# Appendix B

## TM1B - SPS Population and Flow Projections

**The Regional Municipality of Waterloo**

# Wastewater Treatment Master Plan Update

## Technical Memorandum No. 1B: Sewage Pumping Station Population and Flow Projections

**Final**

**5935 Airport Road, Suite 500**
**Mississauga, Ontario**
**L4V 1W5**
**Canada**
**Phone: (905) 695-1005**
**Fax: (905) 695-0525**
**www.cima.ca**

**January 2018**

T000478A

This report contains technical information. Alternate formats of this document are available upon request. Please contact Nicole Sapeta at nsapeta@regionofwaterloo.ca, 519-575-4400 ext. 3682, TTY: 519-575-4608 to request an alternate format.

# 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 | February 2017 | S. Dong | E. Longworth | T. Briggs |
| Final | January 2018 | S. Dong | E. Longworth | T. Briggs |

# Table of Contents

## List of Tables

## List of Figures



## List of Appendices

# 1. Introduction

## 1.1 Background

The Regional Municipality of Waterloo (the Region) is an upper tier municipal government, providing municipal services to seven local area 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) sewage pumping stations (SPSs) (with a seventh station currently in 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-year planning period in a manner consistent with the Region's Strategic Plan.

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

A separate Technical Memorandum (TM) No. 1A has been prepared separately to estimate population and flow projections to the year 2051 for all the Region-owned WWTPs.

## 1.2 Objectives

The objectives of this TM are to:

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

# 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.

## 2.4 Projections

The population and flow projections over the 35-year planning period (2016-2051) were reviewed for all the Region-owned SPSs, including:

- Bridgeport SPS
- Spring Valley SPS
- Baden SPS
- Morningside SPS
- Rose Street SPS

- Ayr SPS
- Nith River Way SPS

The Ayr SPS (also referred to as Swan Street SPS) is currently under construction.

### 2.4.1 Population Projections

Population projections for the wastewater service areas 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 SPS drainage area. Population beyond 2041 was extrapolated based on the previous growth trend.

### 2.4.2 SPS Flow Projections

Flow projections to the raw sewage pumping stations were based on peak wet weather flows. The historic average per capita flow rate, comprised of wastewater discharges from residential, ICI, and extraneous flows such as I&I, was developed using the pumping stations' actual observed flow rates (typically 2013-2016 data) and the 2016 population.

The peak wet weather flow was calculated using the following formula:

*Peak Wet Weather Flow = Base-Year Peak Wet Weather Flow (incl. Extraneous Flow) + Historic Average Per Capita Flow x Increase in Population x Peaking Factor*

The following assumptions were made for generating the SPS peak flow projections:

- The observed historical peak wet weather flow (PWWF) was used as the baseline for existing peak flow conditions. For the stations where historical influent flow monitoring data was available (Spring Valley and Bridgeport SPSs), the existing PWWF was determined based on the historical fifteen-minute average influent flow to the station during 2013 to 2016. This value includes extraneous flow.

  For the stations where historical influent flow monitoring data is unavailable (Baden, Morningside and Rose Street SPSs), the existing PWWF was determined based on the historical fifteen-minute average discharge flow from the station.

- Estimated future flow increases to the pumping stations are based on increases in population times an average per capita flow rate derived from the station historic flow monitoring data (2013 to 2016). The average per capita rate includes flow increases due to population (i.e. residential), ICI, infiltration and inflow. By using this number to project future flow and loadings, it is assumed that the ICI to residential ratio remains similar to the current ratio in each service area.
- The peak factor was determined using Harmon formula as follows:

  *Peak Factor (M) = 1 + 14 / (4+P^0.5);* Where P = population in thousands
- The Ayr SPS is currently under construction and therefore there is no existing population or historic station flow data available. For this station, the peak wet weather flow projection was calculated using the following formula:

  *Peak Wet Weather Flow = (Average Day Dry Weather Flow X Peaking Factor) + Peak Extraneous Flow*

  *= (Average Per Capita Flow x Population x Harmon Factor) + Peak Extraneous Flow*

  The average per capita flow to the Ayr SPS was determined based on the Rose Street SPS historic per capita flow rate of 0.279 $m^3$/cap/d, since the two stations both service the Village of Ayr. The peak extraneous flow was calculated by applying an extraneous flow allowance of 0.15 L/s/ha based on the Region's Design Guidelines (RMOW, February 2012) to the station service area (i.e. 46.6 hectares for Phase 1) derived from the Ayr Sewage Pumping Station Class Environmental Assessment (Stantec, August 2014).

A summary of the historic average per capita flows, along with the existing average day flows and population, are presented in Table 1 for each SPS.

**Table 1 Historic Average Per Capita Flows to Wastewater Pumping Stations**

| Pump Station | SPS Firm Capacity (L/s) (1) | Existing Service Population (2016) (2) | Existing Average Day Flow (L/s) | Existing Peak Wet Weather Flow (L/s) (3) | Historic Average Per Capita Flow ($m^3$/cap/d) |
|---|---|---|---|---|---|
| Bridgeport SPS | 136 | 7,026 | 32 (4) | 85 | 0.394 |
| Spring Valley SPS | 245 | 10,772 | 46 (5) | 207 | 0.366 |
| Baden SPS | 187 | 5,436 | 16 (6) | 185 | 0.255 |
| Morningside SPS | 248 | 14,574 | 42 (7) | 206 | 0.250 |
| Rose Street SPS | 80 | 5,198 | 17 (8) | 38 | 0.279 |
| Ayr SPS (9) | 46 | N/A | N/A | N/A | 0.279 |
| Nith River Way SPS | 3.9 | N/A - Dedicated Development SPS, No Projected Growth. | | | |

Notes:

1. Additional details on the firm capacity of each station is provided in Section 3 of this TM.
2. Based on population provided by the Region.
3. Based on fifteen-minute average of historical flow monitoring data.
4. Based on historic station influent flow monitoring data (July 8, 2015 to June 24, 2016).
5. Based on historic station influent flow monitoring data (April 29, 2015 to June 24, 2016).
6. Based on historic station discharge flow SCADA monitoring data (June 1, 2013 to June 30, 2016).
7. Based on historic station discharge flow SCADA monitoring data (Jun1 2008 to October 31 2012).
8. Based on historic station discharge flow SCADA monitoring data (January 1, 2013 to November 1, 2015).
9. The Ayr SPS is under construction and therefore there is no existing population or station flow data available in 2016. It is assumed the station has same per capita flow rate as Rose Street SPS, as both stations service the Village of Ayr in the Township of North Dumfries.
10. The observed existing PWWF for the Bridgeport and Spring Valley SPS was based on the historic 15-min average influent flow to the station; and the observed existing PWWF for the Baden, Morningside and Rose St. SPS was based on the historic 15-min average discharge flow from the station.

### 2.4.3 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. Bridgeport SPS

## 3.1 Pumping Station Overview

The Bridgeport SPS is situated within the City of Kitchener. The station receives wastewater from the City of Kitchener and the City of Waterloo, and discharges to the Waterloo WWTP service area for treatment. The pumping station is operated under the Ministry of the Environment and Climate Change (MOECC) ECA No. 7007-8CUJZV, issued on January 24, 2011.

The Bridgeport SPS is equipped with two 136 L/s variable speed pumps (one duty, one standby) and one 68 L/s fixed speed jockey pump. The firm capacity of the station (i.e., capacity with the largest pump out of service) is 136 L/s with one variable speed pump operating. The firm capacity does not include the capacity of the jockey pump, as this pump cannot operate at the same time as the larger variable speed pumps due to the lower design operating head.

## 3.2 Population Projections

Figure 1 shows the projected population for the Bridgeport SPS to 2051. The population will increase from approximately 7,026 in 2016 to 9,184 in 2051.

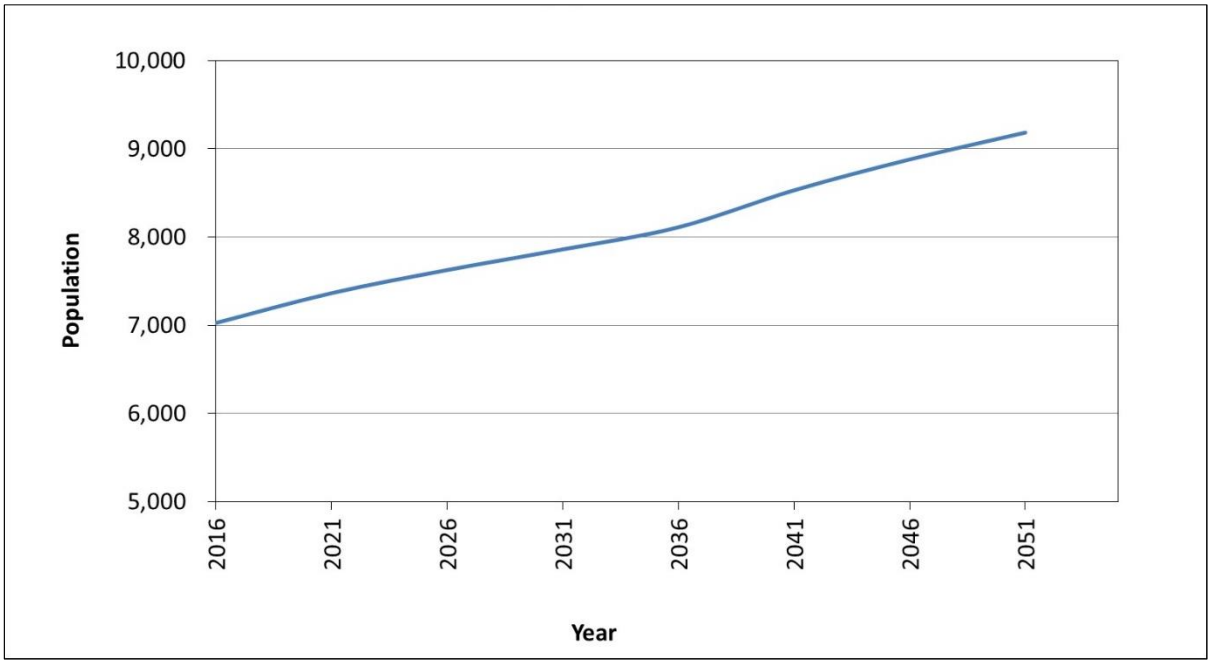


**Figure 1 Population Projections for the Bridgeport SPS**

## 3.3 Flow Projections

Figure 2 shows the projected peak flows to the Bridgeport SPS to 2051, based on population, an average per capita flow of 0.394 $m^3$/cap/d, and a Harmon peaking factor of 3.1.

The current PWWF is 85 L/s, observed on March 31, 2015. The projected peak flow is expected to increase to 114 L/s in 2051 (refer to Appendix A for detailed calculations), which just approaches 85% of the station's firm capacity, or 116 L/s.

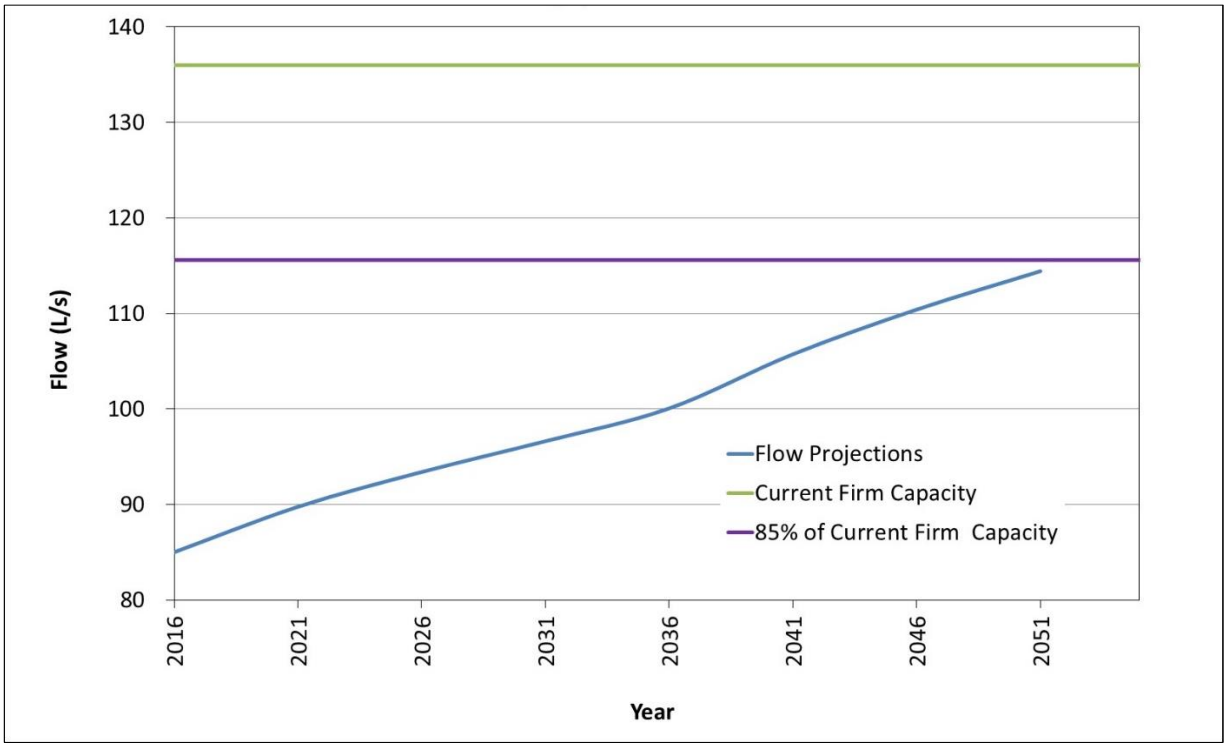


**Figure 2 Flow Projections to the Bridgeport SPS**

## 3.4 Summary

The estimated population and flow projections for the Bridgeport SPS are summarized in Table 2.

**Table 2 Bridgeport SPS Projected Wastewater Flows**

| Parameters | 2016 | 2021 | 2026 | 2031 | 2036 | 2041 | 2046 | 2051 |
|---|---|---|---|---|---|---|---|---|
| Population | 7,026 | 7,364 | 7,626 | 7,860 | 8,111 | 8,530 | 8,880 | 9,184 |
| Flow (PWWF) (L/s) | 85 | 90 | 93 | 97 | 100 | 106 | 110 | 114 |

# 4. Spring Valley SPS

## 4.1 Pumping Station Overview

The Spring Valley SPS is situated within the City of Kitchener and pumps wastewater from a portion of the City of Kitchener to the Kitchener WWTP service area for treatment. The pumping station is operated under MOECC ECA No. 3-0871-92-006, issued on August 4, 1992.

The Spring Valley SPS is equipped with three 195 L/s pumps (two duty, one standby) at a total dynamic head (TDH) of 34.8 m. The Spring Valley SPS Upgrade Preliminary Design Report (R.V. Anderson, 2015) estimated the firm capacity of the station to be 245 L/s based on two pumps operating in parallel and a forcemain C-factor of 120.

As part of a study of the Spring Valley SPS, a hydraulic assessment was completed for the existing system. Field testing suggested a very low C-Factor of 73 for the existing forcemain. It was recommended that the existing pumps be replaced with new pumps of suitable head, in order to maintain the firm station capacity of 245 L/s while allowing for the decreased C-factor of 73 (R.V. Anderson, 2015).

## 4.2 Population Projections

Figure 3 shows the projected population for the Spring Valley SPS to 2051. The population will increase from approximately 10,772 in 2016 to 14,540 in 2051.

## 4.3 Flow Projections

Figure 4 shows the projected peak flows to the Spring Valley SPS to 2051, based population, an average per capita flow of 0.366 $m^3$/cap/d, and a Harmon peaking factor of 2.9.

The current PWWF is 207 L/s, observed on July 14, 2015. The projected peak flow is expected to increase to approximately 85% of the station's firm capacity, or 208 L/s by 2017. It will reach 252 L/s in 2051, which slightly exceeds the station's firm capacity of 245 L/s.

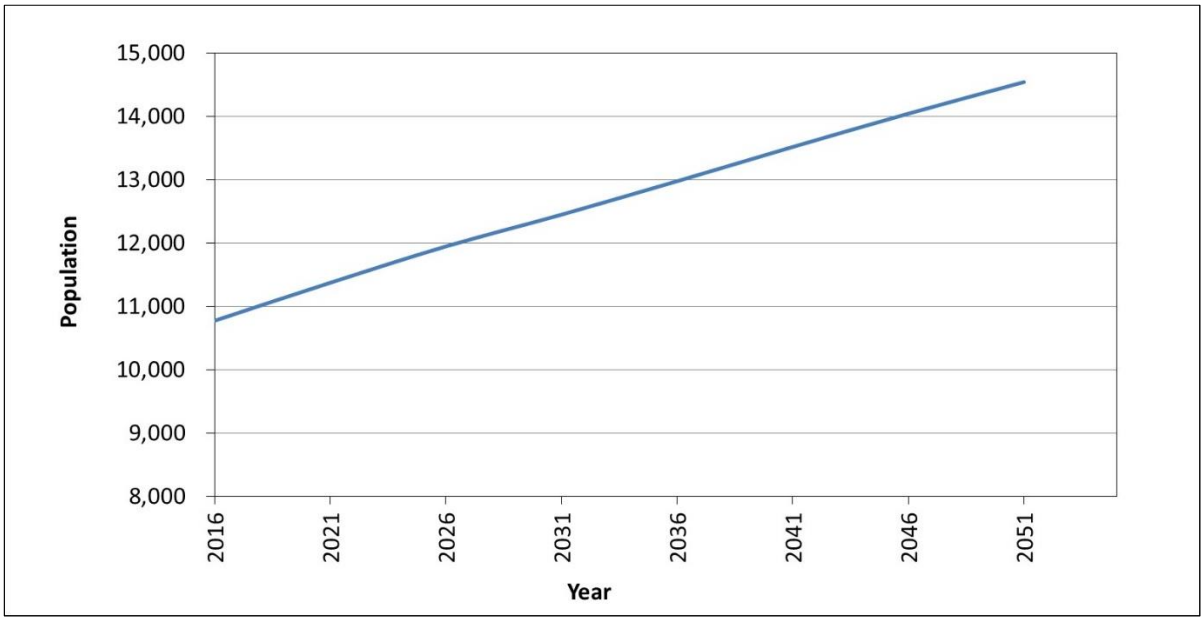


**Figure 3 Population Projections for the Spring Valley SPS**

The Region has recently completed a Feasibility Study investigating the diversion of the Bridgeport SPS flows from the Waterloo WWTP to the Kitchener WWTP by utilizing the Spring Valley SPS. The diversion of these flows is intended to increase the available treatment capacity at the Waterloo WWTP, by utilizing capacity available at the Kitchener WWTP. In order for this diversion to be possible, the Feasibility Study recommended that the capacity of the Spring Valley SPS and downstream conveyance infrastructure (i.e. forcemain) would need to be increased from 245 L/s to 381 L/s (R.V. Anderson, July 2016). This potential diversion will be explored as part of this WWTMP Update.

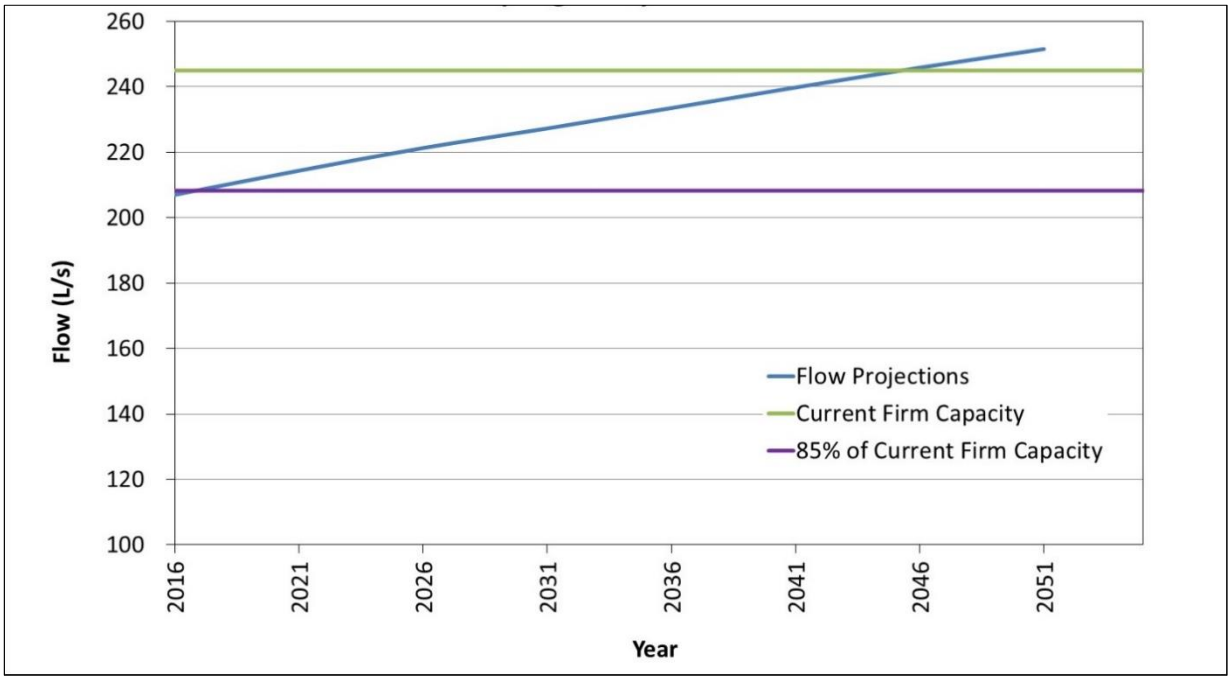


**Figure 4 Flow Projections to the Spring Valley SPS**

## 4.4 Summary

The estimated population and flow projections for the Spring Valley SPS are summarized in Table 3.

**Table 3 Spring Valley SPS Projected Wastewater Flows**

| Parameters | 2016 | 2021 | 2026 | 2031 | 2036 | 2041 | 2046 | 2051 |
|---|---|---|---|---|---|---|---|---|
| Population | 10,772 | 11,372 | 11,945 | 12,447 | 12,975 | 13,516 | 14,041 | 14,540 |
| Flow (PWWF) (L/s) | 207 | 214 | 221 | 227 | 234 | 240 | 246 | 252 |

# 5. Baden SPS

## 5.1 Pumping Station Overview

The Baden SPS is located on Foundry Street in Baden, between Gingerich Rd and Highway 8. The Baden SPS collects wastewater from the community of Baden and conveys it to the Morningside SPS via a 200 mm forcemain, where it is then pumped to the New Hamburg WWTP for treatment. The pumping station is operated under MOECC ECA No. 4162-4LKPG5, issued on June 28, 2000.

The Baden SPS is a dry/wet well configuration. The dry well is equipped with two non-clog dry pit pumps each rated at 49 L/s and one jockey pump rated at 25 L/s that pump wastewater into the 200 mm forcemain. The wet well is equipped with three submersible pumps each rated at 46.7 L/s, which divert flow to an equalization tank (1,400 $m^3$) during high peak flow events.

The Baden SPS Investigation Study Report (HMM, 2015) identified the firm capacity of the dry well as 47 L/s based on the pump and system curves with one existing dry pit pump operating and a forcemain C-factor of 120. The firm capacity does not include the jockey pump, as the jockey pump cannot operate at the same time as the larger dry pit pumps due to the lower operating head. The firm capacity of the wet well was estimated at 140 L/s based on all three submersible pumps operating. Therefore, the total firm capacity of the Baden SPS is 187 L/s (i.e., 47 L/s + 140 L/s).

The original preliminary design completed for the Baden station estimated that the firm capacity could be increased to 200 L/s with replacement of the existing two 49 L/s dry pit pumps with two new 60 L/s pumps (Stanley, 1998). With the increased pump capacity, the flow velocity of the existing 200 mm forcemain is 1.9 m/s, which is still within the maximum velocity of 3.0 m/s recommended by MOECC Design Guidelines (2008). However, replacing the pumps will require extensive electrical upgrades due to the increase in pump horsepower (HMM, 2012).

## 5.2 Population Projections

Figure 5 shows the projected population for the Baden SPS to 2051. The population will increase from approximately 5,436 in 2016 to 10,104 in 2051.

## 5.3 Flow Projections

Figure 6 shows the projected peak flows to the Baden SPS to 2051, based on population, an average per capita flow of 0.255 $m^3$/cap/d, and a Harmon peaking factor of 3.2.

The current PWWF is 185 L/s, observed on September 10, 2014, which has exceeded 85% of the station's firm capacity, or 159 L/s. The projected peak flow is expected to increase to 226 L/s in 2051, which exceeds the station's firm capacity of 187 L/s.

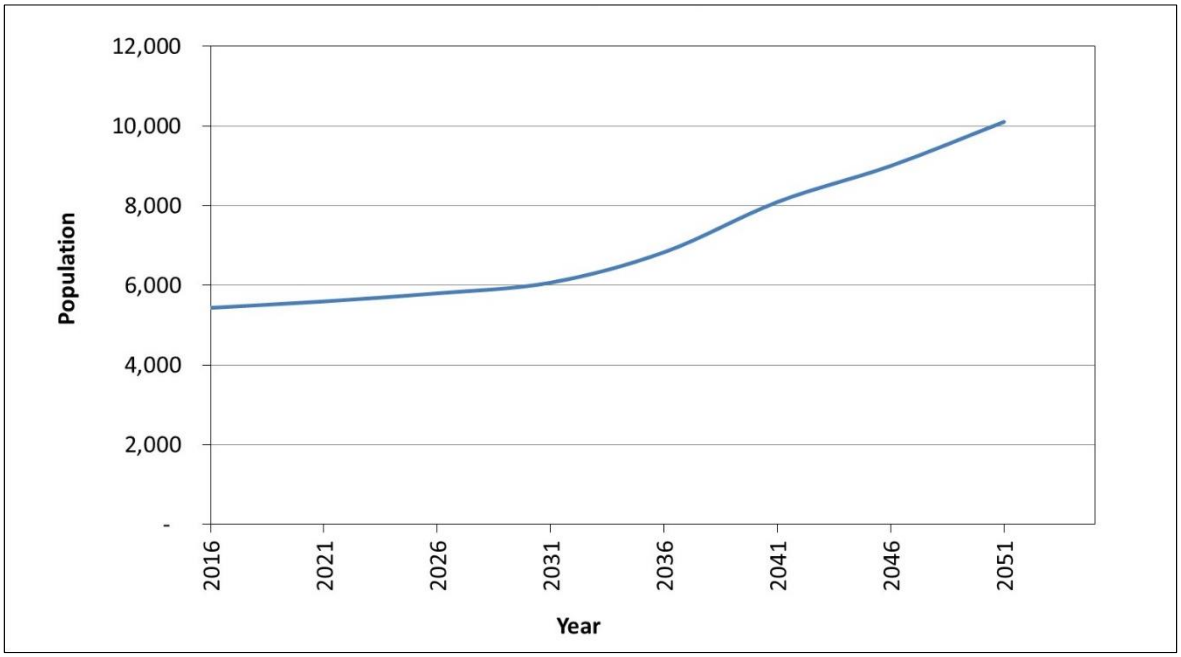


**Figure 5 Population Projections for the Baden SPS**

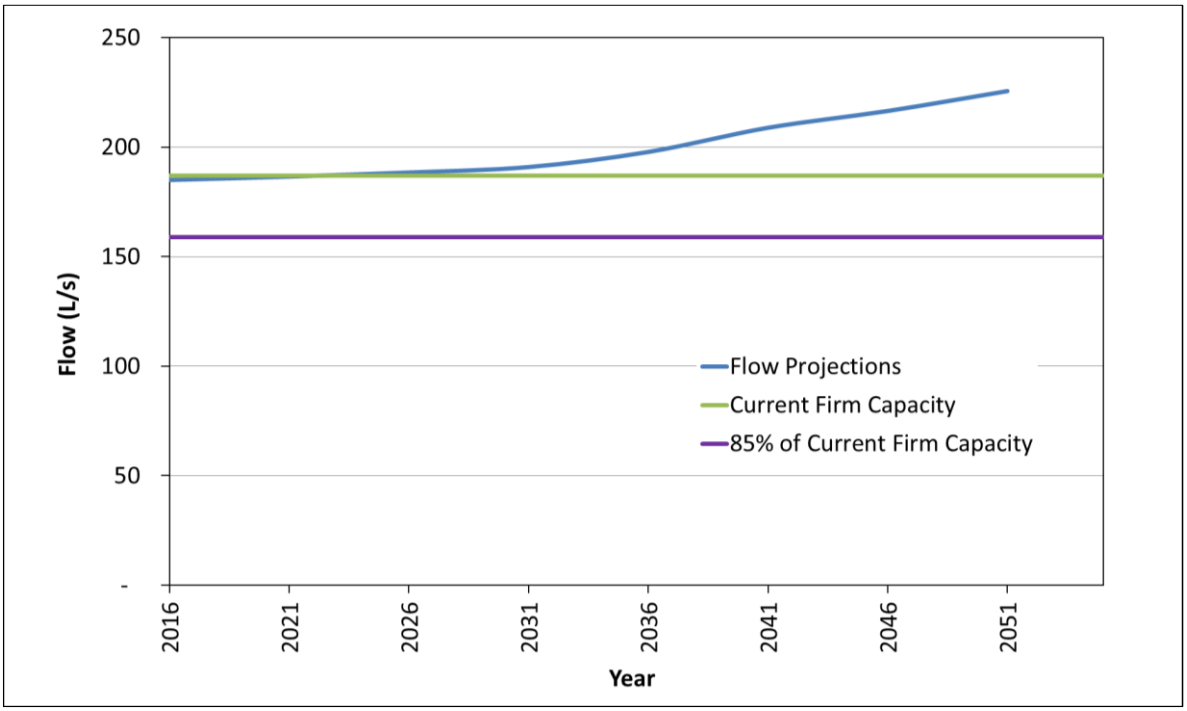


**Figure 6 Flow Projections to the Baden SPS**

## 5.4 Summary

The estimated population and flow projections for the Baden SPS are summarized in Table 4.

**Table 4 Baden SPS Projected Wastewater Flows**

| Parameters | 2016 | 2021 | 2026 | 2031 | 2036 | 2041 | 2046 | 2051 |
|---|---|---|---|---|---|---|---|---|
| Population | 5,436 | 5,598 | 5,801 | 6,069 | 6,830 | 8,092 | 8,999 | 10,104 |
| Flow (PWWF) (L/s) | 185 | 187 | 188 | 191 | 198 | 209 | 217 | 226 |

# 6. Morningside SPS

## 6.1 Pumping Station Overview

The Morningside SPS is situated within the Morningside Retirement Community located southeast of Morningside Circle West. The pumping station collects the wastewater from the communities of Baden and New Hamburg and pumps it directly via twin 300 mm forcemains into the New Hamburg WWTP for treatment. The pumping station is operated under MOECC ECA No. 9998-A35NNL.

The Morningside SPS is currently equipped with four 87.5 L/s submersible pumps (3 duty and 1 standby). Three of the existing pumps are the original Flygt CP3300 model with a 290 mm impeller diameter and the fourth pump was replaced with the Flygt NP 3301 model with a 330 mm impeller diameter in 2015. According to the Morningside SPS Capacity Assessment Report (Stantec, 2017), the firm capacity of the station is 248 L/s based on the pump and system curves with three pumps operating and two forcemains in service and a forcemain C-factor of 130.

A previously completed preliminary design identified that the firm capacity of the station could be increased to 323 L/s by upgrading the impellers on the existing Flygt CP3300 pumps, without the need for any electrical upgrades (Stanley, 1998).

## 6.2 Population Projections

Figure 7 shows the projected population for the Morningside SPS to 2051. The population will increase from approximately 14,574 in 2016 to 23,475 in 2051.

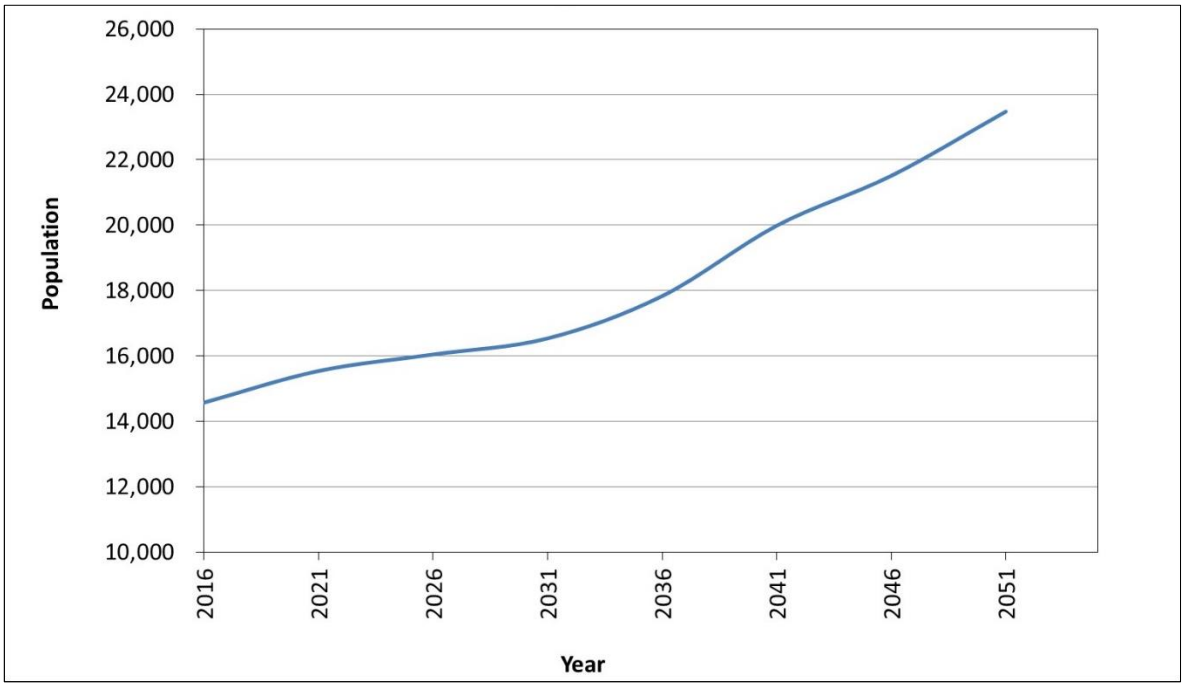


**Figure 7 Population Projections for the Morningside SPS**

## 6.3 Flow Projections

Figure 8 shows the projected peak flows to the Morningside SPS to 2051, based on population, an average per capita flow of 0.250 $m^3$/cap/d, and a Harmon peaking factor of 2.8.

The current PWWF is 206 L/s, observed on June 9, 2010. The projected peak flow is expected to increase to approximately 85% of the station's firm capacity, or 211 L/s by 2019. It will reach 272 L/s in 2051, which exceeds the station's firm capacity of 248 L/s.

A capacity assessment was completed to evaluate the potential capacity upgrade options at the Morningside SPS to meet future growth needs. The assessment identified that an expansion to 290 L/s could be provided with the replacement of all the four existing pumps (Stantec, 2017).

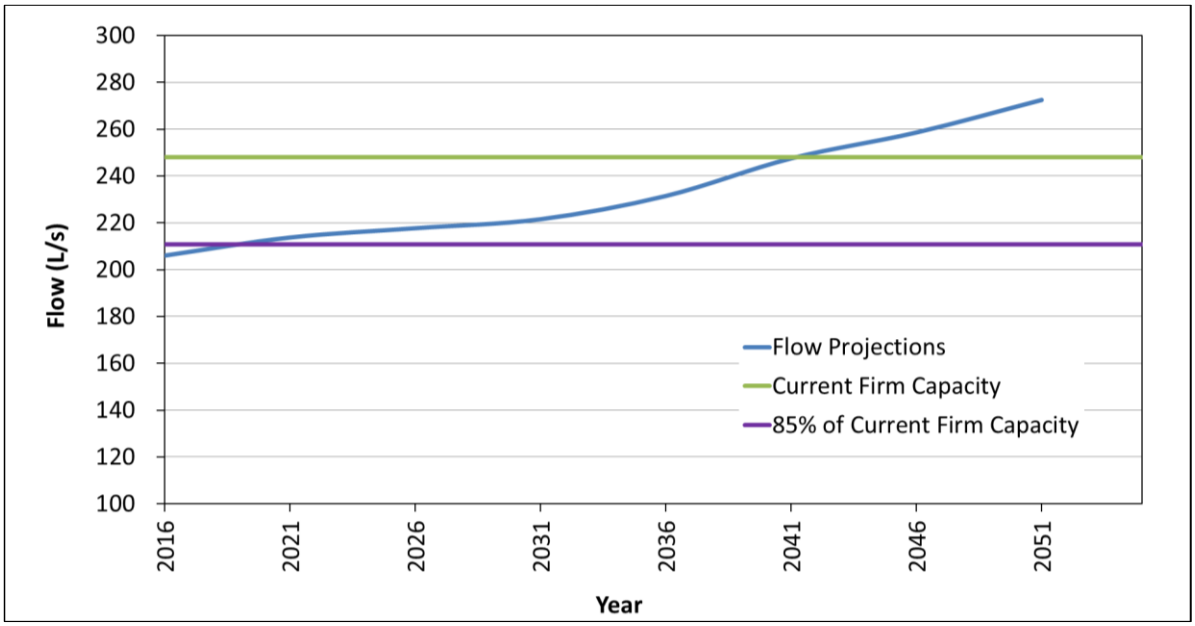


**Figure 8 Flow Projections to the Morningside SPS**

## 6.4 Summary

The estimated population and flow projections for the Morningside SPS are summarized in Table 5.

**Table 5 Morningside SPS Projected Wastewater Flows**

| Parameters | 2016 | 2021 | 2026 | 2031 | 2036 | 2041 | 2046 | 2051 |
|---|---|---|---|---|---|---|---|---|
| Population | 14,574 | 15,541 | 16,045 | 16,537 | 17,832 | 19,986 | 21,512 | 23,475 |
| Flow (PWWF) (L/s) | 206 | 214 | 218 | 222 | 231 | 248 | 259 | 272 |

# 7. Rose Street SPS

## 7.1 Pumping Station Overview

The Rose Street SPS is located at the intersection of Rose Street and Water Street in Ayr. The Rose Street SPS receives all of the wastewater from the Village of Ayr and pumps it directly into the Ayr WWTP for treatment.

The Rose Street SPS is equipped with three 47 L/s raw sewage pumps that pump all wastewater into two available forcemains, one 200 mm in diameter, and the other 250 mm. Historically, only one forcemain is normally in service to maintain scouring velocities. The firm capacity of the station is estimated at 80 L/s with two pumps operating through only the smaller 200 mm forcemain (XCG, 2012).

## 7.2 Population Projections

Figure 9 shows the projected population for the Rose Street SPS to 2051. The population will increase from approximately 5,198 in 2016 to 6,983 in 2051.

## 7.3 Flow Projections

Figure 10 shows the projected peak flows to the Rose Street SPS to 2051, based on population, an average per capita flow of 0.279 $m^3$/cap/d, and a Harmon peaking factor of 3.2.

The current PWWF is 38 L/s, observed on June 14, 2013. The projected peak flow is expected to increase to 56 L/s in 2051, which is well within 85% of the station's firm capacity, or 68 L/s.

## 7.4 Summary

The estimated population and flow projections for the Rose Street SPS are summarized in Table 6.

**Table 6 Rose Street SPS Projected Wastewater Flows**

| Parameters | 2016 | 2021 | 2026 | 2031 | 2036 | 2041 | 2046 | 2051 |
|---|---|---|---|---|---|---|---|---|
| Population | 5,198 | 5,910 | 6,398 | 6,648 | 6,768 | 6,850 | 6,918 | 6,983 |
| Flow (PWWF) (L/s) | 38 | 45 | 50 | 53 | 54 | 55 | 55 | 56 |

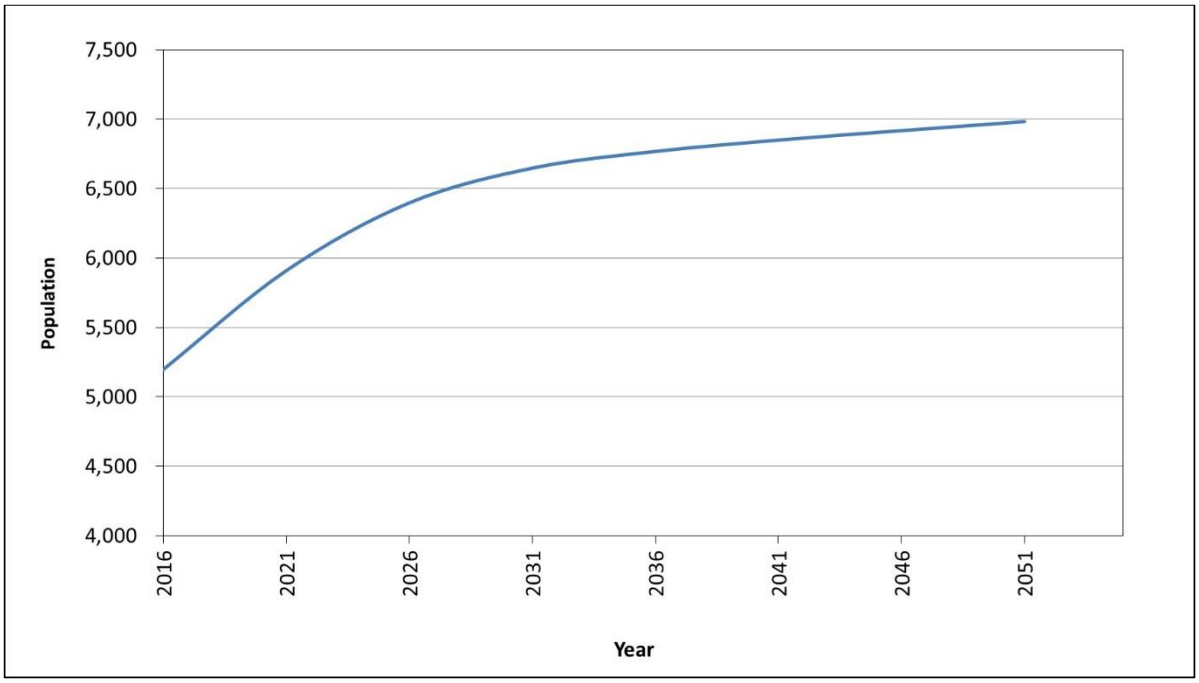


**Figure 9 Population Projections for the Rose Street SPS**

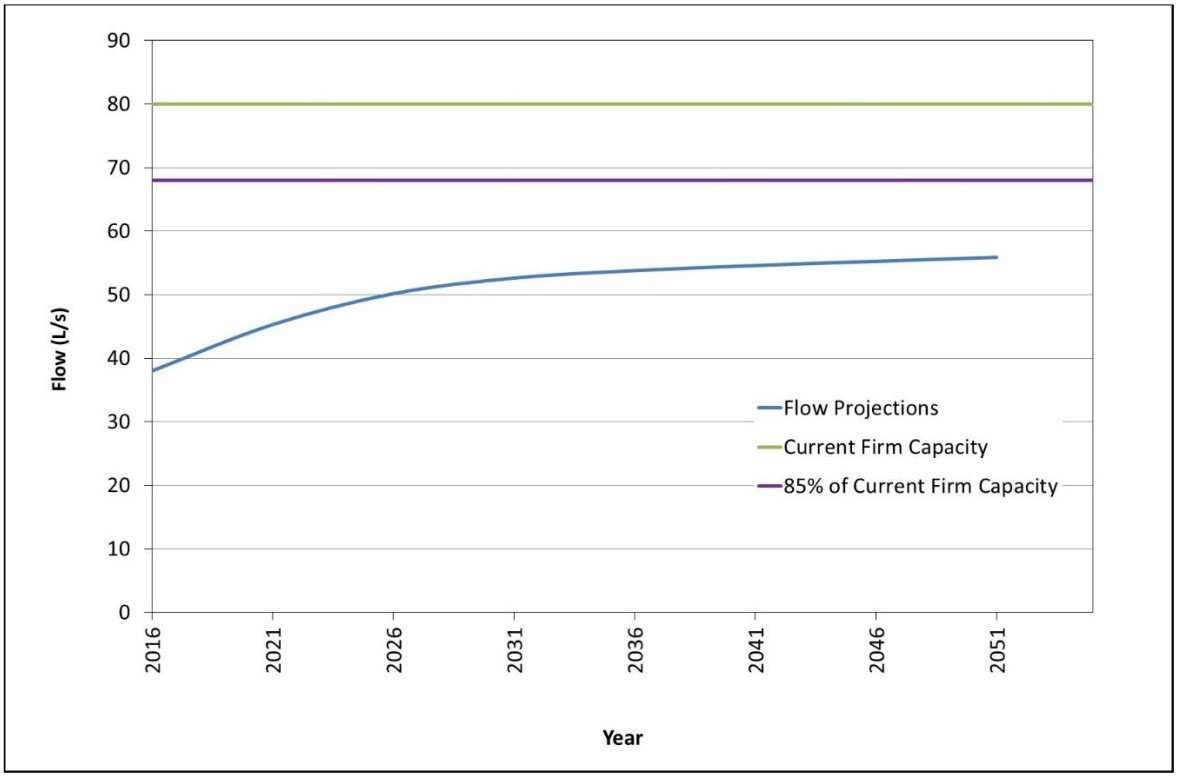


**Figure 10 Flow Projections for the Rose Street SPS**

# 8. Ayr SPS

## 8.1 Pumping Station Overview

The Ayr SPS (also referred to as Swan Street SPS) is a sewage pumping station under construction near the northeast corner of Swan Street and Brant Waterloo Road, to service new development in the south end of the Village of Ayr, Township of North Dumfries. The Ayr SPS will discharge to the Ayr WWTP, along with the Rose Street SPS.

The Ayr SPS will be constructed in two phases (Phase 1 and Phase 2), with a firm capacity of 46 L/s for Phase 1 and 84 L/s for Phase 2 (Blue Plan, 2016). The station is currently in the Phase 1 construction, which includes the installation of two pumps (one duty, one standby, each rated 46 L/s) to meet the Phase 1 flow requirements, with provision to accommodate future Phase 2 flows. Once the population has grown to the point that Phase 1 flow projections are exceeded, upgrades to the station will be required, including one additional pump and a second forcemain (Blue Plan, 2016).

## 8.2 Population Projections

Figure 11 shows the projected population for the Ayr SPS to 2051. The Ayr SPS is currently under construction, and therefore there is no existing population data available in 2016. The population will increase from approximately 441 in 2021 to 3,081 in 2051.

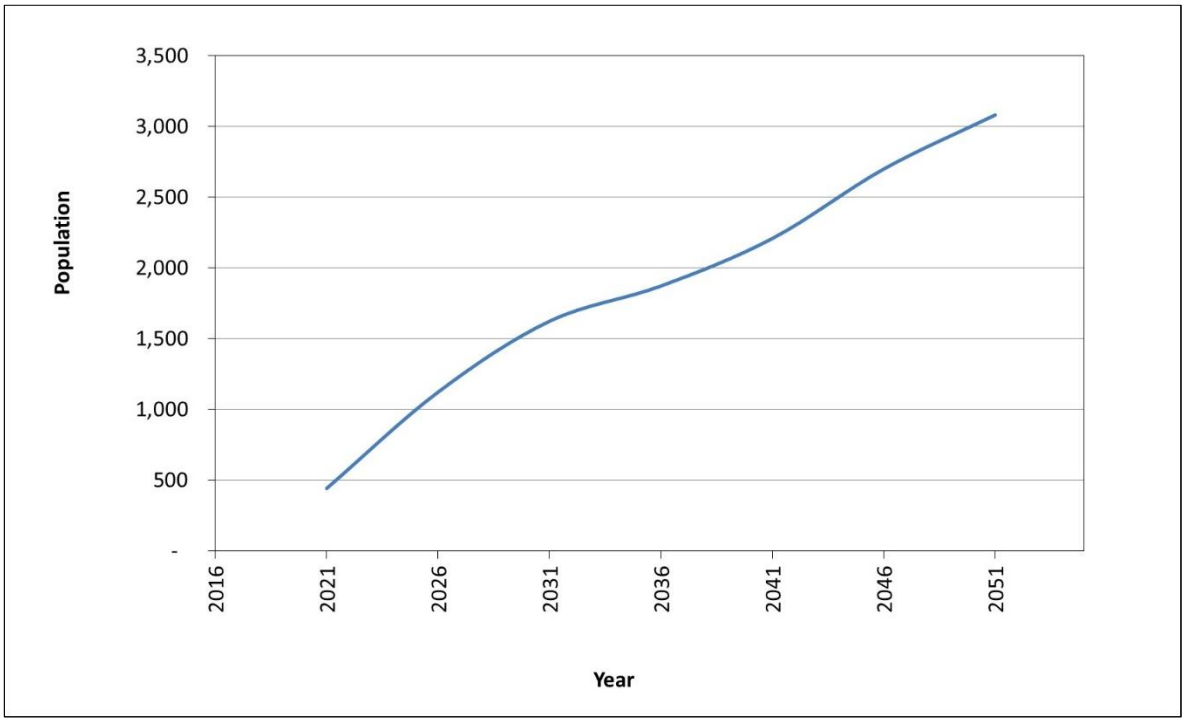


**Figure 11 Population Projections for the Ayr SPS**

## 8.3 Flow Projections

Figure 12 shows the projected peak flows to the Ayr SPS to 2051, based on population, an average per capita flow of 0.279 $m^3$/cap/d and a Harmon peaking factor of 3.6, plus an extraneous flow (refer to Section 2.4.2 for more details of calculations).

The projected peak flow is expected to increase to approximately 85% of the station's Phase 1 firm capacity, or 39 L/s in 2048. It will reach approximately 41 L/s in 2051, which is within the Phase 1 firm capacity of 46 L/s.

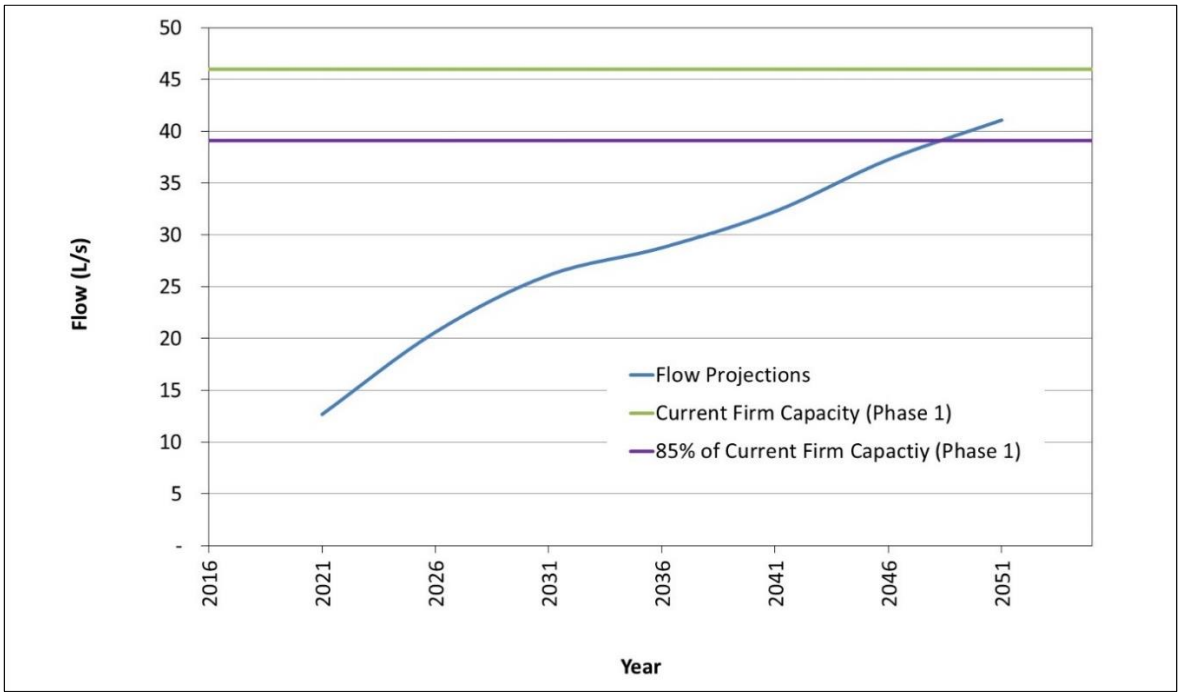


**Figure 12 Flow Projections for the Ayr SPS**

## 8.4 Summary

The estimated population and flow projections for the Ayr SPS are summarized in Table 7.

**Table 7 Ayr SPS Projected Wastewater Flows**

| Parameters | 2016 | 2021 | 2026 | 2031 | 2036 | 2041 | 2046 | 2051 |
|---|---|---|---|---|---|---|---|---|
| Population | N/A | 441 | 1,122 | 1,623 | 1,872 | 2,208 | 2,699 | 3,081 |
| Flow (PWWF) (L/s) | N/A | 13 | 21 | 26 | 29 | 32 | 37 | 41 |

Note:

1. The Ayr SPS is currently under construction, and therefore there is no existing population and flow data in 2016.

# 9. Nith River Way SPS

## 9.1 Pumping Station Overview

The Nith River Way SPS is located on Nith River Way, Ayr and services a small area, receiving wastewater from Seyler Street, Nith River Way, Robson Street, Simone Place, Douglas Street and Broom Street, in the Village of Ayr.

The Nith River Way SPS is equipped with two 3.9 L/s pumps that pump into a 150 mm diameter forcemain that discharges into the Broom Street sanitary sewer. The firm capacity of the Nith River Way SPS is estimated to be 3.9 L/s based with the largest pump out of service and a pump efficiency of 75% (Stantec, 2014).

Nith River Way SPS is a dedicated development SPS. As a result, it was assumed there would be no growth and population and flow projections were not estimated for this station.

## 10. Summary

Table 8 and Table 9 present summaries of the projected populations and flows for sewage pumping stations, respectively, through the planning period (2016-2051).

**Table 8 Future Population Projections to Sewage Pumping Stations**

| SPS | Population | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | 2016 | 2021 | 2026 | 2031 | 2036 | 2041 | 2046 | 2051 |
| Bridgeport SPS | 7,026 | 7,364 | 7,626 | 7,860 | 8,111 | 8,530 | 8,880 | 9,184 |
| Spring Valley SPS | 10,772 | 11,372 | 11,945 | 12,447 | 12,975 | 13,516 | 14,041 | 14,540 |
| Baden SPS | 5,436 | 5,598 | 5,801 | 6,069 | 6,830 | 8,092 | 8,999 | 10,104 |
| Morningside SPS | 14,574 | 15,541 | 16,045 | 16,537 | 17,832 | 19,986 | 21,512 | 23,475 |
| Rose St SPS | 5,198 | 5,910 | 6,398 | 6,648 | 6,768 | 6,850 | 6,918 | 6,983 |
| Ayr SPS | N/A (1) | 441 | 1,122 | 1,623 | 1,872 | 2,208 | 2,699 | 3,081 |
| Nith River Way SPS | N/A - Dedicated Development SPS, No Projected Growth. | | | | | | | |

Notes:

1. Ayr SPS is currently under construction and therefore there is no current population data available in 2016.

**Table 9 Future Projected Flows to Sewage Pumping Stations**

| SPS | Peak Wet Weather Flow (L/s) | | | | | | | | Firm Cap. (L/s) | Year to Reach 85% Firm Cap. | Year to Reach Ext. Firm Cap. |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | 2016 | 2021 | 2026 | 2031 | 2036 | 2041 | 2046 | 2051 | | | |
| Bridgeport | 85 | 90 | 93 | 97 | 100 | 106 | 110 | 114 | 136 | >2051 | >2051 |
| Spring Valley | 207 | 214 | 221 | 227 | 234 | 240 | 246 | 252 | 245 | 2017 | 2045 |
| Baden | 185 | 187 | 188 | 191 | 198 | 209 | 217 | 226 | 187 | <2016 | 2021 |
| Morningside | 206 | 214 | 218 | 222 | 231 | 248 | 259 | 272 | 248 | 2019 | 2041 |
| Rose Street | 38 | 45 | 50 | 53 | 54 | 55 | 55 | 56 | 80 | >2051 | >2051 |
| Ayr (1) | N/A | 13 | 21 | 26 | 29 | 32 | 37 | 41 | 46 | 2048 | >2051 |
| Nith River Way | N/A - Dedicated Development SPS, No Projected Growth. | | | | | | | | 3.9 | N/A – No Projected Growth | |

Notes:

1. Ayr SPS is currently under construction, with a firm capacity of 46 L/s for Phase 1 and 84 L/s for Phase 2. There is no existing population data available in 2016.

# 11. References

1. AECOM (2011). Baden and New Hamburg Water and Wastewater Master Plan Update - Master Plan Report Volume 1: Summary Report (Final), AECOM, June, 2011.
2. Blue Plan Engineering (2016). Ayr Sewage Pumping Station Design Brief Issued for Tender, June 2016.
3. Earth Tech Canada Inc. (2007). Regional Municipality of Waterloo Wastewater Treatment Master Plan Final Report, August 2007.
4. Hatch Mott Macdonald (HMM) (2012). Baden Sewage Pumping Station Investigation, June 2012.
5. Hemson Consulting Ltd. (2013). Places to Grow Greater Golden Horseshoe Growth Forecast to 2041 Technical Report (2012) Addendum.
6. Metcalf and Eddy (2003). Wastewater Engineering Treatment and Reuse, Fourth Edition.
7. Ontario Ministry of Infrastructure (2013). 2013 Office Consolidation of Growth Plan for the Greater Golden Horseshoe, 2006.
8. Ontario Ministry of Infrastructure (2013). Amendment 2 (2013) to the Growth Plan for the Greater Golden Horseshoe, 2006.
9. Ontario Ministry of the Environment and Climate Changes (MOECC) (2008). Design Guidelines for Sewage Works.
10. Ontario Ministry of the Environment and Climate Changes (MOECC) (1995). D-5-1 Calculating and Reporting Uncommitted Reserve Capacity at Sewage and Water Treatment Plants.
11. Region Municipality of Waterloo (RMOW, 2014). Ontario Clean Water Agency Operating and Maintenance Reports.
12. R. V. Anderson (2015). Spring Valley Sewage Pumping Station Pre-Design.
13. R. V. Anderson (2016). Bridgeport Sewage Pumping Station Flow Diversion Technical Memorandum #1 Draft, July 29, 2016.
14. Stanley Consulting Ltd (1998). New Hamburg-Baden Wastewater Treatment and Conveyance Infrastructure, Preliminary Design Report, July 1998.
15. Stanley Consulting Ltd (1998). Morningside Wastewater Pumping Station – Design Brief. Prepared for the Regional Municipality of Waterloo. 1998.
16. Stantec Consulting Ltd (1999). Morningside Sewage Pumping Station Design Modifications, January, 1999.
17. Stantec Consulting Ltd (2014). Ayr Sewage Pumping Station, Forcemain, and Trunk Sewer Routing Municipal Class Environmental Assessment, August 2014.

18. Stantec Consulting Ltd (2017). Morningside Sewage Pumping Station Capacity Assessment, April 2017.
19. XCG Consultants Limited (2012). Ayr Wastewater Master Plan, December, 2012.

# Appendix A

# Calculation Sheets