

3. FLOWS/LOADINGS

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FLOWS/LOADINGS

Current Flows and Loadings

Influent loadings to the plant consist of raw wastewater delivered from the MMSD service area via four force mains and septage holding tank, landfill leachate and other wastes that are trucked to the plant. Historical flows and loadings to the plant were analyzed by examining daily average plant records for the period of January 1996 through December 2007. The annual average plant flows, concentrations, and loadings are presented in Tables 3-1 and 3-2. Detailed current flow and loading analyses are provided in Appendix A, TM1 – Review of Existing Treatment Facilities.

Table 3-1. Historical Daily Average Raw Influent Flow Characteristics for 1996-2007

Year	Flow (mgd)	TSS (mg/L)	BOD ₅ (mg/L)	TKN (mg/L)	TP (mg/L)
1996	38.18	203	209	30.3	6.64
1997	36.92	208	220	31.6	6.54
1998	41.12	205	208	30.9	6.35
1999	41.59	208	208	30.9	6.07
2000	42.10	229	218	31.8	6.07
2001	41.76	222	216	32.2	5.88
2002	40.14	248	224	33.6	6.07
2003	38.56	261	243	35.2	6.49
2004	41.93	251	231	33.9	6.21
2005	39.37	243	245	37.5	6.39
2006	41.22	229	245	38.2	6.29
2007	42.88	215	240	36.4	5.95
Average	40.69	226	225	33.5	6.25

Table 3-2. Historical Daily Average Raw Influent Loadings for 1996-2007

Year	TSS (lb/day)	BOD ₅ (lb/day)	TKN (lb/day)	TP (lb/day)
1996	68,116	69,918	10,020	2,150
1997	65,162	69,954	9,967	2,036
1998	69,414	71,424	10,569	2,180
1999	70,843	71,481	10,741	2,109

Year	TSS (lb/day)	BOD ₅ (lb/day)	TKN (lb/day)	TP (lb/day)
2000	78,127	75,424	11,045	2,102
2001	76,269	74,933	11,162	2,045
2002	81,509	75,107	11,204	2,039
2003	83,769	78,115	11,342	2,087
2004	86,915	80,860	11,915	2,186
2005	80,197	81,648	12,439	2,132
2006	78,214	83,722	13,185	2,165
2007	75,592	84,396	12,955	2,125
Average	76,712	76,796	11,462	2,111

In spite of the wet weather periods that occurred during 1996, 2000 and 2004, the historical raw wastewater flow to the plant appears to have been relatively stable over the period of record. The 5-day biochemical oxygen demand (BOD₅), total suspended solids (TSS), total Kjeldahl nitrogen (TKN) and ammonium nitrogen (NH₄-N) concentrations and loadings in the raw wastewater appear to have been steadily rising over the past 12 years. However, total phosphorus (TP) concentrations and loadings appear to have been relatively stable over the period of record. Detailed information on current flows is included in TM1- Review of Existing Treatment Facilities.

CARPC Population and Flow Projections

As a part of the master planning for MMSD’s sewerage collection system, the CARPC developed population and raw wastewater flow projections for different planning years between Year 2010 and Year 2060. These flow projections were used in estimating future flows for the MMSD wastewater treatment facilities and conveyance system. Major planning period service area populations and total flows are presented in Table 3-3. Detailed projected flows based on service areas and pumping stations are included in Appendix C, TM3 – Conveyance Facilities Analysis (CFA).

Table 3-3. Population and Flow Projection Summary

Year	Population	Average Raw Wastewater Flow (mgd)
2030*	406,000	47
2030**	431,000	50
2060*	491,000	53
2060**	560,000	60

* Population and flow based upon the projections developed by CARPC using Wisconsin Department of Administration (DOA) data and represent the low estimates.

**Population and flow based upon the projections developed by CARPC using Traffic Analysis Zones (TAZ) data and represent the high estimates.

Wastewater Loading Projections

In the previous facilities planning studies by the MMSD, the following three methods have been used to project future loadings for BOD₅, TSS, TKN, and TP:

- **Method based on per capita loading factors and projected future population.** This method determined the current per capita loading factors by dividing current average loadings by the current population of the MMSD service area. The resulting per capita loading factors were then multiplied by projected future populations to project future loadings.
- **Method based on current waste-load strength and projected future raw wastewater flow rates.** This method determined the current average concentrations of the parameters of interest and then multiplied the concentrations by projected future flow rates to project future loadings.
- **Method based on historic loading trends.** This method plotted historical raw wastewater loadings and then projected future loadings based on linear regression of the historical loading trends.

Based on previous facilities planning studies by the MMSD, linear projection based on historical loading trends has proven to be a reasonable and reliable method for predicting the BOD₅, TSS, and TKN loadings to the plant. However it is not appropriate in predicting TP loadings due to lack of long term influent TP monitoring data. Because of the stability of the influent TP concentration and unclear TP loading trends, the method based on waste-load strength was used to project TP loadings in the planning period. Detailed information is included in TM2- Flow and Loading Projections.

The projected wastewater loadings to the NSWTP at different planning years are presented in Table 3-4. Detailed plant loading projection analyses are provided in Appendix B, TM2 – Flow and Loading Projections.

Table 3-4. Total Plant Loading Projection

Parameter	Year 2030	Year 2060
BOD ₅ (lbs/d)	122,000	173,000
TSS (lbs/d)	127,000	179,000
TKN (lbs/d)	20,000	28,000
TP (lbs/d)	2,700	3,200

The current and projected future flows and loadings were used to estimate the current capacity utilization rates of the existing conveyance system and treatment facilities and the additional future capacity needs at different planning years.