CHAPTER 9: SANITARY SEWER

INTRODUCTION

The Metropolitan Land Planning Act (amended 1995) requires local governments to prepare comprehensive plans and submit them to the Metropolitan Council to determine their consistency with the metropolitan system plans. The local Comprehensive Plan is to include a sanitary sewer element covering the collection and disposal of wastewater generated by the community. Similarly, the Metropolitan Sewer Act requires local governments to submit a Comprehensive Sanitary Sewer Plan (CSSP) which describes the current and future service needs required from Metropolitan Council Environmental Services (MCES).

In March 2005, the Metropolitan Council adopted a revised 2030 Water Resources Management Policy Plan (WRMPP). The 2030 WRMPP includes the metropolitan wastewater system plan with which local comprehensive plans must conform. The method Dayton has chosen to demonstrate its conformance is through a separate Comprehensive Sanitary Sewer Plan (CSSP). The Dayton CSSP updates previous sewer planning efforts and describes in detail the expansion of the City's sanitary sewer system to serve urban development.

This update is necessary to reflect land use changes...

The City last updated its CSSP in 2005 and described the expansion of the City's trunk system (in particular within the southwest portion) and the demands this expansion places on the Metropolitan Disposal System (MDS) operated by MCES. MCES also uses the CSSP to determine whether capacity upgrades will be needed at the Metropolitan Wastewater Treatment Plant (WWTP). This update is necessary to reflect land use changes that have occurred since the 2005 CSSP was prepared and to reflect land use changes in this Comprehensive Plan for the 2030 period.

Dayton's sewer system connects to the Metropolitan Council interceptor at two locations. The north sewer district flows into meter station located upstream of the Dayton/Champlin extension of the Champlin/Anoka/Brooklyn Park (CAB) Interceptor. The meter is located off French Lake Road near the Dayton/Champlin border. The west sewer district flows through the Dayton/Hassan Township extension of the Elm Creek Interceptor. A meter is located off Holly Lane approximately 50 feet south of the Dayton/Maple Grove border. Ultimately sewage flowing in the Elm Creek Interceptor arrives at the Metropolitan WWTP in St Paul.

FORECASTS

The population of Dayton totaled nearly 5,000 in 2000 and is projected to increase to approximately 28,400 by 2020, including both sewered and unsewered areas; these data are based on the 2000 Census and the Land Use Chapter of the Dayton Comprehensive Plan. The expected ultimate population and density of Dayton at full build-out (including redevelopment of existing residential areas to their guided densities) is shown in Table 9.1 – Ultimate Population Per Units Per Acre Calculation.

Table 9.1- Ultimate Population Per Units Per Acre Calculation

Land Use	Net Developable Acres	Units/Acre	Units	Population
Urban Reserve	1354	2.30	3,115	7,358
Low Density Residential*	4182	2.30	9,618	23,083
Low-Medium Density Residential	769	4.00	3,077	7,386
Medium Density Residential	179	6.00	1,074	2,578
High Density Residential	133	10.00	1,332	3,196
Mixed Use†	158	8.00	1,267	3,041
Total	6,776		19,483	46,758

** Includes redevelopment of existing residential areas to their guided densities*

† Assumes 25%the total 704 acres planed for Mixed Use will be residential.

In March of 2005, the City of Dayton adopted a resolution and an ordinance regarding the adoption of a Growth Management Policy which limits the number of building permits the City of Dayton will issue each year until 2010. This Growth Management Policy is being revised congruently with the 2008 update to the Dayton Comprehensive Plan to extend beyond 2010. Table 9.2 – Sewered Population Projections shows Dayton's projections for a potential revised Growth Management Policy.

The sewered population data are based on Metropolitan Council projections and City of Dayton projections. The City of Dayton did not include the portion of the City that will be served by the Otsego Treatment Plant in its staging plan, as the staging plan addressed timing of anticipated metro sewer service. However, this area is planned to receive sewer service from the Otsego plan within the 2030 planning period.

Table 9.2- Sewered Population Projections (Metro and Unsewered)

	2010	2020	2030
Population - Unsewered	730	410	290
Population - Sewered Metro	7,700	25,800	33,900
Population-Sewered Otsego			920
Population Total	**8,400**	**26,200**	**35,100**
Households - Unsewered	300	170	120
Households - Sewered Metro	3,200	10,750	14,100
Households-Sewered Otsego			380
Households Total	**2,900**	**10,900**	**14,600**
Employment - Unsewered	0	0	0
Employment - Sewered Metro	2,100	8,000	11,700
Employment-Sewered Otsego			800
Employment Total	**2,100**	**8,000**	**12,500**

*Numbers have been rounded to nearest hundred

SANITARY SEWER DESIGN CRITERIA

The land use plan for the City of Dayton served as the basis for the development of the sanitary sewer flow projections and analysis of the trunk system. Using the land use plan, the area of each land use was determined for each sewer district. Existing land uses used in this plan include rural; low density, low/medium density, medium density, and high density residential; commercial/industrial; agricultural preserve; mixed use/downtown; and conservancy and parks. Several types of commercial and industrial land use are proposed. For the purposes of generating sewer flows, these are lumped into commercial/industrial. Detailed descriptions of the various land uses are found in Chapter 4- Land Use.

Municipal wastewater is made up of a mixture of domestic sewage, commercial and industrial wastes, groundwater infiltration, and surface water inflows. With proper design and construction, groundwater infiltration and surface water inflows, often called infiltration/inflow (I/I), can be minimized. The flows due to I/I are accounted for in the analysis and design of the trunk sewer system.

The anticipated average wastewater flows from the various subdistricts were determined by applying unit flow rates to each of the land use categories. The "system design" unit flow rates are presented in Table 9.3 – System Design Wastewater Unit Flow Rates. The average wastewater flows for each subdistrict are presented in the Dayton Comprehensive Sanitary Sewer Plan (CSSP).

Table 9.3- System Design Wastewater Unit Flow Rates

Land Use Type	Gallons/Unit/Day	Units/Acre	Gallons/Acre/Day
Urban Reserve	216	2.3	497
Low Density Residential	216	2.3	497
Low/Medium Density Residential	216	4.0	864
Medium Density Residential	192	6.0	1,152
High Density Residential	168	10.0	1,680
Commercial/Industrial	--	--	800
Mixed Use	--	15.0	1600
Recreational/Public	--	--	250

For all land uses unit rates per acre were used to generate average flow projections. The units per acre assumptions for low, medium, and high density residential, mixed use, commercial and permanent rural were based in part on information from the City planning staff regarding projected number of units for each land use. Open space, private recreation, permanent rural, rural residential, and right-of-way were all assumed to not generate any sewer flows.

Dayton's "system design" flow projections originate from the land use statistics based directly on the land use plan. Certain reductions in land use area are made to account for wetlands, right-of-ways, etc., and a net developable acreage for each land use category is thus created. The net acreage is multiplied by standard unit flow rates to obtain an average flow for each sewershed. The Dayton CSSP provides these average flows and totals them for all the districts within the Dayton CSSP.

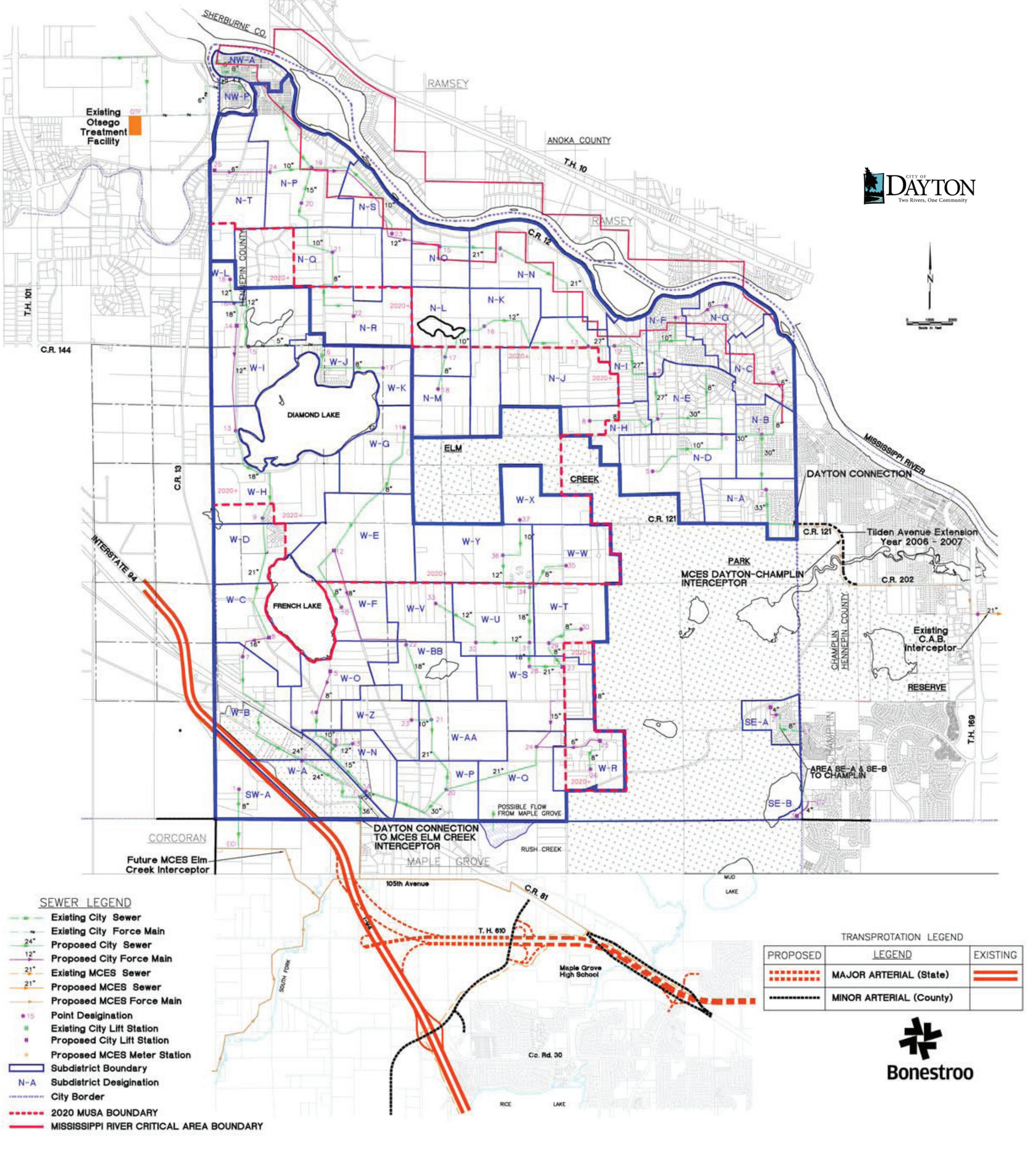
The purpose of the Dayton CSSP spreadsheets is to conservatively estimate demand at the municipal level so that no City trunk is undersized for its projected sewershed. The unit flow rates used in the CSSP to generate average flows in part represent the "old economy" where commercial and industrial land use meant manufacturing and thus the potential for high sewage flows. In the "new economy" commercial and industrial land use means retail, offices, and warehousing which generate very little sewage compared to the old industrial facilities. Nonetheless, typical land use categories allow for a wide range of uses and the chance remains that localized heavy users of sanitary sewer capacity might locate in Dayton. To cover this possibility, Dayton continues to use the high design rates shown in Table 9.3 – System Design Wastewater Unit Flow Rates.

SANITARY SEWER TRUNK SYSTEM

The trunk sewer system layout for the City of Dayton is presented on the Figure 9.1 – Ultimate Trunk Sanitary Sewer map. This map shows the main sanitary sewer districts, existing and proposed trunk sanitary sewers, and existing and proposed lift stations and force mains.

Figure 9.1

Ultimate Trunk Sanitary Sewer



The modeling of the sanitary sewer system was based on a variety of parameters, such as: land use, population density, standard wastewater generation rates, topography, and future land use plans. Based on the topography of the undeveloped areas, the sewer subdistricts were created and the most cost-effective locations for future trunk line facilities were determined. The location of smaller sewer laterals and service lines are dependent upon future land development plats and cannot be accurately located from a study of this type.

Both the existing and proposed pipe systems were evaluated and broken up into design segments. Each end of a design segment has a node assigned to it. The nodes were designated for the following reasons:

1. Flow from a subdistrict entering the pipe network.
2. Significant grade change has occurred.
3. Change in pipe size.
4. Two or more trunks connect.
5. Manmade elements (roads, railroads, etc.) affecting location and installation costs for the trunk system or lateral service of the sub districts.

The proposed alignments shown on the Figure 9.1 – Ultimate Trunk Sanitary Sewer map generally follow the natural drainage of the land to minimize the use of lift stations and consequently provide the City with the most economical ultimate design sanitary sewer system. Minor adjustments in the routing and size of the trunk facilities will take place as determined by the specific land use and development conditions at the time of final design. Any such adjustments are expected to deviate minimally from this plan.

Each sub district contains at least one collection point where the subdistrict's sewage is defined to enter the pipe network. Upstream of that collection point, a lateral network of 8-inch gravity lines can serve unserviced areas.

INTERCOMMUNITY FLOWS

Portions of Dayton are currently sending sewage flow across the Dayton city limits to other communities. A summary of the estimated average and peak sewer flow generated by Otsego at the border with Dayton is presented in Table 9.4 – Ultimate System Intercommunity Flows.

Table 9.4- Ultimate System Intercommunity Flows

SUB-DISTRICT	DESCRIPTION	FROM	TO	ULTIMATE AVERAGE FLOW (MGD)	INTERIM AVERAGE FLOW (MGD)
Point 1 of NW District	Existing, Interim and Ultimate Use	Dayton	Otsego Treatment Facility	0.116	0.282
Point 2 of SE District	Existing Ultimate Use	Dayton	Champlin	0.039	N/A
Point 3 of SE District	Proposed Ultimate Use	Dayton	Champlin	0.002	N/A

Tables 9.5 – Ultimate System Pipe Design (North District), Table 9.6 – Ultimate System Pipe Design (West District), and Table 9.7 – Ultimate System Pipe Design (Southeast, Northwest, and Southwest Districts and Interim) are excerpts from the appendices of the full Dayton CSSP and represents capacities of existing and proposed trunk pipes shown on Figure 9.1 –Ultimate Trunk Sanitary Sewer.

Table 9.5- Ultimate System Pipe Design (North District)

From Point	To Point	Design Flow (MGD)	Exist./ Prop.	Pipe Size (in)	Pipe Material	Length (ft)	Avg Slope (%)	CAPACITY: Inlet Control (cfs)	Inlet Control (MGD)	Outlet Control (cfs)	Outlet Control (MGD)	Capacity (MGD)	Capac./ Design Flow
North District (N)													
25	24	0.665	Prop.	6	PVC	2,300	N/A	Assumed a pumping rate of 5 feet per second				0.63	0.95
24	19	0.665	Prop.	10	PVC	2,000	0.280	1.7	1.10	1.2	0.75	0.75	1.13
23	19	0.464	Prop.	10	PVC	5,300	0.280	1.7	1.10	1.2	0.75	0.75	1.62
22	21	0.349	Prop.	8	PVC	4,400	0.400	1.4	0.90	0.8	0.49	0.49	1.42
21	20	0.765	Prop.	10	PVC	3,200	0.400	1.7	1.10	1.4	0.90	0.90	1.17
20	19	1.726	Prop.	15	PVC	1,650	0.160	4.1	2.65	2.6	1.67	1.67	0.97
19	15	2.573	Prop FM	12	PVC	7,550	N/A	Assumed a pumping rate of 5 feet per second				2.54	0.99
15	14	2.848	Prop.	21	PVC	2,700	0.100	9.1	5.88	5.0	3.24	3.24	1.14
14	13	3.310	Prop.	21	PVC	6,500	0.100	9.1	5.88	5.0	3.24	3.24	0.98
18	17	0.259	Prop.	8	PVC	1,500	0.400	1.4	0.90	0.8	0.49	0.49	1.91
17	16	0.520	Prop.	10	PVC	2,650	0.280	1.7	1.10	1.2	0.75	0.75	1.44
16	13	0.936	Prop.	12	PVC	5,500	0.220	2.2	1.42	1.7	1.08	1.08	1.16
13	12	4.391	Prop.	27	PVC	1,200	0.067	17.7	11.43	8.0	5.19	5.19	1.18
12	9	4.401	Prop.	27	PVC	2,800	0.067	17.7	11.43	8.0	5.19	5.19	1.18
11	10	0.300	Prop FM	6	PVC	2,250	N/A	Assumed a pumping rate of 5 feet per second				0.63	2.11
10	9	0.516	Prop.	10	PVC	3,300	0.280	1.7	1.10	1.2	0.75	0.75	1.45
9	7	4.785	Prop.	27	PVC	1,900	0.070	17.7	11.43	8.2	5.30	5.30	1.11
8	7	0.212	Prop.	8	PVC	3,200	0.400	1.4	0.90	0.8	0.49	0.49	2.33
7	6	5.198	Prop.	30	PVC	3,500	0.058	23.3	15.05	9.9	6.39	6.39	1.23
5	6	0.437	Prop.	10	PVC	4,500	0.280	1.7	1.10	1.2	0.75	0.75	1.72
6	3	5.325	Prop.	30	PVC	1,800	0.058	23.3	15.05	9.9	6.39	6.39	1.20
4	3	0.299	Prop FM	6	PVC	1,800	N/A	Assumed a pumping rate of 5 feet per second				0.63	2.12
4	3	0.299	Prop.	8	PVC	3,600	0.400	1.4	0.90	0.8	0.49	0.49	1.65
3	2	5.753	Prop.	30	PVC	2,700	0.058	23.3	15.05	9.9	6.39	6.39	1.11
2	1	5.952	Prop.	30	PVC	2,700	0.058	23.3	15.05	9.9	6.39	6.39	1.07
1	C.A.B	5.952	Prop.	30	PVC	50	0.058	23.3	15.05	9.9	6.39	6.39	1.07

Table 9.6- Ultimate System Pipe Design (West District)

From Point	To Point	Design Flow (MGD)	Exist./ Prop.	Pipe Size (in)	Pipe Material	Length (ft)	Avg Slope (%)	CAPACITY Inlet Control (cfs)	Inlet Control (MGD)	Outlet Control (cfs)	Outlet Control (MGD)	Capacity (MGD)	Capac./ Design Flow
West District (W)													
19	18	0.665	Prop.	12	PVC	1,100	0.220	2.2	1.42	1.7	1.08	1.08	1.63
18	18A	0.105	Prop.	12	PVC	1,100	0.222	2.2	1.42	1.7	1.09	1.09	10.32
17	16	0.180	Prop.	8	PVC	3,200	0.400	1.4	0.90	0.8	0.49	0.49	2.74
16	15	0.319	Exist FM	5	HDPE	3,700	N/A	UPGRADE EXISTING PUMPS, 2 @ 150 GPM				0.43	1.35
15	18A	0.910	Prop.	12	PVC	2,600	0.220	2.2	1.42	1.7	1.08	1.08	1.19
18A	14	0.983	Prop.	18	PVC	1,100	0.120	6.2	4.01	3.6	2.36	2.36	2.40
14	13	0.983	Prop FM	12	PVC	4,700	N/A	Assumed a pumping rate of 5 feet per second				2.54	2.58
13	9	1.274	Prop.	18	PVC	4,900	0.120	6.2	4.01	3.6	2.36	2.36	1.85
9	8	1.481	Prop.	21	PVC	5,500	0.100	9.1	5.88	5.0	3.24	3.24	2.19
8	7	1.927	Prop FM	16	PVC	1,650	N/A	Assumed a pumping rate of 5 feet per second				4.51	2.34
7	2	2.783	Prop.	24	PVC	6,300	0.080	13.0	8.40	6.4	4.14	4.14	1.49
2	1	3.159	Prop.	24	PVC	3,300	0.080	13.0	8.40	6.4	4.14	4.14	1.31
37	36	0.270	Prop.	10	PVC	2,350	0.400	1.7	1.10	1.4	0.90	0.90	3.32
36	34	0.829	Prop.	12	PVC	2,550	0.220	2.2	1.42	1.7	1.08	1.08	1.31
35	34	0.446	Prop.	8	PVC	2,550	0.400	1.4	0.90	0.8	0.49	0.49	1.11
34	31	1.765	Prop.	18	PVC	6,450	0.120	6.2	4.01	3.6	2.36	2.36	1.33
33	32	0.728	Prop.	12	PVC	2,600	0.220	2.2	1.42	1.7	1.08	1.08	1.49
32	31	0.728	Prop.	12	PVC	2,200	0.220	2.2	1.42	1.7	1.08	1.08	1.49
31	28	2.328	Prop.	18	PVC	1,050	0.120	6.2	4.01	3.6	2.36	2.36	1.01
28	27	2.684	Prop.	21	PVC	1,500	0.120	9.1	5.88	5.5	3.55	3.55	1.32
30	29	0.278	Prop.	8	PVC	1,600	0.400	1.4	0.90	0.8	0.49	0.49	1.78
29	27	0.278	Prop.	8	PVC	1,250	0.400	1.4	0.90	0.8	0.49	0.49	1.78
27	24	2.907	Prop FM	15	PVC	4,300	N/A	Assumed a pumping rate of 5 feet per second				3.45	1.19
26	25	0.332	Prop.	8	PVC	1,550	0.400	1.4	0.90	0.8	0.49	0.49	1.49
25	24	0.332	Prop FM	6	PVC	2,950	N/A	Assumed a pumping rate of 5 feet per second				0.63	1.91
24	20	3.452	Prop.	21	PVC	4,900	0.120	9.1	5.88	5.5	3.55	3.55	1.03
10	12	0.333	Prop.	8	PVC	3,050	0.400	1.4	0.90	0.8	0.49	0.49	1.49
11	12	0.275	Prop.	8	PVC	6,500	0.400	1.4	0.90	0.8	0.49	0.49	1.80
12	22	1.075	Prop FM	8	PVC	6,300	N/A	Assumed a pumping rate of 5 feet per second				1.13	1.05
22	21	1.463	Prop.	18	PVC	3,250	0.170	6.2	4.01	4.3	2.80	2.80	1.92
23	21	0.506	Prop.	10	PVC	850	0.280	1.7	1.10	1.2	0.75	0.75	1.48
21	20	2.078	Prop.	21	PVC	3,350	0.120	9.1	5.88	5.5	3.55	3.55	1.71
20	1A	5.386	Prop.	30	PVC	4,200	0.100	23.3	15.05	13.0	8.40	8.40	1.56
5	4	0.479	Prop FM	8	PVC	1,950	N/A	Assumed a pumping rate of 5 feet per second				1.13	2.35
4	6	0.479	Prop.	8	PVC	1,950	0.500	1.4	0.90	0.9	0.55	0.55	1.15
3	6	0.737	Prop.	12	PVC	1,100	0.220	2.2	1.42	1.7	1.08	1.08	1.47
6	1A	1.140	Prop.	15	PVC	2,850	0.150	4.1	2.65	2.5	1.62	1.62	1.42
1A	1	6.089	Prop.	30	PVC	400	0.080	23.3	15.05	11.6	7.51	7.51	1.23
1	E.C.I.	8.221	Prop.	36	PVC	1,000	0.060	36.5	23.58	16.4	10.58	10.58	1.29

Table 9.7- Ultimate System Pipe Design (Southeast, Northwest, and Southwest Districts and Interim)

From Point	To Point	Design Flow (MGD)	Exist./ Prop.	Pipe Size (in)	Pipe Material	Length (ft)	Avg Slope (%)	CAPACITY Inlet Control (cfs)	Inlet Control (MGD)	Outlet Control (cfs)	Outlet Control (MGD)	Capacity (MGD)	Capac./ Design Flow	
Southeast District (SE)														
1	2	0.152	Prop FM	4	PVC	550	N/A	Assumed a pumping rate of 5 feet per second				**0.28**	1.85	
2	C1	0.152	Exist.	8	PVC	---	0.400	1.4	0.90	0.8	0.49	**0.49**	3.25	
3	C2	0.006	Prop FM	4	PVC	1,100	N/A	Assumed a pumping rate of 5 feet per second				**0.28**	46.33	
Northwest District (NW)														
2	1	0.138	Exist FM	4	HDPE	---	N/A	2 PUMPS @ 86 GPM = 172 GPM = 0.25 MGD				**0.25**	1.60	*
2	1	0.138	Exist.	8	PVC	---	0.400	1.4	0.90	0.8	0.49	**0.49**	3.59	
1	OTF	0.468	Exist FM	6	PVC	---	N/A	2 PUMPS @ 200 GPM = 400 GPM = 0.58 MGD				**0.58**	1.23	
Southwest District (SW)														
1	E.C.I.	0.412	Prop.	8	PVC	2,600	0.400	1.4	0.90	0.8	0.49	**0.49**	1.20	
Interim (I)*														
24-N	26-N	0.693	Prop FM	6	PVC	2,800	N/A					**0.63**	0.91	
26-N	25-N	0.664	Prop.	10	PVC	4,400	0.400	1.7	1.10	1.4	0.90	**0.90**	1.35	
25-N	3-I	1.291	Prop FM	8	PVC	3,200	N/A					**1.13**	0.87	
3-I	1	1.486	Exist.	12	PVC	4,200	0.400	2.2	1.42	2.3	1.46	**1.42**	0.96	
2	1	0.224	Exist FM	6	HDPE	700	N/A					**0.63**	2.83	
1	OTF	2.189	Exist FM	6	PVC	6,300	N/A					**0.63**	0.29	

*Pipe from point 7 to point 6 is oversize to be compatible with the Ultimate System

Currently, the majority of Dayton's homes and businesses use individual on-site facilities for the disposal of their wastewater. Figure 9.2 – Existing On-site Wastewater Disposal Facilities shows the locations of these existing on-site wastewater disposal facilities. As of December 31, 2008, 1822 on-site wastewater disposal facilities exist with in the City. It is anticipated that the number of on-site systems would be reduced as municipal sanitary sewer service is extended throughout the districts. The policy of the City of Dayton is to allow existing on-site wastewater disposal facilities to be maintained within each of the sanitary sewer districts until the community desires service and service is brought into an area.

New on-site wastewater disposal facilities will be allowed by the City in the areas outside of the 2020 Metropolitan Urban Service Area (MUSA) boundary. New on-site wastewater disposal facilities will be allowed by the City in the areas inside the 2020 MUSA boundary provided the properties agree to hook up to the City sewer system when available.

The City of Dayton currently has an ordinance regulating the installation of on-site wastewater disposal systems. Under this ordinance, the design of the system is reviewed in accordance with the guidelines of Minnesota Pollution Control Agency Standards MN Rule 7080, and a permit is required before the system can be installed.

INFILTRATION AND INFLOW

The unit and area flow rates incorporate an allowance for an average of 10 gallons per capita per day of extraneous water entering the sanitary sewer system through inflow and infiltration. The City has adopted wastewater ordinances that address limiting I/I through current accepted engineering practices and prohibiting the connection of roof and foundation drains to the sanitary sewer system. These ordinances were put in place as part of sewer extensions from the Cities of Otsego, Rogers, and Champlin.

Figure 9.2

Existing on-site Wastewater Disposal Facilities