Chapter 5: Treatment Assessment – Future Condition

5.1 Introduction

The future performance of the Milwaukee Metropolitan Sewerage District (MMSD) wastewater treatment plants (WWTPs) is based in part on the facilities as they are projected to exist in the year 2020. As mentioned in Chapter 4, *Treatment Assessment – Existing Condition*, MMSD is currently completing a major capital improvement project program mandated by the terms of the Wisconsin Department of Natural Resources (WDNR) 2002 Stipulation between MMSD and the state of Wisconsin.(1)

Where appropriate in this chapter, completed, committed and recommended MMSD treatment projects are noted. Committed projects discussed in this report are defined as treatment plant projects that are required by the WDNR 2002 Stipulation and additional treatment plant projects with construction contracts or identified as committed by MMSD as of December 31, 2006.(2) Recommended MMSD treatment projects are treatment plant projects that are included in the MMSD 2007 Annual Budget, but the MMSD has not yet committed to.(3) The recommended MMSD treatment projects will be recommended by the 2020 Facilities Plan (2020 FP) as part of the common package of projects that are needed in the future. Committed and recommended MMSD treatment projects are not intended to increase the design capacity of either Jones Island Wastewater Treatment Plant (JIWWTP) or South Shore Wastewater Treatment Plant (SSWWTP), though a number of projects will improve plant performance.

The full lists of the committed and recommended MMSD treatment projects are included in Chapter 8, *Committed and Common Treatment Facilities, Programs, Operational Improvements and Policies for the Recommended Plan* of this report. Significant committed and recommended MMSD treatment projects are discussed under the specific utility or unit process affected in Section 5.3, *Treatment Process Evaluation*.

5.2 Flows and Wasteload Development

The JIWWTP and SSWWTP design flows and wasteloads, along with existing condition flows and wasteloads, were compared to the 2020 Baseline conditions to determine if the future needs of the MMSD system will be met. The existing condition flows and wasteloads shown are an average of the last full five years of the existing condition analysis, 1999-2003. Two major system changes will be in effect by the year 2020, which will affect future influent conditions: the projected 2020 population and land use conditions (a gradual change in total flow and wasteload) and the loss of LeSaffre Yeast at the end of 2005 (an immediate loss of industrial flow and wasteload). LeSaffre Yeast was a major industrial wasteload contributor, especially of biochemical oxygen demand (BOD), although total suspended solids (TSS), phosphorus and nitrogen loads were also significant. The plant, which was located in the JIWWTP service area, closed in late December 2005.

The 2020 Baseline flows and wasteloads were developed using existing condition influent flows and wasteloads from 1999-2003 as base data and then projecting increases to flows and wasteloads. Available LeSaffre Yeast effluent discharge data from 2000-2005 were used to project decreases to flows and wasteloads beginning in the year 2006. The Flow Forecasting System (FFS) and hydraulic model outputs from the MMSD conveyance system 2020 Baseline

conditions analysis were used to project long-term incremental increases to the flows and wasteloads expected by the year 2020. The FFS and hydraulic model outputs were developed using future growth projections for population and land use developed by the Southeastern Regional Planning Commission (SEWRPC), which is discussed in more detail in Chapter 5, *Watershed Assessment – Future Condition* of the *Facilities Plan Report*.

A revision was made to the projected 2020 Baseline conditions for system-wide facilities. The Revised 2020 Baseline population and land use projections were used to develop the analysis used in this chapter. The detailed discussion about the FFS can be found in the *Conveyance Report*. The analysis used to develop the flows and wasteloads for this report is presented in Appendix 5A, *Future Condition Flow & Wasteload Analysis*, which includes specific source references.

The treatment plant future condition assessment in this section only analyzes the affect of the loss of LeSaffre Yeast and the projected increase in population and land use on influent TSS and BOD at JIWWTP and SSWWTP. Projected 2020 biosolids production is discussed in Section 5.2.3, *Future Wasteloads*. Future biosolids management alternatives are reviewed in more detail in Chapter 9, *Alternative Analysis* of this report.

5.2.1 Future Design Capacity

Design Flows and Wasteloads

The design flows and wasteloads at JIWWTP and SSWWTP are not expected to change in the future due to any of the committed projects or recommended MMSD treatment projects discussed in Chapter 8, *Committed and Common Treatment Facilities, Programs, Operational Improvements and Policies for the Recommended Plan*.

5.2.2 Future System Flows

Future Condition Average Daily Flows

In the future, the flows at each treatment plant will still be derived from two sources – billable flow and infiltration/inflow (I/I).

- Table 5-1 compares the 1999-2003 average billable flow to the projected 2006 and 2020 billable flows in millions of gallons per day (MGD) and shows the percent change.
- Table 5-2 compares the projected breakdown of the total average daily flow between the two treatment plants in the years 2006 and 2020 to the actual average breakdown from 1999-2003 and the design flows originally discussed in Chapter 4, *Treatment Assessment - Existing Condition*.(4,5,6)
- Figure 5-1 shows the projected trend in billable flow to the year 2020.(7)
- Figure 5-2 shows the projected trend in flow to the treatment plants to the year 2020.

The billable flows listed in Table 5-1 do not equal the total flow listed in Table 5-2 due to the variance in billable yearly flows versus actual daily flows measured at the plants and the inclusion of I/I in the actual daily flows.

TABLE 5-1
MMSD SYSTEM BILLABLE FLOW BY USER CATEGORY:
ACTUAL AVERAGE FLOW TO PROJECTED FUTURE FLOWS

System Flow	1999-2003 Average Daily Flow (MGD)	Year 2006 Average Daily Flow (MGD)	Revised 2020 Baseline Average Daily Flow (MGD)	% Change 1999-2003 Average to Revised 2020 Baseline Projection
Billable Flow				
Residential	59.6	57.1	64.4	8.2%
Commercial	39.3	36.8	41.7	6.2%
Industrial	17.2	14.6	17.2	0.2%
Total	**116.0**	**108.6**	**123.4**	**6.3%**

Sources: 2000-2004 MMSD Accounting Records and Appendix 5A, *Future Condition Flow and Wasteload Analysis* of this chapter.

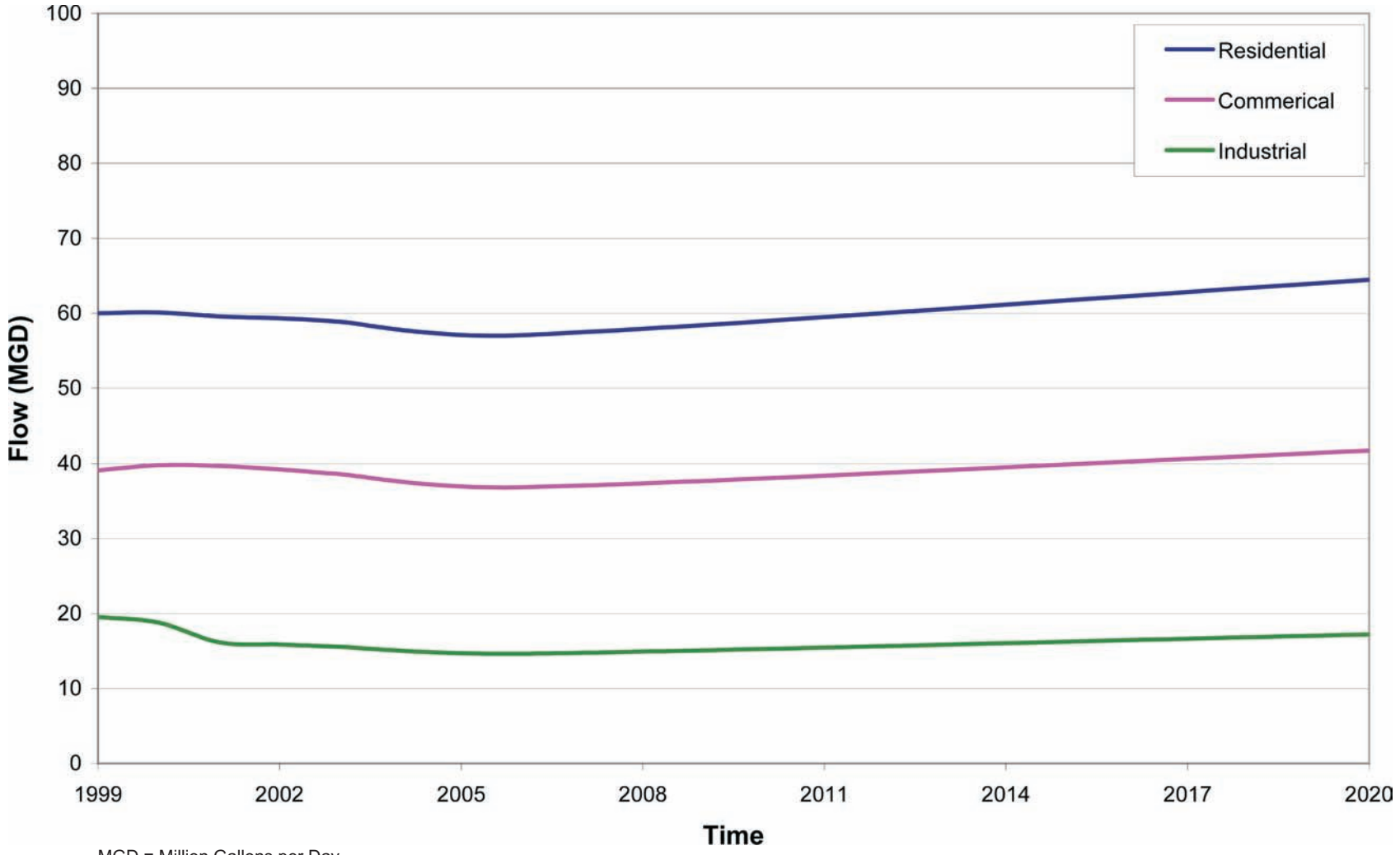
Notes:
1) The sum of the rounded components may not equal the total due to rounding.
2) The values presented under "% Change from 1999-2003 to Revised 2020 Baseline" are based on the change in the calculated values and not the rounded components presented and so may not equal the % change of the rounded values.

TABLE 5-2
WASTEWATER TREATMENT PLANT AVERAGE DAILY FLOWS COMPARISON:
DESIGN AVERAGE DAILY FLOW TO ACTUAL AVERAGE FLOW
AND PROJECTED FUTURE FLOWS

System Flow	DESIGN Average Daily Flow (MGD)	1999-2003 Average Daily Flow (MGD)	Year 2006 Average Daily Flow (MGD)	Revised 2020 Baseline Average Daily Flow (MGD)	% Change 1999-2003 Average to Revised 2020 Baseline Projection
JIWWTP	123	101.5	82.3	98.8	-2.7%
SSWWTP	113	101.6	89.3	115.7	13.9%
Total	**236**	**203.1**	**171.5**	**214.5**	5.6%

Sources: 1999-2003 DMRs and Appendix 5A, *Future Condition Flow and Wasteload Analysis* of this chapter.

Notes:
1) The sum of the rounded components may not equal the total due to rounding.
2) The values presented under "% Change from 1999-2003 to Revised 2020 Baseline" are based on the change in the calculated values and not the rounded components presented and so may not equal the % change of the rounded values.



MGD = Million Gallons per Day

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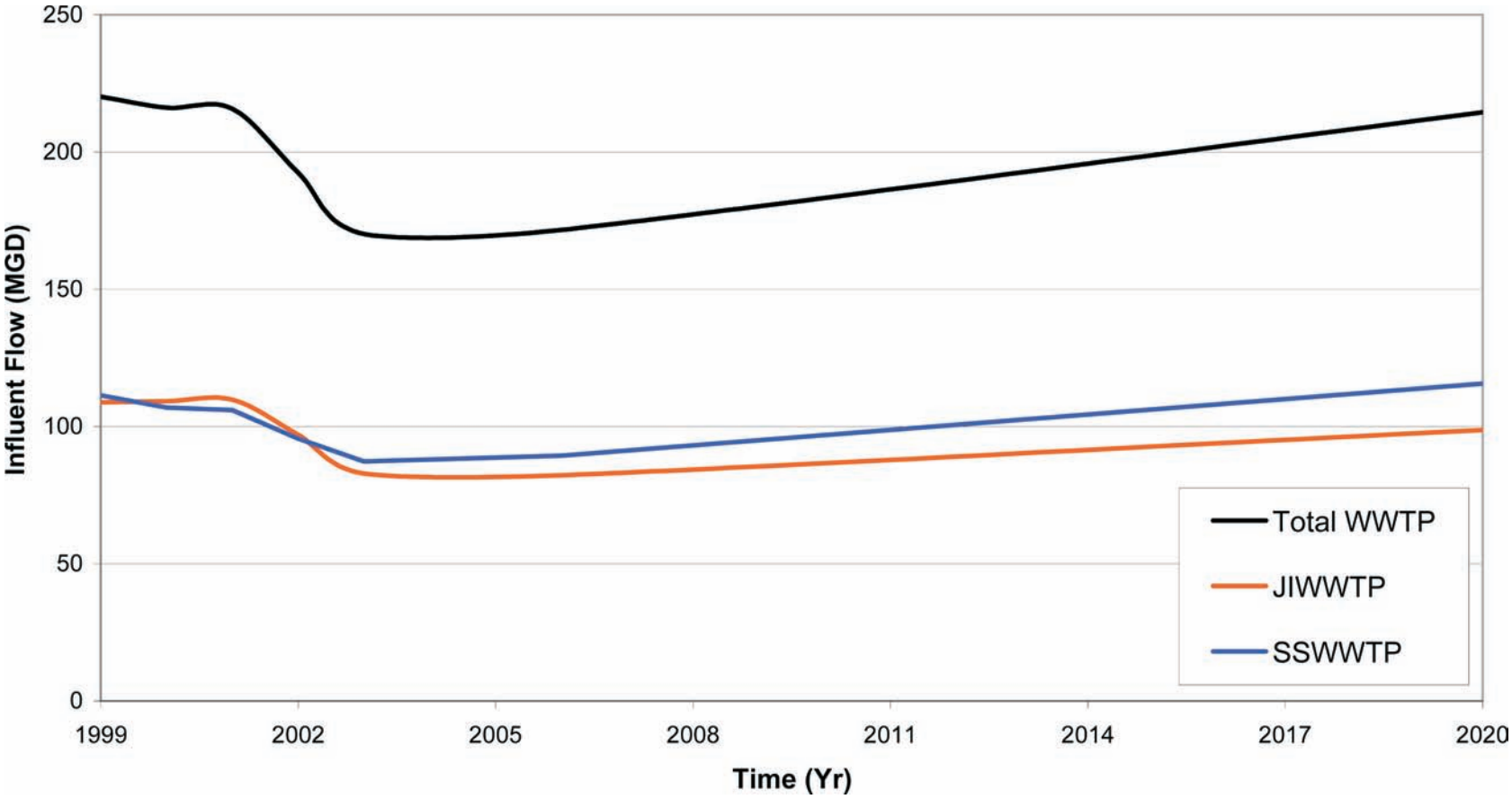
FIGURE 5-1
PROJECTED FUTURE BILLABLE FLOW TRENDS
2020 TREATMENT REPORT
5/12/07 TR_05.0001.07.05.12.cdr



MGD = Million Gallons per Day
WWTP = Wastewater Treatment Plant
JIWWTP = Jones Island Wastewater Treatment Plant
SSWWTP = South Shore Wastewaer Treatment Plant

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FIGURE 5-2
PROJECTED FUTURE WWTP INFLUENT FLOW TRENDS
2020 TREATMENT REPORT
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As can be seen in Table 5-1 and Figure 5-1, all components of the total billable flow are projected to increase at least minimally by the year 2020, though the review of the projected 2006 flows indicates that the flows will initially decline. The projected increase in flow by the year 2020 is due to the projected increases in population and land use throughout the MMSD planning area, as determined by SEWRPC.

Table 5-2 and Figure 5-2 indicate that the projected year 2020 increase in flow is expected to go mostly to SSWWTP. The year 2020 average daily flow (based upon the Revised 2020 Baseline projections) to SSWWTP (115.7 MGD) is projected to slightly exceed the SSWWTP design average daily flow of 113 MGD. The comparatively low average daily flow indicated for JIWWTP for 2006 shown in Table 5-2 is partly due to the relocation and resultant loss of flow from LeSaffre Yeast, but is also due to less than average flows in 2005, which were used as the base for the projections for 2006. Revised 2020 Baseline flows to JIWWTP are expected to decrease slightly from existing condition (years 1999-2003) flows.

Revised 2020 Baseline Peak Flows

Potential Peak Deliverable Conveyance System Flow

Table 5-3 lists the potential peak influent flows to the treatment plants after all committed projects have been completed. Note that the peak flows listed are those that the collection system is projected to hydraulically deliver to the plants, not the actual peak flow capacity of the treatment plants.

Comparison between Peak Future Deliverable Collection System Flows and Treatment Plant Peak Design Capacity

Table 5-4 compares the potential future conveyance system peak flows to the WWTPs with the design peak capacities of the plants.

In comparing the potential future conveyance system peak deliverable flows (based upon the Revised 2020 Baseline) to JIWWTP and SSWWTP to the design peak hourly flows listed in Table 5-4, it appears that the future ability of the collection system to deliver flow will be greater than it was in the existing condition. Note that part of this difference at JIWWTP will be due to the projected increase in the harbor siphon capacity after the completion of the committed Central Metropolitan Interceptor Sewer (CMIS) Harbor Siphons Project. The differences identified here are discussed in this report in Chapter 8, *Committed and Common Treatment Facilities*, *Programs, Operational Improvements and Policies for the Recommended Plan* and Chapter 9, *Alternative Analysis* to determine if adding more treatment capacity would be a cost effective method of meeting system overflow reduction requirements during storm events.

There are no planned, committed or recommended MMSD treatment projects to increase plant hydraulic capacity. Therefore, the existing design flows will be used to evaluate the treatment plant performance under future condition parameters in Section 5.3.2, *Treatment Plant Unit Process Evaluation*.

Treatment Plant	Flow (MGD)
Jones Island Wastewater Treatment Plant	
Influent Flows	
Low Level Siphons[1, 2]	365
High Level Siphons[1, 2]	235
Inline Pump Station[3]	120
Total Influent Flow	720
South Shore Wastewater Treatment Plant	
Influent Flows	
Total Influent Flow[4]	450-500

1) Flows from the low level and high level siphons were established by modeling future peak conditions in the conveyance model discussed in Appendix 5B, *Harbor Siphon Capacity Memorandum* of this chapter. The conveyance model included the committed Central Metropolitan Interceptor Sewer (CMIS) Harbor Siphons Project that increases the gravity flow to JIWWTP, which is discussed in more detail in the *Conveyance Report*. According to the memorandum, the simulated flow results include restrictions due to the harbor siphons capacity, head loss in the flow control chambers, head losses in the JIWWTP head works and intercepting structure capacities.

2) The influent pumping to JIWWTP has less capacity than the future hydraulic conditions are projected to allow through the low and high level siphons. The firm capacity of the low level pumps is 140 MGD and the firm capacity of the high level pumps is 330 MGD, which allows another 190 MGD of flow from the high level siphons.(12) Influent pumping was discussed in more detail in Section 4.2.3, *Treatment Plant Unit Process Evaluation* of Chapter 4, *Treatment Assessment – Existing Condition*. No committed or recommended MMSD treatment projects are planned to increase the capacity of the influent pumps. However, review of the conveyance system model performed as documented in Appendix 5B, *Harbor Siphon Capacity Memorandum,* indicated that overflow elevations on overflows upstream of the harbor siphons control the hydraulic grade line such that the high and low level wet wells will not flood and potentially cause damage to the pumps during peak flows even when influent pumping reaches peak capacity.

3) Inline Storage System (ISS) Pump Station flow was established in Section 4.1.2, *Existing System Flows*, in Chapter 4, *Treatment Assessment - Existing Condition*. The installation of a motor brush cooling system on the pumps, as discussed under subsection *JIWWTP Unit Process Evaluation* in Section 5.3.2, *Treatment Plant Unit Process Evaluation*, may increase the pump capacities but has not been proven yet. Note that this flow is the *potential* flow to JIWWTP from the ISS Pump Station. The 2020 Facilities Plan has assumed a firm capacity of 80 MGD to JIWWTP and 40 MGD to SSWWTP for future planning efforts.

4) The SSWWTP potential influent flow was established in Section 4.1.2, *Existing System Flows*, in Chapter 4 – *Treatment Assessment – Existing Condition*.

TABLE 5-4
COMPARISON OF POTENTIAL FUTURE (REVISED 2020 BASELINE) CONVEYANCE SYSTEM DELIVERABLE FLOW TO TREATMENT PLANT DESIGN CAPACITY

Treatment Plant	Potential Future Conveyance System Peak Flow to Treatment Plant (MGD)	Treatment Plant Design Peak Hourly Flow w/ Blending[1,2] (MGD)	Difference Between Future Conveyance System Deliverable and Treatment Plant Design Peak Flows (MGD)
JIWWTP	720	360	360
SSWWTP	450-500	300	150-200

1) Blending is only allowed, per the WPDES Permit, at JIWWTP up to 60 MGD. Additional blending at the treatment plants is reviewed in Chapter 9, *Alternative Analysis* of this report.
2) The 2020 Facility Plan has assumed the maximum capacity of JIWWTP is 360 MGD (300 MGD maximum sustained capacity plus 60 MGD of allowable blending) for planning purposes. See Chapter 4, *Treatment Assessment – Existing Condition*.

Sources: JIWWTP O&M Manual, SSWWTP O&M Manual, WPDES Permit (Appendix 6A), other references as noted in Footnotes to Table 5-3.

5.2.3 Future Wasteloads

The future condition average daily and maximum wasteloads are compared to design wasteloads to determine if the plants will be able to handle all expected influent wasteloads. As stated at the beginning of this section (Section 5.2), LeSaffre Yeast relocated outside the JIWWTP service area in December 2005, which is expected to have an impact on near-term and future wasteloads.

Future Condition Average Daily Wasteloads

Table 5-5 shows the breakdown of projected 2006 and 2020 (based on Revised 2020 Baseline conditions) billable wasteloads from Appendix 5A, *Future Condition Flow and Wasteload Analysis* compared to the average billable wasteloads from 1999-2003 in pounds per day (lb/day) and shows the percent change.

Figures 5-3 and 5-4 show the projected trend in billable BOD and TSS to the year 2020.(8)

Table 5-6 compares the projected 2006 and 2020 (based on Revised 2020 Baseline conditions) total average daily wasteloads between the two treatment plants from Appendix 5A, *Future Condition Flow & Wasteload Analysis* to the design average wasteloads and the average treatment plant wasteloads from 1999-2003.(9,10,11,12)

Figures 5-5 and 5-6 show the projected trends in influent wasteloads to the treatment plants.(13,14) The difference between the billable wasteloads contributions and the total treatment plant influent wasteloads are the wasteloads associated with I/I, which make up about 10-15% of the total wasteloads.

System Wasteload	1999-2003 Average Day Wasteload (lb/day)	Year 2006 Average Day Wasteload (lb/day)	Revised 2020 Baseline Average Day Wasteload (lb/day)	Percent Change 1999-2003 Average to Revised 2020 Baseline
Biochemical Oxygen Demand				
Residential	154,000	148,000	168,000	9.1%
Commercial	98,000	93,000	105,000	7.1%
Industrial	138,000	92,000	106,000	-23.2%
Total	**390,000**	**333,000**	**379,000**	-2.8%
Total Suspended Solids				
Residential	184,000	176,000	200,000	8.7%
Commercial	117,000	111,000	125,000	6.8%
Industrial	71,000	59,000	66,000	-7.0%
Total	**372,000**	**346,000**	**391,000**	5.1%

Sources: 1999-2003 UWS DWOR and Appendix 5A, *Future Condition Flow and Wasteload Analysis* of this chapter.

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TABLE 5-5
MMSD SYSTEM BILLABLE WASTELOADS BY USER CLASS: AVERAGE DAILY EXISTING WASTELOADS TO PROJECTED FUTURE WASTELOADS
2020 TREATMENT REPORT
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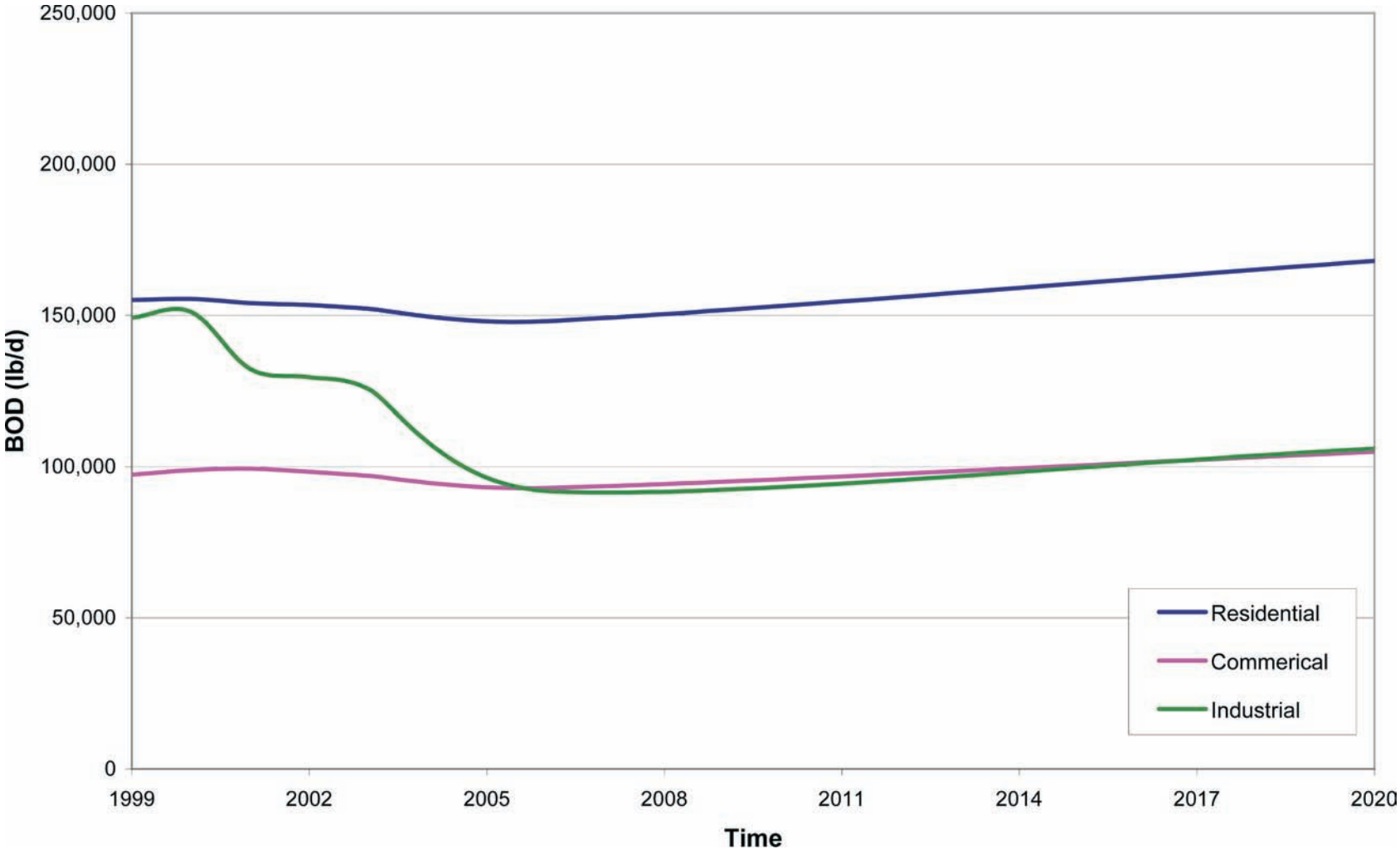

BOD = Biochemical Oxygen Demand

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FIGURE 5-3
PROJECTED FUTURE BILLABLE BOD TRENDS
2020 TREATMENT REPORT
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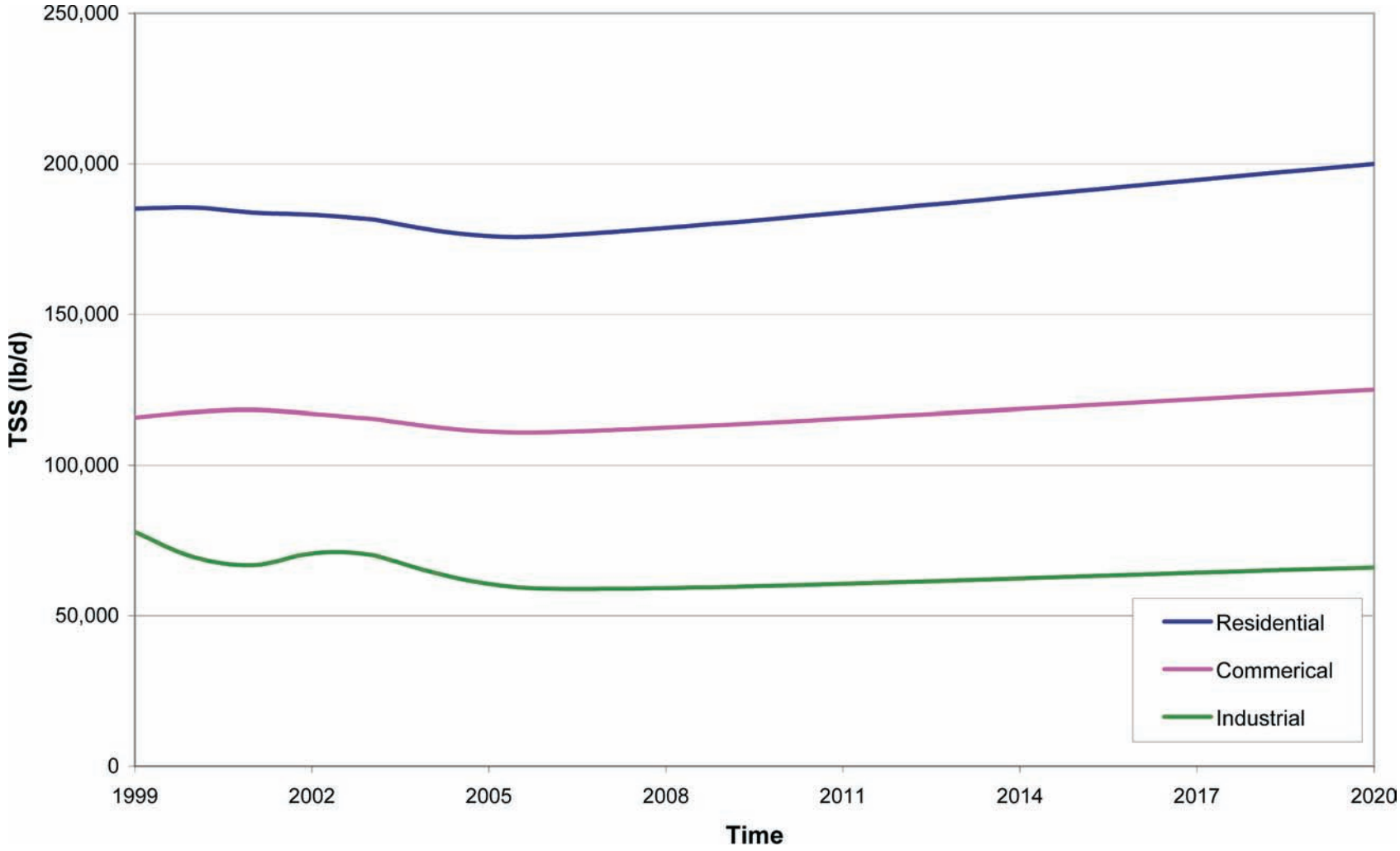

TSS = Total Suspended Solids

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FIGURE 5-4
PROJECTED FUTURE BILLABLE TSS TRENDS
2020 TREATMENT REPORT
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System Wasteload	Design Average Day Wasteload (lb/day)	1999-2003 Average Day Wasteload (lb/day)	Year 2006 Average Day Wasteload (lb/day)	Revised 2020 Baseline Average Day Wasteload (lb/day)	Percent Change 1999-2003 Average to Revised 2020 Baseline
Biochemical Oxygen Demand					
JIWWTP	299,000	264,000	193,000	232,000	(12.1%)
SSWWTP	224,000	149,000	163,000	171,000	14.8%
Total	**523,000**	**413,000**	**356,000**	**403,000**	(2.4%)
Total Suspended Solids					
JIWWTP	314,000	225,000	186,000	220,000	(2.2%)
SSWWTP	266,000	193,000	179,000	223,000	15.5%
Total	**580,000**	**418,000**	**365,000**	**443,000**	6.0%

MGD = Million Gallons per Day
JIWWTP = Jones Island Wastewater Treatment Plant
SSWWTP = South Shore Wastewater Treatment Plant

Sources: 1999-2003 UWS DWOR and Appendix 5A, *Future Condition Flow and Wasteload Analysis* of this chapter.

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TABLE 5-6
WASTEWATER TREATMENT PLANT WASTELOADS COMPARISON: DESIGN AVERAGE DAY WASTELOADS TO ACTUAL AVERAGE AND PROJECTED FUTURE AVERAGE DAY WASTELOADS
2020 TREATMENT REPORT
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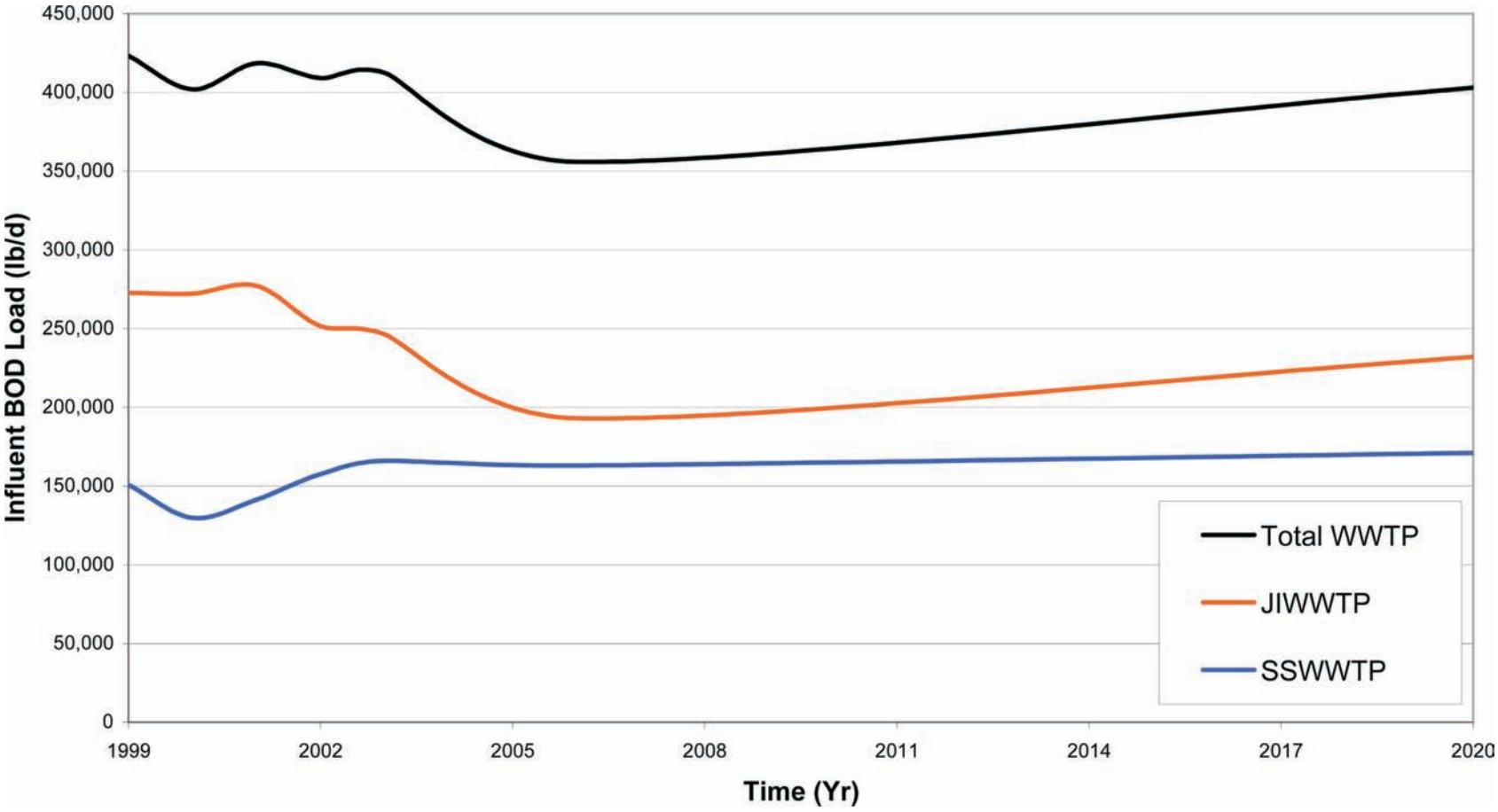

BOD = Biochemical Oxygen Demand
WWTP = Wastewater Treatment Plant
JIWWTP = Jones Island Wastewater Treatment Plant
SSWWTP = South Shore Wastewater Treatment Plant

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FIGURE 5-5
PROJECTED FUTURE WWTP INFLUENT BOD TRENDS
2020 TREATMENT REPORT
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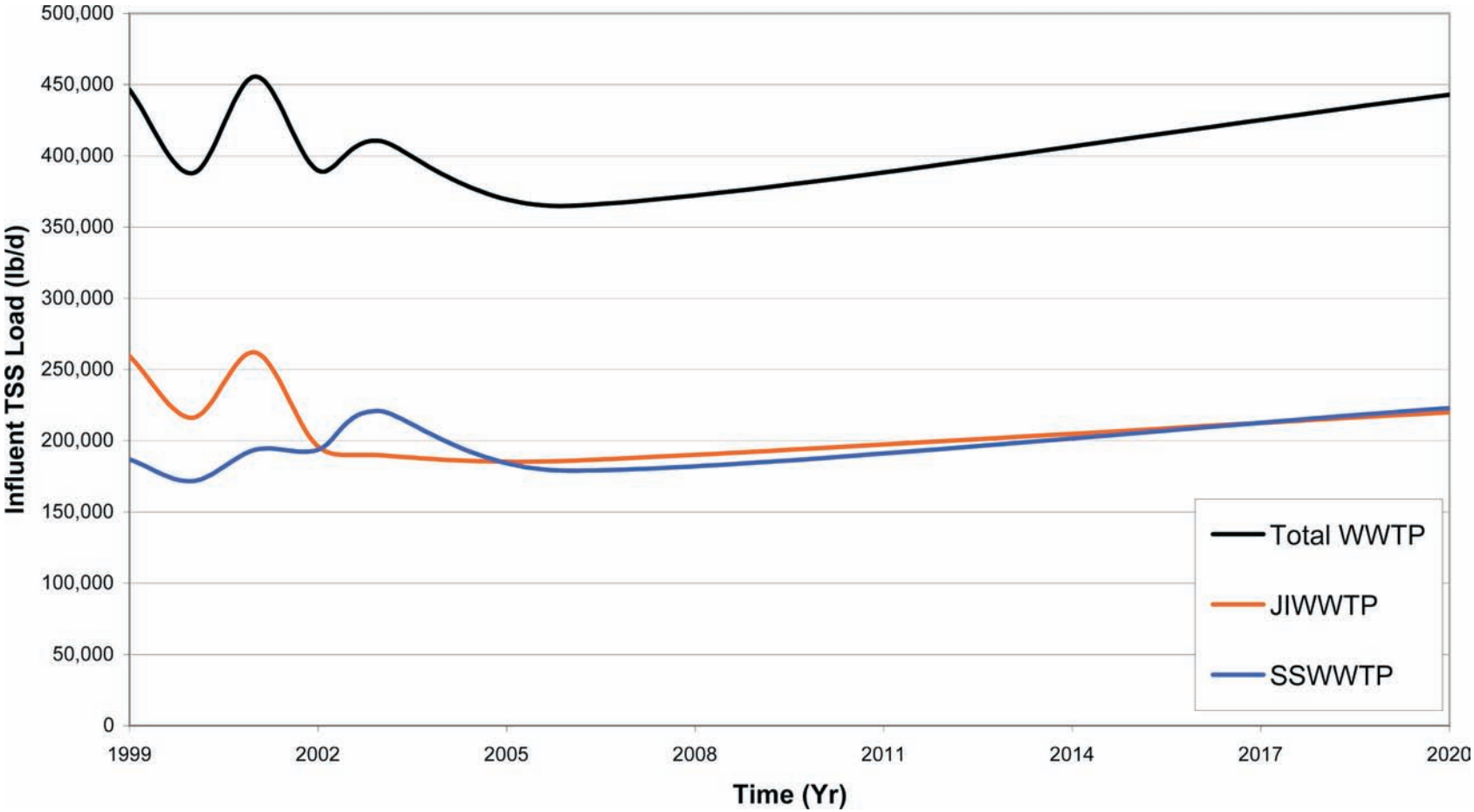

TSS = Total Suspended Solids
WWTP = Wastewater Treatment Plant
JIWWTP = Jones Island Wastewater Treatment Plant
SSWWTP = South Shore Wastewater Treatment Plant

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FIGURE 5-6
PROJECTED FUTURE WWTP INFLUENT TSS TRENDS
2020 TREATMENT REPORT
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The data presented in Table 5-6 and Figures 5-5 and 5-6 indicate that SSWWTP is expected to receive most of the projected increases in wasteloads. The effect of the loss of loadings from the relocation of LeSaffre Yeast on JIWWTP can be seen in the projected decrease in TSS and BOD loads. The 2006 projected trend indicates a significant decrease in both BOD and TSS wasteloads at JIWWTP.

The projected increases in TSS and BOD loadings at JIWWTP from 2006 to Revised 2020 Baseline estimates are significant but projected loads are still less than the 1999-2003 loads. The SSWWTP projected BOD load increases steadily to the year 2020, while the TSS load initially is projected to decrease (from the 1999-2003 average to year 2006) but rebounds and increases by an estimated 25% the year 2020. All 2020 average daily wasteloads (based upon Revised 2020 Baseline) at both treatment plants are projected to be less than design average daily loads.

The projected increase in wasteloads from the year 2006 to the year 2020 is due to the projected increases in population and land use throughout the MMSD planning area, as determined by SEWRPC.

Future Condition Maximum Daily and Weekly Wasteloads

The evaluation in Appendix 5A, *Future Condition Flow and Wasteload Analysis* of this chapter also determined the estimated maximum daily and maximum rolling week wasteloads processed by the treatment plants under 2006 and Revised 2020 Baseline conditions. Table 5-7 indicates the projected maximum daily and weekly wasteloads and compares them to existing condition values.(15,16,17,18)

The values listed in Table 5-7 indicate that JIWWTP maximum wasteloads are expected to drop in 2006, corresponding to the loss of LeSaffre Yeast, and Revised 2020 Baseline wasteload values are projected to only increase back to near existing condition values.

The SSWWTP BOD values are projected to steadily increase from existing condition to Revised 2020 Baseline values, while TSS values are projected to drop in 2006 and then increase significantly by the year 2020. All maximum wasteloads (except maximum weekly BOD) are projected to be above design limits at both treatment plants under Revised 2020 Baseline conditions. However, MMSD consistently achieved effluent limits at both treatment plants during existing conditions while exceeding design limits. Future projected effluent concentrations will be discussed in Section 5.6.2, *Future Blending and Effluent Quality*.

5.3 Treatment Process Evaluation

The JIWWTP and SSWWTP were evaluated in detail in Chapter 4, *Treatment Assessment – Existing Condition* to identify all existing issues and concerns at the treatment plants. In addition to those concerns already identified, the future condition treatment process evaluation focuses on how future flows, future wasteloads, and completed, committed and recommended MMSD treatment projects will affect the unit processes at the treatment plants.

System Wasteload	Design Wasteload (lb/day)	1999-2003 Wasteload (lb/day)[1]	Year 2006 Wasteload (lb/day)	Revised 2020 Baseline Wasteload (lb/day)	Percent Change 1999-2003 to Revised 2020 Baseline
MAXIMUM DAILY WASTELOAD					
Biochemical Oxygen Demand					
JIWWTP	687,000	769,000	321,000	705,000	(8.3%)
SSWWTP	515,200	470,000	481,000	535,000	13.8%
Total	**1,202,200**	**1,239,000**	**802,000**	**1,240,000**	0.1%
Total Suspended Solids					
JIWWTP	722,000	1,448,000	573,000	1,446,000	(0.1%)
SSWWTP	611,800	842,000	443,000	951,000	12.9%
Total	**1,333,800**	**2,290,000**	**1,016,000**	**2,397,000**	4.7%
MAXIMUM WEEKLY WASTELOAD					
Biochemical Oxygen Demand					
JIWWTP	478,000	417,000	229,000	374,000	(10.3%)
SSWWTP	336,000	249,000	261,000	284,000	14.1%
Total	**814,000**	**666,000**	**490,000**	**658,000**	(1.2%)
Total Suspended Solids					
JIWWTP	534,000	734,000	288,000	735,000	0.1%
SSWWTP	452,200	505,000	364,000	570,000	12.9%
Total	**986,200**	**1,239,000**	**652,000**	**1,305,000**	5.3%

JIWWTP = Jones Island Wastewater Treatment Plant
SSWWTP = South Shore Wastewater Treatment Plant
TSS = Total Suspended Solids

NOTE:
1) Influent maximum day and week TSS loadings may not be representative of actual maximum values, as discussed in Chapter 4, *Treatment Assessment – Existing Condition*.

Sources: 1999-2003 UWS Daily/Weekly Operating Reports (DWORs) and Appendix 5A, Future Condition Flow and Wasteload Analysis of this chapter.

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TABLE 5-7
WASTEWATER TREATMENT PLANT WASTELOADS COMPARISON: DESIGN MAXIMUM WASTELOADS TO ACTUAL MAXIMUM AND PROJECTED FUTURE MAXIMUM WASTELOADS
2020 TREATMENT REPORT
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The evaluation criteria used to evaluate the treatment plants in Chapter 4 also apply in the future condition analysis. These criteria include design criteria from Operation and Maintenance (O&M) Manuals, process data from MMSD and United Water Services (UWS), concerns identified in discussions with MMSD and UWS, WPDES permit requirements, current Wis. Admin. Code Natural Resources (NR) 110/204 regulations, and advisory 10-States Standards.(19,20,21,22,23)

The review is divided into four parts:

1) Additional utility, electric and instrumentation and control (I&C) issues not covered in Chapter 4 or requiring more discussion
2) The effects of future flows, future wasteloads, and completed, committed and recommended MMSD treatment projects on individual treatment unit processes at each plant
3) The effects of future flows, future wasteloads, and completed, committed and recommended MMSD treatment projects on biosolids processes at each of the treatment plants
4) Future condition air emission evaluation

5.3.1 Utility, Electric and Instrumentation & Control Processes

Plant Water Systems

Flow meters are being installed on the W3 piping (W3 is the recycled plant effluent service water system) at JIWWTP as part of the committed SSWWTP I&C Upgrade - Final Project.(24) The flow meter will be used in conjunction with the existing secondary treatment effluent meters to calculate the JIWWTP effluent flow.

The W3 system at SSWWTP has pump maintenance issues and no disinfection, which leads to biological growth problems.(25) These issues have been incorporated into the SSWWTP Valve Replacement and Utility Tunnel Improvements Project recommended by MMSD.

Energy Systems

JIWWTP

Future energy issues and requirements at JIWWTP are discussed in Chapter 9, *Alternative Analysis* of this report.

SSWWTP

Upon completion of the SSWWTP Blower Engine System Upgrade Project recommended by MMSD, SSWWTP will have five generators capable of startup in the event that both the primary and secondary power supply cables are disabled.

The replacement of one of the centrifuges with a gravity belt thickener (GBT), completed under the SSWWTP Gravity Belt Thickeners Project in 2005, has decreased the power demands on the plant. The installation of a second GBT was included under the UWS Capital Replacement and Repair program in 2006; this would further reduce power demand on the plant.(26)

Instrumentation and Control

The committed JIWWTP and SSWWTP I&C Upgrade Final Design Projects are scheduled to be completed in 2008.

5.3.2 Treatment Plant Unit Process Evaluation

The unit processes at both treatment plants are reviewed under Revised 2020 Baseline conditions in Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis*. This review along with completed, committed and recommended MMSD treatment projects, continuing issues, and operations are discussed in this section.

The mass balance analysis was employed to review the treatment plants under future average daily and future maximum conditions. The mass balances for JIWWTP and SSWWTP use the influent flows and wasteloads established in Sections 5.2.2, Future System Flows and 5.2.3, Future Wasteloads. Most unit processes were reviewed for average daily and peak hourly flow and wasteload conditions because design and regulations are based on these values. However, the waste activated sludge (WAS) pumping was reviewed for maximum daily wasteload conditions instead because these conditions would be more likely to reach or exceed design capacities.

JIWWTP Unit Process Evaluation

The performance of the nine major wastewater treatment unit processes at JIWWTP was reviewed under Revised 2020 Baseline conditions. Table 5-8 compares the performance of these major unit processes to the design intent.(27) Also included in Table 5-8 are additional secondary wastewater treatment unit processes not discussed in the text. The review also compared the operation of the unit processes at JIWWTP under Revised 2020 Baseline conditions to the current NR 110 requirements and advisory 10-States Standards. The unit processes for which a gap may exist between Revised 2020 Baseline condition operations and current NR 110 design requirements and/or advisory 10-States Standards are shown in Table 5-9.(28,29)

Unit Process No.[1]	Unit Process Title	Design Treatment Capacity		Specific Design Criteria	Projected Performance
		Total	Firm		
PS0801[2]	ISS Pump Station	150 MGD	100 MGD	• 3 pumps: 50 MGD at 380' TDH each • ISHF: – 5 MG solids storage – 2 rotary drum screens, 1000 gpm each – 1 grit separator, 4 cy/hr – 1 transfer pump, 2000 gpm	Installation of additional motor cooling system: pump output expected to increase 10%. increased performance has not been proven long-term so total capacity assumed for future operations remains at 120 MGD, with 2 pumps at 40 MGD each to JIWWTP and 1 pump at 40 MGD to SSWWTP
1	Influent Pumping	LL – 187 MGD HL – 413 MGD	LL – 140 MGD HL – 330 MGD	• LL pumps – 4 screw pumps: 46.7 MGD at 24' TDH each • HL pumps – 5 screw sumps: 82.6 MGD at 13.1' TDH each	LL – 140 MGD HL – 330 MGD
2	Influent Screening	440 MGD	330 MGD	• 8 mechanically cleaned bar screens (2 redundant) at 55 MGD per screen • ¼" clear opening	330 MGD with at least one unit out of service
3	Grit Removal	330 MGD	275 MGD	• 6 Pista grit vortex concentrators • 55 MGD treatment capacity, 70 MGD hydraulic capacity each • 95% removal of particles 70 mesh (0.20 mm) and larger with a specific gravity of 2.65 (silica sand)	330 MGD
4	Primary Clarification	330 MGD	289 MGD	• 8 primary clarifiers • SOR: average day – 760 gpd/sf; est. peak hour – 2,050 gpd/sf • WLR: average day – 30,600 gpd/lf; est. peak hour – 82,100 gpd/lf • Maximum day removal: 60% TSS, 25% BOD • Average day removal: 70% TSS, 35% BOD	Assumed – 7 primary clarifiers during average conditions, 8 primary clarifiers during maximum conditions – Removal rates able to meet design • SOR: average day – 760 gpd/sf, peak hour – 2,100 gpd/sf • WLR: average day – 30,400 gpd/lf, peak hour – 96,200 gpd/lf
5	Secondary Flow Control/ Aeration System	Maximum Day 508,500 lb/d BOD	Maximum Day 492,600 lb/d BOD	• WP – 12 single pass channels, 1 MG • EP– 20 single pass channels,1-1.4 MG, 19-1.65 MG • Average day influent load – 191,500 lb BOD • MLSS – 2400 mg/L • BOD loading: average day – 32 lb/1000 cf, maximum day – 85 lb/1000 cf • Food to microorganism ratio (F/M): average day – 0.3, maximum day – 0.8	Assumed average day – 17 EP and 11 WP; maximum day/peak hour - 20 EP and 12 WP basins operating • Influent Load: average day – 155,000 lb/d BOD, maximum day – 477,000 lb/d BOD • BOD Loading: average day – 30 lb/1000 cf, maximum day – 79 lb/1000 cf • F/M: average day – 0.2, maximum day load – 0.5 • MLSS: 2370 mg/L
6	Secondary Clarification	330 MGD	306 MGD	• WP – 11 at 8,550 sf surface area each; 94,050 sf total (31.2% of total secondary clarification capacity) • EP – 10 at 13,230 sf surface area each; 132,300 sf total (43.9% of total secondary clarification capacity) • NEP – 12 at 6,250 sf surface area each; 75,000 sf total (24.9% of total secondary clarification capacity) • SOR: average day – 410 gpd/sf; est. peak hour – 1,100 gpd/sf • SLR: average day – 12 lb/d/sf; est. peak hour – 34.4 lb/d/sf	Assumed 32 secondary clarifiers (not operating one old east plant clarifier) operating during average day and all clarifiers operating during peak conditions • SOR: average day – 380 gpd/sf, peak hour – 1,150 gpd/sf • SLR: average day – 11.6 lb/d/sf, peak hour – 29.2 lb/d/sf Secondary treatment capacity with biosolids storage was less than 300 MGD only 9% of time based on the available data in 2005.

Unit Process No.[1]	Unit Process Title	Design Treatment Capacity		Specific Design Criteria	Projected Performance
		Total	Firm		
7	Activated Sludge Pumping	Return – 165 MGD Waste – 5390 GPM	Return - 120 MGD Waste – 3350 GPM	• Return sludge – Average day 49 MGD (40% of average flow) – Maximum day 160 MGD (130% of average flow) – WP– 3 centrifugal pumps at 14.8 MGD, 28' TDH, 125 hp each – EP – 4 centifugal pumps at 30.2 MGD, 24' TDH, 200 hp each • Waste sludge – Waste sludge production: average day – 218,000 lb/d (109 tpd); maximum day – 400,000 lb/d (200 tpd) – Flow: average day – 2150 gpm, maximum day – 5390 gpm – WP – 2 centrifugal pumps at 730 gpm, 80' TDH, 25 hp each – EP – 3 centifugal pumps at 1310 gpm, 80' TDH, 50 hp each	• Return sludge – Average day 55 MGD – Peak hour 90 MGD • Waste sludge – Waste sludge production: average day – 103,600 lb/d; maximum day – 319,000 lb/d – Flow: average day – 1240 gpm (1.8 MGD); maximum day – 3820 gpm (5.5 MGD)
8	Disinfection	409 MGD	307 MGD	• 4 contact basins, 8.5 MG total volume • Sodium hypochlorite use: average day – 4,900 gpd, maximum day – 12,000 gpd, emergency – 44,000 gpd • Sodium bisulfite use: average day – 790 gpd, maximum day – 1925 gpd • Contact time: average day – 100 min., peak hour w/o blending – 37.2 min., peak hour with 60 MGD blending – 31.5 min.	Contact time: average day – 115 min, peak hour – 31 min.
9	Effluent Pumping	520 MGD	390 MGD	• 4 propeller pumps, 130 MGD at 10.2' TDH, 300 hp each	Assumed no pumping during normal operation
15	Process Air	472,000 cfm	236,000 cfm	• 4 blowers, 118,000 cfm, 5500 hp each • 2 blowers are redundant	• Air requirement based on oxygen demand: average day – 60,000 cfm; maximum day load – 212,000 cfm • Air requirement based on Mixing: 128,000 cfm
16	Scum Concentration	600 GPM	300 GPM	• 2 rotating drum screens, 300 GPM each • Scum press, 141 cf/hr capacity	• Scum flow: average day – 40 GPM, peak – 100 GPM • Original screens operate below design capacity; both screens needed during peak conditions • Committed preliminary treatment facility upgrade project to include a new 100 gpm scum concentrator and screw press to handle most scum flow, with original scum screens to handle peak flows
20	Pickle Liquor	N/A	N/A	Pumped feed: • Pickle liquor feed – 25 GPM • Iron addition – 25,200 lb/d Gravity feed: • Pickle liquor feed – 15 GPM • Iron addition – 15,000 lb/d	• Pickle liquor addition point relocated to various locations downstream of aeration basins as part of wet weather phase II committed project • Used as needed, which is rarely

BOD = Biochemical Oxygen Demand
cf = Cubic Feet
cfm = Cubic Feet Per Minute
EP = East Plant
gpd = Gallons Per Day
GPM = Gallons Per Minute
hp = Horsepower
ISHF = Inline Solids Handling Facility
JIWWTP = Jones Island Wastewater Treatment Plant
lf = Lineal Feet
LL = Low Level
MG = Million Gallons
MGD = Million Gallons per Day
MLSS = Mixed Liquor Suspended Solids
NEP = New East Plant
sf = Square Feet
SLR = Solids Loading Rate
SOR = Surface Overflow Rate
SSWWTP = South Shore Wastewater Treatment Plant
TDH = Total Dynamic Head
TPD = Tons Per Day
TSS = Total Suspended Solids
WLR = Weir Loading Rate
WP = West Plant

NOTES:
1. All unit processes at JIWWTP have a unit process number designation. Only the major and secondary unit processes which handle wastewater treatment are listed in this table. Unit processes which handle biosolids treatment at JIWWTP are listed in Table 5-13, Milorganite® Processes – Future 2020 Conditions, and Table 5-15, Interplant Solids Pumping. All other unit process are included in Appendix 4F, *MMSD WWTP Unit Process Analysis and Regulation Review* (note that not all number designations are used).
2. The ISS Pump Station is technically not a JIWWTP unit process so its pump station designation, PS0801, was used instead.

Source: Appendix 4F, *MMSD WWTP Unit Process Analysis and Regulation Review*, Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis*, Appendix 5D, *Revised 2020 Baseline Condition Unit Process Calculations*

Unit Process No.	Unit Process Title	Comparison of Unit Process Operations Under Revised 2020 Baseline Conditions to Current Regulations and Advisory Standards	
		Current NR 110 Regulation	Advisory 10-States Standards
4	Primary Clarification	NR 110.18.2 (d).1: • Maximum hourly surface settling rate for primary clarification is 1,500 gpd/sf • Average day weir loading rate for primary clarification is 15,000 gpd/lf • Projected peak hourly surface overflow rate is 2,100 gpd/sf and projected average day weir loading rate is 30,400 gpd/lf	• Sec. 72.21 - Maximum hourly surface settling rate for primary clarification is 2000 gpd/sf • Sect. 72.43 - Maximum hourly weir loading rate is 30,000 gpd/sf • Projected peak hourly surface overflow rate is 2,100 gpd/sf and projected peak hourly weir loading rate is 96,200 gpd/lf
6	Secondary Clarification	Meets regulations as listed in NR 110.18, Settling tanks	• Sec. 72.232 – with chemical addition, maximum hourly surface overflow rate is 900 gpd/sf • Projected peak hourly surface overflow rate is 1,150 gpd/sf

gpd = Gallons Per Day
lf = Lineal Feet
sf = Square Feet
WDNR = Wisconsin Department of Natural Resources
WWTP = Wastewater Treatment Plant

NOTES:

1) Current NR 110 regulations and advisory 10-States Standards were updated after the WWTP unit processes were constructed. Applicable NR 110 regulations were most recently updated May 2001. 10-States Standards were most recently updated in 2004. NR 110 applies to new or modified sewerage systems. NR 110.04 authorizes the WDNR to approve alternate requirements.
2) All unit processes not listed in this table have been determined to meet current NR 110 requirements and advisory 10-States Standards.

Source: Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis*, Jones Island O&M Manual, Individual Unit Process O&M Manuals, NR 110, 10-States Standards

The following discussion highlights Revised 2020 Baseline condition issues, along with completed, committed and recommended MMSD treatment projects:

- *Unit Process No. PS0801: Inline Storage System Pump Station*

  The future planned operation of the ISS Pump Station will direct flow from two of the pumps to JIWWTP and the third pump to SSWWTP. The capacity of each pump remains at approximately 40 MGD. The current NR 110 requirement that a pump station be able to meet capacity with one unit out of service was waived by the WDNR in a letter dated November 2, 1982.(30) Therefore, no issues for the ISS Pump Station are listed in Table 5-9.

  The completed JIWWTP Inline Pump System Improvements Project replaced the original head tanks, which had been damaged due to pump vibrations at the pump station at the end of 2004. Vibrations in the pumps continued after the head tank replacement. Divers were sent into the pump intake pipe in December 2004 to determine if vibrations were due to a potential build-up of silt and grit.(31) The divers found and removed 3-4 feet of silt and grit from portions of the intake pipe. However, pump vibration issues continued and an analysis was done in the fall of 2005 to determine the cause of the pump vibrations. The analysis indicated that the vibrations in the pumps are due to the configuration of the discharge piping.(32).

  The MMSD recommended a treatment project, Conceptual Design to Upgrade JIWWTP ISS Pump Station that will, in part, replace electrical motor starters, variable speed drive equipment, instrument air quality, pump seal water system, and ancillary equipment requiring upgrade or replacement. Part of the project will be installed by UWS under maintenance work rather than as a capital project: an additional motor cooling system will be installed in all three pumps. The UWS expects that modifications will improve the reliability of the pumps and increase output of the pumps by up to 10%.(33) The actual increase in pump output will not be known until all three systems are installed and long-term data during storm events are collected.

- *Unit Process No. 1: Influent Pumping*

  With the committed CMIS Harbor Siphons Project, influent pumping is expected to reach peak capacity during storm events: 140 MGD for the low level screw pumps and 330 MGD for the high level screw pumps. The screw pump equipment, which is reaching the end of its useful life, will be overhauled under the committed Preliminary Treatment Facility Upgrade Project.

- *Unit Process No. 2: Influent Screening*

  The committed Preliminary Treatment Facility Upgrade Project will replace the current screens with screens that have 1/4" openings.(34) The number of influent screens will increase from five to eight (design to meet 330 MGD with six screens in service, two redundant). The additional screens will provide more capacity to handle high leaf load conditions that occur during certain times of the year. The committed Preliminary Treatment Facility Upgrade Project also includes modifications to the lugger loading, heating, ventilating and air conditioning (HVAC) system, scum concentration, and primary sludge systems. It is expected that at the completion of this project, scheduled

for 2010, the screens will remove most of the floatables that currently reach the effluent nets.

With the additional redundant screens, the unit process will meet both current NR 110 regulations and advisory 10-States Standards.

- *Unit Process No. 3: Grit Removal*

  The review of the grit system conducted as part of the ongoing committed JIWWTP Preliminary Treatment Facility Upgrade Project found that the operation of this unit process has greatly improved to acceptable levels.(35) However, there continue to be efficiency issues with high grit loadings to primary clarifiers during wet weather events. The MMSD recommended a treatment project, Upgrade Primary Clarifier Mechanisms, discussed in more detail below, to address this issue.(36)

- *Unit Process No. 4: Primary Clarification*

  The MMSD recommended the Upgrade Primary Clarifier Mechanisms Project to include inspection of primary influent and primary effluent channels, sampling and quantification of grit, cost analysis comparison of primary sludge degritting alternatives, along with the mechanism rehabilitation work. In addition, MMSD is planning to clean the east and west primary clarifier feed channels to remove grease, scum and grit deposits.(37) This may resolve the operational problems in both the influent channel and the clarifiers discussed in Chapter 4, *Treatment Assessment – Existing Condition*. It will not be known until after the channels have been cleaned whether the problems in the Grit Removal Unit Process discussed above will still affect the operations of the primary clarification process.

  Potential settling of the remaining primary sludge withdrawal lines will continue to be a concern in the future.

  For the analysis in Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis*, it has been assumed that the BOD and TSS removal rates will be at design removal rates.

  Review of current NR 110 regulations and advisory 10-States Standards indicates that the projected primary clarification surface overflow peak hourly flow rate and weir loading rates will be higher than the maximum recommended rates under Revised 2020 Baseline conditions as identified in Table 5-9. These findings will be reviewed again in Chapter 8, *Committed and Common Treatment Facilities*, *Programs, Operational Improvements and Policies for the Recommended Plan* of this report to determine if an issue exists.

- *Unit Process No. 5: Secondary Flow Control/Aeration System*

  A review of the daily calculated secondary plant capacity provided in the UWS Daily/Weekly Operating Reports (DWORs) indicated that the secondary treatment capacity has increased since aeration basin biosolids storage was implemented under the completed JIWWTP Phase 1 Wet Weather Secondary Capacity Improvements Project. The calculated secondary treatment capacity was less than 300 MGD for 32% of the time based on available data in 2004. In 2005, the first year that the secondary treatment capacity information listed in the UWS DWORs included biosolids storage, the calculated secondary treatment capacity was less than 300 MGD for only 9% of the time

based on available data. See Appendix 4F, *MMSD WWTP Unit Process Analysis and Regulation Review* and Appendix 5D, *Revised 2020 Baseline Condition Unit Process Calculations* for calculations used to determine these percentages.

This is a significant increase from the 2003 UWS DWOR data, which indicated that calculated secondary treatment capacity was less than 300 MGD for 45% of the time based on available data.(38)

The committed JIWWTP Phase 2 Wet Weather Secondary Capacity Improvements Project will include the installation of reconfigured phosphorus control chemical (ferric chloride or pickle liquor as available) feed piping.

Recent observations of the JIWWTP activated sludge basin dissolved oxygen (DO) meters indicate that DO levels are much higher than the minimum 2.0 mg/L required by NR 110.(39,40) A possible conclusion is that the mixing required to prevent the existing diffusers from plugging with solids is much higher than the oxygen demand requirements now that the wasteload from LeSaffre Yeast is gone. Due to the size of the existing process air compressors, more air is being supplied than is needed to treat the wastewater. Calculations indicate that this issue will continue since future wasteloads to JIWWTP are not expected to increase much.[a]

- *Unit Process No. 6: Secondary Clarification*

  The increase in secondary treatment capacity from the completed JIWWTP Phase 1 Wet Weather Secondary Capacity Project also applies to the capacity of the secondary clarifiers.

  The MMSD recommended the Secondary Clarifier Drive Replacement Project, which would overhaul the existing secondary clarifier drives and mechanisms.

  Projected Revised 2020 Baseline conditions of the secondary clarification process will still meet NR 110 regulations for final settling after activated sludge treatment. However, the projected peak hourly surface overflow rate during projected peak flow conditions is above the maximum recommended peak hourly surface overflow rate for secondary settling with the use of chemical addition indicated in the advisory 10-States Standards, as identified in Table 5-9. This finding will be reviewed again in this report in Chapter 8, *Common Treatment Facilities, Programs, Operational Improvements and Policies for the Recommended Plan* to determine if an issue exists.

- *Unit Process No. 7: Activated Sludge Pumping*

  The MMSD recommended the JIWWTP Return Activated Sludge (RAS) Discharge Pipeline Improvements Project, which will include the replacement of actuators as well as maintenance of sluice gates exhibiting signs of failure.

  All projected operations of the activated sludge pumping process will meet current NR 110 regulations and advisory 10-States Standards. Therefore no issues are listed in Table 5-9.

[a] See *Process Air Requirements* under Appendix 5D, *Revised 2020 Baseline Condition Unit Process Calculations.*

- *Unit Process No. 8: Disinfection*

  The final effluent net installation completed in 2005 as part of the Floatables Removal Project has had limited success. Although collecting a lot of debris, some floatables are still escaping capture. The installation of the influent screens as part of the committed JIWWTP Preliminary Treatment Facility Upgrade Project should reduce the amount of floatables currently reaching the effluent nets.

- *Unit Process No. 9: Effluent Pumping*

  Pump variable frequency drives (VFDs) will be replaced under the RAS Pump Motors and VFD Upgrades Project recommended by MMSD. There are no expected future issues with the effluent pumps. The future operation is expected to remain the same as the operation discussed in Chapter 4, *Treatment Assessment –Existing Condition*.

SSWWTP Unit Process Evaluation

The performance of the nine major wastewater treatment unit processes at SSWWTP was reviewed under Revised 2020 Baseline conditions. Table 5-10 compares the performance of these major unit processes to the design intent.(41) Also included in Table 5-10 are additional secondary wastewater treatment unit processes not discussed in the text. Table 5-11 shows possible gaps in Revised 2020 Baseline unit process performance compared to current NR 110 requirements and advisory 10-States Standards.(42,43)

The following discussion highlights future condition issues, along with completed, committed and recommended MMSD treatment projects:

- *Unit Process No. 1: MIS Flow Control Structure*

  No issues have been identified relating to the MIS Flow Control Structure. The Revised 2020 Baseline condition operation is expected to remain the same as was discussed in Chapter 4, *Treatment Assessment – Existing Condition*.

- *Unit Process No. 2: Influent Screening*

  No issues have been identified relating to influent screening. The influent screening system installed in 2003 is expected to handle Revised 2020 Baseline condition loads.

- *Unit Process No. 3: Grit Removal*

  No issues have been identified relating to the grit removal unit process. The grit removal system installed in 2003 is expected to handle Revised 2020 Baseline condition loads.

- *Unit Process No. 4: Primary Clarification*

  For the analysis in Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis*, it is assumed that the primary clarifiers will perform up to design removal rates under Revised 2020 Baseline conditions. The MMSD recommended the SSWWTP Basin Drain System Overhaul Project, which will replace basin drain pumps and valves as needed. There are no other issues projected for the primary clarification unit process.

  The projected peak surface overflow rate under Revised 2020 Baseline conditions will meet both current NR 110 regulations and advisory 10-States Standards.

Unit Process No.[1]	Unit Process Title	Design Treatment Capacity		Specific Design Criteria	Projected Performance
		Total	Firm		
1	MIS Flow Control Structure	530 MGD	300 MGD	• 2 sluice gates, 6'x10' • Water level monitors, 4 upstream, 2 downstream	300 MGD or more
2	Influent Screening	350 MGD	300 MGD	• 7 fine screens, 50 MGD operating capacity, 0.25" opening each • Screenings – 2.2 cy/hr • Diversion bar screen – 300 MGD capacity	300 MGD
3	Grit Removal	300 MGD	257 MGD	• 7 grit channels, 42.9 MGD treatment capacity • 7 grit pumps, 600 GPM each • 7 slurry cup grit separation units, 590 GPM each	300 MGD
4	Primary Clarification	300 MGD	281 MGD	• Plant flow metering (upstream of primary clarification): 4 magnetic meters, 120 MGD each • 16 rectangular basins • SOR: average day – 1100 gpd/sf, est. peak hour SOR – 2930 gpd/sf • WLR: average day – 24,500 gpd/lf, est. peak hour WLR – 65,100 gpd/lf • Maximum day removal: 44% TSS, 17% BOD • Average day removal: 60% TSS, 32% BOD	Assumed — 14 primary clarifiers during average conditions, 16 primary clarifiers during maximum conditions — Removal rates able to meet design • SOR: average day – 420 gpd/sf, peak hour – 940 gpd/sf • WLR: average day – 4,500 gpd/lf, peak hour WLR – 10,100 gpd/lf
5	Aeration and RAS Pumping	Maximum day 442,400 lb/d BOD RAS – 125 MGD WAS – 4790 GPM	Maximum day 426,600 lb/d BOD RAS – 109 MGD WAS – 3600 GPM	• 28 basins, 1.25 MG each • Average day influent load: 158,500 lb BOD • MLSS: average day – 3030 mg/l, maximum day – 2450 mg/l • BOD loading: average day – 34 lb/1000 cf, maximum day – 95 lb/1000 cf • F/M: average day – 0.24, maximum day – 0.84 • Return sludge pumping: average day – 57 MGD, maximum day – 125 MGD — 6 RAS-WAS transfer pumps, 7.7 MGD each, 3 per battery — 8 RAS pumps, 15.6 MGD each, 2 per battery • Waste sludge: — Waste sludge production: average day – 172,900 lb/d, maximum day – 320,900 lb/d — Flow: average day – 1600 GPM, maximum day – 3810 GPM — 4 WAS pumps, 1200 GPM each	Assumed basins operating: average day – 25, maximum day – 28 • Influent load: average day – 117,700 lb/d BOD, maximum day – 377,000 lb/d BOD • BOD loading: average day – 28 lb/1000 cf, maximum day – 80 lb/1000 cf • F/M: average day – 0.3, maximum day – 0.7 • MLSS: average day – 1720 mg/l, maximum day – 1790 mg/l • Return sludge: — Average day – 60 MGD — Maximum day – 80 MGD • Waste sludge: — Waste sludge production: average day – 58,100 lb/d, maximum day – 184,000 lb/d — Flow: average day – 970 gpm (1.4 MGD), maximum day – 2420 gpm (3.5 MGD)
6	Secondary Clarification	300 MGD	288 MGD	• 24 octagonal clarifiers, 10,333 sf surface area each • SOR: average day – 480 gpd/sf est. peak hour – 1250 gpd/sf • SLR: average day – 18 lb/d/sf est. peak hour – 33.2 lb/d/sf	Assumed clarifiers operating: average day – 22, maximum day – 24 • SOR: average day – 530 gpd/sf, peak hour – 1270 gpd/sf • SLR: average day – 11.4 lb/d/sf, peak hour – 23.1 lb/d/sf

Unit Process No.[1]	Unit Process Title	Design Treatment Capacity		Specific Design Criteria	Projected Performance
		Total	Firm		
8	Disinfection	300 MGD	150 MGD	• 2 contact basins, 5 MG total volume • Sodium hypochlorite use – average day – 3,020 gpd, maximum day – 6,670 gpd, emergency – 44,000 gpd • Sodium bisulfite use: average day – 720 gpd, maximum day – 1600 gpd • Contact time: average day – 64.1 min., peak hour – 24.2 min.	Contact time: average day – 63 min., peak hour – 24 min.
9	Effluent Pumping	375 MGD	300 MGD	• 5 wet pit axial flow pumps, 75 MGD each • Effluent measurement – 15' Parshall flume, not used	• Assumed no pumping during normal operation • Effluent measurement utilized after new technology installed
15	Process Air	150,000 cfm	112,500 cfm	• 4 blowers, 37,500 cfm, 1500 hp each (with electric motor replacement)	• Air requirement based on oxygen demand: average day – 60,000 cfm, maximum day – 116,000 cfm • Air requirement based on Mixing: 93,000 cfm
18	Pickle Liquor Storage and Feed	Maximum day: 13,500 lb/d 21 gpm		• Dose: average day – 5,200 GPM, maximum day – 13,500 lb/d • Usage: average day – 8 GPM, maximum day – 21 GPM • Storage: 20,000 gal	• Pickle liquor feed (assumed increase proportional to increase in flow) — Average day – 3.4 GPM — Maximum day – 16.4 GPM

BOD = Biochemical Oxygen Demand
cf = Cubic Feet
cfm = Cubic Feet Per Minute
cy/hr = Cubic Yards Per Hour
F/M = Food to Microorganism Ratio
gpd = Gallons Per Day
GPM = Gallons Per Minute
hp = Horsepower
lf = Lineal Feet
MG = Million Gallons
MGD = Million Gallons per Day
mg/l = Milligrams/liter
MIS = Metropolitan Interceptor Sewer System
MLSS = Mixed Liquor Suspended Solids
RAS = Return Activated Sludge
sf = Square Feet
SLR = Solids Loading Rate
SOR = Surface Overflow Rate
SSWWTP = South Shore Wastewater Treatment Plant
TSS = Total Suspended Solids
WAS = Waste Activated Sludge
WLR = Weir Loading Rate
WWTP = Wastewater Treatment Plant

NOTE:
1) All unit processes at SSWWTP have a unit process number designation. Only the major and secondary unit processes which handle wastewater treatment are listed in this table. Unit processes which handle biosolids treatment at SSWWTP are listed in Table 5-14, Agri-Life® Processes, and Table 5-15, Interplant Solids Pumping. All other unit processes are included in Appendix 4F, *MMSD WWTP Unit Process Analysis and Regulation Review* (note that not all number designations are used).

Source: Appendix 4F, *MMSD WWTP Unit Process Analysis and Regulation Review*, Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis*, Appendix 5D, *Revised 2020 Baseline Condition Unit Process Calculations*

Unit Process No.	Unit Process Title	Comparison of Unit Process Operations Under Revised 2020 Baseline Conditions to Current Regulations and Advisory Standards	
		Current NR 110 Regulation	**Advisory 10-States Standards**
6	Secondary Clarification	• NR 110.18.2 (d).1 – Maximum hourly surface overflow rate for clarification after activate sludge treatment is 1,200 gpd/sf • Projected peak hourly surface overflow rate is 1,270 gpd/sf	• Sec 72.232 — With chemical addition, maximum hourly surface overflow rate is 900 gpd/sf • Future projected peak hourly surface overflow rate is 1,270 gpd/sf

gpd = Gallons Per Day
sf = Square Feet
WDNR = Wisconsin Department of Natural Resources
WWTP = Wastewater Treatment Plant

NOTES:

1) Current NR 110 regulations and advisory 10-States Standards were updated after the WWTP unit processes were constructed. Applicable NR 110 regulations were most recently updated May 2001. 10-States Standards were most recently updated in 2004. NR 110 applies to new or modified sewerage systems. NR 110.04 authorizes the WDNR to approve alternate requirements.
2) All unit processes not listed in this table have been determined to meet current NR 110 requirements and advisory 10-States Standards.

Source:

Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis*, South Shore O&M Manual, Individual Unit Process O&M Manuals, NR 110, 10-States Standards

- *Unit Process No. 5: Aeration and RAS Pumping*

  The activated sludge system is projected in Revised 2020 Baseline conditions to operate at or below design parameters under all flow and wasteload conditions, as shown in Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis*.

  The MMSD recommended a treatment project, SSWWTP Aeration Basin Concrete Repair, which will repair all deteriorating concrete on the 28 aeration basins by 2011. The RAS system control valves and meters are reaching the end of their useful lives. The control valves are scheduled for replacement under the Secondary Clarifier Upgrade Project recommended by MMSD and the RAS meters will be replaced under the committed SSWWTP I&C Upgrade - Final Project. The WAS pumping projections indicate that the system is projected to meet the WAS pumping needs of SSWWTP up to the year 2020.

  All projected operations of aeration and RAS pumping will meet current NR 110 regulations and advisory 10-States Standards. No regulatory or standards issues were noted other than the 10-States Standards design requirement for WAS pumping noted in Chapter 4, *Treatment Assessment – Existing Condition*. Therefore, no issues for aeration and RAS pumping are listed in Table 5-11.

  Unit Process No. 15, Process Air was reviewed as part of this unit process because the air is necessary to activated sludge treatment. The MMSD recommended a treatment project, SSWWTP Blower Engine System Upgrade, which includes upgrades to the blowers that will increase the firm capacity of the blowers to 112,500 cfm. This capacity is greater than the projected air requirements in the year 2023, which were determined in the *Preliminary Engineering Report, SSWWTP Blower System Upgrade*, based on projected treatment plant flow data determined in the *2010 Facilities Plan*.(44.45,46) This capacity also meets NR 110 requirements that the system be able to provide the maximum air demand with one unit out of service. However, Revised 2020 Baseline projections indicate air requirements in the year 2020 to be 116,000 cfm, which is greater than the future firm capacity of the blowers. Since the *Preliminary Engineering Report, SSWWTP Blower System Upgrade* included an in-depth analysis and review of the system, it has been determined that 101,000 cfm should be the acceptable value for future air requirements at this time.

- *Unit Process No. 6: Secondary Clarification*

  Improvements to the secondary clarification process were done under the completed SSWWTP Wet Weather Secondary Capacity Improvements Project and the committed SSWWTP I&C Upgrade - Final Project.(47) The MMSD recommended a treatment project, SSWWTP Secondary Clarifier Upgrade, that includes replacing equipment that has reached the end of its useful life. The SSWWTP Basin Drain System Overhaul Project recommended by MMSD would replace basin drain pumps and valves.

  As indicated in Table 5-11, the Revised 2020 Baseline projections for secondary clarification surface overflow peak hourly flow rate are higher than the maximum recommended rates as listed in current NR 110 regulations and advisory 10-States Standards. These findings are reviewed in this report in Chapter 8, *Committed and*

Common Treatment Facilities, Programs, Operational Improvements and Policies for the Recommended Plan to determine if an issue exists.

- *Unit Process No. 8: Disinfection*

  The peak flows to SSWWTP under Revised 2020 Baseline conditions are projected to be limited to 300 MGD to meet the peak hour design capacity of SSWWTP. The NR 110 regulations require that the disinfection system be sized to provide a detention time of 60 minutes at average daily flow or 30 minutes at maximum design flow and that effluent bacterial concentrations conform to WPDES permit requirements. The mass balance analysis provided in Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis* projects an average detention time of 64 minutes at average daily flow and 24 minutes at peak hourly flow, with effluent concentrations below permit limits under both conditions. Therefore, the unit process is projected to meet NR 110 regulations because NR 110 regulations allow either 60 minutes at average daily flow or 30 minutes at peak hourly flow with all effluent limits met. Effluent concentrations are discussed in more detail in Section 5.6.2, *Future Blending and Effluent Quality*.

  Blending, though not currently allowed, is reviewed in Chapter 9, *Alternative Analysis* of this report.

  The Parshall flume equipment necessary to meter the effluent flow is being reinstalled as part of the committed SSWWTP I&C Upgrade – Final Project.

- *Unit Process No. 9: Effluent Pumping*

  There are no planned committed or recommended MMSD treatment projects or any expected future issues with the effluent pumps. The future operation is expected to remain the same as the operation discussed in Chapter 4, *Treatment Assessment – Existing Condition*.

5.3.3 Biosolids Evaluation

The MMSD biosolids management was evaluated based on O&M Manual design criteria, projected Revised 2020 Baseline condition performance, current NR 110/204 regulations, and advisory 10-States Standards.(48,49,50,51,52) As stated in Section 5.2, Chapter 9, *Alternative Analysis* of this report will analyze in detail potential future biosolids management alternatives. The analysis included in this section, developed from Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis*, focuses on the operation of the biosolids processes under Revised 2020 Baseline TSS loadings. The Revised 2020 Baseline TSS loadings are based on LeSaffre Yeast relocating outside MMSD's sewer service area and projected Revised 2020 Baseline conditions biosolids production. This review assumes that current biosolids management operations will continue and that committed projects have been installed. Recommended MMSD treatment projects are also noted. Chapter 9, *Alternative Analysis* analyzes in detail potential future biosolids management alternatives.

Average day, maximum day, maximum week and maximum month TSS loadings are reviewed in detail in Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis.* Though maximum day wasteloads are noted, the review focuses on capacity issues under maximum week and maximum month conditions biosolids operations under Revised 2020

Baseline conditions. Biosolids processes appear to handle maximum loads that only occur for short durations; longer durations of maximum loads typically are more of a concern for these processes.

According to the O&M Manuals, JIWWTP is designed to handle 240 tons per day of biosolids and SSWWTP is designed to handle 175 tons per day, for a total treatment system biosolids design capacity of 415 tons per day.(53,54) For the Revised 2020 Baseline condition, total treatment system biosolids production is projected to be 400 tons per day under maximum week wasteload conditions and 290 tons per day under maximum month wasteload conditions.[b] Therefore, since the design capacity is greater than the projected production, the total treatment system is projected to handle the Revised 2020 Baseline biosolids.

Milorganite® Evaluation

Table 5-12 lists projected Revised 2020 Baseline performance conditions of the unit processes used for Milorganite® production. Specific process issues are discussed below. Projections indicate that none of the processes will reach peak design solids loading during maximum week and month wasteload conditions.[c]

Sludge Thickening

No changes are planned in the operation of sludge thickening. The MMSD recommended a treatment project, Thickened Activated Sludge/ Interplant Sludge (TAS/IPS) Wet Wells, which would fix all structural failures beginning to appear in the wet wells.

Sludge Screening and Pumping

The committed Preliminary Treatment Facility Upgrade Project, scheduled to be completed in 2012, includes the installation of five more Parkson screens, each with the same 250 gallons per minute (GPM) capacity as the existing screens. In addition, the existing Contra-Shear screen will be removed as part of the project.(55)

Equalization and Blend

No changes in the operation of the equalization and blend process are planned, nor are any committed or recommended MMSD treatment projects.

Waste Activated Sludge Receiving/ Gallery Solids Piping Intertie

No changes in the operation of the WAS receiving/gallery solids piping intertie process are planned, nor are any committed or recommended MMSD treatment projects.

[b] See Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis* of this chapter.
[c] See Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis* of this chapter.

Unit Process No.	Unit Process Title	Design Treatment Capacity		Specific Design Criteria	Projected Performance
		Total	Firm		
10	Sludge Thickening	5035 GPM 181 tons/d	3780 GPM 135.8 tons/d	• Four 3-meter GBTs • 1260 gpm, 45.25 ton/d each • Four thickened sludge transfer pumps, 1,800 GPM total capacity	• GBT feed — flow - Average day - 1,480 GPM (2.3 MGD) - Maximum day - 4,390 GPM (6.3 MGD) - Maximum Week - 2,850 GPM (4.1 MGD) - Maximum Month - 2,600 GPM (3.7 MGD) • GBT feed — solids loading - Average day - 60 ton/day - Maximum day - 180 ton/day - Maximum Week - 100 ton/day - Maximum Month - 85 ton/day
11	Sludge Screening and Pumping	Screening - 2000 GPM Pumping - 3240 GPM	Screening - 1750 GPM Pumping - 2160 GPM	• 3 existing Parkson screens, 250 GPM each • 5 new Parkson screens, 250 GPM each • Screenings Quantity: Average day - 39 cf/hr, Peak Hour - 630 cf/hr • Screened sludge pumping, 3 units, 1080 GPM each	• Primary sludge pumped - Average day - 335 GPM (0.5 MGD) - Maximum day - 2,220 GPM (3.2 MGD) - Maximum Week - 1,110 GPM (1.6 MGD) - Maximum Month - 800 GPM (1.2 MGD)
12	Equalization and Blend	3430 GPM	1715 GPM	• 2 Mix Tanks, 360,000 gal each • Tank 1 — Primary sludge equalization before pumping to digesters at SS • Tank 2 — Blend portion of JIWWTP primary, portion of JIWWTP WAS, and JIWWTP GBT sludge before Belt Filter Presses	• Blended sludge pumped - Average day - 1,050 GPM (1.5 MGD) - Maximum day - 1,640 GPM (2.4 MGD) - Maximum week - 1,960 GPM (2.8 MGD) - Maximum month - 1,670 GPM (2.4 MGD)

Unit Process No.	Unit Process Title	Design Treatment Capacity		Specific Design Criteria	Projected Performance
		Total	Firm		
23	Waste Activated Sludge Receiving/ Gallery Solids Piping Intertie	5610 GPM	3740 GPM	• 3 pumps, 1870 GPM at 138' TDH, 100 hp each • 2 Wet Wells, 21,200 gal each	• WAS processed (All JIWWTP and all SSWWTP sludge received) - Average day - 2,160 GPM (3.1 MGD) - Maximum day - 5,240 GPM (7.5 MGD) - Maximum week - 4,210 GPM (6.1 MGD) - Maximum month - 3,750 GPM (5.4 MGD)
24, 25, 27	Dewatering and Drying Facility[1]	240 dry tons per day	200 dry tons per day	• 24 2-meter dewatering belt filter presses • 12 rotary drum dryers, each capable of producing 20 tons per day • Two redundant material classification trains • 12 exhaust gas treatment systems consisting of a cyclone and wet electrostatic precipitator	• Milorganite® processed - Total est. - 35,000 tons/year - Average day – 90 dry tons /day - Maximum day - 200 dry tons/day - Maximum week - 150 dry tons/day - Maximum month - 130 dry tons/day

GBT = Gravity Belt Thickener
GPM = Gallons Per Minute
hp = Horsepower
JIWWTP = Jones Island Wastewater Treatment Plan
MGD = Million Gallons per Day
SSWWTP = South Shore Wastewater Treatment Plant
TDH = Total Dynamic Head
WAS = Waste Activated Sludge

NOTES:
1) The Dewatering and Drying facility houses the unit processes necessary to produce Milorganite® from the blended sludge. It is discussed as one unit process.

Source:
Appendix 4F, *MMSD WWTP Unit Process Analysis and Regulation Review*, Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis*

Dewatering and Drying

A number of committed and recommended MMSD treatment projects will be replacing old equipment listed in Chapter 8, *Common Treatment Facilities, Programs, Operational Improvements and Policies for the Recommended Plan*. The completed Dewatering and Drying (D&D) Safety Modifications III Project installed safety equipment and warning systems in 2004. Though some projects are committed and recommended to replace older equipment, the D&D Facility as a whole is reaching the end of its useful life. However, the analysis in this chapter assumes that no changes are planned in the operation of the dewatering and drying process at this time. Future dewatering and drying equipment needs are discussed in Chapter 9, *Alternative Analysis* of this report.

Agri-Life® Production

The Revised 2020 Baseline performance of the unit processes used for Agri-Life® production is listed in Table 5-13. Specific issues relating to Agri-Life® processes are identified below. The anaerobic digestion process is predicted to reach peak design solids loading during maximum week and month wasteload conditions.[d] These issues are reviewed in more detail in Chapter 9, *Alternative Analysis* of this report.

Sludge Dissolved Air Floatation Thickening

The dissolved air floatation thickening process equipment is at the end of its useful life. A review of the unit process in 2004 recommended the replacement of the dissolved air floatation units with GBTs.(56) Chapter 9, *Alternative Analysis* of this report includes an evaluation of future biosolids management alternatives.

Anaerobic Digestion

No committed or recommended MMSD treatment project is planned to improve the mixing in the digesters. Because the actual change in solids destruction in the year 2020 is unknown, the Revised 2020 Baseline conditions analysis conservatively assumes that the solids destruction remains the same. No changes in the operation of the anaerobic digestion process are planned.

The mass balance analysis predicts that the digesters will have volatile solids loadings exceeding design capacity during both maximum week and month Revised 2020 Baseline conditions. This finding is reviewed in again in the biosolids alternatives analysis in Chapter 9, *Alternative Analysis* in this report

Gravity Belt Thickener/ Centrifuge Thickening

A single GBT was installed in May 2005 under the completed SSWWTP Gravity Belt Thickeners Project. This GBT, which replaced one of the centrifuges, has a maximum capacity of 300 GPM and typically operates in the range of 230-250 GPM. The GBT receives most of the digested solids at 1.5%-2% solids and thickens the sludge to 9-10% solids.(57) There are 3-4 centrifuges still operating, depending on repairs, which handle the rest of the digested sludge. A UWS Capital Repair and Replacement Project to install an additional GBT was initiated in 2006.(58) This GBT is included as part of the analysis in this report in Chapter 9, *Alternative Analysis*.

[d] See Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis* of this chapter.

Unit Process No.	Unit Process Title	Design Treatment Capacity		Specific Design Criteria	Projected Performance
		Total	Firm		
10	Sludge Thickening	- 7440 lb/hr TWAS - 675 GPM	- 6200 lb/hr TWAS - 450 GPM	• 6 dissolved air floatation thickeners at 1240 lb/hr each • 1240 sf surface area each • 6% thickened waste activated sludge (TWAS) solids concentration	TWAS pumped – Average day — 6 GPM (0.01 MGD) – Maximum day — 160 GPM (0.2 MGD) – Maximum week and month — 0 GPM (all WAS sent to JIWWTP unthickened) Thickened sludge assumed for all operations — 3.65%
11	Anaerobic Digestion	265,000 lb VS/d	209,000 lb VS/d	• Six anaerobic digesters • Four north digesters — 3.2 MG each • Two south digesters — 1.25 MG each • Bubble cannon mixing on north digesters • Mechanical propeller mixing on south digesters • Design maximum VS loading — 0.13 lb VS/cf/day	Digester feed – Average day — 610 GPM (0.9 MGD) – Maximum day — 3,600 GPM (5.2 MGD) – Maximum week — 1,820 GPM (2.6 MGD) – Maximum month — 1,190 GPM (1.7 MGD) Volatile solids - Average day — 216,200 lb/day - Maximum day — 1,268,800 lb/day - Maximum week — 643,300 lb/day - Maximum month — 417,900 lb/day
12	GBT/ Centrifuge Thickening	1860 GPM	1470 GPM	• One gravity belt thickener (installed 2005), 300 GPM capacity • Four thickening centrifuges, 390 GPM each • 6% - 10% thickened sludge solids	Thickening feed - Average day — 465 GPM (0.7 MGD) - Maximum day — 3,500 GPM (5.2 MGD) - Maximum week — 1,580 GPM (2.3 MGD) - Maximum month — 980 (1.4 MGD) Thickened sludge concentration assumed — 7.1%

Unit Process No.	Unit Process Title	Design Treatment Capacity		Specific Design Criteria	Projected Performance
		Total	Firm		
14	Filter Press Dewatering	• Feed — 3200 GPM • Cake production — 66.3 ton/d	• Feed — 2000 GPM • Cake production — 53 ton/d	• 5 plate and frame presses • 8 pumps, 400 GPM each — 3 pumps per pair of presses for four presses, 2 pumps for fifth press	Plate and frame press production, based on Agri-Life® limits – Est. total — 8,000 dry tons/yr – Average day — 22 dry tons/d – Maximum day — 230 dry tons/d
20	Agri-Life® Storage	Storage: 9 MG	Storage: 7.5 MG	• Using old digesters converted to sludge storage – originally planned on converting all eight south digesters but only converted six • Designed for 1.5 MG storage for each digester • Agri-Life® production at 7% solids: – Maximum month — 205,000 gpd – Average day — 130,000 gpd	• Agri-Life® storage — limited to 9.0 MG, 6 months storage • Agri-Life® production – 33 MG total/yr – Average day - 143,000 gpd – 15,300 dry tons/yr

cf = cubic feet
GPD = Gallons Per Day
GPM = Gallons Per Minute
JIWWTP = Jones Island Wastewater Treatment Plant
lb = Pound
lb/hr = Pounds Per Hour
MG = Million Gallons
MGD = Million Gallons per Day
TWAS = Thickened Waste Activated Sludge
VS = Volatile Solids
WAS = Waste Activated Sludge

Source:
Appendix 4F, *MMSD WWTP Unit Process Analysis and Regulation Review*, Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis*

Agri-Life® Storage

No committed or recommended MMSD treatment project is planned to improve the mixing in the storage digesters. No changes in the operation of the storage digesters are planned. Additional mixing needs in the storage digesters are reviewed in again in the biosolids alternatives analysis in Chapter 9, *Alternative Analysis* in this report.

Land Application/ Landfill Program

The filter press performance is also listed in Table 5-13. While an additional filter press is being considered, there is currently no planned, committed or recommended MMSD treatment project. Chapter 9, *Alternative Analysis* of this report includes a recommendation for the future operation of the filter presses. The filter cake has been either land applied or landfilled as land application needs and storage availability dictate. Landfilling, which did not occur from 1998-2003, was done during 2005 and is expected to be used in the future as needed based on filter cake storage availability.

Future solids loading to the filter presses are projected to exceed design capacity during Revised 2020 Baseline condition maximum week wasteloads. Production rates are also projected to exceed design capacity during Revised 2020 Baseline condition maximum week wasteload. This finding will be reviewed in more detail in this report in, Chapter 9, *Alternative Analysis*

Other Solids Disposal

No changes in operation or committed/recommended MMSD projects are planned for this process. As discussed previously, the disposal of chaff may become an air emissions issue at landfills as they must meet stricter air emissions regulations under the Title V air emissions permits.(59) No changes in operation based on this potential issue are planned at this time.

Interplant Solids Pumping

The TAS/IPS Wet Wells Project recommended by the MMSD would fix all structural deterioration issues in the IPS pumping process. Two other recommended MMSD treatment IPS projects are the IPS Cathodic Protection Project and the IPS & Blended Sludge System Plug Valves Project. There are no planned changes in the operation of the IPS pumping process at either plant. Additional equipment needs for the IPS process are discussed in this report in Chapter 9, *Alternative Analysis.* The projected performance of this process under Revised 2020 Baseline conditions is listed in Table 5-14.

No concerns are projected with the IPS pumping during Revised 2020 Baseline conditions.

TABLE 5-14
INTERPLANT SOLIDS PUMPING – REVISED 2020 BASELINE CONDITION

Unit Process No.	Unit Process Title	Design Treatment Capacity		Specific Design Criteria	Projected Performance
		Total	***Firm***		
13 at both treatment plants	Interplant Solids Pumping	JIWWTP: 6000 GPM SSWWTP: 3780 GPM	JIWWTP: 4000 GPM SSWWTP: 2520 GPM	Three 2-stage pairs of pumps, 2000 GPM each at JIWWTP, 1160 GPM each at SSWWTP 4 Interplant Solids Pipes between plants: #1&#4 = 14-inch #2&#3 = 12-inch JIWWTP Primary to SSWWTP SSWWTP WAS & digested sludge to JIWWTP	**TO SSWWTP**: ***Primary Sludge:*** Average Day: 320 GPM (0.5 MGD) Maximum Day Load: 2,180 GPM (3.1 MGD) Maximum Week Load: 1,080 GPM (1.6 MGD) Maximum Month Load: 770 GPM (1.1 MGD) **FROM SSWWTP**: ***WAS:*** Average Day: 930 GPM (1.3 MGD) Maximum Day Load: 1,420 GPM (2.0 MGD) Maximum Week Load: 1,830 GPM (2.6 MGD) Maximum Month Load: 1,560 GPM (2.2 MGD) ***Digested Sludge:*** Average Day: 140 GPM (0.2 MGD) Maximum Day Load: 110 GPM (0.2 MGD) Maximum Week Load: 240 GPM (0.3 MGD) Maximum Month: 200 GPM (0.3 MGD)

Sources: Jones Island O&M Manual, SSWWTP O&M Manual, and Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis* of this chapter.

5.3.4 Air Emissions Evaluation

The air emissions at SSWWTP and JIWWTP are regulated under WDNR air pollution control operation permits. The permits applicable under the Revised 2020 Baseline condition are Title V permits, which were issued November 22, 2004 for JIWWTP (expires November 22, 2009) and August 31, 2004 for SSWWTP (expires August 31, 2009). Because both permits were issued after the end of the Existing Condition review period, which was established as June 30, 2004 in

Chapter 4, *Treatment Assessment – Existing Condition*, the permits are discussed in this chapter. Both treatment plants are classified as Part-70 Sources, which defines them as major sources of air pollution emissions. The operation permits establish requirements and conditions of operation for the emission sources at the treatment plants. The permits identify regulated pollutants, emission limitations and compliance demonstration requirements.

The MMSD submits the following reports related to air emissions:

- Annual Air Emission Inventory Summary Reports for each treatment plant, which list emissions from the emission sources
- Semi-annual monitoring reports as specified by the compliance demonstration and monitoring requirements specified in the permits
- Annual certification of compliance with the requirements of the permit for each treatment plant

Table 5-15 lists the air emission sources and limitations as set in the Title V air pollution control permit for JIWWTP. It also lists the actual emissions from each source as listed in the 2005 Air Emission Inventory Summary Report for JIWWTP. These emissions must be reported according to Wis. Admin. Code NR 438.(60,61)

Table 5-16 lists the air emission sources and limitations as set in the Title V air pollution control permit for SSWWTP. It also lists and the actual emissions from each source as listed in the 2005 Air Emission Inventory Summary Report for SSWWTP. These emissions must be reported according to Wis. Admin. Code NR 438.(62,63)

In addition to the air emissions limitations listed in Tables 5-15 and 5-16, all limitations listed in Part II, General Permit Conditions of each of the Title V permits also apply, as well as the following Wis. Admin. Code emission limitations for the insignificant air emissions at the treatment plants:

- NR 415.05 – Particulate emission limits for processes
- NR 415.055 – Particulate emission limits for motor gasoline and diesel internal combustion engines
- NR 415.06 – Particulate emission limits for fuel burning installations
- NR 415.07 – Particulate emission limits for incinerators
- NR 423.03 – Solvent metal cleaning
- NR 431.04 and 431.05 – Visible emission limitations
- NR 485.05 – Visible emission limits for motor vehicles, internal combustion engines and mobile sources

Review of the 2005 air emissions compared to permit requirements as well as conversations with MMSD staff indicate that the treatment plants are in compliance with permit requirements.(64)

Section	Stack	Processes	Pollutant	Limitation[1]	2005 Emission
A	S11	P01-P12: Rotary sludge dryers	Particulate matter emissions	1) 0.010 grains per dscf (w/o P15); or, 2) 23.5 lb/hr,	P01 Process 00: 49.336 ton/yr P30 Process 01: 5.019 ton/yr
		P16: Dust collection system for dryer and cyclone area	NOx	1) 49.35 mm cf/mo of natural gas, averaged over any 12 consecutive calendar months	P30 Process 01: 243.415 ton/yr
		P30: 16 MW electricity generating turbine	SO_2	1) No person may cause, allow or permit emission of sulfur or sulfur compounds into the ambient air which substantially contribute to the exceeding of an air standard or cause air pollution	No emissions above NR438 limit for reporting requirements
		P31: 16 MW electricity generating turbine	CO	1) 49.35 MM cf/mo of natural gas, average over any 12 consecutive calendar months.	P30 Process 01: 62.378 ton/yr
			VOC	1) The permittee may not allow VOC emissions from S11 to exceed 42.4 lb VOC/hr 2) The permittee may not allow VOX emissions to exceed 4.61 lb VOC/ton of blended sludge dry 3) 8.975 tons VOC/mo, averaged over any 12 consecutive calendar months	P01 Process 00: 41.319 ton/yr

Section	Stack	Processes	Pollutant	Limitation[1]	2005 Emission
			HAPs	1) No hazardous substances may cause, allow or permit emissions into the ambient air of any hazardous substance in a quantity, concentration, or duration which is injurious to human health, plant or animal life unless the purpose of that emission is for the control of plant or animal life. Hazardous substances include but are not limited to hazardous air contaminants listed in Tables 1-5 of s. NR 445.04, Wis. Adm. Code. 2) Lead – 0.0113 lb/hr. 3) Chloriform – HBACT. 4) Formaldehyde – HBACT. 5) Di(2-ethylexyl)phthalate (DEHP) – HBACT. 6) Hydrogen Chloride – 59.96 lb/hr. 7) Mercury a) No person may cause, allow or permit emissions of mercury in such quantity and duration as to cause the ambient air concentration to exceed 1 ug/m3, averaged over a 30-day period. b) (Combined emissions from the rotary sludge dryers and the dust handling system that exhausts through S17): no person may cause, allow or permit emissions of mercury in quantity greater than 3,200 grams per 24 hr – period.	P01 Process 00: Arsenic – 2.804 lb/yr Formaldehyde – 550.924 lb/yr Hydrogen chloride – 3,806.384 lb/yr Mercury – 70.117 lb/yr Nickel – 12.370 lb/yr Phosphorus – 38.865 lb/yr P30 Process 01: Formaldehyde – 1081.8000 lb/yr
			Visible emissions	1) 20% opacity or No. 1 on the Ringlemann chart	

Section	Stack	Processes	Pollutant	Limitation[1]	2005 Emission
B	S11	P30 and P31: Two 16 MW electricity generating turbines, installed in 1971	Particulate matter	1) Installations located in or near an area identified in s. NR 415.035(2) whose aggregate particulate emissions, excluding fugitive dust, may cause an impact on ambient air quality in the area equal to or greater than an annual concentrations of 1 microgram per cubic meter or a maximum 24-hour concentration of 5 microgram per cubic meter shall meet the following RACT emission limit: a) Installations of more than 100 million Btu per hour: maximum emission from any stack of 0.15 pounds of particulate matter per millions Btu heat input. or, 2) Any fuel burning installation of 250 million Btu per hour or less on which construction or modification was commenced on or before April 1,1972 may emit up to but not more than, an emission rate defined by the following equation: $E = 0.3 - 0.0006\ I$ Where I is the heat input in million of Btu per hour and E is the maximum allowable particulate matter emissions from any stack in pounds per million Btu heat input, if the installation has an emission rate based on original design or equipment performance test conditions, which ever is more restrictive, which is less than the limit set by the above equation, and the emission control system of the installation has not been allowed to degrade more than 0.05 pounds per million Btu heat input from the original design or acceptance performance test condition.	P30 Process 01: 5.019 ton/yr
			SO_2	1) No person may cause, allow or permit emission of sulfur or sulfur compounds into the ambient air which substantially contribute to the exceeding of an air standard or cause air pollution.	No emissions above NR438 limit for reporting requirements

Section	Stack	Processes	Pollutant	Limitation[1]	2005 Emission
			NOx	1) No person may cause, allow or permit nitrogen oxides or nitrogen compounds to be emitted to the ambient air which substantially contribute to the exceeding of an air standard or cause air pollution.	P30 Process 01: 243.415 ton/yr
			HAPs	1) No hazardous substances may cause, allow or permit emissions into the ambient air of any hazardous substance in a quantity, concentration, or duration which is injurious to human health, plant or animal life unless the purpose of that emission is for the control of plant or animal life. Hazardous substances include but are not limited to hazardous air contaminants listed in Tables 1-5 of s. NR 445.04, Wis. Adm. Code.	P30 Process 01: Formaldehyde – 1081.8000 lb/yr
			CO	1) No person may cause, allow or permit carbon monoxide to be emitted to the ambient air, which substantially contribute to the exceeding of an air standard or cause air pollution.	P30 Process 01: 62.378 ton/yr
			Visible emissions	1) 20% opacity or No. 1 on the Ringlemann chart.	

Section	Stack	Processes	Pollutant	Limitation[1]	2005 Emission
C	S01 S02	P30: 16 MW (223 mmBtu/hr) electricity generating turbine installed in 1971 P31: 16 MW (223 mmBtu/hr) electricity generating turbine installed in 1971	Particulate matter	1) Installations located in or near an area identified in s. NR 415.035(2) whose aggregate particulate emissions, excluding fugitive dust, may cause an impact on ambient air quality in the area equal to or greater than an annual concentrations of 1 microgram per cubic meter or a maximum 24-hour concentration of 5 microgram per cubic meter shall meet the following RACT emission limit: a) Installations of more than 100 million Btu per hour: maximum emission from any stack of 0.15 pounds of particulate matter per millions Btu heat input. or, 2) Any fuel burning installation of 250 million Btu per hour or less on which construction or modification was commenced on or before April 1,1972 may emit up to but not more than, an emission rate defined by the following equation: $E = 0.3 - 0.0006\ I$ Where I is the heat input in million of Btu per hour and E is the maximum allowable particulate matter emissions from any stack in pounds per million Btu heat input, if the installation has an emission rate based on original design or equipment performance test conditions, which ever is more restrictive, which is less than the limit set by the above equation, and the emission control system of the installation has not been allowed to degrade more than 0.05 pounds per million Btu heat input from the original design or acceptance performance test condition.	No emissions above NR438 limit for reporting requirements

Section	Stack	Processes	Pollutant	Limitation[1]	2005 Emission
			SO_2	1) No person may cause, allow or permit emission of sulfur or sulfur compounds into the ambient air which substantially contribute to the exceeding of an air standard or cause air pollution. 2) When 12 dryers and the two turbines operate at the same time and the exhaust from the two turbines goes through stacks S01 and S02, the facility shall maintain Sulfur content of the No. 2 fuel oil used in these two turbines no more than 0.05% by weight.	No emissions above NR438 limit for reporting requirements
			NOx	1) No person may cause, allow or permit nitrogen oxides or nitrogen compounds to be emitted to the ambient air which substantially contribute to the exceeding of an air standard or cause air pollution.	No emissions above NR438 limit for reporting requirements
			HAPs	1) No hazardous substances may cause, allow or permit emissions into the ambient air of any hazardous substance in a quantity, concentration, or duration which is injurious to human health, plant or animal life unless the purpose of that emission is for the control of plant or animal life. Hazardous substances include but are not limited to hazardous air contaminants listed in Tables 1-5 of s. NR 445.04, Wis. Adm. Code.	No emissions above NR438 limit for reporting requirements
			CO	1) No person may cause, allow or permit carbon monoxide to be emitted to the ambient air, which substantially contribute to the exceeding of an air standard or cause air pollution.	No emissions above NR438 limit for reporting requirements
			Visible emissions	1) 20% opacity or No. 1 on the Ringlemann chart.	

Section	Stack	Processes	Pollutant	Limitation[1]	2005 Emission
D	S17	P17: Dust collection system for recycle bins and classification area, installed in 1994	Particulate matter	1) The allowable emissions of particulate matter from the dust collection system for recycle bins and classification area are calculated by the use of the following equations: $E = 3.59\ P^{0.62}$ For process weight rates up to 60,000 lb/hr and by the equation: $E = 17.31\ P^{0.16}$ For process weight rates of 60,000 lb/hr or more. Where, E = allowable emissions in lb/hr P = process weight rate, in ton/hr or, 2) 0.010 grain per dscf or, 3) 3.49 lb particulate matter/hr. Whichever is more restrictive.	No emissions above NR438 limit for reporting requirements
			HAPs	1) No person may cause, allow or permit lead or lead compounds to be emitted to the ambient air in amount greater than 0.0017 lb/hr. 2) Mercury (Combined emissions from the rotary sludge dryers and the dust collection system that exhausts through S17) may not exceed the following emission limits: a) In such quantity and duration as to cause the ambient air concentration to exceed 1 ug/m3, averaged over a 30-day period b) In quantity greater than 3200 grams of mercury per 24 hr period from sludge drying plants	Arsenic – 0.502 lb/yr
			Visible emissions	1) 20% opacity or No. 1 on the Ringlemann chart	

Section	Stack	Processes	Pollutant	Limitation[1]	2005 Emission
E	S20 S21	B20, B21: Two natural gas fired Cleaver Brooks four-pass firetube, hot water boilers with heat input ratings of 11.7 MM Btu/hr each, #2 fuel oil is the backup fuel. Installed in 1997	Particulate matter	1) For installations of 250 mm Btu/hr or less, maximum emission from any stack of 0.15 lb particulate matter per million Btu heat input.	No emissions above NR438 limit for reporting requirements
			SO_2	1) No person may cause, allow or permit emission of sulfur or sulfur compounds into the ambient air which substantially contribute to the exceeding of an air standard or cause air pollution. 2) SO2 emissions from each of the two stacks may not exceed 3.0 lb/hr.	No emissions above NR438 limit for reporting requirements
			NOx	1) No person may cause, allow or permit nitrogen oxides or nitrogen compounds to be emitted to the ambient air which substantially contribute to the exceeding of an air standard or cause air pollution.	No emissions above NR438 limit for reporting requirements
			CO	1) No person may cause, allow or permit carbon monoxide to be emitted to the ambient air which substantially contribute to the exceeding of an air standard or cause air pollution.	No emissions above NR438 limit for reporting requirements
			Visible emissions	1) 20% opacity or No. 1 on the Ringlemann chart	
F	S70[2]	F70[3]: All wastewater treatment and solids handling processes	VOC	1) No person may cause, allow or permit organic compounds to be emitted into the ambient air which substantially contribute to the exceeding of an air standard or cause air pollution.	No emissions above NR438 limit for reporting requirements

Section	Stack	Processes	Pollutant	Limitation[1]	2005 Emission
			HAPs	1) No hazardous substances may cause, allow or permit emissions into the ambient air of any hazardous substance in a quantity, concentration, or duration which is injurious to human health, plant or animal life unless the purpose of that emission is for the control of plant or animal life. Hazardous substances include but are not limited to hazardous air contaminants listed in Tables 1-5 of s. NR 445.04, Wis. Adm. Code.	P40 Primary & Secondary Treatment: Acetaldehyde – 1812.226 lb/yr Chloroform – 202.234 lb/yr Formaldehyde – 154.935 lb/yr P60 Disinfection: Chloroform – 178.945 lb/yr
G	S99[4]	P99: Milorganite® rail load-out area	Particulate matter	1) The allowable emissions of particulate matter from each stack are calculated by the use of the following equations: $E = 3.59\ P^{0.62}$ For process weight rates up to 60,000 lb/hr and by the equation: $E = 17.31\ P^{0.16}$ For process weight rates of 60,000 lb/hr or more. Where, E = allowable emissions in lb/hr P = process weight rate, in ton/hr or, 2) 0.40 lb particulate matter per 1000 lb gas. Whichever is more restrictive.	No emissions above NR438 limit for reporting requirements
			Visible emissions	1) 20% opacity or No. 1 on the Ringlemann chart	

Section	Stack	Processes	Pollutant	Limitation[1]	2005 Emission
I		Other Conditions Applicable to the Entire Facility	Emission Compliance Testing	1) Whenever emission testing is required by the Department, the following methods (listed in column b in this section in the permit) shall be employed. 2) The pressure drop monitoring device shall be accurate to within 5% of the pressure drop being measured or within 1 inch of water column, whichever is greater. 3) Whenever compliance testing is required, testing shall be performed while equipment is operating at 100% capacity. If operation at 100% capacity is not possible, the permittee may request in writing and the Department may grant approval to operate at a rate less than 100% capacity. 4) The Department shall be informed at least 20 working days prior to any tests, so a Department representative can witness the testing. At the time of the notification, a compliance emission test plan following the provisions set forth in section NR 439.07, Wis. Adm. Code, shall also be submitted to the Department for approval. When approved in writing, an equivalent test method may be substituted for the reference test method. Two copies of the report on all tests shall be submitted to the Department of evaluation within 60 days after the tests.	
			Emission limit applied to the whole facility	1) The secondary standard for particulate matter measured as total suspended particulate is 150 ug/m3 – maximum 24-hr average concentration, not to be exceeded more than once per year.	
			Reporting	1) The permittee shall periodically submit monitoring and compliance reports.	

Btu – British thermal unit
CO – Carbon monoxide
cf – cubic foot
dscf – dry standard cubic foot
HAPs – Hazardous Air Pollutants
HBACT – Hazardous Air Pollutant Best Available Control Technology
hr – hour
lb – pound
MM – million
mmBtu – million British thermal units
MW – megawatt
mo – month
NOx – Nitrogen oxide
RACT – Reasonably Available Control Technology
SO_2 – Sulfur dioxide
VOC – Volatile Organic Compound
w/o – without
yr – year

NOTES:
1) Limitation – This area lists all applicable emission limitations that apply to the source, including case-by-case limitations such as Latest Available Control techniques (LACT), Best Available Control Technology (BACT), or Lowest Achievable Emission Rate (LAER). It also lists any voluntary restrictions on hours of operation, raw material use, or production rate requested by the permittee to limit potential to emit.
2) Stack S70 includes S18, S40, S46 to S49, S50 to S58 and S60
3) Process F70 includes P18, P19, P20, F40 to F45, F46 to F49, F50 to F58 and P60
4) Stack S99 includes the following stacks:
   - S30 F30: Rail Loadout Dust Filter M-27-29-5
   - S31 F31: Rail Loadout Dust Filter M-27-29-6
   - S32 F32: Dense Phase System Filter Blower M-27-29-1-2
   - S33 F33: Dense Phase System Filter Blower M-27-29-2-2
   - S34 F34: Dust Return Receiving Filter Blower (Tank 33) M-27-48
   - S35 F35: Vacuum Cleaning Filter VC-1-2
   - S36 F36: Silo Air Purge Exhaust Fan M27-39-1
   - S37 F37: Silo Air Purge Exhaust Fan M27-39-2
   - S38 Dust Filter Exhaust Blower M27-29-3-2
   - S39 F39: Spare Dust Filter Exhaust Blower M-27-29-4-2

Source:
2004 Jones Island WDNR Title V Air Permit (Appendix 6B), 2005 Jones Island Air Inventory Summary Report

Section	Stack	Processes	Pollutant	Limitation[1]	2005 Emission
	S12	B12: All boilers and space heating units less than 5 MM Btu/hr	Particulate matter	No specific limitations on emissions	No emissions above NR438 limit for reporting requirements
			SO_2	No specific limitations on emissions	No emissions above NR438 limit for reporting requirements
			NOx	No specific limitations on emissions	No emissions above NR438 limit for reporting requirements
			VOC	No specific limitations on emissions	No emissions above NR438 limit for reporting requirements
			CO	No specific limitations on emissions	No emissions above NR438 limit for reporting requirements
			HAPs	No specific limitations on emissions	No emissions above NR438 limit for reporting requirements
A	S13	B20, B21: 2 — 5.23 MM Btu/hr Cleaver Brooks Boilers used for sludge heating, installed in 1987	Particulate matter	1) Installation of 250 MM Btu/hr or less, installed after April 1, 1972, shall limit particulate matter emissions to 0.15 lb per million Btu heat input.	No emissions above NR438 limit for reporting requirements
			Visible emissions	1) Emissions shall be limited to 20% opacity. Opacity is allowed up to 80% for not more than 5 minutes in any one hour when the combustion equipment is being cleaned or a new fire started.	No emissions above NR438 limit for reporting requirements

Section	Stack	Processes	Pollutant	Limitation[1]	2005 Emission
			NOx	1) No person may cause, allow or permit emissions of nitrogen oxides to the ambient air which substantially contributes to the exceeding of an air standard or cause air pollution.	No emissions above NR438 limit for reporting requirements
			CO	1) No person may cause, allow or permit emissions of carbon monoxide to the ambient air which substantially contributes to the exceeding of an air standard or cause air pollution	No emissions above NR438 limit for reporting requirements
B	S15	B24, B25, B26: 3 — 20.925 MM Btu/hr Kewanee Boilers used for sludge heating/building heat, installed in 1987	Particulate matter	1) Installation of 250 MM Btu/hr or less, installed after April 1, 1972, shall limit particulate matter emissions to 0.15 lb per million Btu heat input.	No emissions above NR438 limit for reporting requirements
			Visible emissions	1) Emissions shall be limited to 20% opacity. Opacity is allowed up to 80% for not more than 5 minutes in any one hour when the combustion equipment is being cleaned or a new fire started.	No emissions above NR438 limit for reporting requirements
			NOx	1) No person may cause, allow or permit emissions of nitrogen oxides to the ambient air which substantially contributes to the exceeding of an air standard or cause air pollution.	No emissions above NR438 limit for reporting requirements
			CO	1) No person may cause, allow or permit emissions of carbon monoxide to the ambient air which substantially contributes to the exceeding of an air standard or cause air pollution.	No emissions above NR438 limit for reporting requirements
			SO_2	1) No person may cause, allow or permit emissions of sulfer or sulfur compounds into the ambient air which substantially contributes to the exceeding of an air standard or cause air pollution.	No emissions above NR438 limit for reporting requirements

Section	Stack	Processes	Pollutant	Limitation[1]	2005 Emission
C	S14	B27, B28: 2 - 5.313 MM Btu/hr Boilers used for building heat, installed in 1987	Particulate matter	1) Emissions shall be limited to 0.15 lbs of particulate matter per million Btu heat inputs.	No emissions above NR438 limit for reporting requirements
			Visible emissions	2) Emissions shall be limited to 20% opacity. Opacity is allowed up to 80% for not more than 5 minutes in any one hour when the combustion equipment is being cleaned or a new fire started.	No emissions above NR438 limit for reporting requirements
			NOx	1) No person may cause, allow or permit emissions of nitrogen oxides to the ambient air which substantially contributes to the exceeding of an air standard or cause air pollution.	No emissions above NR438 limit for reporting requirements
			CO	1) No person may cause, allow or permit emissions of carbon monoxide to the ambient air which substantially contributes to the exceeding of an air standard or cause air pollution.	No emissions above NR438 limit for reporting requirements
D	S20 S 21	P20: Excess digester gas flare @ 90 MM Btu/hr P21: Excess digester gas flare @ 90 MM Btu/hr Installed in 2002	Particulate matter	1) No person may cause, allow or permit particulate matter to be emitted into ambient air which substantially contributes to the exceeding of an air standard or cause air pollution.	No emissions above NR438 limit for reporting requirements
			Visible emissions	1) Emissions shall be limited to 20% opacity.	No emissions above NR438 limit for reporting requirements
			VOCs	1) VOC emissions are limited to 0.78 lb/hr total combined emissions for the two stacks (S20 &S21).[1]	No emissions above NR438 limit for reporting requirements
			CO	1) No person may cause, allow or permit emissions of carbon monoxide to the ambient air which substantially contributes to the exceeding of an air standard or cause air pollution.	9.426 ton/yr

Section	Stack	Processes	Pollutant	Limitation[1]	2005 Emission
			SO_2	1) No person may cause, allow or permit emissions of sulfer or sulfur compounds into the ambient air which substantially contributes to the exceeding of an air standard or cause air pollution	No emissions above NR438 limit for reporting requirements
			NOx	1) No person may cause, allow or permit emissions of nitrogen oxides to the ambient air which substantially contributes to the exceeding of an air standard or cause air pollution.	No emissions above NR438 limit for reporting requirements
E	S10	P30, P31, P32, P33: 4 – 10.59 MM Btu/hr blower engines, installed in 1973	Particulate matter	1) For Stack S10, emissions shall be limited to 0.15 lb particulate matter per million Btu heat input.	No emissions above NR438 limit for reporting requirements
			Visible emissions	1) Emissions shall be limited to 20% opacity. Opacity is allowed up to 80% for not more than 5 minutes in any one hour when the combustion equipment is being cleaned or a new fire started.	No emissions above NR438 limit for reporting requirements
			CO	1) No person may cause, allow or permit emissions of carbon monoxide to the ambient air which substantially contributes to the exceeding of an air standard or cause air pollution.	P30 Process 01: 20.869 ton/yr
			VOCs	1) VOC emissions shall be limited to 1.25 lb/hr average over any 24-hour period.	P30 Process 01: 7.900 ton/yr
			NOx	1) No person may cause, allow or permit emissions of nitrogen oxides to the ambient air which substantially contributes to the exceeding of an air standard or cause air pollution.	P 30 Process 00: 55.540 ton/yr P30 Process 01: 268.597 ton/yr
			Formalde-hyde	1) The owner or operator of any facility that emits any hazardous air pollutant in quantities greater than those listed in Table 3B shall control emissions to a level which is best available control technology (BACT).	P 30 Process 01: 11,118.230 lb/yr

Section	Stack	Processes	Pollutant	Limitation[1]	2005 Emission
F	S11	P34: 16.28 MM Btu/hr engine driven blower, installed in 2000	Particulate matter	1) Emissions shall be limited to 0.15 lbs of particulate matter per million Btu heat inputs.	No emissions above NR438 limit for reporting requirements
			Visible emissions	1) Emissions shall be limited to 20% opacity. Opacity is allowed up to 80% for not more than 5 minutes in any one hour when the combustion equipment is being cleaned or a new fire started.	
			NOx	1) On or after December 31, 2002, no person may cause, allow or permit nitrogen oxides to be emitted during the ozone season from reciprocating engines with a maximum design power output of 2000 horsepower or greater in excess of the 10.0 grams per break horsepower for lean-burn units.	P34 Process 00: 31.705 ton/yr
			SO_2	1) No person may cause, allow or permit emissions of sulfer or sulfur compounds into the ambient air which substantially contributes to the exceeding of an air standard or cause air pollution	No emissions above NR438 limit for reporting requirements
			CO	1) No person may cause, allow or permit emissions of carbon monoxide to the ambient air which substantially contributes to the exceeding of an air standard or cause air pollution.	P34 Process 00: 85.237 ton/yr
			VOCs	1) VOC emissions shall be limited to 2.9 lb/hr average over any 24 hr period.	P34 Process 00: 5.146 ton/yr
			Formalde-hyde	1) The owner or operator of any facility that emits any hazardous air pollutant in quantities greater than those listed in Table 3B shall control emissions to a level which is best available control technology (BACT).	P34 Process 00: 16,677.450 lb/yr

Section	Stack	Processes	Pollutant	Limitation[1]	2005 Emission
G	S70	P70: All air emissions related to 250 MGD wastewater treatment process	Formalde-hyde	1) Permittee shall operate the wastewater treatment facility in accordance with Best Available Control Technology (BACT).	F40: Influent Wastewater 2,355.602 lb/yr
			Chloroform	2) Permittee shall operate the wastewater treatment facility in accordance with Best Available Control Technology (BACT).	F40: Influent Wastewater 255.013 lb/yr
H		Conditions Applicable to the Entire Facility	Compliance Reports/ Records	1) Upon issuance of the operation permit, the permittee shall submit periodic monitoring reports. 2) Upon issuance of the operation permit, the permittee shall submit periodic certification of compliance. 3) The records required under this permit shall be retained for at least five (5) years and shall be made available to department personnel upon request during normal business hours.	
			Malfunction Prevention and Abatement Plan	1) A malfunction prevention and abatement plan shall be prepared and followed for the plant. 2) All air pollution control equipment shall be operated and maintained in conformance with good engineering practices (i.e. operated and maintained according to manufacturer's specifications and directions) to minimize the possibility for the exceedance of any emission limitations.	

BACT – Best Available Control Technology
Btu – British thermal unit
CO – Carbon monoxide
HAPs – Hazardous Air Pollutants
hr – hour
lb – pound
MM – million
NOx – Nitrogen oxide
SO_2 – Sulfur dioxide
VOC – Volatile Organic Compound
yr – year

NOTE:
1) The MTE for VOCs is 0.36 lb/hr for each flare for a total of 0.72 lb/hr combined. The limit of 0.78 lb/hr from construction permit 02-JSB-286 is slightly higher than the combined MTE for these flares. Therefore, with the exclusive gas the emission limit of 0.78 lb/hr will not be exceeded.

Source:
2004 South Shore WDNR Title V Air Permit (Appendix 6C), 2005 South Shore Air Inventory Summary Report

5.4 Future Condition Operations

5.4.1 Operation and Maintenance Contracts

Current Operator – United Water Services

The current Operation and Maintenance Contract is discussed in detail in Section 4.3.1 in Chapter 4, *Treatment Assessment – Existing Condition*. There are two additional items to note since the end of the Existing Condition time period:

1) UWS created a model of JIWWTP and SSWWTP treatment systems
2) The *Mayor's Independent MMSD Audit Committee Final Report* was presented

JIWWTP and SSWWTP Wastewater Treatment Plant Treatment Process Model

The UWS created a wastewater treatment model for JIWWTP and SSWWTP using the GPSX Hydromatic computer model (which is similar to BioWIN®).(65) It is not used for day-to-day operations; instead, the model is used to develop what-if scenarios.

Mayor's Independent Milwaukee Metropolitan Sewerage District Audit Committee Final Report

The results from the Mayor's Independent MMSD Audit Committee's review of the operation of the MMSD system during the May 2004 storm event were presented in the *Final Recommendations and Performance Review of the Milwaukee Metropolitan Sewerage District (MMSD).*(66) The recommendations that pertain to operation of the treatment plants include:

- Blending should be reduced as much as possible
- The performance of UWS has been generally satisfactory; UWS has responded favorably to treatment incentives

Future Operations Contracts

The UWS Operation and Maintenance Contract expires February 29, 2008. The MMSD is currently developing a request for proposals under the Analysis of Options for Operations and Maintenance of District Facilities and Assistance in Implementation of the Preferred Option Project.(67) One concern with the future contract is the expected increase in energy costs for MMSD. The current Operation and Maintenance Contract has provisions that limit pass through of energy cost increases to MMSD. Electrical and (especially) natural gas cost increases have exceeded the negotiated contract rates since the current contract went into effect. The existing energy cost contract provisions, which have saved MMSD considerable costs in the past few years, will probably not be a part of the next contract.

5.4.2 Inline Storage System Pump Station Operations

The planned future operation of the ISS Pump Station is to direct flow from two of the pumps to JIWWTP and the third pump to SSWWTP. The capacity of each pump is assumed to 40 MGD.

5.4.3 In-Plant Diversion Structure Operation

There is no planned change from the existing condition in-plant diversion operation, discussed in Chapter 4, *Treatment Assessment – Existing Condition*. Current operations limit JIWWTP blending to the greatest extent possible, with a permitted maximum capacity of 60 MGD. Blending is not allowed at SSWWTP per the WPDES permit.

The biosolids storage wet weather upgrade to the aeration basins is expected to increase the capacity of secondary treatment, which would reduce the number of blending events that use the primary effluent (PE) diversion at JIWWTP.(68)

Use of blending at both treatment plants is reviewed in Section 9.6.5 in Chapter 9, *Alternatives Development* of the *Facilities Plan Report*.

5.4.4 Biosolids and Energy Operations

Future biosolids operations considering the relocation of LeSaffre Yeast and the changes in energy operations are discussed in more detail in this report in Chapter 9, *Alternative Analysis* of this report.

5.5 Policies/Programs Documentation

As of the beginning of 2006, there are three permanent hazardous waste collection facilities. The newest site, a self -help station, is located at 3879 West Lincoln Avenue in Milwaukee. No additional changes are planned in the Industrial Pretreatment and Household Hazardous Waste programs beyond what was discussed in Section 4.4 in Chapter 4, *Treatment Assessment – Existing Condition*.

5.6 Treatment System Performance Review and Analysis

5.6.1 Revised 2020 Baseline Simulated Wet Weather Events

Wet weather event simulations based on Revised 2020 Baseline conditions are discussed in Chapter 5, *Conveyance System – Future Condition* of the *Conveyance Report*. Upon the completion of the committed JIWWTP Phase 2 Wet Weather Secondary Capacity Project, JIWWTP treatment capacity is projected to be able to treat design maximum day flows for sustained periods during wet weather events. In the simulations, JIWWTP is projected to treat up to 300 MGD of gravity flow through secondary treatment, with the remaining 60 MGD pumped from the ISS Pump Station directly to disinfection, and SSWWTP is projected to treat up to 300 MGD.

5.6.2 Future Blending and Effluent Quality

Future Blending Usage

It was assumed that the use of blending at JIWWTP would continue in the future. For more details on the blending review, see Chapter 9, *Alternatives Development*, of the *Facilities Plan Report*.

Revised 2020 Baseline Effluent Quality

Revised 2020 Baseline condition effluent quality of treatment plant wastewater discharge was predicted using the mass balance under peak hourly influent flows and wasteload conditions.[e] The analysis assumed that the maximum allowable blending at JIWWTP of 60 MGD would occur and the flow would be pumped from the ISS Pump Station directly to disinfection. The projected BOD and TSS loads in the diverted flow were assumed to be equivalent to the wasteload values in the primary effluent since this represented the most accurate available data.

[e] *Appendix 5C, MMSD System Revised 2020 Baseline Condition Mass Balance Analysis* of this chapter.

The results were compared to both WPDES permit limits and UWS contract limits and are shown in Table 5-17.(69,70)

TABLE 5-17
PROJECTED REVISED 2020 BASELINE PEAK FLOW EFFLUENT QUALITY
COMPARED TO UWS CONTRACT EFFLUENT LIMITS AND WDNR PERMIT EFFLUENT LIMITS

Constituent	JIWWTP (60 MGD Blending)	SSWWTP (No Blending)	Contract Limit (Greater than[1])	Permit Limit (Greater than[1])
BOD	12.4 mg/L	5.4 mg/L	15 mg/L[3], 45 mg/L[2]	30 mg/L[3], 45 mg/L[2]
TSS	10.8 mg/L	2.0 mg/L	15 mg/L[3], 45 mg/L[2]	30 mg/L[3], 45 mg/L[2]

BOD = Biochemical Oxygen Demand
Mg/L = Milligrams per Liter
TSS = Total Suspended Solids
JIWWTP = Jones Island Wastewater Treatment Plant
SSWWTP = South Shore Wastewater Treatment Plant

1) "Greater than" listed for contract limit and permit limit means that the measured constituent must be less than the value listed to meet the limit requirements.
2) Weekly average
3) Monthly average

Sources: CCO Monthly Reports, *Mayor's Independent MMSD Audit Committee Final Report,* WPDES Permit (Appendix 6A), and Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis* of this chapter.

This analysis predicts that the effluent quality values during blending will be below all permit values and low enough that weekly and monthly contract limits should not be exceeded.

Use of blending at both treatment plants is reviewed in Section 9.6.5 in Chapter 9, *Alternatives Development* of the *Facilities Plan Report*.

5.6.3 Future Biosolids Production

The 2003 actual and future projected biosolids production is listed in Table 5-18. Biosolids production is projected to decrease in 2006 based on the relocation of LeSaffre Yeast. Biosolids production under Revised 2020 Baseline conditions is presented in this report in Chapter 9, *Alternative Analysis* along with alternatives for biosolids management.

TABLE 5-18
ACTUAL AND PROJECTED MILORGANITE®, AGRI-LIFE® AND FILTER CAKE PRODUCTION

Year	Milorganite® Production[1] (tons/yr)	Agri-Life® Production (tons/yr)	Filter Cake Production[2] (tons/yr)
2003 (actual)	44,839	4,503	1,563
2006 (projected)	31,490	2,200	4,500

1) Milorganite® production listed is dry tonnage and does not include off spec product.
2) Filter cake production only includes the amount that was land applied, not landfilled.

Sources: CCO Annual Report (2003) and MMSD Personnel, and Appendix 5C, *MMSD System Revised 2020 Baseline Condition Mass Balance Analysis* of this chapter.

5.6.4 Future Wisconsin Department of Natural Resources Compliance Review

In 2004, the WDNR changed the Compliance Maintenance Annual Report (CMAR) reporting process,(71.72) First, the CMAR reporting process is now done electronically with a score automatically generated based on the information entered into the program. Second, each area of the entire treatment system is given a letter grade. Points are still accumulated, but they are subtracted from a starting score of 100 to determine the grade. Treatment plants that receive grades of A or B are within the voluntary action range. Treatment plants that receive grades of C or lower are required to provide a response to the WDNR regarding what action they will take to correct the problems in the system. Third, the review has been reorganized–some sections receive more weight than before, some sections have been changed, and some have been expanded. A few of the major changes include:

- Letter grades (and grade points) are determined based on the following numeric score:

  A (grade point of 4) – Score of 91-100

  B (grade point of 3) – Score of 81-90

  C (grade point of 2) – Score of 71-80

  D (grade point of 1) – Score of 61-70

  F (grade point of 0) – Score less than 61

- Effluent BOD and TSS concentrations are reviewed separately and given separate grades. Effluent ammonia and phosphorus are compared to 100% of permit limits, if there are any, and are given separate grades. In previous CMARs, only the effluent BOD and TSS concentrations were reviewed and they were scored together in one section.
- The Biosolids Quality Management Section in the new report incorporates some of the questions under sludge from the old report, but also grades biosolids management on high quality limits.

Table 5-19 lists the new CMAR criteria under which all treatment plants are graded, along with the grades that MMSD received in 2004 for its treatment plants.

TABLE 5-19
2004 COMPLIANCE MAINTENANCE ANNUAL REPORT REVIEW

New CMAR Criteria	Weighting Factor	Treatment Plant Scores	
		JIWWTP	***SSWWTP***
Influent Loadings	3	B	B
Effluent Quality: BOD	10	A	A
Effluent Quality: TSS	5	A	A
Effluent Quality: Ammonia	5	N/A	A
Effluent Quality: Phosphorus	3	A	A
Groundwater Quality	7	N/A	N/A
Biosolids Management	5	A	A
Preventative Maintenance and Staffing	1	A	A
Operator Certification	1	A	A
Financial Management	1	A	A
Collection Systems	3	D	C
Overall Grade (out of 4.00 based on numeric values for letter grades assigned)		**3.63 (A)**	**3.76 (A)**

N/A – Not applicable

Source: Review of the 2004 Wisconsin Department of Natural Resources Compliance Maintenance Annual Reports for the JIWWTP and SSWWTP Wastewater Treatment Plants

Based on these changes, which are required for all CMARs in future years, treatment plant data were reviewed from 1999-2003 to determine what MMSD might expect for grades in the future based on historical data. Only the criteria specific to treatment were reviewed: influent loadings (includes influent flow and BOD load graded together), and effluent quality (concentrations-BOD, TSS, ammonia and phosphorus). The required Biosolids Quality Management Data were not reviewed because these data were not available for review for that time period. Only the questions under each criterion that received deductions in the 2004 CMAR were analyzed for this review. The CMAR score for the conveyance system was also not reviewed in this chapter since the conveyance system as a whole is discussed in the *Conveyance Report*.

The results of this analysis are shown in Appendix 5E, *Projected CMAR Results Analysis*.(73,74) The results indicate that JIWWTP would have received slightly lower grades than SSWWTP for the influent flow and loading parameter during 1999-2001 due to influent flow and BOD loadings exceeding design maximum month flow and average day BOD loading. It should be noted that the analysis at JIWWTP included the reduction in influent flows and loadings based on the relocation of LeSaffre Yeast at the end of 2005, which improved projected CMAR scores. All other parameters at both plants would have received top scores.

References

(1) State of Wisconsin Circuit Court, Stipulation: State of Wisconsin, Plaintiff v. Milwaukee Metropolitan Sewerage District, Defendant, Case No. 02-CV-2701 (May 29, 2002)

(2) Milwaukee Metropolitan Sewerage District, Stipulation Annual Report (December 31, 2007)

(3) Milwaukee Metropolitan Sewerage District, 2007 Annual Budget

(4) United Water Services on behalf of Milwaukee Metropolitan Sewerage District , Discharge Monitoring Report for Permit No. 0036820-1 (1999-2003)

(5) Milwaukee Metropolitan Sewerage District, *Jones Island O&M Manual: Plant Summary and Administration* (July 1, 1993)

(6) Milwaukee Metropolitan Sewerage District MMSD, *South Shore O&M Manual: Plant Summary and Administration* (March 1, 1986)

(7) Milwaukee Metropolitan Sewerage District, Accounting Department Records (1999-2003)

(8) Milwaukee Metropolitan Sewerage District, Accounting Department Records (1999-2003)

(9) United Water Services on behalf of Milwaukee Metropolitan Sewerage District , Discharge Monitoring Report for Permit No. 0036820-1 (1999-2003)

(10) Milwaukee Metropolitan Sewerage District, *Jones Island O&M Manual: Plant Summary and Administration* (July 1, 1993)

(11) Milwaukee Metropolitan Sewerage District MMSD, *South Shore O&M Manual: Plant Summary and Administration* (March 1, 1986)

(12) United Water Services, *Daily/Weekly Operating Report* (1999-2003)

(13) Milwaukee Metropolitan Sewerage District, *Discharge Monitoring Report* (1999-2003)

(14) United Water Services, *Daily/Weekly Operating Report* (1999-2003)

(15) Milwaukee Metropolitan Sewerage District, *Discharge Monitoring Report* (1999-2003)

(16) Milwaukee Metropolitan Sewerage District, *Jones Island O&M Manual: Plant Summary and Administration* (July 1, 1993)

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