Appendix A

TM1A - WWTP Population and Flow Projections

The Regional Municipality of Waterloo

Wastewater Treatment Master Plan Update

Technical Memorandum No. 1A: Wastewater Treatment Plant Population and Flow Projections

Final

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Preparation and Review Log

Version	Date	Prepared by (Deliverable Lead)	QC Reviewer	Project Manager Sign-off
Draft v1	July 2016	S. Dong	E. Longworth	T. Briggs
Draft v2	November 2016	S. Dong	E. Longworth, T. Briggs	T. Briggs
Final	January 2017	S. Dong	E. Longworth	T. Briggs

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1. Introduction

1.1 Background

The Regional Municipality of Waterloo (the Region) is an upper tier municipal government, providing municipal services to seven lower-tier municipalities with a total population of approximately 550,000 people. The Region owns thirteen (13) wastewater treatment plants (WWTPs), one (1) wastewater residuals processing facility, six (6) wastewater pumping stations (with a seventh station planned for construction), and two wastewater collection systems (Ayr in the Township of North Dumfries and Wellesley in the Township of Wellesley), treating an approximate average of 66 million cubic meters annually. Wastewater facilities are operated and maintained by the Ontario Clean Water Agency (OCWA) under contract to the Region. Most of the collection systems and pumping station infrastructure that conveys wastewater to the Region's treatment facilities are owned, managed and operated by the area municipalities (City of Cambridge, City of Kitchener, City of Waterloo, Township of Wilmot, and Township of Woolwich).

The Region has experienced steady residential and industrial/commercial/ institutional (ICI) growth for many years, and anticipates this will continue as a result of factors such as a strong local economy, the Province of Ontario's Places to Grow (P2G) Act, and major Regional and Provincial transportation initiatives that are underway. The Region completed a Wastewater Treatment Master Plan (WWTMP) in 2007 (Earth Tech, 2007) to plan for future growth and provision of treatment capacity throughout the Region. Due to changing population growth patterns, wastewater flows, and environmental regulations, the Region is now updating the WWTMP. Among these factors, updating the population growth projections in the Region is a key objective for the updating the WWTMP.

CIMA Canada Inc. (CIMA) has been retained by the Region to update the 2007 Master Plan to develop a current, comprehensive, cost-effective and feasible strategy to address the anticipated wastewater treatment and disposal needs of the Region over the next 35 to 40-year planning periods in a manner consistent with the Region's Strategic Plan.

This Technical Memorandum (TM-1A) has been prepared to estimate population and flow projections to the year 2051 for all the Region-owned wastewater treatment facilities.

A separate Technical Memorandum (TM) No. 1B is being prepared separately to estimate population and flow projections to the year 2051 for all the Region-owned wastewater pumping stations.

1.2 Objectives

The objectives of this TM are to:

- Provide a review of service population projections to the year 2051 for each WWTP;
- Estimate wastewater flow projections to the year 2051 for each WWTP.

2. Methodology

The Region is subject to the population forecasting completed by the Provincial Government, and documented in the following reports:

- Places to Grow (P2G): Growth Plan for the Greater Golden Horseshoe, 2006, Office Consolidation, Ontario Ministry of Infrastructure, June 2013.
- Places to Grow Amendment 2 (P2GA2): Amendment 2 (2013) to the Growth Plan for the Greater Golden Horseshoe, 2006. Ontario Ministry of Infrastructure, 2013.

The following sections provide brief overviews of these documents as they relate to growth within the Region of Waterloo.

2.1 Places to Grow –The Growth Plan for the Greater Golden Horseshoe

This document was released by Ontario government in June 2006 to promote long term sustainable planning and growth in Ontario. The Growth Plan (Places to Grow – "P2G") applied to over 100 municipalities in the Greater Toronto Areas (including the Region of Waterloo) and provided directions for future growth to ensure that communities work towards sustainable growth by directing growth to areas where the capacity exists to best accommodate the expected population and employment growth. The plan strives to achieve sustainable growth that supports mixed-use design, public transportation and healthy community living within targeted communities.

P2G provided growth information in 5-year increments from the base year of 2006 to 2031. It forecasted 729,000 people and 366,000 jobs in the Region of Waterloo by the year 2031.

2.2 Greater Golden Horseshoe Growth Forecasts to 2041

This report was prepared by Hemson Consulting Ltd. In June 2013 to support the Ontario Ministry of Infrastructure proposed Amendment 2 to the Places to Grow – Growth Plan for the Greater Golden Horseshoe (P2G Amendment 2- "P2GA2"). Amendment 2 updated and extended the time horizon of the growth forecast to 2041 for single- and upper-tier municipalities in the Greater Golden Horseshoe.

The P2GA2 forecasted 742,000 people and 366,000 jobs in the Region of Waterloo by the year 2031; and 835,000 people and 404,000 jobs in the Region of Waterloo by the year 2041.

2.3 Moderate Growth Scenario

The P2G numbers developed by the Province of Ontario were utilized for planning within the Region's 2007 WWTMP Update. Based on observed growth and wastewater flows since the completion of the 2007 WWTMP, these P2G numbers are considered aggressive. As a result, the Region's Planning, Development & Legislative Services (Planning) Department developed growth projections based on the more moderate observed growth within the Region to support the development of infrastructure needs and capital budgets.

While primary infrastructure recommendations will be based on these moderate growth projections, as part of the current WWTMP Update, the Region will conduct a sensitivity analysis to determine infrastructure needs should the P2GA2 projections be realized in the future. It is proposed that infrastructure needs be determined using flow-based "triggers" such that when these flows are reached, regardless of the associated population, infrastructure projects are initiated as required.

The moderate growth population and flow projections were estimated using Regional population projections to 2041 and extrapolated to 2051, in order to facilitate the development of future servicing alternatives for each service area. The methodology used for the development of population and flow projections is described in greater detail in the following sections.

2.3.1 Population Projections

Population projections for the WWTPs were determined based on the population growth information provided by the Region's Development and Legislative Services Planning Department (Planning Department). The population data represents the residential population projections in 5-year increments from 2016 to 2041 for each wastewater treatment plant, including the East Side Lands (ESL) growth area. Population beyond 2041 was extrapolated based on the previous growth trend.

The Planning Department also provided ultimate build-out population for each WWTP, which was estimated based on population projections assuming all lands within the Countryside Line are ultimately developed. As set out in the Region's

Official Plan policy 2.B.1, the purpose of the Countryside Line is to contain future growth within the urban areas thereby protecting farmlands and sensitive natural areas from urban development - areas such as wetlands, woodlands and groundwater recharge locations.

For the purpose of population projections in this WWTMP Update project, the following assumptions were made based on the discussions with Regional Planning staff:

- For all the WWTPs, with the exception of Waterloo, Wellesley and St Jacobs:
  - The ultimate build-out populations and population projections between 2016 and 2041 were estimated based on the data provided by the Region's Planning Department.
- For Waterloo, the amount of greenfield land is limited within the urban boundary and there is a high potential for intensification, therefore, no build-out population is provided for this service area.
- For Wellesley and St Jacobs, the population forecasts from the Townships were higher than the Townships have land to accommodate within the settlement areas. For this reason, projections indicate populations greater than the build-out populations of the settlement area and therefore build-out populations were not used for these two communities.
- For the ESLs,
  - The ultimate population was estimated based on the data provided by the East Side Lands Wastewater Servicing Class Environmental Assessment (referred to as the ESL Class EA) (Associated Engineering, 2015).
  - The population projections from 2016 to 2041 were provided by the Region's Planning Department. Population beyond 2041 was extrapolated based on the previous growth trend.

2.3.2 WWTP Flow Projections

The projected average day wastewater flows to 2051 for each wastewater service area/WWTP were estimated based on the population growth projections provided by the Region and the average per capita flows derived from the Region's Water and Wastewater Monitoring Report (WWWMR), to provide an indication of the wastewater

treatment requirements in the future. As the flow rates approach 85% of plant rated capacity, the planning process for plant expansion should be triggered (i.e. Class Environment Assessment) (MOECC, 1995).

It should be noted that the historic average per capita flow is a conservative value based on the Region's observed historical flows, which includes wastewater discharges from residential, industrial, commercial and institutional (ICI), and extraneous flows such as infiltration and inflow (I/I). If additional water conservation and I&I corrective programs are implemented and effective, lower future wastewater flows may occur.

In addition, it is assumed that the ICI to residential flow ratio in the future will be similar to the current ratio in each service area. This approach was considered the best suited based on currently available information and the level of detail for a master planning process.

For the ESLs area, flows were calculated using detailed population projections developed through the ESL Class EA process, incorporating residential, and ICI population projections and flows separately. These projections were used to develop an average per capita flow rate for future flow projections. The calculated average is based on the equivalent residential population (i.e. forecasted residential population x average per capita flow = forecasted flows based on ESL Class EA). As it is thought that the majority of ICI growth within the Region will be within the ESLs, the methodology for this area is appropriate to ensure that the greater ICI growth is captured in the future projections.

A summary of the historic 5-year average per capita flows, along with the existing ADFs and population, are presented in Table 1. It is noted that Galt, Preston, St Jacobs and Elmira have higher per capita flow rates, which may be attributed to additional contribution from industrial flows and/or historical I&I issues experienced at these WWTPs.

Table 1 Average Per Capita Flows (2011-2015)

WWTP Service Area	Existing Flow (Average 2011-2015) (m^3/d) (1)	Existing Population (2015) (1)	5-Year Average Per Capita Flow ($m^3/cap/d$) (1)
Kitchener	68,772	237,417	0.2961
Waterloo	44,569	137,322	0.3304
Galt	34,238	86,070	0.4051
Preston	8,859	20,722	0.4327
Hespeler	6,981	25,759	0.2752
Ayr	1,289	4,952	0.2742
Baden/New Hamburg	3,644	12,978	0.2926
Wellesley	742	3,353	0.2332
St Jacobs	914	1,912	0.4970
Elmira	4,197	10,025	0.4272
East Side Lands (ESL)	-	-	0.5786 (2)

Notes:

1. Based on the Region's 2016 Water and Wastewater Monitoring Report (RMOW, 2016).
2. Based on the ESL Class EA average daily residential and industrial flows plus extraneous (I/I) flows, which is assumed to equal to 20% of calculated average daily flows (Associated Engineering, 2015)

2.3.3 Sensitivity Analysis

The moderate scenario population and flow projections will be used for developing alternatives and making primary infrastructure recommendations as part of the current WWTMP Update. During the development of alternatives, a sensitivity analysis will be conducted to determine infrastructure needs by looking at variations in the projections should the P2GA2 projections or trends such as improved water efficiencies and conservation efforts be realized in the future.

3. Population and Flow Projections

This section provides a review of population and flow projections for each WWTP service area within the Region.

3.1 Kitchener WWTP

3.1.1 Facility Overview

The Kitchener WWTP is a conventional activated sludge plant that provides treatment for wastewater generated in the City of Kitchener. The plant is currently operated under Ontario Ministry of the Environment and Climate Changes (MOECC) Environmental Compliance Approval (ECA) No. 0102-9RDM5C issued on February 4, 2015. The Kitchener WWTP has a rated ADF capacity of 122,745 m^3/d.

The existing treatment processes include screening, grit removal, primary clarification, aeration, secondary clarification and UV disinfection prior to discharge to the Grand River. Raw sludge is anaerobically digested, dewatered via centrifuges at a nearby Manitou Drive Biosolids Dewatering Facility, before haulage off-site.

The Kitchener WWTP is currently in the process of upgrades to provide reliable and efficient operation and improved effluent quality with full nitrification and tertiary treatment. The rated capacity of the plant will remain 122,745 m^3/d.

3.1.2 Population Projections

The projected residential service population for the Kitchener WWTP to 2051 is shown in Figure 1. The service area population will increase from approximately 242,626 in 2016 to 348,358 in 2051 for the Kitchener WWTP, with an ultimate build-out population of 378,154.

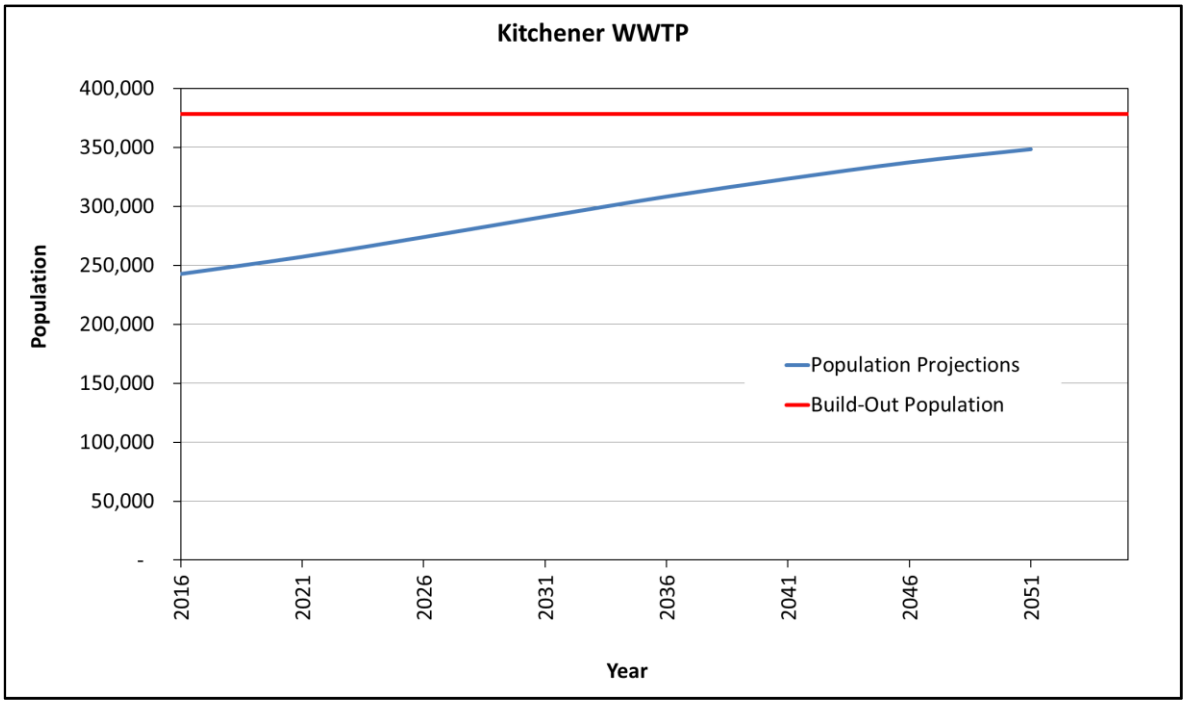

Figure 1 Population Projections for the Kitchener WWTP

3.1.3 Flow Projections

The projected ADF to the Kitchener WWTP to 2051, based on population and an average per capita flow of 0.2961 m^3/cap/d derived from the Region's WWWMR, are shown in Figure 2.

The projected ADF in 2051 is below the rated capacity for the Kitchener WWTP, at approximately 84% of the rated capacity. This suggests that the existing plant will have sufficient capacity to handle the projected ADF over the next 35 years and satisfy the existing effluent limits and objectives. It is also noted that the build-out capacity of 111,971 m^3/d is less than the rated capacity of the plant, however, the flows generated in the ESL growth area (discussed later in Section 11.1) will ultimately be treated at the Kitchener WWTP, and therefore, some of this capacity will be utilized for these flows.

Figure 3 shows the projected ADF to the Kitchener WWTP to 2051, including the flows that will be generated within the ESL growth area. This figure shows that there is sufficient capacity at the Kitchener WWTP, including the forecasted ESL flows, to beyond the year 2051. By about the year 2044, the ADF to the Kitchener WWTP, including the ESL growth area, will reach 85% of the rated capacity.

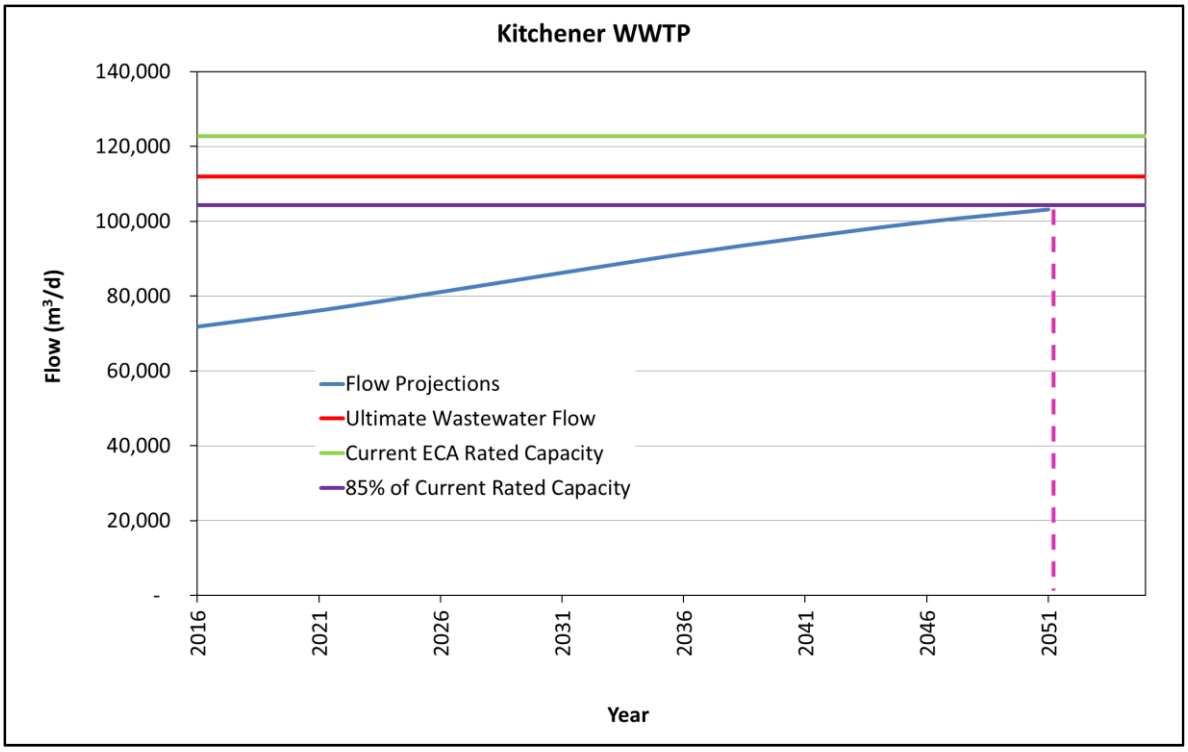

Figure 2 Flow Projections to the Kitchener WWTP (not including East Side Lands)

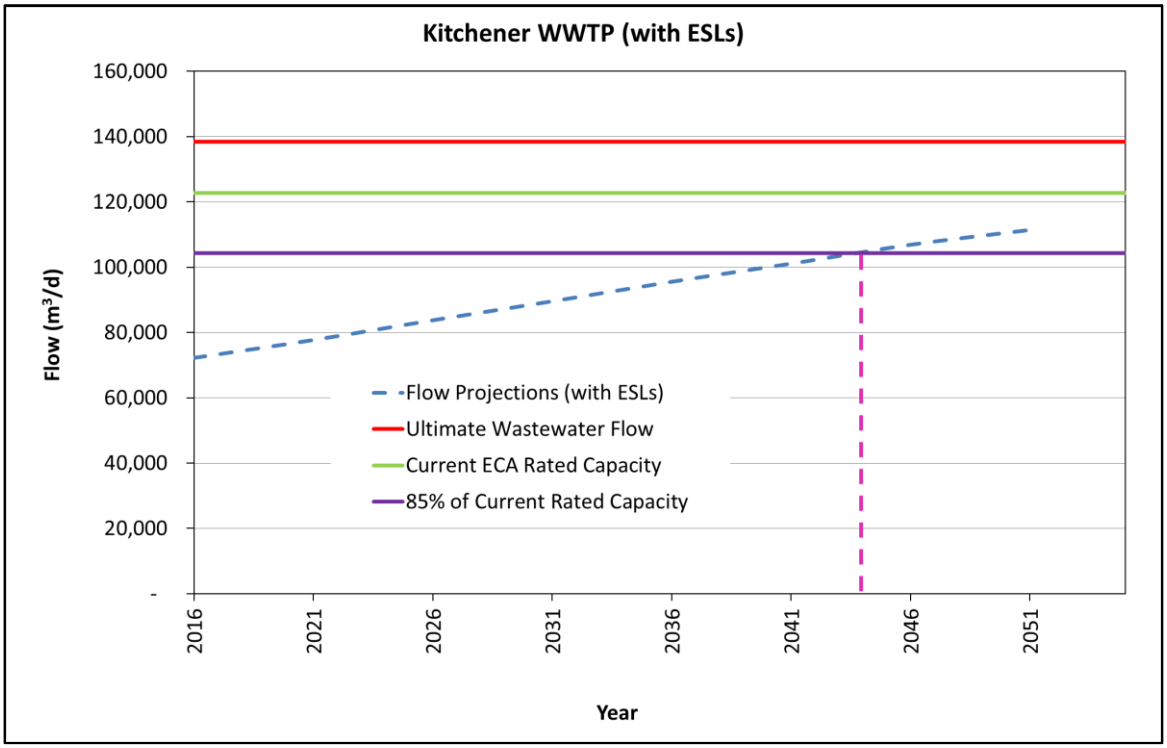

Figure 3 Flow Projections to the Kitchener WWTP (including East Side Lands)

3.1.4 Summary

The estimated population and flow projections to be used in the development of alternatives for wastewater treatment for the Kitchener WWTP are summarized in Table 2.

Table 2 Kitchener WWTP Projected Wastewater Flows (excluding ESL)

Parameters	2016	2021	2026	2031	2036	2041	2046	2051	Build-Out
Population	242,626	257,162	273,850	291,211	308,186	323,356	337,207	348,358	378,154
Flow (ADF) (m^3/d)	71,842	76,146	81,087	86,228	91,254	95,746	99,847	103,149	111,971

Table 3 Kitchener WWTP Projected Wastewater Flows (including ESL)

Parameters	2016	2021	2026	2031	2036	2041	2046	2051	Build-Out
Population	243,254	259,823	278,434	296,964	315,599	332,595	349,389	362,655	423,887
Flow (ADF) (m^3/d)	72,205	77,685	83,739	89,556	95,543	101,091	106,895	111,421	138,433

3.2 Waterloo WWTP

3.2.1 Facility Overview

The Waterloo WWTP is a conventional activated sludge plant that provides treatment for wastewater generated in the City of Waterloo. The plant is currently operated under MOECC ECA No. 9354-8J4PUE issued on January 25, 2012. The plant has an existing ECA approved hydraulic capacity of 72,730 m^3/d, with a rated average day treatment capacity of 57,500 m^3/d. Currently, the Region is completing upgrades that will provide the plant with the capacity to provide full year-round nitrification at the 57,500 m^3/d capacity.

The existing treatment processes include screening, grit removal, primary clarification, aeration, secondary clarification and UV disinfection prior to discharge to the Grand River. Raw sludge and mechanically thickened waste activated sludge (WAS) are anaerobically digested, and dewatered via centrifuges, before haulage off-site.

3.2.2 Population Projections

The projected residential service population for the Waterloo WWTP to 2051 is shown in Figure 4. The service population will increase from approximately 139,527 in 2016 to 181,219 in 2051 for the Waterloo WWTP. As previously described, there is no build-out population for the Waterloo WWTP service area (refer to Section 2.3.1).

3.2.3 Flow Projection

The projected ADF to the Waterloo WWTP to 2051, based on population and an average per capita flow of 0.3340 m^3/cap/d derived from the Region's WWWMR, are shown in Figure 5.

The projected ADF in 2051 exceeds the existing ECA rated capacity for the Waterloo WWTP, suggesting that additional capacity will be required within the next 35 years. By about the year 2020, the ADF to the Waterloo WWTP will reach 85% of the installed capacity of 57,500 m^3/d based on maintaining current per capita flows of 0.3340 m^3/cap/d for future growth.

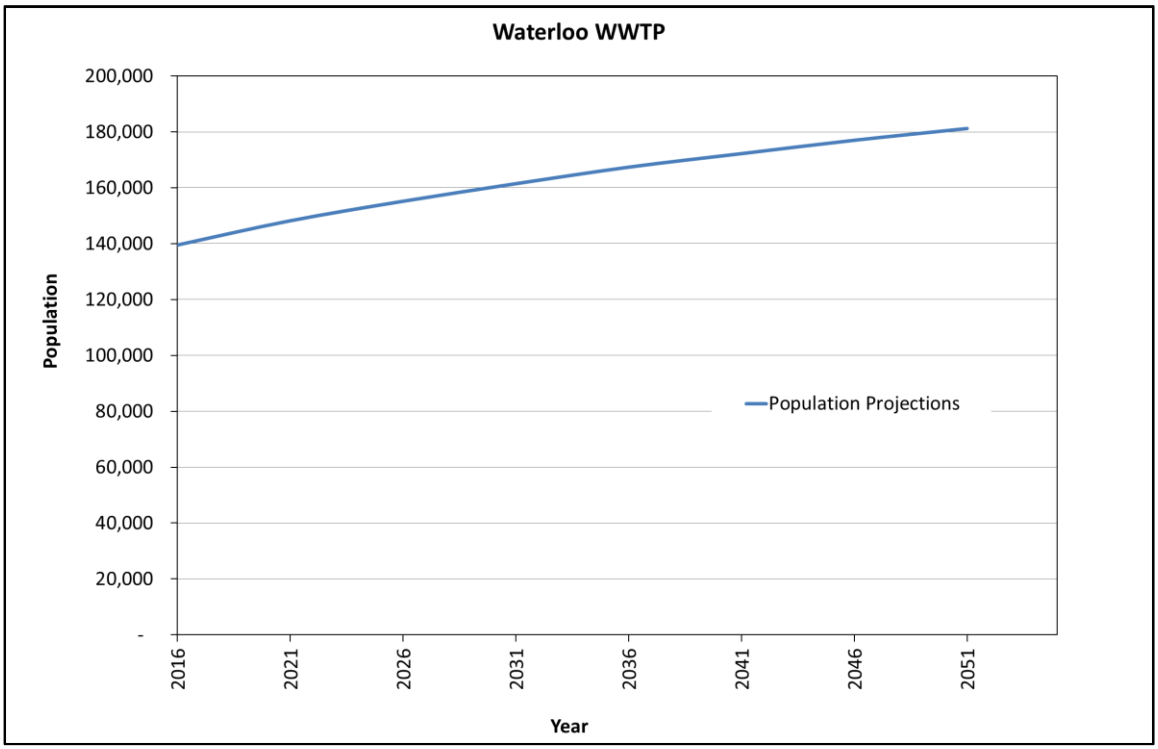

Figure 4 Population Projections for the Waterloo WWTP

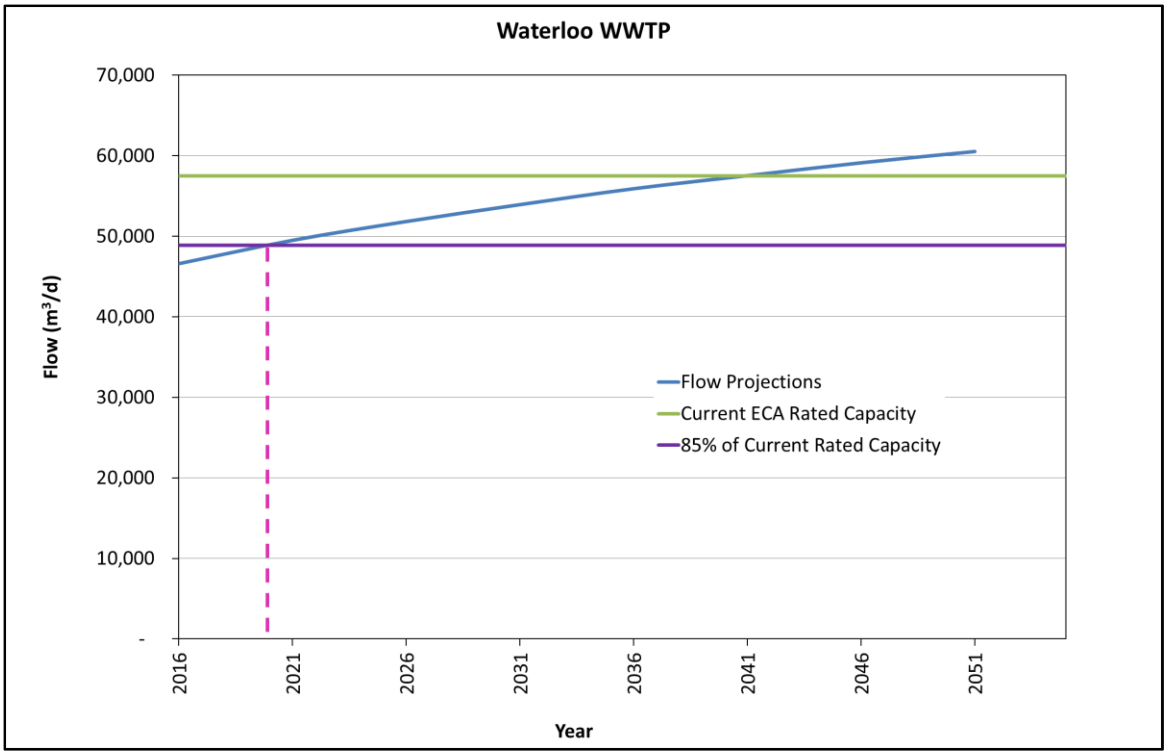

Figure 5 Flow Projections to the Waterloo WWTP

3.2.4 Summary

The estimated population and flow projections to be used in the development of alternatives for wastewater treatment for the Waterloo WWTP are summarized in Table 4.

Table 4 Waterloo WWTP Projected Wastewater Flows

Parameters	2016	2021	2026	2031	2036	2041	2046	2051	Build-Out
Population	139,527	148,197	155,182	161,469	167,384	172,235	177,011	181,219	-
Flow (ADF) (m^3/d)	46,602	49,498	51,831	53,931	55,906	57,526	59,122	60,527	-

3.3 Galt WWTP

3.3.1 Facility Overview

The Galt WWTP is a conventional activated sludge plant that provides treatment for wastewater generated from a portion of the City of Cambridge. The plant is operated under MOECC ECA No. 2567-8ZEHYF issued on January 14, 2013. The Galt WWTP

has a Stage 1 rated ADF capacity of 56,800 m^3/d. The ECA also allows for a future Stage 2 rated ADF capacity of 76,000 m^3/d.

The existing treatment processes include screening, aerated grit removal, primary clarification, aeration, secondary clarification, tertiary filtration and UV disinfection prior to discharge to the Grand River. Raw sludge and mechanically thickened WAS are anaerobically digested, and dewatered via centrifuges, before haulage off-site for disposal.

3.3.2 Population Projections

The projected residential service population for the Galt WWTP to 2051 is shown in Figure 6. The service population will increase from approximately 89,236 in 2016 to 120,984 in 2051 for the Galt WWTP, with an ultimate build-out population of 143,346.

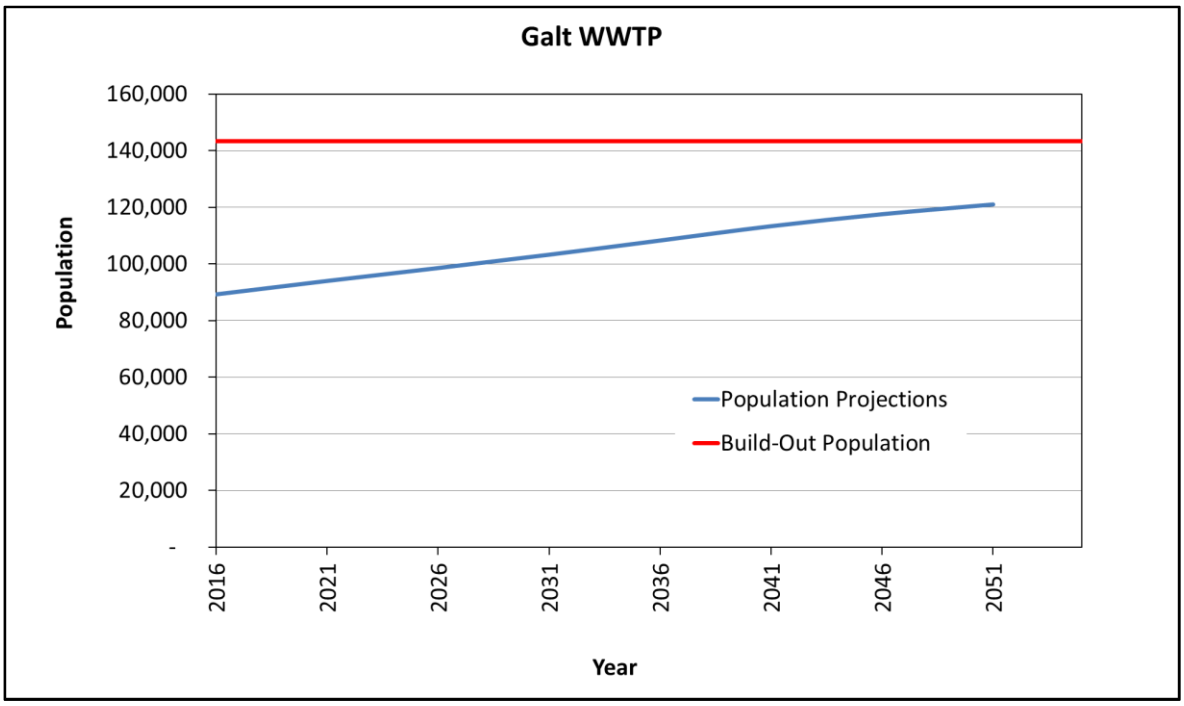

Figure 6 Population Projections for the Galt WWTP

3.3.3 Flow Projections

The projected ADF to the Galt WWTP to 2051, based on population and an average per capita flow of 0.4051 m^3/cap/d derived from the Region's WWWMR, are shown in Figure 7. The higher average per capita flow may be attributed to the higher

industrial contributions within this service area, including the Industrial Road Service Area (IRSA).

The 2051 projected ADF is approximately 86% of the Stage 1 rated capacity. By about the year 2048, the ADF to the Galt WWTP will reach 85% of the Stage 1 rated capacity, based on maintaining current per capita flows of 0.4051 m^3/cap/d for future growth.

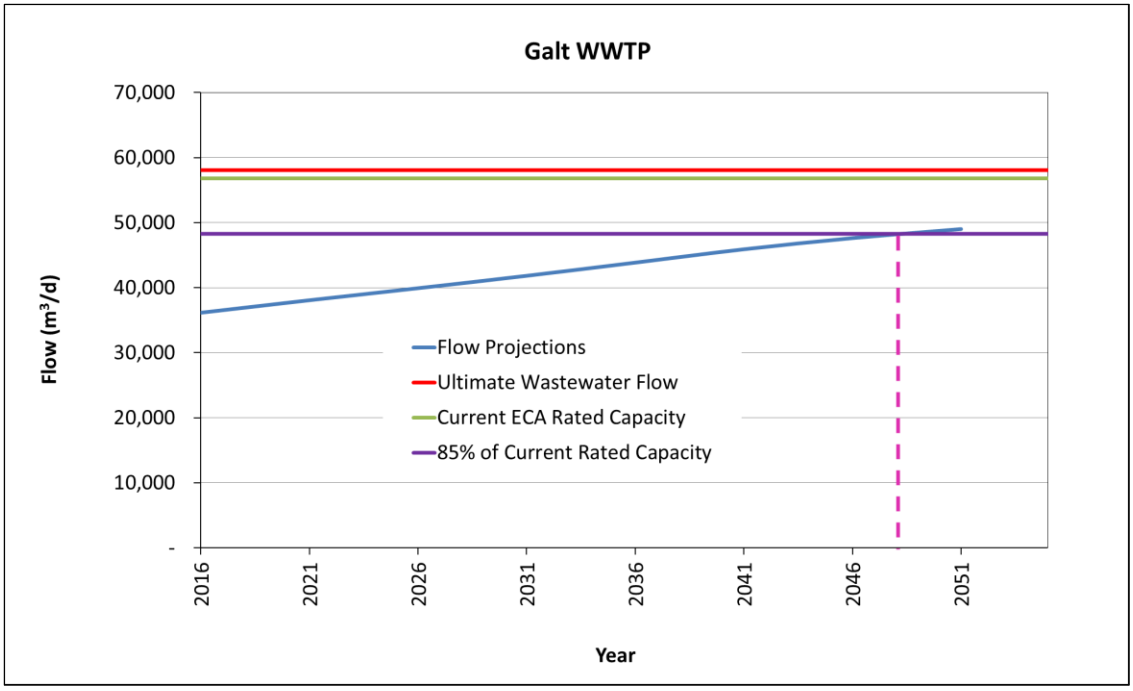

Figure 7 Flow Projections to the Galt WWTP

3.3.4 Summary

The estimated population and flow projections to be used in the development of alternatives for wastewater treatment for the Galt WWTP are summarized in Table 5.

Table 5 Galt WWTP Projected Wastewater Flows

Parameters	2016	2021	2026	2031	2036	2041	2046	2051	Build-Out
Population	89,236	93,974	98,536	103,249	108,251	113,307	117,543	120,984	143,346
Flow (ADF) (m^3/d)	36,150	38,069	39,917	41,826	43,852	45,901	47,617	49,011	58,069

3.4 Preston WWTP

3.4.1 Facility Overview

The Preston WWTP is a conventional activated sludge plant that provides treatment for wastewater generated from a portion of the City of Cambridge. The plant is currently operated under MOECC ECA No. 2526-96VJBA issued on June 27, 2013. The plant has a rated ADF capacity of 16,860 m^3/d.

The existing unit treatment processes include screening, vortex grit removal, primary clarification, aeration, secondary clarification and UV disinfection prior to discharge to the Grand River. Co-thickened WAS and raw sludge is anaerobically digested and hauled for dewatering at the Galt WWTP.

3.4.2 Population Projections

The projected residential service population for the Preston WWTP to 2051 is shown in Figure 8. The service population will increase from approximately 21,961 in 2016 to 27,477 in 2051 for the Preston WWTP, with an ultimate build-out population of 29,275.

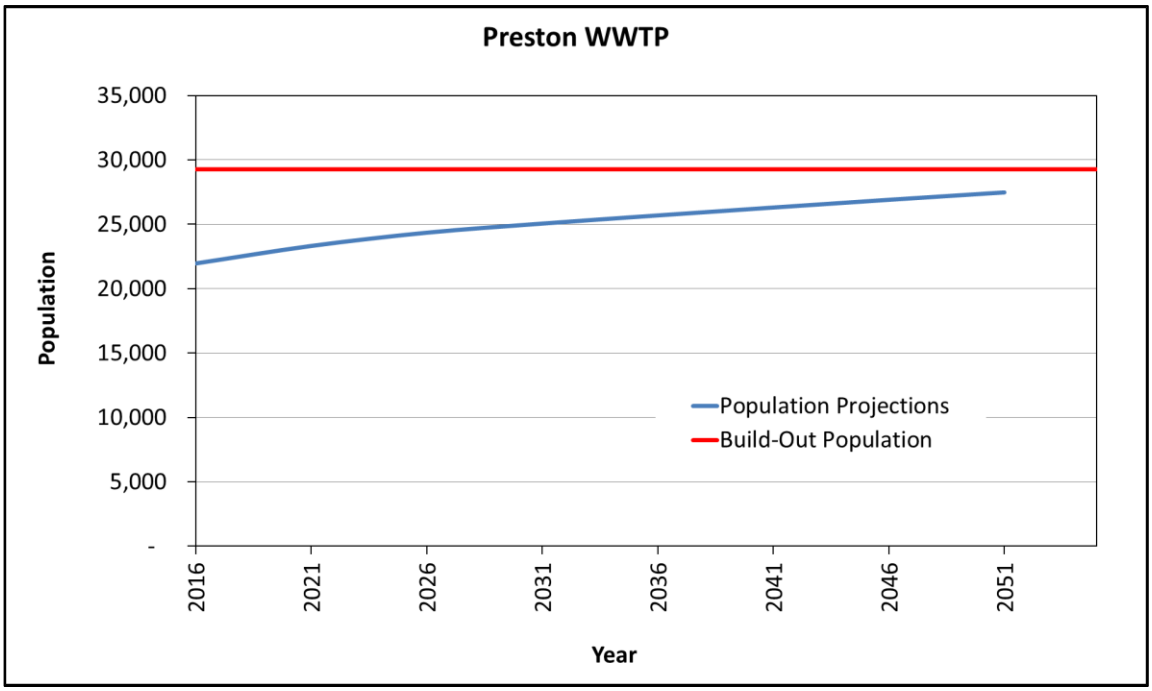

Figure 8 Population Projections for the Preston WWTP

3.4.3 Flow Projections

The projected ADF to the Preston WWTP to 2051, based on population and an average per capita flow of 0.4327 m^3/cap/d derived from the Region's WWWMR, are shown in Figure 9.

The projected ADF in 2051 is well below the rated capacity for the Preston WWTP, at approximately 70% of the rated capacity. The available capacity is a result of the diversion of the IRSA flows from the Preston WWTP to the Galt WWTP in 2012. With the diversion of these flows, additional spare capacity at the Preston WWTP could potentially be used for flows from the ESL growth area in the interim, until ESL flows are ultimately diverted to the Kitchener WWTP (refer to Section 3.11).

Figure 9 shows two projections - one with ESL and one without. When the 85% trigger is reached including flows from the ESL, this would initiate the transfer of the ESL flow to the Kitchener WWTP, estimated to occur in approximately 2032. Without the ESL, projections suggest that the existing plant will have sufficient capacity to handle the projected ADF over the next 35 years and satisfy the existing effluent limits and objectives.

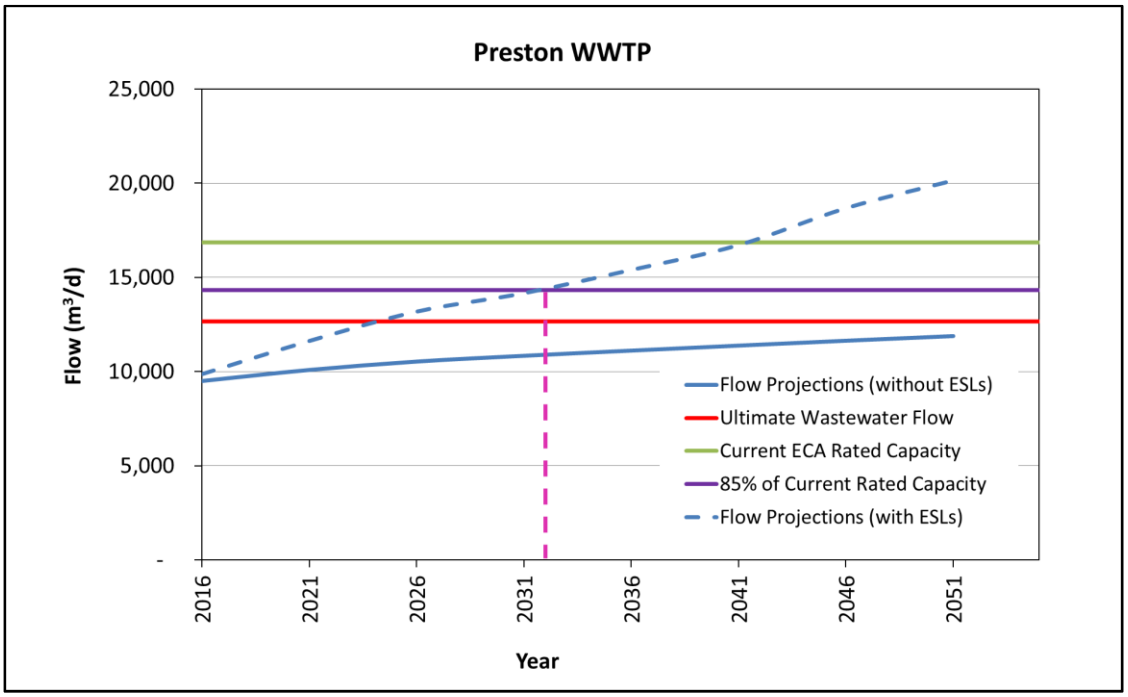

Figure 9 Flow Projections to the Preston WWTP

3.4.4 Summary

The estimated population and flow projections to be used in the development of wastewater treatment alternatives for the Preston WWTP are summarized in Table 6.

Table 6 Preston WWTP Projected Wastewater Flows (excluding ESL)

Parameters	2016	2021	2026	2031	2036	2041	2046	2051	Build-Out
Population	21,961	23,319	24,349	25,056	25,692	26,306	26,905	27,477	29,275
Flow (ADF) (m^3/d)	9,503	10,090	10,536	10,842	11,117	11,383	11,642	11,889	12,667

3.5 Hespeler WWTP

3.5.1 Facility Overview

The Hespeler WWTP is an extended aeration plant that provides treatment for wastewater generated from a portion of the City of Cambridge. The plant is currently operated under MOECC ECA No. 5631-7YZMCQ issued on January 22, 2010, with a rated ADF capacity of 9,320 m^3/d.

The existing unit treatment processes include aerated grit removal, aeration, secondary clarification, sodium hypochlorite disinfection and dechlorination prior to discharge to the Speed River. Waste activated sludge produced at the plant is sent to an aerated sludge holding tank where it is gravity thickened and trucked to the Kitchener or Galt WWTP for further treatment.

3.5.2 Population Projections

The projected residential service population for the Hespeler WWTP to 2051 is shown in Figure 10. The service population will increase from approximately 25,722 in 2016 to 35,984 in 2051 for the Hespeler WWTP, with an ultimate build-out population of 42,670.

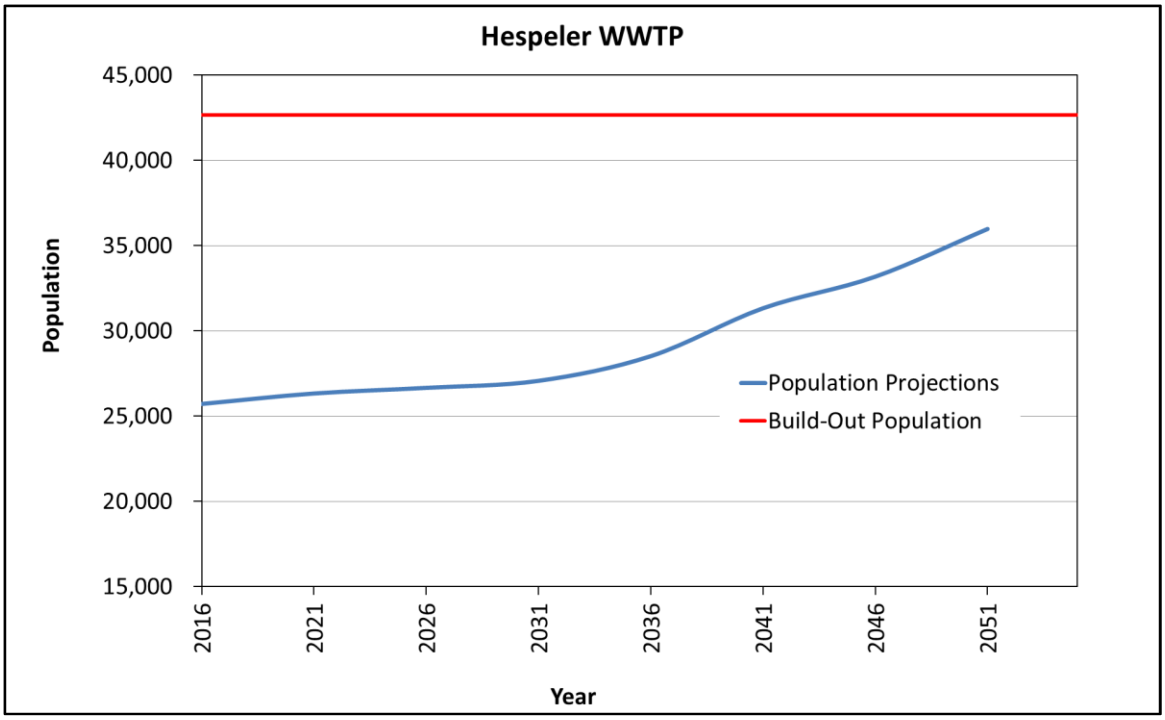

Figure 10 Population Projections for the Hespeler WWTP

3.5.3 Flow Projections

The projected ADF to the Hespeler WWTP to 2051, based on population and an average per capita flow of 0.2752 m^3/cap/d derived from the Region's WWWMR, are shown in Figure 11.

It is anticipated that the projected ADF in 2051 will exceed the rated capacity of the Hespeler WWTP. By about the year 2036, the ADF to the Hespeler WWTP will reach 85% of the rated capacity, based on maintaining current per capita flows of 0.2752 m^3/cap/d for future growth.

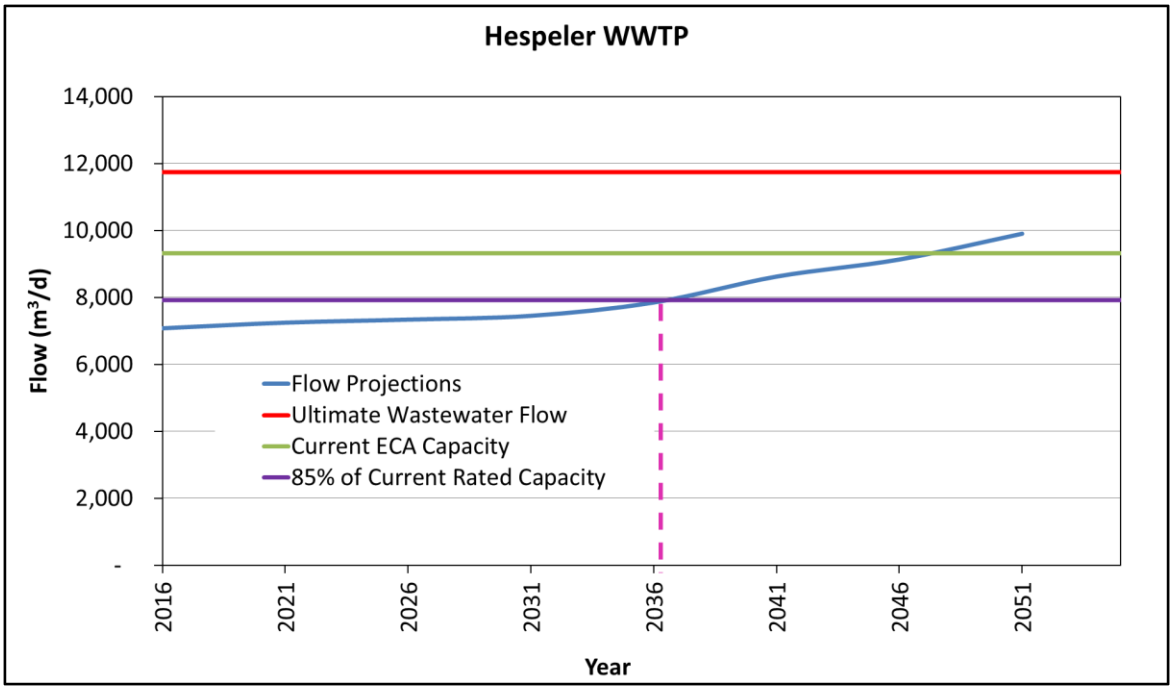

Figure 11 Flow Projections to the Hespeler WWTP

3.5.4 Summary

The estimated population and flow projections to be used in the development of alternatives for wastewater treatment for the Hespeler WWTP are summarized in Table 7.

Table 7 Hespeler WWTP Projected Wastewater Flows

Parameters	2016	2021	2026	2031	2036	2041	2046	2051	Build-Out
Population	25,722	26,336	26,665	27,077	28,523	31,333	33,188	35,984	42,670
Flow (ADF) (m^3/d)	7,079	7,248	7,338	7,452	7,850	8,623	9,133	9,903	11,743

3.6 Ayr WWTP

3.6.1 Facility Overview

The Ayr WWTP is an extended aeration package plant that provides treatment for wastewater generated in the Village of Ayr in the Township of North Dumfries. The plant is currently operated under MOECC ECA No. 4800-6GMFXG issued on October 20, 2005, with a rated ADF capacity of 3,000 m^3/d.

The existing unit treatment processes include screening, aerated grit removal, aeration, secondary clarification, tertiary filtration and UV disinfection prior to discharge to the Nith River. Waste activated sludge is aerobically digested, with liquid digested sludge stored on-site prior to land application.

3.6.2 Population Projections

The projected residential service population for the Ayr WWTP to 2051 is shown in Figure 12. The service population will increase from approximately 5,198 in 2016 to 10,064 in 2051, with an ultimate build-out population of 12,623.

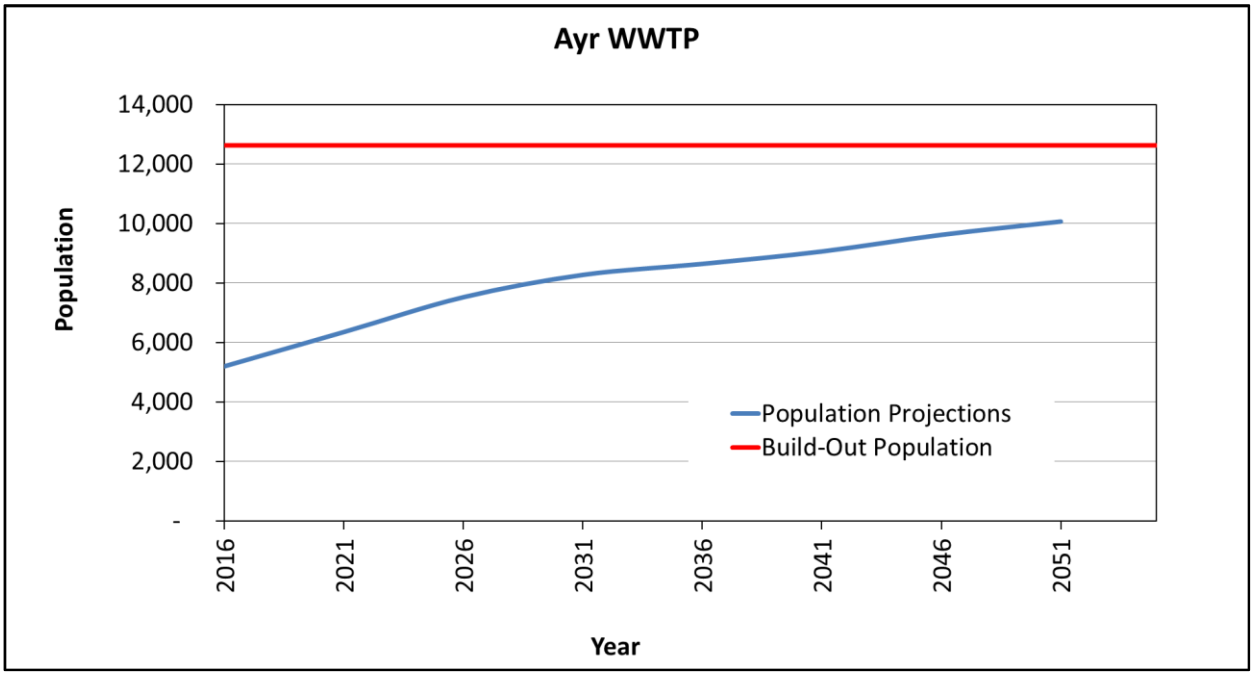

Figure 12 Population Projections for the Ayr WWTP

3.6.3 Flow Projections

The projected ADF to the Ayr WWTP to 2051, based on population and an average per capita flow of 0.2742 m^3/cap/d derived from the Region's WWWMR, are shown in Figure 13.

The projected ADF in 2051 is approximately 92% of the current rated capacity. Based on maintaining the average per capita flow of 0.2742 m^3/cap/d, flows to the Ayr WWTP will reach approximately 85% of its current rated capacity by 2043.

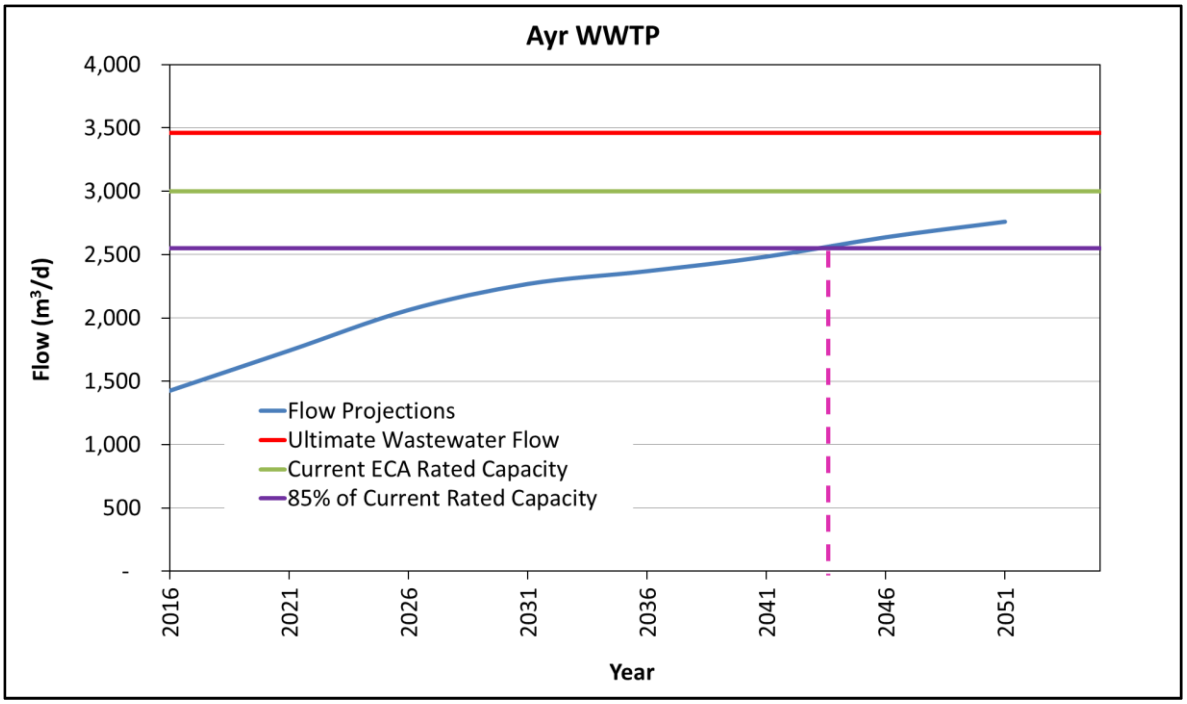

Figure 13 Flow Projections to the Ayr WWTP

3.6.4 Summary

The estimated population and flow projections to be used in the development of alternatives for wastewater treatment for the Ayr WWTP are summarized in Table 8.

Table 8 Ayr WWTP Projected Wastewater Flows

Parameters	2016	2021	2026	2031	2036	2041	2046	2051	Build-Out
Population	5,198	6,351	7,520	8,271	8,640	9,058	9,617	10,064	12,623
Flow (ADF) (m^3/d)	1,425	1,741	2,062	2,268	2,369	2,484	2,637	2,760	3,461

3.7 New Hamburg WWTP

3.7.1 Facility Overview

The New Hamburg WWTP is a sequencing batch reactor (SBR) activated sludge facility that provides treatment for wastewater generated in the communities of Baden and New Hamburg in the Township of Wilmot. The plant is operated under MOECC ECA No. 9330-6G9K5B issued on November 22, 2005, and has a rated ADF capacity of 5,200 m^3/d.

The existing unit treatment processes consist of screening, vortex grit removal, SBR secondary treatment, tertiary sand filtration and UV disinfection prior to discharge to the Nith River. Sludge from the SBRs is pumped to the aerobic digesters for stabilization. Biosolids is transferred to a stabilized sludge storage lagoon and subsequently used in agriculture.

Currently, the Region is completing detailed design for the Phase 2 expansion, which will increase the existing rated ADF capacity from 5,200 m^3/d to 6,900 m^3/d. For the purpose of this TM, plant capacity is based on the Phase 2 upgraded plant, as these upgrades will be constructed within the next 3 years.

3.7.2 Population Projections

The projected residential service population for the New Hamburg WWTP to 2051 is shown in Figure 14. The service population will increase from approximately 14,574 in 2016 to 23,475 in 2051 for the New Hamburg WWTP, with an ultimate build-out population of 28,425.

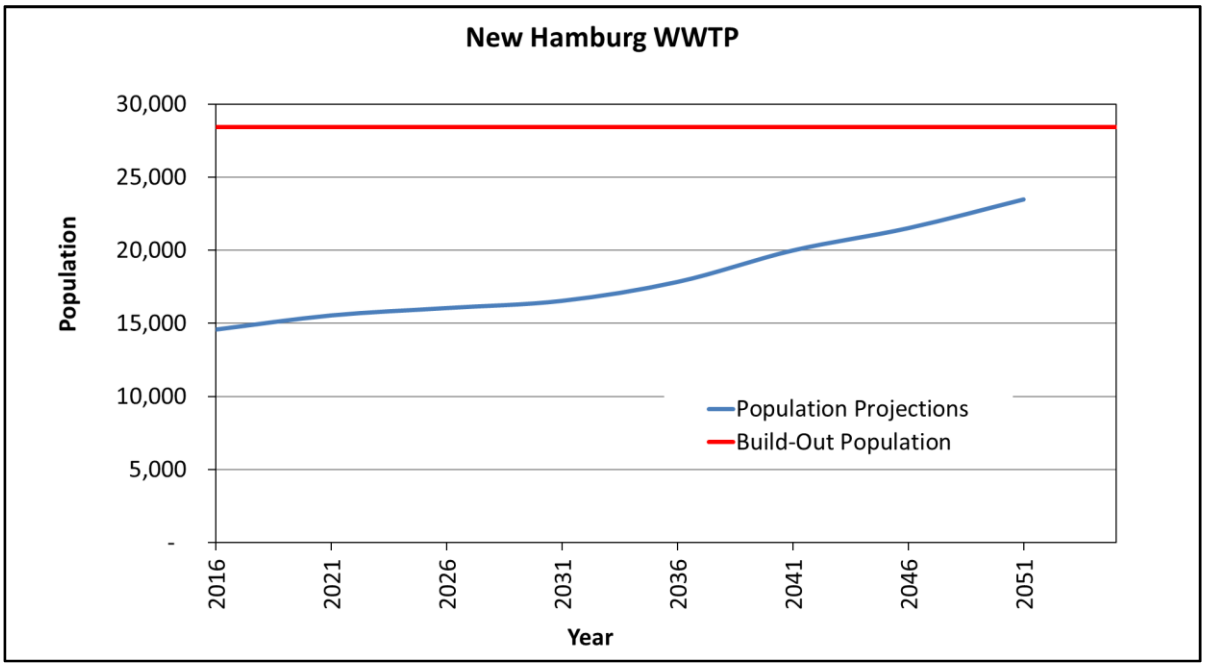

Figure 14 Population Projections for the New Hamburg WWTP

3.7.3 Flow Projections

The projected ADF to the New Hamburg WWTP to 2051, based on population and an average per capita flow of 0.2926 m^3/cap/d derived from the Region's WWWMR, are shown in Figure 15.

The projected ADF in 2051 will reach the rated capacity of the 6,900 m^3/d for the Phase 2 expanded New Hamburg WWTP. By about the year 2041, the ADF to the New Hamburg WWTP will reach 85% of the expanded capacity of 6,900 m^3/d based on maintaining current per capita flows for future growth.

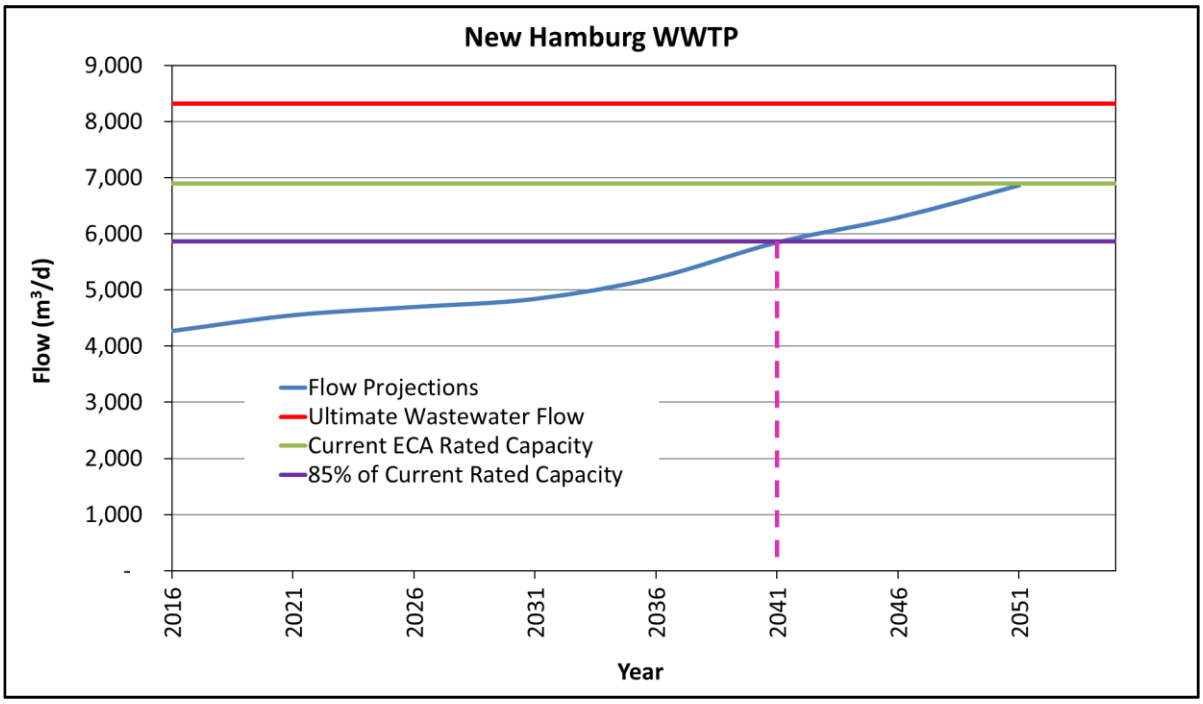

Figure 15 Flow Projections to the New Hamburg WWTP

3.7.4 Summary

The estimated population and flow projections used in the development of alternatives for wastewater treatment for the Baden/New Hamburg WWTP are summarized in Table 9.

Table 9 New Hamburg WWTP Projected Wastewater Flows

Parameters	2016	2021	2026	2031	2036	2041	2046	2051	Build-Out
Population	14,574	15,541	16,045	16,537	17,832	19,986	21,512	23,475	28,425
Flow (ADF) (m^3/d)	4,264	4,547	4,695	4,839	5,218	5,848	6,294	6,869	8,317

3.8 Wellesley WWTP

3.8.1 Facility Overview

The Wellesley WWTP is an extended aeration package plant that provides treatment for wastewater generated in the Township of Wellesley. The treatment plant is currently operated under MOECC ECA No. 3-0048-91-006 issued on May 15, 1991, with a rated ADF capacity of 1,100 m^3/d.

The existing unit treatment processes include manually cleaned screens, aeration, secondary clarification, tertiary filtration and ozone disinfection prior to discharge to the Nith River. Waste activated sludge (WAS) is stored in an aerated sludge holding tank prior to being hauled to the Waterloo WWTP for further processing.

3.8.2 Population Projections

The projected residential service population for the Wellesley WWTP to 2051 is shown in Figure 16. The service population will increase from approximately 3,508 in 2016 to 5,411 in 2051 for the Wellesley WWTP. As previously described, for the Wellesley WWTP service area, the population forecasts from the Township were higher than the Township has land to accommodate within the settlement areas. For this reason, projections indicate populations greater than the build-out populations of the settlement area and therefore build-out populations were not used for this community.

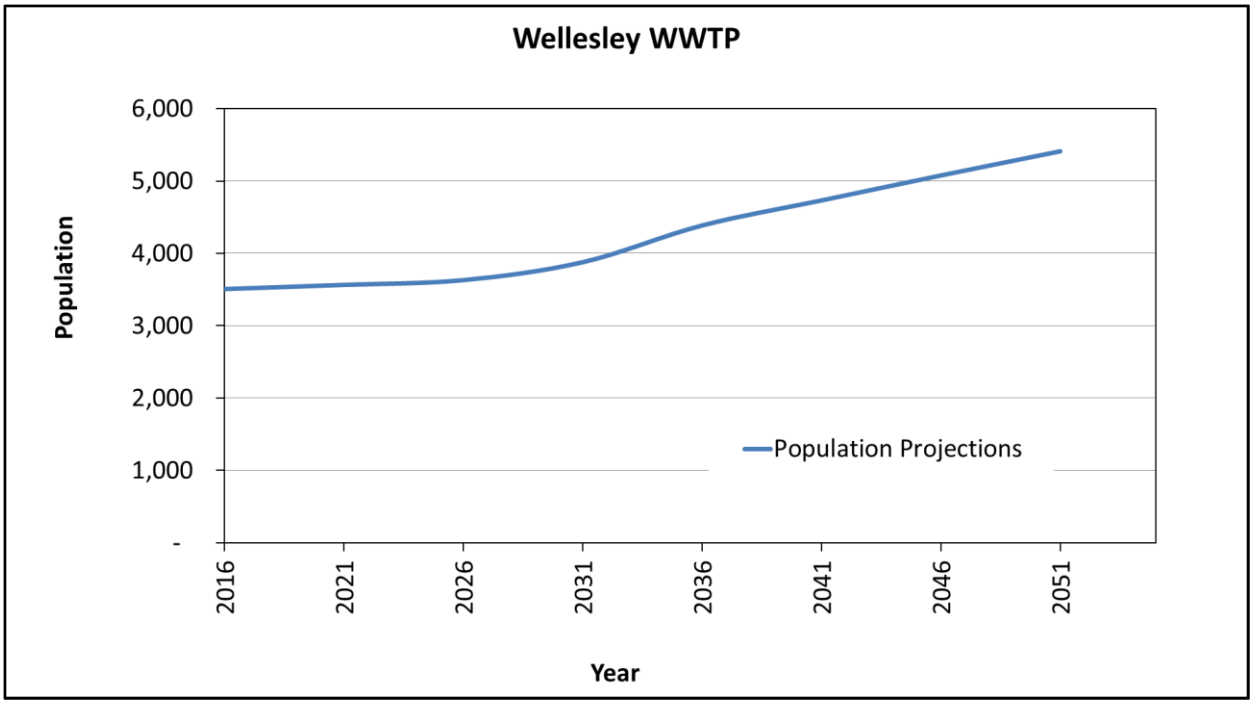

Figure 16 Population Projections for the Wellesley WWTP

3.8.3 Flow Projections

The projected ADF to the Wellesley WWTP to 2051, based on population and an average per capita flow of 0.2332 m^3/cap/d derived from the Region's WWWMR, are shown in Figure 17.

It is anticipated that the projected ADF in 2051 will exceed the rated capacity for the Wellesley WWTP. By approximately the year 2032, the ADF to the Wellesley WWTP will exceed 85% of the existing ECA rated capacity based on maintaining current per capita flows of 0.2332 m^3/cap/d for future growth.

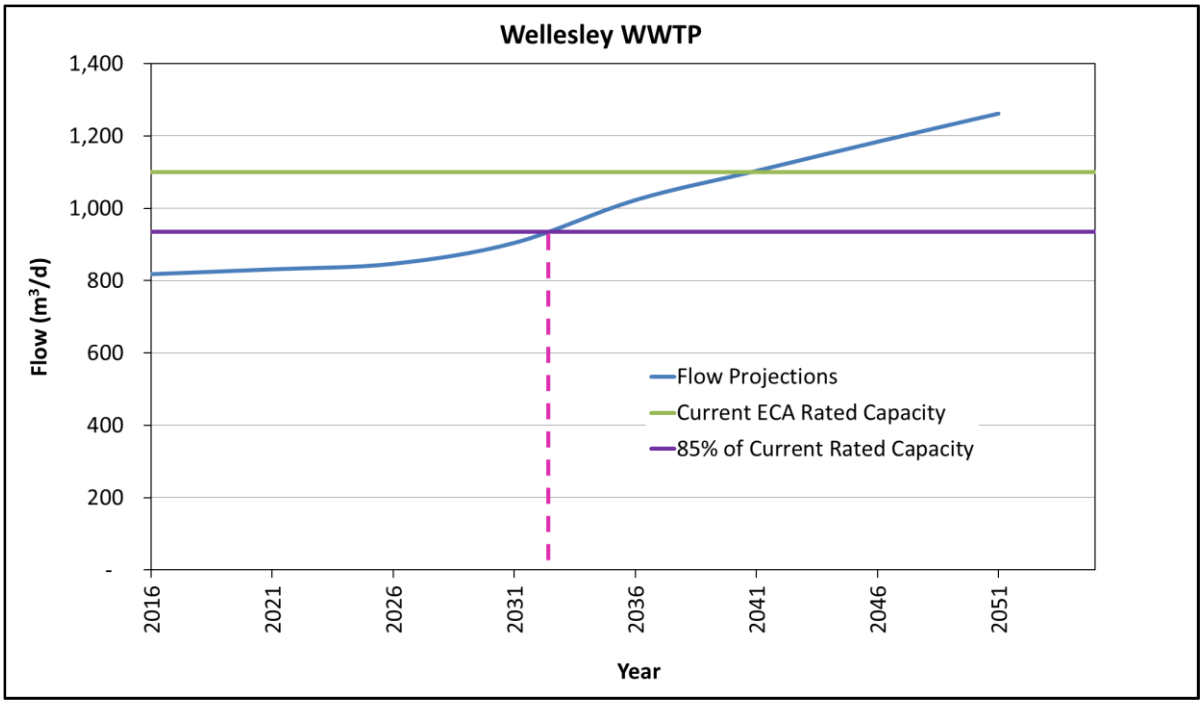

Figure 17 Flow Projections to the Wellesley WWTP

3.8.4 Summary

The estimated population and flow projections to be used in the development of alternatives for wastewater treatment for the Wellesley WWTP are summarized in Table 10.

Table 10 Wellesley WWTP Projected Wastewater Flows

Parameters	2016	2021	2026	2031	2036	2041	2046	2051	Build-Out
Population	3,508	3,565	3,631	3,878	4,386	4,732	5,077	5,411	-
Flow (ADF) (m^3/d)	818	831	847	904	1,023	1,104	1,184	1,262	-

3.9 St Jacobs WWTP

3.9.1 Facility Overview

The St Jacobs WWTP is an oxidation ditch extended aeration plant that provides treatment for wastewater generated in the Town of St Jacobs located in the Township of Woolwich. The plant is operated under MOECC ECA No. 1047-94FHWA issued on March 22, 2013. The St Jacobs WWTP has a rated ADF capacity of 1,450 m^3/d.

The existing unit treatment processes include screening, vortex grit removal, aeration, secondary clarification, tertiary filtration and UV disinfection prior to discharge to the Conestogo River. Waste activated sludge is stored in an aerated sludge holding tank prior to being hauled to the Waterloo WWTP for further processing.

3.9.2 Population Projections

The projected residential service population for the St Jacobs WWTP to 2051 is shown in Figure 18. The service population will increase from approximately 1,993 in 2016 to 3,078 in 2051 for the St Jacobs WWTP. As previously described, for the St Jacobs WWTP service area, the population forecasts from the Township were higher than the Township has land to accommodate within the settlement areas. For this reason, projections indicate populations greater than the build-out populations of the settlement area and therefore build-out populations were not used for this community.

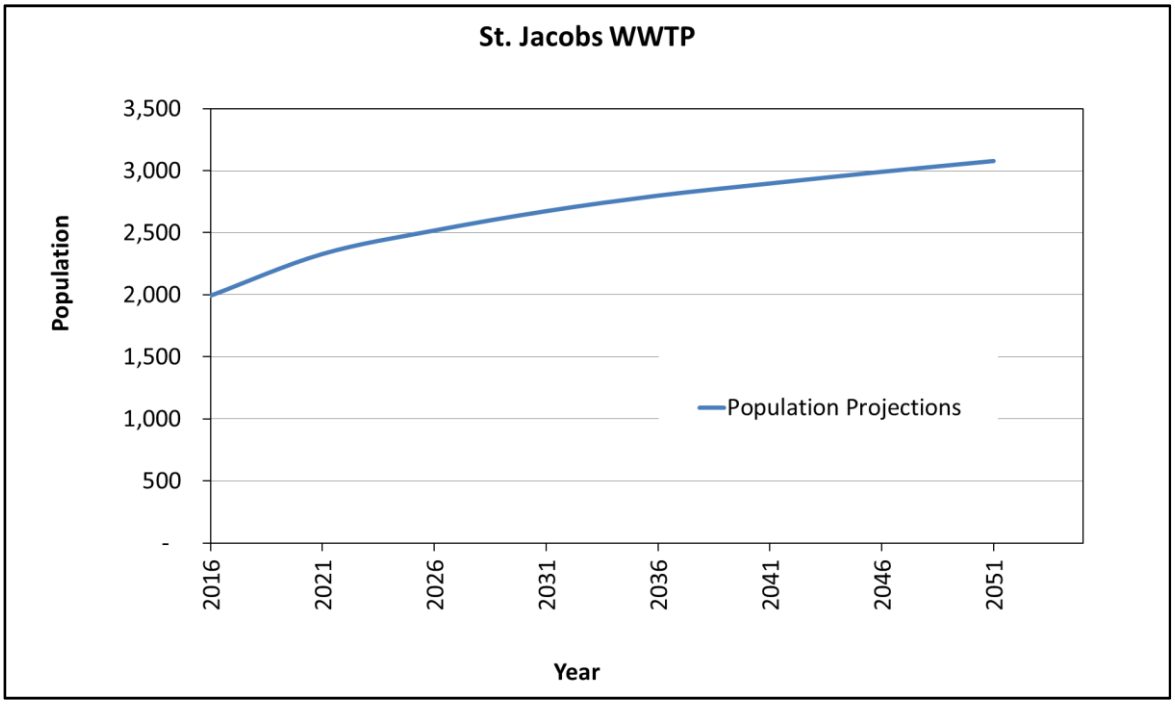

Figure 18 Population Projections for the St Jacobs WWTP

3.9.3 Flow Projections

The projected ADF to the St Jacobs WWTP to 2051, based on population and an average per capita flow of 0.4970 m^3/cap/d derived from the Region's WWWMR, are

shown in Figure 19. The higher per capita flow may be attributed to the historical inflow and infiltration (I&I) issues within the service area.

It is anticipated that the projected ADF will exceed the rated capacity for the St Jacobs WWTP by approximately 2042. Based on maintaining current per capita flows of 0.4970 m^3/cap/d for future growth, by the year 2025, the ADF to the St Jacobs WWTP will exceed 85% of the existing ECA rated capacity. If the I&I issues within the St Jacobs WWTP service area are addressed that may alleviate future treatment capacity limitations.

The Region completed a St Jacobs Elmira Wastewater Treatment Master Plan, which identified a preferred option for servicing the community of St Jacobs by decommissioning the St Jacobs WWTP and transferring flows to the Waterloo WWTP (XCG, 2013). This plan will be reviewed as part of the WWTMP Update.

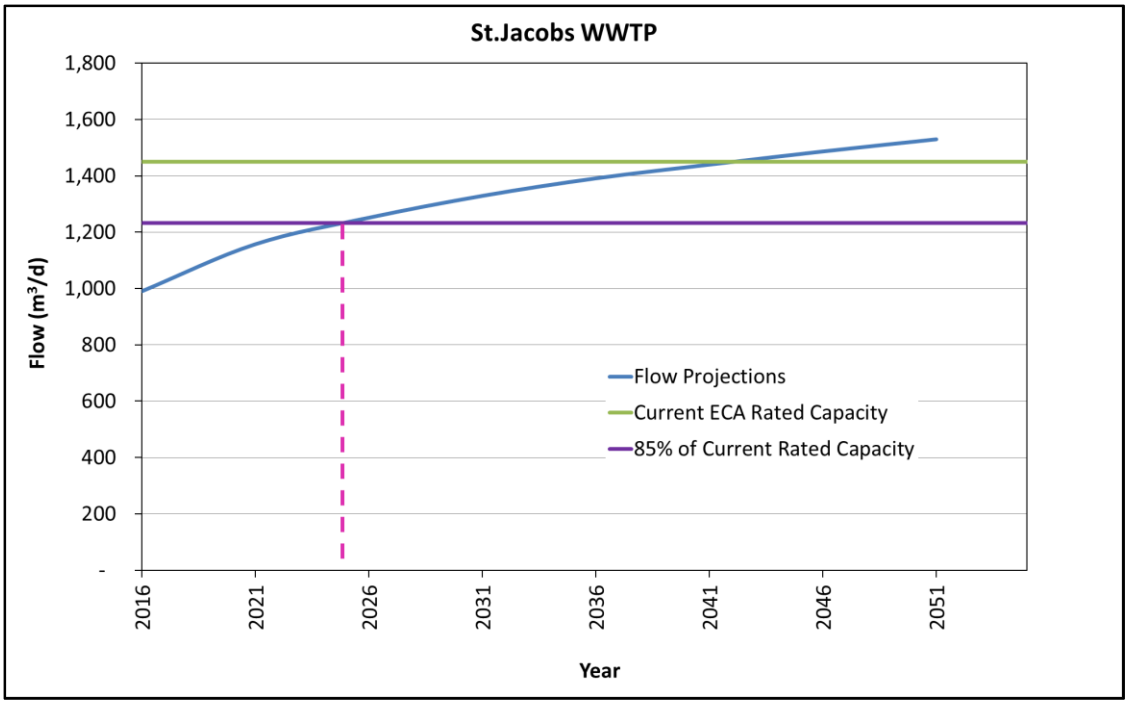

Figure 19 Flow Projections to the St Jacobs WWTP

3.9.4 Summary

The estimated population and flow projections to be used in the development of alternatives for wastewater treatment for the St Jacobs WWTP are summarized in Table 11.

Table 11 St Jacobs WWTP Projected Wastewater Flows

Parameters	2016	2021	2026	2031	2036	2041	2046	2051	Build-Out
Population	1,993	2,329	2,518	2,674	2,799	2,897	2,991	3,078	-
Flow (ADF) (m^3/d)	990	1,157	1,251	1,329	1,391	1,440	1,487	1,530	-

3.10 Elmira WWTP

3.10.1 Facility Overview

The Elmira WWTP is a biological nutrient removal (BNR) plant that provides treatment for wastewater generated in the Town of Elmira located in the Township of Woolwich. The plant is operated under MOECC ECA No. 6698-8QGJ8E issued on January 27, 2012. The Elmira WWTP has a rated ADF capacity of 7,800 m^3/d.

The existing unit treatment processes include flow equalization, screening, vortex grit removal, primary clarification, BNR bioreactors (i.e. a combined anaerobic-anoxic-aeration process), secondary clarification, tertiary filtration and UV disinfection prior to discharge to the Canagagigue Creek. Primary sludge is fermented in a fermenter tank. The supernatant from the fermenter tank is returned to the anaerobic zone of the bioreactors to facilitate biological phosphorus removal. The fermenter sludge and WAS are dewatered in a centrifuge, with haulage off-site for disposal.

3.10.2 Population Projections

The projected residential service population for the Elmira WWTP to 2051 is shown in Figure 20. The service population will increase from approximately 10,484 in 2016 to 22,132 in 2051 for the Elmira WWTP, with an ultimate build-out population of 29,861.

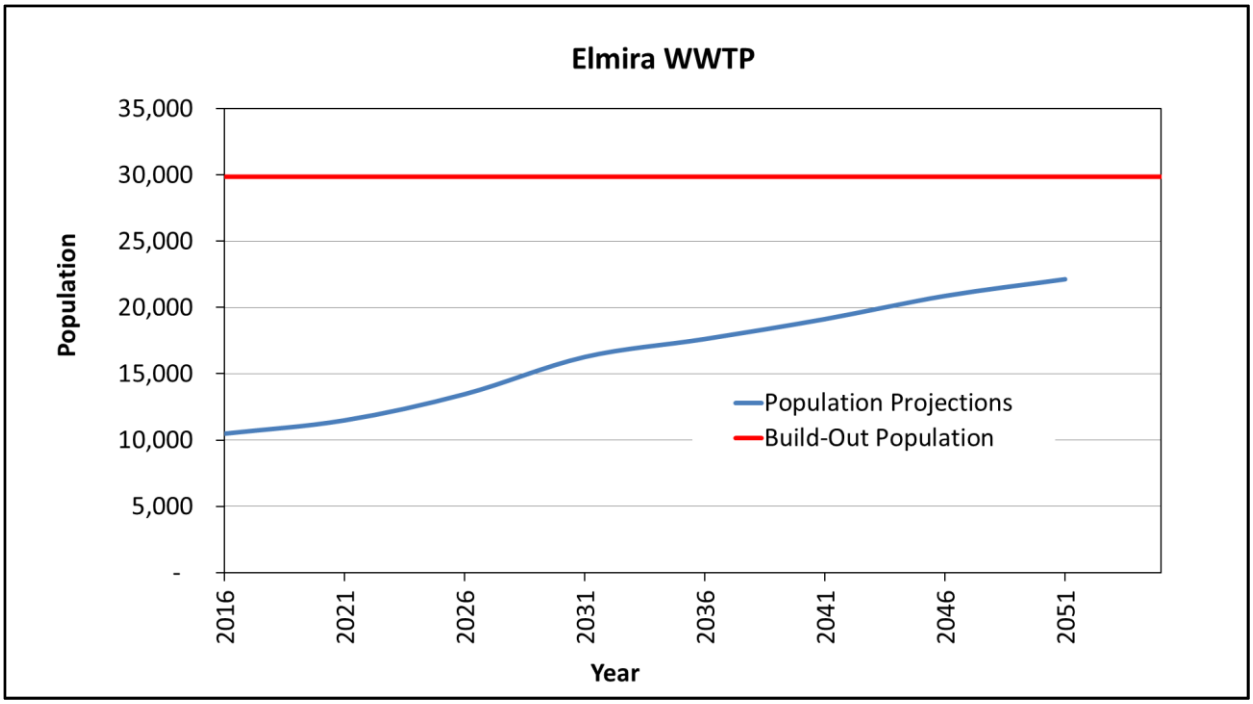

Figure 20 Population Projections for the Elmira WWTP

3.10.3 Flow Projections

The projected ADF to the Elmira WWTP to 2051, based on population and an average per capita flow of 0.4272 m^3/cap/d derived from the Region's WWWMR, are shown in Figure 21. The higher average per capita flow may be attributed to additional contribution from industrial areas and historical I&I issues within the service area.

The projected ADF is expected to increase from the current flow of 4,479 m^3/d in 2016 to approximately 9,455 m^3/d in 2051, which exceeds the plant rated capacity of 7,800 m^3/d. It is anticipated that the projected ADF will exceed the rated capacity for the Elmira WWTP by approximately 2039. Based on maintaining current per capita flows of 0.4272 m^3/cap/d for future growth, by the year 2030, the ADF to the Elmira WWTP will exceed 85% of the existing ECA rated capacity. If the I&I issues within the Elmira WWTP service area are addressed, that may alleviate future treatment capacity limitations.

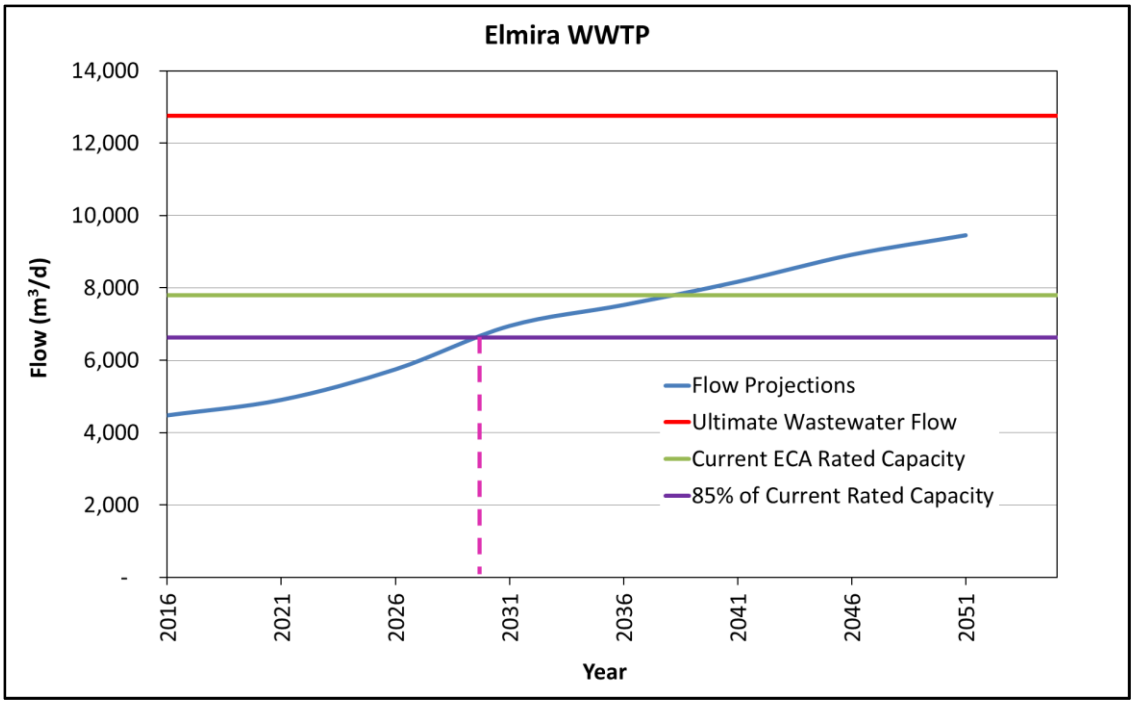

Figure 21 Flow Projections to the Elmira WWTP

3.10.4 Summary

The estimated population and flow projections to be used in the development of alternatives for wastewater treatment for the Elmira WWTP are summarized in Table 12.

Table 12 Elmira WWTP Projected Wastewater Flows

Parameters	2016	2021	2026	2031	2036	2041	2046	2051	Build-Out
Population	10,484	11,487	13,461	16,268	17,623	19,125	20,872	22,132	29,861
Flow (ADF) (m^3/d)	4,479	4,907	5,751	6,950	7,529	8,170	8,917	9,455	12,757

3.11 East Side Lands

3.11.1 Area Overview

The East Side Lands (ESL) is a growth area located on the eastern edge of the Region of Waterloo, at the border of Woolwich Township and Cambridge, near the Region of Waterloo International Airport. The ESL study area in total includes approximately 4,027 gross hectares of land. As part of the 2003 Regional Growth

Management Strategy, the ESL were identified as a significant opportunity for employment development in the Region, due to their proximity to the Region of Waterloo International Airport, Highway 401 and major inter-regional roads (Highways 8 and 24).

A Master Environmental Servicing Plan (MESP) was completed in 2014, and a Class Environmental Assessment (EA) is currently ongoing for the sanitary servicing of the ESL (targeted completion in early 2017).

As indicated in the 2014 MESP, the ultimate build-out of the ESL is subject to development and market conditions and is expected to take at least 35 years (Associated Engineering, 2015). The design of the proposed sanitary servicing infrastructure that will convey sewage to the Kitchener WWTP must be sized to meet ultimate build out conditions; however it must also consider the initial start-up conditions.

The design of sanitary servicing infrastructure must be adaptable to the evolution of the ESL and a large range of design flows. It is logically anticipated that the initial conditions will have a design flow rate that is significantly less than the ultimate flow rate.

Based on the ESL Class EA (AE, 2015), within the ESL, there are a number of areas that should be considered for exclusion from the contributing sanitary drainage area, specifically:

- *Woolwich 1 (W-1*): based on existing topography, this area is likely better serviced via gravity sewer to the Bridgeport Pumping Station with conveyance to the Waterloo WWTP.
- *Woolwich 2.1 (W-2.1*): based on the recently updated Cross Border Agreement with the City of Kitchener, this area is assigned to be conveyed to the Victoria Street Pumping Station in perpetuity and serviced at the Kitchener WWTP.
- *Cambridge 3.2 (C-3.2*): per the Speed River Assimilative Capacity Study, and depending on future capacity upgrades, it is more appropriate to drain this area to the Hespeler WWTP.
- *Cambridge 6 (C-6)* and *Cambridge 7 (C-7)*: The existing developed areas are currently serviced by the Preston WWTP and can remain as such in the long term.

Based on the above rationale, it is recommended that the future maximum "ultimate" flow scenario for the ESL servicing infrastructure be based on the areas noted above being excluded from the flow rate calculation (Ultimate "Exclusion" Scenario). Therefore the theoretical, ultimate peak design flow rate for the ESL sanitary servicing infrastructure is projected to be 628 L/s (54,230 m^3/d) (Associated Engineering, 2015). It should be noted that the theoretical ultimate flow rate will only be achieved at a point in the distant future.

The ultimate servicing of the ESL will be to the Kitchener WWTP. Interim servicing of the Stage 1 lands within the ESL to the Preston WWTP could allow the Region to defer capital investment for servicing infrastructure to convey flows to the Kitchener WWTP. The timing of diversion of flows from the interim servicing at the Preston WWTP to the long-term servicing at the Kitchener WWTP will be determined through this WWTMP Update process.

3.11.2 Population Projections

The projected residential service population for the ESL to 2051 is shown in Figure 22. The service population will increase from approximately 628 in 2016 to 14,297 in 2051 for the ESL growth area, with an ultimate build-out population of 45,733 developed based on the ESL Class EA (Associated Engineering, 2015).

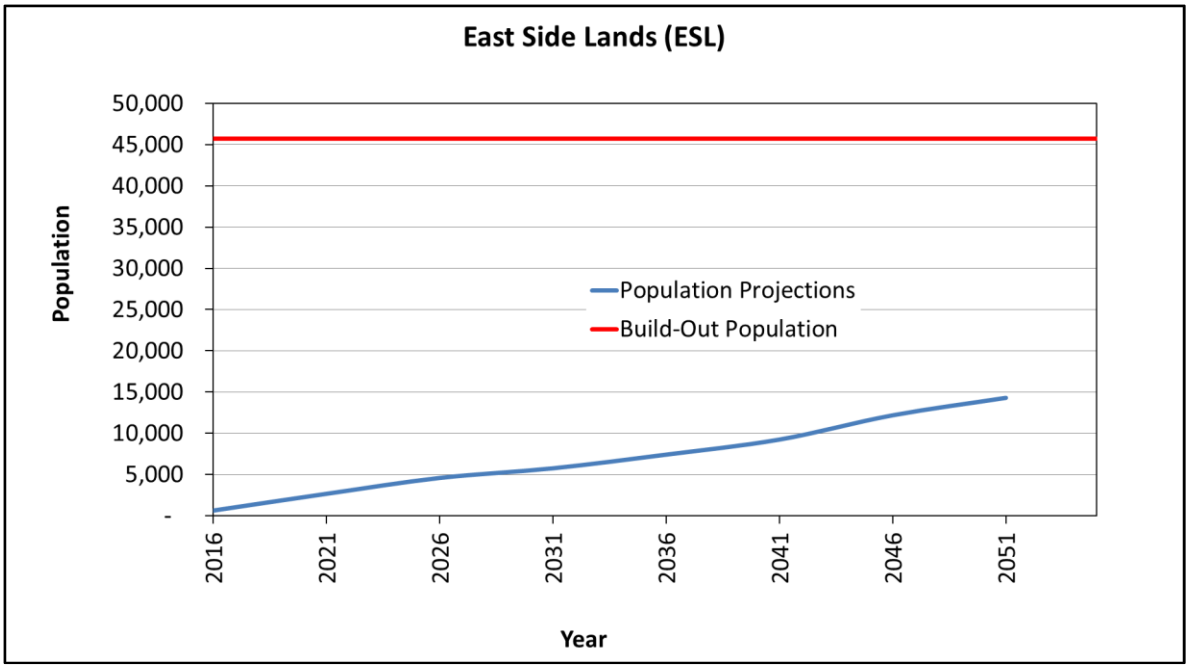

Figure 22 Population Projections for East Side Lands (ESL)

3.11.3 Flow Projections

The projected ADF from the ESL up to 2051, based on population and an average per capita flow of 0.5786 m^3/cap/d, are shown in Figure 23.

The average per capita flow was determined based on the ESL Class EA average daily residential and industrial flows plus extraneous (I/I) flows to the ESL. Extraneous flows were assumed to equal 20% of the calculated average daily flow (Associated Engineering, 2015). The high per capita flow estimated is attributed to the high concentration of industrial lands within the ESL growth area.

Based on the per capita flow of 0.5786 m^3/cap/d for future growth, the projected ADF will increase from 363 m^3/d in 2016 to 8,272 m^3/d in 2051, with an ultimate wastewater flow of 26,461 m^3/d for the ESL.

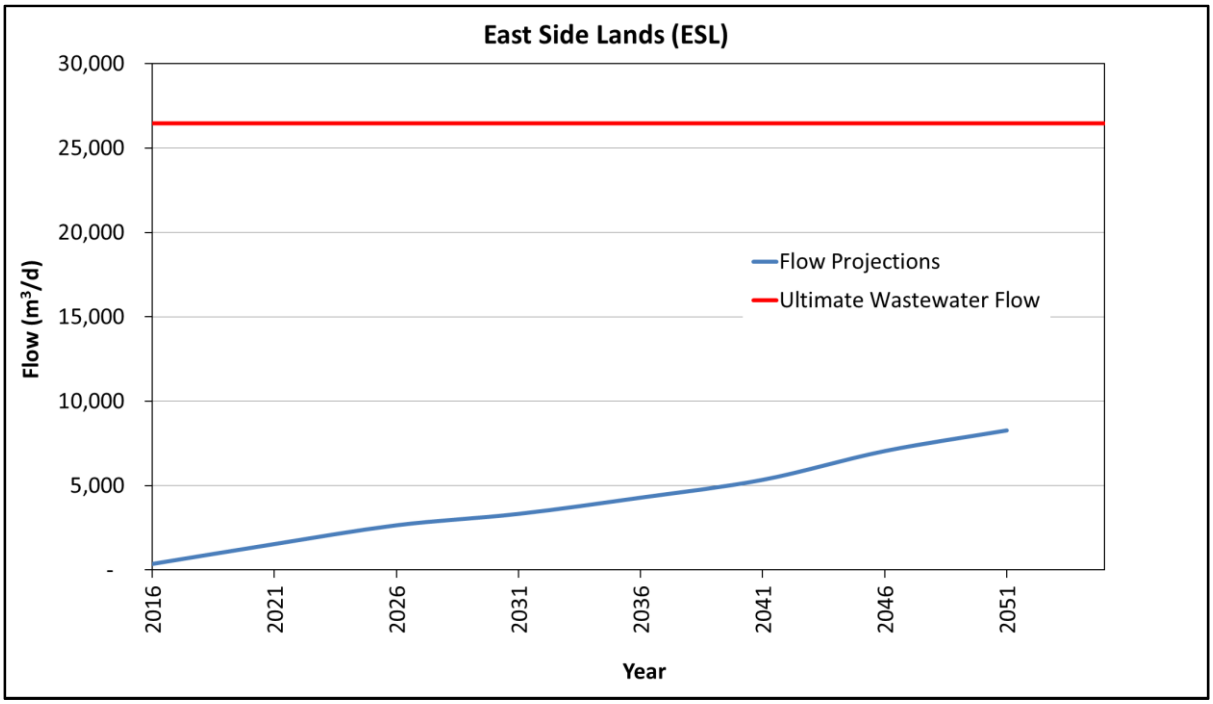

Figure 23 Flow Projections to East Side Lands (ESL)

3.11.4 Summary

The estimated population and flow projections to be used in the development of alternatives for wastewater treatment for the ESL are summarized in Table 13.

Table 13 East Side Lands (ESL) Projected Wastewater Flows

Parameters	2016	2021	2026	2031	2036	2041	2046	2051	Build-Out
Population	628	2,661	4,584	5,753	7,413	9,239	12,182	14,297	45,733
Flow (ADF) (m^3/d)	363	1,540	2,652	3,329	4,289	5,346	7,049	8,272	26,461

3.12 Small Communal Wastewater Treatment Plants

There are three small wastewater treatment plants that are dedicated treatment plants for small developments, including:

- Alt-Heidelberg WWTP
- Foxboro Green WWTP
- Conestoga WWTP

As these treatment plants are considered dedicated to these small developments, there is no projected growth for these areas, and no population and flow projections were estimated for these plants.

4. Summary

Table 14 and Table 15 present summaries of the projected populations and flows for wastewater treatment plants, respectively, through the planning period (2016-2051).

Table 14 Future Population Projections for WWTPs

Service Area	Population								
	2016	2021	2026	2031	2036	2041	2046	2051	Build-out Pop.
Kitchener [1]	242,626	257,162	273,850	291,211	308,186	323,356	337,207	348,358	378,154
Waterloo	139,527	148,197	155,182	161,469	167,384	172,235	177,011	181,219	-
Galt	89,236	93,974	98,536	103,249	108,251	113,307	117,543	120,984	143,346
Preston [1]	21,961	23,319	24,349	25,056	25,692	26,306	26,905	27,477	29,275
Hespeler	25,722	26,336	26,665	27,077	28,523	31,333	33,188	35,984	42,670
Ayr	5,198	6,351	7,520	8,271	8,640	9,058	9,617	10,064	12,623
Baden/New Hamburg	14,574	15,541	16,045	16,537	17,832	19,986	21,512	23,475	28,425
Wellesley	3,508	3,565	3,631	3,878	4,386	4,732	5,077	5,411	-
St Jacobs	1,993	2,329	2,518	2,674	2,799	2,897	2,991	3,078	-
Elmira	10,484	11,487	13,461	16,268	17,623	19,125	20,872	22,132	29,861
Alt-Heidelberg	268	268	268	269	269	270	270	270	279
Foxboro Green	409	406	404	404	405	415	420	424	416
Conestogo	265	263	263	264	265	266	267	268	264
East Side Lands	628	2,661	4,584	5,753	7,413	9,239	12,182	14,297	45,733
Unserviced Areas	30,548	31,951	32,887	33,410	34,250	35,263	37,558	42,780	-
Total	586,947	623,810	660,163	695,790	731,918	767,788	802,620	836,221	-

Notes:

1. Population projections do not include the ESL.

Table 15 Future Wastewater Flow Projections to WWTPs

Service Area	Average Day Flow (m^3/d)									
	2016	2021	2026	2031	2036	2041	2046	2051	Ultimate Flow	Rated Capacity
Kitchener [1]	71,842	76,146	81,087	86,228	91,254	95,746	99,847	103,149	111,971	122,745
Waterloo	46,602	49,498	51,831	53,931	55,906	57,526	59,122	60,527	-	57,500
Galt	36,150	38,069	39,917	41,826	43,852	45,901	47,617	49,011	58,069	56,800
Preston [1]	9,503	10,090	10,536	10,842	11,117	11,383	11,642	11,889	12,667	16,860
Hespeler	7,079	7,248	7,338	7,452	7,850	8,623	9,133	9,903	11,743	9,320
Ayr	1,425	1,741	2,062	2,268	2,369	2,484	2,637	2,760	3,461	3,000
Baden/New Hamburg	4,264	4,547	4,695	4,839	5,218	5,848	6,294	6,869	8,317	6,900
Wellesley	818	831	847	904	1,023	1,104	1,184	1,262	-	1,100
St Jacobs	990	1,157	1,251	1,329	1,391	1,440	1,487	1,530	-	1,450
Elmira	4,479	4,907	5,751	6,950	7,529	8,170	8,917	9,455	12,757	7,800
East Side Lands	363	1,540	2,652	3,329	4,289	5,346	7,049	8,272	26,461	-
Unserviced Areas	8,682	9,081	9,347	9,496	9,734	10,022	10,675	12,159	-	-

Notes:

1. Flow projections do not include the ESL.

5. References

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