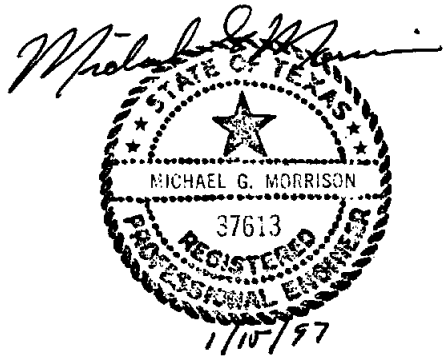
EAST CEDAR CREEK
FRESH WATER SUPPLY DISTRICT

WATER & WASTEWATER MASTER PLAN

FINAL REPORT

JANUARY 1997



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BACKGROUND

The East Cedar Creek Fresh Water Supply District (ECCFWSD) consists of two separate water distribution and wastewater collection systems, the North System and the South System. Each System is hydraulically independent and has its own water and wastewater treatment plants, elevated water storage tanks, and distribution and collection system piping. Both of the wastewater collection systems are primarily pressure systems with the North System using about half gravity sewers and the South System using mostly force main piping with a small amount of gravity sewer. Each System was evaluated as to the current condition of the collection and distributions systems and the ability to meet current Texas Natural Resource Conservation Commission (TNRCC) State Design Criteria. The systems were also evaluated as to expected future conditions for water distribution and wastewater collection.

The North District water system includes a 2.55 million gallon per day (MGD) water treatment plant, 500,000 gallon elevated storage tank, and water distribution piping. District records indicate that the North water distribution system served an average of 2,896 water connections in 1995. The North District wastewater system includes a 0.626 MGD wastewater treatment plant, 67 wastewater collection lift stations, associated house grinder pumps, wastewater force mains, and gravity piping. The North wastewater collection system served an average of 3,075 connections in 1995.

The South District water system includes an existing water treatment plant and hydropneumatic storage tank. However, a proposed 1.73 MGD water treatment plant and

300,000 gallon elevated storage tank have been designed and are under construction. Upon completion of the new facility, the existing treatment plant will be abandoned. Therefore, for the purposes of this study, the evaluation only reviewed the proposed 1.73 MGD water treatment facility, 300,000 gallon elevated storage tank, and water distribution system piping. Based on information provided by ECCFWSD, the South water system served an average of 1,960 water connections in 1995, including 200 water connections in Payne Springs that are no longer served by the District.

The South District wastewater system includes an existing wastewater treatment plant with a permitted capacity of 40,000 gallons per day (gpd), a single wastewater lift station, associated house grinder pumps, and pressure collection system piping. A 200,000 gpd wastewater treatment facility is under design and will be constructed in the near future. Upon completion of the new wastewater facility, the existing wastewater treatment plant will be abandoned. The South wastewater system served an average of 528 wastewater connections in 1995.

FINDINGS

The East Cedar Creek Fresh Water Supply District is largely a rural community with heavy weekend and seasonal fluctuations in population and corresponding water and wastewater flows. Populations within the District are projected to steadily increase with a moderate rate of growth during the 30-year study period. The total population for the planning area is expected to grow from a current population of 11,575 to a population of 17,780 in 2026. There is also a large contingent of the population that remains unserved by

wastewater systems and a small rural contingent that does not have water service.

The water treatment and distribution systems in the District have been developed by developers and previous District administrations, with only minimal advanced planning for the future. TNRCC standards require that water treament plants meet 0.6 gpm per connection for raw water pumping, high service pumping, and treatment plant capacity. TNRCC has allowed the District's water treatment plants to operate on a variance that allows them to meet 0.45 gpm per connection for these criteria. Under this variance, the distribution and treatment systems are not capable of delivering fire flows and are not approved as a "Superior" system by the TNRCC. The District is currently constructing a new water treatment plant to meet the current and future needs of their existing South water system.

The wastewater treatment and collection systems have a high rate of infiltration and inflow (I/I). The District is currently making efforts to repair the system to eliminate these I/I problems. Both wastewater collection systems are primarily pressurized systems with lift stations and grinder pump installations and individual houses. The use of the pressurized system has resulted in heavy maintenance requirements due to pump operations. The District is currently constructing a new wastewater treatment plant to meet the current and future needs of their existing South wastewater system.

RECOMMENDATIONS

A Water and Wastewater Master Plan has been prepared to assist the District in long range planning for the defined study area. The study area does include areas currently outside the District's boundary. The Master Plan has been developed to provide the District with a

plan of action to serve any part of the study. The Master Plan makes the following general recomendations:

- Future water distribution linework is planned in anticipation of meeting future flows including additional capacity for peak and seasonal flows.
- Water treament plant expansions are planned to meet TNRCC standard criteria of 0.6 gpm per connection for raw water pumping, high service pumping, and treatment plant capacity.
- The District should continue with its ongoing efforts to reduce the effects of I/I on the District's wastewater treatment plants.
- Wastewater collection system linework is planned to use as much gravity flow as possible to reduce maintenence requirements of pressurized systems.
- Wastewater treament plant expansions are planned to meet future conditions of the District's wastewater collections sytems including the addition of unserved populations.
- Unserved populations are planned to be added on to the system in yearly increments so that the total population of the study area is provided complete service within the study period.

1.0 INTRODUCTION

1.1 BACKGROUND

The East Cedar Creek Fresh Water Supply District (ECCFWSD) consists of two separate water distribution and wastewater collection systems, the North System and the South System. Each System is hydraulically independent and has its own water and wastewater treatment plants, elevated water storage tanks, and distribution and collection system piping. Both of the wastewater collection systems are primarily pressure systems with the North System using about half gravity sewers and the South System using mostly force main piping with a small amount of gravity sewer. Each System was evaluated as to the current condition of the collection and distributions systems and the ability to meet current Texas Natural Resource Conservation Commission (TNRCC) State Design Criteria. The systems were also evaluated as to expected future conditions for water distribution and wastewater collection.

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The South District water system includes an existing water treatment plant and hydropneumatic storage tank. However, a proposed 1.73 MGD water treatment plant and 300,000 gallon elevated storage tank have been designed and are under construction. Upon completion of the new facility, the existing treatment plant will be abandoned. Therefore, for the purposes of this study, the evaluation only reviewed the proposed 1.73 MGD water treatment facility, 300,000 gallon elevated storage tank, and water distribution system piping. Based on information provided by ECCFWSD, the South water system served an average of 1,960 water connections in 1995, including 200 water connections in Payne Springs that are no longer served by the District.

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1.2 MASTER PLAN SCOPE

The project scope for the Water and Wastewater Master Plan includes a review of the current system conditions, field verification of treatment facilities, field verification of the collection and distribution systems, computer modeling of the collection and distribution systems, development of recommendations, development of an implementation plan for the

recommendations, and presentation of a final report. Technical Memorandum #1 discussed the current system conditions and field verification portions of the project and is included in Appendix A. Technical Memorandum #2 discussed the results of the computer modeling of the collection and distribution systems and is included in Appendix B. Technical Memorandum #3 discussed the recommendations, implementation plan, and cost estimates for the recommended projects and is included in Appendix C.

2.0 CURRENT SYSTEM CONDITION

The TNRCC publishes criteria for the design of water hygiene and sewerage systems in Chapters 290 (dated 10/20/95) and 317 (dated 12/19/95) of 30 Texas Administrative Code. These design criteria provide specific parameters for the design and operation of water and wastewater systems. Based on these criteria, each water and wastewater system was reviewed with respect to current regulations to determine the current condition of each system. This Section will review the results of the current conditions review and field verification for each of the District's water and wastewater treatment plants. Review of the wastewater collection and water distribution systems was conducted during the system modeling portion of the project and is discussed in Section 3.0. Maps of the District's existing water and wastewater systems are provided in Appendix D.

2.1 WATER TREATMENT PLANT SUMMARY

2.1.1 North Water Treatment Plant

The existing North Water Treatment Plant (WTP) is in good condition and currently produces water meeting or exceeding permitted conditions. The North WTP has historically produced high quality water and has adequate capacity to meet current system conditions. Water treatment plants are required by TNRCC design criteria to treat the anticipated maximum water demand of any day during the year. According to historical plant flow records, the North WTP treated a maximum day demand of 1.581 MGD in 1995 and is capable of treating 2.55 MGD. In addition to the criteria for maximum day demand, the TNRCC has criteria for water treatment facilities, water storage, and pumping requirements.

The North WTP is capable of meeting all State Design Criteria with the exception of raw water pumping capacity, high service pumping capacity, and treatment plant capacity. Under these criteria the District is required to meet a capacity of 0.6 gpm per water connection. However, the District has received a variance from this criterion and is allowed by TNRCC to meet capacity requirements of 0.45 gpm per connection for raw water pumping, high service pumping, and treatment plant capacity. Under the variance, the North water system is capable of meeting all TNRCC requirements. However, with the variance in place, the North District cannot be approved as a "Superior" water system by TNRCC and is not rated to meet fire flow conditions. Table 1 summarizes current conditions for each water treatment plant. A more detailed discussion of the current condition of the North WTP can be found in Technical Memorandum #1 in Appendix A.

2.1.2 South Water Treatment Plant

The existing South WTP was not evaluated for compliance with current TNRCC criteria, because a new South WTP is under construction and the old plant will be abandoned upon completion of the new plant. The new South WTP is rated for a maximum day flow of 1.73 MGD and meets state requirements for all treatment, storage and pumping units. According to the existing South WTP flow records, the maximum day flow for the South water system was 0.892 MGD in 1995. The South water system operates under the same variance as the North water system and is allowed by TNRCC to meet capacity requirements of 0.45 gpm per connection for raw water pumping, high service pumping, and treatment plant capacity. Under the variance, the South water system meets all TNRCC requirements.

However, with the variance in place, the South District cannot be approved as a "Superior" water system by TNRCC and is not rated to meet fire flow conditions. Table 1 summarizes current conditions for each water treatment plant. A more detailed discussion of the current condition of the South WTP can be found in Technical Memorandum #1 in Appendix A.

TABLE 1

WATER TREATMENT PLANT CURRENT CONDITIONS SUMMARY

PLANT	RATED PLANT CAPACITY	SYSTEM DEMANDS		1995 AVERAGE # OF CONNECTIONS	MAXIMUM # OF CONNECTIONS ALLOWED	ESTIMATED SERVED POPULATION
		AVG DAY	MAX DAY			
NORTH WTP	2.55 MGD	0.643 MGD	1.581 MGD	2,896	3,935	6,921
PROP. SOUTH WTP	1.75 MGD	0.327 MGD	0.892 MGD	1,960	2,701	3,920

2.2 WASTEWATER TREATMENT PLANT SUMMARY

2.2.1 North Wastewater Treatment Plant

The existing North Wastewater Treatment Plant (WWTP) is in good condition and currently produces effluent meeting or exceeding permitted conditions. The plant is required to meet effluent conditions of 10 mg/l of Biochemical Oxygen Demand (BOD) and 15 mg/l of Total Suspended Solids (TSS). In additions, wastewater treatment plants are required to treat the maximum average monthly flow in any year along with the maximum peak 2-hour flow in any year. According to historical plant flows at the North WWTP, the maximum average monthly flow for 1995 was 0.562 MGD and the 2-hour peak flow was 1.77 MGD. The plant is permitted to treat a maximum monthly average of 0.626 MGD and a 2-hour peak

flow of 1.872 MGD.

The North WWTP meets TNRCC design criteria and capacity requirements for all unit operations at the plant. The wastewater plant currently has permission from TNRCC to waste sludge to the existing surge storage basin in addition to the plant's existing sludge drying beds. A plate and frame sludge press building is under construction and will be completed shortly. At this time, sludge dewatering operations will be handled by the plate and frame press. The District is also planning to add final effluent filters to the wastewater plant to assist in improving plant effluent quality. Table 2 summarizes current conditions for each wastewater treatment plant. A more detailed discussion of the current condition of the North WWTP can be found in Technical Memorandum #1 in Appendix A.

2.2.2 South Wastewater Treatment Plant

The existing South WWTP is not capable of meeting permitted requirements for flow or effluent quality. The District is currently designing a new South WWTP to meet the existing conditions of the South wastewater system. Therefore, the Master Plan only considered the proposed South WWTP. According to District records, the maximum monthly flow for the existing South wastewater system for 1995 was 0.17 MGD with an estimated 2-hour peak flow of 0.595 MGD. The proposed plant will be rated to meet a maximum monthly flow of 0.2 MGD with a peak flow of 0.8 MGD. Therefore, under current flow conditions, the proposed South WWTP will be capable of meeting TNRCC requirements for wastewater treatment plants. Table 2 summarizes current conditions for each wastewater treatment plant. A more detailed discussion of the current condition of the South wastewater

system can be found in Technical Memorandum #1 in Appendix A.

TABLE 2

WASTEWATER TREATMENT PLANT CURRENT CONDITIONS SUMMARY

PLANT	PLANT DESIGN CAPACITY		SYSTEM FLOWS		1995 AVERAGE # OF CONNECTIONS	ESTIMATED SERVED POPULATION
	MONTHLY AVERAGE	PEAK 2-HOUR	MONTHLY AVERAGE	PEAK 2-HOUR		
NORTH WWTP	0.626 MGD	1.872 MGD	0.562 MGD	1.77 MGD	3,075	7,349
PROP. SOUTH WWTP	0.2 MGD	0.8 MGD	0.170 MGD	0.595 MGD	528	1,056

3.0 POPULATION AND FLOW PROJECTIONS

3.1 PRIORITY AREA DEVELOPMENT

In order to determine future water demands and wastewater flows placed on the North and South systems, an estimate was made of current population in these systems. These populations were used to calculate estimates of future populations within each system. This was done by breaking each system into Priority Areas. Priority Areas were established for the North and South systems to assist in determining the priority of projects for those areas. Priority Areas were established in a manner that focused on making improvements in those areas already served by the District before making improvements in unserved areas.

Populations for each Priority Area in both the North and South systems were calculated using the population density per acre for each of the Priority Areas, as taken from the 1990 Census. The service population for both systems was established by multiplying the average number of connections anticipated for each water and wastewater system by the number of people per housing unit, based on the 1990 census, for that particular Priority Area. The difference in total population and the served population is the unserved population for a particular Priority Area. The unserved population includes any persons unserved by water or wastewater and any persons served by another water utility. For a more detailed explanation of the development of Priority Areas and estimated populations, see Technical Memorandum #2 in Appendix B.

3.2 POPULATION GROWTH AND FLOW PROJECTIONS

3.2.1 Population Projections

Projected populations for each Priority Area were calculated using yearly growth rates provided by the Texas Water Development Board (TWDB). The current total population of each Priority Area was estimated using 1990 census population densities. The current population of each Priority Area was then multiplied by TWDB yearly growth rates to calculate the projected population for that area for each year. The estimated population served by the District, in each Priority Area, was then calculated to establish the water or wastewater demand for that Priority Area. These served populations were used as a starting point for water and wastewater demands under current conditions. The remaining unserved populations were added to projected future populations according the area's priority ranking. This allowed for increases in service population based on population growth and the addition of unserved users to the water and wastewater systems. For a more detailed explanation of population growth projections, see Technical Memorandum #2 in Appendix B.

3.2.2 Projected Water Demands

Projected water demands were developed for each Priority Area by calculating the current per-capita water demand for both the North and South systems. The calculated per-capita demands were 127 gallons-per-capita-per-day (gpcd) for the North System and 115 gpcd for the South system. The calculated per-capita demands were then multiplied by estimated future served populations for each Priority Area to determine the future water demand for that Priority Area. The maximum day water demands for each Priority Area were

calculated by multiplying the average water demand by the historical peaking factor for the system. The historical peaking factor for the North water system is 2.6. The historical peaking factor for the South water system is 2.7. Water demands for adjacent water utilities were calculated but were not included in the Districts total water demand. Table 3 shows projected water demands for the North and South water systems. For more detailed description of projected water demands, see Technical Memorandum #2 in Appendix B.

TABLE 3

PROJECTED WATER DEMANDS

North Water System

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	UNSERVED POP.	AVG DAY DEMAND (MGD)	MAX DAY DEMAND (MGD)
1996	2942	6260	4884	430	0.620	1.613
1997	3022	6374	5016	394	0.637	1.656
1998	3101	6489	5148	359	0.654	1.700
1999	3181	6603	5281	323	0.671	1.744
2000	3261	6717	5413	288	0.687	1.787
2001	3333	6817	5533	252	0.703	1.827
2002	3405	6917	5652	217	0.718	1.866
2003	3477	7016	5772	181	0.733	1.906
2004	3549	7115	5892	146	0.748	1.945
2005	3621	7215	6011	110	0.763	1.985
2006	3693	7314	6130	75	0.779	2.024
2007	3747	7413	6220	70	0.790	2.054
2008	3801	7513	6309	64	0.801	2.083
2009	3855	7612	6399	59	0.813	2.113
2010	3909	7712	6488	54	0.824	2.142
2011	3957	7800	6569	48	0.834	2.169
2012	4006	7889	6650	43	0.844	2.196
2013	4054	7977	6730	37	0.855	2.222
2014	4103	8066	6810	32	0.865	2.249
2015	4151	8154	6891	26	0.875	2.275
2016	4199	8243	6971	21	0.885	2.302
2017	4246	8331	7048	19	0.895	2.327
2018	4292	8420	7125	17	0.905	2.353
2019	4338	8508	7202	14	0.915	2.378
2020	4385	8597	7279	12	0.924	2.403
2021	4413	8650	7325	10	0.930	2.419
2022	4440	8701	7371	8	0.936	2.434
2023	4468	8752	7416	6	0.942	2.449
2024	4495	8803	7461	4	0.948	2.464
2025	4522	8855	7507	2	0.953	2.479
2026	4549	8906	7552	1	0.959	2.494

TABLE 3 (CONT.)

PROJECTED WATER DEMANDS

South Water System

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	UNSERVED POP.	AVG DAY DEMAND (MGD)	MAX DAY DEMAND (MGD)
1996	1760	5315	2834	562	0.327	0.893
1997	1805	5435	2907	564	0.335	0.916
1998	1851	5555	2980	566	0.344	0.939
1999	1896	5675	3053	567	0.352	0.962
2000	1942	5795	3126	569	0.361	0.985
2001	1987	5916	3199	570	0.369	1.008
2002	2032	6035	3272	571	0.378	1.031
2003	2078	6154	3345	572	0.386	1.054
2004	2123	6274	3418	573	0.394	1.077
2005	2168	6393	3491	573	0.403	1.100
2006	2214	6512	3564	574	0.411	1.123
2007	2259	6632	3637	575	0.420	1.146
2008	2305	6751	3710	576	0.428	1.169
2009	2350	6870	3784	577	0.437	1.192
2010	2395	6990	3857	577	0.445	1.215
2011	2441	7109	3930	578	0.453	1.238
2012	2486	7227	4003	578	0.462	1.261
2013	2532	7346	4076	578	0.470	1.284
2014	2577	7464	4149	578	0.479	1.307
2015	2622	7583	4222	578	0.487	1.330
2016	2667	7702	4295	578	0.496	1.353
2017	2710	7820	4364	582	0.503	1.375
2018	2753	7939	4433	586	0.511	1.396
2019	2796	8057	4502	590	0.519	1.418
2020	2839	8176	4571	594	0.527	1.440
2021	2882	8294	4640	598	0.535	1.462
2022	2925	8410	4709	599	0.543	1.483
2023	2968	8526	4778	601	0.551	1.505
2024	3011	8642	4847	602	0.559	1.527
2025	3054	8758	4916	603	0.567	1.549
2026	3096	8874	4985	605	0.575	1.570

3.2.3 Projected Wastewater Demands

Projected wastewater demands were developed for each Priority Area by calculating the current per-capita flow rate for wastewater. This was done by dividing the maximum 30-day average flow for both North and South systems by the current estimated served population for that system. Yearly per-capita flowrates, minus Infiltration/Inflow (I/I) reductions, were used to calculated the maximum 30-day average flow for each system by multiplying the per-capita rate by the estimated served population. The estimated per-capita flowrate for 1996 for the North wastewater system is 108.5 gpcd. The estimated per-capita flowrate for 1996 for the South wastewater system is 197.0 gpcd.

Peak 2-hour flow rates were calculated using historical peaking factors and by using Harmon's equation for determining peak flows. The historical peaking factor for the North wastewater system is 3.13. The calculated peaking factor for the South wastewater system is 3.45. The estimated I/I reduction for each system was calculated by determining the estimated yearly I/I removal from the repair of gravity lines and manholes in the North system and repair of home septic tanks and effluent pump installations in the South system. Table 4 shows projected wastewater flows for both the North and South wastewater systems. For a more detailed explanation of wastewater flow projections see Technical Memorandum #2 in Appendix B.

TABLE 4

PROJECTED WASTEWATER FLOWS

North Wastewater System

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	UNSERVED POP.	30 DAY AVG. FLOW (MGD)	PEAK FLOW (MGD)
1996	3125	6260	5188	1073	0.563	1.773
1997	3229	6374	5361	1014	0.579	1.823
1998	3334	6489	5534	955	0.594	1.872
1999	3438	6603	5707	896	0.610	1.922
2000	3542	6717	5880	838	0.626	1.971
2001	3638	6817	6038	779	0.640	2.016
2002	3733	6917	6197	720	0.654	2.061
2003	3829	7016	6355	661	0.669	2.106
2004	3924	7115	6514	601	0.683	2.151
2005	4020	7215	6672	542	0.697	2.196
2006	4115	7314	6831	483	0.712	2.241
2007	4196	7413	6965	448	0.723	2.279
2008	4276	7513	7099	414	0.735	2.316
2009	4357	7612	7232	380	0.747	2.353
2010	4437	7712	7365	346	0.759	2.390
2011	4511	7800	7488	312	0.769	2.423
2012	4585	7889	7611	278	0.780	2.457
2013	4658	7977	7733	245	0.791	2.490
2014	4732	8066	7855	211	0.801	2.524
2015	4806	8154	7978	177	0.812	2.557
2016	4880	8243	8100	143	0.823	2.591
2017	4942	8331	8203	128	0.831	2.618
2018	5003	8420	8306	114	0.840	2.646
2019	5065	8508	8409	100	0.849	2.673
2020	5127	8597	8511	86	0.859	2.705
2021	5168	8650	8578	71	0.866	2.727
2022	5207	8701	8644	57	0.872	2.748
2023	5246	8752	8709	43	0.879	2.768
2024	5286	8803	8775	29	0.885	2.789
2025	5325	8855	8840	14	0.892	2.810
2026	5365	8906	8906	0	0.899	2.831

TABLE 4 (CONT.)

PROJECTED WASTEWATER FLOWS

South Wastewater System

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	UNSERVED POP.	30 DAY AVG. FLOW (MGD)	PEAK FLOW (MGD)
1996	536	5315	863	3543	0.170	0.595
1997	698	5435	1123	3381	0.193	0.676
1998	860	5555	1384	3219	0.216	0.757
1999	1021	5675	1644	3057	0.239	0.838
2000	1183	5795	1905	2895	0.263	0.919
2001	1345	5916	2165	2734	0.286	1.000
2002	1507	6035	2426	2571	0.309	1.081
2003	1668	6154	2686	2408	0.332	1.162
2004	1830	6274	2947	2246	0.355	1.243
2005	1992	6393	3207	2083	0.378	1.324
2006	2154	6512	3468	1920	0.401	1.405
2007	2264	6632	3645	1841	0.416	1.456
2008	2374	6751	3822	1762	0.434	1.517
2009	2484	6870	3999	1683	0.452	1.578
2010	2594	6990	4176	1603	0.470	1.640
2011	2703	7109	4353	1524	0.488	1.701
2012	2813	7227	4530	1444	0.505	1.763
2013	2923	7346	4706	1364	0.523	1.824
2014	3033	7464	4883	1284	0.541	1.886
2015	3143	7583	5060	1204	0.559	1.947
2016	3253	7702	5237	1124	0.577	2.008
2017	3345	7820	5385	1073	0.592	2.059
2018	3436	7939	5533	1023	0.607	2.111
2019	3528	8057	5680	972	0.622	2.162
2020	3620	8176	5828	921	0.636	2.213
2021	3712	8294	5976	871	0.651	2.264
2022	3803	8410	6123	817	0.666	2.315
2023	3895	8526	6271	764	0.681	2.366
2024	3987	8642	6419	711	0.696	2.417
2025	4079	8758	6566	657	0.711	2.468
2026	4170	8874	6714	604	0.726	2.519

4.0 SYSTEM MODELING

4.1 WATER DISTRIBUTION SYSTEM ASSESSMENT

The North and South water distribution systems were modeled using the CYBERNET computer modeling program. The program accepts input from the AutoCAD computer drafting program in the form of water distribution system mapping and is capable of providing a theoretical simulation of the water distribution system and it's capabilities. Based on distributed demands for current and future conditions, the program can aid in determining the future distribution system projects needed to provide adequate water distribution to the District's customers. The program can determine the location of low pressure areas in the system and can simulate elevated tank conditions, pump stations, and distribution piping pressures.

Based on current and projected water demands, the computer model was developed to simulate conditions for the years 1996, 2006, 2016, and 2026. For each time period, weaknesses in the system were located based on TNRCC design criteria. The linework in the system was then augmented to eliminate these weaknesses. For a more detailed explanation of the water system modeling, see Technical Memorandum #2 in Appendix B.

4.2 WASTEWATER COLLECTION SYSTEM ASSESSMENT

The North wastewater collection system was modeled using the HYDRA computer modeling program. This program is very similar to CYBERNET with the exception that it is capable of modeling gravity sewer lines. Since about half of the North System is

gravity sewer, it was determined that HYDRA would provide a better simulation of that system. The CYBERNET program was used for the South wastewater collection system, since this system has a very small amount of gravity sewer. Both programs are capable of providing theoretical simulations of each system and their capabilities. Based on the distributed wastewater flows for current and future conditions, both programs were able to determine future collection system projects needed to provide adequate wastewater collection and treatment to the District's customers. Both programs were able to determine areas with low and high pressure conditions which would indicate pumping problems within each system. The programs were also able to determine inadequacies in collection system piping.

Based on current and projected wastewater flows, the computer models were developed to simulate conditions for the years 1996, 2006, 2016, and 2026. For each time period, the systems were analyzed based on TNRCC design criteria and weaknesses in the systems were located. The linework and pumping capacities of the systems were then augmented to eliminate the weaknesses. For a more detailed explanation of wastewater system modeling, see Technical Memorandum #2 in Appendix B.

5.0 RECOMMENDED SYSTEM IMPROVEMENTS

System improvements identified in the water and wastewater system models and plant reviews have been identified and prioritized based on their anticipated implementation dates. Each project was evaluated using a prioritization matrix based on the project's relative technical importance, regulatory importance, and economic importance. Projects were then ranked based on these evaluations and prioritized based on implementation date and ranked value. The following is the prioritized list of water and wastewater projects for each system. A brief description of each project is provided along with a project identification number which describes the project location and priority. Each project is dated with a time period in which the project should be constructed. The Master Plan projects, priorities, and construction dates may change with changing system conditions and should be updated periodically. Mapping of the recommended improvements is provided in Appendix E.

5.1 NORTH WATER SYSTEM

The following improvements are recommended for the North Water System:

Construction Date	Project No.	Description
1997	NW1	<u>New 12-inch Loop around Legendary Lane, Hwy. 334 and Pleasure Land Street.</u> To supply adequate water to the various general areas within the system, it is recommended that the 12-inch loop around Legendary Lane, Hwy. 334, the Bozeman Easement, and Thunderbird Streets be completed. This will require the construction of a new 12-inch water line from the elevated tank to Hwy. 334 and then along Hwy. 334 to an existing 12-inch water line. A new 12-inch water line will also need to be constructed from Hwy 334 southward down the Bozeman Easement between Pleasureland and Welch Streets to Thunderbird Street. The project will also consist of

constructing a 10-inch water line from Hwy 334 to the new elementary school, including an 8-inch line ending in a fire hydrant behind the new school. Design of this item has been completed and construction will begin soon.

1997	NW2	North WTP Expansion The North Water Treatment Plant is not capable of meeting the requirements of 0.6 gpm per connection for treatment plant capacity. Currently the District operates under a variance which allows them to meet 0.45 gpm per connection. Under this variance the District cannot be approved as a "Superior" water system and cannot provide fire flow capability. In order to meet the 0.6 gpm per connection criteria, the District will need to expand the North WTP by approximately 1 MGD to give the plant a total capacity of 3.6 MGD. Since the District is operating under the 0.45 gpm per connection variance, there is some leeway in the time frame for this project. If the District decides to remain on the 0.45 gpm per connection variance, the plant should be expanded to a capacity of 3.0 MGD and the expansion would not be necessary until the year 2010.
1997	NW3	North WTP High Service Pump Expansion The North WTP high service pumps are not capable of providing 0.6 gpm per connection of pumping capacity. Currently, the District operates under a variance of 0.45 gpm per connection. Expansion of the pumps to meet the 0.6 gpm per connection criteria would require the addition of a 1,100 gpm pump to expand the firm capacity to 3.6 MGD. Since the District is operating under the 0.45 gpm per connection variance, there is some leeway in the time frame for this project. If the District decides to remain on the 0.45 gpm per connection variance, the pumps do not need expansion until 2001, at which time they should be expanded to a firm capacity of 3.0 MGD.
1997	NW4	North WTP Raw Water Pump Expansion The North WTP raw water pumps are not capable of providing 0.6 gpm per connection of pumping capacity. Currently, the District operates under a variance of 0.45 gpm per connection. Expansion of the pumps to meet the 0.6 gpm per connection criteria would require the replacement of the two existing 700 gpm pumps with new 1250 gpm pumps to expand the firm capacity to 3.6 MGD. Since the District is operating under the 0.45 gpm per connection variance, there is some leeway in the time frame for this project. If the District decides to remain on the 0.45 gpm per connection variance, the pumps do not need expansion until 1999, at which time they should be expanded to a firm capacity of 3.0 MGD.
1996-2006	NW5	New 8-inch and 6-inch Waterlines for the Remaining Priority #2 Area on the East Side of the Hwy. 334 Bridge. The area on the east side of the Hwy. 334 Bridge cannot currently provide peak hour summer demands. It is recommended that an 8-inch water line be constructed from the east side of the East Cedar Creek Reservoir to the

		HillCrest Subdivision. A 6-inch waterline will need to be constructed southward through the Oak Ridge Area and then eastward along Lago Drive in the Bonita Point Subdivision.
1996-2006	NW6	New 8-inch Waterlines to the Tamarack Area. The Tamarack Area will not be capable of supplying peak summer demands to the area East of the Hwy. 334 Bridge. It is recommended that a new 8-inch water line be constructed from the existing 8-inch water line at Trailwind Street and Hwy. 334 to the west side of the bridge at the Cedar Creek Reservoir. It is also recommended that an 8-inch water line be constructed from Hwy. 334 and Wildwind Street to Beaver Brush Street.
1996-2006	NW7	New 10-inch and 8-inch Waterlines to Harbor Point Area in the Northwest Region of the Water System. The small existing water lines in the far north part of the Harbor Point Area are unable to supply peak summer demands. It is recommended that an 8-inch water line be constructed northward from an existing 6-inch water line at Commodore and Harbor Point Streets to First Mate and Harbor Point Streets. It is also recommended that a 10-inch water line be constructed from the new 12-inch water line on Hwy. 334 northward along Lakeview Street to an existing 4-inch water line on Commander Street.
1996-2006	NW8	New 6-inch Waterline Along Spanish Trail. The area along the Cedar Creek in the Tanglewood Shores Area and the Sherwood Shores and Southwind Estates Area cannot provide any significant demand to these areas. It is recommended that new 6-inch water lines be constructed in these areas. For the Sherwood Shores and Southwind Estates Areas, a 6-inch water line should be constructed from the end of the existing 8-inch water line at Clear Fork Street to the intersection of Autumn Trail and Legendary Lane. For the Tanglewood Shores Area, a 6-inch water line will be constructed from an existing 6-inch waterline at Guadalupe Street going southward along Spanish Trail to a 4-inch water line at Palo Blanco Street.
1996-2006	NW9	New 6-inch Waterline through Sandy Shores and Eastwood Island Areas. Most of the existing waterlines within these areas are 3-inch and smaller in size, and are not capable of supplying any significant demand. It is recommended that a 6-inch waterline be constructed beginning at the 12-inch waterline at Legendary Lane and Hwy. 334 and going west and south along Southland Street. From Southland Street the 6-inch waterline should be extended down to Lost Forest Street. From Lost Forest Street, it is recommended that a 6-inch waterline be looped around Ocean Street to an existing 4-inch waterline located on Lakeway Street.
1996-2006	NW10	New 6-inch Waterline from Welch Street to Harmon Street. To meet any significant demands in the Northern Shores and Lakeview Acre Areas, it is recommended that a new 6-inch waterline be constructed from the intersection of Welch and Sundrift Streets to an existing 4-inch

		waterline at the intersection of Victor and Harmon Streets.
2006	NW11	Total Storage Capacity Expansion TNRCC criteria require that the District have a total storage capacity equal to 200 gallons of storage per connection. Based on this criterion the North system will not have adequate total storage in the year 2006. The District does have adequate elevated tank storage to last through the end of the Master Plan study period. Therefore, expansion of the elevated tanks is not required. It is therefore recommended that the total storage capacity of the system be expanded by adding a new 182,000 gallon clearwell at the North WTP. This additional storage will allow the District to meet total storage requirements beyond the Master Plan study period.
2006-2016	NW12	New 6-inch and 8-inch Waterlines to Serve Priority Area #3. To provide service to the Priority Area #3 along Hwy 334, toward Hwy. 175, it is recommended that an 8-inch waterline be constructed from the end of the existing 8-inch eastward approximately 4,200 linear feet. It is also recommended that a 6-inch water line be constructed southward to loop in the Hillcrest Shore subdivision and Oak Ridge Subdivision into an existing 6-inch waterline on Lago Drive.
2006-2016	NW13	New 6-inch Waterline From Hwy. 198 to Whispering Trail. Under 2016 Peak Flow Conditions, the southern part of the Tamarack area will have low pressures under peak hour demands during the summer. It is recommended that a 6-inch water line be constructed from Hwy. 198 along Spring Valley Road to an existing 8-inch water line at Beaver Brush Street. This will provide a looped connection for this general area.
2006-2016	NW14	New 6-inch Waterline in the Oak Harbor Subdivision The Oak Harbor Area is unable to provide adequate pressures for the 2016 planning period. It is recommended that a 6-inch waterline be constructed along Lake Shore Drive beginning at Spanish Trail and ending at an existing 6-inch waterline on Oak Harbor Street.
2006-2016	NW15	New 6-inch Waterlines in the Mantle Manors and Sherwood Shores Subdivisions. The Mantle Manor and Southwind Estates Areas will not be capable of providing adequate pressures under a peak 2016 demand condition. It is recommended that a new 6-inch waterline be constructed along Autumn Trail from Lost Forest Street to the existing 8-inch on Legendary Lane. It is also recommended that a new 6-inch waterline be constructed along Colleen Street to the existing 12-inch line on Willowwood. This will provide a 6-inch and larger looped waterline for this area.
2006-2016	NW16	New 6-inch Looped Waterline for the Harbor Point Subdivision. The far north part of the Harbor Point Subdivision will not be capable of supplying adequate demand under peak 2016 conditions. It is recommended that a new looped 6-inch waterline be constructed from the end of the existing 10-inch waterline up around Sea Breeze Road and down along First Mate Street to an existing 8-inch waterline on Harbor Point Street.

2016-2026	NW17	New 10-inch Waterline Along Hwy. 334 to Hwy. 198. To increase the water supply to the Tamarack Area, it is recommended that a new 10-inch waterline be constructed from the 12-inch water line shown on Hwy. 334 to the existing 8-inch and 10-inch waterline at Tamarack Street and Hwy 334.
2016-2026	NW18	New 6-inch Waterline Along Hwy. 334 in Priority Area #3 To provide adequate demands along Hwy. 334, it is recommended that a 6-inch water line be constructed in Priority Area #3 from the end of the existing 8-inch waterline toward Hwy 175.
2016-2026	NW19	New 6-inch Waterline in the Siesta Shores Area. Under 2026 peak flow conditions, the existing waterline in this area will not be capable of meeting adequate demands. It is recommended that a new 6-inch waterline be constructed from Welch Street to an existing 6-inch waterline at Guadalupe Street.
2016-2026	NW20	New 6-inch in the Harbor Point Subdivision. To meet the 2026 demand conditions in the middle of the Harbor Point Subdivision, it is recommended that a 6-inch waterline be constructed along Backlash Street down to Commodore Street.
2016-2026	NW21	New 6-inch Waterline Along Luther Street. To meet future demands along Luther Street, it is recommended that a new 6-inch water line be constructed and tied into the system at an existing 12-inch waterline near Lakeview Airfield and an existing 6-inch waterline on the north side of Luther Street.
2016-2026	NW22	New 6-inch Waterlines in the Mantle Manors and the Southwind Estates Subdivisions. The Mantle Manor and Southwind Estates Areas will not be capable of providing adequate demands under the 2026 demand conditions. It is recommended that new 6-inch waterlines will be constructed along Autumn Trail and Lake View Streets.
2016-2026	NW23	New 6-inch Waterline Along Whispering Trail in the Tamarack Area. To complete a looped system in the Tamarack Area to meet peak hour summer demand, it is recommended that a new 6-inch waterline be constructed from Whispering Trail and Beaver Brush Street to Hwy 334.
2016-2026	NW24	New 6-inch Looped Waterline in Bonita Subdivision. To meet the 2026 demand condition, it is recommended that a new 6-inch looped waterline be constructed along Lake Shores Drive in the Bonita Subdivision.

5.2 SOUTH WATER SYSTEM

The following improvements are recommended for the South Water System:

Year	Project No.	Description
2002	SW1	South WTP, High Service, and Raw Water Pumps Expansion Based on TNRCC requirements of 0.6 gpm per connection for treatment plant capacity, raw water pump capacity and high service pump capacity, the new South WTP will be capable of meeting system conditions until the year 2002. At this time the treatment plant, high service pumps, and raw water pumps will need to be expanded to a capacity of 2.6 MGD. At this capacity the plant should be capable of meeting system requirements until the end of the Master Plan study period. Currently, the District operates the South system under a 0.45 gpm per connection variance. Under this variance the District cannot be approved as a "Superior" water system and cannot provide fire flow capability. Since the District is operating under the variance there is some leeway in the time frame for South WTP expansion. If the District decides to remain on the variance, the plan, high service pumps and raw water pumps would not require expansion until 2016, at which time they should be expanded to a capacity of 2.0 MGD.
1996-2006	SW2	New 12-inch and 10-inch Waterline Along Hwy. 198 to Golden Oaks Addition. To supply peak summer demands to the northern portion of the system, it is recommended that a 12-inch waterline be constructed from the end of the new 12-inch waterline along Hwy. 198 to Leisureland Drive. From Leisure Land Drive it is recommended that a 10-inch waterline be constructed north along Hwy 198 to the Golden Oaks and Bandera Bay Subdivisions.
1996-2006	SW3	New 12-inch Waterline Along Enchanted Drive, Hwy 198 and Southward toward Cedar Branch Park Under Existing Conditions, the South Water System cannot adequately supply peak summer demands to most of the remote areas within the system. It is recommended that a new 12-inch waterline be constructed from the water treatment plant northward along Enchanted Drive to Hwy. 198 and southward to Cedar Branch Park.
1996-2006	SW4	New 12-inch and 8-inch Waterline Through the Cedar Branch Subdivision. To provide adequate demands for Cedar Branch Park for the 2006 condition and to provide supply for the area east and south of Cedar Branch Park, it is recommended that a 12-inch waterline be constructed from the end of the new 12-inch waterline through Cedar Branch Park. It is recommended that the southern part of the waterline within Cedar Branch Park be 8-inch in size.
1996-2006	SW5	New 10-inch and 8-inch Waterline through Forgotten Acres to Lakeland Road. To supply peak demands to the west side of the system it is recommended that a 10-inch waterline be constructed from the New 12-inch waterline on Hwy 198 through Forgotten Acres. It is recommended that an 8-inch

		waterline be constructed from the west side of Forgotten Acres to the Del Mar Subdivision and up to Lakeland Road.
1996-2006	SW6	New 8-inch and 6-inch Waterline Southward Along Enchanted Drive to Enchanted Oaks. To provide adequate demands to Enchanted Oaks and Indian Harbor, it is recommended that an 8-inch waterline be constructed from the water treatment plant southward along Enchanted Drive to Cedarwood Drive. It is recommended that the 8-inch waterline be connected into two separate 6-inch waterlines at the north and south parts of the Indian Harbor Subdivisions. From Cedarwood Drive it is recommended that a 6-inch water line be constructed from the end of the 8-inch waterline down into Enchanted Oaks to an existing 6-inch waterline.
1996-2006	SW7	New 8-inch and 6-inch Waterline to Golden Oaks, Southwood Shores, Bonanza Beach and Oak Shores Subdivisions. To provide adequate peak summer demands to these northern subdivisions, it is recommended that an 8-inch waterline be constructed from the 10-inch waterline at Hwy 198 eastward along the southern part of the Golden Oaks Subdivision. It is recommended that a 6-inch water line be constructed northward through the Golden Oaks Subdivisions along Cartwright Street to the three remaining subdivisions within the northern Priority #1 and #2 Areas.
1996-2006	SW8	New 8-inch and 6-inch Waterline to Baywood Estates Area. To provide adequate demand to the Baywood Estates Area, it is recommended that a new 8-inch waterline be constructed from the end of the 10-inch waterline along Hwy 198 to the Baywood Estates Area. It is also recommended that a 6-inch waterline be constructed along the northern side of the Baywood Estates Area.
1996-2006	SW9	New 6-inch Looped Waterline Through Bandera Bay and Oakwood Shores. To provide adequate demands for the 2006 condition it is recommended that a 6-inch looped water line be constructed from the end of the 10-inch waterline on Hwy. 198 westward through Bandera Bay and then southward through the Oakwood Shores Subdivision to Leisureland Drive.
1996-2006	SW10	New 6-inch Looped Waterline Around Leisureland Subdivision and to Three Harbors Subdivisions. To provide adequate demands for the 2006 condition it is recommended that a 6-inch looped water line be constructed from the new 8-inch waterline at the southeast corner of the Leisureland Subdivision along Lakeland Drive and around Shady Shores Road. At the southwest part of the Leisureland Subdivision, it is also recommended that a 6-inch waterline be constructed down into the Three Harbors Subdivision.
2006-2016	SW11	New 6-inch and 8-inch Waterline to Provide Looped System for the Golden Oaks, Southwood Shores, Bonanza Beach and Oak Shores Subdivisions. To provide peak hour demands during the summer for the 2016 time period to these subdivisions, it is recommended that a 6-inch waterline be constructed from the 12-inch waterline on Hwy 198 up to the Golden Oaks Subdivision. It is recommended that an 8-inch waterline be constructed

		around Golden Oaks and up along the eastern side of the Oak Shores Subdivision.
2006-2016	SW12	New 6-inch Waterline to Enchanted Isles Subdivision. To provide adequate demand on Enchanted Isles for the 2016 condition, it will be necessary to construct a parallel 6-inch waterline from Cedarwood Drive to Enchanted Isles.
2006-2016	SW13	New 6-inch Waterline to Cherokee Hills Subdivision. To provide adequate demands for the 2016 condition, it is recommended that a 6-inch water line be constructed along Hwy 198 through Baywood Estates to the Cherokee Hills Subdivision.
2006-2016	SW14	New 6-inch Waterline Through Oakwood Shores Subdivision. To provide adequate demands along the shoreline around the Oakwood Shores Subdivision it is recommended that a 6-inch waterline be constructed Payne Springs Road to an existing 6-inch waterline on Shady Shores Drive.
2006-2016	SW15	New 6-inch Waterline Through Del Mar Subdivision. To provide adequate demands along the shoreline around the Del Mar Subdivision it is recommended that a 6-inch waterline be constructed through the Del Mar Subdivision to an existing 6-inch waterline in the Three Harbors Subdivision.
2006-2016	SW16	New 6-inch Waterline Through the Timber Bay, Spillview Estates and Diamond Oaks Subdivisions. To provide adequate demands for the 2016 condition, it is recommended that a parallel 6-inch waterline be constructed along an existing 4-inch waterline through these subdivisions.
2006-2016	SW17	Parallel 12-inch Waterline along Enchanted Drive to Hwy. 198. To provide adequate water supply to the Priority #3 Area, it is recommended that a 12-inch waterline be connected to the elevated storage tank and run parallel to the existing 12-inch waterline (2006 condition) from the treatment plant along Enchanted Drive to Hwy. 198.
2006-2016	SW18	New 12-inch and 10-inch Waterline Along Hwy 198 Toward Payne Springs. To provide adequate water supply to the Priority #3 Area it is recommended that a 12-inch water line be extended east along Hwy 198 approximately 3,000 feet. From the end of the 12-inch waterline, a 10-inch waterline should be constructed for approximately another 1,000 ft.
2006-2016	SW19	New 8-inch and 6-inch Waterlines Through the Southern Portion of the Resort Service Area. To provide service to the Resort Area immediately to the east of the Cedar Branch Park Area, it is recommended that an 8-inch and 6-inch looped waterline be constructed through Cedar Branch Park and eastward to the new 8-inch waterline supplying the Payne Springs Area.

2006-2016	SW20	New 8-inch Waterline and Booster Pump Station to Supply Water to the Southeast Parts of the Priority #3 Area including the Lakeshore and Carolynn CCN Areas. To provide adequate supply to meet peak summer demands to the Lakeshore and Carolynn CCN Areas it is recommended that an 8-inch waterline be constructed from the existing 8-inch looped waterline eastward and around Cedar Creek Lake to these remaining areas. Because of the distance from the water treatment plant, it will be necessary to construct a dedicated hydropneumatic booster pump station to provide adequate pressure for the Lakeshore and Carolynn Areas. The hydropneumatic booster pump station shall contain 2 -200 gpm pumps at a rated head of 200 ft. It is recommended that a 200,000 gallon ground storage tank be constructed at the booster pump station site, so that the remaining system will not have to supply the pump station flow during a peak summer demand condition. A 200,000 gallon tank will allow the pumps to operate for approximately 16 hours without an additional supply from the water treatment plant. The ground storage tank can be filled in the same manner as the elevated tank, during off peak times such as at night time. It is also recommended that a 6-inch line be constructed from the main 8-inch water line into each of the populated service areas along the east bank of the Cedar Creek Lake. Initially, these 6-inch waterlines will be tied into the existing water systems within these areas.
2006-2016	SW21	New 8-inch Looped Waterline to Priority #3 Area. To provide water to Payne Springs and to supply water to the far south eastern part of the Priority #3 area, it is recommended that an 8-inch waterline be constructed beginning at the end of the 10-inch waterline on Hwy 198, going south through the current Payne Springs supply point and around to an existing 12-inch waterline in the Cedar Branch Park Subdivision.
2006-2016	SW22	New 6-inch Waterline on the East Side of the Resort Area in Priority #3 Area. To provide adequate demands throughout the Resort Area, it is recommended that a 6-inch waterline be constructed from Hwy 198 along the east side of the Resort Area.
2016-2026	SW23	New 6-inch Waterline in the Southwood Shores Subdivision. To provide adequate demand to the Southwood Shores Subdivision, it is recommended that a 6-inch waterline be constructed from an existing 4-inch waterline along Hwy 198 along the shoreline of Southwood Shores to an existing 6-inch waterline on the north side of the Golden Oaks Subdivision.
2016-2026	SW24	New 6-inch Waterline in the Baywood Estates Subdivision. To provide a significant looped connection throughout the Baywood Estates Subdivision for adequate demands, it is recommended that a 6-inch

		waterline be constructed along the west side of the Baywood Estates Subdivision.
2016-2026	SW25	New 6-inch Waterline along the Del Mar shoreline. To provide adequate demand to the southwestern portion of the Del Mar shoreline under 2026 condition, it is recommended that a new 6-inch waterline be constructed from the existing 6-inch waterline in the Del Mar Subdivision to an existing 4-inch waterline in the Three Harbors Subdivision.
2016-2026	SW26	New 6-inch Waterline Through the Wood Canyon Waters Subdivision. To provide adequate demands through the Wood Canyon Waters and Deer Island Estates Area for the 2026 condition, it is recommended that a 6-inch waterline be constructed parallel to an existing 3-inch waterline.
2016-2026	SW27	New 6-inch Waterline along the North Side of the Golden Oaks. To provide adequate peak demands to the Bonanza Beach, Oak Shores and Golden Oaks Subdivisions, it will be necessary to construct a 6-inch waterline along the north side of the Golden Oaks Subdivision. It is also recommended that a 6-inch waterline be extended from this waterline to the existing 4-inch waterline within the Golden Oaks Area.
2016-2026	SW28	New 8-inch and 6-inch Looped Waterline Along Hwy 198. To provide water system service to the remaining Payne Springs Area within the Priority #3 Area, it is recommended that an 8-inch waterline be constructed along Hwy. 198 eastward to the Priority #3 Boundary. From the end of the 8-inch waterline, it is recommended that a 6-inch waterline be constructed down to an existing 8-inch waterline along the Priority #3 Boundary.
2016-2026	SW29	New 6-inch Waterline Through the Resort Area and the Western Side of Payne Springs. To provide adequate demands for the 2026 condition to the Resort Area and to the western side of Payne Springs, it is recommended that a 6-inch waterline be constructed from an existing 12-inch waterline at the Northern Part of Cedar Branch Park eastward across the Resort Area and to an existing 8-inch waterline on the west side of Payne Springs.
2016-2026	SW30	New 6-inch Waterline in the Northeastern part of the Priority #3 Area. To provide adequate service to the northeastern part of the Priority #3 Area, it is recommended that a 6-inch looped waterline be constructed beginning at Hwy 198 going upward and over to the east side of the Golden Oaks Subdivision.
2016-2026	SW31	New 6-inch Looped Waterline in the Carolynn, Lake Shore, and Southern Resort Service Area. To provide adequate summer peak demands throughout these areas, it is recommended that 6-inch looped water lines be constructed around the Hidden Hills Road, Oak Hills Road, and around the Lake Shore and Carolynn shoreline.

5.3 NORTH WASTEWATER SYSTEM

The following improvements are recommended for the North Wastewater System:

Year	Project No.	Description
1997	NWW1	Expansion of Lift Stations #38 and #39. Lift Stations #38, and #39 pump more than 90% of the total wastewater flow in the North System to the wastewater treatment plant. These lift stations are currently overloaded under peak flow conditions. It is recommended that Lift Station #38 be expanded to have a firm pumping capacity of 930 gpm. It is recommended that Lift Station #39 be expanded to have a firm pumping capacity of 990 gpm. These capacities are based on the projected flow to these two lift stations in the year 2016. It is recommended that the existing 8" line running from LS #38 to the WWTP be replaced with a 10" line. It is also recommended that the existing surge basin at the North WWTP be brought back to full capacity to handle the increase in peak flows from these two lift stations.
2000	NWW2	North WWTP Expansion Based on the projected increases in plant flows, it is recommended that the North WWTP be expanded 0.275 MGD to a total capacity of 0.9 MGD with a peak flowrate of 3.0 MGD. At this capacity the plant will be capable of handling sewage flows beyond the end of the study period.
1996-2006	NWW3	Increase Pumping Capacity of Lift Stations #60 and #61 and Construction of a Gravity Sewer to Lift Station #38. Under existing conditions, Lift Stations #61 and #60 show to be overloaded. It is recommended that the pumping capacity of Lift Stations #61 and #60 be increased to 65 gpm and 165 gpm respectively. It is also recommended that a 4-inch force main be constructed from Lift Station #60 to Harbor Street. An 8-inch/10-inch gravity sewer line will need to be constructed from Harbor Street along an existing creek to Lift Station #38. Once this gravity sewer line is constructed, Lift Station #59 can be abandoned.
1996-2006	NWW4	Increase Pumping Capacity of Lift Stations #25, and #33. Presently, the upstream Lift Stations #24 and #32 pump at a higher capacity than Lift Stations #25, and #33. Increased growth will increase the likelihood of overflow conditions at these downstream lift stations. Therefore it is recommended that the firm pumping capacities of these lift stations be increased in capacity. Lift Stations #25 and #33 will need to be expanded to have a capacity of 80 gpm and 58 gpm respectively.
1996-2006	NWW5	Diversion of Flow in Tamarack Area to Lift Station #56 and Construction of a Gravity Sewer Line from Hwy. 198 to Lift Station #39. Under the existing wastewater system layout, a series of lift stations in the Tamarack area will be overloaded by the year 2006. It is recommended that a 6-inch diversion line be constructed from Trailwind Street to Wildwind Street and then to Spring Valley Street. It is also recommended that an 8-inch force main be constructed from the force mains at the end

		of Spring Valley to Lift Station #56. This will divert much of the flow in the Tamarack area to Lift Station #56. Lift Station #56 will need to be expanded to have a firm pumping capacity of 170 gpm. A 6-inch force main will be constructed from the end of an existing 4-inch force main at Bay View Street to Highway 198. From Highway 198 a 10-inch gravity sewer line will be constructed to Welch Street. The force mains from Lift Stations #33 and #35 will be tied into the 10-inch gravity sewer line. This will reduce the high discharge head of these lift stations, which is currently a problem with Lift Station #35. From Welch Street the sewer line will need to be increased in size to a 12-inch sewer line and connected to Lift Station #39.
1996-2006	NWW6	Diversion of Flow from Lift Station #19 to Lift Station #29 and Expansion of Lift Station #29. Lift Station #19 and Lift Station #29 show to be overloaded under 2006 flow conditions. It is recommended that flow be diverted from Lift Station #19 to Lift Station #29, and that Lift Station #29 be expanded. The diversion line will be a 6-inch gravity sewer line from the Spanish Trail area to Redbird Street. It is recommended that Lift Station #29 be expanded to have a firm pumping capacity of 110 gpm.
1996-2006	NWW7	New 8-inch and 6-inch Gravity Sewer Lines and Lift Stations to Serve Remaining Area in Priority Area #2, East of Tamarack. Currently there exists no wastewater service to the area east of Tamarack Across the Hwy. 334 Bridge. New sewer facilities are described here to serve the remaining Priority Area #2 within the 2006 planning period. These facilities would include a 6-inch and 8-inch gravity sewer line along the Lakeview Drive to the east side of the Hwy. 334 Bridge. There will also need to be a new 50 gpm Lift Station and 4-inch force main along the east side of the Bonita Point Subdivision. This 4-inch force main will tie-in to the 8-inch gravity sewer line at the Oak Ridge Subdivision. On the east side of the Hwy. 334 bridge, a new 120 gpm Lift Station will need to be built to convey this area wastewater flow. It is recommended that flow from this lift station be pumped to Lift Station #36 using a 4-inch force main.
2006-2016	NWW8	New 8-inch Gravity Sewer Line from Lakeview Street to Existing 10-inch Gravity Sewer Line East of Harbor Street. Under the 2016 conditions, Lift Stations #3 and #4 show to be overloaded. It is recommended that an 8-inch gravity sewer line be constructed to divert all of the flow from this area to the existing 10-inch gravity sewer line that feeds into Lift Station #38. This can be done by tieing in the main 6-inch lines along Lakeview Street and by pumping a reduced quantity of flow from Lift Stations #3 and #4 to the new 8-inch gravity sewer line.
2006-2016	NWW9	Expansion of Lift Stations #19 and #44. Lift Stations #19 and #44 show to be overloaded for the 2016 flow condition. It is recommended that Lift Station #19 and #44 be expanded to 115 gpm and 65 gpm respectively.

2006-2016	NWW10	Expansion of Lift Station #5 and Construction of New Force Main from Lift Station #61 to Lift Station #60. Lift Station #5 at the intersection of Lakeview and Bayview Streets shows to be overloaded under peak 2016 flow conditions. It is recommended that this Lift Station be expanded to a capacity of 65 gpm. It is also recommended at this time that a new 4-inch force main be constructed from Lift Station #61 to Lift Station #60.
2006-2016	NWW11	Expansion of Lift Station #7, and New Gravity Sewer Line From Lift Station #21 and #46 to Lift Station #7. Lift Stations #7 and #21 are overloaded under 2016 peak flow conditions. It is recommended that an 8-inch gravity sewer interceptor be constructed along Lost Forrest Street to Sunset Street and then to Lift Station #7. It is also recommended that a 6-inch interceptor be constructed from Lift Station #46 at Lynn Street to Lift Station #10 and then to Lift Station #7. These two gravity sewer lines will allow Lift Station #21, #46 and #10 to be abandoned. Lift Station #7 will need to be expanded to a capacity of 120 gpm. It is also recommended that a new 4-inch force main be constructed from Lift Station #7 to the 8-inch gravity sewer line on Hwy. 334.
2006-2016	NWW12	New 6-inch Gravity Sewer Line to Serve Priority Area #3. A new 6-inch gravity sewer line will need to be constructed along Hwy 334 to convey wastewater flow from Priority Area #3 to the New Lift Station on the east side of the Hwy. 334 Bridge.
2006-2016	NWW13	Expansion of Lift Stations #36 and #40. With the additional flow from new growth and the new wastewater service area on the east side of Hwy. 334, Lift Station #36 and #40 will be overloaded in the 2016 flow condition. Therefore it is recommended that Lift Station #36 and #40 be expanded to 230 gpm and 260 gpm capacities respectively.
2016-2026	NWW14	New 6-inch Gravity Sewer Line Along Hwy. 198 . It is recommended that a 6-inch gravity sewer line be constructed along Hwy. 198 to handle additional flow from the area. If significant growth occurs along Hwy. 198 prior to this time period, it may be necessary to accelerate this project. This sewer line could also be used to relieve some flow from Lift Station #40, if required at this time. Currently, system analysis at this time, does not show that it will be necessary to divert flow under the 2026 flow conditions from the expanded Lift Station #40.
2016-2026	NWW15	New 8-inch and 6-inch gravity sewer line along Luther Street to Lift Station #39. Under the 2026 flow condition, the gravity sewer line along Welch Street shows to be overloaded in the analysis. It is recommended that a diversion gravity sewer line be constructed beginning at the end of Lift Station #40 6-inch force southward along Luther Street and then over to Lift Station #39. It is also recommended that a new 6-inch sewer line be tie-in to the proposed 8-inch sewer line along Luther Street. A diversion box will need to be constructed at the beginning of this project that will allow the splitting of flow in two directions to Lift Station #39.

2016-2026	NWW16	New Gravity Sewer Line along Arbolado Street to Lift Station #24, Expansion of Lift Station #24 and New 4-inch Force Main from Lift Station #24 to Hwy 334. The analysis shows that Lift Station #24 and the existing force main along Legendary Lane will be overloaded under 2026 flow conditions. It is recommended that a new 6-inch gravity sewer line be constructed to divert flow from Lift Station #13 and the existing force main along Legendary Lane, to Lift Station #24. The firm pumping capacity of Lift Station #24 will need to be expanded to a capacity of 95 gpm. It is recommended that a 4-inch force main be constructed from Lift Station #24 directly to the existing 12-inch gravity sewer line along Hwy 334.
2016-2026	NWW17	Expansion of Lift Station #37. Lift Station #37 will be overloaded under 2026 peak flow conditions. It is recommended that Lift Station #37 firm pumping capacity be increased to 310 gpm. The current capacity of Lift Station #37 is rated at 140 gpm at 100 ft of head. From our analysis, it appears that the discharge head may be significantly lower than 100 ft. Our analysis shows that the existing pumps will operate at a point along their pump curve that will currently produce about 220 gpm.
2016-2026	NWW18	New 8-inch Gravity Sewer Line along Harbor Point Road. Our analysis showed that some of the 2-inch force mains in the Northwestern Harbor Point Area, will become overloaded under peak flow conditions. It is recommended that an 8-inch gravity sewer line be constructed along Harbor Point Road down to the existing 8-inch gravity sewer line.

5.4 SOUTH WASTEWATER SYSTEM

The following improvements are recommended for the South Wastewater System:

Year	Project No.	Description
1997	SWW1	South WWTP Improvements Currently, the District is designing a new 0.2 MGD South WWTP and will begin construction shortly. It is recommended that the District continue with these plans. Upon completion of the new plant, the existing 0.04 MGD South WWTP should be abandoned. It is recommended that the design of the new plant include adequate land for future expansion needs.
1996-2006	SWW2	New 15-inch, 12-inch and 10-inch Gravity Sewer Line and Lift Station to Convey Flow From the North Part of the Wastewater System. To transport wastewater flow from the Oakwood Shores and Golden Oak Subdivisions and Subdivisions further north, it will be necessary to construct a gravity sewer line beginning at the southwest corner of the Golden Oaks Subdivision and proceeding along Cedar Creek Branch toward the wastewater treatment plant. It is recommended that the gravity sewer line begin as a 10-inch sewer line and increase in size to a 12-inch and finally a 15-inch as the line draws nearer to the plant. Because of the Hydraulics of the wastewater plant, it will be necessary to construct a lift station near the wastewater plant. It is recommended that this lift station have an initial firm capacity of 400 gpm, and expandable to a total capacity of 1400 gpm.
1996-2006	SWW3	New 6-inch and 4-inch Force Main to the Golden Oaks Subdivision. To provide adequate service to the Golden Oaks Subdivision, it is recommended that a 6-inch force main be constructed parallel to the existing 4-inch force main from the 10-inch gravity sewer line to the golden Oaks Subdivision. It is recommended that a 4-inch force main be constructed down the middle of the Golden Oaks Subdivision. It is recommended that 3-inch lateral force mains be constructed down each of the major streets in the subdivision.
1996-2006	SWW4	New 6-inch Force Main to Enchanted Drive and North to the Mac Oaks Subdivision. To prevent the grinder pump stations from operating at shut-off head under peak flow conditions, it is recommended that a 6-inch force main be constructed parallel to an existing 4-inch force main from the wastewater treatment plant to Enchanted Drive and northward to the Mac Oaks Subdivision.
1996-2006	SWW5	New 6-inch Force Main and Lift Station to Serve the Cedar Branch Park Area. To provide adequate service to the Cedar Branch Park Area, it is recommended that a 6-inch force main be constructed from the beginning of the new 15-inch gravity sewer line around Cedar Creek Branch and down to the Cedar Branch Park Area. It is also recommended that a lift station be constructed at the south end of the Cedar Branch Park Area to

		received and repump wastewater flow from grinder stations in the Timber Bay, Spillview, Diamond Oaks, Wood Canyon and Deer Island Subdivisions.
1996-2006	SWW6	New 4-inch Force Main to the Oakwood Shores Subdivision. To provide adequate service to the Oakwood Shores Subdivision, it is recommended that a 4-inch force main be constructed from the new 10-inch gravity sewer at the southwest corner of the Golden Oaks Subdivision on Hwy 198 to the Oakwood Shores Subdivision. It is recommended that 3-inch lateral force mains be constructed down the major streets of the subdivision.
1996-2006	SWW7	New 4-inch Force Main to the Baywood Estates Subdivision. To provide adequate service to the Baywood Estates Subdivision, it is recommended that a 4-inch force main be constructed from the existing 4-inch force main on Hwy 198 to Baywood Estates and that 3-inch lateral force mains be constructed down the major streets of the subdivision.
1996-2006	SWW8	New 4-inch Force Main to the Southland Shores, Bonanza Beach, and Oakshores Estates Subdivisions. To provide adequate service to the far north subdivisions within the south system, it is recommended that a 4-inch force main be constructed from the existing 4-inch force main on Hwy 198 northeast through each of these subdivisions. It is recommended that 3-inch lateral force mains be constructed down the major streets within each of these subdivisions. It is also recommended that a 6-inch gravity line be constructed to the south of these subdivisions.
1996-2006	SWW9	New 4-inch Force Main Along Leisureland Drive and Associated Lateral Force Mains to Serve Leisureland Subdivision. To provide adequate service to the Leisureland Subdivision, it is recommended that a 4-inch force main be constructed along Leisureland Drive beginning at Enchanted Drive. The 4-inch force main would be extended along Lakeland Drive. It is recommended that 3-inch lateral force mains be extended into each of the major streets in the subdivisions as shown in the mapping. It is also recommended that grinder pumps with shutoff heads of approximately 120 ft. be used in this subdivision.
1996-2006	SWW10	New 4-inch Force Main Along Forgotten Lane and Associated Lateral Force Mains to Serve Del Mar and Three Harbors Subdivisions. To provide adequate service to the Del Mar and Three Harbors Subdivisions, it is recommended that a 4-inch force main be constructed along Forgotten Lane beginning at Enchanted Drive. The 4-inch force main would be extended along the south side of Lakeland Drive to King Arthur Street. It is recommended that 3-inch lateral force mains be extended into each of the major streets in the subdivisions as shown in the mapping. It is also recommended that grinder pumps with shutoff heads of approximately 120 ft. be used in theses two subdivisions.
1996-2006	SWW11	New 4-inch and 3-inch Force Main to Serve the Timber Bay, Diamond Oaks, Spillview, Wood Canyon and Deer Island Subdivisions. To provide service to these subdivisions, it is recommended that a 4-inch

		force main be constructed from the lift station at the south end of the Cedar Branch Park Subdivision southward through to the end of the Wood Canyon Subdivision. From the end of the 4-inch force main it is recommended that a 3-inch force main be constructed through Deer Island Estates. It is also recommended that 3-inch lateral force mains be constructed into each of these subdivisions.
1998-2006	SWW12	South WWTP Expansion Assuming expansion of the South Wastewater System occurs as laid out in the Master Plan, there will be additional need placed on the South WWTP due to expansion into previously unserved areas. It is therefore recommended that the 0.2 MGD South WWTP be expanded to a capacity of 0.5 MGD based on need and expansion of the South collection system. The timing of this expansion should be based on system growth.
2006-2016	SWW13	New 8-inch Gravity Sewer Line to serve the southwestern part of Payne Springs. To convey flow from the southwestern part of Payne Springs, it is recommended that an 8-inch gravity sewer line be constructed down to an existing lift station at Lynn Creek.
2006-2016	SWW14	New 8-inch Gravity Sewer Trunk Lines Along Hwy 198 and Along the Golden Oaks Subdivision. To convey flow from the northwestern part of Payne Springs, it is recommended that these 8-inch gravity sewer lines be constructed and tied into an existing 10-inch and 12-inch gravity sewer line respectively. It is also recommended that the small lateral sewer lines be 6-inch gravity lines.
2006-2016	SWW15	New Parallel 6-inch Force Main to the Indian Harbor Area. To convey the 2016 peak flow from the Indian Harbor and Del Mar Subdivisions, it will be necessary to construct a parallel 6-inch force main along the existing 4-inch force main that currently exists.
2006-2016	SWW16	New Parallel 6-inch Force Main along Enchanted Drive. To convey the 2016 peak flow from the Leisureland and Forgotten Acres Subdivisions, it will be necessary to construct a parallel 6-inch force main along the existing 4-inch force main that currently exists.
2006-2016	SWW17	New Parallel 4-inch Force Main along Lakeland Drive. To convey the 2016 peak flow from the Leisureland Subdivision, it will be necessary to construct a parallel 4-inch force main along the existing 3-inch force main that currently exists. This 4-inch force main will extend the entire length of the Leisureland Subdivision.
2006-2016	SWW18	New 6-inch and 4-inch Force Main to Serve the Southeastern Portion of the Priority #3 Area. To provide service to the area on the south side of Lynn Creek, it is recommended that a grinder system be installed with a 6-inch running from Lynn Creek southward to Lake View Street. From Lake View Street, the force main will need to be 4-inch in size and extended southward to the end of the Priority #3 service area. A 120 gpm lift station will need to be constructed roughly in the middle of the force main route to reduce the

		total pumping head of the grinder stations in the far south part of the Priority #3 Area. It is recommended that 3-inch lateral force mains be constructed to each of the major streets within each of the subdivisions in this area.
2006-2016	SWW19	New 6-inch and 4-inch force main for the Resort CCN within the Priority #3 Area. To provide service to the Resort CCN, it is recommended that a 6-inch and 4-inch force main be constructed from along the shoreline with 3-inch lateral force mains. These force mains will feed into an existing lift station at the southern end of the Cedar Branch Park Subdivision.
2006-2016	SWW20	New 250 gpm Lift Station and 6-inch Force Main at Lynn Creek. To convey flow from the southeastern part of the Priority #3 Area to the wastewater treatment plant, it is recommended that a 250 gpm lift station and 6-inch force main be constructed. The 6-inch force main will begin at Lynn Creek and end at an existing 6-inch force main near Cedar Branch.
2016-2026	SWW21	New 6-inch, 8-inch and 10-inch Gravity Sewer Trunk Line through the Central Part of Payne Springs. To convey flows from the central part of Payne Springs, it is recommended that a 6-inch, 8-inch and 10-inch gravity sewer line be constructed down to the existing lift station at Lynn Creek. It is recommended that lateral lines on this sewer interceptor all be 6-inch in size.
2016-2026	SWW22	New 6-inch Parallel Force Main Along Forgotten Lane. To convey peak 2026 flows from the Del Mar Subdivision, it is recommended that a 6-inch force be constructed along an existing 4-inch force main along Forgotten Lane.
2016-2026	SWW23	New 6-inch Parallel Force Main to serve the Resort CCN Area. To convey 2026 peak flows from the Resort Area, it is recommended that a 6-inch force main be constructed from the lift station at Cedar Branch Creek to the northern part of the Cedar Branch Park Area.
2016-2026	SWW24	New 6-inch Parallel Force Main in the Southern Priority #3 Area. To convey 2026 peak flows from the southern part of the Priority #3 Area, it is recommended that a parallel 6-inch force main be constructed from the middle lift station to the 6-inch force main at Hidden Hills.

Each of the Master Plan projects should be evaluated for cost and environmental impact at the time of design. At this time there are no foreseen environmental problems that may hinder construction of any of the recommended projects. For more information on individual projects, environmental assessment of the Master Plan, and project prioritization, refer to Technical Memorandum #2 in Appendix B and Technical

Memorandum #3 in Appendix C. Mapping of the recommended improvements is provided in Appendix E. Layouts of the projects are preliminary and should be updated with changing system conditions.

6.0 ESTIMATES OF PROBABLE COSTS

6.1 PRELIMINARY COST ESTIMATES

Preliminary cost estimates have been provided for each recommended project. The estimates include probable construction costs, engineering fees, and contingencies. The preliminary estimates are based on the estimated quantities of linework, pumps, or treatment units for each project. The estimates showing individual costs for each project are provided in Table 5. Preliminary estimates are shown in 1996 dollars.

TABLE 5

PRELIMINARY COST ESTIMATES

Project ID#	Construction Date	Project Description	Estimated Cost
NORTH WATER SYSTEM			
NW 1	1997	New 12" loop around Legendary Lane, Hwy 334, and the Bozeman Easement	$830,000
NW 2	1997/2010	North WTP Expansion	$1,663,000
NW 3	1997/1999	North WTP High Service Pump Expansion	$31,000
NW 4	1997/2001	North WTP Raw Water Pump Expansion	$36,000
NW 5	1996-2006	New 8" and 6" Waterlines for the remaining Priority #2 Area on the East Side of the Hwy 334 Bridge	$234,000
NW 6	1996-2006	New 8" Waterlines to the Tamarack Area	$186,000
NW 7	1996-2006	New 10" and 8" Waterlines to Harbor Point	$290,000
NW 8	1996-2006	New 6" Waterline along Spanish Trail	$179,000

Project ID#	Construction Date	Project Description	Estimated Cost
NW 9	1996-2006	New 6" Waterlines through Sandy Shores and Eastwood Island Areas	$235,000
NW 10	1996-2006	New 6" Waterline from Welch Street to Harmon Street	$78,000
NW 11	2006	Total Storage Capacity Expansion	$206,000
NW 12	2006-2016	New 6" and 8" Waterlines to serve Priority Area #3	$279,000
NW 13	2006-2016	New 6" Waterline from Hwy 198 to Whispering Trail	$128,000
NW 14	2006-2016	New 6" Waterline in the Oak Harbor Subdivision	$170,000
NW 15	2006-2016	New 6" Waterlines in the Mantle Manors and Sherwood Shores Subdivisions	$268,000
NW 16	2006-2016	New 6" Looped Waterline for the Harbor Point Subdivision	$246,000
NW 17	2016-2026	New 10" Waterline Along Hwy 334 to Hwy 198	$307,000
NW 18	2016-2026	New 6" Waterline along Hwy 334 in Priority Area #3	$117,000
NW 19	2016-2026	New 6" Waterline in the Siesta Shores Area	$148,000
NW 20	2016-2026	New 6" Waterline in the Harbor Point Subdivision	$67,000
NW 21	2016-2026	New 6" Waterline along Luther Street	$165,000
NW 22	2016-2026	New 6" Waterlines in the Mantle Manors and the Southwind Estates Subdivisions	$168,000

Project ID#	Construction Date	Project Description	Estimated Cost
NW 23	2016-2026	New 6" Waterline along Whispering Trail in the Tamarack Area	$140,000
NW 24	2016-2026	New 6" Looped Waterline in Bonita Subdivision	$128,000
SOUTH WATER SYSTEM			
SW 1	2002/2016	South WTP, High Service & Raw Water Pumps Expansion	$1,724,000
SW 2	1996-2006	New 12" and 10" Waterline along Hwy 198 to Golden Oaks Addition	$230,000
SW 3	1996-2006	New 12" Waterline along Enchanted Drive, Hwy 198, and Southward toward Cedar Branch Park	$528,000
SW 4	1996-2006	New 12" and 8" Waterline through the Cedar Branch Subdivision	$268,000
SW 5	1996-2006	New 10" and 8" Waterline through Forgotten Acres to Lakeland Road	$205,000
SW 6	1996-2006	New 8" and 6" Waterline Southward along Enchanted Drive to Enchanted Oaks	$130,000
SW 7	1996-2006	New 8" and 6" Waterline to Golden Oaks, Southwood Shores, Bonanza Beach, and Oak Shores Subdivisions	$396,000
SW 8	1996-2006	New 8" and 6" Waterline to Baywood Estates Area	$68,000
SW 9	1996-2006	New 6" Looped Waterline through Bandera Bay and Oakwood Shores	$145,000
SW 10	1996-2006	New 6" Looped Waterline around Leisure-land and to Three Harbors Subdivisions	$223,000

Project ID#	Construction Date	Project Description	Estimated Cost
SW 11	2006-2016	New 6" and 8" Waterline to provide looped system for the Golden Oaks, Southwood Shores, Bonanza Beach, and Oak Shores Subdivisions	$524,000
SW 12	2006-2016	New 6" Waterline to Enchanted Isles Subdivision	$112,000
SW 13	2006-2016	New 6" Waterline to Cherokee Hills Subdivision	$28,000
SW 14	2006-2016	New 6" Waterline through Oakwood Shores Subdivision	$84,000
SW 15	2006-2016	New 6" Waterline through Del Mar Subdivision	$115,000
SW 16	2006-2016	New 6" Waterline through the Timber Bay, Spillview Estates, and Diamond Oaks Subdivisions	$73,000
SW 17	2006-2016	Parallel 12" Waterline along Enchanted Drive to Hwy 198	$123,000
SW 18	2006-2016	New 12" and 10" Waterline along Hwy 198 toward Payne Springs	$229,000
SW 19	2006-2016	New 8" and 6" Waterlines through the Southern Portion of the Resort Area	$341,000
SW 20	2006-2016	New 8" Waterline and Booster Pump Station to supply water to the Southeast parts of Priority #3 Area including the Lakeshore and Carolynn CCN areas	$1,375,000
SW 21	2006-2016	New 8" Looped Waterline to Priority #3 Area	$603,000
SW 22	2006-2016	New 6" Waterline on the East Side of the Resort Area in Priority #3 Area	$170,000

Project ID#	Construction Date	Project Description	Estimated Cost
SW 23	2016-2026	New 6" Waterline in the Southwood Shores Subdivision	$162,000
SW 24	2016-2026	New 6" Waterline in the Baywood Estates Subdivision	$47,000
SW 25	2016-2026	New 6" Waterline along Del Mar Shoreline	$59,000
SW 26	2016-2026	New 6" Waterline through the Wood Canyon Waters Subdivision	$75,000
SW 27	2016-2026	New 6" Waterline along the North Side of the Golden Oaks Subdivision	$173,000
SW 28	2016-2026	New 8" and 6" Looped Waterline along Hwy 198	$389,000
SW 29	2016-2026	New 6" Waterline through the Resort area and the Western Side of Payne Springs	$112,000
SW 30	2016-2026	New 6" Waterline in the Northeastern part of the Priority #3 Area	$290,000
SW 31	2016-2026	New 6" Looped Waterline in the Carolynn, Lake Shore, and Southern Resort Service Area	$564,000
NORTH WASTEWATER SYSTEM			
NWW 1	1997	Expansion of LS38 and LS39	$544,000
NWW 2	2000	North WWTP Expansion	$640,000
NWW 3	1996-2006	Increase pumping capacity of LS60, LS61, & construction of a gravity sewer to LS38	$285,000

Project ID#	Construction Date	Project Description	Estimated Cost
NWW 4	1996-2006	Increase pumping capacity of LS25 and and LS33	$20,000
NWW 5	1996-2006	Diversion of flow in Tamarack Area to LS56 and construction of a gravity sewer line from Hwy 198 to LS39	$383,000
NWW 6	1996-2006	Diversion of flow from LS19 to LS29 and expansion of LS29	$26,000
NWW 7	1996-2006	New 8" and 6" gravity sewer lines and Lift Stations to serve remaining area in Priority Area #2, East of Tamarack	$438,000
NWW 8	2006-2016	New 8" gravity sewer line from Lakeview Street to existing 10" gravity sewer line East of Harbor Street	$127,000
NWW 9	2006-2016	Expansion of LS19 and LS44	$23,000
NWW 10	2006-2016	Expansion of LS5 and construction of new force main from LS61 to LS60	$64,000
NWW 11	2006-2016	Expansion of LS7 and new gravity sewer line from LS21 and LS46 to LS7	$184,000
NWW 12	2006-2016	New 6" gravity sewer line to serve Priority Area #3	$140,000
NWW 13	2006-2016	Expansion of LS36 and LS 40	$69,000
NWW 14	2016-2026	New 6" gravity sewer line along Hwy 198	$92,000
NWW 15	2016-2026	New 8" and 6" gravity sewer line along Luther Street to LS39	$227,000
NWW 16	2016-2026	New gravity sewer line along Arbolado Street to LS24, expansion of LS24, and new 4" force main from LS24 to Hwy 334	$177,000

Project ID#	Construction Date	Project Description	Estimated Cost
NWW 17	2016-2026	Expansion of LS37	$40,000
NWW 18	2016-2026	New 8" gravity sewer line along Harbor Point Road	$102,000
SOUTH WASTEWATER SYSTEM			
SWW 1	1997	South WWTP Improvements	$399,000
SWW 2	1996-2006	New 15", 12", and 10" gravity sewer line and Lift Station to convey flow from the North part of the wastewater system	$619,000
SWW 3	1996-2006	New 6" and 4" force main to the Golden Oaks Subdivision	$125,000
SWW 4	1996-2006	New 6" force main to Enchanted Drive and North to the Mac Oaks Subdivision	$67,000
SWW 5	1996-2006	New 6" force main and Lift Station to serve the Cedar Branch Park Area	$325,000
SWW 6	1996-2006	New 4" force main to the Oakwood Shores Subdivision	$89,000
SWW 7	1996-2006	New 4" force main to the Baywood Estates Subdivision	$88,000
SWW 8	1996-2006	New 4" force main to the Southland Shores, Bonanza Beach, and Oakshores	$417,000
SWW 9	1996-2006	New 4" force main along Leisureland Drive and associated lateral force mains to serve Leisureland Subdivision	$168,000

Project ID#	Construction Date	Project Description	Estimated Cost
SWW 10	1996-2006	New 4" force main along Forgotten Lane and associated lateral force mains to serve Del Mar and Three Harbors Subdivisions	$274,000
SWW 11	1996-2006	New 4" and 3" force main to serve the Timber Bay, Diamond Oaks, Spillview, Wood Canyon, and Deer Island Subdivisions	$245,000
SWW 12	1998-2006	South WWTP Expansion	$698,000
SWW 13	2006-2016	New 8" gravity sewer line to serve the Southwestern part of Payne Springs	$204,000
SWW 14	2006-2016	New 8" gravity sewer trunk lines along Hwy 198 and along the Golden Oaks Subdivision	$681,000
SWW 15	2006-2016	New parallel 6" force main to the Indian Harbor Area	$46,000
SWW 16	2006-2016	New parallel 6" force main along Enchanted Drive	$61,000
SWW 17	2006-2016	New parallel 4" force main along Lakeland Drive	$45,000
SWW 18	2006-2016	New 6" and 4" force main to serve the Southeastern portion of Priority #3 Area	$600,000
SWW 19	2006-2016	New 6" and 4" force main for the Resort CCN within the Priority #3 Area	$272,000
SWW 20	2006-2016	New 250 gpm Lift Station and 6" force main at Lynn Creek	$350,000
SWW 21	2016-2026	New 6", 8", and 10" gravity sewer trunk line through the Central part of Payne Springs	$1,258,000
SWW 22	2016-2026	New 6" parallel force main on Forgotten Ln.	$47,000

Project ID#	Construction Date	Project Description	Estimated Cost
SWW 23	2016-2026	New 6" parallel force main to serve the Resort CCN Area	$78,000
SWW 24	2016-2026	New 6" parallel force main in the Southern Priority #3 Area	$142,000

6.2 SUMMARY OF MASTER PLAN COSTS

Estimated costs for each system and the Master Plan totals have been summarized in Table 6. This summary shows the total cost of the Master Plan projects in 1996 dollars for each ten year period of the Master Plan for both water and wastewater systems. The costs for each system have been broken into costs per connection and costs per 1000 gallons of billed water use or wastewater treated. Both cost per connection and cost per 1000 gallons were then amortized at an interest rate of 5% over 20 years. These amortized costs show the required increase in the District's revenue to repay a 20-year loan with a 5% interest rate. For example, to pay for water system improvements totaling $6,849,000 for the period of 1996-2006, the District would need to earn an additional $1.65 in revenue for every 1,000 gallons of billed water use for a 20-year period. Wastewater costs per 1,000 gallons represent the additional revenue the District would need to earn per 1,000 gallons of wastewater treated at the District's wastewater plants to repay a 20-year loan at 5% interest. For more information regarding estimated costs, refer to Technical Memorandum #3 in Appendix C.

TABLE 6

SUMMARY OF MASTER PLAN COSTS

	1996-2006	2006-2016	2016-2026	TOTALS
NORTH WATER				
Total Costs	$2,932,000	$1,297,000	$1,240,000	$5,469,000
Amortized Cost per Connection	$71	$26	$23	$113
Amortized Cost per 1000 Gallons	$1.08	$0.40	$0.34	$1.73
SOUTH WATER				
Total Costs	$3,917,000	$3,777,000	$1,871,000	$9,565,000
Amortized Cost per Connection	$156	$123	$51	$315
Amortized Cost per 1000 Gallons	$2.71	$2.13	$0.89	$5.47
WATER TOTALS				
Total Costs	$6,849,000	$5,074,000	$3,111,000	$15,034,000
Amortized Cost per Connection	$103	$63	$34	$191
Amortized Cost per 1000 Gallons	$1.65	$1.01	$0.55	$3.06
NORTH WASTEWATER				
Total Costs	$1,792,000	$606,000	$639,000	$3,037,000
Amortized Cost per Connection	$40	$11	$10	$55
Amortized Cost per 1000 Gallons	$0.83	$0.23	$0.22	$1.19
SOUTH WASTEWATER				
Total Costs	$3,115,000	$2,260,000	$1,526,000	$6,901,000
Amortized Cost per Connection	$175	$66	$32	$215
Amortized Cost per 1000 Gallons	$4.95	$2.11	$1.09	$6.74
WASTEWATER TOTALS				
Total Costs	$4,907,000	$2,866,000	$2,165,000	$9,938,000
Amortized Cost per Connection	$78	$31	$19	$114
Amortized Cost per 1000 Gallons	$1.76	$0.78	$0.50	$2.77
MASTER PLAN TOTALS				
Total Costs	$11,756,000	$7,940,000	$5,276,000	$24,972,000

Note: Costs per connection and Cost per 1,000 gallons have been amortized over a 20-year period at an interest rate of 5%.

All amounts are in 1996 dollars.

6.3 POTENTIAL FINANCING OPTIONS

There are several potential financing options the District can pursue to assist in the implementation of projects laid out in the Master Plan. These options include user service charges, taxes, Community Development Block Grants (CDBG's), Rural Utilities Service (Formerly Farmers Home Administration) grants and loans, Texas Water Development Board State Revolving Fund (SRF) programs, bond issues, EPA hardship grants, and Economic Development Administration grants. Specific funding vehicles should be determined prior to design and construction of a specific project(s). If the District qualifies, the use of grant monies would reduce the burden of payment for the improvements placed on the District. For more information regarding potential financing options, refer to Technical Memorandum #3 in Appendix C.

APPENDIX A

TECHNICAL MEMORANDUM #1

CURRENT CONDITIONS AND FIELD VERIFICATION SUMMARY

EAST CEDAR CREEK
FRESH WATER SUPPLY DISTRICT

WATER & WASTEWATER MASTER PLAN

TECHNICAL MEMORANDUM #1
SUMMARY OF TASKS B & C -
CURRENT CONDITIONS AND FIELD VERIFICATION

JUNE 1996

FREESE • NICHOLS

ECC95301

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1.0 INTRODUCTION

1.1 ECCFWSD BACKGROUND

The East Cedar Creek Fresh Water Supply District (ECCFWSD) consists of two separate water distribution and wastewater collection systems, the North System and the South System. Each System is hydraulically independent and has it's own water and wastewater treatment plants, elevated water storage tanks, and distribution and collection system piping. Both of the wastewater collection systems are primarily pressure systems with the North System using some gravity sewers and the South System using all force main piping. Each System was evaluated as to the current condition of the collection or distribution system and treatment facilities, and ability to meet current TNRCC State Design Criteria. In each case, the existing system and improvements implemented in 1996 were evaluated by this study.

The North District water system includes a 2.55 MGD water treatment plant, 500,000 gallon elevated storage tank, and water distribution piping system. The North water distribution system served an average of 2,896 water connections in 1995, based on information provided by ECCFWSD. The North District wastewater system includes a 0.626 MGD wastewater treatment plant, 67 wastewater lift stations, and associated house grinder pumps, wastewater force mains and gravity piping. The North wastewater collection system served an average of 3,075 wastewater connections in 1995, based on information provided by ECCFWSD.

The South District water system includes an existing water treatment plant and hydroneumatic storage tank. However, a proposed 1.73 MGD water treatment plant and 300,000 gallon elevated storage tank are under design and planned to be under construction in the near future. Upon completion of the new facility, the existing treatment plant will be

abandoned. Therefore, for the purposes of this study, the evaluation only reviewed the proposed 1.73 MGD water treatment facility and 300,000 gallon elevated storage tank. Based on information provided by ECCFWSD, the South water system served an average of 1,960 water connections in 1995 including 200 water connections in Payne Springs that are currently unserved. Since this demand may return to the system in the future, it is assumed on-line for the purposes of the evaluation. The South District wastewater system includes an existing 40,000 gpd wastewater treatment plant, a single duplex lift station, and associated house grinder pumps and pressure collection system piping. This evaluation looked at the capacity and performance of the existing plant and the capacity of the proposed 200,000 gpd South wastewater treatment plant. The South wastewater system served an average of 528 wastewater connections in 1995, based on information provided by ECCFWSD.

1.2 PROJECT SCOPE

The project scope for the Water and Wastewater Master Plan includes a review of the current system conditions, field verification of treatment facilities, field verification of the collection and distribution systems, computer modeling of the collection and distribution systems, development of recommendations, development of an implementation plan for the recommendations, and presentation of a final report. This Technical Memorandum will review the status of the current conditions review and the field examination portions of the scope.

The scope for the current conditions review included review of current regulatory requirements, flow conditions, projected population, and flow demands for the District's water and wastewater treatment and collections systems. Population estimates were obtained from the

Texas Water Development Board (TWDB). Projections were provided for the period 1995 to 2025. The evaluation also included a review of documents available from ECCFWSD on the existing systems, studies, mapping and design data for the District's water and wastewater treatment and collection systems.

The scope for the field verification included an examination of the existing collection and distribution systems and an examination of the existing and proposed water and wastewater treatment facilities. The system field verification consisted of taking pressure and flow measurements at various locations in the collection and distribution systems for use with the system modeling task. The facilities examination included review of existing construction record drawings, performance and regulatory reports, maintenance records, a comparison of these records with current State Design Criteria, staff interviews, and a field examination of the facility conditions.

This Technical Memorandum will discuss the results of the current conditions review and field verification portions of the Water and Wastewater Master Plan Study. It should be noted that the review of these items is in relation to the present situation in the District. Furthermore, since this is a review of present conditions, future system requirements have not been evaluated. A discussion of future requirements and recommendations will be included in Technical Memorandums 2 and 3 and in the final Master Plan report. In addition, some of the project assumptions, estimated flows, demands and resulting analysis could change as a result of the developing hydraulic model and developing 1996 flow and demand data. These changes will also be included in the final Master Plan report.

2.0 CURRENT CONDITIONS REVIEW

2.1 SUMMARY OF CURRENT REGULATORY REQUIREMENTS

TNRCC Design Criteria for sewerage systems requires that the wastewater collection system be capable of handling peak flows. Design Criteria for water distribution systems require the ability to maintain 20 psi pressures under fire flows during a maximum day condition. Analysis of the collection and distribution systems will be conducted during the hydraulic modeling stage (Task D) of the Master Plan Study. A discussion of the results of the hydraulic model will be given in Technical Memorandum #2 and in the final Master Plan report.

2.2 SUMMARY OF EXISTING SERVICE DEMANDS

2.2.1 Water Treatment and Distribution System

The water demands for the North and South water systems were obtained from plant flow records for the North and South System water treatment plants. The average demand for 1994 and 1995 was obtained for both plants, as well as a maximum day demand for both systems. The maximum day demand for the North System occurred in 1995 and was found to be 1.581 MGD. The maximum day demand for the South System also occurred in 1995 and was found to be 0.892. The maximum day and average day demands were divided by the total number of water connections for the North and South Systems to get the gallons per connection per day (gcd) for each district. A summary of current water treatment capacities, connections, and flow data is provided in Table 1. Copies of the calculations for average, maximum day flows, population projections, connection projections, and flow projections are included in Attachment A.

The population served by the North and South water distribution systems were estimated based on the number of connections in each system and the estimated number of people per household, taken from 1990 census data. Data obtained from the 1990 Census indicates that the North System has approximately 2.39 people per household and the South System has approximately 2.06 people per household. These numbers were taken from the average number of people per household for Gun Barrel City and Enchanted Oaks, respectively. Based on these numbers the estimated service populations for the water distribution systems for each system were calculated by multiplying the estimated number of people per household by the number of connections in that system. The resulting estimated population served by the North water distribution system is 6,921. The resulting estimated population served by the South water distribution system is 4,037. These service populations were also projected for future years based on TWDB population projections. The North System population covers portions of Gun Barrel City and some additional rural population. The South System population includes all of Enchanted Oaks and some additional populations in Payne Springs and rural areas.

2.2.2 Wastewater Collection and Treatment System

The North and South wastewater treatment and collection systems were evaluated for historical and projected average daily and 2-hour peak flows. Average daily flows were taken from historical monthly and daily flow data. The 2-hour peak flow was calculated by multiplying the maximum average 30-day flow for 1995 by a 2-hour peaking factor. The 2-hour peaking factor for the North System was developed from historical peak flow data for 1994 and 1995. The 2-hour wet weather peak flow for the North System is 1.77 MGD.

Since the highest recorded peak in the South System exceeded the chart recorder's maximum reading, the peak 2-hour flow was analyzed using three different methods. The first used Harmon's equation for determining peak flows, the second used historical plant data, and the third used historical data from the North System. Since historical flow data at the South WWTP was limited and historical flows from the North System may not be representative of the South System flows, it was determined that the 2-hour peak should be calculated using Harmon's equation. Harmon's equation is an empirical formula commonly used to develop wet weather peak flows from average flow data when peak flow data is unavailable. The 2-hour peak wet weather flow for the South System using Harmon's equation was calculated to be 0.595 MGD.

The 2-hour peak wet weather flows mentioned above are system peaks that would be expected based on flows entering the wastewater collection systems by gravity. Since the wastewater collection systems for both Systems are pressurized systems, the actual peak flows seen at the plants is based on the influent pumping capacity of the system. Therefore there are two peaks, the estimated 2-hour peak wet weather flow for the collection system and the 2-hour peak flow based on the collection system pumping capacity. The 2-hour peak pumping flow for the North System is 1.79 MGD based on the capacity of the existing system and proposed lift station improvements to stations delivering flows to the North Wastewater Treatment Plant. Since the South System is primarily a parallel system as opposed to the series system used in the North, the estimated 2-hour peak pumping flow for the South System is difficult to predict. Since the peak 2-hour flows seen at the SWWTP are comparable to the peak flow calculated by Harmon's equation, it is reasonable to assume that the pumping peak for the South System is the same as the peak flow calculated from Harmon's equation. Therefore, the pumping peak

for the South System is assumed to be 0.595 MGD.

A summary of current wastewater treatment capacities, connections, and flow data is provided in Table 2. Copies of calculations for determining average flows, peak flows, population projections, and connection and flow projections are included in Attachment A.

TABLE 1

WATER TREATMENT PLANT
CURRENT CONDITIONS SUMMARY

PLANT	RATED PLANT CAPACITY	SYSTEM DEMANDS AVG (MGD)	SYSTEM DEMANDS MAX (MGD)	SYSTEM AVG GPCD	SYSTEM MAX GPCD	1995 AVG # OF CONNECT.[1]	MAX # OF CONN. ALLOWED[2]	EST. POP SERVED
NORTH WTP	2.55 MGD	0.643	1.581	93	228	2896	3935	6921
EXIST. SOUTH WTP	n/a	0.327	0.892	83	228	1960		3920
PROP. SOUTH WTP	1.75 MGD	0.327	0.892	83	228	1960	2701	3920

NOTES: 1 – The average number of connections in the South System includes 200 connections for Payne Springs water customers who have been previously served by the district and are assumed served for current conditions.
2 – The maximum # of connections allowed is the maximum number of connections the District can have at design capacity based on the 0.45 gpm/connection variance.

MGD – Million Gallons Per Day
GPCD – Gallons Per Capita Per Day
GPM – Gallons Per Minute

TABLE 2

WASTEWATER TREATMENT PLANT
CURRENT CONDITIONS SUMMARY

PLANT	PERMITTED & DESIGN PLANT CAPACITY AVG. (MGD)	PERMITTED & DESIGN PLANT CAPACITY PEAK (MGD)	SYSTEM FLOWS[2] MAX 30 DAY AVG (MGD)	SYSTEM FLOWS[2] PEAK (MGD)	SYSTEM FLOWS[2] MAX 3 MO. AVG (MGD)	3 MO. AVG % OF PERMIT CAP	90% OF AVG. PLANT FLOW (MGD)	1995 AVG. # OF CONNECT	EST. POP SERVED
NORTH WWTP	0.626	1.872	0.562	1.77	0.484	77%	0.563	3075	7349
EXIST. SOUTH WWTP	0.04	0.1	0.170	0.595	0.131	328%	0.036	528	1056
PROP. SOUTH WWTP	0.2	0.8	0.170	0.595	0.131	66%	0.180	528	1056

NOTES: 1 – The peak capacity of the North WWTP of 1.872 is the permitted peak capacity of the plant. The calculated peak capacity based on State Design Criteria is 1.94 MGD.
2 – The Maximum 30 Day Average flow, 2–hour Peak Flow, and Maximum 3 Month Average Flow are based on average monthly and daily flow data.

3.0 FACILITIES EXAMINATION

3.1 TREATMENT PLANT CONDITION

The existing water and wastewater treatment plants were evaluated for their existing conditions based on historical plant performance data and visual inspection of each plant site. Historical performance data was provided by the District and includes influent and effluent water quality data and historical flow data.

3.1.1 Water Treatment Plants

The existing North Water Treatment Plant (WTP) is in good condition and currently produces water meeting or exceeding permitted conditions. The plant is a conventional treatment plant with a solids contact clarifier, dual media filters, clearwell and ground storage, chemical feed facilities and chlorination facilities. The North WTP has historically produced high quality water and has adequate capacity to meet current system needs.

The existing South WTP has historically had problems meeting required turbidity limits for water treatment and consistently breaks permitted turbidity limits. The average effluent turbidity for 1995 was 0.7 ntu. The permitted effluent turbidity limit according to State Criteria is 0.5 ntu, however the District has been granted an exception to this rule which allows the South WTP to meet 1 ntu turbidity limits. This exception is in place until construction of the new South WTP is complete. The turbidity levels appear to be due to the operation of the existing plant sedimentation tank. The sedimentation tank has limited sludge removal capability which prevents full use of the hydraulic capacity and detention time in the tank. Interviews with the plant's operations staff indicate that the filter media in the four operating filters has recently

been replaced. The District has also added two additional filters to augment the filter capacity of the plant. The plant includes an influent sedimentation tank, filters, chlorination and chemical feed, and a hydroneumatic storage tank.

Copies of historical plant flow data, influent water quality, and effluent water quality are included in Attachment A.

3.1.2 Wastewater Treatment Plants

The existing North Wastewater Treatment Plant (WWTP) is in good overall service condition and is capable of meeting permitted effluent requirements for BOD and TSS. The plant failed to meet TSS effluent concentrations as average monthly values on five occasions in 1994 and 1995. This has historically been a problem with TNRCC compliance reviews, however 1995 data indicates the plant is doing a much better job meeting effluent TSS requirements after improvements were made to remove a hydraulic restriction in the plant. The RAS return to the ditch is located adjacent to the clarifier influent line. This could result in some short circuiting of the RAS flow. The clarifier sludge rake may be having difficulty in fully removing solids from the clarifier. The effluent weirs on the clarifiers do not have scum baffles to prevent overflow of floatable solids into the effluent trough. Solids were visible in the troughs on the day of the visual inspection. All of these problems may have contributed to past problems with meeting effluent TSS requirements by allowing solids to escape into the plant effluent.

The existing South WWTP has had historical problems meeting BOD and 7-day average BOD effluent requirements. The plant has been cited in TNRCC compliance reviews for

exceeding the 75/90 rule, indicating that design of a new facility should begin. A new 200,000 gpd plant is currently under design. The plant has also been cited for heavy I/I conditions in addition to noncompliant flows during dry weather conditions. During inspection the plant had noticeable corrosion on the plant walls and equipment. The plant clarifier had a considerable amount of solids deposition and algal growth in the effluent trough.

Copies of plant historical flow data, influent quality data, and effluent quality data are included in Attachment A.

3.2 COMPLIANCE WITH TNRCC STANDARD DESIGN CRITERIA

Each water and wastewater treatment plant was evaluated with respect to current TNRCC Design Criteria for treatment plants. Major treatment units for each plant were evaluated regarding adequate size and capability to meet current demands.

3.2.1 Water Treatment Plants

The existing North WTP has adequate capacity for the following unit operations to meet current State Design Criteria for water treatment facilities for sedimentation basins, filter area, backwash rate of flow, clearwell storage and elevated tank storage capacity. The State Criteria for water facilities storage capacity requires that the raw water pumps, high service pumps, and water treatment plant capacity meet a capacity of 0.6 gpm per water connection. Each of these facilities currently meets a capacity of 0.5 gpm per water connection based on the average number of connections in 1995. The District has obtained a variance which allows the district to meet a capacity requirement of 0.45 gpm per connection for raw water pump, high service

pump, and treatment plant capacity. The plant does meet the state requirements for elevated storage and has adequate capacity to meet maximum day demands based on historical plant flows.

The existing South WTP was not evaluated for compliance with State Criteria, because this plant is to be abandoned upon completion of the proposed 1.73 MGD water treatment plant in the South District. The proposed 1.73 MGD water treatment plant was analyzed for compliance with current design criteria. It meets state capacity requirements for the following unit operations: sedimentation basins, filter area, backwash rate of flow, clearwell storage and elevated tank storage capacity. The State Criteria for storage capacity requires that the plant capacity, raw water pumps, and high service pumps meet a minimum of 0.6 gpm per connection. There were 1960 water connections on average in 1995 in the South District. The proposed plant is capable of meeting the State Criteria of 0.6 gpm per connection based on the average number of connections in 1995. The District also has a variance for this criteria for the South System which allows them to meet a capacity of 0.45 gpm per connection for raw water pumping, high service pumping and treatment plant capacity. The proposed plant is capable of meeting state requirements for storage capacity and has adequate treatment capacity to meet maximum day demands based on historical demands for the South District.

A summary of water treatment plant design capacities and TNRCC criteria for each unit operation is provided in Table 3. Copies of calculations for State Criteria sizing of water treatment plant unit operations are provided in Attachment B.

3.2.2 Wastewater Treatment Plants

The existing North WWTP meets the State Criteria and capacity requirements for all unit operations at the plant (Surge Basin Storage, Grit Removal, Bar Screens, Oxidation Ditch, Clarifiers, Chlorine Contact Basins, Sludge Drying Beds, Aeration Requirements, and Chlorinator capacity). The wastewater treatment plant currently has permission from TNRCC to waste sludge to the surge storage basin and, in recent months, has begun to augment this practice with the use of the existing sludge drying beds. The capacity of the proposed District plate and frame press for dewatering of waste sludge has been calculated at 352,000 lbs. of waste solids per year. The existing sludge drying beds at the plant are capable of dewatering approximately 276,000 lbs. of solids each year as calculated using TNRCC Design Criteria. Therefore, since the press has a greater capacity than the design capacity of the plant drying beds, use of the plate and frame press should provide adequate waste sludge dewatering capacity for the treatment plant, once operational.

The existing South WWTP was evaluated for compliance with the State Criteria based on assumed side water depths for the package treatment plant. Since there are no plans available for this plant it was assumed that the plant had a side water depth of 10 feet and operated as an extended aeration activated sludge treatment plant. Based on state criteria for aeration basin and clarifier volumes and loadings, the plant has been calculated as capable of meeting the permitted flow of 40,000 gpd. However, historical effluent data from the plant indicate that the plant has problems meeting effluent permit requirements for BOD at present flow demands. The plant also has historically had problems meeting design flows during dry weather conditions. Since a complete evaluation of the plant is not possible without plans, it is difficult to determine the

cause of these problems. Based on noticeable solids deposition in the clarifier and the fact that the aeration piping has been replaced, it is possible that the plant aeration requirements are not being met or that the clarifier is not operating as it should.

The District is currently in the design phase of a new WWTP to be located at a new 177 acre site north of the existing South WWTP plant. The proposed South WWTP was reviewed for compliance with State Criteria and is capable of meeting effluent and flow requirements for all unit operations (extended air basins, clarifiers, and sludge digestion) for the design flow of 200,000 gpd. A good portion of the peak flows entering the existing South WWTP appear to be I/I related. Substantial I/I work is planned in the system to reduce loadings and flow demands on the plant, increasing it's effectiveness.

A summary of wastewater treatment plant design capacities and TNRCC criteria for each unit operation is provided in Table 4. Copies of calculations for State Criteria sizing of wastewater treatment plant unit operations are provided in Attachment B.

TABLE 3

WATER TREATMENT PLANT
DESIGN CRITERIA SUMMARY

PLANT	UNIT OPERATION	TOTAL CAPACITY	LIMITING CAPACITY	TNRCC CRITERIA
North WTP	Sedimentation Basin	2.55 MGD	2.55 MGD	2-hr detention time
	Filters	2.55 MGD		5 gpm per sq. ft.
	Backwash	15.8 gpm/sf		12.5-18.7 gpm/sf
	Raw Water Pump Capacity	0.5 gpm/conn		0.6 gpm per connect. [1]
	Treatment Plant Capacity	0.5 gpm/conn		0.6 gpm per connect. [1]
	High Service Pump Capacity	0.5 gpm/conn		0.6 gpm per connect. [1]
	Clearwell Storage	11%		5% of plant capacity
	Total Storage	251 gal/conn		200 gal/connection
	Elevated Tank Capacity	172 gal/conn		100 gal/connection
South WTP	Sedimentation Basin	1.75 MGD	1.75 MGD	2-hr detention time
	Filters	2.17 MGD		5 gpm per sq. ft.
	Raw Water Pump Capacity	0.6 gal/conn		0.6 gpm per connect. [1]
	Treatment Plant Capacity	0.6 gal/conn		0.6 gpm per connect. [1]
	High Service Pump Capacity	0.6 gal/conn		0.6 gpm per connect. [1]
	Clearwell Storage	19%		5% of plant capacity
	Total Storage	325 gal/conn		200 gal/connection
	Elevated Tank Capacity	153 gal/conn		100 gal/connection

Notes: 1 – The District currently has an variance which allows them to meet a minimum requirement of 0.45 gpm/connection

TABLE 4

WASTEWATER TREATMENT PLANT
DESIGN CRITERIA SUMMARY

PLANT	UNIT OPERATION	TOTAL CAPACITY	LIMITING CAPACITY	TNRCC CRITERIA
North WWTP	Surge Basin	5.7 MGD		10-20% of Plant Vol.
	Oxidation Ditch	0.626 MGD	0.626 MGD	Loading Rate of 15 lb BOD/day/1000 cu ft
				Minimum HRT = 20 hours
				Minimum of 2 rotors per ditch
				Minimum channel velocity of 1 fps
	Brush Aerators	0.6 MGD		Min 100 hp per 1 MG of Aeration Basin Vol
	Clarifiers	2.145 MGD Qp		Qp Surface Loading 1000 gal/day/sq ft
				Peak Detention Time = 1.8 hrs
		1.072 MGD Qd		Average Surface Loading 500 gal/day/sq ft
				Average Detention Time = 3.6 hrs
				Weir Loading Rate = 20,000 gal/d/lf (Qp)
	Chlorine Contact	1.94 MGD	1.94 MGD Qp	20 min detention time @ peak
	Sludge Drying Beds	0.773 MGD		9.75 sf per # of BOD
	Chlorinators	160%		150% of highest expected dose
South WWTP	Aeration Basin	0.2 MGD	0.2 MGD	Qd Loading Rate of 15 #BOD/day/1000 cu.ft.
				Minimum HRT of 20 hours
	Clarifier	1.336 MGD Qp		Qp Surface Loading 1000 gal/day/sq ft
				Peak Detention Time = 1.8 hrs
		0.668 MGD Qd		Average Surface Loading 500 gal/day/sq ft
				Average Detention Time = 3.6 hrs
				Weir Loading Rate = 20,000 gal/d/lf (Qp)
	Sludge Digester	0.3 MGD		Minimum SRT of 15 days
	Chlorine Contact	0.8 MGD	0.8 MGD Qp	20 min detention time @ peak

4.0 SCHEDULED SYSTEM IMPROVEMENTS

Prior to review of the current conditions and field verification portions of the Master Plan study, the District implemented programs to repair several system and treatment plant inadequacies to help the District provide adequate service and maintain the system in compliance with State requirements. Most of the problems discussed in Section 3.0 are scheduled to be repaired. Deficiencies noted during the field investigation that have been declared by the District staff as rectified in more recent times are noted in this section. The following items are already scheduled for completion or have been completed by the District.

As mentioned, the existing South WTP has historically had problems meeting effluent quality for turbidity. To help eliminate these problems the District staff has implemented repairs for several items at the existing plant. These repairs included the addition of two filters to the plant to increase the plants filtration capability, installation of a static mixer in the raw water line to achieve better coagulation, removal of sheet flow drainage from the backwash pit to help eliminate storm flow to the pit, addition of baffles to aid in prevention of short circuiting in the clarifier, and relocation of turbidimeters to the filter discharge to better monitor and control filter runs. In addition to the repair items at the existing plant, the District currently has a new 1.73 MGD treatment plant under design which will be capable of meeting the South System water needs.

The District has recently repaired a construction joint leak in one aeration basin at the North WWTP, and has plans to replace the clarifier weirs and add scum removal capabilities. Also, the plate and frame press will soon be added to increase sludge handling capacity. A new South WWTP is under design that will be capable of meeting existing and future requirements

for the South System. In addition to this work, the District is currently rehabilitating home grinder pump installations to reduce infiltration/inflow into the wastewater collection systems. The District also has performed rehabilitation to several wastewater lift stations in the North System and has several lift stations scheduled for rehabilitation in the near future.

5.0 SYSTEM MAPPING AND HYDRAULIC MODEL

The system mapping for the hydraulic model has been completed for the North and South water distribution and wastewater collection systems. The system Cybernet and Hydra hydraulic models for modeling of current and future flow conditions have been initiated. A copy of the system maps to be modeled are included in Attachment C. The hydraulic model will be evaluated for existing and future flow conditions and a summary of the modeling results will be presented in Technical Memorandum #2.

ATTACHMENT 1-A

(WATER & WASTEWATER QUALITY, FLOWS AND PROJECTIONS)

FREESE • NICHOLS

Simon W. Freese, P.E. 1900–1990
Marvin C. Nichols, P.E. 1896–1969

Title: EAST CEDAR CREEK FWSD WATER AND WASTEWATER MASTER PLAN
Daily Water Quality Influent and Effluent Data – North WTP
[ECC95301]V:\NWTPDATA.WK1

Date: 04/24/96
By: DRJ
Chkd:

NORTH WATER TREATMENT PLANT 1994

DATE		RAW WATER ANALYSES			FINISHED WATER ANALYSES		
MONTH	DAY	NTU	pH	ALK	NTU	pH	ALK
JANUARY	1	8	7.6	55	0.1	7.9	54
	2	8	7.9	51	0.1	8	53
	3	9	7.7	48	0.1	7.9	53
	4	8	7.7	51	0.1	7.9	54
	5	9	7.7	51	0.1	8	54
	6	11	7.7	47	0.1	8	54
	7	8	8	50	0.1	8.6	53
	8	9	7.9	48	0.1	7.9	51
	9	6	7.7	50	0.2	7.9	54
	10	7	7.3	50	0.1	8.1	54
	11	11	7.2	52	0.1	8.1	54
	12	8	7.8	50	0.1	7.9	53
	13	11	7.6	51	0.1	7.7	55
	14	12	7.8	53	0.1	7.9	53
	15	8	7.9	49	0.1	7.8	53
	16	9	7.4	48	0.1	8	53
	17	7	7.6	47	0.1	8	55
	18	8	8	49	0.1	8.3	53
	19	9	8	49	0.1	8.1	54
	20	8	7.8	51	0.1	8.1	53
	21	8	7.8	49	0.1	8.3	51
	22	9	8	52	0.23	8	51
	23	7	7.8	52	0.15	8	54
	24	8	7.7	51	0.1	7.9	53
	25	9	7.6	51	0.1	7.7	52
	26	10	7.7	48	0.1	7.7	52
	27	9	7.7	50	0.1	8	51
	28	9	7.9	50	0.1	8	51
	29	9	7.7	49	0.1	8.1	50
	30	11	7.8	48	0.1	8	51
	31	10	7.7	51	0.1	7.8	53
FEBRUARY	1	11	7.8	48	0.1	8	50
	2	10	7.9	52	0.1	8.1	52
	3	12	7.8	53	0.1	8.1	53
	4	11	7.8	49	0.1	8	51
	5	9	7.8	50	0.1	8	51
	6	8	7.7	51	0.1	8	51
	7	11	7.6	48	0.1	7.7	53
	8	10	8	52	0.1	7.9	51
	9	11	7.6	49	0.1	8.4	53
	10	11	7.7	39	0.1	8.6	51
	11	14	7.8	48	0.1	8	51
	12	9	7.8	48	0.26	8.1	52
	13	9	7.8	49	0.3	8.1	49
	14	14	7.8	49	0.2	8.1	52
	15	10	7.8	52	0.26	7.8	53
	16	18	7.4	51	0.3	7.7	53
	17	13	7.4	51	0.33	7.8	53
	18	11	7.7	47	0.33	7.8	53
	19	10	7.7	47	0.35	7.9	48
	20	14	7.8	52	0.15	8.1	51
	21	12	8	51	0.33	8	49
	22	14	7.5	47	0.15	7.7	51
	23	12	7.8	51	0.1	7.5	50
	24	12	7.4	49	0.1	8	52

	25	15	7.7	41	0.1	8	52
	26	18	7.5	48	0.1	7.8	54
	27	12	7.8	54	0.28	7.7	46
	28	18	7.3	48	0.12	7.8	50
MARCH	1	17	8.6	50	0.1	8.1	44
	2	15	8.7	51	0.1	8.1	46
	3	15	7.7	48	0.2	8.2	48
	4	26	7.8	43	0.2	8.4	46
	5	14	7.8	52	0.1	8.1	53
	6	14	7.6	46	0.1	8.1	54
	7	17	7.2	47	0.1	7.5	46
	8	26	7.1	46	0.1	7.7	51
	9	23	7.1	52	0.1	8.5	55
	10	14	6.9	43	0.1	7.9	49
	11	23	7.5	45	0.1	8	48
	12	17	7.2	43	0.1	8	48
	13	16	7.3	46	0.1	8	51
	14	20	7.3	46	0.1	7.7	52
	15	19	7.4	42	0.1	7.8	48
	16	18	7.7	40	0.1	8	48
	17	26	7.2	44	0.1	7.6	52
	18	17	7.2	45	0.1	8	52
	19	22	7.5	44	0.1	7.8	48
	20	19	7.8	47	0.1	8	53
	21	16	7.6	48	0.1	8	51
	22	19	7.2	43	0.1	7.6	50
	23	19	7.4	46	0.1	8.3	52
	24	18	7.4	49	0.13	8.5	53
	25	14	7.4	45	0.1	8.1	49
	26	21	7.4	45	0.1	7.7	50
	27	22	7.5	50	0.1	8.2	55
	28	24	7.5	54	0.1	7.9	50
	29	19	7.5	45	0.1	7.9	50
	30	12	7.4	43	0.1	7.7	50
	31	15	7.6	43	0.1	7.7	46
APRIL	1	20	7.7	43	0.1	8.6	51
	2	15	7.8	43	0.1	8.5	48
	3	21	8.4	57	0.1	8	51
	4	17	7.6	53	0.18	7.8	51
	5	15	7.3	43	0.15	8.4	51
	6	8	7	45	0.1	8.6	49
	7	11	7.2	43	0.1	8	44
	8	20	7.3	46	0.1	7.6	50
	9	19	8.1	43	0.1	8.3	51
	10	17	7.4	51	0.1	8.2	52
	11	14	7.1	46	0.1	8	52
	12	19	7.1	52	0.1	7.8	51
	13	10	7.2	45	0.1	7.7	49
	14	18	7	45	0.1	7.3	48
	15	11	8.2	46	0.1	8.1	50
	16	8	7.1	46	0.1	7.8	49
	17	37	7.3	51	0.15	8.1	51
	18	20	7.5	47	0.1	7.8	53
	19	21	7.3	45	0.1	8.1	50
	20	21	7.1	49	0.1	7.9	50
	21	23	7.3	50	0.1	7.8	50
	22	20	7.3	48	0.1	8	50
	23	24	7.2	50	0.1	7.1	51
	24	20	7.4	51	0.1	7.7	51
	25	17	7.4	49	0.1	8.1	51
	26	11	7.5	49	0.1	8.1	50
	27	7	7.8	48	0.1	7.8	51
	28	15	7.6	50	0.1	7.9	49
	29	19	7.2	48	0.1	8.4	53
	30	18	7.4	47	0.1	8.1	53
MAY	1	17	7.4	51	0.1	8.1	51
	2	15	7	49	0.1	8.1	51
	3	17	7.5	51	0.1	7.8	49
	4	17	7.3	47	0.1	7.6	54
	5	15	7.2	49	0.2	7.9	53

	6	13	7.5	51	0.1	8.2	52
	7	15	7.9	50	0.1	8.1	50
	8	8	7	49	0.1	8.2	50
	9	15	7.2	46	0.1	7.7	52
	10	18	7.4	51	0.13	7.6	56
	11	27	7.6	54	0.13	8	49
	12	13	7.1	50	0.1	7.8	54
	13	16	7.6	50	0.1	8.2	52
	14	14	7.8	50	0.1	8.1	51
	15	13	7.6	50	0.1	8.4	53
	16	15	7.3	50	0.1	8	52
	17	15	7.1	50	0.1	7.5	52
	18	13	7.3	45	0.1	7.6	53
	19	18	7.3	45	0.1	8.5	48
	20	16	7.2	46	0.1	8.3	51
	21	10	7.4	51	0.1	8.2	56
	22	12	7.5	49	0.1	8.1	56
	23	7	7.4	44	0.1	7.9	51
	24	5	7.3	49	0.1	7.6	54
	25	5	7.5	47	0.1	8.3	50
	26	8	7.5	47	0.43	7.7	50
	27	5	7.1	45	0.2	7.5	46
	28	10	7.2	40	0.2	7.7	38
	29	6	7	44	0.13	7.5	34
	30	7	7.2	44	0.1	7.9	41
	31	8	7.5	49	0.1	7.8	51
JUNE	1	8	7.5	47	0.1	8.1	51
	2	7	7.4	48	0.1	7.8	54
	3	7	7.4	47	0.1	7.8	51
	4	7	7.2	47	0.1	7.7	48
	5	10	7	48	0.1	7.6	57
	6	7	7.5	48	0.1	7.6	52
	7	7	7.3	53	0.1	8.1	51
	8	4	7.8	48	0.1	8.3	55
	9	5	7.5	49	0.2	8.1	50
	10	13	7	49	0.2	8.3	67
	11	8	7.4	49	0.1	8.3	54
	12	10	7.4	47	0.26	8.3	53
	13	16	7.1	46	0.31	8.6	45
	14	6	7.3	46	0.13	8.8	86
	15	6	7.1	52	0.56	7.5	59
	16	5	7	45	0.31	8.4	47
	17	7	7	46	0.2	8.8	56
	18	5	7	45	0.23	8	54
	19	6	6.8	46	0.2	7.4	55
	20	7	7	48	0.15	8.8	54
	21	6	7.2	45	0.1	7.9	53
	22	5	7.6	48	0.1	7.8	50
	23	5	7.8	51	0.1	7.6	50
	24	7	7.7	46	0.1	7.4	50
	25	5	7.2	55	0.1	7.2	51
	26	6	7.1	55	0.15	7.8	54
	27	6	7.5	48	0.2	8.1	54
	28	4	7.9	45	0.1	7.7	51
	29	5	7.6	48	0.1	7.9	55
	30	6	7.2	46	0.1	8.3	50
JULY	1	5	7.4	48	0.1	8.3	50
	2	7	7.1	53	0.1	7.7	60
	3	6	6.4	31	0.1	7.8	71
	4	6	7.7	45	0.15	7.6	51
	5	5	7.7	43	0.1	7.5	57
	6	6	7.3	48	0.2	8.8	58
	7	6	7.4	49	0.1	8.3	53
	8	7	7.5	51	0.1	8.4	51
	9	7	7.3	47	0.1	7.7	56
	10	7	7.8	47	0.2	7.9	59
	11	8	7.8	50	0.3	7.6	51
	12	6	7	52	0.13	7.7	51
	13	3	7	55	0.1	7.7	54
	14	4	7.2	51	0.1	8.1	55

	15	3	7.1	53	0.1	8	51
	16	4	7.3	54	0.1	8.1	49
	17	4	7.4	52	0.13	8.2	53
	18	7	7.2	45	0.2	7.6	64
	19	4	6.7	50	0.15	8.4	65
	20	3	7.3	48	0.1	8.1	53
	21	3	7.4	48	0.15	8	50
	22	10	7.4	50	0.13	8.1	51
	23	9	7.5	49	0.1	8.1	51
	24	4	7.1	51	0.1	7.7	51
	25	5	7	47	0.1	7.9	55
	26	4	7.3	49	0.1	8.1	51
	27	3	7.4	48	0.1	8.2	53
	28	5	7.5	47	0.1	8.7	59
	29	4	7.4	49	0.1	7.8	52
	30	5	7.4	51	0.1	8.1	52
	31	4	7.4	48	0.1	8.1	52
AUGUST	1	6	7.3	47	0.1	7.6	61
	2	5	7.4	48	0.1	8.4	56
	3	5	7.4	48	0.1	8.8	62
	4	4	7.4	50	0.1	8.4	56
	5	4	7.4	48	0.1	7.5	54
	6	4	7.4	50	0.13	8.2	48
	7	5	7.5	48	0.2	7.9	50
	8	4	7.5	48	0.2	8.3	56
	9	3	7.4	48	0.2	8.2	56
	10	5	7.3	48	0.1	8.2	60
	11	4	7.4	49	0.15	7.9	66
	12	6	7.3	50	0.2	8.9	68
	13	5	7.4	51	0.1	8.5	56
	14	6	7.5	50	0.1	8	51
	15	5	7.4	47	0.1	8	54
	16	4	7.4	50	0.13	8.3	61
	17	6	7.6	51	0.1	7.9	51
	18	5	7.4	50	0.1	7.9	50
	19	3	7.5	50	0.1	7.1	48
	20	4	7.5	49	0.1	8.9	56
	21	12	7.5	49	0.17	8.5	55
	22	3	7.4	48	0.15	8.7	62
	23	4	7.3	49	0.1	8.7	59
	24	3	7.2	49	0.1	8.6	64
	25	4	7.3	50	0.1	8	64
	26	4	7.4	50	0.1	8	65
	27	3	7.4	48	0.1	8.2	53
	28	4	7.3	48	0.1	8.2	52
	29	6	7.4	49	0.1	7.9	57
	30	5	7.3	49	0.1	8.2	63
	31	4	7.1	48	0.1	8.6	57
SEPTEMBER	1	6	7.5	50	0.13	8.7	68
	2	5	7.3	50	0.15	8.4	64
	3	5	7.4	49	0.2	8.4	60
	4	4	7.6	51	0.15	8.4	51
	5	5	7.6	51	0.1	8.6	57
	6	6	7.3	49	0.1	8.2	55
	7	6	7.4	50	0.13	8.2	61
	8	3	7.3	50	0.2	8.5	62
	9	4	7.3	47	0.1	8.6	54
	10	5	7.4	50	0.1	7.9	49
	11	5	7.5	48	0.1	8.3	54
	12	5	7.4	45	0.1	8.4	57
	13	6	7.4	49	0.1	8.4	58
	14	6	7.5	53	0.1	8.3	53
	15	6	7.7	49	0.1	7.4	50
	16	13	7.1	54	0.1	8.3	51
	17	10	7.4	51	0.1	8.3	51
	18	9	7.5	50	0.1	8.3	52
	19	5	7.5	44	0.1	8.1	63
	20	5	7.6	48	0.2	8.5	55
	21	10	7.3	45	0.15	8.6	74
	22	6	7.1	51	0.3	8.3	56

	23	5	7.2	50	0.4	8.4	54
	24	8	7.6	48	0.36	8.6	61
	25	12	7.4	48	0.33	8.4	54
	26	7	7.4	44	0.2	8.6	65
	27	6	7.4	47	0.2	8.4	58
	28	6	7.4	48	0.2	8.4	57
	29	8	7.3	49	0.2	8.5	55
	30	7	7.6	49	0.4	8.1	51
OCTOBER	1	7	7.6	52	0.26	8.7	57
	2	6	7.4	49	0.23	8.5	55
	3	6	7.3	51	0.25	8.6	57
	4	6	7.4	49	0.16	8.8	75
	5	6	7.6	52	0.15	8.4	61
	6	3	7.6	51	0.1	8.1	61
	7	4	7.6	51	0.1	8.1	60
	8	8	7.5	47	0.1	8.4	57
	9	10	7.6	48	0.13	8.3	55
	10	6	7.4	54	0.2	8.1	53
	11	4	7.6	55	0.2	8.2	54
	12	5	7.4	55	0.2	8.3	67
	13	6	7.1	53	0.2	8.1	55
	14	3	7.4	60	0.3	8.6	65
	15	3	7.4	51	0.2	8.5	60
	16	3	7.5	53	0.2	8.4	56
	17	6	7.2	61	0.2	8.6	53
	18	3	7.3	45	0.2	8	58
	19	2	7.3	51	0.1	8.3	52
	20	2	7	63	0.1	7.9	60
	21	2	7.1	59	0.2	7.8	66
	22	5	7.3	52	0.16	8.2	50
	23	3	7.4	53	0.2	8.3	57
	24	9	7.6	47	0.2	7.9	49
	25	8	7.3	53	0.2	8.2	55
	26	6	7.3	53	0.2	7.7	55
	27	6	7.4	50	0.2	8.3	53
	28	6	7.5	53	0.13	8.3	52
	29	4	7.4	53	0.1	8	51
	30	4	7.5	46	0.2	8	52
	31	1	8.3	66	0.2	7.6	54
NOVEMBER	1	3	7.7	59	0.1	7.9	53
	2	2	6.6	55	0.1	7.9	53
	3	3	7.2	55	0.2	7.8	46
	4	4	7.8	51	0.33	7.8	49
	5	7	7.5	49	0.16	7.9	50
	6	6	7.5	48	0.13	7.9	52
	7	2	7.2	51	0.23	7.6	52
	8	2	7.2	48	0.3	7.8	50
	9	3	7.5	53	0.3	7.9	49
	10	3	6.8	38	0.2	7.4	51
	11	4	7.2	48	0.2	8.1	53
	12	4	7.3	49	0.3	8	52
	13	3	7.3	48	0.4	8	53
	14	2	6.9	53	0.43	7.6	54
	15	9	7.1	48	0.5	7.9	53
	16	6	7.3	47	0.4	7.9	51
	17	7	7.7	47	0.25	7.9	51
	18	7	7.6	50	0.2	8.1	51
	19	6	7.5	48	0.2	8	52
	20	9	7.7	52	0.15	7.8	48
	21	7	7.4	51	0.1	8.1	54
	22	4	7.5	55	0.15	7.6	51
	23	5	7.5	50	0.2	8	51
	24	9	7.6	55	0.2	7.7	58
	25	7	7.9	55	0.2	7.7	51
	26	7	7.6	52	0.2	8	55
	27	5	7.6	51	0.1	8	53
	28	4	7.4	51	0.1	7.9	49
	29	7	7.3	44	0.1	7.6	44
	30	7	7.6	51	0.1	7.7	47
DECEMBER	1	2	7.1	61	0.1	7.4	43

	15	3	7.1	53	0.1	8	51
	16	4	7.3	54	0.1	8.1	49
	17	4	7.4	52	0.13	8.2	53
	18	7	7.2	45	0.2	7.6	64
	19	4	6.7	50	0.15	8.4	65
	20	3	7.3	48	0.1	8.1	53
	21	3	7.4	48	0.15	8	50
	22	10	7.4	50	0.13	8.1	51
	23	9	7.5	49	0.1	8.1	51
	24	4	7.1	51	0.1	7.7	51
	25	5	7	47	0.1	7.9	55
	26	4	7.3	49	0.1	8.1	51
	27	3	7.4	48	0.1	8.2	53
	28	5	7.5	47	0.1	8.7	59
	29	4	7.4	49	0.1	7.8	52
	30	5	7.4	51	0.1	8.1	52
	31	4	7.4	48	0.1	8.1	52
AUGUST	1	6	7.3	47	0.1	7.6	61
	2	5	7.4	48	0.1	8.4	56
	3	5	7.4	48	0.1	8.8	62
	4	4	7.4	50	0.1	8.4	56
	5	4	7.4	48	0.1	7.5	54
	6	4	7.4	50	0.13	8.2	48
	7	5	7.5	48	0.2	7.9	50
	8	4	7.5	48	0.2	8.3	56
	9	3	7.4	48	0.2	8.2	56
	10	5	7.3	48	0.1	8.2	60
	11	4	7.4	49	0.15	7.9	66
	12	6	7.3	50	0.2	8.9	68
	13	5	7.4	51	0.1	8.5	56
	14	6	7.5	50	0.1	8	51
	15	5	7.4	47	0.1	8	54
	16	4	7.4	50	0.13	8.3	61
	17	6	7.6	51	0.1	7.9	51
	18	5	7.4	50	0.1	7.9	50
	19	3	7.5	50	0.1	7.1	48
	20	4	7.5	49	0.1	8.9	56
	21	12	7.5	49	0.17	8.5	55
	22	3	7.4	48	0.15	8.7	62
	23	4	7.3	49	0.1	8.7	59
	24	3	7.2	49	0.1	8.6	64
	25	4	7.3	50	0.1	8	64
	26	4	7.4	50	0.1	8	65
	27	3	7.4	48	0.1	8.2	53
	28	4	7.3	48	0.1	8.2	52
	29	6	7.4	49	0.1	7.9	57
	30	5	7.3	49	0.1	8.2	63
	31	4	7.1	48	0.1	8.6	57
SEPTEMBER	1	6	7.5	50	0.13	8.7	68
	2	5	7.3	50	0.15	8.4	64
	3	5	7.4	49	0.2	8.4	60
	4	4	7.6	51	0.15	8.4	51
	5	5	7.6	51	0.1	8.6	57
	6	6	7.3	49	0.1	8.2	55
	7	6	7.4	50	0.13	8.2	61
	8	3	7.3	50	0.2	8.5	62
	9	4	7.3	47	0.1	8.6	54
	10	5	7.4	50	0.1	7.9	49
	11	5	7.5	48	0.1	8.3	54
	12	5	7.4	45	0.1	8.4	57
	13	6	7.4	49	0.1	8.4	58
	14	6	7.5	53	0.1	8.3	53
	15	6	7.7	49	0.1	7.4	50
	16	13	7.1	54	0.1	8.3	51
	17	10	7.4	51	0.1	8.3	51
	18	9	7.5	50	0.1	8.3	52
	19	5	7.5	44	0.1	8.1	63
	20	5	7.6	48	0.2	8.5	55
	21	10	7.3	45	0.15	8.6	74
	22	6	7.1	51	0.3	8.3	56

FREESE • NICHOLS

Simon W. Freese, P.E. 1900–1990
Marvin C. Nichols, P.E. 1896–1969

Title: EAST CEDAR CREEK FWSD WATER AND WASTEWATER MASTER PLAN
Daily Water Quality Influent and Effluent Data – North WTP
[ECC95301]V:\NWTPDATA.WK1

Date: 04/24/96
By: DRJ
Chkd:

NORTH WATER TREATMENT PLANT 1995

DATE		RAW WATER ANALYSES			FINISHED WATER ANALYSES		
MONTH	DAY	NTU	pH	ALK	NTU	pH	ALK
JANUARY	1						
	2						
	3						
	4						
	5						
	6						
	7						
	8						
	9						
	10						
	11						
	12						
	13						
	14						
	15			DATA UNAVAILABLE			
	16						
	17						
	18						
	19						
	20						
	21						
	22						
	23						
	24						
	25						
	26						
	27						
	28						
	29						
	30						
	31						
FEBRUARY	1	18	7.4	39	0.33	7.6	48
	2	30	7.2	43	0.3	7.4	40
	3	23	7.5	40	0.3	7.8	49
	4	31	7.6	41	0.35	7.4	41
	5	21	7.6	38	0.63	7.6	51
	6	20	7.6	40	0.33	7.5	40
	7	28	7.6	39	0.3	8.1	46
	8	18	7.3	31	0.5	7.1	38
	9	12	7.3	39	0.53	7.4	38
	10	27	7.6	36	0.53	7.1	36
	11	25	7.6	34	0.5	7.2	35
	12	30	7.4	25	0.4	7.3	32
	13	21	7.4	39	0.23	8.1	54
	14	26	7.2	32	0.4	7.7	46
	15	20	7.6	36	0.35	7.8	52
	16	26	7.5	44	0.48	7.2	41
	17	32	7.2	40	0.6	7.7	45
	18	33	7.7	41	0.3	7.4	40
	19	26	7.4	37	0.3	7.4	41
	20	33	7.1	37	0.23	7.3	46
	21	23	7.2	36	0.33	7.3	36
	22	32	7.6	39	0.2	7.4	46
	23	28	7.4	36	0.3	7.3	42
	24	17	6.9	38	0.46	8.2	48

	25	34	7.5	36	0.3	7.6	40
	26	29	7.6	41	0.3	7.4	39
	27	17	7.2	42	0.2	7.6	48
	28	22	7.6	43	0.16	7.6	43
MARCH	1	17	7.2	36	0.23	7.7	44
	2	23	7.7	39	0.33	8.2	48
	3	24	7.8	39	0.35	8.4	48
	4	23	7.7	46	0.2	7.5	49
	5	26	7.6	41	0.2	7.4	40
	6	24	7.3	39	0.1	7.3	43
	7	25	7.7	41	0.1	7.5	48
	8	23	7.7	41	0.15	7.4	44
	9	22	7.7	39	0.16	7.4	44
	10	24	7.1	43	0.1	7.4	47
	11	23	7.4	36	0.1	7.5	46
	12	19	7.3	33	0.1	7.4	43
	13	18	7.2	46	0.2	7.7	41
	14	33	7.1	31	0.33	7.6	46
	15	19	7.5	36	0.16	7.7	48
	16	20	7.2	40	0.26	8.1	48
	17	26	7	41	0.1	7.6	45
	18	30	7.2	42	0.1	7.5	43
	19	23	7.2	40	0.1	7.8	48
	20	23	7.3	40	0.1	7.3	46
	21	21	7.2	38	0.13	7.8	47
	22	29	7.2	41	0.1	7.9	60
	23	29	7.9	43	0.13	7.8	50
	24	24	7.4	39	0.15	7.6	47
	25	31	7.1	42	0.1	7.5	48
	26	25	7.5	37	0.15	8.3	46
	27	28	7.1	44	0.16	7.4	46
	28	23	7.2	41	0.15	7.7	51
	29	26	7.6	46	0.15	7.6	53
	30	26	7.7	49	0.2	7.8	50
	31	16	7.2	42	0.2	7.7	39
APRIL	1						
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MAY	1	9	6.7	42	0.1	7.5	57
	2	12	7.5	42	0.16	7.7	54
	3	11	7.2	41	0.16	8	56
	4	8.4	7.5	43	0.2	7.9	58
	5	8.5	7.3	36	0.15	7.5	45

	6	10	7.4	43	0.1	8	56
	7	9	7.3	39	0.1	8.1	54
	8	17	7.1	49	0.16	7.7	46
	9	9	7.2	35	0.15	7.7	40
	10	11	7.1	38	0.15	8.2	56
	11	12	6.8	36	0.2	7.6	53
	12	15	7	40	0.2	7.7	53
	13	21	7.2	44	0.2	7.7	54
	14	16	7.3	39	0.25	8	67
	15	14	7.1	38	0.3	7.8	63
	16	14	7.1	38	0.41	7.8	62
	17	8.8	8.3	40	0.23	8	54
	18	14.5	6.7	40	0.1	8	56
	19	14	7	36	0.2	7.5	49
	20	14	7.1	39	0.25	7.9	50
	21	12	7.3	36	0.2	7.7	58
	22	11	7.2	37	0.2	7.8	60
	23	19	7	37	0.2	7.5	55
	24	18	7.2	35	0.21	8	58
	25	18	7.4	38	0.11	7.4	58
	26	14	7.4	37	0.1	8.4	50
	27	13	7.7	51	0.2	7.7	60
	28	14	7.9	53	0.3	8	64
	29	15	7.5	44	0.33	7.4	66
	30	15	7.6	46	0.38	7.7	59
	31	11.5	7.3	44	0.43	7.3	44
JUNE	1	11.9	7.6	39	0.2	7.2	58
	2	11.6	7.3	33	0.2	7.6	59
	3	7.3	7.6	25	0.2	8.6	58
	4	6.4	7.4	42	0.2	8.7	57
	5	7.4	7.5	44	0.1	8.7	87
	6	16	7.4	32	0.15	8.3	65
	7	16	7.6	39	0.1	8.4	64
	8	8	7.8	52	0.33	8.7	70
	9	12	7.7	52	0.16	8.1	64
	10	12	7.7	48	0.1	8.2	67
	11	19	7.1	53	0.2	8.6	70
	12	9.5	7.6	32	0.2	8.6	80
	13	11	7.3	49	0.16	8.6	64
	14	1.2	9.3	47	0.1	7.5	52
	15	11	7.4	42	0.1	8.5	71
	16	22	6.2	17	0.16	8.7	66
	17	8	7.3	38	0.15	8.3	63
	18	10	7.2	40	0.1	8.4	68
	19	66	7.6	62	0.15	8.7	65
	20	18	7.5	52	0.1	8.6	68
	21	9	7	42	0.13	8.5	69
	22	9	7.1	43	0.15	8.4	62
	23	12	7	40	0.15	8.4	67
	24	12	7.2	38	0.15	8.5	67
	25	15	6.5	41	0.2	8.4	70
	26	5.5	7.2	39	0.28	8.3	50
	27	19	7.2	45	0.15	8.8	68
	28	18	7.4	42	0.35	8.6	66
	29	18	7.8	28	0.2	8.7	70
	30	27	7.7	48	0.2	8.8	72
JULY	1	10	7.6	46	0.36	8.6	68
	2	14	7.5	44	0.16	8.6	65
	3	15	7.6	42	0.1	8.5	63
	4	12	7.5	43	0.1	8.2	60
	5	8	7.2	38	0.1	7.7	58
	6	10	7.4	41	0.2	8.6	68
	7	7	6.2	66	0.4	8.2	70
	8	8	7.2	55	0.5	7.6	67
	9	15	7.2	63	0.5	9	70
	10	5	7.2	44	0.2	8.8	49
	11	5	7.1	42	0.35	7.4	46
	12	4	7.1	48	0.4	6.3	28
	13	4	3.2	52	0.3	6.9	36
	14	4	7	60	0.15	7	56

	15	4	7	46	0.3	7.6	53
	16	7	7.4	44	0.1	7.7	60
	17	5	7.3	48	0.2	7.3	60
	18	7	6.6	56	0.35	7.4	56
	19	13	6.7	60	0.25	9	70
	20	6	7.2	48	0.2	8	68
	21	10	7.2	62	0.4	8.2	68
	22	11	7.7	60	0.23	8.1	59
	23	13	8.3	48	0.2	7.2	60
	24	9	8.6	48	0.25	8.5	60
	25	12	8.4	50	0.2	7.9	60
	26	4	8.3	44	0.1	9.7	80
	27	4	8	45	0.1	9.6	78
	28	8	8.3	44	0.25	8.8	70
	29	2	7.6	54	0.35	7.8	56
	30	2	7.7	60	0.35	8.5	68
	31	7	7.4	48	0.16	7.2	48
AUGUST	1	4.6	7.4	48	0.1	9	76
	2	5.2	7.2	48	0.3	8.3	68
	3	6.3	7.9	44	0.15	8.4	56
	4	9	7.2	48	0.1	9	85
	5	6	7.6	53	0.1	8.7	80
	6	7	7.6	51	0.15	8.4	58
	7	5	7.2	48	0.1	9.3	72
	8	4	7.9	44	0.1	9.4	72
	9	5	7.8	44	0.1	9.2	72
	10	9	8.2	48	0.3	8.6	68
	11	5	7.3	52	0.2	8.8	60
	12	3	7.5	48	0.15	8.6	56
	13	3	7.5	48	0.2	8.6	64
	14	3	7.5	48	0.2	8.6	64
	15	3	7.7	48	0.1	8.2	56
	16	2.6	7.7	44	0.15	7.7	48
	17	2.8	7.7	48	0.25	8.4	48
	18	6	8	48	0.1	7.4	44
	19	6	7.9	53	0.23	7.6	56
	20	6.3	7.2	60	1.1	7.4	60
	21	2.2	7.3	30	0.55	8.5	70
	22	3.4	7.3	48	0.3	7.8	64
	23	2.6	7.4	52	0.13	7.8	60
	24	3	7.4	51	0.075	8	70
	25	4.8	7.5	48	0.075	8	52
	26	5	7.9	63	0.1	8.1	57
	27	5	7.8	59	0.18	7.8	58
	28	3	7.6	44	0.1	8.6	68
	29	4	7.4	52	0.1	8.7	46
	30	3	7.5	51	0.1	8.5	54
	31	3	7.3	44	0.16	7.3	48
SEPTEMBER	1	2.7	7.9	52	0.1	7.1	40
	2	3.5	7.3	52	0.13	8.4	56
	3	4	7.4	48	0.1	8.4	60
	4	3.5	8.2	48	0.1	8.7	60
	5	2.8	8.1	52	0.1	8.7	60
	6	3.2	8.1	52	0.1	8.5	60
	7	4	7.4	52	0.1	8.8	75
	8	3.7	7.7	52	0.1	7.7	44
	9	5.1	7.4	61	0.1	7.9	63
	10	3	7.5	54	0.13	7.5	54
	11	3.9	7.5	52	0.13	7.3	44
	12	4.4	7.4	52	0.1	6.5	52
	13	6	7.8	52	0.15	7.9	60
	14	4	7.7	48	0.13	8.8	72
	15	7	7.4	48	0.15	8.9	80
	16	9	7.5	56	0.1	9.2	90
	17	8	7.6	54	0.1	8.9	76
	18	8	7.8	52	0.16	7.9	52
	19	4	7.4	48	0.1	7.7	52
	20	2	7.4	32	0.13	8.7	64
	21	2	7.5	34	0.1	8.6	62
	22	5	7.3	52	0.1	7.7	56

	23	5	7.2	48	0.1	8.9	64
	24	6	7.3	48	0.1	8.5	56
	25	6	7.4	52	0.1	8.5	54
	26	6	7.1	56	0.1	8.8	70
	27	6	7.4	52	0.1	7.8	64
	28	5	8	56	0.1	8.6	60
	29	15	7.7	56	0.13	7.6	61
	30	5	7.2	51	0.13	9	90
OCTOBER	1	12	7.6	59	0.1	8.2	57
	2	13	7.5	56	0.1	7.9	66
	3	5	7.5	56	0.1	8	64
	4	3	7.5	57	0.1	8.6	66
	5	4	7.6	54	0.1	8.6	65
	6	5	7.3	52	0.1	8.7	66
	7	16	7.4	56	0.1	8.7	71
	8	2	7.1	48	0.1	8.3	60
	9	4	7	56	0.1	8	66
	10	5	7.3	56	0.2	8.5	63
	11	5	7.4	60	0.2	8.9	80
	12	4	7.4	58	0.16	8.8	68
	13	4	7.3	54	0.1	8.7	66
	14	3	7	60	0.1	8.4	64
	15	4	7.3	60	0.1	8.7	68
	16	5	7.3	52	0.1	8.3	67
	17	7	7.4	56	0.1	8.3	66
	18	4	7.3	51	0.1	8.4	65
	19	4	7.3	52	0.1	8.1	63
	20	4	7.4	52	0.15	8.4	66
	21	4	7.6	56	0.13	8.4	68
	22	4	7.6	54	0.1	8	56
	23	3	7.5	44	0.1	8.1	65
	24	4	7.6	50	0.1	7.9	66
	25	4	7.2	56	0.1	7.9	60
	26	4	7.1	57	0.1	8.4	67
	27	3	7.6	54	0.1	8	65
	28	3	7.8	52	0.1	8.2	63
	29	4	6.8	46	0.1	8.3	68
	30	4	7.2	60	0.1	8	68
	31	5	7.2	56	0.1	8.6	72
NOVEMBER	1	5.4	6.9	56	0.1	8.3	64
	2	4	6.6	50	0.08	7.9	66
	3	5.2	7.1	57	0.34	7.9	64
	4	4.8	7.1	52	0.14	7.9	63
	5	5.1	7	54	0.14	8.2	65
	6	5	6.9	53	0.19	8.3	66
	7	4.4	6.9	48	0.16	8	65
	8	5.5	6.8	48	0.16	8	64
	9	6.3	7.1	49	0.1	7.6	58
	10	7.5	6.9	48	0.16	7.5	61
	11	11	7.2	51	0.2	7.5	51
	12	10	6.9	46	0.16	7.9	53
	13	5	6.9	48	0.1	8	63
	14	5.5	7.2	54	0.16	7.9	62
	15	6.3	6.9	49	0.16	7.9	61
	16	6.5	6.9	48	0.16	7.8	62
	17	7	7.4	52	0.2	8.2	63
	18	13	7	49	0.2	8.1	56
	19	8	7.6	56	0.2	8.1	50
	20	11	6.7	43	0.2	8.1	65
	21	10	7.3	54	0.23	8.3	63
	22	8.4	7.3	48	0.2	8	58
	23	7.6	7.3	45	0.2	7.9	60
	24	8	7.4	49	0.2	8.3	65
	25	15	7.1	46	0.1	8.2	63
	26	10	7.2	48	0.1	8.2	63
	27	10	7.3	46	0.1	8.3	65
	28	11	7.7	51	0.2	8.5	66
	29	12	7.9	51	0.2	7.7	52
	30	11	7.5	35	0.2	7.7	58
DECEMBER	1	11	7.6	37	0.2	8	63

		2	10	7.5	40	0.26	8	60
		3	14	7.6	49	0.45	7.8	54
		4	10	7.2	40	0.45	8.1	64
		5	11	7.3	43	0.35	8	61
		6	12	7.2	39	0.3	8.2	64
		7	11	7.4	39	0.31	8.5	68
		8	9	7.4	41	0.36	8.1	63
		9	8.4	7.4	38	0.4	7.8	58
		10	10	7.3	39	0.45	7.8	62
		11	11	7.4	41	0.28	8.1	64
		12	9	7.6	52	0.2	8.3	65
		13	9.4	7.5	48	0.2	7.7	59
		14	14	7.3	29	0.15	7.5	50
		15	12	7.4	26	0.1	8.4	66
		16	9	8	39	0.1	8.2	63
		17	11	7	48	0.15	8.3	64
		18	9	7.7	41	0.26	8.2	61
		19	11	7.8	41	0.1	8.3	64
		20	12	7.6	43	0.1	7.7	54
		21	11	7.4	40	0.1	8.6	68
		22	10	7.7	44	0.1	8.8	80
		23	5	7.8	38	0.1	8.6	80
		24	3	7.6	41	0.1	8.7	62
		25	2	6.9	35	0.15	8.5	66
		26	13	6.9	33	0.36	8	58
		27	12	7.5	38	0.1	8.4	65
		28	10	7.7	43	0.1	8.5	64
		29	11	7.8	40	0.18	8.1	59
		30	12	7.1	64	0.1	8	60
		31	12	7.5	49	0.1	7.9	51
YEARLY	**AVERAGE**	**11.6**	**7.4**	**45.3**	**0.2**	**8.1**	**58.5**	
	MINIMUM	**1.2**	**3.2**	**0.0**	**0.1**	**6.3**	**28.0**	
	MAXIMUM	**66.0**	**9.3**	**66.0**	**1.1**	**9.7**	**90.0**	

Values for Raw and Finished Water Turbidity, pH, and Alkalinity were taken from Texas Water Commission monthly operating reports. Finished water turbidity is an average of the six turbidity measurements taken for each day.

The average, minimum, and maximum values for the year are provided.

FREESE • NICHOLS

Simon W. Freese, P.E. 1900–1990
Marvin C. Nichols, P.E. 1896–1969

Title: EAST CEDAR CREEK FWSD WATER AND WASTEWATER MASTER PLAN
Daily Water Quality Influent and Effluent Data – South WTP
[ECC95301]V:\SWTPDATA.WK1

Date: 04/24/96
By: DRJ
Chkd:

SOUTH WATER TREATMENT PLANT 1994

DATE		RAW WATER ANALYSES			FINISHED WATER ANALYSES		
MONTH	DAY	NTU	pH	ALK	NTU	pH	ALK
OCTOBER	1	11	8.5	54	0.3	7.9	53
	2	12	8.5	52	0.35	8.1	52
	3	14	8.3	54	0.3	7.8	51
	4	11	8.7	55	0.26	8.1	70
	5	6	8.8	53	0.3	7.9	57
	6	7	8.8	57	0.3	8.2	55
	7	14	8.9	66	0.45	7.4	57
	8	21	8.4	46	0.25	7.9	52
	9	19	8.5	48	0.2	8	53
	10	13	8.7	61	0.2	7.7	53
	11	12	8.6	62	0.3	7.7	19
	12	10	8.7	59	0.4	8.4	66
	13	13	8.9	66	0.3	8.1	55
	14	10	8.2	53	0.15	7.6	49
	15	15	8.6	55	0.56	7.9	50
	16	14	8.3	58	0.55	7.9	53
	17	12	8.2	58	0.46	7.8	53
	18	13	8.2	54	0.3	8.2	54
	19	11	8.2	48	0.3	7.8	52
	20	13	8.6	61	0.4	7.6	61
	21	12	8.3	51	0.3	7.8	50
	22	10	8.3	50	0.4	8.1	56
	23	14	8.4	52	0.3	8	48
	24	13	8.3	49	0.3	7.6	62
	25	16	7.8	57	0.2	8	67
	26	14	7.9	55	0.25	7.9	53
	27	14	7.5	46	0.3	7.4	51
	28	8	8.2	58	0.2	7.8	51
	29	8	8.2	53	0.23	8	50
	30	11	8.2	52	0.3	8.2	57
	31	11	8.4	47	0.3	7.9	91
NOVEMBER	1	12	8.1	49	0.26	8	52
	2	10	7.7	50	0.38	7.7	68
	3	10	7.5	60	0.2	8.1	69
	4	11	7.7	54	0.2	7.8	79
	5	19	7.9	56	0.23	8.3	51
	6	15	8.1	54	0.38	8	49
	7	10	7.1	48	0.41	7.7	58
	8	11	7.6	53	0.26	7.6	56
	9	15	7.3	51	0.2	7.8	53
	10	15	7.6	61	0.2	7.4	72
	11	9	7.8	46	0.26	7.8	63
	12	9	7.8	49	0.33	7.9	53
	13	9	7.9	52	0.46	8	49
	14	12	7.6	50	0.26	7.7	60
	15	13	8.3	53	0.28	8	63
	16	9	8.4	49	0.2	8	63
	17	9	8.4	46	0.23	8.1	51
	18	11	8.1	56	0.2	8.2	56
	19	11	8.3	52	0.21	8	53
	20	13	8.5	52	0.38	8.1	57
	21	9	8	48	0.35	7.7	55
	22	10	8	48	0.25	7.9	55
	23	9	7.8	61	0.3	7.7	59
	24	11	7.9	56	0.35	7.8	50

		25	10	7.9	55	0.31	7.7	46
		26	10	7.9	50	0.28	7.8	53
		27	9	8.1	54	0.31	8	51
		28	8	7.8	47	0.35	8.5	59
		29	9	7.7	52	0.35	7.7	51
		30	7	8	45	0.38	7.7	51
DECEMBER		1	7	8.3	49	0.4	7.4	50
		2	6	8	54	0.45	7.5	55
		3	10	8	52	0.45	7.8	53
		4	9	8.1	49	0.41	7.8	51
		5	8	8	50	0.45	7.7	54
		6	9	8.1	43	0.35	7.7	55
		7	13	7.3	46	0.45	7.6	51
		8	12	7.7	49	1.23	8	65
		9	11	7.7	49	0.81	7.9	53
		10	14	7.8	48	1.75	7.6	52
		11	14	7.9	50	1.7	7.5	49
		12	7	8.3	56	0.68	7.5	45
		13	7	7.8	63	0.61	8.3	55
		14	12	8	49	0.75	7.8	50
		15	11	8	49	0.7	8.1	59
		16	10	8.2	44	0.46	8	60
		17	12	7.9	53	0.7	8.3	56
		18	12	7.9	61	0.83	7.6	46
		19	13	8.1	45	0.56	8.2	51
		20	14	7.9	54	0.93	8.1	53
		21	11	7.9	48	1.15	7.5	54
		22	15	7.9	44	0.98	7.4	57
		23	14	8.1	57	0.43	7.8	49
		24	14	7.6	49	0.31	7.8	50
		25	14	7.8	56	0.3	7.6	50
		26	13	7.6	50	0.6	7.8	50
		27	12	7.9	49	0.46	7.5	45
		28	14	7.9	54	0.35	7.6	48
		29	15	7.6	43	0.4	7.4	30
		30	13	7.3	46	0.41	7.4	46
		31	14	7.6	41	0.41	7.4	40
YEARLY	AVERAGE		11.6	8.1	52.1	0.4	7.8	54.2
	MINIMUM		6	7.1	41	0.15	7.4	19
	MAXIMUM		21	8.9	66	1.75	8.5	91

SOUTH WATER TREATMENT PLANT 1995

DATE		RAW WATER ANALYSES			FINISHED WATER ANALYSES		
MONTH	DAY	NTU	pH	ALK	NTU	pH	ALK
JANUARY	1	12	7.9	43	0.45	7.4	40
	2	11	7.6	36	0.21	7.5	36
	3	12	7.6	43	0.28	7.6	52
	4	14	7.8	40	0.28	7.7	40
	5	13	7.9	43	0.33	7.5	46
	6	13	7.5	44	0.35	7.7	51
	7	13	7.6	43	0.4	7.6	41
	8	13	7.8	35	0.51	7.4	41
	9	14	7.6	39	0.43	7.6	49
	10	13	7.8	47	0.45	7.6	64
	11	14	7.8	41	0.41	7.4	41
	12	15	8.1	45	0.33	7.4	53
	13	14	7.6	41	0.33	7.5	41
	14	17	7.4	41	0.31	7.5	41
	15	18	7.5	32	0.28	7.3	46
	16	18	7.7	43	0.5	7.6	45
	17	20	7.7	38	0.28	8	58
	18	33	7.6	37	0.21	8	61
	19	20	7.5	34	0.43	7.6	48
	20	19	7.8	33	0.45	7.7	63
	21	22	7.7	30	0.31	7.9	63
	22	23	7.5	40	0.28	7.5	51
	23	23	7.6	39	0.3	7.3	40
	24	20	7.7	38	0.5	7.6	49

	25	20	7.8	32	0.35	8.5	49
	26	17	7.6	36	0.5	7.5	62
	27	14	7.8	34	0.48	7.4	61
	28	15	7.8	44	0.68	7.3	57
	29	16	7.7	40	1.05	7.3	59
	30	15	8.3	33	1.36	7.5	62
	31	16	7.9	40	2.48	7.4	40
FEBRUARY	1	16	7.8	36	0.7	7.2	36
	2	17	7.9	43	0.58	7.4	41
	3	15	7.4	35	0.53	7.4	41
	4	16	7.7	40	0.56	7.4	36
	5	17	7.5	40	0.66	7.4	39
	6	20	7.4	39	0.68	7.4	39
	7	20	7.5	41	0.8	7.6	43
	8	19	7.4	36	0.85	7.5	39
	9	20	7.6	39	1.11	7.3	53
	10	20	7.7	34	0.68	8.2	46
	11	19	8	39	0.93	7.4	45
	12	19	8.1	40	0.88	7.2	44
	13	20	7.7	38	1.05	7.1	44
	14	21	7.8	42	0.96	7.1	42
	15	21	7.9	42	0.83	7.1	48
	16	22	7.9	46	1.1	7.1	47
	17	22	7.8	35	1.06	7.1	46
	18	23	7.6	39	2.08	7.2	44
	19	23	7.6	37	1.03	7.4	40
	20	23	7.4	41	0.41	6.9	44
	21	23	7.3	42	0.68	7.6	61
	22	21	7.6	43	0.58	7.5	53
	23	20	8.1	41	0.7	7.6	58
	24	21	8.4	46	0.58	7.5	43
	25	25	7.9	51	0.8	7.2	40
	26	26	7.6	41	0.75	7.4	42
	27	20	8.1	42	0.6	7.9	61
	28	21	7.6	46	0.46	7.9	63
MARCH	1	20	7.7	39	0.53	7.6	62
	2	18	7.8	40	0.66	7.6	51
	3	19	7.6	43	0.68	7.2	48
	4	18	7.8	49	0.68	7.4	50
	5	20	7.8	46	0.6	7.4	51
	6	19	7.7	52	0.68	7.5	56
	7	21	7.6	41	0.63	7.4	36
	8	21	7.7	33	0.76	7.5	53
	9	18	7.9	30	0.76	7.4	46
	10	19	8	42	0.98	7.5	43
	11	17	7.9	50	0.7	7.5	51
	12	22	7.8	40	1.11	7.6	50
	13	20	7.5	38	1.81	7.1	49
	14	20	7.7	43	1.51	7.4	58
	15	20	7.6	45	0.93	7.4	48
	16	19	7.8	46	0.71	7.5	60
	17	22	7.6	44	0.8	7.3	50
	18	23	7.9	35	0.96	7.9	43
	19	20	7.5	32	1.3	7.4	60
	20	23	7.9	34	0.96	7.9	43
	21	26	7.9	49	0.71	8.3	60
	22	20	8.4	37	1.3	8	36
	23	19	7.9	51	0.56	7.5	46
	24	20	7.4	40	0.6	7.6	46
	25	18	7.4	34	0.63	7.5	48
	26	22	8.1	42	0.35	7.2	48
	27	30	7.5	41	0.66	7.3	58
	28	21	7.4	41	0.91	7.3	41
	29	22	7.7	45	0.68	8.5	70
	30	22	7.7	35	0.58	8	53
	31	26	7.7	37	0.41	8.7	58
APRIL	1	22	8	45	0.5	7.7	62
	2	21	7.8	43	0.93	7.9	66
	3	22	7.6	45	1.1	7.8	53
	4	32	7.3	39	0.7	8	70

	5	23	7.2	31	0.51	7.4	50
	6	20	7.6	41	0.48	7.8	46
	7	21	7.9	56	0.68	7.9	53
	8	21	7.8	43	0.88	7	52
	9	22	7.8	48	0.45	7.7	59
	10	20	8	40	0.45	7.6	52
	11	23	7.6	41	0.45	7.8	49
	12	18	8.5	42	0.96	7.7	59
	13	26	7.2	39	1.01	7.4	51
	14	24	7.9	41	0.61	7.4	46
	15	19	8	60	0.61	7.4	46
	16	21	7.6	46	0.51	8.6	72
	17	19	8.5	36	0.46	7.9	54
	18	19	8	36	0.36	7.3	48
	19	19	8	49	0.3	7.5	41
	20	17	8.3	44	0.31	7.2	40
	21	17	8.3	44	0.35	7.3	44
	22	17	7.7	38	0.36	7.5	45
	23	19	7.7	46	0.33	7.7	49
	24	15	7.8	49	0.38	8	55
	25	16	8.4	34	0.73	7.6	47
	26	17	8.6	34	0.45	7.6	46
	27	15	7.6	43	0.28	7.5	63
	28	17	7.9	49	0.71	7.9	56
	29	14	7.9	53	0.7	7.8	50
	30	17	7.6	49	0.5	7.4	40
MAY	1	15	7.7	36	0.75	8	57
	2	17	7.6	39	0.26	7.8	62
	3	27	8	42	0.26	7.4	54
	4	19	7.8	38	0.18	7.6	58
	5	17	7.3	37	0.18	7.4	24
	6	23	7.7	36	0.2	7.8	59
	7	24	7.6	38	0.28	7.8	57
	8	19	7.8	49	0.28	7.4	49
	9	16	7.6	31	0.31	7.4	25
	10	18	7.7	51	0.19	7.7	69
	11	10	7.6	32	0.21	7.8	69
	12	9.8	8	42	0.2	8	71
	13	11	7.7	46	0.23	7.9	68
	14	8	7.4	38	0.26	7.9	64
	15	11.3	8.6	30	0.6	8.2	61
	16	14.7	8.4	38.4	0.28	8.7	68
	17	16	8.3	44	0.2	7.5	58
	18	16	7.6	42	0.33	7.4	42
	19	18	7.5	37	0.7	7.2	43
	20	12	7.6	32	0.48	7.3	51
	21	4	7.3	42	0.65	7.2	40
	22	15	7.2	42	1.35	7	38
	23	13	8.5	46	0.93	7	44
	24	12	7.3	40	1.85	8.7	62
	25	18	7.5	41	1.36	8.2	60
	26	19	7.4	46	1.51	8.8	58
	27	15	8.1	38	1.26	8.8	72
	28	16	8.3	40	0.56	8.2	64
	29	15	7.9	48	0.31	8.4	65
	30	16	7.9	49	0.7	8.4	65
	31	15	7.7	46	2.21	8.8	71
JUNE	1						
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	14			DATA UNAVAILABLE			
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JULY	1	14	7.5	47	1.78	8.2	59
	2	16	7.4	42	1.35	8.5	68
	3	17	7.6	48	1.36	7.7	60
	4	16	7.6	43	1.63	7.9	59
	5	13	7	35	1.5	7.7	69
	6	8.5	7.2	37	1.31	8.6	70
	7	9.8	7.1	34	1.33	8.6	72
	8	7	7	30	2	8.5	70
	9	16	7.1	26	0.56	8.8	63
	10	14	7.2	31	0.63	7.7	56
	11	16	7.4	38	0.71	8.3	64
	12	14	7.2	34	0.91	7.6	52
	13	16	7.3	39	0.56	7.8	61
	14	18	7.4	32	0.81	8.3	66
	15	17	7.1	34	1.3	7.9	67
	16	15	7.2	33	1.88	7.7	63
	17	16	7.3	35	1.93	7.9	65
	18	17	7.2	37	1.35	7.8	62
	19	18	7.3	36	4.3	8.2	66
	20	15	7.4	37	1.66	7.9	64
	21	13	7.2	35	2.23	8.2	68
	22	9.8	9	48	2.66	7.1	52
	23	10	8.5	48	2.48	7.8	56
	24	10	8.2	46	1.9	8.1	60
	25	9.5	7.9	44	1.25	8.5	65
	26	10	7.9	48	0.76	8.6	70
	27	9.5	7.8	47	2.48	8.4	64
	28	10	7.6	44	1.11	8.3	60
	29	13	7.8	38	1.71	8.5	70
	30	9	7.8	53	1.28	8.5	68
	31	7.4	7.3	48	0.5	7.6	53
AUGUST	1	6.4	7.6	46	0.3	7.6	59
	2	9.8	8.6	54	0.86	7.7	52
	3	7.6	9.2	62	0.8	7.5	54
	4	2.8	7.7	54	0.78	7.8	59
	5	2.5	7.8	63	0.5	7.9	60
	6	5	9.6	58	0.4	7.5	51
	7	5	7.5	54	0.4	7.6	49
	8	4.5	7.5	51	0.31	8.1	61
	9	4.8	7.5	47	0.38	8.4	65
	10	9.9	9.2	58	0.41	8.7	68
	11	7.6	8.6	52	0.35	8.2	63
	12	7.2	8.4	50	0.36	8.3	65
	13	8	8.7	54	0.48	8.3	68
	14	6.5	8.4	49	0.26	8.3	62
	15	3.5	8.2	58	0.4	8.3	60
	16	3.8	8	56	0.43	7.9	66
	17	3.6	7.9	54	0.65	7.7	57
	18	4.9	8.1	56	1.3	8.8	72
	19	6	7.4	61	0.7	7.6	54
	20	6	7.8	61	0.51	7.5	50
	21	5.5	7.9	60	0.8	7.6	52
	22	5.8	7.8	58	0.38	7.9	62

	23	5.2	7.7	52	0.33	8.2	64
	24	5.6	7.9	56	0.25	8.3	65
	25	5.5	7.7	53	0.2	8.5	68
	26	6	7.8	53	0.2	8	60
	27	6	7.7	51	0.3	8	60
	28	4.8	7.7	50	0.38	8.2	60
	29	5.4	7.8	51	0.23	8.1	58
	30	5.1	7.6	48	0.2	8.2	59
	31	4.8	7.6	49	0.2	8.1	58
SEPTEMBER	1	4.8	7.7	53	0.36	8.5	66
	2	11	8.7	49	0.3	8.7	75
	3	10	8.5	49	0.5	8.1	59
	4	10	8.4	51	0.61	8.4	66
	5	9.5	8.4	50	0.5	8.2	63
	6	8.1	8.3	46	0.36	8.1	60
	7	13	8.5	49	1.98	8.4	64
	8	12	8.3	48	0.91	8.3	62
	9	6	8	33	1.2	8.6	70
	10	8	7.4	53	2.4	7.6	58
	11	9	7.8	56	0.9	7.8	56
	12	10	8.4	53	0.75	8.1	60
	13	9	8.2	51	0.38	8.3	64
	14	9	7.8	50	0.15	8.3	65
	15	8	7.6	46	0.23	8.2	61
	16	8	7.6	52	0.41	8.1	57
	17	9	7.9	56	0.25	8	54
	18	9	8.1	52	0.2	8.1	56
	19	8	8	53	0.2	8.2	57
	20	6	7.5	37	0.25	8	54
	21	6	7.6	34	0.3	8.1	54
	22	5	7.2	38	0.61	8.1	56
	23	6	8.9	47	0.5	8.2	58
	24	9	8	52	0.35	7.3	52
	25	9	7.8	49	0.46	7.7	56
	26	8.4	7.8	48	0.48	7.8	59
	27	8.3	7.7	44	0.41	8	59
	28	27	8	56	0.6	8.7	78
	29	20	7.9	54	0.75	8.1	61
	30	12	7.6	51	0.73	8.3	60
OCTOBER	1	14	7.9	59	0.71	8.3	63
	2	12	7.8	54	1	8.4	66
	3	13	7.8	51	0.75	8	62
	4	14	7.7	53	0.58	8.1	63
	5	17	7.8	53	0.73	8.3	66
	6	19	8	50	0.95	8.5	69
	7	24	4.6	16	1.21	8.4	60
	8	20	7.2	49	1.13	8.4	63
	9	21	7.1	39	0.26	8.2	58
	10	23	7.3	43	0.48	8.2	58
	11	18	7.6	46	0.53	8	56
	12	11	7.8	43	0.36	8.4	67
	13	10	7.7	43	0.75	8.6	70
	14	15	7.5	48	1.8	7.9	68
	15	8.7	8.7	52	1.26	7.7	70
	16	4	8.4	48	0.66	7.7	67
	17	9	8.9	64	0.5	8.3	72
	18	10	8.7	56	0.38	8.6	74
	19	10	8.6	58	0.8	8.2	55
	20	11	8.3	58	0.88	7.6	73
	21	12	8.2	63	0.6	8.5	60
	22	15	7.9	63	0.61	8.4	60
	23	11	8.2	61	0.53	8.4	62
	24	10	8.9	47	0.81	7.6	44
	25	11	8.7	48	1.2	8.5	68
	26	10	8.7	49	0.5	8.4	64
	27	9	8.6	52	0.38	8.3	62
	28	8.5	8.5	51	0.41	8.4	64
	29	10	8	52	0.65	7.6	66
	30	11	8.7	51	0.91	8.4	64
	31	12	8.4	50	0.86	7.6	54

NOVEMBER		1	10	8.3	43	0.26	8.5	69
		2	17	7.3	32	0.3	8	63
		3	16	7.8	40	0.86	8.3	65
		4	12	7.2	61	0.51	8.4	64
		5	16	7.8	42	0.75	8	63
		6	18	8.1	57	0.41	8.5	68
		7	14	7.9	49	0.38	8	59
		8	14	8.4	54	0.35	8.6	70
		9	15	8.2	52	0.41	8.5	58
		10	12	8	43	0.45	8.6	58
		11	13	7.6	56	0.5	8.4	71
		12	14	7.4	53	0.46	8.6	67
		13	13	8.3	56	0.41	8.5	68
		14	14	8.4	54	0.4	8.4	65
		15	13	8.2	49	0.48	8.3	64
		16	13	8.3	48	0.41	8.7	72
		17	14	8.3	51	0.51	8.4	65
		18	14	8.1	53	0.43	8.6	64
		19	14	7.9	49	0.45	8.5	63
		20	14	8.1	50	0.65	7.8	54
		21	14	7.6	57	1.2	7.9	58
		22	14	7.8	58	0.76	7.8	56
		23	13	7.6	58	0.48	7.9	56
		24	9	7.6	58	0.41	8.4	62
		25	12	7.4	44	0.5	7.9	58
		26	11	7.1	42	0.93	7.2	56
		27	13	8.1	48	0.75	7.8	58
		28	12	7.9	51	0.46	7.6	56
		29	10	8	52	0.4	7.8	58
		30	11	8.3	61	0.4	8	62
YEARLY	**AVERAGE**	**14.7**	**7.8**	**44.7**	**0.7**	**7.9**	**56.6**	
	MINIMUM	**2.5**	**4.6**	**0**	**0.15**	**6.9**	**24**	
	MAXIMUM	**33**	**9.6**	**64**	**4.3**	**8.8**	**78**	

Values for Raw and Finished Water Turbidity, pH, and Alkalinity were taken from Texas Water Commission monthly operating reports. Finished water tubidity is an average of the six turbidity measurements taken for each day.

The average, minimum, and maximum values for the year are provided.

FREESE • NICHOLS

Simon W. Freese, P.E. 1900–1990
Marvin C. Nichols, P.E. 1896–1969

Title: EAST CEDAR CREEK W/WW MASTER PLAN
Monthly Water Plant Historical Flow & Effluent Data
[ECC95301]V:\WATERDAT.WK1

Date: 04/24/96
By: DRJ
Chkd:

NORTH WATER TREATMENT PLANT

DATE	DAILY RAW WATER PUMPAGE AVG. FLOW (MGD)	DAILY RAW WATER PUMPAGE MAX. FLOW (MGD)	DAILY RAW WATER PUMPAGE MIN. FLOW (MGD)	DAILY HIGH SERVICE PUMPAGE AVG. FLOW (MGD)	DAILY HIGH SERVICE PUMPAGE MAX. FLOW (MGD)	DAILY HIGH SERVICE PUMPAGE MIN. FLOW (MGD)	# OF SAMPLES > 5 NTU	% OF SAMPLES > 5 NTU	# OF CL2 RESIDUAL < 0.2 mg/l
1994 January	0.524	0.791	0.406	0.480	0.580	0.281	0	0	0
February	0.399	0.616	0.200	0.482	0.839	0.305	0	0	0
March	0.478	0.727	0.201	0.483	0.650	0.286	0	0	0
April	0.505	0.712	0.301	0.502	0.718	0.353	0	0	0
May	0.488	0.700	0.381	0.497	0.708	0.228	1	0.5	0
June	0.665	0.895	0.453	0.646	0.866	0.289	2	1.2	0
July				0.741	1.121	0.410	0	0	0
August	0.886	1.282	0.481	0.794	1.155	0.475	0	0	0
September	0.804	1.253	0.439	0.665	1.308	0.369	0	0	0
October	0.730	1.520	0.364	0.597	1.056	0.350	0	0	0
November	0.590	0.903	0.283	0.544	0.877	0.334	2	1.11	0
December	0.483	0.847	0.316	0.558	0.828	0.363	0	0	0
1995 January									
February	0.467	0.728	0.258	0.467	0.728	0.258	13	8.3	0
March	0.483	0.584	0.403	0.483	0.584	0.403	0	0	0
April									
May	0.548	0.548	0.548	0.552	0.563	0.545	3	2	0
June	0.607	0.948	0.372	0.593	1.404	0.245	1	0.6	0
July	1.173	2.150	0.487	0.796	1.274	0.631	0	0	0
August	1.051	1.894	0.394	0.817	1.240	0.417	4	2.1	0
September	0.893	1.192	0.517	0.785	0.997	0.528	0	0	0
October	0.772	1.425	0.539	0.646	1.581	0.455	0	0	0
November	0.810	1.058	0.452	0.698	0.925	0.388	1	0.5	0
December	0.685	1.104	0.376	0.590	0.869	0.330	1	0.5	0

Average, Maximum, and Minimum Raw and High Service Pumpage and the analytical results of turbidity and chlorine residual were taken from Texas Water Commission monthly operating reports.

FREESE • NICHOLS

Simon W. Freese, P.E. 1900–1990
Marvin C. Nichols, P.E. 1896–1969

Title: EAST CEDAR CREEK W/WW MASTER PLAN
Monthly Water Plant Historical Flow & Effluent Data
[ECC95301]V:\WATERDAT.WK1

Date: 04/24/96
By: DRJ
Chkd:

SOUTH WATER TREATMENT PLANT

DATE	DAILY RAW WATER PUMPAGE AVG. FLOW (MGD)	DAILY RAW WATER PUMPAGE MAX. FLOW (MGD)	DAILY RAW WATER PUMPAGE MIN. FLOW (MGD)	DAILY HIGH SERVICE PUMPAGE AVG. FLOW (MGD)	DAILY HIGH SERVICE PUMPAGE MAX. FLOW (MGD)	DAILY HIGH SERVICE PUMPAGE MIN. FLOW (MGD)	# OF SAMPLES > 5 NTU	% OF SAMPLES > 5 NTU	# OF CL2 RESIDUAL < 0.2 mg/l
1994 January									
February									
March									
April									
May									
June									
July									
August									
September									
October	0.312	0.499	0.195	0.312	0.499	0.195	8	4.3	0
November	0.261	0.338	0.161	0.261	0.338	0.161	1	0.6	0
December	0.306	0.523	0.213	0.306	0.523	0.213	83	45	0
1995 January	0.247	0.348	0.180	0.247	0.348	0.180	33	14.5	0
February	0.293	0.424	0.220	0.293	0.424	0.220	131	78	0
March	0.320	0.446	0.200	0.320	0.446	0.200	149	80	0
April	0.283	0.338	0.195	0.283	0.338	0.195	70	39	0
May	0.319	0.707	0.157	0.319	0.707	0.157	63	34	0
June							158	92	0
July	0.471	0.892	0.237	0.471	0.892	0.237	168	90	0
August	0.391	0.583	0.278	0.391	0.583	0.278	43	23	0
September	0.376	0.684	0.231	0.376	0.684	0.231	68	38	0
October	0.296	0.406	0.230	0.296	0.406	0.230	122	66	0
November	0.276	0.583	0.122	0.276	0.583	0.122	43	23	0
December									

Average, Maximum, and Minimum Raw and High Service Pumpage and the analytical results of turbidity and chlorine residual were taken from Texas Water Commission monthly operating reports.

FREESE • NICHOLS

Simon W. Freese, P.E. 1900–1990
Marvin C. Nichols, P.E. 1896–1969

Title: EAST CEDAR CREEK W/WW MASTER PLAN
Monthly Wastewater Historical Flow & Effluent Data
[ECC95301]V:\WASTEDAT.WK1

Date: 04/24/96
By: DRJ
Chkd:

NORTH WASTEWATER TREATMENT PLANT

DATE	DAILY AVG. FLOW (MGD)	DAILY MAX. FLOW (MGD)	INFLUENT AVG. BOD (mg/l)	INFLUENT AVG TSS (mg/l)	EFFLUENT AVG. BOD (mg/l)	EFFLUENT MAX. BOD (mg/l)	EFFLUENT AVG. TSS (mg/l)	EFFLUENT MAX. TSS (mg/l)	EFFLUENT MIN. CL2 (mg/l)	EFFLUENT MIN. pH	EFFLUENT MAX. pH
Permitted	0.626	1.25	n/a	n/a	10.0	25.0	15.0	40.0	1.0	6.0	9.0
1994 January	0.561	0.826			4.8	6.0	14.8	21.0	1.3	7.2	7.6
February	0.621	1.214			17.3	36.0	20.8	52.0	1.3	7.0	7.6
March	0.654	0.910			5.0	10.0	5.8	17.0	1.0	6.8	7.6
April	0.648	0.827			6.0	8.0	5.3	9.0	1.0	6.6	7.6
May	0.652	0.908			9.0	17.0	7.3	16.0	1.2	6.9	7.4
June	0.551	0.736			10.4	24.0	66.6	240.0	2.0	6.9	7.4
July	0.612	0.744	220.25	185.75	5.8	13.7	32.1	126.0	1.0	6.7	7.4
August	0.614	0.850	284.82	220.40	4.1	7.7	2.7	5.5	1.0	6.6	7.4
September	0.635	0.764	253.93	201.50	2.2	2.3	3.8	11.0	1.2	6.4	7.4
October	0.715	1.177	184.50	254.00	3.3	6.2	10.5	22.0	0.2	6.5	7.4
November	0.692	0.967	226.20	268.00	2.4	3.3	6.8	13.0	1.5	6.7	7.1
December	0.698	1.087	260.78	259.00	105.5	214.6	390.8	824.0	1.6	6.6	7.4
AVERAGE	**0.638**	**0.918**	**238.41**	**231.44**	**14.6**	**29.1**	**47.3**	**113.0**	**1.2**	**6.7**	**7.4**
MINIMUM	**0.551**	**0.736**	**184.50**	**185.75**	**2.2**	**2.3**	**2.7**	**5.5**	**0.2**	**6.4**	**7.1**
MAXIMUM	**0.715**	**1.214**	**284.82**	**268.00**	**105.5**	**214.6**	**390.8**	**824.0**	**2.0**	**7.2**	**7.6**
1995 January	0.555	0.967	243.38	171.50	3.7	6.8	4.8	10.0	1.1	6.5	7.1
February	0.347	0.438	220.12	169.20	2.9	4.3	4.4	10.0	1.1	6.2	7.2
March	0.381	0.484	205.53	143.50	6.1	11.2	17.0	44.0	1.1	6.6	7.3
April	0.400	0.627	155.88	122.00	4.3	7.4	8.1	18.0	1.1	6.9	7.4
May	0.510	1.351	191.92	128.40	3.0	4.5	6.8	18.0	1.2	7.0	7.5
June	0.496	1.055	203.30	132.00	5.8	11.0	5.6	12.0	1.1	6.6	7.5
July	0.447	0.771	207.25	211.50	2.9	5.2	4.5	10.0	0.8	6.9	7.5
August	0.416	0.578	220.60	212.00	5.9	10.2	8.2	14.0	1.0	5.7	7.5
September	0.416	0.579	171.88	229.00	2.7	3.8	5.2	8.0	1.2	7.0	7.6
October	0.341	0.485	195.00	209.50	5.0	10.6	5.9	12.0	1.9	6.9	7.4
November	0.305	0.450	234.20	192.40	7.4	15.2	2.8	5.0		7.0	7.2
December			185.00	191.50	3.7	5.7	4.0	9.0	2.0	7.1	7.2
AVERAGE	**0.419**	**0.708**	**202.84**	**176.04**	**4.4**	**8.0**	**6.4**	**14.2**	**1.2**	**6.7**	**7.4**
MINIMUM	**0.305**	**0.438**	**155.88**	**122.00**	**2.7**	**3.8**	**2.8**	**5.0**	**0.8**	**5.7**	**7.1**
MAXIMUM	**0.555**	**1.351**	**243.38**	**229.00**	**7.4**	**15.2**	**17.0**	**44.0**	**2.0**	**7.1**	**7.6**

Daily Average and Maximum Flows and Effluent Wastewater Quality Data were taken from TNRCC monthly effluent reports. Values for Influent BOD and TSS were taken from monthly lab reports for influent wastewater and averaged for each month.

The average, minimum, and maximum values for the year are provided.

FREESE • NICHOLS

Simon W. Freese, P.E. 1900–1990
Marvin C. Nichols, P.E. 1896–1969

Title: EAST CEDAR CREEK W/WW MASTER PLAN
Monthly Wastewater Historical Flow & Effluent Data
[ECC95301]V:\WASTEDAT.WK1

Date: 04/24/96
By: DRJ
Chkd:

SOUTH WASTEWATER TREATMENT PLANT

DATE	DAILY AVG. FLOW (MGD)	DAILY MAX. FLOW (MGD)	INFLUENT AVG. BOD (mg/l)	INFLUENT AVG TSS (mg/l)	EFFLUENT AVG. BOD (mg/l)	EFFLUENT 7-DAY AVG BOD (mg/l)	EFFLUENT AVG. TSS (mg/l)	EFFLUENT MAX. TSS (mg/l)	EFFLUENT MIN. CL2 (mg/l)	EFFLUENT MIN. pH	EFFLUENT MAX. pH
Permitted	0.04	0.1	n/a	n/a	20.0	30.0	n/a	n/a	1.0	n/a	n/a
1995 January	0.0810	0.2290			9.2	20.0	10.8	20.0	0.0	6.8	6.9
February	0.1053	0.1480			11.4	35.7	25.6	74.0	0.0	6.6	7.2
March	0.1296	0.6000			23.4	75.0	67.4	264.0	0.0	6.7	6.8
April	0.1241	0.2090			12.8	30.0	43.0	120.0	0.0	6.7	7.4
May	0.0490	0.3000			35.4	62.4	30.0	62.0	1.0	6.6	6.9
June	0.0761	0.2110			32.3	115.5	27.0	66.0	1.2	6.6	6.9
July	0.0806	0.1954			16.7	22.1	25.3	48.0	1.8	6.6	7.4
August	0.0560	0.0840			16.6	60.0	28.4	84.0	1.5	6.6	6.9
September	0.0510	0.0920			5.0	8.9	8.3	9.0	2.6	6.7	7.4
October	0.0403	0.0604			5.2	8.7	7.8	14.0	1.5	6.7	6.8
November											
December											
AVERAGE	0.079	0.213			16.8	43.8	27.4	76.1	1.0	6.7	7.1
MINIMUM	0.040	0.060			5.0	8.7	7.8	9.0	0.0	6.6	6.8
MAXIMUM	0.130	0.600			35.4	115.5	67.4	264.0	2.6	6.8	7.4

Daily Average, and Maximum Flows and Effluent Wastewater Quality Data were taken from TNRCC monthly effluent reports. Values for Influent BOD and TSS were not available. The most recent data for South Wastewater Influent BOD and TSS showed a BOD of 191 and a TSS of 140 for the sampling date of Jan 23, 1996. Since these numbers compare favorably with average BOD and TSS for the North District in 1995, those values will be used for analyzing the SWWTP unit processes.

The average, minimum, and maximum values for the year are provided.

FREESE • NICHOLS

Simon W. Freese, P.E. 1900–1990
Marvin C. Nichols, P.E. 1896–1969

Title: EAST CEDAR CREEK FRESH WATER SUPPLY DISTRICT
Water and Wastewater Max Day and Peak 2–Hour Flows
[ECC95301]V:\PEAKDAY.WK1

Date: 06/20/96
By: DRJ
Chkd:

WASTEWATER TREATMENT PLANT FLOWS

YEAR	MONTH	NORTH WWTP AVG. DAILY FLOW (MGD)	NORTH WWTP 3 Mo. Roll AVG (MGD)	NORTH WWTP PEAK 2–HR FLOW (MGD)	NORTH WWTP PEAKING RATIO	SOUTH WWTP AVG. DAILY FLOW (MGD)	SOUTH WWTP 3 Mo. Roll AVG (MGD)	SOUTH WWTP PEAK 2–HR FLOW (MGD)	SOUTH WWTP PEAKING RATIO
1995	January	INACCURATE FLOW MEASUREMENT				0.0810			
	February	0.347		1.18	3.40	0.1053			
	March	0.381		1.12	2.94	0.1296	0.1053	0.50	3.86 *
	April	0.400	0.376	1.26	3.15	0.1241	0.1197		
	May	0.510	0.430	1.35	2.65	0.0490	0.1009		
	June	0.496	0.469	1.38	2.78	0.0761	0.0831		
	July	0.447	0.484	1.24	2.77	0.0806	0.0686	0.15	1.86
	August	0.416	0.453	1.38	3.32	0.0560	0.0709	0.16	2.86
	September	0.416	0.426	1.34	3.23	0.0510	0.0625	0.17	3.33
	October	0.341	0.391	1.08	3.17	0.0403	0.0491	0.13	3.23
	November	0.305	0.354	1.26	4.14				
	December	0.381	0.342	1.20	3.15				
TOTALS	**AVERAGE**	**0.404**	**0.414**	**1.25**	**3.15**	**0.0793**	**0.0825**	**0.22**	**3.03**
	MINIMUM	**0.305**	**0.342**	**1.08**	**2.65**	**0.0403**	**0.0491**	**0.13**	**1.86**
	MAXIMUM	**0.510**	**0.484**	**1.38**	**4.14**	**0.1296**	**0.1197**	**0.50**	**3.86**

* –– Note: The 2–hr peak for the South WWTP in March 1995 exceeded the recorded level of the chart of 0.5 MGD. The actual 2–hr peak seen at the plant is unknown.

Average Daily and 3 month rolling averages are based on monthly flow records. The 30 day average and 3 month rolling averages used for system projections will be developed from the daily flow records in Attachment H.

WATER TREATMENT PLANT FLOWS

YEAR	MONTH	NORTH WTP AVG. DAY FLOW (MGD)	NORTH WTP MAX. DAY FLOW (MGD)	NORTH WTP # of CONNECT	NORTH WTP MAX DAY GPCPD	SOUTH WTP AVG. DAY FLOW (MGD)	SOUTH WTP MAX. DAY FLOW (MGD)	SOUTH WTP # of CONNECT	SOUTH WTP MAX DAY GPCPD
1994	January	0.480	0.580	2,865	202				
	February	0.482	0.839	2,857	294				
	March	0.483	0.650	2,846	228				
	April	0.502	0.718	2,865	251				
	May	0.497	0.708	2,993	237				
	June	0.646	0.866	2,866	302				
	July	0.741	1.121	2,866	391				
	August	0.794	1.155	2,851	405				
	September	0.655	1.308	2,859	458				
	October	0.597	1.056	2,881	367	0.312	0.499	1,764	283
	November	0.544	0.877	2,875	305	0.261	0.338	1,764	192
	December	0.558	0.828	3,014	275	0.306	0.523	1,625	322
TOTALS	**AVERAGE**	**0.582**	**0.892**	**2887**	**309**	**0.293**	**0.453**	**1718**	**265**
	MINIMUM	**0.480**	**0.580**	**2846**	**202**	**0.261**	**0.338**	**1625**	**192**
	MAXIMUM	**0.794**	**1.308**	**3014**	**458**	**0.312**	**0.523**	**1764**	**322**
1995	January					0.247	0.348		
	February	0.467	0.728	2,869	254	0.293	0.424	1,624	261
	March	0.483	0.584	3,018	194	0.320	0.446	1,626	274
	April					0.283	0.338	1,624	208
	May	0.552	0.563	2,885	195	0.319	0.707	1,755	403
	June	0.592	1.404	2,755	510				
	July	0.796	1.274	2,916	437	0.471	0.892	1,775	503
	August	0.817	1.240	2,923	424	0.391	0.583	1,770	329
	September	0.785	0.997	2,905	343	0.376	0.684	1,775	385
	October	0.646	1.581	2,892	547	0.296	0.406	1,780	228
	November	0.698	0.925	2,898	319	0.276	0.583	1,780	328
	December	0.590	0.869	2,901	300				
TOTALS	**AVERAGE**	**0.643**	**1.017**	**2896**	**352**	**0.327**	**0.541**	**1723**	**324**
	MINIMUM	**0.467**	**0.563**	**2755**	**194**	**0.247**	**0.338**	**1624**	**208**
	MAXIMUM	**0.817**	**1.581**	**3018**	**547**	**0.471**	**0.892**	**1780**	**503**

The average daily and maximum daily flows and number of connections were taken from monthly operations reports and summaries. The average daily flow and max day flows are treated water flows coming from the high service pumps at each plant. GPCPD is the gallons per connection per day of flow for the max day.

The average day and max day flows will be used to project the future average and max days for both systems.

Title: EAST CEDAR CREEK FWSD WATER & WASTEWATER MASTER PLAN — 06/20/96
Population and Flow Projections for Water and Wastewater — DRJ
[ECC95301]V:\PROJECTN.WK1

NORTH DISTRICT PROJECTIONS

NORTH DISTRICT WASTEWATER TREATMENT PLANT												
YEAR	GBC POP	EST RURAL POP SERVED	EST TOTAL POP SERVED	AVERAGE CONNECT	CONNECT PER CAP	AVERAGE DAY (MGD)	AVERAGE G/Cap/Day	MAX 30 DAY AVG. (MGD)	MAX 30 DAY G/Conn./Day	SYSTEM 2–HR PEAK (MGD)	SYS. PEAK RATIO	PUMP PEAK 2–HR (MGD)
1995	3894	3455	7349	3075	0.42	0.40	55	0.56	182.76	1.77	3.15	1.79
1996	3968	3496	7463	3123	0.42	0.41	55	0.57	182.76	1.80	3.15	1.79
1997	4041	3536	7577	3170	0.42	0.42	55	0.58	182.76	1.83	3.15	1.79
1998	4115	3576	7691	3218	0.42	0.42	55	0.59	182.76	1.85	3.15	1.79
1999	4188	3616	7805	3266	0.42	0.43	55	0.60	182.76	1.88	3.15	1.79
2000	4262	3657	7919	3313	0.42	0.44	55	0.61	182.76	1.91	3.15	1.79
2001	4326	3691	8017	3354	0.42	0.44	55	0.61	182.76	1.93	3.15	1.79
2002	4390	3725	8115	3395	0.42	0.45	55	0.62	182.76	1.96	3.15	1.79
2003	4454	3759	8213	3436	0.42	0.45	55	0.63	182.76	1.98	3.15	1.79
2004	4518	3793	8311	3477	0.42	0.46	55	0.64	182.76	2.00	3.15	1.79
2005	4582	3827	8409	3518	0.42	0.46	55	0.64	182.76	2.03	3.15	1.79
2006	4646	3861	8507	3559	0.42	0.47	55	0.65	182.76	2.05	3.15	1.79
2007	4710	3895	8605	3601	0.42	0.47	55	0.66	182.76	2.07	3.15	1.79
2008	4774	3929	8703	3642	0.42	0.48	55	0.67	182.76	2.10	3.15	1.79
2009	4838	3963	8801	3683	0.42	0.48	55	0.67	182.76	2.12	3.15	1.79
2010	4902	3997	8899	3724	0.42	0.49	55	0.68	182.76	2.15	3.15	1.79
2011	4959	4026	8985	3759	0.42	0.49	55	0.69	182.76	2.17	3.15	1.79
2012	5016	4054	9070	3795	0.42	0.50	55	0.69	182.76	2.19	3.15	1.79
2013	5073	4082	9156	3831	0.42	0.50	55	0.70	182.76	2.21	3.15	1.79
2014	5130	4111	9241	3867	0.42	0.51	55	0.71	182.76	2.23	3.15	1.79
2015	5188	4139	9326	3902	0.42	0.51	55	0.71	182.76	2.25	3.15	1.79
2016	5245	4167	9412	3938	0.42	0.52	55	0.72	182.76	2.27	3.15	1.79
2017	5302	4196	9497	3974	0.42	0.52	55	0.73	182.76	2.29	3.15	1.79
2018	5359	4224	9583	4009	0.42	0.53	55	0.73	182.76	2.31	3.15	1.79
2019	5416	4252	9668	4045	0.42	0.53	55	0.74	182.76	2.33	3.15	1.79
2020	5473	4280	9753	4081	0.42	0.54	55	0.75	182.76	2.35	3.15	1.79
2021	5506	4290	9796	4099	0.42	0.54	55	0.75	182.76	2.36	3.15	1.79
2022	5540	4299	9839	4117	0.42	0.54	55	0.75	182.76	2.37	3.15	1.79
2023	5573	4309	9882	4135	0.42	0.54	55	0.76	182.76	2.38	3.15	1.79
2024	5607	4319	9925	4153	0.42	0.55	55	0.76	182.76	2.39	3.15	1.79
2025	5640	4328	9968	4171	0.42	0.55	55	0.76	182.76	2.40	3.15	1.79

Population projections are based on an estimated 2.39 persons per wastewater connection as taken from 1990 census data. This number of people per connection is multiplied by the total number of wastewater connections in the North District to estimate the population served by the district. The population served is assumed to include all of Gun Barrel City and the remaining population is assumed to be rural. The populations for Gun Barrel City and the Rural populations are projected based on TWDB population projections for Gun Barrel City and Rural Henderson County.

The current average daily flow is divided by the current number of connections to get an average gallons/connection/day. The average g/conn/day is assumed the same for future years and is used to calculate future average daily flows. The average daily flow used is the maximum 30 day average flow as required by TNRCC design criteria. The system peak 2–hr. flow is developed from historical plant peak flows for 1994 & 1995. This peak flow is divided by the average daily flow to develop a peaking ratio. The peaking ratio is assumed constant for future years and is multiplied by the projected average day for those years to develop a future peak flow. The pump peak 2–hr flow is the peak 2–hr flow capable of being delivered to the system by the collection system lift stations. The peak 2–hr flow assumes that each lift station directly feeding the wastewater plant is operating with only one pump and each lift station is pumping at the same time.

FREESE • NICHOLS

Simon W. Freese, 1900–1990
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Title: EAST CEDAR CREEK FWSD WATER & WASTEWATER MASTER PLAN
Population and Flow Projections for Water and Wastewater
[ECC95301]V:\PROJECTN.WK1

06/20/96
DRJ

NORTH DISTRICT PROJECTIONS

NORTH DISTRICT WATER TREATMENT PLANT									
YEAR	GBC POP	EST RURAL POP SERVED	EST TOTAL POP SERVED	AVERAGE CONNECT	CONNECT PER CAP	AVERAGE DAY (MGD)	AVERAGE G/Conn./Day	MAXIMUM DAY (MGD)	MAXIMUM G/Conn./Day
1994	3820	3080	6900	2887	0.42	0.58	201.59	1.31	453.07
1995	3894	3027	6921	2896	0.42	0.64	222.03	1.58	545.93
1996	3968	3063	7030	2942	0.42	0.62	211.81	1.61	545.93
1997	4041	3098	7139	2987	0.42	0.63	211.81	1.63	545.93
1998	4115	3133	7248	3033	0.42	0.64	211.81	1.66	545.93
1999	4188	3169	7357	3078	0.42	0.65	211.81	1.68	545.93
2000	4262	3204	7466	3124	0.42	0.66	211.81	1.71	545.93
2001	4326	3234	7560	3163	0.42	0.67	211.81	1.73	545.93
2002	4390	3264	7654	3202	0.42	0.68	211.81	1.75	545.93
2003	4454	3294	7748	3242	0.42	0.69	211.81	1.77	545.93
2004	4518	3323	7841	3281	0.42	0.69	211.81	1.79	545.93
2005	4582	3353	7935	3320	0.42	0.70	211.81	1.81	545.93
2006	4646	3383	8029	3359	0.42	0.71	211.81	1.83	545.93
2007	4710	3413	8123	3399	0.42	0.72	211.81	1.86	545.93
2008	4774	3443	8217	3438	0.42	0.73	211.81	1.88	545.93
2009	4838	3473	8311	3477	0.42	0.74	211.81	1.90	545.93
2010	4902	3502	8404	3517	0.42	0.74	211.81	1.92	545.93
2011	4959	3527	8486	3551	0.42	0.75	211.81	1.94	545.93
2012	5016	3552	8568	3585	0.42	0.76	211.81	1.96	545.93
2013	5073	3577	8650	3619	0.42	0.77	211.81	1.98	545.93
2014	5130	3602	8732	3654	0.42	0.77	211.81	1.99	545.93
2015	5188	3626	8814	3688	0.42	0.78	211.81	2.01	545.93
2016	5245	3651	8896	3722	0.42	0.79	211.81	2.03	545.93
2017	5302	3676	8978	3756	0.42	0.80	211.81	2.05	545.93
2018	5359	3701	9060	3791	0.42	0.80	211.81	2.07	545.93
2019	5416	3726	9142	3825	0.42	0.81	211.81	2.09	545.93
2020	5473	3750	9223	3859	0.42	0.82	211.81	2.11	545.93
2021	5506	3759	9265	3877	0.42	0.82	211.81	2.12	545.93
2022	5540	3767	9307	3894	0.42	0.82	211.81	2.13	545.93
2023	5573	3775	9349	3912	0.42	0.83	211.81	2.14	545.93
2024	5607	3784	9390	3929	0.42	0.83	211.81	2.14	545.93
2025	5640	3792	9432	3947	0.42	0.84	211.81	2.15	545.93

Population projections are based on an estimated 2 persons per water connection. This number of people per connection is multiplied by the total number of water connections in the North District to estimate the population served by the district. The population served is assumed to include all of Gun Barrel City and the remaining population is assumed to be rural. The populations for Gun Barrel City and the Rural populations are projected based on TWDB population projections for Gun Barrel City and Rural Henderson County.

The current aveage daily flow is divided by the current number of connections to get an average gallons/connection/day.
The average g/conn/day is assumed the same for future years and is used to calculate future average daily flows. The average daily flow used is the average daily flow for the NWTP for 1995. The maximum daily flow is used to size water treatment plant capacity and is developed from the maximum daily flow for 1995. The maximum daily flow is divided by the number of connections in 1995 to get a max day gal/conn/day. This max gal/conn/day is used to calculate maximum day flows for future years.

SOUTH DISTRICT PROJECTIONS

SOUTH DISTRICT WASTEWATER TREATMENT PLANT												
YEAR	ENCH. OAK POP	PAYNE SP. POP. SERV.	RURAL POP. SERV.	EST. POP. SERVED	AVERAGE CONNECT	CONNECT PER CAP	AVERAGE DAY (MGD)	AVERAGE G/Cap/Day	MAX 30 DAY AVG. (MGD)	MAX 30 DAY G/Conn./Day	SYSTEM 2–HR PEAK (MGD)	SYS. PEAK RATIO
1995	329	0	727	1056	528	0.50	0.079	75	0.170	321.97	0.595	3.50
1996	337	0	735	1072	536	0.50	0.081	75	0.1726	321.97	0.604	3.50
1997	345	0	744	1089	544	0.50	0.082	75	0.1752	321.97	0.613	3.50
1998	352	0	752	1105	552	0.50	0.083	75	0.1779	321.97	0.623	3.50
1999	360	0	761	1121	561	0.50	0.084	75	0.1805	321.97	0.632	3.50
2000	368	0	769	1137	569	0.50	0.085	75	0.1831	321.97	0.641	3.50
2001	376	0	777	1152	576	0.50	0.087	75	0.1855	321.97	0.649	3.50
2002	384	0	784	1167	584	0.50	0.088	75	0.1879	321.97	0.658	3.50
2003	391	0	791	1182	591	0.50	0.089	75	0.1903	321.97	0.666	3.50
2004	399	0	798	1197	599	0.50	0.090	75	0.1927	321.97	0.675	3.50
2005	407	0	805	1212	606	0.50	0.091	75	0.1952	321.97	0.683	3.50
2006	415	0	812	1227	614	0.50	0.092	75	0.1976	321.97	0.691	3.50
2007	423	0	820	1242	621	0.50	0.093	75	0.2000	321.97	0.700	3.50
2008	430	0	827	1257	629	0.50	0.094	75	0.2024	321.97	0.708	3.50
2009	438	0	834	1272	636	0.50	0.096	75	0.2048	321.97	0.717	3.50
2010	446	0	841	1287	644	0.50	0.097	75	0.2072	321.97	0.725	3.50
2011	454	0	847	1301	650	0.50	0.098	75	0.2094	321.97	0.733	3.50
2012	462	0	853	1315	657	0.50	0.099	75	0.2116	321.97	0.741	3.50
2013	469	0	859	1328	664	0.50	0.100	75	0.2138	321.97	0.748	3.50
2014	477	0	865	1342	671	0.50	0.101	75	0.2161	321.97	0.756	3.50
2015	485	0	871	1356	678	0.50	0.102	75	0.2183	321.97	0.764	3.50
2016	493	0	877	1370	685	0.50	0.103	75	0.2205	321.97	0.772	3.50
2017	501	0	883	1383	692	0.50	0.104	75	0.2227	321.97	0.779	3.50
2018	508	0	889	1397	699	0.50	0.105	75	0.2249	321.97	0.787	3.50
2019	516	0	895	1411	705	0.50	0.106	75	0.2271	321.97	0.795	3.50
2020	524	0	901	1425	712	0.50	0.107	75	0.2293	321.97	0.803	3.50
2021	532	0	903	1434	717	0.50	0.108	75	0.2309	321.97	0.808	3.50
2022	540	0	905	1444	722	0.50	0.108	75	0.2325	321.97	0.814	3.50
2023	547	0	907	1454	727	0.50	0.109	75	0.2341	321.97	0.819	3.50
2024	555	0	909	1464	732	0.50	0.110	75	0.2357	321.97	0.825	3.50
2025	563	0	911	1474	737	0.50	0.111	75	0.2372	321.97	0.830	3.50

The population served in the South district is not known. The population served is estimated from the existing number of connections located in Enchanted Oaks, Payne Springs, and the rural population. The same number of connections per people calculated for the North District is used to calculate the estimated population served in the South District.

The average day is the maximum 30 day average flow for 1995 as required by TNRCC criteria. This average flow is used to calculate the average gal/conn/day for 1995. This average gal/conn/day is assumed to be the same for future years and future average daily flows are calculated based on this number. The system 2–hr peak is based on the peaking factor developed from Harmon's equation for estimating peak 2–hr flows.

FREESE • NICHOLS

Simon W. Freese, P.E. 1900–1990
Marvin C. Nichols, P.E. 1896–1969

Title: EAST CEDAR CREEK FWSD WATER & WASTEWATER MASTER PLAN — 06/20/96
Population and Flow Projections for Water and Wastewater — DRJ
[ECC95301]V:\PROJECTN.WK1

SOUTH DISTRICT PROJECTIONS

SOUTH DISTRICT WATER TREATMENT PLANT										
YEAR	ENCH. OAK POP	PAYNE SP. POP. SERV.	RURAL POP. SERV.	EST. POP. SERVED	AVERAGE CONNECT	CONNECT PER CAP	AVERAGE DAY (MGD)	AVERAGE G/Conn./Day	MAXIMUM DAY (MGD)	MAXIMUM G/Conn./Day
1995	329	400	3191	3920	1960	0.50	0.541	276.02	0.892	455.10
1996	337	411	3228	3976	1988	0.50	0.549	276.02	0.905	455.10
1997	345	421	3265	4031	2016	0.50	0.556	276.02	0.917	455.10
1998	352	432	3303	4087	2043	0.50	0.564	276.02	0.930	455.10
1999	360	442	3340	4142	2071	0.50	0.572	276.02	0.943	455.10
2000	368	453	3377	4198	2099	0.50	0.579	276.02	0.955	455.10
2001	376	463	3409	4248	2124	0.50	0.586	276.02	0.967	455.10
2002	384	474	3440	4297	2149	0.50	0.593	276.02	0.978	455.10
2003	391	484	3472	4347	2174	0.50	0.600	276.02	0.989	455.10
2004	399	495	3503	4397	2199	0.50	0.607	276.02	1.001	455.10
2005	407	505	3534	4447	2223	0.50	0.614	276.02	1.012	455.10
2006	415	516	3566	4497	2248	0.50	0.621	276.02	1.023	455.10
2007	423	527	3597	4546	2273	0.50	0.627	276.02	1.035	455.10
2008	430	537	3629	4596	2298	0.50	0.634	276.02	1.046	455.10
2009	438	548	3660	4646	2323	0.50	0.641	276.02	1.057	455.10
2010	446	558	3692	4696	2348	0.50	0.648	276.02	1.069	455.10
2011	454	569	3718	4740	2370	0.50	0.654	276.02	1.079	455.10
2012	462	579	3744	4785	2392	0.50	0.660	276.02	1.089	455.10
2013	469	590	3770	4829	2415	0.50	0.666	276.02	1.099	455.10
2014	477	600	3796	4874	2437	0.50	0.673	276.02	1.109	455.10
2015	485	611	3822	4918	2459	0.50	0.679	276.02	1.119	455.10
2016	493	621	3849	4963	2481	0.50	0.685	276.02	1.129	455.10
2017	501	632	3875	5007	2504	0.50	0.691	276.02	1.139	455.10
2018	508	643	3901	5052	2526	0.50	0.697	276.02	1.150	455.10
2019	516	653	3927	5096	2548	0.50	0.703	276.02	1.160	455.10
2020	524	664	3953	5141	2570	0.50	0.709	276.02	1.170	455.10
2021	532	674	3962	5168	2584	0.50	0.713	276.02	1.176	455.10
2022	540	685	3971	5195	2597	0.50	0.717	276.02	1.182	455.10
2023	547	695	3979	5222	2611	0.50	0.721	276.02	1.188	455.10
2024	555	706	3988	5249	2625	0.50	0.724	276.02	1.194	455.10
2025	563	716	3997	5276	2638	0.50	0.728	276.02	1.201	455.10

The population served in the South district is not known. The population served is estimated from the existing number of connections located in Enchanted Oaks, Payne Springs, and the rural population. The same number of connections per people calculated for the North District is used to calculate the estimated population served in the South District.

The current aveage daily flow is divided by the current number of connections to get an average gallons/connection/day.
The average g/conn/day is assumed the same for future years and is used to calculate future average daily flows. The average daily flow used is the average daily flow for the SWTP for 1995. The maximum daily flow is used to size water treatment plant capacity and is developed from the maximum daily flow for 1995. The maximum daily flow is divided by the number of connections in 1995 to get a max day gal/conn/day. This max gal/conn/day is used to calculate maximum day flows for future years.

FREESE • NICHOLS

Simon W. Freese, P.E. 1900–1990
Marvin C. Nichols, P.E. 1896–1969

Title: EAST CEDAR CREEK FWSD WATER & WASTEWATER MASTER PLAN
Projected Populations
[ECC95301]V:\POPPROJ.WK1

Date: 04/24/96
By: DRJ
Chkd:

YEAR	Gun Barrel	% Growth	Henderson Mabank	% Growth	Kaufman Mabank	% Growth	County Rural	% Growth	County Total	% Growth	Enchanted Oaks	% Growth	Payne Springs	% Growth
1990	3526		281		1458		37318		58543		290		606	
1991	3599.6	2.087351	288.7	2.740213	1554.5	6.618655	37780.3	1.238812	59238.9	1.188698	297.8	2.689655	624.4	3.036303
1992	3673.2	2.044671	296.4	2.667128	1651	6.207783	38242.6	1.223653	59934.8	1.174734	305.6	2.619207	642.8	2.946828
1993	3746.8	2.003702	304.1	2.597840	1747.5	5.844942	38704.9	1.208861	60630.7	1.161095	313.4	2.552356	661.2	2.862476
1994	3820.4	1.964342	311.8	2.532061	1844	5.522174	39167.2	1.194422	61326.6	1.147766	321.2	2.488832	679.6	2.782819
1995	3894	1.926499	319.5	2.469531	1940.5	5.233188	39629.5	1.180324	62022.5	1.134744	329	2.428393	698	2.707474
1996	3967.6	1.890087	327.2	2.410015	2037	4.972945	40091.8	1.166555	62718.4	1.122012	336.8	2.370820	716.4	2.636103
1997	4041.2	1.855025	334.9	2.353300	2133.5	4.737358	40554.1	1.153103	63414.3	1.109562	344.6	2.315914	734.8	2.568397
1998	4114.8	1.821241	342.6	2.299193	2230	4.523084	41016.4	1.139958	64110.2	1.097386	352.4	2.263493	753.2	2.504082
1999	4188.4	1.788665	350.3	2.247518	2326.5	4.327354	41478.7	1.127110	64806.1	1.085474	360.2	2.213393	771.6	2.442910
2000	4262	1.757234	358	2.198115	2423	4.147861	41941	1.114547	65502	1.073818	368	2.165463	790	2.384655
2001	4326	1.501642	367	2.513966	2479.9	2.348328	42331.7	0.931546	66152.1	0.992488	375.8	2.119565	808.4	2.329113
2002	4390	1.479426	376	2.452316	2536.8	2.294447	42722.4	0.922948	66802.2	0.982735	383.6	2.075572	826.8	2.276100
2003	4454	1.457858	385	2.393617	2593.7	2.242983	43113.1	0.914508	67452.3	0.973171	391.4	2.033368	845.2	2.225447
2004	4518	1.436910	394	2.337662	2650.6	2.193777	43503.8	0.906221	68102.4	0.963792	399.2	1.992846	863.6	2.176999
2005	4582	1.416555	403	2.284263	2707.5	2.146683	43894.5	0.898082	68752.5	0.954591	407	1.953907	882	2.130616
2006	4646	1.396769	412	2.233250	2764.4	2.101569	44285.2	0.890088	69402.6	0.945565	414.8	1.916461	900.4	2.086167
2007	4710	1.377529	421	2.184466	2821.3	2.058312	44675.9	0.882236	70052.7	0.936708	422.6	1.880424	918.8	2.043536
2008	4774	1.358811	430	2.137767	2878.2	2.016800	45066.6	0.874520	70702.8	0.928015	430.4	1.845716	937.2	2.002612
2009	4838	1.340594	439	2.093023	2935.1	1.976930	45457.3	0.866939	71352.9	0.919482	438.2	1.812267	955.6	1.963294
2010	4902	1.322860	448	2.050113	2992	1.938605	45848	0.859487	72003	0.911105	446	1.780009	974	1.925491
2011	4959.1	1.164830	456.7	1.941964	3050.3	1.948529	46172.6	0.707991	72579.4	0.800522	453.8	1.748878	992.4	1.889117
2012	5016.2	1.151418	465.4	1.904970	3108.6	1.911287	46497.2	0.703014	73155.8	0.794164	461.6	1.718818	1010.8	1.854091
2013	5073.3	1.138311	474.1	1.869359	3166.9	1.875442	46821.8	0.698106	73732.2	0.787907	469.4	1.689774	1029.2	1.820340
2014	5130.4	1.125500	482.8	1.835055	3225.2	1.840916	47146.4	0.693266	74308.6	0.781748	477.2	1.661695	1047.6	1.787796
2015	5187.5	1.112973	491.5	1.801988	3283.5	1.807639	47471	0.688493	74885	0.775684	485	1.634534	1066	1.756395
2016	5244.6	1.100722	500.2	1.770091	3341.8	1.775544	47795.6	0.683785	75461.4	0.769713	492.8	1.608247	1084.4	1.726078
2017	5301.7	1.088738	508.9	1.739304	3400.1	1.744568	48120.2	0.679142	76037.8	0.763834	500.6	1.582792	1102.8	1.696790
2018	5358.8	1.077013	517.6	1.709569	3458.4	1.714655	48444.8	0.674560	76614.2	0.758044	508.4	1.558130	1121.2	1.668480
2019	5415.9	1.065537	526.3	1.680834	3516.7	1.685750	48769.4	0.670040	77190.6	0.752340	516.2	1.534225	1139.6	1.641098
2020	5473	1.054303	535	1.653049	3575	1.657804	49094	0.665581	77767	0.746723	524	1.511042	1158	1.614601
2021	5506.4	0.610268	542.6	1.420560	3625.4	1.409790	49203.2	0.222430	78040.5	0.351691	531.8	1.488549	1176.4	1.588946
2022	5539.8	0.606566	550.2	1.400663	3675.8	1.390191	49312.4	0.221936	78314	0.350459	539.6	1.466716	1194.8	1.564093
2023	5573.2	0.602909	557.8	1.381315	3726.2	1.371130	49421.6	0.221445	78587.5	0.349235	547.4	1.445515	1213.2	1.540006
2024	5606.6	0.599296	565.4	1.362495	3776.6	1.352584	49530.8	0.220956	78861	0.348019	555.2	1.424917	1231.6	1.516650
2025	5640	0.595726	573	1.344181	3827	1.334533	49640	0.220468	79134.5	0.346812	563	1.404899	1250	1.493991
2030	5807		611		4079		50186		80502					

Gun Barrel City, Mabank populations for Henderson and Kaufman Counties, County rural, and County totals were projected based on TWDB projected populations. Populations for Payne Springs and Enchanted Oaks are projected based census data from 1980 and 1990 and assume a linear growth rate.

% Growth is the calculated percent growth in population for the previous year to the current year shown.

FREESE • NICHOLS

Simon W. Freese, P.E. 1900–1990
Marvin C. Nichols, P.E. 1896–1969

Title: EAST CEDAR CREEK FWSD MASTER PLAN
DAILY WASTEWATER FLOW DATA
[ECC95301]V:\DAYWASTE.WK1

Date: 06/20/96
By: DRJ
Chkd:

		NORTH WWTP			SOUTH WWTP		
MONTH	DAY	FLOW	30 DAY AVERAGE	90 DAY AVERAGE	FLOW	30 DAY AVERAGE	90 DAY AVERAGE
JANUARY	1	789			50		
	2	556			46		
	3	668			64		
	4	685			31		
	5	711			74		
	6	398			33		
	7	796			63		
	8	804			48		
	9	619			56		
	10	582			46		
	11	612			31		
	12	967			229		
	13	821			152		
	14	850			63		
	15	748			77		
	16	446			52		
	17	372			202		
	18	547			106		
	19	427			100		
	20	418			62		
	21	378			62		
	22	409			124		
	23	386			54		
	24	379			46		
	25	352			127		
	26	598			105		
	27	488			81		
	28	432			90		
	29	272			66		
	30	352	562		82	81	
	31	336	547		95	82	
FEBRUARY	1	438	543		95	84	
	2	348	532		62	84	
	3	315	520		94	86	
	4	412	510		85	86	
	5	350	508		137	90	
	6	421	496		126	92	
	7	397	482		138	95	
	8	285	471		98	96	
	9	376	464		77	97	
	10	313	454		105	100	
	11	315	433		101	95	
	12	319	416		128	95	
	13	321	398		97	96	
	14	306	384		108	97	
	15	378	381		108	99	
	16	302	379		116	96	
	17	387	374		113	96	

	18	325	370		102	96	
	19	315	367		112	98	
	20	313	365		148	101	
	21	417	365		97	100	
	22	372	364		58	100	
	23	374	364		120	102	
	24	311	363		110	102	
	25	336	354		114	102	
	26	343	349		107	103	
	27	341	346		122	104	
	28	273	346		74	104	
MARCH	1	377	347		207	108	
	2	377	349		172	111	
	3	284	343		113	112	
	4	406	345		142	114	
	5	242	343		105	115	
	6	343	341		97	115	
	7	465	344		97	114	
	8	293	340		100	113	
	9	334	338		138	113	
	10	477	345		192	116	
	11	294	342		96	117	
	12	482	347		360	125	
	13	484	353		167	127	
	14	397	356		171	129	
	15	339	356		162	131	
	16	349	358		148	132	
	17	452	360		148	134	
	18	365	362		112	133	
	19	468	365		147	135	
	20	356	366		136	136	
	21	428	370		167	138	
	22	249	368		107	136	
	23	361	366		150	138	
	24	412	367		122	140	
	25	290	364		138	141	
	26	413	368		130	141	
	27	391	370		400	151	
	28	409	372		128	152	
	29	367	373		158	153	
	30	452	379		600	170	
	31	457	381		121	167	
APRIL	1	422	383	430	98	165	119
	2	329	384	426	115	165	119
	3	408	384	424	229	168	120
	4	480	392	421	91	168	122
	5	486	397	418	150	169	123
	6	413	395	416	83	169	124
	7	295	395	416	99	169	124
	8	279	393	410	121	168	124
	9	464	393	405	68	164	125
	10	441	398	403	163	166	125
	11	368	394	401	98	158	127
	12	310	388	399	107	156	127
	13	334	386	391	49	152	126
	14	302	385	386	96	149	125
	15	428	388	380	129	149	125
	16	235	380	376	136	148	126
	17	422	382	374	81	147	127
	18	373	379	375	84	145	126
	19	433	382	373	104	144	125
	20	627	388	373	106	142	125

	21	406	394	375	80	141	126
	22	600	402	375	209	143	126
	23	379	400	377	124	143	127
	24	382	404	377	87	141	128
	25	307	400	377	87	140	128
	26	409	401	377	75	129	128
	27	342	398	375	80	128	127
	28	329	397	373	87	125	127
	29	376	395	372	68	108	127
	30	528	397	373	68	106	127
MAY	1				101	106	127
	2				66	104	127
	3				93	100	127
	4				100	100	127
	5				300	105	127
	6				97	105	130
	7				222	110	129
	8				200	112	130
	9				100	113	131
	10				112	112	131
	11				66	110	131
	12				58	109	131
	13				78	110	131
	14				70	109	130
	15				37	106	130
	16				40	103	129
	17				47	102	128
	18				44	100	127
	19				40	98	127
	20				61	97	126
	21				40	95	125
	22				60	90	124
	23				42	88	124
	24				40	86	124
	25				40	84	123
	26				27	83	122
	27				105	84	121
	28				48	82	121
	29				15	81	120
	30				15	79	119
	31				15	76	117
JUNE	1	557			84	77	116
	2	550			84	76	115
	3	555			84	76	115
	4	277			84	69	114
	5	1055			84	68	114
	6	80			84	63	114
	7	476			56	59	114
	8	287			74	58	113
	9	649			211	61	112
	10	615			46	60	113
	11	807			106	62	109
	12	294			48	61	109
	13	445			48	60	107
	14	560			50	61	106
	15	501			50	61	105
	16	675			50	61	104
	17	675			35	61	103
	18	297			79	62	102
	19	434			46	62	101
	20	549			46	62	100
	21	304			87	63	99

	22	594			56	63	99
	23	317			40	63	98
	24	560			117	66	97
	25	392			104	68	97
	26	430			76	67	93
	27	705			81	69	93
	28	198			86	71	92
	29	547			95	74	86
	30	509	496		93	76	86
JULY	1	383	489		93	76	86
	2	177	476		67	76	84
	3	596	487		195	79	84
	4	483	467		174	83	84
	5	475	480		123	84	85
	6	495	481		40	83	86
	7	501	489		61	83	85
	8	340	478		82	78	85
	9	480	473		30	78	84
	10	358	458		31	75	83
	11	427	462		38	75	82
	12	467	463		57	75	82
	13	473	460		78	76	82
	14	247	451		108	78	81
	15	493	445		88	80	81
	16	605	443		41	80	81
	17	290	442		39	78	80
	18	512	445		153	82	80
	19	445	441		61	83	80
	20	304	441		72	82	80
	21	395	435		78	83	78
	22	419	438		108	85	78
	23	405	433		88	84	78
	24	474	436		41	82	78
	25	469	437		39	81	78
	26	711	437		61	80	77
	27	331	442		61	79	77
	28	480	439		82	79	77
	29	460	438		82	78	77
	30	502	440		97	79	77
	31	463	443		131	80	77
AUGUST	1	463	452		70	80	78
	2	322	443		48	75	77
	3	374	439		40	71	74
	4	204	430		61	69	74
	5	422	428		58	69	72
	6	405	425		69	70	70
	7	477	429		35	68	70
	8	416	427		80	70	69
	9	439	430		63	71	69
	10	370	428		60	72	69
	11	361	424		66	72	69
	12	459	424		64	71	69
	13	388	429		63	70	69
	14	521	430		34	68	70
	15	524	427		42	68	70
	16	495	434		66	69	69
	17	486	433		84	67	70
	18	364	430		19	65	70
	19	533	438		27	64	70
	20	420	439		85	64	69
	21	371	437		59	63	70
	22	324	434		78	62	70

	23	436	433		64	63	71
	24	510	434		48	63	71
	25	368	423		51	63	70
	26	418	426		51	63	70
	27	321	421		62	62	71
	28	578	424		68	61	71
	29	462	423	453	47	60	72
	30	102	411	448	50	57	71
	31	356	408	446	55	57	71
SEPTEMBER	1	237	405	442	52	57	71
	2	226	400	442	65	58	70
	3	357	405	434	58	57	70
	4	312	401	437	93	59	70
	5	277	397	434	59	58	70
	6	330	392	435	53	59	70
	7	345	390	432	47	58	68
	8	126	379	426	67	58	68
	9	195	373	419	33	57	68
	10	313	372	420	68	57	68
	11	398	370	419	30	56	68
	12	415	371	417	76	56	68
	13	378	366	416	23	56	68
	14	410	362	413	43	56	68
	15	218	353	408	30	55	68
	16	407	350	409	32	53	67
	17	311	348	408	52	54	67
	18	352	342	406	68	56	67
	19	391	341	407	46	54	67
	20	311	339	404	47	54	67
	21	408	342	405	60	53	67
	22	383	341	403	45	53	66
	23	443	338	403	54	53	66
	24	546	344	404	29	52	65
	25	452	345	402	48	52	65
	26	579	354	406	50	52	64
	27	419	349	404	57	51	64
	28	476	349	404	31	51	63
	29	321	356	403	63	51	63
	30	453	360	404	61	51	63
OCTOBER	1	479	368	407	11	50	63
	2	369	372	405	46	49	61
	3	412	374	404	56	49	59
	4	308	374	402	33	47	59
	5	325	376	400	38	47	58
	6	485	381	400	40	46	58
	7	400	383	401	40	46	58
	8	432	393	400	36	45	58
	9	288	396	399	40	45	58
	10	357	398	399	39	44	58
	11	381	397	398	43	45	58
	12	397	396	397	44	44	57
	13	260	392	397	53	45	57
	14	251	387	394	33	44	56
	15	323	391	391	43	45	56
	16	290	387	391	60	46	56
	17	275	386	389	35	45	55
	18	283	383	387	40	44	55
	19	317	381	387	37	44	55
	20	343	382	386	29	43	54
	21	329	379	385	33	42	53
	22	363	379	385	39	42	53
	23	328	375	383	51	42	53

	24	222	364	381	38	42	53
	25	274	358	376	53	42	52
	26	346	350	376	52	42	52
	27	428	351	375	49	42	52
	28	353	346	374	27	42	52
	29	343	347	373	43	41	51
	30	266	341	370	36	41	50
	31	359	337	369	33	41	49
NOVEMBER	1	359	337	370	69	42	49
	2	239	331	368	21	41	50
	3	331	332	370	26	41	49
	4	269	330	368	29	40	49
	5	318	324	367	54	41	48
	6	294	321	365	37	41	49
	7	254	315	363	37	41	48
	8	312	315	362	34	41	48
	9	240	312	360	34	40	48
	10	428	313	361	35	40	47
	11	356	312	360	66	41	47
	12	383	316	360	66	41	47
	13	321	318	358	78	43	47
	14	300	317	355	39	43	48
	15	332	319	353	46	42	47
	16	314	320	352	48	43	47
	17	311	321	351	57	43	47
	18	316	321	349	35	43	48
	19	266	318	347	32	43	47
	20	256	316	346	55	44	47
	21	257	313	345	35	44	46
	22	364	314	344	43	44	46
	23	247	315	341	60	44	46
	24	335	317	341	54	44	46
	25	263	314	339	54	44	46
	26	289	309	339	57	45	46
	27	133	302	334	56	46	46
	28	292	300	332	56	46	46
	29	312	302	334	36	46	46
	30	450	305	335	32	46	46
DECEMBER	1	415	307	337	46	45	46
	2	285	308	338	42	46	46
	3	329	308	338	42	47	45
	4	331	310	338	31	47	45
	5	231	307	337	49	46	45
	6	322	308	337	43	47	44
	7	457	315	338	62	47	44
	8	302	315	340	43	48	44
	9	324	317	342	48	48	44
	10	354	315	342	25	48	44
	11	333	314	342	31	47	44
	12	287	311	340	54	46	44
	13	380	313	340	51	45	44
	14	363	315	340	50	46	44
	15	333	315	341	49	46	44
	16	392	318	341	48	46	45
	17	401	321	342	48	46	44
	18	449	325	343	73	47	44
	19	375	329	343	38	47	45
	20	363	332	343	42	47	44
	21	331	335	342	42	47	44
	22	391	336	342	43	47	44
	23	210	334	340	27	46	44
	24	333	334	338	51	46	44

	25	314	336	336	43	45	44
	26	327	337	333	55	45	44
	27	314	343	332	44	45	44
	28	604	354	334	45	44	44
	29	413	357	335	55	45	44
	30	397	355	334	55	46	44
	31	441	356	334	67	47	44
JANUARY	1	401	360	334	33	46	45
	2	392	362	334	39	46	44
	3	373	364	334	32	46	44
	4	429	370	335	32	46	44
	5	471	375	335	33	45	44
	6	437	374	336	45	45	44
	7	438	379	336	45	45	44
	8	322	379	336	45	45	44
	9	408	381	337	37	45	44
	10	408	383	337	43	45	44
	11	319	384	336	44	45	44
	12	325	382	337	43	45	44
	13	361	382	338	42	45	44
	14	503	388	340	30	44	44
	15	302	385	340	57	44	44
	16	314	382	341	39	44	44
	17	508	384	343	44	43	44
	18	381	384	344	39	43	44
	19	238	380	343	40	43	44
	20	458	384	344	41	43	45
	21	345	383	344	41	43	45
	22	352	388	344	41	43	44
	23	378	389	346	42	43	44
	24	318	389	346	45	43	44
	25	349	390	346	49	43	44
	26	413	393	346	36	43	44
	27	341	385	346	39	42	44
	28	350	382	346	39	42	44
	29	350	381	347	43	42	44
	30	361	378	347	42	41	44
	31	363	377	347	55	41	44
FEBRUARY	1	376	376	349			
	2	349	376	349			
	3	308	372	349			
	4	426	370	350			
	5	342	367	351			
	6	325	363	352			
	7	338	364	352			
	8	354	362	353			
	9	375	361	353			
	10	383	363	353			
	11	312	362	352			
	12	355	362	353			
	13	321	356	353			
	14	379	359	353			
	15	346	360	354			
	16	342	354	354			
	17	408	355	355			
	18	384	360	356			
	19	245	353	356			
	20	411	355	358			
	21	334	355	358			
	22	289	352	358			
	23	321	352	358			
	24	454	355	360			

	25	377	354	361			
	26	249	351	362			
	27	451	354	364			
	28	322	353	364			
	29	496	358	365			
MARCH	1	249	354	363			
	2	346	353	363			
	3	440	356	365			
	4	211	353	363			
	5	293	348	364			
	6	389	350	365			
	7	237	347	362			
	8	357	348	363			
	9	296	346	363			
	10	229	341	361			
	11	223	336	360			
	12	364	337	361			
	13	197	332	359			
	14	333	332	359			
	15	695	343	363			
	16	261	340	361			
	17	408	342	361			
	18	302	339	360			
	19	312	336	359			
	20	242	336	358			
	21	346	334	358			
	22	364	335	357			
	23	375	338	359			
	24	326	338	359			
	25	370	335	360			
	26	287	332	359			
	27	378	337	360			
	28	306	332	357			
	29	333	332	356			
	30	220	323	354			
	31	342	326	353			
	MAXIMUM	**1055**	**562**	**453**	**600**	**170**	**131**

The 30 day average flow is the average of the previous 30 days. The 3 month rolling average is the average of the previous 90 days. The maximum flows for 30 and 90 days will be used to calculate peak flows and to determine permit compliance, respectively.

ATTACHMENT 1-B

FACILITIES REVIEW CALCULATIONS

Title: East Cedar Creek FWSD - Master Plan
North WTP System Review

Date: 4-22-96
By: DRJ
✓

North Water Treatment Plant Design Flow = 2 MGD
= 1,388 gpm

Sedimentation basin

- Criteria: 2-hrs for solids contact units
  54' ϕ Clarifier = 2,290 Sq. ft
  36' ϕ Flocculation Cone (bottom dia.) = 1018 sq. ft
  18' ϕ (Top dia) Floc Cone = 254 ft²
  15' Side Water Depth

$V_1 = (2,290 - 1018)\,15 = 19,080\ ft^3 = 142,728$ gal

$V_2 = (1018 - 254)\,10.5/2 = 4,008\ ft^3 = 29,986$ gal

$V_3 = (1018 - 28.3)\,4.5 = 4,453\ ft^3 = 33,316$ gal

$V_t = 206,030$ gal

Detention time $\theta_t = \frac{206,030 \text{ gal}}{2,000,000 \text{ gpd}} \cdot 24 \text{ hr/d} =$

$\theta_t = \underline{2.47 \text{ hrs.}}$

Qrated = 2.472 MGD

Dual Media Filters

- Criteria: Minimum 24" of media
  Minimum 12" of gravel
  Provided 30" of media + 12" of gravel
- Criteria: Maximum Flow of 5gpm per Sq. Ft.
  2 - 15' ϕ Filters Area = 177 sq. ft. ea.
  1,388 gpm / 177 sq. ft / 2 = 3.92 gpm/sq. ft.
  Qrated = 2.549 MGD

Backwash rate of flow

- Criteria: Minimum 12.5 gpm/sq. ft.
  Maximum 18.7 gpm/sq. ft.

Backwash pump = 2800 gpm.
2800/177 = 15.8 gpm/sq. ft.

FREESE+NICHOLS

Title: ECCFWSD Master Plan
North WTP System Review

Date: 4-22-96
By: DRJ
✓

Surface Water Facilities Capacity → 2,896 connections

- Criteria:
  - Raw water pump capacity 0.6 gpm per connection
  - Treatment Plant Capacity 0.6 gpm per connection
  - Transfer Pump Capacity 0.6 gpm per connection
  - Clearwell storage 5% of plant capacity
  - Total Storage Capacity 200 gal per connection
  - Elevated Tank Capacity 100 gal per connection

Raw water pump capacity = 1400 w/ largest pump down

$1400/0.6 \xrightarrow{-0.5}$ 2,333 connections

Treatment Plant Capacity = 1,389 gpm

$1,389/0.6 \xrightarrow{-0.5}$ 2,315 connections

H.S. Pumps = 1480 gpm w/ largest pump out of servic

$1480/0.6 \xrightarrow{-0.5}$ 2,466 connections

Clearwell storage = 212,000 gal + 16,000 gal = 228,450 gal

$228{,}450/2{,}000{,}000 \rightarrow 11\%$

Total Storage Capacity = 228,450 + 500,000 gal

$728{,}450/200 = 3{,}642$ Connections

Elevated Tank Capacity = 500,000 gal

$500{,}000/100 = 5{,}000$ connections

FREESE-NICHOLS

Title: ECCFWSD
South Water System Improvements
Proposed Unit Rated Capacities

Date: 4/22/96
By: DMS
✓

CLARIFIERS

DIAMETER	36 FT
SWD	14 FT
TOTAL VOLUME (PER CLARIFIER)	106,592 GAL

VOLUME UNDER FLOC SKIRT

$$V_{Skirt} = \frac{\pi}{4}(16.5)^2 \times 4' + 0.5\left(4\right)\left(\frac{\pi}{4}(22)^2 + \frac{\pi(16.5)^2}{4}\right) + 6.5\left(\frac{\pi}{4}22^2\right)$$

$$= 855.3\,ft^3 + 1187.5\,ft^3 + 2,470.9\,ft^3$$

$$= 4513.7\,ft^3 = 33,762\,gal$$

SETTLING CHAMBER VOLUME = 106,592 - 33,762 gal

= 72,830 gal

REQ'D HRT FOR SC CLARIFIER = 2 HRS

$$Q_{rated} = \frac{72,830\,gal}{2\,hrs} \times \frac{24\,hrs}{day} = \frac{873,960\,gal}{day\text{-}clarifier}$$

$$Q_{rated} = \frac{873,960\,gal}{day\text{-}clarifier} \times 2\,clarifiers = \frac{1,747,920\,gal}{day} \Rightarrow OK$$

$$\boxed{Q_{Trated} = 1.748\ MGD}$$

FREESE-NICHOLS

Title : Proposed Unit Rated Capacities, Cont.

Date : By: DMS ✓

FILTERS (DUAL MEDIA)

MEDIA DEPTH REQ'D = 24" > OK
MEDIA DEPTH PROVIDED = 30"
GRAVEL DEPTH REQ'D = 12" > OK
GRAVEL DEPTH PROVIDED = 12"

NUMBER OF FILTERS - 6
DIAMETER EACH - 8 ft
AREA EACH - 50.3 ft^2
DESIGN FILTRATION RATE - 5 gpm / ft^2

RATED CAPACITY (EACH) = $\frac{5 gpm}{ft^2} \times \frac{50.3 ft^2}{unit}$ = 251.3 gpm (0.36 MGD)

TOTAL RATED CAPACITY = $\frac{5 gpm}{ft^2} \times \frac{50.3 ft^2}{unit} \times 6 units$ = 1509 gpm (2.17 MGD)

RATED CAPACITY OF FILTERS = 1509 gpm or 2.17 MGD

FREESE-NICHOLS

Title: ECCFWSD
South System
Proposed Unit cost capacities

Date: 4/22/96
By: DMS
✓

CLEAR WELL STORAGE

Total storage provided - 300 K - elevated
212 K > ② Plant Clearwells
125 K
637,000 gallons

NO. OF CONNECTIONS -1960

CRITERIA:
COVERED CLEARWELL STORAGE AT PLANT
OF 50 GALLONS PER CONNECTION
OR 5.0% DAILY PLANT CAPACITY

PLANT CLEARWELL STORAGE REQ'D =

50 gal x 1960 = 98,000 gal - OK
OR
0.05 x 1,730,000 = 86,500 gal - OK

337000 gpd / 1,730,000 = 19%

TOTAL STORAGE REQ'D = 200 gallons per connection
OR - 200 gal x 1960 = 392,000 gallons - OK
637000/200 = 3,185 connections

ELEVATED STORAGE CAPACITY REQ'D = 100 gal/connection
OR - 100 x 1960 = 196,000 gallons - OK
300,000/100 = 3,000 connections

Raw Water Pump Capacity = 600 gpm 3ea
1200 gpm w/ one pump out
Criteria = 0.6 gpm/connection 1200/0.6 = 2,000 Connections

Plant Capacity - 0.6 gpm/connection - 1201 gpm / 0.6 = 2002 conn.

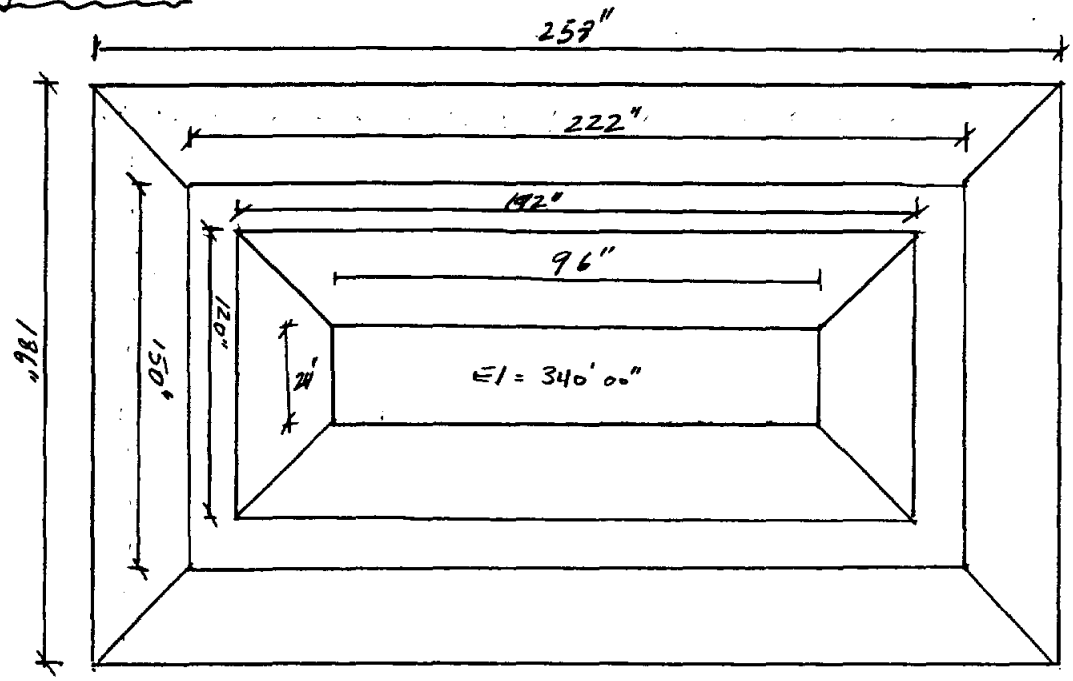
H.S. Pump Capacity - 0.6 gpm/connection - ?

FREESE-NICHOLS

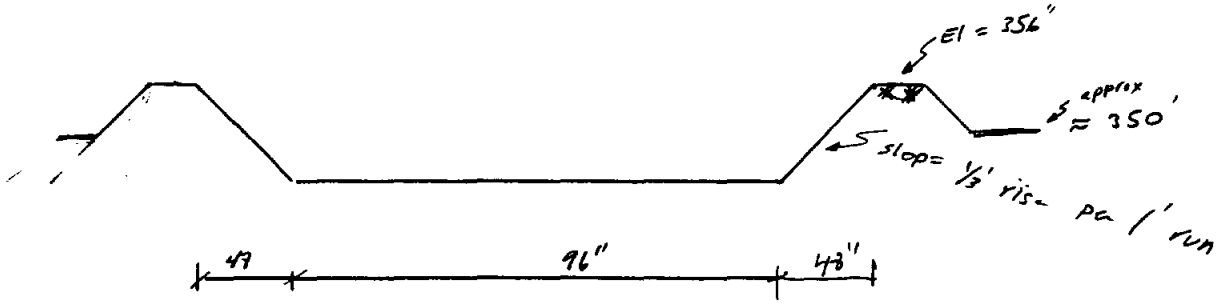
Title: East Cedar Creek FWSD/North District WWTP
*Surge Basin Dimensions and Volume and Capacity

Date: 4/18/96
By: HJM
✓

* Surge Basin



Not to Scale



- Info obtained from plans, sheet #3 - Top of berm elevation = 356".
- Plans indicate that WSE in basin fluctuate.

∴ Assume minimum freeboard = 2" ⇒ Max water depth = 16' - 2" = 14"

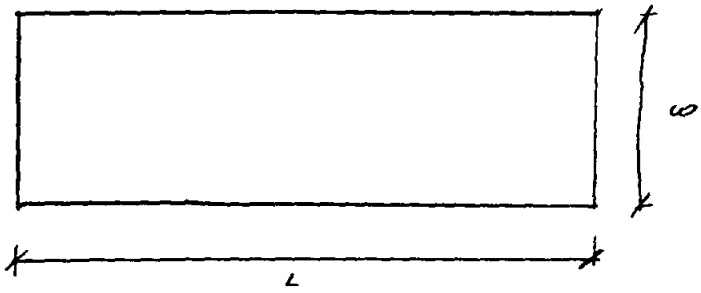
FREESE-NICHOLS

Title : _____ Date : _____

_____ By : _____

_____ ✓ _____

At an elevation @ 355', the surface dimensions of the surge basin are as follows:



These dimensions are obtained from the slope in the surge tank which are 1/3' rise / foot run -

@ Elevation = 355', $L = 96' + 2 \times 14/\frac{1}{3} = 180'$

$w = 24 + 2 \times 14/\frac{1}{3} = 108''$

∴ Volume = Average Area x Water depth

$= \frac{1}{2}(24 \times 96 + 108 \times 180) \times 14 = 152{,}208 \text{ ft}^3$

$\approx 1.139 \text{ MG}$

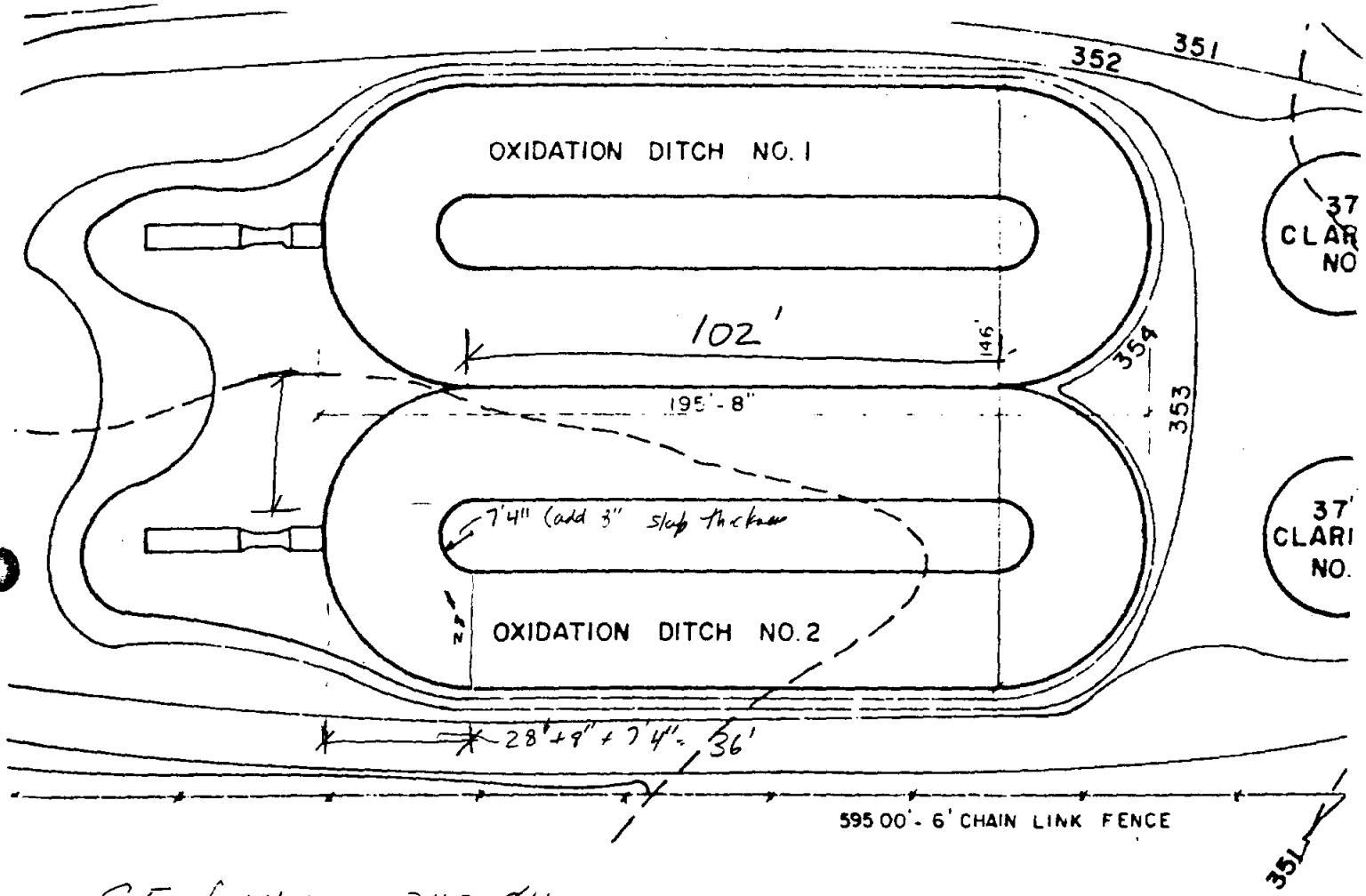
Criteria states that, "generally" the volume of the surge basin is about 10 - 20 % of the anticipated average flow.

* Applying the "20%", and assuming 2' of free board

Title: East Cedar Creek FWSD / North District WWTP
* Capacity - Volume of Oxidation Ditches -

Date: 4/18/96
By: HJM
✓

Oxidation ditch



GE of Ditch = 349.46

WSE = 353.46 ⇒ Water Depth = 4' sheet 7/23

Wet Volume = Area x Water depth

$$\text{Volume/ditch} = (28' \times 122) \times 2 + 2 \times \frac{(\pi \times 36'^2 - \pi \times 8^2)}{2}$$

$$= 6832 + 3870 = 10{,}702 \text{ ft}^3$$

$$\text{Volume/ditch} = 42{,}808 \text{ ft}^3 = 0.3202 \text{ M Gal}$$

FREESE-NICHOLS

Page ____ Of ____

Title : _____ Date : _____

_____ By : _____

_____ ✓ _____

Oxidation ditch Capacity, based on TNRCC state criteria

- TNRCC criteria specifies a design organic loading rate of 15 lb BOD_5/day/1000 cu. ft and a minimum ~~hydraulic~~ hydraulic retention time of 20 hrs (at design flow)

* - Assuming an influent BOD_5 concentration = 250 mg/L which is a typical value, the capacity of each ditch is 0.308 MGD for a total WW capacity = 0.616 MGD

If the influent BOD_5 concentration is assumed at 200 mg/L, the overall combined capacity of the two oxidation ditches would be 0.770 MGD

Concent x 8.34 x Q = BOD lb/day

* Capacity Based on retention time

$$\text{Capacity}_{\text{/ditch}} = \frac{0.3202}{20/24} = 0.3842 \text{ MGD}$$

Total combined capacity = 0.768 MGD

The lower value should be selected.

FREESE-NICHOLS

Page ____ Of ____

Title : _____ Date : _____

_____ By : _____

_____ ✓ _____

Note : In order to be consistent with the stated capacity of the WWTP, an influent BOD_5 concentration of 246 mg/L should be assumed. This concentration would yield a combined capacity of 0.6267 MGD.

FREESE-NICHOLS

Title: East Cedar Creek FWSD / North District WWTP
- Final Clarifiers Capacity / TNRCC Criteria

Date: 4/8/96
By: HIM
✓

Clarifiers

Circular

- Inside Diameter = 37'
- Side Water Depth = 10'
- Weir length = 106'

2 clarifiers

- Area/clarifier = 1075 ft²
- Volume/clarifier = 10752 ft² = 80,425 gallons

TNRCC has several criteria for sizing final clarifiers, some of them pertain to peak capacity and some to design capacity. Each ~~capacity~~ criteria would be discussed separately. The more critical values are selected.

* With respect to surface loading and detention times, it is assumed that the final clarifiers are extended aeration clarifiers

FREESE-NICHOLS

Page ____ Of ____

TABLE 10-3
(continued)

Process or process modification	Description	See Figure
Extended aeration	Extended aeration process is similar to the conventional plug-flow process except that it operates in the endogenous respiration phase of the growth curve, which requires a low organic loading and long aeration time. Process is used extensively for prefabricated package plants for small communities (see Chap. 14).	
High-rate aeration	High-rate aeration is a process modification in which high MLSS concentrations are combined with high volumetric loadings. This combination allows high *F/M* ratios and long mean cell-residence times with relatively short hydraulic detention times. Adequate mixing is very important.	
Kraus process	Kraus process is a variation of the step aeration process used to treat wastewater with low nitrogen levels. Digester supernatant is added as a nutrient source to a portion of the return sludge in a separate aeration tank designed to nitrify. The resulting mixed liquor is then added to the main plug-flow aeration system.	
High-purity oxygen	High-purity oxygen is used instead of air in the activated-sludge process. Oxygen is diffused into covered aeration tanks and is recirculated. A portion of the gas is wasted to reduce the concentration of carbon dioxide. pH adjustment may also be required. The amount of oxygen added is about four times greater than the amount that can be added by conventional aeration systems.	10-6
Oxidation ditch	The oxidation ditch consists of a ring- or oval-shaped channel and is equipped with mechanical aeration devices. Screened wastewater enters the ditch, is aerated, and circulates at about 0.8 to 1.2 ft/s (0.25 to 0.35 m/s). Oxidation ditches typically operate in an extended aeration mode with long detention and solids retention times. Secondary sedimentation tanks are used for most applications.	10-7
Sequencing batch reactor	The sequencing batch reactor is a fill-and-draw type reactor system involving a single complete-mix reactor in which all steps of the activated-sludge process occur. Mixed liquor remains in the reactor during all cycles, thereby eliminating the need for separate secondary sedimentation tanks.	8-21

Title : _____ Date : _____

_____ By : _____

_____ ✓ _____

Peak Capacity = 2.145 MGD (base on detention time)

Capacity per clarifier = 1.07 MGD

C-1) Average Capacity based surface loading rate = 500 gal/day/sq ft

Capacity = 2 clarifiers × 1075 sq. ft × 500 gal/sq.ft-day

= 1.075 MGD (average capacity)

Average Capacity per clarifier = 0.54 MGD

C-2) Average Capacity based on detention time of 3.6 hrs

$$\Rightarrow \text{Capacity} = 2 \text{ clarifiers} \times \frac{30425 \text{ gallons}}{\text{clarifier}} \cdot \frac{1 \text{ MG}}{10^6 \text{ gallons}} \times \frac{24 \text{ hrs}}{\text{day}} \Big/ 3.6 \text{ hrs}$$

= 1.072 MGD

Capacity per clarifier = 0.54 MGD

FREESE-NICHOLS

Title : _____ Date : _____

_____ By : _____

_____ ✓ _____

Based on the overall values:

- Peak capacity of the clarifiers = 2.145 MGD
- Average Capacity of the clarifiers = 1.072 MGD

It should be noted that the loading rates and detention times for the clarifiers were based on extended air secondary clarifier values.

Values given for ~~enhanced~~ secondary, extended air secondary, or second stage nitrification were excluded.

~~check~~

- The reason it was assumed extended air is because of the high detention time and ~~the~~ Metcalf and Eddy's explanation of the proces

FREESE-NICHOLS

Title: East Cedar Creek FWSD - Master Plan
Existing South WWTP System Review

Date: 4-22-96
By: DRJ
✓

Aeration Basin

No plans available so assume 10' SWD

74' x 12' basin

Volume = 8,880 cu ft. = 66,427 gal

Assume extended aeration plant w/ influent BOD of 200 mg/l
Use 15 mg/l/1000 cu ft as design criteria

$$15/1000 \cdot 8880 = Q \times 8.34 \times 200$$

$$Q = 0.0798 \text{ MGD}$$

Clarifier Use extended Air secondary criteria

Max Surface loading @ peak flow = 1000 gpd/sf.
Surface Area = $12^2 \pi/4$ = 113 sq. ft.

= 0.113 MGD

Min detention time @ peak = 1.8 hrs

$$66,427 \text{ gal} / 1.8 \text{ hrs} = 0.885 \text{ MGD}$$

Max surface loading @ design = 500 gpd/sf
= 0.056 MGD

Min detention time @ design flow = 36 hrs
$66,427/B.6 \cdot .24 = .442$ MGD

Wier loading = 20,000 gal/day/linear feet @ peak
10.83' ⌀ weir = 27π = 34 linear feet = 0.68 MGD

FREESE-NICHOLS

East Cedar Creek FWCD Water & Wastewater Master Plan

North District WastewaterTreatment Plant

Treatment Capacity Based On TNRCC State Criteria

	Number	Area (sq-ft) (Each)	Volume (MG) (Each)	Total Average Capacity (MGD)	Total Peak Capacity (MGD)
Aeration Tank	1		0.167	0.2	
Clarifiers	1	1336	0.120	0.668	1.336
Sludge Digesters	3		0.025	0.3	

Note: Plant's Max. 30-day design flow = 0.2
It is assumed that the influent BOD concentration = 200 mg/L

East Cedar Creek FWCD Water & Wastewater Master Plan

South District Package Wastewater Treatment Plant

Treatment Units & Criteria Summary

	Dimensions	Number	Area (sq-ft) (Each)	Volume (cu-ft) (Each)	Volume (MG) (Each)	TNRCC Criteria
Treatment Area						
Aeration Tank (Extended Aeration)		1			0.167	-Design Organic Loading Rate = 15 lb BOD/day/1000 cu ft -Minimum Hydraulic Retention Time = 20 hours
Clarifier	41' 3" Diameter SWD=12' Weir Lenth = 247	1	1336	16,032	0.120	-Peak Surface Loading Rate = 1000 gal/day/sq ft -Peak Detention Time = 1.8 hrs -Average Surface Loading Rate = 500 gal/day/sq ft -Average Detention Time = 3.6 hrs -Weir Loading Rate = 20,000 gal/day/linear foot (Peak Flow)
Sludge Digester		3			0.025	-Minumum sludge retention time of 15 days -Design Volume may be calculated using 20 cu-ft/1lb of BOD per day

Title: ECL FWSD – South District WWTP

Date:

By:

✓

Aerobic Digesters

With respect to the sizing of sludge digesters, the criteria specifies the design volume to be calculated using 20 cu ft / 1 lb BOD

- Total volume of digesters = 3 × 25,000 gallons = 75,000 gallons
  = 10026.7 ft³

lbs of BOD that the digesters can handle = 501.3 lbs

Assuming a concentration of 200 mg/L for BOD_5, the digesters would be capable of handling flow from the following treatment plant capacity

$$Q \times 8.34 \times 200 = 501.3$$

$$Q = 0.3 \text{ MGD}$$ ✓

Title : _____ Date : _____

_____ By : _____

_____ ✓ _____

3-a) Design Surface loady rate

500 gal/day-sq. ft

Capacity = 1336 ft^2 x 500 = 0.668 MGD

3-b) Design based on average detention time

$Q = \frac{V}{t} \Rightarrow$ Capacity = $\frac{1336 \times 12 \times 7.48 \times 24}{3.6 \text{ hrs} \times 10^6}$

= 0.8 MGD

- Avege Capacity of final clarifier = 0.668 MGD
- Peak Capacity = 1.336 MGD

Title : _____ Date : _____

_____ By : _____

_____ ✓ : _____

1- Peak Capacity based on weir loading rate

$\frac{Q}{L} = WOR \quad \times 24 =$

$Q = 20{,}000 \times 247 = 4.94$ MGD ✓

2-a) Peak Surface loading rate

SOR = 1000 gal/day-sq. ft

$Q = \text{Area} \times 1000 \text{ gal/d} = 1336 \text{ ft}^2 \times 1000 \text{ gal} = 1.336$ MGD

2-b) Capacity based on peak detention time

$Q = \frac{V}{t}$; $V = 1336 \text{ ft}^2 \times 12' \times 7.48 \frac{\text{ft}^3 \text{ gal}}{\text{ft}^3}$

$= 119919$ gallons

$Q = \frac{119919 \text{ gallons} \times 24}{1.8 \text{ hrs} \times 10^6} = 1.6$ MGD

FREESE-NICHOLS

Page _____ Of _____

Title: East Cedar Creek FWSD
South District WWTP
Packy Plant

Date: 4/12/96
By: HKH
✓

Final Clarifier

TNRCC has criteria pertaining to secondy clarifiers. For extended aeratin systems, the follwing loadig rates apply

Peak Weir loadig Rate	Peak surface loadig rate	Peak Detentin time	Design Surface loadig rate	Design detentin time
20,000 gpd/d-ft	1000 gd/dy/sq.ft	1.8 hrs	500 gd/dey/sq.ft	3.6 hrs

- The diameter of the clarifier = 41' 3" (plans)

⇒ Area of the clarifiers = 1336 ft²

- Depth of final clarifin ≈ 12' (scaled it off)

* Inner weir length = 10' x 12 = 120'
* Outer weir length = 10.6 x 12 = 127.2

} Total weir length = 247'

FREESE-NICHOLS

Title: East Cedar Creek FWCD
South District WWTP
Packye Plant

Date: 4/11/96
By: HIM
✓ -

Aeration Area

- Aeration Volume = 167,000 gallons
- WL = 11'

Type: extended aeration

For extended aeration, the criteria specifies a design organic loading rate of 15 lb BOD_5/day/1000 cu ft

- Assuming the influent BOD_5 concentration of 220 mg/L, the capacity Q of the packye plant would be:

$$Q \times 8.34 \times 220 = 15 \times \frac{167{,}000}{7.48} \times \frac{1}{1000} = 334.893$$

$$Q = 0.1825 \text{ MGD}$$

In order to achieve a 0.2 MGD capacity, the influent BOD_5 concentration would have to be 200 mg/L

FREESE-NICHOLS

9250 –
15% of counties population

Freese and Nichols, INC
CONSULTING ENGINEERS

Call Ken Tilman
Calculations, [redacted] Plant + Transit Press,
DAVID JACKSON [redacted]

45.9 cu ft capacity

expandable to 79.1 cu.ft capacity

30% solids @ 70#/cu.ft.

964 # per run

10 runs per day

Cantex plant

[redacted] (~10')

365 x 964#

= 351,860 #/year

East Cedar Creek FWCD Water & Wastewater Master Plan

North District WastewaterTreatment Plant

Treatment Capacity Based On TNRCC State Criteria

	Number	Area (sq-ft) (Each)	Volume (cu-ft) (Each)	Volume (MG) (Each)	Total Average Capacity (MGD)	Total Peak Capacity (MGD)
Surge Tank (Flow EQ-Basin)	1		152,208	1,138,516	5.7	
Oxidation Ditches	2	10702	42,808	320,204	0.626	
Clarifiers	2	1075	80,425	601,579	1.072	2.145
Chlorine Contact Chamber	2	300	1,800	13,464		1.94
Sludge Drying Beds	12	1152			0.773	

Note: Plant's Max. 30-day design flow = 0.626 MGD
Plant's 2-Hr Peak Design Flow = 1.872
Plant's Peaking Factor = 2.99

DRJ[ECC95301]v:capacity.wk1

East Cedar Creek FWCD Water & Wastewater Master Plan

North District WastewaterTreatment Plant

Treatment Units & Criteria Summary

	Dimensions	Number	Area (sq-ft) (Each)	Volume (cu-ft) (Each)	Volume (MG) (Each)	TNRCC Criteria
Preliminary Treatment Units						
Grit Chamber	2' Wide x 16'-6" Lon		33	N/A		-Means for grit removal shall be provided -Plants with a single grit chamber shall have a bypass around chamber
Bar Screens (Manual)	1/4" Wide x 1 1/4" Opening					-30 deg - 60 deg slope -Opening not less than 3/4" -Velocity in Channel to Bar Screens > = 2fps -Velocity through screen openings < 3 fps @ design flow
Surge Tank (Flow EQ-Basin)		1		152,208	1.139	-Aeration May be required for odor control -when required, air supply must be sufficient to maintain 1.0 mg/L of DO -Generally, volume = 10% to 20% of the anticipated dry weather 30-day average flow
Treatment Area						
Oxidation Ditches	72'Wide, 4' SWD, 12" FB Radius to Radius = 122'4"	2	10702	42,808	0.320	-Design Organic Loading Rate = 15 lb BOD/day/1000 cu ft -Minimum Hydraulic Retention Time = 20 hours -Minimum of 2 rotors per ditch -Minimum channel velocity of 1 fps
Clarifiers	37' Diameter SWD=10' Weir Lenth = 106'	2	1075	80,425	0.602	-Peak Surface Loading Rate = 1000 gal/day/sq ft assuming extended aeration -Peak Detention Time = 1.8 hrs -Average Surface Loading Rate = 500 gal/day/sq ft -Average Detention Time = 3.6 hrs -Weir Loading Rate = 20,000 gal/day/linear foot (Peak Flow)
Tertiary Treatment Area						
Chlorine Contact Chamber	20' Long x 15' Long SWD = 6 ft	2	300	1,800		-Detention Time = 20 Minutes @ Peak Flow
Sludge Dewatering						
Sludge Drying Beds	24' W x 48'	12	1152			-Required Area = 9.75 sq ft/ lb BOD for Henderson County
Equipment						
Surface Brush Aerators (For Oxidation Ditch)	15 Hp, 1750 rpm	2 per ditch				-Minimum 100 Hp per 1 MG of Aeration Basin Volume -Clean water transfer rates 2 lbs/Hp minimum.
Blowers	500 cfm @ 63 psi 875 rpm, 20 Hp	3				
Chlorinators	Capacity: 200 ppd	2 Each				-Capacity greater than the highest expected dosage to be applied.

Title: East Cedar Creek / North District WWTP Chlorinators

Date: 4/17/96

By: HJM ✓

This section of 30 TAC Ch. 317 pertains to the chlorinators

provide scrubbing unit(s) during facility operation.

§317.6. *Disinfection.*

(a) General policy. Facilities for disinfection shall be provided to protect the public health and as an aid to plant operation.

(b) Chlorination facilities.

(1) Chlorination equipment. Chlorination equipment shall be selected and installed which is capable of applying desired amounts of chlorine continuously to the effluent. Chlorination equipment may also be installed to control odors and generally assist treatment. To accomplish these objectives, points of chlorine application may be established at the head of the plant for prechlorination, in the effluent chlorine contact chamber or other suitable locations.

(A) Capacity. Chlorination equipment shall have a capacity greater than the highest expected dosage to be applied. Chlorination systems shall be capable of operating under all design hydraulic conditions. Duplicate equipment with automatic switch over should be considered for standby service, so that continuous chlorination can be provided.

(B) Controls. Means for automatic proportioning of the chlorine amount to be applied in accordance with the rate of effluent being treated is encouraged for all plants and may be required if a maximum chlorine residual is required in the applicable discharge permit. Manual control will be permitted where the rate of effluent flow is relatively constant and for pre-chlorination applications. Consideration shall also be given to controlling chlorine feed by use of demand.

(C) Measurements. A scale for determining the amount of chlorine used daily, as well as the amount of chlorine remaining in the container, shall be provided.

(D) Safety equipment. Self contained breathing apparatus shall be available for use by plant personnel. The equipment should be located at a safe distance from the chlorine facilities to insure accessibility. Self-contained breathing apparatus shall be located outside the entrance to the chlorine facility.

(E) Housing. Housing of chlorination equipment and cylinders of chlorine shall be in separate rooms above ground level, with the door opening to the outside, as a measure of safety. Doors should

~~It is assumed that chlorinators are adequate~~

8mg/l x 8.34 x Q = Cl_2 in ppd Assume 8mg/l Cl_2 concentration

2 - 200ppd chlorinators are provided

Capacity needed = (8 x 8.34 x 1.872) 1.50 = 187 ppd

Chlorinators are adequate.

FREESE-NICHOLS

Page ____ Of ____

Title: East Cedar Creek FWSD / North District Plant Aeration System

Date: 4/19/96

By: HIM ✓

Aeration System for the Oxidation Ditch

TNRCC criteria specify that aeration systems shall be designed to maintain a minimum dissolved oxygen concentration of 2.0 mg/L throughout the basin at the maximum diurnal organic loading rate and to provide thorough mixing of the mixed liquor.

	Minimum Air Requirement (lb O_2/lb cOD)
Oxidation ditch	1.6

↳ Oxygen transfer efficiency of 4.0%

- For mechanical aeration systems, a minimum of 100 horsepower per million gallons of aeration basin volume shall be furnished.

Volume of each oxidation ditch = 0.3202 Mgal

∴ Required Hp/ditch = 32 Hp/ditch

Available Hp/ditch = 30 Hp/ditch

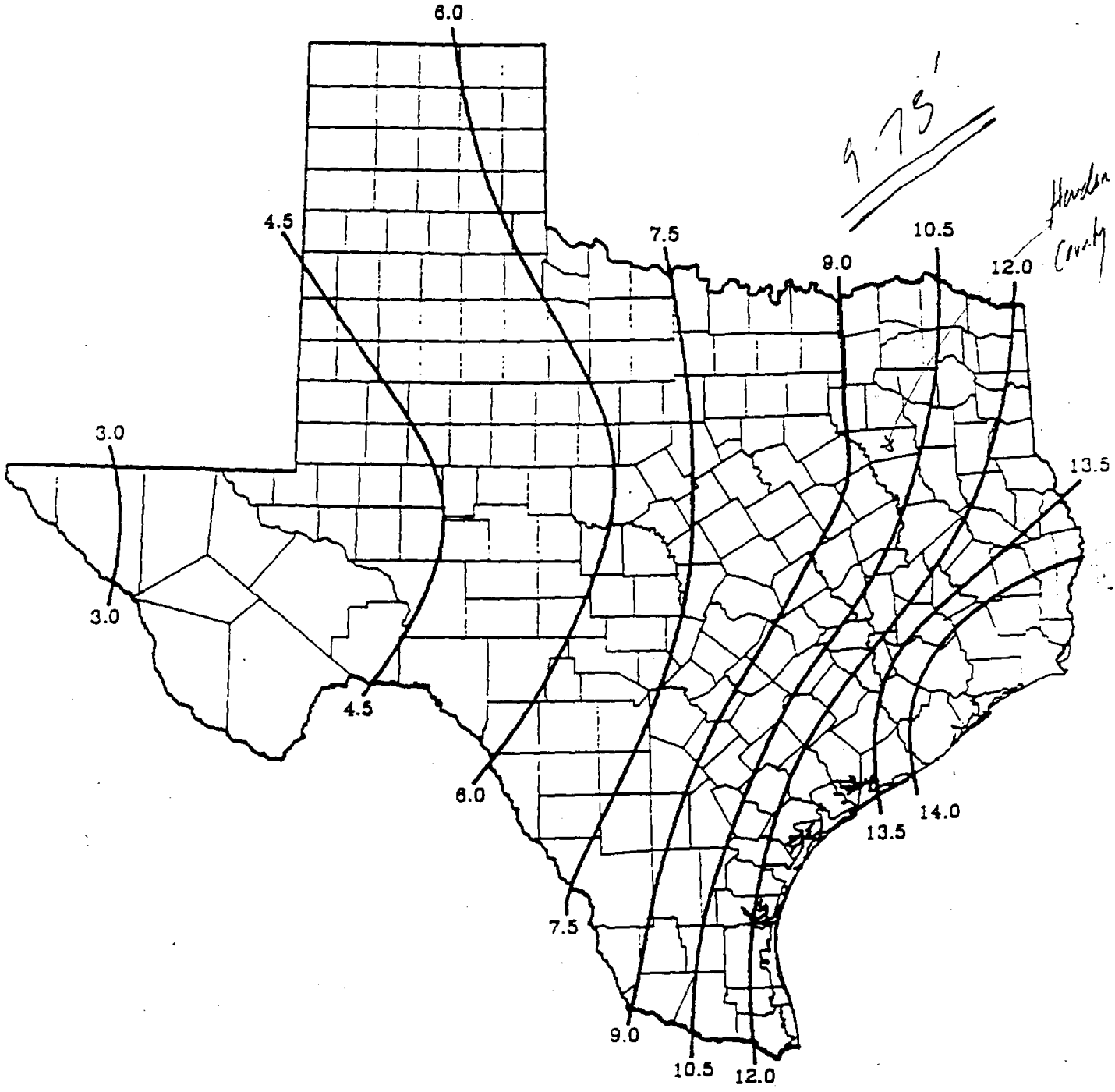
FREESE-NICHOLS

Page ____ Of ____

Chapter 317

APPENDIX D

REQUIRED AREA (ft /lb. BOD)
FOR SLUDGE DRYING BEDS WITH AEROBIC SLUDGES
(REDUCE BY 15% FOR ANAEROBIC SLUDGES)



SHADED AREA SHOULD HAVE COVERAGE OF DRYING BEDS
OR OTHER MEANS OF ACCELERATED DEWATERING

Title: East Cedar Creek FWSD / North District WWTP
Sand Bed Capacity

Date: 4/13/96
By: HTM
✓

TNRCC regulations specify that the area of sludge drying beds to be provided will vary in accordance with the average rainfall, average humidity and type of treatment process used. The bed area sizing requirements are given in appendix D -

For Henderson County, the required area is 9.75 ft²/lb BOD

There are 12 sludge drying beds - Ref sheet 2, 16.

Each drying bed is ≈ 24' x 48'

Area/bed = 1152 sq. ft ⇒ Total area = 13824 ft²

∴ Pounds of BOD that may be processed = 1418 lbs

Flow (MGD) x 8.34 x BOD$_5$* conc = 1418 lbs

Capacity = 0.773 MGD

Assume beds can treat 20# solids/ft²-yr.
Treat - 276,480 # solids/year

* Assumed BOD$_5$ concentration = 220 mg/L

FREESE-NICHOLS

Title: East Cedar Creek / North District WWTP — Date: 4/18/96
Chlorine Contact basin Capacity - TNRCC criteria — By: ✓

Chlorine Contact Chamber

Each basin is 20' x 15'

Max WL = 6'

∴ Volume/basin = 1800 ft³ = 13464 gallons

Total Volume = 3600 ft³ = 26,928 gallons

Peak Capacity = $\frac{26{,}928 \text{ gallons}}{1/3 \text{ hrs}} \times \frac{24 \text{ hrs}}{\text{day}}$ = 1.94 MGD

Peak Capacity of chlorine contact basins = 1.94 MGD

Grit Chamber Max Velocity at bar screen = 3 fps @ QD

Flowrate in channel = 2.89 ft³/s / 4 = 0.72 ft³/s

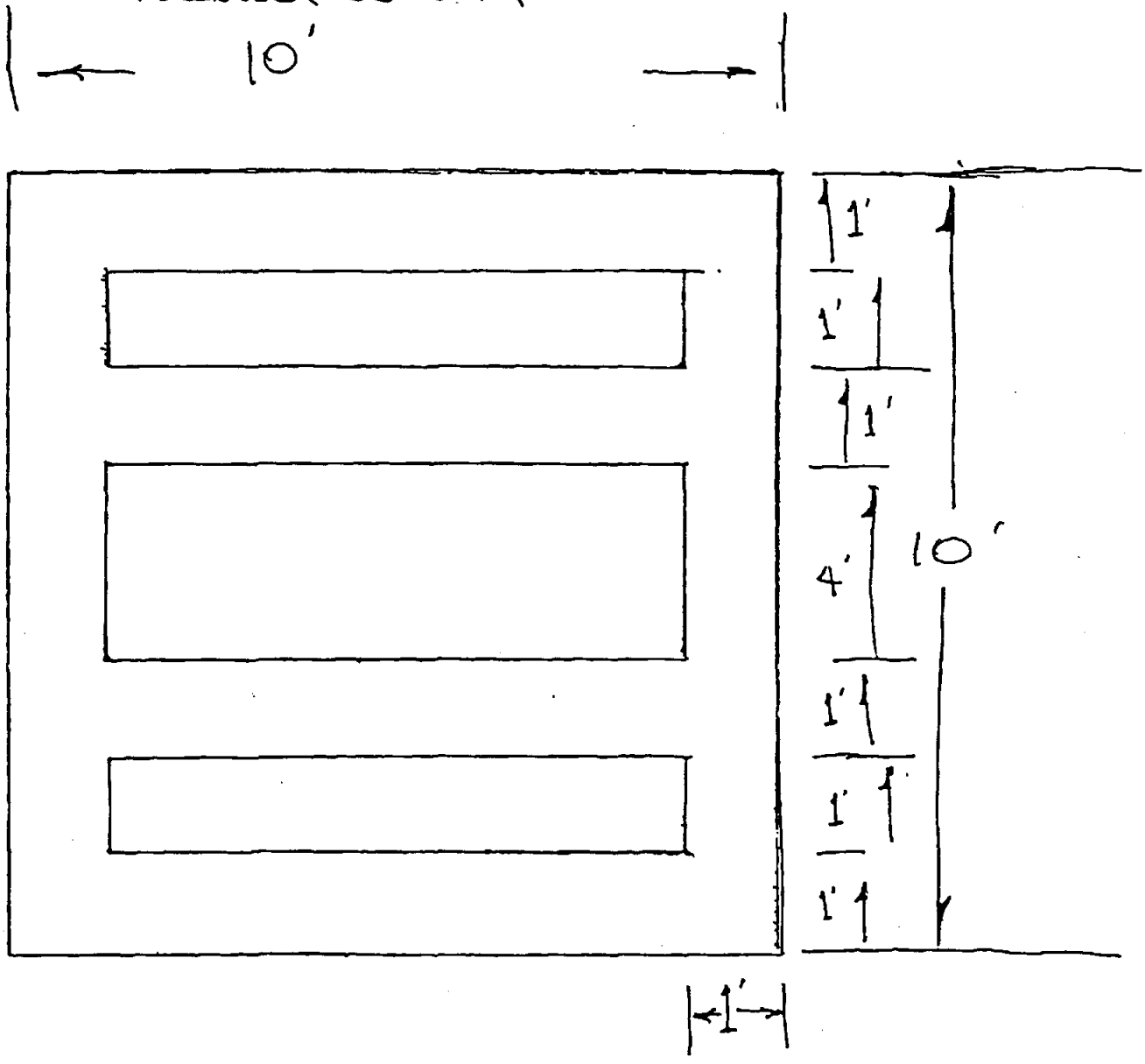
Area in Channel = 1 sq. ft

Max Velocity = 0.72 fps ok

FREESE-NICHOLS

4/17/96

David - 10' square w/ 2 x 1' inside weirs. My calculation is
40' + 18' + 2' + 26' + 18' + 2' = 106' linear weir length
District WWTP



Call me if questions or clarifications
at 903-887-7103.

Curtis.

EAST CEDAR CREEK FRESH WATER SUPPLY DISTRICT
P. O. BOX 309
MABANK, TEXAS 75147
PHONE: (903) 887-7103

FAX # 903-887-4299

DATE FAXED: April 17, 1996 @3:55P

NUMBER CALLED 817-735-7492

TO: Freese + Nichols

ATTN: David Jackson

FROM: Curtis Dawson

TOTAL # OF PAGES 2
INCLUDING THIS ONE.

REMARKS: Sketch of District wastewater treatment plant areas as you requested

Regards,

Title _____ Date: _____

_____ By: _____

_____ ✓ _____

a- Peak capacity based on weir loading rate

WLR = 20,000 gal/day-lin foot

∴ Peak flow capacity per clarifier = 20,000 x 106

= 2.12 MGD

* Total peak capacity of final clarifiers = 4.24 MGD

b-1) Peak Capacity based on peak surface loading rate of 1000 gal/day/sq. ft

Capacity/day = 2 clarifiers x 1075 sq. ft x 1000 gal/sq.ft-dy

= 2.15 MGD ← Total for 2 clarifiers

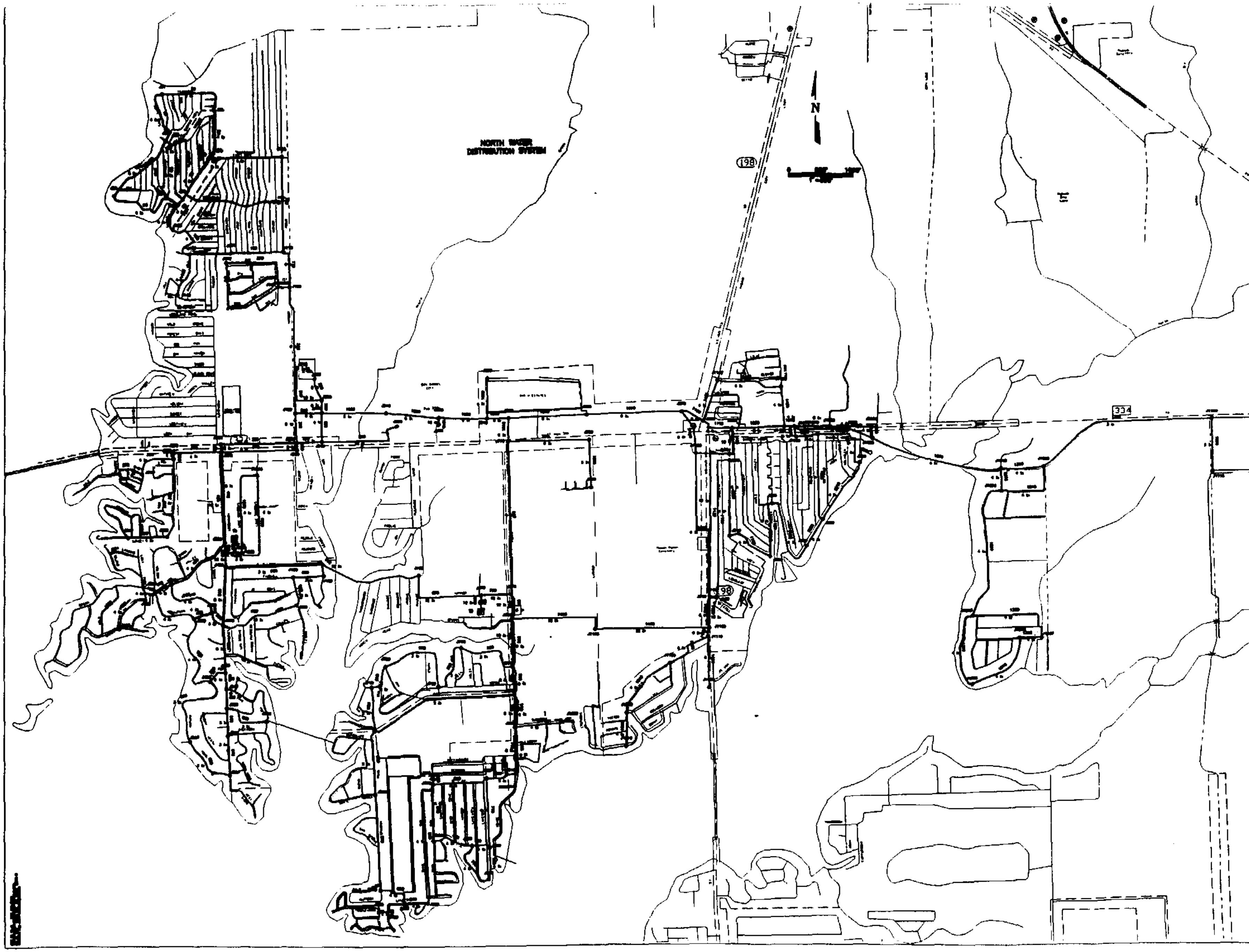
@ Peak Capacity per clarifier = 1.075 MGD

b-2) Peak Capacity based on detention time of 1.8 hrs.

$$\text{Capacity} = \frac{2 \text{ clarifiers} \times \frac{80{,}425 \text{ gallons}}{\text{clarifier}} \times \frac{1 \text{ MG}}{10^6 \text{ gallons}} \times \frac{24 \text{ hrs}}{\text{dy}}}{1.8 \text{ hrs}}$$

FREESE-NICHOLS

Page ____ Of ____


NORTH WATER
DISTRIBUTION SYSTEM
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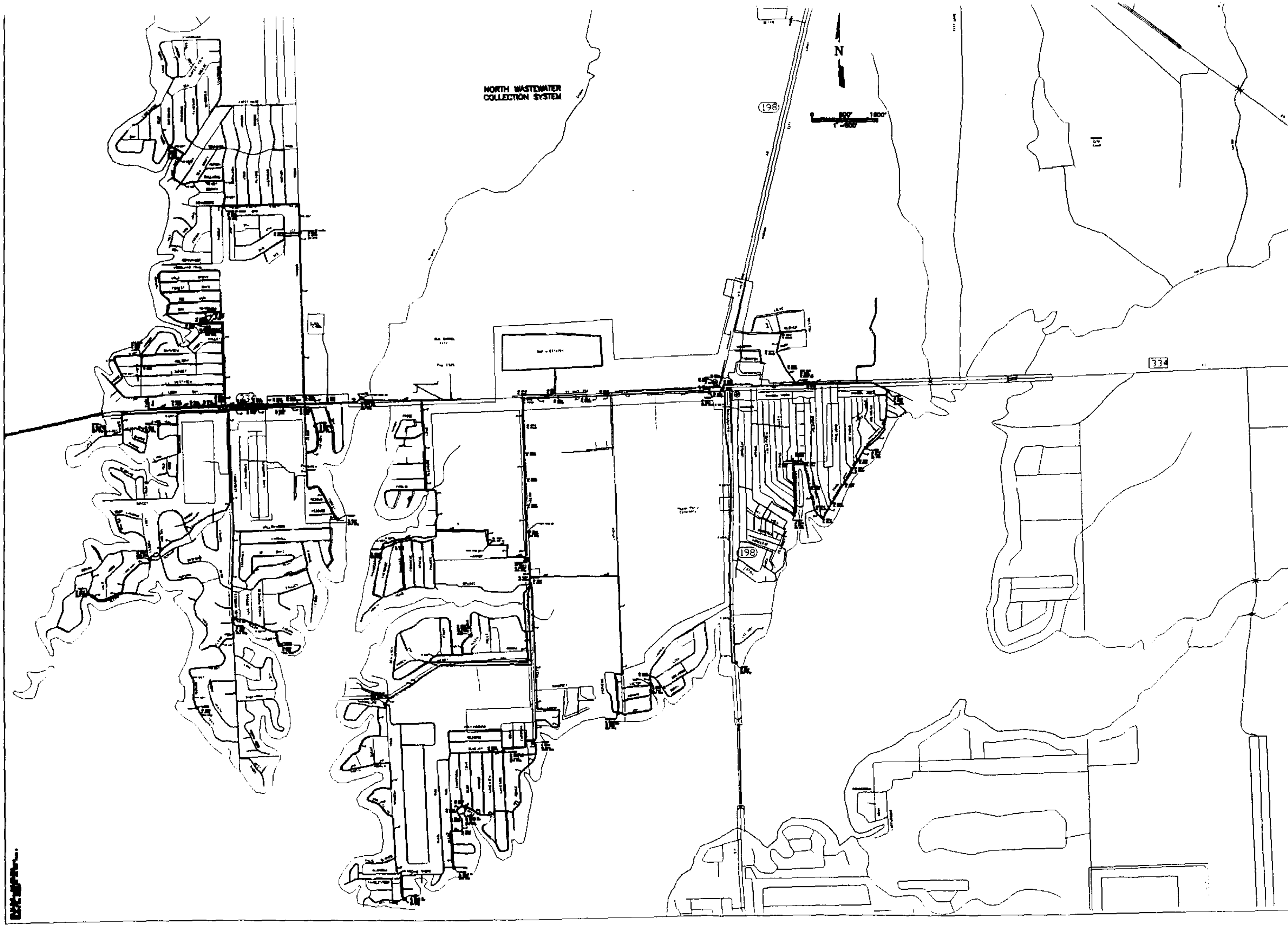
NORTH WASTEWATER
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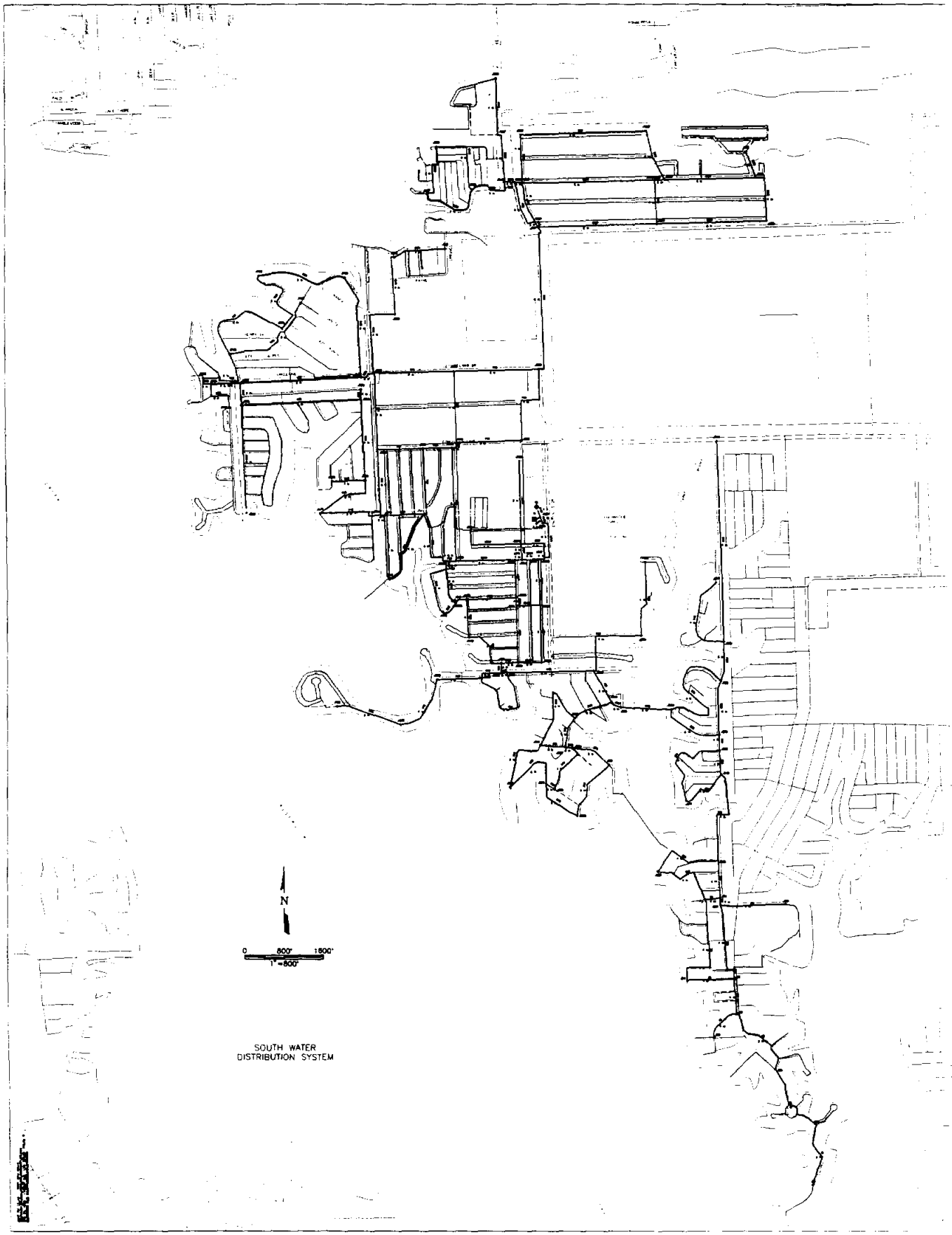
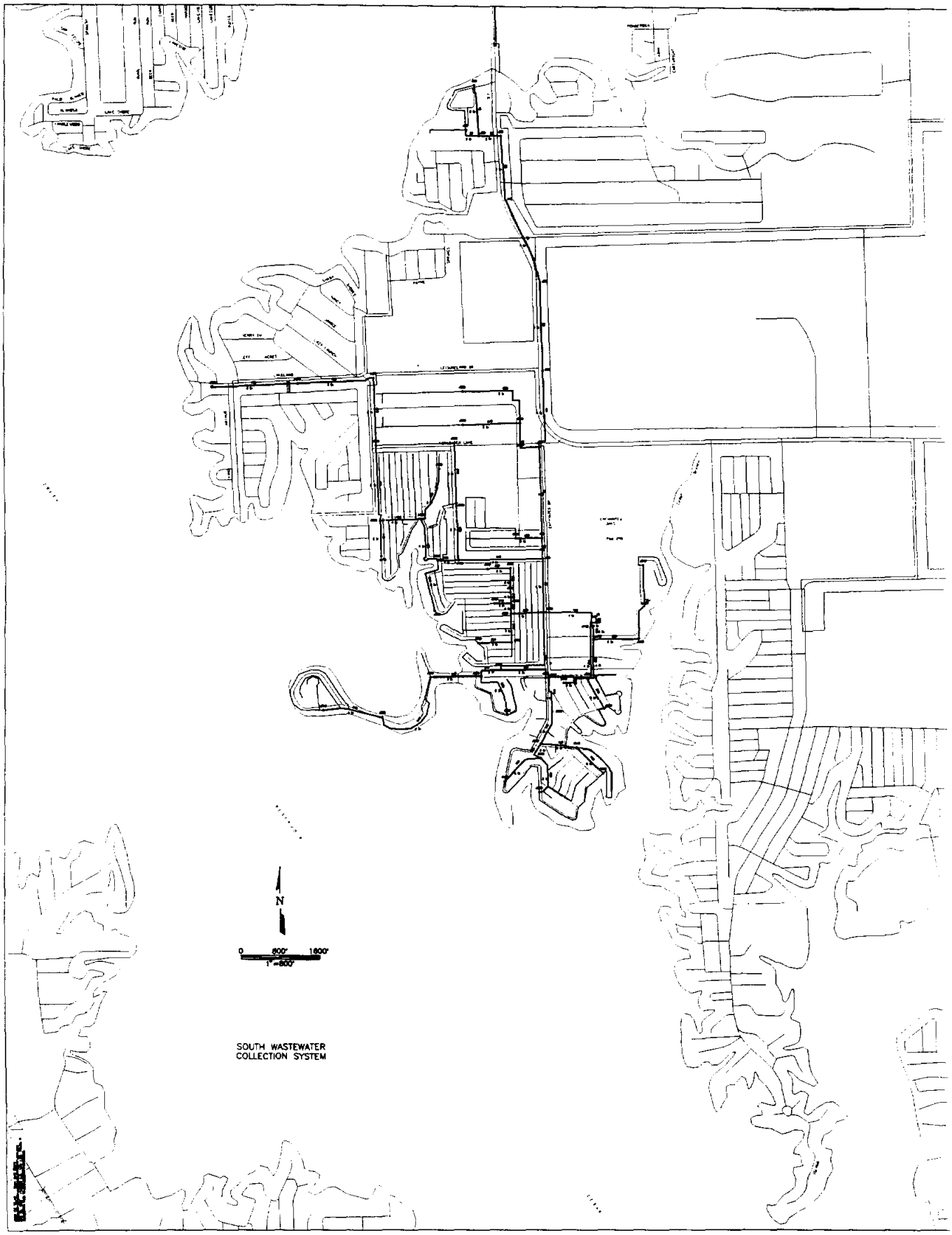


SOUTH WATER
DISTRIBUTION SYSTEM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SOUTH WASTEWATER
COLLECTION SYSTEM

APPENDIX B

TECHNICAL MEMORANDUM #2

SYSTEM MODELING SUMMARY

EAST CEDAR CREEK
FRESH WATER SUPPLY DISTRICT

WATER & WASTEWATER MASTER PLAN

TECHNICAL MEMORANDUM #2
SUMMARY OF TASK D - SYSTEM MODELING

AUGUST 1996

FREESE • NICHOLS

ECC95301

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1.0 INTRODUCTION

1.1 BACKGROUND

The East Cedar Creek Fresh Water Supply District (ECCFWSD) consists of two separate water distribution and wastewater collection systems, the North System and the South System. Each System is hydraulically independent and has it's own water and wastewater treatment plants, elevated water storage tanks, and distribution and collection system piping. Both of the wastewater collection systems are primarily pressure systems with the North System using about half gravity sewers and the South System using mostly force main piping with a small amount of gravity sewer. Each System was evaluated as to the current condition of the collection and distributions systems and the ability to meet current TNRCC State Design Criteria. The systems were also evaluated as to expected future conditions for water distribution and wastewater collection.

The North District water system includes a 2.55 million gallon per day (MGD) water treatment plant, 500,000 gallon elevated storage tank, and water distribution piping. District records indicate that the North water distribution system served an average of 2,896 water connections in 1995. The North District wastewater system includes a 0.626 MGD wastewater treatment plant, 67 wastewater collection lift stations, associated house grinder pumps, wastewater force mains, and gravity piping. The North wastewater collection system served an average of 3,075 connections in 1995.

The South District water system includes an existing water treatment plant and hydropneumatic storage tank. However, a proposed 1.73 MGD water treatment plant and 300,000 gallon elevated storage tank have been designed and are under construction. Upon

completion of the new facility, the existing treatment plant will be abandoned. Therefore, for the purposes of this study, the evaluation only reviewed the proposed 1.73 MGD water treatment facility, 300,000 gallon elevated storage tank, and water distribution system piping. Based on information provided by ECCFWSD, the South water system served an average of 1,960 water connections in 1995, including 200 water connections in Payne Springs that are no longer served by the District. The South District wastewater system includes an existing wastewater treatment plant with a permitted capacity of 40,000 gallons per day (gpd), a single wastewater lift station, associated house grinder pumps, and pressure collection system piping. A 200,000 gpd wastewater treatment facility is under design and will be constructed in the near future. Upon completion of the new wastewater facility, the existing wastewater treatment plant will be abandoned. The South wastewater system served an average of 528 wastewater connections in 1995.

1.2 MODELING SCOPE

The project scope for the Water and Wastewater Master Plan includes a review of the current system conditions, field verification of treatment facilities, field verification of the collection and distribution systems, computer modeling of the collection and distribution systems, development of recommendations, development of an implementation plan for the recommendations, and presentation of a final report. Technical Memorandum #1 reviewed the results of the current conditions review and field verification portions of the project. This Technical Memorandum will review the computer modeling portion of the scope.

The scope for the computer modeling portion of the Master Plan included utilization

of the CYBERNET computer modeling program to perform a hydraulic analysis of the major water and wastewater lines in the North and South Systems. The model used existing mapping available from ECCFWSD to create a theoretical simulation of the systems. The computer models were used to predict the potential response of the systems to projected future demands. The scope has been amended to utilize the HYDRA modeling program for the modeling of the North wastewater system. HYDRA was used for the North wastewater collection system due to the presence of a substantial portion of existing gravity lines. Theoretical demands were determined based on projected populations and imposed on the system to determine the future needs of the water distribution and wastewater collection systems for the years 1996 through 2026. The model was run on ten year intervals for the years 1996, 2006, 2016, and 2026.

This Technical Memorandum will discuss the results of the computer modeling portion of the Water and Wastewater Master Plan Study. This review includes the requirements for anticipated future conditions for the water distribution and wastewater collection systems in the North and South Districts. This review does not include the requirements for anticipated future conditions for the District's water and wastewater treatment plants. A discussion of the recommendations and implementation plan, including recommendations for the treatment plants, will be included in Technical Memorandum #3 and in the final Master Plan report.

2.0 POPULATION AND GROWTH PROJECTIONS

2.1 HISTORICAL GROWTH AND SYSTEM DEMANDS

Historically, all of the cities within the District's boundary have seen lower than 3% growth each year since 1990. Corresponding water and wastewater flows for the District's treatment plants have increased proportionally to this growth. The calculated maximum day water demand for the District's North water treatment plant (WTP) was 1.613 MGD for 1996. The calculated maximum day water demand for the District's South WTP was 0.893 MGD for 1996. The maximum day water demands were calculated based on projected populations and historical per capita water demands. The maximum day water demands are used to determine the capability of the treatment and distribution system to meet current and future needs. According to the Texas Natural Resource Conservation Commission (TNRCC) criteria for water distribution systems, the system must be capable of providing a minimum pressure of 35 pounds per square inch (psi) and 1.5 gallons per minute at all points within the distribution network. In addition to these criteria, the District's water treatment plants must be capable of providing treated water in excess of the anticipated maximum day demand for any year. A discussion of the capacities and capabilities of the water treatment plants can be found in Technical Memorandum #1.

The calculated peak 2-hour flow for the District's North wastewater treatment plant (WWTP) was 1.77 MGD for 1996. The calculated peak 2-hour flow for the District's South WWTP was 0.595 MGD for 1996. These peak flows were calculated base on historical plant flows and calculated peaking factors. TNRCC design criteria for sewerage systems requires that sewer lines be designed for estimated future service populations, plus adequate

allowance for institutional and commercial flows. In addition, the system design should provide a minimum structural life of 50 years. Typically, wastewater collection systems are designed to handle peak 2-hour flow conditions. A discussion of the capacities and capabilities of the wastewater treatment plants can be found in Technical Memorandum #1.

2.2 DEVELOPMENT OF PRIORITY AREAS

Priority Areas were developed for both the North and South Systems to establish priority of any necessary improvements to the systems. Priority Areas were ranked 1 through 3 for the North System and 1 through 4 for the South System. Priority Area 1 was established for the more heavily populated locations in the system with the greatest anticipated and most immediate need for water and wastewater system improvements. Priority Area 2 was established at locations in the system with the second highest anticipated water and wastewater need and growth. Priority Areas 3 and 4 were established as the locations in the study area with the lowest anticipated need and potential for growth, typically the outlying rural areas. It was then determined that services for each Priority Area would be staged in a manner in which the areas with highest priority would be provided complete and adequate service prior to those areas with lower priority. Based on this determination it was decided that Priority Area 1 would describe service needed within the first 10 years of the 30 year study period. Priority Area 2 would describe service needed within the first 20 years of the study period. Priority Area 3 would describe service needed beyond the first 20 years of the 30 year study period. Priority Area 4 would describe service in the South System needed beyond the 30 year study period.

Populations for each Priority Area in both the North and South Systems were calculated using the population density per acre for each of the Priority Areas, as taken from the 1990 Census. The service population for both systems was established by multiplying the average number of connections anticipated for each water and wastewater system by the number of people per housing unit, based on the 1990 census, for that particular Priority Area. The difference in the total population and the served population is the unserved population for a particular Priority Area. This unserved population includes any population served by another water utility's Certificate of Convenience and Necessity (CCN) and any potential users unserved by water or wastewater. A map of the Priority Areas and adjacent water and wastewater CCN's is included in Attachment 2-A.

2.3 PROJECTED GROWTH AND SYSTEM DEMANDS

2.3.1 Population Growth Projections

Projected populations for each Priority Area were calculated using yearly growth rates provided by the Texas Water Development Board (TWDB). The current total population of each Priority Area was estimated using the 1990 census population densities, as mentioned in the previous section. The current population for the Priority Area was then multiplied by the TWDB yearly growth rates to calculate the projected population for that area for each year. In the North District, the population growth rate used for Priority Areas 1 and 2 coincides with the TWDB population growth rate for Gun Barrel City. The population growth rate for Priority Area 3 coincides with the TWDB growth rate for Henderson County. This is because Priority Areas 1 and 2 include all of Gun Barrel City and Priority Area 3 is the rural area east of Gun Barrel City. In the South District, the

population growth rate for Priority Areas 1, 2, and 3 coincide with the TWDB growth rate for Enchanted Oaks. The population growth rate for Priority Area 4 coincides with the TWDB growth rate for Henderson County. This is because Priority Areas 1, 2, and 3 include well developed lakeshore properties, including the City of Enchanted Oaks, and Priority Area 4 is the undeveloped rural area to the east of the South District. The projected total populations for each priority area for the years 1996, 2006, 2016, and 2026 are provided in Table 1.

TABLE 1
POPULATION AND GROWTH PROJECTIONS

		Population Projections				
System	Year	Priority Area 1	Priority Area 2	Priority Area 3	Priority Area 4	System Totals
NORTH	1996	3,067	2,936	257	n/a	6,260
	2006	3,591	3,438	285	n/a	7,314
	2016	4,054	3,881	308	n/a	8,243
	2026	4,386	4,198	322	n/a	8,906
SOUTH	1996	2,454	586	1,792	482	5,314
	2006	3,036	725	2,217	534	6,512
	2016	3,618	864	2,642	578	7,702
	2026	4,199	1,003	3,067	604	8,873

The estimated population served by the District, in each Priority Area, was then calculated to establish the water or wastewater demand for that Priority Area. These served populations were used as a starting point for water and wastewater demands under current conditions. The remaining unserved populations for each Priority Area were then added to

the served population according to the area's priority ranking. Unserved populations for Priority Area 1 were eliminated in the first ten years of the study period. Unserved populations for Priority Area 2 were eliminated in the first 20 years of the study period. Unserved populations for Priority Area 3 were eliminated beginning in year 11 of the study period and ending in the year 30 of the study period. This was done to reduce capital expenditures in the first ten years of the study period. Priority Area 4 was eliminated after the 30 year study period. Populations inside other water and wastewater CCN's were assumed to be served by those CCN's. Projected populations, water demands, and wastewater flows in those CCN's were calculated separately from areas served by the District. A detailed copy of the population and flow projections is provided in Attachment 2-B.

2.3.2 Projected Water Demands

Projected water demands were developed for each priority area by calculating the current per-capita water demand for both the North and South Systems. The calculated per-capita demands were then multiplied by the estimated future served population for each Priority Area to determine the future water demand for that Priority Area. The maximum day demands for each Priority Area were calculated by multiplying the average water demand by the historical peaking factor for the system. Water demands for adjacent water utility CCN's were calculated separately and were not included in the District water demands. The projected water demands for each priority area for the years 1996, 2006, 2016, and 2026 are provided in Table 2. A detailed copy of water demand projections is provided in Attachment 2-B.

TABLE 2

PROJECTED WATER DEMANDS

		Water Connections					Max Day Water Demand (MGD)				
System	Year	Priority Area 1	Priority Area 2	Priority Area 3	Priority Area 4	System Totals	Priority Area 1	Priority Area 2	Priority Area 3	Priority Area 4	System Totals
NORTH	1996	1,442	1,383	118	n/a	2,942	0.790	0.758	0.065	n/a	1.613
	2006	1,899	1,647	147	n/a	3,693	1.041	0.903	0.080	n/a	2.024
	2016	2,144	1,882	173	n/a	4,199	1.175	1.032	0.095	n/a	2.302
	2026	2,319	2,036	194	n/a	4,549	1.271	1.116	0.106	n/a	2.494
SOUTH	1996	1,524	236	0	0	1,760	0.773	0.120	0	0	0.893
	2006	1,886	328	0	0	2,214	0.956	0.167	0	0	1.123
	2016	2,247	420	0	0	2,667	1.139	0.213	0	0	1.353
	2026	2,608	488	0	0	3,096	1.323	0.248	0	0	1.570

2.3.3 Projected Wastewater Flows

Projected wastewater demands were developed for each Priority Area by calculating the current per-capita flow rate for wastewater. This was done by dividing the maximum 30-day average flow for both North and South Systems by the current estimated served population for that system. Yearly per-capita flowrates, minus Infiltration/Inflow (I/I) reductions, were used to calculate the maximum 30-day average flow for each system by multiplying the per-capita rate by the estimated served population. Peak 2-hour flow rates were calculated using historical peaking factors and by using Harmon's equation for determining peak flows.

The estimated I/I reduction for each system was calculated by determining the estimated yearly I/I removal from repair of gravity lines and manholes in the North System and repair of home septic tanks and effluent pump installations in the South System. The District has indicated that it will attempt to complete 100 repairs each year. It was assumed that there would be 50 repairs in the North District and 50 repairs in the South District. Based on information provided in the Guitierrez, Smouse & Wilmut I/I reports of 1994 and 1995 and substantiating data in Water Pollution Control Federation Manual of Practice FD-6, it was estimated that point repairs to the gravity lines, manholes, home septic tanks, and effluent pump installations could remove approximately 50% of the total I/I in the system. This I/I reduction was converted to a per-capita basis and subtracted from the previous year's per-capita flowrate. The yearly per-capita flowrate was then multiplied by the original base population (1996 population) in each system to get a base wastewater flow.

Annual population growth and unserved populations brought on-line each year were

multiplied by a per-capita wastewater rate of 101 gallons per-capita per day. This value of 101 gpcd was developed from historical flow data provided by the District and meets TNRCC minimum design requirements. This per-capita rate was then multiplied by the growth in population and added unserved population for each Priority Area to get yearly growth flowrates. The growth flowrates were added to the base flowrate to get the total estimated flows for each Priority Area for each year of the study period. The projected wastewater demands for each priority area for the years 1996, 2006, 2016, and 2026 are provided in Table 3. A detailed copy of wastewater flow projections is provided in Attachment 2-B.

TABLE 3

PROJECTED WASTEWATER FLOWS

		Wastewater Connections					Peak 2-Hr Wastewater Flow (MGD)				
System	Year	Priority Area 1	Priority Area 2	Priority Area 3	Priority Area 4	System Totals	Priority Area 1	Priority Area 2	Priority Area 3	Priority Area 4	System Totals
NORTH	1996	1,594	1,531	0	n/a	3,125	0.90	0.87	0	n/a	1.773
	2006	2,163	1,952	0	n/a	4,115	1.18	1.06	0	n/a	2.241
	2016	2,442	2,338	100	n/a	4,880	1.30	1.24	0.05	n/a	2.591
	2026	2,642	2,529	194	n/a	5,365	1.39	1.33	0.10	n/a	2.831
SOUTH	1996	536	0	0	0	536	0.595	0	0	0	0.595
	2006	1,886	268	0	0	2,154	1.253	0.153	0	0	1.405
	2016	2,247	537	470	0	3,253	1.447	0.305	0.256	0	2.008
	2026	2,608	623	939	0	4,170	1.652	0.354	0.513	0	2.519

3.0 WATER AND WASTEWATER SYSTEM EVALUATION

3.1 WATER DISTRIBUTION SYSTEM ASSESSMENT

The North and South water distribution systems were modeled using the CYBERNET computer modeling program. The program accepts input from the AutoCadd computer drafting program in the form of water distribution system mapping and is capable of providing a theoretical simulation of the water distribution system and its capabilities. Based on the distributed demands for current and future conditions, the program can aid in determining the future distribution system projects needed to provide adequate water distribution to the District's customers. The program can determine the location of low pressure areas in the system and can simulate elevated tank conditions, pump stations, and distribution piping pressures.

Based on current and projected water demands, the computer model was developed to simulate conditions for the years 1996, 2006, 2016, and 2026. For each time period, weaknesses in the system were located in accordance with TNRCC design criteria and the linework in the system was augmented to eliminate system weaknesses. Where new lines parallel existing lines smaller than 4-inches in size, the existing lines may be abandoned at the time of construction at the District's discretion. The system model is designed to run on the lines proposed in the Master Plan with existing parallel lines abandoned. However, the District should consider the advantage of the operational advantage of leaving the existing lines in place, in the event that future linework dictates a necessary short-term rerouting of water or wastewater flow. All new water and wastewater connections should be connected to the new, larger lines. A list of the anticipated projects needed to meet

water demand conditions for each time period is provided below, along with an explanation of each project. The projects are not listed in any particular order.

North Water System

2006 Condition

1. New 12-inch Loop around Legendary Lane, Hwy. 334 and the Bozeman Easement.

   To supply adequate water to the various general areas within the system, it is recommended that the 12-inch loop around Legendary Lane, Hwy. 334, the Bozeman Easement, and Thunderbird Streets be completed. This will require the construction of a new 12-inch water line from the elevated tank to Hwy. 334 and then along Hwy. 334 to an existing 12-inch water line. A new 12-inch water line will also need to be constructed from Hwy 334 southward down the Bozeman Easement between Pleasureland and Welch Streets to Thunderbird Street. The project will also consist of constructing a 10-inch water line from Hwy 334 to the new elementary school, including an 8-inch line ending in a fire hydrant behind the new school. Design of this item has been completed and construction will begin soon.

2. New 8-inch Waterlines to the Tamarack Area.

   The Tamarack Area will not be capable of supplying peak summer demands to the area East of the Hwy. 334 Bridge. It is recommended that a new 8-inch water line be constructed from the existing 8-inch water line at Trailwind Street and Hwy. 334 to the west side of the bridge at the Cedar Creek Reservoir. It is also recommended that an 8-inch water line be constructed from Hwy. 334 and Wildwind Street to Beaver Brush Street.

3. New 8-inch and 6-inch Waterlines for the Remaining Priority #2 Area on the East Side of the Hwy. 334 Bridge.

   The area on the east side of the Hwy. 334 Bridge cannot currently provide peak hour summer demands. It is recommended that an 8-inch water line be constructed from the east side of the East Cedar Creek Reservoir to the HillCrest Subdivision. A 6-inch waterline will need to be constructed southward through the Oak Ridge Area and then eastward along Lago Drive in the Bonita Point Subdivision.

4. New 10-inch and 8-inch Waterlines to Harbor Point Area in the Northwest Region of the Water System.

The small existing water lines in the far north part of the Harbor Point Area are unable to supply peak summer demands. It is recommended that an 8-inch water line be constructed northward from an existing 6-inch water line at Commodore and Harbor Point Streets to First Mate and Harbor Point Streets. It is also recommended that a 10-inch water line be constructed from the new 12-inch water line on Hwy. 334 northward along Lakeview Street to an existing 4-inch water line on Commander Street.

5. New 6-inch Waterline through Sandy Shores and Eastwood Island Areas.

Most of the existing waterlines within these areas are 3-inch and smaller in size, and are not capable of supplying any significant demand. It is recommended that a 6-inch waterline be constructed beginning at the 12-inch waterline at Legendary Lane and Hwy. 334 and going west and south along Southland Street. From Southland Street the 6-inch waterline should be extended down to Lost Forest Street. From Lost Forest Street, it is recommended that a 6-inch waterline be looped around Ocean Street to an existing 4-inch waterline located on Lakeway Street.

6. New 6-inch Waterline Along Spanish Trail.

The area along the Cedar Creek in the Tanglewood Shores Area and the Sherwood Shores and Southwind Estates Area cannot provide any significant demand to these areas. It is recommended that new 6-inch water lines be constructed in these areas. For the Sherwood Shores and Southwind Estates Areas, a 6-inch water line should be constructed from the end of the existing 8-inch water line at Clear Fork Street to the intersection of Autumn Trail and Legendary Lane. For the Tanglewood Shores Area, a 6-inch water line will be constructed from an existing 6-inch waterline at Guadalupe Street going southward along Spanish Trail to a 4-inch water line at Palo Blanco Street.

7. New 6-inch Waterline from Welch Street to Harmon Street.

To meet any significant demands in the Northern Shores and Lakeview Acre Areas, it is recommended that a new 6-inch waterline be constructed from the intersection of Welch and Sundrift Streets to an existing 4-inch waterline at the intersection of Victor and Harmon Streets.

2016 Condition

1. New 6-inch Waterline From Hwy. 198 to Whispering Trail.

   Under 2016 Peak Flow Conditions, the southern part of the Tamarack area will have low pressures under peak hour demands during the summer. It is recommended that a 6-inch water line be constructed from Hwy. 198 along Spring Valley Road to an existing 8-inch water line at Beaver Brush Street. This will provide a looped connection for this general area.

2. New 6-inch and 8-inch Waterlines to Serve Priority Area #3.

   To provide service to the Priority Area #3 along Hwy 334, toward Hwy. 175, it is recommended that an 8-inch waterline be constructed from the end of the existing 8-inch eastward approximately 4,200 linear feet. It is also recommended that a 6-inch water line be constructed southward to loop in the Hillcrest Shore subdivision and Oak Ridge Subdivision into an existing 6-inch waterline on Lago Drive.

3. New 6-inch Waterline in the Oak Harbor Subdivision

   The Oak Harbor Area is unable to provide adequate pressures for the 2016 planning period. It is recommended that a 6-inch waterline be constructed along Lake Shore Drive beginning at Spanish Trail and ending at an existing 6-inch waterline on Oak Harbor Street.

4. New 6-inch Waterlines in the Mantle Manors and Sherwood Shores Subdivisions.

   The Mantle Manor and Southwind Estates Areas will not be capable of providing adequate pressures under a peak 2016 demand condition. It is recommended that a new 6-inch waterline be constructed along Autumn Trail from Lost Forest Street to the existing 8-inch on Legendary Lane. It is also recommended that a new 6-inch waterline be constructed along Colleen Street to the existing 12-inch line on Willowwood. This will provide a 6-inch and larger looped waterline for this area.

5. New 6-inch Looped Waterline for the Harbor Point Subdivision.

   The far north part of the Harbor Point Subdivision will not be capable of supplying adequate demand under peak 2016 conditions. It is recommended that a new looped 6-inch waterline be constructed from the end of the existing 10-inch waterline up around Sea Breeze Road and down along First Mate Street to an existing 8-inch waterline on Harbor Point Street.

2026 Condition

1. New 6-inch Waterlines in the Mantle Manors and the Southwind Estates Subdivisions.

   The Mantle Manor and Southwind Estates Areas will not be capable of providing adequate demands under the 2026 demand conditions. It is recommended that new 6-inch waterlines be constructed along Autumn Trail and Lake View Streets.

2. New 6-inch Waterline in the Siesta Shores Area.

   Under 2026 peak flow conditions, the existing waterline in this area will not be capable of meeting adequate demands. It is recommended that a new 6-inch waterline be constructed from Welch Street to an existing 6-inch waterline at Guadalupe Street.

3. New 10-inch Waterline Along Hwy. 334 to Hwy. 198.

   To increase the water supply to the Tamarack Area, it is recommended that a new 10-inch waterline be constructed from the 12-inch water line shown on Hwy. 334 to the existing 8-inch and 10-inch waterline at Tamarack Street and Hwy. 334.

4. New 6-inch Waterline Along Whispering Trail in the Tamarack Area.

   To complete a looped system in the Tamarack Area to meet peak hour summer demand, it is recommended that a new 6-inch waterline be constructed from Whispering Trail and Beaver Brush Street to Hwy 334.

5. New 6-inch Waterline Along Luther Street.

   To meet future demands along Luther Street it is recommended that a new 6-inch water line be constructed and tied into the system at an existing 12-inch waterline near Lakeview Airfield and an existing 6-inch waterline on the north side of Luther Street.

6. New 6-inch Looped Waterline in Bonita Subdivision.

   To meet the 2026 demand condition, it is recommended that a new 6-inch looped waterline be constructed along Lake Shores Drive in the Bonita Subdivision.

7. New 6-inch in the Harbor Point Subdivision.

   To meet the 2026 demand conditions in the middle of the Harbor Point Subdivision, it is recommended that a 6-inch waterline be constructed along Backlash Street down to Commodore Street.

8. New 6-inch Waterline Along Hwy. 334 in Priority Area #3

   To provide adequate demands along Hwy. 334, it is recommended that a 6-inch water line be constructed in Priority Area #3 from the end of the existing 8-inch waterline toward Hwy 175.

South Water System

2006 Condition

1. New 12-inch Waterline Along Enchanted Drive, Hwy 198 and Southward toward Cedar Branch Park

   Under Existing Conditions, the South Water System can not adequately supply peak summer demands to most of the remote areas within the system. It is recommended that a new 12-inch waterline be constructed from the water treatment plant northward along Enchanted Drive to Hwy. 198 and southward to Cedar Branch Park.

2. New 12-inch and 10-inch Waterline Along Hwy. 198 to Golden Oaks Addition.

   To supply peak summer demands to the northern portion of the system, it is recommended that a 12-inch waterline be constructed from the end of the new 12-inch waterline along Hwy. 198 to Leisureland Drive. From Leisure Land Drive it is recommended that a 10-inch waterline be constructed north along Hwy 198 to the Golden Oaks and Bandera Bay Subdivisions.

3. New 10-inch and 8-inch Waterline through Forgotten Acres to Lakeland Road.

   To supply peak demands to the west side of the system it is recommended that a 10-inch waterline be constructed from the New 12-inch waterline on Hwy 198 through Forgotten Acres. It is recommended that a 8-inch waterline be constructed from the west side of Forgotten Acres to the Del Mar Subdivision and up to Lakeland Road.

4. New 8-inch and 6-inch Waterline Southward Along Enchanted Drive to Enchanted Oaks.

To provide adequate demands to Enchanted Oaks and Indian Harbor, it is recommended that a 8-inch waterline be constructed from the water treatment plant southward along Enchanted Drive to Cedarwood Drive. It is recommended that the 8-inch waterline be connected into two separate 6-inch waterlines at the north and south parts of the Indian Harbor Subdivisions. From Cedarwood Drive it is recommended that a 6-inch water line be constructed from the end of the 8-inch waterline down into Enchanted Oaks to a existing 6-inch waterline.

5. New 8-inch and 6-inch Waterline to Golden Oaks, Southwood Shores, Bonanza Beach and Oak Shores Subdivisions.

To provide adequate peak summer demands to these northern subdivisions it is recommended that an 8-inch waterline be constructed from the 10-inch waterline at Hwy 198 eastward along the southern part of the Golden Oaks Subdivision. It is recommended that a 6-inch water line be constructed northward through the Golden Oaks Subdivisions along Cartwright Street to the three remaining subdivision within the northern Priority #1 and #2 Areas.

6. New 12-inch and 8-inch Waterline Through the Cedar Branch Subdivision.

To provide adequate demands for Cedar Branch Park for the 2006 condition and to provide supply for the area east and south of Cedar Branch Park, it is recommended that a 12-inch waterline be constructed from the end of the new 12-inch waterline through Cedar Branch Park. It is recommended that the southern part of the waterline within Cedar Branch Park be 8-inch in size.

7. New 6-inch Looped Waterline Around Leisureland Subdivision and to Three Harbors Subdivisions.

To provide adequate demands for the 2006 condition it is recommended that a 6-inch looped water line be constructed from the new 8-inch waterline at the southeast corner of the Leisureland Subdivision along Lakeland Drive and around Shady Shores Road. At the southwest part of the Leisureland Subdivision, it is also recommended that a 6-inch waterline be constructed down into the Three Harbors Subdivision.

8. New 6-inch Looped Waterline Through Bandera Bay and Oakwood Shores.

To provide adequate demand for the 2006 condition it is recommended that a 6-inch looped water line be constructed from the end of the 10-inch

waterline on Hwy. 198 westward through Bandera Bay and then southward through the Oakwood Shores Subdivision to Leisureland Drive.

9. New 8-inch and 6-inch Waterline to Baywood Estates Area.

To provide adequate demand to the Baywood Estates Area, it is recommended that a new 8-inch waterline be constructed from the end of the 10-inch waterline along Hwy 198 to the Baywood Estates Area. It is also recommended that a 6-inch waterline be constructed along the northern side of the Baywood Estates Area.

2016 Condition

1. Parallel 12-inch Waterline along Enchanted Drive to Hwy. 198.

To provide adequate water supply to the Priority #3 Area, it is recommended that a 12-inch waterline be connected to the elevated storage tank and run parallel to the existing 12-inch waterline (2006 condition) from the treatment plant along Enchanted Drive to Hwy. 198.

2. New 12-inch and 10-inch Waterline Along Hwy 198 Toward Payne Springs.

To provide adequate water supply to the Priority #3 Area it is recommended that a 12-inch water line be extended east along Hwy 198 approximately 3,000 feet. From the end of the 12-inch waterline , a 10-inch waterline should be constructed for approximately another 1,000 ft.

3. New 8-inch Looped Waterline to Priority #3 Area.

To provide water to Payne Springs and to supply water to the far south eastern part of the Priority #3 area it is recommended that a 8-inch waterline be constructed beginning at the end of the 10-inch waterline on Hwy 198 going south through the current Payne Springs supply point and around to an existing 12-inch waterline in the Cedar Branch Park Subdivision.

4. New 8-inch and 6-inch Waterlines Through the Southern Portion of the Resort Service Area.

To provide service to the Resort Area immediately to the east of the Cedar Branch Park Area, it is recommended that an 8-inch and 6-inch looped waterline be constructed through Cedar Branch Park and eastward to the new 8-inch waterline supplying the Payne Springs Area.

5. New 8-inch Waterline and Booster Pump Station to Supply Water to the Southeast Parts of the Priority #3 Area including the Lakeshore and Carolynn CCN Areas.

To provide adequate supply to meet peak summer demands to the Lakeshore and Carolynn CCN Areas it is recommended that an 8-inch waterline be constructed from the existing 8-inch looped waterline eastward and around Cedar Creek Lake to these remaining areas. Because of the distance from the water treatment plant, it will be necessary to construct a dedicated hydropneumatic booster pump station to provide adequate pressure for the Lakeshore and Carolynn Areas. The hydropneumatic booster pump station shall contain 2 -200 gpm pumps at a rated head of 200 ft. It is recommended that a 200,000 gallon ground storage tank be constructed at the booster pump station site, so that the remaining system will not have to supply the pump station flow during a peak summer demand condition. A 200,000 gallon tank will allow the pumps to operate for approximately 16 hours without an additional supply from the water treatment plant. The ground storage tank can be filled in the same manner as the elevated tank, during off peak times such as at night time. It is also recommended that a 6-inch line be constructed from the main 8-inch water line into each of the populated service areas along the east bank of the Cedar Creek Lake. Initially, these 6-inch waterlines will be tied into the existing water systems within these areas.

6. New 6-inch and 8-inch Waterline to Provide Looped System for the Golden Oaks, Southwood Shores, Bonanza Beach and Oak Shores Subdivisions.

To provide peak hour demands during the summer for the 2016 time period to these subdivisions, it is recommended that a 6-inch waterline be constructed from the 12-inch waterline on Hwy 198 up to the Golden Oaks Subdivision. It is recommended that an 8-inch waterline be constructed around the Golden Oaks an up along the eastern side of the Oak Shores Subdivision.

7. New 6-inch Waterline Through the Timber Bay, Spillview Estates and Diamond Oaks Subdivisions.

To provide adequate demands for the 2016 condition, it is recommended that a parallel 6-inch waterline be constructed along an existing 4-inch waterline through these subdivisions.

8. New 6-inch Waterline to Enchanted Isles Subdivision.

To provide adequate demand on Enchanted Isles for the 2016 condition, it will be necessary to construct a parallel 6-inch waterline from Cedarwood

Drive to Enchanted Isles.

9. New 6-inch Waterline Through Del Mar Subdivision.

To provide adequate demands along the shoreline around the Del Mar Subdivision it is recommended that a 6-inch waterline be constructed through the Del Mar Subdivision to an existing 6-inch waterline in the Three Harbors Subdivision.

10. New 6-inch Waterline Through Oakwood Shores Subdivision.

To provide adequate demands along the shoreline around the Oakwood Shores Subdivision it is recommended that a 6-inch waterline be constructed Payne Springs Road to an existing 6-inch waterline on Shady Shores Drive.

11. New 6-inch Waterline to Cherokee Hills Subdivision.

To provide adequate demands for the 2016 condition, it is recommended that a 6-inch water line be constructed along Hwy 198 through Baywood Estates to the Cherokee Hills Subdivision.

12. New 6-inch Waterline on the East Side of the Resort Area in Priority #3 Area.

To provide adequate demands throughout the Resort Area, it is recommended that a 6-inch waterline be constructed from Hwy 198 along the east side of the Resort Area.

2026 Condition

1. New 6-inch Waterline along the Del Mar shoreline.

To provide adequate demand to the southwestern portion of the Del Mar shoreline under 2026 condition, it is recommended that a new 6-inch waterline be constructed from the existing 6-inch waterline in the Del Mar Subdivision to an existing 4-inch waterline in the Three Harbors Subdivision.

2. New 6-inch Waterline in the Southwood Shores Subdivision.

To provide adequate demand to the Southwood Shores Subdivision, it is recommended that a 6-inch waterline be constructed from an existing 4-inch waterline along Hwy 198 along the shoreline of Southwood Shores to an existing 6-inch waterline on the north side of the Golden Oaks Subdivision.

3. New 6-inch Waterline along the North Side of the Golden Oaks.

To provide adequate peak demands to the Bonanza Beach, Oak Shores and Golden Oaks Subdivisions, it will be necessary to construct a 6-inch waterline along the north side of the Golden Oaks Subdivision. It is also recommended that a 6-inch waterline be extended from this waterline to the existing 4-inch waterline within the Golden Oaks Area.

4. New 6-inch Waterline in the Baywood Estates Subdivision.

To provide a significant looped connection throughout the Baywood Estates Subdivision for adequate demands, it is recommended that a 6-inch waterline be constructed along the west side of the Baywood Estates Subdivision.

5. New 8-inch and 6-inch Looped Waterline Along Hwy 198.

To provide water system service to the remaining Payne Springs Area within the Priority #3 Area, it is recommended that a 8-inch waterline be constructed along Hwy. 198 eastward to the Priority #3 Boundary. From the end of the 8-inch waterline, it is recommended that a 6-inch waterline be constructed down to an existing 8-inch waterline along the Priority #3 Boundary.

6. New 6-inch Waterline in the Northeastern part of the Priority #3 Area.

To provide adequate service to the northeastern part of the Priority #3 Area, it is recommended that a 6-inch looped waterline be constructed beginning at Hwy 198 going upward and over to the east side of the Golden Oaks Subdivision.

7. New 6-inch Looped Waterline in the Carolynn, Lake Shore, and Southern Resort Service Area.

To provide adequate summer peak demands throughout these areas, it is recommended that 6-inch looped water lines be constructed around the Hidden Hills Road, Oak Hills Road, and around the Lake Shore and Carolynn shoreline.

8. New 6-inch Waterline Through the Resort Area and the Western Side of Payne Springs.

To provide adequate demands for the 2026 condition to the Resort Area and to the western side of Payne Springs, it is recommended that a 6-inch waterline be constructed from an existing 12-inch waterline at the Northern

Part of Cedar Branch Park eastward across the Resort Area and to an existing 8-inch waterline on the west side of Payne Springs.

9. New 6-inch Waterline Through the Wood Canyon Waters Subdivision.

To provide adequate demands through the Wood Canyon Waters and Deer Island Estates Area for the 2026 condition, it is recommended that a 6-inch waterline be constructed parallel to an existing 3-inch waterline.

Each of the recommended projects will be evaluated as to cost and prioritized in the Recommendations and Implementation phase of the Master Plan. A map of the proposed water system improvements is provided in Attachment 2-C.

3.2 WASTEWATER COLLECTION SYSTEM ASSESSMENT

The North wastewater collection system was modeled using the HYDRA computer modeling program. This program is very similar to CYBERNET with the exception that it is capable of modeling gravity sewer lines. Since about half of the North System is gravity sewers, it was determined that HYDRA would provide a better simulation of that system. The CYBERNET program was used for the South wastewater collection system, since this system has a very small amount of gravity sewer. Both programs are capable of providing theoretical simulations of each system and their capabilities. Based on the distributed wastewater flows for current and future conditions, both programs were able to determine future collection system projects needed to provide adequate wastewater collection and treatment to the District's customers. Both programs were able to determine areas with low and high pressure conditions which would indicate pumping problems within each system. The programs were also able to determine inadequacies in collection system piping.

Based on current and projected wastewater flows, the computer models were

developed to simulate conditions for the years 1996, 2006, 2016, and 2026. For each time period, weaknesses in the systems were located and the linework and pumping capacities of the systems were augmented to eliminate the weaknesses. Where new lines parallel existing lines smaller than 4-inches in size, the existing lines may be abandoned at the time of construction at the District's discretion. The system model is designed to run on the lines proposed in the Master Plan with existing parallel lines abandoned. However, the District should consider the advantage of the operational advantage of leaving the existing lines in place, in the event that future linework dictates a necessary short-term rerouting of water or wastewater flow. All new water and wastewater connections should be connected to the new, larger lines. A list of anticipated projects needed to meet wastewater flow conditions for each time period is provided below, along with an explanation of each project. The projects are not listed in any particular order.

North Wastewater System

2006 Condition

1. Diversion of Flow from Lift Station #19 to Lift Station #29 and Expansion of Lift Station #29.

   Lift Station #19 and Lift Station #29 show to be overloaded under 2006 flow conditions. It is recommended that flow be diverted from Lift Station #19 to Lift Station #29, and that Lift Station #29 be expanded. The diversion line will be a 6-inch gravity sewer line from the Spanish Trail area to Redbird Street. It is recommended that Lift Station #29 be expanded to have a firm pumping capacity of 110 gpm.

2. Diversion of Flow in Tamarack Area to Lift Station #56 and Construction of a Gravity Sewer Line from Hwy. 198 to Lift Station #39.

   Under the existing wastewater system layout, a series of lift stations in the Tamarack area will be overloaded by the year 2006. It is recommended that

a 6-inch diversion line be constructed from Trailwind Street to Wildwind Street and then to Spring Valley Street. It is also recommended that an 8-inch force main be constructed from the force mains at the end of Spring Valley to Lift Station #56. This will divert much of the flow in the Tamarack area to Lift Station #56. Lift Station #56 will need to be expanded to have a firm pumping capacity of 170 gpm. A 6-inch force main will be constructed from the end of an existing 4-inch force main at Bay View Street to Highway 198. From Highway 198 a 10-inch gravity sewer line will be constructed to Welch Street. The force mains from Lift Stations #33 and #35 will be tied into the 10-inch gravity sewer line. This will reduce the high discharge head of these lift stations, which is currently a problem with Lift Station #35. From Welch Street the sewer line will need to be increased in size to a 12-inch sewer line and connected to Lift Station #39.

3. New 8-inch and 6-inch Gravity Sewer Lines and Lift Stations to Serve Remaining Area in Priority Area #2, East of Tamarack.

Currently there exists no wastewater service to the area east of Tamarack Across the Hwy. 334 Bridge. New sewer facilities are described here to serve the remaining Priority Area #2 within the 2006 planning period. These facilities would include a 6-inch and 8-inch gravity sewer line along the Lakeview Drive to the east side of the Hwy. 334 Bridge. There will also need to be a new 50 gpm Lift Station and 4-inch force main along the east side of the Bonita Point Subdivision. This 4-inch force main will tie-in to the 8-inch gravity sewer line at the Oak Ridge Subdivision. On the east side of the Hwy. 334 bridge, a new 120 gpm Lift Station will need to be built to convey this area wastewater flow. It is recommended that flow from this lift station be pumped to Lift Station #36 using a 4-inch force main.

4. Increase Pumping Capacity of Lift Stations #25, and #33.

Presently, the upstream Lift Stations #24 and #32 pump at a higher capacity than Lift Stations #25, and #33. Increased growth will increase the likelihood of overflow conditions at these downstream lift stations. Therefore it is recommended that the firm pumping capacities of these lift stations be increased in capacity. Lift Stations #25 and #33 will need to be expanded to have a capacity of 80 gpm and 58 gpm respectively.

5. Increase Pumping Capacity of Lift Stations #60 and #61 and Construction of a Gravity Sewer to Lift Station #38.

Under existing conditions, Lift Station #61 and #60 show to be overloaded. It is recommended that the pumping capacity of Lift Stations #61 and #60 be increased to 65 gpm and 165 gpm respectively. It is also recommended that

a 4-inch force main be constructed from Lift Station #60 to Harbor Street. A 8-inch/10-inch gravity sewer line will need to be constructed from Harbor Street along an existing creek to Lift Station #38. Once this gravity sewer line is constructed, Lift Station #59 can be abandoned.

6. Expansion of Lift Stations #38 and #39.

Lift Stations #38, and #39 pump over 90% of the total wastewater flow in the North System to the wastewater treatment plant. These lift stations are currently overloaded under peak flow conditions. It is recommended that Lift Station #38 be expanded to have a firm pumping capacity of 930 gpm. It is recommended that Lift Station #39 be expanded to have a firm pumping capacity of 990 gpm. These capacities are based on the projected flow to these two lift stations in the year 2016.

2016 Condition

1. Expansion of Lift Stations #36 and #40.

With the additional flow from new growth and the new wastewater service area on the east side of Hwy. 334, Lift Station #36 and #40 will be overloaded in the 2016 flow condition. Therefore it is recommended that Lift Station #36 and #40 be expanded to 230 gpm and 260 gpm capacities respectively.

2. New 6-inch Gravity Sewer Line to Serve Priority Area #3.

A new 6-inch gravity sewer line will need to be constructed along Hwy 334 to convey wastewater flow from Priority Area #3 to the New Lift Station on the east side of the Hwy. 334 Bridge.

3. Expansion of Lift Stations #19 and #44.

Lift Stations #19 and #44 show to be overloaded for the 2016 flow condition. It is recommended that Lift Station #19 and #44 be expanded to 115 gpm and 65 gpm respectively.

4. Expansion of Lift Station #7, and New Gravity Sewer Line From Lift Station #21 and #46 to Lift Station #7.

Lift Stations #7 and #21 are overloaded under 2016 peak flow conditions. It is recommended that an 8-inch gravity sewer interceptor be constructed along Lost Forrest Street to Sunset Street and then to Lift Station #7. It is also recommended that a 6-inch interceptor be constructed from Lift Station

#46 at Lynn Street to Lift Station #10 and then to Lift Station #7. These two gravity sewer lines will allow Lift Station #21, #46 and #10 to be abandoned. Lift Station #7 will need to be expanded to a capacity of 120 gpm. It is also recommended that a new 4-inch force main be constructed from Lift Station #7 to the 8-inch gravity sewer line on Hwy. 334.

5. Expansion of Lift Station #5 and Construction of New Force Main from Lift Station #61 to Lift Station #60.

Lift Station #5 at the intersection of Lakeview and Bayview Streets shows to be overloaded under peak 2016 flow conditions. It is recommended that this Lift Station be expanded to a capacity of 65 gpm. It is also recommended at this time that a new 4-inch force main be constructed from Lift Station #61 to Lift Station #60.

6. New 8-inch Gravity Sewer Line from Lakeview Street to Existing 10-inch Gravity Sewer Line East of Harbor Street.

Under the 2016 conditions, Lift Station #3 and #4 show to be overloaded. It is recommended that a 8-inch gravity sewer line be constructed to divert all of the flow from this area to the existing 10-inch gravity sewer line that feeds into Lift Station #38. This can be done by tying in the main 6-inch lines along Lakeview Street and by pumping a reduce quantity of flow from Lift Stations #3 and #4 to the new 8-inch gravity sewer line.

2026 Condition

1. New 8-inch and 6-inch gravity sewer line along Luther Street to Lift Station #39.

Under the 2026 flow condition, the gravity sewer line along Welch Street shows to be overloaded in the analysis. It is recommended that a diversion gravity sewer line be constructed beginning at the end of Lift Station #40 6-inch force southward along Luther Street and then over to Lift Station #39. It is also recommended that a new 6-inch sewer line be tie-in to the proposed 8-inch sewer line along Luther Street. A diversion box will need to be constructed at the beginning of this project that will allow the splitting of flow in two directions to Lift Station #39.

2. New 6-inch Gravity Sewer Line Along Hwy. 198 .

It is recommended that a 6-inch gravity sewer line be constructed along Hwy. 198 to handle additional flow from the area. If significant growth occurs along Hwy. 198 prior to this time period, it may be necessary to accelerate

this project. This sewer line could also be used to relieve some flow from Lift Station #40, if required at this time. Currently, system analysis at this time, does not show that it will be necessary to divert flow under the 2026 flow conditions from the expanded Lift Station #40.

3. Expansion of Lift Station #37.

   Lift Station #37 will be overloaded under 2026 peak flow conditions. It is recommended that Lift Station #37 firm pumping capacity be increased to 310 gpm. The current capacity of Lift Station #37 is rated at 140 gpm at 100 ft of head. From our analysis, it appears that the discharge head may be significantly lower than 100 ft. Our analysis shows that the existing pumps will operate at a point along their pump curve that will currently produce about 220 gpm.

4. New Gravity Sewer Line along Arbolado Street to Lift Station #24, Expansion of Lift Station #24 and New 4-inch Force Main from Lift Station #24 to Hwy 334.

   The analysis shows that Lift Station #24 and the existing force main along Legendary Lane will be overloaded under 2026 flow conditions. It is recommended that a new 6-inch gravity sewer line be constructed to divert flow from Lift Station #13 and the existing force main along Legendary Lane, to Lift Station #24. The firm pumping capacity of Lift Station #24 will need to be expanded to a capacity of 95 gpm. It is recommended that a 4-inch force main be constructed from Lift Station #24 directly to the existing 12-inch gravity sewer line along Hwy 334.

5. New 8-inch Gravity Sewer Line along Harbor Point Road.

   Our analysis showed that some of the 2-inch force mains in the Northwestern Harbor Point Area, will become overloaded under peak flow conditions. It is recommended that a 8-inch gravity sewer line be constructed along Harbor Point Road down to the existing 8-inch gravity sewer line.

South Wastewater System

2006 Condition

1. New 6-inch Force Main to Enchanted Drive and North to the Mac Oaks Subdivision.

   To prevent the grinder pump stations from operating at shut-off head under peak flow conditions, it is recommended that a 6-inch force main be

constructed parallel to an existing 4-inch force main from the wastewater treatment plant to Enchanted Drive and northward to the Mac Oaks Subdivision.

2. New 4-inch Force Main Along Forgotten Lane and Associated Lateral Force Mains to Serve Del Mar and Three Harbors Subdivisions.

   To provide adequate service to the Del Mar and Three Harbors Subdivisions, it is recommended that a 4-inch force main be constructed along Forgotten Lane beginning at Enchanted Drive. The 4-inch force main would be extended along the southside of Lakeland Drive to King Arthur Street. It is recommended that 3-inch lateral force mains be extended into each of the major streets in the subdivisions as shown in the mapping. It is also recommended that grinder pumps with shutoff heads of approximately 120 ft. be used in theses two subdivisions.

3. New 4-inch Force Main Along Leisureland Drive and Associated Lateral Force Mains to Serve Leisureland Subdivision.

   To provide adequate service to the Leisureland Subdivision, it is recommended that a 4-inch force main be constructed along Leisureland Drive beginning at Enchanted Drive. The 4-inch force main would be extended along Lakeland Drive. It is recommended that 3-inch lateral force mains be extended into each of the major streets in the subdivisions as shown in the mapping. It is also recommended that grinder pumps with shutoff heads of approximately 120 ft. be used in this subdivision.

4. New 15-inch, 12-inch and 10-inch Gravity Sewer Line and Lift Station to Convey Flow From the North Part of the Wastewater System.

   To transport wastewater flow from the Oakwood Shores and Golden Oak Subdivisions and Subdivisions further north, it will be necessary to construct a gravity sewer line beginning at the southwest corner of the Golden Oaks Subdivision and proceeding along Cedar Creek Branch toward the wastewater treatment plant. It is recommended that the gravity sewer line begin as a 10-inch sewer line and increase in size to a 12-inch and finally a 15-inch as the line draws nearer to the plant. Because of the Hydraulics of the wastewater plant, it will be necessary to construct a lift station near the wastewater plant. It is recommended that this lift station have an initial firm capacity of 400 gpm, and expandable to a total capacity of 1400 gpm.

5. New 4-inch Force Main to the Oakwood Shores Subdivision.

   To provide adequate service to the Oakwood Shores Subdivision, it is

recommended that a 4-inch force main be constructed from the new 10-inch gravity sewer at the southwest corner of the Golden Oaks Subdivision on Hwy 198 to the Oakwood Shores Subdivision. It is recommended that 3-inch lateral force mains be constructed down the major streets of the subdivision.

6. New 4-inch Force Main to the Baywood Estates Subdivision.

To provide adequate service to the Baywood Estates Subdivision, it is recommended that a 4-inch force main be constructed from the existing 4-inch force main on Hwy 198 to Baywood Estates and that 3-inch lateral force mains be constructed down the major streets of the subdivision.

7. New 6-inch and 4-inch Force Main to the Golden Oaks Subdivision.

To provide adequate service to the Golden Oaks Subdivision, it is recommended that a 6-inch force main be constructed parallel to the existing 4-inch force main from the 10-inch gravity sewer line to the golden Oaks Subdivision. It is recommended that a 4-inch force main be constructed down the middle of the Golden Oaks Subdivision. It is recommended that 3-inch lateral force mains be constructed down each of the major streets in the subdivision.

8. New 4-inch Force Main to the Southland Shores, Bonanza Beach, and Oakshores Estates Subdivisions.

To provide adequate service to the far north subdivisions within the south system, it is recommended that a 4-inch force main be constructed from the existing 4-inch force main on Hwy 198 northeast through each of these subdivisions. It is recommended that 3-inch lateral force mains be constructed down the major streets within each of these subdivisions. It is also recommended that a 6-inch gravity line be constructed to the south of these subdivisions.

9. New 6-inch Force Main and Lift Station to Serve the Cedar Branch Park Area.

To provide adequate service to the Cedar Branch Park Area, it is recommended that a 6-inch force main be constructed from the beginning of the new 15-inch gravity sewer line around Cedar Creek Branch and down to the Cedar Branch Park Area. It is also recommended that a 250 gpm lift station be constructed at the south end of the Cedar Branch Park Area to receive and repump wastewater flow from grinder stations in the Timber Bay, Spillview, Diamond Oaks, Wood Canyon and Deer Island Subdivisions.

10. New 4-inch and 3-inch Force Main to Serve the Timber Bay, Diamond Oaks, Spillview, Wood Canyon and Deer Island Subdivisions.

To provide service to these subdivisions it is recommended that a 4-inch force main be constructed from the lift station at the south end of the Cedar Branch Park Subdivision southward through to the end of the Wood Canyon Subdivision. From the end of the 4-inch force main it is recommended that a 3-inch force main be constructed through Deer Island Estates. It is also recommended that 3-inch lateral force mains be constructed into each of these subdivisions.

2016 Condition

1. New 6-inch and 4-inch Force Main to Serve the Southeastern Portion of the Priority #3 Area.

To provide service to the area on the south side of Lynn Creek, it is recommended that a grinder system be installed with a 6-inch running from Lynn Creek southward to Lake View Street. From Lake View Street, the force main will need to be 4-inch in size and extended southward to the end of the Priority #3 service area. A 120 gpm lift station will need to be constructed roughly in the middle of the force main route to reduce the total pumping head of the grinder stations in the far south part of the Priority #3 Area. It is recommended that 3-inch lateral force mains be constructed to each of the major streets within each of the subdivisions in this area.

2. New 250 gpm Lift Station and 6-inch Force Main at Lynn Creek.

To convey flow from the southeastern part of the Priority #3 Area to the wastewater treatment plant, it is recommended that a 250 gpm lift station and 6-inch force main be constructed, The 6-inch force main will begin at Lynn Creek and end at an existing 6-inch force main near Cedar Branch.

3. New 6-inch and 4-inch force main for the Resort CCN within the Priority #3 Area.

To provide service to the Resort CCN, it is recommended that a 6-inch and 4-inch force main be constructed from along the shoreline with 3-inch lateral force mains. These force mains will feed into an existing lift station at the southern end of the Cedar Branch Park Subdivision.

4. New Parallel 6-inch Force Main to the Indian Harbor Area.

To convey the 2016 peak flow from the Indian Harbor and Del Mar

Subdivisions, it will be necessary to construct a parallel 6-inch force main along the existing 4-inch force main that currently exists.

5. New Parallel 6-inch Force Main along Enchanted Drive.

To convey the 2016 peak flow from the Leisureland and Forgotten Acres Subdivisions, it will be necessary to construct a parallel 6-inch force main along the existing 4-inch force main that currently exists.

6. New Parallel 4-inch Force Main along Lakeland Drive.

To convey the 2016 peak flow from the Leisureland Subdivision, it will be necessary to construct a parallel 4-inch force main along the existing 3-inch force main that currently exists. This 4-inch force main will extend the entire length of the Leisureland Subdivision.

7. New 8-inch Gravity Sewer Trunk Lines Along Hwy 198 and Along the Golden Oaks Subdivision.

To convey flow from the northwestern part of Payne Springs, it is recommended that these 8-inch gravity sewer lines be constructed and tied into an existing 10-inch and 12-inch gravity sewer line respectively. It is also recommended that the small lateral sewer lines be 6-inch gravity lines.

8. New 8-inch Gravity Sewer Line to serve the southwestern part of Payne Springs.

To convey flow from the southwestern part of Payne Springs, it is recommended that a 8-inch gravity sewer line be constructed down to an existing lift station at Lynn Creek.

2026 Condition

1. New 6-inch Parallel Force Main in the Southern Priority #3 Area.

To convey 2026 peak flows from the southern part of the Priority #3 Area, it is recommended that a parallel 6-inch force main be constructed from the middle lift station to the 6-inch force main at Hidden Hills.

2. New 6-inch Parallel Force Main to serve the Resort CCN Area.

To convey 2026 peak flows from the Resort Area, it is recommended that a 6-inch force main be constructed from the lift station at Cedar Branch Creek to the northern part of the Cedar Branch Park Area.

3. New 6-inch Parallel Force Main Along Forgotten Lane.

   To convey peak 2026 flows from the Del Mar Subdivision, it is recommended that a 6-inch force be constructed along an existing 4-inch force main along Forgotten Lane.

4. New 6-inch, 8-inch and 10-inch Gravity Sewer Trunk Line through the Central Part of Payne Springs.

   To convey flows from the central part of Payne Springs, it is recommended that a 6-inch, 8-inch and 10-inch gravity sewer line be constructed down to the existing lift station at Lynn Creek. It is recommended that lateral lines on this sewer interceptor all be 6-inch in size.

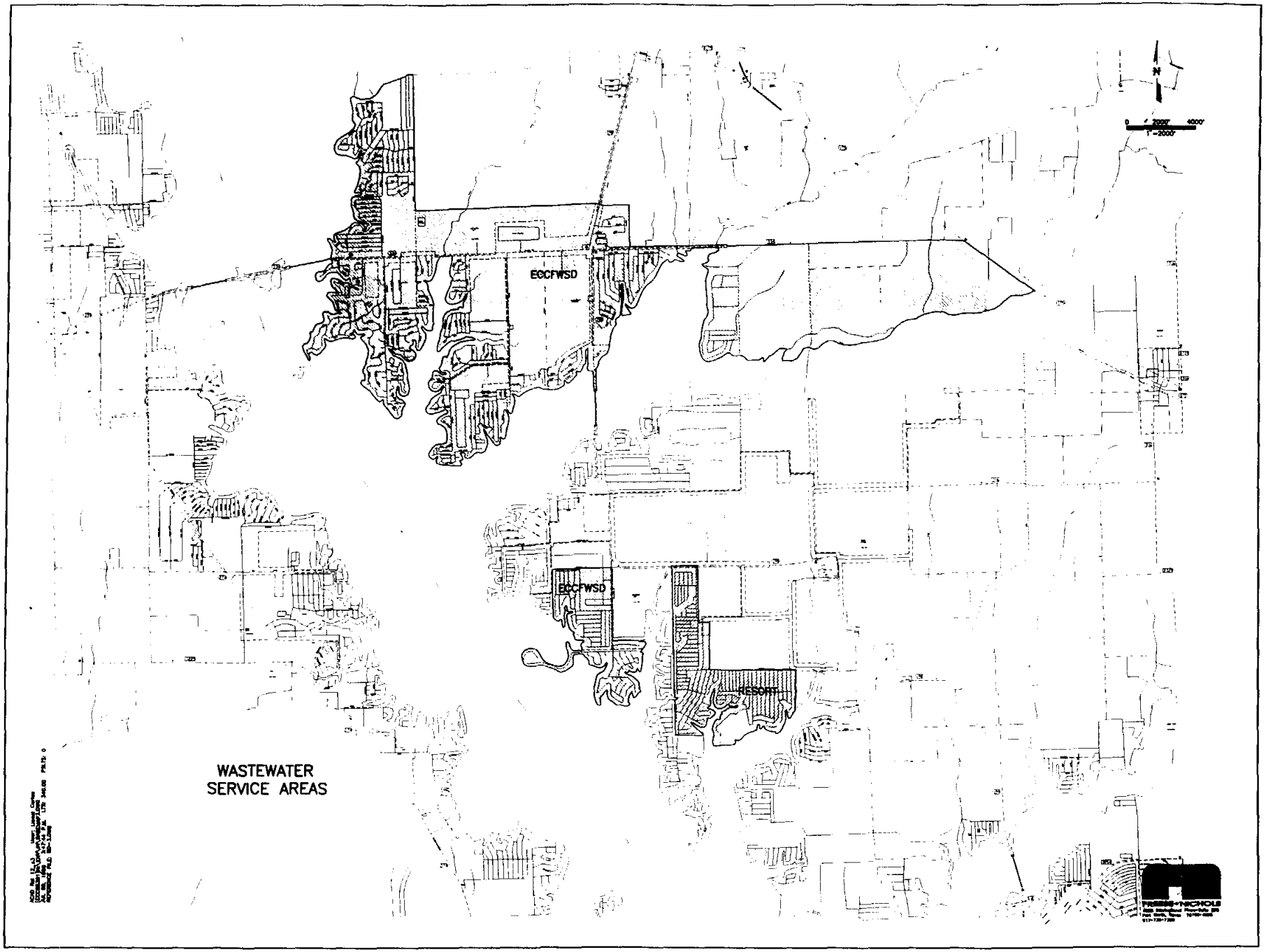
Each of the recommended projects will be evaluated as to cost and prioritized in the Recommendations and Implementation phase of the Master Plan. Currently, there is a potential change in the location of the proposed South WWTP. The exact location of the plant has not been determined. Therefore, the original planned location of the plant will be used for the purposes of this study. Once the new plant site has been selected, the South wastewater model should be rerun to determine any changes needed in the system. A map of the proposed wastewater system improvements is provided in Attachment 2-C.

4.0 RECOMMENDATIONS AND IMPLEMENTATION

Based on the information developed in this Technical Memorandum and Technical Memorandum #1, a list of recommendations will be developed to address the present and future needs of the District's water and wastewater systems and treatment facilities. These recommendations will be grouped into phases for implementation and an implementation plan will be developed. Cost estimates will be provided for each recommended project and an environmental assessment of each project will be performed. The environmental assessment will be compiled in accordance with TWDB guidelines and will include a review of the proposed improvements for potential environmental impacts. This information will be developed and presented in Technical Memorandum #3 and the final Master Plan report.

ATTACHMENT 2-A

PRIORITY AND SERVICE AREA MAPPING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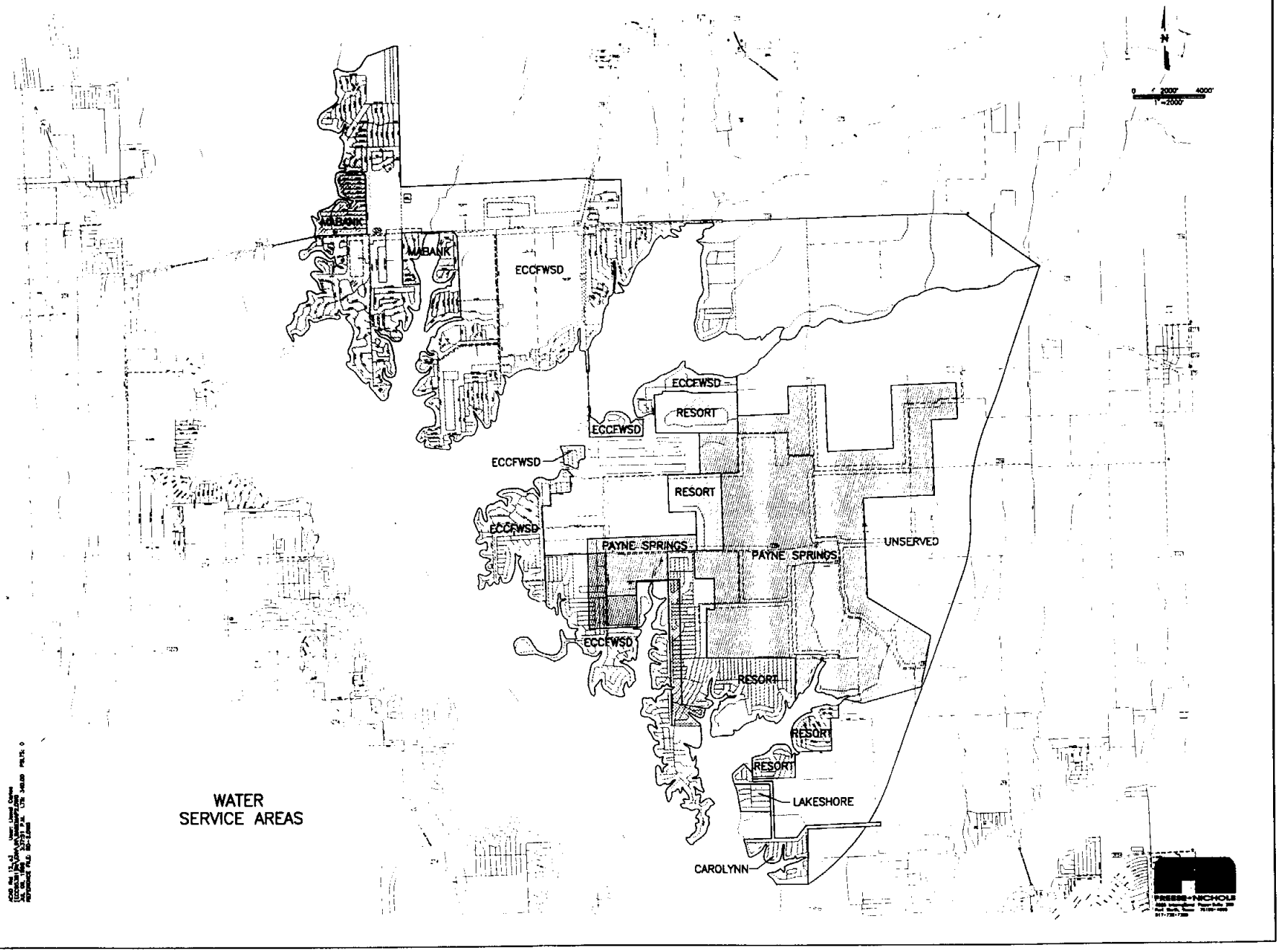
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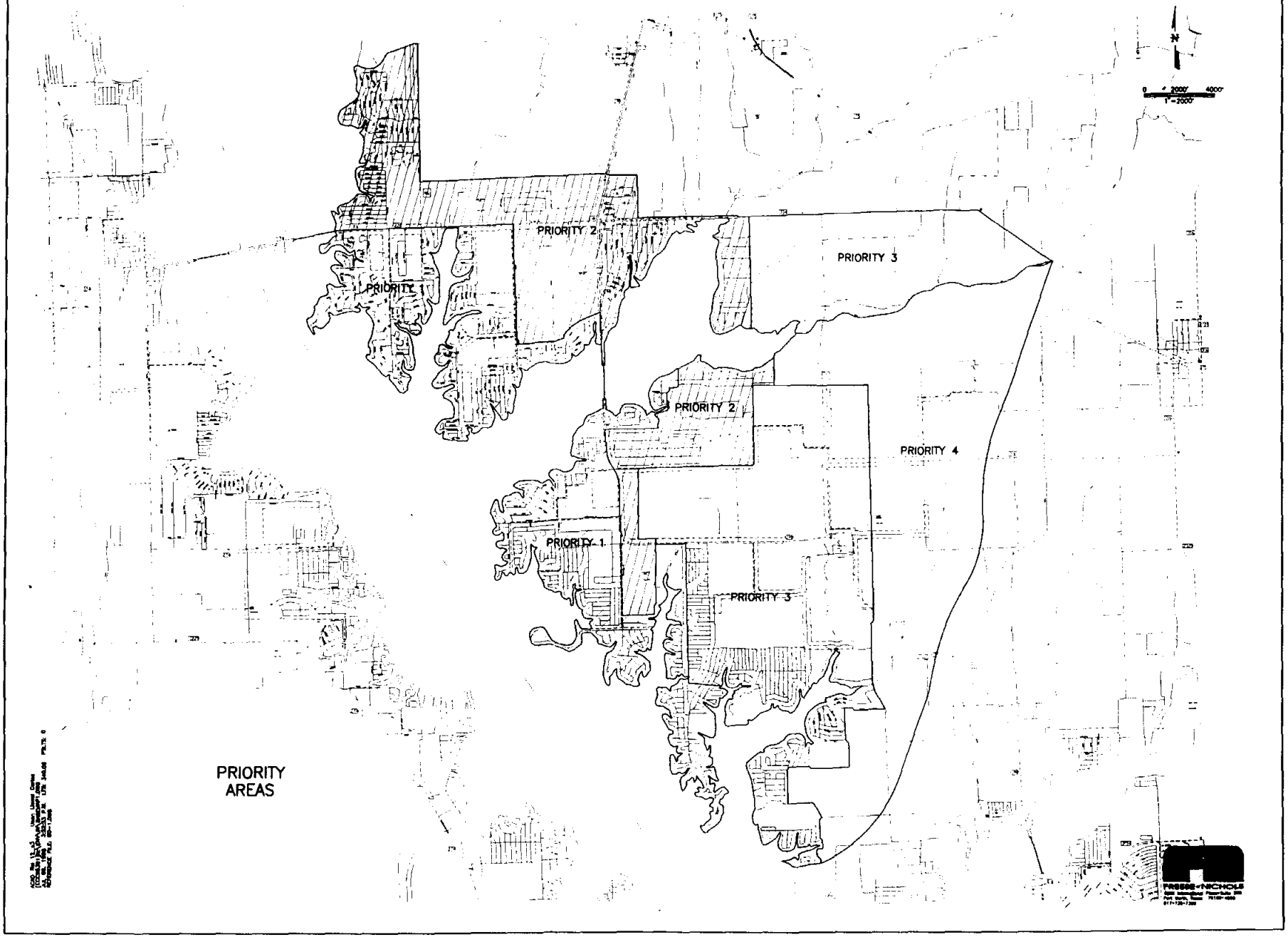
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PRIORITY 2
PRIORITY 3
PRIORITY 1
PRIORITY 2
PRIORITY 3
PRIORITY 4
PRIORITY
AREAS

ATTACHMENT 2-B

POPULATION AND FLOW PROJECTIONS

FREESE • NICHOLS

Simon W. Freese, P.E. 1900–1990
Marvin C. Nichols, P.E. 1896–1969

Title: EAST CEDAR CREEK FWSD WATER AND WASTEWATER MASTERPLAN
PRIORITY AREA PROJECTIONS -- NORTH DISTRICT
[ECC95301]V:\NPRIORTY.WK1

Date: 08/14/96
By: DRJ
Chkd:

NORTH DISTRICT WASTEWATER

PRIORITY 1 PLANNING AREA

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	BASE POP.	UNSERVED POP.	POPULATION GROWTH (%)	I/I REDUCTION (GPCD)	BASE 30 DAY PER CAPITA (GPCD)	GROWTH 30 DAY PER CAPITA (GPCD)	30 DAY AVG. FLOW (MGD)	90 DAY AVG. FLOW (MGD)	PEAK FLOW (MGD)
1996	1594	3067	2646	2646	421	1.855	0.00	108.5	100.9	0.287	0.247	0.90
1997	1653	3124	2745	2646	379	1.821	0.33	108.2	100.9	0.296	0.255	0.93
1998	1713	3181	2843	2646	337	1.789	0.33	107.8	100.9	0.305	0.262	0.96
1999	1772	3238	2942	2646	295	1.757	0.33	107.5	100.9	0.314	0.270	0.99
2000	1832	3295	3041	2646	253	1.502	0.33	107.2	100.9	0.323	0.278	1.02
2001	1887	3344	3133	2646	211	1.479	0.33	106.9	100.9	0.332	0.285	1.05
2002	1942	3394	3224	2646	169	1.458	0.33	106.5	100.9	0.340	0.292	1.07
2003	1997	3443	3316	2646	127	1.437	0.33	106.2	100.9	0.349	0.300	1.10
2004	2052	3492	3407	2646	85	1.417	0.33	105.9	100.9	0.357	0.307	1.12
2005	2108	3542	3499	2646	43	1.397	0.33	105.5	100.9	0.365	0.314	1.15
2006	2163	3591	3590	2646	1	1.378	0.33	105.2	100.9	0.374	0.321	1.18
2007	2193	3641	3641	2646	0	1.359	0.33	104.9	100.9	0.378	0.325	1.19
2008	2223	3690	3690	2646	0	1.341	0.33	104.6	100.9	0.382	0.328	1.20
2009	2253	3740	3739	2646	0	1.323	0.33	104.2	100.9	0.386	0.332	1.22
2010	2282	3789	3789	2646	0	1.165	0.33	103.9	100.9	0.390	0.335	1.23
2011	2309	3833	3833	2646	0	1.151	0.33	103.6	100.9	0.394	0.339	1.24
2012	2336	3878	3877	2646	0	1.138	0.33	103.2	100.9	0.397	0.342	1.25
2013	2362	3922	3921	2646	0	1.126	0.33	102.9	100.9	0.401	0.345	1.26
2014	2389	3966	3965	2646	0	1.113	0.33	102.6	100.9	0.405	0.348	1.27
2015	2415	4010	4010	2646	0	1.101	0.33	102.3	100.9	0.408	0.351	1.29
2016	2442	4054	4054	2646	0	1.089	0.33	101.9	100.9	0.412	0.354	1.30
2017	2469	4098	4098	2646	0	1.077	0.33	101.6	100.9	0.415	0.357	1.31
2018	2495	4142	4142	2646	0	1.066	0.33	101.3	100.9	0.419	0.360	1.32
2019	2522	4187	4186	2646	0	1.054	0.33	100.9	100.9	0.422	0.363	1.33
2020	2548	4231	4230	2646	0	0.610	0.00	100.9	100.9	0.427	0.367	1.34
2021	2564	4257	4256	2646	0	0.607	0.00	100.9	100.9	0.429	0.369	1.35
2022	2579	4282	4282	2646	0	0.603	0.00	100.9	100.9	0.432	0.371	1.36
2023	2595	4308	4308	2646	0	0.599	0.00	100.9	100.9	0.435	0.374	1.37
2024	2611	4334	4334	2646	0	0.596	0.00	100.9	100.9	0.437	0.376	1.38
2025	2626	4360	4359	2646	0	0.592	0.00	100.9	100.9	0.440	0.378	1.39
2026	2642	4386	4385	2646	0		0.00	100.9	100.9	0.443	0.380	1.39

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[ECC95301]V:\NPRIORTY.WK1

Date: 08/14/96
By: DRJ
Chkd:

NORTH DISTRICT WASTEWATER

PRIORITY 2 PLANNING AREA

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	BASE POP.	UNSERVED POP.	POPULATION GROWTH (%)	I/I REDUCTION (GCD)	BASE 30 DAY PER CAPITA (GPCD)	GROWTH 30 DAY PER CAPITA (GPCD)	30 DAY AVG. FLOW (MGD)	90 DAY AVG. FLOW (MGD)	PEAK FLOW (MGD)
1996	1531	2936	2542	2542	394	1.855	0	108.5	100.9	0.276	0.237	0.87
1997	1576	2990	2616	2542	374	1.821	0.33	108.2	100.9	0.282	0.243	0.89
1998	1621	3045	2690	2542	355	1.789	0.33	107.8	100.9	0.289	0.249	0.91
1999	1665	3099	2764	2542	335	1.757	0.33	107.5	100.9	0.296	0.254	0.93
2000	1710	3154	2839	2542	315	1.502	0.33	107.2	100.9	0.302	0.260	0.95
2001	1750	3201	2906	2542	296	1.479	0.33	106.9	100.9	0.308	0.265	0.97
2002	1791	3249	2973	2542	276	1.458	0.33	106.5	100.9	0.314	0.270	0.99
2003	1831	3296	3040	2542	256	1.437	0.33	106.2	100.9	0.320	0.275	1.01
2004	1872	3343	3107	2542	237	1.417	0.33	105.9	100.9	0.326	0.280	1.03
2005	1912	3391	3174	2542	217	1.397	0.33	105.5	100.9	0.332	0.285	1.05
2006	1952	3438	3241	2542	197	1.378	0.33	105.2	100.9	0.338	0.291	1.06
2007	1993	3485	3308	2542	177	1.359	0.33	104.9	100.9	0.344	0.296	1.08
2008	2033	3533	3375	2542	158	1.341	0.33	104.6	100.9	0.350	0.301	1.10
2009	2074	3580	3442	2542	138	1.323	0.33	104.2	100.9	0.356	0.306	1.12
2010	2114	3627	3509	2542	118	1.165	0.33	103.9	100.9	0.362	0.311	1.14
2011	2151	3670	3571	2542	99	1.151	0.33	103.6	100.9	0.367	0.316	1.16
2012	2189	3712	3633	2542	79	1.138	0.33	103.2	100.9	0.372	0.320	1.17
2013	2226	3754	3695	2542	59	1.126	0.33	102.9	100.9	0.378	0.325	1.19
2014	2263	3796	3757	2542	40	1.113	0.33	102.6	100.9	0.383	0.330	1.21
2015	2301	3839	3819	2542	20	1.101	0.33	102.3	100.9	0.389	0.334	1.22
2016	2338	3881	3881	2542	0	1.089	0.33	101.9	100.9	0.394	0.339	1.24
2017	2363	3923	3923	2542	0	1.077	0.33	101.6	100.9	0.398	0.342	1.25
2018	2389	3965	3965	2542	0	1.066	0.33	101.3	100.9	0.401	0.345	1.26
2019	2414	4008	4008	2542	0	1.054	0.33	100.9	100.9	0.404	0.348	1.27
2020	2440	4050	4050	2542	0	0.610	0.00	100.9	100.9	0.409	0.351	1.29
2021	2455	4075	4075	2542	0	0.607	0.00	100.9	100.9	0.411	0.353	1.30
2022	2469	4099	4099	2542	0	0.603	0.00	100.9	100.9	0.414	0.356	1.30
2023	2484	4124	4124	2542	0	0.599	0.00	100.9	100.9	0.416	0.358	1.31
2024	2499	4149	4149	2542	0	0.596	0.00	100.9	100.9	0.419	0.360	1.32
2025	2514	4174	4173	2542	0	0.592	0.00	100.9	100.9	0.421	0.362	1.33
2026	2529	4198	4198	2542	0		0.00	100.9	100.9	0.424	0.364	1.33

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NORTH DISTRICT WASTEWATER

PRIORITY 3 PLANNING AREA

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	BASE POP.	UNSERVED POP.	POPULATION GROWTH (%)	I/I REDUCTION (GCD)	BASE 30 DAY PER CAPITA (GPCD)	GROWTH 30 DAY PER CAPITA (GPCD)	30 DAY AVG. FLOW (MGD)	90 DAY AVG. FLOW (MGD)	PEAK FLOW (MGD)
1996	0	257	0	0	257	1.167	0	108.5	100.9	0.000	0.000	0.00
1997	0	260	0	0	260	1.153	0.33	108.2	100.9	0.000	0.000	0.00
1998	0	263	0	0	263	1.140	0.33	107.8	100.9	0.000	0.000	0.00
1999	0	266	0	0	266	1.127	0.33	107.5	100.9	0.000	0.000	0.00
2000	0	269	0	0	269	1.115	0.33	107.2	100.9	0.000	0.000	0.00
2001	0	272	0	0	272	0.932	0.33	106.9	100.9	0.000	0.000	0.00
2002	0	275	0	0	275	0.923	0.33	106.5	100.9	0.000	0.000	0.00
2003	0	277	0	0	277	0.915	0.33	106.2	100.9	0.000	0.000	0.00
2004	0	280	0	0	280	0.906	0.33	105.9	100.9	0.000	0.000	0.00
2005	0	282	0	0	282	0.898	0.33	105.5	100.9	0.000	0.000	0.00
2006	0	285	0	0	285	0.890	0.33	105.2	100.9	0.000	0.000	0.00
2007	10	287	17	0	270	0.882	0.33	104.9	100.9	0.002	0.001	0.01
2008	20	290	34	0	256	0.875	0.33	104.6	100.9	0.003	0.003	0.01
2009	30	292	50	0	242	0.867	0.33	104.2	100.9	0.005	0.004	0.02
2010	40	295	67	0	228	0.859	0.33	103.9	100.9	0.007	0.006	0.02
2011	51	297	84	0	213	0.708	0.33	103.6	100.9	0.008	0.007	0.03
2012	60	299	100	0	199	0.703	0.33	103.2	100.9	0.010	0.009	0.03
2013	70	302	117	0	185	0.698	0.33	102.9	100.9	0.012	0.010	0.04
2014	80	304	133	0	171	0.693	0.33	102.6	100.9	0.013	0.012	0.04
2015	90	306	149	0	156	0.688	0.33	102.3	100.9	0.015	0.013	0.05
2016	100	308	166	0	142	0.684	0.33	101.9	100.9	0.017	0.014	0.05
2017	110	310	182	0	128	0.679	0.33	101.6	100.9	0.018	0.016	0.06
2018	120	312	198	0	114	0.675	0.33	101.3	100.9	0.020	0.017	0.06
2019	129	314	215	0	99	0.670	0.33	100.9	100.9	0.022	0.019	0.07
2020	139	316	231	0	85	0.666	0.00	100.9	100.9	0.023	0.020	0.07
2021	149	318	247	0	71	0.222	0.00	100.9	100.9	0.025	0.021	0.08
2022	158	319	262	0	57	0.222	0.00	100.9	100.9	0.026	0.023	0.08
2023	167	320	277	0	42	0.221	0.00	100.9	100.9	0.028	0.024	0.09
2024	176	321	292	0	28	0.221	0.00	100.9	100.9	0.029	0.025	0.09
2025	185	321	307	0	14	0.220	0.00	100.9	100.9	0.031	0.027	0.10
2026	194	322	322	0	-0		0.00	100.9	100.9	0.033	0.028	0.10

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NORTH DISTRICT WASTEWATER

NORTH WASTEWATER TOTALS

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	BASE POP.	UNSERVED POP.	POPULATION GROWTH (%)	I/I REDUCTION (GCD)	BASE 30 DAY PER CAPITA (GPCD)	GROWTH 30 DAY PER CAPITA (GPCD)	30 DAY AVG. FLOW (MGD)	90 DAY AVG. FLOW (MGD)	PEAK FLOW (MGD)
1996	3125	6260	5188	5188	1073	1.827	0.00	108.5	100.9	0.563	0.484	1.773
1997	3229	6374	5361	5188	1014	1.794	0.33	107.9	100.9	0.579	0.497	1.823
1998	3334	6489	5534	5188	955	1.762	0.33	107.4	100.9	0.594	0.511	1.872
1999	3438	6603	5707	5188	896	1.732	0.33	106.9	100.9	0.610	0.525	1.922
2000	3542	6717	5880	5188	838	1.486	0.33	106.4	100.9	0.626	0.538	1.971
2001	3638	6817	6038	5188	779	1.458	0.33	106.0	100.9	0.640	0.550	2.016
2002	3733	6917	6197	5188	720	1.437	0.33	105.6	100.9	0.654	0.563	2.061
2003	3829	7016	6355	5188	661	1.416	0.33	105.2	100.9	0.669	0.575	2.106
2004	3924	7115	6514	5188	601	1.397	0.33	104.9	100.9	0.683	0.587	2.151
2005	4020	7215	6672	5188	542	1.377	0.33	104.5	100.9	0.697	0.599	2.196
2006	4115	7314	6831	5188	483	1.359	0.33	104.2	100.9	0.712	0.612	2.241
2007	4196	7413	6965	5188	448	1.340	0.33	103.9	100.9	0.723	0.622	2.279
2008	4276	7513	7099	5188	414	1.323	0.33	103.6	100.9	0.735	0.632	2.316
2009	4357	7612	7232	5188	380	1.305	0.33	103.3	100.9	0.747	0.642	2.353
2010	4437	7712	7365	5188	346	1.153	0.33	103.0	100.9	0.759	0.652	2.390
2011	4511	7800	7488	5188	312	1.135	0.33	102.7	100.9	0.769	0.661	2.423
2012	4585	7889	7611	5188	278	1.122	0.33	102.5	100.9	0.780	0.671	2.457
2013	4658	7977	7733	5188	245	1.109	0.33	102.2	100.9	0.791	0.680	2.490
2014	4732	8066	7855	5188	211	1.097	0.33	102.0	100.9	0.801	0.689	2.524
2015	4806	8154	7978	5188	177	1.085	0.33	101.8	100.9	0.812	0.698	2.557
2016	4880	8243	8100	5188	143	1.074	0.33	101.5	100.9	0.823	0.707	2.591
2017	4942	8331	8203	5188	128	1.062	0.33	101.3	100.9	0.831	0.715	2.618
2018	5003	8420	8306	5188	114	1.051	0.33	101.1	100.9	0.840	0.722	2.646
2019	5065	8508	8409	5188	100	1.040	0.33	100.9	100.9	0.849	0.729	2.673
2020	5127	8597	8511	5188	86	0.612	0.00	100.9	100.9	0.859	0.738	2.705
2021	5168	8650	8578	5188	71	0.592	0.00	100.9	100.9	0.866	0.744	2.727
2022	5207	8701	8644	5188	57	0.589	0.00	100.9	100.9	0.872	0.750	2.748
2023	5246	8752	8709	5188	43	0.585	0.00	100.9	100.9	0.879	0.756	2.768
2024	5286	8803	8775	5188	29	0.582	0.00	100.9	100.9	0.885	0.761	2.789
2025	5325	8855	8840	5188	14	0.579	0.00	100.9	100.9	0.892	0.767	2.810
2026	5365	8906	8906	5188	0		0.00	100.9	100.9	0.899	0.773	2.831

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NORTH DISTRICT WATER

PRIORITY 1 PLANNING AREA

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	MABANK SERVICE POP.	UNSERVED POP.	POPULATION GROWTH (%)	PER CAPITA WATER (GCD)	AVG DAY DEMAND (MGD)	MAX DAY DEMAND (MGD)	MABANK MAX DAY (MGD)
1996	1442	3067	2393	374	300	1.855	127	0.304	0.790	0.124
1997	1490	3124	2473	381	270	1.821	127	0.314	0.817	0.126
1998	1538	3181	2553	388	240	1.789	127	0.324	0.843	0.128
1999	1586	3238	2633	395	210	1.757	127	0.334	0.869	0.130
2000	1634	3295	2713	402	180	1.502	127	0.345	0.896	0.133
2001	1678	3344	2786	408	150	1.479	127	0.354	0.920	0.135
2002	1723	3394	2860	414	120	1.458	127	0.363	0.944	0.137
2003	1767	3443	2933	420	90	1.437	127	0.373	0.969	0.139
2004	1811	3492	3007	426	60	1.417	127	0.382	0.993	0.141
2005	1855	3542	3080	432	30	1.397	127	0.391	1.017	0.143
2006	1899	3591	3153	438	0	1.378	127	0.400	1.041	0.145
2007	1926	3641	3196	444	0	1.359	127	0.406	1.055	0.147
2008	1952	3690	3240	450	0	1.341	127	0.411	1.070	0.149
2009	1978	3740	3283	456	0	1.323	127	0.417	1.084	0.151
2010	2004	3789	3327	462	0	1.165	127	0.422	1.098	0.153
2011	2027	3833	3365	468	0	1.151	127	0.427	1.111	0.154
2012	2051	3878	3404	473	0	1.138	127	0.432	1.124	0.156
2013	2074	3922	3443	478	0	1.126	127	0.437	1.137	0.158
2014	2097	3966	3482	484	0	1.113	127	0.442	1.150	0.160
2015	2121	4010	3520	489	0	1.101	127	0.447	1.162	0.162
2016	2144	4054	3559	495	0	1.089	127	0.452	1.175	0.163
2017	2167	4098	3598	500	0	1.077	127	0.457	1.188	0.165
2018	2191	4142	3637	505	0	1.066	127	0.462	1.201	0.167
2019	2214	4187	3675	511	0	1.054	127	0.467	1.214	0.169
2020	2237	4231	3714	516	0	0.610	127	0.472	1.226	0.170
2021	2251	4257	3737	519	0	0.607	127	0.475	1.234	0.171
2022	2265	4282	3760	522	0	0.603	127	0.477	1.241	0.173
2023	2278	4308	3782	526	0	0.599	127	0.480	1.249	0.174
2024	2292	4334	3805	529	0	0.596	127	0.483	1.256	0.175
2025	2306	4360	3828	532	0	0.592	127	0.486	1.264	0.176
2026	2319	4386	3850	535	0		127	0.489	1.271	0.177

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NORTH DISTRICT WATER

PRIORITY 2 PLANNING AREA

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	MABANK SERVICE POP.	UNSERVED POP.	POPULATION GROWTH (%)	PER CAPITA WATER (GCD)	AVG DAY DEMAND (MGD)	MAX DAY DEMAND (MGD)	MABANK MAX DAY (MGD)
1996	1383	2936	2295	573	68	1.855	127	0.292	0.758	0.189
1997	1411	2990	2343	583	65	1.821	127	0.298	0.774	0.193
1998	1440	3045	2390	594	61	1.789	127	0.304	0.789	0.196
1999	1468	3099	2437	604	58	1.757	127	0.310	0.805	0.200
2000	1497	3154	2484	615	55	1.502	127	0.316	0.820	0.203
2001	1522	3201	2526	624	51	1.479	127	0.321	0.834	0.206
2002	1547	3249	2567	633	48	1.458	127	0.326	0.848	0.209
2003	1572	3296	2609	643	44	1.437	127	0.331	0.861	0.212
2004	1597	3343	2650	652	41	1.417	127	0.337	0.875	0.215
2005	1622	3391	2692	661	38	1.397	127	0.342	0.889	0.218
2006	1647	3438	2733	670	34	1.378	127	0.347	0.903	0.221
2007	1672	3485	2775	680	31	1.359	127	0.352	0.916	0.224
2008	1697	3533	2817	689	27	1.341	127	0.358	0.930	0.227
2009	1722	3580	2858	698	24	1.323	127	0.363	0.944	0.231
2010	1747	3627	2900	707	21	1.165	127	0.368	0.957	0.234
2011	1769	3670	2937	716	17	1.151	127	0.373	0.970	0.236
2012	1792	3712	2974	724	14	1.138	127	0.378	0.982	0.239
2013	1814	3754	3012	732	10	1.126	127	0.382	0.994	0.242
2014	1837	3796	3049	740	7	1.113	127	0.387	1.007	0.244
2015	1859	3839	3087	749	4	1.101	127	0.392	1.019	0.247
2016	1882	3881	3124	757	0	1.089	127	0.397	1.032	0.250
2017	1902	3923	3158	765	0	1.077	127	0.401	1.043	0.253
2018	1923	3965	3192	773	0	1.066	127	0.405	1.054	0.255
2019	1943	4008	3226	782	0	1.054	127	0.410	1.065	0.258
2020	1964	4050	3260	790	0	0.610	127	0.414	1.076	0.261
2021	1976	4075	3280	795	0	0.607	127	0.417	1.083	0.262
2022	1988	4099	3300	799	0	0.603	127	0.419	1.090	0.264
2023	2000	4124	3320	804	0	0.599	127	0.422	1.096	0.266
2024	2012	4149	3340	809	0	0.596	127	0.424	1.103	0.267
2025	2024	4174	3360	814	0	0.592	127	0.427	1.109	0.269
2026	2036	4198	3379	819	0		127	0.429	1.116	0.270

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PRIORITY AREA PROJECTIONS -- NORTH DISTRICT
[ECC95301]V:\NPRIORTY.WK1

Date: 08/14/96
By: DRJ
Chkd:

NORTH DISTRICT WATER

PRIORITY 3 PLANNING AREA

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	MABANK SERVICE POP.	UNSERVED POP.	POPULATION GROWTH (%)	PER CAPITA WATER (GCD)	AVG DAY DEMAND (MGD)	MAX DAY DEMAND (MGD)	MABANK MAX DAY (MGD)
1996	118	257	195	0	62	1.167	127	0.025	0.065	0.000
1997	121	260	200	0	60	1.153	127	0.025	0.066	0.000
1998	124	263	205	0	58	1.140	127	0.026	0.068	0.000
1999	127	266	211	0	55	1.127	127	0.027	0.070	0.000
2000	130	269	216	0	53	1.115	127	0.027	0.071	0.000
2001	133	272	221	0	51	0.932	127	0.028	0.073	0.000
2002	136	275	225	0	49	0.923	127	0.029	0.074	0.000
2003	138	277	230	0	47	0.915	127	0.029	0.076	0.000
2004	141	280	235	0	45	0.906	127	0.030	0.077	0.000
2005	144	282	239	0	43	0.898	127	0.030	0.079	0.000
2006	147	285	244	0	41	0.890	127	0.031	0.080	0.000
2007	150	287	248	0	39	0.882	127	0.032	0.082	0.000
2008	152	290	253	0	37	0.875	127	0.032	0.084	0.000
2009	155	292	258	0	35	0.867	127	0.033	0.085	0.000
2010	158	295	262	0	33	0.859	127	0.033	0.087	0.000
2011	161	297	267	0	31	0.708	127	0.034	0.088	0.000
2012	163	299	271	0	29	0.703	127	0.034	0.089	0.000
2013	166	302	275	0	26	0.698	127	0.035	0.091	0.000
2014	168	304	279	0	24	0.693	127	0.035	0.092	0.000
2015	171	306	283	0	22	0.688	127	0.036	0.094	0.000
2016	173	308	288	0	20	0.684	127	0.037	0.095	0.000
2017	176	310	292	0	18	0.679	127	0.037	0.096	0.000
2018	178	312	296	0	16	0.675	127	0.038	0.098	0.000
2019	181	314	300	0	14	0.670	127	0.038	0.099	0.000
2020	183	316	304	0	12	0.666	127	0.039	0.100	0.000
2021	186	318	308	0	10	0.222	127	0.039	0.102	0.000
2022	188	319	311	0	8	0.222	127	0.040	0.103	0.000
2023	189	320	314	0	6	0.221	127	0.040	0.104	0.000
2024	191	321	317	0	4	0.221	127	0.040	0.105	0.000
2025	193	321	320	0	2	0.220	127	0.041	0.106	0.000
2026	194	322	322	0	0		127	0.041	0.106	0.000

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NORTH DISTRICT WATER

NORTH WATER TOTALS

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	MABANK SERVICE POP.	UNSERVED POP.	POPULATION GROWTH (%)	PER CAPITA WATER (GCD)	AVG DAY DEMAND (MGD)	MAX DAY DEMAND (MGD)	MABANK MAX DAY (MGD)
1996	2942	6260	4884	947	430	1.827	127	0.620	1.613	0.313
1997	3022	6374	5016	964	394	1.794	127	0.637	1.656	0.318
1998	3101	6489	5148	982	359	1.762	127	0.654	1.700	0.324
1999	3181	6603	5281	999	323	1.732	127	0.671	1.744	0.330
2000	3261	6717	5413	1017	288	1.486	127	0.687	1.787	0.336
2001	3333	6817	5533	1032	252	1.458	127	0.703	1.827	0.341
2002	3405	6917	5652	1047	217	1.437	127	0.718	1.866	0.346
2003	3477	7016	5772	1063	181	1.416	127	0.733	1.906	0.351
2004	3549	7115	5892	1078	146	1.397	127	0.748	1.945	0.356
2005	3621	7215	6011	1093	110	1.377	127	0.763	1.985	0.361
2006	3693	7314	6130	1109	75	1.359	127	0.779	2.024	0.366
2007	3747	7413	6220	1124	70	1.340	127	0.790	2.054	0.371
2008	3801	7513	6309	1139	64	1.323	127	0.801	2.083	0.376
2009	3855	7612	6399	1154	59	1.305	127	0.813	2.113	0.381
2010	3909	7712	6488	1170	54	1.153	127	0.824	2.142	0.386
2011	3957	7800	6569	1183	48	1.135	127	0.834	2.169	0.391
2012	4006	7889	6650	1197	43	1.122	127	0.844	2.196	0.395
2013	4054	7977	6730	1211	37	1.109	127	0.855	2.222	0.400
2014	4103	8066	6810	1224	32	1.097	127	0.865	2.249	0.404
2015	4151	8154	6891	1238	26	1.085	127	0.875	2.275	0.409
2016	4199	8243	6971	1251	21	1.074	127	0.885	2.302	0.413
2017	4246	8331	7048	1265	19	1.062	127	0.895	2.327	0.418
2018	4292	8420	7125	1279	17	1.051	127	0.905	2.353	0.422
2019	4338	8508	7202	1292	14	1.040	127	0.915	2.378	0.427
2020	4385	8597	7279	1306	12	0.612	127	0.924	2.403	0.431
2021	4413	8650	7325	1314	10	0.592	127	0.930	2.419	0.434
2022	4440	8701	7371	1322	8	0.589	127	0.936	2.434	0.436
2023	4468	8752	7416	1330	6	0.585	127	0.942	2.449	0.439
2024	4495	8803	7461	1338	4	0.582	127	0.948	2.464	0.442
2025	4522	8855	7507	1346	2	0.579	127	0.953	2.479	0.444
2026	4549	8906	7552	1354	1		127	0.959	2.494	0.447

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SOUTH DISTRICT WASTEWATER

PRIORITY 1 PLANNING AREA

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	BASE POP.	UNSERVED POP.	RESORT POP.	POPULATION GROWTH (%)	I/I REDUCTION (GPCD)	BASE 30 DAY PER CAPITA (GPCD)	GROWTH 30 DAY PER CAPITA (GPCD)	RESORT 30 DAY FLOW (MGD)	RESORT PEAK FLOW (MGD)	30 DAY AVG. FLOW (MGD)	90 DAY AVG. FLOW (MGD)	PEAK FLOW (MGD)
1996	536	2454	863	863	1591	0	2.37	0.00	197.0	100.9	0	0	0.170	0.131	0.595
1997	671	2512	1080	863	1432	0	2.32	3.64	193.4	100.9	0	0	0.189	0.145	0.661
1998	806	2570	1298	863	1273	0	2.26	3.64	189.7	100.9	0	0	0.208	0.160	0.727
1999	941	2629	1515	863	1114	0	2.21	3.64	186.1	100.9	0	0	0.226	0.174	0.792
2000	1076	2687	1732	863	955	0	2.17	3.64	182.5	100.9	0	0	0.245	0.189	0.858
2001	1211	2745	1949	863	796	0	2.12	3.64	178.8	100.9	0	0	0.264	0.203	0.924
2002	1346	2803	2167	863	636	0	2.08	3.64	175.2	100.9	0	0	0.283	0.218	0.990
2003	1481	2861	2384	863	477	0	2.03	3.64	171.6	100.9	0	0	0.302	0.232	1.055
2004	1616	2919	2601	863	318	0	1.99	3.64	167.9	100.9	0	0	0.320	0.247	1.121
2005	1751	2978	2818	863	159	0	1.95	3.64	164.3	100.9	0	0	0.339	0.261	1.187
2006	1886	3036	3036	863	0	0	1.92	3.64	160.6	100.9	0	0	0.358	0.276	1.253
2007	1922	3094	3094	863	0	0	1.88	3.64	157.0	100.9	0	0	0.361	0.278	1.262
2008	1958	3152	3152	863	0	0	1.85	0.00	157.0	100.9	0	0	0.366	0.282	1.283
2009	1994	3210	3210	863	0	0	1.81	0.00	157.0	100.9	0	0	0.372	0.287	1.303
2010	2030	3269	3268	863	0	0	1.78	0.00	157.0	100.9	0	0	0.378	0.291	1.324
2011	2066	3327	3327	863	0	0	1.75	0.00	157.0	100.9	0	0	0.384	0.296	1.344
2012	2102	3385	3385	863	0	0	1.72	0.00	157.0	100.9	0	0	0.390	0.300	1.365
2013	2139	3443	3443	863	0	0	1.69	0.00	157.0	100.9	0	0	0.396	0.305	1.385
2014	2175	3501	3501	863	0	0	1.66	0.00	157.0	100.9	0	0	0.402	0.309	1.406
2015	2211	3559	3559	863	0	0	1.63	0.00	157.0	100.9	0	0	0.408	0.314	1.426
2016	2247	3618	3618	863	0	0	1.61	0.00	157.0	100.9	0	0	0.413	0.318	1.447
2017	2283	3676	3676	863	0	0	1.58	0.00	157.0	100.9	0	0	0.419	0.323	1.468
2018	2319	3734	3734	863	0	0	1.56	0.00	157.0	100.9	0	0	0.425	0.327	1.488
2019	2355	3792	3792	863	0	0	1.53	0.00	157.0	100.9	0	0	0.431	0.332	1.509
2020	2391	3850	3850	863	0	0	1.51	0.00	157.0	100.9	0	0	0.437	0.336	1.529
2021	2428	3909	3908	863	0	0	1.49	0.00	157.0	100.9	0	0	0.443	0.341	1.550
2022	2464	3967	3967	863	0	0	1.47	0.00	157.0	100.9	0	0	0.449	0.345	1.570
2023	2500	4025	4025	863	0	0	1.45	0.00	157.0	100.9	0	0	0.455	0.350	1.591
2024	2536	4083	4083	863	0	0	1.42	0.00	157.0	100.9	0	0	0.460	0.355	1.611
2025	2572	4141	4141	863	0	0	1.40	0.00	157.0	100.9	0	0	0.466	0.359	1.632
2026	2608	4199	4199	863	0	0		0.00	157.0	100.9	0	0	0.472	0.364	1.652

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Chkd:

SOUTH DISTRICT WASTEWATER

PRIORITY 2 PLANNING AREA

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	BASE POP.	UNSERVED POP.	RESORT POP.	POPULATION GROWTH (%)	I/I REDUCTION (GCD)	BASE 30 DAY PER CAPITA (GPCD)	GROWTH 30 DAY PER CAPITA (GPCD)	RESORT 30 DAY FLOW (MGD)	RESORT PEAK FLOW (MGD)	30 DAY AVG. FLOW (MGD)	90 DAY AVG. FLOW (MGD)	PEAK FLOW (MGD)
1996	0	586	0	0	586	0	2.37	0.00	197.0	100.9	0	0	0.000	0.000	0.000
1997	27	600	43	0	557	0	2.32	3.64	193.4	100.9	0	0	0.004	0.003	0.015
1998	54	614	86	0	527	0	2.26	3.64	189.7	100.9	0	0	0.009	0.007	0.031
1999	80	628	130	0	498	0	2.21	3.64	186.1	100.9	0	0	0.013	0.010	0.046
2000	107	642	173	0	469	0	2.17	3.64	182.5	100.9	0	0	0.017	0.013	0.061
2001	134	655	216	0	440	0	2.12	3.64	178.8	100.9	0	0	0.022	0.017	0.076
2002	161	669	259	0	410	0	2.08	3.64	175.2	100.9	0	0	0.026	0.020	0.092
2003	188	683	302	0	381	0	2.03	3.64	171.6	100.9	0	0	0.031	0.023	0.107
2004	215	697	346	0	352	0	1.99	3.64	167.9	100.9	0	0	0.035	0.027	0.122
2005	241	711	389	0	322	0	1.95	3.64	164.3	100.9	0	0	0.039	0.030	0.137
2006	268	725	432	0	293	0	1.92	3.64	160.6	100.9	0	0	0.044	0.034	0.153
2007	295	739	475	0	264	0	1.88	3.64	157.0	100.9	0	0	0.048	0.037	0.168
2008	322	753	518	0	234	0	1.85	0.00	157.0	100.9	0	0	0.052	0.040	0.183
2009	349	767	562	0	205	0	1.81	0.00	157.0	100.9	0	0	0.057	0.044	0.198
2010	376	781	605	0	176	0	1.78	0.00	157.0	100.9	0	0	0.061	0.047	0.214
2011	402	794	648	0	147	0	1.75	0.00	157.0	100.9	0	0	0.065	0.050	0.229
2012	429	808	691	0	117	0	1.72	0.00	157.0	100.9	0	0	0.070	0.054	0.244
2013	456	822	734	0	88	0	1.69	0.00	157.0	100.9	0	0	0.074	0.057	0.259
2014	483	836	777	0	59	0	1.66	0.00	157.0	100.9	0	0	0.078	0.060	0.275
2015	510	850	821	0	29	0	1.63	0.00	157.0	100.9	0	0	0.083	0.064	0.290
2016	537	864	864	0	0	0	1.61	0.00	157.0	100.9	0	0	0.087	0.067	0.305
2017	545	878	878	0	0	0	1.58	0.00	157.0	100.9	0	0	0.089	0.068	0.310
2018	554	892	892	0	0	0	1.56	0.00	157.0	100.9	0	0	0.090	0.069	0.315
2019	562	906	906	0	0	0	1.53	0.00	157.0	100.9	0	0	0.091	0.070	0.320
2020	571	919	919	0	0	0	1.51	0.00	157.0	100.9	0	0	0.093	0.071	0.325
2021	580	933	933	0	0	0	1.49	0.00	157.0	100.9	0	0	0.094	0.073	0.330
2022	588	947	947	0	0	0	1.47	0.00	157.0	100.9	0	0	0.096	0.074	0.335
2023	597	961	961	0	0	0	1.45	0.00	157.0	100.9	0	0	0.097	0.075	0.339
2024	606	975	975	0	0	0	1.42	0.00	157.0	100.9	0	0	0.098	0.076	0.344
2025	614	989	989	0	0	0	1.40	0.00	157.0	100.9	0	0	0.100	0.077	0.349
2026	623	1003	1003	0	0	0		0.00	157.0	100.9	0	0	0.101	0.078	0.354

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PRIORITY 3 PLANNING AREA

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	BASE POP.	UNSERVED POP.	RESORT POP.	POPULATION GROWTH (%)	I/I REDUCTION (GCD)	BASE 30 DAY PER CAPITA (GPCD)	GROWTH 30 DAY PER CAPITA (GPCD)	RESORT 30 DAY FLOW (MGD)	RESORT PEAK FLOW (MGD)	30 DAY AVG. FLOW (MGD)	90 DAY AVG. FLOW (MGD)	PEAK FLOW (MGD)
1996	0	1792	0	0	883	909	2.37	0.00	197.0	100.9	0.092	0.321	0.000	0.000	0.000
1997	0	1835	0	0	904	930	2.32	3.64	193.4	100.9	0.094	0.329	0.000	0.000	0.000
1998	0	1877	0	0	925	952	2.26	3.64	189.7	100.9	0.096	0.336	0.000	0.000	0.000
1999	0	1920	0	0	946	974	2.21	3.64	186.1	100.9	0.098	0.344	0.000	0.000	0.000
2000	0	1962	0	0	967	995	2.17	3.64	182.5	100.9	0.100	0.351	0.000	0.000	0.000
2001	0	2005	0	0	988	1017	2.12	3.64	178.8	100.9	0.103	0.359	0.000	0.000	0.000
2002	0	2047	0	0	1009	1038	2.08	3.64	175.2	100.9	0.105	0.367	0.000	0.000	0.000
2003	0	2090	0	0	1030	1060	2.03	3.64	171.6	100.9	0.107	0.374	0.000	0.000	0.000
2004	0	2132	0	0	1051	1081	1.99	3.64	167.9	100.9	0.109	0.382	0.000	0.000	0.000
2005	0	2175	0	0	1072	1103	1.95	3.64	164.3	100.9	0.111	0.389	0.000	0.000	0.000
2006	0	2217	0	0	1093	1124	1.92	3.64	160.6	100.9	0.113	0.397	0.000	0.000	0.000
2007	47	2260	76	0	1038	1146	1.88	3.64	157.0	100.9	0.116	0.405	0.008	0.006	0.026
2008	94	2302	151	0	984	1168	1.85	0.00	157.0	100.9	0.118	0.412	0.015	0.012	0.051
2009	141	2345	227	0	929	1189	1.81	0.00	157.0	100.9	0.120	0.420	0.023	0.018	0.077
2010	188	2387	302	0	874	1211	1.78	0.00	157.0	100.9	0.122	0.428	0.031	0.023	0.103
2011	235	2430	378	0	820	1232	1.75	0.00	157.0	100.9	0.124	0.435	0.038	0.029	0.128
2012	282	2472	454	0	765	1254	1.72	0.00	157.0	100.9	0.127	0.443	0.046	0.035	0.154
2013	329	2515	529	0	710	1275	1.69	0.00	157.0	100.9	0.129	0.450	0.053	0.041	0.179
2014	376	2557	605	0	656	1297	1.66	0.00	157.0	100.9	0.131	0.458	0.061	0.047	0.205
2015	423	2600	680	0	601	1318	1.63	0.00	157.0	100.9	0.133	0.466	0.069	0.053	0.231
2016	470	2642	756	0	546	1340	1.61	0.00	157.0	100.9	0.135	0.473	0.076	0.059	0.256
2017	516	2685	832	0	492	1361	1.58	0.00	157.0	100.9	0.137	0.481	0.084	0.065	0.282
2018	563	2727	907	0	437	1383	1.56	0.00	157.0	100.9	0.140	0.488	0.092	0.070	0.308
2019	610	2770	983	0	383	1405	1.53	0.00	157.0	100.9	0.142	0.496	0.099	0.076	0.333
2020	657	2812	1058	0	328	1426	1.51	0.00	157.0	100.9	0.144	0.504	0.107	0.082	0.359
2021	704	2855	1134	0	273	1448	1.49	0.00	157.0	100.9	0.146	0.511	0.114	0.088	0.384
2022	751	2897	1210	0	219	1469	1.47	0.00	157.0	100.9	0.148	0.519	0.122	0.094	0.410
2023	798	2940	1285	0	164	1491	1.45	0.00	157.0	100.9	0.150	0.526	0.130	0.100	0.436
2024	845	2982	1361	0	109	1512	1.42	0.00	157.0	100.9	0.153	0.534	0.137	0.106	0.461
2025	892	3025	1436	0	55	1534	1.40	0.00	157.0	100.9	0.155	0.542	0.145	0.112	0.487
2026	939	3067	1512	0	-0	1555		0.00	157.0	100.9	0.157	0.549	0.153	0.117	0.513

FREESE • NICHOLS

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PRIORITY AREA PROJECTIONS -- SOUTH DISTRICT
[ECC95301]V:\SPRIORTY.WK1

Date: 08/14/96
By: DRJ
Chkd:

SOUTH DISTRICT WASTEWATER

PRIORITY 4 PLANNING AREA

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	BASE POP.	UNSERVED POP.	RESORT POP.	POPULATION GROWTH (%)	I/I REDUCTION (GCD)	BASE 30 DAY PER CAPITA (GPCD)	GROWTH 30 DAY PER CAPITA (GPCD)	RESORT 30 DAY FLOW (MGD)	RESORT PEAK FLOW (MGD)	30 DAY AVG. FLOW (MGD)	90 DAY AVG. FLOW (MGD)	PEAK FLOW (MGD)
1996	0	482	0	0	482	0	1.17	0.00	197.0	100.9	0.000	0.000	0.000	0.000	0.000
1997	0	488	0	0	488	0	1.15	3.64	193.4	100.9	0.000	0.000	0.000	0.000	0.000
1998	0	493	0	0	493	0	1.14	3.64	189.7	100.9	0.000	0.000	0.000	0.000	0.000
1999	0	499	0	0	499	0	1.13	3.64	186.1	100.9	0.000	0.000	0.000	0.000	0.000
2000	0	505	0	0	505	0	1.11	3.64	182.5	100.9	0.000	0.000	0.000	0.000	0.000
2001	0	510	0	0	510	0	0.93	3.64	178.8	100.9	0.000	0.000	0.000	0.000	0.000
2002	0	515	0	0	515	0	0.92	3.64	175.2	100.9	0.000	0.000	0.000	0.000	0.000
2003	0	520	0	0	520	0	0.91	3.64	171.6	100.9	0.000	0.000	0.000	0.000	0.000
2004	0	525	0	0	525	0	0.91	3.64	167.9	100.9	0.000	0.000	0.000	0.000	0.000
2005	0	529	0	0	529	0	0.90	3.64	164.3	100.9	0.000	0.000	0.000	0.000	0.000
2006	0	534	0	0	534	0	0.89	3.64	160.6	100.9	0.000	0.000	0.000	0.000	0.000
2007	0	539	0	0	539	0	0.88	3.64	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2008	0	544	0	0	544	0	0.87	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2009	0	548	0	0	548	0	0.87	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2010	0	553	0	0	553	0	0.86	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2011	0	558	0	0	558	0	0.71	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2012	0	562	0	0	562	0	0.70	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2013	0	566	0	0	566	0	0.70	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2014	0	570	0	0	570	0	0.69	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2015	0	574	0	0	574	0	0.69	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2016	0	578	0	0	578	0	0.68	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2017	0	582	0	0	582	0	0.68	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2018	0	586	0	0	586	0	0.67	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2019	0	589	0	0	589	0	0.67	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2020	0	593	0	0	593	0	0.67	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2021	0	597	0	0	597	0	0.22	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2022	0	599	0	0	599	0	0.22	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2023	0	600	0	0	600	0	0.22	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2024	0	601	0	0	601	0	0.22	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2025	0	603	0	0	603	0	0.22	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2026	0	604	0	0	604	0	0.220	0.00	157.0	100.9	0.000	0.000	0.000	0.000	0.000
2028	39	607	63	0	544	0	0.220	0.00	157.0	100.9	0.000	0.000	0.006	0.005	0.020
2030	78	609	126	0	483	0	0.220	0.00	157.0	100.9	0.000	0.000	0.013	0.010	0.040
2032	118	612	189	0	423	0	0.220	0.00	157.0	100.9	0.000	0.000	0.019	0.015	0.060
2034	157	615	252	0	362	0	0.220	0.00	157.0	100.9	0.000	0.000	0.025	0.020	0.080
2036	196	617	315	0	302	0	0.220	0.00	157.0	100.9	0.000	0.000	0.032	0.025	0.100
2038	235	620	379	0	242	0	0.220	0.00	157.0	100.9	0.000	0.000	0.038	0.029	0.120
2040	274	623	442	0	181	0	0.220	0.00	157.0	100.9	0.000	0.000	0.045	0.034	0.140
2042	314	626	505	0	121	0	0.220	0.00	157.0	100.9	0.000	0.000	0.051	0.039	0.160
2044	353	628	568	0	60	0	0.220	0.00	157.0	100.9	0.000	0.000	0.057	0.044	0.181
2046	392	631	631	0	0	0		0.00	157.0	100.9	0.000	0.000	0.064	0.049	0.201

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PRIORITY AREA PROJECTIONS -- SOUTH DISTRICT
[ECC95301]V:\SPRIORTY.WK1

Date: 08/14/96
By: DRJ
Chkd:

SOUTH DISTRICT WASTEWATER

SOUTH WASTEWATER TOTALS

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	BASE POP.	UNSERVED POP.	RESORT POP.	POPULATION GROWTH (%)	I/I REDUCTION (GCD)	BASE 30 DAY PER CAPITA (GPCD)	GROWTH 30 DAY PER CAPITA (GPCD)	RESORT 30 DAY FLOW (MGD)	RESORT PEAK FLOW (MGD)	30 DAY AVG. FLOW (MGD)	90 DAY AVG. FLOW (MGD)	PEAK FLOW (MGD)
1996	536	5315	863	863	3543	909	2.07	0.00	197.00	100.90	0.092	0.321	0.170	0.131	0.595
1997	698	5435	1123	863	3381	930	2.03	3.64	193.36	100.90	0.094	0.329	0.193	0.149	0.676
1998	860	5555	1384	863	3219	952	1.98	3.64	189.73	100.90	0.096	0.336	0.216	0.167	0.757
1999	1021	5675	1644	863	3057	974	1.94	3.64	186.09	100.90	0.098	0.344	0.239	0.184	0.838
2000	1183	5795	1905	863	2895	995	1.90	3.64	182.46	100.90	0.100	0.351	0.263	0.202	0.919
2001	1345	5916	2165	863	2734	1017	1.82	3.64	178.82	100.90	0.103	0.359	0.286	0.220	1.000
2002	1507	6035	2426	863	2571	1038	1.79	3.64	175.19	100.90	0.105	0.367	0.309	0.238	1.081
2003	1668	6154	2686	863	2408	1060	1.75	3.64	171.55	100.90	0.107	0.374	0.332	0.256	1.162
2004	1830	6274	2947	863	2246	1081	1.72	3.64	167.92	100.90	0.109	0.382	0.355	0.273	1.243
2005	1992	6393	3207	863	2083	1103	1.69	3.64	164.28	100.90	0.111	0.389	0.378	0.291	1.324
2006	2154	6512	3468	863	1920	1124	1.66	3.64	160.65	100.90	0.113	0.397	0.401	0.309	1.405
2007	2264	6632	3645	863	1841	1146	1.63	3.64	157.01	100.90	0.116	0.405	0.416	0.320	1.456
2008	2374	6751	3822	863	1762	1168	1.60	0.00	157.01	100.90	0.118	0.412	0.434	0.334	1.517
2009	2484	6870	3999	863	1683	1189	1.58	0.00	157.01	100.90	0.120	0.420	0.452	0.348	1.578
2010	2594	6990	4176	863	1603	1211	1.55	0.00	157.01	100.90	0.122	0.428	0.470	0.362	1.640
2011	2703	7109	4353	863	1524	1232	1.49	0.00	157.01	100.90	0.124	0.435	0.488	0.375	1.701
2012	2813	7227	4530	863	1444	1254	1.46	0.00	157.01	100.90	0.127	0.443	0.505	0.389	1.763
2013	2923	7346	4706	863	1364	1275	1.44	0.00	157.01	100.90	0.129	0.450	0.523	0.403	1.824
2014	3033	7464	4883	863	1284	1297	1.42	0.00	157.01	100.90	0.131	0.458	0.541	0.417	1.886
2015	3143	7583	5060	863	1204	1318	1.40	0.00	157.01	100.90	0.133	0.466	0.559	0.430	1.947
2016	3253	7702	5237	863	1124	1340	1.38	0.00	157.01	100.90	0.135	0.473	0.577	0.444	2.008
2017	3345	7820	5385	863	1073	1361	1.36	0.00	157.01	100.90	0.137	0.481	0.592	0.456	2.059
2018	3436	7939	5533	863	1023	1383	1.34	0.00	157.01	100.90	0.140	0.488	0.607	0.467	2.111
2019	3528	8057	5680	863	972	1405	1.32	0.00	157.01	100.90	0.142	0.496	0.622	0.479	2.162
2020	3620	8176	5828	863	921	1426	1.30	0.00	157.01	100.90	0.144	0.504	0.636	0.490	2.213
2021	3712	8294	5976	863	871	1448	1.17	0.00	157.01	100.90	0.146	0.511	0.651	0.502	2.264
2022	3803	8410	6123	863	817	1469	1.16	0.00	157.01	100.90	0.148	0.519	0.666	0.513	2.315
2023	3895	8526	6271	863	764	1491	1.14	0.00	157.01	100.90	0.150	0.526	0.681	0.525	2.366
2024	3987	8642	6419	863	711	1512	1.12	0.00	157.01	100.90	0.153	0.534	0.696	0.536	2.417
2025	4079	8758	6566	863	657	1534	1.11	0.00	157.01	100.90	0.155	0.542	0.711	0.547	2.468
2026	4170	8874	6714	863	604	1555	0.06	0.00	157.01	100.90	0.157	0.549	0.726	0.559	2.519

SOUTH DISTRICT WATER

PRIORITY 1 PLANNING AREA

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	RESORT SERVICE POP.	P.S. SERVICE POP.	LAKESHORE SERVICE POP.	CAROLYNN SERVICE POP.	UNSERVED POP.	POPULATION GROWTH (%)	PER CAPITA WATER (GCD)	RESORT MAX DAY (MGD)	P.S. MAX DAY (MGD)	LAKESHORE MAX DAY (MGD)	CAROLYNN DEMAND (MGD)	AVG DAY DEMAND (MGD)	MAX DAY DEMAND (MGD)
1996	1524	2454	2454	0	0	0	0	0	2.37	115.38	0.000	0.000	0.000	0.000	0.283	0.773
1997	1560	2512	2512	0	0	0	0	0	2.32	115.38	0.000	0.000	0.000	0.000	0.290	0.791
1998	1596	2570	2570	0	0	0	0	0	2.26	115.38	0.000	0.000	0.000	0.000	0.297	0.810
1999	1633	2629	2628	0	0	0	0	0	2.21	115.38	0.000	0.000	0.000	0.000	0.303	0.828
2000	1669	2687	2687	0	0	0	0	0	2.17	115.38	0.000	0.000	0.000	0.000	0.310	0.846
2001	1705	2745	2745	0	0	0	0	0	2.12	115.38	0.000	0.000	0.000	0.000	0.317	0.865
2002	1741	2803	2803	0	0	0	0	0	2.08	115.38	0.000	0.000	0.000	0.000	0.323	0.883
2003	1777	2861	2861	0	0	0	0	0	2.03	115.38	0.000	0.000	0.000	0.000	0.330	0.901
2004	1813	2919	2919	0	0	0	0	0	1.99	115.38	0.000	0.000	0.000	0.000	0.337	0.920
2005	1849	2978	2978	0	0	0	0	0	1.95	115.38	0.000	0.000	0.000	0.000	0.344	0.938
2006	1886	3036	3036	0	0	0	0	0	1.92	115.38	0.000	0.000	0.000	0.000	0.350	0.956
2007	1922	3094	3094	0	0	0	0	0	1.88	115.38	0.000	0.000	0.000	0.000	0.357	0.975
2008	1958	3152	3152	0	0	0	0	0	1.85	115.38	0.000	0.000	0.000	0.000	0.364	0.993
2009	1994	3210	3210	0	0	0	0	0	1.81	115.38	0.000	0.000	0.000	0.000	0.370	1.011
2010	2030	3269	3268	0	0	0	0	0	1.78	115.38	0.000	0.000	0.000	0.000	0.377	1.030
2011	2066	3327	3327	0	0	0	0	0	1.75	115.38	0.000	0.000	0.000	0.000	0.384	1.048
2012	2102	3385	3385	0	0	0	0	0	1.72	115.38	0.000	0.000	0.000	0.000	0.391	1.066
2013	2138	3443	3443	0	0	0	0	0	1.69	115.38	0.000	0.000	0.000	0.000	0.397	1.084
2014	2175	3501	3501	0	0	0	0	0	1.66	115.38	0.000	0.000	0.000	0.000	0.404	1.103
2015	2211	3559	3559	0	0	0	0	0	1.63	115.38	0.000	0.000	0.000	0.000	0.411	1.121
2016	2247	3618	3618	0	0	0	0	0	1.61	115.38	0.000	0.000	0.000	0.000	0.417	1.139
2017	2283	3676	3676	0	0	0	0	0	1.58	115.38	0.000	0.000	0.000	0.000	0.424	1.158
2018	2319	3734	3734	0	0	0	0	0	1.56	115.38	0.000	0.000	0.000	0.000	0.431	1.176
2019	2355	3792	3792	0	0	0	0	0	1.53	115.38	0.000	0.000	0.000	0.000	0.438	1.194
2020	2391	3850	3850	0	0	0	0	0	1.51	115.38	0.000	0.000	0.000	0.000	0.444	1.213
2021	2428	3909	3908	0	0	0	0	0	1.49	115.38	0.000	0.000	0.000	0.000	0.451	1.231
2022	2464	3967	3967	0	0	0	0	0	1.47	115.38	0.000	0.000	0.000	0.000	0.458	1.249
2023	2500	4025	4025	0	0	0	0	0	1.45	115.38	0.000	0.000	0.000	0.000	0.464	1.268
2024	2536	4083	4083	0	0	0	0	0	1.42	115.38	0.000	0.000	0.000	0.000	0.471	1.286
2025	2572	4141	4141	0	0	0	0	0	1.40	115.38	0.000	0.000	0.000	0.000	0.478	1.304
2026	2608	4199	4199	0	0	0	0	0		115.38	0.000	0.000	0.000	0.000	0.485	1.323

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[ECC95301]V:\SPRIORTY.WK1

Date: 06/14/96
By: DRJ
Chkd:

SOUTH DISTRICT WATER

PRIORITY 2 PLANNING AREA

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	RESORT SERVICE POP.	P.S. SERVICE POP.	LAKESHORE SERVICE POP.	CAROLYNN SERVICE POP.	UNSERVED POP.	POPULATION GROWTH (%)	PER CAPITA WATER (GCD)	RESORT MAX DAY (MGD)	P.S. MAX DAY (MGD)	LAKESHORE MAX DAY (MGD)	CAROLYNN DEMAND (MGD)	AVG DAY DEMAND (MGD)	MAX DAY DEMAND (MGD)
1996	236	586	380	127	0	0	0	80	2.37	115.38	0.040	0.000	0.000	0.000	0.044	0.120
1997	245	600	395	130	0	0	0	76	2.32	115.38	0.041	0.000	0.000	0.000	0.046	0.124
1998	254	614	409	133	0	0	0	72	2.26	115.38	0.042	0.000	0.000	0.000	0.047	0.129
1999	264	628	424	136	0	0	0	68	2.21	115.38	0.043	0.000	0.000	0.000	0.049	0.134
2000	273	642	439	139	0	0	0	64	2.17	115.38	0.044	0.000	0.000	0.000	0.051	0.138
2001	282	655	454	142	0	0	0	60	2.12	115.38	0.045	0.000	0.000	0.000	0.052	0.143
2002	291	669	469	145	0	0	0	56	2.08	115.38	0.046	0.000	0.000	0.000	0.054	0.148
2003	301	683	484	148	0	0	0	52	2.03	115.38	0.047	0.000	0.000	0.000	0.056	0.152
2004	310	697	499	151	0	0	0	48	1.99	115.38	0.047	0.000	0.000	0.000	0.058	0.157
2005	319	711	514	154	0	0	0	44	1.95	115.38	0.048	0.000	0.000	0.000	0.059	0.162
2006	328	725	529	157	0	0	0	40	1.92	115.38	0.049	0.000	0.000	0.000	0.061	0.167
2007	338	739	543	160	0	0	0	36	1.88	115.38	0.050	0.000	0.000	0.000	0.063	0.171
2008	347	753	558	163	0	0	0	32	1.85	115.38	0.051	0.000	0.000	0.000	0.064	0.176
2009	356	767	573	166	0	0	0	28	1.81	115.38	0.052	0.000	0.000	0.000	0.066	0.181
2010	365	781	588	169	0	0	0	24	1.78	115.38	0.053	0.000	0.000	0.000	0.068	0.185
2011	375	794	603	172	0	0	0	20	1.75	115.38	0.054	0.000	0.000	0.000	0.070	0.190
2012	384	808	618	175	0	0	0	16	1.72	115.38	0.055	0.000	0.000	0.000	0.071	0.195
2013	393	822	633	178	0	0	0	12	1.69	115.38	0.056	0.000	0.000	0.000	0.073	0.199
2014	402	836	648	181	0	0	0	8	1.66	115.38	0.057	0.000	0.000	0.000	0.075	0.204
2015	412	850	663	184	0	0	0	4	1.63	115.38	0.058	0.000	0.000	0.000	0.076	0.209
2016	420	864	677	187	0	0	0	0	1.61	115.38	0.059	0.000	0.000	0.000	0.078	0.213
2017	427	878	688	190	0	0	0	0	1.58	115.38	0.060	0.000	0.000	0.000	0.079	0.217
2018	434	892	699	193	0	0	0	0	1.56	115.38	0.061	0.000	0.000	0.000	0.081	0.220
2019	441	906	710	196	0	0	0	0	1.53	115.38	0.062	0.000	0.000	0.000	0.082	0.224
2020	448	919	721	199	0	0	0	0	1.51	115.38	0.063	0.000	0.000	0.000	0.083	0.227
2021	454	933	731	202	0	0	0	0	1.49	115.38	0.064	0.000	0.000	0.000	0.084	0.230
2022	461	947	742	205	0	0	0	0	1.47	115.38	0.064	0.000	0.000	0.000	0.086	0.234
2023	468	961	753	208	0	0	0	0	1.45	115.38	0.065	0.000	0.000	0.000	0.087	0.237
2024	475	975	764	211	0	0	0	0	1.42	115.38	0.066	0.000	0.000	0.000	0.088	0.241
2025	481	989	775	214	0	0	0	0	1.40	115.38	0.067	0.000	0.000	0.000	0.089	0.244
2026	488	1003	786	217	0	0	0	0		115.38	0.068	0.000	0.000	0.000	0.091	0.248

FREESE • NICHOLS

Simon W. Freese, P.E. 1900–1990
Marvin C. Nichols, P.E. 1896–1969

Title: EAST CEDAR CREEK FWSD WATER AND WASTEWATER MASTERPLAN
PRIORITY AREA PROJECTIONS -- SOUTH DISTRICT
[ECC95301]V:\SPRIORTY.WK1

Date: 08/14/96
By: DRJ
Chkd:

SOUTH DISTRICT WATER

PRIORITY 3 PLANNING AREA

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	RESORT SERVICE POP.	P.S. SERVICE POP.	LAKESHORE SERVICE POP.	CAROLYNN SERVICE POP.	UNSERVED POP.	POPULATION GROWTH (%)	PER CAPITA WATER (GCD)	RESORT MAX DAY (MGD)	P.S. MAX DAY (MGD)	LAKESHORE MAX DAY (MGD)	CAROLYNN DEMAND (MGD)	AVG DAY DEMAND (MGD)	MAX DAY DEMAND (MGD)
1996	0	1792	0	1162	337	71	222	0	2.37	115.38	0.366	0.106	0.022	0.070	0.000	0.000
1997	0	1835	0	1190	345	73	228	0	2.32	115.38	0.375	0.109	0.023	0.072	0.000	0.000
1998	0	1877	0	1217	353	74	233	0	2.26	115.38	0.383	0.111	0.023	0.073	0.000	0.000
1999	0	1920	0	1245	361	76	238	0	2.21	115.38	0.392	0.114	0.024	0.075	0.000	0.000
2000	0	1962	0	1272	368	78	243	0	2.17	115.38	0.401	0.116	0.025	0.077	0.000	0.000
2001	0	2005	0	1300	376	79	249	0	2.12	115.38	0.409	0.119	0.025	0.078	0.000	0.000
2002	0	2047	0	1327	384	81	254	0	2.08	115.38	0.418	0.121	0.026	0.080	0.000	0.000
2003	0	2090	0	1355	392	83	259	0	2.03	115.38	0.427	0.124	0.026	0.082	0.000	0.000
2004	0	2132	0	1383	400	85	265	0	1.99	115.38	0.435	0.126	0.027	0.083	0.000	0.000
2005	0	2175	0	1410	408	86	270	0	1.95	115.38	0.444	0.129	0.027	0.085	0.000	0.000
2006	0	2217	0	1438	416	88	275	0	1.92	115.38	0.453	0.131	0.028	0.087	0.000	0.000
2007	0	2260	0	1465	424	90	280	0	1.88	115.38	0.462	0.134	0.028	0.088	0.000	0.000
2008	0	2302	0	1493	432	91	286	0	1.85	115.38	0.470	0.136	0.029	0.090	0.000	0.000
2009	0	2345	0	1520	440	93	291	0	1.81	115.38	0.479	0.139	0.029	0.092	0.000	0.000
2010	0	2387	0	1548	448	95	296	0	1.78	115.38	0.488	0.141	0.030	0.093	0.000	0.000
2011	0	2430	0	1575	456	96	301	0	1.75	115.38	0.496	0.144	0.030	0.095	0.000	0.000
2012	0	2472	0	1603	464	98	307	0	1.72	115.38	0.505	0.146	0.031	0.097	0.000	0.000
2013	0	2515	0	1631	472	100	312	0	1.69	115.38	0.514	0.149	0.031	0.098	0.000	0.000
2014	0	2557	0	1658	480	101	317	0	1.66	115.38	0.522	0.151	0.032	0.100	0.000	0.000
2015	0	2600	0	1686	488	103	323	0	1.63	115.38	0.531	0.154	0.032	0.102	0.000	0.000
2016	0	2642	0	1713	496	105	328	0	1.61	115.38	0.540	0.156	0.033	0.103	0.000	0.000
2017	0	2685	0	1741	504	106	333	0	1.58	115.38	0.548	0.159	0.034	0.105	0.000	0.000
2018	0	2727	0	1768	512	108	338	0	1.56	115.38	0.557	0.161	0.034	0.107	0.000	0.000
2019	0	2770	0	1796	520	110	344	0	1.53	115.38	0.566	0.164	0.035	0.108	0.000	0.000
2020	0	2812	0	1823	528	111	349	0	1.51	115.38	0.574	0.166	0.035	0.110	0.000	0.000
2021	0	2855	0	1851	536	113	354	0	1.49	115.38	0.583	0.169	0.036	0.112	0.000	0.000
2022	0	2897	0	1879	544	115	359	0	1.47	115.38	0.592	0.171	0.036	0.113	0.000	0.000
2023	0	2940	0	1906	552	117	365	0	1.45	115.38	0.600	0.174	0.037	0.115	0.000	0.000
2024	0	2982	0	1934	560	118	370	0	1.42	115.38	0.609	0.176	0.037	0.117	0.000	0.000
2025	0	3025	0	1961	568	120	375	0	1.40	115.38	0.618	0.179	0.038	0.118	0.000	0.000
2026	0	3067	0	1989	576	122	380	0		115.38	0.626	0.181	0.038	0.120	0.000	0.000

FREESE • NICHOLS

Simon W. Freese, P.E. 1900–1990
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PRIORITY AREA PROJECTIONS -- SOUTH DISTRICT
[ECC95301]V:\SPRIORTY.WK1

Date: 08/14/96
By: DRJ
Chkd:

SOUTH DISTRICT WATER

PRIORITY 4 PLANNING AREA

PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	RESORT SERVICE POP.	P.S. SERVICE POP.	LAKESHORE SERVICE POP.	CAROLYNN SERVICE POP.	UNSERVED POP.	POPULATION GROWTH (%)	PER CAPITA WATER (GCD)	RESORT MAX DAY (MGD)	P.S. MAX DAY (MGD)	LAKESHORE MAX DAY (MGD)	CAROLYNN DEMAND (MGD)	AVG DAY DEMAND (MGD)	MAX DAY DEMAND (MGD)
1996	0	482	0	0	0	0	0	482	1.17	115.38	0.000	0.000	0.000	0.000	0.000	0.000
1997	0	488	0	0	0	0	0	488	1.15	115.38	0.000	0.000	0.000	0.000	0.000	0.000
1998	0	493	0	0	0	0	0	493	1.14	115.38	0.000	0.000	0.000	0.000	0.000	0.000
1999	0	499	0	0	0	0	0	499	1.13	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2000	0	505	0	0	0	0	0	505	1.11	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2001	0	510	0	0	0	0	0	510	0.93	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2002	0	515	0	0	0	0	0	515	0.92	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2003	0	520	0	0	0	0	0	520	0.91	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2004	0	525	0	0	0	0	0	525	0.91	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2005	0	529	0	0	0	0	0	529	0.90	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2006	0	534	0	0	0	0	0	534	0.89	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2007	0	539	0	0	0	0	0	539	0.88	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2008	0	544	0	0	0	0	0	544	0.87	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2009	0	548	0	0	0	0	0	548	0.87	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2010	0	553	0	0	0	0	0	553	0.86	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2011	0	558	0	0	0	0	0	558	0.71	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2012	0	562	0	0	0	0	0	562	0.70	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2013	0	566	0	0	0	0	0	566	0.70	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2014	0	570	0	0	0	0	0	570	0.69	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2015	0	574	0	0	0	0	0	574	0.69	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2016	0	578	0	0	0	0	0	578	0.68	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2017	0	582	0	0	0	0	0	582	0.68	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2018	0	586	0	0	0	0	0	586	0.67	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2019	0	589	0	0	0	0	0	589	0.67	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2020	0	593	0	0	0	0	0	593	0.67	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2021	0	597	0	0	0	0	0	597	0.22	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2022	0	599	0	0	0	0	0	599	0.22	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2023	0	600	0	0	0	0	0	600	0.22	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2024	0	601	0	0	0	0	0	601	0.22	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2025	0	603	0	0	0	0	0	603	0.22	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2026	0	604	0	0	0	0	0	604	0.22	115.38	0.000	0.000	0.000	0.000	0.000	0.000
2028	39	607	63	0	0	0	0	544	0.22	115.38	0.000	0.000	0.000	0.000	0.007	0.020
2030	78	609	126	0	0	0	0	483	0.22	115.38	0.000	0.000	0.000	0.000	0.015	0.040
2032	118	612	189	0	0	0	0	423	0.22	115.38	0.000	0.000	0.000	0.000	0.022	0.060
2034	157	615	252	0	0	0	0	362	0.22	115.38	0.000	0.000	0.000	0.000	0.029	0.079
2036	196	617	315	0	0	0	0	302	0.22	115.38	0.000	0.000	0.000	0.000	0.036	0.099
2038	235	620	379	0	0	0	0	242	0.22	115.38	0.000	0.000	0.000	0.000	0.044	0.119
2040	274	623	442	0	0	0	0	181	0.22	115.38	0.000	0.000	0.000	0.000	0.051	0.139
2042	314	626	505	0	0	0	0	121	0.22	115.38	0.000	0.000	0.000	0.000	0.058	0.159
2044	353	628	568	0	0	0	0	60	0.22	115.38	0.000	0.000	0.000	0.000	0.066	0.179
2046	392	631	631	0	0	0	0	0	0.22	115.38	0.000	0.000	0.000	0.000	0.073	0.199

Title: EAST CEDAR CREEK FWSD WATER AND WASTEWATER MASTERPLAN
PRIORITY AREA PROJECTIONS -- SOUTH DISTRICT
[ECC95301]V:\SPRIORTY.WK1

Date: 08/14/96
By: DRJ
Chkd:

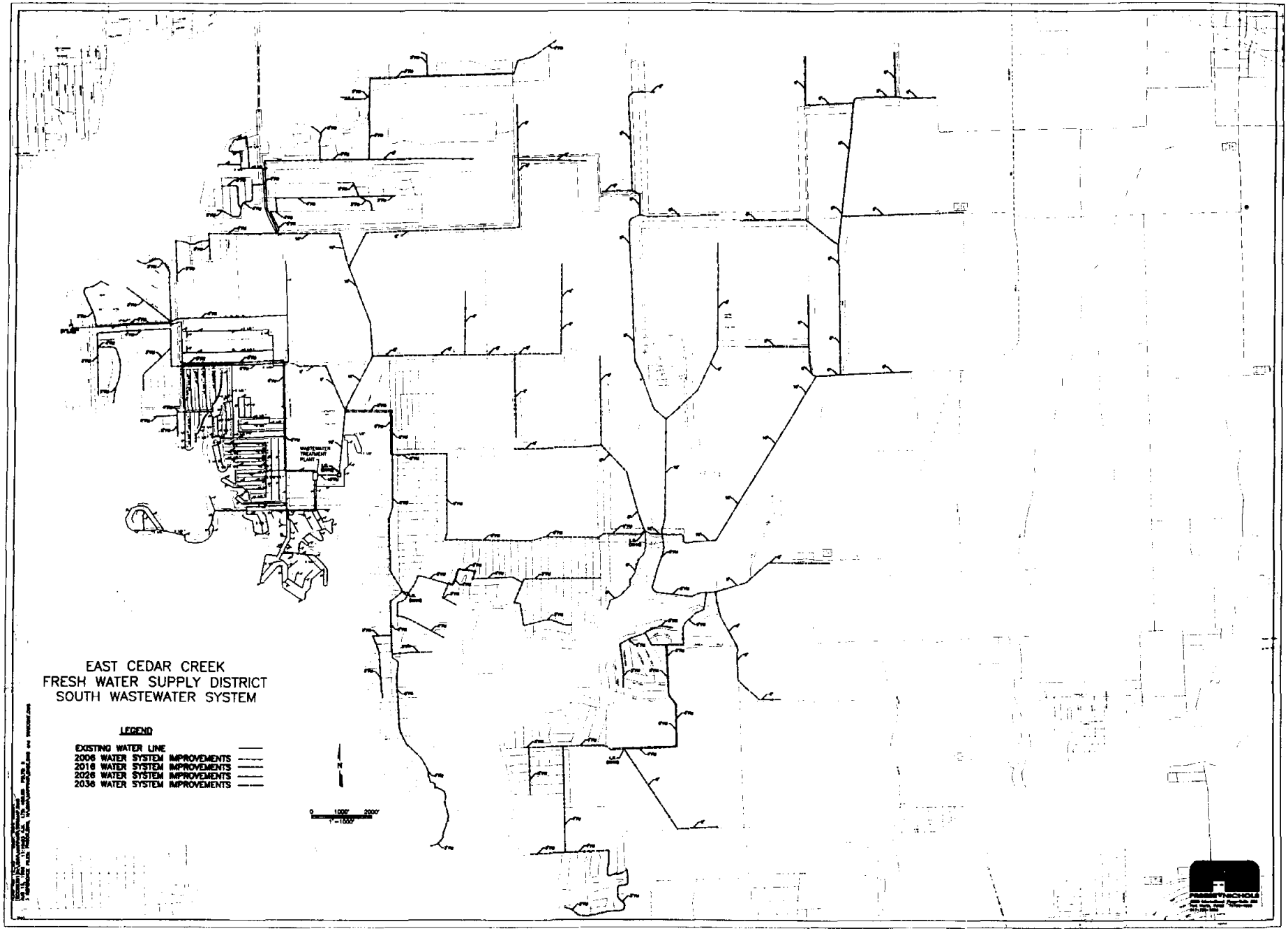
SOUTH DISTRICT WATER

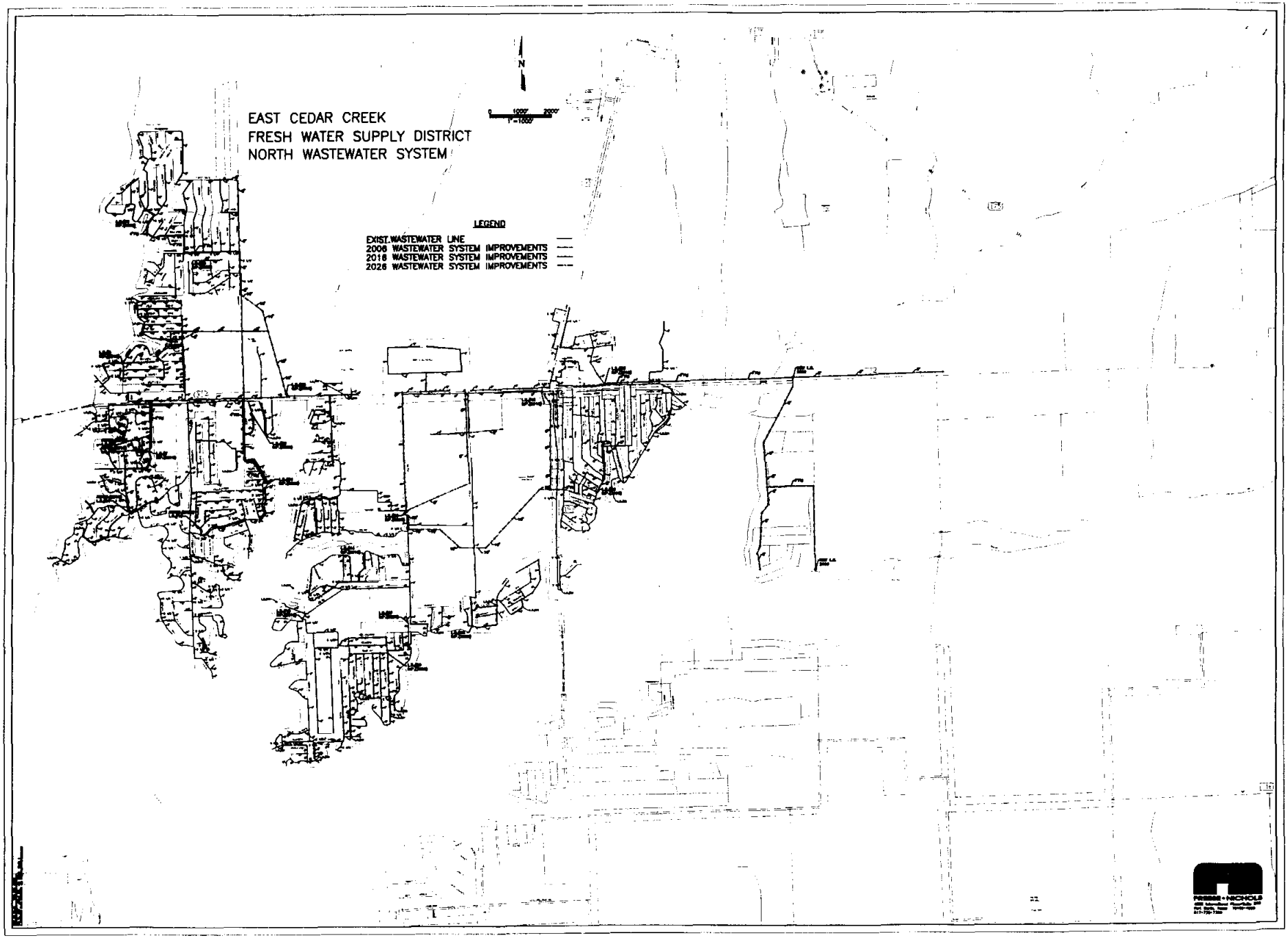
SOUTH WATER TOTALS

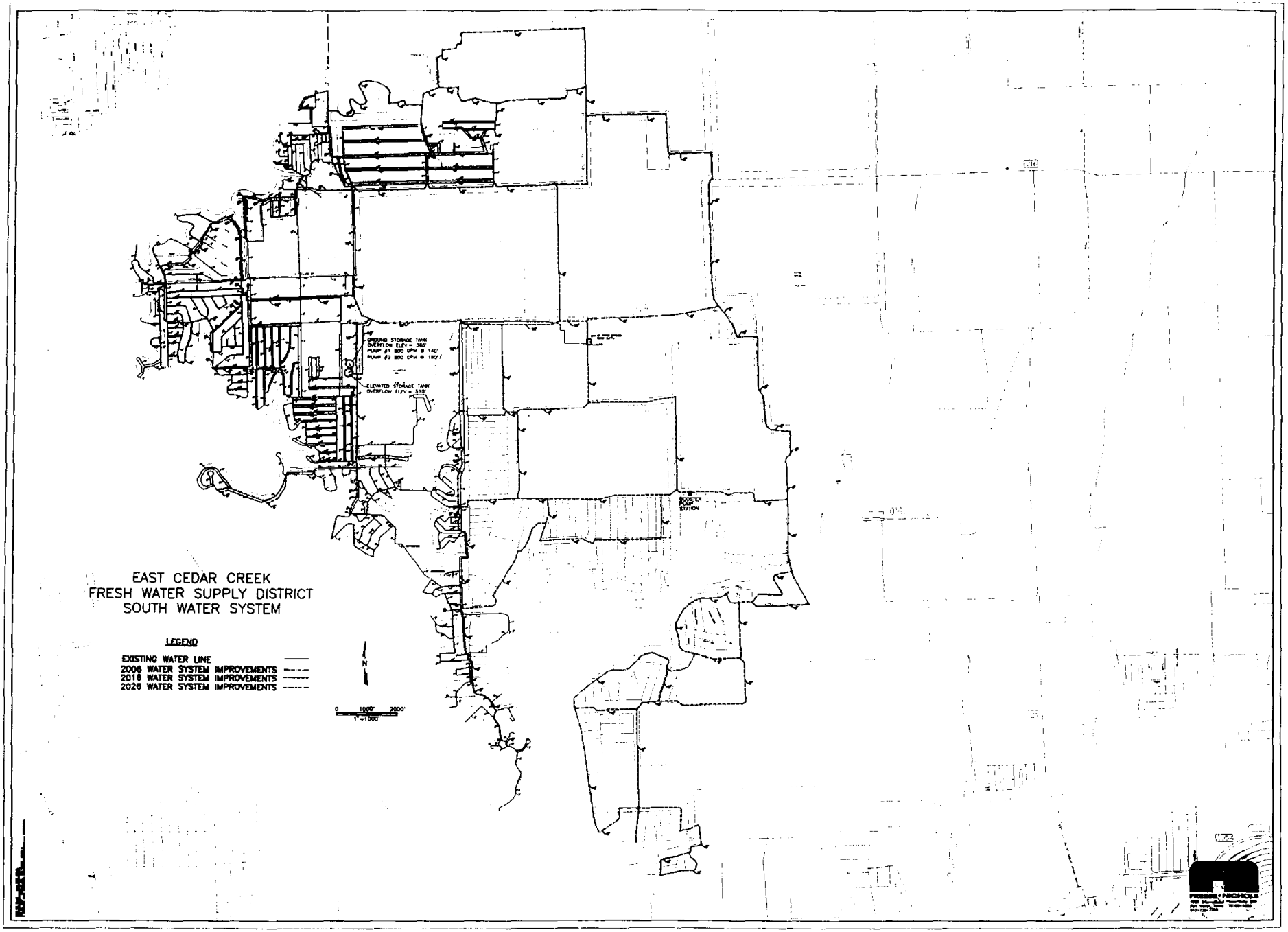
PLAN YEAR	ACTIVE CONN.	TOTAL POP.	SERVED POP.	RESORT SERVICE POP.	P.S. SERVICE POP.	LAKESHORE SERVICE POP.	CAROLYNN SERVICE POP.	UNSERVED POP.	POPULATION GROWTH (%)	PER CAPITA WATER (GCD)	RESORT MAX DAY (MGD)	P.S. MAX DAY (MGD)	LAKESHORE MAX DAY (MGD)	CAROLYNN MAX DAY (MGD)	AVG DAY DEMAND (MGD)	MAX DAY DEMAND (MGD)
1996	1760	5315	2834	1289	337	71	222	562	2.07	115.38	0.406	0.106	0.022	0.070	0.327	0.893
1997	1805	5435	2907	1319	345	73	228	564	2.03	115.38	0.416	0.109	0.023	0.072	0.335	0.916
1998	1851	5555	2980	1350	353	74	233	566	1.98	115.38	0.425	0.111	0.023	0.073	0.344	0.939
1999	1896	5675	3053	1381	361	76	238	567	1.94	115.38	0.435	0.114	0.024	0.075	0.352	0.962
2000	1942	5795	3126	1411	368	78	243	569	1.90	115.38	0.444	0.116	0.025	0.077	0.361	0.985
2001	1987	5916	3199	1442	376	79	249	570	1.82	115.38	0.454	0.119	0.025	0.078	0.369	1.008
2002	2032	6035	3272	1472	384	81	254	571	1.79	115.38	0.464	0.121	0.026	0.080	0.378	1.031
2003	2078	6154	3345	1503	392	83	259	572	1.75	115.38	0.473	0.124	0.026	0.082	0.386	1.054
2004	2123	6274	3418	1533	400	85	265	573	1.72	115.38	0.483	0.126	0.027	0.083	0.394	1.077
2005	2168	6393	3491	1564	408	86	270	573	1.69	115.38	0.493	0.129	0.027	0.085	0.403	1.100
2006	2214	6512	3564	1594	416	88	275	574	1.66	115.38	0.502	0.131	0.028	0.087	0.411	1.123
2007	2259	6632	3637	1625	424	90	280	575	1.63	115.38	0.512	0.134	0.028	0.088	0.420	1.146
2008	2305	6751	3710	1656	432	91	286	576	1.60	115.38	0.521	0.136	0.029	0.090	0.428	1.169
2009	2350	6870	3784	1686	440	93	291	577	1.58	115.38	0.531	0.139	0.029	0.092	0.437	1.192
2010	2395	6990	3857	1717	448	95	296	577	1.55	115.38	0.541	0.141	0.030	0.093	0.445	1.215
2011	2441	7109	3930	1747	456	96	301	578	1.49	115.38	0.550	0.144	0.030	0.095	0.453	1.238
2012	2486	7227	4003	1778	464	98	307	578	1.46	115.38	0.560	0.146	0.031	0.097	0.462	1.261
2013	2532	7346	4076	1808	472	100	312	578	1.44	115.38	0.570	0.149	0.031	0.098	0.470	1.284
2014	2577	7464	4149	1839	480	101	317	578	1.42	115.38	0.579	0.151	0.032	0.100	0.479	1.307
2015	2622	7583	4222	1869	488	103	323	578	1.40	115.38	0.589	0.154	0.032	0.102	0.487	1.330
2016	2667	7702	4295	1900	496	105	328	578	1.38	115.38	0.598	0.156	0.033	0.103	0.496	1.353
2017	2710	7820	4364	1931	504	106	333	582	1.36	115.38	0.608	0.159	0.034	0.105	0.503	1.374
2018	2753	7939	4433	1961	512	108	338	586	1.34	115.38	0.618	0.161	0.034	0.107	0.511	1.396
2019	2796	8057	4502	1992	520	110	344	590	1.32	115.38	0.627	0.164	0.035	0.108	0.519	1.418
2020	2839	8176	4571	2022	528	111	349	594	1.30	115.38	0.637	0.166	0.035	0.110	0.527	1.440
2021	2882	8294	4640	2053	536	113	354	598	1.17	115.38	0.647	0.169	0.036	0.112	0.535	1.462
2022	2925	8410	4709	2083	544	115	359	599	1.16	115.38	0.656	0.171	0.036	0.113	0.543	1.483
2023	2968	8526	4778	2114	552	117	365	601	1.14	115.38	0.666	0.174	0.037	0.115	0.551	1.505
2024	3011	8642	4847	2144	560	118	370	602	1.12	115.38	0.675	0.176	0.037	0.117	0.559	1.527
2025	3054	8758	4916	2175	568	120	375	603	1.11	115.38	0.685	0.179	0.038	0.118	0.567	1.549
2026	3096	8874	4985	2206	576	122	380	605		115.38	0.695	0.181	0.038	0.120	0.575	1.570

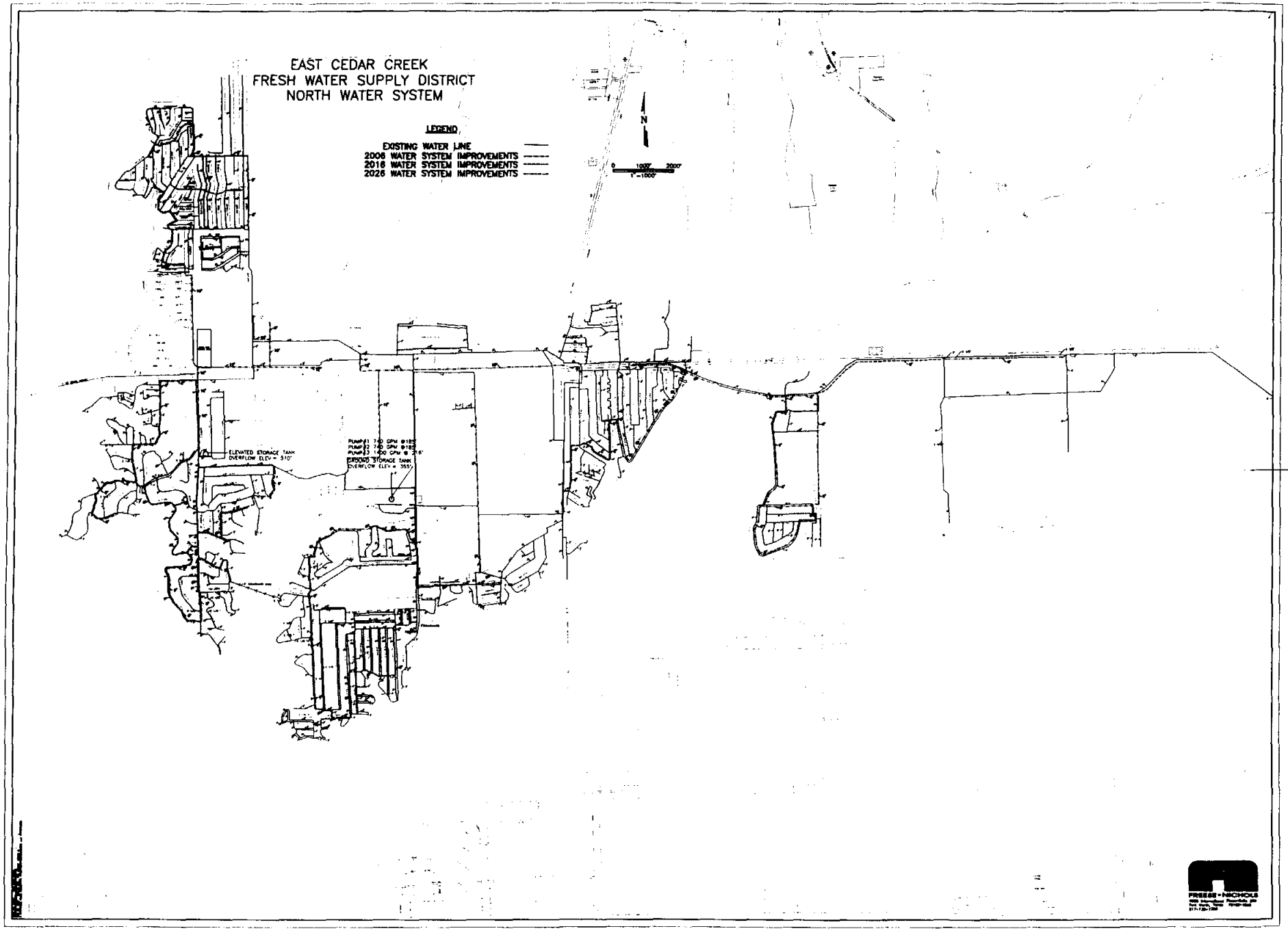
ATTACHMENT 2-C

MODELING AND SYSTEM MAPPING


EAST CEDAR CREEK
FRESH WATER SUPPLY DISTRICT
SOUTH WASTEWATER SYSTEM
LEGEND
EXISTING WATER LINE
2006 WATER SYSTEM IMPROVEMENTS
2016 WATER SYSTEM IMPROVEMENTS
2026 WATER SYSTEM IMPROVEMENTS
2036 WATER SYSTEM IMPROVEMENTS
WASTEWATER TREATMENT PLANT
N
0 1000' 2000'
1"=1000'


EAST CEDAR CREEK
FRESH WATER SUPPLY DISTRICT
NORTH WASTEWATER SYSTEM
N
LEGEND
EXIST. WASTEWATER LINE
2006 WASTEWATER SYSTEM IMPROVEMENTS
2016 WASTEWATER SYSTEM IMPROVEMENTS
2026 WASTEWATER SYSTEM IMPROVEMENTS


EAST CEDAR CREEK
FRESH WATER SUPPLY DISTRICT
SOUTH WATER SYSTEM
LEGEND
EXISTING WATER LINE
2006 WATER SYSTEM IMPROVEMENTS
2016 WATER SYSTEM IMPROVEMENTS
2026 WATER SYSTEM IMPROVEMENTS
N
0 1000' 2000'
1"=1000'
BOOSTER PUMP STATION


EAST CEDAR CREEK
FRESH WATER SUPPLY DISTRICT
NORTH WATER SYSTEM
LEGEND
EXISTING WATER LINE
2006 WATER SYSTEM IMPROVEMENTS
2016 WATER SYSTEM IMPROVEMENTS
2026 WATER SYSTEM IMPROVEMENTS
N
0 1000' 2000'
1"=1000'
ELEVATED STORAGE TANK
OVERFLOW ELEV = 510'
GROUND STORAGE TANK
OVERFLOW ELEV = 355'
FREESE + NICHOLS

APPENDIX C

TECHNICAL MEMORANDUM #3

RECOMMENDATIONS AND IMPLEMENTATION PLAN SUMMARY

EAST CEDAR CREEK
FRESH WATER SUPPLY DISTRICT

WATER & WASTEWATER MASTER PLAN

TECHNICAL MEMORANDUM #3

SUMMARY OF TASKS E AND F
RECOMMENDATIONS AND IMPLEMENTATION PLAN

OCTOBER 1996

FREESE • NICHOLS

ECC95301

TABLE OF CONTENTS

LIST OF TABLES

1.0 INTRODUCTION

1.1 BACKGROUND

The East Cedar Creek Fresh Water Supply District (ECCFWSD) consists of two separate water distribution and wastewater collection systems, the North System and the South System. Each System is hydraulically independent and has its own water and wastewater treatment plants, elevated water storage tanks, and distribution and collection system piping. Both of the wastewater collection systems are primarily pressure systems with the North System using about half gravity sewers and the South System using mostly force main piping with a small amount of gravity sewer. Each System was evaluated as to the current condition and expected future conditions of the treatment plants, sewage collection systems and water distribution systems and their ability to meet current TNRCC State Design Criteria.

The North District water system includes a 2.55 million gallon per day (MGD) water treatment plant, 500,000 gallon elevated storage tank, and water distribution piping. District records indicate that the North water distribution system served an average of 2,896 water connections in 1995. The North District wastewater system includes a 0.626 MGD wastewater treatment plant, 67 wastewater collection lift stations, associated house grinder pumps, wastewater force mains, and gravity piping. The North wastewater collection system served an average of 3,075 connections in 1995.

The South District water system includes an existing water treatment plant and hydropneumatic storage tank. However, a proposed 1.73 MGD water treatment plant and 300,000 gallon elevated storage tank have been designed and are under construction. Upon completion of the new facility, the existing treatment plant will be abandoned. Therefore, for the

purposes of this study, the evaluation only reviewed the proposed 1.73 MGD water treatment facility, 300,000 gallon elevated storage tank, and water distribution system piping. Based on information provided by ECCFWSD, the South water system served an average of 1,960 water connections in 1995, including 200 water connections in Payne Springs that are no longer served by the District. The South District wastewater system includes an existing wastewater treatment plant with a permitted capacity of 40,000 gallons per day (gpd), a single wastewater lift station, associated house grinder pumps, and pressure collection system piping. A new wastewater treatment facility is under design and will be constructed in the near future. Upon completion of the new wastewater facility, the existing wastewater treatment plant will be abandoned. The South wastewater system served an average of 528 wastewater connections in 1995.

1.2 RECOMMENDATION AND IMPLEMENTATION PLAN SCOPE

The project scope for the Water and Wastewater Master Plan includes a review of the current system conditions, field verification of treatment facilities, field verification of the collection and distribution systems, computer modeling of the collection and distribution systems, development of recommendations, development of an implementation plan, and presentation of a final report. Technical Memorandums #1 and #2 discussed the results of the current conditions review, field verification and computer modeling portions of the project.

The scope for the recommendations and implementation plan provides for the development of a list of recommendations to address the present and future needs of the District's water and wastewater systems. The recommendations will be grouped into phases for implementation. The scope also includes the development of an opinion of probable project costs for each of the

recommended projects and an environmental assessment of the proposed improvements. The environmental assessment will be compiled in accordance with TWDB guidelines. The projects will be prioritized through a matrix evaluation and recommendations will be made for phasing of the projects. In addition, a brief evaluation of potential financing options will be included. This Technical Memorandum will discuss the results of the recommendations and implementation phase of the Master Plan.

2.0 RECOMMENDED IMPROVEMENTS

2.1 DISTRIBUTION AND COLLECTION SYSTEM IMPROVEMENTS

The North and South water distribution and wastewater collection systems were modeled using the CYBERNET and HYDRA computer modeling programs. The programs were used to determine the future distribution and collection system projects needed to provide adequate water and wastewater service to the District's customers. The models showed the location of deficiencies in the water and wastewater systems and were used to develop solutions to overcome those weaknesses. Water and wastewater system projects were developed based on Texas Natural Resource Conservation Commission (TNRCC) design criteria. TNRCC criteria for water systems require that the system be capable of providing a minimum pressure of 35 pounds per square inch (psi) and 1.5 gallons per minute (gpm) of flow at all points in the distribution system. TNRCC criteria for sewerage systems require that sewer lines be designed for estimated future service populations, plus adequate allowance for institutional and commercial flows. Descriptions of the proposed water distribution and wastewater collection system projects are provided in Technical Memorandum #2. Mapping of the proposed improvements is provided in Attachment 3-A.

2.2 WATER TREATMENT PLANT IMPROVEMENTS

Each water treatment plant was evaluated for future capacity needs, and recommendations were made for the expansion needs of each plant. Recommendations for plant expansion do not take into account flows from adjacent areas operated by another water utility. If these service areas are added to the system in the future, plant flows would increase accordingly.

2.2.1 North Water Treatment Plant

The current rated capacity of the North Water Treatment Plant (WTP) is 2.55 Million Gallons per Day (MGD). This capacity is dictated by design criteria established by the TNRCC and published in Chapter 290 of 30 Texas Administrative Code. Under TNRCC rules, water treatment plants are required to meet capacity criteria of 0.6 gpm per connection for raw water pumping, high service pumping, and treatment plant capacity. The District currently has a variance from this rule which allows them to meet 0.45 gpm per connection for these capacity requirements. Under this variance the District cannot be approved as a "Superior" water system by TNRCC and is not rated to meet fire flows. This variance may be removed at the discretion of the TNRCC based on the ability of the District to treat and/or distribute water of an approved quality and quantity. In order to meet adequate capacity requirements for fire flows and to be approved as a "Superior" water system, the District would need to expand the North Water Treatment Plant to meet the 0.6 gpm per connection criteria.

Based on water demand projections provided in Technical Memorandum #2, the requirement of 0.6 gpm per connection for raw water pumping, high service pumping, and treatment plant capacity has already been exceeded. Under the existing 0.45 gpm per connection variance, the District will not exceed these capacities until 1999, 2001, and 2010, respectively. TNRCC rules also require that the North water system have a total water storage capacity of 200 gallons per connection. The current storage capacity of the system is 728,450 gallons including elevated and clearwell storage tanks. This total storage requirement will be exceeded in 2006.

Based on these projections it is recommended that the District expand the capacity of the North raw water pumps, high service pumps, and water treatment plant to a capacity of 3.6 MGD

prior to 1999. Expansion of the raw water pump station will likely require replacement of the two existing 700 gpm pumps with new 1250 gpm pumps. This would raise the firm capacity of the raw water pump station to 3.6 MGD. Expansion of the high service pumps would require addition of an 1100 gpm pump to expand the firm capacity to 3.6 MGD. Plant expansion would require expansion of plant treatment units including clarifiers and filters. The plant clearwells do not need to be expanded as part of the plant expansion, but will require expansion based on the need for expanded total storage in 2006. At this time a new 182,000 gallon clearwell should be added.

These expansions will meet the 0.6 gpm per connection requirement for treatment plant capacity, raw water pumping, and high service pumping until the year 2016. Since the District is operating under the 0.45 gpm per connection variance, there is some leeway in the time scale for expansion of these items. However, even under the variance, the District will need to expand the raw water pumps, high service pumps and treatment plant capacity no later than 1999, 2001, and 2010, respectively. If the District decides to design these expansions based on the 0.45 gpm per connection variance, the expanded capacity of these items will need to be only 3.0 MGD which would provide adequate capacity under the variance beyond the year 2026. The total storage capacity of the system should be expanded to 910,000 gallons in 2006. This would provide the system enough total storage to last beyond 2026. Table 1 shows the TNRCC design criteria and design life of the existing and expanded treatment units at the North WTP. Estimates for the expansion of these items are based on the 0.6 gpm per connection criteria and are included in Section 4.0: Cost Estimates.

Table 1

North Water Treatment Plant Capacity

UNIT OPERATION	DESIGN CRITERIA	CURRENT CAPACITY	YEAR EXCEEDED	EXPANDED CAPACITY	EXPANDED DESIGN LIFE
Rated Flow	Greater than Max Day Yield	2.55 MGD	> 2026	3.6 MGD	> 2026
Clarifiers	2-hr. detention time	2.55 MGD	> 2026	3.6 MGD	> 2026
Filters	5 gpm per square foot	2.55 MGD	> 2026	3.6 MGD	> 2026
Raw Water Pumps	0.6 gpm per connection	2.01 MGD/2,333 connect.	1996	3.6 MGD/4,166 connect.	2016
	0.45 gpm per connection	2.01 MGD/3,111 connect.	1999	3.0 MGD/4,629 connect.	> 2026
Treatment Capacity	0.6 gpm per connection	2.55 MGD/2,951 connect.	1996	3.6 MGD/4,166 connect.	2016
	0.45 gpm per connection	2.55 MGD/3,935 connect.	2010	3.0 MGD/4,629 connect.	> 2026
High Service Pumps	0.6 gpm per connection	2.13 MGD/2,466 connect.	1996	3.6 MGD/4,166 connect.	2016
	0.45 gpm per connection	2.13 MGD/3,288 connect.	2001	3.0 MGD/4,629 connect.	> 2026
Clearwell Storage	5% of plant capacity	4.57 MGD/228,450 gal.	> 2026	n/a	> 2026
Total Storage	200 gallons/connection	728,450 gal/3,642 connect.	2006	910,000 gal/4,550 connect.	> 2026
Elevated Tank Capacity	100 gallons/connection	500,000 gal/5,000 connect.	>2026	n/a	> 2026

* TNRCC rules require municipalities to meet a minimum of 0.6 gpm per connection for raw water pumping, high service pumping, and treatment plant capacity. The District currently has a variance from this rule which allows them to meet a minimum of 0.45 gpm per connection. Under this variance, the District cannot be rated as a "Superior" water system by TNRCC and is not rated to meet fire flows.

2.2.2 South Water Treatment Plant

The rated capacity of the new South Water Treatment Plant (WTP) is 1.73 Million Gallons per Day (MGD). This capacity is dictated by design criteria established by TNRCC and published in Chapter 290 of 30 Texas Administrative Code. Based on TNRCC rules, water treatment plants are required to meet capacity requirements of 0.6 gallons per minute (gpm) per connection for raw water pumping, high service pumping, and treatment plant capacity. The District currently has a variance from this rule which allows them to meet 0.45 gpm per connection for these capacity requirements. Under this variance the District cannot be approved as a "Superior" water system by TNRCC and is not rated to meet fire flows. This variance may be removed at the discretion of the TNRCC based on the ability of the District to treat and/or distribute water of an approved quality and quantity. In order to meet adequate capacity requirements for fire flows and to be approved as a "Superior" water system, the District would need to expand the South Water Treatment Plant in 2002 to meet the 0.6 gpm per connection criteria.

Based on water demand projections provided in Technical Memorandum #2, the requirement of 0.6 gpm per connection for raw water pumping, high service pumping, and treatment plant capacities will be exceeded in 2002. Under the existing 0.45 gpm per connection variance, the District will not exceed these capacities until 2016. Based on these projections it is recommended that the District expand the capacity of the South raw water pumps, high service pumps, and water treatment plant to a capacity of 2.6 MGD prior to 2002. Expansion of the raw water pumps will likely require replacement of two of the existing 600 gpm pumps with new 1200 gpm pumps. This would raise the firm capacity of the raw water pump station to 2.6 MGD. Expansion of the high service pumps would likely require replacement of the existing high service

pumps with two 1200 gpm pumps and one 600 gpm pump to expand the firm capacity to 2.6 MGD. It is recommended that these existing pumps be replaced during plant expansion due to their age and head requirements. Plant expansion would require expansion of plant treatment units including clarifiers and filters.

These expansions will meet the 0.6 gpm per connection requirement for treatment plant capacity, raw water pumping, and high service pumping beyond the year 2024. Since the District is operating under the 0.45 gpm per connection variance, there is some leeway in the time scale for expansion of these items. However, even under the variance, the District will need to expand the raw water pumps, high service pumps and treatment plant capacity no later than 2016. If the District decides to design these expansions based on the 0.45 gpm per connection variance, the expanded capacity of these items will need to be only 2.0 MGD to provide adequate capacity under the variance beyond the year 2026. Table 2 shows the TNRCC design criteria and design life of the existing and expanded treatment units at the South WTP. Estimates for the expansion of these items are based on the 0.6 gpm per connection criteria and are included in Section 4.0: Cost Estimates.

Table 2

South Water Treatment Plant Capacity

UNIT OPERATION	DESIGN CRITERIA	CURRENT CAPACITY	YEAR EXCEEDED	EXPANDED CAPACITY	EXPANDED DESIGN LIFE
Rated Flow	Greater than Max Day Yield	1.73 MGD	> 2026	2.6 MGD	> 2026
Clarifiers	2-hr. detention time	1.73 MGD	> 2026	2.6 MGD	> 2026
Filters	5 gpm per square foot	2.17 MGD	> 2026	2.6 MGD	> 2026
Raw Water Pumps	0.6 gpm per connection	1.73 MGD/2,000 connect.	2002	2.6 MGD/3,000 connect.	2024
	0.45 gpm per connection	1.73 MGD/2,666 connect.	2016	2.0 MGD/3,086 connect.	> 2026
Treatment Capacity	0.6 gpm per connection	1.73 MGD/2,000 connect.	2002	2.6 MGD/3,000 connect.	2024
	0.45 gpm per connection	1.73 MGD/2,666 connect.	2016	2.0 MGD/3,086 connect.	> 2026
High Service Pumps	0.6 gpm per connection	1.73 MGD/2,000 connect.	2002	2.6 MGD/3,000 connect.	2024
	0.45 gpm per connection	1.73 MGD/2,666 connect.	2016	2.0 MGD/3,086 connect.	> 2026
Clearwell Storage	5% of plant capacity	337,000 gal/6.74 MGD	> 2026	n/a	> 2026
Total Storage	200 gallons/connection	637,000 gal/3,185 connect.	> 2026	n/a	> 2026
Elevated Tank Capacity	100 gallons/connection	300,000 gal/3,000 connect.	2024	n/a	2024

* TNRCC rules require municipalities to meet a minimum of 0.6 gpm per connection for raw water pumping, high service pumping, and treatment plant capacity. The District currently has a variance from this rule which allows them to meet a minimum of 0.45 gpm per connection. Under this variance, the District cannot be rated as a "Superior" water system by TNRCC and is not rated to meet fire flows.

2.3 WASTEWATER TREATMENT PLANT IMPROVEMENTS

Each wastewater treatment plant was evaluated for future capacity needs, and recommendations were made for the expansion needs of each plant. Recommendations for plant expansion do not take into account flows from adjacent areas operated by another wastewater utility. If these service areas are added to the system in the future, plant flows would increase accordingly.

2.3.1 North Wastewater Treatment Plant

The design capacity of the North Wastewater Treatment Plant (WWTP) is 0.626 MGD. The 2 hour peak capacity of the North WWTP is 1.87 MGD. These capacities are dictated by design criteria established by TNRCC and published in Chapter 317 of 30 Texas Administrative Code. Under these rules, wastewater treatment plants are required to treat a design flowrate equal to the maximum 30-day average flow for a wet weather period, and a peak flowrate equal to the highest two-hour average flowrate expected to be delivered to the plant. In addition, Chapter 305 of 30 Texas Administrative Code requires that whenever flow measurements for any sewage treatment plant reaches 75% of the permitted average daily flow for three consecutive months, the permittee must initiate engineering and financial planning for expansion and/or upgrading of the wastewater treatment facilities.

Currently, plant flows at the North WWTP have already exceeded 75% of the permitted capacity and planning should begin on the North WWTP expansion. Based on the flow projections provided in Technical Memorandum #2, the North WWTP is capable of meeting permit requirements for the North wastewater collection system until the year 2000. At this time

the plant flow will exceed the maximum 30-day capacity of the plant and construction should be completed on an expanded plant. The expanded capacity of the plant should be 0.9 MGD with a peak capacity of 3.0 MGD. The current plant peak flowrate will be increased prior to the year 2000 by the expansion of lift stations 38 and 39. The existing plant should be capable of handling the new peak flows assuming full utilization of the existing surge basin. This can be accomplished by bringing the new plate and frame press on-line to handle sludge dewatering processes for the plant and by cleaning waste sludge out of the existing surge basin. This should bring the existing surge basin back to its full capacity of 1.1 million gallons.

Based on these projections, it is recommended that the surge basin be brought back on-line at its full capacity to handle larger peak flows expected from the expansion of lift stations 38 and 39. It is also recommended that the North WWTP be expanded before the year 2000 to a capacity of 0.9 MGD with a peak flowrate of 3.0 MGD. At this capacity the plant will be capable of providing adequate treatment capabilities beyond the year 2026. Table 3 shows the TNRCC design criteria and design life of the existing and expanded treatment units at the North WWTP. Estimates for expansion of the North WWTP are included in Section 4.0: Cost Estimates.

Table 3

North Wastewater Treatment Plant Capacity

UNIT OPERATION	DESIGN CRITERIA	CURRENT CAPACITY	YEAR EXCEEDED	EXPANDED CAPACITY	EXPANDED DESIGN LIFE
Design Flow	> Maximum 30 day average	0.626 MGD	2000	0.9 MGD	> 2026
Peak Flow	> Anticipated 2-hr peak flows	1.872 MGD	> 2000	3.0 MGD	> 2026
Pumping Peak Flow	Flowrate of all pumps pumping to plant	1.79 MGD	Exp. Date of LS's 38 & 39	3.0 MGD	> 2026
Surge Basin	10-20% of plant volume	1.1 MG	n/a	n/a	n/a
Oxidation Ditch	Loading Rate of 15 lb BOD/day/1000 ft^2 Min. HRT = 20 hours Min of 2 rotors per ditch Min channel velocity of 1 fps	0.626 MGD	2000	0.9 MGD	> 2026
Clarifiers	Qp Surface Loading 1000 gal/day/ft^2 Peak Detention Time = 1.8 hrs. Weir loading rate = 20,000 gal/d/lf	2.145 MGD Qp	2004	3.0 MGD	> 2026
	Average Surface Loading 500 gal/day/ft^2 Avg. Detention time = 3.6 hrs.	1.072 MGD Qd	> 2026	>1.0 MGD	> 2026
Chlorine Contact	20 min. detention time @ Qp	1.94 MGD	> 2000	3.0 MGD	> 2026
Chlorinators	150% of highest expected dose	2 MGD Qp	2001	3.0 MGD	> 2026

2.3.2 South Wastewater Treatment Plant

The design capacity of the existing South WWTP is 0.04 MGD with a 2-hour peak capacity of 0.1 MGD. Based on TNRCC rules, the existing South WWTP is unable to meet current design criteria for daily and peak flows currently entering the plant. The District is currently designing a new 0.2 MGD South WWTP to replace the existing plant. The new plant will be capable of handling current and anticipated future flowrates. Since the existing plant will be abandoned upon completion of the new plant, only the new plant was considered in this evaluation.

Under TNRCC rules, wastewater treatment plants are required to treat a design flowrate equal to the maximum 30-day average flow for a wet weather period, and a peak flowrate equal to the highest two-hour average flow rate expected to be delivered to the plant. Since the wastewater flows have already exceeded the existing plant's capacity, the District has begun planning to replace the plant with a larger facility. The current maximum 30-day average and peak flowrates for the South system are 0.17 MGD and 0.6 MGD respectively.

Based on the current flows and the projected expansion of the South wastewater collection system, it is recommended that the new South wastewater plant be designed for an average flow capacity of 0.2 MGD with a peak capacity of 0.8 MGD. Assuming that expansion of the South wastewater collection system occurs as laid out in the Master Plan, these flows will provide adequate treatment capacity until the year 1998. Therefore, it is recommended that the new plant design include land needed for eventual expansion of the plant to a design capacity of 0.5 MGD and a peak capacity of 1.76 MGD. Assuming that expansion of the South sewage collection system occurs as laid out in the Master Plan, expansion of the new 0.2 MGD plant to an eventual

design capacity of 0.5 MGD would extend the plant's life until the year 2012. Since dates for expansion of the South WWTP are directly related to the actual expansion of the South wastewater collection system, these dates may vary. Costs for expansion of the South WWTP are provided in Section 4.0: Cost Estimates.

Table 4

South Wastewater Treatment Plant Capacity

UNIT OPERATION	DESIGN CRITERIA	CURRENT CAPACITY	YEAR EXCEEDED	EXPANDED CAPACITY	EXPANDED DESIGN LIFE
Design Flow	> Maximum 30 day average	0.04 MGD	1996	0.2 MGD	> 1998
Peak Flow	> Anticipated 2-hr peak flows	0.1 MGD	1996	0.8 MGD	> 1998

2.4 PRIORITIZATION OF IMPROVEMENTS

Each project listed above and those listed in Technical Memorandum #2 were evaluated using an evaluation matrix to prioritize those projects which occur in the same general time period. Each project was evaluated on a scale of 1 to 5, with 1 being lowest and 5 highest, for three categories: technical importance, regulatory importance, and economic importance. Technical importance describes the effect of the project on the water or wastewater system operation. Those projects that have a large technical impact on system operation were rated higher than those with a smaller impact. Regulatory importance describes the regulatory impact of constructing or not-constructing the project. Those projects with a high regulatory impact, such as the construction of treatment plant improvements, were rated higher than those with a smaller impact. Economic importance evaluates the potential effects of the project on the local economy. Those projects that enhance the attractiveness of a larger industrial and commercial areas, such as the areas next to Highway 334, would be rated higher than improvements in small subdivisions.

The value of each category was added together to get the total value for each project. Projects occurring in the same time period were then ranked in order based on their total rated value. Each project was given a project identification number based on its total rating and location. For instance, the highest rated project in the North wastewater system would be identified as project number NWW1. Project dates and ratings are preliminary and should be adjusted for changes in priority in the development of the District's water and wastewater systems. Copies of the evaluation matrix for each water and wastewater project is provided in Attachment 3-B.

3.0 ENVIRONMENTAL ASSESSMENT

As part of the overall Master Plan, a preliminary environmental assessment was conducted to overview the potential environmental impacts of the proposed master plan projects. The environmental assessment looked for "fatal flaws" in the layout of the potential projects. For the most part, the distribution and collection system projects are located within and adjacent to existing roadways and easements. A few ancillary lines cross cropland, pastureland, or otherwise undeveloped land. Environmental considerations identified in the preliminary analysis of the project include permitting, archeology, and endangered and threatened species. Layouts of the projects are preliminary and the District will need to conduct a detailed environmental assessment for each project prior to construction to ensure compliance with environmental guidelines.

3.1 PERMITTING

Section 404 of the Clean Water Act addresses impacts associated with those hydrologic areas determined to be jurisdictional waters of the U.S. These jurisdictional waters include lakes, ponds, rivers, streams, and any other water bodies as well as wetlands and special aquatic sites. Construction activities within these jurisdictional waters require authorization from the U.S. Army Corps of Engineers (Corps). Some proposed projects will cross numerous unnamed drainages which flow into Cedar Creek Reservoir and areas that may be wetlands. Construction of the pipeline crossings for these drainages and wetlands can be authorized under Nationwide Permit 12 (NWP 12) - Utility Line Backfill and Bedding. It is not necessary to notify the Corps prior to construction as long as construction activities are conducted in accordance with the guidelines of NWP 12. A definition of NWP 12 is included in Attachment 3-C.

3.2 ARCHEOLOGICAL, HISTORICAL, AND CULTURAL SURVEY

Prior to construction of a particular project, it may be necessary to conduct a review of the historical and archeological value of the project site. A cultural resources survey of portions of the distribution and collection lines may be required. This survey should be performed by a professional archeologist and could include historical background checks, site visits, and archeological review of the project site. The Texas Water Development Board (TWDB) has indicated that their agency will coordinate these activities. The District would need to coordinate these efforts with the TWDB for archeological resources.

3.3 THREATENED AND ENDANGERED SPECIES

The proposed project is located in Henderson County which is in the range of 14 threatened and endangered species. These species include the bald eagle, red-cockaded woodpecker, whooping crane, Louisiana pine snake, paddlefish, white-faced ibis, American swallow-tailed kite, Bachman's sparrow, wood stork, Texas horned lizard, northern scarlet snake, alligator snapping turtle, and timber rattlesnake. The developed conditions of a majority of the distribution and collection lines preclude any concern regarding any of these species. However, in the event any of the pipeline routes cross undeveloped areas, the District should ensure that no threatened or endangered species would be impacted.

TABLE 5
PRELIMINARY COST ESTIMATES

Project ID#	Construction Date	Project Description		Estimated Cost
NORTH WATER SYSTEM				
* NW 1	1997	New 12" loop around Legendary Lane, Hwy 334, and the Bozeman Easement	12 " WL 10 " WL 8 " WL	$830,000
* NW 2	1997/2010	North WTP Expansion	1 MGD	$1,663,000
* NW 3	1997/1999	North WTP High Service Pump Expansion	1100 gpm	$31,000
* NW 4	1997/2001	North WTP Raw Water Pump Expansion	2500 gpm	$36,000
NW 5	1996-2006	New 8" and 6" Waterlines for the remaining Priority #2 Area on the East Side of the Hwy 334 Bridge	8 " WL 6 " WL	$234,000
NW 6	1996-2006	New 8" Waterlines to the Tamarack Area	8 " WL	$186,000
NW 7	1996-2006	New 10" and 8" Waterlines to Harbor Point	10 " WL 8 " WL	$290,000
NW 8	1996-2006	New 6" Waterline along Spanish Trail	6 " WL	$179,000
NW 9	1996-2006	New 6" Waterlines through Sandy Shores and Eastwood Island Areas	6 " WL	$235,000
NW 10	1996-2006	New 6" Waterline from Welch Street to Harmon Street	6 " WL	$78,000
NW 11	2006	Total Storage Capacity Expansion	182000 Gal	$206,000
NW 12	2006-2016	New 6" and 8" Waterlines to serve Priority Area #3	8 " WL 6 " WL	$279,000
NW 13	2006-2016	New 6" Waterline from Hwy 198 to Whispering Trail	6 " WL	$128,000
NW 14	2006-2016	New 6" Waterline in the Oak Harbor Subdivision	6 " WL	$170,000
NW 15	2006-2016	New 6" Waterlines in the Mantle Manors and Sherwood Shores Subdivisions	6 " WL	$268,000
NW 16	2006-2016	New 6" Looped Waterline for the Harbor Point Subdivision	6 " WL	$246,000
NW 17	2016-2026	New 10" Waterline Along Hwy 334 to Hwy 198	10 " WL	$307,000
NW 18	2016-2026	New 6" Waterline along Hwy 334 in Priority Area #3	6 " WL	$117,000

TABLE 5 (CONT.)
PRELIMINARY COST ESTIMATES

Project ID#	Construction Date	Project Description		Estimated Cost
NW 19	2016-2026	New 6" Waterline in the Siesta Shores Area	6 " WL	$148,000
NW 20	2016-2026	New 6" Waterline in the Harbor Point Subdivision	6 " WL	$67,000
NW 21	2016-2026	New 6" Waterline along Luther Street	6 " WL	$165,000
NW 22	2016-2026	New 6" Waterlines in the Mantle Manors and the Southwind Estates Subdivisions	6 " WL	$168,000
NW 23	2016-2026	New 6" Waterline along Whispering Trail in the Tamarack Area	6 " WL	$140,000
NW 24	2016-2026	New 6" Looped Waterline in Bonita Subdivision	6 " WL	$128,000

Total Costs 1996-2006 = $2,932,000
Total Costs 2006-2016 = $1,297,000
Total Costs 2016-2026 = $1,240,000

North Water System
Total Project Costs = $5,469,000

* Note: Project NW1 is currently under design and will be under construction shortly. Therefore it is not included in the final estimate.

Projects NW2, NW3, and NW4 are based on expansion of treatment plant and pumping capacity under TNRCC criteria for 0.6 gpm per connection.

TABLE 5 (CONT.)
PRELIMINARY COST ESTIMATES

Project ID#	Construction Date	Project Description		Estimated Cost
SOUTH WATER SYSTEM				
* SW 1	2002/2016	South WTP, High Service & Raw Water Pumps Expansion	0.864 MGD	$1,724,000
SW 2	1996-2006	New 12" and 10" Waterline along Hwy 198 to Golden Oaks Addition	12 " WL 10 " WL	$230,000
SW 3	1996-2006	New 12" Waterline along Enchanted Drive, Hwy 198, and Southward toward Cedar Branch Park	12 " WL	$528,000
SW 4	1996-2006	New 12" and 8" Waterline through the Cedar Branch Subdivision	12 " WL 8 " WL	$268,000
SW 5	1996-2006	New 10" and 8" Waterline through Forgotten Acres to Lakeland Road	10 " WL 8 " WL	$205,000
SW 6	1996-2006	New 8" and 6" Waterline Southward along Enchanted Drive to Enchanted Oaks	8 " WL 6 " WL	$130,000
SW 7	1996-2006	New 8" and 6" Waterline to Golden Oaks, Southwood Shores, Bonanza Beach, and Oak Shores Subdivisions	8 " WL 6 " WL	$396,000
SW 8	1996-2006	New 8" and 6" Waterline to Baywood Estates Area	8 " WL 6 " WL	$68,000
SW 9	1996-2006	New 6" Looped Waterline through Bandera Bay and Oakwood Shores	6 " WL	$145,000
SW 10	1996-2006	New 6" Looped Waterline around Leisure-land and to Three Harbors Subdivisions	6 " WL	$223,000
SW 11	2006-2016	New 6" and 8" Waterline to provide looped system for the Golden Oaks, Southwood Shores, Bonanza Beach, and Oak Shores Subdivisions	8 " WL 6 " WL	$524,000
SW 12	2006-2016	New 6" Waterline to Enchanted Isles Subdivision	6 " WL	$112,000
SW 13	2006-2016	New 6" Waterline to Cherokee Hills Subdivision	6 " WL	$28,000
SW 14	2006-2016	New 6" Waterline through Oakwood Shores Subdivision	6 " WL	$84,000
SW 15	2006-2016	New 6" Waterline through Del Mar Subdivision	6 " WL	$115,000

TABLE 5 (CONT.)
PRELIMINARY COST ESTIMATES

Project ID#	Construction Date	Project Description		Estimated Cost
SW 16	2006-2016	New 6" Waterline through the Timber Bay, Spillview Estates, and Diamond Oaks Subdivisions	6 " WL	$73,000
SW 17	2006-2016	Parallel 12" Waterline along Enchanted Drive to Hwy 198	12 " WL	$123,000
SW 18	2006-2016	New 12" and 10" Waterline along Hwy 198 toward Payne Springs	12 " WL 10 " WL	$229,000
SW 19	2006-2016	New 8" and 6" Waterlines through the Southern Portion of the Resort Service Area	8 " WL 6 " WL	$341,000
SW 20	2006-2016	New 8" Waterline and Booster Pump Station to supply water to the Southeast parts of Priority #3 Area including the Lakeshore and Carolynn CCN areas	8 " WL 6 " WL 200 gpm pump 200000 gal tank	$1,375,000
SW 21	2006-2016	New 8" Looped Waterline to Priority #3 Area	8 " WL	$603,000
SW 22	2006-2016	New 6" Waterline on the East Side of the Resort Area in Priority #3 Area	6 " WL	$170,000
SW 23	2016-2026	New 6" Waterline in the Southwood Shores Subdivision	6 " WL	$162,000
SW 24	2016-2026	New 6" Waterline in the Baywood Estates Subdivision	6 " WL	$47,000
SW 25	2016-2026	New 6" Waterline along Del Mar Shoreline	6 " WL	$59,000
SW 26	2016-2026	New 6" Waterline through the Wood Canyon Waters Subdivision	6 " WL	$75,000
SW 27	2016-2026	New 6" Waterline along the North Side of the Golden Oaks Subdivision	6 " WL	$173,000
SW 28	2016-2026	New 8" and 6" Looped Waterline along Hwy 198	8 " WL 6 " WL	$389,000
SW 29	2016-2026	New 6" Waterline through the Resort area and the Western Side of Payne Springs	6 " WL	$112,000
SW 30	2016-2026	New 6" Waterline in the Northeastern part of the Priority #3 Area	6 " WL	$290,000

TABLE 5 (CONT.)
PRELIMINARY COST ESTIMATES

Project ID#	Construction Date	Project Description		Estimated Cost
SW 31	2016-2026	New 6" Looped Waterline in the Carolynn, Lake Shore, and Southern Resort Service Area	6 " WL	$564,000

Total Costs 1996-2006 = $3,917,000
Total Costs 2006-2016 = $3,777,000
Total Costs 2016-2026 = $1,871,000

South Water System
Total Project Costs = $9,565,000

* Note: Projects SW1 is based on expansion of treatment plant and pumping capacities under TNRCC criteria for 0.6 gpm per connection.

TABLE 5 (CONT.)
PRELIMINARY COST ESTIMATES

Project ID#	Construction Date	Project Description		Estimated Cost
NORTH WASTEWATER SYSTEM				
* NWW 1	1997	Expansion of LS38 and LS39	930 gpm LS 990 gpm LS 10 " FM	$544,000
NWW 2	2000	North WWTP Expansion	0.275 MGD	$640,000
NWW 3	1996-2006	Increase pumping capacity of LS60, LS61, & construction of a gravity sewer to LS38	65 gpm LS 165 gpm LS 10 " Gravity 8 " Gravity 4 " FM	$285,000
NWW 4	1996-2006	Increase pumping capacity of LS25 and and LS33	80 gpm LS 58 gpm LS	$20,000
NWW 5	1996-2006	Diversion of flow in Tamarack Area to LS56 and construction of a gravity sewer line from Hwy 198 to LS39	12 " Gravity 10 " Gravity 8 " FM 6 " Gravity 6 " FM 170 gpm LS	$383,000
NWW 6	1996-2006	Diversion of flow from LS19 to LS29 and expansion of LS29	6 " Gravity 110 gpm LS	$26,000
NWW 7	1996-2006	New 8" and 6" gravity sewer lines and Lift Stations to serve remaining area in Priority Area #2, East of Tamarack	8 " Gravity 6 " Gravity 4 " FM 50 gpm LS 120 gpm LS	$438,000
NWW 8	2006-2016	New 8" gravity sewer line from Lakeview Street to existing 10" gravity sewer line East of Harbor Street	8 " Gravity	$127,000
NWW 9	2006-2016	Expansion of LS19 and LS44	115 gpm LS 65 gpm LS	$23,000
NWW 10	2006-2016	Expansion of LS5 and construction of new force main from LS61 to LS60	65 gpm LS 4 " FM	$64,000
NWW 11	2006-2016	Expansion of LS7 and new gravity sewer line from LS21 and LS46 to LS7	120 gpm LS 8 " Gravity 6 " Gravity 4 " FM	$184,000
NWW 12	2006-2016	New 6" gravity sewer line to serve Priority Area #3	6 " Gravity	$140,000
NWW 13	2006-2016	Expansion of LS36 and LS 40	230 gpm LS	$69,000

TABLE 5 (CONT.)
PRELIMINARY COST ESTIMATES

Project ID#	Construction Date	Project Description		Estimated Cost
NWW 14	2016-2026	New 6" gravity sewer line along Hwy 198	6 " Gravity	$92,000
NWW 15	2016-2026	New 8" and 6" gravity sewer line along Luther Street to LS39	8 " Gravity 6 " Gravity	$227,000
NWW 16	2016-2026	New gravity sewer line along Arbolado Street to LS24, expansion of LS24, and new 4" force main from LS24 to Hwy 334	8 " Gravity 6 " Gravity 4 " FM 95 gpm LS	$177,000
NWW 17	2016-2026	Expansion of LS37	310 gpm LS	$40,000
NWW 18	2016-2026	New 8" gravity sewer line along Harbor Point Road	8 " Gravity 6 " Gravity	$102,000

Total Costs 1996-2006 =	$1,792,000
Total Costs 2006-2016 =	$606,000
Total Costs 2016-2026 =	$639,000
South Water System Total Project Costs =	$3,037,000

* Note: Project NWW1 is currently under design and will be under construction shortly. Therefore it is not included in the final estimate.

TABLE 5 (CONT.)
PRELIMINARY COST ESTIMATES

Project ID#	Construction Date	Project Description		Estimated Cost
SOUTH WASTEWATER SYSTEM				
* SWW 1	1997	South WWTP Improvements	0.2 MGD	$399,000
SWW 2	1996-2006	New 15", 12", and 10" gravity sewer line and Lift Station to convey flow from the North part of the wastewater system	15 " Gravity 12 " Gravity 10 " Gravity 400 gpm LS	$619,000
SWW 3	1996-2006	New 6" and 4" force main to the Golden Oaks Subdivision	6 " FM 4 " FM 3 " FM	$125,000
SWW 4	1996-2006	New 6" force main to Enchanted Drive and North to the Mac Oaks Subdivision	6 " FM	$67,000
SWW 5	1996-2006	New 6" force main and Lift Station to serve the Cedar Branch Park Area	6 " FM 250 gpm LS	$325,000
SWW 6	1996-2006	New 4" force main to the Oakwood Shores Subdivision	4 " FM 3 " FM	$89,000
SWW 7	1996-2006	New 4" force main to the Baywood Estates Subdivision	4 " FM 3 " FM	$88,000
SWW 8	1996-2006	New 4" force main to the Southland Shores, Bonanza Beach, and Oakshores	6 " FM 4 " FM	$417,000
SWW 9	1996-2006	New 4" force main along Leisureland Drive and associated lateral force mains to serve Leisureland Subdivision	4 " FM 3 " FM	$168,000
SWW 10	1996-2006	New 4" force main along Forgotten Lane and associated lateral force mains to serve Del Mar and Three Harbors Subdivisions	4 " FM 3 " FM	$274,000
SWW 11	1996-2006	New 4" and 3" force main to serve the Timber Bay, Diamond Oaks, Spillview, Wood Canyon, and Deer Island Subdivisions	4 " FM 3 " FM	$245,000
SWW 12	1998-2006	South WWTP Expansion	0.3 MGD	$698,000
SWW 13	2006-2016	New 8" gravity sewer line to serve the Southwestern part of Payne Springs	8 " Gravity 6 " Gravity	$204,000
SWW 14	2006-2016	New 8" gravity sewer trunk lines along Hwy 198 and along the Golden Oaks Subdivision	8 " Gravity 6 " Gravity	$681,000

TABLE 5 (CONT.)
PRELIMINARY COST ESTIMATES

Project ID#	Construction Date	Project Description		Estimated Cost
SWW 15	2006-2016	New parallel 6" force main to the Indian Harbor Area	6 " FM	$46,000
SWW 16	2006-2016	New parallel 6" force main along Enchanted Drive	6 " FM	$61,000
SWW 17	2006-2016	New parallel 4" force main along Lakeland Drive	4 " FM	$45,000
SWW 18	2006-2016	New 6" and 4" force main to serve the Southeastern portion of Priority #3 Area	6 " FM 4 " FM 3 " FM 120 gpm LS	$600,000
SWW 19	2006-2016	New 6" and 4" force main for the Resort CCN within the Priority #3 Area	6 " FM 4 " FM 3 " FM	$272,000
SWW 20	2006-2016	New 250 gpm Lift Station and 6" force main at Lynn Creek	250 gpm LS 6 " FM	$350,000
SWW 21	2016-2026	New 6", 8", and 10" gravity sewer trunk line through the Central part of Payne Springs	10 " Gravity 8 " Gravity 6 " Gravity	$1,258,000
SWW 22	2016-2026	New 6" parallel force main on Forgotten Ln.	6 " FM	$47,000
SWW 23	2016-2026	New 6" parallel force main to serve the Resort CCN Area	6 " FM	$78,000
SWW 24	2016-2026	New 6" parallel force main in the Southern Priority #3 Area	6 " FM	$142,000

Total Costs 1996-2006 =	$3,115,000
Total Costs 2006-2016 =	$2,260,000
Total Costs 2016-2026 =	$1,526,000
South Water System Total Project Costs =	$6,901,000

* Note: Project SWW1 is currently under design and will be under construction shortly. Therefore it is not included in the final estimate.

TOTAL MASTER PLAN COSTS 1996-2006	$11,756,000
TOTAL MASTER PLAN COSTS 2006-2016	$7,940,000
TOTAL MASTER PLAN COSTS 2016-2026	$5,276,000
TOTAL MASTER PLAN COSTS =	$24,972,000

A summary of the total estimated Master Plan costs is provided in Table 6. This summary shows the total cost of the Master Plan projects for each ten year period for both water and wastewater systems. The costs for each system have been broken into costs per connection and costs per 1000 gallons of billed water use or wastewater treated. The cost per connection for a ten year period is calculated by dividing the Master Plan costs for that period by the average estimated number of water or wastewater connections for that period. The cost per 1000 gallons for a ten year period is calculated by dividing the systems total cost for that period by the estimated average billed water usage or estimated wastewater treated for that same period. Billed water use is estimated by assuming that 85% of the future water demand at the District's water treatment plants is billed directly to the customer. Since not all water customers are on the wastewater system and vice versa, estimates for wastewater projects were based on estimates of treated wastewater. Both cost per connection and cost per 1000 gallons were then amortized at an interest rate of 5% over 20 years. These amortized costs show the required increase in the District's revenue to repay a 20-year loan with a 5% interest rate.

The cumulative cost per 1000 gallons is the cost over each ten year period to repay all outstanding debt service based on loans of 20 years at 5% interest. For example, in the second ten-year period for the District's water systems, the cumulative cost per 1000 gallons is $2.66. This is the total cost for repayment of the loan taken in the first ten years ($1.65) plus the cost of the loan taken in the second ten years ($1.01). At the end of the second ten-year period, the first 20-year loan ($1.65) is paid off and the third 20-year loan ($0.55) is added. This is only one example of potential amortization of the debt service for Master Plan costs. The District will need to consider individual funding options prior to design and construction of Master Plan projects.

TABLE 6

MASTER PLAN COSTS SUMMARY

	1996-2006	2006-2016	2016-2026	TOTALS
NORTH WATER				
Total Costs	$2,932,000	$1,297,000	$1,240,000	$5,469,000
Cost per Connection	$71	$26	$23	$113
Cost per 1000 Gallons	$1.08	$0.40	$0.34	$1.73
SOUTH WATER				
Total Costs	$3,917,000	$3,777,000	$1,871,000	$9,565,000
Cost per Connection	$156	$123	$51	$315
Cost per 1000 Gallons	$2.71	$2.13	$0.89	$5.47
WATER TOTALS				
Total Costs	$6,849,000	$5,074,000	$3,111,000	$15,034,000
Cost per Connection	$103	$63	$34	$191
Cost per 1000 Gallons	$1.65	$1.01	$0.55	$3.06
Cummulative Cost per 1000 Gal	$1.65	$2.66	$1.56	n/a
NORTH WASTEWATER				
Total Costs	$1,792,000	$606,000	$639,000	$3,037,000
Cost per Connection	$40	$11	$10	$55
Cost per 1000 Gallons	$0.83	$0.23	$0.22	$1.19
SOUTH WASTEWATER				
Total Costs	$3,115,000	$2,260,000	$1,526,000	$6,901,000
Cost per Connection	$175	$66	$32	$215
Cost per 1000 Gallons	$4.95	$2.11	$1.09	$6.74
WASTEWATER TOTALS				
Total Costs	$4,907,000	$2,866,000	$2,165,000	$9,938,000
Cost per Connection	$78	$31	$19	$114
Cost per 1000 Gallons	$1.76	$0.78	$0.50	$2.77
Cummulative Cost per 1000 Gal	$1.76	$2.53	$1.28	n/a
MASTER PLAN TOTALS				
Total Costs	$11,756,000	$7,940,000	$5,276,000	$24,972,000
Cost per Connection	$91	$46	$26	$150
Cost per 1000 Gallons	$1.69	$0.91	$0.53	$2.94
Cummulative Cost per 1000 Gal	$1.69	$2.61	$1.44	n/a

5.0 POTENTIAL FINANCING OPTIONS

There are several potential financing options the District can pursue to assist in the implementation of projects laid out in the Master Plan. These options include user service charges, taxes, Community Development Block Grants (CDBG's), Rural Utilities Service (formerly Farmers Home Administration, FmHA) grants and loans, State Revolving Fund (SRF) funding, bond issues, EPA hardship grants, and Economic Development Administration grants. Specific funding vehicles should be determined prior to design and construction of a specific project(s). If the District qualifies, the use of grant monies would reduce the burden of payment for the improvements placed on the District.

Increased service charges are the most common method of paying for capital improvements projects. Service charge increases are typically used in conjunction with loan programs to assist in repayment of loans over a long period of time. As indicated in Table 6, this increase in the base charge per 1,000 gallons of sewer or water service would be between $1.30 and $2.50 depending on the system and timing of improvements. Another option for increasing revenues without additional service charge is the implementation of some form of special service tax.

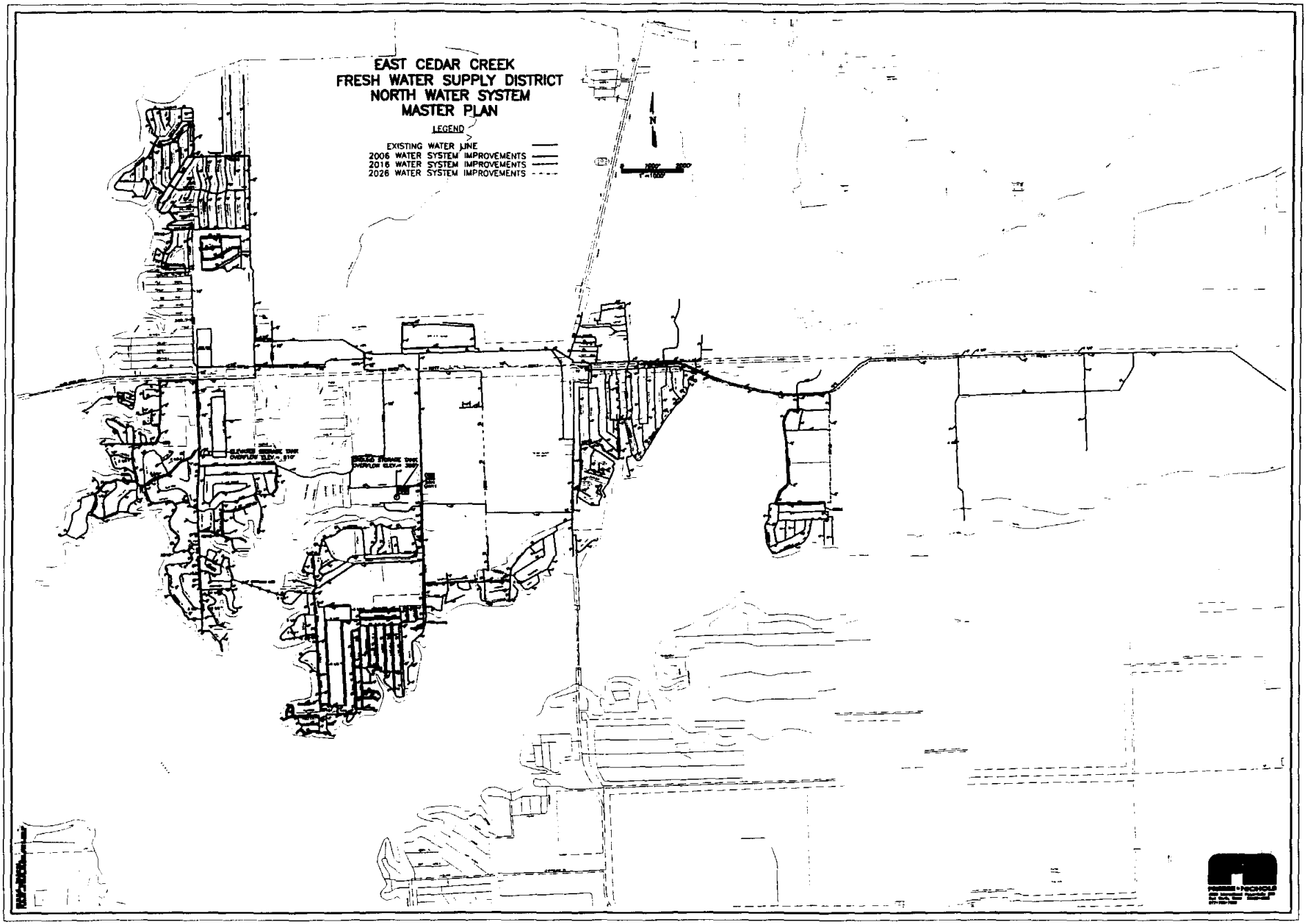
Several federal and state grant programs exist to assist small communities in paying for capital improvement programs including EDA and FmHA programs. FmHA loans and grants are provided for communities that are financially sound, but unable to obtain funds from other sources at reasonable rates. Grants covering up to 75 percent of a project's costs may be made to help reduce the repayment burden placed on the systems users. Eligible applicants include municipal service districts with priority given to communities of 5,500 or less or to projects meeting certain other criteria establishing urgent need.

The Texas Water Development Board SRF program provides a low interest, 20-year loan for 100 percent of water and wastewater treatment, water distribution and wastewater collection program costs. Funds are not released until construction begins and are disbursed as these costs are incurred. The loan amount can include costs for all three phases of a water/wastewater project - planning, design, and construction - and can include expenses for building "excess capacity" for future use, as long as needs are well documented.

The EPA has recently published draft guidelines for the Hardship Grants Program for Rural Communities. The intent of the program is to provide assistance to qualifying rural communities with fewer than 3,000 residents. Funds will be made available for improvements to wastewater systems and for alternative wastewater services, such as on-site treatment systems.

ATTACHMENT 3-A

MAPPING OF PROPOSED IMPROVEMENTS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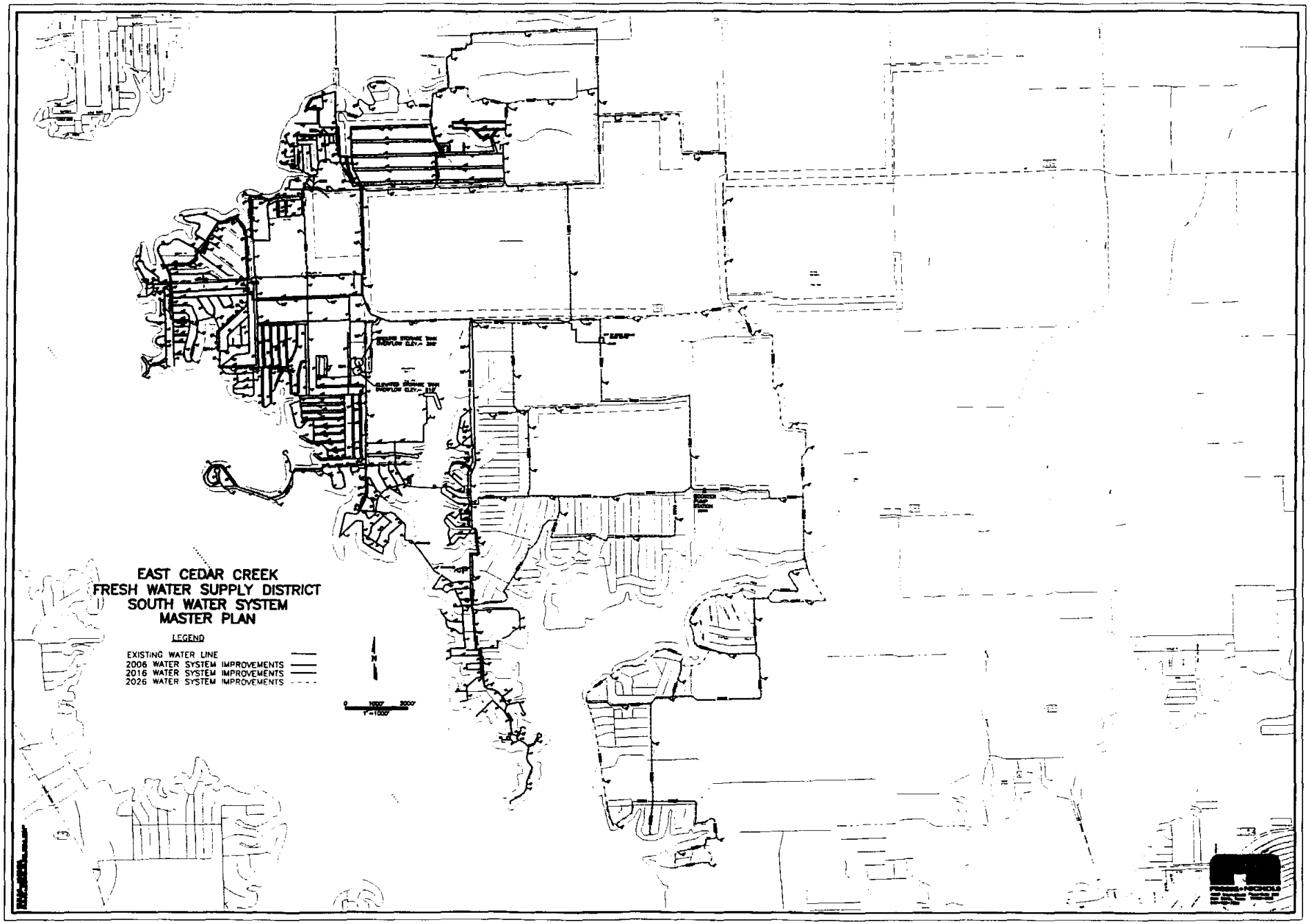
FRESH WATER SUPPLY DISTRICT
NORTH WATER SYSTEM
MASTER PLAN
LEGEND
EXISTING WATER LINE
2006 WATER SYSTEM IMPROVEMENTS
2016 WATER SYSTEM IMPROVEMENTS
2026 WATER SYSTEM IMPROVEMENTS
N


EAST CEDAR CREEK
FRESH WATER SUPPLY DISTRICT
SOUTH WATER SYSTEM
MASTER PLAN
LEGEND
EXISTING WATER LINE
2006 WATER SYSTEM IMPROVEMENTS
2016 WATER SYSTEM IMPROVEMENTS
2026 WATER SYSTEM IMPROVEMENTS
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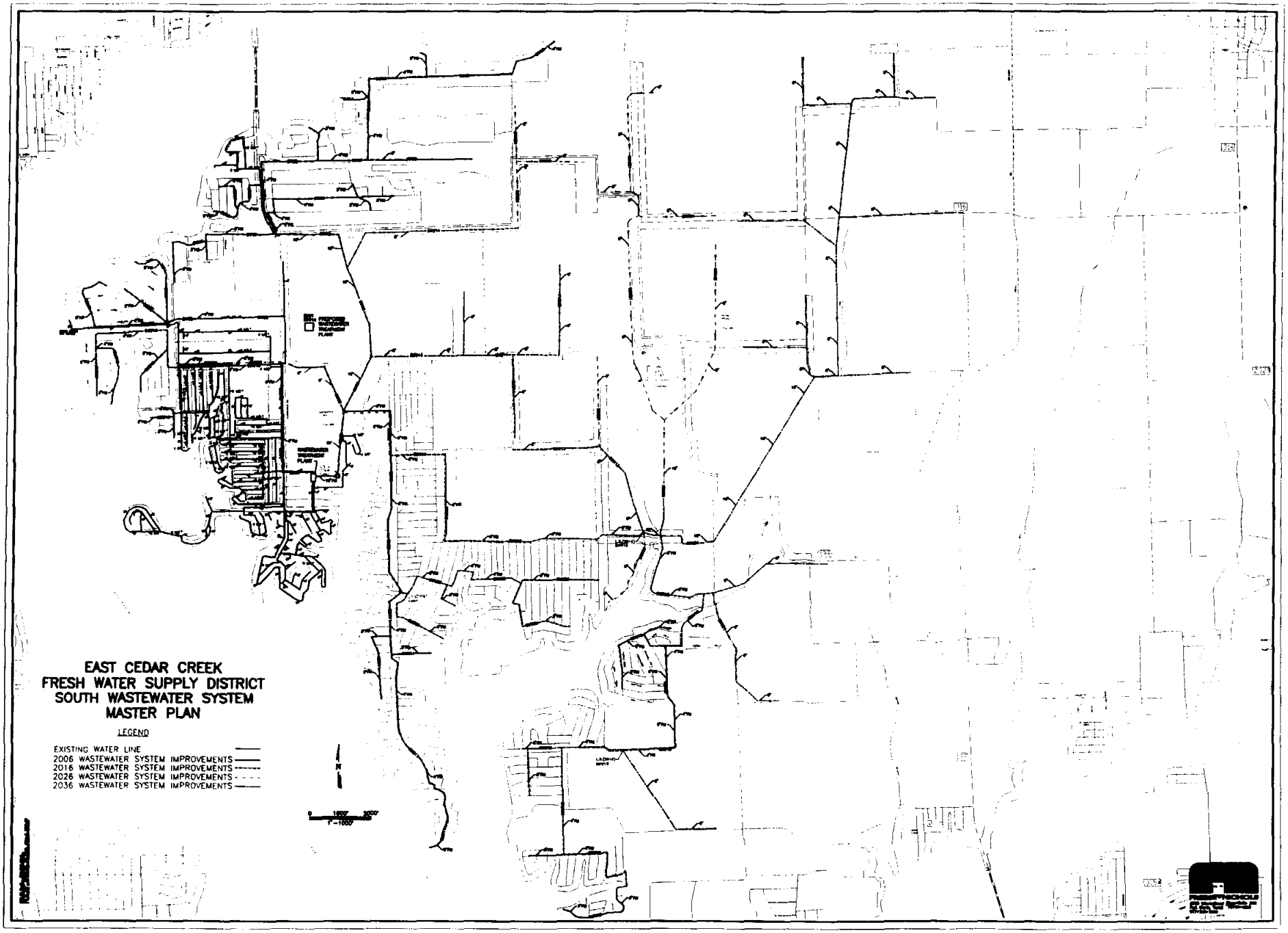
2000'
1"=1000'


EAST CEDAR CREEK
FRESH WATER SUPPLY DISTRICT
SOUTH WASTEWATER SYSTEM
MASTER PLAN
LEGEND
EXISTING WATER LINE
2006 WASTEWATER SYSTEM IMPROVEMENTS
2016 WASTEWATER SYSTEM IMPROVEMENTS
2026 WASTEWATER SYSTEM IMPROVEMENTS
2036 WASTEWATER SYSTEM IMPROVEMENTS
N
1"=1000'

ATTACHMENT 3-B

MATRIX EVALUATION

EAST CEDAR CREEK FRESH WATER SUPPLY DISTRICT

PROJECTS MATRIX EVALUATION

North Water System

Project ID#	Construction Date	Project Description	TI	RI	EI	TOTALS
NW 1	1997	New 12" water loop	5	5	5	15
NW 2	1997/2010	North WTP Expansion	5	5	5	15
NW 3	1997/1999	North WTP High Service Pump Expansion	5	5	3	13
NW 4	1997/2001	North WTP Raw Water Pump Expansion	5	5	3	13
NW 5	1996-2006	New 8" and 6" WL's for E. of Hwy 334 Bridge	4	3	4	11
NW 6	1996-2006	New 8" Waterlines to the Tamarack Area	4	3	4	11
NW 7	1996-2006	New 10" and 8" Waterlines to Harbor Point	4	3	3	10
NW 8	1996-2006	New 6" Waterline along Spanish Trail	3	2	2	7
NW 9	1996-2006	New 6" WL thru Sandy Shores & Eastwood Isle	3	2	2	7
NW 10	1996-2006	New 6" WL from Welch to Harmon	3	2	2	7
NW 11	2006	Total Storage Capacity Expansion	5	5	3	13
NW 12	2006-2016	New 6" and 8" WL's to serve Priority#3	5	3	2	10
NW 13	2006-2016	New 6" WL from Hwy 198 to Whispering Trail	4	3	2	9
NW 14	2006-2016	New 6" Waterline in Oak Harbor	3	2	2	7
NW 15	2006-2016	New 6" WL in Mantle Manors & Sherwood	3	2	2	7
NW 16	2006-2016	New 6" Looped WL for the Harbor Point	3	2	2	7
NW 17	2016-2026	New 10" WL Along Hwy 334 to Hwy 198	3	2	2	7
NW 18	2016-2026	New 6" WL along Hwy 334 in Priority #3	2	2	2	6
NW 19	2016-2026	New 6" Waterline in the Siesta Shores	2	1	1	4
NW 20	2016-2026	New 6" Waterline in the Harbor Point	2	1	1	4
NW 21	2016-2026	New 6" Waterline along Luther Street	2	1	1	4
NW 22	2016-2026	New 6" WL in Mantle Manors & Southwind Est.	2	1	1	4
NW 23	2016-2026	New 6" WL along Whispering Trail in Tamarack	2	1	1	4
NW 24	2016-2026	New 6" Looped Waterline in Bonita subdivision	2	1	1	4

TI - Technical Importance
RI - Regulatory Importance
EI - Economic Importance

Each category was rated for each individual project on a scale of 1 to 5 with 1 being lowest and 5 highest

South Water System

Project ID#	Construction Date	Project Description	TI	RI	EI	TOTALS
SW 1	2002/2016	South WTP, High Service & Raw Water Pump Expa	5	5	5	15
SW 2	1996-2006	New 12" and 10" WL along 198 to Golden Oaks	5	5	5	15
SW 3	1996-2006	New 12" WL along Enchanted Dr., 198, & Cedar	5	5	5	15
SW 4	1996-2006	New 12" and 8" WL through the Cedar Branch	4	4	4	12
SW 5	1996-2006	New 10" and 8" WL thru Forgotten Acres to Lakelan	4	4	4	12
SW 6	1996-2006	New 8" and 6" WL along Enchanted Dr. to Ench. O	4	3	3	10
SW 7	1996-2006	New 8" and 6" WL to Gold Oaks, Southwood, Bona	3	3	2	8
SW 8	1996-2006	New 8" and 6" WL to Baywood Estates	3	3	2	8
SW 9	1996-2006	New 6" Loop thru Bandera Bay & Oakwood Shores	3	2	2	7
SW 10	1996-2006	New 6" Loop around Leisureland and Three Harbor	3	2	2	7
SW 11	2006-2016	New 6" and 8" loops for Gold Oaks, Southwood, Bo	4	3	2	9
SW 12	2006-2016	New 6" Waterline to Enchanted Isles	4	2	2	8
SW 13	2006-2016	New 6" Waterline to Cherokee Hills	4	2	2	8
SW 14	2006-2016	New 6" Waterline through Oakwood Shores	4	2	2	8
SW 15	2006-2016	New 6" Waterline through Del Mar	4	2	2	8
SW 16	2006-2016	New 6" WL in Timber Bay, Spillview, & Diamond Oa	4	2	2	8
SW 17	2006-2016	Parallel 12" WL along Enchanted Dr. to 198	3	2	2	7
SW 18	2006-2016	New 12" and 10" WL along 198 to Payne Springs	3	2	2	7
SW 19	2006-2016	New 8" and 6" WL thru South Resort Area	3	1	2	6
SW 20	2006-2016	New 8" Waterline and Booster Pump Station	3	1	2	6
SW 21	2006-2016	New 8" Looped Waterline to Priority #3	3	1	2	6
SW 22	2006-2016	New 6" WL on East Side of Resort in Priority #3	3	1	1	5
SW 23	2016-2026	New 6" Waterline in the Southwood Shores	2	2	1	5
SW 24	2016-2026	New 6" Waterline in the Baywood Estates	2	2	1	5
SW 25	2016-2026	New 6" Waterline along Del Mar Shoreline	2	2	1	5
SW 26	2016-2026	New 6" WL through Wood Canyon Waters	2	2	1	5
SW 27	2016-2026	New 6" WL on North Side of Golden Oaks	2	2	1	5
SW 28	2016-2026	New 8" and 6" Loops along 198	2	1	1	4
SW 29	2016-2026	New 6" WL in Resort & W. Payne Springs	1	1	1	3
SW 30	2016-2026	New 6" WL in NE part of Priority #3 Area	1	1	1	3
SW 31	2016-2026	New 6" Loop in Carolynn, Lakeshore, and S. Resort	1	1	1	3

TI - Technical Importance
RI - Regulatory Importance
EI - Economic Importance

Each category was rated for each individual project on a scale of 1 to 5 with 1 being lowest and 5 highest

North Wastewater System

Project ID#	Construction Date	Project Description	TI	RI	EI	TOTALS
NWW 1	1997	Expansion of LS38 and LS39	5	5	5	15
NWW 2	2000	North WWTP Expansion	5	5	5	15
NWW 3	1996-2006	Expansion of LS60, LS61, & new GS to LS38	5	4	3	12
NWW 4	1996-2006	Increase pumping capacity of LS25 and LS33	5	3	3	11
NWW 5	1996-2006	Divert to LS 56 & GS from 198 to LS39	4	3	3	10
NWW 6	1996-2006	Divert flow from LS19 to LS29 & exp. LS29	4	3	3	10
NWW 7	1996-2006	New 8" and 6" GS & LS to serve P2, E. of Tamarac	4	2	3	9
NWW 8	2006-2016	New 8" GS from Lakeview to exist 10" E. of Harbor	4	2	2	8
NWW 9	2006-2016	Expansion of LS19 and LS44	4	2	2	8
NWW 10	2006-2016	Expand of LS5 and new FM from LS61 to LS60	4	2	2	8
NWW 11	2006-2016	Expand LS7 and new GS from LS21 and LS46 to L	4	2	2	8
NWW 12	2006-2016	New 6" gravity sewer line to serve Priority #3	4	1	2	7
NWW 13	2006-2016	Expansion of LS36 and LS 40	4	1	2	7
NWW 14	2016-2026	New 6" gravity sewer line along Hwy 198	3	2	3	8
NWW 15	2016-2026	New 8" and 6" GS along Luther to LS39	3	2	1	6
NWW 16	2016-2026	GS on Arbolado to LS24, Expand LS24, & new 4" f	3	2	1	6
NWW 17	2016-2026	Expansion of LS37	3	2	1	6
NWW 18	2016-2026	New 8" gravity sewer line along Harbor Point Rd.	2	1	1	4

TI - Technical Importance
RI - Regulatory Importance
EI - Economic Importance

Each category was rated for each individual project on a scale of 1 to 5 with 1 being lowest and 5 highest

South Wastewater System

Project ID#	Construction Date	Project Description	TI	RI	EI	TOTALS
SWW 1	1997	South WWTP Improvements	5	5	5	15
SWW 2	1996-2006	New 15", 12", & 10" GS & LS to convey flow from N	4	4	4	12
SWW 3	1996-2006	New 6" and 4" force main to the Golden Oaks	4	4	3	11
SWW 4	1996-2006	New 6" FM to Enchanted Dr & North to Mac Oaks	4	4	3	11
SWW 5	1996-2006	New 6" FM & LS to serve Cedar Branch Park Area	4	4	3	11
SWW 6	1996-2006	New 4" force main to the Oakwood Shores	4	3	3	10
SWW 7	1996-2006	New 4" force main to the Baywood Estates	4	3	3	10
SWW 8	1996-2006	New 4" FM to Southland, Bonanza Beach, and Oak	4	3	3	10
SWW 9	1996-2006	New 4" FM on Leisureland Dr & laterals to Leisurela	4	3	3	10
SWW 10	1996-2006	New 4" FM on Forgotten Ln & laterals to Del Mar &	4	3	3	10
SWW 11	1996-2006	New 4" & 3" FM in Timber bay, Diamond Oaks, Spill	4	3	3	10
SWW 12	1998-2006	South WWTP Expansion	5	5	5	15
SWW 13	2006-2016	New 8" GS line to serve the SE part of Payne Spring	3	2	3	8
SWW 14	2006-2016	New 8" GS along 198 and Golden Oaks	3	2	3	8
SWW 15	2006-2016	New parallel 6" force main to the Indian Harbor	3	2	2	7
SWW 16	2006-2016	New parallel 6" force main along Enchanted Drive	3	2	2	7
SWW 17	2006-2016	New parallel 4" force main along Lakeland Drive	3	2	2	7
SWW 18	2006-2016	New 6" and 4" FM to serve the SE portion of Priority	3	1	2	6
SWW 19	2006-2016	New 6" and 4" FM for the Resort CCN in Priority #3	3	1	2	6
SWW 20	2006-2016	New 250 gpm Lift Station and 6" FM at Lynn Creek	3	1	2	6
SWW 21	2016-2026	New 6", 8", and 10" GS through central Payne Sprin	2	1	2	5
SWW 22	2016-2026	New 6" parallel force main along Forgotten Lane	2	2	1	5
SWW 23	2016-2026	New 6" parallel force main to serve the Resort CCN	2	1	1	4
SWW 24	2016-2026	New 6" parallel force main in the Southern Priority #	2	1	1	4

TI - Technical Importance
RI - Regulatory Importance
EI - Economic Importance

Each category was rated for each individual project on a scale of 1 to 5 with 1 being lowest and 5 highest

ATTACHMENT 3-C

ENVIRONMENTAL ASSESSMENT

(Sections 10 and 404)

6. **Survey Activities.** Survey activities including core sampling, seismic exploratory operations, and plugging of seismic shot holes and other exploratory-type bore holes. Drilling and the discharge of excavated material from test wells for oil and gas exploration is not authorized by this nationwide permit; the plugging of such wells is authorized. Fill placed for roads, pads and other similar activities is not authorized by this nationwide permit. The discharge of drilling muds and cuttings may require a permit under Section 402 of the Clean Water Act. (Sections 10 and 404)

7. **Outfall Structures.** Activities related to construction of outfall structures and associated intake structures where the effluent from the outfall is authorized, conditionally authorized, or specifically exempted, or are otherwise in compliance with regulations issued under the National Pollutant Discharge Elimination System program (Section 402 of the Clean Water Act), provided that the nationwide permittee notifies the district engineer in accordance with the "Notification" general condition.

(Also see 33 CFR 330.1(e)). Intake structures per se are not included - only those directly associated with an outfall structure. (Sections 10 and 404)

8. **Oil and Gas Structures.** Structures for the exploration, production, and transportation of oil, gas, and minerals on the outer continental shelf within areas leased for such purposes by the Department of the Interior, Minerals Management Service. Such structures shall not be placed within the limits of any designated shipping safety fairway or traffic separation scheme, except temporary anchors that comply with the fairway regulations in 33 CFR 322.5(l). (Where such limits have not been designated, or where changes are anticipated, district engineers will consider asserting discretionary authority in accordance with 33 CFR 330.4(e) and will also review such proposals to ensure they comply with the provisions of the fairway regulations in 33 CFR 322.5(1)). Such structures will not be placed in established danger zones or restricted areas as designated in 33 CFR Part 334: nor will such structures be permitted in EPA or Corps designated dredged material disposal areas. (Section 10)

9. **Structures in Fleeting and Anchorage Areas.** Structures, buoys, floats, and other devices placed within anchorage or fleeting areas to facilitate moorage of vessels where such areas have been established for that purpose by the U.S. Coast Guard. (Section 10)

10. **Mooring Buoys.** Non-commercial, single-boat, mooring buoys. (Section 10)

11. **Temporary Recreational Structures.** Temporary buoys, markers, small floating docks, and similar structures placed for recreational use during specific events such as water skiing competitions and boat races or seasonal use provided that such structures are removed within 30 days after use has been discontinued. At Corps of Engineers reservoirs, the reservoir manager must approve each buoy or marker individually. (Section 10)

12. **Utility Line Backfill and Bedding.** Discharges of material for backfill or bedding for utility lines, including outfall and intake structures, provided there is no change in preconstruction contours. A "utility line" is defined as any pipe or pipeline for the transportation of any gaseous,

liquid, liquefiable, or slurry substance, for any purpose, and any cable, line, or wire for the transmission for any purpose of electrical energy, telephone and telegraph messages, and radio and television communication. The term "utility line" does not include activities which drain a water of the United States, such as drainage tile, however, it does apply to pipes conveying drainage from another area. Material resulting from trench excavation may be temporarily sidecast (up to three months) into waters of the United States provided that the material is not placed in such a manner that it is dispersed by currents or other forces. The DE may extend the period of temporary side-casting up to 180 days, where appropriate. The area of waters of the United States that is disturbed must be limited to the minimum necessary to construct the utility line. In wetlands, the top 6" to 12" of the trench should generally be backfilled with topsoil from the trench. Excess material must be removed to upland areas immediately upon completion of construction. Any exposed slopes and streambanks must be stabilized immediately upon completion of the utility line. The utility line itself will require a Section 10 permit if in navigable waters of the United States. (See 33 CFR Part 322). (Section 404)

13. **Bank Stabilization.** Bank stabilization activities necessary for erosion prevention provided:

a. No material is placed in excess of the minimum needed for erosion protection;

b. The bank stabilization activity is less than 500 feet in length;

c. The activity will not exceed an average of one cubic yard per running foot placed along the bank below the plane of the ordinary high water mark or the high tide line;

d. No material is placed in any special aquatic site, including wetlands;

e. No material is of the type or is placed in any location or in any manner so as to impair surface water flow into or out of any wetland area;

f. No material is placed in a manner that will be eroded by normal or expected high flows (properly anchored trees and treetops may be used in low energy areas); and.

g. The activity is part of a single and complete project.

Bank stabilization activities in excess of 500 feet in length or greater than an average of one cubic yard per running foot may be authorized if the permittee notifies the district engineer in accordance with the "Notification" general condition and the district engineer determines the activity complies with the other terms and conditions of the nationwide permit and the adverse environmental impacts are minimal both individually and cumulatively. (Sections 10 and 404)

14. **Road Crossing.** Fills for roads crossing waters of the United States (including wetlands and other special aquatic sites) provided:

a. The width of the fill is limited to the minimum necessary for the actual crossing;

b. The fill placed in waters of the United States is limited to a filled area of no more than

ATTACHMENT 3-D

COST ESTIMATES

North Water System

Project ID#	Construction Date	Project Description		Estimated Cost	Quantity	Unit Cost		Subtotal	Contingency
* NW 1	1997	New 12" loop around Legendary Lane, Hwy 334, and the Bozeman Easement	12 " WL	$830,000	12700 LF	$42.00	/lf	$533,400	1.33
			10 " WL		2100 LF	$35.00	/lf	$73,500	
			8 " WL		600 LF	$28.00	/lf	$16,800	
* NW 2	1997/2010	North WTP Expansion	1 MGD	$1,663,000	n/a	$1.25	/gal	$1,250,000	
* NW 3	1997/1999	North WTP High Service Pump Expansion	1100 gpm	$31,000	1 EA	$21.50	/gpm	$23,650	
* NW 4	1997/2001	North WTP Raw Water Pump Expansion	2500 gpm	$36,000	1 EA	$10.71	/gpm	$26,775	
NW 5	1996-2006	New 8" and 6" Waterlines for the remaining Priority #2 Area on the East Side of the Hwy 334 Bridge	8 " WL	$234,000	2000 LF	$28.00	/lf	$56,000	
			6 " WL		5700 LF	$21.00	/lf	$119,700	
NW 6	1996-2006	New 8" Waterlines to the Tamarack Area	8 " WL	$186,000	5000 LF	$28.00	/lf	$140,000	
NW 7	1996-2006	New 10" and 8" Waterlines to Harbor Point	10 " WL	$290,000	4300 LF	$35.00	/lf	$150,500	
			8 " WL		2400 LF	$28.00	/lf	$67,200	
NW 8	1996-2006	New 6" Waterline along Spanish Trail	6 " WL	$179,000	6400 LF	$21.00	/lf	$134,400	
NW 9	1996-2006	New 6" Waterlines through Sandy Shores and Eastwood Island Areas	6 " WL	$235,000	8400 LF	$21.00	/lf	$176,400	
NW 10	1996-2006	New 6" Waterline from Welch Street to Harmon Street	6 " WL	$78,000	2800 LF	$21.00	/lf	$58,800	
NW 11	2006	Total Storage Capacity Expansion	182000 Gal	$206,000	1 EA	$0.85	/gal	$154,700	
NW 12	2006-2016	New 6" and 8" Waterlines to serve Priority Area #3	8 " WL	$279,000	4600 LF	$28.00	/lf	$128,800	
			6 " WL		3850 LF	$21.00	/lf	$80,850	
NW 13	2006-2016	New 6" Waterline from Hwy 198 to Whispering Trail	6 " WL	$128,000	4600 LF	$21.00	/lf	$96,600	
NW 14	2006-2016	New 6" Waterline in the Oak Harbor Subdivision	6 " WL	$170,000	6100 LF	$21.00	/lf	$128,100	
NW 15	2006-2016	New 6" Waterlines in the Mantle Manors and Sherwood Shores Subdivisions	6 " WL	$268,000	9600 LF	$21.00	/lf	$201,600	
NW 16	2006-2016	New 6" Looped Waterline for the Harbor Point Subdivision	6 " WL	$246,000	8800 LF	$21.00	/lf	$184,800	
NW 17	2016-2026	New 10" Waterline Along Hwy 334 to Hwy 198	10 " WL	$307,000	6600 LF	$35.00	/lf	$231,000	
NW 18	2016-2026	New 6" Waterline along Hwy 334 in	6 " WL	$117,000	4200 LF	$21.00	/lf	$88,200	

		Priority Area #3					
NW 19	2016-2026	New 6" Waterline in the Siesta Shores Area	6 " WL	$148,000	5300 LF	$21.00 /lf	$111,300
NW 20	2016-2026	New 6" Waterline in the Harbor Point Subdivision	6 " WL	$67,000	2400 LF	$21.00 /lf	$50,400
NW 21	2016-2026	New 6" Waterline along Luther Street	6 " WL	$165,000	5900 LF	$21.00 /lf	$123,900
NW 22	2016-2026	New 6" Waterlines in the Mantle Manors and the Southwind Estates Subdivisions	6 " WL	$168,000	6000 LF	$21.00 /lf	$126,000
NW 23	2016-2026	New 6" Waterline along Whispering Trail in the Tamarack Area	6 " WL	$140,000	5000 LF	$21.00 /lf	$105,000
NW 24	2016-2026	New 6" Looped Waterline in Bonita Subdivision	6 " WL	$128,000	4600 LF	$21.00 /lf	$96,600

Total Costs 1996-2006 = $2,932,000
Total Costs 2006-2016 = $1,297,000
Total Costs 2016-2026 = $1,240,000

North Water System
Total Project Costs = $5,469,000

* Note: Project NW1 is currently under design and will be under construction shortly. Therefore it is not included in the final estimate.

Projects NW2, NW3, and NW4 are based on expansion of treatment plant and pumping capacity under TNRCC criteria for 0.6 gpm per connection.

South Water System

Project ID#	Construction Date	Project Description		Estimated Cost	Quantity	Unit Cost		Subtotal	Contingency
* SW 1	2002/2016	South WTP, High Service & Raw Water Pumps Expansion	0.864 MGD	$1,724,000	n/a	$1.50	/gal	$1,296,000	
SW 2	1996-2006	New 12" and 10" Waterline along Hwy 198 to Golden Oaks Addition	12 " WL 10 " WL	$230,000	1700 LF 2900 LF	$42.00 $35.00	/lf /lf	$71,400 $101,500	1.33
SW 3	1996-2006	New 12" Waterline along Enchanted Drive, Hwy 198, and Southward toward Cedar Branch Park	12 " WL	$528,000	9450 LF	$42.00	/lf	$396,900	
SW 4	1996-2006	New 12" and 8" Waterline through the Cedar Branch Subdivision	12 " WL 8 " WL	$268,000	2000 LF 4200 LF	$42.00 $28.00	/lf /lf	$84,000 $117,600	
SW 5	1996-2006	New 10" and 8" Waterline through Forgotten Acres to Lakeland Road	10 " WL 8 " WL	$205,000	4000 LF 500 LF	$35.00 $28.00	/lf /lf	$140,000 $14,000	
SW 6	1996-2006	New 8" and 6" Waterline Southward along Enchanted Drive to Enchanted Oaks	8 " WL 6 " WL	$130,000	2150 LF 1800 LF	$28.00 $21.00	/lf /lf	$60,200 $37,800	
SW 7	1996-2006	New 8" and 6" Waterline to Golden Oaks, Southwood Shores, Bonanza Beach, and Oak Shores Subdivisions	8 " WL 6 " WL	$396,000	2600 LF 10700 LF	$28.00 $21.00	/lf /lf	$72,800 $224,700	
SW 8	1996-2006	New 8" and 6" Waterline to Baywood Estates Area	8 " WL 6 " WL	$68,000	1200 LF 850 LF	$28.00 $21.00	/lf /lf	$33,600 $17,850	
SW 9	1996-2006	New 6" Looped Waterline through Bandera Bay and Oakwood Shores	6 " WL	$145,000	5200 LF	$21.00	/lf	$109,200	
SW 10	1996-2006	New 6" Looped Waterline around Leisure-land and to Three Harbors Subdivisions	6 " WL	$223,000	8000 LF	$21.00	/lf	$168,000	
SW 11	2006-2016	New 6" and 8" Waterline to provide looped system for the Golden Oaks, Southwood Shores, Bonanza Beach, and Oak Shores Subdivisions	8 " WL 6 " WL	$524,000	10700 LF 4500 LF	$28.00 $21.00	/lf /lf	$299,600 $94,500	
SW 12	2006-2016	New 6" Waterline to Enchanted Isles Subdivision	6 " WL	$112,000	4000 LF	$21.00	/lf	$84,000	
SW 13	2006-2016	New 6" Waterline to Cherokee Hills Subdivision	6 " WL	$28,000	1000 LF	$21.00	/lf	$21,000	
SW 14	2006-2016	New 6" Waterline through Oakwood Shore Subdivision	6 " WL	$84,000	3000 LF	$21.00	/lf	$63,000	
SW 15	2006-2016	New 6" Waterline through Del Mar Subdivision	6 " WL	$115,000	4100 LF	$21.00	/lf	$86,100	

SW 16	2006-2016	New 6" Waterline through the Timber Bay, Spillview Estates, and Diamond Oaks Subdivisions	6 " WL	$73,000	2600 LF	$21.00 /lf	$54,600
SW 17	2006-2016	Parallel 12" Waterline along Enchanted Drive to Hwy 198	12 " WL	$123,000	2200 LF	$42.00 /lf	$92,400
SW 18	2006-2016	New 12" and 10" Waterline along Hwy 198 toward Payne Springs	12 " WL 10 " WL	$229,000	3300 LF 950 LF	$42.00 /lf $35.00 /lf	$138,600 $33,250
SW 19	2006-2016	New 8" and 6" Waterlines through the Southern Portion of the Resort Service Area	8 " WL 6 " WL	$341,000	2850 LF 8400 LF	$28.00 /lf $21.00 /lf	$79,800 $176,400
SW 20	2006-2016	New 8" Waterline and Booster Pump Station to supply water to the Southeast parts of Priority #3 Area including the Lakeshore and Carolynn CCN areas	8 " WL 6 " WL 200 gpm pump 200000 gal tank	$1,375,000	26000 LF 6000 LF 2 EA 1 EA	$28.00 /lf $21.00 /lf $5,000.00 ea $0.85 ea	$728,000 $126,000 $10,000 $170,000
SW 21	2006-2016	New 8" Looped Waterline to Priority #3 Area	8 " WL	$603,000	16200 LF	$28.00 /lf	$453,600
SW 22	2006-2016	New 6" Waterline on the East Side of the Resort Area in Priority #3 Area	6 " WL	$170,000	6100 LF	$21.00 /lf	$128,100
SW 23	2016-2026	New 6" Waterline in the Southwood Shores Subdivision	6 " WL	$162,000	5800 LF	$21.00 /lf	$121,800
SW 24	2016-2026	New 6" Waterline in the Baywood Estates Subdivision	6 " WL	$47,000	1700 LF	$21.00 /lf	$35,700
SW 25	2016-2026	New 6" Waterline along Del Mar Shoreline	6 " WL	$59,000	2100 LF	$21.00 /lf	$44,100
SW 26	2016-2026	New 6" Waterline through the Wood Canyon Waters Subdivision	6 " WL	$75,000	2700 LF	$21.00 /lf	$56,700
SW 27	2016-2026	New 6" Waterline along the North Side of the Golden Oaks Subdivision	6 " WL	$173,000	6200 LF	$21.00 /lf	$130,200
SW 28	2016-2026	New 8" and 6" Looped Waterline along Hwy 198	8 " WL 6 " WL	$389,000	4300 LF 8200 LF	$28.00 /lf $21.00 /lf	$120,400 $172,200
SW 29	2016-2026	New 6" Waterline through the Resort area and the Western Side of Payne Springs	6 " WL	$112,000	4000 LF	$21.00 /lf	$84,000
SW 30	2016-2026	New 6" Waterline in the Northeastern part of the Priority #3 Area	6 " WL	$290,000	10400 LF	$21.00 /lf	$218,400
SW 31	2016-2026	New 6" Looped Waterline in the Carolynn, Lake Shore, and Southern Resort Service Area	6 " WL	$564,000	20200 LF	$21.00 /lf	$424,200

Total Costs 1996-2006 =	$3,917,000
Total Costs 2006-2016 =	$3,777,000
Total Costs 2016-2026 =	$1,871,000

South Water System
Total Project Costs = $9,565,000

* Note: Projects SW1 is based on expansion of treatment plant and pumping capacities under TNRCC criteria for 0.6 gpm per connection.

North Wastewater System

Project ID#	Construction Date	Project Description	Materials	Estimated Cost	Quantity	Unit Cost	Subtotal	Contingency
* NWW 1	1997	Expansion of LS38 and LS39	930 gpm LS	$544,000	1 EA	$96.70 /gpm	$89,931	1.33
			990 gpm LS		1 EA	$96.00 /gpm	$95,040	
			10 FM		6400 LF	$35.00 /LF	$224,000	
NWW 2	2002	North WWTP Expansion	0.275 MGD	$640,000	n/a	$1.75 /gal	$481,250	
NWW 3	1996-2006	Increase pumping capacity of LS60, LS61, & construction of a gravity sewer to LS38	65 gpm LS	$285,000	1 EA	$7,500.00 ea	$7,500	
			165 gpm LS		1 EA	$13,000.00 ea	$13,000	
			10 " Gravity		3700 LF	$35.00 /lf	$129,500	
			8 " Gravity		1400 LF	$28.00 /lf	$39,200	
			4 " FM		1800 LF	$14.00 /lf	$25,200	
NWW 4	1996-2006	Increase pumping capacity of LS25 and and LS33	80 gpm LS	$20,000	1 EA	$7,500.00 ea	$7,500	
			58 gpm LS		1 EA	$7,500.00 ea	$7,500	
NWW 5	1996-2006	Diversion of flow in Tamarack Area to LS56 and construction of a gravity sewer line from Hwy 198 to LS39	12 " Gravity	$383,000	600 LF	$42.00 /lf	$25,200	
			10 " Gravity		5700 LF	$35.00 /lf	$199,500	
			8 " FM		300 LF	$28.00 /lf	$8,400	
			6 " Gravity		800 LF	$21.00 /lf	$16,800	
			6 " FM		1200 LF	$21.00 /lf	$25,200	
			170 gpm LS		1 EA	$13,000.00 ea	$13,000	
NWW 6	1996-2006	Diversion of flow from LS19 to LS29 and expansion of LS29	6 " Gravity	$26,000	450 LF	$21.00 /lf	$9,450	
			110 gpm LS		1 EA	$10,000.00 ea	$10,000	
NWW 7	1996-2006	New 8" and 6" gravity sewer lines and Lift Stations to serve remaining area in Priority Area #2, East of Tamarack	8 " Gravity	$438,000	3700 LF	$28.00 /lf	$103,600	
			6 " Gravity		2900 LF	$21.00 /lf	$60,900	
			4 " FM		10500 LF	$14.00 /lf	$147,000	
			50 gpm LS		1 EA	$7,500.00 ea	$7,500	
			120 gpm LS		1 EA	$10,000.00 ea	$10,000	
NWW 8	2006-2016	New 8" gravity sewer line from Lakeview Street to existing 10" gravity sewer line East of Harbor Street	8 " Gravity	$127,000	3400 LF	$28.00 /lf	$95,200	
NWW 9	2006-2016	Expansion of LS19 and LS44	115 gpm LS	$23,000	1 EA	$10,000.00 ea	$10,000	
			65 gpm LS		1 EA	$7,500.00 ea	$7,500	
NWW 10	2006-2016	Expansion of LS5 and construction of new force main from LS61 to LS60	65 gpm LS	$64,000	1 EA	$7,500.00 ea	$7,500	
			4 " FM		2900 LF	$14.00 /lf	$40,600	
NWW 11	2006-2016	Expansion of LS7 and new gravity sewer line from LS21 and LS46 to LS7	120 gpm LS	$184,000	1 EA	$10,000.00 ea	$10,000	
			8 " Gravity		2800 LF	$28.00 /lf	$78,400	
			6 " Gravity		900 LF	$21.00 /lf	$18,900	
			4 " FM		2200 LF	$14.00 /lf	$30,800	
NWW 12	2006-2016	New 6" gravity sewer line to serve Priority Area #3	6 " Gravity	$140,000	5000 LF	$21.00 /lf	$105,000	

NWW 13	2006-2016	Expansion of LS36 and LS 40	230 gpm LS	$69,000	1 EA	$25,000.00	ea	$25,000
			260 gpm LS		1 EA	$27,000.00	ea	$27,000
NWW 14	2016-2026	New 6" gravity sewer line along Hwy 198	6 " Gravity	$92,000	3300 LF	$21.00	/lf	$69,300
NWW 15	2016-2026	New 8" and 6" gravity sewer line along	8 " Gravity	$227,000	5200 LF	$28.00	/lf	$145,600
		Luther Street to LS39	6 " Gravity		1200 LF	$21.00	/lf	$25,200
NWW 16	2016-2026	New gravity sewer line along Arbolado	8 " Gravity	$177,000	1000 LF	$28.00	/lf	$28,000
		Street to LS24, expansion of LS24, and	6 " Gravity		2400 LF	$21.00	/lf	$50,400
		new 4" force main from LS24 to Hwy 334	4 " FM		3200 LF	$14.00	/lf	$44,800
			95 gpm LS		1 EA	$10,000.00	ea	$10,000
NWW 17	2016-2026	Expansion of LS37	310 gpm LS	$40,000	1 EA	$30,000.00	ea	$30,000
NWW 18	2016-2026	New 8" gravity sewer line along Harbor	8 " Gravity	$102,000	2300 LF	$28.00	/lf	$64,400
		Point Road	6 " Gravity		600 LF	$21.00	/lf	$12,600

Total Costs 1996-2006 = $1,792,000
Total Costs 2006-2016 = $606,000
Total Costs 2016-2026 = $639,000

South Water System
Total Project Costs = $3,037,000

* Note: Project NWW1 is currently under design and will be under construction shortly. Therefore it is not included in the final estimate.

South Wastewater System

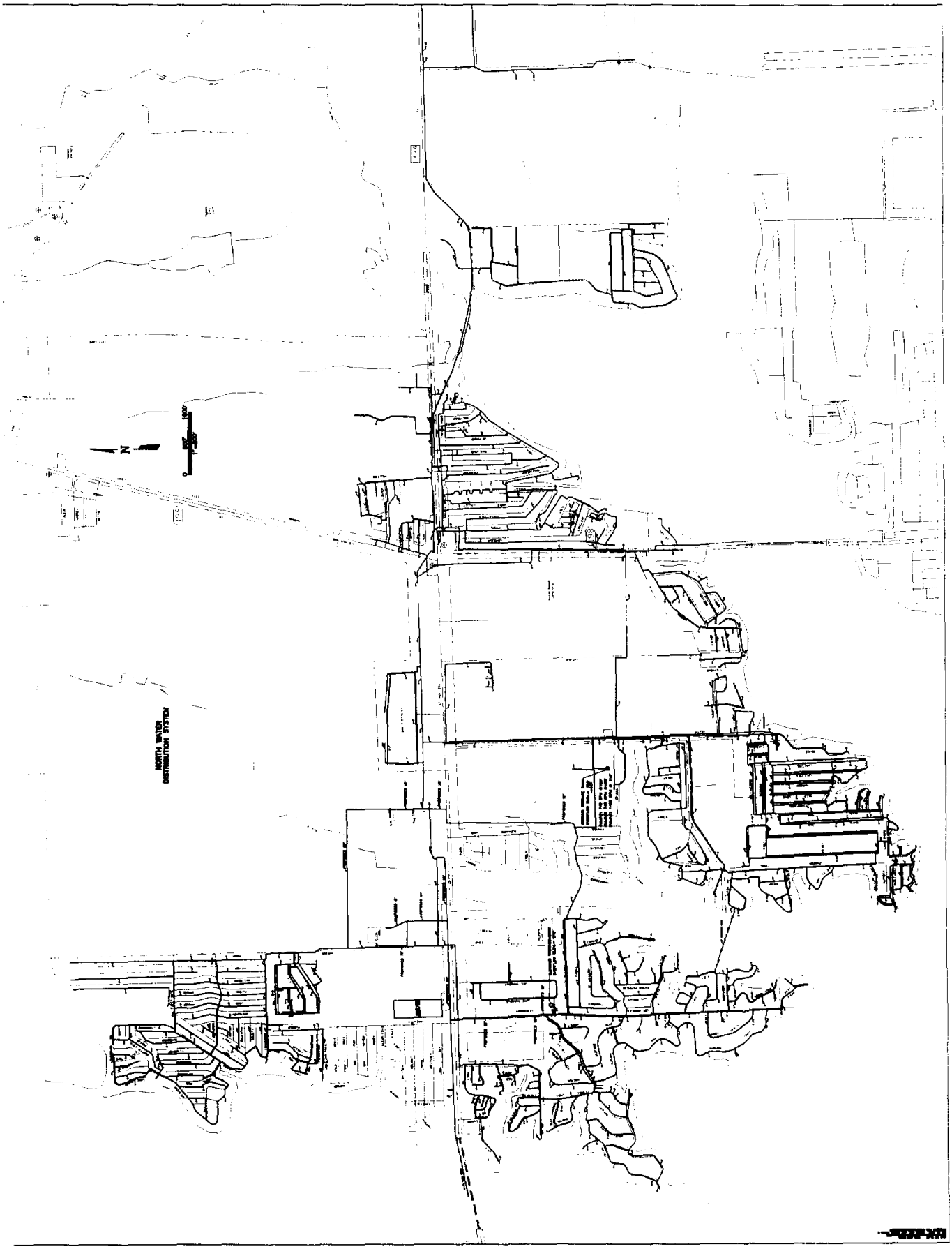
Project ID#	Construction Date	Project Description		Estimated Cost	Quantity	Unit Cost		Subtotal	Contingency
* SWW 1	1997	South WWTP Improvements	0.2 MGD	$399,000	n/a	$1.50	/gal	$300,000	1.33
SWW 2	1996-2006	New 15", 12", and 10" gravity sewer line and Lift Station to convey flow from the North part of the wastewater system	15 " Gravity	$619,000	2000 LF	$52.50	/lf	$105,000	
			12 " Gravity		2000 LF	$42.00	/lf	$84,000	
			10 " Gravity		6800 LF	$35.00	/lf	$238,000	
			400 gpm LS		1 EA	$38,700.00	ea	$38,700	
SWW 3	1996-2006	New 6" and 4" force main to the Golden Oaks Subdivision	6 " FM	$125,000	900 LF	$21.00	/lf	$18,900	
			4 " FM		3500 LF	$14.00	/lf	$49,000	
			3 " FM		2500 LF	$10.50	/lf	$26,250	
SWW 4	1996-2006	New 6" force main to Enchanted Drive and North to the Mac Oaks Subdivision	6 " FM	$67,000	2400 LF	$21.00	/lf	$50,400	
SWW 5	1996-2006	New 6" force main and Lift Station to serve the Cedar Branch Park Area	6 " FM	$325,000	10400 LF	$21.00	/lf	$218,400	
			250 gpm LS		1 EA	$26,000.00	ea	$26,000	
SWW 6	1996-2006	New 4" force main to the Oakwood Shores Subdivision	4 " FM	$89,000	2450 LF	$14.00	/lf	$34,300	
			3 " FM		3100 LF	$10.50	/lf	$32,550	
SWW 7	1996-2006	New 4" force main to the Baywood Estates Subdivision	4 " FM	$88,000	3200 LF	$14.00	/lf	$44,800	
			3 " FM		2000 LF	$10.50	/lf	$21,000	
SWW 8	1996-2006	New 4" force main to the Southland Shores, Bonanza Beach, and Oakshores	6 " FM	$417,000	3400 LF	$21.00	/lf	$71,400	
			4 " FM		13400 LF	$14.00	/lf	$187,600	
SWW 9	1996-2006	New 4" force main along Leisureland Drive and associated lateral force mains to serve Leisureland Subdivision	4 " FM	$168,000	3900 LF	$14.00	/lf	$54,600	
			3 " FM		6800 LF	$10.50	/lf	$71,400	
SWW 10	1996-2006	New 4" force main along Forgotten Lane and associated lateral force mains to serve Del Mar and Three Harbors Subdivisions	4 " FM	$274,000	8100 LF	$14.00	/lf	$113,400	
			3 " FM		8800 LF	$10.50	/lf	$92,400	
SWW 11	1996-2006	New 4" and 3" force main to serve the Timber Bay, Diamond Oaks, Spillview, Wood Canyon, and Deer Island Subdivisions	4 " FM	$245,000	9500 LF	$14.00	/lf	$133,000	
			3 " FM		4900 LF	$10.50	/lf	$51,450	
SWW 12	1998-2006	South WWTP Expansion	0.3 MGD	$698,000	n/a	$1.75	/gal	$525,000	
SWW 13	2006-2016	New 8" gravity sewer line to serve the Southwestern part of Payne Springs	8 " Gravity	$204,000	3300 LF	$28.00	/lf	$92,400	
			6 " Gravity		2900 LF	$21.00	/lf	$60,900	
SWW 14	2006-2016	New 8" gravity sewer trunk lines along Hwy 198 and along the Golden Oaks Subdivision	8 " Gravity	$681,000	12500 LF	$28.00	/lf	$350,000	
			6 " Gravity		7700 LF	$21.00	/lf	$161,700	
SWW 15	2006-2016	New parallel 6" force main to the Indian	6 " FM	$46,000	1650 LF	$21.00	/lf	$34,650	

		Harbor Area						
SWW 16	2006-2016	New parallel 6" force main along Enchanted Drive	6 " FM	$61,000	2200	LF	$21.00 /lf	$46,200
SWW 17	2006-2016	New parallel 4" force main along Lakeland Drive	4 " FM	$45,000	2400	LF	$14.00 /lf	$33,600
SWW 18	2006-2016	New 6" and 4" force main to serve the Southeastern portion of Priority #3 Area	6 " FM	$600,000	6300	LF	$21.00 /lf	$132,300
			4 " FM		15000	LF	$14.00 /lf	$210,000
			3 " FM		9400	LF	$10.50 /lf	$98,700
			120 gpm LS		1	EA	$10,400.00 ea	$10,400
SWW 19	2006-2016	New 6" and 4" force main for the Resort CCN within the Priority #3 Area	6 " FM	$272,000	3300	LF	$21.00 /lf	$69,300
			4 " FM		4500	LF	$14.00 /lf	$63,000
			3 " FM		6900	LF	$10.50 /lf	$72,450
SWW 20	2006-2016	New 250 gpm Lift Station and 6" force main at Lynn Creek	250 gpm LS	$350,000	1	EA	$26,000.00 ea	$26,000
			6 " FM		11300	LF	$21.00 /lf	$237,300
SWW 21	2016-2026	New 6", 8", and 10" gravity sewer trunk line through the Central part of Payne Springs	10 " Gravity	$1,258,000	5800	LF	$35.00 /lf	$203,000
			8 " Gravity		13100	LF	$28.00 /lf	$366,800
			6 " Gravity		17900	LF	$21.00 /lf	$375,900
SWW 22	2016-2026	New 6" parallel force main on Forgotten Ln.	6 " FM	$47,000	1700	LF	$21.00 /lf	$35,700
SWW 23	2016-2026	New 6" parallel force main to serve the Resort CCN Area	6 " FM	$78,000	2800	LF	$21.00 /lf	$58,800
SWW 24	2016-2026	New 6" parallel force main in the Southern Priority #3 Area	6 " FM	$142,000	5100	LF	$21.00 /lf	$107,100

Total Costs 1996-2006 =	$3,115,000
Total Costs 2006-2016 =	$2,260,000
Total Costs 2016-2026 =	$1,526,000
South Water System Total Project Costs =	$6,901,000

* Note: Project SWW1 is currently under design and will be under construction shortly. Therefore it is not included in the final estimate.

TOTAL MASTER PLAN COSTS 1996-200	$11,756,000
TOTAL MASTER PLAN COSTS 2006-201	$7,940,000
TOTAL MASTER PLAN COSTS 2016-202	$5,276,000
TOTAL MASTER PLAN COSTS =	$24,972,000


N
NORTH WATER
DISTRIBUTION SYSTEM

		Harbor Area						
SWW 16	2006-2016	New parallel 6" force main along Enchanted Drive	6 " FM	$61,000	2200 LF	$21.00	/lf	$46,200
SWW 17	2006-2016	New parallel 4" force main along Lakeland Drive	4 " FM	$45,000	2400 LF	$14.00	/lf	$33,600
SWW 18	2006-2016	New 6" and 4" force main to serve the Southeastern portion of Priority #3 Area	6 " FM	$600,000	6300 LF	$21.00	/lf	$132,300
			4 " FM		15000 LF	$14.00	/lf	$210,000
			3 " FM		9400 LF	$10.50	/lf	$98,700
			120 gpm LS		1 EA	$10,400.00	ea	$10,400
SWW 19	2006-2016	New 6" and 4" force main for the Resort CCN within the Priority #3 Area	6 " FM	$272,000	3300 LF	$21.00	/lf	$69,300
			4 " FM		4500 LF	$14.00	/lf	$63,000
			3 " FM		6900 LF	$10.50	/lf	$72,450
SWW 20	2006-2016	New 250 gpm Lift Station and 6" force main at Lynn Creek	250 gpm LS	$350,000	1 EA	$26,000.00	ea	$26,000
			6 " FM		11300 LF	$21.00	/lf	$237,300
SWW 21	2016-2026	New 6", 8", and 10" gravity sewer trunk line through the Central part of Payne Springs	10 " Gravity	$1,258,000	5800 LF	$35.00	/lf	$203,000
			8 " Gravity		13100 LF	$28.00	/lf	$366,800
			6 " Gravity		17900 LF	$21.00	/lf	$375,900
SWW 22	2016-2026	New 6" parallel force main on Forgotten Ln.	6 " FM	$47,000	1700 LF	$21.00	/lf	$35,700
SWW 23	2016-2026	New 6" parallel force main to serve the Resort CCN Area	6 " FM	$78,000	2800 LF	$21.00	/lf	$58,800
SWW 24	2016-2026	New 6" parallel force main in the Southern Priority #3 Area	6 " FM	$142,000	5100 LF	$21.00	/lf	$107,100

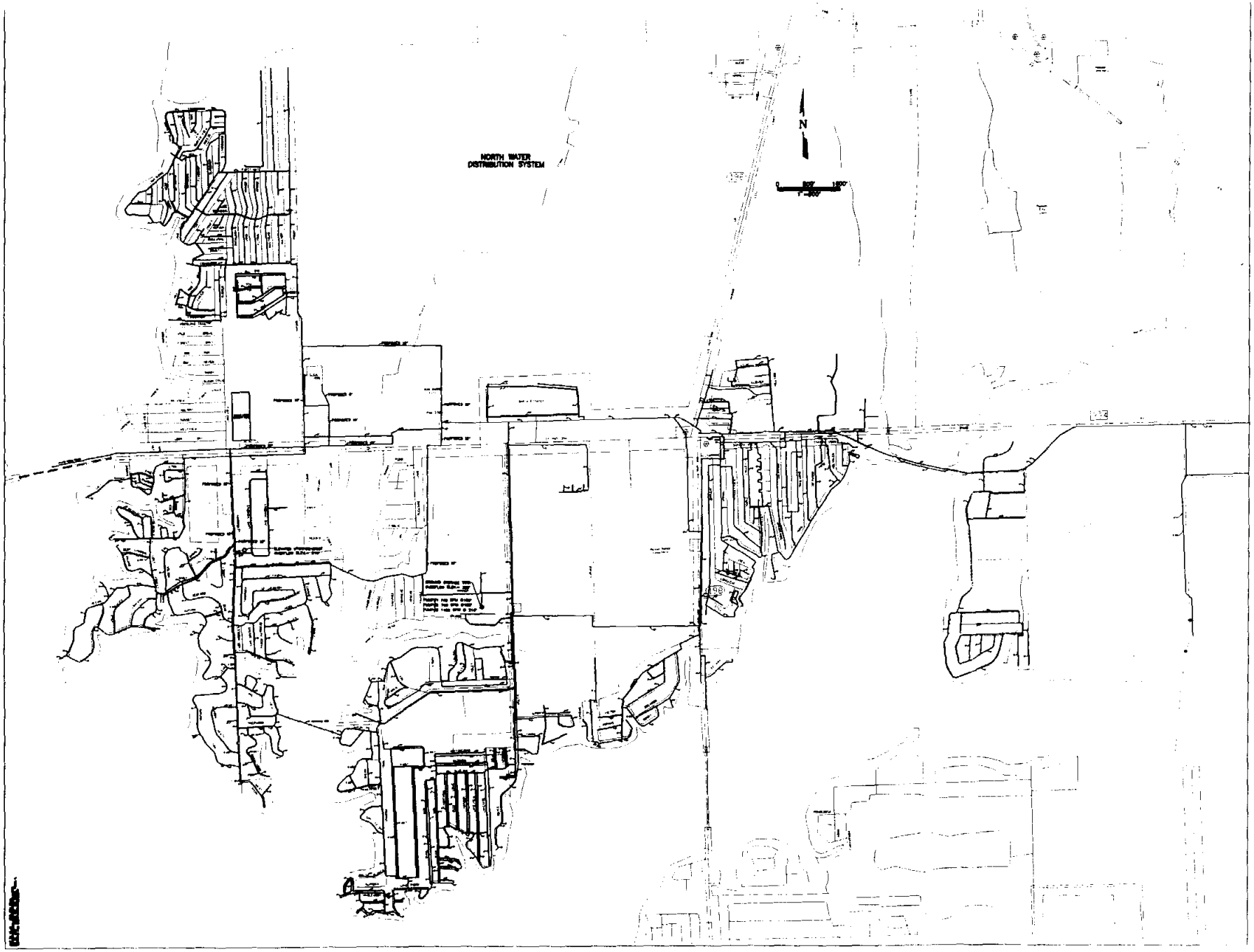
Total Costs 1996-2006 =	$3,115,000
Total Costs 2006-2016 =	$2,260,000
Total Costs 2016-2026 =	$1,526,000
South Water System Total Project Costs =	$6,901,000

* Note: Project SWW1 is currently under design and will be under construction shortly. Therefore it is not included in the final estimate.

TOTAL MASTER PLAN COSTS 1996-200	$11,756,000
TOTAL MASTER PLAN COSTS 2006-201	$7,940,000
TOTAL MASTER PLAN COSTS 2016-202	$5,276,000
TOTAL MASTER PLAN COSTS =	$24,972,000

APPENDIX D

CURRENT SYSTEM MAPPING


NORTH WATER
DISTRIBUTION SYSTEM
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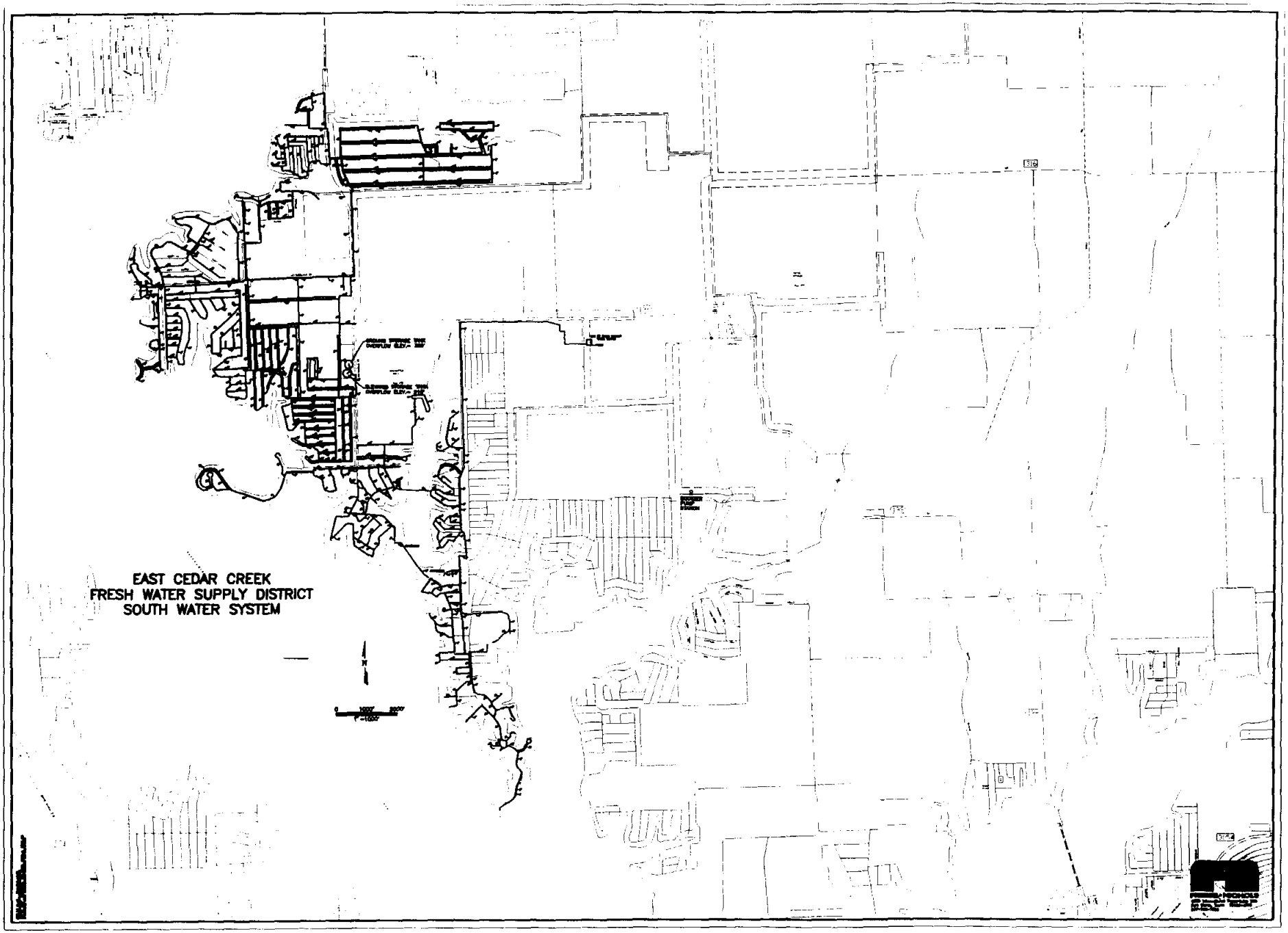
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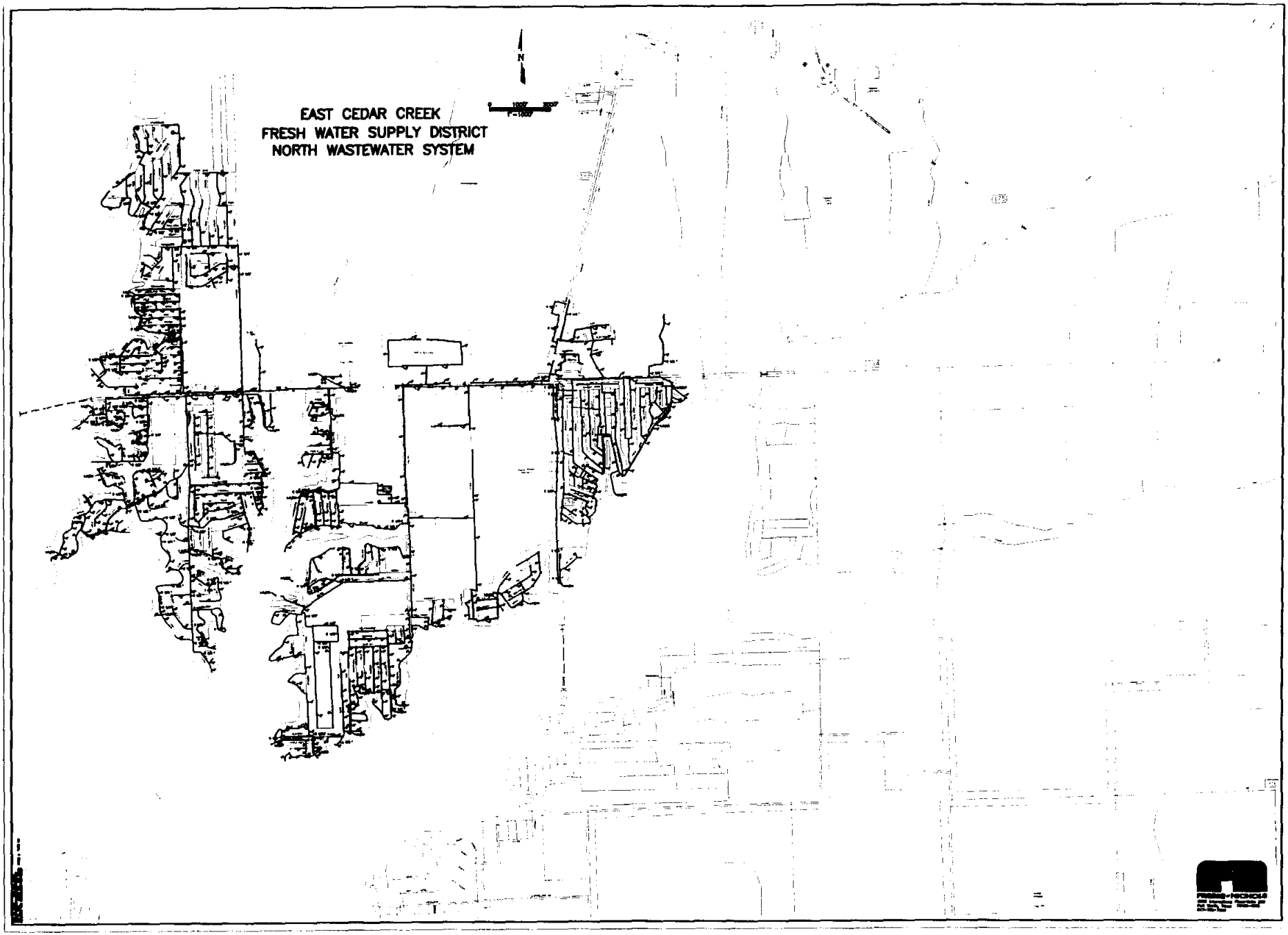
FRESH WATER SUPPLY DISTRICT
SOUTH WATER SYSTEM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FRESH WATER SUPPLY DISTRICT
NORTH WASTEWATER SYSTEM
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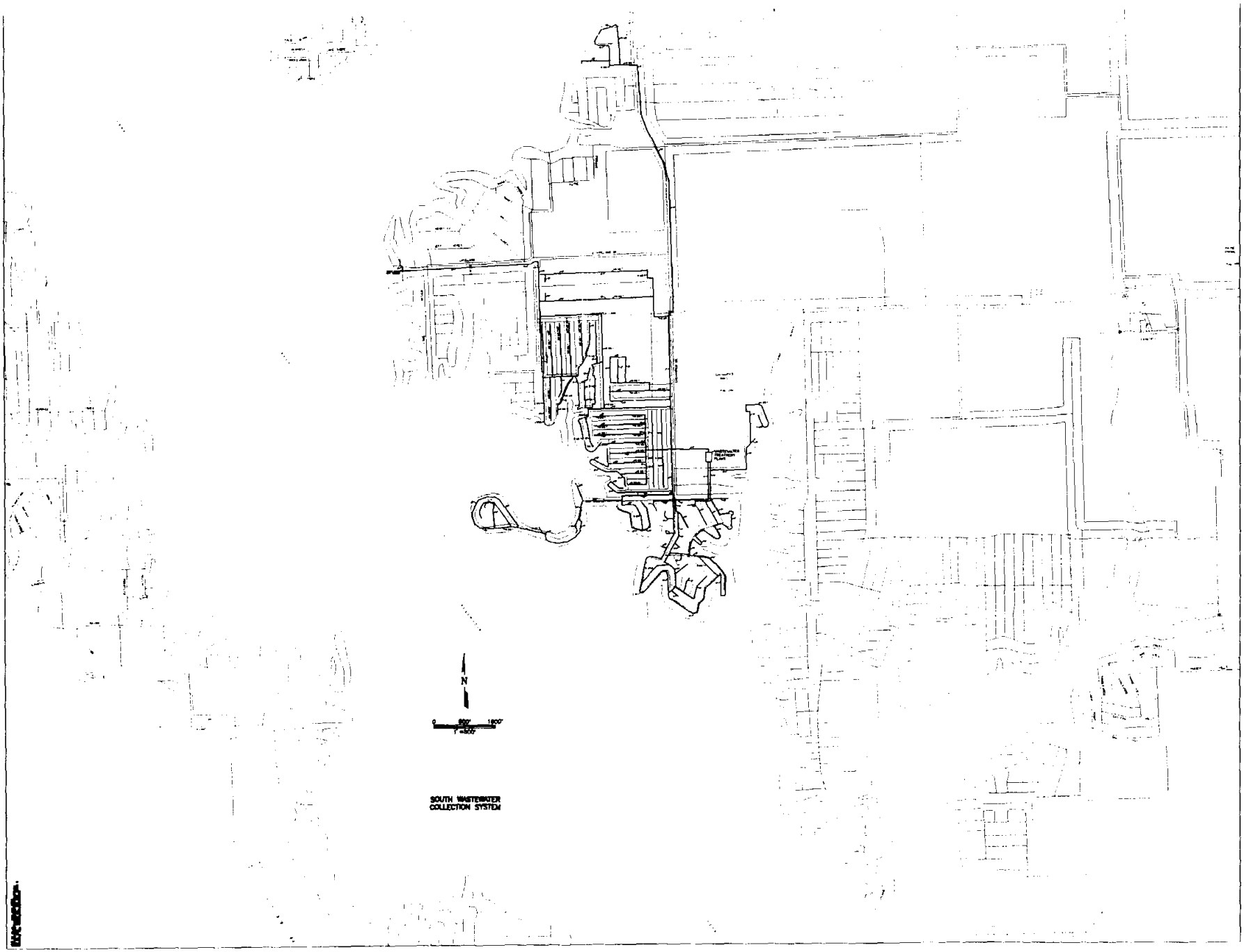
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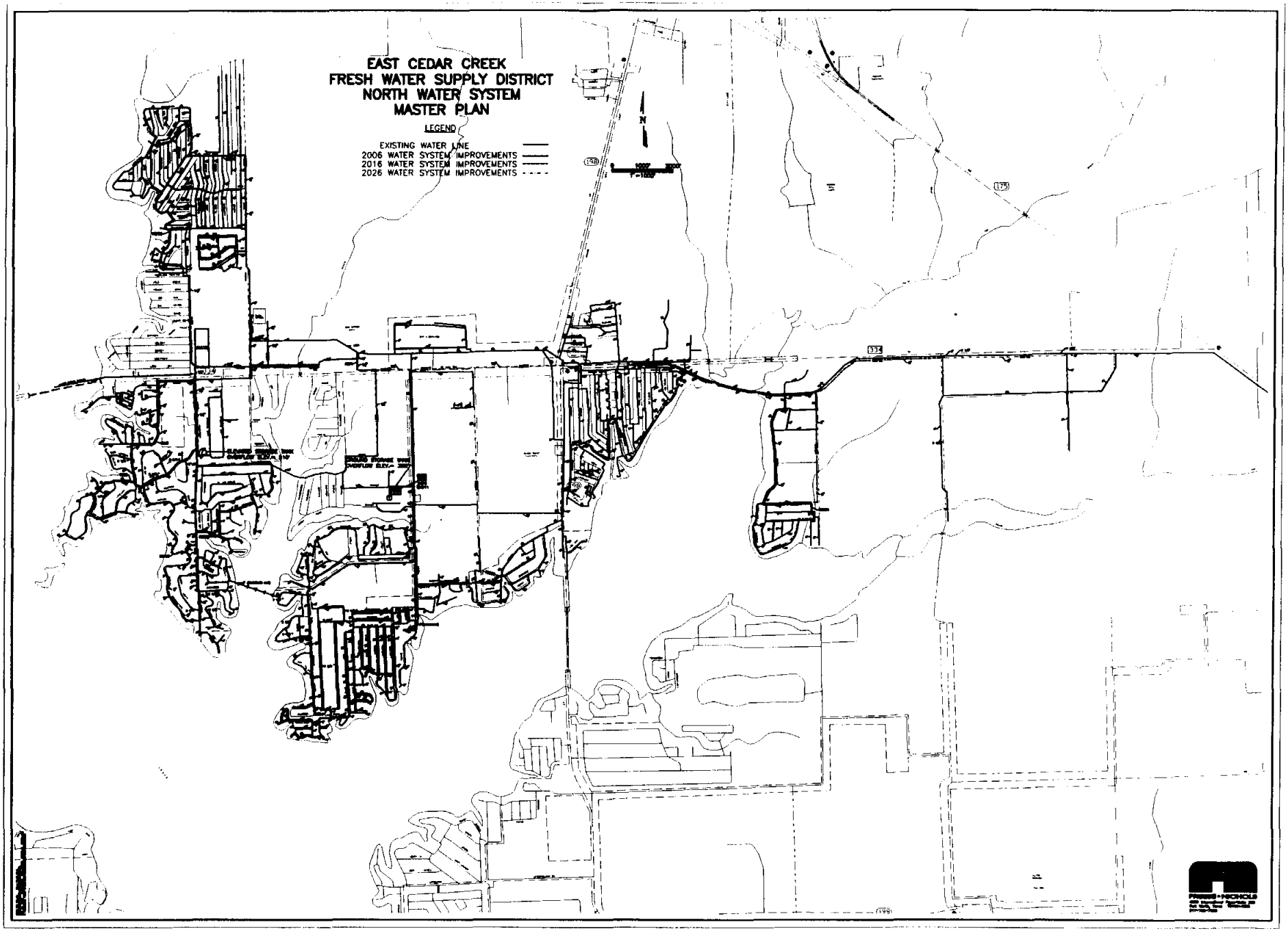
SOUTH WASTEWATER
COLLECTION SYSTEM

APPENDIX E

PROPOSED SYSTEM MAPPING


EAST CEDAR CREEK
FRESH WATER SUPPLY DISTRICT
NORTH WATER SYSTEM
MASTER PLAN
LEGEND
EXISTING WATER LINE
2006 WATER SYSTEM IMPROVEMENTS
2016 WATER SYSTEM IMPROVEMENTS
2026 WATER SYSTEM IMPROVEMENTS
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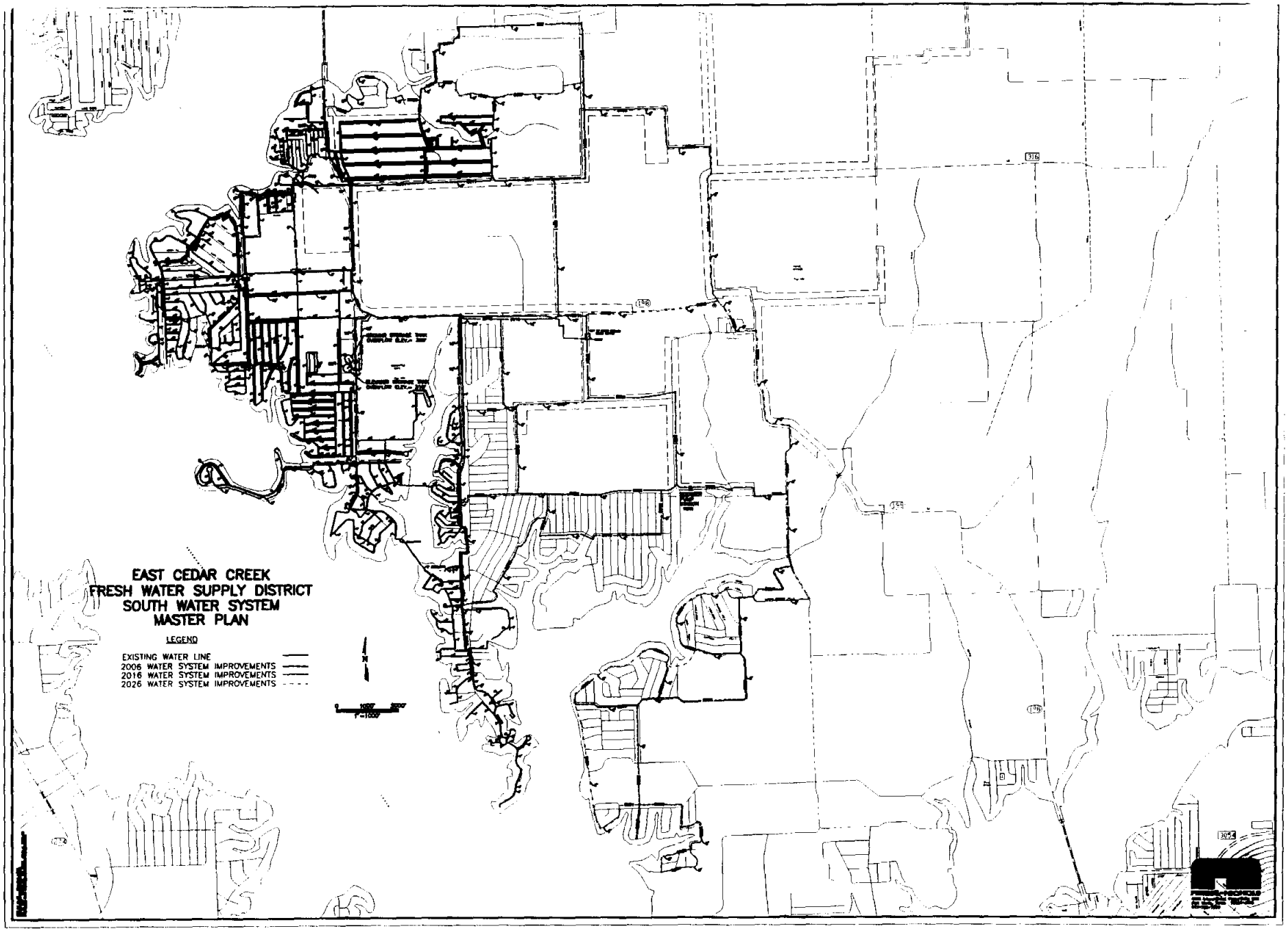
148
175
334


EAST CEDAR CREEK
FRESH WATER SUPPLY DISTRICT
SOUTH WATER SYSTEM
MASTER PLAN
LEGEND
EXISTING WATER LINE
2006 WATER SYSTEM IMPROVEMENTS
2016 WATER SYSTEM IMPROVEMENTS
2026 WATER SYSTEM IMPROVEMENTS
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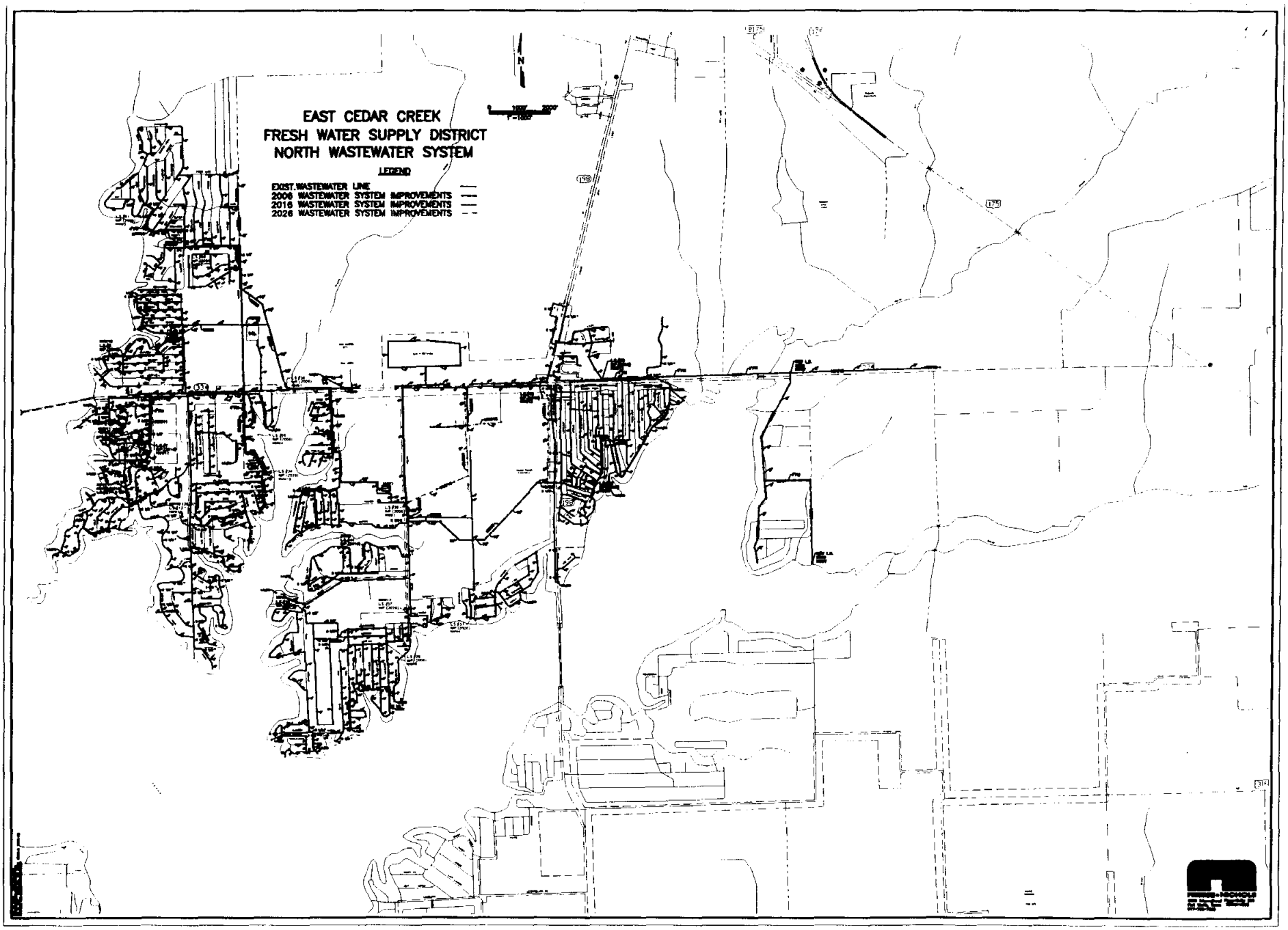
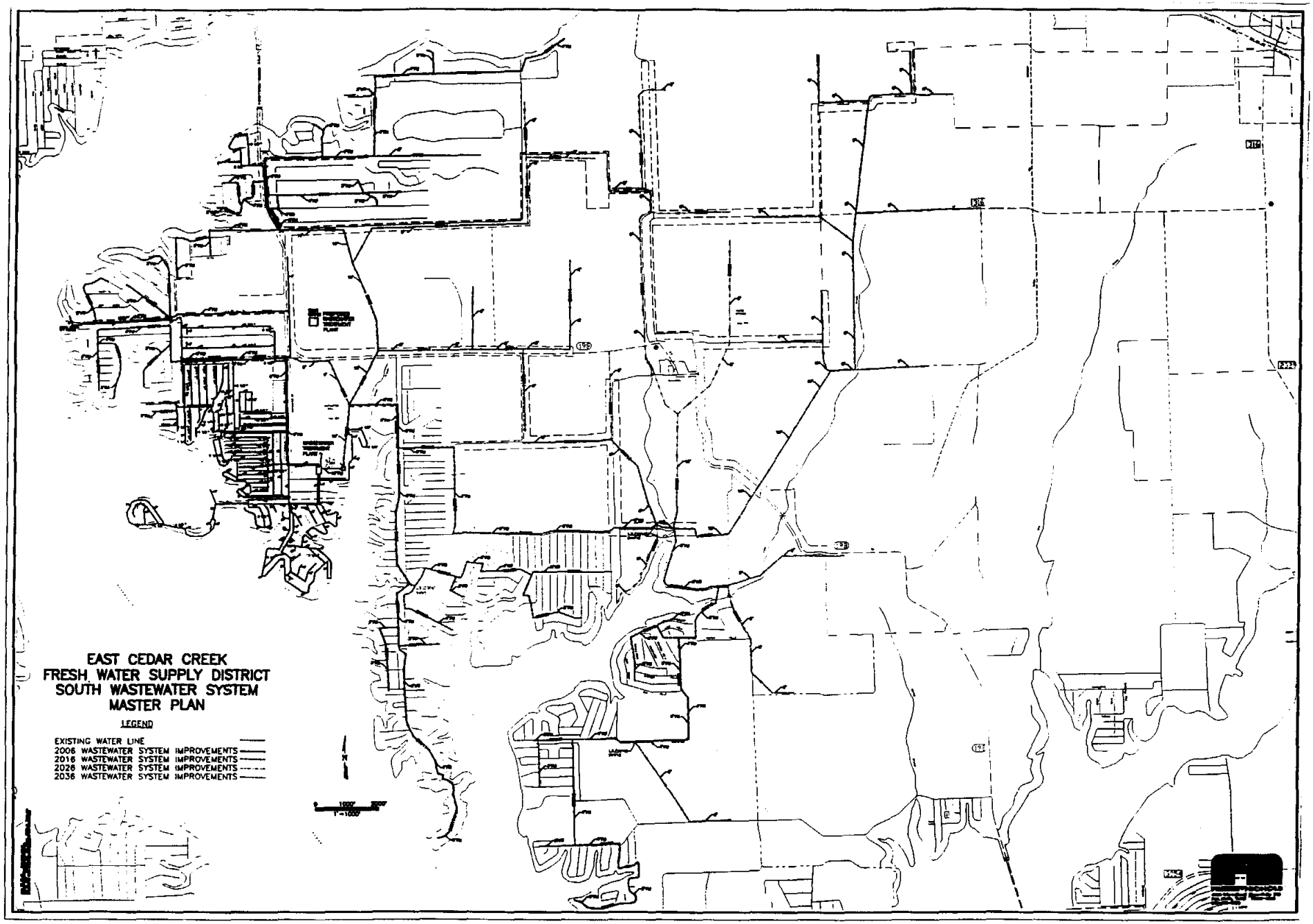
1" = 1000'
316
156
155
156
305


EAST CEDAR CREEK
FRESH WATER SUPPLY DISTRICT
NORTH WASTEWATER SYSTEM
LEGEND
EXIST. WASTEWATER LINE
2006 WASTEWATER SYSTEM IMPROVEMENTS
2016 WASTEWATER SYSTEM IMPROVEMENTS
2026 WASTEWATER SYSTEM IMPROVEMENTS
N


EAST CEDAR CREEK
FRESH WATER SUPPLY DISTRICT
SOUTH WASTEWATER SYSTEM
MASTER PLAN
LEGEND
EXISTING WATER LINE
2006 WASTEWATER SYSTEM IMPROVEMENTS
2016 WASTEWATER SYSTEM IMPROVEMENTS
2026 WASTEWATER SYSTEM IMPROVEMENTS
2036 WASTEWATER SYSTEM IMPROVEMENTS

APPENDIX F

COST ESTIMATES

		Harbor Area						
SWW 16	2006-2016	New parallel 6" force main along Enchanted Drive	6 " FM	$61,000	2200 LF	$21.00	/lf	$46,200
SWW 17	2006-2016	New parallel 4" force main along Lakeland Drive	4 " FM	$45,000	2400 LF	$14.00	/lf	$33,600
SWW 18	2006-2016	New 6" and 4" force main to serve the Southeastern portion of Priority #3 Area	6 " FM	$600,000	6300 LF	$21.00	/lf	$132,300
			4 " FM		15000 LF	$14.00	/lf	$210,000
			3 " FM		9400 LF	$10.50	/lf	$98,700
			120 gpm LS		1 EA	$10,400.00	ea	$10,400
SWW 19	2006-2016	New 6" and 4" force main for the Resort CCN within the Priority #3 Area	6 " FM	$272,000	3300 LF	$21.00	/lf	$69,300
			4 " FM		4500 LF	$14.00	/lf	$63,000
			3 " FM		6900 LF	$10.50	/lf	$72,450
SWW 20	2006-2016	New 250 gpm Lift Station and 6" force main at Lynn Creek	250 gpm LS	$350,000	1 EA	$26,000.00	ea	$26,000
			6 " FM		11300 LF	$21.00	/lf	$237,300
SWW 21	2016-2026	New 6", 8", and 10" gravity sewer trunk line through the Central part of Payne Springs	10 " Gravity	$1,258,000	5800 LF	$35.00	/lf	$203,000
			8 " Gravity		13100 LF	$28.00	/lf	$366,800
			6 " Gravity		17900 LF	$21.00	/lf	$375,900
SWW 22	2016-2026	New 6" parallel force main on Forgotten Ln.	6 " FM	$47,000	1700 LF	$21.00	/lf	$35,700
SWW 23	2016-2026	New 6" parallel force main to serve the Resort CCN Area	6 " FM	$78,000	2800 LF	$21.00	/lf	$58,800
SWW 24	2016-2026	New 6" parallel force main in the Southern Priority #3 Area	6 " FM	$142,000	5100 LF	$21.00	/lf	$107,100

Total Costs 1996-2006 =	$3,115,000
Total Costs 2006-2016 =	$2,260,000
Total Costs 2016-2026 =	$1,526,000
South Water System Total Project Costs =	$6,901,000

* Note: Project SWW1 is currently under design and will be under construction shortly. Therefore it is not included in the final estimate.

TOTAL MASTER PLAN COSTS 1996-200	$11,756,000
TOTAL MASTER PLAN COSTS 2006-201	$7,940,000
TOTAL MASTER PLAN COSTS 2016-202	$5,276,000
TOTAL MASTER PLAN COSTS =	$24,972,000

South Wastewater System

Project ID#	Construction Date	Project Description		Estimated Cost	Quantity	Unit Cost		Subtotal	Contingency
* SWW 1	1997	South WWTP Improvements	0.2 MGD	$399,000	n/a	$1.50	/gal	$300,000	1.33
SWW 2	1996-2006	New 15", 12", and 10" gravity sewer line and Lift Station to convey flow from the North part of the wastewater system	15 " Gravity	$619,000	2000 LF	$52.50	/lf	$105,000	
			12 " Gravity		2000 LF	$42.00	/lf	$84,000	
			10 " Gravity		6800 LF	$35.00	/lf	$238,000	
			400 gpm LS		1 EA	$38,700.00	ea	$38,700	
SWW 3	1996-2006	New 6" and 4" force main to the Golden Oaks Subdivision	6 " FM	$125,000	900 LF	$21.00	/lf	$18,900	
			4 " FM		3500 LF	$14.00	/lf	$49,000	
			3 " FM		2500 LF	$10.50	/lf	$26,250	
SWW 4	1996-2006	New 6" force main to Enchanted Drive and North to the Mac Oaks Subdivision	6 " FM	$67,000	2400 LF	$21.00	/lf	$50,400	
SWW 5	1996-2006	New 6" force main and Lift Station to serve the Cedar Branch Park Area	6 " FM	$325,000	10400 LF	$21.00	/lf	$218,400	
			250 gpm LS		1 EA	$26,000.00	ea	$26,000	
SWW 6	1996-2006	New 4" force main to the Oakwood Shores Subdivision	4 " FM	$89,000	2450 LF	$14.00	/lf	$34,300	
			3 " FM		3100 LF	$10.50	/lf	$32,550	
SWW 7	1996-2006	New 4" force main to the Baywood Estates Subdivision	4 " FM	$88,000	3200 LF	$14.00	/lf	$44,800	
			3 " FM		2000 LF	$10.50	/lf	$21,000	
SWW 8	1996-2006	New 4" force main to the Southland Shores, Bonanza Beach, and Oakshores	6 " FM	$417,000	3400 LF	$21.00	/lf	$71,400	
			4 " FM		13400 LF	$14.00	/lf	$187,600	
SWW 9	1996-2006	New 4" force main along Leisureland Drive and associated lateral force mains to serve Leisureland Subdivision	4 " FM	$168,000	3900 LF	$14.00	/lf	$54,600	
			3 " FM		6800 LF	$10.50	/lf	$71,400	
SWW 10	1996-2006	New 4" force main along Forgotten Lane and associated lateral force mains to serve Del Mar and Three Harbors Subdivisions	4 " FM	$274,000	8100 LF	$14.00	/lf	$113,400	
			3 " FM		8800 LF	$10.50	/lf	$92,400	
SWW 11	1996-2006	New 4" and 3" force main to serve the Timber Bay, Diamond Oaks, Spillview, Wood Canyon, and Deer Island Subdivisions	4 " FM	$245,000	9500 LF	$14.00	/lf	$133,000	
			3 " FM		4900 LF	$10.50	/lf	$51,450	
SWW 12	1998-2006	South WWTP Expansion	0.3 MGD	$698,000	n/a	$1.75	/gal	$525,000	
SWW 13	2006-2016	New 8" gravity sewer line to serve the Southwestern part of Payne Springs	8 " Gravity	$204,000	3300 LF	$28.00	/lf	$92,400	
			6 " Gravity		2900 LF	$21.00	/lf	$60,900	
SWW 14	2006-2016	New 8" gravity sewer trunk lines along Hwy 198 and along the Golden Oaks Subdivision	8 " Gravity	$681,000	12500 LF	$28.00	/lf	$350,000	
			6 " Gravity		7700 LF	$21.00	/lf	$161,700	
SWW 15	2006-2016	New parallel 6" force main to the Indian	6 " FM	$46,000	1650 LF	$21.00	/lf	$34,650	

NWW 13	2006-2016	Expansion of LS36 and LS 40	230 gpm LS	$69,000	1 EA	$25,000.00	ea	$25,000
			260 gpm LS		1 EA	$27,000.00	ea	$27,000
NWW 14	2016-2026	New 6" gravity sewer line along Hwy 198	6 " Gravity	$92,000	3300 LF	$21.00	/lf	$69,300
NWW 15	2016-2026	New 8" and 6" gravity sewer line along	8 " Gravity	$227,000	5200 LF	$28.00	/lf	$145,600
		Luther Street to LS39	6 " Gravity		1200 LF	$21.00	/lf	$25,200
NWW 16	2016-2026	New gravity sewer line along Arbolado	8 " Gravity	$177,000	1000 LF	$28.00	/lf	$28,000
		Street to LS24, expansion of LS24, and	6 " Gravity		2400 LF	$21.00	/lf	$50,400
		new 4" force main from LS24 to Hwy 334	4 " FM		3200 LF	$14.00	/lf	$44,800
			95 gpm LS		1 EA	$10,000.00	ea	$10,000
NWW 17	2016-2026	Expansion of LS37	310 gpm LS	$40,000	1 EA	$30,000.00	ea	$30,000
NWW 18	2016-2026	New 8" gravity sewer line along Harbor	8 " Gravity	$102,000	2300 LF	$28.00	/lf	$64,400
		Point Road	6 " Gravity		600 LF	$21.00	/lf	$12,600

Total Costs 1996-2006 = $1,792,000
Total Costs 2006-2016 = $606,000
Total Costs 2016-2026 = $639,000

South Water System
Total Project Costs = $3,037,000

* Note: Project NWW1 is currently under design and will be under construction shortly. Therefore it is not included in the final estimate.

North Wastewater System

Project ID#	Construction Date	Project Description	Materials	Estimated Cost	Quantity	Unit Cost	Subtotal	Contingency
* NWW 1	1997	Expansion of LS38 and LS39	930 gpm LS	$544,000	1 EA	$96.70 /gpm	$89,931	1.33
			990 gpm LS		1 EA	$96.00 /gpm	$95,040	
			10 FM		6400 LF	$35.00 /LF	$224,000	
NWW 2	2002	North WWTP Expansion	0.275 MGD	$640,000	n/a	$1.75 /gal	$481,250	
NWW 3	1996-2006	Increase pumping capacity of LS60, LS61, & construction of a gravity sewer to LS38	65 gpm LS	$285,000	1 EA	$7,500.00 ea	$7,500	
			165 gpm LS		1 EA	$13,000.00 ea	$13,000	
			10 " Gravity		3700 LF	$35.00 /lf	$129,500	
			8 " Gravity		1400 LF	$28.00 /lf	$39,200	
			4 " FM		1800 LF	$14.00 /lf	$25,200	
NWW 4	1996-2006	Increase pumping capacity of LS25 and and LS33	80 gpm LS	$20,000	1 EA	$7,500.00 ea	$7,500	
			58 gpm LS		1 EA	$7,500.00 ea	$7,500	
NWW 5	1996-2006	Diversion of flow in Tamarack Area to LS56 and construction of a gravity sewer line from Hwy 198 to LS39	12 " Gravity	$383,000	600 LF	$42.00 /lf	$25,200	
			10 " Gravity		5700 LF	$35.00 /lf	$199,500	
			8 " FM		300 LF	$28.00 /lf	$8,400	
			6 " Gravity		800 LF	$21.00 /lf	$16,800	
			6 " FM		1200 LF	$21.00 /lf	$25,200	
			170 gpm LS		1 EA	$13,000.00 ea	$13,000	
NWW 6	1996-2006	Diversion of flow from LS19 to LS29 and expansion of LS29	6 " Gravity	$26,000	450 LF	$21.00 /lf	$9,450	
			110 gpm LS		1 EA	$10,000.00 ea	$10,000	
NWW 7	1996-2006	New 8" and 6" gravity sewer lines and Lift Stations to serve remaining area in Priority Area #2, East of Tamarack	8 " Gravity	$438,000	3700 LF	$28.00 /lf	$103,600	
			6 " Gravity		2900 LF	$21.00 /lf	$60,900	
			4 " FM		10500 LF	$14.00 /lf	$147,000	
			50 gpm LS		1 EA	$7,500.00 ea	$7,500	
			120 gpm LS		1 EA	$10,000.00 ea	$10,000	
NWW 8	2006-2016	New 8" gravity sewer line from Lakeview Street to existing 10" gravity sewer line East of Harbor Street	8 " Gravity	$127,000	3400 LF	$28.00 /lf	$95,200	
NWW 9	2006-2016	Expansion of LS19 and LS44	115 gpm LS	$23,000	1 EA	$10,000.00 ea	$10,000	
			65 gpm LS		1 EA	$7,500.00 ea	$7,500	
NWW 10	2006-2016	Expansion of LS5 and construction of new force main from LS61 to LS60	65 gpm LS	$64,000	1 EA	$7,500.00 ea	$7,500	
			4 " FM		2900 LF	$14.00 /lf	$40,600	
NWW 11	2006-2016	Expansion of LS7 and new gravity sewer line from LS21 and LS46 to LS7	120 gpm LS	$184,000	1 EA	$10,000.00 ea	$10,000	
			8 " Gravity		2800 LF	$28.00 /lf	$78,400	
			6 " Gravity		900 LF	$21.00 /lf	$18,900	
			4 " FM		2200 LF	$14.00 /lf	$30,800	
NWW 12	2006-2016	New 6" gravity sewer line to serve Priority Area #3	6 " Gravity	$140,000	5000 LF	$21.00 /lf	$105,000	

Total Costs 1996-2006 =	$3,917,000
Total Costs 2006-2016 =	$3,777,000
Total Costs 2016-2026 =	$1,871,000

South Water System
Total Project Costs = $9,565,000

* Note: Projects SW1 is based on expansion of treatment plant and pumping capacities under TNRCC criteria for 0.6 gpm per connection.

SW 16	2006-2016	New 6" Waterline through the Timber Bay, Spillview Estates, and Diamond Oaks Subdivisions	6 " WL	$73,000	2600 LF	$21.00	/lf	$54,600
SW 17	2006-2016	Parallel 12" Waterline along Enchanted Drive to Hwy 198	12 " WL	$123,000	2200 LF	$42.00	/lf	$92,400
SW 18	2006-2016	New 12" and 10" Waterline along Hwy 198 toward Payne Springs	12 " WL 10 " WL	$229,000	3300 LF 950 LF	$42.00 $35.00	/lf /lf	$138,600 $33,250
SW 19	2006-2016	New 8" and 6" Waterlines through the Southern Portion of the Resort Service Area	8 " WL 6 " WL	$341,000	2850 LF 8400 LF	$28.00 $21.00	/lf /lf	$79,800 $176,400
SW 20	2006-2016	New 8" Waterline and Booster Pump Station to supply water to the Southeast parts of Priority #3 Area including the Lakeshore and Carolynn CCN areas	8 " WL 6 " WL 200 gpm pump 200000 gal tank	$1,375,000	26000 LF 6000 LF 2 EA 1 EA	$28.00 $21.00 $5,000.00 $0.85	/lf /lf ea ea	$728,000 $126,000 $10,000 $170,000
SW 21	2006-2016	New 8" Looped Waterline to Priority #3 Area	8 " WL	$603,000	16200 LF	$28.00	/lf	$453,600
SW 22	2006-2016	New 6" Waterline on the East Side of the Resort Area in Priority #3 Area	6 " WL	$170,000	6100 LF	$21.00	/lf	$128,100
SW 23	2016-2026	New 6" Waterline in the Southwood Shores Subdivision	6 " WL	$162,000	5800 LF	$21.00	/lf	$121,800
SW 24	2016-2026	New 6" Waterline in the Baywood Estates Subdivision	6 " WL	$47,000	1700 LF	$21.00	/lf	$35,700
SW 25	2016-2026	New 6" Waterline along Del Mar Shoreline	6 " WL	$59,000	2100 LF	$21.00	/lf	$44,100
SW 26	2016-2026	New 6" Waterline through the Wood Canyon Waters Subdivision	6 " WL	$75,000	2700 LF	$21.00	/lf	$56,700
SW 27	2016-2026	New 6" Waterline along the North Side of the Golden Oaks Subdivision	6 " WL	$173,000	6200 LF	$21.00	/lf	$130,200
SW 28	2016-2026	New 8" and 6" Looped Waterline along Hwy 198	8 " WL 6 " WL	$389,000	4300 LF 8200 LF	$28.00 $21.00	/lf /lf	$120,400 $172,200
SW 29	2016-2026	New 6" Waterline through the Resort area and the Western Side of Payne Springs	6 " WL	$112,000	4000 LF	$21.00	/lf	$84,000
SW 30	2016-2026	New 6" Waterline in the Northeastern part of the Priority #3 Area	6 " WL	$290,000	10400 LF	$21.00	/lf	$218,400
SW 31	2016-2026	New 6" Looped Waterline in the Carolynn, Lake Shore, and Southern Resort Service Area	6 " WL	$564,000	20200 LF	$21.00	/lf	$424,200

South Water System

Project ID#	Construction Date	Project Description		Estimated Cost	Quantity	Unit Cost	Subtotal	Contingency
* SW 1	2002/2016	South WTP, High Service & Raw Water Pumps Expansion	0.864 MGD	$1,724,000	n/a	$1.50 /gal	$1,296,000	
SW 2	1996-2006	New 12" and 10" Waterline along Hwy 198 to Golden Oaks Addition	12 " WL 10 " WL	$230,000	1700 LF 2900 LF	$42.00 /lf $35.00 /lf	$71,400 $101,500	1.33
SW 3	1996-2006	New 12" Waterline along Enchanted Drive, Hwy 198, and Southward toward Cedar Branch Park	12 " WL	$528,000	9450 LF	$42.00 /lf	$396,900	
SW 4	1996-2006	New 12" and 8" Waterline through the Cedar Branch Subdivision	12 " WL 8 " WL	$268,000	2000 LF 4200 LF	$42.00 /lf $28.00 /lf	$84,000 $117,600	
SW 5	1996-2006	New 10" and 8" Waterline through Forgotten Acres to Lakeland Road	10 " WL 8 " WL	$205,000	4000 LF 500 LF	$35.00 /lf $28.00 /lf	$140,000 $14,000	
SW 6	1996-2006	New 8" and 6" Waterline Southward along Enchanted Drive to Enchanted Oaks	8 " WL 6 " WL	$130,000	2150 LF 1800 LF	$28.00 /lf $21.00 /lf	$60,200 $37,800	
SW 7	1996-2006	New 8" and 6" Waterline to Golden Oaks, Southwood Shores, Bonanza Beach, and Oak Shores Subdivisions	8 " WL 6 " WL	$396,000	2600 LF 10700 LF	$28.00 /lf $21.00 /lf	$72,800 $224,700	
SW 8	1996-2006	New 8" and 6" Waterline to Baywood Estates Area	8 " WL 6 " WL	$68,000	1200 LF 850 LF	$28.00 /lf $21.00 /lf	$33,600 $17,850	
SW 9	1996-2006	New 6" Looped Waterline through Bandera Bay and Oakwood Shores	6 " WL	$145,000	5200 LF	$21.00 /lf	$109,200	
SW 10	1996-2006	New 6" Looped Waterline around Leisure-land and to Three Harbors Subdivisions	6 " WL	$223,000	8000 LF	$21.00 /lf	$168,000	
SW 11	2006-2016	New 6" and 8" Waterline to provide looped system for the Golden Oaks, Southwood Shores, Bonanza Beach, and Oak Shores Subdivisions	8 " WL 6 " WL	$524,000	10700 LF 4500 LF	$28.00 /lf $21.00 /lf	$299,600 $94,500	
SW 12	2006-2016	New 6" Waterline to Enchanted Isles Subdivision	6 " WL	$112,000	4000 LF	$21.00 /lf	$84,000	
SW 13	2006-2016	New 6" Waterline to Cherokee Hills Subdivision	6 " WL	$28,000	1000 LF	$21.00 /lf	$21,000	
SW 14	2006-2016	New 6" Waterline through Oakwood Shore Subdivision	6 " WL	$84,000	3000 LF	$21.00 /lf	$63,000	
SW 15	2006-2016	New 6" Waterline through Del Mar Subdivision	6 " WL	$115,000	4100 LF	$21.00 /lf	$86,100	

North Water System

Project ID#	Construction Date	Project Description		Estimated Cost	Quantity	Unit Cost	Subtotal	Contingency
* NW 1	1997	New 12" loop around Legendary Lane, Hwy 334, and the Bozeman Easement	12 " WL 10 " WL 8 " WL	$830,000	12700 LF 2100 LF 600 LF	$42.00 /lf $35.00 /lf $28.00 /lf	$533,400 $73,500 $16,800	1.33
* NW 2	1997/2010	North WTP Expansion	1 MGD	$1,663,000	n/a	$1.25 /gal	$1,250,000	
* NW 3	1997/1999	North WTP High Service Pump Expansion	1100 gpm	$31,000	1 EA	$21.50 /gpm	$23,650	
* NW 4	1997/2001	North WTP Raw Water Pump Expansion	2500 gpm	$36,000	1 EA	$10.71 /gpm	$26,775	
NW 5	1996-2006	New 8" and 6" Waterlines for the remaining Priority #2 Area on the East Side of the Hwy 334 Bridge	8 " WL 6 " WL	$234,000	2000 LF 5700 LF	$28.00 /lf $21.00 /lf	$56,000 $119,700	
NW 6	1996-2006	New 8" Waterlines to the Tamarack Area	8 " WL	$186,000	5000 LF	$28.00 /lf	$140,000	
NW 7	1996-2006	New 10" and 8" Waterlines to Harbor Point	10 " WL 8 " WL	$290,000	4300 LF 2400 LF	$35.00 /lf $28.00 /lf	$150,500 $67,200	
NW 8	1996-2006	New 6" Waterline along Spanish Trail	6 " WL	$179,000	6400 LF	$21.00 /lf	$134,400	
NW 9	1996-2006	New 6" Waterlines through Sandy Shores and Eastwood Island Areas	6 " WL	$235,000	8400 LF	$21.00 /lf	$176,400	
NW 10	1996-2006	New 6" Waterline from Welch Street to Harmon Street	6 " WL	$78,000	2800 LF	$21.00 /lf	$58,800	
NW 11	2006	Total Storage Capacity Expansion	182000 Gal	$206,000	1 EA	$0.85 /gal	$154,700	
NW 12	2006-2016	New 6" and 8" Waterlines to serve Priority Area #3	8 " WL 6 " WL	$279,000	4600 LF 3850 LF	$28.00 /lf $21.00 /lf	$128,800 $80,850	
NW 13	2006-2016	New 6" Waterline from Hwy 198 to Whispering Trail	6 " WL	$128,000	4600 LF	$21.00 /lf	$96,600	
NW 14	2006-2016	New 6" Waterline in the Oak Harbor Subdivision	6 " WL	$170,000	6100 LF	$21.00 /lf	$128,100	
NW 15	2006-2016	New 6" Waterlines in the Mantle Manors and Sherwood Shores Subdivisions	6 " WL	$268,000	9600 LF	$21.00 /lf	$201,600	
NW 16	2006-2016	New 6" Looped Waterline for the Harbor Point Subdivision	6 " WL	$246,000	8800 LF	$21.00 /lf	$184,800	
NW 17	2016-2026	New 10" Waterline Along Hwy 334 to Hwy 198	10 " WL	$307,000	6600 LF	$35.00 /lf	$231,000	
NW 18	2016-2026	New 6" Waterline along Hwy 334 in	6 " WL	$117,000	4200 LF	$21.00 /lf	$88,200	

		Priority Area #3					
NW 19	2016-2026	New 6" Waterline in the Siesta Shores Area	6 " WL	$148,000	5300 LF	$21.00 /lf	$111,300
NW 20	2016-2026	New 6" Waterline in the Harbor Point Subdivision	6 " WL	$67,000	2400 LF	$21.00 /lf	$50,400
NW 21	2016-2026	New 6" Waterline along Luther Street	6 " WL	$165,000	5900 LF	$21.00 /lf	$123,900
NW 22	2016-2026	New 6" Waterlines in the Mantle Manors and the Southwind Estates Subdivisions	6 " WL	$168,000	6000 LF	$21.00 /lf	$126,000
NW 23	2016-2026	New 6" Waterline along Whispering Trail in the Tamarack Area	6 " WL	$140,000	5000 LF	$21.00 /lf	$105,000
NW 24	2016-2026	New 6" Looped Waterline in Bonita Subdivision	6 " WL	$128,000	4600 LF	$21.00 /lf	$96,600

Total Costs 1996-2006 = $2,932,000
Total Costs 2006-2016 = $1,297,000
Total Costs 2016-2026 = $1,240,000

North Water System
Total Project Costs = $5,469,000

* Note: Project NW1 is currently under design and will be under construction shortly. Therefore it is not included in the final estimate.

Projects NW2, NW3, and NW4 are based on expansion of treatment plant and pumping capacity under TNRCC criteria for 0.6 gpm per connection.