewater flow projections developed in Section 5 are computer modeled to evaluate the wastewater system with regards to the current and future capacity of the City's interceptor system. When capacity is inadequate, recommendations for expansion, upsizing interceptors and rerouting flows are made. For areas served by lift stations and force main, recommendations for new or upgraded lift stations and associated infrastructure are made.

<u>Section 8</u>: Wastewater Treatment Facilities – The discussion in this section presents an evaluation of alternatives for expanding wastewater treatment capacity to meet the wastewater flow projections developed in Section 5. These alternatives include expansion of existing facilities, development of smaller satellite plants and addition of centralized treatment facilities.

<u>Section 9</u>: Water System Capital Improvement Program –The water capital improvement program, phased in five-year increments to meet the demands and deficiencies identified in this update, are presented in the section.

<u>Section 10</u>: Wastewater System Capital Improvement Program – The wastewater capital improvement program, also phased in five-year increments to meet the demands and deficiencies identified in this update, is presented in Section 10.

1.2 Existing Planning Documents

Several separate studies related to the City's water and wastewater systems have been completed prior to this update. Brief descriptions of applicable studies and their relevance to this Update are provided below:

<u>City of Las Cruces 40-Year Water Development Plan (October 2007)</u> – This version of the plan is currently under review by the New Mexico Office of the State Engineer where comments and/or approval is anticipated. The plan provides the most current information regarding area population, water supply and demand projections and will be used as the base for this update. These projections provide the basis for evaluating existing water and wastewater system capacities and deficiencies and future infrastructure needs. The Plan also includes the City's Water Conservation Ordinance and its assumed effect on overall per capita water consumption.

<u>City of Las Cruces Water and Wastewater System Master Plan Update (June 1995)</u> – This update of the original master plan serves as a base document and starting point for the current update. The 1995 Master Plan Update provided recommendations for improvements to the City's water and wastewater systems to correct deficiencies and meet anticipated growth demands in four five-year increments for the 1995-2015 planning period.

The New Mexico Lower Rio Grande Regional Water Plan (August 2004) – This plan provides population projections for the lower Rio Grande region at ten-year intervals for the 2000 to 2040 period. Population projections are made for three different rates of regional growth to provide a high estimate, a medium-range estimate, and a low-range estimate. Projected public water supply requirements for the area are made through the year 2040 for the low, medium and high growth scenarios. This plan includes other public water supply systems located within the planning area with relevant estimates of the population served and the total amount of water provided by these systems.

Land Use Assumptions for Development Impact Fees Interim Study (July 2005) – This study identifies the service area and presents land use and population projection data. This study will be used in evaluating and developing future water and wastewater service populations and areas, identifying other water purveyors, and evaluating new wastewater treatment plant site alternatives.

Las Cruces City Plan (1999) – This plan is an update to the 1985 Comprehensive Plan. Land use goals and existing and anticipated future (2015) water and wastewater service area boundaries are presented. These service area boundaries and land use goals have been taken into account in developing water and wastewater flow projections.

Doña Ana County Final Regional Wastewater Facilities Master Plan (August 1998) – This plan provides a conceptual design for a regional wastewater treatment facility and provides a brief description of the extent of the existing wastewater treatment system. The concepts presented in the plan have been reviewed and considered as applicable in identifying new wastewater treatment plant alternatives.

El Paso-Las Cruces Regional Sustainable Water Project (November 1999) – This report presents a siting study for a potential surface water treatment plant in the Doña Ana County planning area. Water demands for the planning area, several potential water treatment plant locations, and cost estimates for treatment plant construction, operation, and maintenance are presented. The concepts presented in this report have been reviewed and considered as applicable in evaluating future water demands and the potential need for a new surface water treatment facility.

1.3 Planning Area

The planning area includes areas currently served by the City's existing water and wastewater infrastructure as well as areas of future development.

The City of Las Cruces is located in Doña Ana County in south-central New Mexico. The City lies within the Mesilla Valley along the Rio Grande and is located approximately 225 miles south of Albuquerque New Mexico and 50 miles north of El Paso Texas. It is the second largest city in New Mexico in terms of size and population.

The geographic planning area considered for this Update are approximately bounded by the Rio Grande along the west including the West Mesa Industrial Park and airport on the west mesa to Hanger Lake Road on the east, , the I-10/I-25 Interchange on the southern border and the Doña Ana Mountain foothills on the north.

The current planning area includes the entire area within the current City limits, the recent annexations on the east and west mesas, as well as additional areas of future development that may occur outside the current city limits. The recent annexations and other future service areas are discussed in more detail in Section 5 for the 2010, 2015, 2020, and 2025 timeframes.

The planning area includes approximately 500 miles of City water distribution lines and 40 million gallons per day of potential City water well supply. The City of Las Cruces water system serves the majority of water customers located within the City limits. Other water utilities including but not limited to Doña Ana Mutual Domestic Water Consumers Association (DAMDWCA), Moongate Water Company, Jornada Water Company, Town of Mesilla, and New Mexico State University (NMSU) also provide water service to areas within or adjacent to the City limits but are not included in this update.

Existing wastewater facilities include approximately 450 miles of wastewater collection system, the 13.5 MGD Jacob A. Hands Wastewater Treatment Facility and the 0.40 MGD West Mesa Industrial Park Wastewater Treatment Facility. The City wastewater system serves the majority of wastewater customers within the City limits as well as customers who are provided water utility service by Doña Ana MDWCA, Moongate Water Company, Jornada Water Company, Town of Mesilla, San Pablo MDWCA, and NMSU.

1.4 Planning Horizon

The 1995 Water and Wastewater Master Plan that covered the period from 1995 to 2015 serves as the basis of this Update. As is typical for a master plan, the planning periods will overlap to make sure there is consistency and continuity in the planning. Therefore, the planning period for this update starts from 2005, updating the evaluations made by the previous plan for 2010 and 2015 and extending evaluations to the year 2025.

However, this planning area includes interconnections for emergency purposes with four other water systems: NMSU, Onate High School, DAMDWCA and the Town of Mesilla. Wastewater, non-emergency, interconnection points also exist with DAMDWCA, Town of Mesilla, San Pablo and NMSU.

Section 2
Water and Wastewater Master Planning Process

2.0 Overview of Master Planning Process

The primary purpose of this Water and Wastewater Master Plan Update is to provide a comprehensive plan for identifying, budgeting and scheduling the construction of improvements to the existing water and wastewater conveyance system, water supply, and water and wastewater treatment infrastructure to meet projected needs to the year 2025.

Preparing a master plan is a multi-step process with each step sequentially building on the previous step beginning with evaluations of the primary components:

- water supply, transmission and distribution system;
- wastewater collection system; and
- wastewater treatment facilities.

Evaluation of these Update components is interrelated because one component may have an influence on the planning options available for others. For example, siting a new wastewater treatment facility will have an effect on the available options for expanding existing interceptor corridors or creating new ones.

For the water and wastewater conveyance systems, current and future deficiencies are identified using modeling software and recommendations for improvements are made. The planning process also identifies the need for the development of new water and wastewater treatment facilities or the expansion of existing facilities. Other factors, such as economics, public acceptance, and the ability to implement improvements are also important considerations in the planning process.

The water and wastewater master planning process considers changes and redistribution of population and employment, land use, regulatory policies, and their effect on the condition and capacity of water and wastewater facilities and associated infrastructure. Municipal water and wastewater alternative solutions are developed and evaluated to meet needs forecast by the Update. This requires accurate forecasts of land use, water use, and population and employment data as well as relevant water supply and conservation plans for the current and planned service area.

2.1 Planning and Forecasting Methods

There are different methods for developing projections of population to determine future water demands and wastewater flows. This Update uses the overall population and water demand projection and per capita water use rates developed in the Las Cruces 40-Year Water Development Plan (October 2007) and the growth rates of individual City parcels (defined as Traffic Analysis Zones) in 5-year increments developed in the Land Use Assumptions for Development Impact Fees Interim Study (July 2005). Forecasting future water and wastewater demands is based on the principle that changes in water demand and wastewater flow are primarily a function of the changing population.

In the Land Use Assumptions Study, projections of population are provided by the City's Community Development Department for three growth scenarios (low, medium, and high) for the City of Las Cruces. For planning purposes, the City has selected the high growth population projection for future planning based on current development and annexations and City staff's estimates of the population.

Population increases are expected to be the result of the "baby boomer" generation retiring (2008 through 2028) in the Las Cruces area. Additional increases in population and associated housing and employment may be attributed to increased military and civilian employment at White Sands Missile Range and continued growth in the southern Doña Ana County.

2.1.1 Land Use Projections

The City of Las Cruces Community Development Department currently identifies the following neighborhoods (City of Las Cruces Consolidated Plan, draft 2003):

- East Mesa - a mix of commercial, office, and residential uses, and several mixed use/multi-phase developments currently accounting for more than one-quarter of the City's population.
- Central - Central Business district, Mesquite/Old Town and Alameda-Depot residential historic districts where more than half of the City's population reside.
- University – commercial corridors and a variety of residential uses. New Mexico State University is also included in this planning area although it is located outside the City limits
- West Side – areas with a high degree of industrial activity.

The Land Use Assumptions for Development Impact Fees Interim Study (July 2005) provides estimates for the total amount of non-residential employment (number of employees) by land use and residential households (number of households) by traffic analysis zone (TAZ). According to the U.S. Census bureau a TAZ is an area identified by state or local transportation officials for tabulating journey-to-work and place-of-work statistics. It usually consists of one or more census blocks, block groups, or census tracts. Each TAZ is identified by a six-character alphanumeric code unique to a county.

The Land Use Assumptions Study allocated population projections to traffic analysis zones (TAZ) which are numbered geographic units within the Update's service area. The Land Use Assumptions Study contains land use inventory data and data for seven types of land use within the City. The TAZ allocations are used in this Update to spatially locate the future population growth however the TAZ population projections were replaced by projections from the Las Cruces 40-Year Water Development Plan (October 2007).

The TAZ allocation area covers all of Doña Ana County and therefore is larger than the City of Las Cruces. Figure 2-1 and 2-2 show the TAZ areas that include the entire water and wastewater master planning areas respectively that extend outside the City's current limits including areas recently annexed by the City.

Non-residential land uses are categorized as:

- Industrial Manufacturing
- Retail
- Service (requiring high traffic)
- Service (requiring low traffic)
- Schools
- Hotel/Motels

Residential land use is categorized in the Land Use Assumptions Study as the total number of households per TAZ. The Land Use Assumptions Study contains 328 TAZ with boundaries that spatially cover the Doña Ana County area. Many of the TAZ are not served or are partially served by the City of Las Cruces. The number of households and employment data estimated for each TAZ is available for the year 2000 (baseline), 2010, and 2030. Residential household and non-residential employment are listed as total values within a TAZ without corresponding spatial identification. Land use projections are made based on the premise that land use creation and change are a function of the changing population. Therefore, existing and future land uses, including types of housing and places of employment, are directly related to population growth.

The TAZ were developed for long-range transportation purposes. However, the TAZ data can also be used in different groupings as appropriate for estimating water and wastewater needs based on population and land use.

2.1.2 Population Projections

Population growth and the associated demands on the water and wastewater systems are the key factors for sizing and locating treatment and conveyance systems under the master planning process. Demographic forecasts of population, employment, and housing for the planning area are used as a basis for projecting land development. The land use information is then used in estimating future demands. Section 5 discusses how this information has been used in developing the water demand and wastewater flow projections for the Update.

As the second largest city in New Mexico, the City of Las Cruces population grew from 62,126 in 1990 to 74,267 in 2000 at an annual compounded growth rate of 1.70 percent. Census population estimates from April 2000 through 2004 indicate that the City has grown during that period at an annual rate of 1.98 percent. Seventy-four percent of this growth was due to the natural increase in population (more births than deaths) and the remaining growth was due to net in-migration (more people moving in than moving out).

The increase to net in-migration is primarily due to the growing number of retirees settling in Las Cruces, increased employment opportunities, and increased numbers of students attending New Mexico State University. This trend of increased net in-migration to Las Cruces is expected to continue as the area becomes a desirable location for retiring baby boomers and job growth continues in the area.

According to the Mesilla Valley Economic Development Alliance, the primary employers in Las Cruces are in the governmental or service sectors, including New Mexico State University, White Sands Missile Range, Las Cruces Public Schools, the City of Las Cruces, NASA, Memorial Medical Center, Wal-Mart and Doña Ana County.

The 40-Year Water Development Plan (October 2007) estimated population projections for the City of Las Cruces under four population growth scenarios from 2005 to 2025. For planning purposes, the City has selected the high growth population projection for future planning based on current development, annexations and City staff's estimates of the population. The 40-Year Water Development Plan population projections are shown in Table 2-1.

The utility-adjusted maximum growth rate was established by the City of Las Cruces to account for recent annexations of thousands of acres for the Vistas at Presidio, Sierra Norte, Kennon and other major developments. The low, medium and high growth projections are based on population projections from the City of Las Cruces Community Development Department, as published in the July 2005 report *Land use assumptions for development impact fees*. The master plans for the development of the annexed areas show a greater density of residential units than assumed in the July 2005 report. Utilizing the densities proposed by the master plans, it was found that the City population may grow at an average annual rate of as much as 4 percent based on the development of the master-planned communities alone. Therefore, a Utility-Adjusted Growth curve was developed in case such development does occur. Due to the annexations, the Community Development Department is currently reviewing land-use assumptions. The growth rate of 4% appeared unreasonably high; therefore an assumed rate of 3.5% was adopted for Utility-Adjusted Growth. Because it is not clear that the growth will occur at the rate presented in the development community master plans, this Update will use the high growth scenario from the 40-Year Water Development Plan.

Table 2-1 City of Las Cruces Population Projections[1]

Year	Low Growth	Medium Growth	High Growth	Utility-Adjusted Maximum Growth
2005	82,611	82,611	82,611	82,611
2010	90,646	90,646	98,154	98,154
2015	90,646	99,835	114,219	116,576
2020	90,646	109,796	130,283	138,456
2025	93,535	122,569	151,606	164,442

[1] *Data taken from the 40-Year Water Development Plan (February 2007)*

2.1.3 Modeling

The ability of the water and wastewater conveyance infrastructure to convey existing and projected demands/flows through the year 2025 must also be assessed. Computerized water and wastewater models are used for this assessment. This modeling information is used in the master planning process in the following ways:

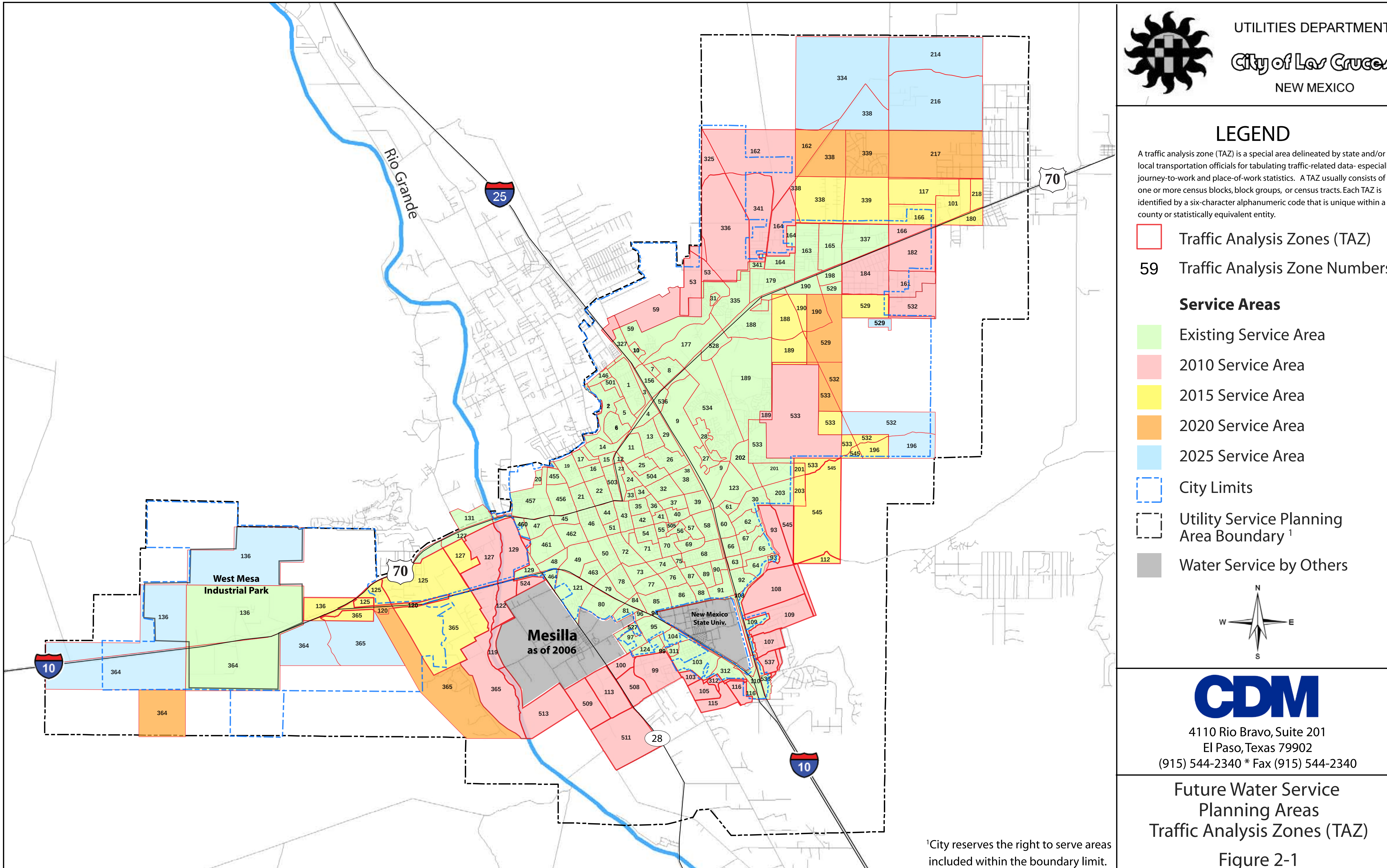
- Evaluating the overall impact of current and future water and wastewater flows on the existing conveyance systems by locating segments or areas where capacity deficiencies exist or will exist in the future. This assessment is conducted in 5-year projection increments through the planning horizon of 2025.

- Determining which wastewater treatment plant locations would be the most beneficial for relieving wastewater flows in downstream interceptors, thereby reducing the amount of pipeline construction required.

- Balancing the supply, pressure and storage of water throughout the distribution system to meet future demands.

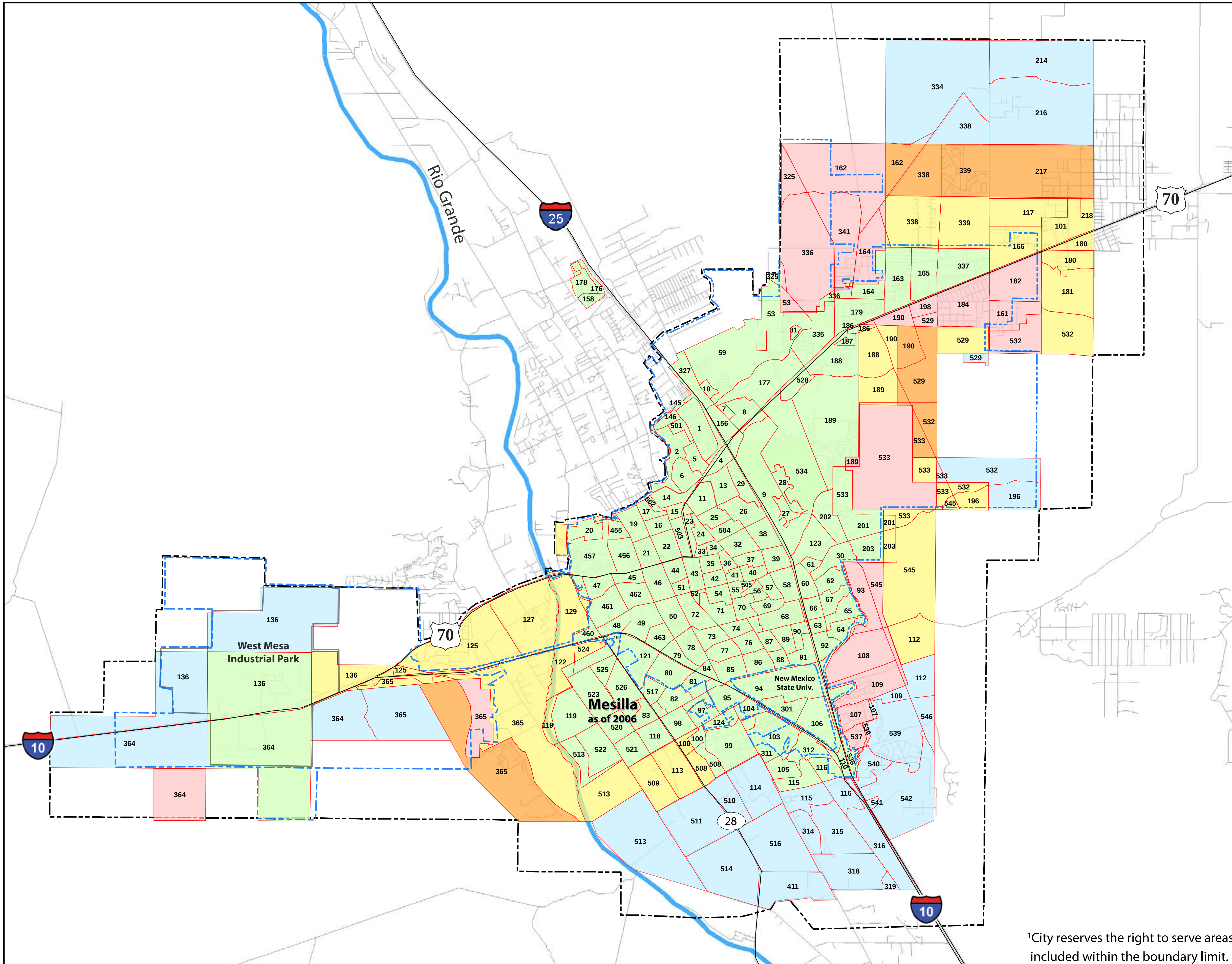
- Providing information that will be used for long-term Capital Improvement Program planning, short-term system evaluation, and maintenance database interfacing.

The primary modeling tool to evaluate the water transmission and distribution system is INFOWater and is described in detail in Section 6. The primary modeling tool to evaluate the wastewater collection system is INFOSewer and is described in detail in Section 7.



Future Water Service Planning Areas Traffic Analysis Zones (TAZ)

Figure 2-1



[1]City reserves the right to serve areas included within the boundary limit.

UTILITIES DEPARTMENT
City of Las Cruces
NEW MEXICO

LEGEND

A traffic analysis zone (TAZ) is a special area delineated by state and/or local transportation officials for tabulating traffic-related data- especially journey-to-work and place-of-work statistics. A TAZ usually consists of one or more census blocks, block groups, or census tracts. Each TAZ is identified by a six-character alphanumeric code that is unique within a county or statistically equivalent entity.

- Traffic Analysis Zones (TAZ)
- 59 Traffic Analysis Zone Numbers

Service Areas

- Existing Service Area
- 2010 Service Area
- 2015 Service Area
- 2020 Service Area
- 2025 Service Area
- City Limits
- Utility Service Planning Area Boundary [1]

CDM
4110 Rio Bravo, Suite 201
El Paso, Texas 79902
(915) 544-2340 * Fax (915) 544-2340

Future Wastewater Service Planning Areas Traffic Analysis Zones (TAZ)

Figure 2-2

Section 3
Existing Water System

3.0 Existing Water System Facilities

The key features of the Las Cruces existing water system include:

- 10 pressure zones
- 29 control valves
- 36 supply wells
- 8 booster pump stations
- 1 elevated and 13 ground storage reservoirs and
- 500 miles of transmission and distribution systems

These features are schematically illustrated in Figure 3-1 at the end of this Section.

3.1 Pressure Zones

A water system typically covers a large area encompassing different topographical features with high and low elevations. This variation in topographical features produces different zones of elevation, or pressure, within a system called pressure zones. These zones produce pressure differences within a system requiring specific design, equipment and operation for each pressure zone. The City's service area contains 10 existing pressure zones, as shown schematically on Figure 3-2. Table 3-1 lists each pressure zone and its range in ground elevation across the zone.

Zone 2 has been added since the 1995 Master Plan. Zone 2 is located in the far northeast corner of the service area. The remaining zones are unchanged since the 1995 Master Plan.

Table 3-1 Existing Pressure Zones

Pressure Zone	Pressure Zone Elevation Range (ft)		Reservoir Overflow (ft)	Customer Static Pressure (psi)	
	Top	Bottom		Top	Bottom
Zone 2	4472	4357	4587	49	99
Zone 1	4357	4242	4472	49	99
Jornada	4242	4127	4357	50	100
High	4127	4012	4242	50	100
Telshor	4189	4040	4304	50	114
North Intermediate	4040	3940	4155 (1)	50	93
Central Intermediate	4080	3955	4195 (1)	50	104
South Intermediate	4070	3960	4185 (1)	50	97
Low	4012	3897	4124	48	98
Airport	4462	4342	4577	49	101

(1) Pressure Regulated Zone. Gradient calculated for PRV with highest HGL setting in zone.

Figure 3-1 shows the location of 29 automatic control valves, typically called pressure sustaining (PSV), pressure reducing (PRV) or flow control valves (FCV), throughout the system, and their relationship to each zone. The valves are used to maintain the zone pressures by controlling flow into and out of the zones based on each zone's requirement. For the purposes of this document, Figure 3-1 identifies these valves as pressure control valves. Table 3-2 provides information on key characteristics of the control valve station stations.

Table 3-2 Existing Control Valve Station Characteristics

Model ID	Descriptive Name	Approximate Location	Zones From	Zones To	Valve Type*	Elev (ft)	Setting (psi) Sus	Setting (psi) Red	Diam (in)
V40	Well 40	Just west of Well 40. Normally closed.	Zone 2	Zone 1	Com	4475	0	0	8
V70	Highway 70	Bataan West, west of Mesa Grande Dr	Zone 2	Zone 1	Com	4381	83	33	8
VCT	Cattleman's	Bixler Dr, north of Bataan West	Zone 1	Jornada	Com	4262	84	41	8
VDM	Desert & Madrid	Intersection of Desert Dr and Madrid Ave	C Int	Low	Sus	3970	90	--	8
VEK	Elks	Elks Dr, 70' north of Lenox Ave	High	N Int	Com	4007	95	64	8
VEL	East Lohman	East end of Lohman Ave	Zone 1	Jornada	Com	4235	87	42	6
VFH	Foothills	Foothills Rd, 200' northeast of Nacho Dr	Jornada	Telshor	Com	4181	61	42	6
VHN	Huntington	West end of Huntington Dr	Telshor	S Int	Red	4032	--	55	6
VHR	Hillrise	East end of Hillrise Dr	Zone 1	Jornada	Red	4223	--	47	10
VIR	Imperial Ridge	East end of Imperial Ridge	Zone 1	Jornada	Red	4255	--	38	10
VJS	Johnson	South end of Johnson St	N Int	Low	Red	3955	--	64	6
VLS	Lester	Intersection of Lester Ave and Taylor St	Telshor	S Int	Com	4038	100	53	8
VLU	Locust & University	Intersection of Locust St and University Ave	S Int	Low	Sus	3970	95	--	8
VMS	Morning Star	Morning Star Dr, 150' west of Sonoma Ranch Blvd	Zone 1	Jornada	Com	4232	89	43	8
VN1	North Zone 1	Just east of North Zone 1 Tank	Zone 1	Zone 1	Sus	4440	0	--	10
VNR	Northrise	Northrise Dr, 700' northeast of Roadrunner Pkwy	Zone 1	Jornada	Red	4235	--	42	4
VNT	North Telshor	Telshor Blvd, 500' south of Summit Ct	Telshor	High	Com	4125	62	40	6
VPH	Parkhill	Parkhill Dr, 250' west of Rinconada Blvd	Zone 1	Jornada	Com	4242	93	43	8
VSA	San Acacio	North end of Fairbanks Dr, 100' north of San Acacio St	High	C Int	Red	4049	--	63	8
VSE	Settler's East	Settler's Pass, 100' south of Rinconada Blvd	Zone 1	Jornada	Com	4242	84	39	8
VSP	Settler's Pass	Settler's Pass, 120' west of Pineridge Run	Jornada	High	Com	4125	85	40	6
VST	Spruce & Triviz	Intersection of Spruce Ave and Triviz Dr	C Int	Low	Sus	4054	61	--	14
VTK	Turkey Knob	Turkey Knob Dr, 250' west of Panther Peak Dr	Jornada	High	Com	4127	93	43	6
VTR	Triviz	Triviz Dr, 1600' south of Fairfax Ave	High	C Int	Red	4058	--	59	14
VTS	Telshor	In Missouri Booster Station	Telshor	S Int	Red	4085	--	43	12
VUG	Upper Griggs	East of the intersection of Griggs Ave and Triviz Dr	Telshor	C Int	Red	4084	--	48	6
VUT	University & Telshor	Intersection of University Ave and Telshor Blvd	Telshor	S Int	Com	4062	98	53	12
VVV	Valley View	Valley View Ave 100' west of Lavender Dr	High	N Int	Com	4020	81	48	8
VWM	Wal-Mart	Intersection of Walton Blvd and Divot Ave	Telshor	S Int	Com	4045	106	61	6

* Com - combination pressure sustaining and pressure reducing valve; Sus - pressure sustaining valve; Red - pressure reducing valve

3.2 Supply Wells

Groundwater from surrounding aquifers currently supplies the system from 36 wells. These wells are scattered throughout the system as shown on Figure 3-1 and provide sufficient water to meet existing demands. Table 3-3 describes existing well characteristics. The 40 year Water Master Plan lists the current combined capacity of these wells as approximately 38,200 gpm (26.5 mgd, 29,710 ac ft/yr).

Table 3-3 Existing Well Characteristics

Well No.	Year Drilled	Depth (feet)	Current Design Capacity (gpm)	Static Water Level Depth (feet)	Motor (hp)	Address	Ground-water Basin	Pressure Zone Served
10*	1951	381	500	74	60	708 E. CHESTNUT	Mesilla	Low
19*	1962	612	725	233	125	101 S. TRIVIZ	Mesilla	Low
20*	1962	677	900	245	150	820 S. TRIVIZ	Mesilla	Low
21*	1962	632	1,100	250	150	671 N. TRIVIZ	Mesilla	Low
23	1966	592	775	230	225	HWY 70 AND I 25	Mesilla	High
24*	1966	591	690	215	200	2346 E. LESTER	Mesilla	Telshor
25	1969	620	1,050	230	225	2409 N. TRIVIZ	Mesilla	High
26	1969	700	725	176	200	832 S. WALNUT	Mesilla	Low
27*	1970	730	800	223	150	2250 E. GRIGGS	Mesilla	Low
28	1971	751	900	223	250	1755 N. TRIVIZ	Mesilla	C Intermediate
29	1976	634	1,080	30	125	1125 W. HAYNER AVE	Mesilla	Low
31	1976	622	950	12	125	1901 ISAACKS LN.	Mesilla	Low
32	1977	697	625	52	125	975 MESQUITE	Mesilla	Low
33	1978	606	400	48	125	2581 N. EL CAMINO	Mesilla	N Intermediate
35	1981	678	900	40	200	1800 S. EAST PARK	Mesilla	Low
36	1982	1,210	450	322	100	7109 W. I-10 VIADUCT	Mesilla	W Mesa
38*	1984	780	1,150	264	250	2707 E. IDAHO	Mesilla	Telshor
39	1987	600	800	194	200	2321 TEMPLE ST.	Mesilla	High
40	1988	1,170	1,350	411	350	7780 HOLMAN RD	Jornada	Zone 2
41	1993	980	1,390	404	350	7990 HOLMAN RD	Jornada	Zone 1
42	1998	1,170	1,300	467	400	9157 EL CENTRO BLVD.	Jornada	Zone 2
43	1998	1,150	1,420	496	350	9255 EL CENTRO BLVD.	Jornada	Zone 2
44*	1987	620	800	155	125	2250 E. MISSOURI	Mesilla	Low
46	1982	1,288	2,000	318	n/a	6451 W. 1-10 VIADUCT	Mesilla	W Mesa
58	1992	688	1,650	26	250	1980 STERN DR	Mesilla	Low
59	1992	772	1,550	24	250	680 MOTEL BLVD	Mesilla	Low
60*	1994	700	1,409	87	200	701 S ESPINA ST	Mesilla	Low
61	1995	1,070	1,914	240	200	2365 SAMBRANO AVE	Mesilla	Low
62	1995	681	840	244	150	2825 N. TRIVIZ	Mesilla	High
63	1996	1,290	3,130	322	n/a	7125 W I-10/VIADUCT	Mesilla	W Mesa
65	1997	765	2,500	27	400	2539 LAKESIDE DR	Mesilla	Low
67	2002	648	2,000	35	400	SE OF VALLEY/AMADOR	Mesilla	Low
68	2006	1100	600	327		EL CENTRO BLVD/ CATTLE GUARD TRAIL	Jornada	Zone 1
69	2006	1080	1,000	311			Jornada	Zone 1
70	2007	683	3,000	45		SW OF MILTON/ESPINA	Mesilla	Low
71	2007	725	3,000	42		NE OF BURNLAKE/I10	Mesilla	Low
Total	36 Wells	Capacity	38,024					

*Wells are currently offline; their capacities are not included in the total production capacity.

3.3 Storage Reservoirs

The system includes thirteen ground storage tanks and one elevated storage tank. The combined storage capacity of all tanks is approximately 29.4 million gallons. Figure 3-1 shows the tank locations, and Table 3-4 summarizes existing tank characteristics.

Table 3-4 Existing Tank Characteristics

Storage Tank Name	Model ID	Material	Year Constructed	Service Zone	Max Depth (FT)	Diameter (FT)	Capacity (MG)	Ground Elevation(FT)	Overflow Elevation(FT)
North Zone 2	TN2	Steel	2001	Zone 2	32	103	2.0	4555	4587
North Zone 1 A	TN1A	Steel	1992	Zone 1	32	103	2.0	4440	4472
North Zone 1 B	TN1B	Steel		Zone 1	32	103	2.0	4440	4472
Central Zone 1	TC1	Steel	1995	Zone 1	39	93	2.0	4433	4472
Telshor A	TTSA	Steel	1965	Telshor	32	104	2.0	4272	4304
Loma Vista A	TLVA	Steel	1964	High	39	92.5	2.0	4203	4242
North Jornada	TJ1	Steel	1992	Jornada	32	103	2.0	4325	4357
South Jornada	TJ2	Steel		Jornada	39	95	2.0	4318	4357
Spruce	TSP	Steel	1970	Low	39	114	3.0	4085	4124
Upper Griggs	TUG	Steel	1962	Low	39	114	3.0	4085	4124
Missouri	TMI	Steel	1956	Low	34	100	2.0	4090	4124
Airport Ground	TAG	Steel	1983	West Mesa	31	46.5	0.4	4432	4463
Airport Elevated	TAE	Steel	1983	West Mesa	37.5	--	0.5	4540	4577
West Mesa	TWM	Steel	2000	West Mesa	39	140	4.5	4195	4234
						Total	29.4		

3.4 Transmission and Distribution System

The water transmission and distribution system contains approximately 500 miles of pipe ranging in size from 6 to 30 inches in diameter. Pipeline materials include concrete cylinder, asbestos cement, ductile iron and PVC.

Currently the system contains eight booster pump stations which are used to boost and sustain pressure and to move water around within the system. These booster pump stations are shown in Figure 3-1, with key characteristics listed in Table 3-5.

Table 3-5 Existing Booster Pump Station Characteristics

Booster Pump Station	Model ID	Source Zone	Service Zone	Year Constructed	No. of Pumps	Motor[a] (Hp)	Design Capacity[b] (gpm)
Loma Vista	BLV	High	Jornada	1986	3	60	900
North Jornada	BJ1	Jornada	Zone 1	1995	3	75/40	400
South Jornada	BJ2	Jornada	Zone 1		3	85	1500
Upper Griggs	BUG	Low	Telshor	1982	2	100	800
Missouri	BMI	Low	Telshor	1975	4	75	800
					3	105	1500
Telshor	BTS	Telshor	Zone 1	1984	3	40	300
			Zone 1		2	46	600
			Jornada		2	55	1500
Airport	BAP	Airport	Airport	1983	2	50	800
West Mesa	BWM	Airport	Airport	2000	2	200	1100

3.5 Emergency Connections to Other Water Purveyors

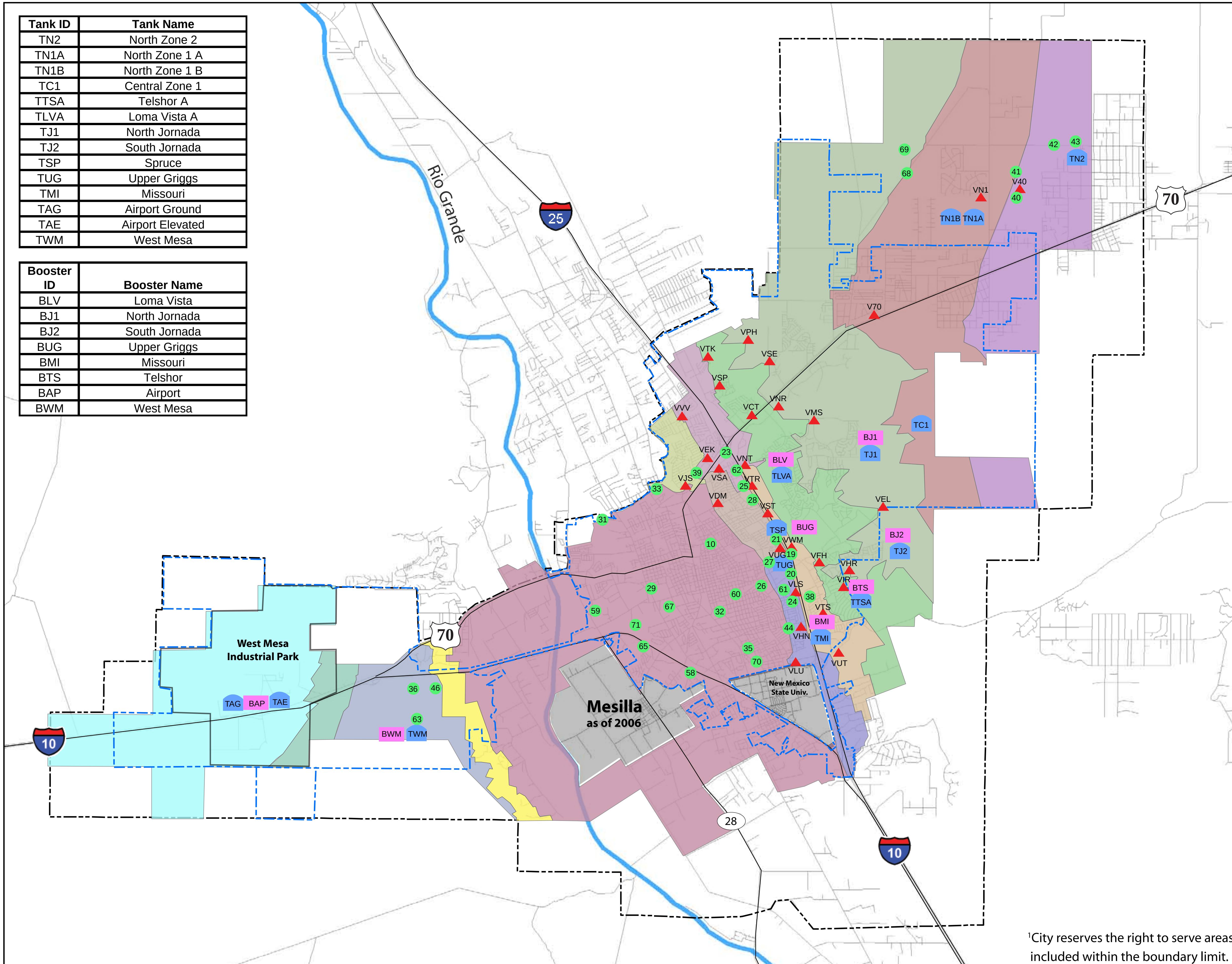
The City has agreements with the Town of Mesilla and New Mexico State University (NMSU) to supply them with water in an emergency at the locations listed in Table 3-6 below.

Table 3-6 Existing Interconnection Characteristics

Interconnection	Normal Operational Mode	Location
City – NMSU	Emergency	Stern Dr.
City – Mesilla	Emergency	Hwy. 28 & Park Drain
City – NMSU	Emergency	El Paseo & College
City – Doña Ana	Emergency	Hatfield & Elks

Tank ID	Tank Name
TN2	North Zone 2
TN1A	North Zone 1 A
TN1B	North Zone 1 B
TC1	Central Zone 1
TTSA	Telshor A
TLVA	Loma Vista A
TJ1	North Jornada
TJ2	South Jornada
TSP	Spruce
TUG	Upper Griggs
TMI	Missouri
TAG	Airport Ground
TAE	Airport Elevated
TWM	West Mesa

Booster ID	Booster Name
BLV	Loma Vista
BJ1	North Jornada
BJ2	South Jornada
BUG	Upper Griggs
BMI	Missouri
BTS	Telshor
BAP	Airport
BWM	West Mesa



UTILITIES DEPARTMENT
City of Las Cruces
NEW MEXICO

LEGEND

Pressure Zones
- Airport Zone
- East Airport Zone
- West Mesa Zone
- Low Mesa Zone
- Low Zone
- North Intermediate Zone
- Central Intermediate Zone
- South Intermediate Zone
- High Zone
- Telshor Zone
- Jornada Zone
- Zone 1
- Zone 2
- Zone 3
- Booster Station
- Well
- Pressure Control Valve
- Water Storage Tank
- City Limits
- Utility Service Planning Area Boundary [1]
- Water Service from Others

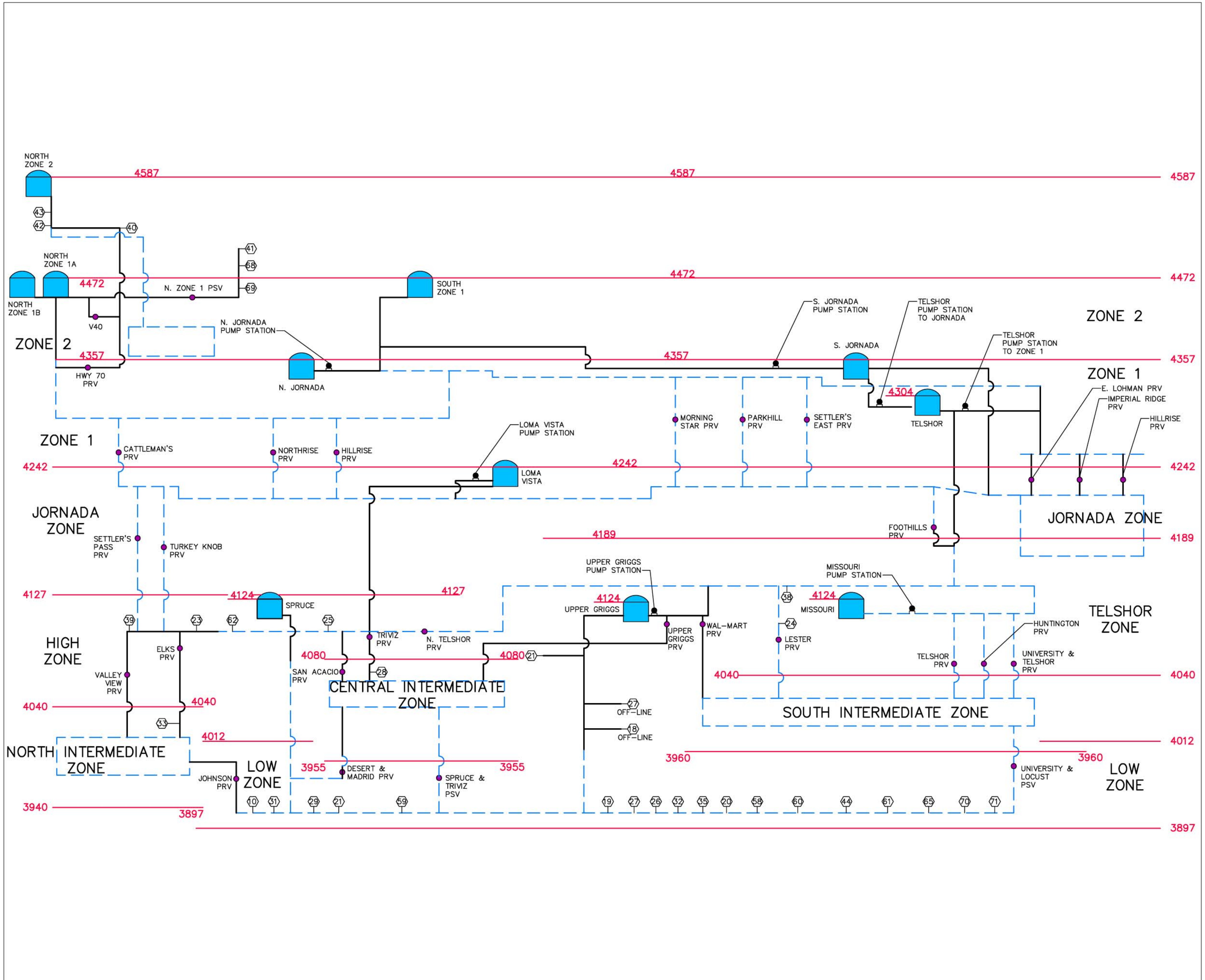
CDM
4110 Rio Bravo, Suite 201
El Paso, Texas 79902
(915) 544-2340 * Fax (915) 544-2340

[1]City reserves the right to serve areas included within the boundary limit.

Existing Water System Facilities And Pressure Zones

Figure 3-1

UTILITIES ENGINEERING DEPARTMENT
City of Las Cruces
NEW MEXICO



LEGEND

- RESERVOIR
- PRV OR PSV
- WELL
- PUMP STATION
- TRANSMISSION PIPING
- DISTRIBUTION PIPING

Note: The Airport Water System Is Not Included In This Schematic

CDM
4110 RIO BRAVO DRIVE, SUITE 201
EL PASO, TEXAS 79902
TEL: 915 544-2340 FAX: 915 544-1345
consulting . engineering . construction . operations

CITY OF LAS CRUCES
EXISTING WATER SYSTEM/PRESSURE ZONE SCHEMATIC
FIGURE 3-2

Section 4
Existing Wastewater System

4.0 Existing Wastewater System Facilities

This section describes the wastewater service area, key features of the existing collection and treatment facilities, and the current per capita wastewater flow rate.

The conveyance system collects untreated wastewater effluent from residential, institutional, commercial, and industrial sources through a system of service, collection, and interceptor pipelines. Where gravity flow is not possible, lift stations and forcemains are required to pump the wastewater to the treatment facilities or to locations where gravity flow is possible. Wastewater received at the treatment facilities undergoes a series of physical and biological processes to meet regulatory requirements prior to being discharged to the Rio Grande.

4.1 Wastewater System Service Area

The City of Las Cruces presently serves most areas within the City limits with wastewater collection and treatment as shown in Figure 4-1, where only interceptor lines are shown. Those who are not served by the City's wastewater system rely on individual and group septic tanks. In addition to treating Las Cruces wastewater, the City treats wastewater from areas receiving water service from Doña Ana Mutual Domestic Water Consumers Association, Moongate Water Company, Jornada Water Company, the Town of Mesilla, San Pablo, and New Mexico State University.

The City currently operates two separate sewer collection systems within the City limits as presented in Figure 4-1. The main system collects wastewater flow from the east side of the Rio Grande to the farthest eastern edge of and north and south to the City limits. A smaller system, located within the West Mesa Industrial Park collects wastewater from the Industrial Park tenants on the south side of I-10. The wastewater produced on the west side of the Rio Grande, between the river and the Industrial Park, is typically treated by on-site systems. Figures 4-2 and 4-3 show a schematic of the existing interceptors and lift stations in the City's main sewer collection system.

The City estimates that within the city limits, 1,880 parcels with single family residences may be on septic systems in addition to another 44 parcels containing 216 mobile home units. The majority of septic systems that are currently in use within the city limits are located in City Council District 5 in the northern and northeastern reaches of the City followed by City Council District 2 near the southern boundary. More detailed information may be found in the Septic Tank Identification and Prioritization Plan (April 2007) in Appendix A.

4.2 Collection System

For the purpose of this Update, the wastewater collection system is comprised of the infrastructure required to convey raw wastewater effluent to the wastewater treatment facility. This infrastructure includes interceptors and lift stations. Smaller diameter gravity pipes (less than 10 inches in diameter or individual service and collector lines) are not included in this Update. The conditions of the existing collection system including pipelines, manholes and lift stations are generally good. Rainfall-driven inflow/infiltration is very low due to the arid climate.

4.2.1 Pipelines

Pipelines are the primary component of the wastewater collection system to transport wastewater by gravity to the treatment facility. This Update generally defines interceptors as sewers with a diameter of 15-inches or greater. Therefore, smaller diameter sewers are only considered if they are critical to system operation. Figure 4-2 shows the sewer interceptor system and lift stations with pipelines 8 inches and greater.

The existing city collection system is comprised of approximately 450 miles of pipes. Thirty-nine (39) miles of them are interceptors with a diameter of 15-inches or greater. Except for the West Mesa Industrial Park wastewater system, these interceptors receive flow from throughout the service area and convey the flow in a westerly direction to the main Jacob A. Hands Wastewater Treatment Facility (JAHWWTF). The West Mesa Industrial Park Wastewater Treatment Facility (WMIP) is a separate system that receives flows from West Mesa Industrial Park tenants through one central interceptor located in Crawford Blvd.

Table 4-1 summarizes data on the existing Las Cruces gravity collection system included in the model based on the City's GIS database. For cases when a pipeline installation date was missing, it was assumed the pipeline was installed after 1975. Table 4-1 shows that approximately one-third of the total pipes, equal to or greater than 10 inches, are less than 20 years old and that greater than three-fourths are less than 30 years old. The majority of the pipes shown in Table 4-1 are constructed of vitrified clay pipe (VCP) and polyvinyl chloride pipe (PVC) with the VCP being more common in sewers with diameters less than 15 inches. Other pipeline materials in this system include cast iron, ductile iron, and reinforced concrete.

Table 4-1 Las Cruces Existing Major Sewer Pipelines

Pipeline Diameter (in)	Pipeline Age (feet installed)				Total Feet
	1996-2006	1986-1995	1976-1985	1975 and Older	
10	17,392	16,596	45,440	22,244	101,672
12	5,486	18,829	70,062	24,226	118,603
14		7,579			7,579
15	6,740	25,899	37,396	29,410	99,445
18	17,884	4,247	2,211	1,661	26,003
21	1,524		16,184	3,047	20,755
24	2,512	436	1,409	2,388	6,745
30	32	5,980	9,873	78	15,963
33			5,167	325	5,492
36	117		4,145	7,714	11,976
42	1,165	7,217	4,130	8,234	20,745
Estimated sewer pipeline greater than 40 years old				99,327	

Typical design life of sewer pipeline is 40 years at which time those lines should be identified, surveyed for condition to determine if repair or replacement is needed. This is a continual process in which pipelines are identified and included in either the maintenance program or appropriate CIP program. Per City staff's recent survey, no pipelines have been recommended to be included in this Update's CIP program.

4.2.2 Lift Stations

Lift stations are used in the Las Cruces interceptor system to pump wastewater through the associated force mains from locations where gravity flow is not possible to locations downstream where gravity flow may occur.

Lift stations are designed to operate efficiently under average daily flow conditions with the capacity to reliably convey peak hourly flows. These operating requirements must be met for current conditions with capacity allowances also provided for meeting future conditions at the end of the planning period.

Figure 4-2 presents a map of the existing wastewater system. Figure 4-3 presents a schematic diagram of the existing interceptor system.

Table 4-2 below provides a summary of the available information furnished by the Utilities Department staff for the 12 existing lift stations.

Table 4-2 Existing Lift Stations

Station Name	Year Built	Year Rehabilitated	Pumps (HP)	Capacity (gpm)
Boutz	1988		2 @ 214 1 @ 35	2100 900
Brown		1998	2 @ 5	323
Carver (Rios Encantados)	1999		2 @ 5	111
Chisholm	2003		2 @ 3	160
Frenger	1991		2 @ 20	950
Mesilla Park		1996	2 @ 10	300
Sandhill	2005		2 @ 45	1000
Shadow Run		2000	2 @ 5	90
Tortugas	1991		2 @ 5	240
University	1978	2008	2 @ 20	800
Inspiration	2008			750
Sanctuary	2008			300

4.3 Existing Wastewater Treatment Facilities

The City currently has two operational wastewater treatment facilities, the Jacob A. Hands Wastewater Treatment Facility and the West Mesa Industrial Park Wastewater Treatment Facility. The East Mesa Water Reclamation Facility is scheduled to be completed and begin operation by spring of 2009.

4.3.1 Jacob A. Hands Wastewater Treatment Facility

The Jacob A. Hands Wastewater Treatment Facility is located on the east bank of the Rio Grande north of Interstate 10. The facility treats all wastewater collected east of the Rio Grande and discharges it to the river.

The facility capacity is 13.5 mgd which is expected to be sufficient for an additional 15 years. The plant is designed to produce an effluent containing < 30 milligrams per liter (mg/l) of both biochemical oxygen demand (BOD) and total suspended solids (TSS). The facility's solid waste is composted on site and distributed to the public with excess may be sent to the land-fill.

A new facility was built in the mid-1980 and converted the older existing process into an activated sludge process. Design and partial implementation of more recent upgrades started during 2007 and is ongoing. Portions of the upgrades are being installed as required by flow volume growth and regulatory requirements.

The facility’s treatment processes include screening, grit removal, primary clarification, plastic media trickling filters, de-nitrifying basins, short detention aeration basins, secondary clarification, chlorination, and dechlorination. Primary clarification and centrifuge thickened sludges are anaerobically digested. Digester gas fuels a co-generation plant that supplies a portion of the power used at the facility. The treated wastewater from this facility is not used for irrigation.

Current NPDES Permit

Section 402 of the Clean Water Act (CWA) requires all point source discharges of pollutants to waters of the United States (including lakes, rivers, wetlands, etc.) to be authorized under a National Pollutant Discharge Elimination System (NPDES) permit. NPDES permits issued for point sources must contain provisions by the State or the USEPA for the discharge to meet water quality-based and technology-based requirements of Section 301 of the CWA. Water quality-based standards are designed to protect specific water bodies, and technology-based standards are designed to assure a minimum level of control for a particular class of discharge, no matter where that discharge takes place.

The NPDES permit under which the Jacob A. Hands Wastewater Treatment Facility currently operates under became effective on September 1, 2004 and expires on August 31, 2009. Table 4-3 presents the current NPDES permit requirements.

Table 4-3 Jacob A. Hands WWTF NPDES Permit Requirements

Parameter	30-Day Average	7-Day Average
Biochemical Demand (5-day), mg/l	30	45
Total Suspended Solids, mg/l	30	45
Fecal Coliform Bacteria (Colonies/100 ml)	200	400
Whole Effluent Lethality	22% minimum	22% minimum

Wastewater effluent is required to be dechlorinated. After dechlorination, and prior to final disposal, the effluent is to contain no measurable total residual chlorine at any time. This facility is in full compliance with all existing NPDES and New Mexico Environmental Department (NMED) permits.

4.3.2 West Mesa Industrial Park Wastewater Treatment Facility

The West Mesa Industrial Park Wastewater Treatment Facility was completed in 2000 to provide treatment to the tenants located in the West Mesa Industrial Park west of the city on Interstate 10. The facility is currently operating below its design capacity of 0.40 mgd and is not scheduled for expansion or modification. The collection system is in good condition and there are no force mains or lift stations. An expansion of the collection system is currently underway and will increase the flows received by this facility.

4.3.3 East Mesa Water Reclamation Facility

The City of Las Cruces began construction of the East Mesa Water Reclamation Facility on the east mesa in April 2008. This facility will treat wastewater to produce high quality irrigation water for use on golf courses, parks and other landscaped areas. The intent of this project is to conserve potable water by reusing treated wastewater for irrigation.

The facility is intended to collect wastewater from existing interceptors serving the east mesa area, specifically High Range and Sonoma Ranch areas. It will also collect flows from new development in the area east of the facility.

The proposed collection system for the reclamation facility will collect a portion of the existing east mesa wastewater northeast of Lohman Blvd. The flows will be intercepted and collected at the lowest point on the existing east mesa collection system before it crosses under the dam and I-25. This crossing point occurs near the south eastern base of the dam at the low point in the system and also allows for the collection of wastewater from new and future east mesa subdivisions.

The East Mesa Water Reclamation Facility is currently planned for an initial capacity of 1.0 mgd. Expansion will be determined by flow volume growth. Expansion planning should begin when the facility reaches 75% of initial capacity.

East mesa development that occurs after installation of the reclamation facility may tie into the existing collection system or new lines that are installed as the service area grows. Proximity to the new facility will reduce the size, depth and cost of the new sewer lines that would otherwise be needed to reach the Jacob A. Hands Wastewater Treatment Facility and will also delay the need for additional crossings of I-25 and the dam to accommodate future growth.

4.4 Current per Capita Wastewater Contribution Rates

The estimated 2005 Las Cruces population was 82,611 (see Section 2). The City of Las Cruces estimates 1880 parcels with single family residences and another 216 mobile home units are located within the Las Cruces sewer service area that are not sewered and rely on septic tanks for wastewater disposal. Assuming 2.46 persons per parcel and mobile home unit per the 40-Year Water Development Plan (October 2007) results in an estimated population of 5,156 that live within the city limits but who are not sewered. Deducting the estimated number of non sewered population results in a revised 2005 population of 77,455 connected to the City's wastewater collection system.

In Table 4-4 below, average daily and peak day monthly wastewater flow data and corresponding per capita wastewater contributions for the year 2005 are summarized.

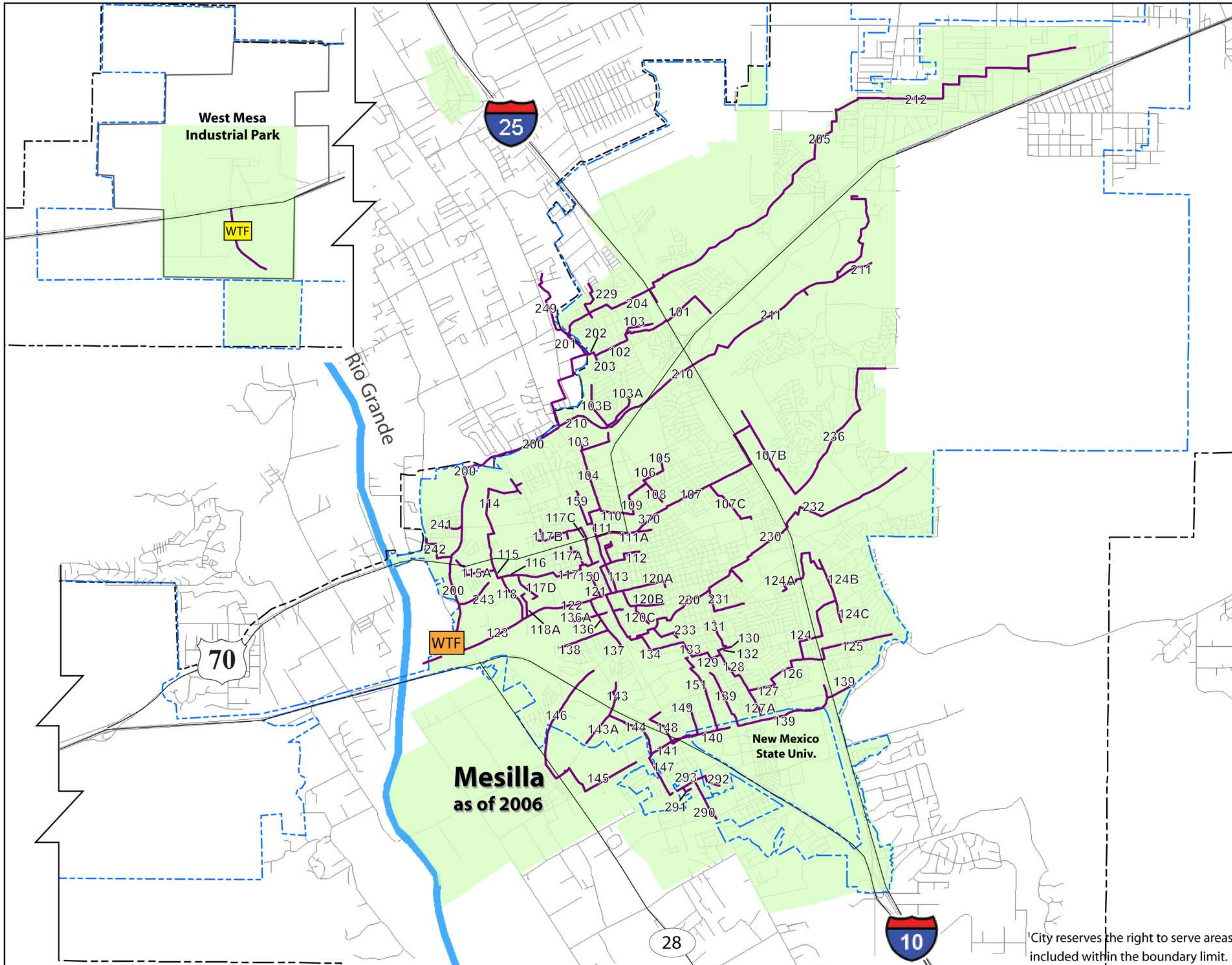
Table 4-4 2005 Wastewater Flow Data

Month	Average Day Flows		Peak Day Flows		Peak Day/ Average Day Ratio
	(mgd)	(gpcd)	(mgd)	(gpcd)	
January	7.18	92.7	7.80	100.7	1.09
February	7.40	95.5	8.10	104.6	1.10
March	7.11	91.8	7.70	99.4	1.08
April	7.25	93.6	7.80	100.7	1.08
May	7.23	93.3	7.90	102.0	1.09
June	7.48	96.6	8.20	105.9	1.10
July	7.79	100.6	8.20	105.9	1.05
August	8.20	105.9	9.10	117.5	1.11
September	7.95	102.6	8.80	113.6	1.11
October	7.80	100.7	8.70	112.3	1.12
November	7.51	97.0	8.30	107.2	1.11
December	7.22	93.2	8.70	112.3	1.20
Average	**7.51**	**97.0**	**8.28**	**106.9**	**1.10**

The data in Table 4-4 indicates that the average daily wastewater contribution per capita was 97 gpcd over the 2005 period and agrees with the estimate made in the 40-Year Water Development Plan October 2007. This per capita is based on population only and does not differentiate between contributions from residential customers and commercial/industrial users.

The data also indicates that per capita flows for each month's peak day averaged 107 gpcd. The 1.10 ratio of peak day to average day in 2005 is very close to the 1995 Water and Wastewater System Master Plan Update's calculation of 1.11 for the years 1989 through 1993.

For the purposes of this Update, the ratio of peak day to average day will be 1.10 and the ratio of peak hour to average day will be assumed to be 1.50. These ratios were determined by City staff using historical data and standard operating and design practices.



UTILITIES DEPARTMENT

City of Las Cruces

NEW MEXICO

LEGEND

- WTF — Jacob A. Hands Wastewater Treatment Facility
- WTF — West Mesa Industrial Park Wastewater Treatment Facility
- Existing System Interceptor ID Number (139)
- Existing Service Area
- City Limits
- Utility Service Planning Area Boundary[1]

CDM

4110 Rio Bravo, Suite 201

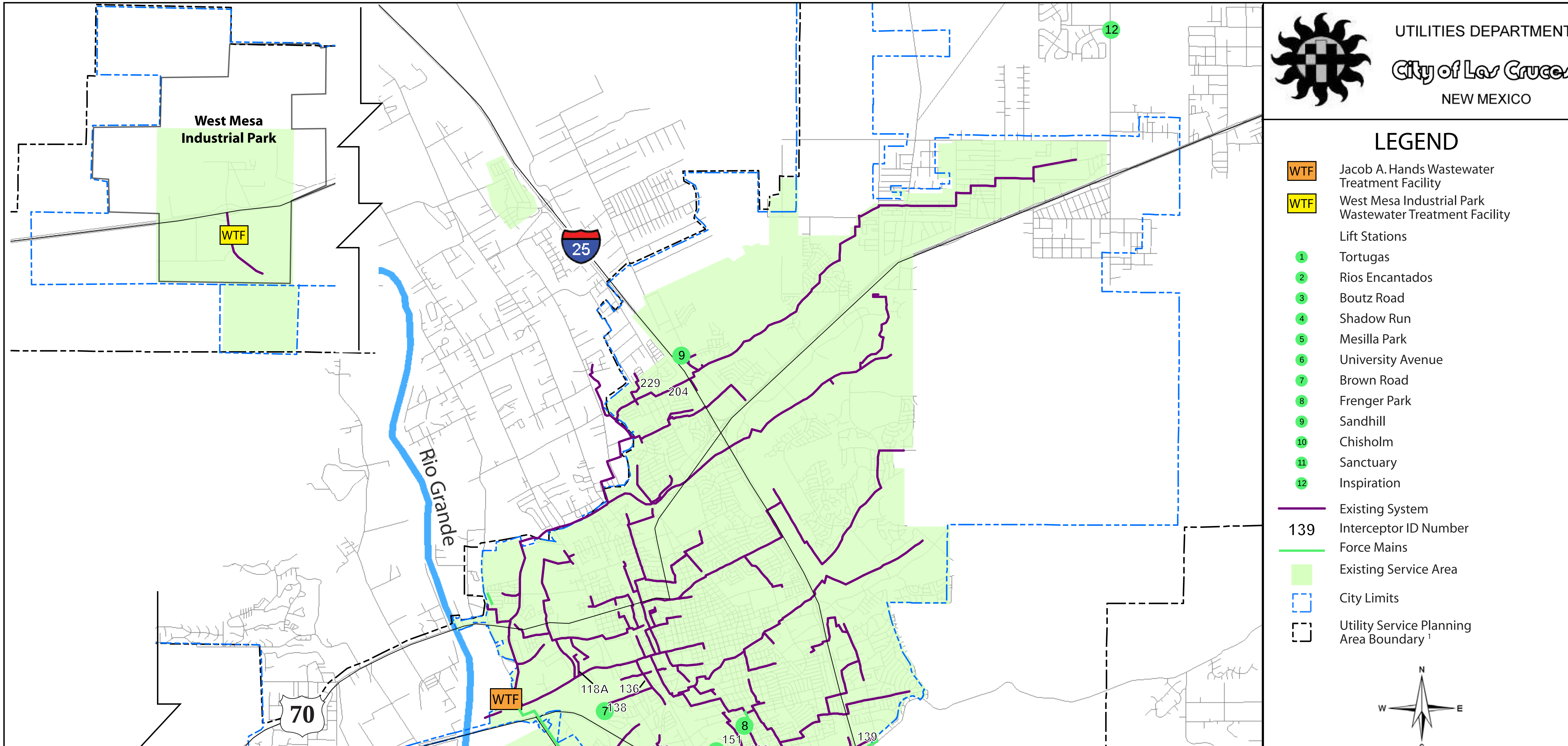
El Paso, Texas 79902

(915) 544-2340 * Fax (915) 544-2340

Existing Interceptor Map

Figure 4-1

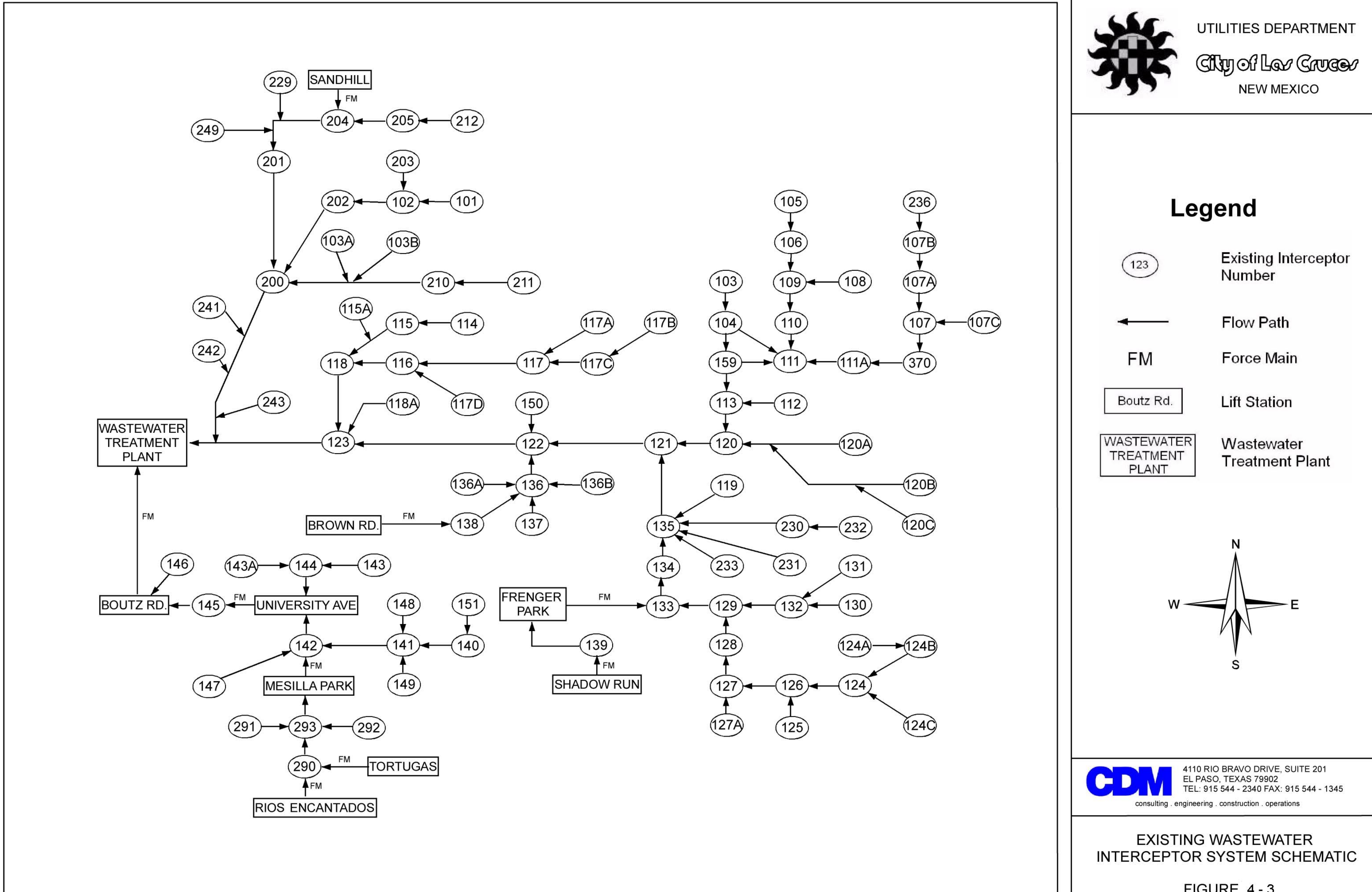
UTILITIES DEPARTMENT
City of Las Cruces
NEW MEXICO



CDM
4110 Rio Bravo, Suite 201
El Paso, Texas 79902
(915) 544-2340 * Fax (915) 544-2340

Existing Wastewater System

Figure 4-2



UTILITIES DEPARTMENT
City of Las Cruces
NEW MEXICO

CDM
4110 RIO BRAVO DRIVE, SUITE 201
EL PASO, TEXAS 79902
TEL: 915 544 - 2340 FAX: 915 544 - 1345
consulting . engineering . construction . operations

EXISTING WASTEWATER INTERCEPTOR SYSTEM SCHEMATIC

FIGURE 4 - 3

Section 5
Water and Wastewater Flow Projections

This section presents information on the projections for service areas, water demands, and wastewater flows during the planning period. The land use and population projections discussed in Section 2 have been used in developing these projections.

5.0 Water Service Area

Figure 5-1 shows the existing area served by the Las Cruces water system, and the proposed service areas to the year 2025.

Numerous community water systems are located within or near the existing water service area that include privately owned systems, mutual domestic water consumer associations (MDWCA) and mobile home parks (MHP). Table 5-1 provides a list from the USEPA Safe Drinking Water Information System of these community water systems and the estimated population served by them. Water usage per capita per day is based on an analysis of available information on water systems provided in the Regional Water Plan (2004). Due to the number and small size of these systems, they are not shown on the figures in this Update.

Table 5-1 Community Water Systems located in the Planning Area in 2005

Water Supplier	2005 Population Served	Usage (gpcd)
Alameda Acres MHP	330	100
Bill Moreno Water System	59	Not Available
Butterfield Park MDWCA	1132	73
Country Mobile Manor	222	68
Covered Wagon Mobile Home Manor	101	116
De La Te Mobile Manor	157	Not Available
Doña Ana MDWCA	8929	127
Dove Canyon LLC	157	Not Available
El Patio MHP #2	136	Not Available
Fairview Estates Water System	152	154
Hacienda Acres Water System	2155	174
Holly Garden MHP	311	136
Jornada Water	Not Available	Not Available
Las Alturas Estates	650	255
Las Cruces MHP	174	Not Available
Madrid MHP	83	Not Available
Mesa Development Center Inc.	840	126
Mesilla Park Manor Water System	848	202
Mesilla Water System	2500	96
Millers Mobile Manor	116	Not Available
Moongate Water System	6555	131
Moongate West	3434	-

Table 5-1 Community Water Systems located in the Planning Area in 2005

Water Supplier	2005 Population Served	Usage (gpcd)
New Mexico State University	24302	Not Available
Picacho Hills Utility Co	1074	846
Picacho MDWCA	1200	118
Rancho Vista MHP	120	118
San Andres Estates Water System	741	155
San Pablo MDWCA	570	Not Available
Skoshi MHP	171	101
St Johns MHP	395	132
Summer Wind MHP	476	Not Available
Talavera MDWCA	211	114
Triple J MHP	72	Not Available
University Estates Water System	3206	218
Villa Del Sol MHP	516	Not Available
Vista Real MHP	69	143
West Mesa Water Company Inc.	238	Not Available
West Mesa Water System	1754	Not Available
Winterhaven MDWC and SWA	163	Not Available

Many of the privately owned for profit water utilities such as Mesa Development Center originally served residential customers in rural areas outside of the city limits, then over time the City annexed into areas where they were providing water utility service or into areas where they claimed a right to serve. Their existing or claimed service areas within the city limits may be potential areas for future expansion by the City's water utility either through acquisition or competition. The City is currently in litigation with a private water company concerning whether this water company has an exclusive service area within the City limits. This is a critical issue to resolve because this water company claims an exclusive right to serve within much of the recently annexed Vistas at Presidio and Sierra Norte areas.

Many of the mutual domestic companies such as Doña Ana Mutual have service areas protected by 7 U.S.C. Section 1926(b). That federal statute has been interpreted to prevent cities from providing municipal water and/or wastewater service within the service areas as such mutual domestic companies for so long as the mutual domestics are indebted to the federal government.

5.1 Future Water Demand

Table 5-2 summarizes the City's projected total water demands for the four growth periods starting in 2005 that are considered in this Update. This information is summarized from the 40-Year Water Development Plan, October 2007. These demand projections represent the four population growth scenarios discussed in Section 2 (Table 2-1).

Table 5-2 City of Las Cruces Projected Demands for Public Water Supply

Year	Low Growth Demand		Medium Growth Demand		High Growth Demand		Utility-Adjusted Maximum Growth	
	ac-ft/yr	mgd	ac-ft/yr	mgd	ac-ft/yr	mgd	ac-ft/yr	mgd
2005	19,036	17.00	19,036	17.00	19,036	17.00	19,036	17.00
2010	22,063	19.70	22,781	20.34	23,765	21.22	23,765	21.22
2015	21,227	18.95	23,053	20.58	26,374	23.55	26,918	24.03
2020	20,893	18.65	24,737	22.08	29,353	26.20	31,194	27.85
2025	20,549	18.34	26,928	24.04	33,307	29.73	36,128	32.25

Table 5-3 presents projected total gallons per capita per day (gpcd) water use based on estimated total water demand divided by population served, and domestic gpcd use based on estimated total metered water deliveries to single-family residences, divided by the population living in single-family residences. Table 5-3 projections are based on the goals set by the City's water conservation program as presented in the 40-Year Water Development Plan, October 2007.

Table 5-3 City of Las Cruces Gallons per Capita per Day (gpcd) Projections

Year	Total gpcd	Domestic gpcd
2005	206	153
2010	216	161
2015	206	150
2020	201	146
2025	196	142

5.2 Water Conservation

The City has the goal to reduce total gallons per capita per day (gpcd) water use by 22 percent by 2045, from the 2000-2005 average value of 230 gpcd. The City will reduce total gpcd use through the City's Water Conservation Program, water reclamation, enforcing plumbing efficiency standards for all new residential construction, and reducing water losses.

Initial water conservation efforts are focused on reducing domestic outdoor water consumption where reduction of per capita water consumption would be the greatest. The key strategy of the water conservation program is to focus on reducing summer peak demands that occur from landscape irrigation. City records indicate that peak water demand nearly doubles during the summer months with single-family residences being the largest consumptive user group. According to the 40-Year Water Development Plan (October 2007), in a typical summer month, less than 10% of single family residents account for over 30% of single family residential water deliveries. Reductions in domestic indoor consumption are expected to be less than outdoor consumption. Indoor water use reductions will occur through installation of water conserving devices in new homes and businesses and through retrofits using lower water use plumbing fixtures and appliances of older homes and businesses over the next 40 years.

5.3 Wastewater Service Area

Figure 5-2 shows the existing area served by the Las Cruces wastewater system, and the proposed service areas to the year 2025. Future growth density is expected to include medium to high residential development to the east and northeast, low residential development to the south, and high mixed use to the west.

The City is the only significant provider of wastewater service within the planning area. However, the Septic Tank Identification and Prioritization Plan completed in 2007 identified an estimated 1,880 parcels using septic systems located within the City limits. Utilities staff has recommended to the Utilities Board that before the close of the 2010 period of the CIP, the City modify the current ordinance to require hookup of some of these systems to the existing wastewater collection system as soon as funding is available. This will apply to septic systems identified by the Septic Tank Identification and Prioritization Plan as Top Priority Septic Systems that impact the City's well head protection program. These septic tank conversions are essential to the well head protection program to prevent contamination of the groundwater being used in the City's drinking water supply.

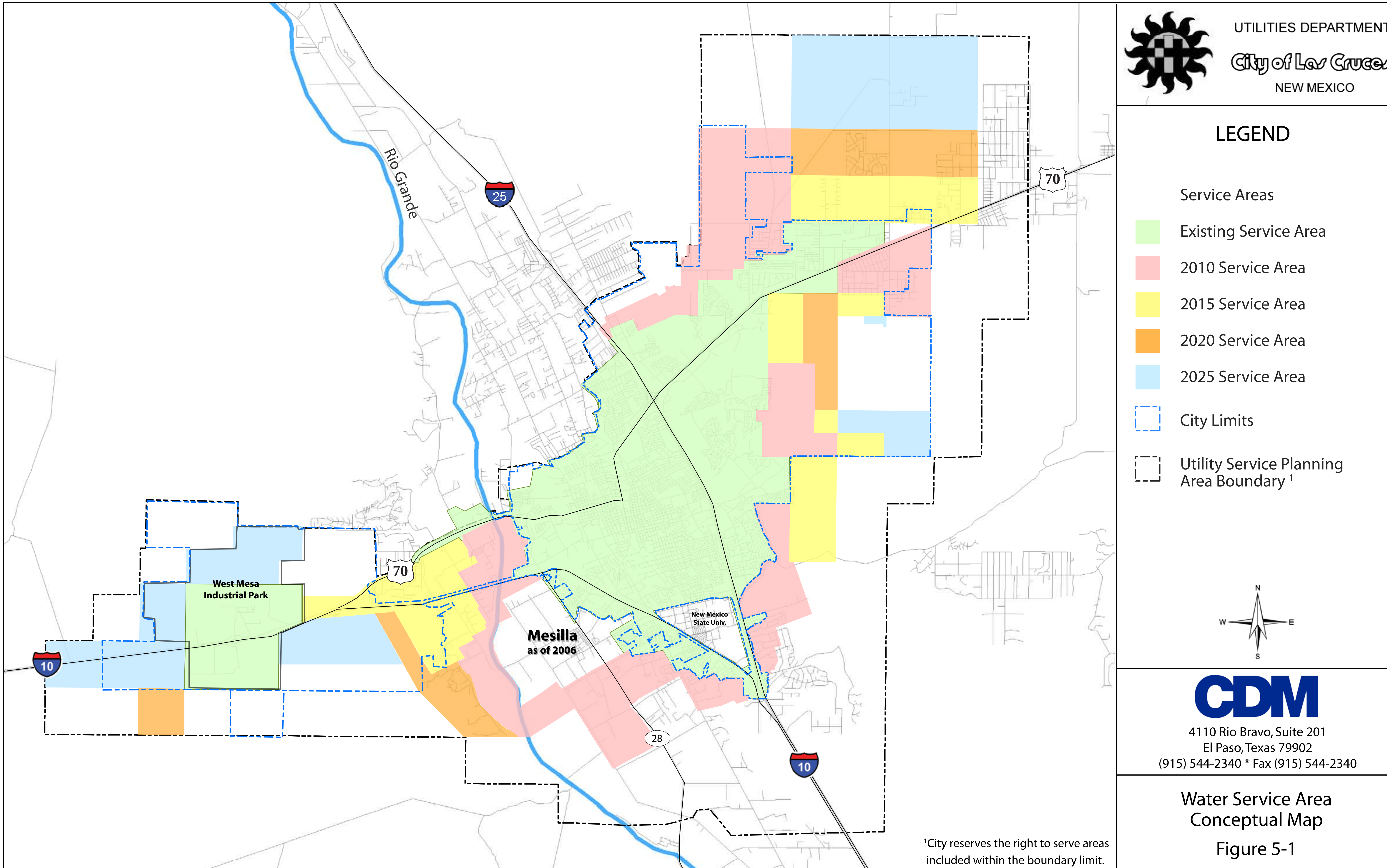
5.4 Wastewater Flow Projections

Table 5-4 summarizes the wastewater flow projections in 5-year increments from 2005 to 2025. These projections are based on using the average day per capita wastewater contribution of 97 gallons developed in Section 4 and the high growth population projections listed in Section 2. The peak day and peak hour wastewater flows are based on the ratios of 1.1 and 1.5 respectively to average daily flows developed in Section 4.4. Table 5-4 assumes that beyond the year 2010 the entire population within the service area is sewered. Please note that the projected wastewater flows shown in Table 5-4 are slightly lower than the modeled flows in Section 7. This is due to differences between the total populations projected by the 40-Year Water Development Plan and the populations developed by TAZ from water billing account data and the Land Use Assumptions for Development Impact Fees Study and future annexations.

It is assumed that indoor water use and total per capita wastewater contributions will remain the same at 97 gpcd during the 2005-2025 planning period. The City's conservation program is designed primarily to reduce outdoor use and is not expected to reduce wastewater contributions.

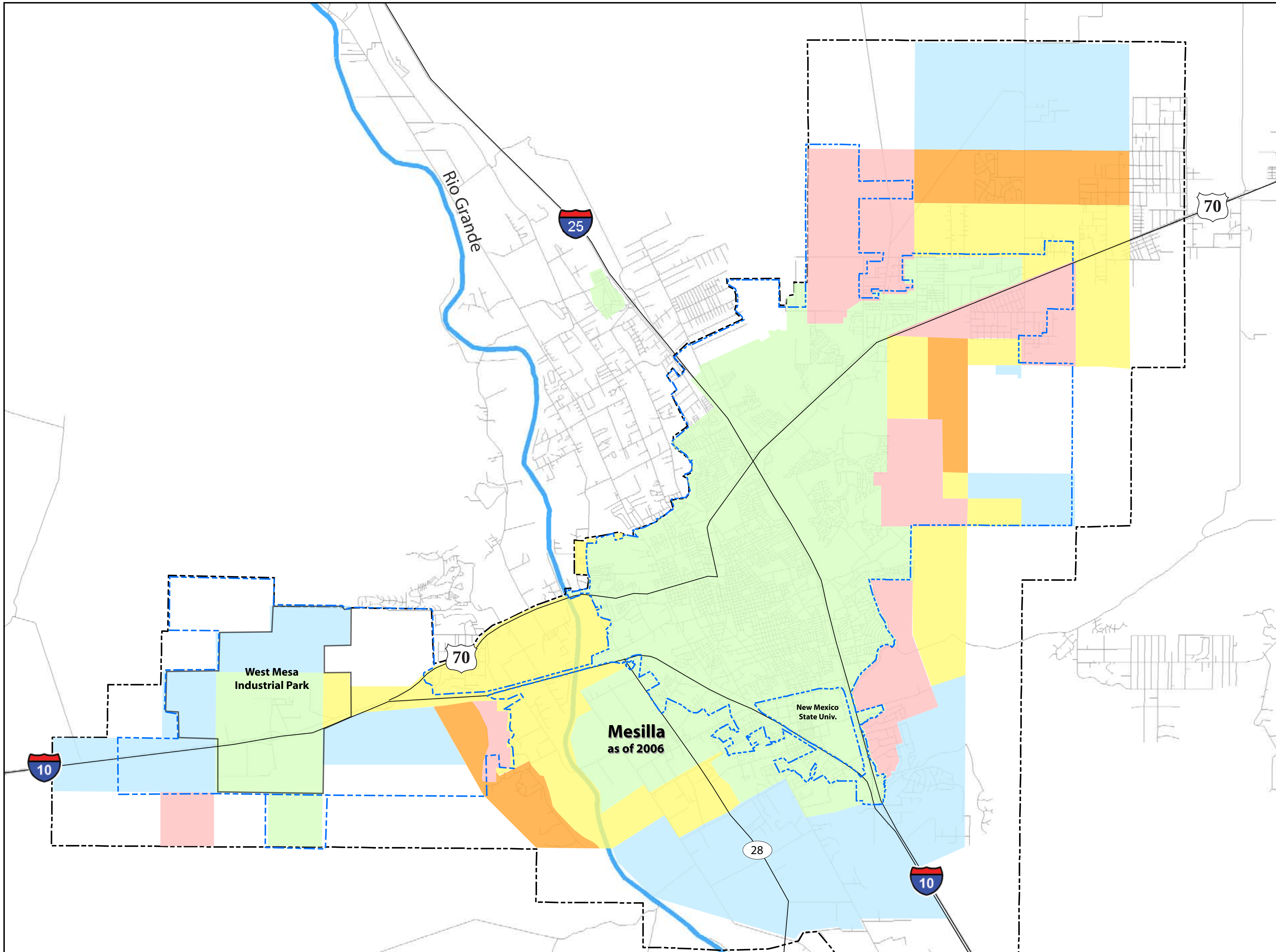
Table 5-4 City of Las Cruces Projected Wastewater Flows

Year	Served Population	Average Day (mgd)	Peak Day (mgd)	Peak Hour (mgd)
2008	77,445	8.7	8.3	11.3
2010	98,154	9.7	10.5	14.3
2015	114,219	11.4	12.2	16.6
2020	130,283	11.6	13.9	19.0
2025	151,606	13.0	16.2	22.1



Water Service Area Conceptual Map

Figure 5-1



UTILITIES DEPARTMENT
City of Las Cruces
NEW MEXICO

LEGEND

Service Areas
- Existing Service Area
- 2010 Service Area
- 2015 Service Area
- 2020 Service Area
- 2025 Service Area
- City Limits
- Utility Service Planning Area Boundary [1]

[1] City reserves the right to serve areas included within the boundary limit.

CDM
4110 Rio Bravo, Suite 201
El Paso, Texas 79902
(915) 544-2340 * Fax (915) 544-2340

Wastewater Service Area Conceptual Map

Figure 5-2

Section 6
Water System Evaluation

6.0 Water Transmission and Distribution System Evaluation

This section identifies shortfalls or deficiencies and required improvements in the City's water transmission and distribution system. Based on the City's utility design standards and common engineering practice, the water production, storage, pipeline, pump station and control valve capacities are evaluated. Results for the water transmission and distribution system are developed from evaluations using the hydraulic model developed for master planning purposes.

6.1 Design Standards

Based on the City of Las Cruces Utility Standards (May, 2008) and common engineering practice, the following criteria were selected to help establish the minimum acceptable conditions under which the water system would be considered adequate. The inadequacies in the existing facilities as well as the size of proposed improvements are determined by the criteria listed below.

- Water production facilities should be capable of meeting the average daily demand on the maximum demand day in the year. Standby capacity is added to provide extra reliability to the system. Standby capacity is estimated by assuming that 80 percent of the total production capacity would be available for use at any time, i.e., 20 percent of the total capacity may be out of service at any given time.

- Booster pump stations deliver water from a lower pressure zone into a higher pressure zone. Multiple pump stations or multiple booster pumps at each station should be able to supply the maximum day demand of the served pressure zone with the biggest booster pump at any station out of service, as a standby unit.

- System storage capacity is the sum of three components: operational storage, emergency storage and fire suppression storage. The design standards require 25 to 33 percent of the maximum day demand for operational storage, and half of the average day demand for emergency storage. Each fire suppression service area (multiple pressure zones) is required to have a storage volume amounting to the maximum fire flow. The maximum fire flow is 1,500 gpm with a two-hour duration, which is a fire suppression storage volume of 0.18 mg for each fire suppression service area.

Criteria used in the hydraulic modeling to evaluate pipeline capacity in response to maximum day water demands include the following:

- Hazen-Williams coefficient (C): for new pipes in the model a C factor of 130 is used. For existing pipes, C factors are set lower depending on pipe material and age.

- Velocities greater than 5 feet-per-second (fps) indicate inadequate flow capacity and are used for sizing new larger pipelines. Existing pipelines with velocities greater than 5 fps are identified in the analysis but are not flagged as deficient unless there are corresponding pressure problems in areas near the pipeline.

- Desirable maximum service pressure is 100 psi for any service nodes (nodes with demands). In the City's existing system, a large number of service nodes are lower than the bottom elevations of their pressure zones, especially in Low Zone, Telshor Zone and Zone 1, and have resulting static pressures higher than 100 psi. Because the maximum pressure criterion is a desired goal, existing service areas with pressures above 100 psi are identified in the analysis, but are not flagged as deficient.

- Allowable minimum pressure is 40 psi under normal conditions for any service nodes. The areas with pressure less than 40 psi are identified as deficiencies.

- The required residual pressure during fire flow is 20 psi with 1,000 gpm available flow for residential service nodes, or 1,500 gpm available flows for industrial and commercial service nodes. Areas not meeting these requirements are identified as deficient.

6.2 Hydraulic Model

A hydraulic computer model is constructed to represent the City of Las Cruces' water system, including the physical facilities, operational characteristics, and production and consumption data. The hydraulic model is an important tool for analyses of the water system in the master plan. It can simulate existing and future scenarios, identify system shortfalls or deficiencies, analyze impacts from increased demands and determine the effectiveness of proposed improvements.

The hydraulic model provides a simulation of the operation and capacity analysis of the pipe network, pumping facilities, and water storage reservoirs. The hydraulic model developed for the previous master plan utilized version 2.0 of CYBERNET (later renamed Water CAD) from Haestead Methods Inc. The model selected to perform the hydraulic analysis for this master plan is InfoWater developed by MWH Soft.

The three PIPE2000 files, mp-eastm, mp-valle, and ma-westm were imported into the InfoWater model. The 1995 Master Plan, CH2M Draft Operational Manual and 40-Year Water Development Plan (October 2007) were referenced to integrate system facility information. The information of newly completed developments between the last Master Plan and this Master Plan were provided by the City, and added into the InfoWater Model as part of the existing system. The elevation information was obtained from the City's 2-ft contour GIS data.

System demand for the model is determined from the City's water customer billing data for 2005, the Land Use Assumptions Study by Traffic Analysis Zones, Sierra

Norte Development Master Plan population, Vistas at Presidio Development Master Plan population and the population projections in the 40-Year Water Development Plan (October 2007). Section 5 presents the demand projections and general methodology used. Appendix B provides a detailed discussion of the procedure used to derive the model demand estimates.

Calibration of a model is typically performed by comparing modeled results with field measured pressures and real-time SCADA data. The field measured pressures are obtained from fire hydrant tests. The calibration hydrant tests for this model were performed from November 16, 2006 to November 27, 2006. A hydrant was tested in each pressure zone and the pressure drop in the system that resulted from each field test is compared to the modeled pressure drop in the same area of the system due to modeled fire flow. According to the AWWA Engineering Computer applications Committee's recommendation, a model is considered to be calibrated when the modeled pressure drops are within a +/- 5 psi difference with the field pressure drops.

Based on this standard, seven of the fifteen tests modeled matched well with the field observations. In the case of the discrepancies, the test hydrants are located downstream from combination pressure-sustaining/pressure-reducing valves which this version of the modeling software is not capable of modeling correctly. This appears to result in a field test showing a larger pressure drop than the model simulation. In the field test, the upstream combination valve(s) modulate to maintain the pressure in the upstream zone however, in the model simulation the valve simply opens to meet the downstream demand, resulting in much smaller pressure drops than the field test showed.

For this reason, the water model used for this Master Plan Update is considered calibrated and adequate for planning purposes but not for system operation decisions. The discussion of existing water system deficiencies in this report is to be considered supplemental to the City's on-going evaluation of the existing water system.

Once the model is calibrated, it is updated to include current capital improvement projects that are either under construction or already funded. The model, including these planned facilities, is used to represent the existing water distribution system for existing and future demand evaluations.

6.3 Water System Analysis

This section provides the facility analysis and hydraulic analysis of the City's existing water system to identify deficient areas that require improvement.

Step 1. A facility analysis is done to compare the existing production, pumping and storage capacity with the required capacities based on the criteria discussed in Section 6.1.

Step 2. The transmission and distribution system is hydraulically evaluated using the hydraulic model developed for the master plan.

6.3.1 Projected Water Demands

Table 6-1 summarizes the water demands used for the system analysis. The future demands are projected as discussed in Section 5. To estimate future maximum day demand, a peaking factor of 2.0, adopted from the City's historical data, was applied to the average day demand.

Table 6-1 Water Demands for System Analysis & Comparison with 40-Year Plan Projection

Year	Projected Average Day Water Demand (mgd)	Projected Water Demand (AC-FT/YR)	40-Year High Growth Water Demand (AC-FT/YR)	(CDM - 40yrMP)/ 40yrMP	Projected Maximum Day Demand [(1)] (mgd)
2010	20.8	23,272	23,765	-2.07%	41.6
2015	23.9	26,816	26,374	1.68%	47.9
2020	26.6	29,842	29,353	1.67%	53.3
2025	29.6	33,125	33,307	-0.55%	59.1

[(1)] Maximum day demand estimated at 2.0 times the average daily demand, based on City historical data.

6.3.2 Water Production Evaluation

As discussed in Section 6.1, firm production capacity equals 80 percent of the total production capacity. This assumes that up to 20 percent of the total capacity may be unavailable at any given time.

All existing water supply is groundwater from wells in the Mesilla and Jornada groundwater basins. The existing water system is comprised of two separate systems: the main system and the west system. The two separate systems are planned to be integrated into a single system by the year 2010.

The main system has a firm production capacity of 37.4 mgd and the west system has a firm capacity of 6.4 mgd. It is expected that when the two systems are combined into a single system, it will have a total well production capacity of 54.8 mgd, and a firm production capacity of 43.8 mgd.

The City has begun preliminary studies for a surface water treatment plant to offset groundwater pumping. Production for the surface water treatment plant is expected to enter the system from February through October. However, surface water may not be available in all years due to drought. In years when surface water is unavailable, the well supply system would be required to meet the maximum day system demand. Therefore the analysis considered supply from groundwater wells only and did not consider supply from a surface water treatment plant. Table 6-2 shows production capacity requirements for the 20-year planning period without consideration of future use of surface water supply. A comprehensive surface water treatment facility feasibility study is currently being completed and will be considered an appendix to this Update under separate cover.

Table 6-2 Water Production Capacity Evaluation

Year	Existing Wells Firm Capacity (mgd) [1]	Maximum Day Demand (mgd)	Shortfall (mgd)	Well Firm Capacity Needed [1] (mgd)	Well Total Additional Capacity Needed [1] (mgd)
2005 Main System	37.4	29.0	No	0	0
2005 West System	6.4	0.6	No	0	0
2010	43.8	41.6	No	0	0
2015	43.8	47.9	4.1	4.1	5.1
2020	43.8	53.3	9.5	9.5	11.9
2025	43.8	59.1	15.3	15.3	19.1

[1]Firm capacity is calculated as 80 percent of total well capacity. Firm capacity is used for projecting well capacity needs, assuming that 20 percent of wells may be unavailable on maximum demand day, due to normal maintenance, equipment problems or water quality reasons.

The City's existing groundwater wells will be able to serve the projected water demand through 2010. The additional well capacity required by 2015 is 4.5 mgd and by 2025 will increase to 16.8 mgd. The required capacities are assumed to be met by developing new wells in the East Mesa well field and West Mesa well field, for which the City has already obtained permits. These planned wells are listed in Table 6-3. The total capacity of the proposed wells is 24.1 mgd, which is sufficient to meet the projected production requirement of 16.8 mgd in 2025. The City has sufficient groundwater rights to meet future demands, and new wells will be developed when needed.

Table 6-3 Potential Future Wells

	Well No./NMOSE file numbers	Estimated Capacity (mgd)
West Mesa Well Field	LRG430S40	4.3
	LRG430S41	4.3
	LRG430S39	4.3
East Mesa Well Field	LRG-3283	1.4
	LRG-3284	1.4
	LRG-3285	1.4
	LRG-3292	1.4
	LRG-3293	1.4
	LRG-3294	1.4
	LRG-3295	1.4
	LRG-3296	1.4
Total		**24.1**

6.3.3 Booster Station Evaluation

The City has several existing booster stations that pump water from lower service zones to higher service zones within the system. In pressure zones where a booster station is the only source of supply, the booster station would be sized for a firm capacity equal to the maximum day demand, and storage would be designed to meet variations in demand. Because of the interconnectedness of the City system, most booster stations serve zones that also either have supply wells, or have PRV connections from adjacent zones. Therefore, a comparison of pump station capacity with zone demand is not presented. In identifying future booster station needs, the hydraulic model is used to determine pumping needs by zone, to move water from the preferred supply locations (West Mesa and Low Zone well fields) to higher elevation zones within the service area.

6.3.4 Storage Evaluation

As described in Section 6.1, the total required storage volume is estimated as the sum of the following components:

- 33% of maximum day demand for operational storage,
- 50% of average day demand for emergency storage, and
- 0.18 mg fire suppression storage.

Based on the pressure zone delineation and their hydraulic connection with adjacent zones, the existing water system is divided into three fire suppression zones. Each of the fire suppression zones requires 0.18 mg of fire suppression storage, based on the design criteria discussed in Section 6.1. The operational storage and emergency storage capacities of each zone are calculated from the 2005 actual demand for the existing system, and from the projected demand for the future system.

Table 6-4 presents the evaluation of the system storage capacities, surpluses, and shortfalls, with storage computations by the three fire suppression zones. For each of the three areas, existing and future pressure zones are also indicated. As the table shows, the West Area, which includes the existing Airport pressure zone, and future zones on the west side of the system, there is a storage surplus through 2025. The Middle Area, which includes Low, South Intermediate, Central Intermediate, North Intermediate, Telshor and High zones, has an existing storage shortfall of 2.4 mg, increasing to 4.5 mg by 2025. The East Area, which includes Jornada Zone, Zone 1, Zone 2 and the future Zone 3, has sufficient storage until 2015, when 0.15 mg will be required. The storage deficit increases to 9.5 mg by 2025. This future shortfall will be reduced by several planned CIP projects that are either recently completed or currently under construction. The overall system has sufficient capacity to offset any localized area shortfall. In the next update we recommend a re-evaluation of this issue.

Table 6-4 Storage Capacity Evaluation

West Area (Airport, future East Airport, future West Mesa and future Low Mesa)					
Parameter	**2008**	**2010**	**2015**	**2020**	**2025**
Average Day Demand, ADD (mgd)	0.35	0.35	0.41	0.46	0.55
Max Day Demand, MDD (mgd)	0.70	0.70	0.82	0.92	1.10
Storage Requirements					
Operational Storage (mg) (33% of MDD)	0.23	0.23	0.27	0.30	0.36
Fire Suppression Storage (mg)	0.18	0.18	0.18	0.18	0.18
Emergency Storage (mg) (50% of ADD)	0.18	0.18	0.21	0.23	0.28
Total Required (mg)	**0.59**	**0.59**	**0.66**	**0.71**	**0.82**
Existing Storage					
Existing Storage (mg)(Airport Ground, Airport Elevated, West Mesa)	5.40	5.40	5.40	5.40	5.40
Less Total Required (mg)	(0.59)	(0.59)	(0.66)	(0.71)	(0.82)
Surplus (mg)	**4.81**	**4.81**	**4.74**	**4.69**	**4.58**

Middle Area (Low, South Intermediate, Central Intermediate, North Intermediate, Telshor and High)					
Parameter	**2008**	**2010**	**2015**	**2020**	**2025**
Average Day Demand (mgd)	12.27	13.57	13.74	13.85	14.11
Max Day Demand (mgd)	24.54	27.13	27.47	27.69	28.22
Storage Requirements					
Operational Storage (mg) (33% of MDD)	8.10	8.95	9.07	9.14	9.31
Fire Suppression Storage (mg)	0.18	0.18	0.18	0.18	0.18
Emergency Storage (mg) (50% of ADD)	6.14	6.79	6.87	6.93	7.06
Total Required (mg)	**14.41**	**15.92**	**16.12**	**16.24**	**16.55**
Existing Storage					
Existing Storage (Spruce, Upper Griggs, Missouri, Telshor, Loma Vista)	12.00	12.00	12.00	12.00	12.00
Less Total Required (mg)	(14.41)	(15.92)	(16.12)	(16.24)	(16.55)
Shortfall (mg)	**(2.41)**	**(3.92)**	**(4.12)**	**(4.24)**	**(4.55)**

East Area (Jornada, Zone 1, Zone 2, and future Zone 3)					
Parameter	**2008**	**2010**	**2015**	**2020**	**2025**
Average Day Demand (mgd)	4.40	6.9	9.8	12.3	14.9
Max Day Demand (mgd)	8.70	13.7	19.6	24.7	29.8
Storage Requirements					
Operational Storage (mg) (33% of MDD)	2.87	4.52	6.47	8.15	9.83
Fire Suppression Storage (mg)	0.18	0.18	0.18	0.18	0.18
Emergency Storage (mg) (50% of ADD)	2.20	3.45	4.90	6.15	7.45
Total Required (mg)	**5.25**	**8.15**	**11.55**	**14.48**	**17.46**

Table 6-4 Storage Capacity Evaluation

Existing Storage					
Existing Storage (Jornada, South Zone 1, North Zone 1, North Zone 2)[1]	12.00	12.00	12.00	12.00	12.00
Less Total Required (mg)	(8.00)	(8.00)	(8.00)	(8.00)	(8.00)
Surplus or (Shortfall) (mg)	**6.75**	**3.85**	**0.45**	**(2.48)**	**(5.46)**
Total System Surplus or (Shortfall) (mg)	**9.15**	**4.74**	**1.07**	**(2.03)**	**(5.43)**

[1]. *Existing storage includes planned CIP projects South Jornada and Zone 1 North # 2 storage reservoirs (4 MG total)*

6.3.5 Hydraulic Evaluation

The hydraulic model described in Section 6.2 is used to conduct hydraulic analyses of the water system. The hydraulic analyses are performed to assess system performance and identify deficiencies in pressure and fire flow. Evaluations are prepared for maximum day demands, representing normal operating conditions, and for maximum day demands plus fire flow for both existing and 2025 demand conditions. As noted in Section 6.2, the existing system model which includes all existing facilities and planned CIP facilities (those either already under construction, or already funded) is used for the system analysis.

Maximum Day Demand Plus Fire Flow

The analysis found four locations within the existing system that provide less than 1,000 gpm fire flow for residential customers or 1,500 gpm fire flow for commercial or industrial customers. Table 6-5 summarizes these locations.

Table 6-5 Fire Flow Shortfalls

Junction Model ID	Location	Zone	Available Flow		Demand Type	Note
			Existing	2025		
Existing Demand Scenario						
V_J-375	Hillrise Cir.	Telshor	1209	1176	Commercial	6-inch pipeline. Will be upgraded to 8 inch when street improvements are made
V_1223	Hernandez Rd and Willow St	C Intermediate	1470	1429	Residential & Commercial	6-inch pipeline. Will be upgraded to 8 inch when street improvements are made
V_704	W. Boutz Rd	Low	838	806	Residential	6-inch pipeline. Will be upgraded to 8 inch when street improvements are made
V_1435	Brown Rd	Low	>1000	975	Residential	6-inch pipeline. Will be upgraded to 8 inch when street improvements are made.

6.4 Recommended Water System Improvements

The water distribution system is analyzed under maximum day demand, and maximum day demand plus fire flow through 2025. Capacity deficiencies are evaluated using the design standards and criteria listed in Section 6.1. Recommended water system improvements based on this evaluation are identified in the following sections.

6.4.1 Future Storage Reservoirs

Table 6-6 shows the additional storage necessary to meet the capacity requirements identified in Section 6.3.2, and the year the improvement is needed. Three new tanks are listed in Table 6-6. Following the City's past practices, each tank is sized for 2.0 million gallons.

Table 6-6 Storage Reservoir Improvements

Tank ID	Tank Name	Volume (mg)	Year Needed
TTSB	Telshor B	2.0	2015
TLVB	Loma Vista B	2.0	2020
TS2	South Zone 2	2.0	2020
TS3	Zone 3	2.0	2025
Total		**8.0**	

6.4.2 Future Water Delivery System Improvements

Improvements to the delivery system include additional pump stations, control and pressure reducing valves and new pipelines. The improvements analysis focused on:

1) Developing conceptual pipeline layouts to serve future areas; and,

2) Placement of pump stations and new transmission lines to move water from the existing and planned wells to the existing and future system areas.

Future Water System Layout

To lay out pump stations and pipelines to future areas, topographic data is overlaid with the model system to establish where new pressure zones would be needed. Once future zone locations and boundaries are established, conceptual pipeline layouts are developed based on review of the existing roads and rights-of-way and proposed development plans. Control valves are also included between zones to be able to feed from a higher zone to a lower zone during an emergency.

The City has plans to develop 25 mgd of new well supply – 13 mgd in the west mesa area and 12 mgd in the east mesa area. The City has indicated that the west mesa wells would be used preferentially, with east mesa wells reserved to be used as needed during peak capacity periods. Most planned growth in the City is on the east and north side. Therefore, system layouts evaluated reinforcing the transmission through the system from the west mesa well field to the northeast part of the system.

Figure 6-1 identifies the water system facilities and pressure zones necessary to serve future growth. Figure 6-2 shows a schematic view of the future system.

Table 6-7 summarizes new pressure zones and their anticipated customer service elevation ranges, reservoir overflow elevation and customer static pressures.

Table 6-7 Future Pressure Zones

Pressure Zone	Pressure Zone Elevation Range (ft)		Reservoir Overflow (ft)	Customer Static Pressure (psi)	
	Top	Bottom		Top	Bottom
Zone 3	4587	4472	4702	50	100
Low Mesa	4114	4012	4234[(1)]	52	96
West Mesa	4227	4114	4345[(1)]	51	100
East Airport	4342	4227	4463	52	102

[(1)] Pressure Regulated Zone. Gradient calculated for PRV with highest HGL setting in zone.

Future Improvements and Phasing

Future pump station, control valve, pipeline and reservoir improvements are shown on Figure 6-3. Color-coding on the figure is used to indicate the phasing of facilities.

Tables 6-8 and 6-9 list additional pump stations and control valves, respectively, and the year they are needed. Table 6-10 identifies pipeline segment lengths and diameters needed for future growth. In some future service areas, the hydraulic model was updated to include some smaller-diameter pipelines (less than 16-inch diameter) where necessary to complete looping. Table 6-11 only identifies pipelines that are 16-inch diameter and larger, because only these diameters are included in the City's CIP.

Table 6-8 Pump Station Improvements

Pump Station Name	PUMP Model ID	Note	Service Zone	Design Head (ft)	Design Flow (gpm)	HP	Phase
South Zone 1	F-B1S1	New Station	Zone 2	150	1500	81	2015
	F-B1S2		Zone 2	150	1500	81	2015
	F-B1S3		Zone 2	150	1500	81	2015
South Zone 2	F-PS2Z1	New Station	Zone 3	160	1000	58	2020
	F-PS2Z2		Zone 3	160	1000	58	2020
Loma Vista	F-BLV3	Expand Existing Station	Jornada	170	900	55	2020
Outfall	F-BOF1	New Station	High	127	1000	46	2020
	F-BOF2		High	127	1000	46	2020
	F-BOF3		High	127	1,000	46	2020
Telshor	F-BTS6	Expand Existing Station	Jornada	80	1000	29	2020
	F-PTS8		Jornada	80	1000	29	2020
	F-PTS9		Zone 1	210	600	46	2020
Spruce	F-BSP1	New Station	Jornada	267	1000	96	2025
	F-BSP2		Jornada	267	1000	96	2025
	F-BSP3		Jornada	267	1000	96	2025

Table 6-9 Control Valve Improvements

Model ID	DESCRIPT	Type[1]	Service Zone From, To	Elevation (ft)	Setting	Diameter (in)	Year
F-VEA	East Airport Valve	PRV	Airport, East Airport	4,272	70 psi	12	2025
F-VWM	West Mesa Valve 1	PRV	Airport, W Mesa	4,196	50 psi	12	2025
F-VWMN	West Mesa Valve	PRV	E Airport, W Mesa	4,206	46 psi	12	2025
F-VSS	Sonora Spring Valve	PRV	Zone 2, Zone 1	4,350	50 psi	16	2015
F-VRW	Red Wolf PRV	PRV	W Mesa, L Mesa	4,113	45 psi	12	2025
F-VLV	Las Vistas PRV	PRV	W Mesa, L Mesa	4,083	58 psi	12	2025

1 PRV = pressure reducing valve, FCV = flow control valve, PSV = pressure sustaining valve

Table 6-10 Pipeline CIP Improvements, Diameter ≥16 inch

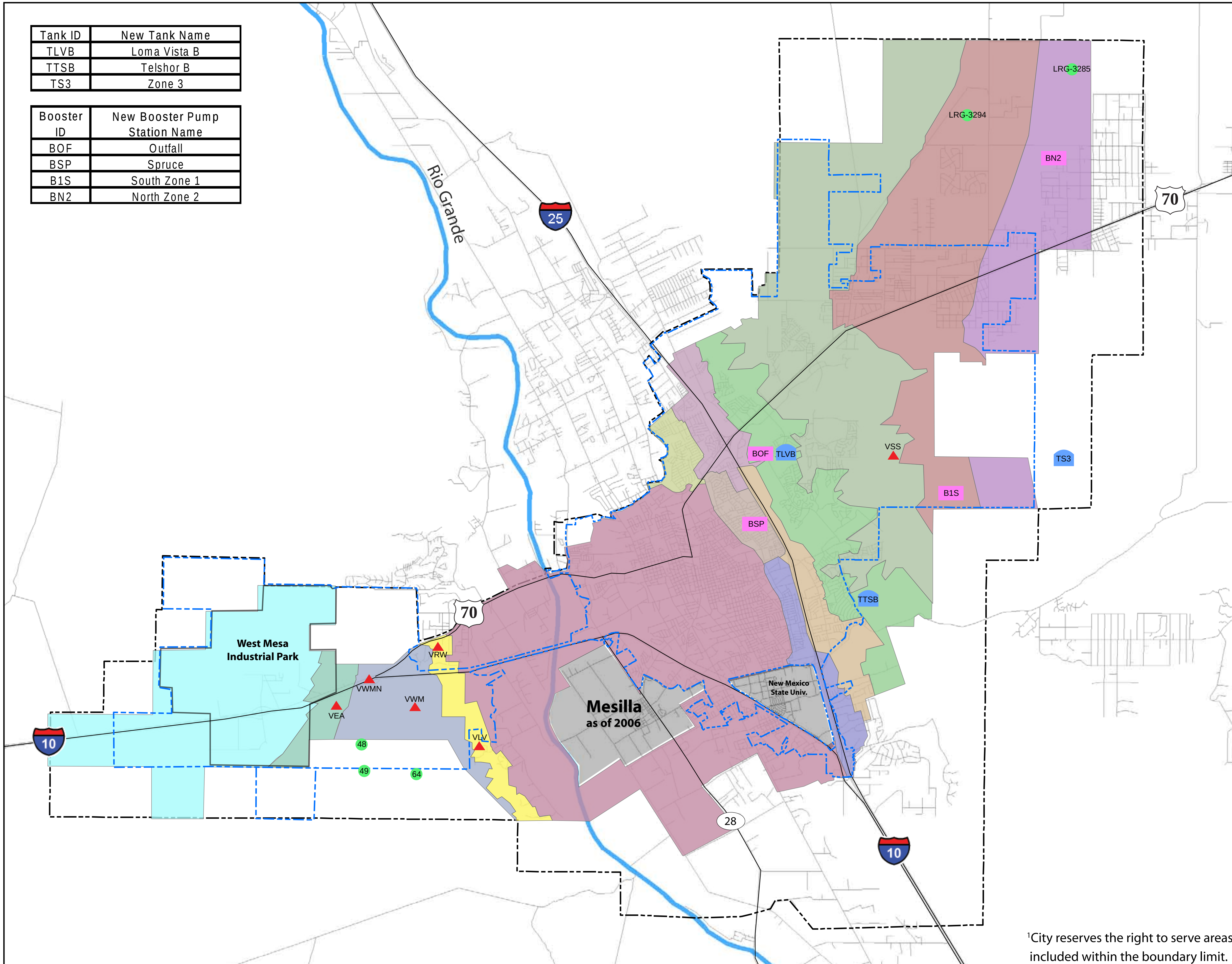
ID	ZONE	LENGTH (ft)	DIAMETER (in)	PHASE
F-11	Airport	3,204.00	16	2010
F-156	Zone 1	1,534.66	24	2010
F-157	Zone 1	1,823.61	24	2010
F-163	Zone 1	4,691.64	24	2010
F-164	Zone 1	3,065.95	24	2010
F-165	Zone 1	3,342.33	24	2010
N-127	Zone 1	2,637.90	18	2010
N-127S	Zone 1	8,039.78	18	2010
F-134	Zone 1	2,542.00	18	2015
F-135	Zone 1	6,255.00	18	2015
F-158	Zone 1	4,883.77	24	2015
F-162	Zone 1	1,970.38	24	2015
F-178	Zone 2	864.74	24	2015
F-179	Zone 2	2,531.72	24	2015
F-180	Zone 2	2,946.99	24	2015
F-186	Zone 2	2,594.45	16	2015
F-187	Zone 2	2,693.77	16	2015
F-255	Zone 1	6,627.00	18	2015
F-257	Low	4,636.03	36	2015
F-80	Low	1,009.13	36	2015
F-81	Low	1,293.49	36	2015
F-83	Low	1,474.75	36	2015
F-84	Low	8,974.93	36	2015
F-166	Zone 1	1,388.29	24	2020
F-167	Zone 1	1,314.89	24	2020
F-199	Zone 3	5,849.68	24	2020

Table 6-10 Pipeline CIP Improvements, Diameter ≥16 inch

ID	ZONE	LENGTH (ft)	DIAMETER (in)	PHASE
F-201	Zone 3	5,281.64	16	2020
F-202	Zone 3	5,344.97	16	2020
F-275	Low Mesa	13	30	2020
F-302	High	414.57	16	2020
V_127	Telshor	1,595.00	18	2020
V_139	Telshor	1,155.00	18	2020
V_140	Telshor	264	18	2020
V_141	Telshor	250	18	2020
V_142	Telshor	880	18	2020
V_2721	Telshor	820	18	2020
V_2745	Telshor	220	18	2020
V_2748	Telshor	3,333.00	18	2020
V_4015	Telshor	196	18	2020
F-175	Zone 1	50	16	2020
F-181	Zone 2	1,616.18	16	2020
F-182	Zone 2	522.27	16	2020
F-183	Zone 2	4,519.18	16	2020
F-184	Zone 2	6,611.43	16	2020
F-185	Zone 2	5,246.85	16	2020
F-190	Zone 2	5,952.72	24	2020
F-192	Zone 2	107.15	16	2020
F-197	Zone 3	774.21	16	2020
F-198	Zone 3	4,437.50	16	2020
F-247	Jornada	188.5	18	2020
F-248	Jornada	968.97	18	2020
F-256	Low Mesa	2,908.00	30	2020
F-278	Low	14,300.69	24	2020
F-279	Low	5,258.74	30	2020
F-280	Low	3,070.44	24	2020
F-283	Low	2,145.01	24	2020
F-284	Low	10,674.78	24	2020
F-288	Low	353.23	24	2020
F-57	Low Mesa	7,281.70	18	2020
F-60	Jornada	22	16	2020
F-98	Low	15.46	16	2020

Table 6-10 Pipeline CIP Improvements, Diameter ≥16 inch

ID	ZONE	LENGTH (ft)	DIAMETER (in)	PHASE
F-265	Low Mesa	5,240.80	24	2025
F-276	Telshor	5,294.95	24	2025
F-290	Low	202.6	16	2025
F-49	Low Mesa	20	16	2025
F-52	Low Mesa	2,769.20	18	2025
F-87	Low	11,275.23	18	2025
F-161	Zone 1	1,199.17	18	2025
F-191	Zone 2	508.48	24	2025
F-200	Zone 3	2,221.30	24	2025
F-249	Jornada	887.91	24	2025
F-250	Jornada	616.51	24	2025
F-251	Jornada	2,907.79	24	2025
F-252	Telshor	65.61	24	2025
F-253	Jornada	336.61	24	2025
F-274	Zone 3	1,872.82	24	2025
F-285	Low	1,000.00	24	2025
F-286	Low	13,425.93	24	2025
F-287	Low	9,033.23	24	2025
F-295	Jornada	3,238.93	16	2025
F-85	Low	2,848.15	24	2025



Tank ID	New Tank Name
TLVB	Loma Vista B
TTSB	Telshor B
TS3	Zone 3

Booster ID	New Booster Pump Station Name
BOF	Outfall
BSP	Spruce
B1S	South Zone 1
BN2	North Zone 2

UTILITIES DEPARTMENT
City of Las Cruces
NEW MEXICO

LEGEND

Pressure Zones
- Airport Zone
- East Airport Zone
- West Mesa Zone
- Low Mesa Zone
- Low Zone
- North Intermediate Zone
- Central Intermediate Zone
- South Intermediate Zone
- High Zone
- Telshor Zone
- Jornada Zone
- Zone 1
- Zone 2
- Zone 3

- Booster Station
- Well
- Pressure Control Valve
- Water Storage Tank

- City Limits
- Utility Service Planning Area Boundary [1]
- Water Service from Others

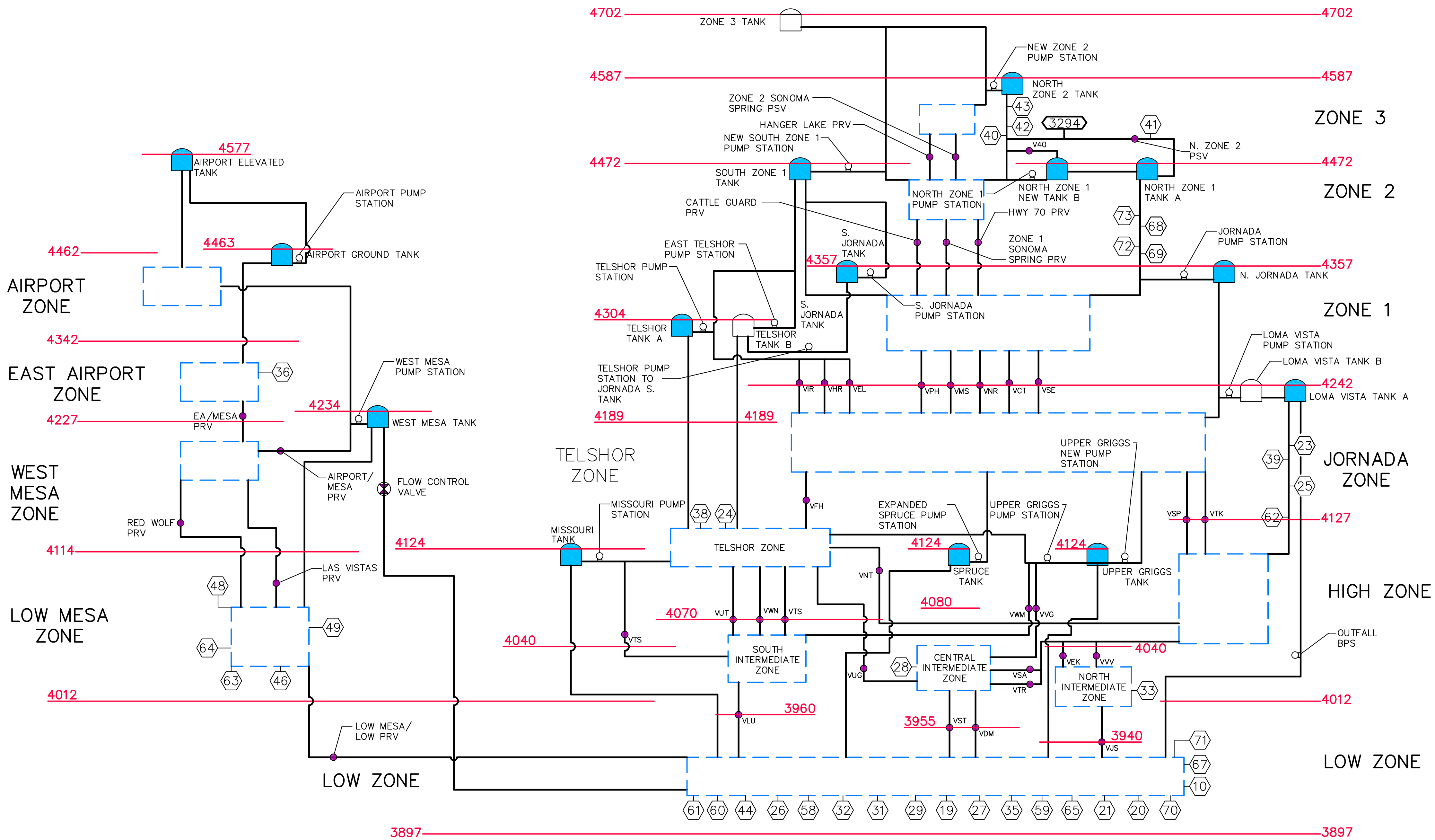
N W E S

CDM
4110 Rio Bravo, Suite 201
El Paso, Texas 79902
(915) 544-2340 * Fax (915) 544-2340

Future Water System Facilities And Pressure Zones

Figure 6-1

UTILITIES ENGINEERING DEPARTMENT
City of Las Cruces
NEW MEXICO



LEGEND

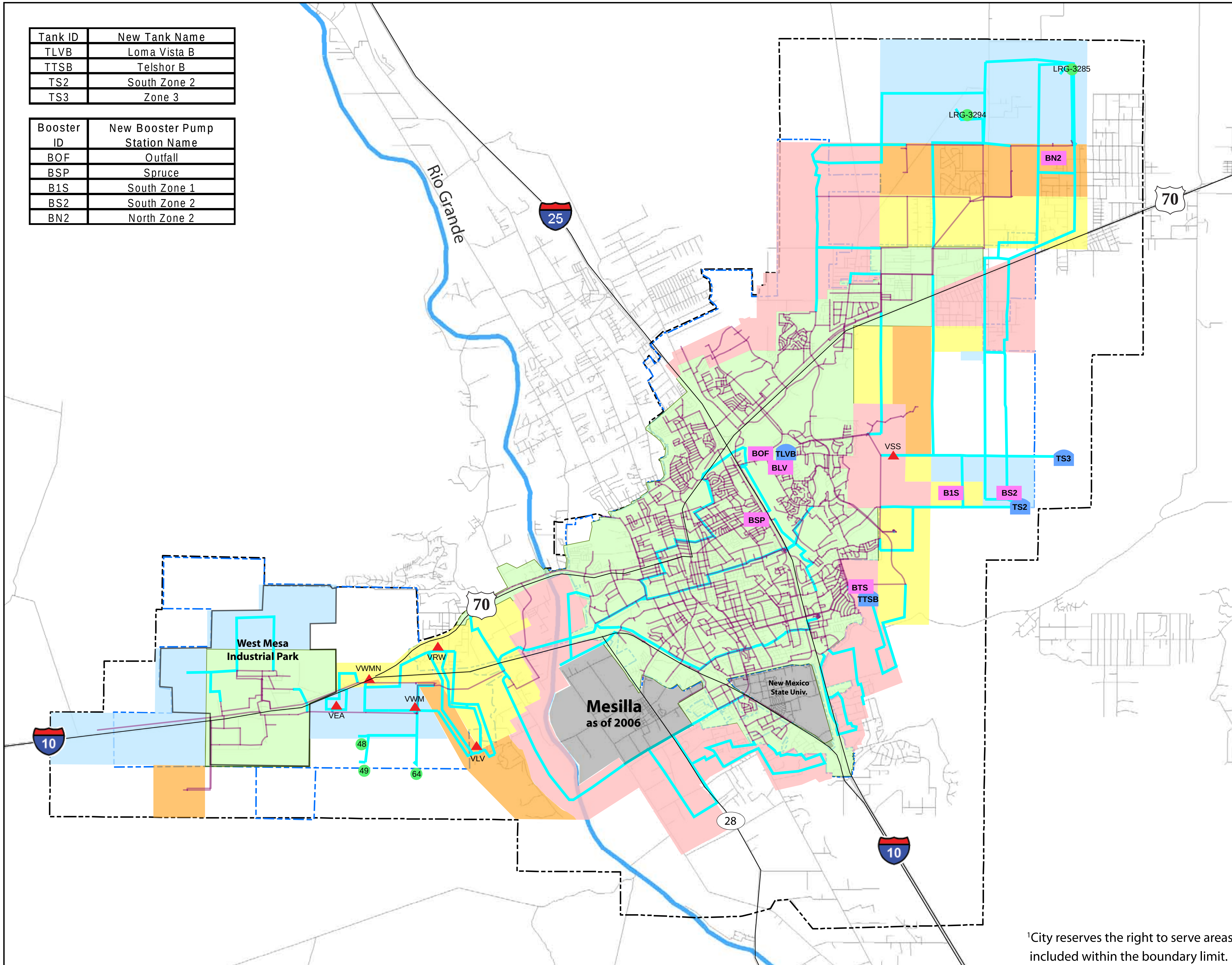
- EXISTING STORAGE TANK
- PUMP STATION
- WELL
- FLOW CONTROL VALVE
- PRV OR PSV
- TRANSMISSION PIPING
- DISTRIBUTION PIPING
- FUTURE STORAGE TANK
- FUTURE SUPPLY

CDM
4110 RIO BRAVO DRIVE, SUITE 201
EL PASO, TEXAS 79902
TEL: 915 544-2340 FAX: 915 544-1345
consulting . engineering . construction . operations

CITY OF LAS CRUCES
2025 WATER SYSTEM/PRESSURE ZONE SCHEMATIC
FIGURE 6-2

Tank ID	New Tank Name
TLVB	Loma Vista B
TTSB	Telshor B
TS2	South Zone 2
TS3	Zone 3

Booster ID	New Booster Pump Station Name
BOF	Outfall
BSP	Spruce
B1S	South Zone 1
BS2	South Zone 2
BN2	North Zone 2



[1]City reserves the right to serve areas included within the boundary limit.

UTILITIES DEPARTMENT

City of Las Cruces

NEW MEXICO

LEGEND

- Existing Service Area
- 2010
- 2015
- 2020
- 2025
- City Limits
- Utility Service Planning Area Boundary [1]
- Water Service by Others
- New Water Lines
- Existing Water Lines
- Booster Station
- Well
- Pressure Control Valve
- Water Storage Tank

CDM

4110 Rio Bravo, Suite 201

El Paso, Texas 79902

(915) 544-2340 * Fax (915) 544-2340

New Water System Improvement

Figure 6-3

Section 7
Wastewater Collection System Evaluation

This section presents an assessment of the carrying capacity for the existing Las Cruces interceptor system for 2005 wastewater flows and projected flows through the year 2025. Deficiencies are identified and a summary of proposed improvements is provided, based on the assessed needs over the 20-year planning period. The primary tool used to make this evaluation is the InfoSewer hydraulic model developed by MWH Soft.

7.0 Hydraulic Model

Computer hydraulic models are used in the analysis and planning of wastewater collection systems by simulating the capacity and operation of the system. Models simulate the routing of flows through pipes and other hydraulic structures in the network to determine system deficiencies in existing interceptors and wastewater facilities and capacity requirements for future infrastructure. A hydraulic model includes nodes and links connected together to represent a collection system, the nodes representing manholes and links representing pipes, lift stations, and other hydraulic structures.

The hydraulic model developed for the previous Update utilized HYDRA, a steady-state (static) model developed by Pizer, Inc. The HYDRA model consisted of 288 nodes, with 6 lift stations operated at fixed flow. Steady state models estimate hydraulic conditions at a specific point in time, requiring only that the upstream boundary condition (flow input) be described. They do not consider temporal variations in flow and have limited capabilities for simulation of backwater profiles. They are very useful in conducting capacity analyses and pipe sizing for planning purposes.

The model selected to perform the hydraulic analysis for this master plan is InfoSewer developed by MWH Soft. InfoSewer is a model with both steady state and pseudo-dynamic capability that uses the Muskingham-Cunge flow routing model and approximates a simplified (diffusion wave) version of the full St. Venant equations. The pseudo-dynamic capability of InfoSewer allows for extended period simulation (EPS) for loading the collection system, through a base load and diurnal curve, over a period of time steps.

EPS modeling includes temporal variations by considering a sequence of successive steady state periods where control mechanisms and flow conditions are allowed to vary from one steady state to another. After each steady state step, the system boundary conditions are reevaluated and updated to reflect changes in junction flows, wet well levels, pump operations, and so on. Then another steady state run is completed at the next time step. The process continues until the end of the simulation.

The InfoSewer model for the wastewater system existing conditions was developed based on GIS manhole and pipe shapefiles obtained from the City and consists of approximately 1,500 nodes, including pipes greater than 10 inches in diameter. The model was calibrated using manhole metering data and recorded flows from lift stations supplied by the Utilities staff.

As with all data, the input data had to be checked and errors corrected. Some of the typical corrections that were made in the pipe network database included duplicate manhole references; pipes connected to improper manholes, pipes without upstream or downstream manholes, reversed inverts and discontinued connectivity. The City is responsible for twelve lift stations, including the screw pumps at the Jacob A. Hands Wastewater Treatment Facility headworks that have been included in the existing conditions model.

The approach used to model City of Las Cruces water demand relied on population forecasted growth rates by Traffic Analysis Zone (TAZ) from the Land Use Assumptions Study (July 2005) and total (high growth) population estimates including per capita water demand for the City of Las Cruces service area from the 40-Year Water Development Plan (October 2007) as discussed in Section 5.

Using this methodology, wastewater flow volumes from the existing service area and future surface areas were estimated. Table 7-1 presents the modeled average daily flows. These flows are based on the average day per capita wastewater contribution of 97 gallons developed in Section 4.

Table 7-1 Wastewater Flow Projection Based on Number of Residents in the Traffic Analysis Zones

Service Area	**Average Wastewater Flow (mgd)**				
	2008	**2010**	**2015**	**2020**	**2025**
West Mesa Industrial Park Wastewater Treatment Facility	0.029	0.253	0.253	0.253	0.294
East Mesa Water Reclamation Facility	0.598	0.826	1.038	1.238	1.317
Northeast Water Reclamation Facility	0	0	0	1.000	1.000
Existing (JAH) Main Plant	**Estimated New Flows (mgd)**				
New South-East Interceptors 150, 151 & 152	0	0.112	0.457	0.586	0.765
New East-Central Interceptor 237	0	0.094	0.215	0.293	0.368
New North-East Interceptors 213 & 214	0.237	0.793	1.845	1.730	2.876
New West Interceptor 301	0	0.004	0.184	0.206	0.223
Total Flows Received at Existing Main Plant (JAH)	8.749	9.752	11.450	11.564	12.982

Notes:

1. In 2005 the average main plant effluent flow was 7.51 mgd, which is included in this table.
2. Residential population flow contribution is assumed to be 97 gallons/capita/day
3. Until 2020 when a 1.0 mgd Northeast WRF is built , all flows from the Northeast WRF service area will flow to JAH

7.0.1 Model Calibration

Calibration of the model was performed by matching modeled flows at known metered locations and adjusting the input parameters of the model to match the metered flows. Wastewater flows were metered by the City at 17 different locations within the interceptor system. Comparison of modeled flows to metered flows after calibration is shown in Table 7-2. No reliable meter data was available for flow meters M10, M12, and M16. Table 7-2 shows that for the most part, modeled flows match closely to metered flows.

Calibration of the model was performed by overlaying water billing account locations on the 220 sub-service areas delineated for the system by the model. The sum of the gallons of water billed in a sub-service area was loaded to the nearest manhole on the interceptor or lift station within the sub-service area. Because the City experiences less than 12 inches of rainfall per year, minimal rainfall-driven inflow-infiltration (RDII) is expected and model calibration refers to the adjustment of the average dry weather flow in the model to match the measured average dry weather flow at the metered locations. Flow depths, velocities and rates between modeled and measured were also compared.

The flow monitoring was initially intended to measure flows at 17 locations continuously over nine months. But the planned sites M10, M12 and M16 were not measured. The measurements were performed in July and August 2006. Three flow meters were used. After one or two weeks of monitoring the meters were moved to the next locations. There were often gaps between the time periods that flow data for some sites were measured. Data were recorded at two different time increments, either hourly or every 15 minutes.

A quality check of the data was performed and errors were found in the data from Meters 01, 02, 03 and 05 and that data was not used for model calibration. Meters 01, 02 and 03 were located upstream of Meter 17, but the sum of their average flows was higher than the average flow at Meter 17. Meter 04 was downstream of Meter 05, but its flow was much higher than that at Meter 05. The flows at Meters 17 and 04 were validated by additional flow monitoring. The additional monitoring of Meter 17 was used to also try to validate the data from Meters 01, 02, 03 and 05; however this data could never be validated and therefore was not used.

Figure 7-2 Comparison of Measured and Model Predicted Average Flows

Flow meter	Manhole ID	Location	Pipe Diameter (inches)	Average Measured Flow (mgd)	Model Predicted Flow (mgd)	Notes
M01	1004468	Valley View Avenue, East of Winter Street	12	0.826	0.473	Meter data may be erroneous
M02	1003972	Jasmine Drive, West of Mondale Loop	15	0.345	0.2	Meter data may be erroneous
M03	1003546	Easement north of El Camino Real	12	0.877	0.502	Meter data may be erroneous
M04	1001945	Next to Furniture Row on Telshor	12	0.795	0.795	Meter data verified
M05	1004715	Easement east of North Telshor Blvd	12	0.212	0.117	Meter data may be erroneous
M06	1003760	Walnut Street in turning median to Sierra Middle School	10	0.227	0.227	
M07	1002237	1340 North Alameda Boulevard	21	0.289	0.289	
M08	1002471	Middle of Chestnut (between Mesquite & Main St)	18	0.382	0.382	
M09	1005548	Middle of Court Ave between Water St & Alameda	15	0.110	0.112	
M10	1001811	Easement east of South Alameda Blvd	10	No Data		
M11	1002704	Easement east of Espanola Street	15	0.704	0.704	
M12	1002552	Espanola Street	12	No Data		
M13	1001407	East University Avenue	12	0.594	0.594	
M14	1000458	100 Feet north of University Lift Station	18	0.168	0.191	
M15	1000221	Middle of Pandelere St between Solano & Locus	12	1.011	1.034	
M16	1000287	West Amador Avenue	42	No Data		
M17	1000228	Motel Blvd south of JU next to small access road	42	1.678	1.668	Meter data verified

The calibration plots of depth, velocity and flow rate are shown as graphs located in Appendix D. The measured data were compared with the model results of both the upstream and downstream pipes. Overall, the model results agree with the measured data. For Meter 17, the measured depths are higher than the modeled depths of the downstream pipe but lower than the modeled depths of the upstream pipes Velocities presented opposite comparisons. This is because InfoSewer only provides hydraulic parameters for the pipes rather than for manholes. Theoretically, it is possible that the depths and velocities may be different at the upstream and downstream manholes however InfoSewer is unable to distinguish the differences.

7.1 Design Standards

Typically, factors impacting capacity include pipe size and/or slope. Increasing the pipe size and/or slope to allow for higher flows can resolve situations of inadequate capacity. The assumptions and design criteria used to evaluate interceptor capacity are the same as those used in the 1995 Master Plan Update and are as follows:

Existing Interceptors (2005)

- Manning's pipe friction factor, n = 0.013
- Hazen-Williams pressure pipe (force main) friction coefficient, Ch = 100
- Minimum desired partial flow velocity, V = 2.5 fps
- Maximum desired depth of flow in relation to diameter of pipe, d/D = 0.90

All Future Interceptors (2010-2025)

- Manning's pipe friction factor, n, 0.013
- Hazen-Williams pressure pipe (force main) friction coefficient, Ch = 100
- Minimum pipe diameter, D = 8 inches
- Minimum depth to invert, d = 6 feet
- Maximum depth to invert, dmx = 20 feet
- Minimum ground cover over pipe, 3 feet
- Maximum desired depth of flow in relation to diameter of pipe, d/D = 0.75
- Minimum allowable velocity when pipe is flowing at design, V = 2 fps
- Minimum slope of pipe, S = 0.001 feet per foot

The criteria used to evaluate lift station capacity are as follows:

Lift Stations

- Firm capacity equals two times the average daily flow
- Total capacity equals three times the average daily flow

7.2 Future Service Areas

Typically wastewater service areas are areas where wastewater flows can be collected and conveyed by gravity to a geographical low point to be treated and discharged. These areas may be bound by geographic or man-made barriers that determine the size of area that wastewater may be collected. The City's overall wastewater service area is broken into five sub-areas. The sub-areas identified in this Update are:

1. Main service area. This area collects and conveys current and future wastewater flows to the Jacob A. Hands Wastewater Treatment Facility near I-10 and the Rio Grande where it is treated and discharged.

2. East Mesa area. This area collects and conveys wastewater to the East Mesa Reclamation Facility from the area along Lohman between the dam and the

Organ Mountains where it is treated and used as reclaimed water on large landscaped areas in the east mesa.

3. Northeast area. This is a proposed future service area that would collect and convey flows from the east mesa area north of Highway 70 to a proposed reclamation facility located near Dragon Fly east of Sonoma Ranch Blvd.

4. Southern area. This proposed future service area would collect wastewater flows generated south of the I-10 and I-25 intersection and would convey them to a City owned site located near the Rio Grande for treatment and discharge.

5. West Mesa area. This area is served by the West Mesa Industrial Park Wastewater Treatment Facility which treats all flows collected from the West Mesa Industrial Park

Figures 7-1 through 7-5 identify service area boundaries for existing facilities and future growth. Wastewater treatment facilities and new facility alternatives are discussed in Section 8.

7.2.1 Future Conveyance Corridors

New interceptors will be needed to serve areas of new development to connect them to downstream interceptors and treatment plants. It may also be necessary to replace, upgrade, or parallel some of the existing older interceptors, as these facilities will continue to receive greater flows, both from within their current service areas as well as from new connections or interceptor extensions in the upstream reaches.

Interceptor corridors to serve future growth areas (identified in Figures 7-1 through 7-5) typically will follow corridors already being used to convey utilities, new road right-of-way or be combined within new improvements required for development. Corridors for future interceptors should be identified as early as possible in the planning process so that easements can be obtained before growth and development makes this more difficult. Whenever possible, and if feasible with regard to topography, new corridors should utilize existing right-of-ways as well as other planned corridors for transportation, drainage, or other utilities.

7.3 Analysis Results and Required Improvements

Using the sizing and design criteria in Section 7.1, InfoSewer was used to model and analyze improvements to meet existing and future needs. Multiple model runs were made to identify required new pipeline segments, diameters, and their locations in five-year increments from 2005 to 2025 for the existing and future service areas. Flows to existing and proposed new lift stations were also identified.

Those improvements include:

1. Figure 7-1 identifies proposed new interceptors to convey wastewater to the existing Jacob A. Hands Wastewater Treatment Facility, designated as CIP recommendations.

2. Figure 7-2 identifies proposed new lift station and interceptors designed to convey wastewater flows to a proposed new satellite treatment plant in the northeast, designated as CIP recommendations.

3. Figure 7-3 identifies proposed new interceptors and a proposed new lift station designed to provide wastewater flows to a new East Mesa treatment plant, designated as CIP recommendations.

4. Figure 7-4 identifies proposed interceptors to convey wastewater flows to a new treatment plant serving the southern portion of the City, designated as CIP recommendations.

5. Figure 7-5 identifies the existing West Mesa Water Reclamation Facility, designated as CIP recommendations.

7.3.1 Interceptor Improvements

Table 7-3 identifies required interceptor improvements by the area served and year needed.

Table 7-3 Proposed Interceptor Improvements

Facility Service Area	Pipe ID	CIP Year	Diameter (in)	Length (ft)	Pipe Type	Notes
Jacob A. Hands Wastewater Treatment Facility	213	2008-2010	15	12,000	Interceptor	
	214	2016-2020	15	15,000	Interceptor	
	211	2021-2025	12	1,358	Parallel Interceptor to Existing Interceptor	Future Shortfall
	237	2011-2015	10	8,473	Interceptor	
	107B	2011-2015	12	4,202	Parallel Interceptor to Existing Interceptor	Future Shortfall
	150	2016-2020	12	8,420	Interceptor	
	151	2016-2020	12	4,471	Interceptor	
	152	2021-2025	12	6,501	Interceptor	
	139B	2021-2025	8	1,930	Relief Line	Flow Diversion from University Ave to Panlener Ave
	301	2011-2015	10	20,000	Interceptor	
	301	2011-2015	10	9,609	Interceptor	River Crossing by Developer
	301A	2008-2010	10	1055	River Crossing	River Crossing by Developer
	FM-TT	2008-2010	8	2,880	Force Main	Route Flow from Tortugas LS to University Ave Interceptor
East Mesa Water Reclamation Facility	235	2016-2020	15	6,468	Interceptor	
	FM-LS2	2016-2020	10	10,560	Force Main	Force Main for the Proposed LS

Table 7-3 Proposed Interceptor Improvements

Facility Service Area	Pipe ID	CIP Year	Diameter (in)	Length (ft)	Pipe Type	Notes
Northeast Water Reclamation Facility	215	2016-2020	15	4,200	Interceptor	By Developer
		2016-2020	12	10,000	Interceptor	
	251	2008-2010	12	9,761	Interceptor	
	252	2008-2010	21	8,481	Interceptor	
	253	2016-2020	12	26,666	Interceptor	
	FM-NE	2011-2015	10	19,120	Force Main	Force Main for the Proposed LS by Developer

7.3.2 Lift Stations

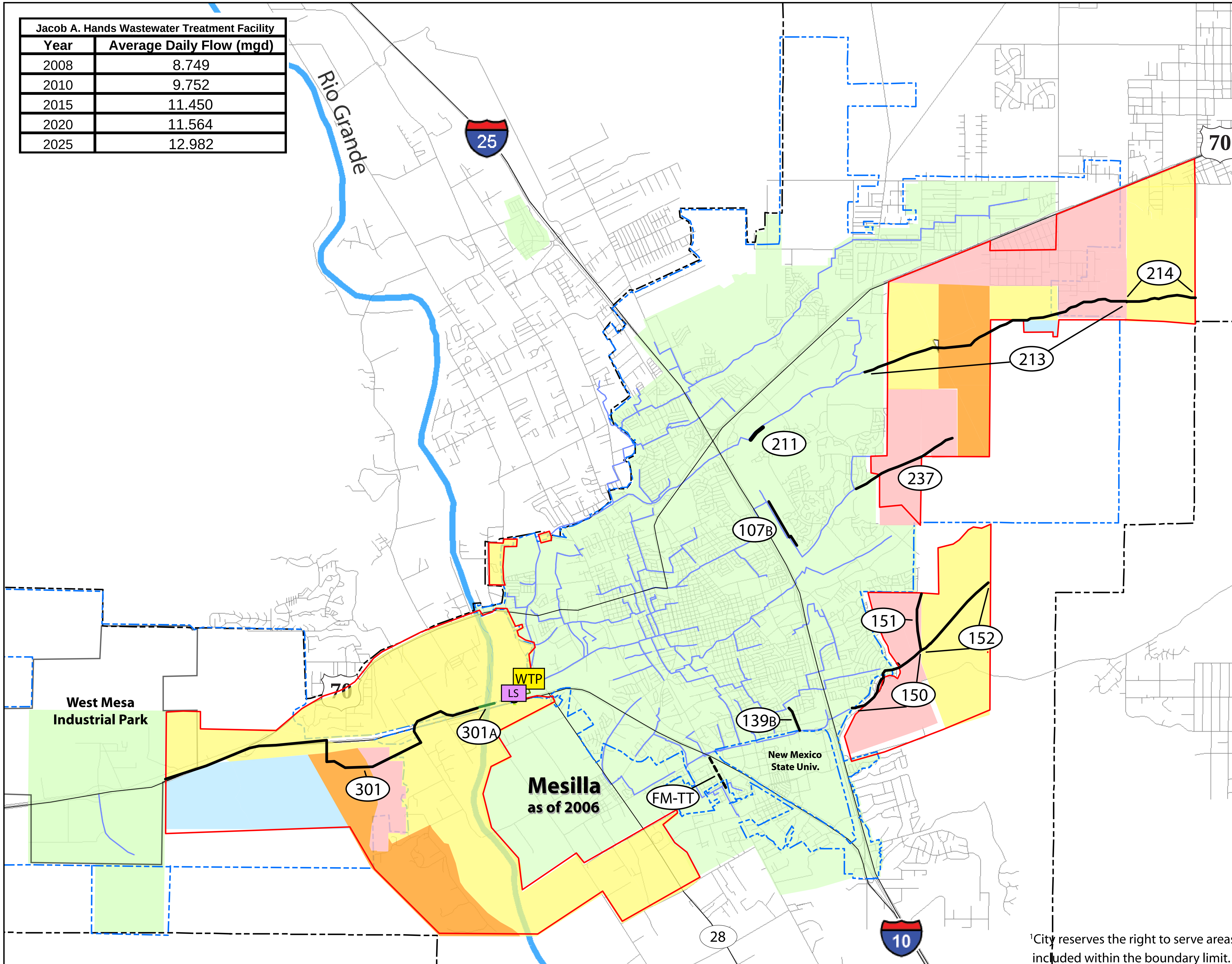
Table 7-4 and 7-5 identifies flows to major existing and proposed new lift stations to serve the JAHWWTF, Northeast Plant and East Mesa service areas.

Table 7-4 Proposed Major Lift Stations

Proposed Lift Stations		River Crossing (by Developer)	East Mesa LS2	Northeast
Average Flow (mgd)	2008	0.000	0.000	0.237
	2010	0.004	0.149	0.237
	2015	0.184	0.276	0.569
	2020	0.206	0.467	0.629
	2025	0.223	0.527	0.703
Infrastructure	Proposed No. of Pumps	2	2	2
	Proposed Capacity of Each Pump (mgd)	350	750	1000
	2 x Projected Average Flow by 2025 (gpm)	310	731	977

7.3.3 Septic System Identification and Prioritization

Section 4 describes the septic systems that exist within the City limits. The Septic Tank Identification and Prioritization Plan lists those septic systems that are considered High Priority because they are located within 1,000 feet of a municipal well and are a source of potential contamination for certain of the City's groundwater supply wells. In accordance with the NMED well head protection guidance and the City's Well-Head Protection Program, projects to provide connections at the property line for these systems will be scheduled to begin in the next five-years.



Jacob A. Hands Wastewater Treatment Facility	
Year	Average Daily Flow (mgd)
2008	8.749
2010	9.752
2015	11.450
2020	11.564
2025	12.982

UTILITIES DEPARTMENT
City of Las Cruces
NEW MEXICO

LEGEND

- WTP Existing Treatment Plant
- LS Proposed New Lift Stations
- Current Sewer System
- Proposed New Interceptors
- Proposed New Force Mains
- Proposed River Crossing
- Proposed Jacob A. Hands Wastewater Treatment Facility Service Area
- Existing Service Area
- 2010
- 2015
- 2020
- 2025
- City Limits
- Utility Service Planning Area Boundary [1]

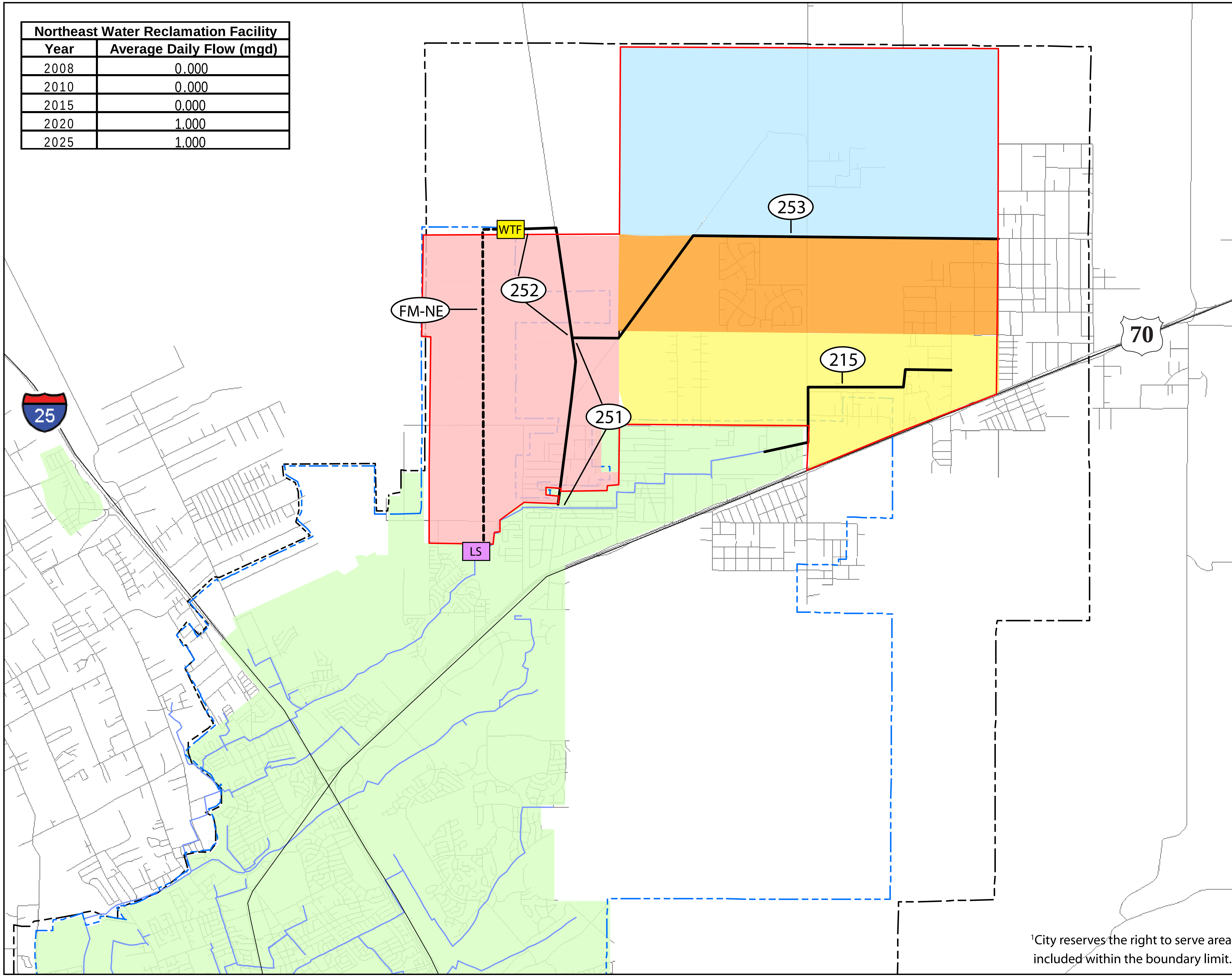
N
W E
S

CDM
4110 Rio Bravo, Suite 201
El Paso, Texas 79902
(915) 544-2340 * Fax (915) 544-2340

Jacob A. Hands Wastewater Treatment Facility Service Area CIP Recommendations

Figure 7-1

Northeast Water Reclamation Facility	
Year	Average Daily Flow (mgd)
2008	0.000
2010	0.000
2015	0.000
2020	1.000
2025	1.000



UTILITIES DEPARTMENT
City of Las Cruces
NEW MEXICO

LEGEND

- WTF Proposed Northeast Water Reclamation Facility Site
- LS Proposed New Lift Stations
- Current Sewer System
- Proposed New Interceptors
- Proposed New Force Mains
- Proposed NE Plant Svs Area
- Existing Service Area
- 2010
- 2015
- 2020
- 2025
- City Limits
- Utility Service Planning Area Boundary [1]

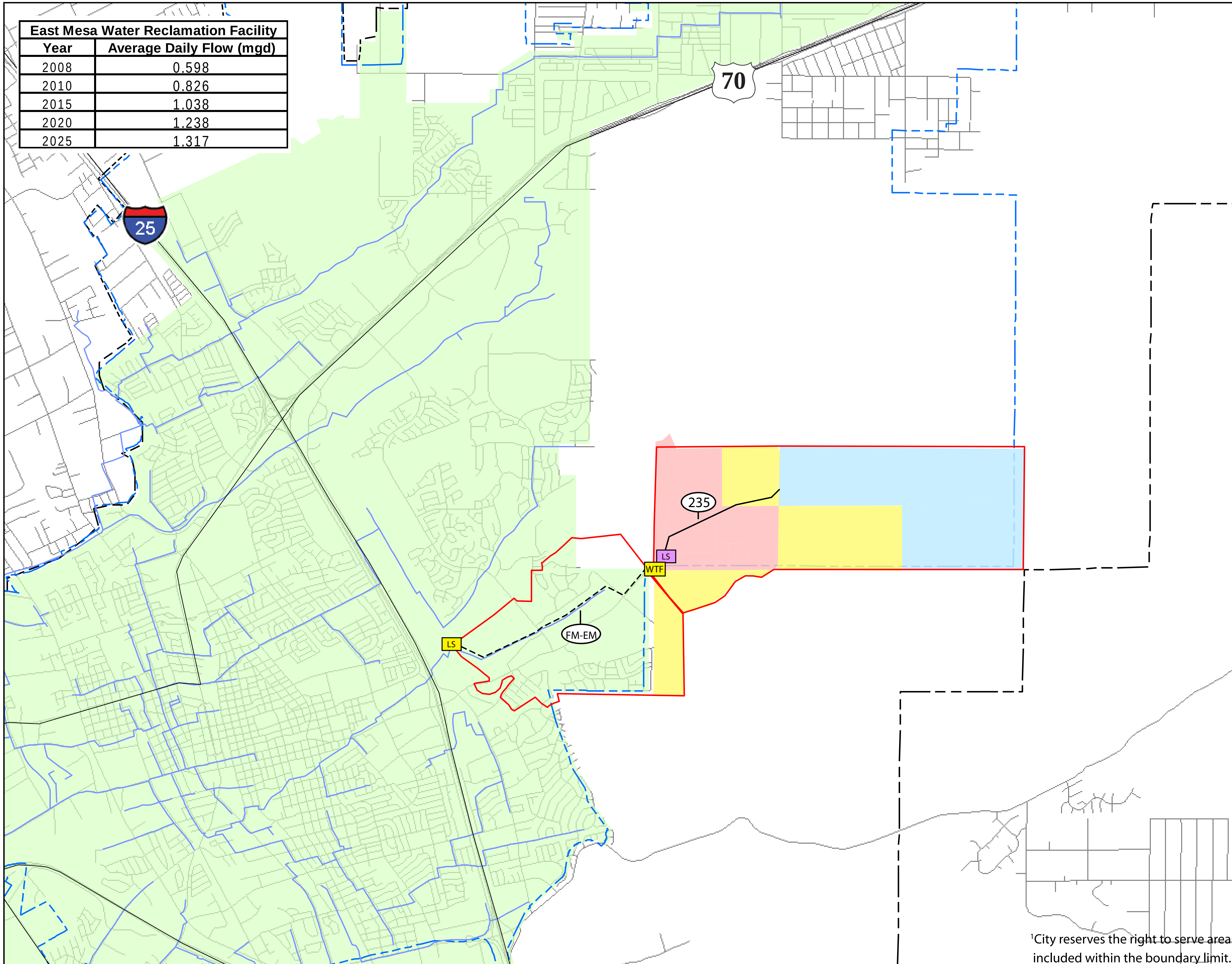
N W E S

CDM
4110 Rio Bravo, Suite 201
El Paso, Texas 79902
(915) 544-2340 * Fax (915) 544-2340

Proposed Northeast Water Reclamation Service Area CIP Recommendations

Figure 7-2

East Mesa Water Reclamation Facility	
Year	Average Daily Flow (mgd)
2008	0.598
2010	0.826
2015	1.038
2020	1.238
2025	1.317



[1]City reserves the right to serve areas included within the boundary limit.

UTILITIES DEPARTMENT
City of Las Cruces
NEW MEXICO

LEGEND

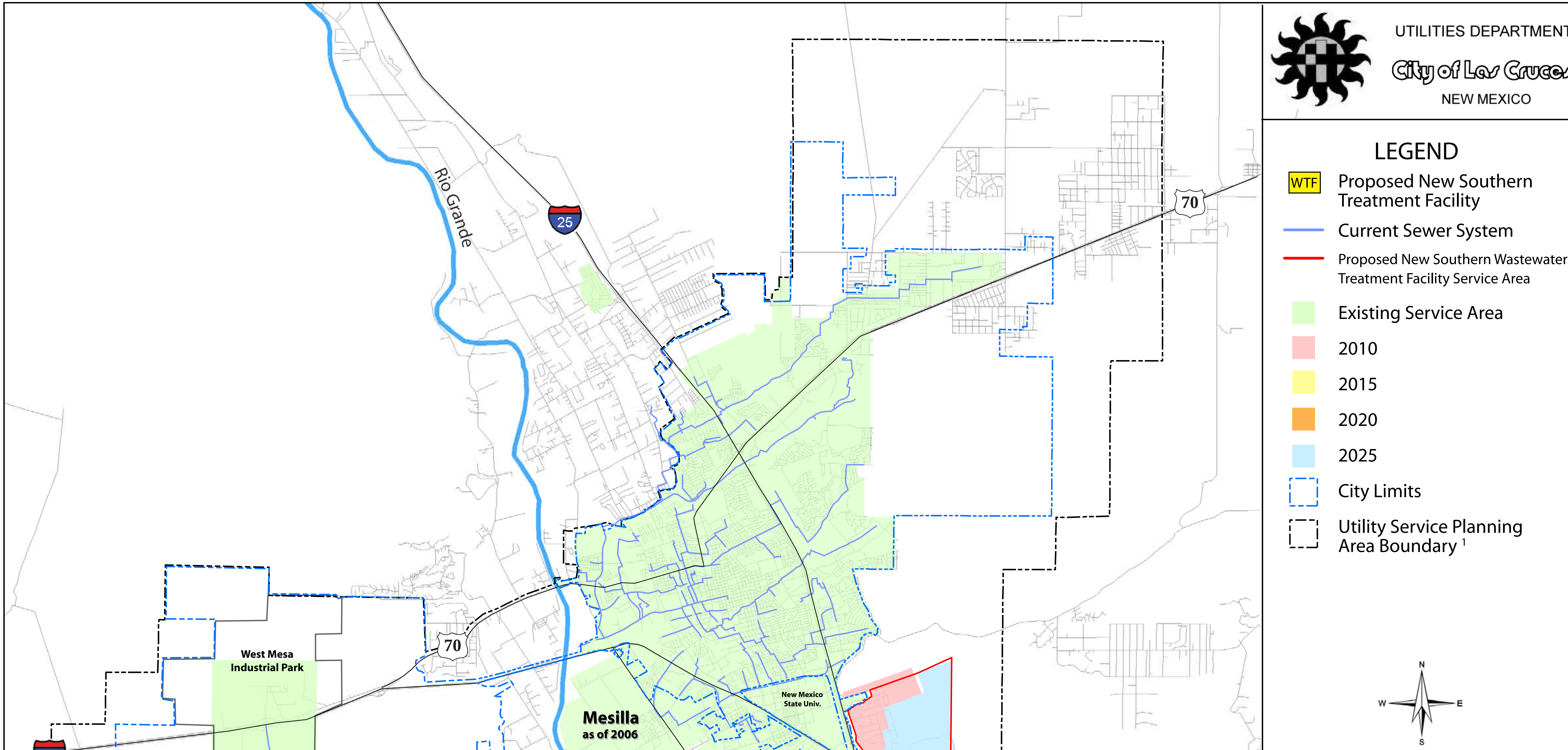
- WTF East Mesa Water Reclamation Facility Site
- LS Proposed New Lift Station
- LS Existing Lift Station
- Current Sewer System
- Proposed New Interceptors
- Force Mains
- Proposed East Mesa Plant Service Area
- Existing Service Area
- 2010
- 2015
- 2020
- 2025
- City Limits
- Utility Service Planning Area Boundary [1]

N W E S

CDM
4110 Rio Bravo, Suite 201
El Paso, Texas 79902
(915) 544-2340 * Fax (915) 544-2340

Proposed East Mesa Water Reclamation Facility Service Area CIP Recommendations

Figure 7-3



UTILITIES DEPARTMENT
City of Las Cruces
NEW MEXICO

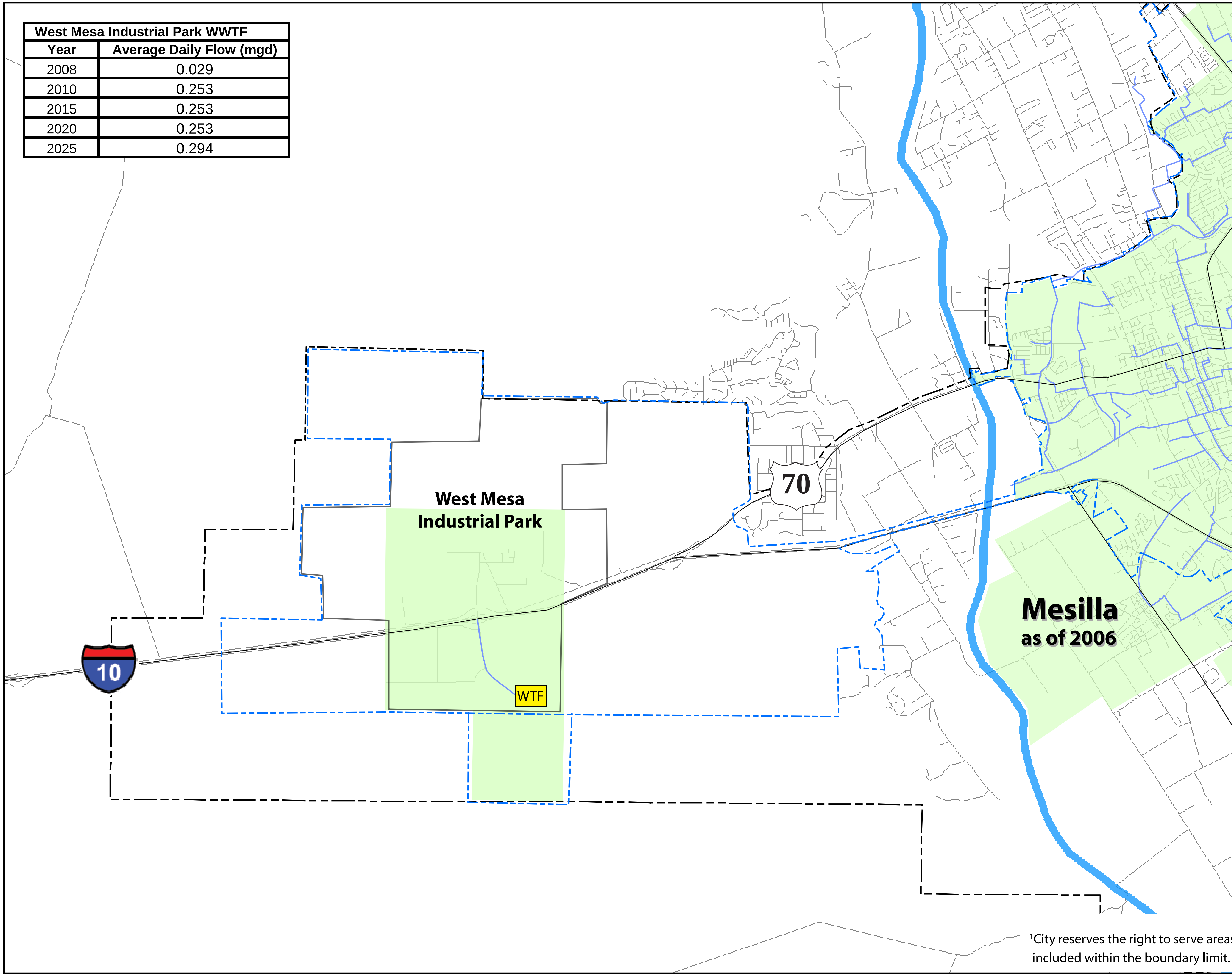
CDM

4110 Rio Bravo, Suite 201
El Paso, Texas 79902
(915) 544-2340 * Fax (915) 544-2340

Proposed New Southern
WWTF Service Area
CIP Recommendations

Figure 7-4

West Mesa Industrial Park WWTF	
Year	Average Daily Flow (mgd)
2008	0.029
2010	0.253
2015	0.253
2020	0.253
2025	0.294



[1]City reserves the right to serve areas included within the boundary limit.

UTILITIES DEPARTMENT
City of Las Cruces
NEW MEXICO

LEGEND

- WTF West Mesa Industrial Park Wastewater Treatment Facility Site
- Current Sewer System
- City Limits
- Existing Service Area
- Utility Service Planning Area Boundary [1]

CDM
4110 Rio Bravo, Suite 201
El Paso, Texas 79902
(915) 544-2340 * Fax (915) 544-2340

Proposed West Mesa Industrial Park WWTF CIP Recommendations

Figure 7-5

Section 8
Wastewater Treatment Facilities

8.0 Wastewater Treatment Facilities

The City currently owns and operates two wastewater treatment facilities.

- Jacob A. Hands Wastewater Treatment Facility is the main facility, with a current capacity of 13.5 mgd, located on the east side of the Rio Grande between the I-10 Rio Grande Bridge and the Picacho Avenue Bridge.

- West Mesa Industrial Park Wastewater Treatment Facility is the second facility, with a capacity of 0.40 mgd, located west of the city in the West Mesa Industrial Park on the south side of I-10.

East Mesa Water Reclamation Facility is under construction and will be completed by early 2009. It is located on the east mesa, north of the Foothills Landfill, and will collect and treat approximately 1.0 mgd to meet reclaimed water standards for reuse as landscape irrigation.

These existing facilities are described in more detail in Section 4. Sites for the proposed facilities are approximate and generalized and may be moved based on future studies.

The capacity of the existing treatment facilities to handle the increase in wastewater flows due to the projected population growth is evaluated in this Update to determine the need for new treatment facilities. The evaluation determined a need to:

1. Reduce the time wastewater flows through the sewer to the treatment facility causing odor and corrosion problems.

2. Extend the operational capacity and life of the main JAH facility.

In order to meet these needs, an additional satellite reclamation facility, the Northeast Water Reclamation Facility, located on the east mesa, north of Highway 70, is proposed. This proposed facility is located in an area that is the farthest from JAH and is experiencing high growth.

The Southern Wastewater Treatment Facility was originally proposed in the 1995 Master Plan Update. Although growth in the southern portion of the City service area has not met projections, this facility will be needed to treat future flows from that area. Without this facility, flows would have to be pumped from this area to JAH and the same problem of long flow times, odor and corrosion will occur. This facility is not included in this CIP.

New facilities discussed in this Update include:

- Northeast Water Reclamation Facility is proposed to be located on the east mesa, north of highway 70 near the intersection of Dragonfly and Sonoma Ranch Blvd.

- Southern Wastewater Treatment Facility is proposed for the southern portion of the service area south of the intersection of I-10 and I-25.

Table 8-1 illustrates the flows for both the existing and proposed facilities during the planning period 2005 to 2025.

Table 8-1 Projected Wastewater Flows for Existing and Proposed Future Facilities

	Average Daily Wastewater Flow (mgd)				
Service Area	**2008**	**2010**	**2015**	**2020**	**2025**
Existing Main Plant, JAHWWTF	8.749	9.752	11.450	11.564	12.982
West Mesa IPWWTF	0.029	0.253	0.253	0.253	0.294
East Mesa Water Reclamation Facility	0.598	0.826	1.038	1.238	1.317
Northeast Water Reclamation Facility	0	0	0	1.000	1.000
Southern Wastewater Treatment Facility	0	0	0	0	0
Total	**9.376**	**10.831**	**12.741**	**14.055**	**15.593**

These flow projections assume that the JAH will be relieved of some flow volume as presented in Table 8-2 when the new East Mesa and proposed Northeast Water Reclamation Facilities begin operation.

8.1 Treatment Facility Alternatives

Options to provide future wastewater treatment capacity include expanding the capacity of existing wastewater treatment facilities, the use of new satellite treatment facilities and/or a new centralized treatment facility.

8.1.1 Satellite Facilities

A satellite treatment facility is a facility that is separated from the main treatment facility and collects, treats and discharges wastewater from a separate service area. Typically a satellite facility is still dependent upon the main facility for sludge handling and excess flows. This type of facility is often used when the distance within a service area is too great for sewage conveyance to the main facility. To reach the main facility, the sewage would have to spend too much time flowing through the interceptor system becoming septic and causing odor problems.

Often satellite facilities are used to treat wastewater to meet reclamation standards that allow for its use as landscape irrigation water. A full treatment scheme is required to treat the raw sewage to this level for nonpotable reuse. Biosolids produced by the facility typically are removed from the site and handled at the larger main facility.

During periods of low demand for the reclaimed water, it may be intentionally discharged to the ground, requiring a groundwater discharge permit and often eliminating the need for a surface water discharge NPDES permit. Because these discharges may also be to an existing intermittent stream or lake bed consideration should also be given to obtaining a NPDES permit and/or the dedication of an area for excess discharge disposal. Excess effluent flows may also be discharged to the existing collection system to continue to the main plant for discharge.

8.1.2 Expansion of Existing Facilities

8.1.2.1 Expansion of Jacob A. Hands Wastewater Treatment Facility

This facility has just completed an expansion to a capacity of 13.5 mgd which should be sufficient capacity until 2025. Further expansion of the existing facility within the planning period of this Update is not expected due to the following reasons:

- The operation of the new East Mesa Water Reclamation Facility
- The construction of the proposed Northeast Water Reclamation Facility on the east mesa north of Highway 70

Table 8-2 Flow Decrease at JAH due to Satellite Facilities

Facility Name	2010	2015	2020	2025
East Mesa Water Reclamation Facility	0.826	1.000	1.238	1.317
Northeast Water Reclamation Facility	-	-	1.000	1.000
JAH Flow Decrease (mgd)	**0.826**	**1.000**	**2.238**	**2.317**

These two satellite facilities will intercept flows that would normally proceed to JAH thereby reducing the influent volume needing treatment at the older facility. These two new facilities will also reduce the length of time and the distance wastewater flows remain in the interceptors. This improvement will prolong the life and reduce the odor problems of the existing and new sewer system by reducing the occurrences of hydrogen sulfide gas.

JAH will receive sludge from both satellite facilities requiring expansion of the current sludge handling facilities. Current sludge handling includes transporting, thickening, dewatering and composting. The addition of sludge from the satellite plants may require expansion of the digestion facilities, sludge hauling tanker fleet, thickening facilities, dewatering presses and composting area. The only item of this sludge handling expansion that is considered a capital expense is the expansion of digestion facilities and the purchase of additional land for the expansion of the composting area; the remaining items are considered operational expenses and are not included in the CIP. Utility staff is in the process of locating a new composting facility on the west mesa.

8.1.2.2. East Mesa Water Reclamation Facility

This facility is considered a satellite facility and will produce reclamation water to be used for landscape irrigation. Construction of this facility is scheduled to be completed in early 2009. The facility will initially treat 1.0 mgd from a newly developed service area to the east and southwest of the facility. The service area for the facility is clearly defined and limited to growth within these areas.

Expansion of this facility should be flow dependent; however for planning purposes, we expect average daily flows to exceed its capacity in 2020 if growth continues at the high rate. If this occurs, the facility is projected to need an additional 0.50 mgd capacity by the end of 2015. At this time, the site contains 10 acres with enough space available for the expansion.

This facility is expected to reduce the future volume of wastewater treated at the existing JAH facility by 1.0 to 1.5mgd.

8.1.2.3. Northeast Water Reclamation Facility

This facility will also be considered a satellite reclamation facility. Capacity for the facility is estimated to be 1.0 mgd dependent upon the rate of development in the area. New development is estimated to require the facility by 2020.

The location of this facility is only approximate at this time, an exact location should be determined in a later, more detailed study. The proposed location is currently near Dragon Fly Road east of Sonoma Ranch Blvd in an undeveloped area. The site should be identified and obtained as soon as possible so that appropriate planning of the surrounding area may include this facility.

As with the East Mesa Facility, this facility is expected reduce the future capacity needed at the existing JAH facility by approximately 1.0 mgd.

8.1.2.4 Southern Treatment Facility

The 1995 Master Plan Update identified a future facility located downstream of the City's collection system, south of JAH, to minimize the need for force mains to convey flow to JAH. This type of wastewater treatment facility will discharge to the Rio Grande and require a NPDES permit. The City purchased a suitable site based on the 1995 Master Plan Update recommendation however growth has not supported the construction of a southern facility.

The projected wastewater flows that occur downstream of JAH and south of the City modeled for this Update did not justify the inclusion of this type of facility in this CIP before 2025. The cost to plan, design and construct a facility in this area is not supported by the number of current or projected users. A re-evaluation of this facility should be undertaken and should take into consideration the length of pipeline necessary to serve the area and whether the users can sufficiently support the facility.

This facility is not included in this CIP.

8.1.2.5 Expansion of the West Mesa Industrial Park Wastewater Treatment Facility

The West Mesa Industrial Park Wastewater Treatment Facility was constructed to serve the tenants of the West Mesa Industrial Park (Park). The facility does not discharge to surface waters but land applies its treated effluent. The current flows are well below the 400,000 gpd facility capacity.

Expansion of this facility is unnecessary under current conditions. The growth models used in this Update are not relevant to the Park due to its purely commercial and industrial use. However, if the Southern New Mexico Correctional Institute and F&A Dairy become dischargers to the system, the facility may require a treatment upgrade to handle the higher levels of BOD contributed from both.

This treatment upgrade would require analysis and study to determine the most effective and economical method to provide the necessary type of treatment. The current facility is an aerated lagoon which requires long detention times, an upgrade in treatment technology could shorten the detention times resulting in increased hydraulic capacity.

No additional land would be necessary for this treatment upgrade. The timing of the upgrade would depend upon when the correctional facility and F&A Dairy became full-time contributors. For the purposes of this Plan, it is assumed that they may connect to this system no later than 2010.

8.2 Screening Criteria and Concepts

Criteria and factors to consider in identifying or evaluating options for increasing wastewater treatment capacity are:

- Projected growth of wastewater flows based on population projections and the areas of growth as proposed in this Update.
- Configuration of existing wastewater treatment facilities and potential for expansion
- Proximity to discharge points, either to surface waters or suitability for reuse.
- Availability of adequate land for siting new facilities, consideration of zoning that is either suitable or could be changed. This includes consideration of institutional arrangements that would be required or difficulties likely to be encountered in acquiring ownership or securing a lease or right-of-way for a facility site on private, public or federal lands.

- Proximity to residential and commercial areas, which may impact the degree of odor control and other aesthetic and environmental considerations that would need to be incorporated into the design.

8.3 Summary of Recommended New Facilities and Expansion of Existing Facilities

To summarize the recommendations of this section, the following Table 8-3 is presented.

Table 8-3 Summary of Wastewater Treatment Recommendations

CIP Year	JAHWWTF	East Mesa Reclamation Facility	Northeast Reclamation Facility	West Mesa IPWWTF
2005-2009	Expansion to 13.5 mgd Complete 2008	Construct new 1.0 mgd facility	no action	no action
2010	no action	no action	no action	Treatment upgrade
2015	no action	no action	no action	no action
2020	Expand solids handling	Expand to 1.5 mgd	Construct 1.0 mgd new facility	no action
2025	no action	no action	no action	no action

Section 9
Water System Capital Improvement Program

9.0 Water System Capital Improvement Program

This section presents an opinion of the anticipated cost of construction for new improvements to the City's water system as determined in previous sections of this master plan. These improvements are intended to meet the increased demands of future growth within the existing service area, as well as for expansion of the existing water system to newly annexed areas.

Opinions of the anticipated cost of construction are provided for both the water treatment, storage and distribution systems, in 5 year (phased) increments, evaluated using the base dollar year of 2007. All opinions of anticipated construction costs are considered to be planning level costs to assist the City of Las Cruces in the development of its capital improvements program. During the actual development of infrastructure improvements it's recommended that the City reevaluate and update these planning level costs as a check against current cost data. This recommendation is due to the volatile fluctuations experienced in the construction industry over the last several years, particularly in the petroleum industry, the cost of steel and acts of nature such as hurricane Katrina.

In addition, it's noted that the master plan CIP of the various planning years is simply a tool which the City of Las Cruces may use at its discretion. As future growth dictates the appropriation of project funds and the determination of projects with the highest priority, the City may choose the most viable projects to construct. Based upon the available data and information provided by the City of Las Cruces staff, the system modeling results only indicate when and where infrastructure improvements may be necessary. It is not intended that the City base the development of its yearly CIP solely on the findings of this Update. This section provides a planning tool to track growth and development across the City; however, the City should evaluate the direction of growth, as well as its resources and funding options in determining the most suitable projects to construct from year to year.

9.1 Cost Estimating Criteria

Planning-level capital cost opinions were developed for the improvements. The total anticipated capital costs include construction costs, contingencies, and markups for contractor overhead and profit, as well as engineering and administration. Because of its variability, gross receipts tax is not included. Table 9-1 identifies the factors used in compiling these costs.

Table 9-1 Cost Estimating Criteria

Base dollar year	2007
Included in Unit Prices	
Factor for construction contractor overhead and profit	20% of construction subtotal cost
Allowance for escalation[1]	Assume 3% per year
Not included in Unit Prices	
Allowance of construction contingencies	15% for year 2010 20% for year 2015 25% for year 2020 30% for year 2025
Allowance for engineering and administration	15% of construction subtotal cost

[1]Escalation Factors taken from published tables for 3% compound interest factors

The construction contingency used is increased incrementally for each year to account for the increased level of unknown and unanticipated factors as the planning period is extended. The construction contingency used in these opinions is 15% for year 2010, 20% for year 2015, 25% for year 2020 and 30% for year 2025. The allowance for engineering design and administration is 15% of the construction costs. Engineering for construction phase services is not included.

9.2 Supply System Improvements

Supply system improvements include construction of new groundwater source wells. Costs are for planning purposes only, actual costs are dependent on the type of equipment used. Unit costs are based upon actual 2008 bid data plus the allowance for escalation as shown in Table 9-1 applied each year up to the target year identified in each table.

Preliminary studies are being performed concurrently with this Update to determine the feasibility of a surface water treatment facility. This facility would be used from October to February as long as water in the Rio Grande is available. During periods when water is not available due to drought conditions or after the irrigation season ends from March to September, groundwater will be the only available source of supply. Therefore the City must continue to develop its ground water supplies.

9.3 Distribution System Improvements

9.3.1 Pipeline Costs

The following three tables provide the basis for determining the total anticipated capital cost of distribution system pipelines for the pipe diameters proposed for the years 2010 through 2025.

Table 9-2, Total Pipeline Length by Pipe Diameter, provides a total length of anticipated pipeline for pipe sizes 8- through 42-inch. Anticipated lengths are identified for each pipe diameter proposed for the study years 2010 through 2025. For each year, the total anticipated length of pipe is shown for informational purposes. The largest quantity of pipeline identified for installation is expected to occur in year 2010.

Table 9-2 Anticipated Total Pipeline Length (ft) by Pipe Diameter (in)

Year	16	18	24	36	Combined Length
2010	3,050	9,290	13,728		26,068
2015	5,288	15,430	13,190	20,100	51,258
2020	3,726		9,164		12,890
2025	3,239	8,713	22,023		33,975

Table 9-3, Year 2007 Opinion of Installed Cost per Foot of Pipe shows the installed cost of pipeline in the various sizes at current year prices on a cost per foot of pipe basis. The costs shown are the total costs for installation by a standard utility contractor and include the cost of excavation, bedding, backfill, pavement and base material removal and replacement, isolation valves, air/vacuum valves, fire hydrants, testing and disinfection, trench safety, traffic control and storm water pollution prevention plans, as well as contractor overhead and profit.

Note that fire hydrants are identified to be installed off of 8-inch lines only. Isolation valves for pipe sizes 8- through 14-inch are identified to be installed using gate valves and butterfly valves for use on pipe sizes 16- through 42-inch.

Pavement and base material removal and replacement are determined by assuming widths of pipe trench. For pipe sizes from:

- 8- through 16-inch, trench width is assumed to be 6-feet wide;
- 18- through 24-inch, trench width is assumed to be 7-feet wide;
- 30- through 36-inch, trench width is assumed to be 8-feet wide;
- 42-inch pipe size, trench width is assumed to be 9-feet wide.

Bonds, insurance, mobilization, demobilization and contractor profit and overhead are also included in the costs per foot of pipe shown in this table.

Table 9-3 Year 2007 Opinion of Installed Cost Per Foot of Pipe by Pipe Diameter

Pipe Diameter (in)	8	12	14	16	18	24	30	36	42
2007 Installed Cost Per Foot (ft)	$71.36	$80.59	$88.06	$94.70	$103.37	$120.72	$141.20	$205.25	$256.03

Table 9-4, Summary of Potable Water Distribution Opinion of Total Construction Cost utilizes the current year costs per foot from Table 9-3, multiplied by a yearly escalation factor of 3% per year, as shown in Table 9-4. This is to establish the future costs per foot of pipe as the basis for determining construction costs within the study period.

The escalation factor of 3% was derived from an evaluation of two separate cost data sources.

- The Federal Reserve Bank shows a national average for escalation at 2.75% for the past 10 years.
- Engineering News Record (ENR) construction cost escalation factor is 3.7% based on 20 US cities. Applying a local factor of 85.5% to the 20 US cities factor results in a local escalation factor of 3.16%.

For the purposes of this Master Plan, 3% per year is used.

Using the future costs per foot of pipe for the various pipe sizes shown within the study period and multiplying these unit costs per foot by the total length of pipe shown in Table 9-2, the total anticipated cost of construction was obtained for each year from 2010 through 2025.

Table 9-4 Summary of Opinion of Base Construction Cost for Potable Water Pipe by Diameter

Year	16	18	24	30	36
2010	$103.48	$112.96	$131.91	$154.29	$224.28
2015	$119.96	$130.95	$152.92	$178.87	$260.00
2020	$139.07	$151.81	$177.28	$207.36	$301.42
2025	$161.22	$175.98	$205.52	$240.38	$349.42

9.3.2 Reservoirs

Storage reservoir costs are based on a unit cost per gallon of capacity for ground-level welded steel tanks and includes the reservoir foundation and underground drain system, site piping, site security fencing, site preparation and grading, reservoir overflow and drain lines, level controls and on-site overflow pond. Table 9-5 identifies reservoirs to be constructed in 2015 and 2020.

Table 9-5 Storage Reservoir Improvements

Year Needed	Tank ID	Tank Name	Volume (mg)	Construction Cost
2015	TTSB	Telshor B	2.0	$3,740,000
2020	TLVB	Loma Vista B	2.0	$4,320,000
2020	TS2	South Zone 2	2.0	$4,320,000
2025	TS3	Zone 3	2.0	$5,026,247
		Total	8.0	$17,406,247

9.3.3 Pump Stations

The anticipated cost of construction for typical pump stations include the cost of pumps, motors, piping and appurtenances, control building, security fencing and site access, architectural and landscaping, instrumentation and controls, as well as engine drivers and associated electrical work. The opinion of anticipated costs for pump stations is based on the cost per horsepower as presented in the Table 9-6 below. Table 9-7 identifies pump stations proposed for construction by 2015 and 2025.

Table 9-6 Anticipated Cost of Pumps based on Horsepower

Year	2007	2010	2015	2020	2025
Pump Station Cost per Pump hp	$ 1,500	$ 1,688	$ 2,016	$ 2,337	$ 2,709

Table 9-7 Summary of Pump Station Construction and Probable Capital Construction Cost

Pump Station Name	PUMP Model ID	Note	Service Zone	Design Head (ft)	Design Flow (gpm)	HP	Phase	Probable Base Construction Cost
South Zone 1	F-B1S1	New Station	Zone 2	150	1500	81	2015	$163,296
	F-B1S2		Zone 2	150	1500	81	2015	$163,296
	F-B1S3		Zone 2	150	1500	81	2015	$163,296
South Zone 2	F-PS2Z1	New Station	Zone 3	160	1000	58	2020	$135,546
	F-PS2Z2		Zone 3	160	1000	58	2020	$135,546
Loma Vista	F-BLV3	Expand Existing Station	Jornada	170	900	55	2020	$128,535
Outfall	F-BOF1	New Station	High	127	1000	46	2020	$107,502
	F-BOF2		High	127	1000	46	2020	$107,502
	F-BOF3		High	127	1,000	46	2020	$107,502
Telshor	F-BTS6	Expand Existing Station	Jornada	80	1000	29	2020	$67,773
	F-PTS8		Jornada	80	1000	29	2020	$67,773
	F-PTS9		Zone 1	210	600	46	2020	$107,502
Spruce	F-BSP1	New Station	Jornada	267	1000	96	2025	$260,064
	F-BSP2		Jornada	267	1000	96	2025	$260,064
	F-BSP3		Jornada	267	1000	96	2025	$260,064

9.3.4 Regulating Valves

Additional improvements to the water distribution system include pressure reduction valves (PRV) and flow control valves (FCV). Due to significant elevation differences in the natural relief of the terrain upon which the City is built, PRV's are necessary to provide an acceptable operating pressure within homes and businesses. PRV's may be used to reduce system pressure at the meter to an acceptable level.

Table 9-8 below shows the items assumed to be included for the installation of regulating valves for the expansion of the distribution system and the probable cost during the planning period. Table 9-9 identifies planned regulating valves required for future expansion.

Table 9-8 Anticipated Cost per Regulating Valve

	2007	2010	2015	2020	2025
3% Escalation Factor	0	1.1255	1.3439	1.558	1.8061
12" PRV Station	$80,000	$90,040	$107,512	$124,640	$144,488
16" PRV Station	$122,000	$137,311	$163,956	$190,076	$220,344

Table 9-9 Summary of Regulating Valves Opinion of Probably Construction Costs

Model ID	DESCRIPTION	Type	Service Zone From, To	Elevation (ft)	Setting	Diameter (in)	Year	Probable Construction Cost
F-VWMN	West Mesa Valve	PRV	E Airport, W Mesa	4,206	46 psi	12	2015	$107,512
F-VSS	Sonora Spring Valve	PRV	Zone 2, Zone 1	4,350	50 psi	16	2015	$163,956
F-VEA	East Airport Valve	PRV	Airport, East Airport	4,272	70 psi	12	2015	$107,512
F-VWM	West Mesa Valve 1	PRV	Airport, W Mesa	4,196	50 psi	12	2025	$144,488
F-VRW	Red Wolf PRV	PRV	W Mesa, L Mesa	4,113	45 psi	12	2025	$144,488
F-VLV	Las Vistas PRV	PRV	W Mesa, L Mesa	4,083	58 psi	12	2025	$144,488

9.4 Phased Capital Improvement Program

A summary of all water system improvements and the year required for construction is provided in Tables 9-10 to 9-32 below. Included in these tables is an anticipated breakdown of water development impact fees paid by the builder or developer and the rate base contribution. If a project provides existing users with improved supply, pressure or water quality; or new infrastructure that will be used by existing residents, the project is considered beneficial to the rate base. If, however the project does not provide any benefit to existing users but is required for new growth or development, the cost will be recovered through the imposition of the water development impact fees. The tables at the end of this section provide a summary of total cost for each year with the estimated percentage of rate base and development impact fee noted at the bottom of each table.

9.4.1 Year 2010 Improvements

Table 9-10 2010 Project 1 – Arroyo Vista Water Transmission Lines

Description	Diameter (in)	Quantity (LF)	Unit Cost ($/LF)	Total Cost
Arroyo Vista Water Transmission Line, Zone 1 Arroyo Vista Blvd from Mesa Dr to Sonoma Ranch Blvd Line	18	9,200	112.96	$1,039,232
Anticipated Base Construction Cost				**$1,039,232**
Construction Contingency - 15%				$155,885
Subtotal				**$1,195,117**
Engineering & Administration - 15%				$179,268
Total Anticipated Capital Cost				**$1,374,384**
Rate Base %		**Water Development Impact %**		

Table 9-11 2010 Project 2 – Mesa Grande Transmission Line and Bore

Description	Diameter (in)	Quantity (LF)	Unit Cost ($/LF)	Total Cost
Mesa Grande Transmission Lines, Mesa Grande from Mesa Central to Calle Jitas	24	10,370	131.91	$1,367,907
Bore across Hwy 70 west of Mesa Grande Dr. including 16" casing and 12"carrier pipe	16	250	260.00	$65,000
Anticipated Base Construction Cost				**$1,432,907**
Construction Contingency - 15%				214,936
Subtotal				**$1,647,843**
Engineering & Administration - 15%				247,176
Total Anticipated Capital Cost				**$1,895,019**
Rate Base %		**Water Development Impact %**		

Table 9-12 2010 Project 3 –Lohman Transmission Line Extension

Description	Diameter (in)	Quantity (LF)	Unit Cost ($/LF)	Total Cost
Zone 1 Transmission Line, Lohman extension west of Mesa Grande Dr.	24	3,358	131.91	$442,954
Anticipated Base Construction Cost				**$442,954**
Construction Contingency - 15%				66,443
Subtotal				**$509,397**
Engineering & Administration - 15%				76,410
Total Anticipated Capital Cost				**$585,807**
Rate Base %		**Water Development Impact %**		

Table 9-13 2010 Project 4- Airport Zone Transmission Line and Bore

Description	**Diameter (in)**	**Quantity (LF)**	**Unit Cost ($/LF)**	**Total Cost**
Airport Zone Transmission Line, Microwave to Mountain Vista Parkway	16	2,800	103.48	$289,744
Bore across I-10 including 20" casing and carrier pipe	20	300	253.33	75,999
			Anticipated Base Construction Cost	**$365,743**
			Construction Contingency - 15%	54,861
			Subtotal	**$420,604**
			Engineering & Administration - 15%	63,091
			Total Anticipated Capital Cost	**$483,695**
Rate Base %		**Water Development Impact %**		

Table 9-14 2010 Equip Wells 72 & 73[1]

Description	**Quantity (each)**	**Unit Cost ($/each)**	**Total Cost**
Equip Well 73	1	672,027	**$ 672,027**
Equip Well 72	1	672,027	672,027
		Anticipated Base Construction Cost	**$ 1,344,054**
		Construction Contingency - 15%	201,608
		Subtotal	**$ 1,545,662**
		Engineering & Administration - 15%	231,849
		Total Anticipated Capital Cost	**$ 1,777,511**
Rate Base %		**Water Development Impact %**	

[1] *CLC Estimate*

9.4.2 Year 2015 Improvements

Table 9-15 2015 Project 1 - Zone 1 Sonora Springs Transmission Line

Description	**Diameter (in)**	**Quantity (LF)**	**Unit Cost ($/LF)**	**Total Cost**
Sonora Springs Transmission Line from Mesa Grande	24	1,970	152.92	$301,252
			Anticipated Base Construction Cost	**$301,252**
			Construction Contingency - 20%	60,250
			Subtotal	**$361,502**
			Engineering & Administration - 15%	54,225
			Total Anticipated Capital Cost	**$415,728**
Rate Base %		**Water Development Impact %**		

Table 9-16 2015 Project 2 – Lohman Transmission Line Extension 2

Description	Diameter (in)	Quantity (LF)	Unit Cost ($/LF)	Total Cost
Lohman Transmission Line Extension to Wilt	24	4,880	152.92	$746,250
Wilt Transmission line from Lohman to Sonora Springs	16	5,288	119.96	634,348
Lohman Transmission Line Extension, Sonora Springs from Zone 1 to Wilt	24	6,340	152.92	969,513
Regulating Valves	**(in)**	**(each)**	**($/each)**	
PRV on Sonora Springs Blvd	16	1	163,956	163,956
Lohman & Wilt Booster Pump Station	**No. of Pumps**	**(hp)**	**($/hp)**	
Zone 2	3	81	2,016	489,888
Anticipated Base Construction Cost				**$3,003,955**
Construction Contingency - 20%				600,791
Subtotal				**$3,604,746**
Engineering & Administration - 15%				540,712
Total Anticipated Capital Cost				**$4,145,458**
Rate Base %		**Water Development Impact %**		

Table 9-17 2015 Project 3 – Zone 1, Well 69 Transmission Line

Description	Diameter (in)	Quantity (LF)	Unit Cost ($/LF)	Total Cost
Zone 1 Transmission Line, from Well 69 on Dragonfly to Sonoma Ranch Blvd	18	8,800	130.95	$1,152,360
Anticipated Base Construction Cost				**$1,152,360**
Construction Contingency - 20%				230,472
Subtotal				**$1,382,832**
Engineering & Administration - 15%				207,425
Total Anticipated Capital Cost				**$1,590,257**
Rate Base %		**Water Development Impact %**		

Table 9-18 2015 Project 4 – Zone 1, Peachtree Hills Transmission Line

Description	Diameter (in)	Quantity (LF)	Unit Cost ($/LF)	Total Cost
Zone 1 Transmission Line on Peachtree Hills Rd, from Mesa Grande Dr. to Sonoma Ranch Blvd	18	6,630	130.95	$ 868,199
			Anticipated Base Construction Cost	**$ 868,199**
			Construction Contingency - 20%	173,640
			Subtotal	**$1,041,838**
			Engineering & Administration - 15%	156,276
			Total Anticipated Capital Cost	**$1,198,114**
Rate Base %			**Water Development Impact %**	

Table 9-19 2015 Project 5 – Low Zone and Low Mesa Transmission Lines

Description	Diameter (in)	Quantity (LF)	Unit Cost ($/LF)	Total Cost
Low Zone Transmission Line from Fairacres Rd to Motel Blvd.	36	15,500	260.00	$3,315,000
Low Mesa Zone from West Mesa Tank to Well 46	36	4,600	260.00	1,196,000
			Anticipated Base Construction Cost	**$4,511,000**
			Construction Contingency - 20%	902,200
			Subtotal	**$5,413,200**
			Engineering & Administration - 15%	811,980
			Total Anticipated Capital Cost	**$6,225,180**
Rate Base %			**Water Development Impact %**	

Table 9-20 2015 Project 6 – Low Zone and Low Mesa Transmission Lines

Description	Quantity (mg)	Unit Cost ($/mg)	Total Cost
Telshor Tank B	2	1.87	$3,740,000
		Anticipated Base Construction Cost	**$3,740,000**
		Construction Contingency - 20%	748,000
		Subtotal	**$4,488,000**
		Engineering & Administration - 15%	897,600
		Total Anticipated Capital Cost	**$5,385,600**
Rate Base %		**Water Development Impact %**	

9.4.1 Year 2020 Improvements

9-21 2020 North Zone 2 Booster Pumps

Description	No. of Pumps	Quantity (hp)	Unit Cost ($/hp)	Total Cost
North Zone 2 Booster Pumps	2	58	$2,337.00	$271,092
			Anticipated Base Construction Cost	**$271,092**
			Construction Contingency - 25%	67,773
			Subtotal	**$338,865**
			Engineering & Administration - 15%	50,830
			Total Anticipated Capital Cost	**$389,695**
Rate Base %			**Water Development Impact %**	

9-22 2020 Zone 2 Transmission Lines

Description	Diameter (in)	Quantity (lf)	Unit Cost ($/lf)	Total Cost
Zone 2 Transmission Line	16	107	$139.07	$14,901
Zone 2 Transmission Line plus F-191 (Zone 2)	24	6,461	$177.28	1,145,406
			Anticipated Base Construction Cost	**$1,160,307**
			Construction Contingency - 25%	290,077
			Subtotal	**$1,450,384**
			Engineering & Administration - 15%	217,558
			Total Anticipated Capital Cost	**$1,667,942**
Rate Base %			**Water Development Impact %**	

9-23 2020 Zone 1 Transmission Line

Description	Diameter (in)	Quantity (lf)	Unit Cost ($/lf)	Total Cost
Zone 1 Transmission Line	24	2,703	$177.28	$479,220
			Anticipated Base Construction Cost	**$479,220**
			Construction Contingency - 25%	$119,805
			Subtotal	**$599,025**
			Engineering & Administration - 15%	$89,854
			Total Anticipated Capital Cost	**$688,878**
Rate Base %			**Water Development Impact %**	

9-24 2020 Loma Vista Tank and Associated Pipeline and Booster Pump Station Expansion

Description		Quantity (mg)	Unit Cost ($/gal)	Total Cost
Loma Vista Tank No. 2		2	$2.16	$4,320,000
	Diameter (in)	**(lf)**	**$/lf**	
Associated pipeline	16	415	$139.07	57,714
	No. of Pumps	**Quantity (hp)**	**Unit Cost ($/hp)**	
Loma Vista Booster Pumps Station Expansion	1	55	$2,337	128,535
			Anticipated Base Construction Cost	**$2,486,249**
			Construction Contingency - 25%	621,562
			Subtotal	**$3,107,811**
			Engineering & Administration – 15%	466,172
			Total Anticipated Capital Cost	**$3,573,983**
Rate Base %			**Water Development Impact %**	

9-25 2020 Airport Transmission Line

Description	Diameter (in)	Quanity (lf)	Unit Cost ($/lf)	Total Cost
Airport Transmission Line	16	3,204	$139.07	$445,580
			Anticipated Base Construction Cost	**$445,580**
			Construction Contingency - 25%	111,395
			Subtotal	**$556,975**
			Engineering & Administration - 15%	83,546
			Total Anticipated Capital Cost	**$640,522**
Rate Base %			**Water Development Impact %**	

9-26 2020 Outfall Booster Pump Station

Description	No. of Pumps	Quanity (hp)	Unit Cost ($/hp)	Total Cost
Outfall Booster Pump Station	3	46	$2,337.00	$322,506
			Anticipated Base Construction Cost	**$322,506**
			Construction Contingency - 25%	80,627
			Subtotal	**$403,133**
			Engineering & Administration - 15%	60,470
			Total Anticipated Capital Cost	**$463,602**
Rate Base %			**Water Development Impact %**	

9-27 2020 Telshor Booster Pump Station Expansion

Description	No. of Pumps	Quantity (hp)	Unit Cost ($/hp)	Total Cost
Telshor Booster Pumps Station Expansion	2	29	2,337.00	$ 135,546
Telshor Booster Pumps Station Expansion	1	46	2,337.00	$107,502
			Anticipated Base Construction Cost	**$ 243,048**
			Construction Contingency - 25%	60,762
			Subtotal	**$ 303,810**
			Engineering & Administration - 15%	45,571
			Total Anticipated Capital Cost	**$ 349,381**
Rate Base %			**Water Development Impact %**	

9-28 2020 South Zone 2 Tank

Description	Quantity (mg)	Unit Cost ($/gal)	Total Cost
South Zone 2 Tank	2.0	$2.16	$4,320,000
		Anticipated Base Construction Cost	**$4,320,000**
		Construction Contingency - 25%	1,080,000
		Subtotal	**$5,400,000**
		Engineering & Administration – 15%	810,000
		Total Anticipated Capital Cost	**$6,210,000**
Rate Base %		**Water Development Impact %**	

9.4.2 Year 2025 Improvements

9-29 2025 Low Zone Transmission Line

Description	Diameter (in)	Quanity (lf)	Unit Cost ($/lf)	Total Cost
Low Zone Transmission Line	24	17,274	$205.52	$3,550,169
			Anticipated Base Construction Cost	**$3,550,169**
			Construction Contingency - 30%	1,065,051
			Subtotal	**$4,615,220**
			Engineering & Administration - 15%	692,283
			Total Anticipated Capital Cost	**$5,307,503**
Rate Base %			**Water Development Impact %**	

9-30 2025 Jornada Zone Transmission Line

Description		Diameter (in)	Quantity (lf)	Unit Cost ($/lf)	Total Cost
Jornada Zone Transmission Line		16	3,239	$161.22	$522,180
Jornada Zone Transmission Line		24	4,749	$205.52	975,977
				Anticipated Base Construction Cost	**$1,498,158**
				Construction Contingency - 30%	449,447
				Subtotal	**$1,947,605**
				Engineering & Administration - 15%	292,141
				Total Anticipated Capital Cost	**$2,239,746**
Rate Base %				**Water Development Impact %**	

9-31 2025 Spruce Booster Pump Station

Description		No. of Pumps	Quantity (hp)	Unit Cost ($/hp)	Total Cost
Spruce Booster Pump Station		3	96	$2,709.00	$780,192
				Anticipated Base Construction Cost	**$ 780,192**
				Construction Contingency - 30%	234,058
				Subtotal	**$ 1,014,250**
				Engineering & Administration - 15%	152,137
				Total Anticipated Capital Cost	**$ 1,166,387**
Rate Base %				**Water Development Impact %**	

9-32 2025 West Mesa, Red Wolf and Las Vistas Valves

Description		Diameter (in)	Quantity (each)	Unit Cost ($/each)	Total Cost
West Mesa Valve 1		12	1	$144,488	$144,488
Red Wolf PRV		12	1	$144,488	144,488
Las Vistas PRV		12	1	$144,488	144,488
East Airport Valve		12	1	$144,488	144,488
West Mesa Valve		12	1	$144,488	144,488
				Anticipated Base Construction Cost	**$722,440**
				Construction Contingency - 30%	216,732
				Subtotal	**$939,172**
				Engineering & Administration - 15%	140,875
				Total Anticipated Capital Cost	**$1,080,047**
Rate Base %				**Water Development Impact %**	

9-33 2025 Telshor Zone Transmission Line

Description		Diameter (in)	Quanity (lf)	Unit Cost ($/lf)	Total Cost
Telshor Zone Transmission Line		18	8,713	$175.98	$1,533,314
				Anticipated Base Construction Cost	**$1,533,314**
				Construction Contingency - 30%	459,994
				Subtotal	**$1,993,308**
				Engineering & Administration - 15%	298,996
				Total Anticipated Capital Cost	**$2,292,304**
Rate Base %				**Water Development Impact %**	

Table 9-34 2025 Drill, Develop and Equip Wells

Description		Quantity (each)	Unit Cost ($/each)	Total Cost
Well 48		1	$1,046,996	$1,046,996
Well 49		1	$1,046,996	1,046,996
			Anticipated Base Construction Cost	**$2,093,992**
			Construction Contingency - 30%	628,198
			Subtotal	**$2,722,190**
			Engineering & Administration - 15%	408,328
			Total Anticipated Capital Cost	**$3,130,518**
Rate Base %			**Water Development Impact %**	

9-35 2025 Zone 3 Tank

Description		Quantity (mg)	Unit Cost ($/gal)	Total Cost
Zone 3 Tank		2	$2.67	$5,332,660
			Anticipated Base Construction Cost	**$5,332,660**
			Construction Contingency - 30%	1,599,798
			Subtotal	**$6,932,489**
			Engineering & Administration - 15%	1,039,869
			Total Anticipated Capital Cost	**$7,972,328**
Rate Base %			**Water Development Impact %**	

9.5 Summary of Improvements

Table 9-35 2010 Summary of Improvements

Anticipated Base Construction Cost	**$**	**4,624,890**
Total Construction Contingencies – 15%		**693,734**
Subtotal	**$**	**5,318,624**
Total Engineering & Administration – 15%		**797,794**
Total Anticipated Capital Cost	**$**	**6,116,418**

Table 9-36 2015 Summary of Improvements

Anticipated Base Construction Cost	**$**	**13,576,766**
Construction Contingency - 20%		**2,715,353**
Subtotal	**$**	**16,292,119**
Engineering & Administration - 15%		**2,443,818**
Total Anticipated Capital Cost	**$**	**18,735,937**

Table 9-37 2020 Summary of Improvements

Anticipated Base Construction Cost	**$**	**9,728,002**
Construction Contingency - 25%		2,715,353
Subtotal	**$**	**12,160,003**
Engineering & Administration - 15%		1,824,000
Total Anticipated Capital Cost	**$**	**13,984,003**

Table 9-38 2025 Summary of Improvements

Anticipated Base Construction Cost	**$**	**15,510,925**
Construction Contingency - 30%		4,653,228
Subtotal	**$**	**20,164,203**
Engineering & Administration - 15%		3,024,630
Total Anticipated Capital Cost	**$**	**23,188,833**

Section 10
Wastewater System Capital Improvement Program

10.0 Wastewater System Capital Improvement Program

This section presents an opinion of the anticipated cost of construction for new improvements to the City's wastewater system as determined in previous sections of this master plan. These improvements are intended to meet the increased demands of future growth within the existing service area, as well as for expansion of the existing wastewater system to newly annexed areas through the year 2025.

Also included in this section are anticipated construction costs for connecting septic tanks listed as top and high priority in the Septic Tank Prioritization Study included in Appendix A to the existing system. To allow for adequate time to perform public outreach and budgeting, these projects are not proposed to begin until 2010. All of the projects listed as top priority are included in the 2010 CIP, however only the top six of the twelve high priority projects are included in the remaining years of this Update due to the anticipated high cost of these projects.

Opinions of the anticipated cost of construction are provided for wastewater treatment, lift stations, force mains and collection systems, in 5 year (phased) increments, evaluated using the current base dollar year of 2007. All opinions of anticipated construction costs are considered to be planning level costs to assist the City of Las Cruces in the development of its capital improvements program. During the actual development of infrastructure improvements it's recommended that the city reevaluate and update these planning level costs as a check against current cost data. This recommendation is due to the volatile fluctuations experienced in the construction industry over the last several years, particularly in the petroleum industry, the cost of steel and acts of nature such as hurricane Katrina.

In addition, it's noted that the master plan CIP of the various planning years is simply a tool which the City of Las Cruces may use at its discretion. As future growth dictates the appropriation of project funds and the determination of projects with the highest priority, the City may choose the most viable projects to construct. Based upon the available data and information provided by the City of Las Cruces staff, the system modeling results only indicates when infrastructure improvements may be necessary. It is not intended that the City base the development of its yearly CIP solely on the findings of this Update. This section provides the City with a planning tool in its tracking of growth and development across the City; therefore, the City should evaluate the direction of growth, as well as its resources and funding options in determining the most suitable projects to construct from year to year.

In planning discussions and direction received from the City Utilities staff and based upon the City's current and projected resources and its intimate knowledge of the direction of growth, some projects identified to occur in specific planning years have shifted to later years in the CIP in order to accommodate the City's anticipated needs.

10.1 Cost Estimating Criteria

Planning-level capital cost opinions were developed for the improvements. The anticipated capital costs include construction costs, contingencies, and markups for contractor overhead and profit, engineering and administration. Table 10-1 identifies the markups added to the construction costs.

Table 10-1 Cost Estimating Criteria

Base dollar year	2007
Included in Unit Prices	
Factor for construction contractor overhead and profit Allowance for escalation[1]	20% of base construction cost Assume 3% per year
Not included in Unit Prices	
Allowance of construction contingencies	15% for year 2010 20% for year 2015 25% for year 2020 30% for year 2025
Allowance for engineering and administration	15% of construction subtotal cost

[1] Escalation Factors taken from published tables for 3% compound interest factors

The escalation factor of 3% was derived from an evaluation of two separate cost data sources.

- o The Federal Reserve Bank shows a national average for escalation at 2.75% for the past 10 years.
- o Engineering News Record (ENR) construction cost escalation factor is 3.7% based on 20 US cities. Applying a local factor of 85.5% to the 20 US cities factor results in a local escalation factor of 3.16%.

For the purposes of this Master Plan, 3% per year is used.

10.2 Treatment System Improvements

Treatment system improvements include construction of new wastewater treatment plants to meet increased demands as discussed in Section 8. Table 10-5 provides a cost opinion for a new 1.0 mgd East Mesa satellite plant currently under construction in 2008. Table 10-12 provides a cost opinion for 0.5 mgd expansion for the East Mesa plant in 2020. Table 10-15 provides a cost opinion for a new 1.0 mgd Northeast plant in 2020.

The expansion of JAH capacity to 13.5 mgd expected to be completed in 2008, will provide sufficient treatment capacity at this facility for the period of this Update. Therefore no major CIP improvements for JAH are included however an evaluation of solids handling, including an increase in digester capacity, should be done.

10.3 Collection System Improvements

10.3.1 Pipeline Costs

Unit costs used for the construction of new interceptors are given in Table 10-2 below. These costs are based on PVC (SDR 35) pipe for gravity flow interceptors installed with a cover of 6 to 8 feet. For collector and interceptor pipelines with a cover greater than 8 feet, add 20% to the cost per foot increment shown in Table 10-2. The costs shown are the total costs for installation by a standard utility contractor and include the cost of excavation, bedding, backfill, pavement and base material removal and replacement, preparation of right-of-way, testing, trench safety, manholes, utility interferences, traffic control and storm water pollution prevention plans, as well as contractor overhead and profit.

Table 10-2 Anticipated Cost of Buried Gravity Sewer Pipe

Anticipated Cost Per Foot of Sewer Pipe Buried with 6-8 Feet of Cover[1]						
		Pipe Diameter (in)				
Year	**8**	**10**	**12**	**15**	**18**	**21**
2007	$ 85	$ 98	$ 106	$ 128	$ 149	$ 176
2010	$ 93	$ 107	$ 116	$ 140	$ 163	$ 192
2015	$ 108	$ 124	$ 134	$ 162	$ 189	$ 223
2020	$ 125	$ 144	$ 156	$ 188	$ 219	$ 258
2025	$ 145	$ 167	$ 180	$ 218	$ 254	$ 299

[1]Includes excavation, bedding, backfill, pavement & base course, preparation of ROW, testing, trench safety, utility interferences, traffic control, SWPP, contractor overhead & profit and manholes

10.3.2 Lift Stations

Lift Station cost opinions are taken from bid tabulations for similar types of lift stations and include all electrical equipment, emergency generator, security fencing, pumps and accessories, lift station structure with wet well and yard piping for a typical lift station. Lift station construction is assumed to be submersible pump lift stations with wet well and dry pit to house check valves, isolation valves, air release valves, etc.

The total installed cost for lift station force mains includes excavation, bedding, backfill, pavement and base material removal and replacement, manholes, sewage air/vacuum valves, testing, trench safety, traffic control and storm water pollution plans.

10.4 Septic Tank Prioritization Program

Refer to Section 7 and Appendix A for discussion of the Septic Tank Identification and Prioritization Plan.

10.5 Phased Capital Improvement Program

A summary of all wastewater system improvements and the year required for construction is provided in Tables 10-3 to 10-20 below. Included in these tables is an anticipated breakdown of water and wastewater development impact fees paid by the builder or developer and the rate base contribution. Tables 10-21 to 10-24 provide a summary of total cost for each year.

10.5.1 Year 2008 (Current) Improvements

The following tables provide information on the major CIP wastewater projects under construction at the time of this Update.

Table 10-3 2008 East Mesa Water Reclamation Facility Construction Bid[1]

Description		Unit	Unit Cost	Anticipated Construction Cost
		Flow (mgd)	($/gal)	
East Mesa LS 1		1.2	$0.69	$823,080
	Diameter (in)	Length (ft)	($/lf)	
East Mesa LS 1 Force Main	10	8,021	$35.71	$286,430
East Mesa Reclamation Line	12	2,137	$38.58	$82,446
			Total Anticipated Construction Cost	$1,191,956
Rate Base Benefit			Development Impact	

[1] Actual amount bid by contractor

Table 10-4 2008 East Mesa Water Reclamation Facility Construction Bid [2]

Description	Unit	Unit Cost	Anticipated Construction Cost
	Flow (mgd)	($/gal)	
East Mesa Water Reclamation Facility	1.0	$8.06	$8,060,000
		Total Anticipated Construction Cost	$8,060,000
Rate Base Benefit		Development Impact	

[2] Actual amount bid by contractor

Table 10-5 2008 Sandhill Interceptor (201, 204, 205)

Description	Unit	Unit Cost	Anticipated Construction Cost[3]
	Length (ft)	($/lf)	
Sandhill Interceptor	21,090	$109.10	$2,301,000
		Total Anticipated Construction Cost	$2,301,000
Rate Base Benefit		Development Impact	

[3] Mozen-Corbin & Associates Estimate

Table 10-6 2008 University Lift Station Expansion

Description		Unit (gpm)	Unit Cost ($/gal)	Anticipated Construction Cost[4]
University Avenue Lift Station Expansion		1,730	$520.23	$900,000
			Total Anticipated Construction Cost	$900,000
Rate Base Benefit			**Development Impact**	

[4] *CLC Estimate*

10.5.2 Year 2010 Improvements

Table10-7 2010 - Interceptor 213 Improvements[1]

	Diameter (in)	Length (lf)	Unit Cost ($/lf)	Anticipated Construction Cost
Interceptor 213	15	12,000	$ 140.00	$ 1,680,000
			Anticipated Construction Cost	**$ 1,680,000**
			Construction Contingency - 15%	252,000
			Subtotal	**$ 1,932,000**
			Engineering & Administration - 15%	289,800
			Total Anticipated Capital Cost	**$ 2,221,800**
Rate Base Benefit		**Development Impact**		

[1] *CLC Estimate*

Table 10-8 2010 - Tortugas Gravity, Lift Station and Forcemain3

Description		Unit Flow (mgd)	Unit Cost ($/gal)	Anticipated Construction Cost
Tortugas Lift Station		0.5	$0.73	$365,000
	Diameter (in)	Length (ft)	($/lf)	
Tortugas Force Main	8	2,880	$30.31	87,293
Tortugas Gravity Line	12	2,700	$116.00	313,200
			Anticipated Base Construction Cost	**$765,493**
			Construction Contingency - 15 %	114,824
			Subtotal	**$880,317**
			Engineering & Administration - 15%	132,047
			Total Anticipated Capital Cost	**$1,012,364**
Rate Base Benefit			**Development Impact**	

[3] *Based on 2008 construction bid for East Mesa Lift Station*

10.5.3 Year 2015 Improvements

Table 10-9 2015 - Interceptor 237 Improvements

	Diameter (in)	Length (lf)	Unit Cost ($/lf)	Anticipated Construction Cost
Interceptor 237	10	8,473	$124.00	$1,050,652
			Anticipated Construction Cost	**$1,050,652**
			Construction Contingency - 20 %	210,130
			Subtotal	**$1,260,782**
			Engineering & Administration - 15%	189,117
			Total Anticipated Capital Cost	**$1,449,900**
Rate Base Benefit			**Development Impact**	

Table 10-10 2015 - Interceptor 107B Improvements

	Diameter (in)	Length (lf)	Unit Cost ($/lf)	Anticipated Construction Cost
Interceptor 107B	12	4,202	$134.00	$563,068
			Anticipated Construction Cost	**$563,068**
			Construction Contingency - 20%	112,614
			Subtotal	**$675,682**
			Engineering & Administration - 15%	101,352
			Total Anticipated Capital Cost	**$777,034**
Rate Base Benefit			**Development Impact**	

Table 10-11 2015 - Interceptor 301 Improvements

	Diameter (in)	Length (lf)	Unit Cost ($/lf)	Anticipated Construction Cost
Interceptor 301	10	20,000	$124.00	$2,480,000
			Anticipated Construction Cost	**$2,480,000**
			Construction Contingency - 20%	496,000
			Subtotal	**$2,976,000**
			Engineering & Administration - 15%	446,400
			Total Anticipated Capital Cost	**$3,422,400**
Rate Base Benefit			**Development Impact**	

10.5.4 Year 2020 Improvements

Table 10-12 2020 - Interceptor 215 Improvements[2]

	Diameter (in)	Length (lf)	Unit Cost ($/lf)	Anticipated Construction Cost
Interceptor 215	15	4,200	$188.00	$789,600
Anticipated Construction Cost				**$789,600**
Construction Contingency - 25%				197,400
Subtotal				**$987,000**
Engineering & Administration - 15%				148,050
Total Anticipated Capital Cost				**$1,135,050**
Rate Base Benefit		**Development Impact**		

[2] *CLC Estimate*

Table 10-13 2020 - Interceptors 150 and 151 Improvements

	Diameter (in)	Length (lf)	Unit Cost ($/lf)	Anticipated Construction Cost
Interceptor 150	12	8,420	$156.00	$1,313,520
Interceptor 151	12	4,471	$156.00	$697,476
Anticipated Construction Cost				**$2,010,996**
Construction Contingency - 25 %				502,749
Subtotal				**$2,513,745**
Engineering & Administration - 15%				377,062
Total Anticipated Capital Cost				**$2,890,807**
Rate Base Benefit		**Development Impact**		

Table 10-14 2020 - Interceptor 235 Improvements

	Diameter (in)	Length (lf)	Unit Cost ($/lf)	Anticipated Construction Cost
Interceptor 235	15	6,468	$188.00	$1,215,984
Anticipated Construction Cost				**$1,215,984**
Construction Contingency - 25 %				303,996
Subtotal				**$1,519,980**
Engineering & Administration - 15%				227,997
Total Anticipated Capital Cost				**$1,747,977**
Rate Base Benefit		**Development Impact**		

Table 10-15 2020 East Mesa Water Reclamation Facility Expansion

Item	Quantity (mgd)	Unit Price ($/gal)	Anticipated Construction Cost
East Mesa Water Reclamation Facility Expansion	0.5	$13.32	$6,660,000
East Mesa Water Reclamation Lift Station 2 & Forcemain	1	$1.52	1,520,000
		Anticipated Base Construction Cost	**$8,180,000**
		Construction Contingency - 25 %	2,045,000
		Subtotal	**$10,225,000**
		Engineering & Administration - 15%	1,533,750
		Total Anticipated Capital Cost	**$11,758,750**
Rate Base Benefit		**Development Impact**	

Table 10-16 2020 - Interceptor 215 Improvements

	Diameter (in)	Length (lf)	Unit Cost ($/lf)	Anticipated Construction Cost
Interceptor 215	12	10,000	$156.00	$1,560,000
			Anticipated Construction Cost	**$1,560,000**
			Construction Contingency - 25 %	390,000
			Subtotal	**$1,950,000**
			Engineering & Administration - 15%	292,500
			Total Anticipated Capital Cost	**$2,242,500**
Rate Base Benefit				

Table 10-17 2020 - Interceptors 214 Improvements

	Diameter (in)	Length (lf)	Unit Cost ($/lf)	Anticipated Construction Cost
Interceptor 214	15	15,000	$188.00	$2,820,000
			Anticipated Construction Cost	**$2,820,000**
			Construction Contingency - 25 %	705,000
			Subtotal	**$3,525,000**
			Engineering & Administration - 15%	528,750
			Total Anticipated Capital Cost	**$4,053,750**
Rate Base Benefit		**Development Impact**		

10.5.5 Year 2025 Improvements

Table 10-18 2025 - Interceptor 211 Improvements

	Diameter (in)	**Length (lf)**	**Unit Cost ($/lf)**	**Anticipated Construction Cost**
Interceptor 211	12	1,358	$180.00	$244,440
			Anticipated Construction Cost	**$244,440**
			Construction Contingency - 30%	73,332
			Subtotal	**$317,772**
			Engineering & Administration - 15%	47,665
			Total Anticipated Capital Cost	**$365,437**
Rate Base Benefit			**Development Impact**	

Table 10-19 2020 - Interceptors 152 and 139B Improvements

	Diameter (in)	**Length (lf)**	**Unit Cost ($/lf)**	**Anticipated Construction Cost**
Interceptor 152	12	6,501	$180.00	$1,170,180
Interceptor 139B	8	1,930	$145.00	$279,850
			Anticipated Construction Cost	**$1,450,030**
			Construction Contingency - 30%	435,009
			Subtotal	**$1,885,039**
			Engineering & Administration - 15%	282,756
			Total Anticipated Capital Cost	**$2,167,795**
Rate Base Benefit			**Development Impact**	

10.6 Summary of Improvements

Table 10-20 2010 Summary of Improvements

Anticipated Base Construction Cost	**$**	**2,444,329**
Total Construction Contingencies		366,649
Subtotal	**$**	**2,810,978**
Total Engineering & Administration		421,647
Total Anticipated Capital Cost	**$**	**3,232,625**

Table 10-21 2015 Summary of Improvements

Anticipated Base Construction Cost	**$**	**4,093,720**
Total Construction Contingencies		614,058
Subtotal	**$**	**4,707,778**
Total Engineering & Administration		706,167
Total Anticipated Capital Cost	**$**	**5,413,945**

Table 10-22 2020 Summary of Improvements

Anticipated Base Construction Cost	**$**	**16,576,580**
Total Construction Contingencies		2,486,487
Subtotal	**$**	**19,063,067**
Total Engineering & Administration		2,859,460
Total Anticipated Capital Cost	**$**	**21,922,527**

Table 10-23 2025 Summary of Improvements

Anticipated Base Construction Cost	**$**	**1,694,470**
Total Construction Contingencies		254,171
Subtotal	**$**	**1,948,641**
Total Engineering & Administration		292,296
Total Anticipated Capital Cost	**$**	**2,240,937**

City of Las Cruces, NM

Septic Tank Identification and Prioritization Plan

CDM Project No. #8501-52474

April 2007

Final Report

Contents

List of Figures

List of Tables

List of Maps

Appendices

1.0 Introduction

A typical septic tank system consists of a septic tank and a below-ground absorption field (also called a drain field or leaching field). The drain field system typically consists of distribution pipes installed in trenches and covered with gravel. Effluent flows out of the septic tank and is distributed into the soil through the drain field.

When properly designed, sited, constructed, and maintained, septic tank systems can effectively reduce or eliminate most human health or environmental threats posed by pollutants in wastewater. However, failures of septic tank systems do occur due to improper siting, inappropriate choice of technology, faulty design, poor installation, poor operation, or inadequate maintenance. For example, in high-density residential subdivisions conventional septic tank systems might be an inappropriate choice of technology because leaching of nitrate-nitrogen could result in nitrate concentrations in local aquifers that exceed the drinking water standard. In soils with excessive permeability or shallow water tables, inadequate treatment in the unsaturated soil zone might allow pathogenic bacteria and viruses to enter the groundwater and impact public water supplies if no mitigating measures are taken. This was reported to occur by the New Mexico Environment Department on June 28, 2002 at a trailer park water system in Las Cruces when laboratory results indicated that total coliform and E. coli bacteria exceeded the maximum contaminant level.

The City of Las Cruces has identified an estimated 1880 parcels located within the existing City limits that are on septic tank systems and not served by the City's wastewater collection and treatment system. This estimate was made through a GIS query that identified all parcels (properties) with an address and those parcels that are within 200 feet of an existing sewer line. Parcels that were identified with an address but not identified as being within 200 feet of an existing sewer line were listed as being on septic tank systems. Added to the estimate are mobile home parks identified by Utility operations as not having City sewer services. As such, some of these parcels may have the potential to impact public health and the environment.

This report provides an analysis of the City's known septic tank systems and serves as a plan to provide future sewer collection for the unsewered areas. The locations of known active septic tank systems within the City limits are identified and grouped geographically into distinct areas. Using the geographic grouping of these systems, each group is evaluated with regards to its potential impact on public health and the environment and a prioritized ranking of the groups to be connected to the City's wastewater collection system is made. A cost estimate to extend the wastewater collection system to serve the unsewered parcels is made and the conceptual pipeline collection routes for conveying wastewater from the septic system groupings to the nearest sewer line are identified.

2.0 Septic Tank System Group Locations

The majority of septic tanks are located within City Council District 5, followed by District 2. District 3 is the only district with no suspected septic tank systems. Figure 2-1 shows the parcel locations and council district boundaries within the City of Las Cruces limits. Parcels that are occupied with mobile home parks are shown in Figure 2-2 as being either sewered or served by a septic tank system.

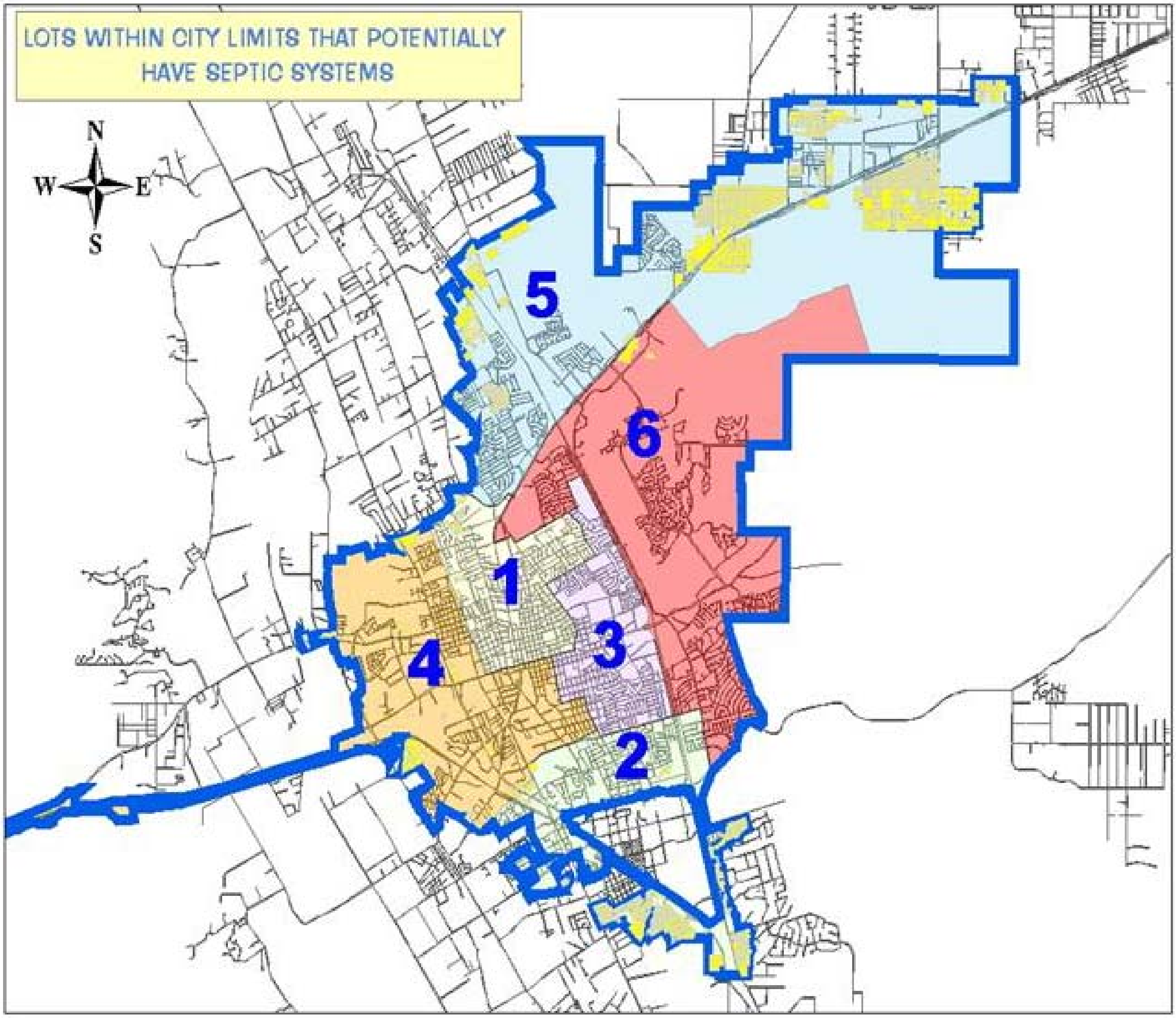


Figure 2-1 City Council Districts

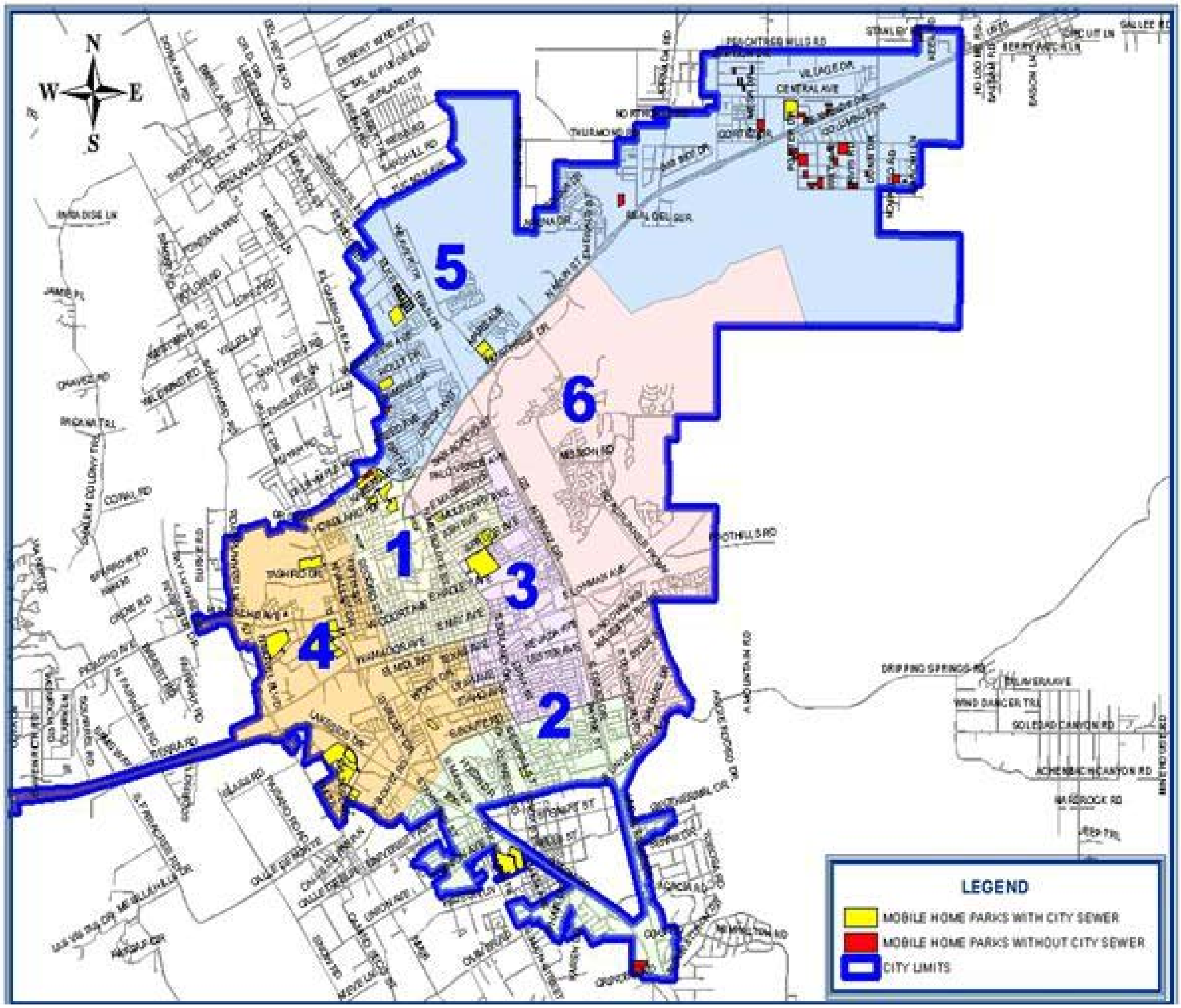


Figure 2-2 Mobile Home Parcels with and without City Sewer

In general, unsewered parcels with septic tank systems within the City of Las Cruces limits are clustered into geographic groups. These clusters of unsewered parcels with septic tank systems are referred to as developments and are named in this report by either subdivision name or the geographic area (street name) in which they are located.

A detailed listing of the unsewered parcels with property address, development name, and parcel acreage for each of the council districts is presented in Appendix A.

2.1 Council District 1

City Council District 1 has an estimated 48 parcels with septic tank systems covering 27.86 acres. Six of the 48 parcels have mobile home parks with septic tank systems. There are 46 mobile homes on the parcels covering 5.92 acres.

District 1 unsewered parcels are located in the northwest corner of the council district and are all west of Alameda Boulevard. All but three of the 48 parcels are north of Hoagland Road. Figure 2-3 shows Council District 1 unsewered parcels with septic tank systems. For the purpose of this report unsewered parcels in Council District 1 are grouped geographically into the following developments:

- Alameda Acres/Estates
- McClure/2nd Street

2.2 Council District 2

City Council District 2 has an estimated 489 parcels with septic tank systems covering 353.62 acres. Two of the 489 parcels have mobile home parks with septic tank systems. There are 53 mobile homes on the two parcels covering 12.44 acres.

District 2 parcels are located primarily in the southeast and southwest corner of the council district, east of I-25 and southwest of I-10, with a few parcels located north of University Boulevard. Figure 2-4 shows locations of Council District 2 unsewered parcels with septic tank systems. Due to low elevation, parcels located at the southeastern corner of the district will require lift stations and force mains to pump wastewater flows to the City's collection system. For the purpose of this report unsewered parcels in Council District 2 are grouped geographically into the following developments:

- Brittany Estates
- Bumgarner
- College Park Addition
- EBL&T
- Estados Serenos
- Las Alturas Estates/Mission Bell/Quail Run/Shadow Run/Tellbrook
- Los Nogales
- Orion Estates/Salopek/University Mesa
- South Valley/South Main
- University Estates
- Stern

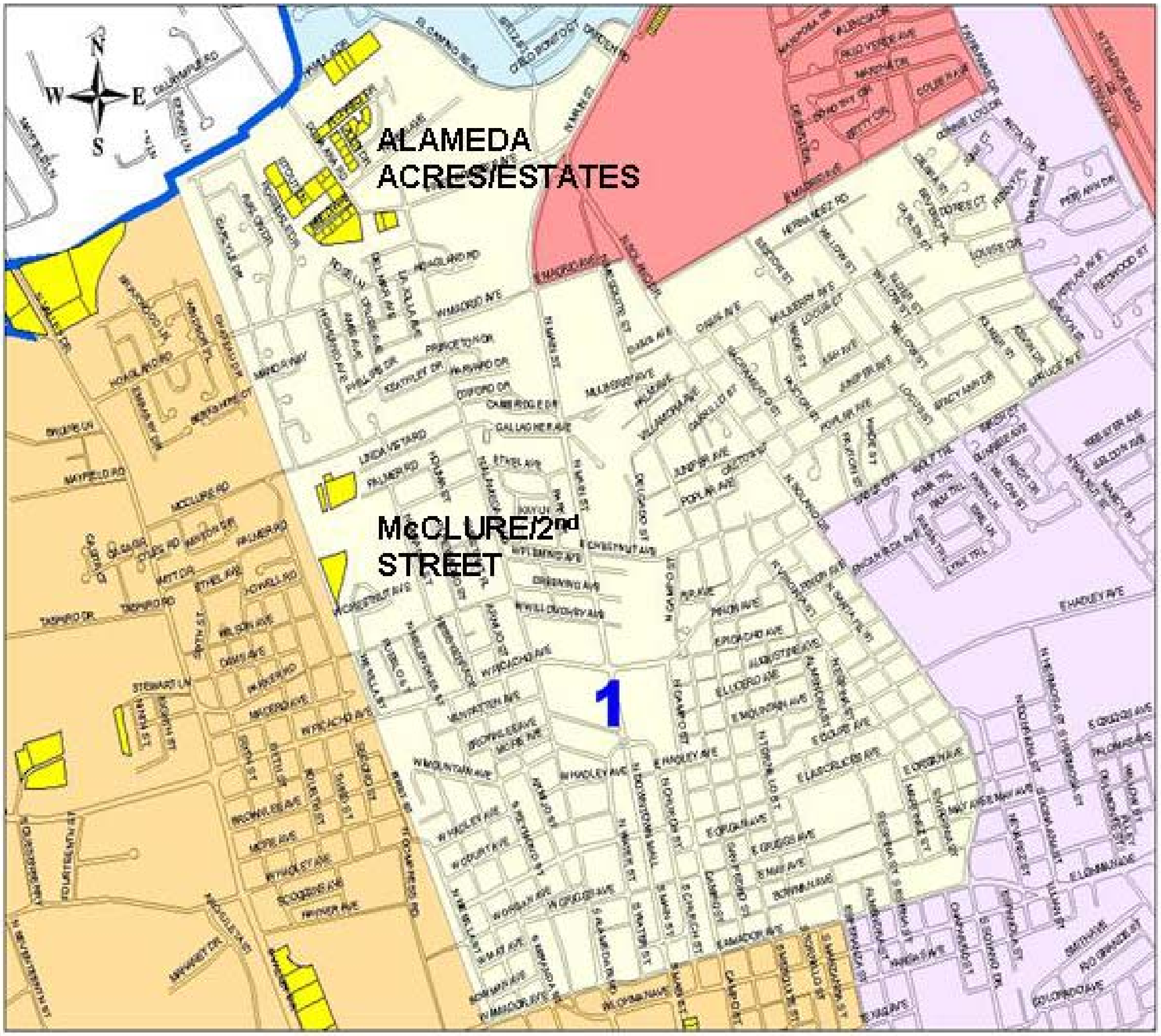


Figure 2-3 District 1 Unsewered Parcels

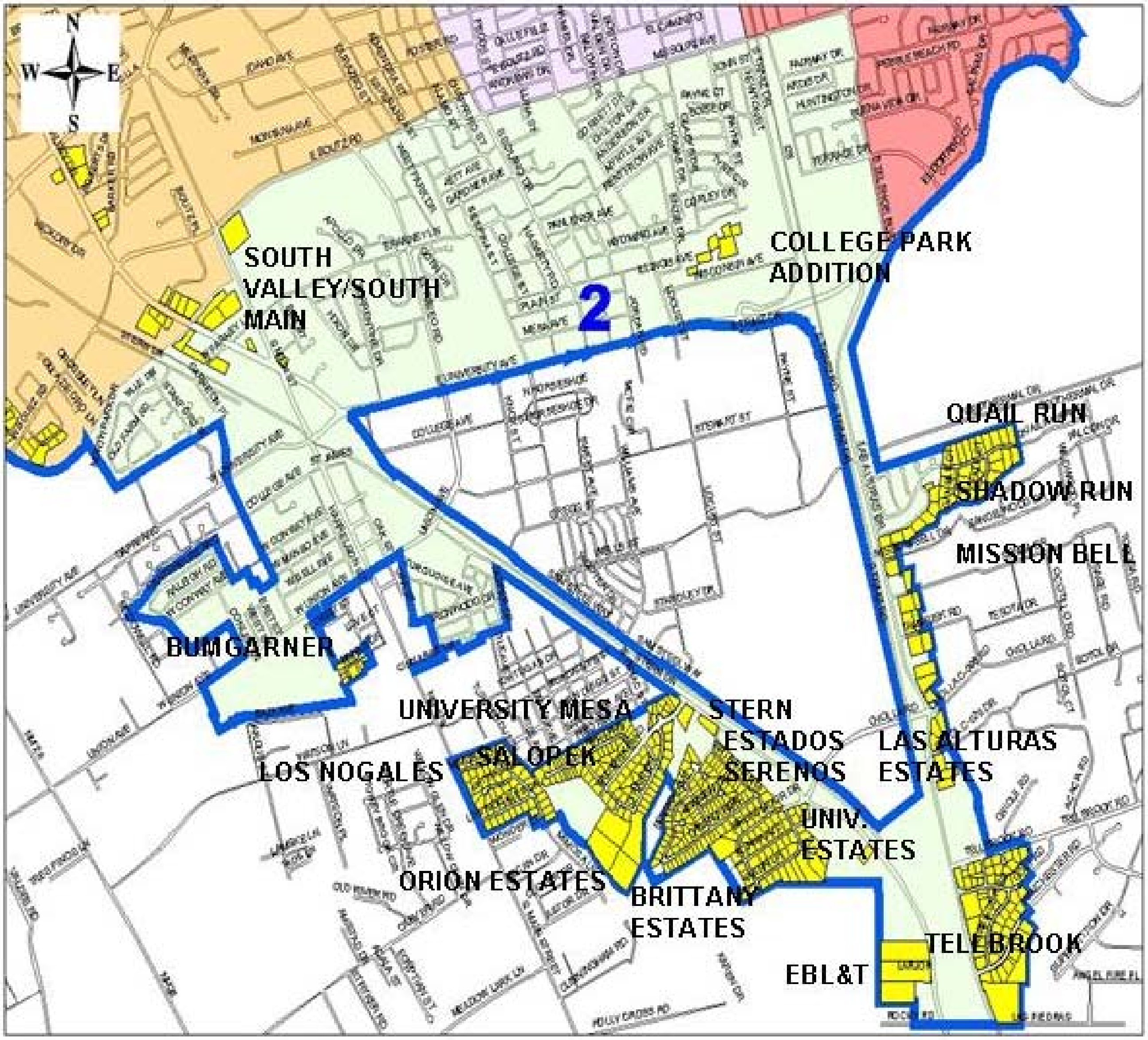


Figure 2-4 District 2 Unsewered Parcels

2.3 Council District 4

City Council District 4 has an estimated 72 parcels with septic tank systems covering 122.08 acres. One of the 72 parcels has a mobile home park with a septic tank system. There are 4 mobile homes on the parcel covering 0.83 acres.

Council District 4 parcels are randomly located throughout the district. Figure 2-5 shows Council District 4 parcels with septic tank systems. For the purpose of this report unsewered parcels in Council District 4 are grouped geographically into the following developments:

- Alicante Orchard/Buena Vista Estates
- Brown
- Industry West
- North Valley
- Picacho
- South Valley

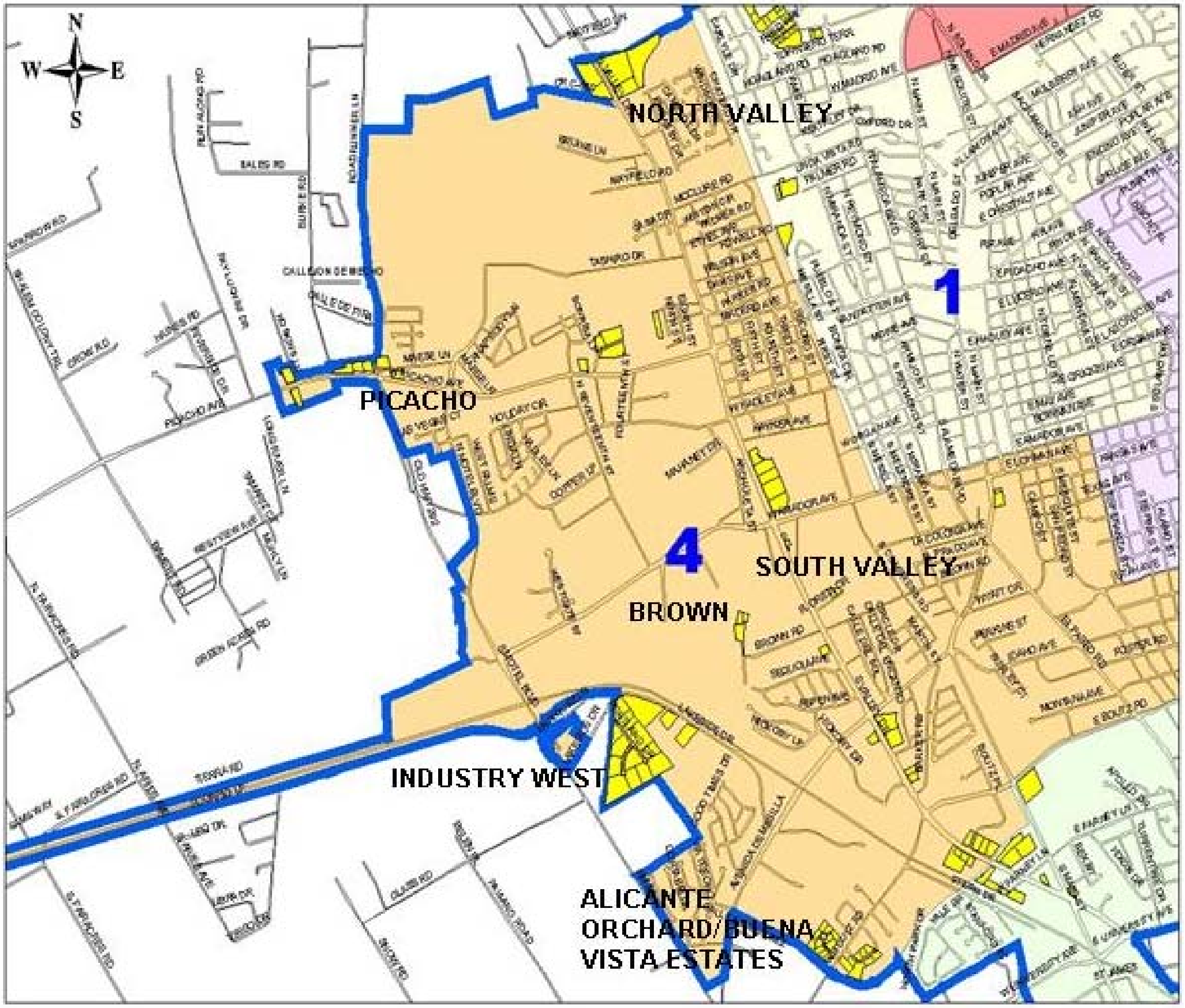


Figure 2-5 District 4 Unsewered Parcels

2.4 Council District 5

City Council District 5 is the largest district and has the greatest number of septic tank systems among all council districts with an estimated 1192 parcels with septic tank systems covering 1372.83 acres. 35 of the parcels have mobile home parks with septic tank systems. There are 113 mobile homes on the parcels covering 84.96 acres.

Unsewered District 5 parcels are concentrated in the communities of June Acres, Hacienda Acres, Mesa Grande, Mesa Village, Jornada South, and Jornada North, adjacent to I-70 in northeast Las Cruces and in random areas adjacent to I-25 in northern Las Cruces. Figures 2-6 and 2-7 show Council District 5 parcels with septic tank systems. For the purpose of this report unsewered parcels in Council District 5 are grouped geographically into the following developments:

- Bataan Memorial East/West
- EBL&T
- Government Heights Addition
- Hacienda Acres
- Homestead Acres/Estates
- Jornada North
- Jornada South
- Lantana Estates/Country Club Manor/Sun Country Estates
- Mesa Development
- Mesa Grande Subdivision
- Mesa Grande Tracts
- Mesa Village Tracts
- Paloma Knolls
- Rodriquez Subdivision/Sunset-Sunrise Heights
- Sandhill Center Subdivision
- Sunny Acres

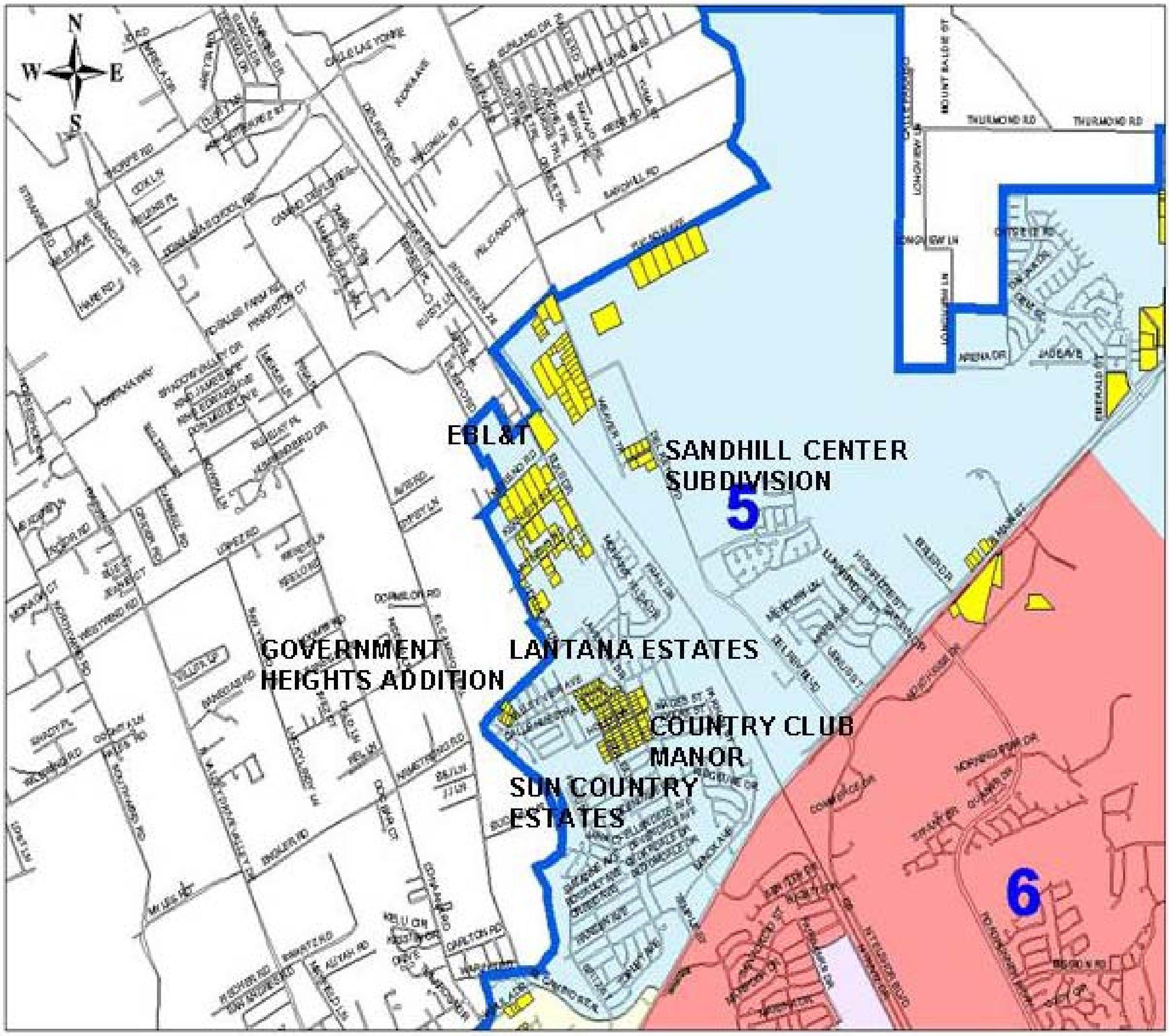


Figure 2-6 District 5 Unsewered Parcels

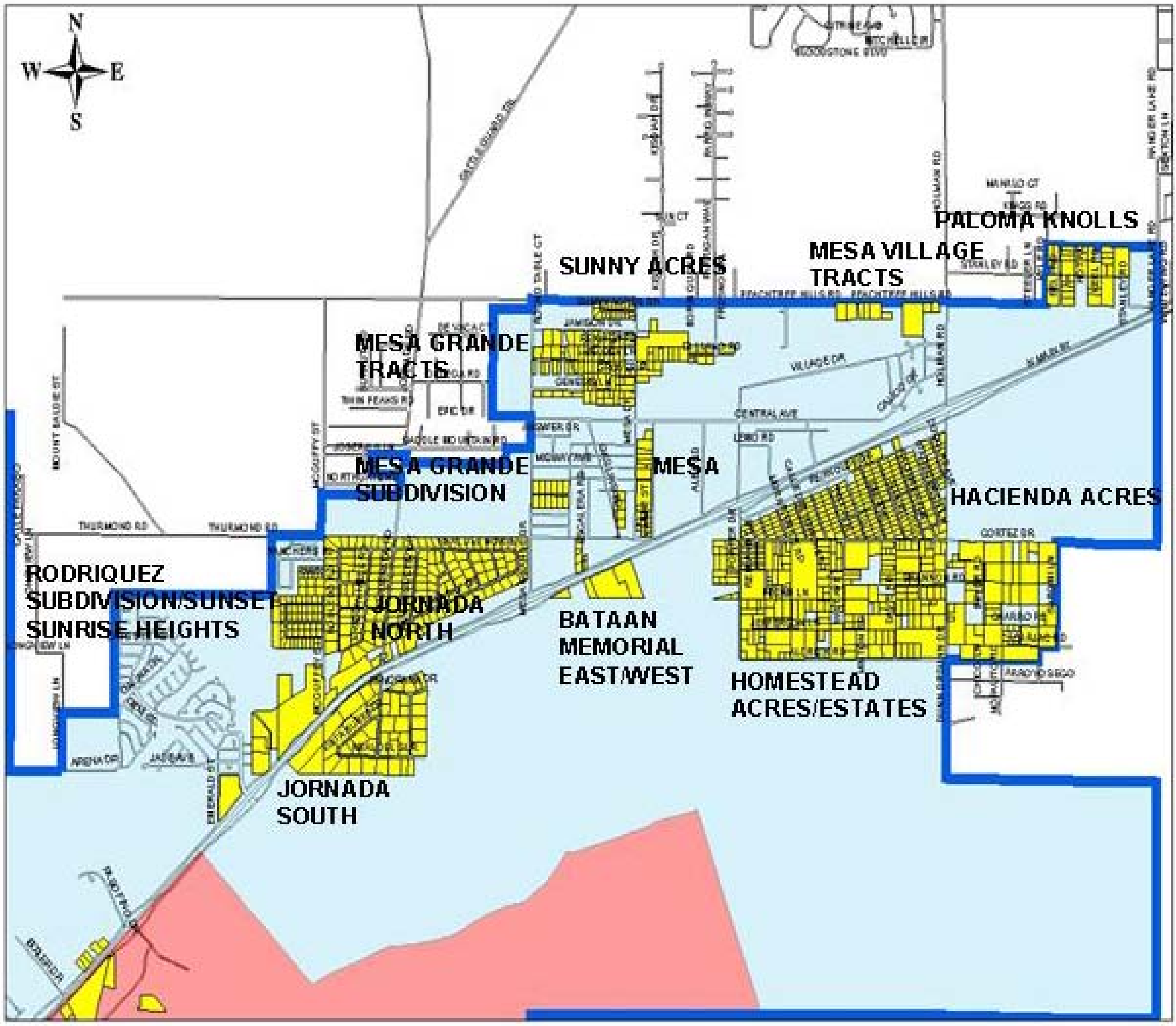


Figure 2-7 District 5 Unsewered Parcels (NE Corner)

2.5 Council District 6

City Council District 6 has the least number of septic tank systems among all council districts with an estimated 22 parcels with septic tank systems covering 27.65 acres. There are no known mobile home parks on septic tank systems in District 6.

District 6 parcels are concentrated south of I-70, west of Roadrunner Parkway, and north of Northrise Drive. Figure 2-8 shows Council District 6 parcels with septic tank systems. For the purpose of this report unsewered parcels in Council District 6 are grouped geographically into the following developments:

- Bataan Memorial West
- Fairways Vista Subdivision

3.0 Potential Septic Tank System Impacts

Nitrate, phosphorus, pathogens, and other contaminants are present in significant concentrations in most wastewaters treated by septic tank systems. The potential of septic tank systems to impact groundwater and public water supply is dependent upon factors that include the relative density of the septic tank systems, the depth to groundwater and the relative distance to public water supply systems.

3.1 Proximity to Groundwater and Public Water Supply

Water levels in the Mesilla Basin, the City of Las Cruces's groundwater source, range from only 10 to 25 feet below ground level in the Rio Grande floodplain to 300 or more feet in the western and east-central part of the basin. The Mesilla Basin contains thick, unconsolidated Santa Fe Group basin-fill sediments overlain by Rio Grande floodplain alluvium.

The Rio Grande alluvial deposits are very susceptible to pollution because the aquifer consists of highly transmissive gravels and sands, and the water table is usually less than 25 feet below the ground surface. Water in the deeper Santa Fe deposits is less likely to face contamination because the water table can be hundreds of feet below ground surface.

Groundwater level monitoring data from USGS observation wells in the Mesilla Basin indicate that depth to groundwater varies significantly for wells completed in the Santa Fe formation among the different City of Las Cruces Council Districts respective of the district's proximity to the Rio Grande.

For the area east of the Rio Grande and west of I-25, depth to groundwater varies from approximately 55 to 70 feet below ground level. For the area east of I-25, in Council District's No. 5 and 6, the depth to water exceeds 200 ft below ground level.

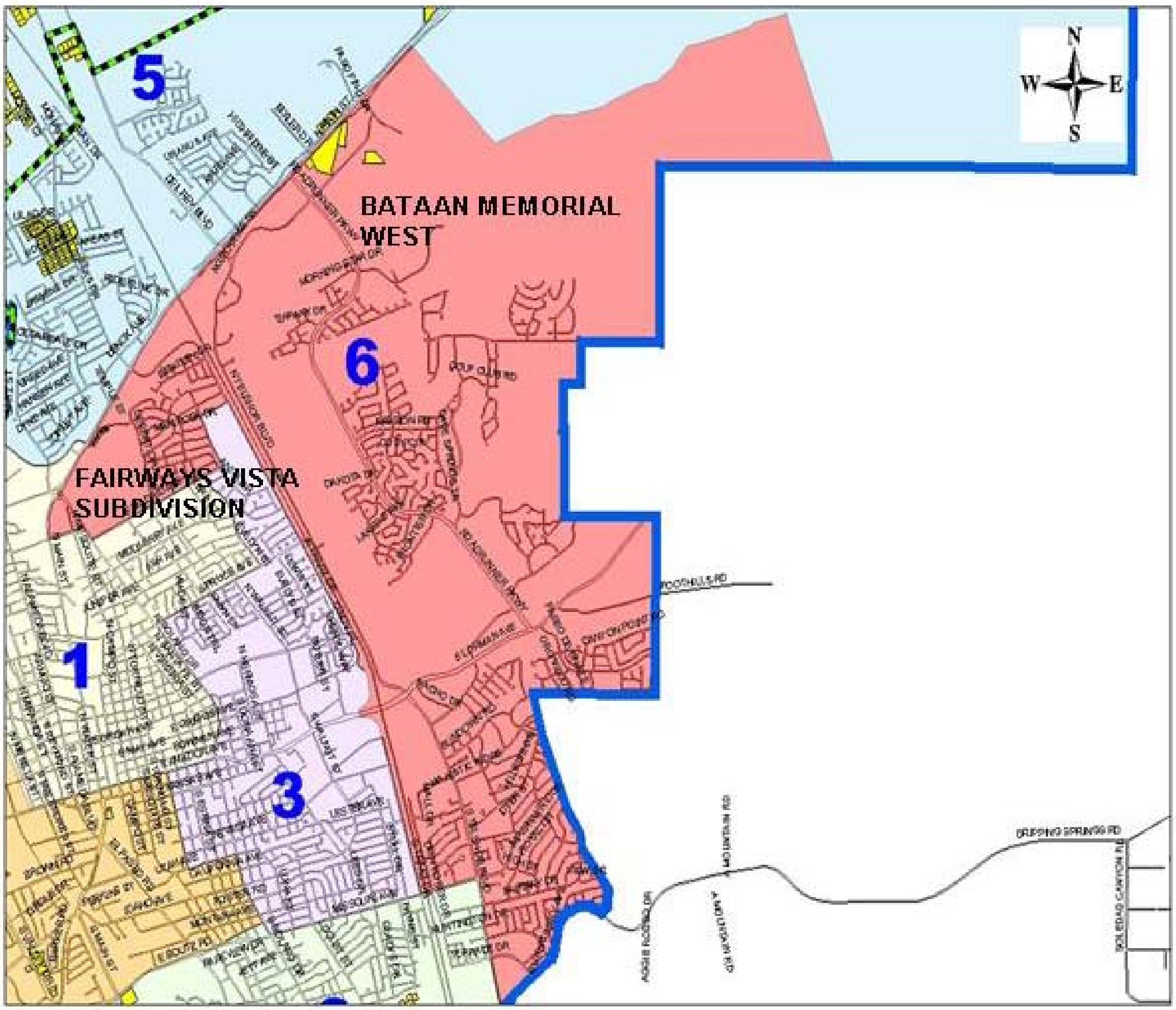


Figure 2-8 District 6 Unsewered Parcels

The City of Las Cruces water system serves most of the residents within the City limits. Depth to groundwater information regarding City owned and operated wells located within the Council Districts that are within one mile to septic tank systems is provided below:

Table 3-1 Septic Tank System Parcels within 1 Mile Radius to Municipal Wells

Well No.	Address	Static Water Level Depth (ft)	Council District	Development	Closest Horizontal Distance (ft)
10	706 E. Chestnut Ave.	74	1	McClure/2nd Street	5150
33	2581 N. El Camino	48	1	Alameda Acres/Estates	250
30	215 W. Union	45	2	Bumgarner	1150
44	2220 E. Missouri	155	2	College Park Addition	2600
35	1800 S. East Park	40	2	College Park Addition	5200
N/A	2539 Lakeside Drive	N/A	4	Industry West	750
N/A	El Molino?	N/A	4	South Valley	700
29	1125 W. Hayner	30	4	South Valley	<100
32	975 S. Mesquite	50	4	South Valley	2000
60	S. Espina St.	N/A	4	South Valley	2900
31	1901 Isaack Rd.	12	4	North Valley	600
58	1980 Stern Drive	N/A	4 2	SouthValley S.Valley/S. Main	400 600
23	Hwy. 70 & I-25	230	6	Bataan Memorial West	3100

N/A – Data not available

3.2 Septic Tank System Density

The New Mexico Environment Department adopted new liquid waste disposal regulations that became effective September 1, 2005 that revised the rules governing lot sizes. Lot size determines the rate of mass loading per area and is a critical factor in the degree to which natural attenuation can occur between the location where septic tank effluents enter the aquifer and the nearest down-gradient point of groundwater withdrawal. Population density ultimately determines the effluent load per unit of land area and hence the concentration of contaminants in groundwater.

For lots platted February 1, 1990 or later the minimum allowed lot size served by a septic tank system is 0.75 acres. For lots developed before February 1, 1990 with existing septic tank systems, the lot size in effect on the record date is allowed as long as the design flow has not increased. For undeveloped lots platted before February 1, 1990, minimum lot sizes are from 0.5 to 0.75 acres, depending on depth to groundwater, water source, and proximity to public wells. No septic tank systems are allowed on lots smaller than 0.75 acre in areas with depth to groundwater 100 feet or less, or within 200 feet of a public well. A minimum lot size of 0.5 acre is allowed only when depth to groundwater is greater than 600 feet.

The following subsections present tables that list the total number of unsewered parcels with septic tank systems by development that are 0.75 acre and smaller for each council district.

3.2.1 Council District 1

Table 3-2 Council District 1 Unsewered Septic Tank Parcels

Development	Approx. Number of Parcels with Septic Tank Systems	Number Parcels 0.5 – 0.75 acre	Number Parcels <0.5 acre	Total Parcels <0.75 acre	Percent Unsewered Parcels <0.75 acre
Alameda Acres/Estates	45	10	29	39	87%
McClure/2nd Street	3	0	1	1	33%

3.2.2 Council District 2

Table 3-3 Council District 2 Unsewered Septic Tank Parcels

Development	Approx. Number of Parcels with Septic Tank Systems	Number Parcels 0.5 – 0.75 acre	Number Parcels <0.5 acre	Total Parcels <0.75 acre	Percent Unsewered Parcels <0.75 acre
Brittany Estates	37	3	34	37	100%
Bumgarner	7	1	6	7	100%
College Park Addition	5	2	0	2	40%
EBL & T	3	0	0	0	0%
Estados Serenos	80	4	76	80	100%
Las Alturas Estates	16	1	0	1	6%
Los Nogales	53	50	1	51	96%
Mission Bell/Quail Run/Shadow Run	36	0	1	1	3%
Orion Estates	4	0	0	0	0%
Salopek/University Mesa	102	57	43	100	98%
South Valley/South Main	16	3	2	5	31%
Stern	2	0	0	0	0%
Tellbrook	60	35	5	40	67%
University Estates	68	49	8	57	84%

3.2.3 Council District 4

Table 3-4 Council District 4 Unsewered Septic Tank Parcels

Development	Approx. Number of Parcels with Septic Tank Systems	Number Parcels 0.5 – 0.75 acre	Number Parcels <0.5 acre	Total Parcels <0.75 acre	Percent Unsewered Parcels <0.75 acre
Alicante Orchard/ Buena Vista Estates	19	16	0	16	84%
Brown	3	0	2	2	67%
Industry West	16	0	0	0	0%
North Valley	5	0	0	0	%
Picacho	12	0	0	0	%
South Valley	17	2	5	7	41%

3.2.4 Council District 5

Table 3-5 Council District 5 Unsewered Septic Tank Parcels

Development	Approx. Number of Parcels with Septic Tank Systems	Number Parcels 0.5 – 0.75 acre	Number Parcels <0.5 acre	Total Parcels <0.75 acre	Percent Unsewered Parcels <0.75 acre
Bataan Memorial East/ West	12	2	1	3	25%
EBL&T	59	11	9	20	39%
Government Heights Addition	8	7	1	8	100%
Hacienda Acres	285	214	31	245	86%
Homestead Acres	204	44	12	27	13%
Homestead Estates	31	4	24	28	90%
Jornada North	177	1	2	3	2%
Jornada South	50	0	0	0	0%
Lantana Estates/ Country Club Manor/ Sun Country Estates	91	4	84	88	97%
Mesa Development	11	2	4	6	55%
Mesa Grande Subdivision	12	0	0	0	0%
Mesa Grande Tracts	98	28	17	45	46%
Mesa Village Tracts	8	0	0	0	0%
Paloma Knolls	31	2	4	6	19%
Rodriquez Subdivision/ Sunset-Sunrise Heights	69	48	16	64	93%
Sandhill Center Subdivision	5	0	0	0	0%
Sunny Acres	41	5	25	30	73%

3.2.5 Council District 6

Table 3-6 Council District 6 Unsewered Septic Tank Parcels

Development	Approx. Number of Parcels with Septic Tank Systems	Number Parcels 0.5 – 0.75 acre	Number Parcels <0.5 acre	Total Parcels <0.75 acre	Percent Unsewered Parcels <0.75 acre
Bataan Memorial West	4	0	0	0	0%
Fairway Vistas Subdivision*	18	0	18	18	100%

* land area for all parcels range from 0.09 to 0.13 acres

3.3 Prioritization Ranking for Sewering Septic Tank System Parcels

Taking into account the proximity of parcels with known septic tanks to existing City domestic wells, depth to groundwater, the density of septic tank systems, and the size of the parcels, Tables 3-7 through 3-10 have been developed to prioritize the sewering of septic tank systems. Developments are shown on the referenced maps.

Four categories are used to prioritize developments for connection to the City's wastewater collection system. Beginning with the greatest priority to be sewered, these categories are top, high, middle, and low priority. Developments ranked first within a category have the greatest potential negative impact on public health and the environment and therefore have the greatest priority for connection to the existing collection system, followed by the developments ranked second and so on.

Developments with the potential to impact groundwater supplies that are located within 1000 feet from a City well are a top priority to be connected to the City's wastewater collection system regardless of parcel size. High priority developments are those with the greatest number of unsewered parcels that are less than 0.5 acre in size. Middle priority developments are those with the greatest number of unsewered parcels that are between 0.5-0.75 acres in size. Low priority developments are those developments with parcels larger than 0.75 acre with very little to no potential impact to groundwater supplies.

Table 3-7 Top Priority Septic Tank System Parcels for Connection to City Wastewater Collection System – All within 1000' from City well

Priority Ranking	Development	Council District	Map Number
1	South Valley	4	4
2	Alameda Acres/Estates	1	1
3	SouthValley/South Main	2	4
4	North Valley	4	1
5	Industry West	4	4

Table 3-8 High Priority Septic Tank System Parcels for Connection to City Wastewater Collection System – Greatest number of parcels <0.5 acre

Priority Ranking	Development	Council District	Map Number
1	Lantana Estates/Country Club Manor/Sun Country Estates	5	5
2	Estados Serenos	2	2
3	Orion Estates/Salopek/University Mesa	2	2
4	Brittany Estates	2	2
5	Homestead Acres/Estates	5	6
6	Hacienda Acres	5	6
7	Sunny Acres	5	6
8	Fairway Vistas Subdivision	6	1
9	Mesa Grande Tracts	5	6
10	Rodriguez Subdivision/Sunset-Sunrise Heights	5	6
11	EBL&T	5	5
12	Bumgarner	2	2

Table 3-9 Middle Priority Septic Tank System Parcels for Connection to City Wastewater Collection System – Greatest number of parcels 0.5 - 0.75 acres

Priority Ranking	Development	Council District	Map Number
1	Los Nogales	2	2
2	University Estates	2	2
3	Las Alturas Estates/Mission Bell/Quail Run/Shadow Run/ Tellbrook	2	2
4	Alicante Orchard/Buena Vista Estates	4	4
5	Government Heights Addition	5	5
6	Paloma Knolls	5	6
7	Mesa Development	5	6
8	Jornada North	5	6
9	Bataan Memorial East/West	5	6
10	College Park Addition	2	3
11	Brown	4	4
12	McClure/2nd Street	1	1

Table 3-10 Low Priority Septic Tank System Parcels for Connection to City Wastewater Collection System – All parcels >0.75 acre and very little to no potential threat to groundwater

Priority Ranking	Development	Council District	Map Number
1	Jornada South	5	6
2	Picacho	4	1
3	Mesa Grande Subdivision	5	6
4	Mesa Village Tracts	5	6
5	Sandhill Center Subdivision	5	5
6	Bataan Memorial West	6	5
7	EBL&T	2	2
8	Stern	2	2

4.0 Future Collection System Routes

For the purpose of developing a conceptual layout of the wastewater conveyance system to serve the unsewered areas identified within the Council Districts, the following criteria were used:

- Residential neighborhoods are served by 8-inch diameter gravity pipelines. Currently this pipe diameter is common for sewering Las Cruces neighborhoods. Actual size may vary and would be determined in future design phases. Future modeling analysis is needed to determine impact of increased flows to downstream interceptors.
- No new gravity pipelines with diameters less than 8 inches will be used unless for areas requiring extension of existing smaller diameter pipelines.
- The recommended minimum slope for 8 inch sewer lines is 0.40 (vertical) feet per 100 (horizontal) feet (per NMED Construction Programs Bureau-Recommended Standards for Wastewater Facilities).
- Manholes are required at every change in direction, where two or more pipes meet, and are to be spaced no greater than 500 feet apart.
- Pipeline routes follow utility right-of-ways and easements when existing and flow can be maintained by gravity. Otherwise routes are located in roads or follow property boundaries.
- For estimating wastewater flows to lift stations
  - 2.32 people per parcel (per City of Las Cruces 40-Year Water Development Plan)
  - Per capita contribution of 100 gallons per day (gpd)
  - Peak hour flow factor of 2.5

Future collection system routes to provide wastewater service to unsewered parcels with septic tank systems are shown in Maps 1-6.

5.0 Septic Tank Conversion Cost Estimates

5.1 Cost Summary

Costs to provide wastewater service to those parcels identified as being unsewered and on septic tank systems are provided below for each development by council district. A detailed cost breakdown and summary of quantities is provided in Appendix B. The cost estimate assumes the following:

- One bend or fitting every 1000 linear feet
- One pipe interference or crossing every 1000 linear feet
- No tipping fee for pavement disposal (recycle)
- Width and depth of trench to be 7 feet
- No rock excavation is required
- No nominal dewatering is needed
- No consideration for contaminated soils or hazardous materials
- 40 hour construction work week with no overtime
- No utility costs to establish service to lift stations

The unit costs used for the cost estimate include both direct (labor, material, subcontractors, equipment, other) and indirect (permits, sales tax, insurance, etc.) costs, a 25 percent contingency on direct costs as well as a 7 percent escalation in construction costs to April 2007.

5.2 Collection System Cost Estimate

Estimated costs to extend the existing wastewater collection system to serve individual developments are provided in the tables below. Costs include construction of collection lines and associated appurtenances and do not include installation and connection to service lines. Service lines are typically stubbed out at the time of construction for the main. The priority ranking refers to where a develop ranks out of the total number of developments listed in the categories of top, high, middle, and low.

Table 5-1 Council District 1 Collection System Cost Estimate Summary

Development	Estimated Construction Cost	Priority Ranking (Top, High, Middle, Low)
Alameda Acres/Estates	$811,283	Top (#2 of 5 Developments)
McClure/2nd Street	$148,952	Middle (#12 of 12 Developments)

Table 5-2 Council District 2 Collection System Cost Estimate Summary

Development	Estimated Construction Cost	Priority Ranking (Top, High, Middle, Low)
South Valley/South Main	$625,265	Top (#3 of 5 Developments)
Estados Serenos	$802,232	High (#2 of 12 Developments)
Orion Estates/Salopek/University Mesa	$1,787,171	High (#3 of 12 Developments)
Brittany Estates	$519,429	High (#4 of 12 Developments)
Bumgarner	$380,119	High (#12 of 12 Developments)
Los Nogales	$918,224	Middle (#1 of 12 Developments)
University Estates	$956,303	Middle (#2 of 12 Developments)
Las Alturas Estates/Mission Bell/Quail Run/ Shadow Run/Tellbrook	$3,943,231	Middle (#3 of 12 Developments)
College Park Addition	$89,130	Middle (#10 of 12 Developments)
EBL&T	$446,180	Low (#7 of 8 Developments)
Stern	$316,084	Low (#8 of 8 Developments)

Table 5-3 Council District 4 Collection System Cost Estimate Summary

Development	Estimated Construction Cost	Priority Ranking (Top, High, Middle, Low)
South Valley	$931,710	Top (#1 of 5 Developments)
North Valley	$208,248	Top (#4 of 5 Developments)
Industry West	$916,555	Top (#5 of 5 Developments)
Alicante Orchard/Buena Vista Estates	$293,996	Middle (#4 of 12 Developments)
Brown	$100,620	Middle (#11 of 12 Developments)
Picacho	$675,040	Low (#2 of 8 Developments)

Table 5-4 Council District 5 Collection System Cost Estimate Summary

Development	Estimated Construction Cost	Priority Ranking (Top, High, Middle, Low)
Lantana Estates/Country Club Manor/ Sun Country Estates	$1,022,260	High (#1 of 12 Developments)
Homestead Acres/Estates	$8,485,443	High (#5 of 12 Developments)
Hacienda Acres	$4,592,109	High (#6 of 12 Developments)
Sunny Acres	$458,441	High (#7 of 12 Developments)
Mesa Grande Tracts	$3,270,536	High (#9 of 12 Developments)
Rodriquez Subdivision/Sunset-Sunrise Heights	$1,533,755	High (#10 of 12 Developments)
EBL&T	$4,197,686	High (#11 of 12 Developments)
Government Heights Addition	$109,068	Middle (#5 of 12 Developments)
Paloma Knolls	$1,598,245	Middle (#6 of 12 Developments)
Mesa Development	$1,289,459	Middle (#7 of 12 Developments)
Jornada North	$4,732,635	Middle (#8 of 12 Developments)
Bataan Memorial East/West	$628,165	Middle (#9 of 12 Developments)
Jornada South	$2,056,041	Low (#1 of 8 Developments)
Mesa Grande Subdivision	$148,399	Low (#3 of 8 Developments)
Mesa Village Tracts	$613,210	Low (#4 of 8 Developments)
Sandhill Center Subdivision	$202,062	Low (#5 of 8 Developments)

Table 5-5 Council District 6 Collection System Cost Estimate Summary

Development	Estimated Construction Cost	Priority Ranking (Top, High, Middle, Low)
Fairways Vista Subdivision	$240,278	High (#8 of 12 Developments)
Bataan Memorial West	$106,363	Low (#6 of 8 Developments)

5.3 Individual Residential Service Line Cost Estimate

The cost to install service lines from a resident's septic tank inlet to the collection line is dependant on several factors that include:

- Distance from property boundary to septic tank inlet
- Type and amount of landscaping that will be disturbed and replaced
- Need for plumbing to be rerouted under house due to grade issues with state code requirements between septic tank inlet and collection line

The unit price cost estimate for installed 4" SDR 35 sewer pipe service line is $45 per linear foot, and the cost for each 4" SDR sewer service connection to the collection line is $500.

6.0 Survey Questionnaire

Below is a list of general questions that were included in a survey questionnaire sent to septic tank users within City limits. The survey was conducted by the New Mexico State University (NMSU) – College of Agriculture and Home Economics. A total of 1520 questionnaires were delivered to Las Cruces residents. 540 completed surveys were received by NMSU. Of these, 515 surveys were received by mail, 18 surveys were received online over the internet, and 7 surveys were returned by residents already connected to the city sewer system.

Reponses from the surveys were compiled and summarized. A survey questionnaire summary for each question is included in Appendix C of this Report. NMSU survey data is also included in the attached compact disk.

Survey Questions

1. At the address listed are you the owner, renter?
2. How many people are served by your septic tank?
3. Number of bedrooms?
4. How long have you been an occupant at this address?
5. What is the size of your lot (approximately)?
6. Where does your drinking water come from?
7. How old is your septic system (years/unsure)?
8. What is the capacity (gallons) of your septic tank (gallons/unsure)?
9. Do you perform any maintenance on your private septic system (yes/no)?
10. Do you use any septic tank additives (yes/no/unsure)?
11. Has your septic system or drain field ever failed or performed at a level that is less than satisfactory (yes/no/unsure)?
12. To the best of your knowledge, has your septic system or drain field ever been repaired or replaced (yes/no/unsure)?
13. How would you rank your septic system concerns in order of importance from 1 to 4 (1- being most troubling to you): continued reliability of septic system, septic tank contamination, marketability of property, environmental impacts?
14. Do you want to receive sewer service from the City of Las Cruces (yes/no/unsure)?
15. If your septic system failed, which of the following choices would you select: invest in a replacement septic system or use those same dollars in the extension of a municipal sanitary system?
16. If you were to pay a line extension cost of approximately $457 to hook up to the main sewer system, would you hook up sometime in the next year (yes/no)?

17. If you were to pay a one time sewer impact fee of approximately $1,165 to hook into the city sewer system, would you hook up sometime in the next year (yes/no)?
18. If your monthly waste water bill averaged $35, would you connect to the city sewer system in the next year (yes/no)?
19. If the City Council passed a resolution that required all septic systems located within the city limits to be hooked into the city sewer system, when would you connect?
20. If financing was available toward the hook up cost, would you connect into the city sewer system in the next year (yes/no/unsure)?
21. Please rank the following items in order of importance from 1 to 4 with respect to your concerns about the subject of municipal sewer (1 – being the most troubling to you): installation cost, monthly fee, not having a choice in the matter, environmental impacts.
22. What is your occupation?
23. What is your age?
24. What is the highest level of education you have completed?
25. Are you a registered voter (yes/no)?
26. What is your City Council district number (number/unsure)?

Table 6-1 provides a summary of the responses. Table 6-1 indicates that those served by septic tank systems are primarily owners of 3 bedroom homes on half acre lots occupied by 2 people. The individuals in these homes are overwhelmingly registered voters who are generally either retired or professionals greater than 35 years old who have lived in their homes for more than 15 years. The majority of these homeowners are also college educated.

About half of the residents that have septic systems are provided water service from private companies with the other half served by the City of Las Cruces. Septic tank systems tend to be between 11 and 20 years old, are generally maintained, and have not required repairs or replacement. About half of the septic tank systems have never received tank additives.

Septic systems owners rank the continued reliability of the septic system as their main concern. The marketability of property and the environmental impacts from septic tank systems is not a big concern. Overall, septic tank owners are willing and interested in receiving service from the City of Las Cruces sewer system. However, in the event that City Council passes a resolution that requires all septic systems located within the city limits to be hooked in the city sewer system, the greatest response was that they would do so when ordered to by mandate.

In the event that their septic system fails, homeowners would prefer that the municipal sanitary system be extended to allow them to connect. About half are willing to pay a line extension fee of $457 while the other half are not. The majority of septic system owners are not willing to pay a $1,165 sewer impact fee as well as a monthly bill of $35 for wastewater services.

Septic systems owners are divided as to if they would connect into the city sewer system if financing were available. Their primary concerns are installation cost followed by monthly fee. Septic systems owners want to have a choice with regards to connecting or not connecting to the municipal sewer system. The potential impacts to the environment from the septic systems are not a concern.

Table 6-1 Summary of Survey Questionnaire

Question	Most Common Response	Percent Response
1 – Status of ownership	Homeowner	97
2 - Number of people served by septic tank	2	50
3 – Number of bedrooms	3	64
4 - Time occupying this address	Over 15 years	34
5 – Approximate size of lot	½ acre	33
6 - Drinking water source	Private water company/City of Las Cruces	48/43
7 – Age of septic system	11-20 years	41
8 – Capacity of septic tank	Unsure	71
9 – Is septic system maintenance performed?	Yes	61
10 – Are septic tank additives used?	No	52
11 - Has septic system failed or performed unsatisfactory?	No	77
12 – Has septic system ever been repaired/replaced?	No	67
13 – Ranking of septic tank system concerns (1- most troubling, 4-least troubling) – Continued reliability of septic system – Septic tank contamination – Marketability of property – Environmental impacts	 1 2 4 4	 55 28 31 25

Table 6-1 Summary of Survey Questionnaire

14 – Willingness to receive City of Las Cruces sewer service	Yes	43
15 – Choice for replacing failed septic system	Extend municipal sanitary system	50
16 – Willingness to pay $457 line extension fee	No/Yes	48/48
17 – Willingness to pay $1,165 sewer impact fee	No	64
18 – Willingness to pay monthly $35 wastewater bill	No	58
19 – Willingness to connect to city sewer system per City Council resolution	When ordered by mandate	31
20 – Use of financing (if available) towards connecting to city sewer system	No/Yes	40/37
21 – Ranking of concerns about connecting to municipal sewer (1-most troubling, 4-least troubling) – Installation cost – Monthly fee – Not having a choice in the matter – Environmental impacts	 1 2 1 4	 47 40 27 50
22 – Primary Occupation – Retired – Professional	 - -	 38 24
23 – Age of responder	35-54 years 55-64 years 65 and over	35 26 34
24 – Level of responder's education	Some college College graduate Adv. College degree	26 28 30
25 – Registered voter	Yes	90
26 – City Council District number	1 2 3 4 5 6 Unsure	1 19 <1 1 28 1 42

APPENDIX A

UNSEWERED PARCEL LISTING

The pages included in Appendix A can be found in the original report.

APPENDIX B

COST ESTIMATE
AND
SUMMARY OF QUANTITIES

The pages included in Appendix B can be found in the original report.

APPENDIX C

SURVEY QUESTIONNAIRE DATA AND SUMMARY

The pages included in Appendix C can be found in the original report.

Appendix B - Demand Forecast Methodology

The water demands of City of Las Cruces used in the model were estimated based on the population projection from the Land Use Assumptions Study by TAZ and the population projection by the individual developments. The detailed methodology is described below.

Existing service area water demand data was acquired from (metered) billing accounts from the City of Las Cruces. This data is cataloged by rate codes by single-family residential, multi-unit residential and other uses. Other uses include commercial, industrial, and institutional. An attempt was made to intersect billing information with the current Land Use Assumptions Study (2000 baseline) land use data by TAZ to characterize per capita water use by TAZ and billing type. For residential (domestic) demand, the total number of residential (metered) accounts within a TAZ was compared to the total number of households listed in the TAZ by the Land Use Assumptions Study. A slight difference in values was expected due to the comparison of two separate databases, the possibility that some of the households in the TAZ dataset are served by individual and/or private community water systems, and differences in the periods that estimates in total households were made and records from metered accounts were obtained. However, comparison between the two databases showed a huge disparity between the number of residential billing accounts and households by TAZ.

Because of the disparity between the number of metered accounts and households listed by TAZ in the Land Use Assumptions Study, 2005 baseline population was established using only the metered account data. This data was used as the basis for loading water demand data into the water model. Metered data contains spatial location by street address, rate code, and monthly water usage. Each multi-unit residential account was assumed to equal 11 single-family residential accounts in terms of population served. This conversion of multi-unit residential accounts to single-family residential accounts was derived using 2000 census data with an estimate of 26 persons per multi-unit residential account. Total served population was determined by multiplying total domestic accounts and "converted" multi-unit residential accounts by 2.46 persons (40-Year Water Development Plan, Final Draft-February 2007) per single-family household.

Using this approach, the 2005 residential population served by the City of Las Cruces water system was estimated at 81,615 individuals. This compares closely to the 40-Year Water Development Plan 2005 population of 82,611. 2005 population based on the TAZ data alone was 70,491. The scale factor of the 2005 population based on meter account data to 2005 TAZ population is 1.16. This scale factor was applied to the future population projection by TAZ.

Within the City's future service area, the populations of two areas were estimated based on the developer-driven growth. The developers of Sierra Norte and Vistas at

Presidio provided their land use plan to the City. CDM calculated the populations of these two development areas, and the projection was approved by the City. In Table B-1, the populations of Sierra Norte and Vistas at Presidio are estimated based on information provided by the developers instead of by TAZ data. The CDM projected total population is compared with the High Growth Projection (Table 4, Page 19) in the report of City of Las Cruces 40-Year Water Development Plan (40-Yr DP).

Table B-1 Population Estimates

Source		Service area Population				
		2005	2010	2015	2020	2025
From Billing[1] Data	2005 Existing Service Area	81,615	81,615	81,615	81,615	81,615
From TAZ Using Scale Factor Developed by Billing Data	2010 New Service Area		11,701	13,284	15,293	17,850
	2015 New Service Area			8,299	10,210	12,829
	2020 New Service Area				2,702	3,080
	2025 New Service Area					1,693
Sub Total		81,615	93,316	103,199	109,820	117,068
From Developments	Sierra Norte Population		3,091	7,544	12,273	16,694
	Vistas At Presidio Population		3,557	5,472	8,419	12,952
Total Projected Population		81,615	99,964	116,215	130,512	146,714
40 Year Water Development Plan High Growth Population		82,611	98,154	114,219	130,283	151,606
(CDM-40YrMP)/40YrMP		-1.21%	1.84%	1.75%	0.18%	-3.23%

1. Population based on 2.46 residents per household

The future water demands used in the model were forecasted by the CDM projected population and 40-Yr DP projected GPCD data shown in Table 5, Page 25. Within the 2005 existing service area, an assumption was made that there will be minimum growth in the existing service area and the future demand increase is caused only by the service area expansion. The increased demands over 2005 demand were calculated by the populations over 2005 population and the total GPCDs of the year. Table B-2 presents the demand forecast for the various planning periods and the comparison with 40-Yr DP projection.

Table B - 2 Demand Forecast

Year	2005	2010	2015	2020	2025
Residential Population	81,615	99,964	116,215	130,512	146,714
Total GPCD Water Demand per 40ryMP	206	216	206	201	196
Projected Water Demand (mgd)	16.81	20.78	23.94	26.64	29.57
Total Projected Water Demand (AC-FT/YR)	18,833	23,272	26,816	29,842	33,125
40-Year MP Plan High Groth Water Demand (AC-FT/YR)	19,036	23,765	26,374	29,353	33,307
(CDM-40yrMP)/40yrMP	-1.07%	-2.07%	1.68%	1.67%	-0.55%

Appendix C- Maximum Day Model Simulation Results

The tables in this Appendix are the maximum day model simulation results for the existing and future systems. The following pressure and velocity results are not reported as deficiency based on the City's direction. They are reported in this Appendix.

The junctions with high pressures are higher than 100 psi. (existing & future) The no demand junctions with pressures lower than 40 psi .(existing & future) The pipelines experience velocity higher than 5 ft/s. (existing & future)

Tabel C-1 Existing System Demand Junction with Pressure > 100 psi

ID	ZONE	DEMAND (gpm)	ELEVATION (ft)	PRESSURE (psi)
V_2850	Low	0.03	3,884.00	104.05
E_3941	Zone 1	0.03	4,224.17	115.91
V_2864	Low	0.06	3,884.00	104.24
V_4169	Low	0.08	3,889.20	106.67
V_258	Low	0.12	3,882.00	105.12
V_3075	Low	0.14	3,886.55	101.7
V_1394	Low	0.24	3,884.81	102.34
V_2862	Low	0.27	3,883.53	104.46
V_J-287	Low	0.29	3,880.83	105.56
V_2865	Low	0.32	3,886.57	101.97
V_J-369	Low	0.32	3,888.00	101.99
E_508	Zone 1	0.35	4,272.00	103.71
V_255	Low	0.41	3,882.00	105.26
V_1441	Low	0.46	3,896.00	102.17
V_3001	Telshor	0.5	4,066.69	101.59
E_J-__4	Zone 2	0.55	4,337.12	106.65
V_1445	Low	0.56	3,885.19	103.83
V_2860	Low	0.61	3,882.00	104.8
E_353	Zone 1	0.71	4,271.32	104.24
V_543	Low	0.93	3,876.04	107.35
V_268	Low	1.11	3,890.00	100.56
V_2863	Low	1.3	3,891.61	100.94
E_J-_61	Zone 1	1.48	4,236.76	104.53
V_3916	Low	1.54	3,888.00	103.31
E_132	Zone 1	1.59	4,242.07	117.44
V_270	Low	1.73	3,890.00	101.65
V_292	Low	1.76	3,881.50	105.26
V_J-308	Low	1.84	3,882.00	105.06
E_3939	Zone 1	1.98	4,232.49	105.03
V_4167	Low	2.05	3,882.38	104.89

Tabel C-1 Existing System Demand Junction with Pressure > 100 psi

ID	ZONE	DEMAND (gpm)	ELEVATION (ft)	PRESSURE (psi)
E_360	Zone 1	2.09	4,247.65	114.48
V_320	Low	2.18	3,886.00	101.9
V_180	Telshor	2.24	4,051.03	108.64
V_J-358	N Intermediate	2.26	3,914.00	108.83
V_928	Low	2.31	3,890.62	100.29
E_355	Zone 1	2.45	4,248.26	114.2
V_257	Low	2.64	3,879.61	106.08
E_2127	Zone 2	2.76	4,351.86	100.21
E_207	Zone 1	2.76	4,232.25	121.14
V_1500	Telshor	3.14	4,069.23	100.5
E_80	Zone 1	3.21	4,227.28	123.29
E_2247	Jornada	3.24	4,118.00	102.54
E_3949	Zone 1	3.49	4,244.00	100.04
E_509	Zone 1	3.49	4,278.53	100.96
E_913	Zone 1	3.54	4,220.24	126.34
V_176	Low	3.57	3,890.00	100.65
V_256	Low	3.63	3,882.00	105.05
V_293	Low	3.65	3,880.00	105.89
E_J-_44	Zone 1	3.73	4,227.49	106.64
V_3070	Low	3.83	3,888.14	102.99
V_282	Low	3.86	3,892.00	100.57
V_930	Low	3.9	3,888.00	101.23
V_3913	Low	3.96	3,887.07	103.65
E_506	Zone 1	3.98	4,269.45	104.85
E_72	Zone 1	4.05	4,226.88	124.02
E_134	Zone 1	4.31	4,236.00	120.07
V_400	Telshor	4.46	4,062.00	104.26
E_115	Zone 1	4.56	4,224.00	125.27
E_206	Zone 1	4.61	4,235.39	119.78
V_3077	Low	4.67	3,885.94	101.96
V_360	Telshor	4.77	4,068.00	101.69
V_1421	Low	4.81	3,890.14	100.18
V_935	Low	4.83	3,890.00	100.35
E_110	Zone 1	4.98	4,244.51	116.38
V_1502	Telshor	5.02	4,051.08	108.36
V_1450	Low	5.04	3,882.00	105.04
V_4171	Low	5.16	3,888.33	101.94
E_352	Zone 1	5.17	4,266.05	106.5
E_507	Zone 1	5.42	4,272.00	103.73
E_2126	Zone 2	5.55	4,347.91	101.93
V_4165	Low	5.6	3,882.00	105.05
E_354	Zone 1	5.61	4,219.76	126.55
V_1504	Telshor	5.75	4,034.84	115.4
E_112	Zone 1	5.88	4,252.00	113.14
E_340	Zone 1	5.99	4,241.28	117.23
V_J-215	Low	6.01	3,881.87	104.99

Tabel C-1 Existing System Demand Junction with Pressure > 100 psi

ID	ZONE	DEMAND (gpm)	ELEVATION (ft)	PRESSURE (psi)
V_181	Telshor	6.05	4,056.00	106.49
V_1437	Low	6.12	3,896.00	100.9
V_344	Low	6.17	3,892.96	100.19
V_1225	C Intermediate	6.19	3,956.10	101.46
V_196	Telshor	6.34	4,064.00	102.73
E_350	Zone 1	6.52	4,241.90	116.91
E_2123	Zone 2	6.82	4,352.00	100.15
E_502	Zone 1	7.11	4,248.93	113.8
E_205	Zone 1	7.44	4,229.66	122.26
V_195	Telshor	7.46	4,031.50	116.85
E_71	Zone 1	7.58	4,242.00	117.47
V_1443	Low	7.59	3,893.35	100.14
V_1233	C Intermediate	7.64	3,958.31	100.52
V_710	Low	7.65	3,888.43	102.12
V_541	Low	7.67	3,878.00	106.5
E_2122	Zone 2	7.85	4,346.00	102.75
V_544	Low	7.86	3,877.54	106.72
N-23	Zone 1	7.89	4,242.00	118.08
V_673	Low	8.02	3,894.22	102.85
V_348	N Intermediate	8.24	3,912.00	110.76
V_J-184	Low	8.44	3,888.00	105.57
E_3054	Zone 1	8.64	4,233.24	104.16
V_1419	Low	8.69	3,890.07	100.53
V_1446	Low	8.73	3,878.06	106.75
E_501	Zone 1	8.89	4,230.00	122.1
E_2125	Zone 2	8.99	4,350.60	100.76
V_1464	Telshor	9	4,033.82	115.85
E_351	Zone 1	9.03	4,248.81	113.95
V_540	Low	9.07	3,880.00	105.66
V_1466	Telshor	9.68	4,070.39	100.02
E_359	Zone 1	10.25	4,244.00	116.05
V_532	Low	10.31	3,892.87	100.04
E_514	Zone 1	10.31	4,268.00	105.53
V_1223	C Intermediate	10.37	3,959.31	100.06
V_J-213	Low	10.38	3,879.98	105.85
V_4168	Low	10.78	3,886.00	106.61
V_545	Low	11.09	3,877.46	106.73
V_J-214	Telshor	11.37	4,070.00	100.83
V_3886	Low	11.55	3,887.25	101.39
V_1501	Telshor	11.84	4,060.00	104.49
E_510	Zone 1	12.03	4,276.00	102.07
E_503	Zone 1	12.36	4,254.84	111.2
V_4170	Low	12.4	3,888.16	102.02
V_3071	Low	12.42	3,888.00	103.04
E_3051	Zone 1	12.54	4,234.90	103.44
E_111	Zone 1	12.67	4,214.74	129.28

Tabel C-1 Existing System Demand Junction with Pressure > 100 psi

ID	ZONE	DEMAND (gpm)	ELEVATION (ft)	PRESSURE (psi)
E_3159	Zone 1	12.98	4,234.38	103.35
V_251	Low	13.03	3,884.29	103.48
E_2205	Zone 1	13.37	4,235.88	100.97
V_1433	Low	13.75	3,891.45	100.43
V_1505	Telshor	13.75	4,042.70	111.99
E_204	Zone 1	14.1	4,257.55	110.18
E_133	Zone 1	14.18	4,241.50	117.68
V_4160	Low	14.2	3,880.39	105.73
E_358	Zone 1	14.22	4,244.00	116.05
V_362	High	14.24	4,007.39	101.96
E_505	Zone 1	14.25	4,274.00	102.88
V_4162	Low	14.52	3,882.00	105.05
V_194	Telshor	14.57	4,037.69	114.17
V_705	Low	14.58	3,886.00	104.37
E_3041	Zone 1	14.72	4,237.22	102.52
E_203	Zone 1	15.15	4,263.21	107.72
V_542	Low	15.32	3,878.00	106.5
V_704	Low	15.37	3,882.00	105.43
V_274	Low	15.44	3,891.54	101.1
V_3912	Low	15.46	3,887.24	103.58
V_1503	Telshor	15.54	4,046.00	110.56
V_533	Low	15.6	3,892.00	100.42
E_513	Zone 1	15.88	4,272.73	103.76
V_322	Low	16.28	3,878.00	106.76
V_294	Low	16.5	3,880.00	105.67
V_1465	Telshor	16.63	4,065.23	102.26
E_512	Zone 1	16.72	4,270.00	104.83
E_J-_42	Zone 1	16.75	4,229.93	105.58
E_3052	Zone 1	17.04	4,239.69	101.37
V_1448	Low	17.21	3,880.43	105.71
E_504	Zone 1	17.55	4,266.18	106.28
V_260	Low	17.56	3,888.27	100.61
V_1434	Low	17.58	3,892.00	100.22
V_286	Low	18.01	3,888.00	102.81
V_401	Low	18.46	3,892.00	100.71
V_1396	Low	18.76	3,888.00	100.85
V_1442	Low	19.28	3,894.00	100.47
E_114	Zone 1	19.64	4,249.56	114.23
V_4164	Low	20.06	3,882.00	105.05
V_288	Low	20.4	3,882.06	105.44
V_410	Telshor	21.21	4,064.99	102.96
V_2859	Low	21.42	3,884.00	103.89
V_39	High	22.6	3,998.08	105.38
V_2866	Low	23.93	3,886.00	102.21
V_3078	Low	25.58	3,886.00	101.93
V_3930	Low	26.26	3,884.00	103.91
V_1447	Low	26.88	3,881.75	105.14

Tabel C-1 Existing System Demand Junction with Pressure > 100 psi

ID	ZONE	DEMAND (gpm)	ELEVATION (ft)	PRESSURE (psi)
V_218	Telshor	29.75	4,066.50	101.91
V_291	Low	30.04	3,886.02	103.31
V_295	Low	31.23	3,890.19	101.25
V_4161	Low	31.75	3,882.00	105.07
V_1417	Low	31.91	3,888.00	102.49
V_4163	Low	32.11	3,880.00	105.91
V_273	Low	32.35	3,890.00	101.76
V_254	Low	33.59	3,882.35	103.88
V_177	Low	34.59	3,890.00	100.35
V_1393	Low	36.54	3,886.00	101.78
V_1440	Low	37.7	3,892.00	102.65
V_3914	Low	39.63	3,888.00	103.25
V_2867	Low	39.82	3,886.00	102.14
V_674	Low	41.41	3,895.51	101.99
V_1451	Low	42.11	3,882.60	107.66
E_511	Zone 1	43.04	4,276.41	101.93
V_1444	Low	43.46	3,880.00	105.92
V_272	Low	44.5	3,892.00	100.44
V_275	Low	46.15	3,892.00	101.39
V_340	Low	46.78	3,882.00	105.02
V_333	Low	49.92	3,887.60	101.46
V_252	Low	50.34	3,887.81	101.55
V_1449	Low	52.04	3,885.01	103.72
V_3074	Low	56.13	3,886.44	103.46
V_289	Low	56.48	3,886.00	103.38
V_1395	Low	57.78	3,888.40	100.79
V_311	Low	59.07	3,890.86	101.9
V_J-185	Low	64.63	3,880.00	109.03
V_3005	Telshor	65.61	4,058.72	105.02
V_341	Low	67.13	3,883.98	105.15
V_4174	Low	68.21	3,890.00	100.44
V_708	Low	79.88	3,886.00	103.71
V_J-210	Low	80.55	3,885.83	106.5
V_253	Low	102.55	3,888.00	101.02
V_J-216	Low	119.85	3,880.68	105.63
V_402	Low	132.64	3,894.00	100.45
V_711	Low	146.65	3,887.26	102.63
V_3000	Telshor	161.08	4,068.00	101.02
V_281	Low	195.08	3,890.00	100.16

Table C-2 Existing System No Demand Junction with Pressure < 40 psi

ID	ZONE	DEMAND (gpm)	ELEVATION (ft)	PRESSURE (psi)
E_3132	Zone 1	0	4,478.67	-1.92
E_3130	Zone 1	0	4,478.59	-1.88
E_328	Jornada	0	4,328.00	11.14

Table C-2 Existing System No Demand Junction with Pressure < 40 psi

ID	ZONE	DEMAND (gpm)	ELEVATION (ft)	PRESSURE (psi)
E_904	Jornada	0	4,328.00	11.14
E_3080	Zone 2	0	4,558.00	11.18
W_328	W Mesa	0	4,430.00	11.66
N-56	Telshor	0	4,274.00	11.72
N-55	Telshor	0	4,274.00	11.75
V_3010	Low	0	4,084.00	12.42
V_336	Low	0	4,085.06	12.98
V_3015	Low	0	4,084.09	13.39
W_320	W Mesa	0	4,194.00	13.6
W_J-3	W Mesa	0	4,194.00	13.61
W_J-2	W Mesa	0	4,194.00	13.62
E_907	Telshor	0	4,268.68	14.11
V_335	Low	0	4,086.00	14.3
E_902	High	0	4,204.00	14.58
E_906	High	0	4,204.00	14.6
N-104	W Mesa	0	4,194.00	15.48
V_3050	Low	0	4,083.35	15.87
N-910	Telshor	0	4,264.00	16.14
V_135	Low	0	4,077.18	16.39
V_337	Low	0	4,081.66	16.61
W_327	W Mesa	0	4,416.00	17.72
V_334	High	0	4,198.19	17.89
V_312	Low	0	4,078.31	18.06
N-30	Low	0	4,078.00	18.19
N-50	Telshor	0	4,258.00	18.28
N-121	Jornada	0	4,310.00	18.62
N-103	Jornada	0	4,310.00	18.7
E_2101	Zone 1	0	4,424.59	19.4
V_179	Telshor	0	4,254.30	20.36
E_327	Jornada	0	4,304.96	21.12
E_J-158	Zone 1	0	4,420.24	21.3
E_325	Jornada	0	4,304.00	21.55
E_326	Jornada	0	4,303.29	21.85
E_324	Jornada	0	4,302.00	22.42
V_211	Low	0	4,068.00	22.53
E_323	Jornada	0	4,300.69	23
E_319	Jornada	0	4,300.60	23.1
E_2100	Zone 1	0	4,416.00	23.11
E_721	Zone 1	0	4,413.71	23.31
E_321	Jornada	0	4,300.00	23.32
E_320	Jornada	0	4,298.00	24.2
E_322	Jornada	0	4,296.24	24.93
V_133	Low	0	4,057.81	24.93
N-20	Jornada	0	4,295.00	24.98
E_318	Jornada	0	4,296.00	25.11
WELL34	Low	0	4,061.11	25.52
V_127	Low	0	4,073.25	25.58

Table C-2 Existing System No Demand Junction with Pressure < 40 psi

ID	ZONE	DEMAND (gpm)	ELEVATION (ft)	PRESSURE (psi)
V_128	Low	0	4,074.00	25.6
E_720	Zone 1	0	4,408.00	26.07
V_3900	Low	0	4,070.17	26.85
V_131	Low	0	4,079.45	27.36
E_3082	Zone 2	0	4,520.00	27.64
V_50	Low	0	4,054.00	28.05
V_51	Low	0	4,054.00	28.05
V_221	Low	0	4,062.33	28.43
N-43	Telshor	0	4,235.00	28.66
E_719	Zone 1	0	4,400.00	29.69
V_123	Low	0	4,046.00	30.09
E_3020	Jornada	0	4,284.03	30.16
E_718	Zone 1	0	4,397.76	30.85
N-10	Jornada	0	4,280.00	32.06
E_3016	Jornada	0	4,278.72	32.39
E_3015	Jornada	0	4,277.19	33.05
V_1456	High	0	4,162.00	33.58
V_126	Low	0	4,051.80	34.85
V_130	Low	0	4,062.00	34.87
E_3014	Jornada	0	4,272.84	34.92
E_716	Zone 1	0	4,389.33	34.93
E_717	Zone 1	0	4,388.00	35.36
E_2104	Zone 1	0	4,387.05	35.71
N-126	Zone 1	0	4,386.00	36.09
E_2103	Zone 1	0	4,386.00	36.15
V_209	Low	0	4,035.84	36.95
E_113	Jornada	0	4,267.28	37.77
N-57	Jornada	0	4,274.00	38.2
E_3158	Zone 1	0	4,380.66	38.59
E_J-156	Zone 1	0	4,380.00	38.75
WELL18	Low	0	4,026.00	38.75
E_2102	Zone 1	0	4,378.00	39.61
E_201	Jornada	0	4,262.35	39.91

Table C-3 Existing System Pipe Velocity > 5 ft/s

ID	ZONE	LENGTH (ft)	DIAMETER (in)	FROM	TO	VELOCITY (ft/s)	HL_1000 (ft/kft)
V_948	Low	825	6	V_67	V_914	9.68	64.93
W_208	W Mesa	15	8	BWM1	W_321	9.31	345.57
E_1021	High	21.12	8	E_902	BLV1	7.52	541.74
E_1022	Jornada	32.57	8	BLV1	E_901	7.52	358.86
N-106	W Mesa	136	12	WP46	N-104	7.16	31.62
W_1521	W Mesa	0.5	12	R46	WP46	7.16	14.16
W_P-15	W Mesa	136	12	N-104	W_J-2	7.16	31.62
V_4010	Low	87	8	TUG	V_3010	6.65	26.86
V_4011	Low	74	8	V_3010	BUG1	6.65	26.86
V_4012	Telshor	69	8	BUG1	V_3011	6.65	26.86
V_2678	Low	180	10	WP59	V_1461	6.6	20.39

Table C-3 Existing System Pipe Velocity > 5 ft/s

ID	ZONE	LENGTH (ft)	DIAMETER (in)	FROM	TO	VELOCITY (ft/s)	HL_1000 (ft/kft)
N-77	Telshor	10	12	N-56	BTS7	6.25	9.52
N-78	Telshor	10	12	N-56	BTS6	6.25	9.52
N-79	Jornada	10	12	BTS7	N-57	6.25	9.52
N-80	Jornada	10	12	BTS6	N-57	6.25	9.52
V_2698	Low	150	10	WP58	V_1451	5.72	13.33
V_4168	Low	157	12	WP65	V_4169	5.7	9.23
V_WR65	Low	0.5	12	R65	WP65	5.7	9.28
V_431	C Intermediate	10	8	V_66	V_323	5.46	15.87
V_81	C Intermediate	120	8	V_323	VDM	5.45	15.84
V_L81	Low	1	8	VDM	V_67	5.45	16.11
N-2	Low	450	16	WP70	N-2	5.23	5.63
N-W70	Low	1	16	R70	WP70	5.23	5.62

Tabel C-4 Existing System No Demand Junction with Pressure > 100 psi

ID (Char)	ZONE (Char)	DEMAND (gpm)	ELEVATION (Real)	PRESSURE (psi)
1000	Low	0	3,891.00	100.02
N-26	Zone 1	0	4,280.00	100.16
E_J-155	Zone 1	0	4,242.25	100.34
1001	Low	0	3,890.00	100.47
HF14	Low	0	3,892.42	100.54
1005	Low	0	3,890.00	100.62
N-5	Low	0	3,890.00	100.69
1100	Low	0	3,890.00	100.71
V_343	Low	0	3,890.00	100.91
V_J-373	Low	0	3,890.00	101.12
V_J-374	Low	0	3,890.00	101.12
1008	Low	0	3,890.00	101.22
HP14	Low	0	3,890.00	101.34
V_271	Low	0	3,890.00	101.58
V_31	High	0	4,007.66	101.8
V_3910	Low	0	3,890.76	101.99
V_J-368	Low	0	3,888.00	101.99
V_J-371	Low	0	3,888.00	101.99
E_J-165	Zone 1	0	4,262.27	102.35
V_3915	Low	0	3,890.00	102.49
E_228	Jornada	0	4,116.34	102.53
E_202	Zone 1	0	4,276.00	102.65
V_269	Low	0	3,888.00	102.78
V_145	Telshor	0	4,065.42	102.82
V_3073	Low	0	3,888.00	102.92
V_3012	Telshor	0	4,066.00	102.98
E_J-154	Jornada	0	4,118.00	103.14
V_3911	Low	0	3,888.00	103.25
V_3072	Low	0	3,887.15	103.43
V_1439	Low	0	3,892.00	103.5
V_J-372	Low	0	3,884.00	103.72
V_350	Low	0	3,886.43	103.9

Tabel C-4 Existing System No Demand Junction with Pressure > 100 psi

ID (Char)	ZONE (Char)	DEMAND (gpm)	ELEVATION (Real)	PRESSURE (psi)
V_2852	Low	0	3,884.11	103.91
V_2854	Low	0	3,884.00	103.93
V_2855	Low	0	3,884.00	103.93
V_2857	Low	0	3,884.00	103.93
V_3004	Telshor	0	4,061.27	103.94
N-1	Low	0	3,884.00	104.21
N-125	Low	0	3,884.00	104.22
V_349	N Intermediate	0	3,920.00	104.38
N-8	Low	0	3,883.00	104.63
V_1461	Low	0	3,892.61	104.77
N-2	Low	0	3,885.00	104.84
V_J-276	Low	0	3,882.00	105.04
V_4166	Low	0	3,882.00	105.05
V_J-283	Low	0	3,882.00	105.06
1108	Low	0	3,882.00	105.32
V_J-309	Low	0	3,880.00	105.67
WELL54	Jornada	0	4,108.67	105.82
V_J-212	Low	0	3,880.54	105.84
V_J-222	Low	0	3,880.16	105.85
E_2211	Zone 1	0	4,224.05	105.89
V_J-217	Low	0	3,880.00	105.92
V_J-220	Low	0	3,880.00	105.92
V_J-290	Low	0	3,880.00	105.92
V_J-298	Low	0	3,880.00	105.92
HP2	Zone 1	0	4,266.57	106.11
V_3006	Telshor	0	4,056.19	106.12
E_3943	Zone 1	0	4,249.19	106.39
E_413	Zone 1	0	4,267.22	106.53
E_3157	Zone 1	0	4,223.30	106.54
E_3162	Zone 1	0	4,225.98	106.9
WELL30	Low	0	3,876.82	107.27
V_3003	Telshor	0	4,052.95	107.54
E_3946	Zone 1	0	4,239.11	107.6
E_909	Zone 1	0	4,265.53	107.89
E_515	Zone 1	0	4,264.00	107.99
V_3002	Telshor	0	4,050.85	108.45
W_5005	W Mesa	0	4,206.00	108.71
E_J-161	Zone 1	0	4,244.00	108.78
E_522	Zone 1	0	4,259.63	110.44
HP8	Telshor	0	4,046.00	110.56
HF2	Zone 1	0	4,255.73	110.82
E_908	Zone 1	0	4,258.00	111.15
N-51	Zone 1	0	4,258.00	111.26
E_521	Zone 1	0	4,256.48	111.81
V_1457	Telshor	0	4,043.03	112.01
N-54	Zone 1	0	4,256.00	112.01
E_3117	Zone 1	0	4,243.80	112.36

Tabel C-4 Existing System No Demand Junction with Pressure > 100 psi

ID (Char)	ZONE (Char)	DEMAND (gpm)	ELEVATION (Real)	PRESSURE (psi)
E_3161	Zone 1	0	4,210.79	113.48
E_J-166	Zone 1	0	4,234.46	113.51
HF8	Telshor	0	4,039.00	113.59
E_J-_62	Zone 1	0	4,218.00	114.76
W_325	W Mesa	0	4,192.00	114.78
W_326	W Mesa	0	4,192.00	114.78
V_355	Telshor	0	4,036.00	114.9
V_1458	Telshor	0	4,034.66	115.64
E_516	Zone 1	0	4,244.06	116.72
E_520	Zone 1	0	4,237.69	119.9
E_517	Zone 1	0	4,233.67	121.35
E_519	Zone 1	0	4,225.26	125.23
E_518	Zone 1	0	4,206.00	133.51
N-106	W Mesa	0	3,889.00	147.64
W_5006	W Mesa	0	4,202.00	167.72
W_321	W Mesa	0	4,194.00	173.01

Table C-5 Future System Pipe Velocity > 5 ft/s

ID	ZONE	PHASE	LENGTH (ft)	DIAMETER (in)	FROM	TO	VELOCITY (ft/s)	OUTPUT: HL_1000 (ft/kft)
V_4010	Low	existing	87	8	TUG	V_3010	17.63	163.34
F-282	Telshor	future	69	8	F-PUG4	V_3011	11.87	57.62
W_208	Airport	existing	15	8	BWM1	W_321	9.48	358.2
V_948	Low	existing	825	6	V_67	V_914	9.14	58.37
F-21	Jornada	future	32.57	8	F-BLV3	E_901	6.74	287.95
F-3	High	future	21.12	8	E_902	F-BLV3	6.74	434.54
E_1022	Jornada	existing	32.57	8	BLV1	E_901	6.74	287.95
E_1021	High	existing	21.12	8	E_902	BLV1	6.74	434.54
E_1004	Zone 1	existing	3	6	BJ12	E_903	6.57	2,814.62
E_1001	Jornada	existing	3	6	E_904	BJ11	6.57	2,814.62
E_1002	Zone 1	existing	3	6	BJ11	E_903	6.57	2,814.62
E_1003	Jornada	existing	3	6	E_904	BJ12	6.57	2,814.62
N-106	Low Mesa	existing	136	12	WP46	N-104	6.54	26.51
W_1521	Low Mesa	existing	0.5	12	R46	WP46	6.54	11.72
W_P-15	Low Mesa	existing	4,621.74	12	N-104	W_J-2	6.54	12.34
V_2678	Low	existing	180	10	WP59	V_1461	6.51	19.88
W_P-_9	Low Mesa	existing	83	14	WP63	W_J-3	6.42	30.8
W_WR63	Low Mesa	existing	0.5	14	R63	WP63	6.42	9.77
F-275	Low Mesa	existing	13	30	W_J-2	F-VWL	6.31	75.12
F-53	Low Mesa	future	20	14	F-R64	F-WP64	6.27	9.19
F-51	Low Mesa	future	20	14	F-R49	F-WP49	6.26	9.17
F-50	Low Mesa	future	20	14	F-WP48	F-J31	6.25	9.13
E_708	Jornada	existing	122.58	12	E_901	E_905	5.99	11.99
N-W71	Low	existing	1	14	R71	WP71	5.97	8.3
N-7	Low	existing	150	14	WP71	N-5	5.97	8.39
F-264	Jornada	future	10	12	F-PTS9	N-57	5.78	8.3
F-262	Telshor	future	10	12	N-56	F-PTS9	5.78	8.25

Table C-5 Future System Pipe Velocity > 5 ft/s								
ID	ZONE	PHASE	LENGTH (ft)	DIAMETER (in)	FROM	TO	VELOCITY (ft/s)	OUTPUT: HL_1000 (ft/kft)
V_4012	Telshor	existing	69	8	BUG1	V_3011	5.76	20.56
V_4011	Low	existing	74	8	V_3010	BUG1	5.76	20.57
V_2698	Low	existing	150	10	WP58	V_1451	5.64	12.97
V_WR65	Low	existing	0.5	12	R65	WP65	5.49	8.79
F-98	Low	future	15.46	16	TUG	F-J22	5.49	6.16
V_4168	Low	existing	157	12	WP65	V_4169	5.49	8.61
F-171	Zone 1	future	62.73	14	F-TS1N	F-J127	5.36	6.89
E_4122	Zone 1	existing	2,286.00	18	E_3117	N-26	5.3	4.37
F-281	Low	future	68	12	V_3010	F-PUG4	5.28	8
W_P-13	Low Mesa	existing	13	30	W_J-3	W_J-2	5.26	52.36
BTD	Zone 1	existing	3	6	BTS3	E_908	5.23	28.65
BTU	Telshor	existing	3	6	E_907	BTS3	5.23	28.65
N-W70	Low	existing	1	16	R70	WP70	5.22	5.62
N-2	Low	existing	450	16	WP70	N-2	5.22	5.6
V_431	C Intermediate	existing	10	8	V_66	V_323	5.16	14.31
V_81	C Intermediate	existing	120	8	V_323	VDM	5.15	14.25
V_L81	Low	existing	1	8	VDM	V_67	5.15	14.16
F-93	Jornada	existing	22	12	F-J134	F-BJ14	5.09	58.7
F-174	Zone 1	existing	20	12	F-BJ14	F-J138	5.09	259.03
F-258	Low	future	56.86	12	F-J22	F-PUG3	5.02	7.28
F-259	Jornada	future	41.62	12	F-PUG3	F-J23	5.02	7.29

Table C-6 Future System No Demand Junctions with Pressure > 100 psi					
ID	ZONE	ELEVATION (ft)	PHASE	DEMAND (gpm)	PRESSURE (psi)
F-J55	Airport	4,270.00	existing	0	132.22
W_5006	Airport	4,202.00	existing	0	162.8
W_321	Airport	4,194.00	existing	0	167.79
F-J50	East Airport	4,218.00	existing	0	104.65
W_5005	East Airport	4,206.00	existing	0	109.87
W_325	East Airport	4,192.00	existing	0	116.89
W_326	East Airport	4,192.00	existing	0	116.89
V_31	High	4,007.66	existing	0	102.07
E_J-_21	Jornada	4,132.00	existing	0	100.25
E_233	Jornada	4,140.42	existing	0	102.71
E_J-154	Jornada	4,118.00	existing	0	105.76
E_232	Jornada	4,130.00	existing	0	107.21
E_229	Jornada	4,125.18	existing	0	109.21
E_230	Jornada	4,123.88	existing	0	109.79
E_228	Jornada	4,116.34	existing	0	113.04
WELL54	Jornada	4,108.67	existing	0	115.81
F-J51	Jornada	4,148.00	future	0	100.91
F-J35	Jornada	4,108.00	future	0	120.66
F-J30	Jornada	4,097.00	future	0	125.94
F-J498	Jornada	4,089.00	future	0	132.97
F-J29	Jornada	4,080.00	future	0	134.04

Table C-6 Future System No Demand Junctions with Pressure > 100 psi

ID	ZONE	ELEVATION (ft)	PHASE	DEMAND (gpm)	PRESSURE (psi)
F-J28	Jornada	4,069.00	future	0	140.26
F-J23	Jornada	4,066.00	future	0	141.85
HF13	Low	3,895.79	existing	0	100.14
V_2869	Low	3,890.00	existing	0	100.83
V_J-_11	Low	3,890.00	existing	0	100.84
V_J-_10	Low	3,889.66	existing	0	100.98
HP13	Low	3,894.00	existing	0	101.17
V_1418	Low	3,891.90	existing	0	101.37
V_J-372	Low	3,884.00	existing	0	101.37
1103	Low	3,897.00	existing	0	101.56
V_1023	Low	3,891.00	existing	0	101.65
1004	Low	3,896.00	existing	0	101.83
1102	Low	3,896.00	existing	0	101.85
HF14	Low	3,892.42	existing	0	102.21
1009	Low	3,894.00	existing	0	102.37
V_J-309	Low	3,880.00	existing	0	102.44
1003	Low	3,894.00	existing	0	102.53
N-125	Low	3,884.00	existing	0	102.68
N-1	Low	3,884.00	existing	0	102.68
V_343	Low	3,890.00	existing	0	102.83
HP14	Low	3,890.00	existing	0	103.09
N-8	Low	3,883.00	existing	0	103.11
1000	Low	3,891.00	existing	0	103.2
V_J-276	Low	3,882.00	existing	0	103.44
V_J-283	Low	3,882.00	existing	0	103.54
V_2852	Low	3,884.11	existing	0	103.56
V_2854	Low	3,884.00	existing	0	103.59
V_2855	Low	3,884.00	existing	0	103.59
V_2857	Low	3,884.00	existing	0	103.59
1001	Low	3,890.00	existing	0	103.81
V_271	Low	3,890.00	existing	0	103.82
V_3910	Low	3,890.76	existing	0	104.11
V_269	Low	3,888.00	existing	0	104.35
V_J-222	Low	3,880.16	existing	0	104.35
V_J-220	Low	3,880.00	existing	0	104.42
V_J-298	Low	3,880.00	existing	0	104.42
V_J-290	Low	3,880.00	existing	0	104.43
V_J-217	Low	3,880.00	existing	0	104.45
V_3073	Low	3,888.00	existing	0	104.62
V_J-212	Low	3,880.54	existing	0	104.62
V_3915	Low	3,890.00	existing	0	104.66
1108	Low	3,882.00	existing	0	104.74
1007	Low	3,892.00	existing	0	104.77
N-2	Low	3,885.00	existing	0	105.07
V_3072	Low	3,887.15	existing	0	105.09
1005	Low	3,890.00	existing	0	105.09
V_1439	Low	3,892.00	existing	0	105.15

Table C-6 Future System No Demand Junctions with Pressure > 100 psi

ID	ZONE	ELEVATION (ft)	PHASE	DEMAND (gpm)	PRESSURE (psi)
V_4166	Low	3,882.00	existing	0	105.35
V_3911	Low	3,888.00	existing	0	105.39
V_350	Low	3,886.43	existing	0	105.45
N-5	Low	3,890.00	existing	0	105.6
1100	Low	3,890.00	existing	0	105.61
1008	Low	3,890.00	existing	0	105.8
WELL30	Low	3,876.82	existing	0	105.83
V_1461	Low	3,892.61	existing	0	106.41
F-J698	Low	3,892.00	existing	0	115.13
F-J568	Low	3,892.00	existing	0	115.85
N-106	Low	3,889.00	existing	0	127.92
F-J69	Low	3,882.00	future	0	100.07
F-J122	Low	3,886.00	future	0	100.64
F-J60	Low	3,884.00	future	0	100.73
F-J67	Low	3,878.00	future	0	102.07
F-J68	Low	3,878.00	future	0	102.28
F-J61	Low	3,880.00	future	0	102.49
F-J84	Low	3,895.00	future	0	103.12
F-J83	Low	3,894.00	future	0	103.52
F-J65	Low	3,874.00	future	0	103.74
F-J54	Low	3,874.00	future	0	104.06
F-J48	Low	3,876.00	future	0	104.28
F-J85	Low	3,890.00	future	0	105.4
F-J64	Low	3,868.00	future	0	106.35
F-J82	Low	3,886.00	future	0	106.55
F-J365	Low	3,886.00	future	0	107.96
F-J354	Low	3,890.00	future	0	114.94
F-J466	Low	3,895.51	future	0	116.41
F-J44	Low	3,890.00	future	0	125.91
F-J43	Low	3,890.00	future	0	126.8
V_349	N Intermediate	3,920.00	existing	0	104.01
N-31	Telshor	4,078.00	existing	0	100.73
V_146	Telshor	4,082.23	existing	0	102.86
V_3011	Telshor	4,084.07	existing	0	102.92
V_510S	Telshor	4,082.00	existing	0	103.58
V_420	Telshor	4,076.45	existing	0	105.98
V_470	Telshor	4,076.00	existing	0	106.17
V_440	Telshor	4,075.98	existing	0	106.18
V_430	Telshor	4,074.00	existing	0	107.04
V_3004	Telshor	4,061.27	existing	0	107.26
V_450	Telshor	4,072.96	existing	0	107.49
V_3006	Telshor	4,056.19	existing	0	109.23
V_3012	Telshor	4,066.00	existing	0	110.43
V_145	Telshor	4,065.42	existing	0	110.82
V_3003	Telshor	4,052.95	existing	0	110.87
V_3002	Telshor	4,050.85	existing	0	111.78

Table C-6 Future System No Demand Junctions with Pressure > 100 psi

ID	ZONE	ELEVATION (ft)	PHASE	DEMAND (gpm)	PRESSURE (psi)
HP8	Telshor	4,046.00	existing	0	114.1
HF8	Telshor	4,039.00	existing	0	117.13
V_1457	Telshor	4,043.03	existing	0	117.19
V_355	Telshor	4,036.00	existing	0	118.45
V_1458	Telshor	4,034.66	existing	0	120.81
F-J95	Telshor	4,055.00	future	0	109.57
E_J-161	Zone 1	4,244.00	existing	0	100.42
E_522	Zone 1	4,259.63	existing	0	100.92
E_3946	Zone 1	4,239.11	existing	0	101.41
N-51	Zone 1	4,258.00	existing	0	101.7
E_908	Zone 1	4,258.00	existing	0	101.73
E_521	Zone 1	4,256.48	existing	0	102.22
N-54	Zone 1	4,256.00	existing	0	102.42
E_J-166	Zone 1	4,234.46	existing	0	104.76
E_3162	Zone 1	4,225.98	existing	0	105.09
E_2211	Zone 1	4,224.05	existing	0	105.23
E_3157	Zone 1	4,223.30	existing	0	105.69
E_J-_62	Zone 1	4,218.00	existing	0	109.87
E_520	Zone 1	4,237.69	existing	0	110.2
E_3161	Zone 1	4,210.79	existing	0	111.67
E_519	Zone 1	4,225.26	existing	0	115.38
E_518	Zone 1	4,206.00	existing	0	123.49
F-J132	Zone 2	4,370.00	future	0	105.36

Table C-7 Future System Maximum Day No Demand Junctions with Pressure < 40 psi

ID	ZONE	ELEVATION (ft)	PHASE	DEMAND (gpm)	PRESSURE (psi)
W_328	East Airport	4,430.00	existing	0	11.66
W_327	East Airport	4,416.00	existing	0	18.71
E_902	High	4,204.00	existing	0	14.86
E_906	High	4,204.00	existing	0	14.92
V_334	High	4,198.19	existing	0	18.19
V_1456	High	4,162.00	existing	0	34.28
E_904	Jornada	4,328.00	existing	0	10.65
E_328	Jornada	4,328.00	existing	0	11.14
N-121	Jornada	4,310.00	existing	0	18.62
N-103	Jornada	4,310.00	existing	0	18.74
E_327	Jornada	4,304.96	existing	0	21.85
E_326	Jornada	4,303.29	existing	0	23.58
E_325	Jornada	4,304.00	existing	0	24.55
N-20	Jornada	4,295.00	existing	0	24.95
E_324	Jornada	4,302.00	existing	0	26.5
E_323	Jornada	4,300.69	existing	0	28.1
E_319	Jornada	4,300.60	existing	0	29.14
E_321	Jornada	4,300.00	existing	0	29.23

Table C-7 Future System Maximum Day No Demand Junctions with Pressure < 40 psi

ID	ZONE	ELEVATION (ft)	PHASE	DEMAND (gpm)	PRESSURE (psi)
E_320	Jornada	4,298.00	existing	0	30.15
E_322	Jornada	4,296.24	existing	0	30.76
E_318	Jornada	4,296.00	existing	0	31.23
N-10	Jornada	4,280.00	existing	0	32.61
E_3020	Jornada	4,284.03	existing	0	36.81
N-57	Jornada	4,274.00	existing	0	39.9
F-J134	Jornada	4,328.00	future	0	11.12
F-J87	Low	4,194.00	existing	0	0.96
V_3010	Low	4,084.00	existing	0	7.3
V_336	Low	4,085.06	existing	0	12.98
V_3015	Low	4,084.09	existing	0	13.39
V_335	Low	4,086.00	existing	0	14.3
V_3050	Low	4,083.35	existing	0	15.82
V_135	Low	4,077.18	existing	0	16.39
V_337	Low	4,081.66	existing	0	16.61
V_312	Low	4,078.31	existing	0	18.06
N-30	Low	4,078.00	existing	0	18.15
V_211	Low	4,068.00	existing	0	22.53
V_133	Low	4,057.81	existing	0	25.14
WELL34	Low	4,061.11	existing	0	25.52
V_127	Low	4,073.25	existing	0	25.94
V_128	Low	4,074.00	existing	0	25.95
V_3900	Low	4,070.17	existing	0	27.21
V_131	Low	4,079.45	existing	0	27.7
V_50	Low	4,054.00	existing	0	28.62
V_51	Low	4,054.00	existing	0	28.62
V_221	Low	4,062.33	existing	0	28.78
V_123	Low	4,046.00	existing	0	30.36
V_126	Low	4,051.80	existing	0	35.21
V_130	Low	4,062.00	existing	0	35.21
F-J80	Low	4,110.00	existing	0	36.36
V_209	Low	4,035.84	existing	0	37.29
WELL18	Low	4,026.00	existing	0	39.03
F-J22	Low	4,066.00	future	0	21.19
W_J-2	Low Mesa	4,194.00	existing	0	13.3
W_320	Low Mesa	4,194.00	existing	0	13.6
W_J-3	Low Mesa	4,194.00	existing	0	13.6
N-104	Low Mesa	4,194.00	existing	0	38.01
F-J211	Low Mesa	4,200.00	future	0	13.16
F-J31	Low Mesa	4,206.00	future	0	16
F-J32	Low Mesa	4,126.00	future	0	39.28
N-56	Telshor	4,274.00	existing	0	11.73
N-55	Telshor	4,274.00	existing	0	11.78
E_907	Telshor	4,268.68	existing	0	14.3
N-910	Telshor	4,264.00	existing	0	16.4
N-50	Telshor	4,258.00	existing	0	18.89

Table C-7 Future System Maximum Day No Demand Junctions with Pressure < 40 psi

ID	ZONE	ELEVATION (ft)	PHASE	DEMAND (gpm)	PRESSURE (psi)
V_179	Telshor	4,254.30	existing	0	21.2
N-43	Telshor	4,235.00	existing	0	29.12
E_3132	Zone 1	4,478.67	existing	0	-4.1
E_3130	Zone 1	4,478.59	existing	0	-4.07
E_2101	Zone 1	4,424.59	existing	0	19.2
E_J-158	Zone 1	4,420.24	existing	0	21.43
E_2100	Zone 1	4,416.00	existing	0	22.94
E_721	Zone 1	4,413.71	existing	0	23.18
E_720	Zone 1	4,408.00	existing	0	25.74
E_719	Zone 1	4,400.00	existing	0	29.25
E_718	Zone 1	4,397.76	existing	0	30.27
E_716	Zone 1	4,389.33	existing	0	34.05
E_717	Zone 1	4,388.00	existing	0	34.58
E_2104	Zone 1	4,387.05	existing	0	35.39
E_2103	Zone 1	4,386.00	existing	0	35.86
N-126	Zone 1	4,386.00	existing	0	35.86
E_3158	Zone 1	4,380.66	existing	0	38.05
E_J-156	Zone 1	4,380.00	existing	0	38.47
E_715	Zone 1	4,377.98	existing	0	39.12
E_2102	Zone 1	4,378.00	existing	0	39.35
F-J127	Zone 1	4,434.00	future	0	14.11
F-J12	Zone 1	4,403.00	future	0	31.77
E_3080	Zone 2	4,558.00	existing	0	11.22
E_3082	Zone 2	4,520.00	existing	0	28.01
F-J150	Zone 2	4,559.00	future	0	10.61
F-J144	Zone 2	4,551.00	future	0	13.82
F-J7	Zone 2	4,556.00	future	0	14.74
F-J6	Zone 2	4,546.00	future	0	25.34

Table C-8 Future System Maximum Day Demand Junction with Pressure > 100 psi

ID	ZONE	ELEVATION (ft)	PHASE	DEMAND (gpm)	PRESSURE (psi)
V_1223	C Intermediate	3,959.31	existing	8.85	100.75
V_1225	C Intermediate	3,956.10	existing	10.17	102.14
V_1233	C Intermediate	3,958.31	existing	8.77	101.18
V_1235	C Intermediate	3,960.00	existing	3.72	100.45
V_362	High	4,007.39	existing	16.36	102.26
V_39	High	3,998.08	existing	25.96	106.12
E_2236	Jornada	4,124.00	existing	15.96	103.66
E_2237	Jornada	4,132.00	existing	15.36	100.19
E_2247	Jornada	4,118.00	existing	3.72	106.27
E_225	Jornada	4,126.00	existing	7	102.88
E_2253	Jornada	4,129.54	existing	10.45	101.3
E_2255	Jornada	4,129.68	existing	2	101.22
E_2256	Jornada	4,130.10	existing	6.12	101.06
E_2265	Jornada	4,131.58	existing	12	100.42
E_2267	Jornada	4,129.47	existing	1.27	101.34

Table C-8 Future System Maximum Day Demand Junction with Pressure > 100 psi					
ID	ZONE	ELEVATION (ft)	PHASE	DEMAND (gpm)	PRESSURE (psi)
E_2268	Jornada	4,128.61	existing	9.84	101.71
E_231	Jornada	4,133.57	existing	2.06	105.61
E_236	Jornada	4,146.00	existing	3.95	101.5
E_245	Jornada	4,142.41	existing	7.46	101.24
E_247	Jornada	4,138.00	existing	6.19	103.1
E_330	Jornada	4,125.43	existing	1.56	109.1
E_J-_87	Jornada	4,144.00	existing	10.17	100.33
F-J46	Low	3,880.00	future	50.88	102.66
F-J47	Low	3,878.00	future	17.88	103.47
F-J49	Low	3,875.00	future	43.66	104.68
F-J52	Low	3,878.00	future	80.04	102.9
F-J53	Low	3,864.00	future	283	108.4
F-J56	Low	3,878.00	future	60	102.33
F-J57	Low	3,882.00	future	26.36	101.72
F-J59	Low	3,882.00	future	0.88	102.81
F-J63	Low	3,878.00	future	43.06	102.16
F-J66	Low	3,878.00	future	331.04	101.99
F-J70	Low	3,876.00	future	2.64	102.27
F-J71	Low	3,872.00	future	41.78	103.85
F-J72	Low	3,872.00	future	60	103.52
F-J73	Low	3,876.00	future	27.84	101.61
F-J79	Low	3,891.00	future	25.48	103.78
F-J81	Low	3,886.00	future	12.3	106.47
F-J86	Low	3,886.00	future	21.4	106.54
V_1363	Low	3,892.06	existing	7.98	100.17
V_1364	Low	3,892.00	existing	14.64	100.05
V_1365	Low	3,892.00	existing	14.72	100.39
V_1393	Low	3,886.00	existing	41.96	102.42
V_1394	Low	3,884.81	existing	0.28	102.94
V_1395	Low	3,888.40	existing	66.36	101.39
V_1396	Low	3,888.00	existing	21.55	101.59
V_1399	Low	3,890.00	existing	8.46	100.86
V_1402	Low	3,890.00	existing	12.53	100.86
V_1416	Low	3,890.00	existing	10.06	100.94
V_1417	Low	3,888.00	existing	36.65	103.5
V_1419	Low	3,890.07	existing	9.98	102.54
V_1420	Low	3,891.41	existing	8.04	101.78
V_1421	Low	3,890.14	existing	5.52	102.25
V_1422	Low	3,890.57	existing	8.32	102.08
V_1423	Low	3,891.81	existing	6.65	101.59
V_1424	Low	3,892.00	existing	6.46	101.51
V_1425	Low	3,893.35	existing	21.19	100.95
V_1426	Low	3,891.30	existing	4.54	101.77
V_1427	Low	3,892.00	existing	0.52	101.46
V_1428	Low	3,892.00	existing	0.35	101.54
V_1429	Low	3,893.22	existing	9.22	101.2
V_1430	Low	3,892.00	existing	10.3	102.6

Table C-8 Future System Maximum Day Demand Junction with Pressure > 100 psi					
ID	ZONE	ELEVATION (ft)	PHASE	DEMAND (gpm)	PRESSURE (psi)
V_1431	Low	3,890.00	existing	32.93	101.06
V_1432	Low	3,892.00	existing	1.01	100.1
V_1433	Low	3,891.45	existing	15.79	103.01
V_1434	Low	3,892.00	existing	20.19	102.95
V_1435	Low	3,892.00	existing	8.39	102.98
V_1437	Low	3,896.00	existing	7.03	102.56
V_1440	Low	3,892.00	existing	43.29	104.3
V_1441	Low	3,896.00	existing	0.53	103.85
V_1442	Low	3,894.00	existing	22.14	102.31
V_1443	Low	3,893.35	existing	8.72	101.61
V_1444	Low	3,880.00	existing	49.92	105.36
V_1445	Low	3,885.19	existing	0.64	102.6
V_1446	Low	3,878.06	existing	10.02	105.38
V_1447	Low	3,881.75	existing	30.87	104.02
V_1448	Low	3,880.43	existing	19.76	104.47
V_1449	Low	3,885.01	existing	59.76	102.46
V_1450	Low	3,882.00	existing	5.78	103.88
V_1451	Low	3,882.60	existing	48.37	108.58
V_176	Low	3,890.00	existing	4.1	102.28
V_177	Low	3,890.00	existing	39.72	102.3
V_251	Low	3,884.29	existing	14.97	103.3
V_252	Low	3,887.81	existing	57.81	101.66
V_253	Low	3,888.00	existing	117.78	101.54
V_254	Low	3,882.35	existing	38.58	104.14
V_255	Low	3,882.00	existing	0.47	106.02
V_256	Low	3,882.00	existing	4.17	104.53
V_257	Low	3,879.61	existing	3.03	105.51
V_258	Low	3,882.00	existing	0.14	104.61
V_260	Low	3,888.27	existing	20.17	101.58
V_262	Low	3,892.00	existing	18.17	100.05
V_263	Low	3,892.00	existing	5.82	100.06
V_264	Low	3,892.00	existing	19.98	100.11
V_265	Low	3,892.00	existing	8.36	100.22
V_266	Low	3,892.00	existing	33.95	100.6
V_267	Low	3,890.40	existing	83.34	101.13
V_268	Low	3,890.00	existing	1.28	102.56
V_270	Low	3,890.00	existing	1.99	103.82
V_272	Low	3,892.00	existing	51.11	102.77
V_273	Low	3,890.00	existing	37.16	103.92
V_274	Low	3,891.54	existing	17.73	103.26
V_275	Low	3,892.00	existing	53	103.51
V_277	Low	3,896.00	existing	9.95	101.55
V_278	Low	3,894.00	existing	5.14	100.49
V_280	Low	3,890.92	existing	6.26	101.98
V_281	Low	3,890.00	existing	224.04	102.24
V_282	Low	3,892.00	existing	4.43	102.37
V_284	Low	3,890.88	existing	8.15	101.27

Table C-8 Future System Maximum Day Demand Junction with Pressure > 100 psi					
ID	ZONE	ELEVATION (ft)	PHASE	DEMAND (gpm)	PRESSURE (psi)
V_285	Low	3,890.00	existing	8.21	101.06
V_2850	Low	3,884.00	existing	0.04	103.66
V_2859	Low	3,884.00	existing	24.6	103.59
V_286	Low	3,888.00	existing	20.69	104.31
V_2860	Low	3,882.00	existing	0.7	104.46
V_2862	Low	3,883.53	existing	0.31	105.42
V_2863	Low	3,891.61	existing	1.5	101.93
V_2864	Low	3,884.00	existing	0.07	105.22
V_2865	Low	3,886.57	existing	0.36	102.25
V_2866	Low	3,886.00	existing	27.48	102.5
V_2867	Low	3,886.00	existing	45.73	102.48
V_2868	Low	3,890.00	existing	10.18	100.83
V_288	Low	3,882.06	existing	23.43	106.38
V_289	Low	3,886.00	existing	64.86	102.56
V_291	Low	3,886.02	existing	34.5	102.24
V_292	Low	3,881.50	existing	2.03	104.26
V_293	Low	3,880.00	existing	4.19	104.45
V_294	Low	3,880.00	existing	18.95	102.44
V_3040	Low	3,892.00	existing	10.8	102.46
V_3070	Low	3,888.14	existing	4.4	104.71
V_3071	Low	3,888.00	existing	14.27	104.73
V_3074	Low	3,886.44	existing	64.47	105.19
V_3075	Low	3,886.55	existing	0.16	102.19
V_3077	Low	3,885.94	existing	5.37	102.45
V_3078	Low	3,886.00	existing	29.38	102.42
V_311	Low	3,890.86	existing	67.84	104.01
V_320	Low	3,886.00	existing	2.5	102.42
V_322	Low	3,878.00	existing	18.7	105.32
V_333	Low	3,887.60	existing	57.34	101.73
V_340	Low	3,882.00	existing	53.73	103.52
V_341	Low	3,883.98	existing	77.1	105.73
V_342	Low	3,893.78	existing	10.23	102.22
V_344	Low	3,892.96	existing	7.09	101.88
V_3886	Low	3,887.25	existing	13.27	101.88
V_3912	Low	3,887.24	existing	17.76	105.72
V_3913	Low	3,887.07	existing	4.55	105.79
V_3914	Low	3,888.00	existing	45.52	105.39
V_3916	Low	3,888.00	existing	1.77	105.46
V_3930	Low	3,884.00	existing	30.15	101.01
V_401	Low	3,892.00	existing	21.2	102.42
V_402	Low	3,894.00	existing	152.34	102.09
V_4160	Low	3,880.39	existing	16.31	106.06
V_4161	Low	3,882.00	existing	36.47	105.35
V_4162	Low	3,882.00	existing	16.68	104.74
V_4163	Low	3,880.00	existing	36.88	105.6
V_4164	Low	3,882.00	existing	23.04	105.35
V_4165	Low	3,882.00	existing	6.43	105.35

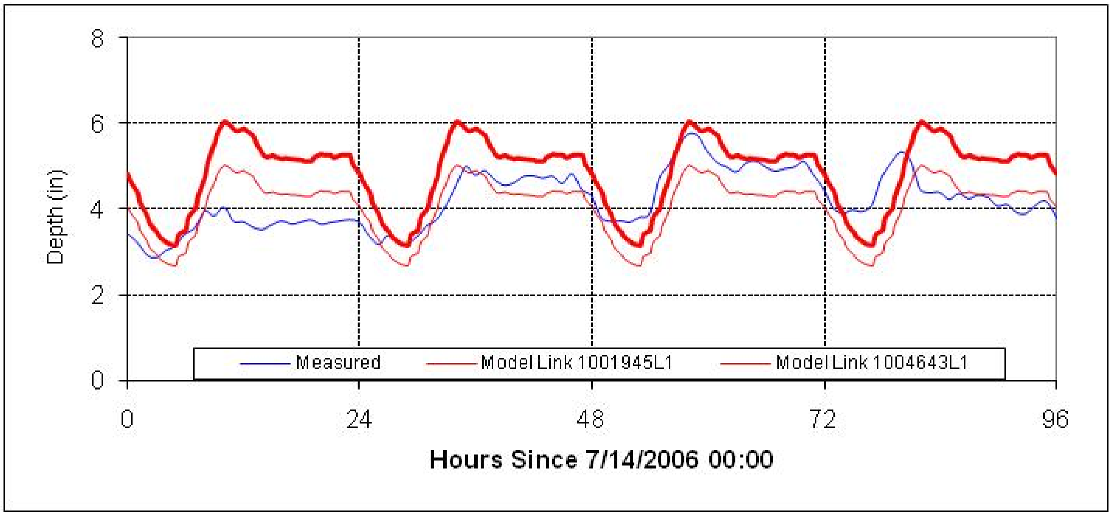
Table C-8 Future System Maximum Day Demand Junction with Pressure > 100 psi					
ID	ZONE	ELEVATION (ft)	PHASE	DEMAND (gpm)	PRESSURE (psi)
V_4167	Low	3,882.38	existing	2.36	104.89
V_4168	Low	3,886.00	existing	12.38	109.42
V_4169	Low	3,889.20	existing	0.09	109.88
V_4170	Low	3,888.16	existing	14.24	106.23
V_4171	Low	3,888.33	existing	5.93	106.16
V_4173	Low	3,894.00	existing	1.26	100.34
V_4174	Low	3,890.00	existing	78.33	102.22
V_540	Low	3,880.00	existing	10.42	101.83
V_541	Low	3,878.00	existing	8.8	102.05
V_542	Low	3,878.00	existing	17.59	101.86
V_543	Low	3,876.04	existing	43.07	101.48
V_544	Low	3,877.54	existing	9.03	102.52
V_545	Low	3,877.46	existing	12.73	102.28
V_673	Low	3,894.22	existing	9.22	104.52
V_674	Low	3,895.51	existing	47.55	103.65
V_704	Low	3,882.00	existing	17.65	106.67
V_705	Low	3,886.00	existing	16.75	105.81
V_708	Low	3,886.00	existing	91.74	104.95
V_710	Low	3,888.43	existing	8.78	101.24
V_711	Low	3,887.26	existing	168.42	101.75
V_927	Low	3,894.61	existing	4.9	100.31
V_928	Low	3,890.62	existing	2.65	101.98
V_929	Low	3,890.00	existing	26.17	100.87
V_930	Low	3,888.00	existing	4.48	101.61
V_935	Low	3,890.00	existing	5.55	102.31
V_98	Low	3,895.66	existing	34.63	100.03
V_J-__1	Low	3,894.73	existing	13.9	101.56
V_J-__8	Low	3,890.00	existing	19.52	100.84
V_J-__9	Low	3,890.69	existing	8.83	100.56
V_J-163	Low	3,890.00	existing	1.47	100.9
V_J-165	Low	3,890.41	existing	49.42	100.68
V_J-174	Low	3,890.33	existing	2.15	100.74
V_J-184	Low	3,888.00	existing	9.69	108.33
V_J-185	Low	3,880.00	existing	74.23	111.79
V_J-210	Low	3,885.83	existing	92.51	109.25
V_J-213	Low	3,879.98	existing	11.92	104.04
V_J-215	Low	3,881.87	existing	6.9	102.81
V_J-216	Low	3,880.68	existing	137.65	104.25
V_J-287	Low	3,880.83	existing	0.33	104.02
V_J-308	Low	3,882.00	existing	2.11	103.53
V_J-366	Low	3,891.08	existing	307.32	101.05
V_J-374	Low	3,890.00	existing	0.3	124.91
V_348	N Intermediate	3,912.00	existing	9.46	110.4
V_J-358	N Intermediate	3,914.00	existing	2.6	108.47
V_1463	Telshor	4,074.00	existing	13.07	101.99
V_1464	Telshor	4,033.82	existing	10.33	119.4
V_1465	Telshor	4,065.23	existing	19.1	105.85

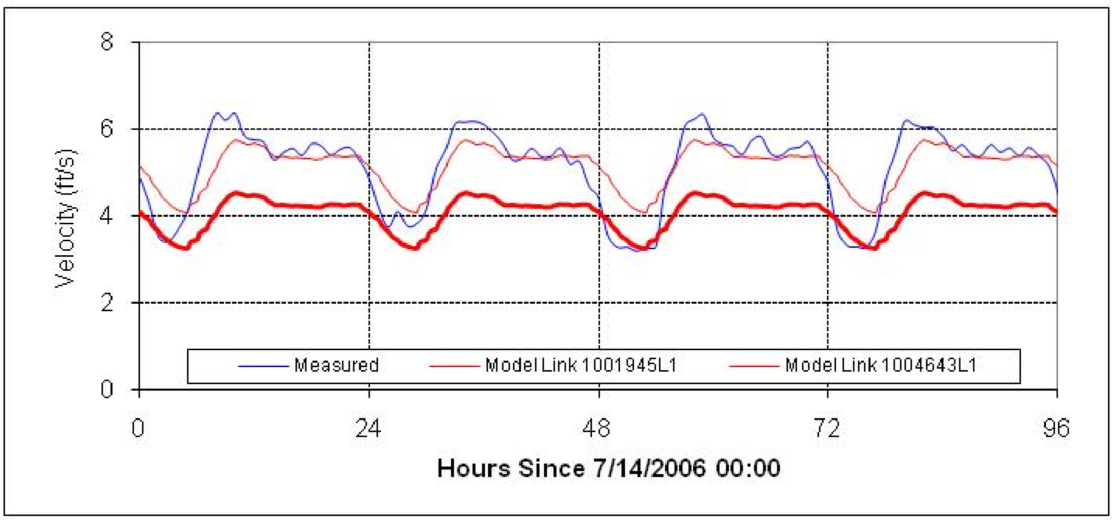
Table C-8 Future System Maximum Day Demand Junction with Pressure > 100 psi

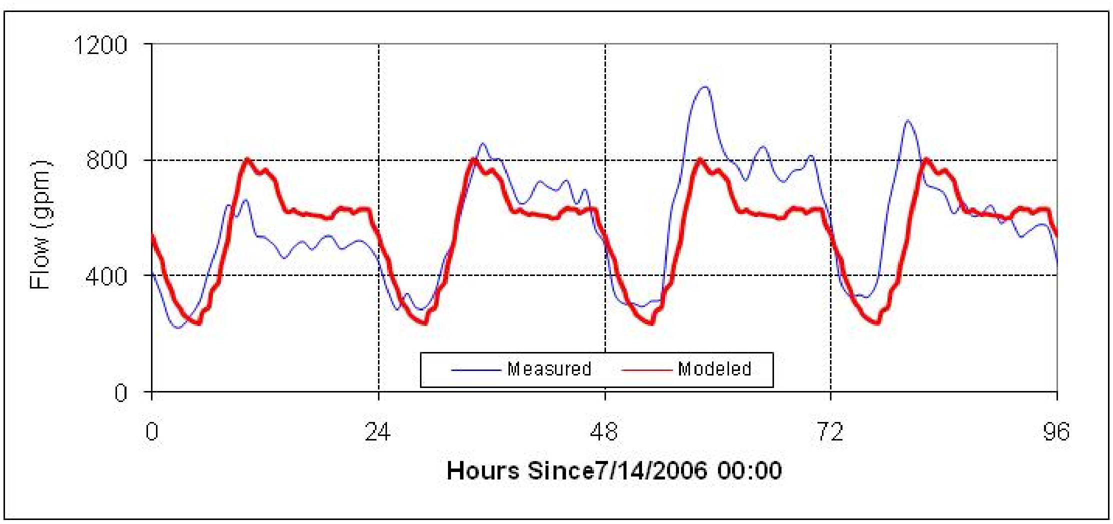
ID	ZONE	ELEVATION (ft)	PHASE	DEMAND (gpm)	PRESSURE (psi)
V_1466	Telshor	4,070.39	existing	11.12	103.57
V_1469	Telshor	4,082.00	existing	51.67	100.3
V_1500	Telshor	4,069.23	existing	3.61	103.89
V_1501	Telshor	4,060.00	existing	13.6	108.03
V_1502	Telshor	4,051.08	existing	5.77	111.9
V_1503	Telshor	4,046.00	existing	17.85	114.1
V_1504	Telshor	4,034.84	existing	6.61	118.94
V_1505	Telshor	4,042.70	existing	15.79	115.53
V_180	Telshor	4,051.03	existing	2.57	113.39
V_181	Telshor	4,056.00	existing	6.95	111.25
V_182	Telshor	4,075.81	existing	35.33	102.62
V_183	Telshor	4,072.00	existing	22.41	104.34
V_194	Telshor	4,037.69	existing	16.73	117.72
V_195	Telshor	4,031.50	existing	8.57	120.4
V_196	Telshor	4,064.00	existing	7.28	105.74
V_218	Telshor	4,066.50	existing	34.17	106.67
V_3000	Telshor	4,068.00	existing	184.99	104.35
V_3001	Telshor	4,066.69	existing	0.58	104.92
V_3005	Telshor	4,058.72	existing	75.36	108.13
V_360	Telshor	4,068.00	existing	5.48	109.68
V_370	Telshor	4,084.00	existing	6.46	102.74
V_390	Telshor	4,080.00	existing	15.8	104.45
V_400	Telshor	4,062.00	existing	5.12	112.25
V_410	Telshor	4,064.99	existing	24.36	110.95
V_460	Telshor	4,074.00	existing	23.3	107.04
V_J-214	Telshor	4,070.00	existing	13.06	108.83
E_110	Zone 1	4,244.51	existing	5.71	105.45
E_111	Zone 1	4,214.74	existing	14.55	118.35
E_112	Zone 1	4,252.00	existing	6.75	102.21
E_114	Zone 1	4,249.56	existing	22.56	103.31
E_115	Zone 1	4,224.00	existing	5.24	114.34
E_132	Zone 1	4,242.07	existing	1.82	106.51
E_133	Zone 1	4,241.50	existing	16.29	106.75
E_134	Zone 1	4,236.00	existing	4.95	109.14
E_205	Zone 1	4,229.66	existing	8.54	109.94
E_206	Zone 1	4,235.39	existing	5.29	107.46
E_207	Zone 1	4,232.25	existing	3.17	108.82
E_3041	Zone 1	4,237.22	existing	16.91	100.22
E_3051	Zone 1	4,234.90	existing	14.4	101.08
E_3054	Zone 1	4,233.24	existing	9.92	101.8
E_3159	Zone 1	4,234.38	existing	14.9	101.47
E_340	Zone 1	4,241.28	existing	6.88	104.89
E_350	Zone 1	4,241.90	existing	7.49	104.44
E_351	Zone 1	4,248.81	existing	10.37	101.54
E_354	Zone 1	4,219.76	existing	6.45	114.23
E_355	Zone 1	4,248.26	existing	2.81	101.88
E_358	Zone 1	4,244.00	existing	16.33	103.73

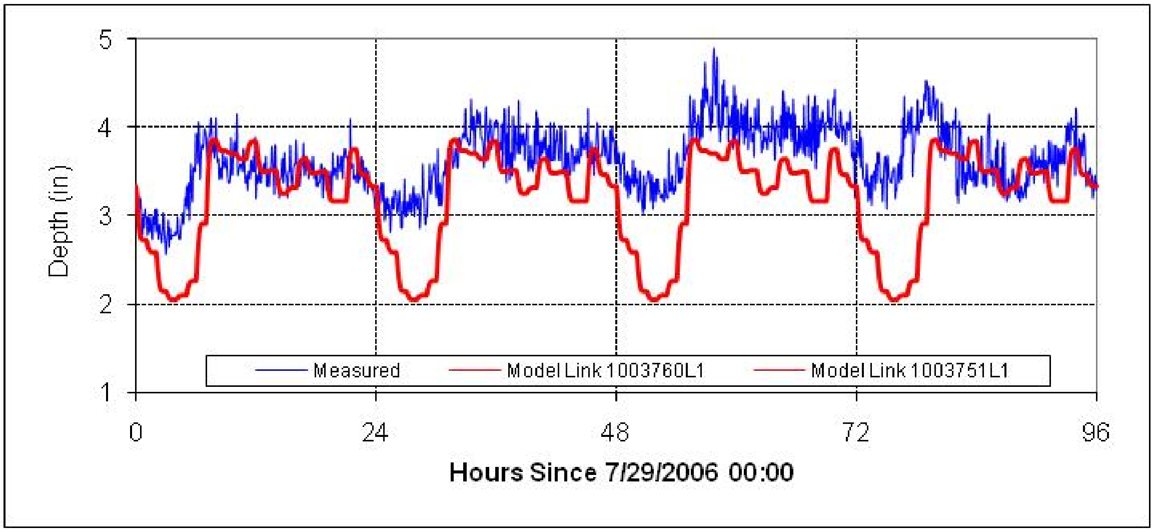
Table C-8 Future System Maximum Day Demand Junction with Pressure > 100 psi					
ID	ZONE	ELEVATION (ft)	PHASE	DEMAND (gpm)	PRESSURE (psi)
E_359	Zone 1	4,244.00	existing	11.78	103.74
E_360	Zone 1	4,247.65	existing	2.41	102.17
E_3939	Zone 1	4,232.49	existing	2.27	102.46
E_3941	Zone 1	4,224.17	existing	0.03	108.51
E_501	Zone 1	4,230.00	existing	10.2	109.7
E_502	Zone 1	4,248.93	existing	8.16	101.15
E_516	Zone 1	4,244.06	existing	7.32	106.01
E_517	Zone 1	4,233.67	existing	30.76	110.93
E_71	Zone 1	4,242.00	existing	8.7	106.54
E_72	Zone 1	4,226.88	existing	4.65	113.09
E_80	Zone 1	4,227.28	existing	3.68	110.97
E_913	Zone 1	4,220.24	existing	4.06	114.03
E_J-_42	Zone 1	4,229.93	existing	19.24	103.44
E_J-_44	Zone 1	4,227.49	existing	4.29	104.5
E_J-_61	Zone 1	4,236.76	existing	1.69	101.02
N-23	Zone 1	4,242.00	existing	9.06	108.5
E_2122	Zone 2	4,346.00	existing	9.01	102.56
E_2125	Zone 2	4,350.60	existing	10.33	100.56
E_2126	Zone 2	4,347.91	existing	6.37	101.73
E_2127	Zone 2	4,351.86	existing	3.17	100.02
E_J-__4	Zone 2	4,337.12	existing	0.63	106.45
F-J171	Zone 2	4,389.00	future	1.18	102.24

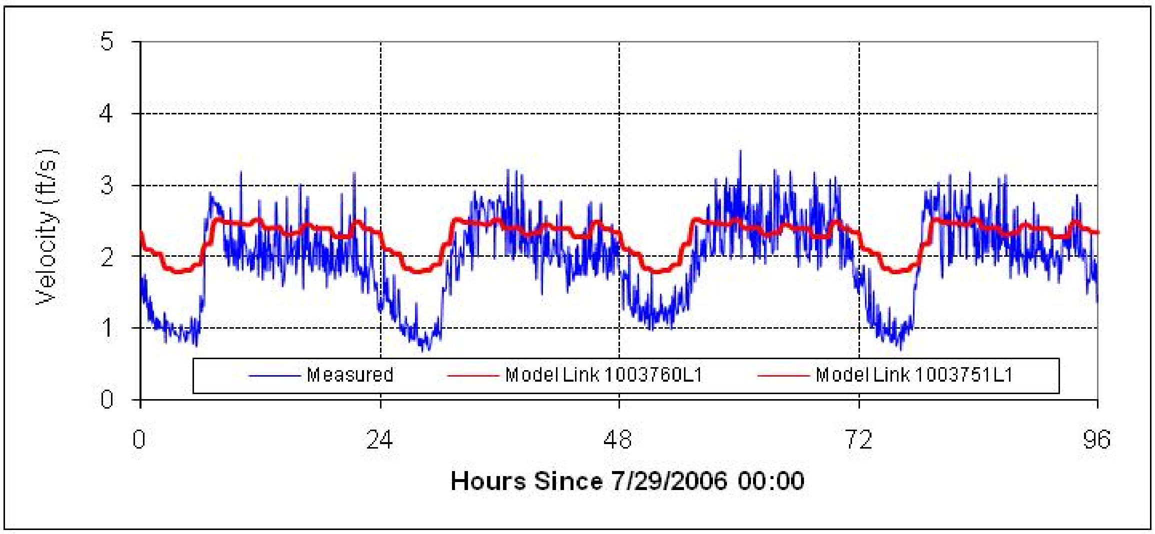
Appendix D – Calibration Graphs for the Wastewater Collection System

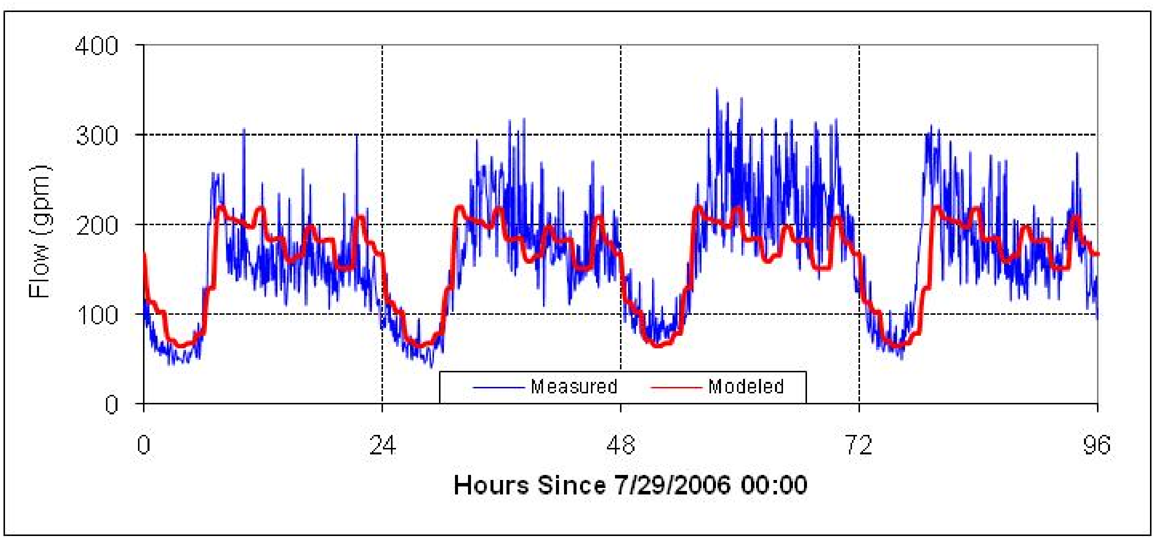


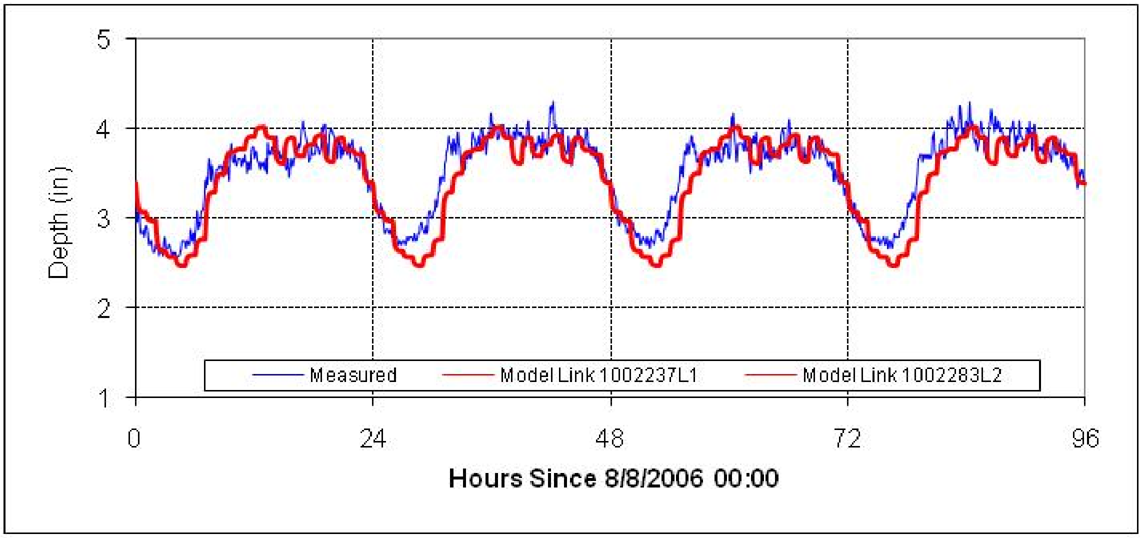




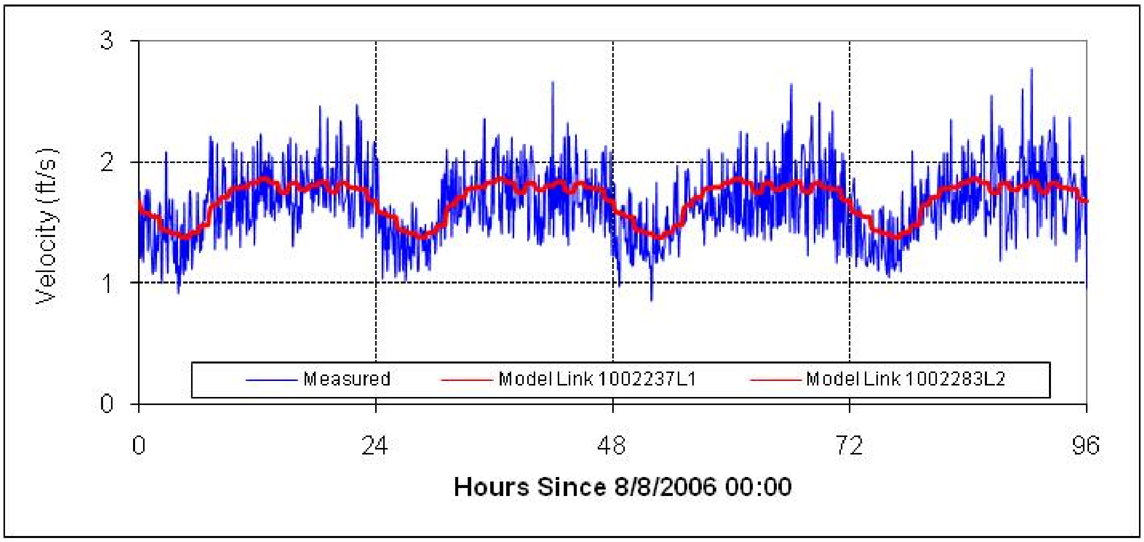

Depth (in)
5
4
3
2
1
Measured
Model Link 1003760L1
Model Link 1003751L1
0
24
48
72
96
Hours Since 7/29/2006 00:00


Velocity (ft/s)
5
4
3
2
1
0
Measured
Model Link 1003760L1
Model Link 1003751L1
0
24
48
72
96
Hours Since 7/29/2006 00:00

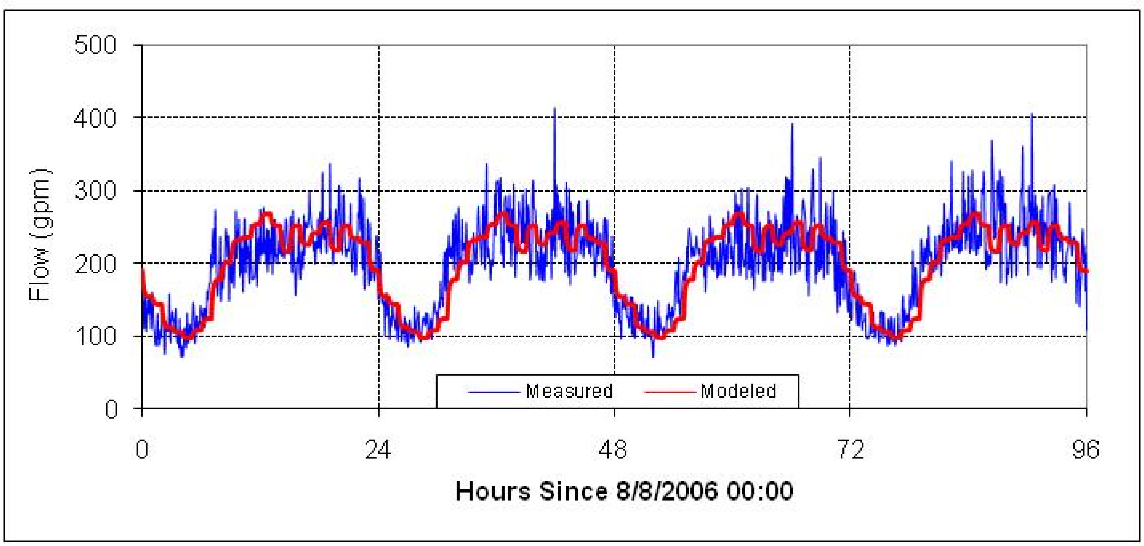

Flow (gpm)
400
300
200
100
0
Measured
Modeled
0
24
48
72
96
Hours Since 7/29/2006 00:00



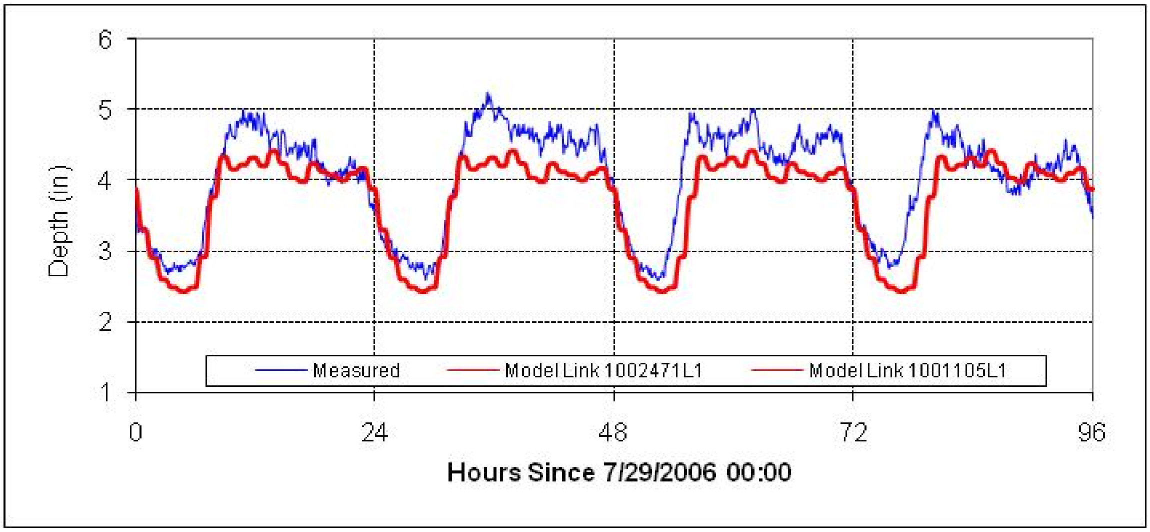
Depth (in)
5
4
3
2
1
0
24
48
72
96
Hours Since 8/8/2006 00:00
Measured
Model Link 1002237L1
Model Link 1002283L2

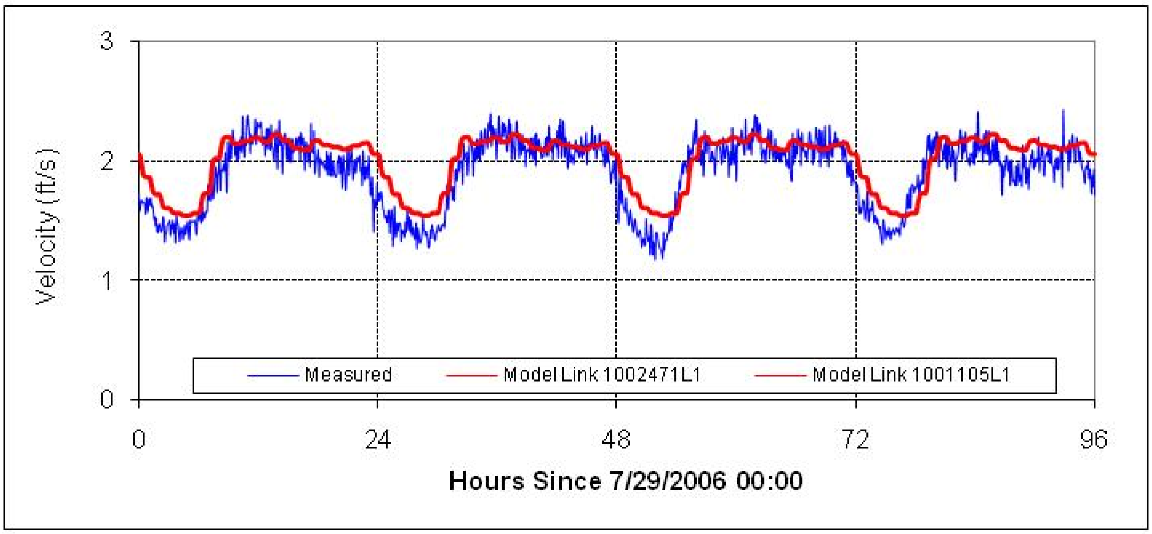


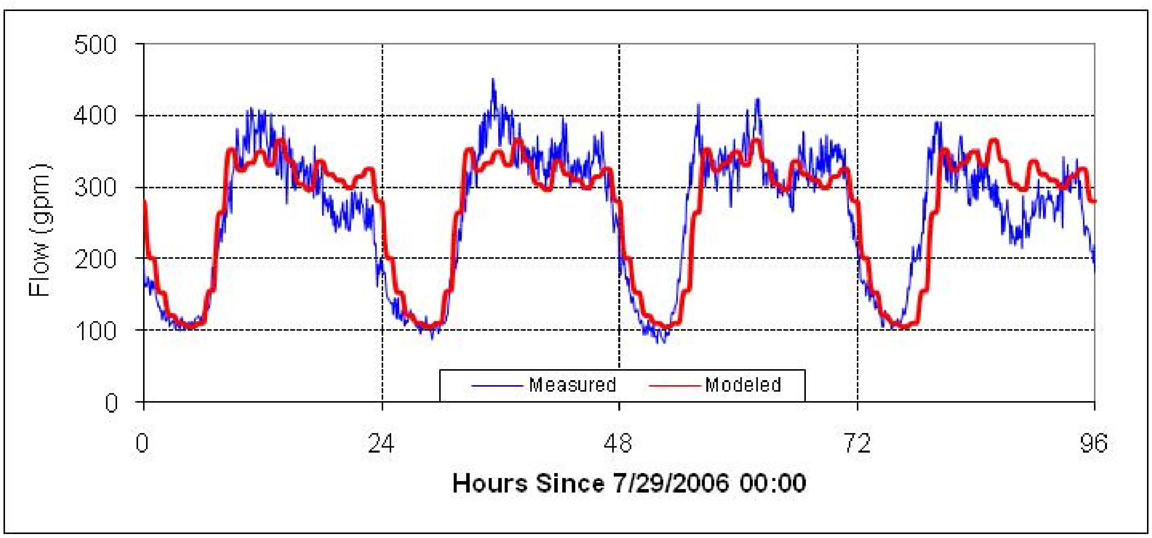
Velocity (ft/s)
3
2
1
0
0
24
48
72
96
Hours Since 8/8/2006 00:00
Measured
Model Link 1002237L1
Model Link 1002283L2

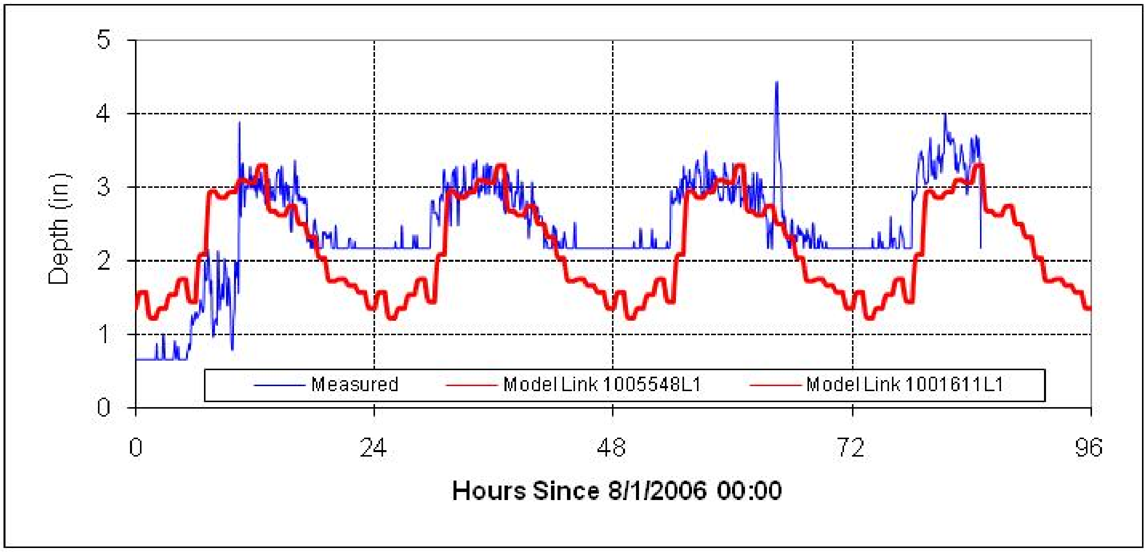


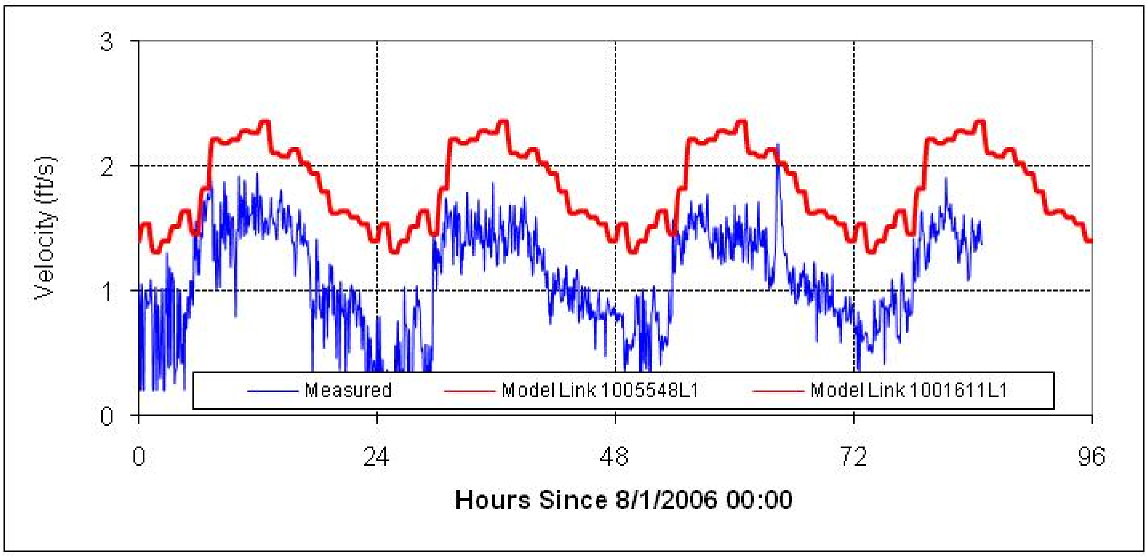
Flow (gpm)
500
400
300
200
100
0
0
24
48
72
96
Hours Since 8/8/2006 00:00
Measured
Modeled

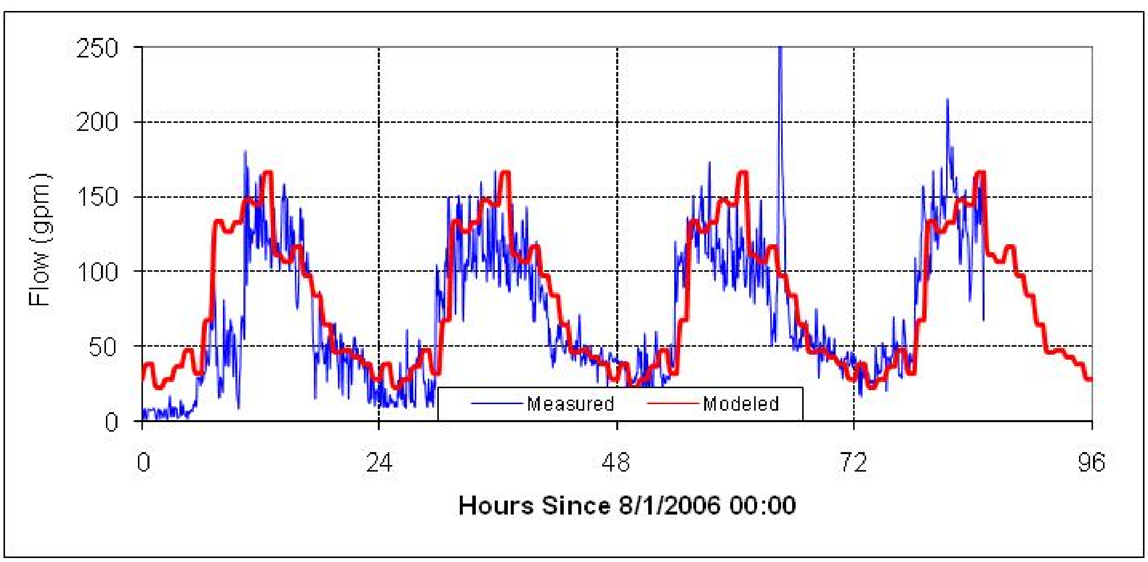

Depth (in)
Measured
Model Link 1002471L1
Model Link 1001105L1
Hours Since 7/29/2006 00:00

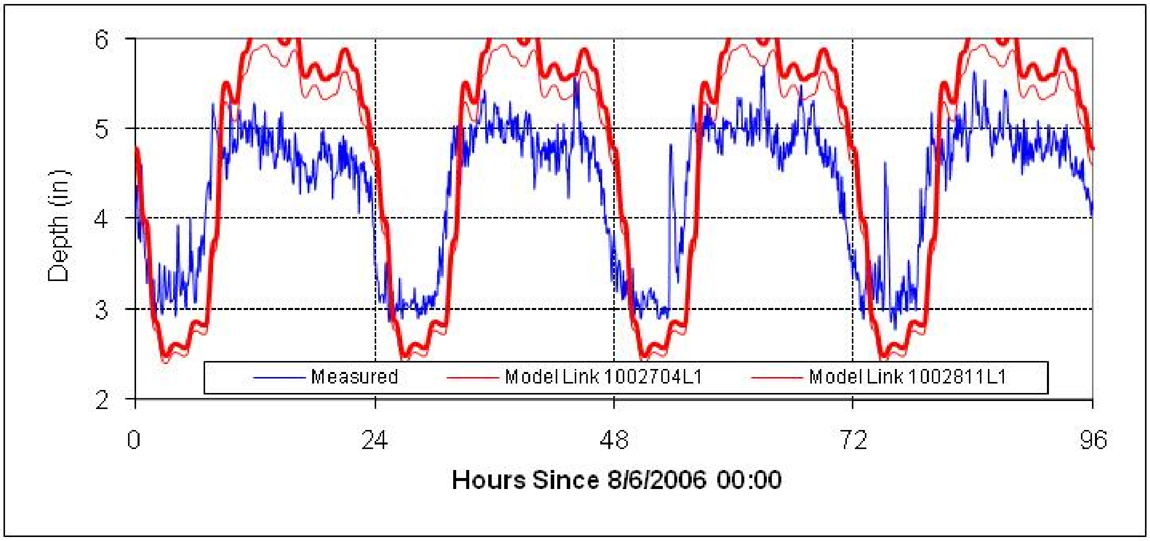

Velocity (ft/s)
Measured
Model Link 1002471L1
Model Link 1001105L1
Hours Since 7/29/2006 00:00

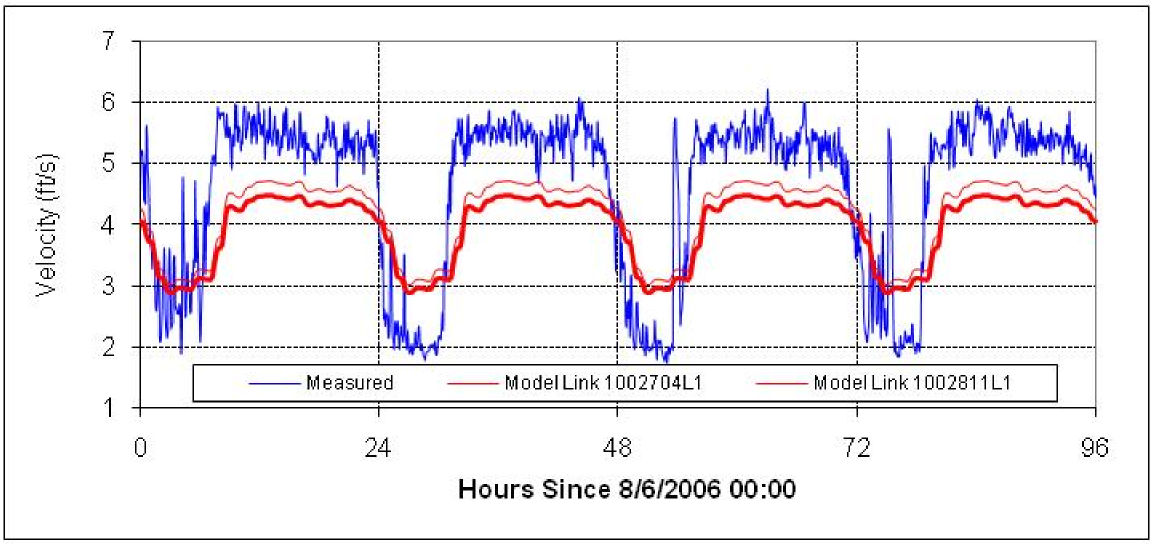

Flow (gpm)
Measured
Modeled
Hours Since 7/29/2006 00:00

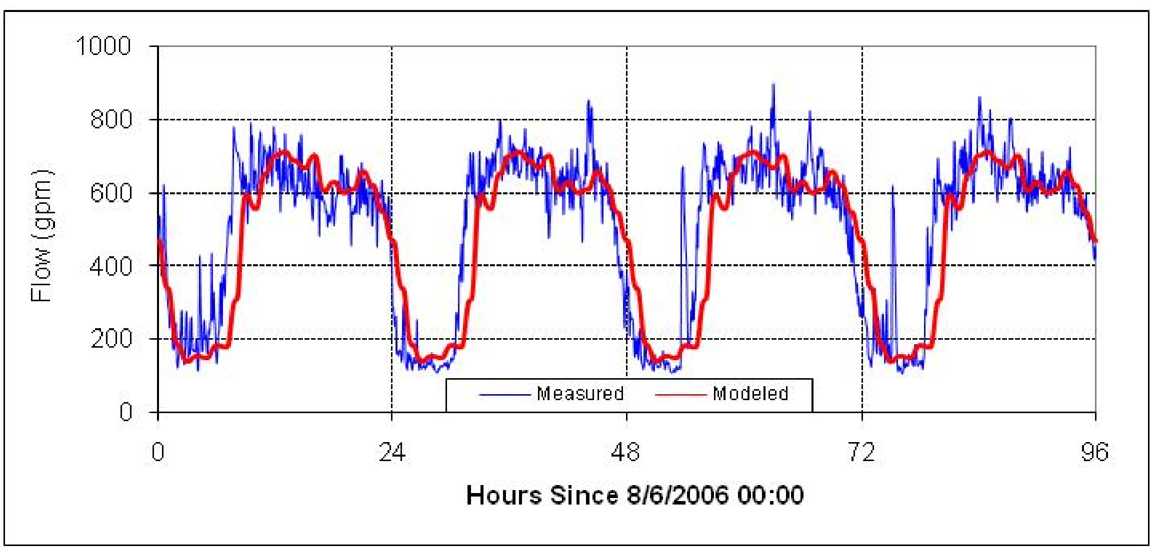

5
4
3
2
1
0
Depth (in)
Measured
Model Link 1005548L1
Model Link 1001611L1
0
24
48
72
96
Hours Since 8/1/2006 00:00

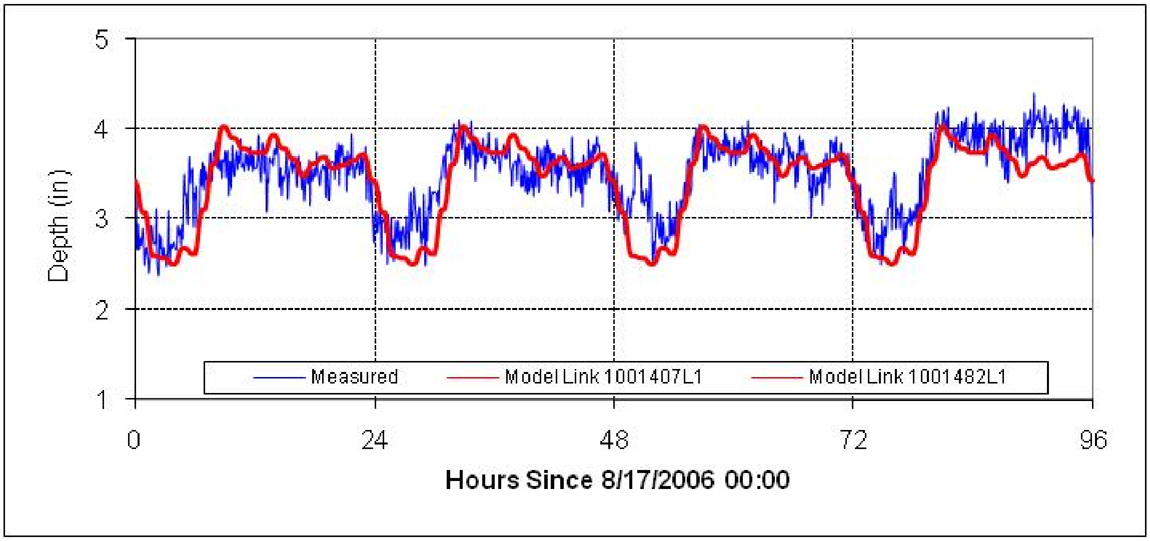

3
2
1
0
Velocity (ft/s)
Measured
Model Link 1005548L1
Model Link 1001611L1
0
24
48
72
96
Hours Since 8/1/2006 00:00


250
200
150
100
50
0
Flow (gpm)
Measured
Modeled
0
24
48
72
96
Hours Since 8/1/2006 00:00

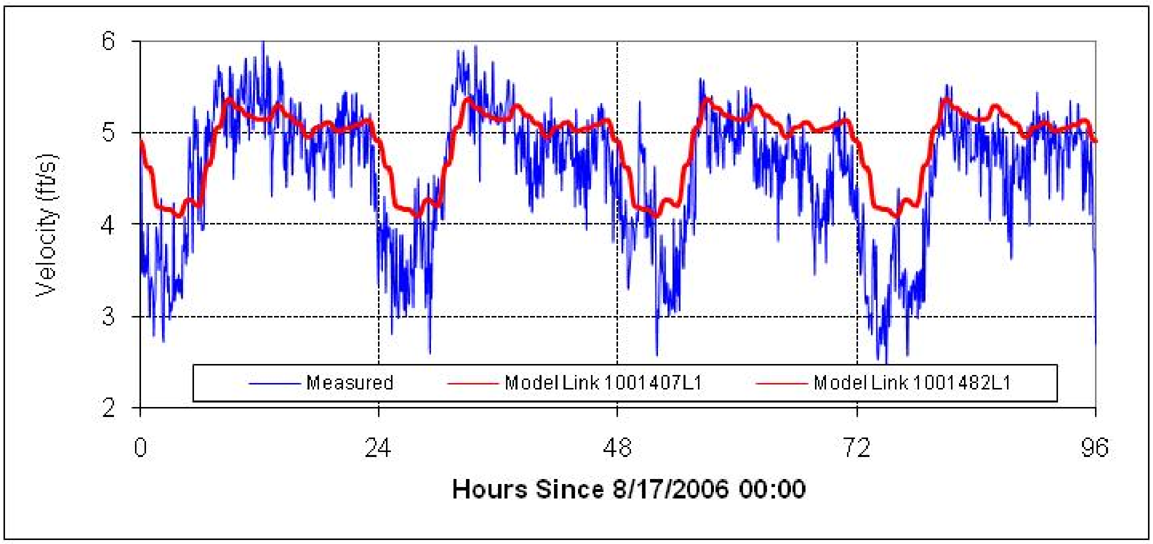

Depth (in)
6
5
4
3
2
Measured
Model Link 1002704L1
Model Link 1002811L1
0
24
48
72
96
Hours Since 8/6/2006 00:00


Velocity (ft/s)
7
6
5
4
3
2
1
Measured
Model Link 1002704L1
Model Link 1002811L1
0
24
48
72
96
Hours Since 8/6/2006 00:00

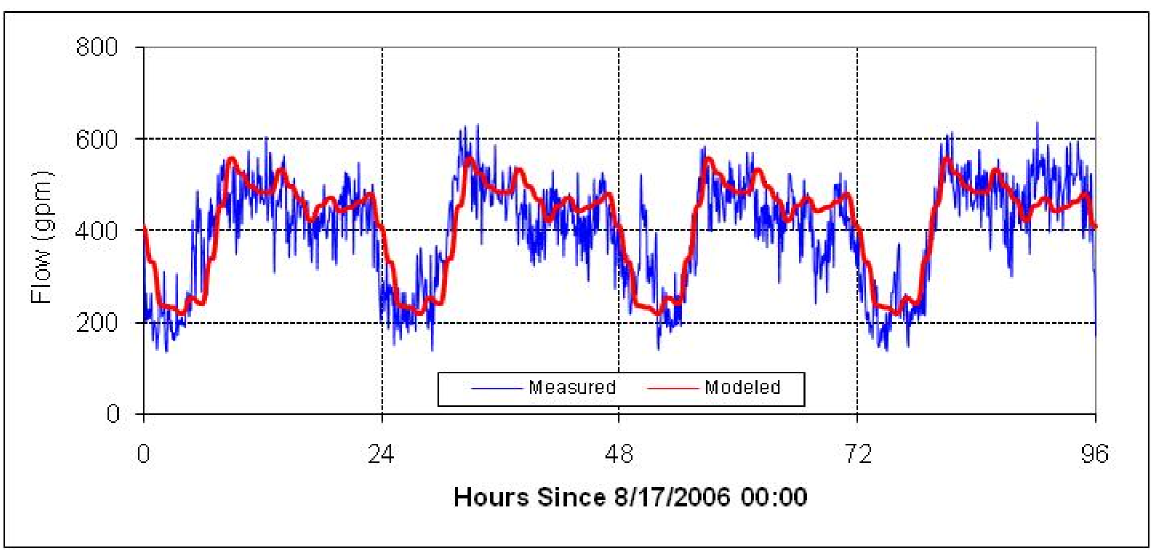

Flow (gpm)
1000
800
600
400
200
0
Measured
Modeled
0
24
48
72
96
Hours Since 8/6/2006 00:00



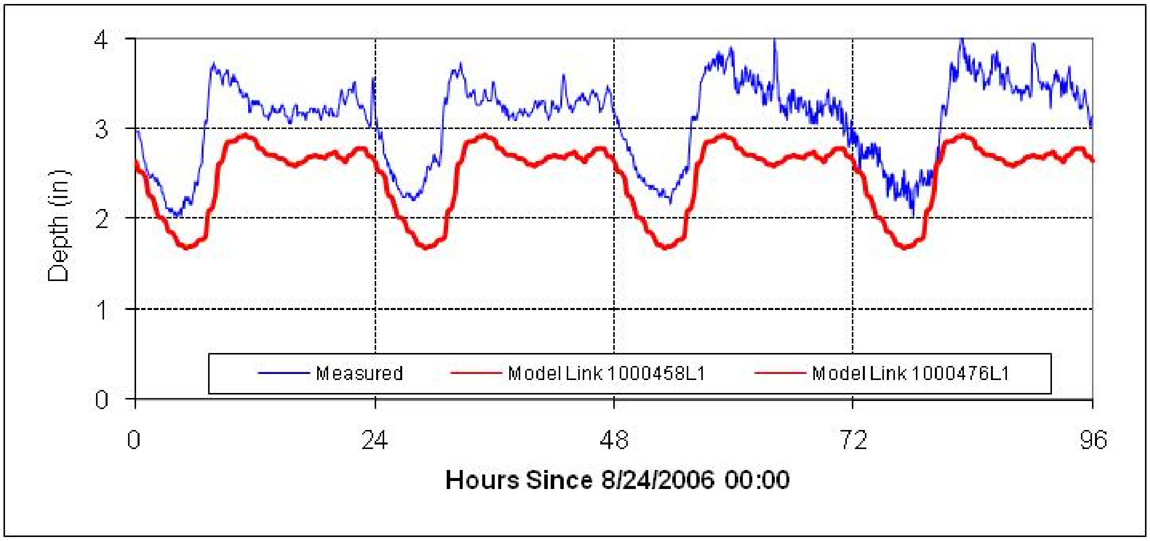
Depth (in)
5
4
3
2
1
Measured
Model Link 1001407L1
Model Link 1001482L1
0
24
48
72
96
Hours Since 8/17/2006 00:00

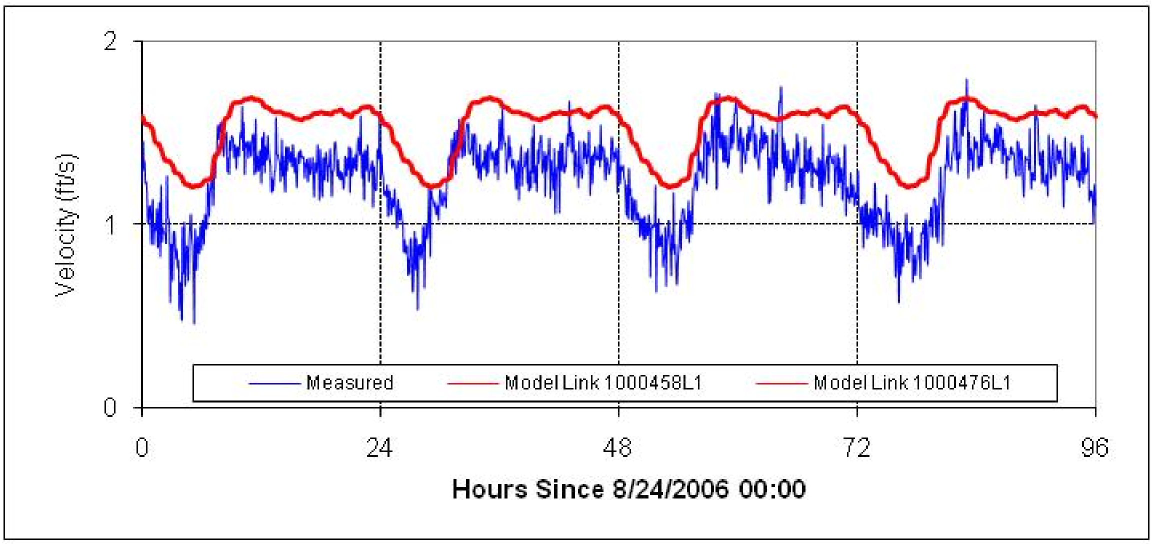


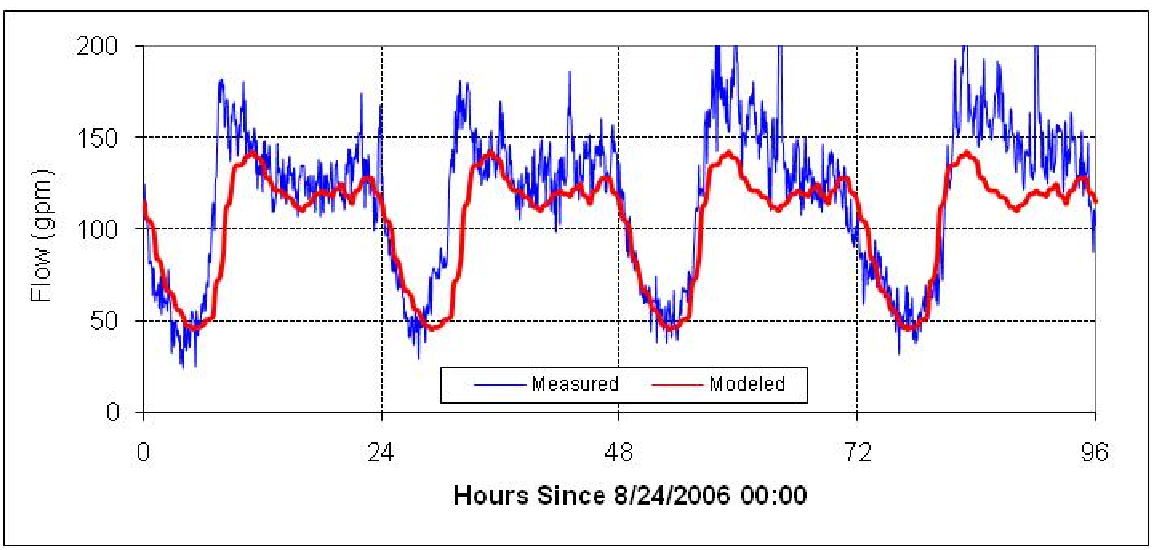
Velocity (ft/s)
6
5
4
3
2
Measured
Model Link 1001407L1
Model Link 1001482L1
0
24
48
72
96
Hours Since 8/17/2006 00:00

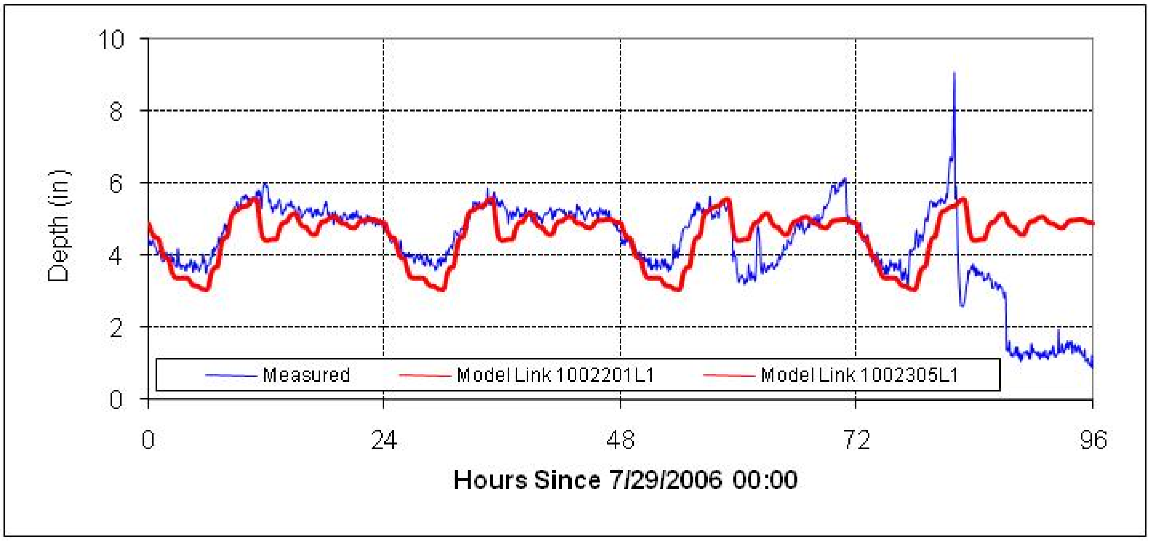


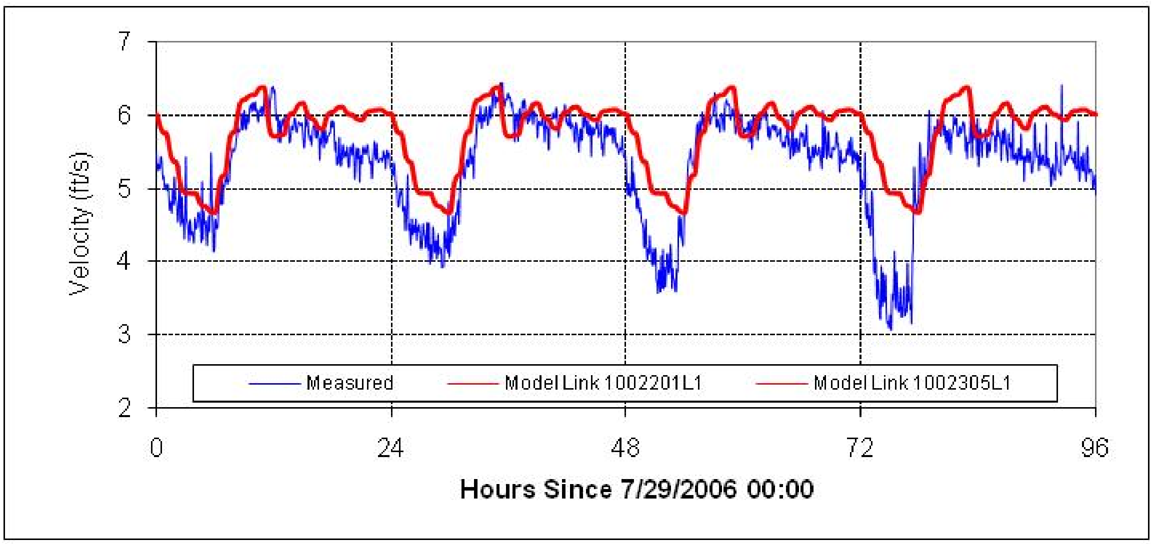
Flow (gpm)
800
600
400
200
0
Measured
Modeled
0
24
48
72
96
Hours Since 8/17/2006 00:00

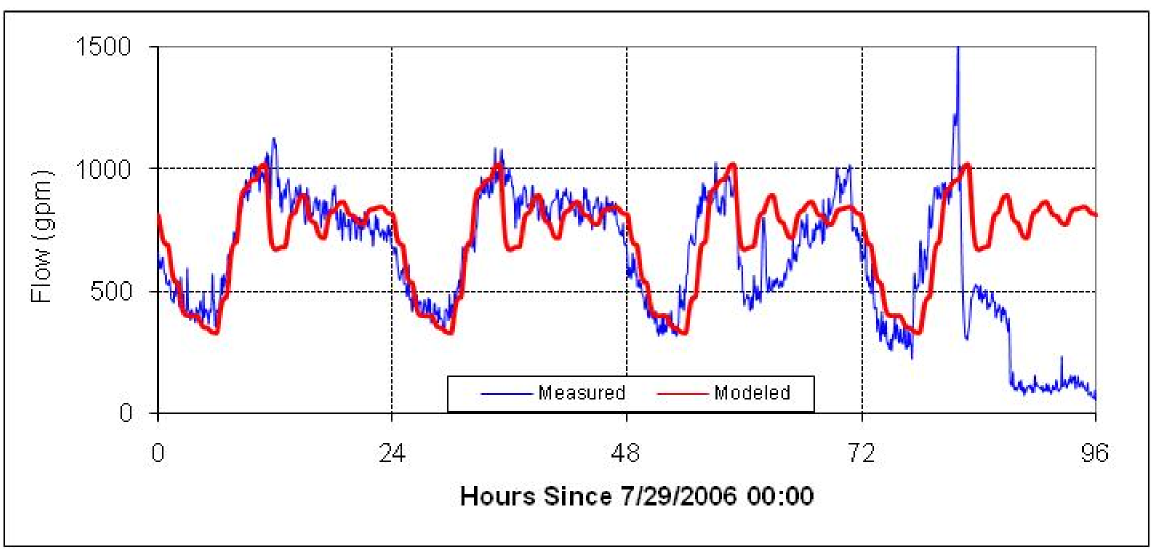

Depth (in)
Measured
Model Link 1000458L1
Model Link 1000476L1
Hours Since 8/24/2006 00:00

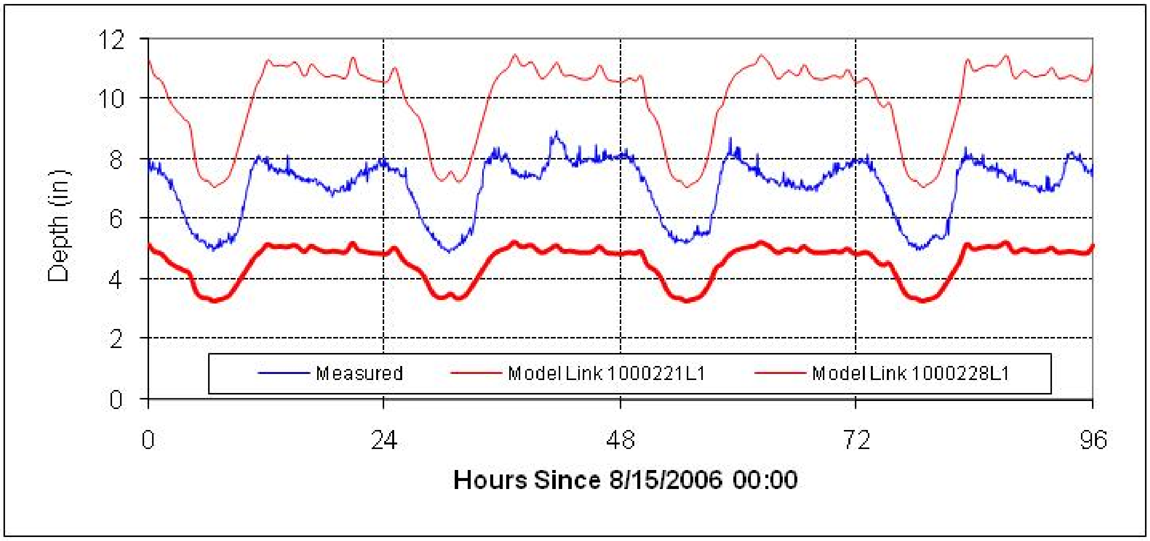

Velocity (ft/s)
Measured
Model Link 1000458L1
Model Link 1000476L1
Hours Since 8/24/2006 00:00


Flow (gpm)
Measured
Modeled
Hours Since 8/24/2006 00:00

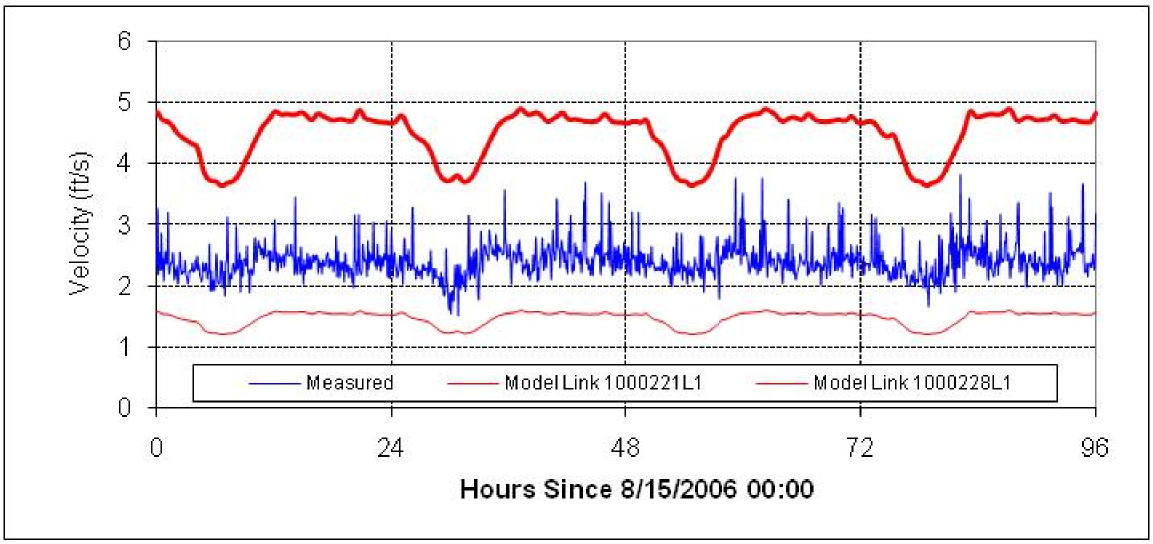

Depth (in)
Measured
Model Link 1002201L1
Model Link 1002305L1
Hours Since 7/29/2006 00:00


Velocity (ft/s)
Measured
Model Link 1002201L1
Model Link 1002305L1
Hours Since 7/29/2006 00:00

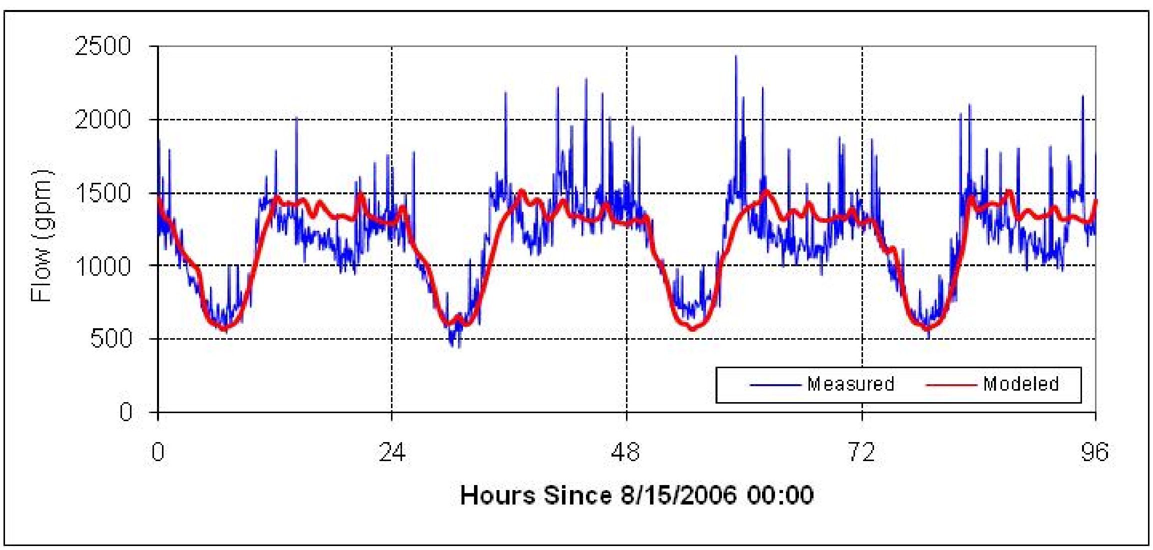

Flow (gpm)
Measured
Modeled
Hours Since 7/29/2006 00:00



12
10
8
6
4
2
0
Depth (in)
Measured
Model Link 1000221L1
Model Link 1000228L1
0
24
48
72
96
Hours Since 8/15/2006 00:00



6
5
4
3
2
1
0
Velocity (ft/s)
Measured
Model Link 1000221L1
Model Link 1000228L1
0
24
48
72
96
Hours Since 8/15/2006 00:00



2500
2000
1500
1000
500
0
Flow (gpm)
Measured
Modeled
0
24
48
72
96
Hours Since 8/15/2006 00:00