Municipality of Mississippi Mills

Gemmill's Bay Wastewater Pumping Station and Mississippi Mills Wastewater Treatment Plant Expansion Class EA Study

Technical Memorandum 2 – Design Basis

Final Submission

Wednesday, May 20, 2026

Z0029544

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Project no. Z0029544

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List of Acronyms

ADF	Average Day Flow
ATAD	Autothermal Thermophilic Aerobic Digestion
BOD	Biochemical Oxygen Demand
EA	Environmental Assessment
ECA	Environmental Compliance Agreement
GBPS	Gemmill's Bay Wastewater Pumping Station
I&I	Inflow and Infiltration
ICI	Industrial, Commercial, and Institutional
JLR	J. L. Richards and Associates Ltd.
MECP	Ministry of the Environment, Conservation and Parks
MMF	Max Month Flowrate
OCWA	Ontario Clean Water Agency
PHF	Peak Hourly Flowrate
PIF	Peak Instantaneous Flowrate
SPS	Sewage Pumping Station
TAN	Total Ammonia Nitrogen
TKN	Total Kjeldahl Nitrogen
TM	Technical Memorandum
TP	Total Phosphorus
TSS	Total Suspended Solids
UV	Ultraviolet

WWMP	Water and Wastewater Infrastructure Master Plan
WWTP	Wastewater Treatment Plant

1. Introduction

The Town of Almonte in the Municipality of Mississippi Mills (the Municipality) is serviced by the Mississippi Mills Wastewater Treatment Plant (WWTP) and the Gemmill's Bay Wastewater Pumping Station (GBPS). Wastewater flow from Almonte is directed to GBPS then pumped to the Mississippi Mills WWTP. The facilities function under the Environmental Compliance Approval (ECA) 1637-AC8NT7, dated August 8, 2016.

Prior to 2012, wastewater from Almonte was treated by a lagoon treatment facility. This facility was replaced with a mechanical WWTP in 2012. The Mississippi Mills WWTP was constructed with a rated capacity of 4,700 m^3/day and a peak treatment flow capacity of 14,100 m^3/d. Note, the two (2) trains of headworks equipment (i.e. screens and grit removal) each have a peak treatment capacity of 28,100 m^3/d. Influent flows above 14,100 m^3/d are intended to be bypassed to the onsite attenuation lagoon to mitigate peak flows through secondary, tertiary, and disinfection process units.

Over the past 5 years (2020-2024), the WWTP operated at an average of 67% of its rated capacity, based on effluent flow monitoring. The WWTP has experienced operational challenges, specifically with managing peak flows, in the past 5 years.

The GBPS was originally constructed in the 1960s, with major station upgrades occurring in 1972, 1979, 1997, and 2012. Bypasses and performance issues over the past 5 years at the GBPS indicate that short-term upgrades are critical for the station.

Currently, the ECA states that the GBPS has three (3) raw sewage pumps, each rated for 163 L/s (14,083 m^3/d) at 44.31 m total dynamic head; however, recent pump tests have determined that the maximum operational firm capacity (i.e. 2 pumps operating) of the station is 243 L/s (20,995 m^3/d). Note, recent pump tests have also determined that the capacity of all three (3) pumps operating simultaneously (i.e. no redundancy) results in discharge flows of approximately 292 L/s (25,195 m^3/d). However, in accordance with the 2008 MECP Design Guidelines, firm capacity (i.e. station capacity with the largest pump out of service) shall be the standard for assessing the GBPS' existing capacity.

The Municipality has recently completed a Water and Wastewater Infrastructure Master Plan (WWMP) (J.L. Richards, 2024). The study found that due to forecasted growth from new developments, both the GBPS and Mississippi Mills WWTP will require capacity expansions in the short-term to accommodate projected wastewater flows over the 25-year planning period.

The Municipality is currently undertaking a Schedule B and Schedule C Municipal Class Environmental Assessment (Class EA) study for GBPS and Mississippi Mills WWTP, respectively, continuing the Class EA process from the WWMP, to realise the required upgrades and expansion in an environmentally responsible manner. CIMA Canada Inc. (CIMA+) was retained by the Municipality to complete the Class EA study, which will identify and evaluate alternative design concepts for both facilities.

1.1 Purpose

The purpose of Technical Memorandum (TM) 2 is to summarize the design basis for future flows and loadings for the Mississippi Mills WWTP and GBPS Class EA study.

2. Design Basis Development

2.1 Population Projections

2.1.1 2024 Water and Wastewater Master Plan (WWMP) (JLR) and Official Plan Population Projections

Population projections for the 2024 WWMP were developed based on the "Population Projection 2048 for Economic Development Vision", recent reviews for the Municipality's population allocation, and the Official Plans for both the County of Lanark and the Municipality of Mississippi Mills. Based on these projections, the Mississippi Mills' Official Plan allocated 70% of future growth to Almonte on full services and 30% to rural areas and existing villages.

The 2024 WWMP also noted that since the 2018 WWMP update report, several relevant changes for wastewater servicing had occurred in the Municipality such as:

- New population projections for Lanark County, and
- The Urban Boundary expanded through an Official Plan Amendment #22, 2021.

The 2024 WWMP planning periods were as follows:

- Existing Conditions – 2021 census population: 6,098
- Short-Term (2023-2028) – 1 to 5 Years – Projected population: 8,238
- Mid-Term (2028-2038) – 5 to 15 Years – Projected population: 11,718
- Long-Term (2038-2048) – 15 to 25 Years – Projected population: 12,952

Assumptions made for developing the population projections:

- Average household size: 2.4 persons/unit
- Annual Almonte unit growth: 115 units/year

2.1.2 Class EA Population Projection Extrapolation

For this Class EA, the Municipality's preferred approach is to extrapolate the population projections from the 2024 WWMP to the year 2055. Therefore, Table 2-1 shows population projections that will form the basis for this Class EA.

Table 2-1 Class EA Population Projections Design Basis

Planning Period	GBPS and WWTP Service Population
Existing Conditions (2024)	6,926

Planning Period	GBPS and WWTP Service Population
Short-Term (2025-2035)	9,962
Mid-Term (2035-2045)	12,722
Long-Term (2045-2055)	15,482

2.2 Wastewater Quantity

2.2.1 Historical Per Capita Wastewater Generation Rate

The following historical per capita flows were determined in the 2024 WWMP, calculated for this Class EA using 2020-2024 flows, and the flow monitoring program performed on newer neighbourhoods in Almonte by the Municipality.

Table 2-2 Historical Per Capita Wastewater Generation Rates

Study	Equivalent Per Capita Wastewater Generation Rate (L/cap/d)
2024 WWMP (JLR) (1)	614
2025 Class EA (CIMA+) (2)	494
2025 Flow Monitoring (Municipality/JLR/FlowMetrix) (3)	185

Table Notes:

(1) Calculated based on an average of the 2018-2022 MM WWTP influent yearly ADFs divided by the 2021 population.
(2) Calculated as an average of 2020-2024 MM WWTP effluent ADFs divided by 2020-2024 service population (each year).
(3) Per the 2024 Wastewater Master Plan – J.L. Richards & Associates Limited, 2024.

Some of the discrepancy between the wastewater flows recorded during the flow monitoring program and those recorded at the plant's Parshall Flumes can be attributed to potable water usage at the MM WWTP. As shown in Table 2-3, the estimated potable water usage at the plant is substantial, the majority of which is used for the Autothermal Thermophilic Aerobic Digestion (ATAD) process heat exchanger service water. Service water used by the heat exchanger is ultimately sent to the influent side of the sand filters; therefore, reducing service water usage at the plant will alleviate some capacity constraints for the sand filters and Ultraviolet (UV) disinfection equipment. The

Municipality is exploring options to utilize existing equipment and infrastructure to supply effluent water to various service water needs through the plant and redirect service water discharge to downstream of the sand filters.

Table 2-3 Estimated Historical Potable Water Usage at the MM WWTP

	2020	2021	2022	2023	2024
Estimated WWTP Annual Potable Water Usage (m^3) (1)	54,049	61,663	81,152	166,510	163,932
Estimated Daily Usage (m^3/d)	148	169	222	456	449

Table Notes:

(1) OCWA provided data. Meter readings are from manual records on daily round sheets taken from the meter readout. Monthly averages for 2023 and 2024 were used as an estimate for potable water usage in December 2023 and January 2024 where no data was available.

CIMA+ is proposing to use historically calculated average day flow, per capita rate of 494 L/cap/d, and average (2020 – 2024) population (i.e. 6,387) to capture existing ADF. Although some optimization of service water usage and inflow and infiltration (I&I) reductions can be realized prior to the proposed WWTP expansion, the conservative factor of 494 L/cap/d for the existing population's wastewater generation is recommended.

2.2.2 Future Per Capita Wastewater Generation Rate

The future population is anticipated to have a lower per capita wastewater generation rate, as shown by the WWMP flow monitoring study. In addition, many Municipalities and reference sources project lower per capita wastewater generation rates, as shown in Table 2-4, attributed to lower residential water usage and I&I reduction efforts. Note, the WWMP flow monitoring study was performed over a relatively short period of time, however, the results appear consistent with CIMA+'s experience for new developments.

Table 2-4 Comparison of Potential Future Per Capita Wastewater Generation Rates

Source	Per Capita Day Wastewater Generation Rate (L/cap/d)
Township of Russell	250
City of Ottawa	280

Source	Per Capita Day Wastewater Generation Rate (L/cap/d)
Carleton Place	280
2024 WWMP (JLR)	350
Typical (Metcalf and Eddy) (1)	257-290

Table Notes:

(1) Typical wastewater flowrates from urban residential sources in the United States, using 2-3 persons per household with current level of conservation.

CIMA+ is proposing to use a future per capita rate of 304 L/cap/d to determine the average day anticipated wastewater generation for the population growth above 2024 (i.e. above 6,926). Note, continued flow monitoring is recommended to confirm the appropriateness of 304 L/cap/d, exclusive of I&I. Projected I&I flowrates are calculated in Section 2.2.2.1 below. A per capita generation rate of 304 L/cap/d was recommended for use by the Municipality to align with the 2024 WWMP – Appendix E: Wastewater Conveyance System findings. This per capita generation rate was the average across the entire flow monitoring program, inclusive of wet weather events.

Table 2-5 illustrates the projected ADF at the identified planning periods based on historic population generation rates, the extrapolated population in Section 2.1.2, and a future per capita generation rate of 304 L/cap/d.

Table 2-5: Projected ADF based on Population Extrapolation

Planning Period	Population	Average Day Flowrate (m^3/d)
Existing Conditions (2024)	6,926	3,155
Short-Term (2025-2035)	9,962	4,078
Mid-Term (2035-2045)	12,722	4,917
Long-Term (2045-2055)	15,482	5,756

2.2.2.1 Projected I&I Flowrates

Existing I&I flowrates have been captured as part of the historical flowrates noted in Table 2-2.

Future I&I flowrates will be based on projected greenfield residential development per the 2024 WWMP. The 2024 WWMP identifies 127 ha of residential greenfield development and 2 ha of greenfield residential community facility development per Figure 1 in Appendix E. Note, residential intensification was not considered to contribute to I&I as a greater number of units will be constructed in an already developed area, therefore, new sewerage is likely not required.

It is important to note that the above noted areas are representative of a buildout condition, assumed to be 2055 for this TM. Therefore, without sufficient information to better characterize development phasing, residential greenfield construction was assumed to be split evenly between each of the planning periods (i.e. 2035, 2045, 2055).

An I&I rate of 0.05 L/ha/s was assumed per the City of Ottawa Design Guidelines for dry weather I&I. The City of Ottawa does recommend I&I rates for wet weather and peak wet weather I&I (0.28 and 0.33 L/ha/s, respectively); however, it is unlikely the entirety of the proposed development areas will contribute to I&I (i.e. park space). Additionally, new developments typically experience less I&I, as previously noted, therefore, 0.05 L/s/ha is considered adequate to represent projected I&I into the system from new residential development. The use of 0.05 L/s/ha is supported by the previously completed flow monitoring study which identified a dry weather I&I rate of 0.03 L/s/ha.

Table 2-6 illustrates the projected I&I flowrates over the planning periods previously identified.

Table 2-6: Projected I&I Flowrates

Parameter	2035	2045	2055	Total
Residential Development Area (ha)	43	43	43	129
Design I&I Flowrate (L/ha/s)	0.05	0.05	0.05	N/A
I&I Flowrate (m^3/d)	186	186	186	557
Equivalent Population (persons)	611	611	611	1,833

CIMA+ is proposing to add 186 m^3/d to the ADF wastewater generated per planning period (611 population equivalent, using 304 L/cap/d), which corresponds to the anticipated I&I for new, greenfield residential developments.

I&I flows from new, greenfield residential developments are calculated to total an average of 557 m^3/d (1,833 population equivalent) by 2055.

2.2.3 Industrial, Commercial, and Institutional Flowrates

Existing Industrial, Commercial, and Institutional (ICI) flowrates have been captured as part of the historical flowrates noted in Table 2-2.

Per communication with Municipality staff, future industrial and commercial development area which should be considered for this Class EA are 18.7 ha and 30.15 ha, respectively. These areas are based on the following assumptions from the County of Lanark's Growth Management Plan (Watson & Associates, 2025) and the Municipality's urban/rural growth policy:

- Projection of 330 new industrial jobs in Almonte by 2051 and 760 new commercial jobs in the Municipality by 2051,
- 15% employment growth through intensification,
- 70% urban growth, and
- 15 jobs/ha.

Per City of Ottawa Design Guidelines, wastewater generation rates of 35,000 L/ha/d and 28,000 L/ha/d were assumed for industrial areas (light industrial assumed) and commercial areas, respectively.

Similar to Section 2.2.2.1, the 18.7 ha of industrial development land and 30.15 ha of commercial development land are representative of buildout conditions, assumed to be 2055 for this TM. Therefore, without sufficient information to better characterize development phasing, ICI construction was assumed to be split evenly between each of the planning periods (i.e. 2035, 2045, 2055).

Table 2-7 illustrates the projected ICI rates over the planning periods previously identified.

Table 2-7: Project ICI Flowrates

Parameter	2035	2045	2055	Total
Industrial Development Area (ha)	6.23	6.23	6.23	18.7
Design Average Light Industrial Flowrate (L/ha/d)	35,000	35,000	35,000	N/A

Parameter	2035	2045	2055	Total
Anticipate Industrial Flowrate (m^3/d)	**218**	**218**	**218**	**654**
Commercial Development Area (ha)	10.05	10.05	10.05	30.15
Design Average Commercial Flowrate (L/ha/d)	28,000	28,000	28,000	N/A
Anticipate Commercial Flowrate (m^3/d)	**281**	**281**	**281**	**844**
Total ICI Flowrate (m^3/d)	500	500	500	1,500
Equivalent Population (persons)	1,643	1,643	1,643	4,930

2.2.4 Existing Peak Flows

Table 2-8 outlines the historical (2020-2024) peak flowrates observed, and their associated peaking factors in comparison to the ADF. The MM WWTP influent flow monitoring Parshall flumes count attenuation flow from the onsite lagoons twice due to the location of attenuation bypassing in the plant. Therefore, to determine ADF, PDF, and MMF, effluent flowrate metering data was used. However, influent flow metering data was used to determine PHF and PIF flowrates due to the necessity of headworks to treat all influent flowrates.

Note, bypass events were considered (added to the WWTP influent flowrate data) when adequate data was available. GBPS bypassing flowrates could not be considered for PHF and PIF since granular bypassing data was not available.

Table 2-8: Historical (2020-2024) Flowrates and Peaking Factors Observed at the MM WWTP

Parameter	Flowrate (m^3/d)	Peaking Factor
Average Daily Flowrate (ADF)	3,155 (1)	-
Max Month Flowrate (MMF)	6,401 (1)	2.03

Parameter	Flowrate (m³/d)	Peaking Factor
Peak Daily Flowrate (PDF)	18,974 (1)	6.01
Peak Hourly Flowrate (PHF)	29,688 (2)	9.41
Peak Instantaneous Flowrate (PIF)	30,069 (2)	9.53

Table Notes:

(1) Determined from historical (2020-2024) MM WWTP effluent flow metering data and considering GBPS bypass flowrates.
(2) Determined from historical (2020-2024) MM WWTP 5-minute influent flow metering data. GBPS bypassing data could not be considered as appropriate granularity of the data did not exist.

The historical peaking factors at the MM WWTP are very high, specifically for PDF, PHF, and PIF. A sensitivity analysis was performed on the PDF, PHF, and PIF data to understand if the peaking factors could be reduced, in an effort to mitigate oversizing future WWTP expansion requirements. When the historical data was evaluated, the following was found:

- PDF 99.95th percentile captured all data except a single day in 2023, reducing flowrate to approximately 15,820 m^3/d (Figure 2-1),
- PHF 99.95th percentile captured the majority of data except for several hours during two (2) peak events in 2020, reducing flowrate to approximately 23,000 m^3/d (Figure 2-2), and
- PIF 99.95th percentile captured the majority of data except for several 5-minute intervals in 2020 and three (3) 5-minute intervals in 2024, reducing the flowrate to approximately 25,000 m^3/d (Figure 2-3).

CIMA+ is proposing to use the following values to represent the historical (2020-2024) GBPS and WWTP influent flows:

Table 2-9: Proposed Class EA Influent Flow Design Basis

Parameter	Flowrate (m³/d)	Peaking Factor
Average Daily Flowrate (ADF)	3,155 (1)	-
Max Month Flowrate (MMF)	6,401 (1)	2.03

Parameter	Flowrate (m^3/d)	Peaking Factor
Peak Daily Flowrate (PDF)	15,820 (1) (2)	5.01
Peak Hourly Flowrate (PHF)	23,000 (2)	7.29
Peak Instantaneous Flowrate (PIF)	25,000 (2)	7.92

Table Notes:

(1) Determined from historical (2020-2024) MM WWTP effluent flow metering data and considering GBPS bypass flowrates.
(2) 99.95th percentile from historical (2020-2024) MM WWTP flow metering data.

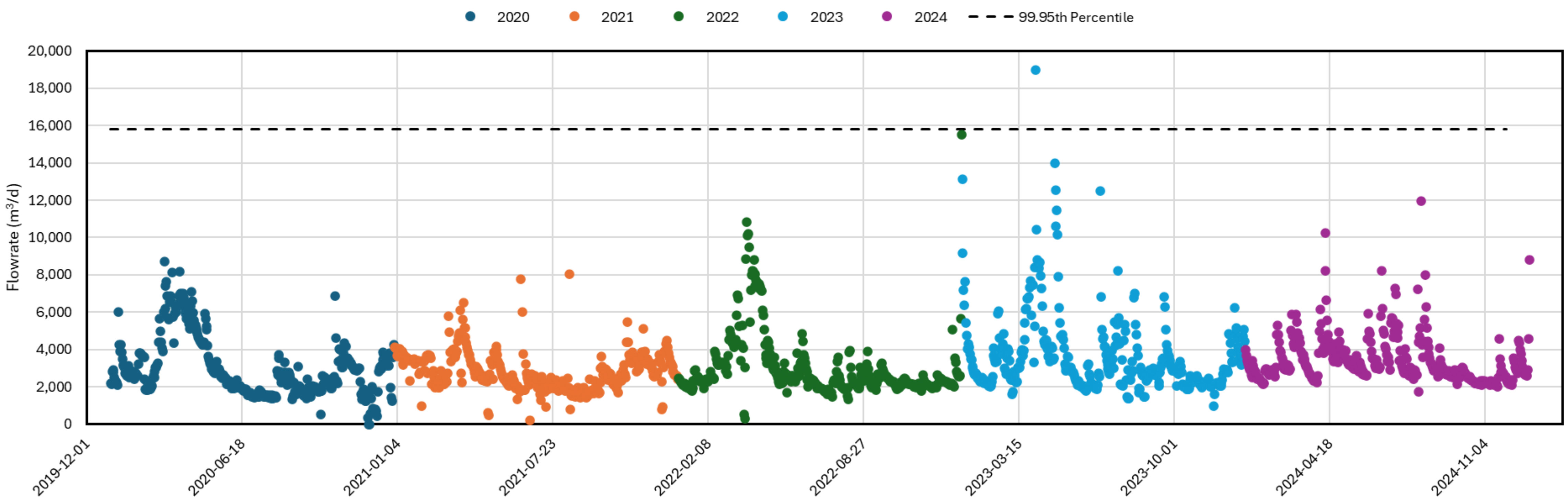

Figure 2-1: Sensitivity Analysis of Historical Peak Daily Flowrates

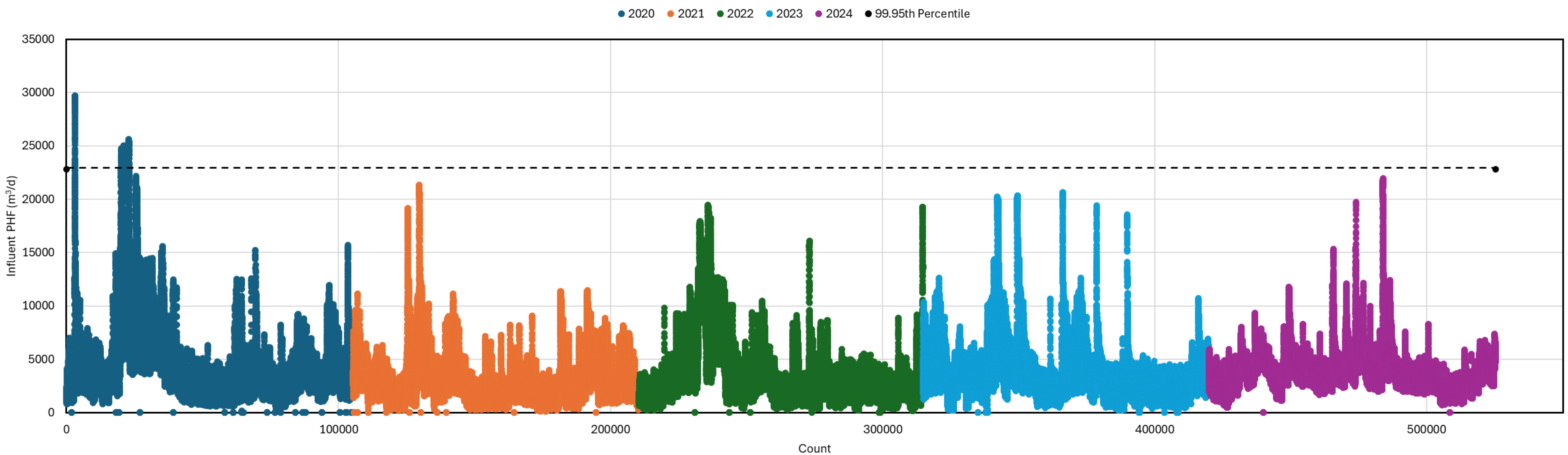

Figure 2-2: Sensitivity Analysis of Historical Peak Hourly Flowrates

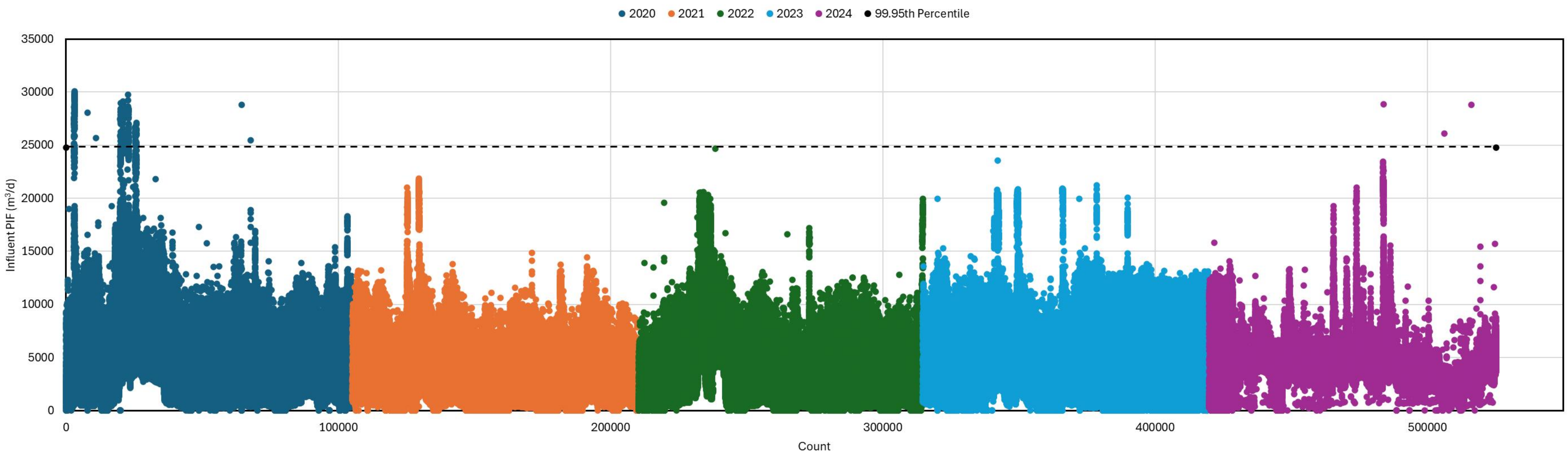

Figure 2-3: Sensitivity Analysis of Historical Peak Instantaneous Flowrates

2.2.5 Proposed Future Peaking Factors

The expected growth within the GBPS and MM WWTP catchment area will be due to new construction. Newly constructed developments typically experience reduced levels of I&I within the collection network, reducing peak flows to the sewage pumping station and WWTP. Additionally, water efficient appliances are typically used, reducing wastewater generation further. Therefore, it is anticipated future growth will generate reduced peaking factors.

Table 2-10 outlines both the existing and proposed future influent flowrate peaking factors to be used for the GBPS and MM WWTP design basis.

Table 2-10 Existing and Future Peaking Factors

Parameter	Existing PF	Proposed Future PF
Maximum Month Peaking Factor	2.03	1.7 (3)
Daily Peaking Factor	5.01 (1)	2.7 (3)
Hourly Peaking Factor	7.29 (2)	4.0 (4)
Instantaneous Peaking Factor	7.92 (2)	4.0 (4)

Table Notes:

(1) Determined by the 99.95th percentile based on historic average daily effluent flowrate, while considering GBPS bypass events.
(2) Determined by the 99.95th percentile based on 5-minute influent flow monitoring values.
(3) Engineering judgement is required when selecting peaking factors. Max month and peak daily peaking factors align with typical values of 1.3-2 for maximum month and 2-3 for peak daily flowrate.
(4) Peaking value per the Municipality’s recommendation.

CIMA+ is proposing to use historical peaking factors to capture anticipated peak flows from the existing Almonte population (i.e. 6,926), then the proposed future peaking factors shall be used to determine future developments’ (including greenfield residential and ICI) peak flows. Continued flow monitoring of new developments would be an effective method of quantifying peak flow events from new developments; this would better inform future studies.

2.2.6 Septage Flows

The existing MM WWTP contains septage receiving capabilities, including:

- 150mm camlock inlet connection,
- Receiving tank,
- Rock trap and debris tank,
- Grinder, and
- Flow meter.

Table 2-11 presented historical processed septage flows, provided by OCWA for 2020, 2021, 2022, and 2024 (septage was not received at MM WWTP in 2023) and the percentage that septage represented of the overall plant's treated effluent average day flows.

Table 2-11 Historical Septage Flows at MM WWTP

Year	Total Processed Septage Flow (m^3)	% of Effluent ADF
2020	2,934	0.3%
2021	1,915	0.2%
2022	400	0.04%
2024	1,118	0.09%
Daily Average	4.4	-
Annual Average	1,592	-

Table 2-12 presents the values that were used to calculate the volume of septage that the MM WWTP is anticipated to be required to receive and treat over the planning period. To calculate the future septage treatment capacity requirements for the MM WWTP, it was assumed that only septage originating from septic tanks of rural residents in the Municipality would be accepted. However, the Municipality may consider expanding the future septage receiving program to additional residents in Lanark County, depending on the future capacity of the MM WWTP.

Table 2-12 Estimated Future Septage Flows at MM WWTP

<table>
<tr><th>Parameter</th><th>Value</th></tr>
<tr><td>2024 Rural Population of the Municipality of Mississippi Mills</td><td>8,973 persons</td></tr>
<tr><td>Estimated Annual Growth of Rural Residential Units in the Municipality (WWMP 2024)</td><td>46 units/year</td></tr>
<tr><td>Estimated Number of Persons per Rural Unit (WWMP 2024)</td><td>2.4 persons/unit</td></tr>
<tr><td>Estimated 2055 Rural Population of the Municipality of Mississippi Mills</td><td>12,396 persons</td></tr>
<tr><td rowspan="4">Estimated Number of Septic Tanks by Planning Period (1)</td><td>Existing (2024): 3,739 tanks</td></tr>
<tr><td>Short-Term (2025-2035): 4,245 tanks</td></tr>
<tr><td>Mid-Term (2035-2045): 4,705 tanks</td></tr>
<tr><td>Long-Term (2045-2055): 5,165 tanks</td></tr>
<tr><td>Assumed Capacity per Septic Tank (2)</td><td>3,600 L</td></tr>
<tr><td>Assumed Frequency of Emptying Septic Tank</td><td>3 years</td></tr>
<tr><td rowspan="4">Estimated Annual (Daily) Septage Volume to be Treated at MM WWTP</td><td>Existing (2024):
4,487 m^3/year (12.3 m^3/d)</td></tr>
<tr><td>Short-Term (2025-2035):
5,094 m^3/year (14 m^3/d)</td></tr>
<tr><td>Mid-Term (2035-2045):
5,646 m^3/year (15.5 m^3/d)</td></tr>
<tr><td>Long-Term (2045-2055):
6,198 m^3/year (17 m^3/d)</td></tr>
</table>

Table Notes:

(1) It is assumed that each rural unit is serviced by one septic tank.
(2) Based on Ontario Building Code minimum septic tank size requirement.

Currently, the MM WWTP receives and processes septage well below the estimated existing generation rate (1,592 m^3/year historical average vs. 4,487 m^3/year theoretical septage generation rate). However, the Municipality has expressed interest in planning for increased future septage flows at the MM WWTP as part of this Class EA study. In addition, planning for increased processing capacity for septage at the MM WWTP will provide the Municipality with flexibility for accepting septage from commercial and non-Municipality sources.

CIMA+ is proposing to increase septage flows generated per planning period, per Table 2-12, to contribute to ADF influent wastewater values. Anticipated composition of the septage stream will be discussed in Section 2.3.3.

2.2.7 Projected Influent Wastewater Flows

Wastewater influent flowrates to the GBPS and MM WWTP were projected for the previously noted planning periods. Historical flowrates were assumed to be maintained throughout each planning period. Future projected flowrates assumed a per capita generation rate of 304 L/c/d, as noted in Section 2.2.2. Projected I&I, ICI, and septage flowrates were added to the anticipated residential generation flowrate per planning period.

Based on the projected influent flowrates, the MM WWTP is anticipated to be beyond its current ECA rated capacity for ADF prior to 2035, however, peak flow capacity has already been exceeded. Note, Cell D of the previous lagoon treatment facility is available to the MM WWTP for influent flowrate attenuation. Further investigation is required to understand the serviceability of the lagoon during future peak flow events across the noted planning periods.

Table 2-13 outlines current rated capacity, projected flowrates, and associated blended peaking factors throughout the planning periods. Note, peaking factors decrease over time due to the future population assumed to generate reduced peak flowrates.

Table 2-13 Existing and Projected Wastewater Flows

Parameter	Existing	Short-Term (2025-2035)	Mid-Term (2035-2045)	Long-Term (2045-2055)
ADF Generation **(m³/d)**	3,155	4,078	4,917	5,756
ICI (m³/d)	-	500	1,000	1,500
I&I (m³/d)	-	186	372	557
Septage (m³/d)	-	14	29	46
Total ADF [1] (m³/d)	**3,155**	**4,778**	**6,303**	**7,829**
Total Equivalent Population (persons)	6,926	12,262	17,281	22,301
MMF (m³/d) - PF	6,401 (2.03)	9,159 (1.92)	11,753 (1.86)	14,346 (1.83)
PDF [2] (m³/d) - PF	15,820 (5.01)	20,200 (4.23)	24,320 (3.86)	28,440 (3.63)
PHF (m³/d) - PF	23,000 (7.29)	29,489 (6.17)	35,592 (5.65)	41,696 (5.33)
PIF [3, 4] (m³/d) - PF	25,000 (7.92)	31,489 (6.59)	37,592 (5.96)	43,696 (5.58)

Table Notes:

(1) MM WWTP ECA rated ADF capacity is 4,700 m³/d.
(2) MM WWTP ECA rated PDF capacity is 14,100 m³/d for process units downstream of headworks.
(3) MM WWTP ECA rated PIF capacity is 28,100 m³/d for headworks equipment only.

(4) Firm capacity of GBPS is 20,995 m^3/d based on recent operational performance testing with two (2) raw sewage pumps operating. GBPS must be able to pump all PIF flowrates to the WWTP.

CIMA+ is proposing to use the projected influent wastewater flowrates, as shown in Table 2-13, as the Class EA wastewater quantity design basis for both GBPS and the MM WWTP.

2.3 Wastewater Influent Quality

2.3.1 Historical Wastewater Influent Quality

The following historical wastewater influent quality was measured by OCWA between 2020-2024. MM WWTP currently receives low to medium strength influent wastewater, Table 2-14.

Table 2-14 Existing Mississippi Mills WWTP Influent Wastewater Quality

Parameter	Average Influent Concentration (1, 2) (mg/L)	Average Influent Loading (1) (kg/d)	Max Month Influent Loading (1) (kg/d) - PF
5-day Biological Oxygen Demand (BOD_5)	159	504	1,257 (2.5)
Total Suspended Solids (TSS)	207	678	2,715 (4)
Total Phosphorus (TP)	5	16	42 (2.6)
Total Kjeldahl Nitrogen (TKN)	34	110	208 (1.9)
Temperature	Min: 2.5 °C Max: 28.8 °C	-	-

Table Notes:

(1) Calculated from data provided by OCWA from 2020-2024; therefore, based on an average daily flowrate of 3,155 m^3/d.
(2) Influent wastewater quality considered to be low to medium strength.

2.3.2 Future Anticipated Wastewater Influent Quality

Assumptions were taken to project the wastewater influent quality at the MM WWTP based on historical wastewater constituent per capita generation rates. Table 2-15 outlines the assumed per capita generation rates for the key wastewater constituents and the expected average day influent quality during the identified planning periods.

Note, wastewater influent quality is projected to increase in strength due to reduced per capita generation rates projected in Section 2.2.2. Residential and ICI population equivalents were used; however, I&I flowrate population equivalence was not considered because it was assumed I&I will not generate a meaningful load of any constituent.

Table 2-15: Future Anticipated Wastewater Influent Quality

Planning Period	BOD_5	TSS	TP	TKN
Existing per capita loading (g/p/d)	79	106	2.5	17.2
Projected per capita loading (1) (g/p/d)	79	106	2.5	17.2
Short-Term (2025-2035) (mg/L)	183	247	5.8	39.9
Mid-Term (2035-2045) (mg/L)	194	261	6.1	42.3
Long-Term (2045-2055) (mg/L)	201	270	6.3	43.7

Table Notes:

(1) Historical (2020-2024) per capita loading assumed for future scenarios.

2.3.3 Septage Loadings

Compared with conventional sewage collection system influent, septage generally contains higher concentrations of nutrients. Table 2-16 presents the historical characterization of septage received at MM WWTP compared with the MECP Design Guidelines' suggested septage parameter design values for BOD_5, Total Solids (TS), TSS, TP, TKN, and pH.

Table 2-16 Historical and MECP Design Septage Nutrient Concentrations

Parameter	MM WWTP Septage Receiving (1)	MECP Suggested Design Values (2)
5-day Biological Oxygen Demand (BOD_5) (mg/L)	Min: 86 Average: 1,749	7,000

Parameter	MM WWTP Septage Receiving (1)	MECP Suggested Design Values (2)
	Max: 7,800	
Total Solids (TS) (mg/L)	Min: 180	40,000
	Average: 11,973	
	Max: 196,000	
Total Suspended Solids (TSS) (mg/L)	Min: 65	15,000
	Average: 6,666	
	Max: 117,000	
Total Phosphorus (TP) (mg/L)	Min: 3.6	250
	Average: 148	
	Max: 905	
Total Kjeldahl Nitrogen (TKN) (mg/L)	Min: 19	700
	Average: 1241	
	Max: 3,970	
pH	Min: 5.3	6.0
	Average: 7.8	
	Max: 8.8	

Table Notes:

(1) Historical (2020, 2021, 2022, & 2024) septage lab results (OCWA). Septage was not accepted at MM WWTP in 2023.
(2) MECP Design Guidelines, 2008

Since future septage received and processed at the MM WWTP may vary significantly from existing conditions, it is recommended to apply MECP Design Values, as noted in Table 2-16, to anticipate future septage loadings. Based on the anticipated future volumes of septage, outlined in Table 2-12, the future septage loadings are calculated in Table 2-17 below.

Table 2-17: Future Projected Average Day Septage Loading of Key Wastewater Constituents

Planning Period	BOD_5 (kg/d) – Average Day (1)	TSS (kg/d) – Average Day (1)	TP (kg/d) – Average Day (1)	TKN (kg/d) – Average Day (1)
Short-Term (2025-2035)	98	209	3.5	9.8
Mid-Term (2035-2045)	108	232	309	10.8
Long-Term (2045-2055)	119	255	4.2	11.9

Table Notes:

(1) Future average day septage flows (Table 2-12) used to calculate septage loadings by planning period.

CIMA+ is proposing to add anticipated loading from septage, per Table 2-12, to the overall design basis for influent wastewater quality.

2.3.4 Projected Influent Wastewater Loadings

Projecting influent constituent loading is important for process unit design as these processes must treat all loading which enters the WWTP. Table 2-14 outlined historical average day and max month loading. Based on the projected influent per capita loading noted in Table 2-15 and the anticipated flowrates noted in Table 2-13, future loading to the MM WWTP can be projected. Note, population equivalence for I&I flowrates was not considered due to the assumption that I&I will not generate a meaningful load of any constituent.

Table 2-18 outlines the projected future average day and max month loading to the MM WWTP. Note, historical constituent max month peaking factors as noted in Table 2-14 were carried forward to project future max month loadings.

Table 2-18: Future Projected Average Day and Max Month Loading of Key Wastewater Constituents

Planning Period	BOD (kg/d) – Average Day / Max Month (1)	TSS (kg/d) – Average Day / Max Month (1)	TP (kg/d) – Average Day / Max Month (1)	TKN (kg/d) – Average Day / Max Month (1)
Short-Term (2025-2035)	970 (2,422)	1,385 (5,542)	31.0 (81.2)	200 (378)
Mid-Term (2035-2045)	1,328 (3,315)	1,875 (7,504)	42.3 (110.8)	277 (523)
Long-Term (2045-2055)	1,686 (4,208)	2,365 (9,467)	53.7 (140.5)	354 (669)

Table Notes:

(1) Historical peaking factors assumed, Table 2-14.

CIMA+ is proposing to use the projected influent wastewater loadings, as shown in Table 2-18, as the Class EA wastewater quality design basis.

2.4 Wastewater Effluent Quality

2.4.1 Historical Wastewater Effluent Quality

The MM WWTP must meet both ECA effluent monthly average constituent concentration and loading limits. Table 2-19 outlines the effluent limits which historically must be met by the MM WWTP.

Table 2-19: ECA Effluent Limits and Objectives of the Existing MM WWTP

Parameter	Average Monthly Concentration Objectives / Limits (mg/L)	Average Monthly Loading Objectives / Limits (kg/d)
$cBOD_5$	10 / 25	47 / 117.5
TSS	10 / 15	47 / 70.5
TP	0.15 / 0.3 (Sept 1 – May 31) 0.15 / 0.2 (June 1 – Aug 31)	0.71 / 1.41 (Sept 1 – May 31) 0.71 / 0.94 (June 1 – Aug 31)

Parameter	Average Monthly Concentration Objectives / Limits (mg/L)	Average Monthly Loading Objectives / Limits (kg/d)
TAN	12 / 15 (Sept 1 – Apr 30) 3 / 5 (May 1 – Aug 31)	56.4 / 70.5 (Sept 1 – Apr 30) 14.1 / 23.5 (May 1 – Aug 31)
pH	-	6.0 – 9.5
E. Coli	100 CFU/100mL / No Limit	-

Historical wastewater effluent quality was measured by OCWA between 2020-2024. The MM WWTP did not exceed ECA monthly average effluent concentration regulations between 2020-2024.

In May 2022, a spike in effluent TP almost exceeded effluent ECA concentration limits, however, remained below the allowable limit. The spike in effluent TP corresponded with similar elevated effluent concentrations of BOD and TSS. This is typical as the particulate matter of BOD and TSS contribute to TP concentrations.

The following figures illustrate the historical (2020-2024) monthly average effluent concentrations produced by the MM WWTP compared to the ECA effluent limits:

- Figure 2-4 illustrates historical effluent monthly average BOD concentrations,
    - It is assumed that 3 mg/L is the detectable limit for the BOD as no concentrations below 3 mg/L were reported,
- Figure 2-5 illustrates historical effluent monthly average TSS concentrations,
- Figure 2-6 illustrates historical effluent monthly average TP concentrations,
- Figure 2-7 illustrates historical effluent monthly average TAN concentrations, and
- Figure 2-8 illustrates historical effluent monthly average pH.

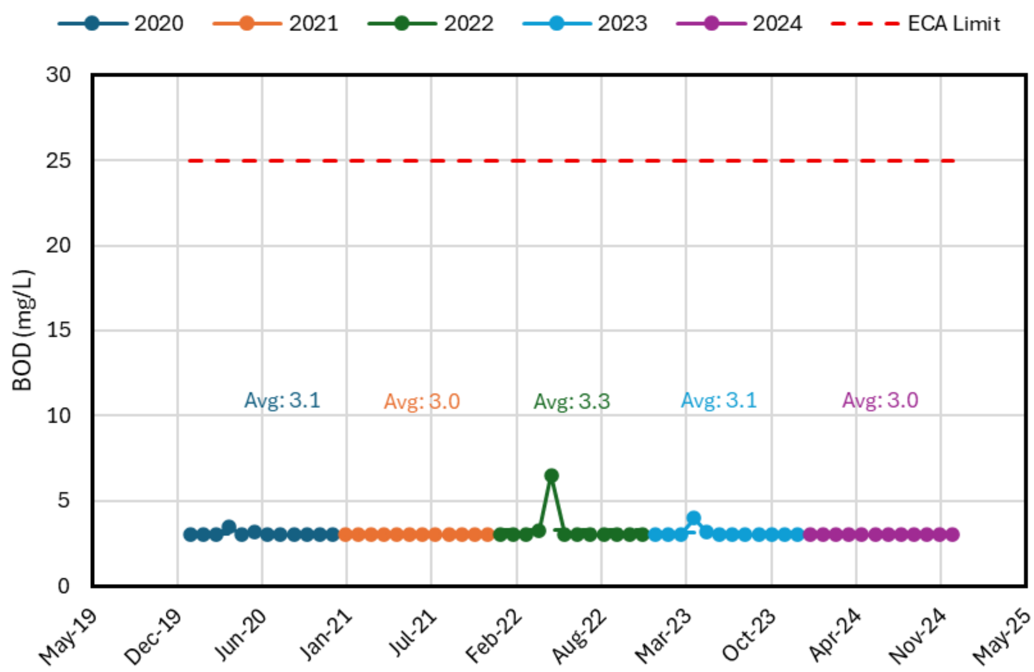

Figure 2-4: Monthly Average Effluent BOD Concentration

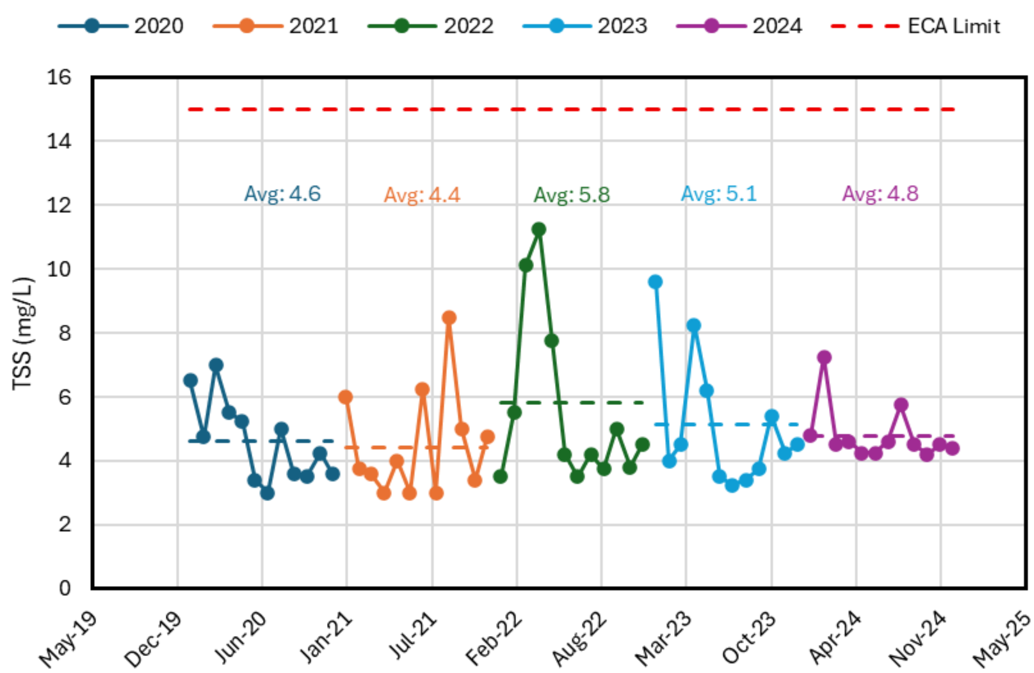

Figure 2-5: Monthly Average Effluent TSS Concentration

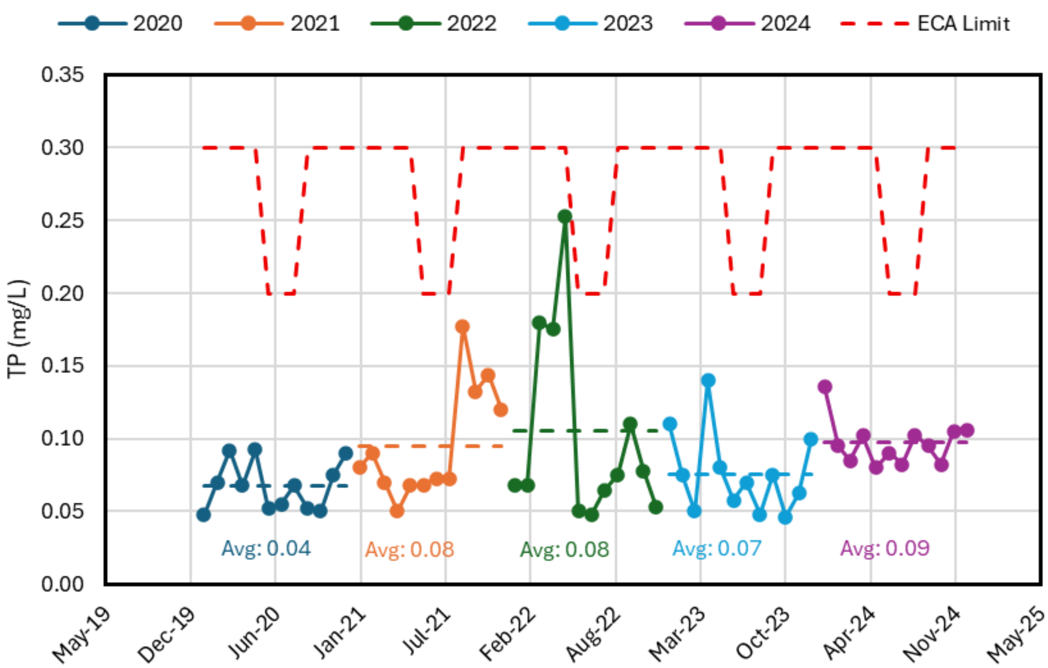

Figure 2-6: Monthly Average Effluent TP Concentration

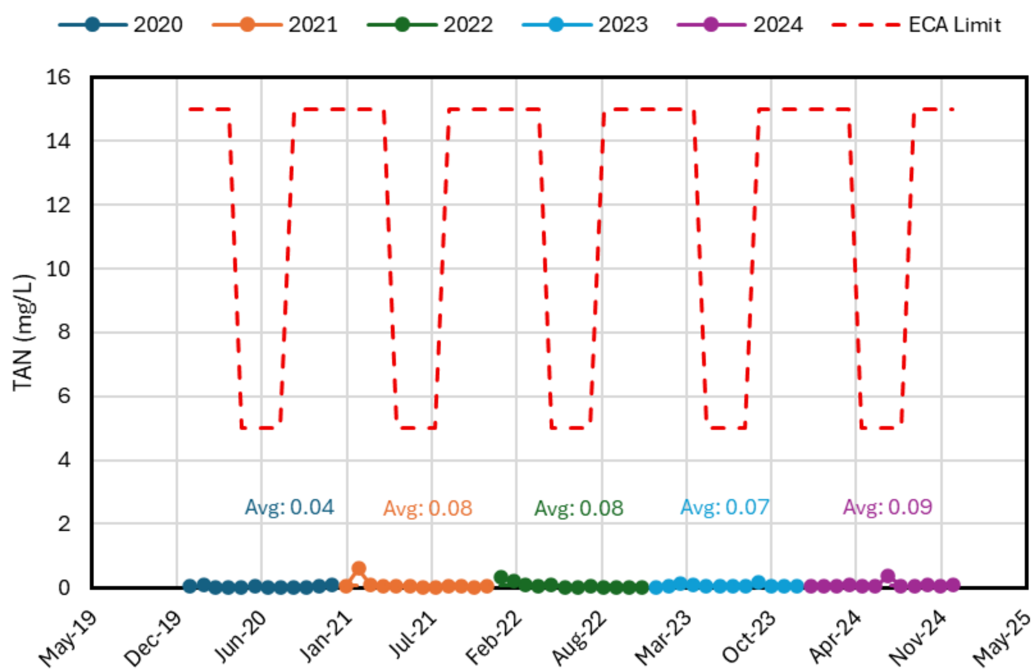

Figure 2-7: Monthly Average Effluent TAN Concentration

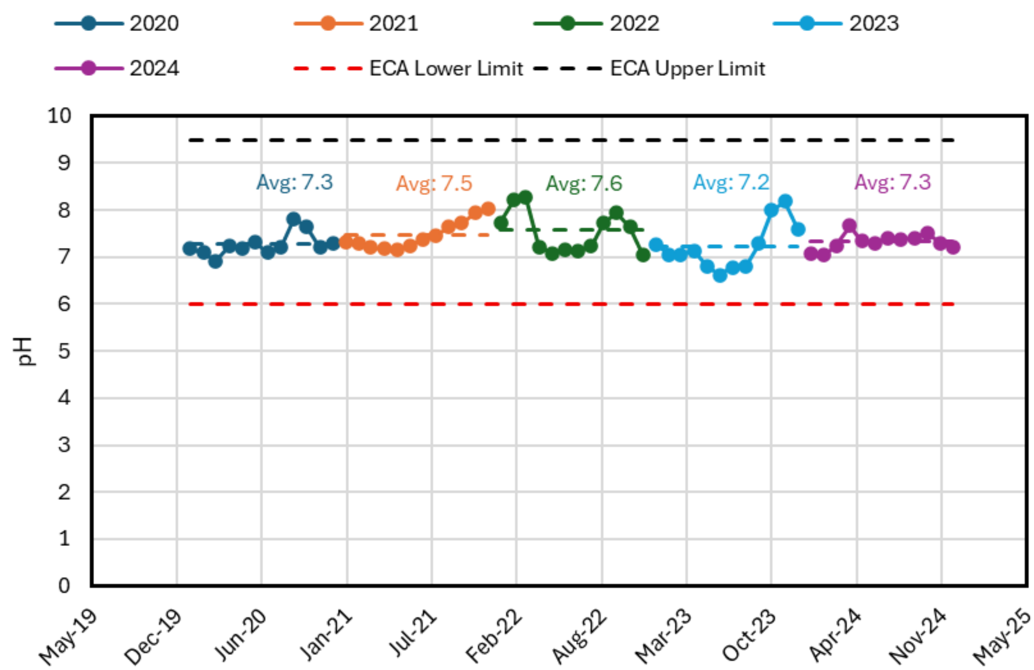

Figure 2-8: Monthly Average Effluent pH

TSS effluent monthly average loading was exceeded in April 2023. TP effluent monthly average loading was nearly exceeded in April 2023 as well but remained below the ECA limit.

The following figures illustrate the historical (2020-2024) monthly average effluent loadings produced by the MM WWTP compared to the ECA effluent limits:

- Figure 2-9 illustrates historical effluent monthly average BOD loadings,
- Figure 2-10 illustrates historical effluent monthly average TSS loadings,
- Figure 2-11 illustrates historical effluent monthly average TP loadings,
- Figure 2-12 illustrates historical effluent monthly average TAN loadings,

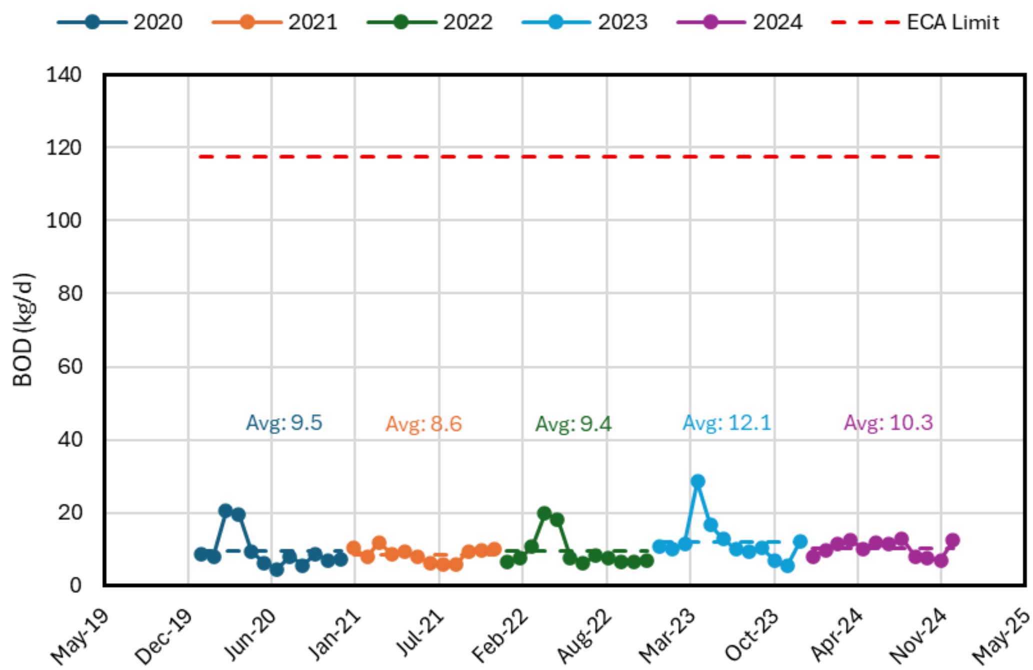

Figure 2-9: Monthly Average Effluent BOD Loading

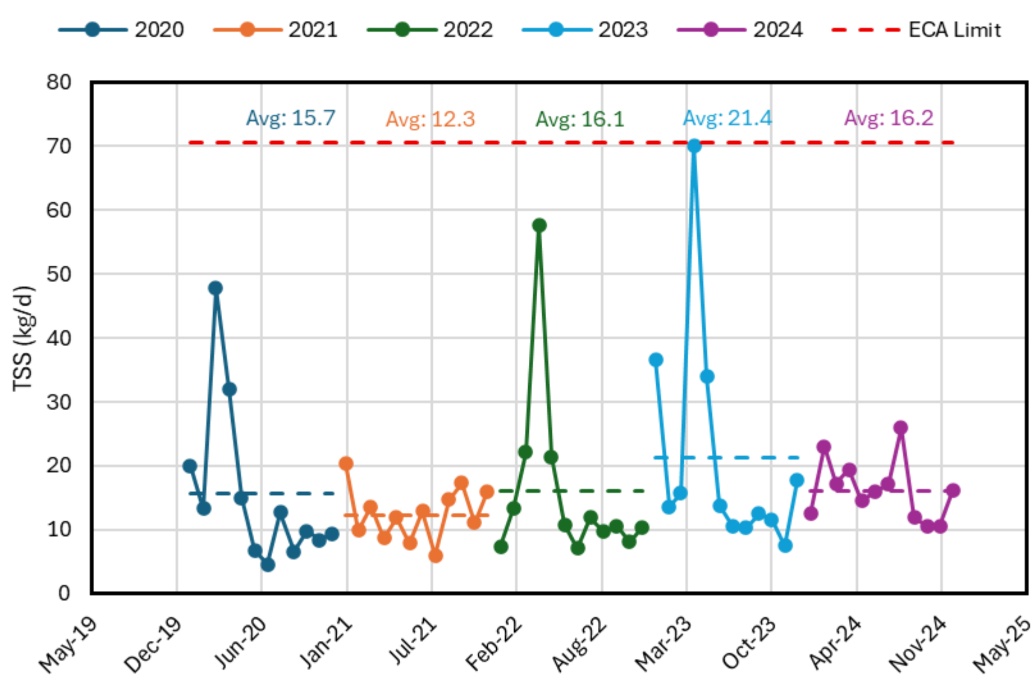

Figure 2-10: Monthly Average Effluent TSS Loading

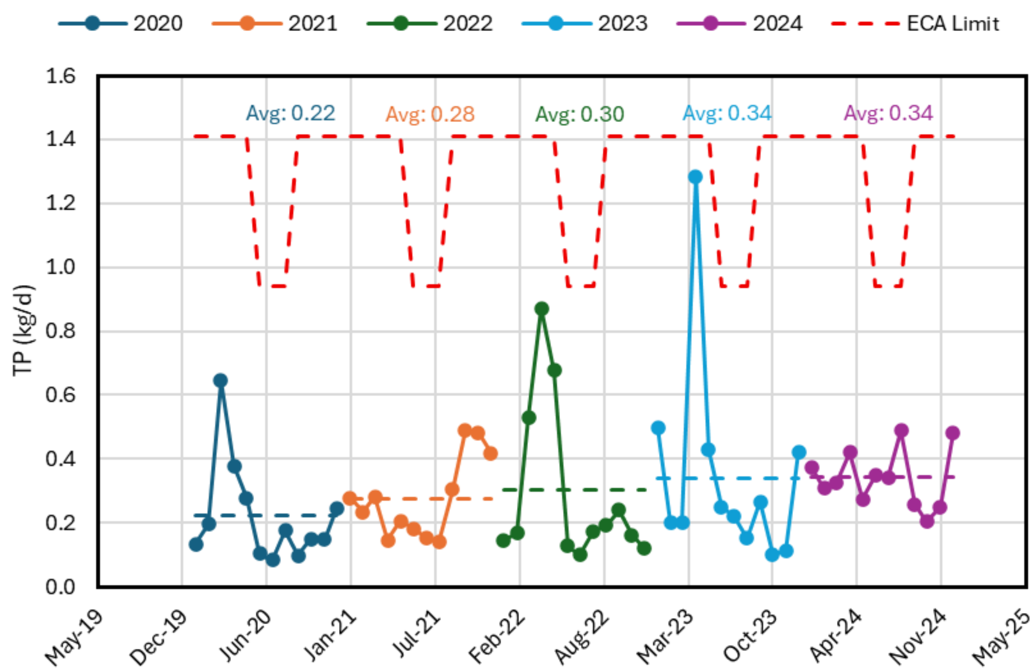

Figure 2-11: Monthly Average Effluent TP Loading

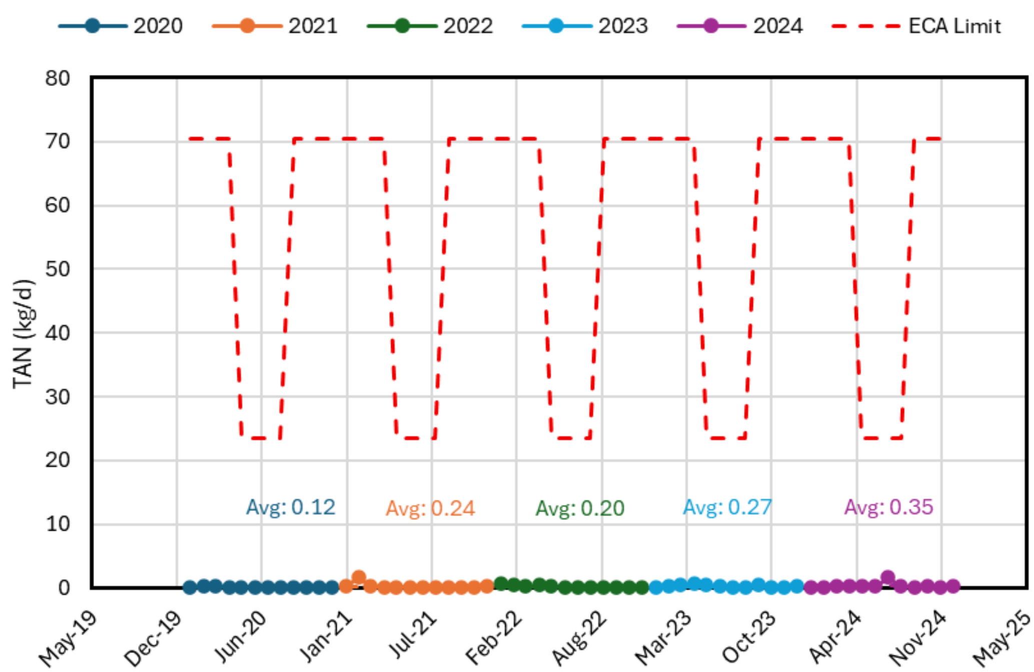

Figure 2-12: Monthly Average Effluent TAN Loading

2.4.2 Future Anticipated Wastewater Effluent Quality

An Assimilative Capacity Study (ACS) of the MM WWTP discharge receiver (the Mississippi River) was conducted by the engineering firm Stantec. The ACS study, and its recommendations, was accepted by the MECP. The major finding of the completed study is that the Mississippi River has capacity to accept increased loading from the MM WWTP.

The proposed effluent objectives and limits are outlined in Table 2-20, which were accepted by the MECP. It is important to note that the ACS was performed under the assumption the rated ADF capacity of the MM WWTP would be 10,355 m^3/d, significantly greater than the project 2055 ADF, Table 2-13.

Table 2-20: Proposed Mississippi Mills WWTP Monthly Average Effluent Limits and Objectives (Stantec, February 4, 2026)

Effluent Parameter	Effluent Objectives		Effluent Limits	
	Monthly Average Concentration, mg/L	Average Loading, kg/day	Monthly Average Concentration, mg/L	Average Loading, kg/day
$CBOD_5$	10	103.7	15	155.5
TSS	10	103.7	15	155.5
TP	0.15	1.56	0.2	2.07
TAN (N)	2 (May 15 – Sep 30) 4 (Oct 1 – May 14)	20.7 41.4	3 (May 15 – Sep 30) 6 (Oct 1 – May 14)	31.1 62.2
pH	–		6 – 9.5 inclusive, at all time	
E.coli	100 organisms per 100 mL		200 organisms per 100 mL	

3. Summary of Class EA Design Basis

Table 3-1 outlines a summary of the influent and effluent design basis for the GBPS and MM WWTP that is proposed to be used for the Class EA study.

Table 3-1: Summary of GBPS and MM WWTP Design Basis

Parameter	Existing	Short-Term (2025-2035)	Mid-Term (2035-2045)	Long-Term (2045-2055)
Population	6,926	9,962	12,722	15,482
Flowrate				
ADF (m^3/d)	3,155	4,778	6,303	7,829
MMF (m^3/d) - PF	6,401 (2.03)	9,159 (1.92)	11,753 (1.85)	14,346 (1.83)
PDF (m^3/d) - PF	15,820 (5.01)	20,200 (4.23)	24,320 (3.86)	28,440 (3.63)
PHF (m^3/d) - PF	23,000 (7.29)	29,489 (6.17)	35,592 (5.65)	41,696 (5.33)
PIF (m^3/d) - PF	25,000 (7.92)	31,489 (6.59)	37,592 (5.96)	43,696 (5.58)
Average Day Loading				
BOD (kg/d)	504	970	1,328	1,686
TSS (kg/d)	678	1,385	1,875	2,365
TP (kg/d)	15.9	31.0	42.3	53.7
TKN (kg/d)	110	200	277	354
Max Month Loading				
BOD (kg/d) – PF	1,257 (2.5)	2,422 (2.5)	3,315 (2.5)	4,208 (2.5)

Parameter	Existing	Short-Term (2025-2035)	Mid-Term (2035-2045)	Long-Term (2045-2055)
TSS (kg/d) – PF	2,715 (4.0)	5,542 (4.0)	7,504 (4.0)	9,467 (4.0)
TP (kg/d) – PF	41.6 (2.6)	81.2 (2.6)	110.8 (2.6)	140.5 (2.6)
TKN (kg/d) – PF	208 (1.9)	378 (1.9)	523 (1.9)	669 (1.9)
Effluent Concentration Limits				
$cBOD_5$ (mg/L)	25	15	15	15
TSS (mg/L)	15	15	15	15
TP (mg/L)	0.3 (1) 0.2 (2)	0.2	0.2	0.2
TAN (mg/L)	15 (3) 5 (4)	6 (5) 3 (6)	6 (5) 3 (6)	6 (5) 3 (6)
pH	6.0 – 9.5	6.0 – 9.5	6.0 – 9.5	6.0 – 9.5
E.Coli (CFU/100mL)	-	200	200	200
Effluent Loading Limits				
$cBOD_5$ (kg/d)	117.5	155.5	155.5	155.5
TSS (kg/d)	70.5	155.5	155.5	155.5
TP (kg/d)	1.41 (1) 0.94 (2)	2.07	2.07	2.07
TAN (kg/d)	70.5 (3) 23.5 (4)	62.2 (5) 31.1 (6)	62.2 (5) 31.1 (6)	62.2 (5) 31.1 (6)

Table Notes:

(1) September 1 – May 31.

(2) June 1 – August 31.
(3) September 1 – April 30.
(4) May 1 – August 31.
(5) October 1 – May 14.
(6) May 15 – September 30.

4. References

JLR. (2024). *Phase 2 Report Mississippi Mills Water and Wastewater Infrastructure Master Plan.* Mississippi Mills : Municipality of Mississippi Mills .

Watson & Associates. (2025). *Growth Management Strategy - Lanark County (Final Report).*

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