

Appendix D

Meaford WWTP Existing and Future Wastewater Flows

Municipality of Meaford Wastewater Treatment Plant Class EA Update

Technical Memorandum
Existing and Future Wastewater Flows

Prepared For:
The Municipality of Meaford

September 2023

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MUNICIPALITY OF MEAFORD WASTEWATER TREATMENT PLANT CLASS EA UPDATE TECHNICAL MEMORANDUM EXISTING AND FUTURE WASTEWATER FLOWS

PROJECT NO. 121027

Prepared For:

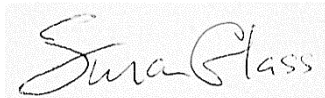
The Municipality of Meaford

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1 Introduction

This Technical Memorandum has been prepared in support of a Schedule 'C' Class EA for the expansion of Meaford Wastewater Treatment Plant (WWTP EA), building from the 2015 Meaford Water and Wastewater Master Plan (the Master Plan). Planning for expansion of the Meaford WWTP was initiated in 2007 with the completion of a previous Schedule 'C' EA, the Master Plan reinforced the historical general alternative that recommended increasing the capacity of the plant by expanding within the existing property within the existing property upon which the plant is situated. In order to implement the recommended design alternative, and satisfy the requirements of the Ministry of Environment, Conservation and Parks (MECP), this study was initiated to complete Phase 3 and Phase 4 of the Class EA process following from the Master Plan. The Municipality has retained Ainley Group to conduct the EA, review the previous design recommendations and investigate new technologies.

This Technical Memorandum provides an overview of the past and current wastewater flows and a projection of future flows based on current development information. The analysis of anticipated future flows in the Meaford WWTP service area from development is provided using Ministry of Environment, Conservation and Parks (MECP) Design Guidelines for Sewage Works, in conjunction with standard assumptions used for new development flow estimation by the Municipality. Flow projections will be conducted for the 30-year planning horizon to 2051, as well as for the full build-out of the urban boundary. The service area of Meaford's WWTP is limited to the urban area, as such, growth in the rural area is not considered as a component of the evaluation.

The Meaford WWTP has an ECA rated capacity of 3,910 m³/d with a peak flow capacity of 11,730 m³/day. Flow projections and current flows will be compared to existing capacity.

2 Objectives

The objectives of this Technical Memorandum are as follows:

- Review of historical growth trends and planning documentation
- Confirm sanitary sewage collection system flows from the existing community
- Establish growth potential for the Municipality based on the Official Plan (OP) settlement area boundary and current projected growth targets
- Project future sanitary sewage collection system flows for the full build-out of the community and to the end of the planning period in 2054.
- Assess the impact of future wastewater flows on the capacity of the WWTP.

3 2014 Official Plan

The 2014 Municipality of Meaford Official Plan, outlines a growth projection from 2006 through to 2026. The projected growth plan is summarised in **Table 1**.

Table 1 - 2014 Official Plan Growth Projection

Year	Permanent Population Growth	Employment Growth	Household Growth
2006	11,400	3,100	4,400

Year	Permanent Population Growth	Employment Growth	Household Growth
2011	12,000	3,300	4,700
2016	12,500	3,500	5,000
2021	13,100	3,600	5,300
2026	13,300	3,600	5,500
Total Increase	1,900	500	1,100

In an effort to direct growth to settlement areas, the Municipality set out targets for development within the settlement area for residential growth via new lot/unit creation. The goal of the plan was to direct 90% of new development to the Settlement Area. As such, 990 of the total 1,100 units projected out to 2026 were anticipated to be within the Settlement Area.

In order to support the identified growth targets, the Official Plan established that, as a minimum target, 10% of new growth in the primary settlement area of Meaford is to be achieved through intensification. Further, an overall average development density of 20 units per hectare for development projects should be achieved.

The Municipality is completing an update to the Official Plan with work taking place concurrently with this Study Update.

4 Population and Employment Projection Information

Existing and historical population in the urban area of the Municipality are taken from Statistic Canada Census Data and are provided in **Table 2**.

Table 2 - Population Data, Statistic Canada Census Data

	2006	2011	2016	2021
Meaford Urban Area	4,686	4,860	4,945	5,078

Population and employment projection information is based on information provided in the Hemson report. The Hemson report provides a projection of future units in each Municipality within Grey County, however no specific breakdown of the allocation between the urban and rural areas is specified. Based on discussion with Meaford's Planning Department, and in following with the 2014 Official Plan assumptions, a 90% and 10% allocation for the urban and rural areas respectively was adopted. The projected new jobs are assumed to be within the urban boundary.

The Hemson report provides a Municipality wide assessment of current housing units and jobs as of 2021 and the 25-year projection to an assumed number of units and jobs in the year 2046. The values presented by Hemson are provided in **Table 3**.

Table 3 - Hemson Housing Units and Jobs Projection

Year	Number of Units	Jobs
2021	5,150	3,700
2046	6,270	4,350

Assuming growth occurs linearly over the planning period, the planning projection average 44.8 units/year in the Municipality. Following the rural/urban population distribution assumption, the Municipality should anticipate 40.3 units/year in the urban area. While the planning projection is based on a 25-year time period, the same rate of development will be assumed for a 30-year period for the purpose of this study. Similarly, the report projects 650 new jobs over the 25-year period for an average of 26 new jobs per year. This rate of growth will also be assumed over the 30-year planning period for this study.

5 Wastewater Flow Design Basis

5.1 Flows From Existing Service Area

The flow trends for the Meaford WWTP were reviewed over the 2011-2022 time period. The flow data used in this analysis was taken from the Parshall Flume at the outlet to the Meaford WWTP. The character of recorded flow data changes between 2018 and 2019. In 2019 the Municipality began using flow data from a strap-on flow meter on the pumping station discharge which is connected to the plant SCADA system. Previous to 2019, incoming flow information was interpreted from chart recorders.

Depending on the process, WWTP unit processes are sized based on average daily flow (ADF), the peak (hourly/daily) flow, peak instantaneous flow (PIF) and maximum month flow (MMF). Generally, to calculate the capacity of a biological treatment system (e.g., aeration tanks) the hydraulic retention time (HRT) is an important factor. The HRT of a biological processes usually varies between 4 to 15 hours (depending on the process). Therefore, the average daily flow of the plant must be considered to allocate enough time for the micro-organism to degrade pollutants dissolved in the wastewater. On the other hand, in sedimentation tanks (with minimal biological processes) or sludge digester systems (with very high retention time) sizing, some other peak daily flow (PDF) or peak hourly flow (PHF) factors are important (for example: surface and weir loading rate and solid retention time).

Therefore, the capacity of a plant is calculated based on both average and peak flows. In summary, **Table 4** below describes the sizing basis of different units at the Meaford WWTP.

Table 4 - Meaford WWTP Unit Process Sizing Basis

Flow Type	Preliminary Treatment	Secondary Treatment		UV Disinfection	Sludge Digestion	Biosolids Storage
	Screening	Aeration	Secondary Clarifier			
ADF		✓				✓
PHF			✓	✓		
PDF						
PIF	✓					
MMF					✓	

The Meaford WWTP has experienced an average day flow (ADF) of 2,734 m³/d over the last 5 years (2018-2022). The observed average day flow rate from the existing community, exceeds the typical design average day flow rates used for new development. The average day flow rate

has remained relatively constant over the time period, a summary of the flow data for this period is presented in **Table 5**.

Peak day flows during the observation period are also provided. Over the observation period peak flows appear to generally trend upwards both in absolute terms and in terms of the ratio between peak and average day flow. Peak day flows in the Municipality have ranged in magnitude from 3.4 – 4.7 times ADF. The highest peak instantaneous flow was measured on March 31, 2016 at 6.7 times ADF.

Table 5 - Meaford Wastewater Flow Data Summary

Year	Average Day Flow (m ³ /d)	Peak Day Flow (m ³ /d)	Peak Instantaneous Flow (m ³ /d)
2011	2,676	9,505	9,505
2012	2,346	8,715	8,715
2013	2,777	11,774	11,774
2014	2,662	9,910	9,910
2015	2,204	6,550	6,550
2016	2,777	13,075	18,573
2017	3,141	11,133	13,285
2018	2,811	11,864	16,974
2019	2,951	11,952	14,268
2020	2,891	9,731	14,005
2021	2,681	12,623	13,997
2022	2,335	8,648	13,997
5-Year Summary	2,734	12,623	16,974

Figure 1 displays the monthly average flow and monthly peak day flow from the 2011-2022 time period. Average monthly flow is relatively consistent year over year, with increased flow averages during the spring months, and very consistent low flow averages during the summer months. The highest observed peaks generally occur within February to April. Peak flow observations shown from 2019 appear to be much higher than previous years. However, this is possibly a function of the new flow meter than any actual change in flow conditions. The 2019 flow observations should be understood as peak instantaneous rather than peak day flows.

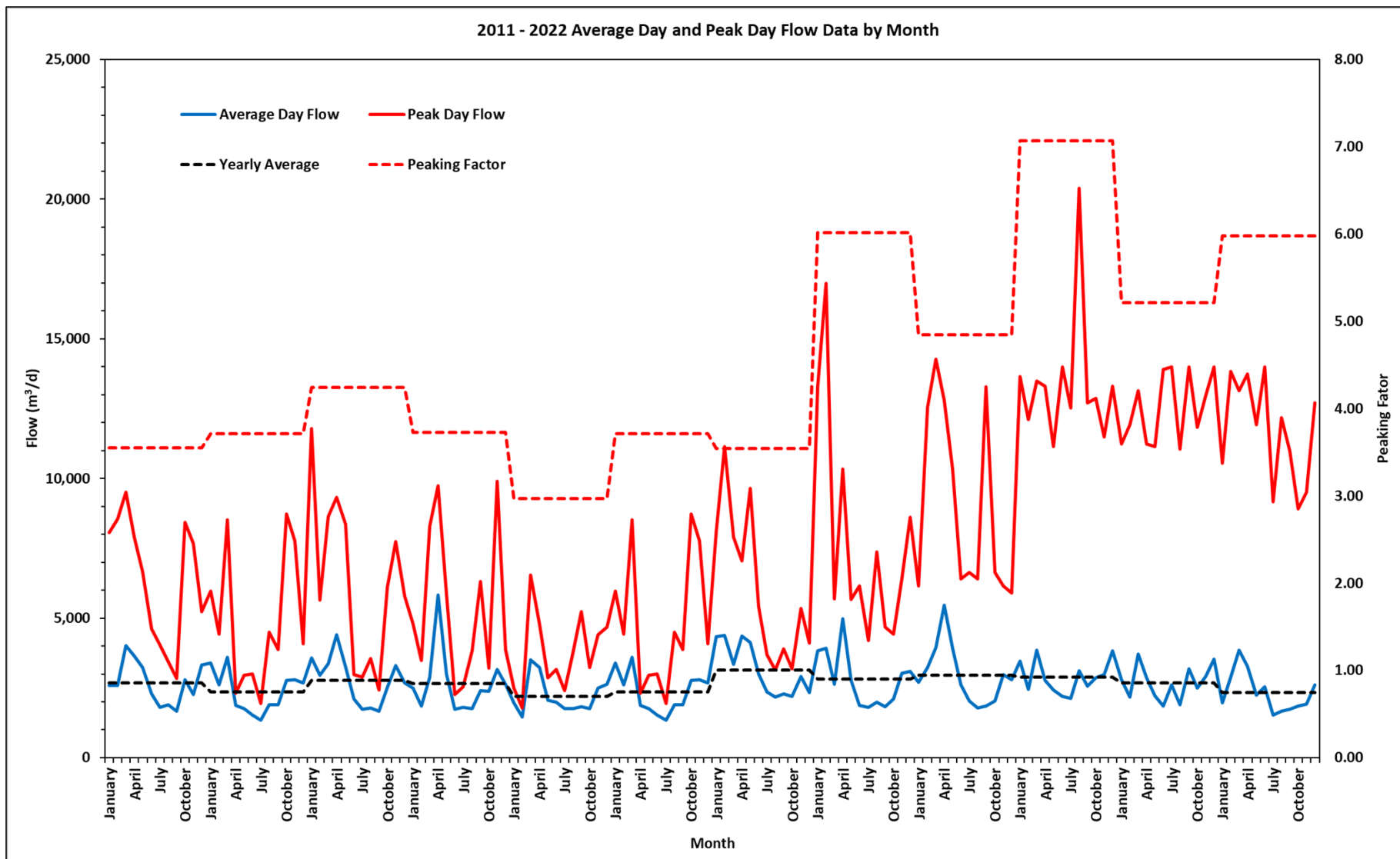


Figure 1 - Meaford Wastewater Flow Trend (2011-2022), Monthly Average

The Municipality has engaged in efforts to reduce inflow and infiltration (I&I) following recommendations in the 2015 Master Plan. A collapsed pipe identified on Sykes Street was repaired, and smoke testing was completed and successfully identified cross connections with stormwater collection which were remedied. The Municipality has also completed extensive rehabilitation of maintenance holes.

One of the most notable issues with the Municipality's collection system is the connection of roof drains from the commercial area along Sykes Street between Collingwood Street and Trowbridge Street; the Municipality has engaged a consultant to plan for the disconnection of the roof drains and re-routing to a new storm sewer. Based on current estimates, this may relieve up to 50 m³/d on ADF to the WWTP, and a substantial reduction in PDF.

The Municipality is committed to reducing I&I and has developed an I&I Reduction Strategy that has begun planning remedial action for 180 pipe deficiencies identified through the Municipality's CCTV inspection efforts. Currently the Municipality has anticipated \$3.4 million in construction costs towards spot repairs, relining and replacement of sanitary sewer to reduce the infiltration component. In addition, the Municipality is planning on continued smoke testing to identify cross connections with storm collection and illegal downspout connections. Although the Municipality is making efforts to reduce I&I, planning should proceed on the basis of historical observations.

5.2 Flows from Future Development

In recent years it has been recognized, through changes to the plumbing code and additional efforts to reduce water use; that the wastewater flow rates historically used in Ontario for design of wastewater systems, are high and, where applied in design of collection systems, could result in unnecessary infrastructure spending. More typically, wastewater system capacities are being designed based on lower flows that reflect actual water use. That stated, the Municipality of Meaford has years of historical flow data which can be drawn upon to estimate future flow conditions. A balance must be struck between historical data from the existing community and the condition of the existing collection system and the lower flow rates that are expected from new development projects.

Table 6 outlines the assumptions which will be used to generate the estimated average daily flow for new residential, institutional, commercial and industrial development as well as inflow and infiltration from development in Meaford.

Table 6 - Flow Assumptions for New Development

Parameter	Assumption
Residential Flow	350 L/c/d ¹
Inflow and Infiltration	90 L/c/d
Industrial Flow	28 m ³ /ha/d ²
Commercial Flow	28 m ³ /ha/d
Job (Factory Employee) ³	125 L/shift
Peaking Factor	Harmon Formula

¹ L/c/d – Liter flow per capita per day

² m³/ha/d – Cubic meter per hectare per day

³ Ontario Building Code Table 8.2.1.3.B – Assumption for 8-hour Factory Shift with Shower

The volume of wastewater generation from new development areas and infill areas of Meaford presented in the following sections, are calculated on an area-by-area basis using the per capita flows established herein. Average day flows and peak day flows were calculated by area.

5.3 Planned Development

The build-out of the Municipality is defined as complete development of all available parcels within the settlement area boundary.

Based on housing unit counts and Census population data from 2016 which are the most definitive numbers available, the Municipality had 2,236 residential units and urban population of 4,945, which closely approximates the 2.21 person per unit assumption. The character of resident within the urban area is not expected to change within the planning period. Meaford serves primarily as a tourist center and retirement community with low occupancy rates.

Table 8 presents flow estimates for all development areas within the urban area, including residential and industrial, commercial, and institutional (ICI). Flow contributions from ICI growth areas are presented as an equivalent residential population. Equivalent population is determined by calculating the flows based on the flow assumptions outlined in **Table 7** and then dividing by the per capita flow contribution of 440 L/c/d (Residential + I&I). The growth areas considered within the analysis with a combined area of 147.68 ha are listed in **Table 8** and are reflected in **Figure 2**.

Figure 2 shows the geographical location of developments listed in **Table 8**.

Flow estimates are calculated on the following basis:

$$ADF = Area * Housing Density * Occupants Per Unit * Per Capita Flow$$

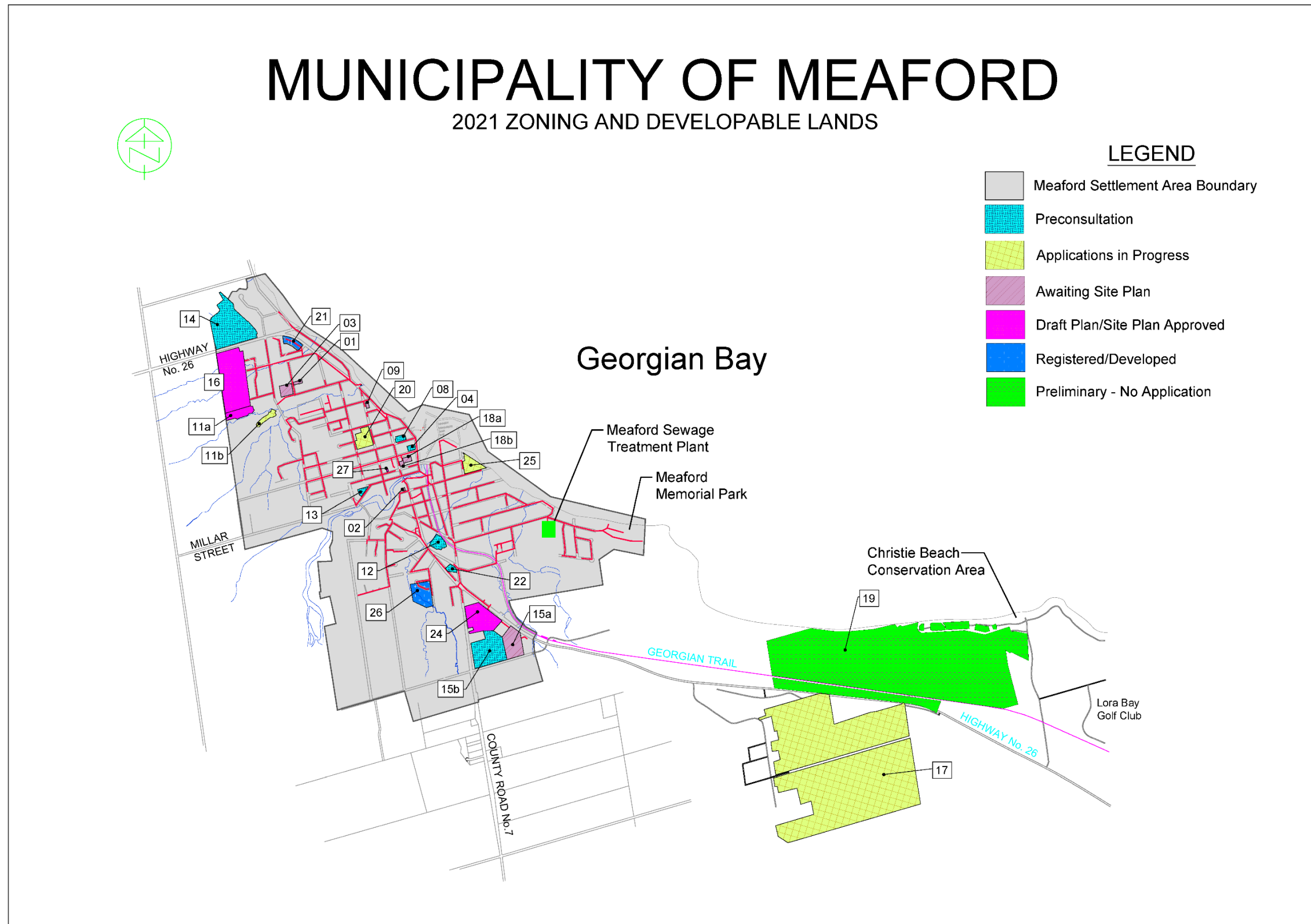


Figure 2 - 2021 Meaford Planned Development Areas

Table 7 - Wastewater Flows from New Growth Areas

	Identification	Designation	Units	Eq. Population	ADF Estimate (m ³ /d)
1	142 Susan Street - Tosello	Industrial		17	7.45
2	18 Boucher Street West	Commercial	6	13	5.83
3	365 Sports	Industrial		84	36.74
4	74 Bayfield Street	Residential	60	133	58.34
8	Collingwood Street	N/A	70	155	68.07
9	Cook Street	Residential	11	24	10.70
11a	Golf Course	Residential	38	84	36.95
11b	Golf Course	Residential	51	113	49.59
12	Knights of Meaford	Industrial		98	43.34
13	Legion	Residential	150	332	145.86
14	Loon Call	Residential	201	444	195.45
15a	Mac-Lands	Industrial/ Commercial		303	133.43
15b	Mac-Lands	Industrial/ Commercial		566	248.85
15c	Mac-Lands	Industrial/ Commercial		1,142	502.5
16	Meaford Haven	Residential	400	884	388.96
18a	Nelson Street East	Commercial/ Residential	45	99	43.76
18b	Sykes Street	Commercial/ Residential	52	115	50.56
20	PeopleCare ⁴	Commercial	275	608	267.41
21	Pinehurst	Residential	27	60	26.25
22	Plaza	Commercial/ Residential	20	44	19.45
24	School	Institutional		448	197.04
25	Skydevco	Commercial	54	119	52.51
25b	Skydevco	Residential	169	373	164.34
26	Terrace Wood	Residential	26	57	25.28
27	Trowbridge Street West	Commercial/ Residential	2	4	1.94
Total:			1,657	6,320	2,781

* Note: Flows for Industrial and Commercial areas calculated on a gross area basis at 28 m³/ha/d.

The number of units for planned developments are based on the development proposal, not based on assumed densities from Official Plan documentation. Unit assumptions are based on best available information at the time of writing this report and may not be final.

⁴ Residential PPU assumed as 1 for 128 units, and as 1.5 for 147 units.

Table 7 provides an average day wastewater flow estimate for of planned development areas and does not reflect any allocations or timing of any development.

In addition to the development planned within the urban area there are two developments outside of the urban boundary with potential for future connection to the Meaford collection and treatment systems. Information for development areas outside of the urban boundary is provided in **Table 8**.

Table 8 - Development Areas Outside of the Urban Boundary

	Identification	Designation	Units	Eq. Population	ADF Estimate (m ³ /d)
17	Meaford Highlands Resort	Industrial/ Commercial		N/A	N/A
19	Parkbridge	Unknown	1,000	2,210	972.40

5.4 Build-out of Infill and Intensification Areas

A map of potential growth areas was developed and is provided in **Figure 3**. The areas are within the urban area boundary of the Municipality and while current development plans are not existing for the sites, they are assumed to have long term development potential. The Municipality's Official Plan (OP) states that new development within the urban area shall be a minimum density of 20 units/ha, projections have been made for the infill and intensification areas on this basis.



Table 9 summarises the population and average day flow projections for the infill and intensification areas identified in **Figure 3**.

Table 9 - Wastewater Flows from Infill Areas

Identification	Designation	Area (ha)	Eq. Population	ADF Estimate (m ³ /d)
Existing Unserved	Residential		178	62.2
Infill	Residential		32	11.2
1-II	Residential	0.34	15	6.6
2-II	Residential	7.37	326	143.3
3-II	Residential	2.48	110	48.2
4-II	Residential	4.26	188	82.8
5-II	Residential	20.24	895	393.6
6-II	Residential	25.23	1,115	490.7
7-II	Residential	30.88	1,365	600.6
8-II	Residential	35.56	1,572	691.6
9-II	Residential	15.37	679	298.9
10-II	Residential	17.92	792	348.5
Total:		159.65	7,057	3,105

5.5 Build-out Wastewater Flow Summary

The total flow volume from the full build-out of the existing settlement area boundary is summarized in **Table 11**. Based on the estimated growth trends from the Hemson Report, the full build-out of the existing settlement area boundary will not be reached within the next 50 years, assuming development continues at a consistent pace.

Peak flows for new growth areas, and for infill and intensification areas are based on Harmon Peaking Factor. Harmon Peaking Factor for the new growth area population in the urban boundary of 6,320 is 3.1, peak factor for the infill area population of 7,057 is 3.1, peak factor for the new growth population outside the urban boundary of 2,210 is 3.6.

Table 10 - Wastewater Flow Summary for Build-out Development

	Population	Average Day Flow (m ³ /d)	Peak Day Flow (m ³ /d)
Existing System (2021)	5,078	2,734	12,623
New Growth Areas	6,320	2,781	8,758
Infill Areas	7,057	3,105	9,635
New Growth – Outside Urban Area	2,210	972	3,452
Total:	20,665	9,592	34,469

5.6 30-Year Wastewater Flow

An estimation of wastewater flow over time is provided in **Figure 4** and **Figure 5**. New development is estimated to proceed at a rate of 44.8 units/year, with 10% of all new units being constructed outside of the urban boundary and the catchment for the WWTP. New residential growth in the urban area is estimated at a rate of 40.3 units/year with an average occupancy of 2.21 person per unit. In addition, 26 new jobs per year are assumed with flow estimated using the Ontario Building Code assumption for an 8-hour work day in a factory with showers. On this basis, projected flow rate in the year 2054 is in the range of 3,694 - 4,309 m³/d. The low estimate assumes the 5-year minimum as the basis of projection and the high estimate assumed the 5-year maximum as the basis for projection. For the purpose of maintaining a conservative planning approach, the upper bound flow projection is carried forward. On this basis, average daily flows (ADF) will exceed the plant rated capacity in the year 2044.

Table 12 summarises the population and flow projections anticipated for 2054 based on the assumptions outlined herein. Plant data does not provide a basis for the projection of peak hour flows, a peak hourly peak factor of 4 is assumed. A peak instantaneous flow factor of 5 is assumed for the study period.

Table 11 - Wastewater Flow Projections for 2054

2054 Population	2054 Average Day Flow	2054 Peak Day Flow	2054 Peak Hour Flow	2054 Peak Inst. Flow
8,019	4,400 m ³ /d	17,000 m ³ /d	17,600 m ³ /d	22,000 m ³ /d

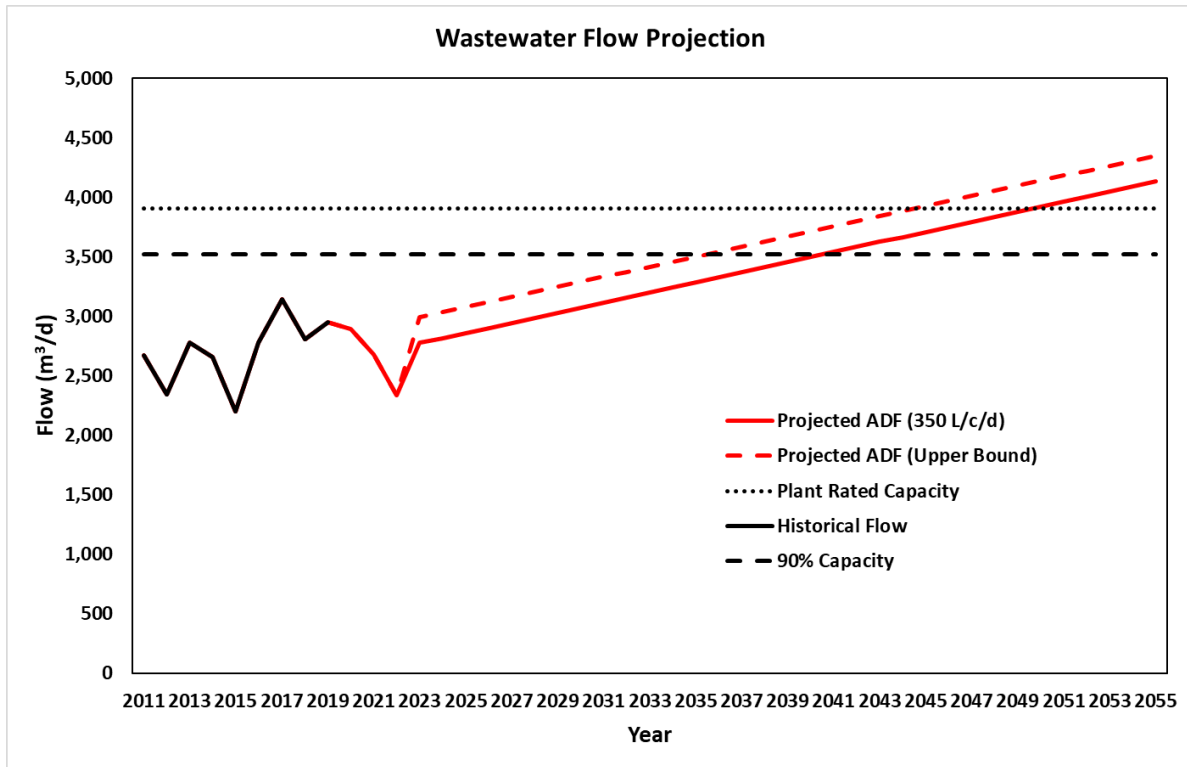


Figure 4 - Wastewater Flow Overtime Based on Growth Projection

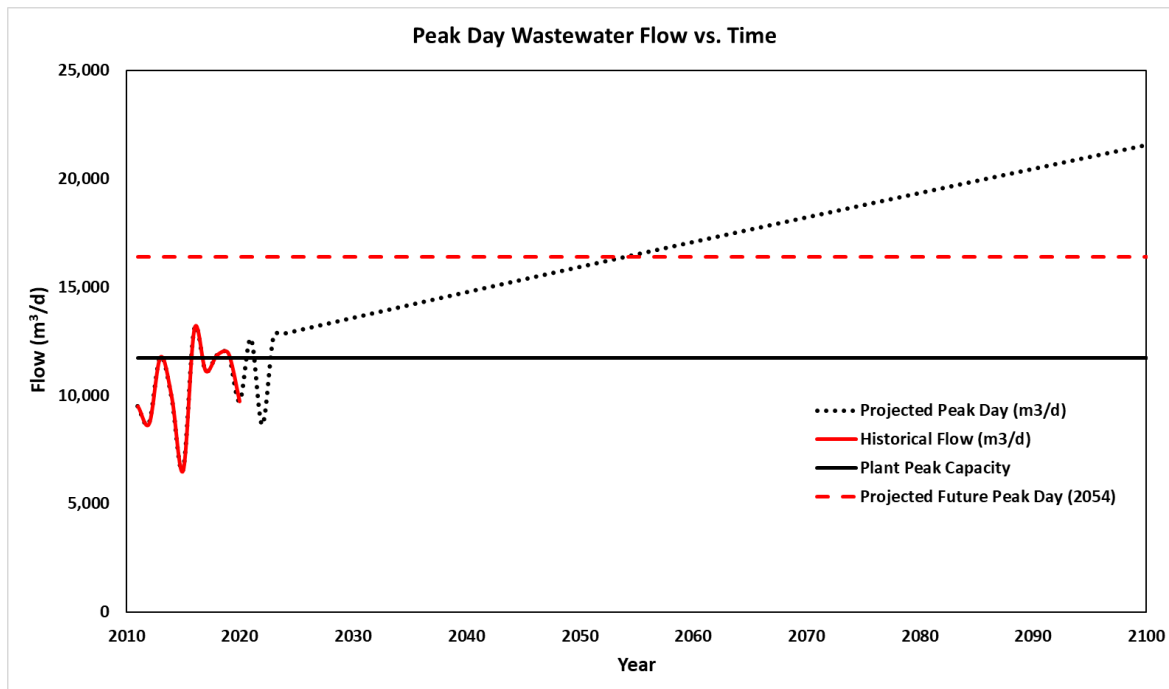


Figure 5 - Peak Day Wastewater Flow vs. Time Based on Growth Projection

6 Impact on Existing Infrastructure

6.1 ADF WPCP Flows

This section addresses the total wastewater flows from all of the existing developed areas currently serviced by the communal wastewater system in Meaford. Based on the projected pace of development the Meaford WWTP has sufficient ADF capacity until 2044 without any upgrades. The projected ADF in 2044 is 3,885 m³/d, slightly below the current plant capacity (shown in **Figure 6**).

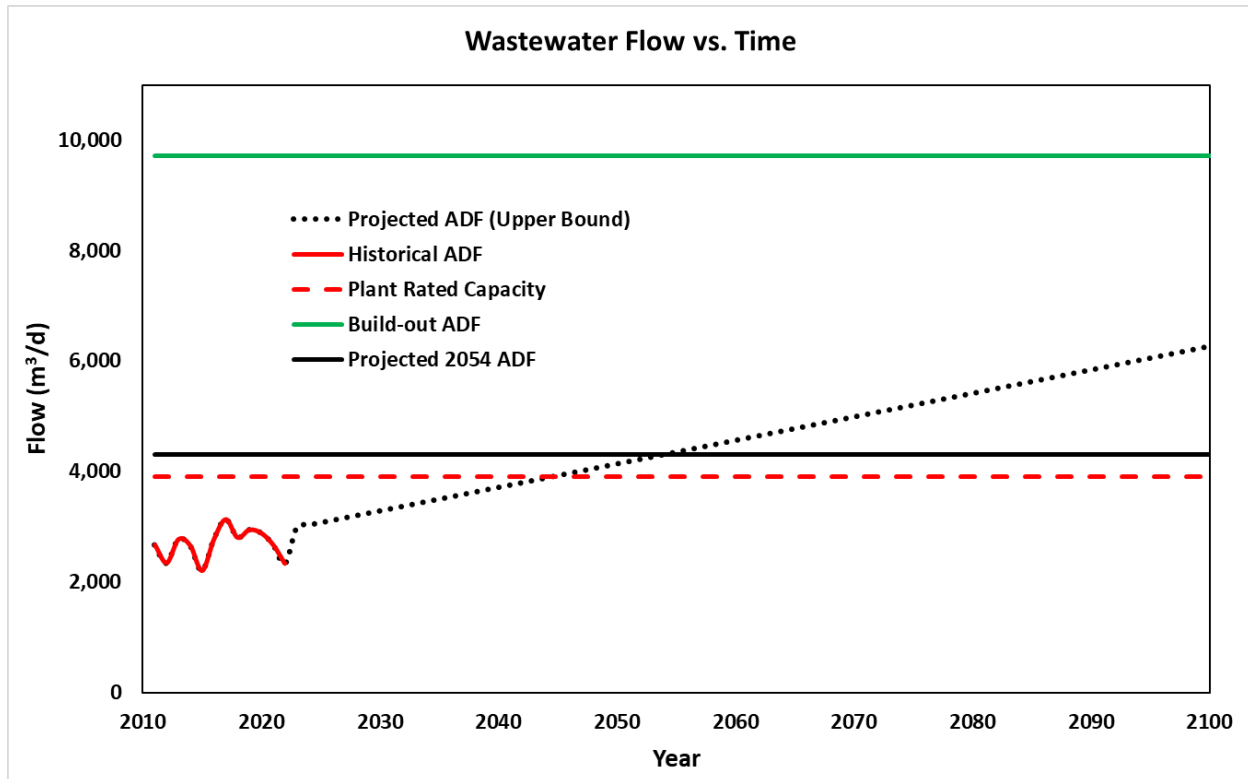


Figure 6 - Wastewater Average Day Flow Projection and WWTP Capacity

6.2 WPCP Peak Flows

While ADF flows to the WPCP are manageable and remain within the current rated capacity of the plant, the peak flows are a challenge for plant operation. The original design of the plant allowed for a peak flow factor of approximately 2.95 times the ADF and this factor is being exceeded, particularly during the spring freshet period. Currently the plant is operating, on average, at 70% of ADF capacity, however peak day flows have exceeded peak day capacity on numerous occasions since 2016. Peak day flow to the WWTP has varied between 3.4 – 4.7 times ADF. Peak instantaneous flows to the plant have reached as high at 6.7 times ADF.

7 Conclusions and Recommendations

This Technical Memorandum, prepared in support of the Meaford Wastewater Treatment Plant Environmental Assessment Amendment (Meaford WWTP Class EA), provides:

- A review of planning documentation.

- An overview of historical WWTP flows from the existing urban area wastewater collection system in Meaford.
- A comprehensive review of growth potential for the Municipality within the settlement area boundary to the year 2054.
- An assessment of the impact of future wastewater flows on the capacity of the WWTP.

This Technical Memorandum concludes the following:

- The Update to the County of Grey Growth Management Strategy (Hemson, 2021) is the best basis available for the projection of new residential units in the Municipality.
- The Hemson report projects 1,120 additional residential units within Meaford between 2021 and 2046, which equates to 44.8 new units per year.
- The Municipality of Meaford Official Plan identifies a split of 90%/10% new home construction between the urban and rural areas respectively.
- The density of development assumed for future development is 20 units/ha, based on the Municipality's Official Plan.
- Per the Municipality's Planning Department, the occupancy per housing unit is anticipated to remain at approximately 2.21 PPU as development proceeds.
- The existing wastewater flows indicate high rates of inflow and infiltration entering the collection system, with peak day flow ratios ranging between 3.4 – 4.7 over the review period between 2011-2022.
- Inflow and infiltration primarily impact the system primarily during the spring freshet period and has historically caused peak hour flows as high as 6.7 times ADF.
- The design parameters are proposed for future development flow estimation are provided in **Table 13**:

Table 12 - Flow assumptions for preliminary design

Parameter	Assumption
Residential Flow	350 L/c/d
Inflow and Infiltration	90 L/c/d
Industrial Flow	28 m ³ /ha/d
Commercial Flow	28 m ³ /ha/d
Job (Factory Employee)	125 L/shift
Peaking Factor	Harmon Formula

- The Municipality is currently engaged in efforts to reduce inflow and infiltration entering the collection system:
 - The Municipality is currently pursuing a project to redirect roof drains from the Sykes Street commercial area away from the sanitary collection system. Preliminary estimates suggest that an average day flow of 50 m³/d of inflow could be reduced, this would represent a dramatic decrease in peak flows during high rainfall days.

- Municipality is committed to inflow and infiltration reduction efforts; however, planning must proceed on the basis of actual conditions and consider the worst-case scenario that high I&I persists.
- A full accounting of planned development and potential for infill and intensification development was conducted and the preliminary design flow assumptions were applied; the resulting full build out flow projections are provided in **Table 14**:

Table 13 - Wastewater Flow Summary for Build-out Development

	Population	Average Day Flow (m ³ /d)	Peak Day Flow (m ³ /d)
Existing System (2021)	5,078	2,734	12,623
New Growth Areas	6,320	2,781	8,758
Infill Areas	7,057	3,105	9,635
New Growth – Outside Urban Area	2,210	972	3,452
Total:	20,665	9,592	34,469

- A total of 147.68 ha of new development area is identified within the existing settlement area.
- Projected flow at the end of the study period in 2054 is based on the rate of development projected by Hemson and the preliminary design factors. The projected flows are provided in **Table 15**:

Table 14 - Population and Flow Projections for 2054

2054 Population	2054 Average Day Flow	2054 Peak Day Flow	2054 Peak Hour Flow	2054 Peak Inst. Flow
8,019	4,400 m ³ /d	17,000 m ³ /d	17,600 m ³ /d	22,000 m ³ /d

- The full build-out of the existing settlement area boundary will not be reached within the next 50 years, assuming development continues at a consistent pace.
- Based on the projected pace of development the Meaford WWTP has sufficient ADF capacity until 2045 without any upgrades, assuming the ECA capacity is correct. The projected ADF in 2044 is 3,885 m³/d, slightly below the current plant capacity.
- The peak flows are currently above the capacity of the plant and will need to be actively managed through the Municipality's inflow and infiltration reduction efforts.