MUNICIPALITY OF KINCARDINE

2022 Water and Wastewater Servicing Master Plan Update

THE MUNICIPALITY OF KINCARDINE
great energy. balanced life.

BMROSS
engineering better communities

MUNICIPALITY OF KINCARDINE
2022 WATER AND WASTEWATER SERVICING
MASTER PLAN UPDATE

June 9, 2023

B. M. ROSS AND ASSOCIATES LIMITED
Engineers and Planners
62 North Street
Goderich, Ontario N7A 2T4
Phone (519) 524-2641
www.bmross.net

File No. 18265

TABLE OF CONTENTS

List of Tables

List of Figures

List of Appendices

B. M. ROSS AND ASSOCIATES LIMITED
Engineers and Planners
62 North Street, Goderich, ON N7A 2T4
p. (519) 524-2641 **www.bmross.net**

File No. 22128

MUNICIPALITY OF KINCARDINE
2022 WATER AND WASTEWATER SERVICING MASTER PLAN UPDATE

EXECUTIVE SUMMARY

ES 1.0 INTRODUCTION

ES 1.1 Purpose of the Master Plan

The Municipality of Kincardine initiated a Master Plan in May 2022 to identify infrastructure requirements associated with water supply, storage and distribution, and wastewater collection and treatment in Kincardine. The analysis applies to the Kincardine Drinking Water and Wastewater Systems, the Tiverton Drinking Water System (DWS) and the Bruce Energy Centre (BEC) Wastewater System, as well as their corresponding service areas.

This Master Plan establishes infrastructure improvement and expansion needs to accommodate current and projected growth in service areas for the above noted systems.

The Master Plan will become the basis for, and used in support of, future projects required to accommodate approved growth.

ES 2.0 KEY FINDINGS

ES 2.1 Growth and Development

The population of the Municipality of Kincardine (from the 2021 Census) is 12,268 (Statistics Canada, 2023). It is estimated that of this population, 7,728 people are within the community of Kincardine, 717 in the community of Tiverton, and 1,257 in the Lakeshore area from Inverhuron to West Ridge on the Lake.

Several different growth projections were available. These are listed in Section 3.0. The growth rates were then applied to the population figures for Kincardine and Tiverton using the 2021 Census data and DWS customer counts provided by the Municipality. The population for Kincardine also includes the Lakeshore area from West Ridge on the Lake to Inverhuron. This created four different sets of 20-year population projections for each community.

Table ES 1.1 – Summary of Kincardine Population Forecasts

Source of Forecast	Rate of Growth	2021 Population	2043 Population	2043 Equivalent Residential Units (ERU)
2021 Official Plan	0.56%	8,985	10,167	4,822
Ministry of Finance	1.28%	8,985	11,846	5,371
2021 DC Background Study	0.63%	8,985	10,321	4,679
Bruce County – "Good Growth"	1.01%	8,985	11,201	5,079

Table ES 1.2 – Summary of Tiverton Population Forecasts

Source of Forecast	Rate of Growth	2021 Population	2043 Population	2043 ERUs
2021 Official Plan	0.56%	717	811	440
Ministry of Finance	1.28%	717	945	490
2021 DC Background Study	0.63%	717	824	427
Bruce County – "Good Growth"	1.25%	717	942	488

For both communities, the projected future populations did not differ significantly among the different growth forecasts. The 2021 Official Plan projections produced the lowest population values, while the 2021 Draft Development Charges Background Study and By-law produced the lowest ERU projections. The Ministry of Finance projected the largest populations and ERUs for each community. To simplify water demand and wastewater flow projections, only the scenario producing the smallest and largest value for ERUs will be considered. These will be referred to by the following:

- **Low Growth Scenario** – 2021 Draft Development Charges Background Study and By-law (Hemson); and
- **High Growth Scenario** – Ontario Ministry of Finance Population Projections (2021-2046).

These values have been used in the evaluation of capacity requirements for the major water and wastewater facilities.

ES 2.2 Kincardine Water System

ES 2.2.1 Treatment Capacity

The Kincardine Water Treatment Plant (WTP) has a rated capacity of 11,563 m^3/day. Water in Kincardine is primarily supplied to a single pressure zone, though a booster pumping station (BPS) on Gary Street services a limited number of properties at the northeast area of the community.

The existing maximum day demand is estimated to be 6,954 m^3/day, which corresponds to 1.71 m^3/day/ERU. Reserve capacity is sufficient to handle growth and development commitments over the next 20 years for both growth scenarios. Currently, the uncommitted reserve may supply an additional 1,076 ERUs, which only accounts for approximately 49% of the 2,187 ERUs currently known as pending development or proposals.

There is no immediate need to consider further expansion of the Kincardine WTP based on community growth projections. However, a Class EA is currently underway assessing the need to increase the capacity of the WTP, which is primarily driven by potential interest from Bruce Power to be serviced by Municipal water.

ES 2.2.2 Water Storage

There is currently approximately 7,480 m^3 of total water storage capacity, provided by a combination of the WTP reservoir and the Kincardine standpipe. Of this, slightly more than 4,700 m^3 is readily available for use (i.e., effective volume). Ministry of the Environment, Conservation and Parks (MECP) Design Guidelines recommend 4,650 m^3 of water storage for the current service population, therefore there is currently a surplus in effective storage of only 55 m^3.

It is recommended that disinfection process modifications at the WTP be carried out to reduce the volume required for chlorine contact and maximize the current total volume available for use. With these modifications, storage will be sufficient for existing plus development commitments, including the addition of Bruce Power as a customer.

Future additional water storage should be considered depending on rate and extent of development beyond current proposals. When needed, a recommended location for a new facility is generally north of the existing urban limit on Gary Street, as far north and east as development is planned at that time. Infrastructure in that general vicinity would be subject to height restrictions due to the Municipal airport.

ES 2.2.3 Water Distribution

A WaterCAD® model of the distribution system was utilized to identify potential flow and pressure issues. Key findings are:

- There are no locations currently experiencing pressures above the MECP recommended maximum of 700 kPa or below the MECP recommended minimum of 275 kPa.

- Some residential locations (3.5% of system currently and 6.6% for the 20-year projection) have fire flows less than the 50 L/s criteria used in the Master Plan. These are generally along the lakeshore, north of the community of Kincardine, and at the end of dead-end watermain. These could be addressed by watermain improvements in conjunction with development or road reconstruction, though it is generally typical that at system extremities and dead-ends there will always be limitations to available fire flow.

ES 2.3 Tiverton Water System

ES 2.3.1 Treatment Capacity

The Tiverton water supply and treatment facilities consist of three wells and two pumphouses, with a combined rated capacity of 774.66 m^3/day in the Permit to Take Water (PTTW). The Municipal Drinking Water Licence (MDWL) states a rated capacity of 1,114.56 m^3/day, but currently the PTTW value governs.

The existing maximum day demand is estimated to be 616 m^3/day, which corresponds to 1.66 m^3/day/ERU. Based on development commitments, the system is overcommitted by 265 m^3/day. Therefore, the addition of development commitments would currently exceed the reserve capacity. However, assuming the highest growth rate considered in the Master Plan, additional supply and treatment capacity would not be required until 2039. Ultimately, the timing required for a capacity increase will be linked to development status rather than calendar year. It is recommended that potential approaches to supply capacity increase be evaluated at this time. Current indications are that there would be low potential for re-rating any of the current wells, so an alternate source will likely be required when the capacity increase is needed. Alternatives to consider should include addition of a new well(s) or connecting to the Kincardine system.

ES 2.3.2 Water Storage

There is currently 1,500 m^3 of total water storage capacity within the Tiverton standpipe. Of this, approximately 1,390 m^3 is effective volume. MECP Design Guidelines recommend 534 m^3 of water storage for the current service population. Therefore, there is a surplus in effective storage of approximately 856 m^3. The effective storage is adequate for all commitments under both growth scenarios for the next 20 years.

ES 2.3.3 Water Distribution

A WaterCAD® model of the distribution system was utilized to identify potential flow and pressure issues. Key findings are:

- Several locations (26% of system currently and 28% in 2043) have fire flows less than the 50 L/s criteria used in the Master Plan. The majority are in the northern part of the community, and others are at the ends of small diameter watermain dead-ends. Flow to the northern part of the community could be improved by construction of a parallel or larger diameter watermain along King Street, north of Stanley/Cameron Streets.

ES 2.4 Kincardine Wastewater System

ES 2.4.1 Wastewater Flows

The Kincardine wastewater system currently experiences average day wastewater flows estimated to be 3,828 m^3/day, which corresponds to 1.01 m^3/day/ERU.

ES 2.4.2 Collection System

SewerCAD® models of the six major Sewage Pumping Station (SPS) catchment areas were utilized to identify potential sanitary sewage pipe capacity issues. The SPSs were also evaluated based on a comparison of current rated capacities to estimated current and future peak flows. All collection system analyses were carried out on the basis of full development of the SPS catchment areas. Key findings for each SPS are:

- Connaught Park SPS:
    - The existing SPS rated capacity is 89 L/s, while the projected 20-year peak flow is estimated to be 90 L/s. There is not a need to increase station capacity.
- Durham Street SPS:
    - The existing SPS rated capacity is 27 L/s, while the projected 20-year peak flow is estimated to be 83 L/s. Expansion of the SPS is currently being designed, with a plan of being constructed in 2023.
- Huron Terrace SPS:
    - The future catchment area expansion includes relatively large land areas north of the existing urban boundary, up to Concession 5. It may take many years for development in these lands to significantly affect flows.
    - The SPS and its forcemain were recently upgraded and the SPS has a rated capacity of 300 L/s.
    - Within this catchment area, sanitary sewer upgrades on Queen and Kingsway Streets will be required for servicing future development. At this time there is likely no urgency associated with the upgrades, and they should be carried out as part of road reconstruction projects or as development warrants.
- Park Street SPS:
    - The existing rated capacity is 99 L/s, while the projected 20-year peak flow is estimated to be 200 L/s.
    - Design of the Park Street SPS pump upgrades is tentatively planned for 2023, with construction tentatively planned for 2024.

- Goderich Street SPS:
    - The existing SPS rated capacity is 46 L/s, with estimated current peak flow of 29 L/s and projected 20-year peak flow of 63 L/s. There is currently no need to increase station capacity but flows to the station should be monitored.
- Kincardine Avenue SPS:
    - The existing SPS rated capacity is 49 L/s, with estimated current peak flow of 40 L/s and projected 20-year peak flow of 61 L/s. Currently, there is not a need to increase station capacity, but flows to the station should be monitored.

ES 2.4.3 Treatment Capacity

The Kincardine WWTP has a rated capacity of 5,910 m^3/day. The plant has an estimated uncommitted reserve capacity for 924 ERUs. This will be sufficient for existing plus development commitments for the next 20 years under low growth scenarios, and until approximately 2037 under the high growth scenario.

There is no immediate need to consider expansion of the Kincardine WWTP. However, it is recommended that the reserve capacity calculations be reviewed 5 years following completion of this Master Plan, and the potential need to expand the WWTP be reconsidered.

ES 2.5 BEC & Service Area Wastewater Systems

ES 2.5.1 BEC WWTP Wastewater Flows

The BEC WWTP services the BEC industrial lands, Inverhuron Provincial Park, a portion of the Inverhuron community, and Tiverton. The BEC WWTP currently experiences average day wastewater flows estimated at 729 m^3/day, which corresponds to 1.58 m^3/day/ERU.

ES 2.5.2 Tiverton Collection System

A SewerCAD® model including both SPS catchment areas was utilized to identify potential sanitary sewage pipe capacity issues. The SPSs were also evaluated based on a comparison of current rated capacities to estimated current and future peak flows. All collection system analyses were carried out on the basis of full development of the SPS catchment areas. Key findings for each SPS are:

- King Street SPS:
    - The station rated capacity is considered adequate for current and projected future flows.

- Maple Street SPS:
    - The existing SPS rated capacity is 30 L/s, while future peak flow is estimated to be 67 L/s. Peak flows have been observed to have declined in recent years, which may be a result of seasonal variation, or may be a result of recent sewer reconstruction work in the area. It is recommended that peak flows continue to be monitored.

ES 2.5.3 Treatment Capacity

The BEC WWTP has a rated capacity of 2,200 m^3/day. The plant has an estimated uncommitted reserve capacity for 640 ERUs. Under both growth scenarios, the existing rated capacity of the BEC WWTP will be sufficient for existing plus development commitments for the next 20 years.

It is noted that there is significant development potential associated with the BEC and Concession 2 industrial lands. If the BEC Development and Concession 2 Industrial Lands were fully developed with light industry, it would create an estimated deficit in treatment capacity of 1,857 m^3/day. Therefore, significant development could trigger a need for an increase to plant rated capacity, but there is no known immediacy for this.

ES 3.0 SUMMARY OF RECOMMENDED WORKS

The following table provides a summary of recommended works to meet existing and future servicing issues. In most cases, the solutions are subject to additional more detailed investigations.

Table ES 3.1 – Summary of Recommended Works

System	Project	Description	Probable Cost (2023 $)[1]	EA Requirements	Timing
Kincardine Drinking Water System	Modify WTP Disinfection Process	Convert primary disinfection to UV process, allowing volume currently used for chlorine contact to be available for customer use	Currently under review as part of Class EA	Exempt	Currently under review as part of a separate Class EA process
Kincardine Drinking Water System	Increase WTP Capacity	In response to Bruce Power's interest in connection to the municipal system	Currently under review as part of Class EA	Schedule C	Currently under review as part of a separate Class EA process
Tiverton Drinking Water System	Well Inspection to Confirm Capacity	Engage a hydrogeologist to complete testing of Dent Well #2 and Briar Hill Well #2	$50,000	Not Applicable	Within next 3 years
Tiverton Drinking Water System	Evaluate Increase to DWS Capacity	Complete Class EA to evaluate additional well versus connection to Kincardine system	$75,000 (plus $50,000 for Source Water Protection modeling costs, if any)	Schedule B	2024; sooner if development status requires
Tiverton Drinking Water System	King Street Watermain	Parallel or replace existing watermain to improve fire flow to north	$660,000 (watermain only)	Exempt	In response to development needs or with planned road reconstruction

System	Project	Description	Probable Cost (2023 $)[1]	EA Requirements	Timing
Kincardine Wastewater System	Construct Durham Street SPS Upgrades	Durham Street SPS – pump and electrical replacement	$1,250,000	Exempt	2023
Kincardine Wastewater System	Design Park Street SPS Upgrades	Park Street SPS – pump replacement design and approvals	$100,000	Exempt	2024
Kincardine Wastewater System	Kincardine WWTP Capacity Monitoring	Maintain up-to-date reserve capacity calculations for the Kincardine WWTP	$5,000 per capacity update	Not applicable	Every 5 years; sooner if development status warrants or flows change noticeably
Kincardine Wastewater System	Queen Street and Kingsway Street Sewer Upgrades	Sewer upgrades to accommodate future development north of the existing Huron Terrace SPS catchment area	$1,600,000 (sanitary sewer only)	Exempt	In response to development needs or with planned road reconstruction.
Kincardine Wastewater System	Goderich Street SPS and Kincardine Ave SPS Flow Monitoring	Ongoing monitoring of station flows vs. rated capacity, to ensure adequacy	Not applicable	Exempt	Ongoing
Tiverton Wastewater System	Maple Street SPS Flow Monitoring	Ongoing monitoring of station flows vs. rated capacity, to ensure adequacy	Not applicable	Exempt	Ongoing

System	Project	Description	Probable Cost (2023 $)[1]	EA Requirements	Timing
BEC and Service Area Wastewater Systems	BEC WWTP Reserve Capacity Monitoring	Maintain up-to-date reserve capacity calculations for the BEC WWTP	$5,000 per capacity update	Not applicable	Every 5 years; sooner if development status warrants or flows change noticeably

[1] Refer to previous sections for assumptions and limitations for cost estimates.

B. M. ROSS AND ASSOCIATES LIMITED
Engineers and Planners
62 North Street, Goderich, ON N7A 2T4
p. (519) 524-2641 **www.bmross.net**

MUNICIPALITY OF KINCARDINE
2022 WATER AND WASTEWATER SERVICING
MASTER PLAN UPDATE

1.0 INTRODUCTION

1.1 Purpose of the Master Plan

The Municipality of Kincardine initiated a Master Plan in May 2022 to identify infrastructure requirements associated with water supply, storage and distribution, and wastewater collection and treatment in Kincardine. The analysis applies to the Kincardine Drinking Water and Wastewater Systems, the Tiverton Drinking Water System (DWS) and the Bruce Energy Centre (BEC) Wastewater System, as well as their corresponding service areas.

This Master Plan establishes infrastructure improvement and expansion needs to accommodate current and projected growth in the Municipality of Kincardine.

In this regard, the Master Plan will become the basis for, and used in support of, future specific projects required to accommodate approved growth.

1.2 General Description of Master Plans

Master Plans are long-range plans which integrate infrastructure requirements for existing and future land uses with environmental assessment planning principles (Municipal Engineers Association, 2000). These plans examine existing infrastructure systems within defined areas to provide a framework for planning subsequent works. Master Plans typically exhibit several common characteristics. They:

- Address the key principles of successful environmental planning;
- Provide a strategic level assessment of various options to better address overall system needs and potential impacts and mitigation;
- Address at least the first two phases of the Municipal Class Environmental Assessment (MCEA) process;
- Are generally long-term in nature;

- Apply a system-wide approach to planning which relates infrastructure either geographically or by a particular function;
- Recommend an infrastructure servicing plan which can be implemented through the completion of separate projects; and
- Include descriptions of the specific projects needed to implement the Master Plan.

1.3 Integration with the Class EA Process

1.3.1 Class EA Phases

The Master Plan has been completed in accordance with the planning and design process of the Municipal Class EA. The Class EA is an approved planning document which describes the environmental assessment process that proponents must follow in order to meet the requirements of the Environmental Assessment Act (EA Act) (Municipal Engineers Association, 2000).

The Class EA approach allows for the evaluation of alternative methods of carrying out a project and identifies potential environmental impacts.

The Class EA planning process is divided into five phases which are described below and illustrated in Figure 1.1.

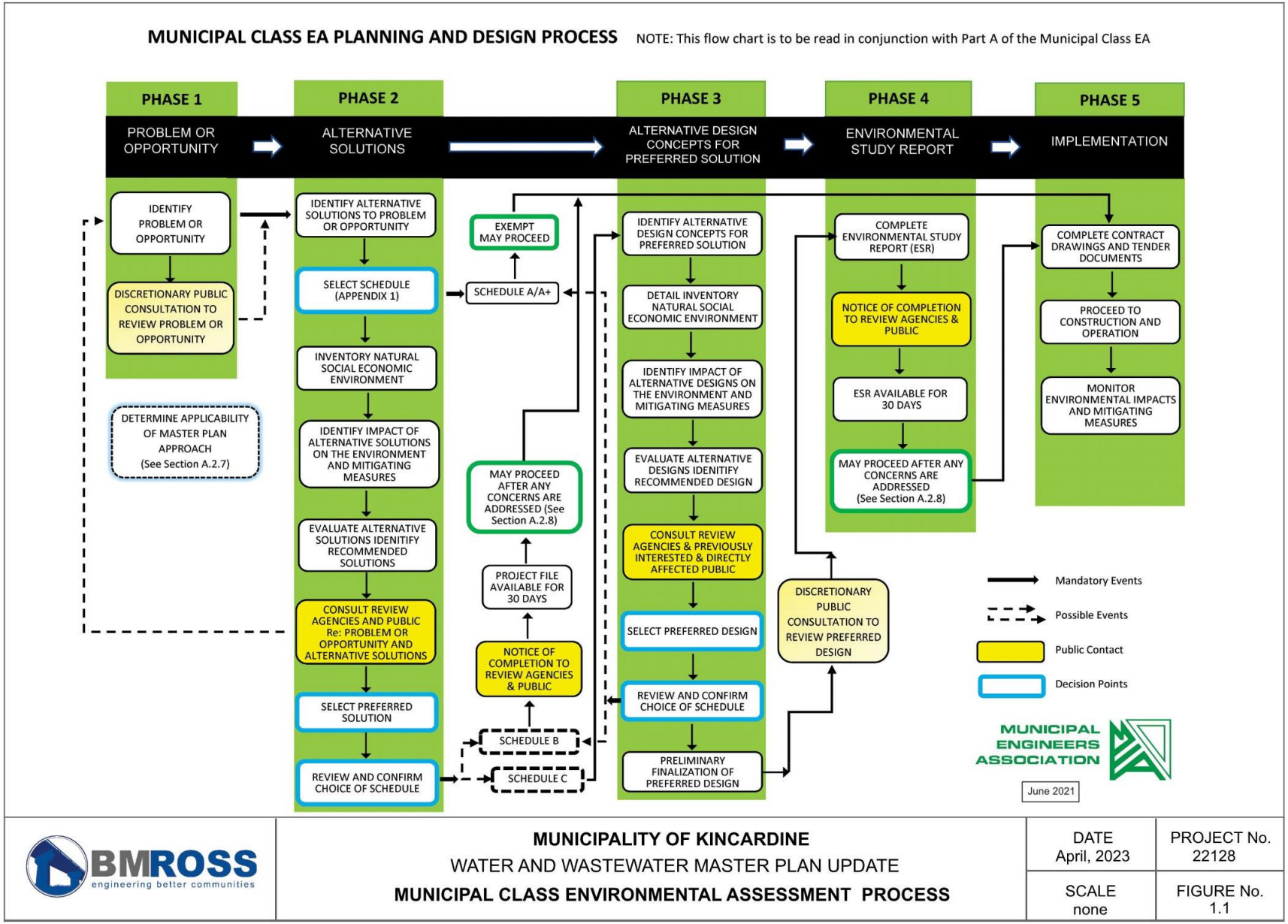
- Phase 1 - Problem or Opportunity identification;
- Phase 2 - Evaluation of alternative solutions to the defined problems and selection of a preferred solution;
- Phase 3 - Identification and evaluation of alternative design concepts and selection of a preferred design concept;
- Phase 4 - Preparation and submission of an Environmental Study Report (ESR) for Stakeholder review; and
- Phase 5 - Implementation of the preferred alternative and monitoring of any impacts.

1.3.2 Classification of Project Schedules

Projects associated with master plans are classified into different project schedules according to the potential complexity and the degree of environmental impacts that could be associated with the project. There are four schedules:

- Exempt – Projects that are exempt from the Environmental Assessment Act;
- Eligible for Screening to Exempt – projects that may be eligible for exemption based on the results of an archaeological potential and/or collector road screening process;

Figure 1.1 – Class EA Process



- Schedule B – Projects that are approved following the completion of a screening process that incorporates Phases 1 and 2 of the Class EA process, as a minimum; and

- Schedule C – Projects that are approved subject to following the full Class EA process.

The Class EA process is self-regulatory, and municipalities are expected to identify the appropriate level of environmental assessment based upon the project they are considering.

1.4 Master Plan Framework

1.4.1 Master Plan Approaches

Given the broad nature and scope of master plans, the Class EA document provides proponents with four approaches to conducting master plan investigations. Proponents are encouraged to adapt and tailor the master planning process to suit the needs of the study being undertaken, providing that, at a minimum, the assessment involves an evaluation of servicing deficiencies followed by a review of possible solutions (i.e., Phases 1 and 2 of the Class EA process).

Table 1.1 summarizes the primary components associated with each of the four Master Plan approaches outlined within the Municipal Class EA document (MCEA).

Table 1.1 – Summary of MCEA Master Plan Approaches

Approach	Key Characteristics	Project Implementation
1	- Master Plan prepared at the conclusion of Phases 1 and 2 of the Class EA process. - Completed at a broad level of assessment. - Serves as basis for future investigations associated with specific Schedule B and C projects.	- Schedule B and C projects would require further Class EA investigations.
2	- Master Plan prepared at the conclusion of Phases 1 and 2 of MCEA process. - Includes a more detailed level of investigation and consultation completed, such that it satisfies requirements for Schedule B screenings. - Final public notice for Master Plan serves as Notice of Completion for individual Schedule B projects.	- Schedule B projects are approved. - Schedule C projects must complete Phase 3 and 4 of Class EA process.

Approach	Key Characteristics	Project Implementation
3	- Master Plan prepared at the conclusion of Phase 4 of Class EA process. - Level of review and consultation encompasses Phases 1 to 4 of the Class EA process. - Final public notice for Master Plan serves as Notice of Completion for Schedule B and C projects reviewed through the Master Plan.	- Further Class EA investigations are not required for projects reviewed through the Master Plan.
4	- Integration of Master Plan with associated Planning Act approvals. - Establishes need and justification in a very broad context. - Best suited when planning for a significant geographical area for an extended period.	- Depending on level of investigation associated with the Master Plan, Class EA investigations may be required for specific projects.

1.4.2 Applied Framework

At the outset of the Master Plan process, it was identified that Approach 1 would be utilized for this assessment. Under this framework, the Master Plan defines broad infrastructure requirements within the study area and serves as the basis of future detailed investigations. Under this framework, Schedule B and C projects that are identified will require additional MCEA investigations.

The Master Plan is subject to approval from the Municipality of Kincardine but does not require formal approval under the EA Act. A Completion Notice will be issued at the conclusion of the Master Plan. Any projects identified within this Master Plan that are considered Schedule B and C activities will be required to complete additional investigations to satisfy the requirements of Class EA process, prior to approval, design and construction.

2.0 STUDY AREA AND EXISTING CONDITIONS

2.1 Study Area

The areas examined as part of the Water and Wastewater Servicing Master Plan include the former Town of Kincardine; former Village of Tiverton; the lakeshore area north of Kincardine to the north end of Inverhuron; and the BEC and Concession 2 Industrial Parks. These areas represent the largest areas of existing water and wastewater servicing within the Municipality, as well as areas of potential growth and development. The study area for this Master Plan is shown in Figure 2.1.

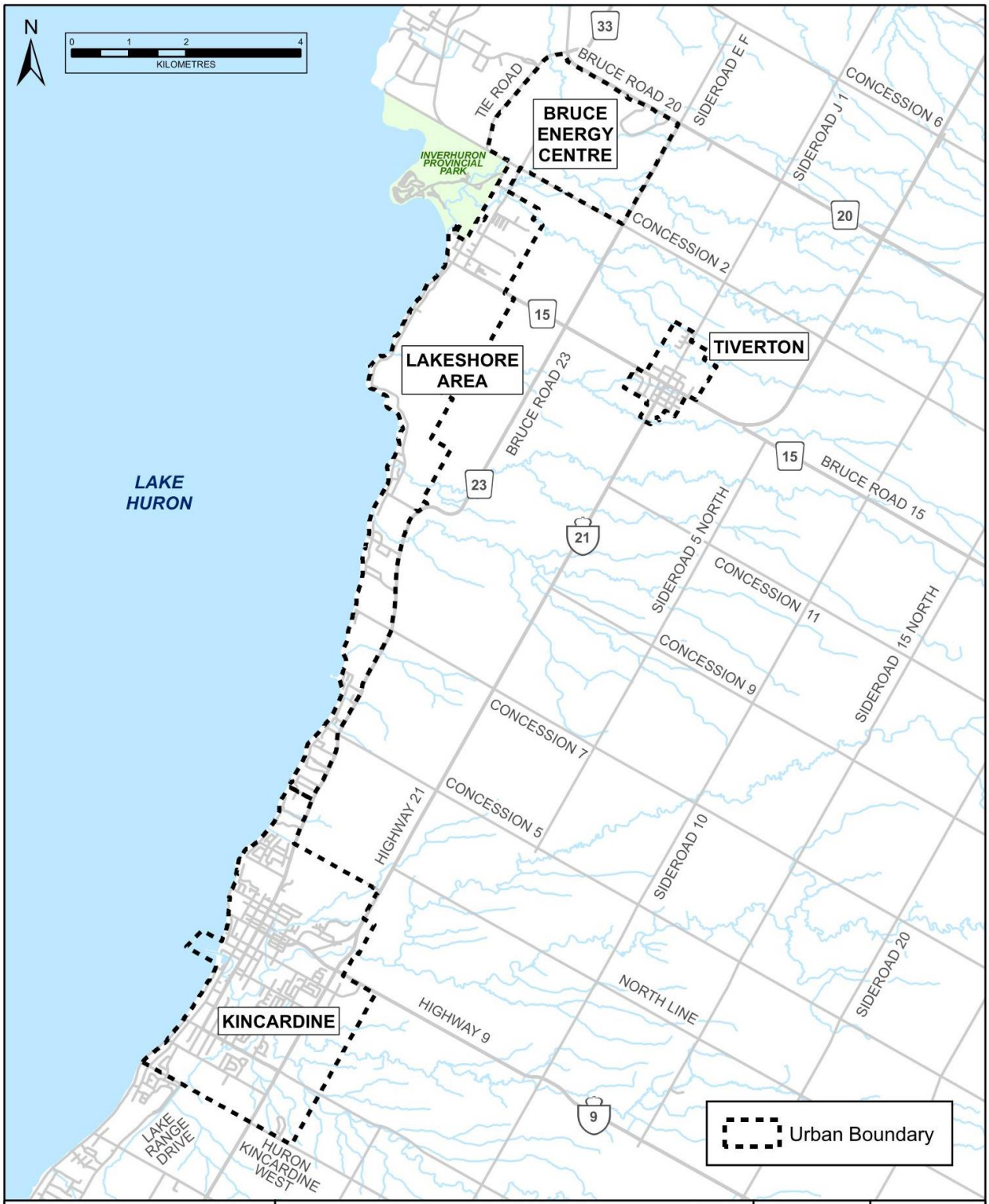
The former Town of Kincardine roughly extends from Saratoga Road north to Wickham Cove Lane, and east from Lake Huron to the Kincardine Business Park, located on the east side of the Bluewater Highway (Highway 21). Majority of existing development within Kincardine is located between the Bluewater Highway and Lake Huron.

Tiverton is located approximately 12 km north of Kincardine, at the intersection of Bruce Road 15 and the Bluewater Highway (Highway 21). It generally includes the lands east of Maple Street to McLaren Street and from Elizabeth Street south to the end of King Street.

The Lakeshore area included in this Master Plan encompasses the lands north of Kincardine, between Lake Huron and Bruce Road 23, to Alma Street in the northern portion of the community of Inverhuron.

The Bruce Energy Centre Industrial Park is located southwest of the intersection of Bruce Road 23 and Bruce Road 20. The Industrial Park includes the lands fronting on Farrell Drive. South of the BEC, along Concession 2, are additional Industrial Park lands.

Figure 2.1 – Master Plan Study Area



2.2 General Description of the Water and Wastewater Facilities

2.2.1 Kincardine Drinking Water System

The Kincardine Drinking Water System (KDWS) services 4,073 connections within the former Town of Kincardine, the Huronville area in the northwestern area of the Township of Huron-Kinloss, and the Kincardine Shoreline Distribution System (KSDS). Detailed descriptions of the principal treatment, storage, and distribution infrastructure are provided within Section 4.1 of this Master Plan.

Water in Kincardine is primarily supplied to a single pressure zone, though a booster pumping station (BPS) on Gary Street services a limited number of properties at the northeast area of the community.

2.2.2 Tiverton Drinking Water System

The Tiverton Drinking Water System (TDWS) services 372 connections within the community of Tiverton. Detailed descriptions of the principal treatment, storage, and distribution infrastructure are provided within Section 4.2 of this Master Plan.

2.2.3 Kincardine Wastewater Treatment and Collection System

The Kincardine Wastewater Treatment Plant (WWTP) and collection system services the former Town of Kincardine and Huronville subdivision in the northwestern area of the Township of Huron-Kinloss. Detailed descriptions of the principal collection and treatment infrastructure are provided within Section 5.1 of this Master Plan.

2.2.4 Tiverton Wastewater Collection System

The Tiverton Wastewater collection system services the community of Tiverton. Detailed descriptions of the principal collection infrastructure are provided within Section 5.2 of this Master Plan.

2.2.5 Bruce Energy Centre Wastewater Treatment System

The BEC WWTP services the BEC Industrial Park, Inverhuron, Tiverton and Inverhuron Provincial Park (IPP). A detailed description of the treatment infrastructure is provided within Section 5.2 of this Master Plan.

2.3 Environmental Setting

2.3.1 General

The MCEA Master Plan process requires an inventory of the environment. The environmental review represents a general overview of local conditions. This environmental inventory is used to identify factors that could influence the identification and selection of alternative solutions to the problem or opportunity being investigated. The background review for the Master Plan process incorporated the assembly of information about the local environment.

Information was collected as part of a desktop analysis, based on the following key sources:

- Saugeen Valley Conservation Authority, website and mapping;
- County of Bruce, website, mapping and files;
- Municipality of Kincardine, website and files;
- Government of Canada Species at Risk website;
- Ministry of Natural Resources and Forestry Natural Heritage Information Centre (NHIC) mapping; and
- Existing files and reports completed by BMROSS.

2.3.2 General Physiography

There are two distinct physiographic regions within the study area: the Huron Fringe and the Huron Slope (Chapman & Putnam, 1984). The Huron Fringe, located immediately adjacent to Lake Huron, is the narrow strip of wave cut terraces of glacial Lake Algonquin and Lake Nipissing. The Huron Fringe stretches from Sarnia to Tobermory along the Lake Huron shoreline. The lakeshore area of the Municipality, Inverhuron and the western-most portion of Kincardine are located within the Huron Fringe.

The Huron Slope encompasses the lands between the Algonquin shore cliff to the west (Huron Fringe) and Wyoming Moraine to the east. It is a clay plain, modified by a narrow strip of sand and the twin beaches of glacial Lake Warren on the eastern side (Chapman & Putnam, 1984). The till in the area is formed from brown calcareous clay and has minimal pebbles and boulders. It is approximately 1.5 m to 3 m thick and overlays brown stratified clay. The plain is deeply trenched by the Penetangore River as it flows through Kincardine to a river outlet at Lake Huron. Tiverton, the BEC Industrial Park and the majority of the former Town of Kincardine are located within the Huron Slope.

2.3.3 Soils

Within the study area, the predominate soil groups are grey-brown podzolic soils (Hoffman & Richards, 1954). South of Inverhuron, the soils are sandy loams of the Brady soil series or the Perth soil series. These soils are sandy loams or clay loams, formed from outwash material and shale till. The soils are considered to have imperfect drainage. In the vicinity of Inverhuron, the Elderslie soil type is found. This soil is formed from lacustrine deposits and ranges from a clay loam to a silty clay loam. Similar to the Brady and Perth soils, the Elderslie soil also has imperfect drainage. In the Lorne Beach area, the presence of Marsh soils is noted. The thickness of the surficial deposits generally increases from west to east, from 5 m thick to 10-50 m thick throughout the majority of the Municipality of Kincardine.

2.3.4 Significant Natural Features

(a) General

The study area for this Master Plan encompasses a large area that includes lakeshore, agricultural and urban areas. Within the urban areas of Kincardine and Tiverton, vegetation and wildlife habitats are limited; however, there are corridors and parklands that provide opportunities for habitation. Generally, the study area is within Ecoregion 6, which is characterized by communities of sugar maple-beech-hemlock; sugar maple-oak-ash; and oak-ash in drier areas and hemlock, yellow cedar, spruce and cedar in wetter areas where the land has not been cleared for agriculture. Along the lakeshore, vegetation communities tend to be in later stages of succession (North-South Environmental Inc. and Dougan & Associates, 2009).

(b) Watercourses

The Penetangore River is the largest watercourse in the study area. It drains approximately 192 km^2 of land, including Kincardine and the lands northeast and east via its two major tributaries: the North Penetangore and Main Penetangore. The Kincardine and Millarton Creeks also drain into the Penetangore River which then drains into Lake Huron, south of Harbour Street in Kincardine. The majority of the watershed is in agricultural areas. The last watershed report card for the Penetangore River, produced by the Saugeen Valley Conservation Authority in 2018, identified average total phosphorus concentrations above the Provincial Water Quality Objective of 0.03 mg/L (Saugeen Valley Conservation Authority, 2018).

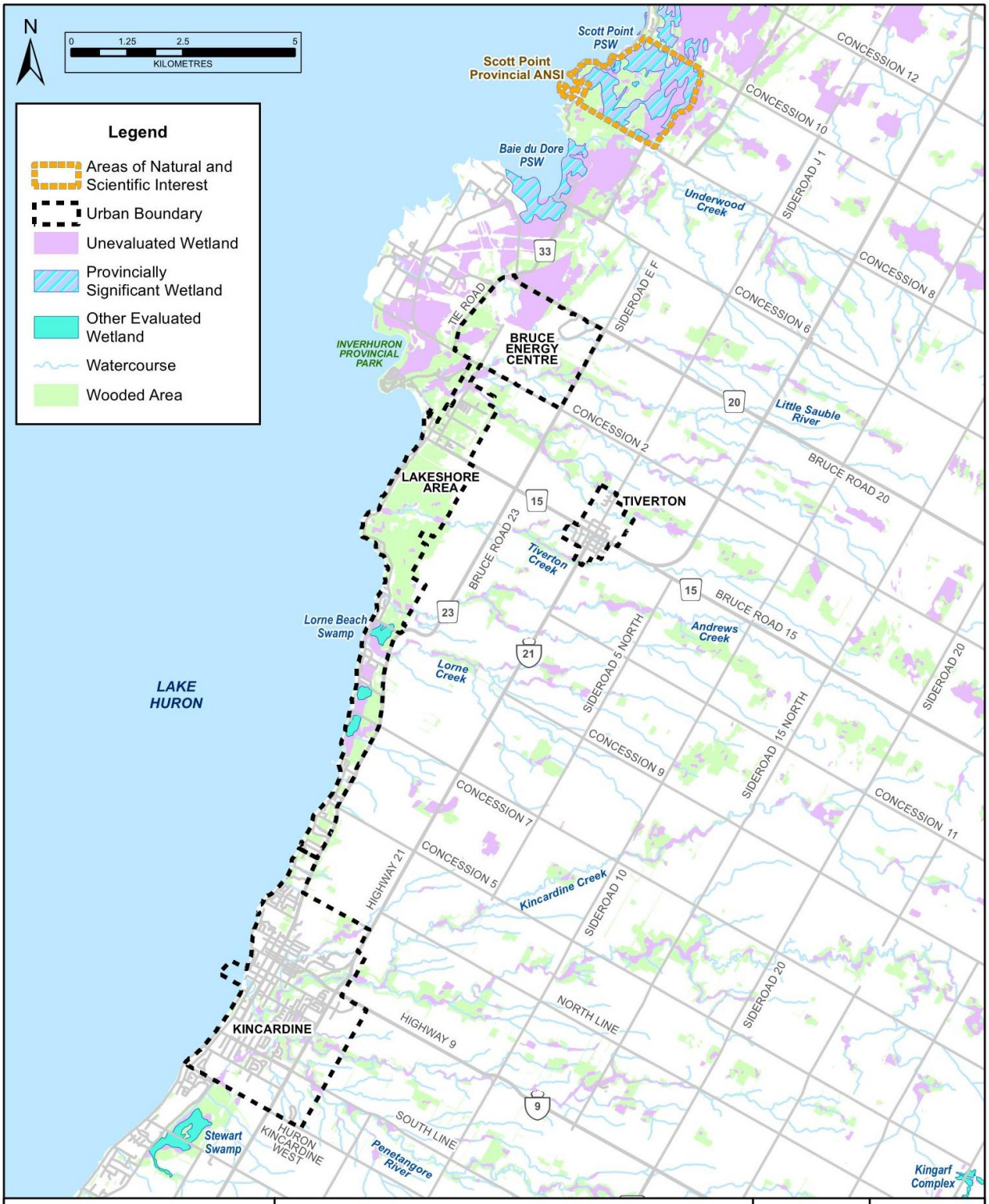
The Lake Fringe watershed is a narrow strip of land located along Lake Huron from Kincardine to Southampton. The watershed consists of small tributaries, including Lorne, Andrews, and Tiverton Creeks which discharge into Lake Huron. The watershed drains approximately 254 km^2 of land which mainly consists of agricultural lands. Tiverton and the Lakeshore Areas are located within this watershed. The last watershed report card for the Lake Fringe watershed, produced by the Saugeen Valley Conservation Authority in 2018, identified average total phosphorus concentrations lower than the Provincial Water Quality Objective of 0.03 mg/L (Saugeen Valley Conservation Authority, 2018).

The watershed report cards can be found in Appendix A.

(c) Areas of Natural and Scientific Interest

The Ministry of Natural Resources and Forestry (MNRF) maintains an inventory of Areas of Natural and Scientific Interest (ANSIs) in Ontario. These life science or earth science features are recognized for their importance related to natural heritage, scientific study, or education. To identify ANSIs within the vicinity of Kincardine, Tiverton and the Lakeshore Area, the MNRF Make a Map: Natural Heritage Areas application was consulted (Ministry of Natural Resources and Forestry, 2017). There is one ANSI located near the Lakeshore Area, the Scott Point Provincial ANSI. This feature is a Life Science ANSI, located approximately 4 km north of the Lakeshore Area (see Figure 2.2).

Figure 2.2 – Natural Features



BMROSS engineering better communities	**MUNICIPALITY OF KINCARDINE** WATER AND WASTEWATER MASTER PLAN UPDATE **NATURAL HERITAGE FEATURES**	DATE SEPT. 14, 2022	PROJECT No. 22128
		SCALE AS SHOWN	FIGURE No. 2.2

(d) Wetlands and Woodlands

The following wooded and wetland areas were identified through a search of the NHIC database:

Table 2.1 – Natural Areas within Proximity to Study Area

Type	Name	Location	Description
Natural Area	Stewart Swamp	South of Kincardine	Wetland that has been evaluated as other. The wetland type is swamp.
Natural Area	Lorne Beach Swamp and Shoreline	Lakeshore Area	Wetland that has been evaluated as other. The wetland type is swamp.
Natural Area	Stoney Island Conservation Area	Lakeshore Area	98 acres of wooded area consisting of recreational trails. Several creeks run through the property. Owned by SVCA.
Natural Area	Inverhuron Provincial Park	Adjacent to Lakeshore Area	Contains glacial lake shoreline, sand dune system, wetland and young hardwood forest. Open to campers and day-users.
Natural Area	Baie du Dore	North of the Lakeshore Area	Provincially significant wetland. The wetland type is fen.
Natural Area	Scott Point	North of the Lakeshore Area	Provincially significant wetland. The wetland type is swamp.
Plant Community	Little Bluestem – Long-leaved Reed Grass – Great Lakes Wheat Grass Dune Grassland Type	Lakeshore North and Lakeshore South	Very rare in Ontario (SRANK: S2). Found along the Great Lakes shoreline on stabilized foredunes.
Plant Community	Sea Rocket Sand Beach Type	Kincardine, Lakeshore Area	Rare in Ontario (SRANK: S2S3). Found along the Great Lakes shoreline.
Wildlife Concentration Area	Mixed Wader Nesting Colony	Tiverton, Lakeshore Area	Suitable nesting habitat for mixed waterbirds.

There are two provincially significant wetlands north of the Lakeshore Area including the Scott Point and Baie du Dore wetlands. The Lorne Shoreline and Lorne Beach Swamp are located within the Lakeshore Area. The Stewart Swamp is an evaluated wetland and is located south of the town of Kincardine.

Little Bluestem, Long-leaved Reed Grass, Great Lakes Wheat Grass dune grassland habitat is very rare in Ontario and Sea Rocket sand beach habitat is rare in Ontario. Both habitats are present along the shorelines of Kincardine and the Lakeshore Area. Wildlife concentration areas consisting of mixed wader nesting colonies can be found within the existing boundaries of Tiverton and the Lakeshore Area. Wooded areas surrounding the study area appear relatively fragmented and disconnected based on historic and present agricultural land uses.

The Stony Island Conservation Area is located within the Lakeshore Area. It is owned by the Saugeen Valley Conservation Area and contains recreational trails for public use. The property consists of 98 acres of managed forest. Historically, a small island and shoal was present south of the Conservation Area and was demolished by a storm in 1857.

North of the community of Inverhuron is IPP. Originally established in 1967, the Park has been reclassified a historical park due to the presence of sites dating from Archaic Indians to European Settlement. In addition to the historic features, the park also includes a former glacial lake shoreline, sand dune system, wetland and young hardwood forest. The Park is open to campers and day-users, outside of the winter months. A boat launch provides access to Lake Huron from the parklands. Potable water in the Park is supplied from the Kincardine Drinking Water System, and its wastewater is pumped to the BEC WWTP.

2.3.5 Species at Risk

An evaluation for the presence of significant species and their associated habitats within the study area has been incorporated into the project planning process. A review of available information on species and habitat occurrences determined that the study area may contain species and/or associated habitats that are legally protected under Provincial and Federal legislation.

The protection of species at risk and their associated habitats comes from the following federal and provincial legislation:

- The Federal Species at Risk Act, 2020 (SARA) provides for the recovery and legal protection of listed wildlife species and associated critical habitats that are extirpated, endangered, threatened or of special concern and secures the necessary actions for their recovery. On lands that are not federally owned, only aquatic species and bird species included in the Migratory Bird Convention Act (1994) are legally protected under SARA (Environment Canada, 2017).

- The Provincial Endangered Species Act, 2007 (ESA) provides legal protection of endangered and threatened species and their associated habitat in Ontario. Under the legislation, measures to support their recovery are also defined.

To identify what species at risk may be located in the vicinity of Kincardine, Tiverton and the Lakeshore area, the following sources were consulted:

- Natural Heritage Information Centre, Make a Heritage Map;
- Environment Canada, Species at Risk Public Registry. SARA Schedule 1 Species List;
- Ontario Reptile & Amphibian Atlas;
- Ontario Species at Risk Website;
- Fisheries and Oceans Canada Aquatic Species at Risk Online Mapping;
- Ontario Breeding Bird Atlas, Region 8;
- Atlas of the Mammals of Ontario; and
- TEA Ontario Butterfly Atlas.

A list of potential species at risk found within the County of Bruce, provided by the MNRF is included in Appendix B. The County incorporates a large area and wide variety of environs that include terrestrial and aquatic habitats. To identify species more likely to be found within the study area, the NHIC database was consulted. The NHIC database provides species occurrences based on 1 km^2 square system. The squares that overlapped with the settlement areas of Kincardine, Tiverton and the Lakeshore Area were searched for species occurrences. Species that were recorded within the study area are identified in the list provided in Appendix B.

It should be noted that the majority of the study area for this Master Plan is within an existing urban settlement area, with extensive previously disturbed areas.

2.3.6 Breeding Birds

The Atlas of Breeding Birds of Ontario (2001-2005) was used to identify the bird species with confirmed, probable, and possible breeding habitat in proximity to the study area. The study area lies within the 100 km^2 areas identified by the Atlas as Squares 17MJ49, 17MJ59 and 17MK50, in Region 8: Bruce (Bird Studies Canada, 2009). A total of 129 species were observed within the squares. A total of 78 species of breeding birds were confirmed to have habitat within the area. In addition to the confirmed species, 39 species are considered to have probable breeding habitats in the area. There are an additional 12 species listed as having possible breeding habitats in the area. Thirteen species at risk were recorded within the squares.

The survey area includes key habitat for identified species, such as forest (in all stages of growth), riverine areas, agricultural areas, wetlands, and shoreline areas.

2.3.7 Cultural Heritage and Archaeological Resources

The Municipality of Kincardine has a Municipal Heritage Committee, with a mission to “identify and preserve built structures, historical artifacts, ruins and lands of cultural historical significance or historical value” (Municipality of Kincardine, 2017). The

committee also advises Council on designation and alteration to designated or historic properties. Presently, there are 46 heritage designated properties within the Municipality. Most of these sites are located within the former Town of Kincardine.

A heritage conservation district was established in the town of Kincardine in 2021 (Stantec Consulting Ltd and a+LINK Architecture Inc., 2021). A Heritage Conservation District Plan was developed in 2021 and outlines polices and guidelines for managing changes within the designated area. Projects identified as part of this Master Plan will need to follow the policies and guidelines outlined in the plan if work is proposed within the heritage conservation district limits.

There have been several archaeological assessments completed throughout the Municipality in conjunction with past environmental assessments. Archaeological resources have been found as a result of these assessments and include both First Nation and early European artifacts. Given the potential for archaeological resources throughout the Municipality, any projects identified as part of this Master Plan will need to complete the appropriate screening for cultural, built heritage, and archaeological resources as part of any required EA processes.

2.4 Climate Change

The intent of this Master Plan is to identify future infrastructure needs. It is anticipated that project specific MCEA studies will be completed for identified projects and as part of the Class EA process, potential impacts associated with climate change will be evaluated. Some of the phenomena associated with climate change that may be considered during impact evaluations include:

- Changes in the frequency, intensity and duration of precipitation, wind and heat events;
- Changes in soil moisture;
- Changes in sea/lake levels;
- Shifts in plant growth and growing seasons; and
- Changes in the geographic extent of species ranges and habitat.

There are two approaches that can be utilized to address climate change in project planning. These are as follows:

- Reducing a project's impact on climate change (climate change mitigation). Mitigation of climate change impacts may include:
    - Reducing greenhouse gas emissions related to the project.
    - Alternative methods of completing the project that would reduce any adverse contributions to climate change.

- Increasing the project and local ecosystem's resilience to climate change (climate change adaptation). Considerations related to climate adaptation include:
    - How vulnerable is the project to climate-related severe events?
    - Are there alternative methods of carrying out the project that would reduce the negative impacts of climate change on the project?

Through the evaluation of alternatives as part of the second phase of the MCEA process, consideration of each of these approaches should be completed and included in the final determination of the preferred approach to completing a project.

2.5 Planning Policies

2.5.1 Provincial Planning Policies

Under the Planning Act (Section 3), the Provincial Policy Statement (PPS) guides the policies in relation to land use and development applications within the Province of Ontario (Ministry of Municipal Affairs and Housing, 2020). Decisions surrounding land use and development must be consistent with the policies contained within the PPS in order to support the overarching provincial interest. Given the intent of the Master Plan, the following policies of the PPS have been identified to support consideration of a servicing strategy (Ministry of Municipal Affairs and Housing, 2020):

<u>Section 1.1: Managing and Directing Land Use to Achieve Efficient and Resilient Development and Land Use Patterns</u>

- The Master Plan will sustain a healthy, liveable and safe community by promoting efficient development and land use patterns through a servicing strategy;
- The servicing works identified in the Master Plan will allow development and land use patterns that will not prevent the potential expansion of any settlement area to adjacent areas;
- The Master Plan will provide a servicing strategy that will promote cost-effective development patterns to minimize servicing costs;

<u>Section 1.1.3: Settlement Areas</u>

- The Master Plan, and identified servicing strategy, will provide a basis for planning land use patterns that are appropriate for, and efficiently use, existing and planned infrastructure;
- It will assist in the development and implementation of phasing policies to ensure the orderly progression of development and timely provision of infrastructure;

Section 1.6.1: Infrastructure and Public Service Facilities

- The servicing strategy identified in the Master Plan will allow for the provision of coordinated, efficient and cost-effective infrastructure that accommodates existing and future need;
- The development of the servicing strategy will be coordinated with land use planning principles to ensure infrastructure is financially viable and able to meet current and future needs;
- It will consider existing infrastructure and how it may be optimized;

Section 1.6.6: Sewage and Water

- The Master Plan incorporates expected growth and development, and the servicing strategy will promote the efficient use and optimization of existing municipal water and sewage services;
- Development of the servicing strategy considered feasibility, financial viability, regulatory compliance requirements, sustainability, impacts of climate change, and protection of human health and the natural environment; and
- The Master Plan supports the provision of municipal servicing as the preferred form of servicing within the settlement areas.

2.5.2 Local Planning Policies

The Bruce County Official Plan (Approved June 2013) serves as the upper-tier planning policy framework for municipalities within the County. The County Official Plan provides guidance on development, as well as population projections, for the lower-tier municipalities (County of Bruce, 2013). In addition to providing general planning policies for growth and protection of the natural environment, the Official Plan outlines specific requirements related to multi-year sewage and water servicing plans. For municipalities with sewage and water services, the Official Plan requires the preparation of a servicing plan to support any new Local Official Plans or as part of a review of update to an existing Local Official Plan. The Local Official Plan will incorporate the conclusions or recommendations of the servicing plan. A Sewage and Water Servicing Plan will also support:

- Local Official Plan Amendments for major new developments;
- Applications to expand the settlement area boundaries;
- Planning applications with potential for significant environmental health risks that need to be addressed; or
- Any planning application with the potential to affect the carrying capacity of a regional groundwater system or the assimilative capacity of a receiving body.

The Municipality of Kincardine has a local Official Plan that outlines policies for the settlement areas of Kincardine, Tiverton, Inverhuron, and the Lakeshore Area. Policies for the remainder of the Municipality come from the Bruce County Official Plan. The intent of the Municipality of Kincardine Official Plan is to provide a coordinated, integrated and comprehensive approach to planning matters (MacNaughton Hermsen Britton Clarkson Planning Limited, 2021). Aside from planning policies related to residential, commercial, industrial, environmental and other land uses, the Official Plan identifies growth projections and policies relating to the provision of municipal services. Generally, the Official Plan promotes optimizing the long-term availability and use of land, resources, infrastructure, and public facilities. It also states support for the continued development of the BEC Industrial Park and associated residential and commercial growth.

The Official Plan specifies that the Municipality will plan to complete a long-term sewage and water servicing plan. The intent of the sewage and water servicing plan is to ensure growth is accommodated in a manner that considers the efficiency of the existing systems. The servicing plan will also provide direction for future extensions or expansions of the existing water and sewage systems. With respect to the BEC WWTP, the Official Plan states the Municipality will continue to utilize treatment capacity at the site.

2.6 Clean Water Act (Source Water Protection)

The intent of the Clean Water Act, 2006 is to “protect existing and future drinking water” sources in Ontario. Under the Act, source protection areas and regions were established, giving conservation authorities the duties and power of a drinking water source protection authority. These duties focus on the development, implementation, monitoring and enforcement of information and policies related to source water protection.

The Municipality of Kincardine is located in the Saugeen Valley Protection Area, within the Saugeen, Grey and Northern Bruce Peninsula Source Protection Region. The Source Protection Plan for this source protection region came into effect in July 2016, under the direction of the Clean Water Act (2006). The Source Protection Plan outlines policies developed to protect municipal drinking water sources from threats and the Approved Assessment Report summarizes the watershed characteristics and drinking water threats.

The Highly Vulnerable Aquifers (HVA) and Significant Groundwater Recharge Areas (SGRA) within the Municipality were also delineated for the Assessment Report. HVAs were found along the sandy shoreline areas, with vulnerabilities ranging from two to six. The areas of higher vulnerabilities correspond to areas where intrinsic susceptibility was high. The total area of HVAs in the Municipality is 24.6 km^2 (Saugeen, Grey Sauble, Northern Bruce Peninsula Source Protection Region, 2015). Generally, the SGRA within the Municipality were inland, in areas with gravel-like sand overburden.

The Well Head Protection Area (WHPA) delineated for the Tiverton wells are shown in Figure 2.3. The Briar Hill WHPA, which generally extends southeast of the two wells, includes approximately 0.31 km^2 of land. The Dent Well WHPA also extends southeast but only encompasses 0.25 km^2 of land. The WHPA areas include residential, commercial, municipal, and agricultural land uses. Within the WHPA for the three wells,

22 significant drinking water threats were identified (Saugeen, Grey Sauble, Northern Bruce Peninsula Source Protection Region, 2015). These threats are found within WHPA-A and pertain to septic systems, sewer lines, fuel storage, waste disposal, applications of agricultural source material to land, application of non-agricultural source material to land, and the application of pesticide to land. With respect to water quality, it was noted the source aquifer for the Tiverton wells has naturally high fluoride and iron levels, but these issues are dealt with during treatment. There were no drinking water quality issues resulting from ongoing or past activities identified for the Tiverton wells.

The Intake Protection Zone (IPZ) for the Kincardine Drinking Water System intake is shown in Figure 2.4 and includes both offshore and onshore components. The onshore area of IPZ-1 and IPZ-2 totals 6.9 km^2. Additionally, an IPZ-3 and Event Based Area (EBA) were delineated to model spill scenarios. It is noted that the modelling of the EBA areas examined transport pathways, including stormwater infrastructure, and future significant changes to the stormwater collection system could impact the modelling results. Three EBA categories were identified: 3,000 L and greater; 5,000 L and greater; and 10,000 L and greater. The vulnerability scores assigned to IPZ-1 and IPZ-2 are 6 and 4.8, respectively. Five existing significant drinking water threats were identified relating to the events-based modeling for fuel handling and storage. There were no drinking water quality issues identified relating to ongoing or past activities for the KDWS (Saugeen, Grey Sauble, Northern Bruce Peninsula Source Protection Region, 2015).

The Source Protection Plan defines the policies in place within vulnerable areas to protect sources from significant drinking water threats. Vulnerable areas within the Water and Wastewater Servicing Master Plan study area include: the EBA-3000, EBA-5000 and EBA-10000 around Kincardine; WHPA-A, B and C for the Tiverton wells. With respect to the Master Plan, the following threats or activity categories relate to activities associated with water and wastewater servicing (Saugeen, Grey Sauble, Northern Bruce Peninsula Source Protection Region, 2015):

- Establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage;
- Fuel Handling and Storage; and
- Transportation Pathways.

The policies that apply to these threats are briefly summarized in Table 2.2.

Figure 2.3 –Wellhead Protection Areas for Tiverton Wells

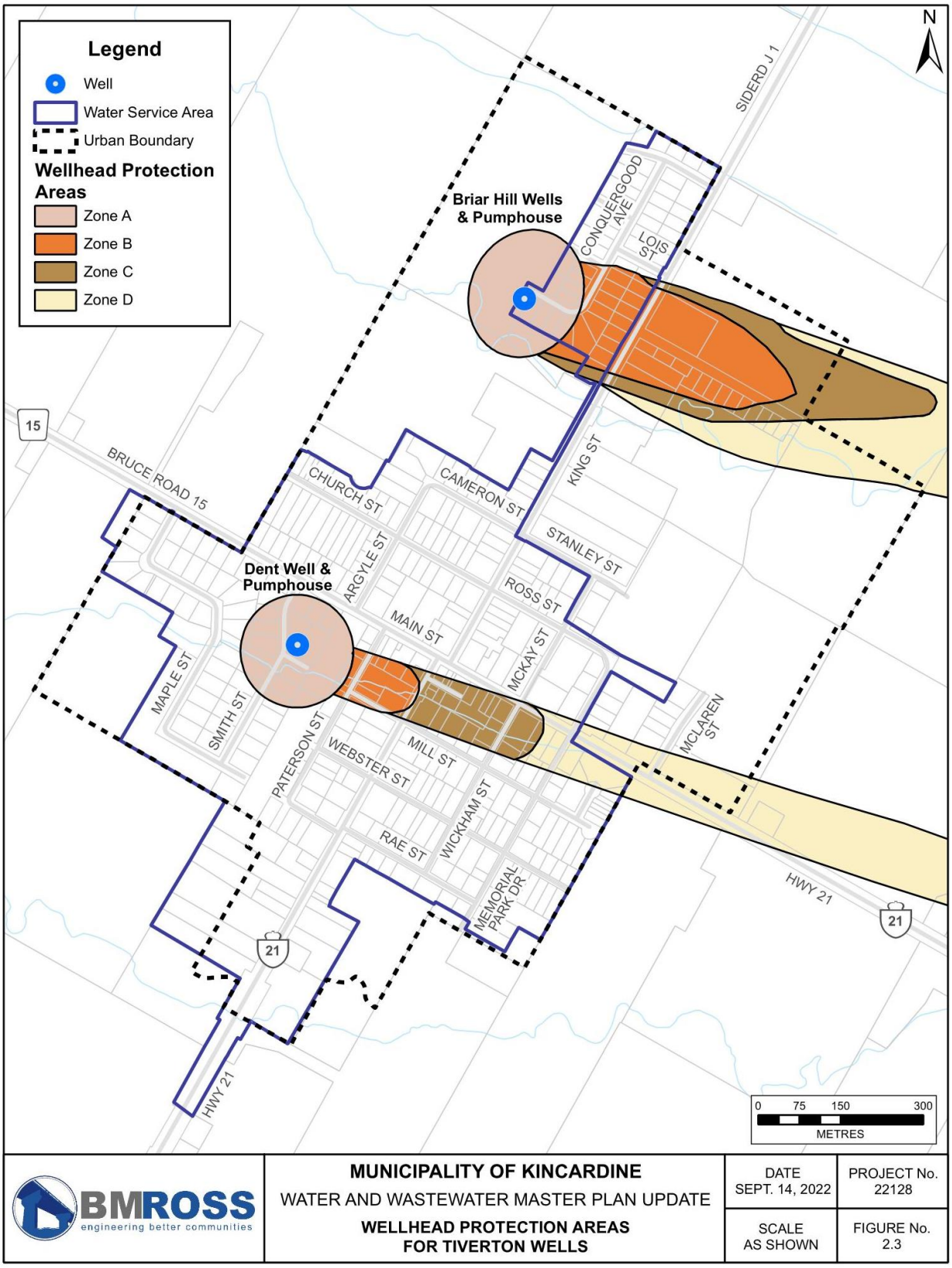


Figure 2.4 – Intake Protection Zones for Kincardine Water Intake

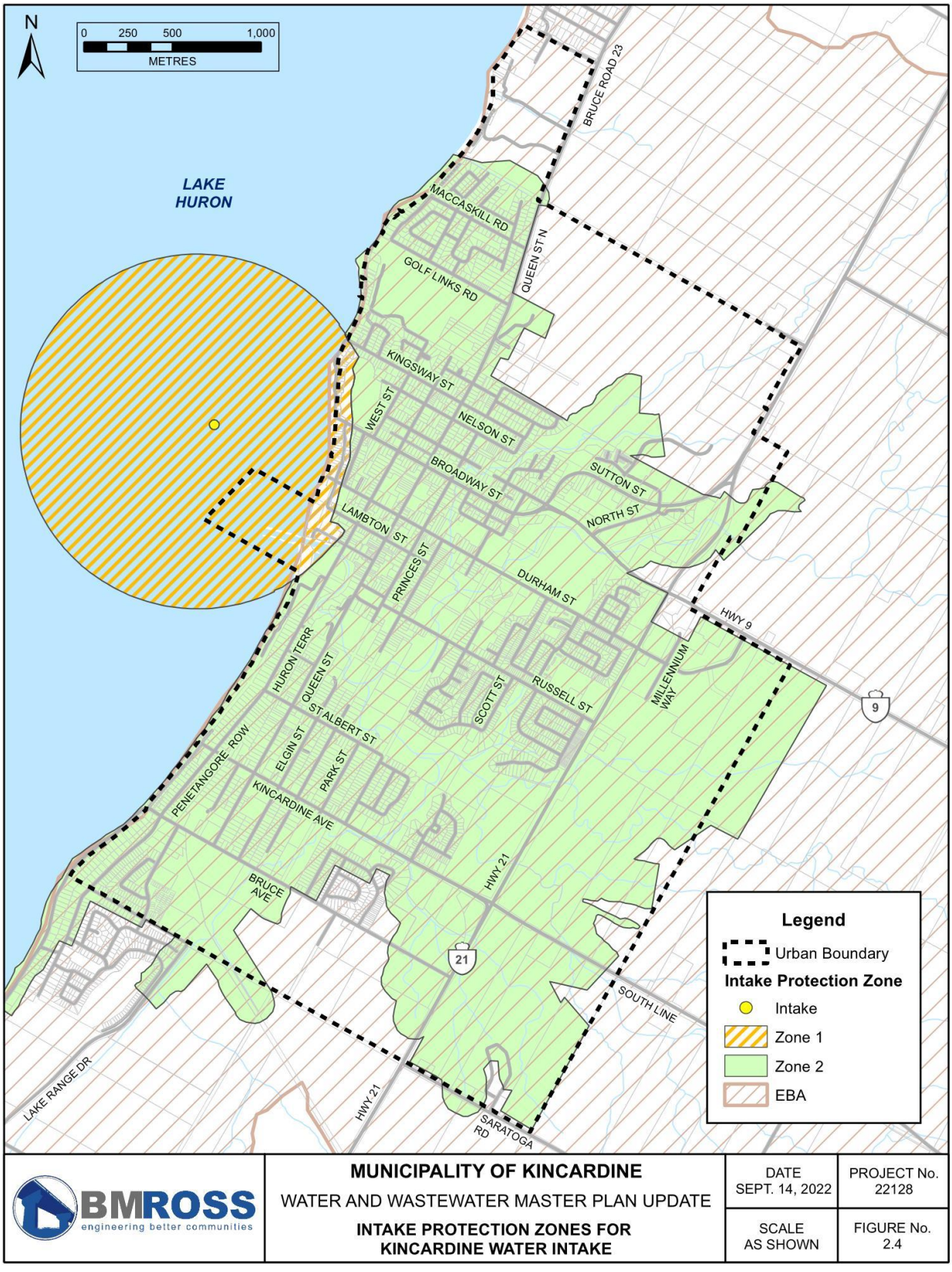


Table 2.2 – Source Water Policies Relating to the Water and Wastewater Servicing

Policy	Policy Description
02-01 Sewer Connection Bylaw	Municipalities with a sewer line in a vulnerable area or within 100 m of a vulnerable area will enact a sewer connection by-law.
02-03 Constraint on Environmental Compliance Approvals for On-site Sewage System	Installation of an on-site sewage system is not permitted in locations where there is a sewer connection bylaw; installation of a treatment unit may be permitted provided the approval contains appropriate terms and conditions to ensure the sewage system never becomes a significant drinking water threat.
02-05 Sewer Requirement for New Lots	Where a future septic system would be a significant drinking water threat, new lots created through severance or Plan of Subdivision will only be permitted where lots will be serviced by a municipal sewage system or where a septic system can be located outside of a vulnerable area.
02-07 Review of Environmental Compliance Approvals for Sewage Works	For industrial effluent discharge, sewage treatment plant bypass discharge to surface water, storage of sewage (e.g., treatment plant tanks) and sewage treatment plant effluent discharge (including lagoons) in vulnerable areas, the MOECC shall: review existing approvals and determine whether the approvals contain appropriate terms and conditions.
02-08 Constraints on Environmental Compliance Approvals for Sewage Works	No future sewage works (industrial effluent discharge, sewage treatment plant bypass discharge to surface water, storage of sewage (e.g., treatment plant tanks) and sewage treatment plant effluent discharge (including lagoons) in vulnerable areas shall be established. Approvals for an expansion of an existing sewage works or renewal/updating of a previous approval may be approved upon certain conditions.
02-09 Sewer Maintenance	In all vulnerable areas, where establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage (future and existing), municipalities shall inspect and maintain municipal sanitary sewers and related pipes to uphold high standards of performance and minimize the risk of leaks.
02-10 Sewer Locating Program	In all areas where establishment, operation or maintenance of a system that collects, stores, transmits, treats or disposes of sewage (existing and future), Municipalities will consider establishing or continuing a program that will: collect information and document the location of sewage lines, and document how properties are serviced.
02-12 Separation of Combined Sewers	In all vulnerable areas, where there is combined sewer discharge to surface water; or sewage treatment plant bypass discharge to surface water, Municipalities will give due consideration to establishing or continuing a program to separate combined sewers.
02-13 Infiltration Prevention	In all vulnerable areas, with existing sanitary sewers and related pipes, and/or discharge of Stormwater from a stormwater management facility, Municipalities shall give due consideration to establishing or continuing programs that reduce infiltration of wastewater into groundwater aquifers that are used as drinking water sources.

Policy	Policy Description
15-04 Prohibition of Fuel near Great Lakes Intakes	Applies where storage of fuel would be a significant drinking water threat (future activity) in EBA for the Kincardine Drinking Water System where fuel is stored in quantity of 3,000 L or more. Establishment of new fuel storage is prohibited.
15-05 Risk Management Plan for Fuel near Great Lakes Intakes	Where the existing storage of fuel is a significant threat (3,000 L or more in EBA-3000) or existing or future storage of 5,000 L or more (in EBA-5000) or 10,000 L or more (EBA-10000), establishment of a Risk Management Plan is required.
TP-02 Municipal By-law for Water Connection	Municipalities shall give due consideration to enacting a water connection by-law in WHPA A or WHPA B vulnerable areas (for existing or future activities).
TP-03 Circulation of Proposals with New Transport Pathways	Municipalities are obligated to provide information on any proposals involving future transport pathways to the source protection authority and source protection committee.
TP-04 Water Services for New Lots	Municipalities will give consideration to including in their official plan a provision regarding the servicing of new lots (future activity) in WHPA A or WHPA B vulnerable area that stipulates new lots are only permitted where the property will be connected to a municipal water system.

2.7 Dust, Noise and Air Quality

There are multiple sensitive receptors located within the study area including schools, hospitals, day-care facilities, senior care facilities and sensitive natural environments. The Kincardine and BEC WWTPs are considered existing sources of odour and air pollution and emissions, with established set-back buffers. Currently, there are no sensitive receptors located adjacent to the existing WWTPs.

In the 2021 annual performance report for the Kincardine WWTP, one complaint was reported regarding wastewater odour from the effluent station. The Municipality is considering the addition of a dumping station at the lagoons during upgrades to reduce wastewater odour (Municipality of Kincardine, 2021). No complaints were received in 2021 regarding the BEC Lagoon System (Municipality of Kincardine, 2021).

Depending on the project, there may be temporary impacts related to construction, which will be evaluated as part of the evaluation of alternative and potential mitigation measures during project planning. Additional upgrades to the WWTPs may be required to deal with increases in wastewater odour and air pollution emissions.

2.8 Contaminated Sites

There are no current waste disposal sites located within the project study area. Waste from the Municipality of Kincardine is disposed of at the Kincardine Waste Management Centre, located south of Armow. The Ontario Power Generation Landfill is located directly west of the Bruce Energy Centre, outside of the project limits.

The former Town of Kincardine landfill is located between Bruce Avenue and Saratoga Road, east of the Kincardine Wastewater Treatment Plant. This site is closed. There is also a closed site located west of Tie Road, between Bruce Road 20 and Concession 2, west of the Concession 2 Industrial Lands. These closed sites are not expected to be impacted by any projects identified through the Master Plan.

Soil testing will be completed for projects requiring soil removal or movement to determine contamination levels caused by previous land uses and dumping. Soils that are determined to be contaminated will be disposed of in an appropriate location as per the Environmental Protection Act (EPA) and Ontario Regulation 153/04: Records of Site Condition. Excess soils that are not contaminated will be transported and reused at a local site requiring soil as per Ontario Regulation 406/19: On-Site and Excess Soil Management. Waste produced during construction will be properly disposed in an appropriate location as per ministry requirements.

3.0 POPULATION GROWTH AND FUTURE DEVELOPMENT

3.1 Information Sources

The following information was used to assess current conditions and make projections:

- 2021 Census data;
- 2021 Official Plan of the Municipality of Kincardine, Section B1.4;
- Ontario Ministry of Finance Population Projections (2021-2046);
- 2021 Draft Development Charges Background Study and By-law (Hemson);
- Forecast from Good Growth Discussion Paper (Bruce County Official Plan), which includes seasonal residents;
- Known approved developments and development proposals;
- Historical water demand information (2019 to 2021) and customer counts (2021) from the Municipality; and
- The current Municipal Drinking Water Licenses (MDWLs) and Drinking Water Works Permits (DWWPs) for water systems, and Environmental Compliance Approvals (ECAs) for wastewater systems.

3.2 Existing Population

3.2.1 Municipality of Kincardine

The Municipality of Kincardine has experienced some growth since 2016, as shown in Table 3.1. The population of the Municipality for the 2021 Census is 12,268 (Statistics Canada, 2023). The population increased by 879 persons from 2016 to 2021, which is an increase of 7.7% from the 2016 population. The average annual growth rate since 2016 is 1.50%.

Table 3.1 – Municipality of Kincardine Census Population Counts, 2001-2021

Year	Population	Total Dwellings	Occupied Dwellings	Persons Per Unit
2001	11,029	5,257	4,315	2.56
2006	11,173	5,447	4,586	2.44
2011	11,174	5,789	4,829	2.31
2016	11,389	5,883	4,855	2.35
2021	12,268	6,142	5,160	2.38
5-year change	**879**	**259**	**305**	**0.03**
10-year change	**1,094**	**353**	**331**	**0.06**
5-year Average Annual Growth Rate (%)	**1.50**	**0.87**	**1.23**	**0.27**
10-year Average Annual Growth Rate (%)	**0.94**	**0.59**	**0.67**	**0.27**
5-year Population Change (%)	**7.72**	**4.40**	**6.28**	**1.35**
10-year population change (%)	**9.79**	**6.10**	**6.85**	**2.75**

Census data also shows a steady increase in the number of dwellings within the Municipality since 2001. The increase of 885 new dwellings over the last 20 years aligns with the observed increase in population, as well as other general demographic trends including decreases in family size. The decline in family size and increase in single-person occupied homes is also reflected in the decrease in the average number of Person Per Unit (PPU) throughout the Municipality, though this has rebounded somewhat since 2011. Overall, the average number of persons per unit has decreased from 2.56 person/occupied unit in 2001 to 2.38 person/occupied unit in 2021.

3.3 Existing Customers

The existing customer counts were provided by the municipality on the following dates:

- Kincardine Wastewater system, June 9, 2022 = 3,780;
- BEC Wastewater system, June 9, 2022 = 460;
- Kincardine Water system, May 15, 2021 = 4,073; and
- Tiverton Water system, March 15, 2021 = 372.

3.4 Growth Expressed as Equivalent Units

For the purposes of quantifying servicing requirements for current development commitments and future growth, water demands and wastewater flows are described in terms of Equivalent Residential Units (ERUs). An ERU is defined as the unit flow design value for a detached residential unit. Design flows for other types of residential development are proportioned to single detached units based on expected per person

occupancies (PPU). For calculation purposes the following values, as developed from 2021 Census data and rounded upwards, are used:

- Single detached = 2.48 PPU = 1.00 ERU;
- Multi-family = 2.01 PPU = 0.85 ERU; and
- Apartments = 1.38 PPU = 0.60 ERU.

In parts of the analysis ERUs have been assigned to Industrial, Commercial, and Institutional (ICI) development proposals. ICI is also referred to as “non-residential”. It is assumed that for every residential unit built there will be a proportional increase in non-residential. Only the number of ERUs generated from residential proposals are considered for the reserve capacity analyses and projections. It is also assumed that non-residential development and water usage will continue in the same proportion as it is currently. The current customer count includes both residential and non-residential. Total flows include water supplied and wastewater generated from both as well. Water demands and wastewater flows per ERU, including consideration of non-residential development, are calculated in Sections 4.0 to 8.0.

3.5 Development Commitments

The following tables are based on plans and draft plans of development that are “approved”, including those already under construction or for which approval is pending. Pending projects are ones where no formal plans have been submitted, so the number of units is a preliminary estimate based on the available development area and approximate development density for other recent developments in Kincardine. Table 3.2, Table 3.3, and Figure 3.1 present all known development commitments and pending projects for Kincardine, which have the potential to affect both water and wastewater systems. Kincardine’s pending projects shown in Table 3.3 fall within the Vacant Lands shown in Figure 3.1. However, not all Vacant Lands have pending projects, nor do the pending projects currently listed have the same boundaries as the Vacant Lands parcels shown in Figure 3.1. In some cases, assumptions have been made about the number of potential units in multi-unit parcels. It is noted that, for these pending developments, the values provided are estimates based on preliminary information only and it is recommended that this analysis be re-evaluated once final details are available.

Table 3.2 – Kincardine Development Commitments

Development Name	Number of Units[1,2]	Number of ERUs[3]
West Ridge on the Lake	S 213	213
West Ridge on the Lake	M 117	99
West Ridge on the Lake	A - 117	70
Brown Subdivision	A - 216	130
Brown Subdivision	M - 82	70
Brown Subdivision	S - 46	46
Inverhuron Servicing	S – 200	200
Bradstones	S - 36	36
O'Malley (Sutton/Gary Street)	A - 54	32
Battler Subdivision	M - 23	20
Battler Subdivision	S - 10	10
7 Mount Forest Avenue	A - 41	25
1182 Queen Street	A - 20	12
Campbell Avenue	S - 4	4
Kincardine Infill Allowance	S - 365	365[4]
Concession 2 Industrial Park	ICI	292[5]
Residential Commitments	**1,544**	**1,332**
Kincardine ICI Commitments	**-**	**292**
Kincardine Commitments	**1,544**	**1,624**

Notes:

1. For developments under construction, “Number of Units” column shows an estimate of remaining units not currently constructed.
2. S = single family, M = multi-family, A = apartment or trailer park, ICI = Industrial, Commercial, and Institutional.
3. See Section 3.4 for ERU values for each unit type.
4. Value taken from 2021 Reserve Capacity Analysis.
5. Value based on past discussion with Municipal staff suggesting estimate of 500 m^3/day at unit flow of 1.71 m^3/ERU·day.

Table 3.3 – Kincardine Pending Projects

Development Name	Number of Units[1,2]	Number of ERUs[3]
7 Millennium Way	A - 258	155
7 Millennium Way	M - 21	18
Brigadoon	S - 150	150
869 Kincardine Avenue Trailer Park	A - 146	88
Inverhuron - Sundance	S - 60	60
OPF Lands	S - 960	960
OPF Lands	ICI	46
9 & 21 Business Park	ICI - 500	628
CR Developers	ICI - 182	82
829 Kincardine Avenue Self Storage	ICI	1
Residential Pending	**1,595**	**1,430**
Kincardine ICI Pending	**682**	**757**
Kincardine Pending	**2,277**	**2,187**

Notes:

1. For developments under construction, “Number of Units” column shows an estimate of remaining units not currently constructed.
2. S = single family, M = multi-family, A = apartment or trailer park, ICI = Industrial, Commercial, and Institutional.
3. See Section 3.4 for ERU values for each unit type.

In addition to receiving added customers through new developments, the Kincardine DWS could be expanded to service Bruce Power. An estimated 2,765 m^3/day maximum day demand is expected to be required by Bruce Power. The impacts of adding this demand to the existing Kincardine DWS are being examined through a separate Class Environmental Assessment (Class EA).

Wastewater flows from the BEC Development Lands, Inverhuron and Tiverton are treated by the BEC Wastewater System. The Bruce Power reserve relates to a quantity held in reserve as part of the BEC WWTP asset transfer from Bruce Power to the Municipality. Future developments within the BEC Development Lands, the future Concession 2 Industrial Lands and future Tiverton Development Commitments presented in Table 3.4 and Figure 3.2, Tiverton’s pending projects shown in Table 3.5, and future Inverhuron Development Commitments presented in Table 3.2, are also to be serviced by the BEC Wastewater System.

Tiverton’s pending projects shown in Table 3.5 fall within the Vacant Lands shown in Figure 3.2. However, not all Vacant Lands have pending projects, nor do the pending projects currently listed have the same boundaries as the Vacant Lands parcels shown in Figure 3.2. In some cases, assumptions have been made about the number of potential units in multi-unit parcels. It is noted that, for these pending developments, the values provided are estimates based on preliminary information only and it is recommended that this analysis be re-evaluated once final details are available. The Tiverton DWS analysis is only impacted by non-ICI development presented in Table 3.4.

Table 3.4 – BEC Development Commitments

Development Name	Number of Units[1,2]	Number of ERUs[3]
Conquergood	M - 86	73
Conquergood	S - 23	23
Conquergood	A - 21	13
Pine Tree Campground	A – 99	59
Kaydan Drive	M - 16	14
Maple Street	S - 14	14
Rae Street (Karn Development)	M - 28	24
Rae Street (Karn Development)	S - 1	1
Mackwade	M – 6	5
Infill Allowance	S - 30	30[4]
Bruce Power Reserve	ICI	278[4]
Tiverton Commitments	**324**	**534**

Notes:

1. For developments under construction, “Number of Units” column shows an estimate of remaining units not currently constructed.
2. S = single family, M = multi-family, A = apartment or trailer park, ICI = Industrial, Commercial, and Institutional.
3. See Section 3.4 for ERU values for each unit type.
4. Value taken from 2018 Water and Wastewater Master Plan.

Table 3.5 – Tiverton Pending Projects

Development Name	Number of Units[1,2]	Number of ERUs[3]
Breymark Homes	A - 76	46
Breymark Homes	M - 8	7
Fast Holdings Ltd.	S - 26	26
Fast Holdings Ltd.	M – 62	53
Tiverton Pending	**172**	**131**

Notes:

1. For developments under construction, “Number of Units” column shows an estimate of remaining units not currently constructed.
2. S = single family, M = multi-family, A = apartment or trailer park, ICI = Industrial, Commercial, and Institutional.
3. See Section 3.4 for ERU values for each unit type.

Figure 3.1 – Kincardine Potential Development Areas

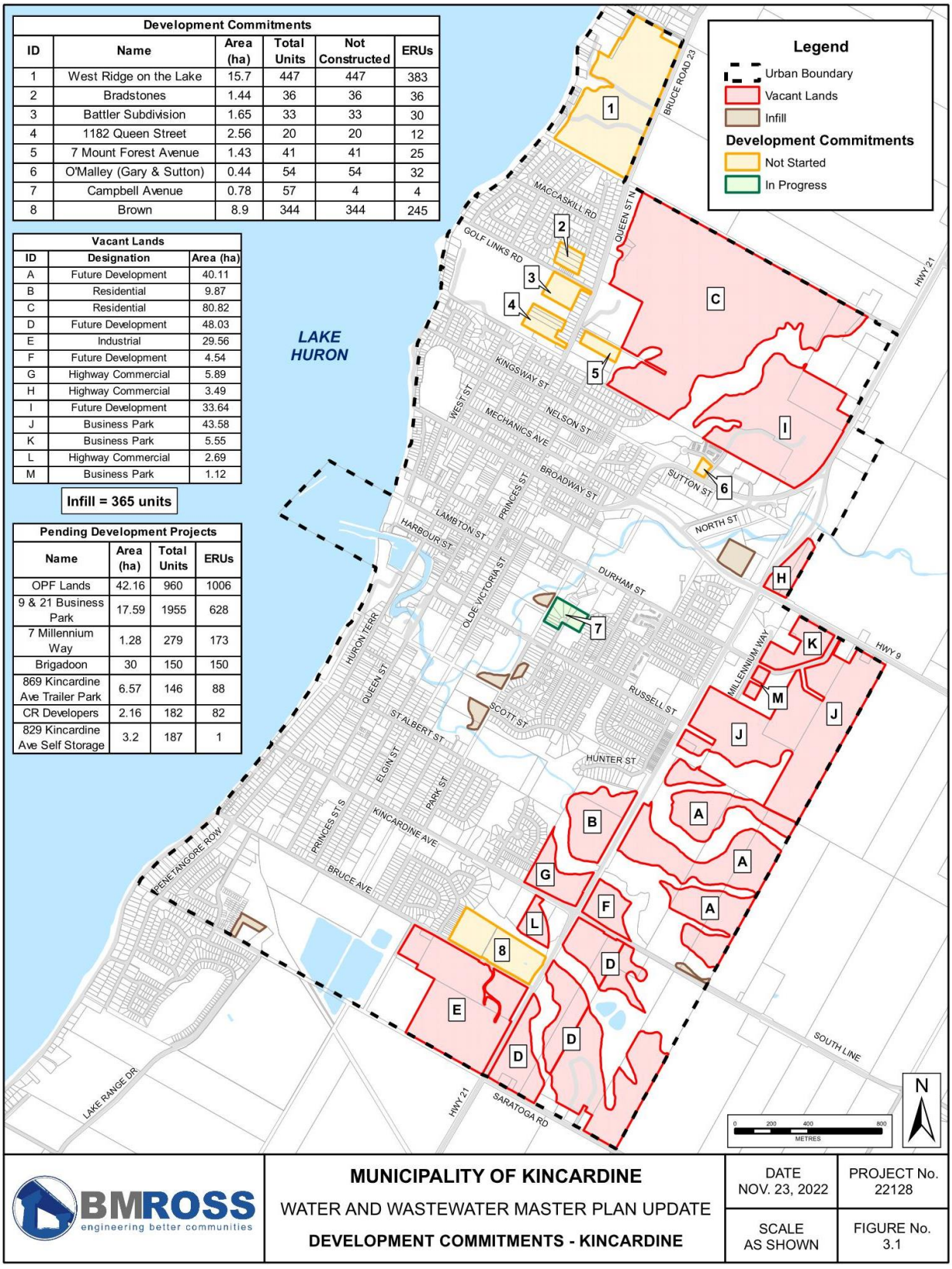
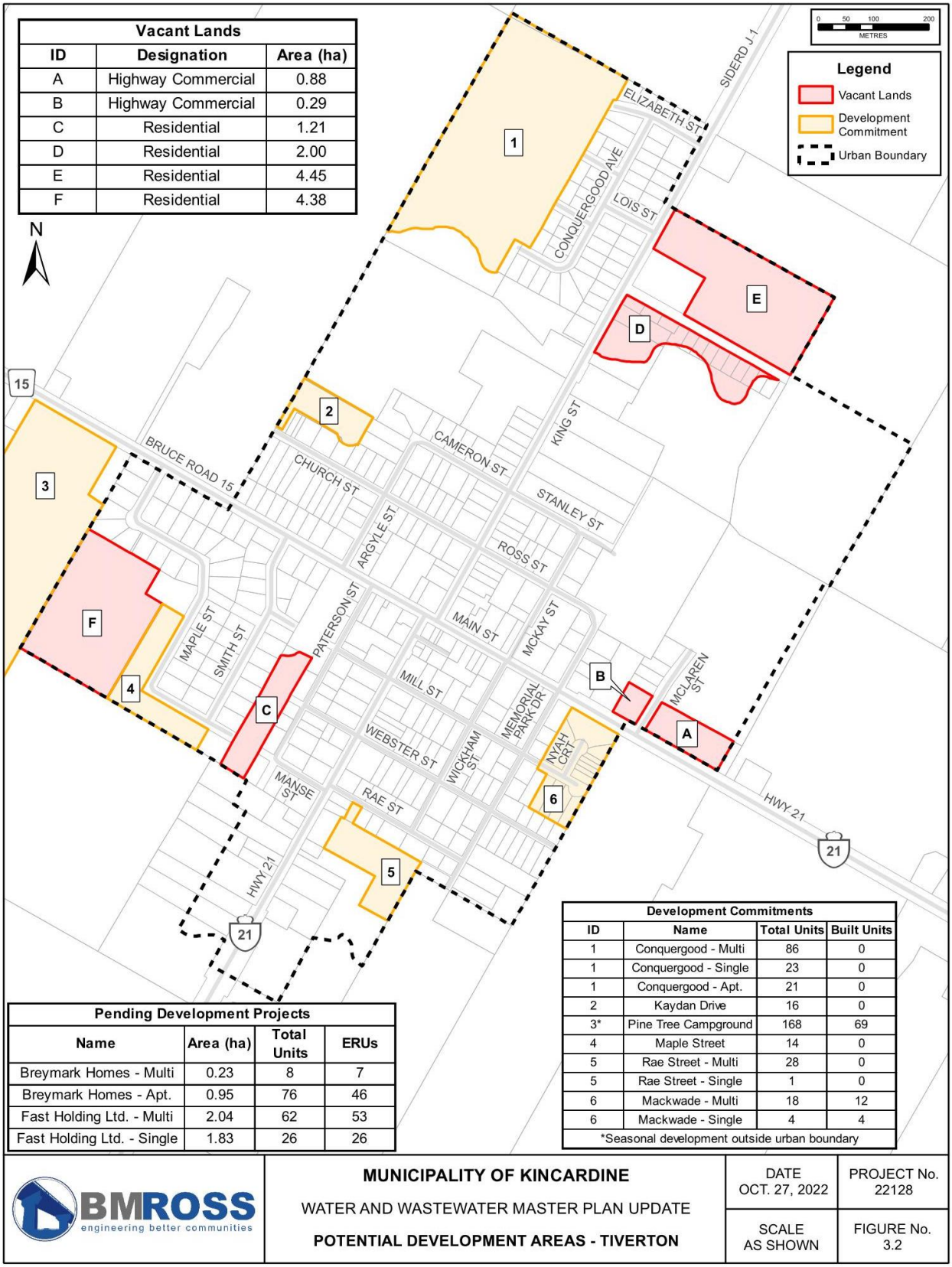


Figure 3.2 – Tiverton Potential Development Areas



3.6 Population and Growth Forecasts

Several different growth projections were available. These are listed in Section 3.0. The growth rates were then applied to the population figures for Kincardine and Tiverton using the 2021 Census data and DWS customer counts provided by the Municipality. The population for Kincardine also includes the Lakeshore area from West Ridge on the Lake to Inverhuron. This created four different sets of 20-year population projections for each community.

Table 3.6 – Summary of Kincardine Population Forecasts

Source of Forecast	Rate of Growth	2043 Population	2043 ERUs
2021 Official Plan	0.56%	10,167	4,822
Ministry of Finance	1.28%	11,846	5,371
2021 DC Background Study	0.63%	10,321	4,679
Bruce County – “Good Growth”	1.01%	11,201	5,079

Table 3.7 – Summary of Tiverton Population Forecasts

Source of Forecast	Rate of Growth	2043 Population	2043 ERUs
2021 Official Plan	0.56%	811	440
Ministry of Finance	1.28%	945	490
2021 DC Background Study	0.63%	824	427
Bruce County – “Good Growth”	1.25%	942	488

As part of the December 9, 2022 Maximum Day Water Demand Projections for Kincardine and Tiverton Methodology and Results Memo, an analysis was performed to determine the preferred approach to establishing the existing water demand per ERU in Kincardine. The selected method was to divide the total maximum day demand (6,954 m^3/day) by the total number of customers (4,073) and define one ERU as equivalent to one customer for the existing condition. The demand per ERU is then the average use by all customers, which would include large user demand. It depends on the assumption that as residential demand increases, non-residential demand will increase proportionally. The same approach is used for all water and wastewater systems.

For both communities, the projected future populations did not differ significantly among the different growth forecasts. The 2021 Official Plan projections produced the lowest population values, while the 2021 Draft Development Charges Background Study and By-law produced the lowest ERU projections. The Ministry of Finance projected the largest populations and ERUs for each community. To simplify the water demand and wastewater flow projections, only the scenario producing the smallest and largest value for ERUs will be considered. These will be referred to by the following:

- **Low Growth Scenario** – 2021 Draft Development Charges Background Study and By-law (Hemson); and

- **High Growth Scenario** – Ontario Ministry of Finance Population Projections (2021-2046).

Across all the forecasts, the approximate proportion of the total Municipal population represented by the Town of Kincardine (75%), Lakeshore area (10%) and Tiverton (6%) are assumed to remain relatively constant. Under the low growth scenario, 661 ERUs homes will be added in the study area by 2043. This is equivalent to a 0.6% annual average growth rate. The high growth scenario predicts an annual growth rate of 1.3%, with 1,416 new ERUs constructed during the forecast period.

Currently for the study area, the ERU split for residential development commitments, proposals and pending projects is as follows:

Kincardine

- Single Detached - 70%
- Multi- family - 11%
- Apartments/Trailer Parks - 19%

Tiverton

- Single Detached - 24%
- Multi- family - 45%
- Apartments/Trailer Parks - 31%

3.7 Comparison to Current Commitments and Proposals

To compare the forecasted growth against current commitments and proposed developments, the number of single detached, multi-unit and apartments for each forecast scenario was estimated. The proportion of single detached, multi-unit and apartment units is based on ratio of ERUs currently proposed for development in Kincardine. The number of new housing units, by type, for each forecasting scenario is summarized in Figure 3.3 for Kincardine and Figure 3.4 for Tiverton.

In Kincardine, the number of development commitments is relatively close to the forecasted 20-year growth under the high growth scenario; however, for the low growth scenario, there are an additional 770 ERUs in development commitments beyond what is projected to be needed.

In Tiverton, there are an additional 272 ERUs in development commitments beyond what is needed under the low growth scenario and 218 additional ERUs under the high growth scenario.

Figure 3.3 – Kincardine's Forecasted ERUs for Growth Scenarios and Development Commitments & Pending/Proposed Units

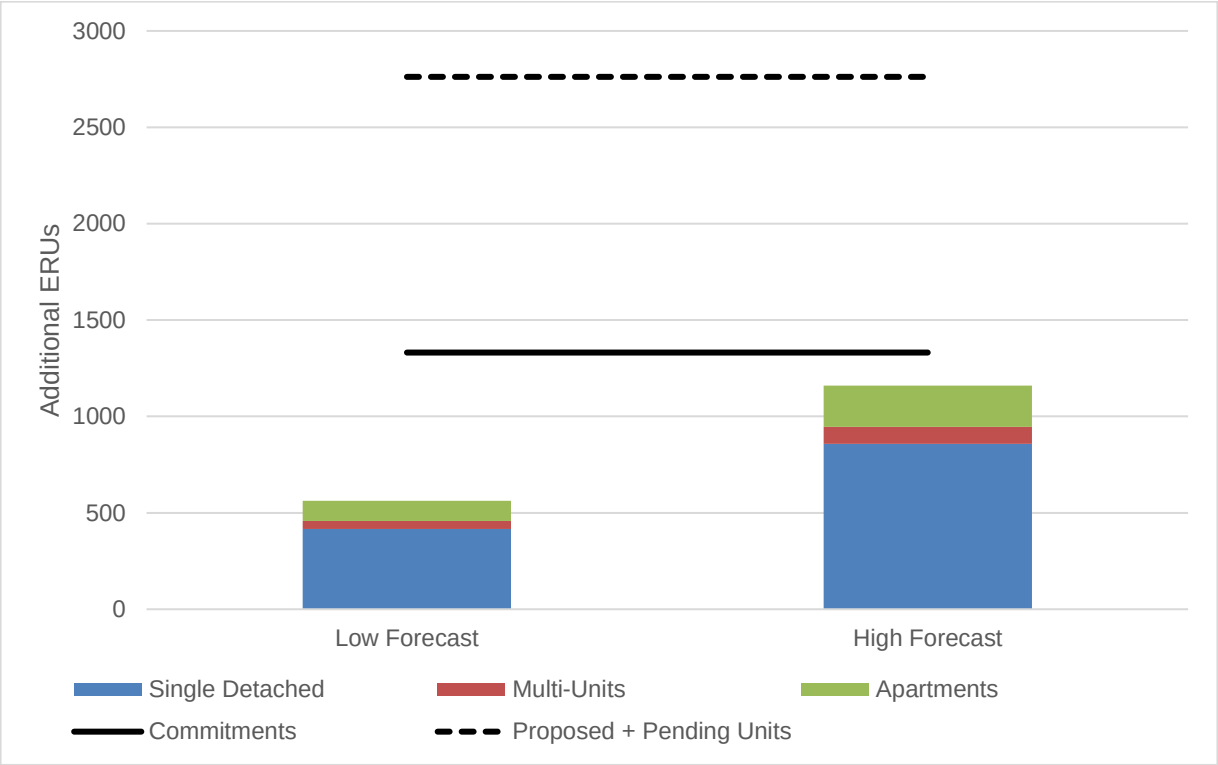
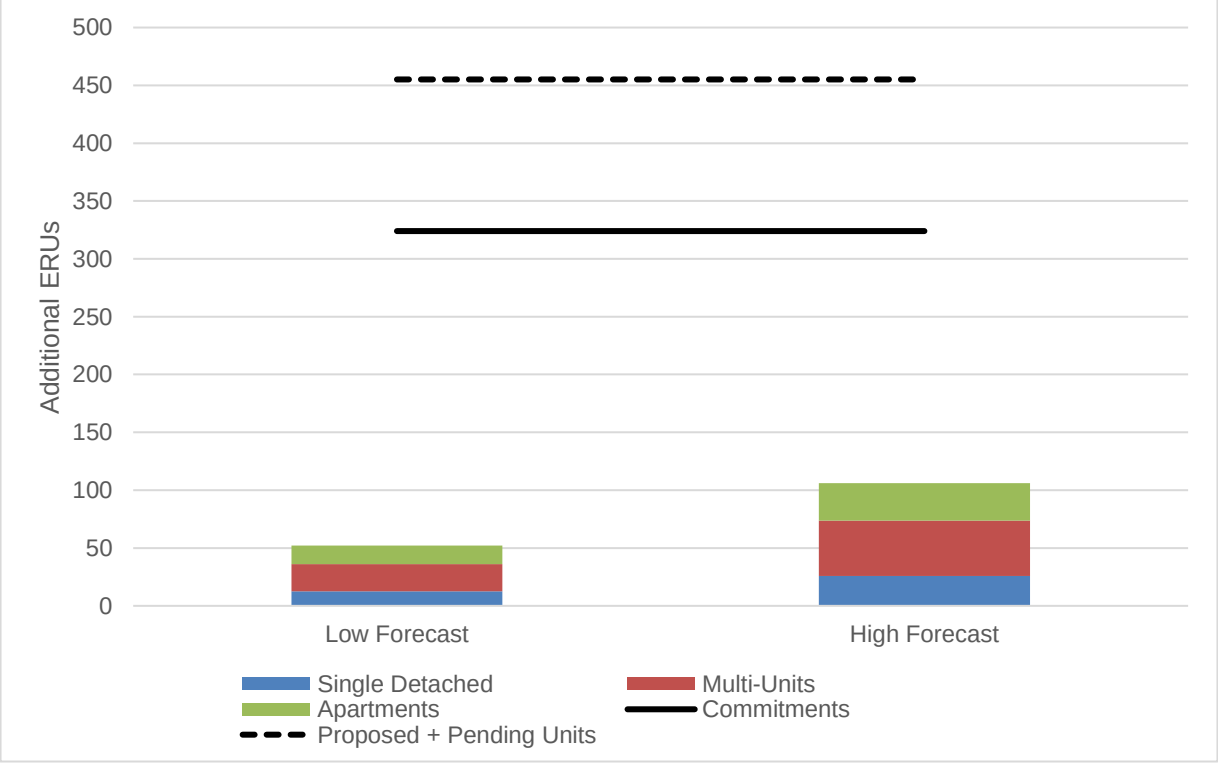


Figure 3.4 – Tiverton's Forecasted ERUs for Growth Scenarios and Developments Commitments & Pending/Proposed Units



3.8 Growth Expressed as Equivalent Units

Using the growth forecast and the ERUs split summarized in Section 3.5, the total growth in ERUs for the period 2023 to 2043 has been calculated to be:

- Kincardine Low Growth Scenario = 562 ERUs;
- Kincardine High Growth Scenario = 1,160 ERUs;
- Tiverton Low Growth Scenario = 52 ERUs;
- Tiverton High Growth Scenario = 106 ERUs;
- Total Low Growth Scenario = 614 ERUs; and
- Total High Growth Scenario = 1,266 ERUs.

These values have been used in the evaluation of capacity requirements for major water and wastewater facilities as presented in the following sections of the Master Plan.

4.0 WATER SERVICING

4.1 Kincardine Drinking Water System

4.1.1 Description

The KDWS is approved by the Ministry of the Environment, Conservation and Parks (MECP) and described in DWWP No. 088-202 Issue No. 5 and MDWL No. 088-02 Issue No. 3.

The KDWS services the former town of Kincardine, a portion of the community of Inverhuron, IPP, and portions of the Lakeshore between Kincardine and Inverhuron. The locations of major facilities in the existing KDWS are shown in Figures 4.1 and 4.2. The major facilities include a single WTP, standpipe, chlorine booster station at Inverhuron, and distribution watermain.

Water in Kincardine is primarily supplied to a single pressure zone, though a booster pumping station (BPS) on Gary Street services a limited number of properties at the northeast area of the community. In total, there is approximately 68.4 km of watermain 100 mm diameter or greater within the Municipality of Kincardine. As of May 2021, there were 4,073 customers in Kincardine.

Figure 4.1 – Kincardine Drinking Water System

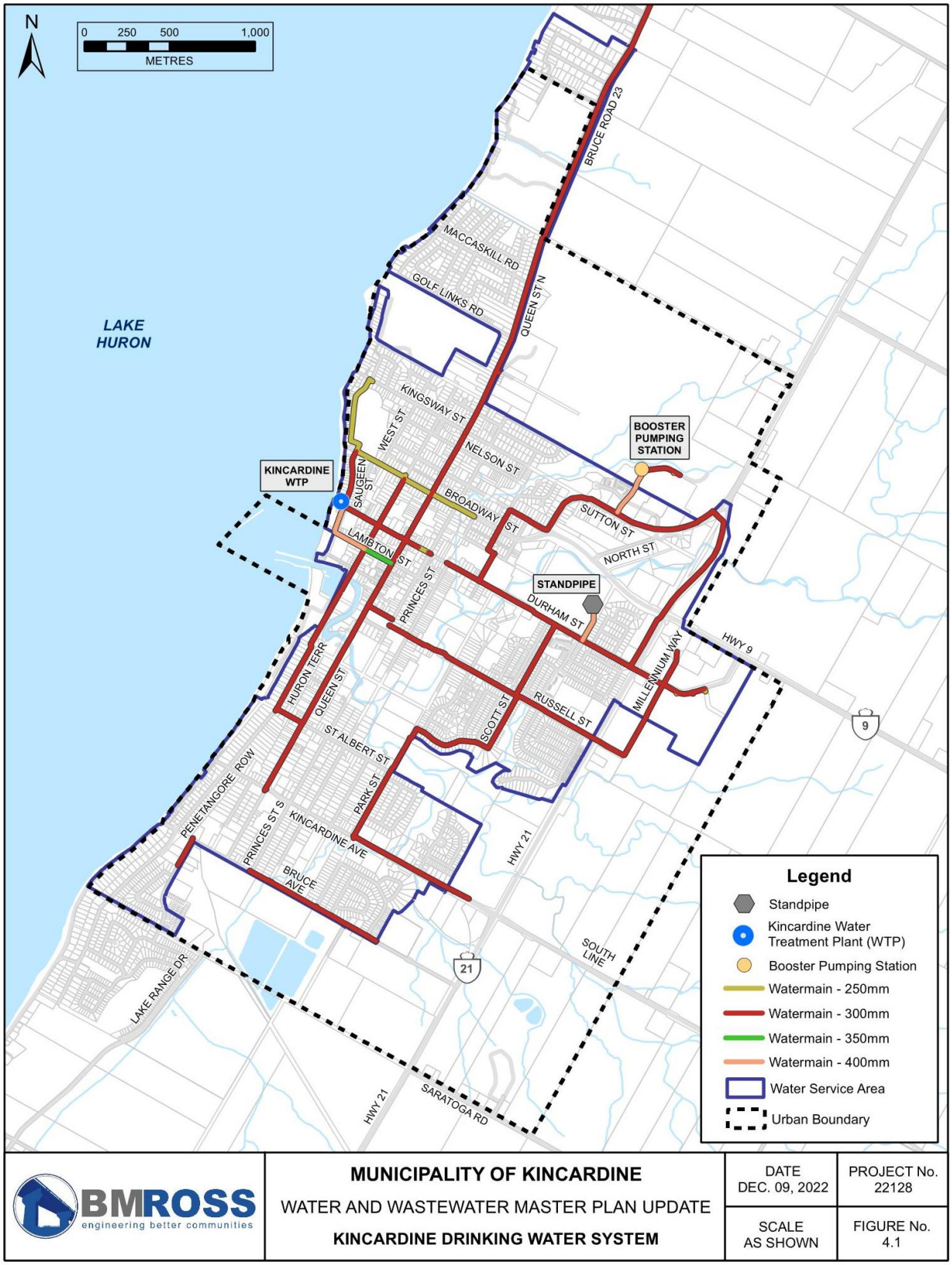
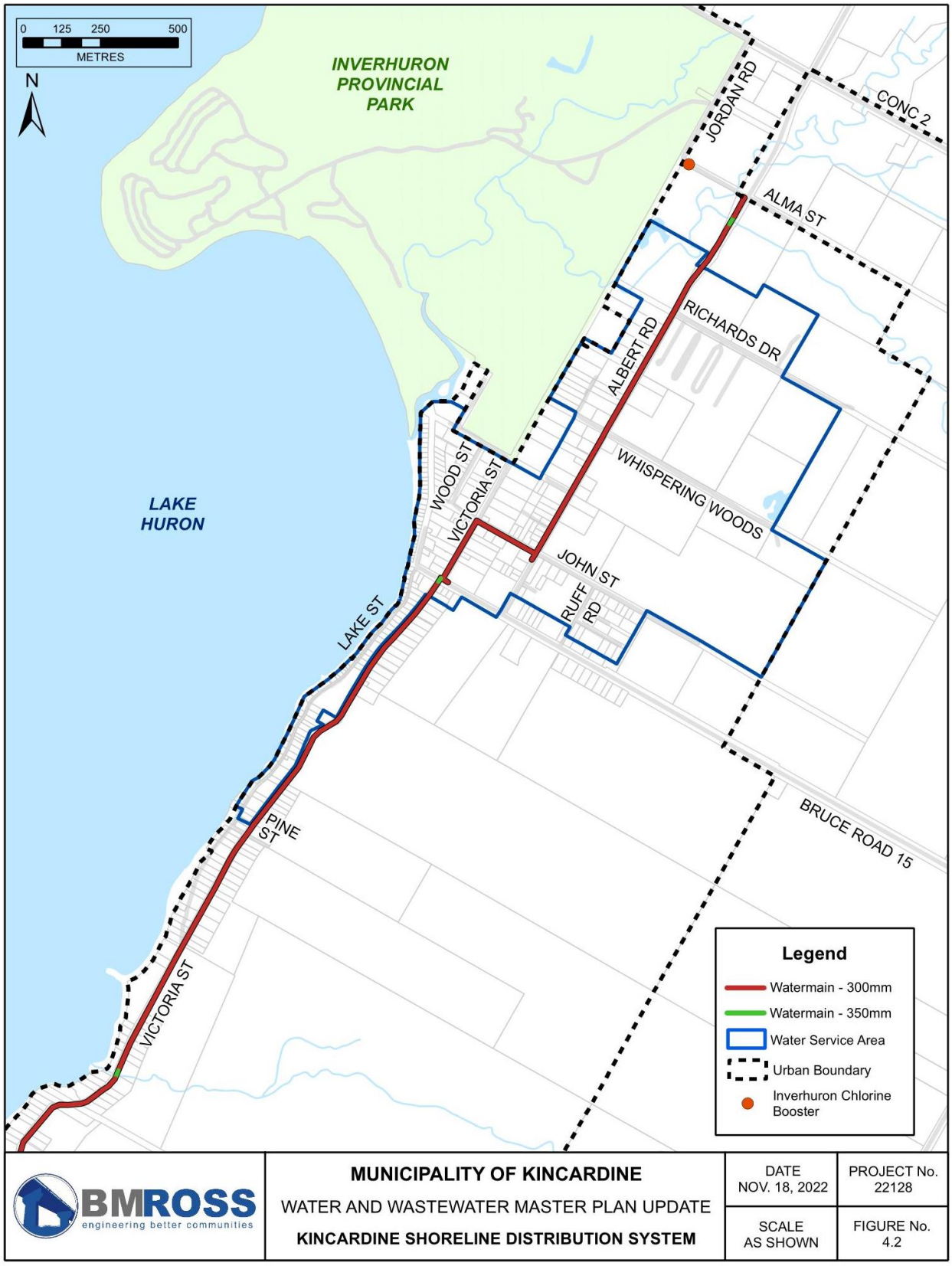


Figure 4.2 – Kincardine Shoreline Distribution System



4.1.2 Existing and Future Water Demands

4.1.2.1 Methodology

Water supply capability is assessed using annual maximum day demands, as shown for the KDWS in Table 4.1.

Table 4.1 – Kincardine Maximum Day Demand 2019 to 2021

Year	Maximum Day (m^3/d)
2019	5,383
2020	6,421
2021	6,954

Because maximum water demands vary from year to year depending on environmental conditions, the existing demand for reserve capacity calculations purposes is generally considered to be the Maximum Day in the previous three years.

Current Maximum Demand = **6,954 m^3/d**

It is noted that the current maximum demand is comparable to the value reported in the 2018 Master Plan, which was 6,965 m^3/d corresponding to 2015.

4.1.2.2 Total Reserve Capacity

Total Reserve = 11,563 – 6,954

= **4,609 m^3/d**

4.1.2.3 Per Customer Usage

$$\text{Per Customer Demand} = \frac{6{,}954\ m^3/d}{4{,}073\ \text{customers}}$$

= 1.71 m^3/d per customer

4.1.2.4 Uncommitted Reserve Capacity

WTP Capacity	=	11,563 m^3/d
Current Demand	=	6,954
Total Reserve	=	4,609 m^3/d
Commitments (1,624 units x 1.71)	=	2,773 m^3/d
Uncommitted Reserve	=	**1,836 m^3/d**

This Uncommitted Reserve would be inadequate to provide the approximately 2,765 m^3/day maximum day demand expected to be required by Bruce Power. At 1.71 m^3/d per ERU, the Uncommitted Reserve would be adequate for approximately 1,076 additional ERUs. This would only account for approximately 49% of the expected 2,187 customers represented by pending development.

4.1.2.5 Forecasted Maximum Day Flows

Using both the low growth and high growth scenarios identified in Section 3.6, maximum day demands for Kincardine are projected to increase over time as shown in Figures 4.3 and 4.4.

The Reference line shows the expected increase based on existing usage and a projected rate of growth. The Reference + Commitments line adds the unbuilt development commitments shown in Table 3.2 to the Reference values. Commitments are considered the most impactful of the developments because they are already approved and will likely move forward to construction. The assumption is that the Municipality will maintain roughly the same level of unbuilt commitments over time. The next line, which is for Reference + Commitments + Bruce Power (BP), includes the 2,765 m^3/day maximum day demand expected to be required by BP.

The existing capacity of the Kincardine WTP (11,563 m^3/day) is also shown in Figures 4.3 and 4.4. The capacity of the Kincardine WTP is stated in Schedule C, Table 1 of Drinking Water Systems License No. 088-102 Issue No. 3. Based on comments from operations staff and recent performance evaluation of the plant, there are times when seasonal environmental factors reduce the actual treatment capacity of the facilities. For the purposes of these projections, it is assumed that physical or operational changes at the facilities may allow for treatment up to the rated capacity.

Figure 4.3 – Kincardine Annual Maximum Day Demand – Low Growth Scenario

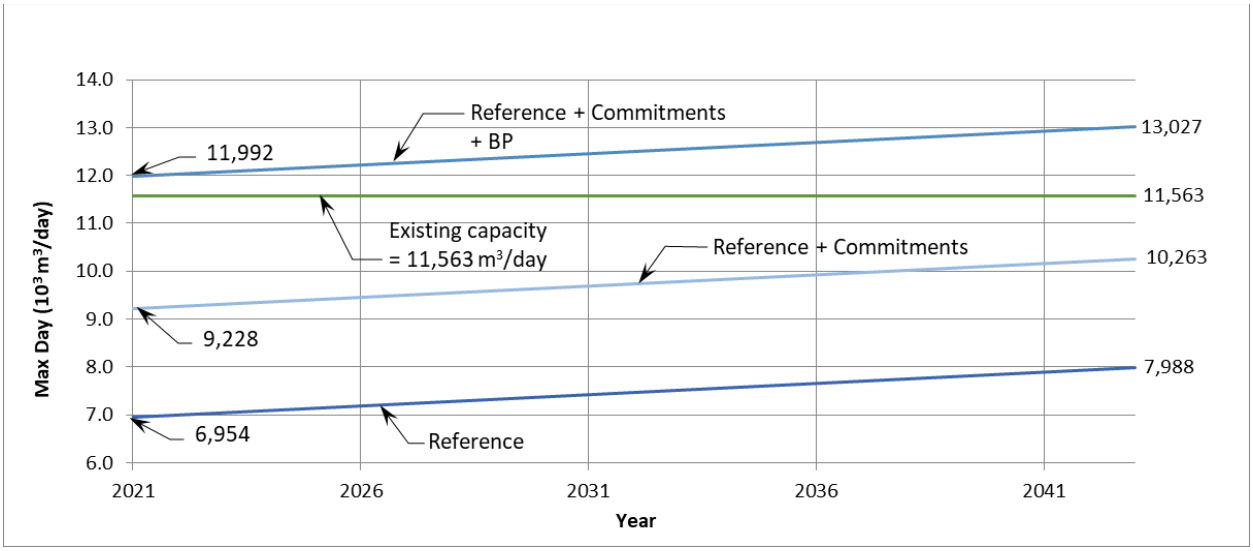
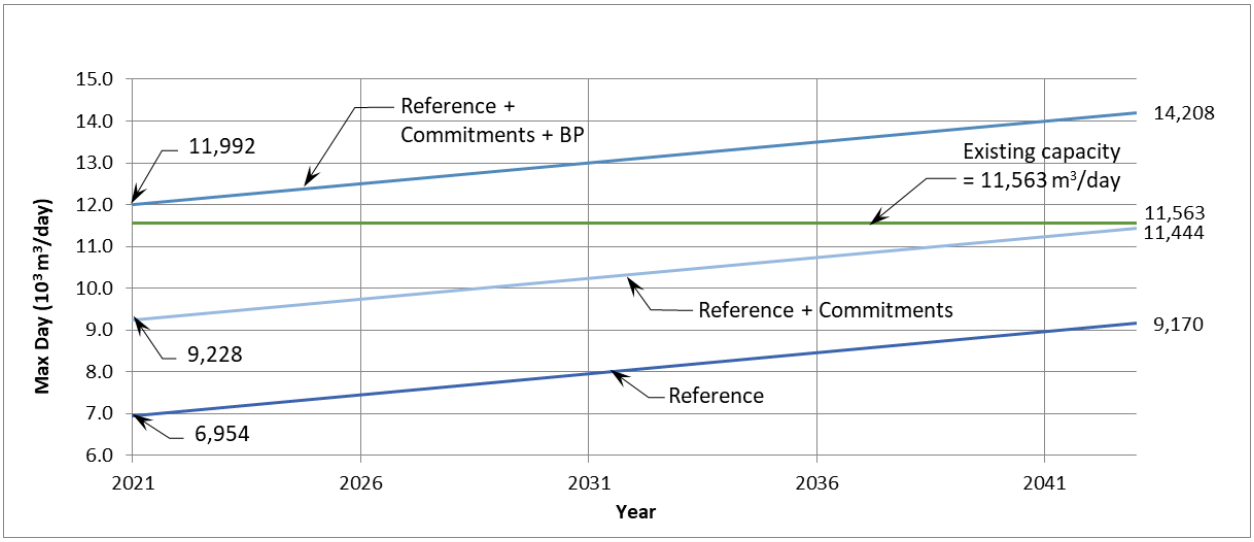


Figure 4.4 – Kincardine Annual Maximum Day Demand – High Growth Scenario



General comments and observations regarding Figures 4.3 and 4.4 are as follows:

- Both growth scenarios used the same starting value for maximum day flow (i.e., current customer demand).
- The difference in demand between the high and low growth scenarios at the end of the 20-year projection period is approximately 1,180 m^3/day.
- The existing capacity of the Kincardine DWS is expected to be sufficient to handle growth and development commitments over the next 20 years for both growth scenarios without Bruce Power as a customer.
- This demand includes 93 ERUs (159 m^3/day) located in Huron-Kinloss.
- The Municipality could maintain the same number of commitments (i.e., inventory) as it currently has (approximately 1,140 residential units) in either scenario.
- The addition of the Bruce Power demands to the existing and committed demands would result in committed demand immediately exceeding the capacity of the existing DWS without any added growth. In the absence of a capacity expansion, no additional development could be approved.

4.1.3 Reserve Capacity for Storage

4.1.3.1 Existing Facilities

Table 4.2 identifies the existing storage facilities and their volumes.

Table 4.2 – Kincardine Water Storage Facilities

Facility	Total Volume (m^3)	Effective Volume (m^3)
Kincardine WTP Reservoir	4,120	1,700[1]
Kincardine Standpipe	3,360	3,005[2]
Kincardine Totals	**7,480**	**4,705**

Notes:

1. The balance of the volume is retained for chlorine contact purposes. The value shown is considered conservative and is based on a chlorine concentration of 0.7 mg/L and pH of 8.5 under winter conditions per October 2020 CT calculation revisions. Depending on actual chlorine alarm setting, pH, and temperature, the effective volume may be increased by over 1,000 m^3.
2. Use of full effective volume based on BPS operation.

4.1.3.2 Basis of Assessment

The theoretical required storage is based on a formula in the MECP design guidelines. The guidelines recommend storage be provided for peak flow equalization, fire flows and emergencies. The equalization component is 25% of the maximum daily demand. Fire flow rates and durations are linked to the population served. The emergency storage component is calculated as 25% of the equalization and fire values. Essentially all are linked to the population served.

4.1.3.3 Required Water Storage

Table 4.3 provides the total storage required for the existing and committed serviced scenarios in Kincardine.

Table 4.3 – Kincardine Storage Requirements

Scenario	Volume Required[1] (m^3)			
	For Equalization	For Fire[2]	For Emergencies	Total
Existing	1,738	1,982	930	4,650
Existing + Commitments	2,307	2,322	1,157	5,786
Existing + Commitments + Bruce Power	2,998	2,322[3]	1,330	6,650
Existing + Commitments + Bruce Power + Proposals/Pending	3,608	3,279	1,722	8,609

Notes:

1. Volumes are based on formulas in MECP Guidelines (2008).
2. Where population is between MECP Guideline categories, fire flow rate and duration are interpolated.
3. Bruce Power does not require fire storage.

The total effective volume is currently 55 m^3 greater than the recommended value of 4,650 m^3 based on MECP Guideline values. This is a surplus of approximately 1% of the suggested value.

Using both the low growth and high growth scenarios identified in Section 3.6, storage requirements for Kincardine are projected to increase over time as shown in Figures 4.5 and 4.6. The Reference line shows the expected increase based on existing usage and a projected rate of growth. The Reference + Commitments line adds the development commitments shown in Table 3.2. The next line, which is for Reference + Commitments + BP, includes the storage requirements expected to be required for BP. The existing effective volume of storage for the Kincardine DWS (4,705 m^3) is also shown.

Figure 4.5 – Kincardine Water Storage Requirements – Low Growth Scenario

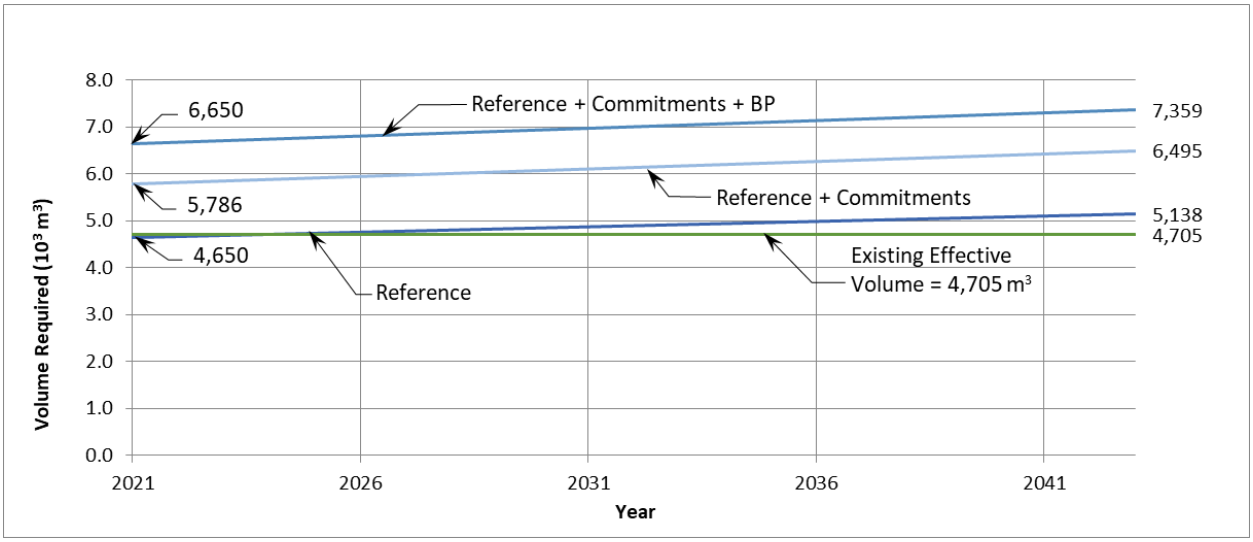
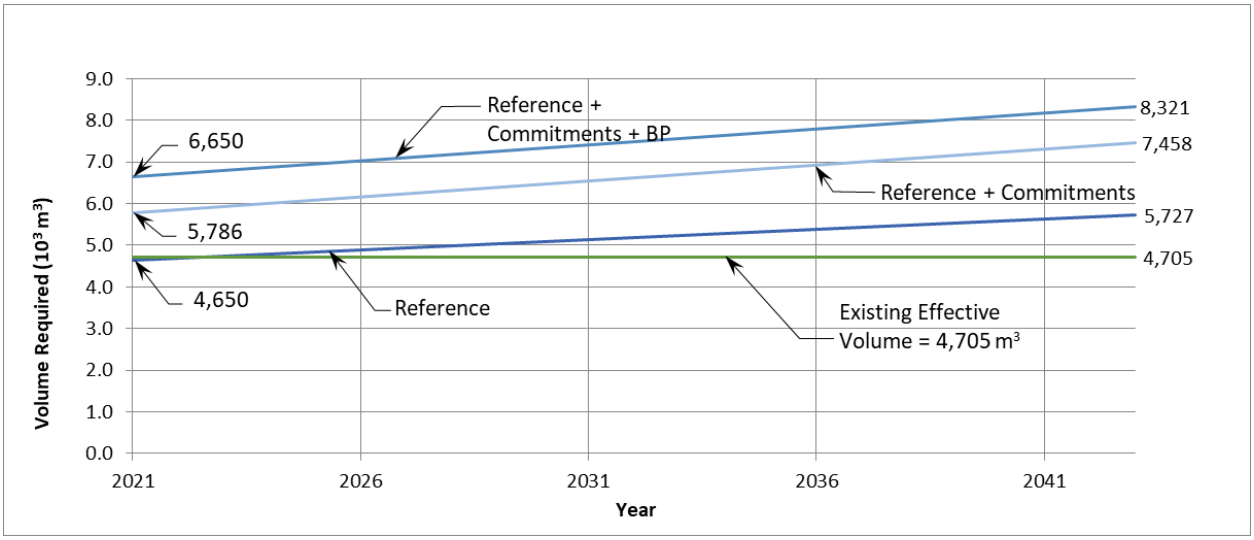


Figure 4.6 – Kincardine Water Storage Requirements – High Growth Scenario



The Municipality has contemplated potential treatment modifications at the WTP, which could make all but 115 m^3 of the WTP reservoir available as effective storage. The timing for such modifications is under review as part of a current Class EA evaluating WTP expansion alternatives. If modifications are carried out, the total existing effective storage would become approximately 7,090 m^3, which would be sufficient to cover existing customers, commitments, and Bruce Power demands.

General comments and observations regarding Figures 4.5 and 4.6 are as follows:

- Both growth scenarios used the same starting value for storage volume required.
- The difference in required volume for the high and low growth scenarios at the end of the 20-year projection period ranges from 589 to 962 m^3.
- The existing effective volume in the Kincardine DWS is currently just sufficient for providing the recommend storage for peak flow equalization, fire flows and emergencies for the existing service population, but would become insufficient in the near future under either growth scenario.
- With WTP modifications, storage would be sufficient for existing plus development commitments and Bruce Power needs.
- Under the low growth scenario and with WTP modifications, storage will be sufficient for existing plus development commitments and Bruce Power needs until approximately 2034.
- Under the high growth scenario and with WTP modification, storage will be sufficient for existing plus development commitments until 2038 (plus Bruce Power needs until 2026).

4.1.4 Water Distribution System Modelling

4.1.4.1 Background

The Kincardine water distribution system was modelled using WaterCAD®. The purpose of the modelling was to identify potential flow and pressure issues during periods of high demand for the existing system, and to determine constraints related to supplying future development areas.

4.1.4.2 Model Details

(a) WaterCAD® Software

BMROSS used Bentley® WaterCAD® CONNECT Edition Update 2 for the water distribution system modelling. The model contains 453 pipes and 356 junctions for the existing Kincardine network. Refer to Appendix C for model details.

(b) Sources of Data

The WaterCAD® model for the Kincardine watermain network was originally created as part of the 2018 Master Plan. In summary for the current model:

- Watermain installation locations and diameters were verified based on distribution system mapping (i.e., GIS database) provided by the Municipality.
- Watermain C-factors were assigned in accordance with values provided in the MECP Guidelines, as summarized in the table below. For 100 mm diameter pipe, not listed in the MECP Guidelines, a C factor of 100 was used:

Diameter (mm)	C
150	100
200-250	110
300-600	120

- Elevation information was obtained from GIS data provided by the Municipality.
- Pump and storage characteristics were obtained from a combination of existing BMROSS records from past projects, the DWWP for the KDWS, and Municipal staff comments.
- Water demand information was developed as part of this Master Plan (B. M. Ross and Associates Limited, 2022).
- Design fire flow demands will vary from about 50 L/s for residential areas to 150 L/s or greater in ICI areas. Considering the relatively small demand associated with consumption as compared to fire flow, and the fact that there are few customers with significant water demand, the total system demand is distributed evenly over all model junctions.
- All fire flows were assessed at 140 kPa minimum system residual pressure.

(c) Establishing Flows at Junctions

WaterCAD® model "junctions" are created at every pipe intersection or dead-end. Water demands for the system are applied at these junctions. For the existing Kincardine model, the total system demand was divided by the total number of model junctions to calculate the demand per junction. This demand value was assigned to each junction. Appendix C contains a detailed summary of the demand allocation methodology.

For the future development model, the assumed locations for future trunk watermains were incorporated into the model, creating a series of additional pipes and junctions within the development lands. Demands for existing development are left unchanged, and the incremental future demand for development areas is applied to the nearest model junctions within or adjacent to the development lands. Demand associated with infill is applied evenly across all junctions.

4.1.4.3 Analyses Run

In general, the model was used under steady-state analysis to determine system pressures under peak demands, and available fire flows under maximum day demands, for both existing and future development scenarios under different storage and pumping configurations. Various water treatment plant high-lift pump (HLP) statuses (i.e., on/off)

and water storage levels in the standpipe were analyzed, to determine a range of operational conditions. A detailed list of all model scenarios includes:

- Existing development demands (peak) with standpipe at a nominal (i.e., average of normal high and low) water level, all HLPs off;
- Existing development demands (maximum day) plus fire flow:
  - Standpipe at nominal water level, all HLPs off;
  - Standpipe at low water level, HLP3 on;
  - Standpipe at low water level, HLP1 and HLP3 on;
- 2043 development demands (peak) with standpipe at a nominal water level, all HLPs off; and
- 2043 development demands (maximum day) plus fire flow:
  - Standpipe at nominal water level, HLPs off;
  - Standpipe at low water level, HLP3 on; and
  - Standpipe at low water level, HLP1 and HLP3 on.

4.1.4.4 Qualifications on Results

Results of the distribution system modelling are based on the system information as described above. Limited work was completed to calibrate/verify the model by way of comparison to actual field data. If future distribution system modifications are to be based on the results of system modelling, it is recommended that a field testing program be carried out for the purpose of comparing actual field measurements to model predictions. The field testing can be limited to the general location of the system expansion being evaluated.

4.1.4.5 Results of Analysis

The results of the WaterCAD® analysis for both the existing and future (i.e., 2043) conditions are presented in Table 4.4.

Table 4.4 – Summary of Kincardine WaterCAD® Analysis

Analysis[1] and Criteria[2]	Existing	Future
Peak Flow		
No. of junctions with kPa > 700	0	0
No. of junctions with kPa > 480 and <= 700	182	122
No. of junctions with kPa > 350 and <= 480	160	208
No. of junctions with kPa > 275 and <= 350	14	26
No. of junctions with kPa < 275	0	0
Fire Flows – All HLPs Off		
No. of junctions with Q < 40 L/s at 140 kPa	4	11
No. of junctions with Q > 40 and < 50 L/s at 140 kPa	10	16
No. of junctions with Q > 50 and < 100 L/s at 140 kPa	96	100

Analysis[1] and Criteria[2]	Existing	Future
Fire Flows – HLP3 On		
No. of junctions with Q < 40 L/s at 140 kPa	2	6
No. of junctions with Q > 40 and < 50 L/s at 140 kPa	9	15
No. of junctions with Q > 50 and < 100 L/s at 140 kPa	87	84
Fire Flows – HLP1 and HLP3 On		
No. of junctions with Q < 40 L/s at 140 kPa	1	5
No. of junctions with Q > 40 and < 50 L/s at 140 kPa	8	14
No. of junctions with Q > 50 and < 100 L/s at 140 kPa	82	81

Notes:
1. 20-year scenario assumes same pipe as existing model plus several extensions to development lands where proposed watermain is known.
2. Pressure and flow criteria base on MECP Guidelines 2008
   Pressures (kPa)
   > 700 not recommended.
   > 480 but < 700 and > 275 but < 350 are acceptable.
   < 275 unacceptable.
   > 350 but < 480 is optimum.
   Fire Flows
   < 40 L/s not recommended for residential areas.

4.1.4.6 Findings for Existing Arrangement

The WaterCAD® model identified the following conditions for the existing arrangement:

- There are no junctions with normal (i.e., static up to peak hour) pressures greater than 700 or less than 275 kPa.
- Approximately 45% of the model junctions are in the optimum pressure range (350 to 480 kPa) during average and peak flows.
- 4 junctions (≈ 1%) have <40 L/s fire flow. These are generally along the lakeshore, north of the community of Kincardine, and at the end of dead-end watermains.

4.1.4.7 Findings for Future Scenario

With reference to Table 4.4, the model predicts the following for the future scenario:

- The pressure and flow conclusions for the future scenario are generally like the existing scenario. Most junctions experience a slight decrease in available fire flow, reflective of the increase in maximum day demand projected for the future.
- Under peak demand, no junctions decrease to unacceptable pressures (i.e., below 275 kPa). An additional 12 junctions (≈ 3.4% of system), compared to existing conditions, decrease to below the lower end of the optimum range (i.e., 350 kPa).

4.1.4.8 Kincardine Shoreline Distribution System

The KSDS generally refers to the sections of watermain in the KDWS that are north of the former Township of Kincardine/Town of Kincardine boundary and the Huron Ridge subdivision (refer to Figure 4.2). The KSDS provides water service to the lakeshore areas from the community of Kincardine to Inverhuron, including the Inverhuron area and IPP. The system was designed with capacity allocation for the community of Tiverton, which is not currently utilized. The KSDS terminates at the intersection of Albert Road and Alma Street in the community of Inverhuron. The total length of watermain, from the Huron Ridge subdivision to the northerly terminus, is nearly 14 km.

The current demand at IPP is allocated as 7.5 L/s, in accordance with an agreement between the Park and the Municipality. Tiverton is not connected to the KSDS. In general, it is concluded that foreseeable demand within the KSDS is in line with historical design values and at this time there are no apparent needs related to upgrading of the KSDS. However, as part of the Class EA work evaluating the potential servicing of Bruce Power, the need for KSDS improvements (e.g., add one or more BPSs, increase size or parallel portions of watermain) is being evaluated due to the increased supply through this trunk watermain compared to its original design basis.

4.1.4.9 Conclusions and Recommendations

The following are general conclusions reached as a result of the modelling. Conclusions and recommendations for the existing system and development are as follows:

- There are no junctions with normal (i.e., static up to peak hour) pressures greater than 700 or less than 275 kPa.
- 4 junctions (≈ 1%) have less than 40 L/s fire flow. These are generally along the lakeshore, north of the community of Kincardine, and at the end of dead-end watermains.

The future condition was examined by adding approved and proposed development within the existing urban area to the existing system model. Conclusions and recommendations for the future system are as follows:

- The pressure and flow conclusions for the future scenario are generally like the existing scenario. Most junctions experience a slight decrease in available fire flow, reflective of the increase in maximum day demand projected for the future.

Fire flow analyses indicate generally acceptable results. In areas where less than target fire flow is available, this is typically a result of dead-end watermain or remote proximity from available storage or supply. Such situations are not considered to be unusual for a system such as the KDWS, but as opportunities arise (e.g., road reconstruction in relevant areas) the Municipality should consider addressing low flow areas.

Figure 4.7 provides suggested trunk watermain additions on Bruce and Kincardine Avenues to accommodate the future development areas toward the southeast area of the community.

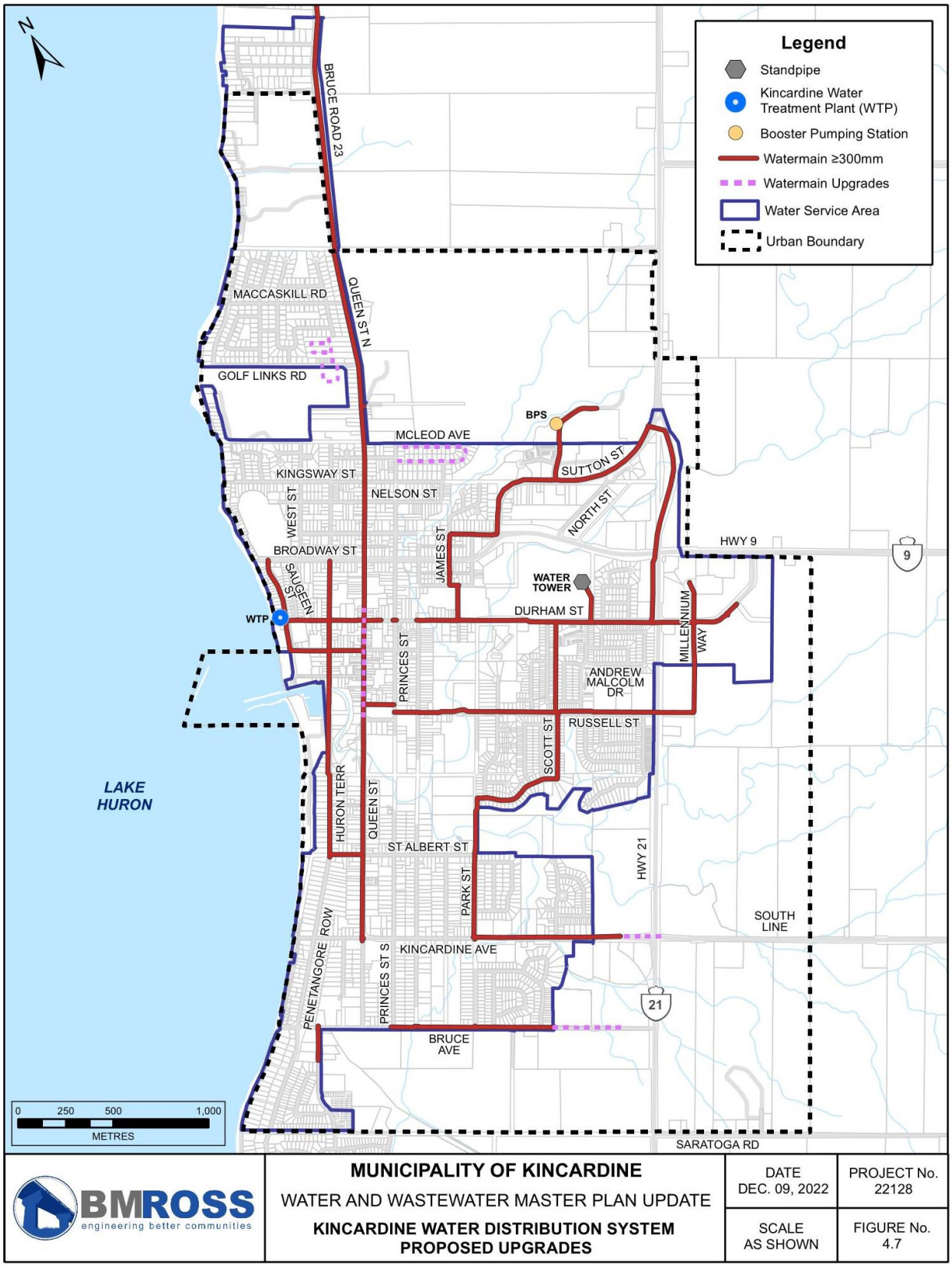
A relatively short watermain extension on Bruce Avenue, east of the current watermain limit, is proposed to service proposed development within that vicinity. The exact route and size of the watermain is currently under review but, based on current planning, the watermain extension will likely remain a dead-end watermain in that area. Lands to the east of this area (see Figure 3.1) have not experienced significant development interest (B. M. Ross and Associates Limited, 2017). To service such areas via extensions of watermain on Kincardine and/or Bruce Avenues would be possible, at least to a limited extent, subject to topographical constraints, or more fully with provision of a BPS.

Further extensions beyond what is shown will be required depending on the nature and location of what developments proceed. It is important to note that the required watermain sizing is dependent on the actual scale and sequence of development.

It is also noted that:

- The locations are presented schematically.
- Timing will depend on development status.
- Additional looping within the Highway No. 21 corridor may be desired. The MTO requires that any future Class EA related to the expansion of the water distribution system consider all viable alternatives to placing utilities inside the Highway No. 21 corridor. The MTO currently does not support or endorse utilities placed within the Highway No. 21 corridor.
- Any expansions to the water distribution system will also be subject to screenings for cultural heritage and archeological resources.

Figure 4.7 – Kincardine Water Distribution System Proposed Upgrades



4.1.5 Climate Change Considerations

Climate change is predicted to result in more intense storms and potentially, periods of prolonged drought. The Kincardine water supply comes from the Kincardine WTP, which is surface water supplied, with Lake Huron as the source, giving it a capacity far greater than the potential needs of Kincardine. However, prolonged droughts could encourage more water use for discretionary uses such as lawn watering in the summer period. There is potential for the pumping and storage facilities to become overtaxed at some point in the future. Increased restrictions and/or seasonal water rates may be required to manage demand and potential impacts on supply and storage.

4.1.6 Problems and Opportunities for Water

4.1.6.1 General

For the Kincardine DWS problems and opportunities fall into three categories: supply, storage and distribution.

4.1.6.2 Water Supply

Total reserve capacity was calculated to be 4,609 m^3/d. Of this, 2,773 m^3/day is committed, and 1,836 m^3/day is uncommitted. Reserve capacity is sufficient to handle growth and development commitments over the next 20 years for both growth scenarios without consideration of Bruce Power as a customer.

Currently, the uncommitted reserve may supply an additional 1,076 ERUs, which only accounts for approximately 49% of the 2,187 ERUs currently known as pending development or proposals.

The addition of the Bruce Power demands to the existing and committed demands would result in committed demand immediately exceeding the capacity of the existing DWS without any added growth. In the absence of a capacity expansion, no additional development could be approved.

A Class EA is currently underway to evaluate WTP expansion, which will include an assessment of probable costs associated with the expansion.

4.1.6.3 Water Storage

There is a surplus in effective storage of only 55 m^3. Treatment modifications at the WTP could increase the effective storage to approximately 7,090 m^3, which would be adequate for all commitments and the addition of Bruce Power as a customer. With these treatment modifications, storage will be sufficient for existing plus development commitments and Bruce Power needs until 2026 under the high growth scenario and until 2034 under the low growth scenario. Storage is under review as a part of the current WTP expansion Class EA.

4.1.6.4 Distribution

Currently there are no junctions with normal (i.e., static up to peak hour) pressures greater than 700 or less than 275 kPa.

Fire flow analyses indicate generally acceptable results. In areas where less than target fire flow is available, this is typically a result of dead-end watermain or remote proximity from available storage or supply. Such situations are not considered to be unusual for a system such as the KDWS, but as opportunities arise (e.g., road reconstruction in relevant areas) the Municipality should consider addressing low flow areas.

4.2 Tiverton Drinking Water System

4.2.1 Description

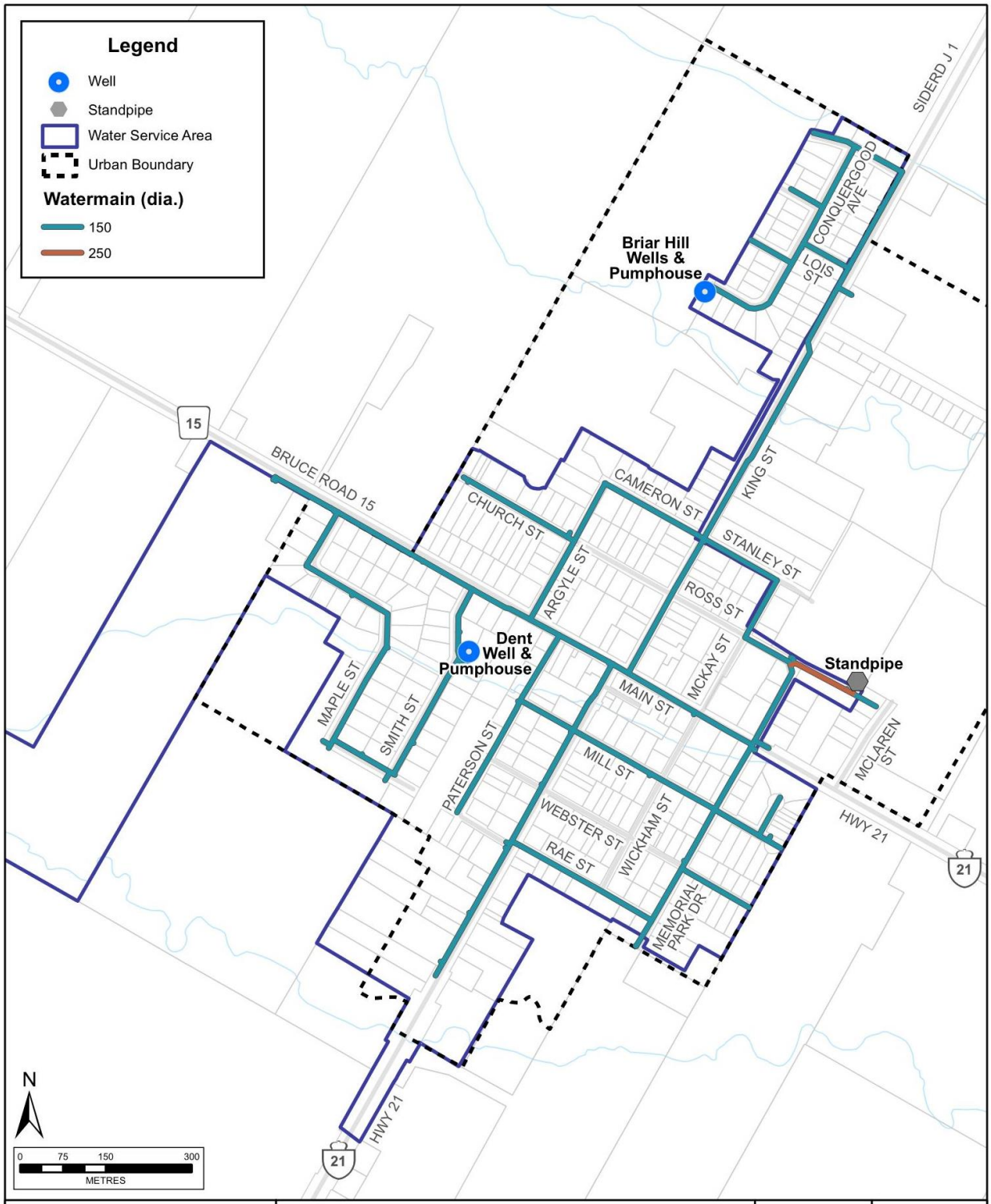
The TDWS is approved by the MECP and described within DWWP No. 088-204 Issue No. 3 and MDWL No. 088-104 Issue No. 3. The rated capacity of the TDWS is limited by the Permit to Take Water (PTTW) value of approximately 775 m^3/day.

The TDWS services the community of Tiverton. The locations of major facilities in the existing TDWS are shown in Figure 4.8. The major facilities include two groundwater well sites complete with pumphouses (Dent Well #2, and Briar Hill Well #1 and #2), standpipe, and distribution watermain.

The Dent Well is located at 6 Smith Street, and the Briar Hill Wells are located at 36 Conquergood Avenue in Tiverton. Each well is a drilled groundwater production well. In total, there is approximately 7.9 km of watermain 100 mm diameter or greater within the Municipality of Kincardine. As of March 2021, there were 372 customers in Tiverton.

The Tiverton Standpipe and associated BPS were constructed in 1984-1985.

Figure 4.8 – Tiverton Drinking Water System



BMROSS engineering better communities	**MUNICIPALITY OF KINCARDINE** WATER AND WASTEWATER MASTER PLAN UPDATE **TIVERTON DRINKING WATER SYSTEM**	DATE NOV. 07, 2022	PROJECT No. 22128
		SCALE AS SHOWN	FIGURE No. 4.8

4.2.2 Existing and Future Water Demands

4.2.2.1 Methodology

Water supply capability is assessed using annual maximum day demands, as shown for the TDWS in Table 4.5.

Table 4.5 – Tiverton Maximum Day Demand 2019 to 2021

Year	Maximum Day (m^3/d)
2019	616
2020	544
2021	481

Because maximum water demands vary from year to year depending on environmental conditions, the existing demand for reserve capacity calculations purposes is generally considered to be the Maximum Day in the previous three years.

Current Maximum Demand = **616 m^3/d**

It is noted that the current maximum demand is comparable to but less than the value reported in the 2018 Master Plan, which was 659 m^3/d.

4.2.2.2 Total Reserve Capacity

Total Reserve = 775 – 616

= **159 m^3/d**

4.2.2.3 Per Customer Usage

Per Customer Demand = $\frac{616\ m^3/d}{372\ \text{customers}}$

= 1.66 m^3/d per customer

4.2.2.4 Uncommitted Reserve Capacity

Pumphouses Capacity	=	775 m^3/d
Current Demand	=	616
Total Reserve	=	159 m^3/d
Commitments (256 units x 1.66)	=	424 m^3/d
Uncommitted Reserve	=	-**265 m^3/d**

At 1.66 m^3/d per ERU, the deficit in reserve capacity would be approximately equal to 160 ERUs.

4.2.2.5 Forecasted Maximum Day Flows

Using both the low growth and high growth scenarios identified in Section 3.6, maximum day demands for Tiverton are projected to increase over time as shown in Figures 4.9 and 4.10.

The Reference line shows the expected increase based on existing usage and a projected rate of growth. The Reference + Commitments line adds the development commitments shown in Table 3.4. The existing capacity of the Tiverton Well Supply (775 m^3/day) is also shown. This consists of the permitted capacity of the Briar Hill Pumphouse (524.16 m^3/day) and the permitted capacity from the Dent Pumphouse (250.5 m^3/day).

For the Dent Pumphouse, the reported water level data (after the sensors were repaired/upgraded in 2016) suggest that the low water levels under maximum water taking are below the bottom of the well casing and likely below the upper water bearing zone at 39.6 m. Being that the water level in a bedrock well should not be maintained below the uppermost water bearing zone, and preferably not below the base of the casing, if the reported water level data is accurate, there appears to be no additional capacity available. Water taking data indicates that the maximum permitted rate of withdrawal (reported to us as monthly maximum daily withdrawal) from Dent is being used on occasion and has been exceeded at least once.

A 2006 pumping test of Briar Hill #2 indicated that 50-60% of the available drawdown (around 30 m above base of casing) was used at 545 L/min, which suggests that some additional yield may be possible. However, the reported water level data after 2016 suggest that the water level in the well may be getting as low as 50 to 70 m, far below the base of the casing. The reported water taking data suggests that only about half the permitted maximum rate of withdrawal (784 m^3/day) is being used on maximum days.

The water level data for the less used Briar Hill #1, indicates low water levels in the range of 10-15 m due to interference from Briar Hill #2, which is significant.

Figure 4.9 – Tiverton Annual Maximum Day Demand – Low Growth Scenario

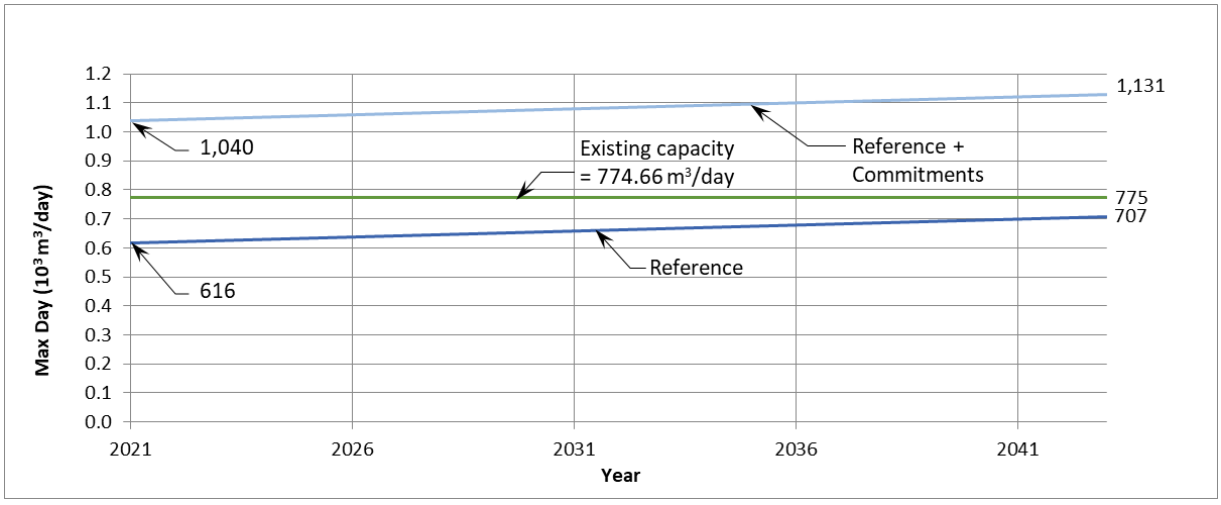
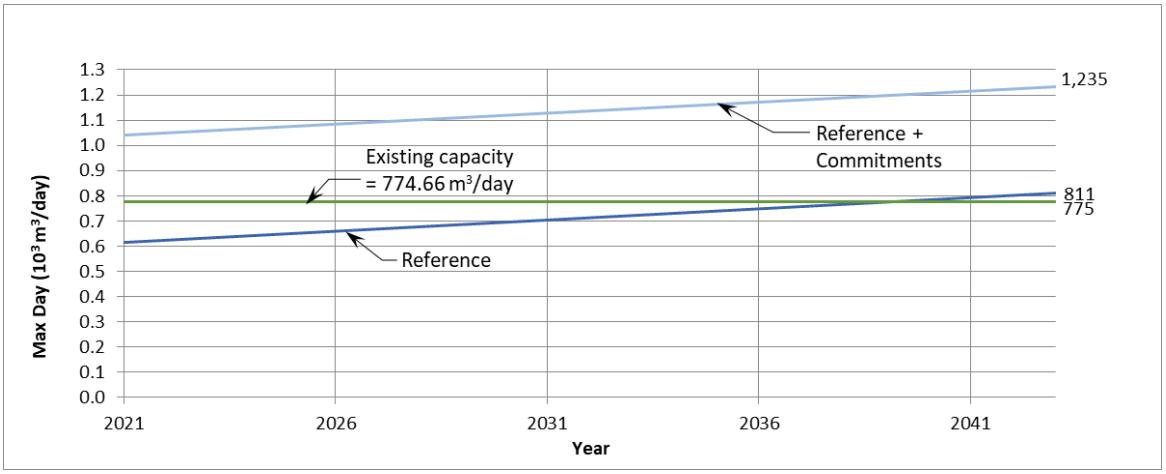


Figure 4.10 – Tiverton Annual Maximum Day Demand – High Growth Scenario



General comments and observations regarding Figures 4.9 and 4.10 are as follows:

- Both growth scenarios used the same starting value for maximum day flow (i.e., current customer demand).
- The difference between the high and low growth scenarios at the end of the 20-year projection period amount to approximately 100 m^3/day.
- Under the low growth scenario, the addition of the development commitments to the expected growth will exceed the DWS capacity under current conditions; but without the addition of these commitments, capacity will be adequate for the entire 20-year period.
- Under the high growth scenario, the addition of the development commitments to the expected growth will exceed the DWS capacity under current conditions; but without the addition of these commitments, capacity will be adequate until approximately 2039.
- Indications are that Dent #2 is at capacity but seems to be operating as expected.
- For Briar Hill #2, if the reported water level data after 2016 and the water taking data is accurate, the well efficiency has dropped significantly since 2006.
- Both Dent #2 and Briar Hill #2 should be camera-inspected to confirm well conditions and location of water bearing zones. Pumping tests should also be conducted using the current pumping equipment to confirm capacity.

4.2.3 Reserve Capacity for Storage

4.2.3.1 Existing Facilities

Table 4.6 identifies the existing storage facilities and their volumes.

Table 4.6 – Tiverton Water Storage Facilities

Facility	Total Volume (m^3)	Effective Volume (m^3)
Tiverton Standpipe	1,500	1,390[1]

Notes:

1. Use of full effective volume based on BPS operation.

4.2.3.2 Basis of Assessment

The theoretical required storage is based on a formula in the MECP design guidelines. The guidelines recommend storage be provided for peak flow equalization, fire flows and emergencies. The equalization component is 25% of the maximum daily demand. Fire flow rates and durations are linked to the population served. The emergency storage component is calculated as 25% of the equalization and fire values. Essentially all are linked to the population served.

4.2.3.3 Required Water Storage

Table 4.7 provides the total storage required for the existing and committed serviced scenarios in Tiverton.

Table 4.7 – Tiverton Storage Requirements

Scenario	Volume Required[1] (m^3)			
	For Equalization	For Fire[2]	For Emergencies	Total
Existing	154	274	107	534
Existing + Commitments	260	531	198	988

Notes:

1. Volumes are based on formulas in MECP Guidelines (2008).
2. Where population is between MECP Guideline categories, fire flow rate and duration are interpolated.

The total effective volume is currently 856 m^3 greater than the recommended value of 534 m^3 based on MECP Guideline values. This is a surplus of approximately 160% of the suggested value. The total existing effective storage is sufficient for existing plus committed customers. There would still be a surplus of 402 m^3 if all development proposals were included; this surplus is approximately 41% of the volume suggested in the Guidelines.

Using both the low growth and high growth scenarios identified in Section 3.6, storage requirements for Tiverton are projected to increase over time as shown in Figures 4.11 and 4.12. The Reference line shows the expected increase based on existing usage and a projected rate of growth. The Reference + Commitments line adds the development commitments shown in Table 3.4. The existing effective volume of storage for the Tiverton DWS (1,390 m^3) is also shown.

Figure 4.11 – Tiverton Total Storage Required – Low Growth Scenario

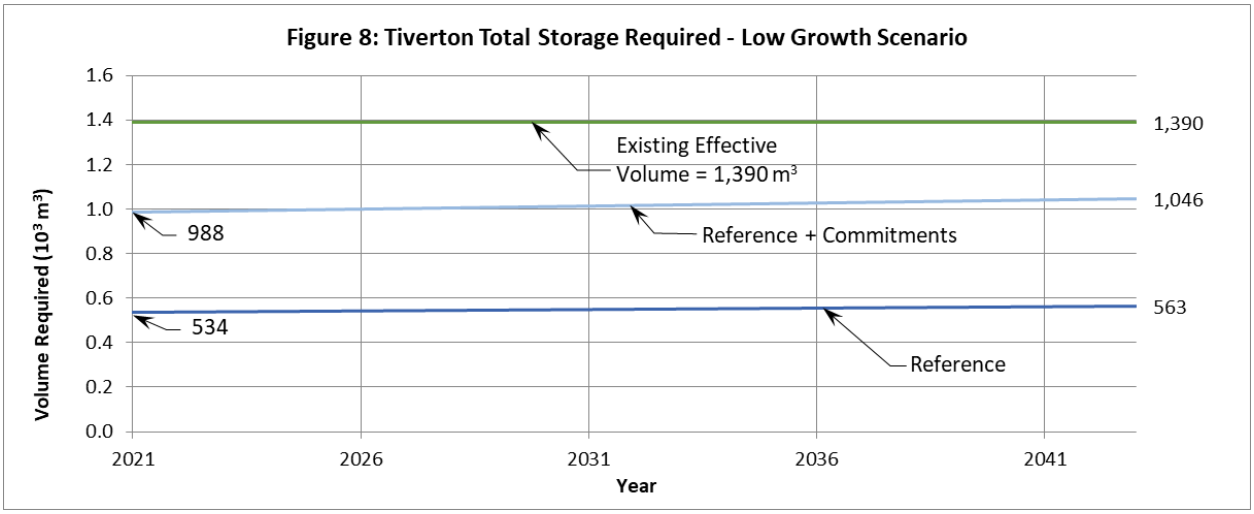
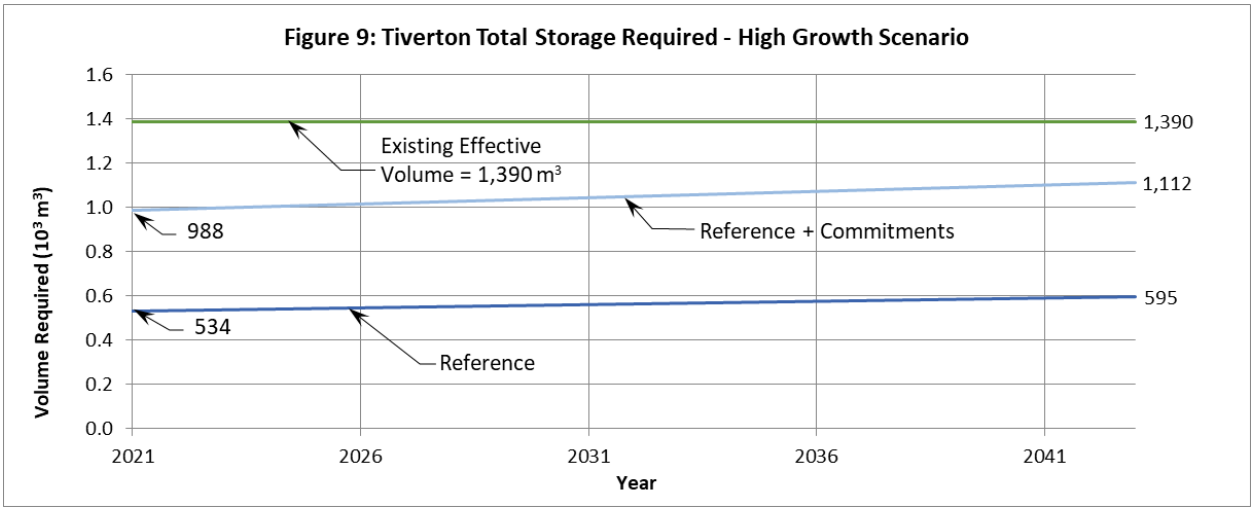


Figure 4.12 – Tiverton Total Storage Required – High Growth Scenario



General comments and observations regarding Figures 4.11 and 4.12 are as follows:

- Both growth scenarios used the same starting value for storage volume required.
- The difference in required volume for the high and low growth scenarios at the end of the 20-year projection period is 33 m^3 without development commitments, and 66 m^3 with development commitments.
- The existing effective volume of the Tiverton DWS is sufficient for providing the recommended storage for peak flow equalization, fire flows and emergencies under both growth scenarios for the next 20 years.

4.2.4 Water Distribution System Modelling

4.2.4.1 Background

The Tiverton water distribution system was modelled using WaterCAD®. The purpose of the modelling was to identify potential flow and pressure issues during periods of high demand for the existing system, and to determine constraints related to supplying future development areas.

4.2.4.2 Model Details

In general, the same methodology described in Section 4.1.4.2 for Kincardine was used for the Tiverton water model. The Tiverton model contains 72 pipes and 57 junctions. Refer to Appendix D for details.

4.2.4.3 Analyses Run

Refer to Section 4.1.4.3 for a general description of methodology. A detailed list of all model scenarios includes:

- Existing development demands (peak) with standpipe at a nominal (i.e., average of normal high and low) water level, all HLPs off;
- Existing development demands (maximum day) plus fire flow:
  - Standpipe at nominal water level, all HLPs off;
  - Standpipe at low water level, Dent Well #2 and Briar Hill Well #1 on;
- 2043 development demands (peak) with standpipe at a nominal water level, all HLPs off; and
- 2043 development demands (maximum day) plus fire flow:
  - Standpipe at nominal water level, HLPs off; and
  - Standpipe at low water level, Dent Well #2 and Briar Hill Well #1 on.

4.2.4.4 Qualifications on Results

Refer to 4.1.4.4.

4.2.4.5 Results of Analysis

The results of the WaterCAD® analysis for both the existing and future (i.e., 2043) conditions are presented in Table 4.8.

Table 4.8 – Summary of Tiverton WaterCAD® Analysis

Analysis[1] and Criteria[2]	Existing	Future
Peak Flow		
No. of junctions with kPa > 700	0	0
No. of junctions with kPa > 480 and <= 700	0	0
No. of junctions with kPa > 350 and <= 480	39	31
No. of junctions with kPa > 275 and <= 350	18	26
No. of junctions with kPa < 275	0	0
Fire Flows – All HLPs Off		
No. of junctions with Q < 40 L/s at 140 kPa	15	15
No. of junctions with Q > 40 and < 50 L/s at 140 kPa	2	2
No. of junctions with Q > 50 and < 100 L/s at 140 kPa	31	32
Fire Flows – DW2 and BH1 On		
No. of junctions with Q < 40 L/s at 140 kPa	4	4
No. of junctions with Q > 40 and < 50 L/s at 140 kPa	10	12
No. of junctions with Q > 50 and < 100 L/s at 140 kPa	29	28

Notes:
1. 20 year scenario assumes same pipe as existing model plus several extensions to development lands where proposed watermain is known.
2. Pressure and flow criteria base on MECP Guidelines 2008
   Pressures (kPa)
   > 700 not recommended.
   > 480 but < 700 and > 275 but < 350 are acceptable.
   < 275 unacceptable.
   > 350 but < 480 is optimum.
   Fire Flows
   < 40 L/s not recommended for residential areas.

4.2.4.6 Findings for Existing Arrangement

The WaterCAD® model identified the following conditions for the existing arrangement:

- There are no junctions with normal (i.e., static up to peak hour) pressures greater than 700 or less than 275 kPa.
- Approximately 68% of the model junctions are in the optimum pressure range (350 to 480 kPa) during average and peak flows.
- 15 junctions (≈ 26%) have <40 L/s fire flow. It is noted:
  - Most of these junctions are in the north part of the community, where a single watermain on King Street connects to the southern portion of the system. The marginal benefit from the Briar Hill well pump is sufficient to increase most junctions to greater than 40 L/s, but still less than 50 L/s.
  - 4 junctions at the end of 100 mm diameter dead-end lines would have extremely poor fire flow (i.e., 10 L/s or less) regardless of pump status, but it is noted that mains of this size (i.e., less than 150 mm diameter) are not typically designed for provision of fire flow.

4.2.4.7 Findings for Future Scenario

With reference to Table 4.8, the model predicts the following for the future scenario:

- Operating pressures under 2043 peak demand conditions are very similar (i.e., typically within 5 kPa, some junctions decrease by up to 13 kPa) to existing peak demand conditions.
- Fire flow analyses indicate generally acceptable results, except for areas in the north part of the system that are fed by a single 150 mm diameter watermain, and other locations at the end of dead-end 100 mm diameter watermains.

4.2.4.8 Conclusions and Recommendations

The following are general conclusions reached because of the modelling. Conclusions and recommendations for the existing system and development are as follows:

- There are no junctions with normal (i.e., static up to peak hour) pressures greater than 700 or less than 275 kPa.
- 15 junctions (≈ 26%) have less than 40 L/s fire flow. These are generally in the north part of the community or at the end of small diameter, dead-end watermains.

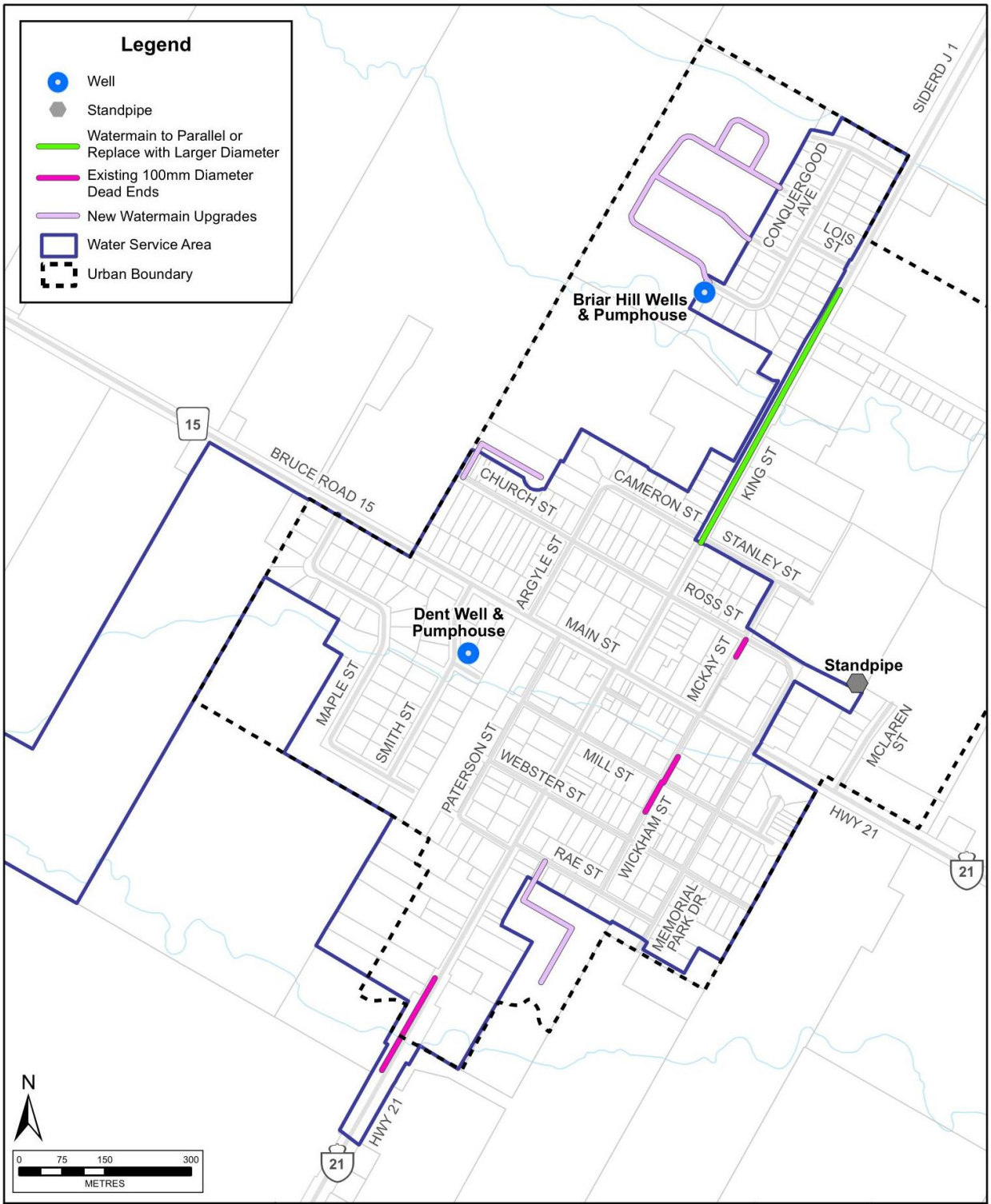
The future condition was examined by adding approved and proposed development within the existing urban area to the existing system model. Conclusions and recommendations for the future system are as follows:

- The pressure and flow conclusions for the future scenario are generally like the existing scenario. Most junctions experience a slight decrease in available fire flow, reflective of the increase in maximum day demand projected for the future.

Fire flow analyses indicate generally acceptable results. In areas where less than target fire flow is available, this is typically a result of dead-end watermain or remote proximity from available storage or supply. Such situations are not considered to be unusual, but if development to the north part of the community progresses, consideration should be given to increasing available fire flow. This could be accomplished by paralleling the single watermain on King Street from Stanley/Cameron Streets to Lois Street with a minimum 150 mm diameter watermain, or fully replacing it with minimum 200 mm diameter watermain.

Figure 4.13 illustrates the King Street watermain which could be paralleled or replaced, as well as locations of dead-end 100 mm diameter watermains which currently limit fire flow. Also shown are locations of watermain proposed as part of development.

Figure 4.13 – Tiverton Water Distribution System Proposed Upgrades



4.2.5 Climate Change Considerations

Climate change is predicted to result in more intense storms and potentially, periods of prolonged drought. The Tiverton water supply comes from the Dent Well located at 6 Smith Street, and the Briar Hill Wells located at 36 Conquergood Avenue in Tiverton, which are drilled groundwater production wells. The water supply comes from deep bedrock aquifers that should be reasonably protected from periodic drought conditions. However, prolonged droughts could encourage more water use for discretionary uses such as lawn watering in the summer period. There is potential for the pumping and storage facilities to become overtaxed at some point in the future. Increased restrictions and/or seasonal water rates may be required to manage demand and potential impacts on supply and storage.

4.2.6 Problems and Opportunities for Water

4.2.6.1 General

For the Tiverton drinking water system, problems and opportunities fall into three categories: supply, storage and distribution.

4.2.6.2 Water Supply

Total reserve capacity was calculated to be 159 m^3/day. Currently, 424 m^3/day is committed, leaving a deficit of 265 m^3/day. The deficit in reserve capacity would be approximately equal to 160 ERUs. Therefore, the addition of all development commitments would cause an exceedance in the system capacity. However, the number of commitments relative to projected growth is significant; under the low growth scenario the expected growth will not exceed the DWS capacity over the next 20 years, and under the high growth scenario the expected growth will exceed the DWS capacity at some point around 2039.

Indications are that Dent #2 is at capacity but seems to be operating as expected. For Briar Hill #2, if the reported water level data after 2016 and the water taking data is accurate, the well efficiency has dropped significantly since 2006. Pumping tests should be conducted at both locations using the current pumping equipment to confirm.

Briar Hill #2 is either losing efficiency, or the water level monitoring equipment is not properly calibrated. It should be camera-inspected to confirm well conditions and the location of water bearing zones. A camera-inspection of the Dent #2 well is also recommended to better understand its current conditions.

Given the potential for additional development to require an increase to the supply capacity, it is recommended that investigations commence to evaluate potential methods of increase (e.g., re-rating of existing well(s), new well(s), or connect to the Kincardine system). Current indications are that there would be no great potential for re-rating any of the current wells, so an alternate source will likely be required when the capacity increase is needed. A Class EA would be required for these alternatives. It is suggested that $50,000 be budgeted for testing and hydrogeological review of Dent Well #2 and Briar Hill #2, and $75,000 be budgeted for a Class EA related to evaluation of options for a system capacity increase. The $75,000 does not include Source Water

Protection modelling costs; if such costs are determined to be applicable during the Class EA, the Municipality may want to budget an additional $50,000 for such costs.

4.2.6.3 Water Storage

There is a surplus in effective storage of approximately 856 m^3. The effective storage is adequate for all commitments under both growth scenarios for the next 20 years, with a current surplus of 402 m^3. This surplus is approximately 41% of the total volume suggested.

4.2.6.4 Distribution

Currently, there are no junctions with normal (i.e., static up to peak hour) pressures greater than 700 or less than 275 kPa.

Fire flow analyses indicate generally acceptable results. In areas where less than target fire flow is available, this is typically a result of dead-end watermain or remote proximity from available storage or supply. Figure 4.13 identifies the watermain upgrade along King Street that could be considered to increase available fire flow to the north portion of the community, as well as areas currently serviced by dead-end 100 mm diameter watermain. Such situations are not considered to be unusual for a system such as the TDWS, but as opportunities arise (e.g., road reconstruction in relevant areas) the Municipality should consider addressing low flow areas. The probable cost for the King Street watermain works as shown is $660,000 for the watermain only, or $3,300,000 if full road reconstruction is considered for the project. Costs are based on a 2023 assumed value of $5,500 per m of road reconstruction, of which 20% applies to watermain, 50% to sanitary sewer, and 30% applies to storm/drainage. Costs include 15% for engineering and exclude HST.

5.0 WASTEWATER SERVICING

5.1 Kincardine Wastewater System

5.1.1 Pumping and Treatment

The Kincardine wastewater system consists of a single WWTP, nine SPSs and two landfill related pumping stations (i.e., groundwater and leachate) and their associated forcemains, and a gravity sewer collection network. Of the SPSs, six major stations which typically pump >95% of the total sewage flow for the community are included within the context of this Master Plan. The following Environmental Compliance Approval (ECA) documents, issued by the MECP, apply to the major infrastructure considered in this analysis:

- Kincardine WWTP – ECA No. 4648-8DVSSR.
- All SPSs and collection system – Consolidated Linear Infrastructure (CLI) ECA 088-W601, Issue No. 1.

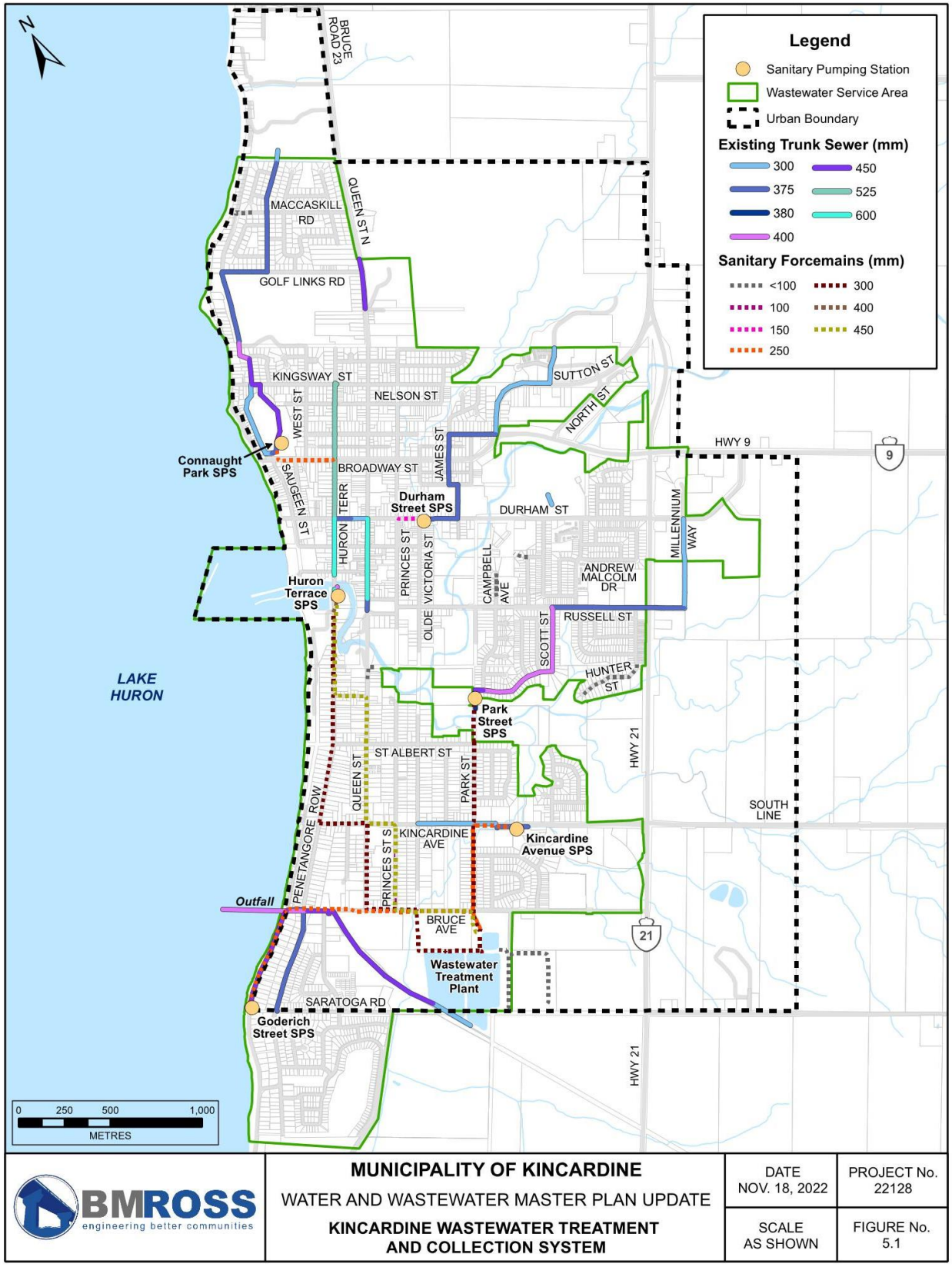
The hydraulic or volumetric capacity of the existing WWTP is established by ECA No. 4648-8DVSSR. The Kincardine WWTP has a rated capacity of 5,910 m^3/d on an annual average basis.

The WWTP, located at 520 Bruce Avenue, generally consists of one aerated and two conventional lagoon cells, with phosphorus removal and UV disinfection equipment. Effluent is discharged to Lake Huron. In total, there are approximately 60.7 km of sanitary gravity sewers and 11.8 km of sanitary forcemains within the Municipality of Kincardine. As of June 2022, there were 3,780 customers in Kincardine.

5.1.2 Collection System

The Kincardine Collection system services the former Town of Kincardine and Huronville subdivision in the northwestern area of the Township of Huron-Kinloss. The extent of the wastewater collection system is shown in Figure 5.1.

Figure 5.1 – Kincardine Wastewater System



5.1.3 Existing and Future Wastewater Flows

5.1.3.1 Existing Wastewater Flows

Table 5.1 shows a summary of recent historical wastewater flow information.

Table 5.1– Kincardine – Historical Wastewater Flows

Year	AADF[1] (m^3/day)
2019	3,792
2020	3,747
2021	3,945

Notes:
1. AADF = Annual Average Daily Flow

The existing demand, for reserve capacity calculations purposes, is generally considered to be the average value for the previous three years.

Current Average Flow = **3,828 m^3/d**

5.1.3.2 Per Customer Flows

$$\text{Per Customer Flow} = \frac{3{,}828 m^3/d}{3{,}780}$$

$$= 1.01\ m^3/d$$

The existing average day flow is estimated to be 3,828 m^3/day, which corresponds to 1.01 m^3/day per current customer. For flow forecasting purposes we propose to consider a customer as equivalent to an ERU which is in turn equivalent to a detached residence.

5.1.3.3 By-passing and Overflow

It is known from operator experience that the Durham Street, Park Street, and Huron Terrace stations all experience high peak flows due to I&I and have surcharged to high levels, in some cases causing station bypasses. The Huron Terrace SPS has recently undergone upgrades and capacity expansion (commissioned early 2023) which will significantly reduce risk of bypassing.

5.1.4 Reserve Treatment Capacity

5.1.4.1 Total Reserve

Typically, the reserve capacity of a WWTP is assessed by deducting the average flow from the previous three years from the ECA rated capacity. Wastewater flow can vary from year to year depending on environmental conditions, but as per the information above, flows are reasonably consistent in Kincardine.

It is noted that the current average flow is comparable to the value reported in the 2018 Master Plan, which was 3,811 m^3/d corresponding to 2014 to 2016.

The Kincardine WWTP is rated for an AADF of 5,910 m^3/day. The Total Reserve Capacity at the end of 2021 is as follows:

Total Reserve = 5,910 – 3,828

= **2,082 m^3/d**

5.1.4.2 Uncommitted Reserve

WWTP Capacity	=	5,910 m^3/d
Current Usage	=	3,828
Total Reserve	=	2,082 m^3/d
Commitments (1,132 units x 1.01 m^3/d)	=	1,146 m^3/d
Uncommitted reserve	=	**936 m^3/d**

At 1.01 m^3/d per ERU, the Uncommitted Reserve would be adequate for approximately 924 additional ERUs. This is less than the 2,127 ERUs represented by proposals and pending development. If all commitments, proposals and pending development were to become real customers, there would be an estimated deficit in treatment capacity of 1,218 m^3/day.

5.1.4.3 Treatment Capacity by Year

With reference to the growth projections presented in Section 3.6, Figures 5.2 and 5.3 show the expected annual average sewage flows from 2021 to 2043.

Figure 5.2 – Kincardine Annual Average Day Sewage Flow - Low Growth Scenario

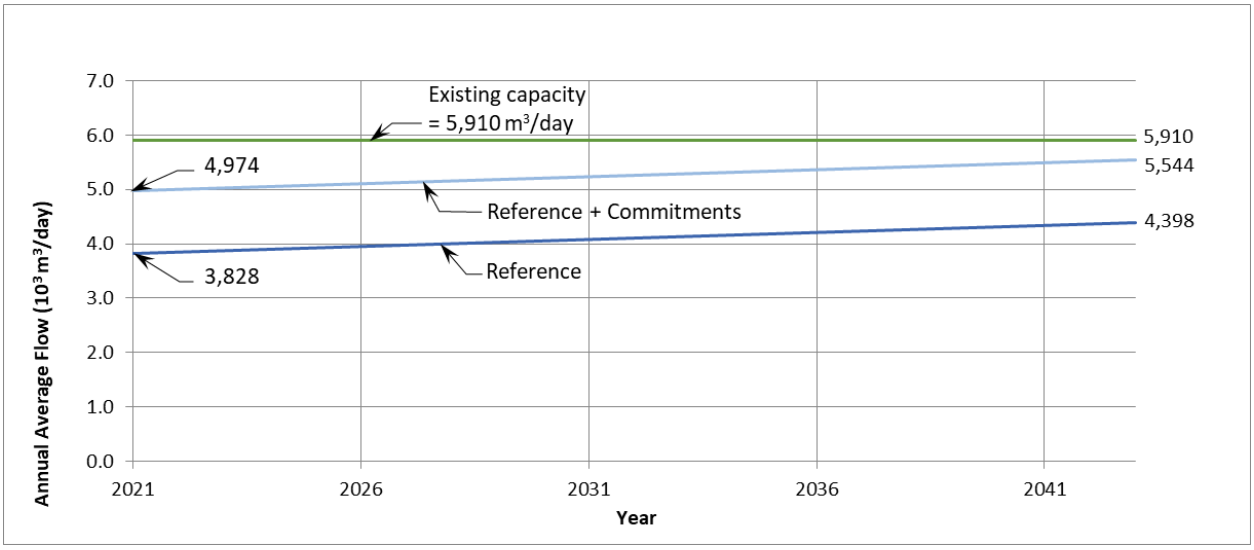
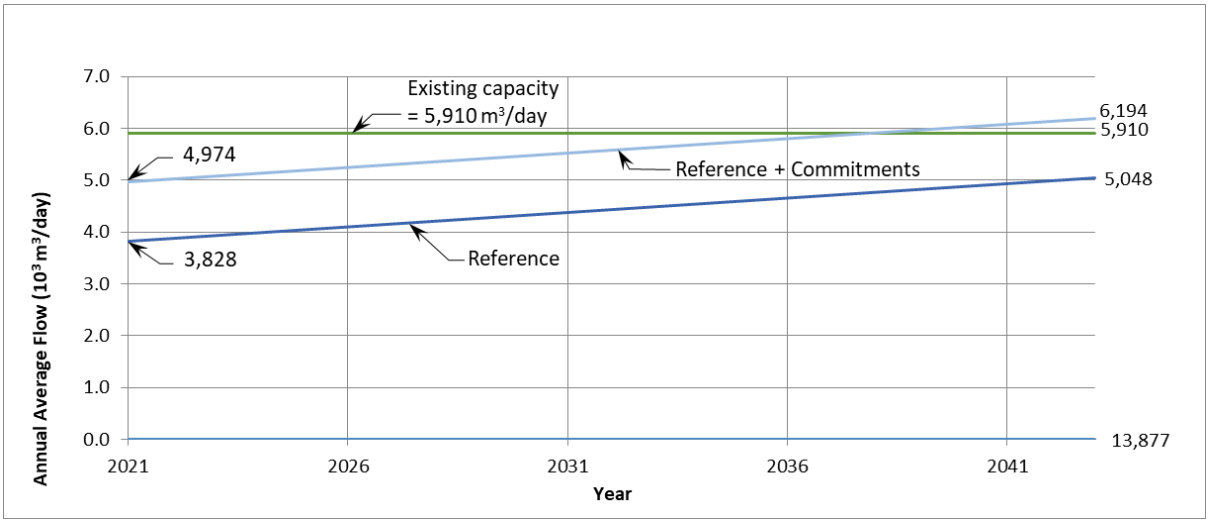


Figure 5.3 – Kincardine Annual Average Day Sewage Flow - High Growth Scenario



General comments and observations regarding Figures 5.2 and 5.3 are as follows:

- The difference in flow between the high and low growth scenarios at the end of the 20-year projection period is 650 m^3/day.
- Under the low growth scenario, the existing rated capacity of the Kincardine WWTP will be sufficient for existing plus development commitments for the next 20 years.
- Under the high growth scenario, the existing rated capacity of the Kincardine WWTP will be sufficient for existing plus development commitments only until approximately 2037.
- These flows include 281 ERUs (285 m^3/day) located in Huron-Kinloss.

5.1.5 Kincardine WWTP Treatment Performance

5.1.5.1 Effluent Criteria

The existing ECA for the Kincardine WWTP provides both treatment objectives and limits. The final effluent objective criteria are set out in Section 6 of the ECA and are as follows:

Final Effluent Parameter	Averaging Calculator	Objective
$CBOD_5$	Monthly Average Effluent Concentration	25 mg/L
Total Suspended Solids	Monthly Average Effluent Concentration	30 mg/L
Total Phosphorus	Monthly Average Effluent Concentration	1.0 mg/L
E. coli	Geometric Mean Density	*150 CFU/100 ml for any calendar month
pH	Single Sample Result	6.5 – 9.0 inclusive

The final effluent compliance criteria are set out in Section 7 of the ECA. Both concentration and loading criteria are stipulated and are as follows:

Final Effluent Parameter	Averaging Calculator	Limit
$CBOD_5$	Monthly Average Effluent Concentration	30 mg/L
Total Suspended Solids	Monthly Average Effluent Concentration	40 mg/L
Total Phosphorus	Monthly Average Effluent Concentration	1.0 mg/L
E. coli	Geometric Mean Density	200 CFU per 100 mL
pH	Single Sample Result	between 6.0 - 9.5 inclusive

Final Effluent Parameter	Averaging Calculator	Limit
$CBOD_5$	Monthly Average Effluent Concentration	177 kg/d
Total Suspended Solids	Monthly Average Effluent Concentration	236 kg/d
Total Phosphorus	Monthly Average Effluent Concentration	5.9 kg/d

5.1.5.2 Performance Review

A review of Annual Reports for January 2018 to December 2021 was undertaken. The review established that the WWTP consistently meets the performance criteria.

During the hot summer months, the Dissolved Oxygen (DO) in the Aerated Cell typically falls to less than 2 mg/L. Aerator hours and cycles are adjusted to improve the DO without lifting the sludge blanket. The addition of leachate is typically stopped temporarily during this time as well. The aerators are currently in the process of being replaced with a diffused air system (commissioning expected spring 2023).

5.1.6 Wastewater Collection System Modelling

5.1.6.1 Background

The Kincardine wastewater collection system was modelled using SewerCAD®. The purpose of the modelling was to identify potential pipe capacity constraints during periods of peak flow and to determine requirements for servicing future development areas.

5.1.6.2 Model Details

(a) Software

BMROSS used Bentley® SewerCAD® V8i (SELECTseries 5) for the wastewater collection system modelling. Six separate models were utilized, one for each of the major SPS catchment areas considered in the Master Plan. Refer to Appendix E for model details for each SPS.

(b) Methodology

The SewerCAD® models for the Kincardine wastewater network were originally created as part of the 2018 Master Plan and updated as needed for the current analyses. In summary:

- Sanitary sewer and maintenance hole (MH) installation locations, elevations, and diameters were verified from collection system mapping (i.e., GIS database) provided by the Municipality;
- A Manning's n value of 0.013 was used for all gravity sewer pipe;
- Wastewater flows for each catchment area were developed as part of this Master Plan (refer to Appendix E); and
- Assessments of sanitary sewer pipe were completed on the basis of comparing calculated flow in the pipe to full-flow capacity. Pipes were identified where the ratio of flow to capacity exceeded 80%.

(c) Establishing Flows at Maintenance Holes

Wastewater flows in the SewerCAD® model may be applied at MHs (i.e., point loads) or over the length of a sewer pipe (i.e., linear loads). For the existing Kincardine model, the total catchment area wastewater flow was divided by the total number of MHs to calculate the flow per MH. This flow value was assigned to each MH and generally corresponds to dividing the total flow for the catchment area over the catchment area evenly.

It is noted that, for the six SPS catchment areas analyzed, the total existing peak flow applied in the model for all stations is approximately 375 L/s (32,400 m^3/day). While this is greater than the peak flow observed at the WWTP for the combined system, the analysis recognizes that not all stations would necessarily experience peak flows at the same time. In other words, the cumulative total of all individual station design flows can be expected to be greater than the total system flow at any one time and likely provides an over-estimation of actual flow in the modelling. Appendix E provides detailed calculations for each catchment area.

For the future development model, the assumed locations for future trunk sanitary sewers were incorporated into the model, as applicable, creating a series of additional pipes and MHs within the development lands. Flows for existing development were left unchanged, and the incremental future flows were added to applicable adjacent or new MHs. Refer to Appendix E for detailed calculations.

5.1.6.3 Analyses Run

The model was used to calculate the flow in each sanitary sewer pipe, and percentage of full-flow capacity utilized, for peak flow conditions in the following scenarios:

- Existing development flows; and
- Future flows based on full development of future service areas.

5.1.6.4 Qualifications on Results

Results of the wastewater system modelling are based on the system information as described above. Limited work was completed in relation to verification of the model by way of confirming elevation data from GIS to actual field measurements. Peak flows were calculated based on methodology described in Appendix E and no work was completed to monitor actual flow in the sanitary sewers.

5.1.6.5 Connaught Park SPS Catchment Area

Table 5.2 summarizes the results of the SewerCAD® analysis for the existing system, as well as the future conditions. Full details are provided in Appendix E.

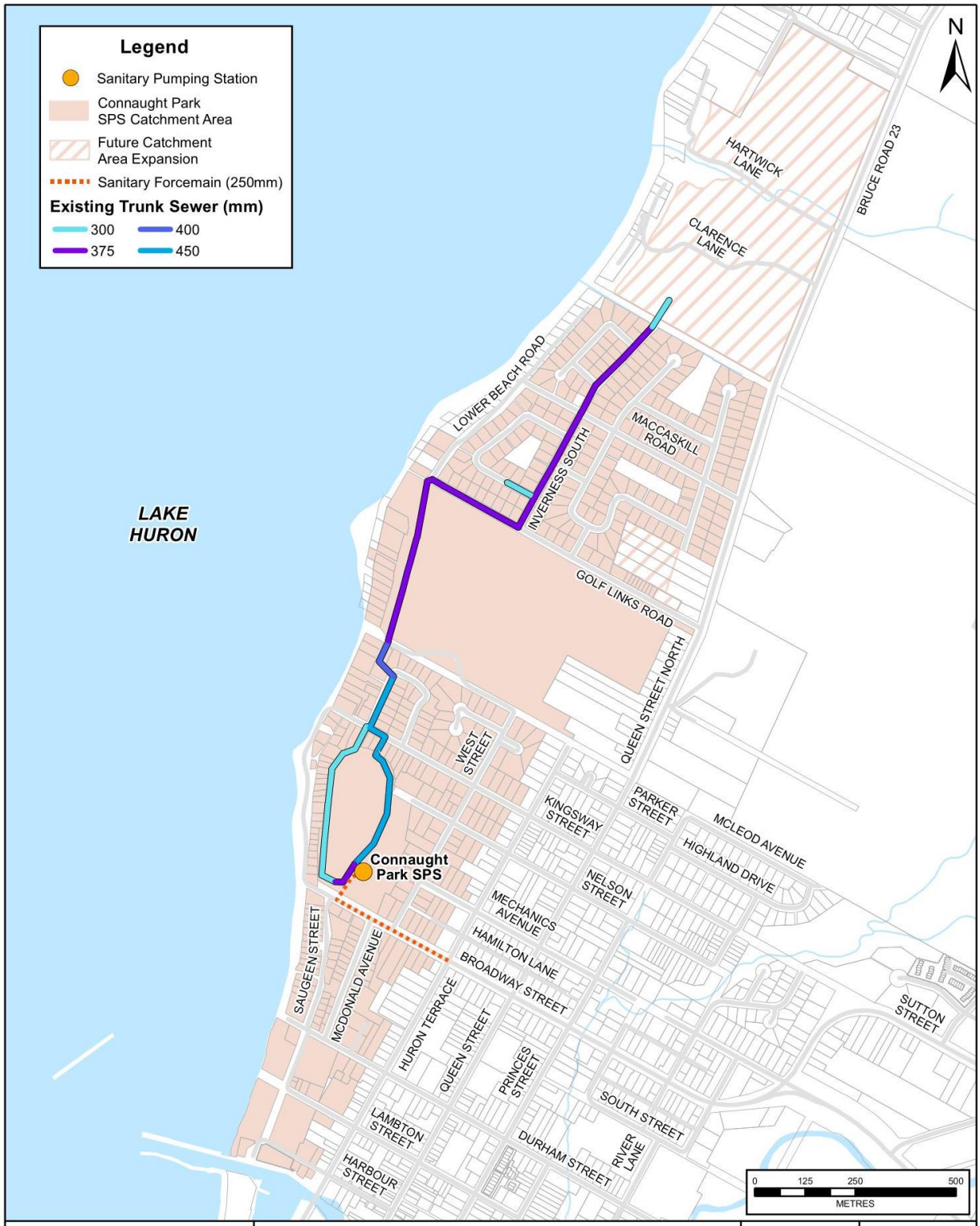
The future system model was analyzed on the basis of including existing flow plus flow from the West Ridge on the Lake development (383 ERUs, 15.7 ha), Bradstones (Shepherd) Subdivision (36 ERUs, 1.44 ha), Golf Links Townhouses (7 ERUs, 0.15 ha), and Battler Subdivision (30 ERUs, 1.65 ha), plus a proportionate amount of the total infill. Figure 5.4 illustrates the existing and future catchment areas for the Connaught Park SPS.

Table 5.2 – Connaught Park SPS Summary of Sewer Analysis

Analysis and Criteria	Existing System and Flows	Future System and Flows – All Areas Developed
Approximate No. of pipes with flow <80% design capacity	111	111
Approximate No. of pipes with flow >80% and <100% design capacity	1	0
Approximate No. of pipes with flow >100% design capacity	0	1

The existing SPS rated capacity is 89 L/s, while the projected 20-year peak flow is estimated to be 90 L/s. The wastewater collection system capacity is considered adequate for the existing and future conditions, and no upgrades were identified as being required at this time.

Figure 5.4 – Connaught Park SPS Existing and Future Catchment Area



5.1.6.6 Durham Street SPS Catchment Area

Table 5.3 summarizes the results of the SewerCAD® analysis for the existing system, as well as the future conditions. Full details are provided in Appendix E.

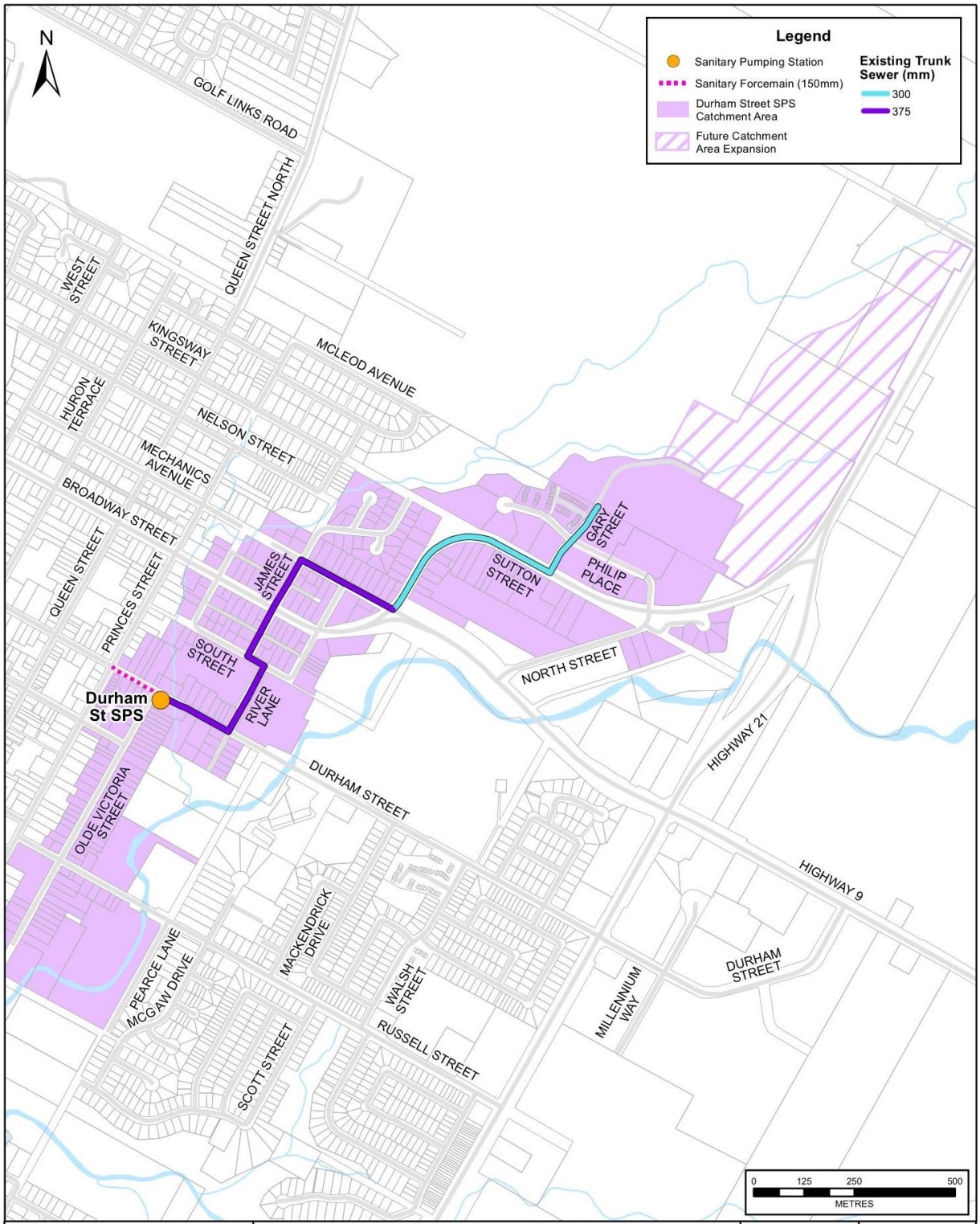
The future system model was analyzed on the basis of including existing flow plus approximately 33 ha of new light industrial development north of Gary Street. Figure 5.5 illustrates the existing and future catchment areas for the Durham Street SPS.

Table 5.3 – Durham Street SPS Summary of Sewer Analysis

Analysis and Criteria	Existing System and Flows	Future System and Flows – All Areas Developed
Approximate No. of pipes with flow <80% design capacity	77	77
Approximate No. of pipes with flow >80% and <100% design capacity	0	0
Approximate No. of pipes with flow >100% design capacity	0	0

The existing SPS rated capacity is 27 L/s, while the projected 20-year peak flow is estimated to be 83 L/s. Expansion of the SPS is currently being designed, with a plan of being constructed in 2023.

Figure 5.5 – Durham Street SPS Existing and Future Catchment Area



BMROSS engineering better communities	**MUNICIPALITY OF KINCARDINE** WATER AND WASTEWATER MASTER PLAN UPDATE **DURHAM STREET SPS EXISTING & FUTURE CATCHMENT AREA**	DATE OCT. 20, 2022	PROJECT No. 22128
		SCALE AS SHOWN	FIGURE No. 5.5

5.1.6.7 Huron Terrace SPS Catchment Area

Table 5.4 summarizes the results of the SewerCAD® analysis for the existing system, as well as future conditions. Full details are provided in Appendix E.

The Huron Terrace SPS catchment area includes a gravity collection sewer system, as well as receiving flows from the Connaught and Durham Street SPSs. The Huron Terrace SPS was recently upgraded and expanded (commissioned early 2023).

The future system model was analyzed using existing flows, omitting lands to the north of the Urban Boundary, but including the OPF lands (960 ERUs from residential development), 1182 Queen Street (12 ERUs), and 7 Mount Forest Avenue (25 ERUs).

The OPF lands also contain approximately 3 ha of proposed institutional area. Infill ERUs (62 ERUs) are also included in the future flows proportionally to the catchment area's existing ERUs. Figure 5.6 illustrates the existing and future catchment areas for the Huron Terrace SPS.

Table 5.4 – Huron Terrace SPS Summary of Sewer Analysis

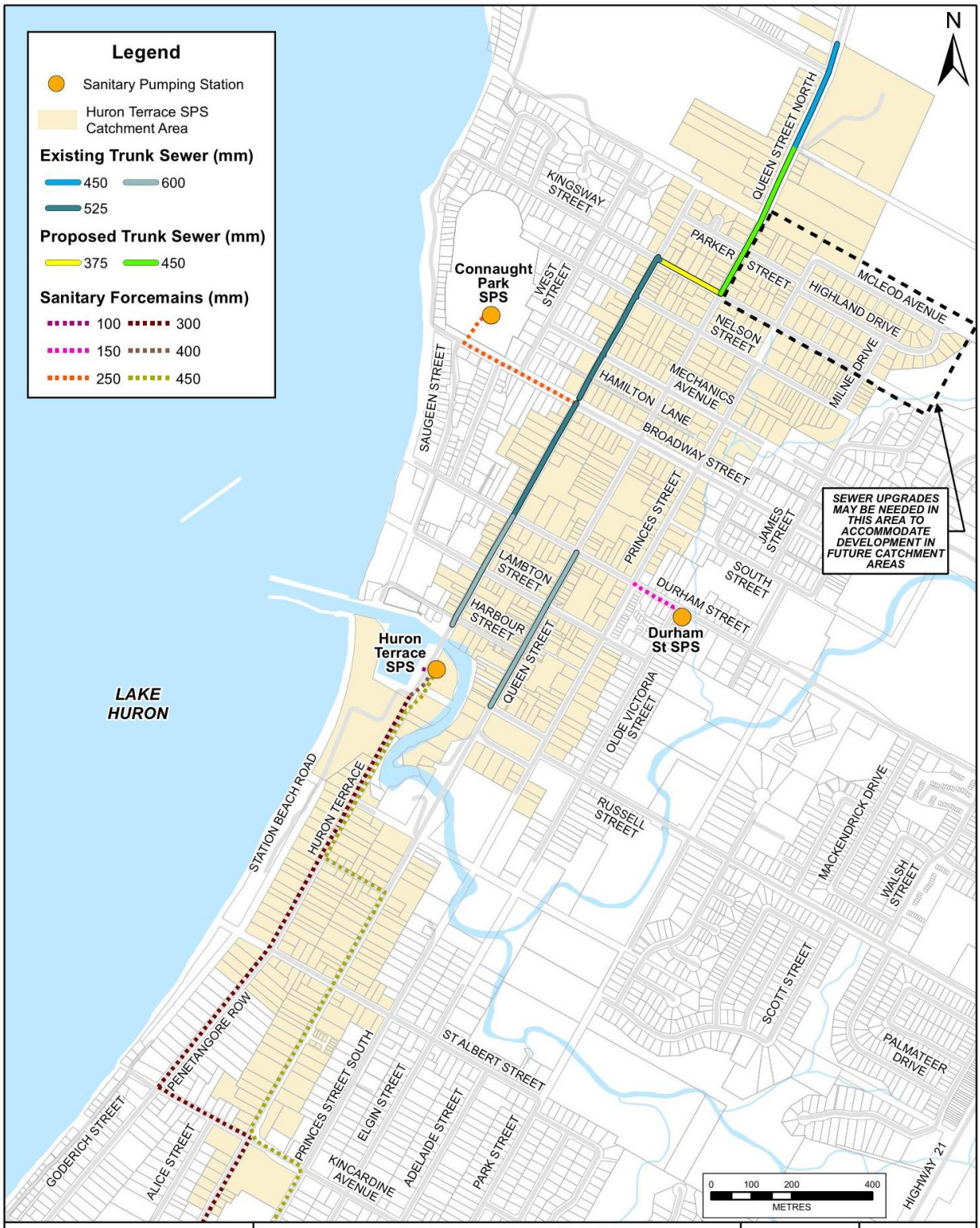
Analysis and Criteria	Existing System and Flows	Future System and Flows – All Areas Developed
Approximate No. of pipes with flow <80% design capacity	130	128
Approximate No. of pipes with flow >80% and <100% design capacity	2	2
Approximate No. of pipes with flow >100% design capacity	8	24

For the existing and future systems, 8 and 24 pipes respectively have been identified as having calculated flows greater than the full-flow capacity of the pipe. By implementing the remaining recommendations of the 2018 Water and Wastewater Master Plan that have not yet been carried out, most future design flow would be fully accommodated. This would include the sanitary sewer upgrades on Queen Street (Mount Forest Avenue to Kingsway Street) and Kingsway Street (Queen Street to Huron Terrace). With these changes, nominal capacity exceedances of some individual pipe sections at various locations in the catchment area would remain for the future model, but in our opinion, they are not significant.

Within the area of McLeod Avenue, Highland Drive, Prince Street North, and Kingsway Street east of Queen Street, the future modeling scenario indicates pipes would be above capacity based on OPF development assumptions. It is noted that the scale of the OPF development and the outlet location are still under review.

The SPS and its forcemain were recently upgraded and the SPS has a rated capacity of 300 L/s. At this time there is likely no urgency associated with sewer upgrades within the Huron Terrace SPS catchment area, and they should be carried out as part of road reconstruction projects or as development warrants.

Figure 5.6 – Huron Terrace SPS Existing and Future Catchment Area



BMROSS engineering better communities	**MUNICIPALITY OF KINCARDINE** WATER AND WASTEWATER MASTER PLAN UPDATE **HURON TERRACE SPS EXISTING & FUTURE CATCHMENT AREA (ALSO RECEIVES CONNAUGHT & DURHAM SPS FLOWS)**	DATE APR. 24, 2023	PROJECT No. 22128
		SCALE AS SHOWN	FIGURE No. 5.6

5.1.6.8 Park Street SPS Catchment Area

Table 5.5 summarizes the results of the SewerCAD® analysis for the existing system, as well as the future conditions. Full details are provided in Appendix E.

The future system model was analyzed using existing flow plus flow from the Campbell Avenue development (4 ERUs), the Highway 9 & 21 Business Park (554 ERUs from Residential, 15.29 ha of residential, 31.63 ha of institutional/commercial and 20.8 ha of industrial), 7 Millennium Way (173 ERUs, 0.81 ha of residential), and a proportionate amount of infill ERUs (95 ERUs). It is important to note that the details related to the future development type, density, and corresponding design flows for the 9 & 21 Business Park are currently under review. Modelling of the future catchment area was completed by assuming the recently constructed Millennium Way and Russell Street trunk sewers are flowing at 100% of their original design capacity which would correspond to full development of the Business Park per the development characteristics assumed as part of that trunk sewer design. Changes to the characteristics of the 9 & 21 Business Park lands could pose a threat to overcommitting those sewers, but that was not evaluated as part of the modelling. Figure 5.7 illustrates the existing and future catchment areas for the Park Street SPS.

Table 5.5 – Park Street SPS Summary of Sewer Analysis

Analysis and Criteria	Existing System and Flows	Future System and Flows – All Areas Developed
Approximate No. of pipes with flow <80% design capacity	148	138
Approximate No. of pipes with flow >80% and <100% design capacity	1	8
Approximate No. of pipes with flow >100% design capacity	1	4

The existing rated capacity is 99 L/s, while the projected 20-year peak flow is estimated to be 200 L/s. Trunk sewer from the Park Street SPS, along Scott Street up to approximately the Red Trail (i.e., south of Kennard Street) is known to be at capacity and experiences limited surcharging at times. This section of sewer is relatively deep and, generally, a limited amount of surcharging is not expected to cause issues such as customer backups. It is also noted that sewer depth and soil conditions in this area are not favourable for construction and sewer replacement in this area will be challenging. It is anticipated that for some time, the existing sewer will be sufficient to service the catchment area. Significant development within the catchment area (e.g., the 9&21 Business Park) may cause a need to address this trunk sewer capacity; ultimately timing and sizing will depend on development status.

5.1.6.9 Goderich Street SPS Catchment Area

Table 5.6 summarizes the results of the SewerCAD® analysis for the existing system, as well as the future conditions. Full details are provided in Appendix E.

No new developments are currently planned for the Goderich SPS catchment area; therefore, the future flow is only expected to increase due to infill (56 ERUs). Figure 5.8 illustrates the existing and future catchment areas for the Goderich Street SPS.

Figure 5.7 – Park Street SPS Existing and Future Catchment Area

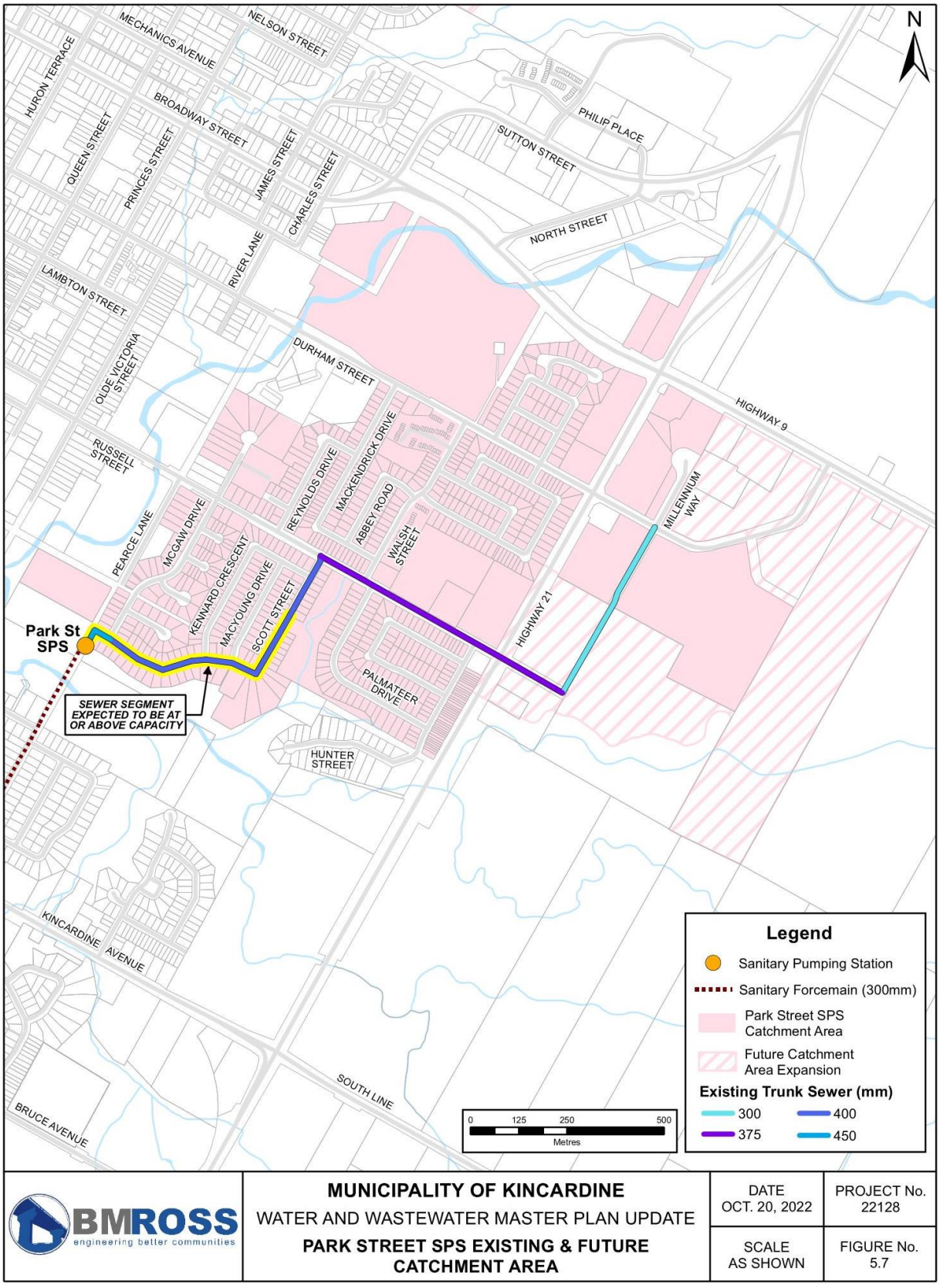


Figure 5.8 – Goderich Street SPS Existing and Future Catchment Area

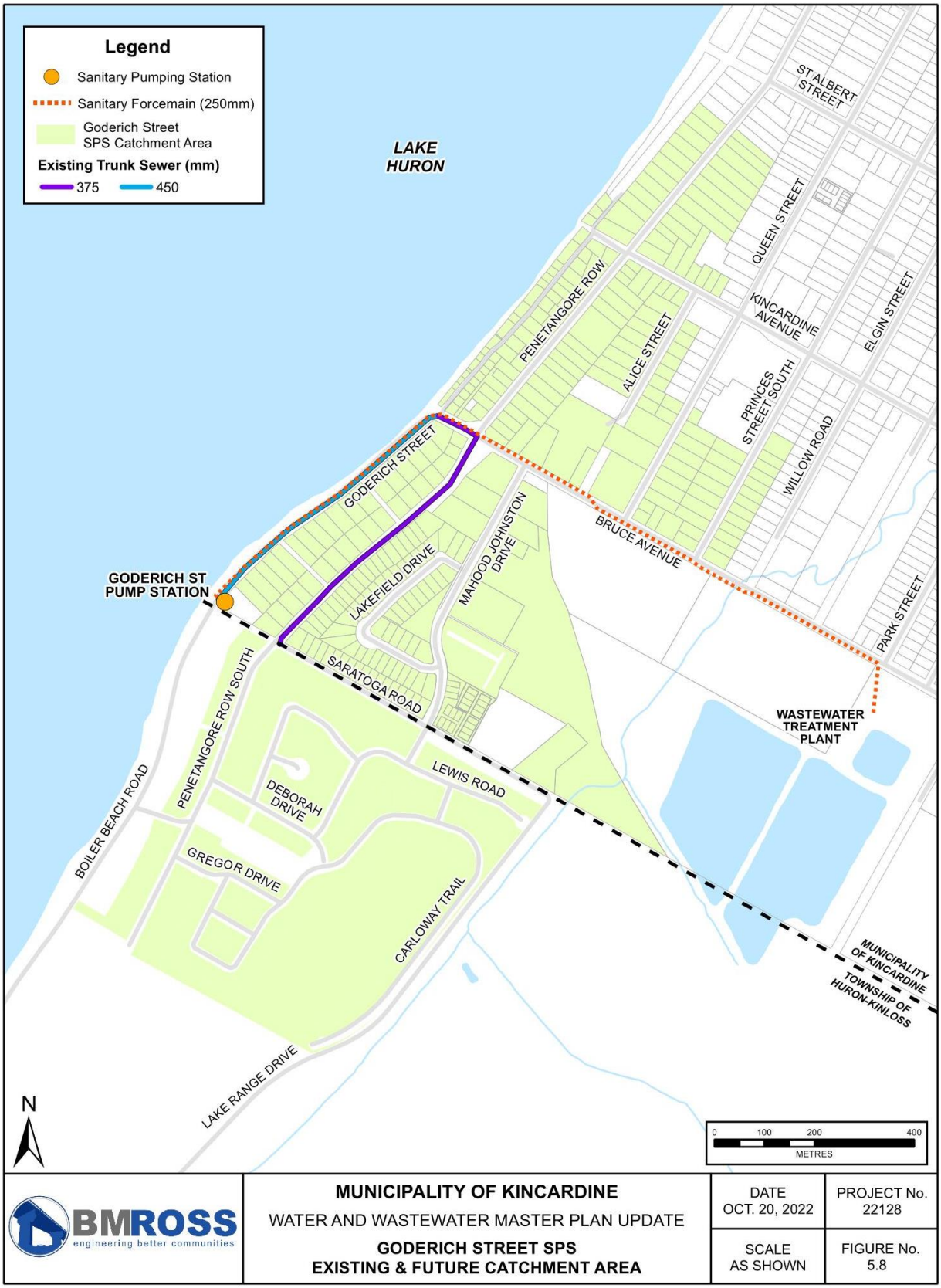


Table 5.6 – Goderich Street SPS Summary of Sewer Analysis

Analysis and Criteria	Existing System and Flows	Future System and Flows – All Areas Developed
Approximate No. of pipes with flow <80% design capacity	119	114
Approximate No. of pipes with flow >80% and <100% design capacity	0	5
Approximate No. of pipes with flow >100% design capacity	0	0

The existing SPS rated capacity is 46 L/s, with an estimated current peak flow of 29 L/s and projected 20-year peak flow of 63 L/s. The wastewater collection system capacity is considered adequate for the existing and future conditions, and no upgrades were identified as being required at this time, but flows to the station should be monitored.

5.1.6.10 Kincardine Avenue SPS Catchment Area

Table 5.7 summarizes the results of the SewerCAD® analysis for the existing system, as well as the future conditions. Full details are provided in Appendix E.

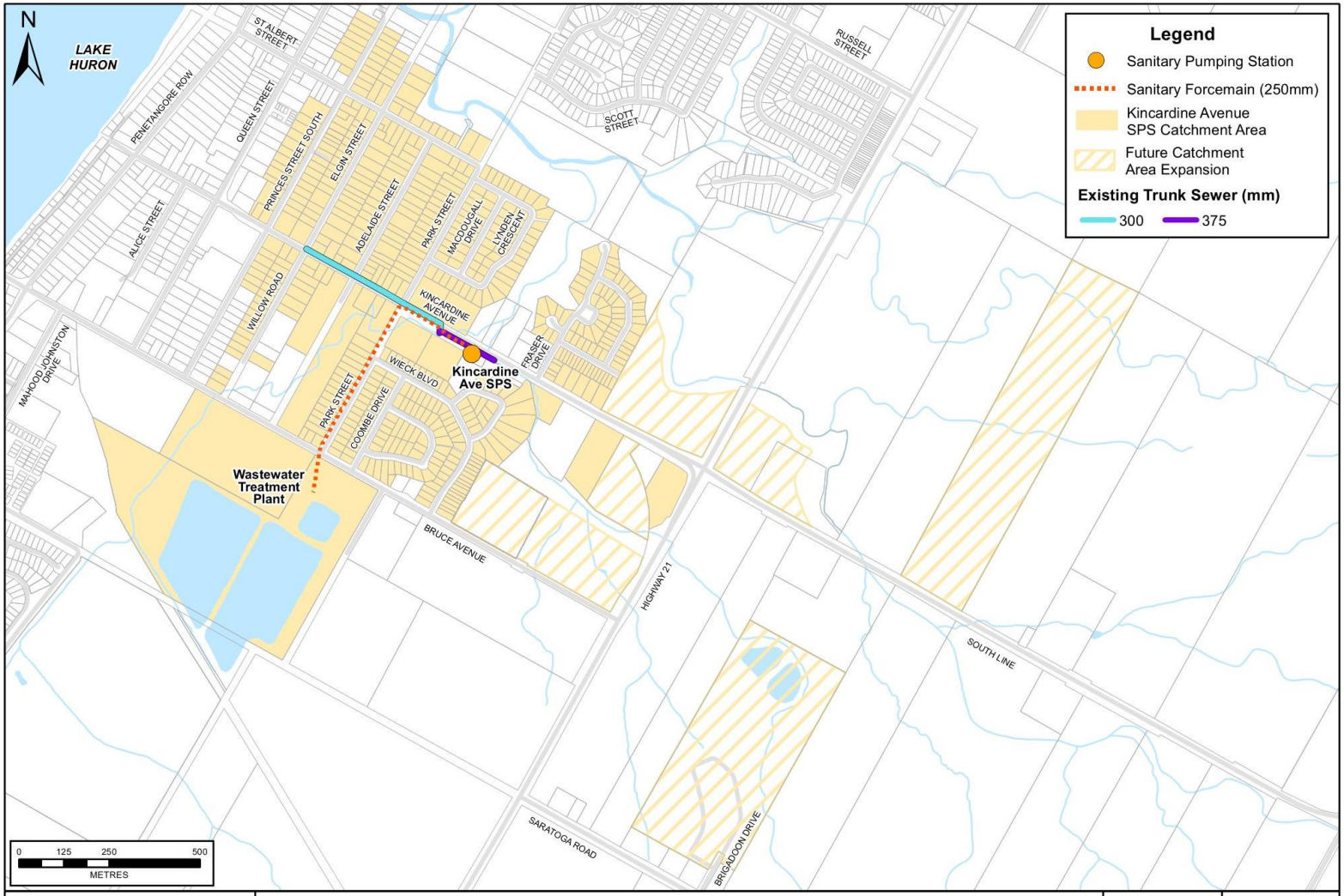
The future system model was analyzed using existing flow plus flow from Brown Subdivision (245 ERUs), Brigadoon Subdivision (150 ERUs), CR Developers project (82 ERUs from hotels and 0.6 ha of commercial land), 869 Kincardine Avenue trailer park development (88 ERUs), and a proportionate amount of infill ERUs (51 ERUs). Figure 5.9 illustrates the existing and future catchment areas for the Kincardine Avenue SPS.

Table 5.7 – Kincardine Avenue SPS Summary of Sewer Analysis

Analysis and Criteria	Existing System and Flows	Future System and Flows – All Areas Developed
Approximate No. of pipes with flow <80% design capacity	106	105
Approximate No. of pipes with flow >80% and <100% design capacity	0	0
Approximate No. of pipes with flow >100% design capacity	1	2

For the future system, 2 pipes between McCullough Crescent and Kincardine Avenue, were identified as having calculated flow greater than full-flow capacity, but the extent of the exceedances is not considered significant to the point of requiring upgrades in those locations. The existing SPS rated capacity is 49 L/s, with an estimated current peak flow of 40 L/s and projected 20-year peak flow of 61 L/s. The wastewater collection system capacity is considered adequate for the existing and future conditions, and no upgrades were identified as being required at this time but flows to the station should be monitored.

Figure 5.9 – Kincardine Avenue SPS Existing and Future Catchment Area



BMROSS engineering better communities	**MUNICIPALITY OF KINCARDINE** WATER AND WASTEWATER MASTER PLAN UPDATE **KINCARDINE AVENUE SPS** **EXISTING & FUTURE CATCHMENT AREA**	DATE MAY 24, 2023	PROJECT No. 22128
		SCALE AS SHOWN	FIGURE No. 5.9

5.1.1 Climate Change Considerations

Climate change is predicted to result in more intense storms and potentially, periods of prolonged drought. The Kincardine wastewater system will potentially be impacted by precipitation events that increase the amount of extraneous flow in the sanitary collection system. This could impact on both the ability to convey the wastewater and treat it at the WWTP. Extraneous flow is accounted for in wastewater infrastructure design.

The number of power outages related to extreme weather events could increase in the future. It will be important to ensure that emergency power facilities (i.e., generators) are properly sized and maintained.

5.1.2 Problems and Opportunities

5.1.2.1 Wastewater Treatment

The following wastewater treatment issues have been identified:

- The current un-committed reserve capacity for the WWTP is adequate for 924 ERUs which is adequate for development commitments. The pending developments or proposals, which number 2,127 ERUs, would require an additional 1,218 m^3/day in treatment capacity.

- Under the high growth scenario, the existing rated capacity of the Kincardine WWTP will be fully committed by approximately 2037.

5.1.2.2 Wastewater Pumping

The six major SPSs within the Kincardine wastewater system are operating at various proportions of their rated capacities. The Durham Street SPS has estimated peak flows that are greater than the rated capacity, and the Park Street SPS has estimated peak flows that have historically exceeded station rated capacity and in recent years are estimated to be at the station capacity. This situation is anticipated to worsen as development within each station catchment area continues. Recommended next steps related to each SPS are summarized as follows:

- Connaught Park SPS:
    - No capacity increase recommended at this time.
- Durham Street SPS:
    - Capacity increase for existing and future conditions is recommended; currently under design for 2023 tender. The established budget for the upgrades is $1,250,000.
- Huron Terrace SPS:
    - A capacity increase for existing and future conditions has been recently completed (commissioned in early 2023).

- Park Street SPS:
    - Capacity increase for existing and future conditions is recommended; tentatively planned for design of station pump replacement in 2023, with tendering to follow in 2024.
- Goderich Street SPS:
    - Continue to monitor flows. No capacity increase recommended at this time.
- Kincardine Avenue SPS:
    - Continue to monitor flows. No capacity increase recommended at this time.

5.1.2.3 Wastewater Collection

The wastewater collection system consists of multiple catchment areas, each with its own SPS. Each catchment area was analyzed using future peak wastewater flows in each sewer pipe versus sewer pipe full-flow capacity. In general, as opportunities arise (e.g., road reconstruction), aged sewer pipe should continue to be replaced in areas where condition is known to be poor based on operator experience or where capacity increases are recommended to service future development. Where capacity increases are recommended for future development, the timing of the upgrades should be in response to development status. For the Queen and Kingsway Street sewers identified as requiring capacity increases for future development, the probable cost for sewer replacement as shown is $1,900,000 for sewer only, or $3,700,000 if full road reconstruction is considered for the project. Costs are based on a 2023 assumed value of $5,500 per m of road reconstruction, of which 20% applies to watermain, 50% to sanitary sewer, and 30% applies to storm/drainage. Costs include 15% for engineering and exclude HST.

5.2 BEC & Service Area Wastewater Systems

5.2.1 Pumping and Treatment

The BEC WWTP services the BEC industrial lands, IPP, a portion of the Inverhuron community, and Tiverton. BEC industrial lands direct wastewater flows via a trunk gravity sewer directly to the BEC WWTP. IPP and the Inverhuron community are serviced by a small collection system and SPS that pumps to the BEC WWTP. The Tiverton wastewater system consists of a gravity sewer collection network and two SPSs. The Tiverton Maple Street SPS pumps to the BEC WWTP.

The following ECA documents apply to the major infrastructure considered in this analysis:

- BEC WWTP – ECA No. 2362-BXVTJS; and
- All SPSs and collection system – Consolidated Linear Infrastructure (CLI) ECA 088-W601, Issue No. 1.

The WWTP, located at 1842 Concession Road 2 (northwest corner of Concession Road 2 and Albert Road), generally consists of four aerated lagoon cells, with phosphorus removal equipment and UV disinfection. Effluent is discharged to Lake Huron via the Bruce Power "B" water cooling channel. In total, there are approximately 8.5 km of sanitary gravity sewers and 0.4 km of sanitary forcemains within Tiverton, in addition to the 6.3 km forcemain connection to the BEC WWTP. As of June 2022, there were 460 customers connected to the BEC WWTP.

5.2.2 Collection System

The BEC WWTP services the BEC Industrial Park, Inverhuron, Tiverton and IPP. The WWTP location is shown in Figure 5.10. The Tiverton Wastewater Collection system services the community of Tiverton. The extent of the wastewater collection system is shown in Figure 5.11.

Figure 5.10 – BEC Wastewater Treatment and Trunk Infrastructure

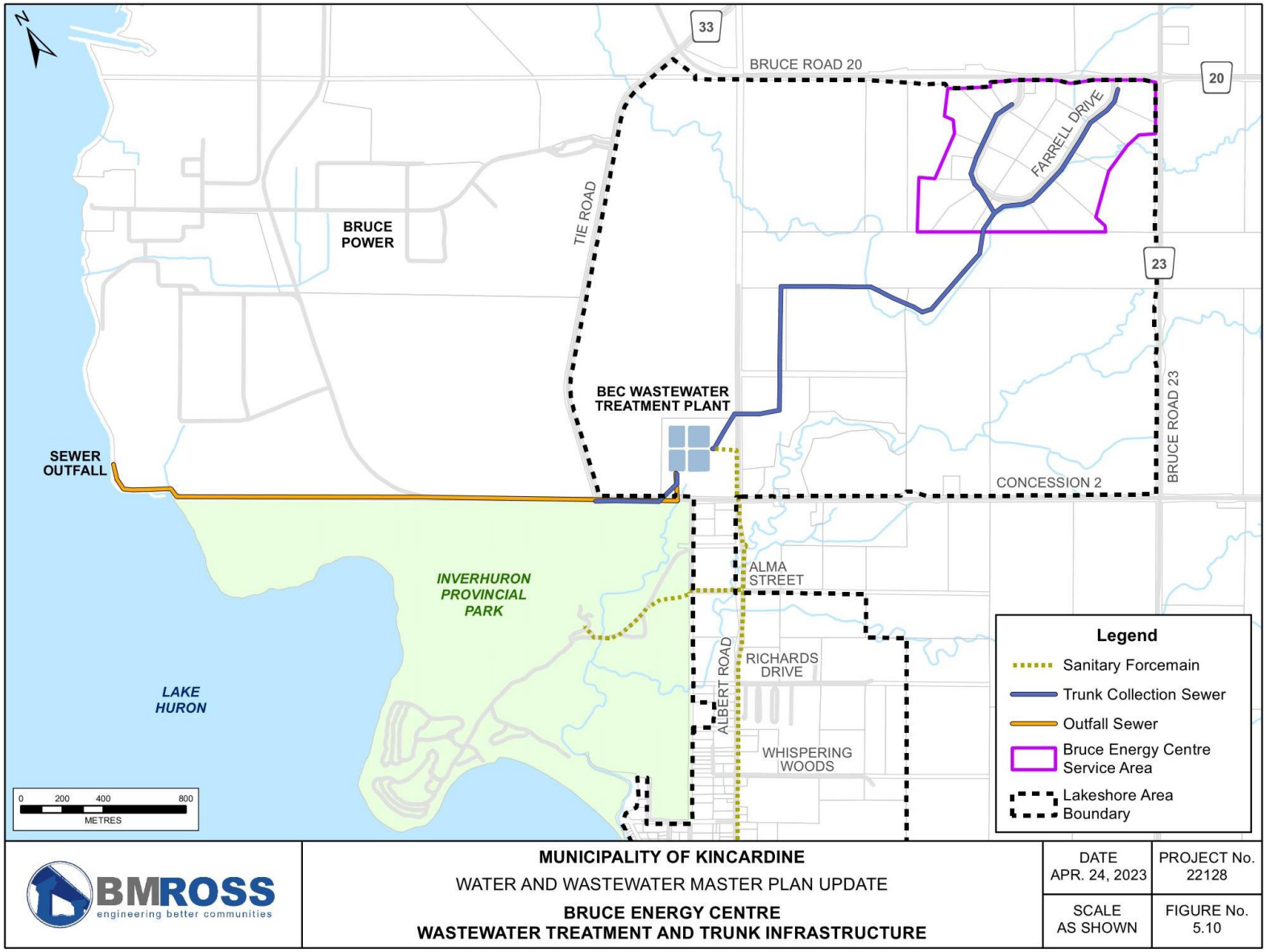
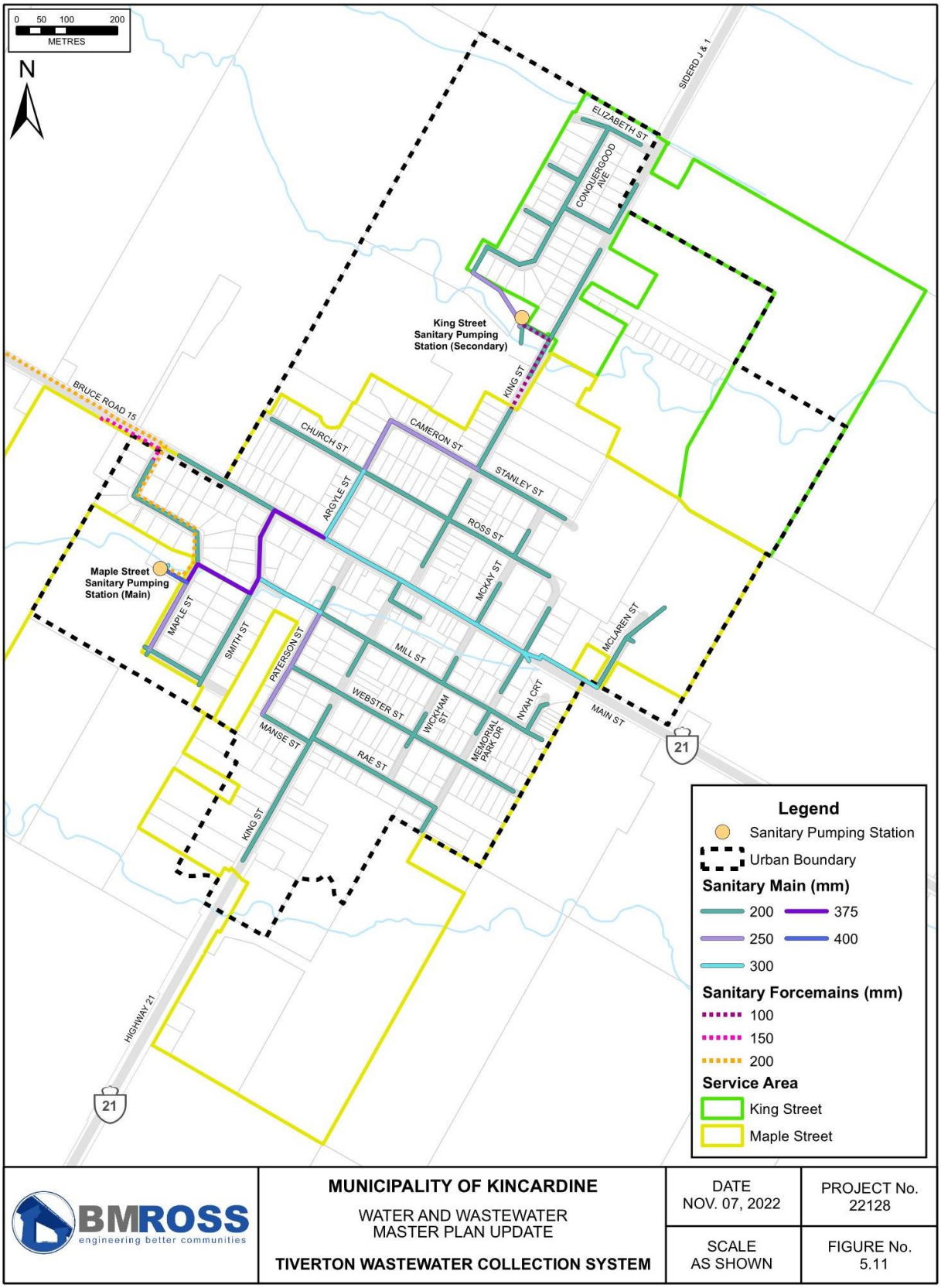


Figure 5.11 – Tiverton Wastewater Collection System



5.2.3 Existing and Future Wastewater Flows

5.2.3.1 Existing Wastewater Flows

Table 5.8 shows a summary of recent historical wastewater flow information.

Table 5.8 – BEC – Historical Wastewater Flows

Year	AADF[1] (m^3/day)
2019	781
2020	691
2021	715

Notes:
1. AADF = Annual Average Daily Flow

The existing demand, for reserve capacity calculations purposes, is generally considered to be the average value for the previous three years.

Current Average Flow = **729 m^3/d**

5.2.3.2 Per Customer Flows

$$\text{Per Customer Flow} = \frac{729\ m^3/d}{460}$$

$$= 1.58\ m^3/d$$

The existing average day flow is estimated to be 729 m^3/day, which corresponds to 1.58 m^3/day per current customer. This is approximately 56% greater than the per customer flow received by the Kincardine WWTP, demonstrating the impact of the BEC.

5.2.3.3 By-passing and Overflow

On some occasions in recent years, the Maple Street SPS has experienced high peak flows and bypassed. The frequency and magnitude of bypassing has subsided following reconstruction of sewer on a portion of Maple Street.

5.2.4 Reserve Treatment Capacity

5.2.4.1 Total Reserve

Typically, the reserve capacity of a WWTP is assessed by deducting the average flow from the previous three years from the ECA rated capacity. Wastewater flow can vary from year to year depending on environmental conditions, but as per the information above, flows to the BEC WWTP are reasonably consistent.

It is noted that the current average flow is comparable to, but lower than, the value reported in the 2018 Master Plan, which was 805 m^3/d corresponding to 2014 to 2016.

The BEC Wastewater System has a rated capacity of 2,200 m^3/d on an annual average basis. The Total Reserve Capacity at the end of 2021 is as follows:

Total Reserve = 2,200 – 729
= **1,471 m^3/d**

5.2.4.2 Uncommitted Reserve

WW System Capacity	=	2,200 m^3/d
Current Usage	=	729
Total Reserve	=	1,471 m^3/d
Commitments (456 units x 1.58 m^3/d)	=	1,723 m^3/d
Uncommitted reserve	=	**1,015 m^3/d**

At 1.58 m^3/d per ERU, the uncommitted reserve would be adequate for approximately 640 additional ERUs.

It is noted that the BEC Development Lands have 67.77 ha of undeveloped land. According to the MECP Design Guidelines for Sewage Works (2008), the calculation of design average and peak sewage flow rates for industrial areas is industry/process specific and may be difficult to predict accurately. These demands will vary greatly with the type of industry. Assuming wastewater flows will be roughly equal to water flows, the common allowance from the MECP Design Guidelines for Drinking Water Systems (2008) for a light industrial area of 35 m^3/(ha·d) can be used to estimate a 2,372 m^3/day wastewater flow for the BEC Development Lands.

Using the 500 m^3/day maximum day water demand allocation provided by Municipal staff for the Concession 2 Industrial Lands, we have assumed this will be the average day wastewater flow allowance for the lands.

Based on the allowances noted, the BEC and Concession 2 Industrial Lands combined will produce an estimated average wastewater flow of 2,872 m^3/day. If such allowances became commitments, it would leave an estimated deficit in uncommitted treatment capacity of 1,857 m^3/day. We emphasize that, based on experience in areas like the BEC, the flow allowance of 35 m^3/(ha·d) is likely quite high. This is demonstrated by the fact that the calculated flow of 2,372 m^3/day on this basis, for vacant lands in the BEC, is a greater flow than the original total design capacity of the BEC WWTP. Ultimately, any additional development will need to consider industry-specific wastewater servicing needs and the corresponding impact to the BEC WWTP reserve.

5.2.4.3 Treatment Capacity by Year

With reference to the growth projections presented in Section 3.6, Figures 5.12 and 5.13 show the expected annual average sewage flows from 2021 to 2043.

Figure 5.12 – BEC Annual Average Day Sewage Flow - Low Growth Scenario

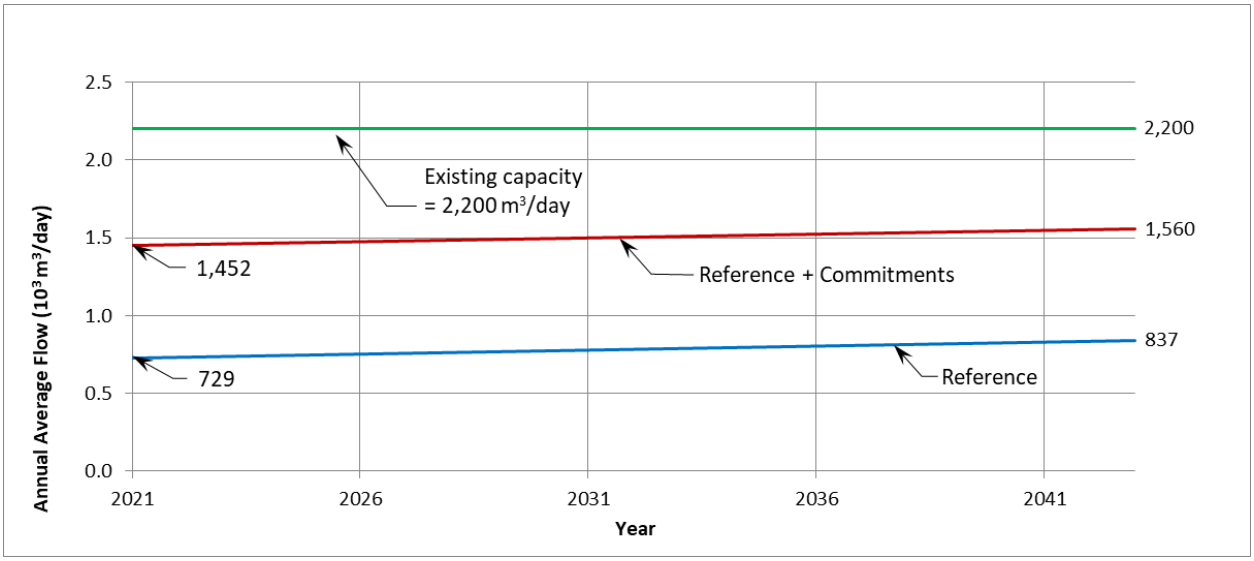
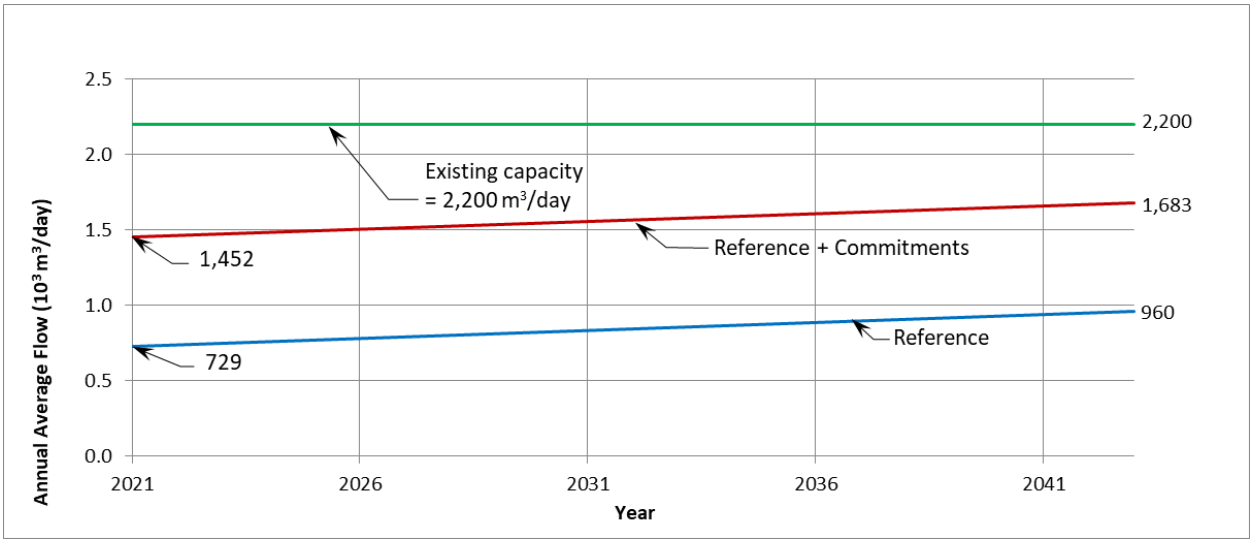


Figure 5.13 – BEC Annual Average Day Sewage Flow - High Growth Scenario



General comments and observations regarding Figures 5.12 and 5.13 are as follows:

- The difference in flow between the high and low growth scenarios at the end of the 20-year projection period is 124 m^3/day.
- Under both growth scenarios, the existing rated capacity of the BEC WWTP will be sufficient for existing plus development commitments for the next 20 years.
- Addition of the wastewater flow from the Concession 2 Industrial Lands and the BEC Development Lands if fully developed, with industry for which the 35 m^3/(ha·d) value applies, would exceed the existing rated capacity of the BEC Wastewater System. Based on our experience, it is unlikely that all industrial land would be developed with industry for which this flow allowance applies. Ultimately the actual sewage flows generated will be industry specific.

5.2.5 BEC WWTP Treatment Performance

5.2.5.1 Effluent Criteria

The existing ECA for the BEC WWTP provides both treatment objectives and limits within Schedule B, including concentration and loading criteria, as follows:

Final Effluent Parameter	Averaging Calculator	Concentration Objective
CBOD5	Monthly Average Effluent Concentration	25 mg/L
Total Suspended Solids	Monthly Average Effluent Concentration	25 mg/L
Total Phosphorus	Monthly Average Effluent Concentration	0.8 mg/L
Total Ammonia Nitrogen	Monthly Average Effluent Concentration	5 mg/L (Non-Freezing Period: T > 5°C - April 15 - December 15) 12 mg/L (Freezing Period: T < 5 °C)
E. coli	Geometric Mean Density	150 CFU/100 ml for any calendar month[1]
pH	Single Sample Result	6.5 – 8.5 inclusive

Notes:
1. If the MPN method is utilized for *E. coli* analysis the objective shall be 150 MPN/100 mL

Final Effluent Parameter	Averaging Calculator	Loading Objective
$CBOD_5$	Monthly Average Effluent Concentration	55 kg/d
Total Suspended Solids	Monthly Average Effluent Concentration	55 kg/d
Total Phosphorus	Monthly Average Effluent Concentration	1.8 kg/d
Total Ammonia Nitrogen	Monthly Average Effluent Concentration	11 kg/d (Non-Freezing Period: T > 5°C - April 15 - December 15) 26.4 kg/d (Freezing Period: T < 5 °C)

Final Effluent Parameter	Averaging Calculator	Concentration Limit
$CBOD_5$	Monthly Average Effluent Concentration	30 mg/L
Total Suspended Solids	Monthly Average Effluent Concentration	30 mg/L
Total Phosphorus	Monthly Average Effluent Concentration	1.0 mg/L
Total Ammonia Nitrogen	Monthly Average Effluent Concentration	7.5 mg/L (Non-Freezing Period: T > 5°C - April 15 - December 15) 15 mg/L (Freezing Period: T < 5 °C)
E. coli	Monthly Geometric Mean Density	200 CFU per 100 mL[1]

Notes:
1. If the MPN method is utilized for *E. coli* analysis the objective shall be 200 MPN/100 mL

Final Effluent Parameter	Averaging Calculator	Limit
$CBOD_5$	Single Sample Result	45 mg/L
Total Suspended Solids	Single Sample Result	45 mg/L
Total Phosphorus	Single Sample Result	1.5 mg/L
Total Ammonia Nitrogen	Single Sample Result	10 mg/L (Non-Freezing Period: T > 5°C - April 15 - December 15) 20 mg/L (Freezing Period: T < 5 °C)
pH	Single Sample Result	6.0 – 9.5 inclusive

5.2.5.2 Performance Review

A review of Annual Reports for 2019 through 2021 was undertaken. The review established that the WWTP consistently meets the performance criteria.

Overall, there were no major operational problems encountered between 2019 and 2021. Discharge of effluent was stopped for periods of 12 days in May 2019, 4 days in September 2020, and 24 days in June/July 2021 to raise the cell levels and extend the retention time. The lagoon system was effective at treating the wastewater and the effluent CBOD, Total Suspended Solids and Phosphorous did not exceed the non-compliance limits during this period.

5.2.6 Wastewater Collection System Modelling

5.2.6.1 Background

The BEC wastewater collection system was modelled using SewerCAD®. The purpose of the modelling was to identify potential pipe capacity constraints during periods of peak flow and to determine requirements for servicing future development areas.

5.2.6.2 Model Details

(a) Software

A SewerCAD® model, including both SPS catchment areas, was utilized to identify potential sanitary sewage pipe capacity issues. The SPSs were also evaluated based on a comparison of current rated capacities to estimated current and future peak flows. All collection system analyses were carried out based on full development of the SPS catchment areas. Refer to Appendix F for model details for each SPS.

(b) Methodology

Refer to Section 5.1.6.2 for additional details regarding methodology for model creation for the Kincardine system. The same methodology was generally used for Tiverton.

5.2.6.3 Analyses Run

The model was used to calculate the flow in each sanitary sewer pipe, and percentage of full-flow capacity utilized, for peak flow conditions in the following scenarios:

- Existing development flows; and
- Future flows based on full development of future service areas.

5.2.6.4 Qualifications on Results

Results of the wastewater system modelling are based on the system information as described above. Limited work was completed in relation to verification of the model by way of confirming elevation data from GIS to actual field measurements. Peak flows were calculated based on methodology described in Appendix F and no work was completed to monitor actual flow in the sanitary sewers.

5.2.6.5 Maple Street and King Street SPS Catchment Area

Table 5.9 summarizes the results of the SewerCAD® analysis for the existing system, as well as the future conditions. Full details are provided in Appendix F.

For future conditions, demands for existing development are left unchanged, and the incremental future demand for development areas is applied to the nearest model junctions within or adjacent to the development lands. Figure 5.14 illustrates the existing and future catchment areas for the Tiverton wastewater system.

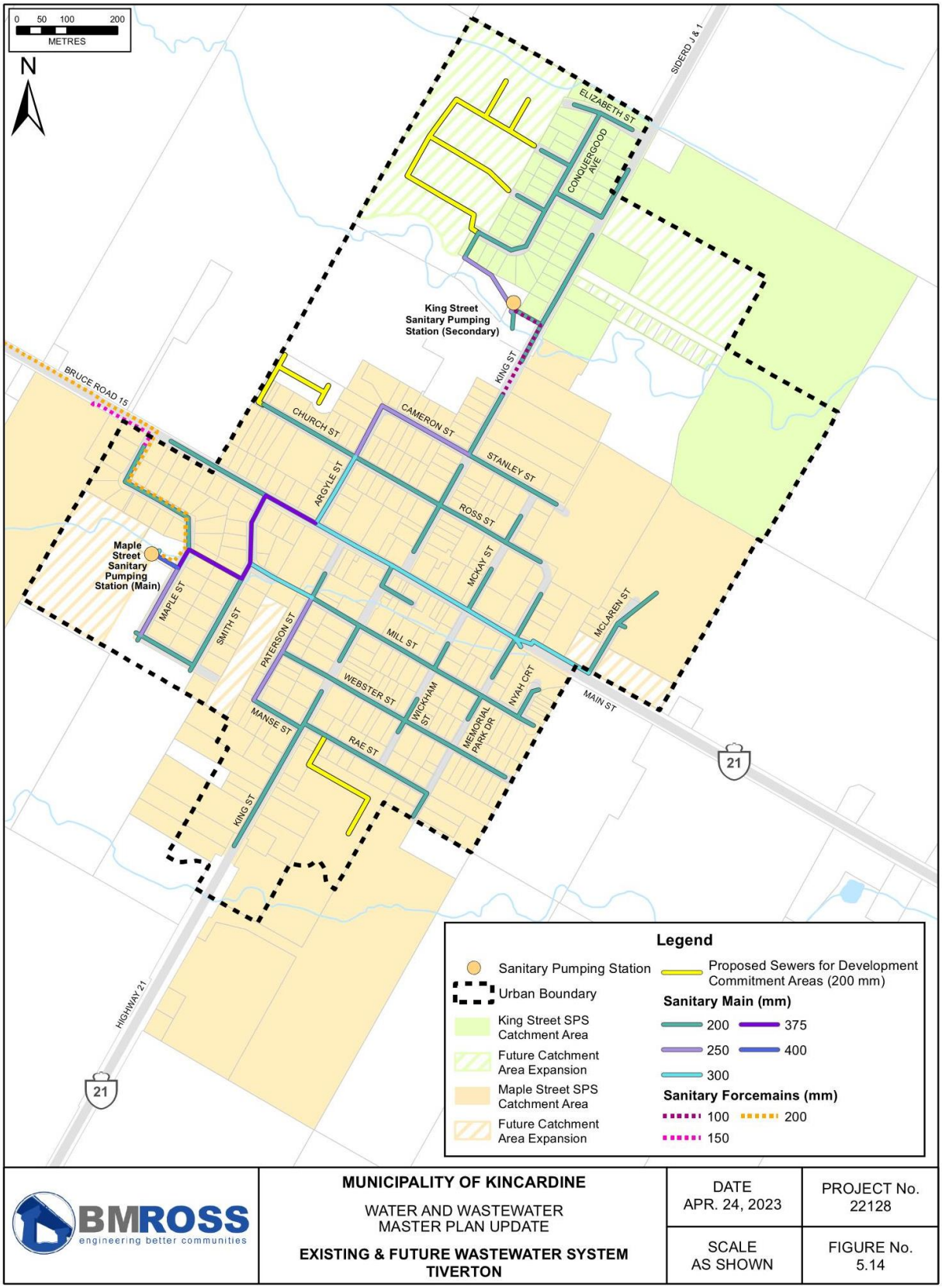
Table 5.9 – Maple and King Street SPSs Summary of Sewer Analysis

Analysis and Criteria	Existing System and Flows	Future System and Flows – All Areas Developed
Approximate No. of pipes with flow <80% design capacity	101	101
Approximate No. of pipes with flow >80% and <100% design capacity	0	0
Approximate No. of pipes with flow >100% design capacity	0	0

The rated capacity of the Maple Street SPS is 30 L/s, while future peak flow is estimated to be 67 L/s. Peak flows have been observed to have declined in recent years, which may be a result of seasonal variation or may be a result of recent sewer reconstruction work in the area. The wastewater collection system capacity is considered adequate for the existing and future conditions, and no upgrades were identified as being required at this time, but peak flows should continue to be monitored.

The rated capacity of the King Street SPS is considered adequate for current and projected future flows.

Figure 5.14 – Tiverton Wastewater System Existing and Future Catchment Area



BMROSS engineering better communities	**MUNICIPALITY OF KINCARDINE** WATER AND WASTEWATER MASTER PLAN UPDATE **EXISTING & FUTURE WASTEWATER SYSTEM TIVERTON**	DATE APR. 24, 2023	PROJECT No. 22128
		SCALE AS SHOWN	FIGURE No. 5.14

5.2.7 Climate Change Considerations

Climate change is predicted to result in more intense storms and potentially, periods of prolonged drought. The Tiverton wastewater system will potentially be impacted by precipitation events that increase the amount of extraneous flow in the sanitary collection system. This could impact on both the ability to convey the wastewater and treat it at the WWTP.

The number of power outages related to extreme weather events could increase in the future. It will be important to ensure that emergency power facilities (i.e., generators) are properly sized and maintained.

5.2.8 Problems and Opportunities

5.2.8.1 Wastewater Treatment

The following wastewater treatment issues have been identified:

- Total reserve capacity was calculated to be 1,471 m^3/day, with current commitments of 1,723 m^3/day. Under both growth scenarios, the existing rated capacity of the BEC WWTP will be sufficient for existing customers plus development commitments for the next 20 years.

- The uncommitted reserve is estimated to be 1,015 m^3/day, which is sufficient for 640 ERUs. If the BEC Development and Concession 2 Industrial Lands were fully developed with light industry, it would create an estimated deficit in treatment capacity of 1,857 m^3/day.

- Additional development within the BEC will need to consider industry-specific wastewater servicing needs and associated impacts to reserve capacity. MECP Guideline values for industrial lands would project flows for all vacant BEC lands to exceed the plant capacity, however it is probable that Guideline values are unrealistically high.

5.2.8.2 Wastewater Pumping

The two Tiverton SPSs operate at various proportions of their rated capacities. The Maple Street station has experienced flows, from time to time, that exceed the existing station rated capacity, but it is noted that this trend has decreased in recent years following sewer replacement work on Maple Street. Recommended next steps related to the SPSs are summarized as follows:

- King Street SPS:
    - No capacity issues to address currently.
- Maple Street SPS:
    - Continue to monitor flows. No capacity increase recommended at this time.

5.2.8.3 Wastewater Collection

The Tiverton wastewater collection system consists of two catchment areas, each with its own SPS. The system was analyzed based on future peak wastewater flows in each sewer pipe versus sewer pipe full-flow capacity. It is concluded that the existing collection system is adequate for future design conditions and no upgrades are recommended currently.

In general, as opportunities arise (e.g., road reconstruction), aged sewer pipes should continue to be replaced in areas where condition is known to be poor based on operator experience.

6.0 Consultation

6.1 General

Public consultation represents an integral part of the master planning process. During this study, a consultation program was implemented to obtain input on key study issues from the general public, government review agencies, and key stakeholders. Information gathered through this process was incorporated into the analysis of future servicing needs and the evaluation of alternatives. The following subsections summarize the consultation program.

6.2 Initial Public Consultation

The Municipality issued a Notice of Study Commencement/Public Open House on November 2, 2022. The Notice identified that the Municipality was undertaking an update to the previous Water and Wastewater Servicing Master Plan and the date, location and time of a public open house. The Notice was placed in the November 9 and 16 editions of the Kincardine Independent and Kincardine News. It was also placed on the Municipality's website.

A copy of the Notice is included in Appendix G.

No responses from the public were received as a result of the Notice.

6.3 Review Agency Consultation

Input into the Master Plan process was solicited from government review agencies and project stakeholders by way of direct mail correspondence. Agencies that might have an interest in the project were sent an information letter outlining the nature of the Master Plan. The information was circulated to 8 review agencies on November 2, 2022. Appendix G contains a copy of the letter circulated, a list of the agencies it was sent to and the responses received. Table 6.1 summarizes the comments received in response.

Table 6.1 Summary of Agency Comments Received

Agency	Comments	Response
Michael Oberle, Saugeen Valley Conservation Authority (SVCA), November 23, 2022	• SVCA will identify areas in the Master Plan where SVCA input will be required such as where the works may require SVCA permit(s). • Requested notifying the SVCA as subsequent steps arrive.	• Noted.
Joseph Harvey, Ministry of Citizenship and Multiculturalism (MCM), November 14, 2022	• MCM understands the master plan would typically be done at a broad level of assessment. Therefore, a description of the existing conditions related to cultural heritage resources needs to be included in the master plan document. • The existing conditions subsection should indicate if the Master Plan includes areas of archaeological potential or not and acknowledge that archaeological assessments will be required for future project-specific projects. • A statement should be included that archaeological assessments are to be undertaken by a licensed archaeologist. • Recommends that an Existing Conditions Report be undertaken by a qualified person. • Please advise MCM if any technical cultural heritage studies will be completed for this master plan and provide them before issuing a Notice of Completion.	• Noted. • An Existing Conditions Report will not be undertaken as part of this Master Plan as it is a broad, technical study over multiple studies areas. It would be a more appropriate use of resources to assess built heritage and cultural heritage landscapes on a project-specific basis.

Agency	Comments	Response
Mark Badali, Ministry of Environment, Conservation and Parks, November 25, 2022	• Provided the updated Areas of Interest to be addressed in the EA documentation. • The procedural aspects of rights-based consultation are delegated to the proponent. • Draft copy of the report should be sent 30 days prior to the filing of the final report. • Please send a copy of the final notice to the ministry's Southwest Region EA notification email account.	• Noted.
Coreena Smith, Bruce County Planning, November 23, 2022	• Are available to provide support (e.g., attendance at public meetings, provision of current growth projection numbers).	• Noted.
Mark Badali, Ministry of Environment, Conservation and Parks, May 31, 2023	• Reviewed draft Master Plan Update Report. • Recommend defining ERU at first instance of use in Executive Summary. • Recommend updated Figure 1.1 to the updated MCEA figure. • Noted that Approach 1 consists of only preliminary completion of Phases 1 and 2. Please ensure subsequent Schedule B and C projects complete the entirety of all applicable phases of the Class EA process, including identification of reasonable and feasible alternatives solutions to the problem.	• Revised Master Plan to reflect comments.

6.4 First Nation and Métis Consultation

The Crown has a duty to consult with First Nation and Métis communities if there is a potential to impact of Aboriginal or Treaty rights. This requirement is delegated to project proponents as part of the MCEA process, therefore, the project proponent has a responsibility to conduct adequate and thorough consultation with Aboriginal communities.

6.4.1 Background Review

In order to identify Aboriginal communities potentially impacted by this project, the Aboriginal and Treaty Rights Information Systems (ATRIS) was consulted. A search was conducted for Aboriginal Communities, including their traditional territories within a 50 m radius of the project study area. Utilizing this process, seven Aboriginal and Métis communities were identified as potentially having interest in the project.

Correspondence was subsequently forwarded to each community/organization detailing the proposed project and asked for input. A copy of the letter and Public Open House Notice sent to the following communities is included in Appendix G:

- Métis Nation of Ontario;
- Chippewas of Saugeen;
- Chippewas of Nawash;
- Great Lakes Métis Council;
- Historic Saugeen Métis;
- Saugeen Ojibway Nation; and
- Chippewas of Kettle and Stony Point First Nation.

6.4.2 Consultation Record

A response to the initial letter and Notice of Study Commencement and Open House was received from the Historic Saugeen Métis. No other responses were received. A consultation log is included in Table 6.2.

Table 6.2 Aboriginal Community Consultation Log

To	From	Comments	Action Taken/Response
SON Environmental Office (via email) – Emily Martin and Juanita Meekins, October 28, 2022	BMROSS	• Provided letter outlining project scope • Provided copy of Notice for Public Open House	• No response
Chief Henry, Chippewas of Saugeen First Nation (via email), October 28, 2022	BMROSS	• Provided letter outlining project scope • Provided copy of Notice for Public Open House	• No response

To	From	Comments	Action Taken/Response
Chief Smith, Chippewas of Nawash Unceded First Nation (via email), October 28, 2022	BMROSS	• Provided letter outlining project scope • Provided copy of Notice for Public Open House	• No response
Great Lakes Métis Council (via email), October 28, 2022	BMROSS	• Provided letter outlining project scope • Provided copy of Notice for Public Open House	• No response
Historic Saugeen Métis (HSM) (via email), October 28, 2022	BMROSS	• Provided letter outlining project scope • Provided copy of Notice for Public Open House	• Responded on November 9, 2022
Métis Nation of Ontario (via email) – October 28, 2022	BMROSS	• Provided letter outlining project scope • Provided copy of Notice for Public Open House	• No response
BMROSS (via email) – November 9, 2022	HSM	• Interested in receiving further information as it becomes available	• Noted

6.5 Stakeholder Consultation

The developer stakeholders were sent a copy of the Notice of Commencement and Public Open House to solicit any initial input on the Master Plan. Two responded with requests for further information.

Following the public meeting, a stakeholder submitted a request that the Municipality extend potable water to BEC Industrial Lands. Given that a Municipal Class Environmental Assessment is currently being undertaken to examine the expansion of the Kincardine Water Treatment Plant and potable water services to Bruce Power, the stakeholder was advised to submit their request to the consultants leading the EA process.

6.6 Public Open House

A Public Open House was held on Tuesday November 29, 2022, from 6 PM to 8 PM at the Kincardine Municipal Administration Centre. Information regarding the open house was given in the Notice of Commencement, which was published in the Kincardine Independent and Kincardine News two weeks prior to the meeting. The Notice was also placed on the Municipality's website and emailed to local developers.

The meeting included an open house portion, with display boards outlining the study purpose and findings. Project team members were available to answer questions. Additionally, a presentation regarding the Master Plan was given. A copy of the presentation is included in Appendix G.

The general purpose of the meeting was to provide attendees with the following:

- A summary of the Master Plan process;
- Review the 2018 Water and Wastewater Servicing Master Plan and projects previously identified as needed;
- An overview of growth projections and reserve capacity calculations for the water and wastewater systems;
- A summary of the identified needs and potential alternative solutions related to water and wastewater services; and
- The MCEA schedules and timelines for identified projects.

There were five members of the public in attendance. The following table (Table 6.3) summarizes the comments and questions received at and subsequent to the public open house.

Table 6.3 Comments Received During and Following the Public Open House

Question/Comment	Response/Action
Can I get a copy of the presentation?	A copy of the presentation was provided subsequent to the meeting.
Do commitments for water or wastewater capacity for developments expire?	At this time, commitments for water and wastewater capacity do not expire. There is no formal allocation policy in place but that is recommended as part of this Master Plan for the future.
Would like to have the extension of potable water to the BEC considered as part of the EA.	Noted that there is currently an EA underway to investigate the extension of potable water from Kincardine to Bruce Power. Forwarded comment and commentor contact information to study team.

7.0 Costs and Financing

7.1 General

If the Kincardine DWS were expanded to service Bruce Power, an estimated 2,765 m^3/day maximum day demand would be added to the system. The impacts of adding this demand to the existing Kincardine DWS are being examined through a separate MCEA. Water supply to Bruce Power would result in the need for a BPS along the Lakeshore watermain. Identification of a preferred location is part of the current

MCEA for the water supply expansion. The need for WTP disinfection modifications is also being reviewed as part this MCEA process. With WTP modifications, existing storage would be sufficient for existing plus development commitments and Bruce Power needs. Funding of the WTP upgrades, construction of the BPS, and watermain extension to Bruce Power is all being reviewed in tandem with the MCEA process. It is anticipated that, for any works for which Bruce Power is the sole beneficiary, Bruce Power would be fully responsible for funding those works.

Several projects have been identified based on the progression of growth and future needs. These projects include:

- Watermain extensions on Kincardine and Bruce Avenues in community of Kincardine, for future servicing of development lands;
- Construction of a parallel or larger diameter watermain along King Street in Tiverton, north of Stanley/Cameron Streets;
- Increased capacity at the Durham Street and Park Street SPSs; and
- Sewer upgrades within the Huron Terrace SPS catchment area, generally on Queen and Kingsway Streets, and potentially McLeod Avenue, Highland Drive, Prince Street North, and Kingsway Street east of Queen Street.

The actual need and timing of these projects is dependent on where and when future development occurs. Given that the need for these projects is driven by future growth, the Municipality may consider financing these projects through development charges or through the Municipal Act.

7.2 Development Charges

The future projects identified in the Master Plan are driven by growth and will significantly benefit future growth. Municipalities can collect for the growth-related costs of capital works projects through the Development Charges Act. The Act allows municipalities to collect development charges against future development for the costs associated with the provision of infrastructure and services that benefit growth. The Municipality of Kincardine has a Development Charge By-law in place and currently collects development charges related to road, water, and wastewater services, among others.

In the future, should the Municipality need to undertake the above-noted projects, the portion of project costs that benefit growth can be collected through development charges.

7.3 Municipal Act

Part XII of the Municipal Act provides municipalities with broad powers to impose fees and charges via passage of a by-law. The powers, as presented in S. 391(1) of the Municipal Act authorize a municipality to impose fees or charges for:

- Services or activities provided or done by or on behalf of it;
- Costs payable by it for services or activities provided or done by or on behalf of any other municipality of local boards; and

- The use of its property, including property under its control.

Municipalities use the authority of the Municipal Act to collect capital charges from water and sewage projects. Under the Act, municipalities can charge an immediate benefit to those properties who will receive a benefit at a future time. Under the Act, municipalities are permitted to pass a by-law requiring mandatory connections to the system and mandatory pay by-laws.

There are many methods available to assess and calculate a capital cost recovery rate for a project, including:

- By metres of frontage of the property;
- An area rate based on hectares;
- A fixed charge for each parcel (flat rate); or
- Any other method Council considers fair.

8.0 Implementation

8.1 General

This Master Plan identifies several future requirements for water and wastewater infrastructure. Upon approval of the Master Plan, the Municipality of Kincardine may initiate the associated studies or steps associated with the identified preliminary preferred solutions. Given that many of the identified problems/opportunities are based on future need, the progression of development will determine the timing of implementing the recommendations in this Master Plan. It is recommended that the Master Plan be reviewed on a regular basis to evaluate the accuracy of key assumptions (e.g., the rate of growth) and to confirm the suitability of the preferred solutions. The Master Plan should be modified as required to address any changes in the environmental setting and/or local conditions.

8.2 Additional Studies Required

8.2.1 Water Supply and Storage

The Master Plan identified a need to monitor water supply capacity going forward. It is recommended that the supply capacity be evaluated on a 5-year basis.

It was identified that additional water supply would be required to meet the needs of Bruce Power. The impacts of supplying Bruce Power from the Kincardine DWS are currently being investigated as part of the Class EA for water supply expansion.

It was identified that the Tiverton water supply is currently overcommitted. However, based on the highest growth scenario considered, it is not expected that the system capacity would be exceeded until 2039. For Briar Hill #2 pumphouse in Tiverton, it appears the well efficiency has dropped significantly since 2006. Video inspections as well as performance step testing should be conducted for both the Briar Hill #2 and Dent #2 pumphouses using the current pumping equipment to confirm their current

conditions. Given the potential for additional development to require an increase to the supply capacity, it is recommended that investigations commence to evaluate potential methods of increase (e.g., re-rating of existing well(s), new well(s), or connect to the Kincardine system). A Class EA would be required for these alternatives. Current indications are that there would be low potential for re-rating any of the current wells, so an alternate source will likely be required when the capacity increase is needed.

8.2.2 Wastewater Treatment

The Master Plan identified that under the highest growth scenario considered, the Kincardine WWTP would have sufficient capacity until 2037 and the BEC WWTP would have sufficient capacity beyond 20 years. However, it is noted that the community of Kincardine has a significant number of potential development areas, and the BEC industrial lands may have high wastewater flows depending on the nature and scale of industrial development. To increase capacity at either WWTP, a Schedule C MCEA will need to be undertaken to investigate options. At this time, it is recommended that reserve capacities for each plant be regularly updated (e.g., at intervals not exceeding 5 years).

8.3 Master Plan Approval

The Kincardine Water and Wastewater Servicing Master Plan Update was developed following an approved Master Plan process, as set out in the MCEA document. For this study, the Master Plan process incorporated the completion of Phases 1 and 2 of the Class EA process.

The Master Plan will be approved for implementation subject to adoption by the Council of Municipality of Kincardine. This Master Plan identifies future projects that will need to be considered based on where and when growth proceeds. Some projects, such as the need for additional water supply or additional wastewater treatment capacity will require a MCEA study to evaluate site-specific impacts and alternatives.

8.4 Requirements for Master Plan Completion

The following activities are required to complete the formal MCEA process:

- Issue a Notice of Master Plan;
- Make the Master Plan Report available for public review in conjunction with the Notice of Master Plan;
- Obtain feedback from the public, stakeholders and agencies;
- Address any outstanding issues resulting from the Notice of Master Plan; and
- Advise the Municipality and MECP when the process is complete.

8.5 Final Public Consultation

Upon completion of the Master Plan, a Notice of Master Plan will be circulated to stakeholders, review agencies, and placed in local papers. The notice will summarize

the projects identified in the Master Plan and indicate the approval process associated with moving forward with implementation.

8.6 Master Plan Recommendations

8.6.1 Recommended Works

It is anticipated that development within the Municipality of Kincardine will continue over the foreseeable future. The information included in this report provides directions for infrastructure improvements and expansions to service existing and future users. It will also provide the background context for any additional studies (e.g., environmental assessments) required prior to implementation of the recommended works. Any projects identified as Schedule B or C projects under the Municipal Class EA process will require additional screening to meet the investigative requirements.

The following represents the key study recommendations developed following the evaluation of alternatives as part of the Master Plan process:

- Additional water supply capacity would be needed to service Bruce Power. The Municipality is engaged in a Class EA to investigate increasing the WTP capacity.
- The Tiverton water supply is overcommitted. For pumphouses in Tiverton, video inspections and pumping tests should be conducted using the current pumping equipment to confirm the suspected decrease in efficiency. A Class EA would be required to increase well supply capacity (if possible), or add an additional well(s), or change the source of supply by way of connection to the Kincardine system.
- It is recommended that the reserve capacities for the Kincardine and BEC WWTPs be regularly updated.
- Construction of a parallel or larger diameter watermain along King Street in Tiverton, north of Stanley/Cameron Streets.
- Increased capacity at the Durham Street and Park Street SPSs.
- Sewer improvements within the Huron Terrace SPS catchment area, including on Queen and Kingsway, and potentially McLeod and Highland depending on development area outlets. The timing for such upgrades would be dependent on development status.

The Master Plan should be reviewed on a regular basis to evaluate the accuracy of key assumptions (e.g., the progression and rate of growth). The Master Plan should be modified as required to address changes to the environmental setting and local conditions.

8.6.2 Summary of Preliminary Preferred Solutions

The following table provides a summary of the preferred solutions to existing and future servicing issues. In most cases the solutions are subject to additional more detailed investigations.

Table 8.1 – Summary of Preliminary Preferred Solutions

Service	Facility	Identified Issue	Required by Year	Preferred Solutions	Probable Cost (2023$)[1]	Class EA Schedule
Kincardine Water Treatment	Kincardine WTP	Existing plant reservoir storage not being fully available for use.	Required now but timing is linked to Class EA process currently being undertaken.	Convert primary disinfection to UV process, allowing volume currently used for chlorine contact to be available for customer use.	Currently under review as part of separate Class EA process	Exempt
Kincardine Water Supply	Kincardine WTP/Distribution System	Bruce Power's interest in connection to the municipal system.	Currently under review as part of Class EA process.	Complete Class EA to evaluate feasibility of connection to Kincardine system.	Currently under review as part of Class EA process	C
Tiverton Water Supply	Existing Wells	Potential loss of well efficiency over time; need to confirm current capacity	Within next 3 years.	Engage a hydrogeologist to complete testing of Dent Well #2 and Briar Hill Well #2	$50,000	Not Applicable
Tiverton Water Supply	Existing Wells	Overcommitment of water supply based on development commitments.	Within next 3 years; sooner if development status requires.	Complete Class EA to evaluate increase to well supply capacity, additional well or connection to Kincardine system.	$75,000, plus $50,000 for Source Water Protection costs, if any	B
Tiverton Water Supply	King Street Watermain, north of Stanley/Cameron Streets	Low fire flows in the northern part of Tiverton.	In response to development needs or in conjunction with planned road reconstruction.	Parallel or replace existing King Street watermain to improve fire flow to north.	$660,000 (watermain only; full road reconstruction extra)	Exempt

Service	Facility	Identified Issue	Required by Year	Preferred Solutions	Probable Cost (2023$)[1]	Class EA Schedule
Kincardine Wastewater Pumping	Durham Street SPS	Existing SPS capacity inadequate to meet projected 20-year peak flow.	2023	Construct Durham Street SPS Upgrades – pump and electrical replacement.	$1,250,000	Exempt
Kincardine Wastewater Pumping	Park Street SPS	Existing SPS capacity inadequate to meet projected 20-year peak flow.	2024	Design Park Street SPS Upgrades – pump replacement design and approvals.	$100,000	Exempt
Kincardine Wastewater Pumping	Goderich Street SPS and Kincardine Ave SPS	Projected 20-year peak flow greater than SPS capacities.	Ongoing	There is currently no need to increase station capacities but flows to the stations should be monitored.	Not applicable	Not applicable
Kincardine Wastewater Treatment	Kincardine WWTP	Need for monitoring of WWTP long-term capacity.	Every 5 years; sooner if development status warrants or flows change noticeably.	Maintain up-to-date reserve capacity calculations for the Kincardine WWTP.	$5,000 per capacity update	Not applicable
Kincardine Wastewater Collection	Queen and Kingsway Streets sanitary sewers	Sewer upgrades required to accommodate future development.	In response to development needs or in conjunction with planned road reconstruction.	Sewer upgrades on Queen Street and Kingsway Street to accommodate future development north of the existing Huron Terrace SPS catchment area.	$1,900,000 (sewer only; full road reconstruction extra)	Exempt
Tiverton Wastewater Pumping	Maple Street SPS	Projected 20-year peak flow greater than Maple Street SPS capacity.	Ongoing	There is currently no need to increase station capacity but flows to the station should be monitored.	Not applicable	Not applicable
BEC Wastewater Treatment	BEC WWTP	Need for monitoring of WWTP long-term capacity.	Every 5 years; sooner if development status warrants or flows change noticeably.	Maintain up-to-date reserve capacity calculations for the Kincardine WWTP.	$5,000 per capacity update	Not applicable

[1] Refer to previous sections for assumptions and limitations for cost estimates.

9.0 Summary

The Municipality of Kincardine initiated a Master Plan Update to investigate infrastructure needs and requirements relating to water and wastewater servicing within the communities of Kincardine and Tiverton, as well as any additional areas within the service areas of those communities. The intent of this Master Plan Update is to serve as the basis for and support future infrastructure projects as identified through the study. The Master Plan Update followed the MCEA process, such that the requirements of Master Plan Approach 1 are met, including an inventory of existing environmental conditions, identification of problems or opportunities and alternative solutions to be considered in the future.

The Master Plan Update summarizes the existing environmental conditions within Kincardine, as well as the existing water and wastewater infrastructure. An analysis of existing population and projected future growth, based on proposed developments, was also undertaken to understand future infrastructure requirements.

To assess water infrastructure needs, the study included a review of the existing water supply, storage and distribution infrastructure. This included an examination of existing water demands, potential future water demands and reserve capacities. Existing WaterCAD® models were updated and reviewed to assess fire flows and pressures throughout the water distribution systems. It was identified that additional water supply and storage would be required to accommodate the servicing of Bruce Power through the Kincardine system, which is being investigated as part of a current Class EA. It was identified that the Tiverton supply is overcommitted, however based on projected growth forecasts it may be 2039 before the current capacity is utilized. The distribution system modeling identified generally acceptable results, with locations typically at the end of dead-end mains and/or with small diameter mains having low fire flows in some cases.

For wastewater, the study assessed collection, pumping and treatment infrastructure. The assessment included an evaluation of reserve capacity and SewerCAD® analysis for the existing collection system, as well as the future conditions. From the assessment of existing infrastructure and projected future needs, it was identified that additional sewage treatment capacity is not projected to be required at the Kincardine WWTP until 2037 at the highest growth projection, and not within 20 years for the BEC WWTP, however development potential within each service area is significant. Assessment of collection infrastructure identified that capacity increases are warranted at the Durham and Park Street SPSs. Several sewer sections within the Huron Terrace SPS catchment area are theoretically overcommitted, as is a section of trunk sewer leading to the Park Street SPS.

A series of alternative solutions for the identified problems were evaluated. The identified problems or opportunities, based on the progression of growth and future needs include:

- Additional water supply capacity within the Kincardine system if Bruce Power is to be added as a customer.
- Additional water supply capacity within the Tiverton system, depending on the status (i.e., timing) of development commitments.

- Additional water storage within the Kincardine system.
- Watermain improvements in the north part of Tiverton.
- Increased capacity at the Durham Street and Park Street SPSs.
- Sewer upgrades within the Huron Terrace and Park Street SPS catchment areas, depending on the status of development commitments.

Alternative solutions to the above-noted problems and opportunities were evaluated. Based on the evaluations undertaken, the following solutions were recommended:

- Expand the Kincardine WTP capacity.
- Kincardine WTP disinfection modifications, to increase the effective available volume of water from the existing reservoir.
- Further study of an additional well or connection to Kincardine for the Tiverton DWS.
- Durham Street SPS pump upgrades and related works (planned for 2023).
- Park Street SPS pump upgrades and related works (tentatively planed for 2024).
- Regular updates of the reserve capacity calculations for both WWTPs. When appropriate based on development status and plant flow increases, undertake MCEA to investigate increases to each WWTP capacity.
- Sewer upgrades as needed for new development.

Based on the preferred solutions, the Master Plan recommends:

- Additional water supply capacity would be needed to service Bruce Power. The Municipality is engaged in a Class EA to investigate increasing the WTP capacity.
- As part of the Class EA for a Kincardine WTP capacity increase, options for treatment modifications (specifically conversion to a UV system for primary disinfection) should be reviewed to make more of the existing plant reservoir storage available for use.
- Additional water capacity will be required for Tiverton in the future. Timing will be dependent on development status, but study work is expected to take place in 2024. It is recommended that the Municipality investigate installing an additional well or connecting to the Kincardine system. Both options would require the completion of a Class EA process.
- Continue design of Durham Street SPS pump upgrades for 2023 construction.
- Commence design of Park Street SPS pump upgrades for 2024 construction.

- Watermain improvements within the north part of Tiverton and on Bruce and Kincardine Avenues in Kincardine, and sanitary sewer collection improvements within the Kincardine Huron Terrace and Park Street SPS catchment areas. Generally, timing of such upgrades should be planned in accordance with development status.

- The Master Plan should be reviewed on a regular basis to evaluate the accuracy of key assumptions (e.g., the progression and rate of growth). The Master Plan should be modified as required to address changes to the environmental setting and local conditions.

A consultation program developed for this Master Plan was directed towards stakeholders, the public, First Nation and Métis communities, and provincial review agencies. Relatively few comments were received from the public, stakeholders and First Nation and Métis communities during the Master Plan process, and generally reflected a desire for further information on the Master Plan.

The 2022 Water and Wastewater Servicing Master Plan Update has been completed in accordance with the planning and design process of the MCEA. For this study, the Master Plan process incorporated the completion of Phases 1 and 2 of the MCEA process. The Master Plan will be approved for implementation subject to adoption by the Council of the Municipality of Kincardine.

All of which is respectfully submitted.

B. M. ROSS AND ASSOCIATES LIMITED

Per _____

Andrew J. Garland, P. Eng.

Per _____

Ben R. Sheardown, P.Eng.

Per _____

Lisa J. Courtney, RPP, MCIP

:hv

10.0 References

B. M. Ross and Associates Limited. (2014). *Class Environmental Assessment for Extension of Municipal Water and Sanitary Sewer Servicing for the Community of Inverhuron.* Municipality of Kincardine.

B. M. Ross and Associates Limited. (2017). *Kincardine Business Park Servicing Master Plan.* Municipality of Kincardine.

B. M. Ross and Associates Limited. (2017). *Water and Wastewater Master Plan Technical Memo 2.*

Bird Studies Canada. (2009). *Data Summaries*. Retrieved from Atlas of the Breeding Birds of Ontario: http://www.birdsontario.org/atlas/datasummaries.jsp?lang=en

Chapman, L., & Putnam, D. (1984). *The Physiogrpahy of Southern Ontario.* Ontario Geological Survey.

County of Bruce. (2013). *County of Bruce Official Plan.*

Environment Canada. (2017). *List of Wildlife Species at Risk: Schedule 1.* Retrieved from https://www.canada.ca/en/environment-climate-change/services/species-risk-act-accord- funding/listing-process/wildlife-schedule-1.html

Hoffman, D., & Richards, N. (1954). *Soil Survey of Bruce County.*

MacNaughton Hermsen Britton Clarkson Planning Limited. (2021). *Official Plan of the Municipality of Kincardine.*

Ministry of Natural Resources and Forestry. (2017). *Make A Map: Natural Heritage Areas*. Retrieved from http://www.gisapplication.lrc.gov.on.ca/mamnh/Index.html?site=MNR_NHLUPS_NaturalHeritage&viewer=NaturalHeritage&locale=en-US

MOE. (2008). *Design Guidelines for Drinking-Water Systems.*

Municipal Engineers Association. (2000). *Municipal Class Environmental Assessment October 2000, as amended in 2007 & 2011.*

Municipality of Kincardine. (2017). *Kincardine Heritage*. Retrieved from Municipality of Kincardine: http://www.kincardine.net/kincardineheritage.cfm

Municipality of Kincardine. (2021). *Bruce Energy Centre Lagoon System 2021 Annual Report.*

Municipality of Kincardine. (2021). *Kincardine Wastewater Treatment Plan 2021 Annual Performance Report.*

North-South Environmental Inc. and Dougan & Associates. (2009). *Natural Heritage Study for the Municipality of Kincardine Volume 1: Existing Conditions, Scientific Methodology and Preliminary Natural Heritage System (NHS).*

Saugeen Valley Conservation Authority. (2018). *Watershed Report Card.*

Saugeen, Grey Sauble, Northern Bruce Peninsula Source Protection Region. (2015). *Approved Assessment Report for the Saugeen Valley Source Protection Area.*

Saugeen, Grey Sauble, Northern Bruce Peninsula Source Protection Region. (2015). *Approved Source Protection Plan.*

Stantec Consulting Ltd and a+LINK Architecture Inc. (2021). *Kincardine Heritage Conservation District Plan.*

Statistics Canada. (2023). *Kincardine [Population centre], Ontario and Ontario [Province] (table). Census Profile.* Retrieved from Statistics Canada Catalogue no. 98-316-X2021001. Ottawa. Released March 29, 2023: https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E (accessed April 24, 2023).

Statistics Canada. (2023). *Kincardine, MU [Census subdivision], Ontario and Bruce, CTY [Census division], Ontario (table).* Retrieved from Census Profile. 2021 Census. Statistics Canada Catalogue no. 98-316-X2021001. Ottawa. Released March 29, 2023: https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E (accessed April 24, 2023).

Statistics Canada. (2023). *Tiverton, DMU [Designated place], Ontario and Ontario [Province] (table). Census Profile.* Retrieved from 2021 Census. Statistics Canada Catalogue no. 98-316-X2021001. Ottawa. Released March 29, 2023: https://www12.statcan.gc.ca/census-recensement/2021/dp-pd/prof/index.cfm?Lang=E (accessed April 24, 2023).

Appendix A

Watershed Report Cards

WATERSHED REPORT CARD

Penetangore River Watershed

D+

The Penetangore River consists of two major tributaries, the North and Main Penetangore Rivers, as well as two intermediate tributaries; Millarton and Kincardine Creeks. The system drains 192 square kms, falling 12.5 metres in 51.2 kms, with an average gradient of 2.2 metres per km.

The topography of this watershed is generally smooth with gentle sloping areas. It is predominantly agricultural (83%). The Town of Kincardine and the communities of Bervie and Millarton also exist here.

Working to Keep Your Future Green

Staff work with partners and organizations in implementing projects that aim to improve the local environment. Research, lab and field work, data analysis, observations, testing, and so much more, is completed by staff in helping to determine the best and most applicable environmental measures to apply in each sub-watershed.

Watersheds are complex systems where everything is connected. We all live downstream.

Saugeen Conservation is a proud member of Conservation Ontario

1078 Bruce Rd. 12, P.O. Box 150, Formosa ON N0G 1W0 Tel. 519-367-3040 Email: publicinfo@svca.on.ca www.svca.on.ca

Alternative formats of this report are available upon request.

General Information

Area
192 sq. km

Municipalities
Municipality of Kincardine, Township of Huron-Kinloss, Municipality of Brockton

Physiography
43% till plain (undrumlinized), 27% till plain (bevelled), 15% sand plain, 9% till moraine, 5% beaches and shorecliffs

Soils
61% clay loam, 18% fine to moderately coarse sandy loam, 10% silty loam, 9% other (may include small percentages of alluvium, breypan, bottomlands etc), 2% organic material

Dams
There are no dams in the watershed

Sewage Treatment Facilities
Kincardine

Woodlot Size
Limited forest cover along the lakeshore and at the back of farm lots

Land Use
83% agriculture; 11% forested; 3.9% urban

Provincially Significant Natural Areas - none

Groundwater Aquifer Sources
Detroit River Group; Onondage Formation

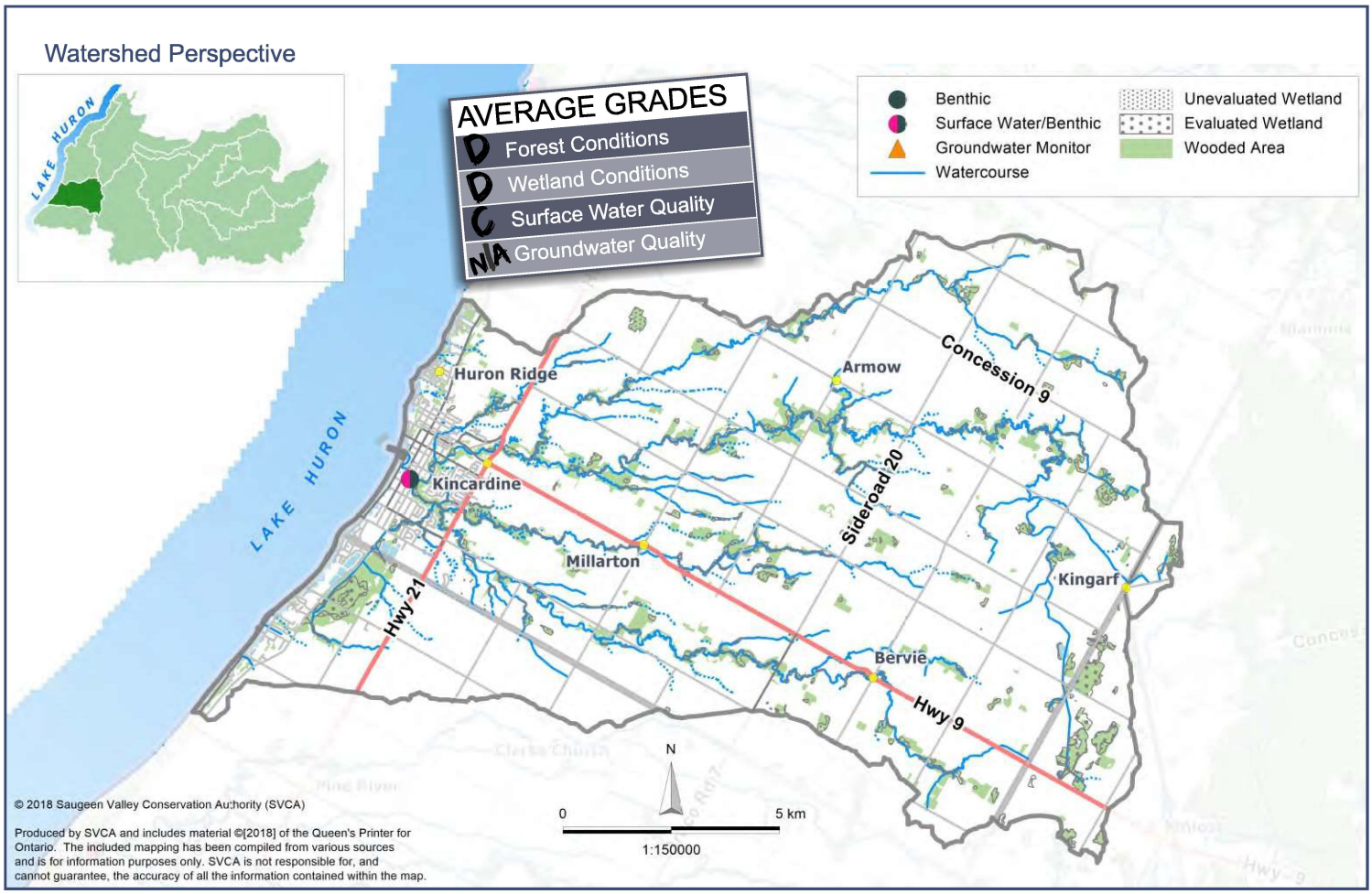
Stream Flow (mean)
Mean annual flow - 1.63 cubic metres per second (cms)

Stream Flow (low) *
7Q10 flow[1] - 0.1 cms 7Q20 flow[2] - less than 20 years of data

Rare Species (obtained from the National Heritage Information Centre (NHIC) Website)
Clamp-tipped Emerald, Beaked Spike-rush, Great Lakes Sand Reed, Great Lakes Wild Rye, Snapping Turtle, Eastern Meadowlark, Ram's Head Lady Slipper, Round Goby, Sand Dune Wild Rye, Bobolink

* [1] 7Q10 - the lowest mean flow for seven consecutive days that has a 10-year recurrence interval period, or a 1 in 10 chance of occurring in any one year.

[2] 7Q20 - the lowest mean flow for seven consecutive days that has a 20-year recurrence interval period, or a 1 in 20 chance of occurring in any one year.



	Indicators	2002 - 2006	2007 - 2011	2012 - 2016	Indicator Description
Forest Conditions	Forest Cover (% of Area)	D 11.3	D 10.8	**D 10.8**	Forest cover is the percentage of the watershed that is forested or wooded. ***Environment Canada suggests that 30% forest cover is the minimum required to support healthy wildlife habitat.***
	Forest Interior (% of Area)	F 1.3	F 1.0	**F 0.8**	Forest interior refers to the protected core area found inside a woodlot. It is the sheltered, secluded environment away from forest edges and open habitats. ***Environment Canada recommends that a minimum of 10% of a watershed should be interior forest cover to sustain healthy plant and animal species.***
	Riparian Cover (% of Area)	B 49.0	C 29.8	**C 36.3**	Riparian Cover is the percentage of forested habitat along a given waterway. ***Environment Canada guidelines suggest that at least 75% of stream length should have 30 metre naturally vegetated buffers. Forested vegetation represents about two-thirds with the rest being marsh, meadow, and shrub thicket.***
	Average Grade	D	D	**D**	Grade D indicates poor ecosystem conditions and overall improvements are necessary.
Wetland Conditio	Wetland Cover	No Data	D 4.0	**D 4.0**	Wetland cover is the percentage of existing wetland in a watershed. ***Environment Canada suggests that 10% wetland cover is the minimum needed for a healthy watershed. Grade D indicates poor ecosystem conditions and overall improvements are necessary.***

	Indicators	2002 - 2006	2007 - 2011	2012 - 2016	Indicator Description
Surface Water Quality	Benthic Invertebrates (FBI)	D 6.02	D 5.97	**D 5.83**	Benthos or benthic invertebrates are bottom dwelling insects, crustaceans, worms, mollusks, and related aquatic animals that live in watercourses. They are good indicators of water quality, responding quickly to environmental stressors such as pollutants. ***The Modified Family Biotic Index (FBI) using New York State tolerance values provide stream health information and values ranging from 1 (healthy) to 10 (degraded).***
	Total Phosphorus (mg/L)	B 0.030	C 0.034	**C 0.031**	Total phosphorus is indicative of nutrient levels within a watercourse. Phosphorus is required for the growth of aquatic plants and algae, however, concentrations above the Provincial Water Quality Objective may result in unhealthy stream conditions. ***The Provincial Water Quality Objective is 0.03 mg/L.***
	E. coli (cfu/100mL)	C 148	B 81	**C 124**	*E. coli* originate from the wastes of warm blooded animals, including humans, livestock, wildlife, pets and waterfowl. ***The Ontario Recreational Water Quality Guidelines suggest that waters with less than 100 CFUs/100mL are safe for swimming.***
	Average Grade	C	C	**C**	Grade C indicates ecosystem conditions that need to be enhanced.
Groundwater Quality	Nitrite + Nitrate (mg/L)	N/A	N/A	**N/A**	Nitrates are present in water as a result of decaying plant or animal material, the use of fertilizers, domestic sewage or treated wastewater, as well as geological formations containing soluble nitrogen compounds. ***The Ontario Drinking Water Standard for nitrite + nitrate is 10 mg/L.***
	Chloride (mg/L)	N/A	N/A	**N/A**	While chloride can be naturally occurring, the presence of elevated chloride may indicate contamination from road salt, industrial discharges, or landfill leachate. ***The Ontario Drinking Water Standard for chloride is only for aesthetic purposes with an objective of 250 mg/L.***
	Average Grade	N/A	N/A	**N/A**	There are no monitoring wells located within this watershed, however, other monitoring wells in the vicinity have good water quality achieving an A grade.

Surface Water Quality

The Penetangore River scores an average grade of 'C' for surface water quality. The overall grade has stayed the same since the previous report cards. The average total phosphorus concentration is above the Provincial Water Quality Objective of 0.03 mg/L. E. coli is now above the recreational guidelines of 100 CFU/100mL., having changed from a' B' to a 'C'. At this new rating, the river would be considered unsafe for swimming.

The benthic invertebrate grade stayed the same at a 'D'. Changes in aquatuc organisms or the benthic invertebrate community are seen as early indicators of changes in water quality. Efforts must continue to encourage landowners and the agricultural community to preserve and improve natural land cover.

Groundwater Quality

There are no groundwater monitoring wells located within this watershed.

Forest Conditions

This watershed falls short of meeting the Environment Canada guidelines of 30% forest cover, with an average grade of 'D'. Forest cover and forest interior grades did not change with a 'D' and an 'F', respectively. There are a limited number of small, fragmented forests, many of which exist along the banks of streams. Riparian forested cover scored a 'C' grade. The recommendation is that 50% of the 30 metre wide riparian zone should have forest cover. The Penetangore River Watershed has only 36.3% of the riparian zone forested. Tree planting along riparian zones and on marginal farmland should be considered to improve forest conditions and existing forests should be protected.

Wetland Conditions

This report card summarizes the conditions of all wetlands within this watershed, which score a 'D' grade at only 4.0% wetland cover. This is below the Environment Canada recommendation of 10% as the minimum standard. Almost all of the wetlands have been cleared for agricultural land. It would be highly recommended to allow low lying or wet areas to naturalize and to protect existing ones. These are key areas in terms of overall watershed health.

The wetland evaluation system was created to inform Ontario land use planning process. Under the Planning Act, provincially significant wetlands are protected from development and alteration.

Ecosystem Grade Description

A	Excellent conditions.
B	Good conditions. Some areas may require enhancement and/or improvements.
C	Conditions that warrant general improvements.
D	Poor conditions. Overall improvements necessary.
F	Degraded conditions, in need of considerable improvement.

What is being done *in this Watershed?*

✓**Saugeen Conservation** aims to improve watershed health through virtually all its programs.

✓**Saugeen Conservation** is a key player in providing assistance and technical expertise to local groups, committees, ministries etc. that work to improve the local environment.

✓Through **Saugeen Conservation's tree planting efforts and Ontario's 50 Million Tree Program,** a total of 45,100 trees were planted in this watershed.

✓The **Penetangore Watershed Group** (established in 2011), plants approximately 3,000 trees each year in this watershed. This group is also involved in habitat development as well as habitat rehabilitation and invasive species removal. Their focus is to increase tree cover in the watershed, especially along local waterways to help improve water quality.

✓The **Huron Fringe Field Naturalists** work to preserve wildlife and natural habitat and to promote public interest and knowledge of the natural history in this area. In so doing, they conduct public hikes and workshop, participate in tree planting efforts, bird house construction and bird counts.

✓The **Ontario Steelheader's Association and the Lake Huron Fishing Club** release adult rainbow trout into this river system on an annual basis. (This was discontinued in 2016.)

✓Saugeen Conservation works closely with **local agricultural organizations** to provide ongoing workshops and seminars for farmers on a variety of different conservation topics.

✓**Grey Bruce Sustainability Network** works closely with Saugeen Conservation on several different environmental and educational projects.

✓The **Bruce Grey Woodlands Association** hosts various workshops and tours on forestry related topics.

What is being done *in this Watershed?*

✓ The **Forest Health Collaborative helps to** educate municipalities and the public on forest health issues.

✓ **Stewardship Grey Bruce** offers funding and technical support for landowners in the watershed interested in completing habitat enhancement projects.

✓ The **Lake Huron Fishing Club** (with funding from Bruce Power), works with local schools in setting up fish aquariums to educate students about the importance of a healthy fishery.

✓ Saugeen Conservation offers over **50 different hands-on environmental programs** to over 10,000 children annually, including the Grey Bruce Children's Water Festival and the Bruce Grey Forest Festival.

✓ Staff have implemented the **Yellow Fish Road Program,** (a program of Trout Unlimited Canada), which educates students and the public about storm drains and how they are corridors to local rivers and streams.

✓ **Grey-Bruce ALUS** program recognizes land stewardship and assists farmers in implementing and funding projects to produce ecosystem services. ALUS aims to improve the biodiversity on the agricultural landscape.

✓ **Environmental self assessments** are now available for the rural non-farm landowner with the release of The Rural Landowner Stewardship Guide for the Lake Huron Watershed. This guide provides a framework for landowners to evaluate their property and help determine best management practices.

✓ The **Lake Huron Centre for Coastal Conservation** initiates a number of programs aimed at protecting and restoring Lake Huron's shoreline's coastal environment and promoting a healthy coastal ecosystem

Recognizing our Important Partners

Saugeen Valley Conservation Foundation · The Coastal Centre · Pine River Watershed Initiative Network · Brockton · Huron-Kinloss · Municipality of Kincardine · Bruce Power · Enbridge · Lake Huron Fishing Club · ALUS · Ontario Power Generation · Yellow Fish Road · Bruce Grey Woodlands Association · Grey Bruce Sustainability Network · Stewardship Grey Bruce · Healthy Lake Huron · Ontario · Maitland Conservation · O.P.P. · St. John Ambulance · Bluewater District School Board · Penetangore Watershed Group · RBC · RBC Blue Water Project · TD · TD Friends of the Environment Foundation

WATERSHED REPORT CARD

Lake Fringe Watershed

B+

The Lake Fringe area is a narrow strip of land along Lake Huron stretching from north of Kincardine to Southampton.

This watershed is 254 square kms, with a number of small tributaries flowing directly into Lake Huron. The main tributaries are Lorne, Andrews, Tiverton and Underwood Creeks, as well as the Little Sauble River.

This watershed area is mainly agricultural (60%), with forested sections along the lakeshore where intensive development exists. It includes the communities of Southampton, Port Elgin, and Tiverton. Bruce Nuclear Power Development (BNPD) also exists here.

Working to Keep Your Future Green

Staff work with partners and organizations in implementing projects that aim to improve the local environment. Research, lab and field work, data analysis, observations, testing, and so much more, is completed by staff in helping to determine the best and most applicable environmental measures to apply in each sub-watershed.

Watersheds are complex systems where everything is connected. We all live downstream.

Saugeen Conservation is a proud member of Conservation Ontario

1078 Bruce Rd. 12, P.O. Box 150, Formosa ON N0G 1W0 Tel. 519-367-3040 Email: publicinfo@svca.on.ca www.svca.on.ca

Alternative formats of this report are available upon request.

General Information

Area
254 sq. km

Municipalities
Municipality of Kincardine, Town of Saugeen Shores

Physiography
44% till plain (drumlinized), 39% sand plain, 15% beaches and shore cliffs, 2% peat and muck

Soils
23% silty loam, 18% clay loam, 16% fine to moderately coarse sandy loam, 12% silty clay, 11% medium to moderately fine loam, 6% organic material, 6% other (may include small percentages of alluvium, breypan, bottomlands etc), 6% coarse sandy loam and loamy sand, and 0.3% gravel

Dams
There are no dams in the watershed

Sewage Treatment Facilities
None

Woodlot Size
Large woodlots with forest interior along the lakeshore with the rest of the watershed limited to small fragmented forests at the back of farm lots

Land Use
60% agriculture; 29% forested; 6.1% urban

Provincially Significan Natural Areas
- Scott Point, Baie duDore, MacGregor Point Wetland Complex

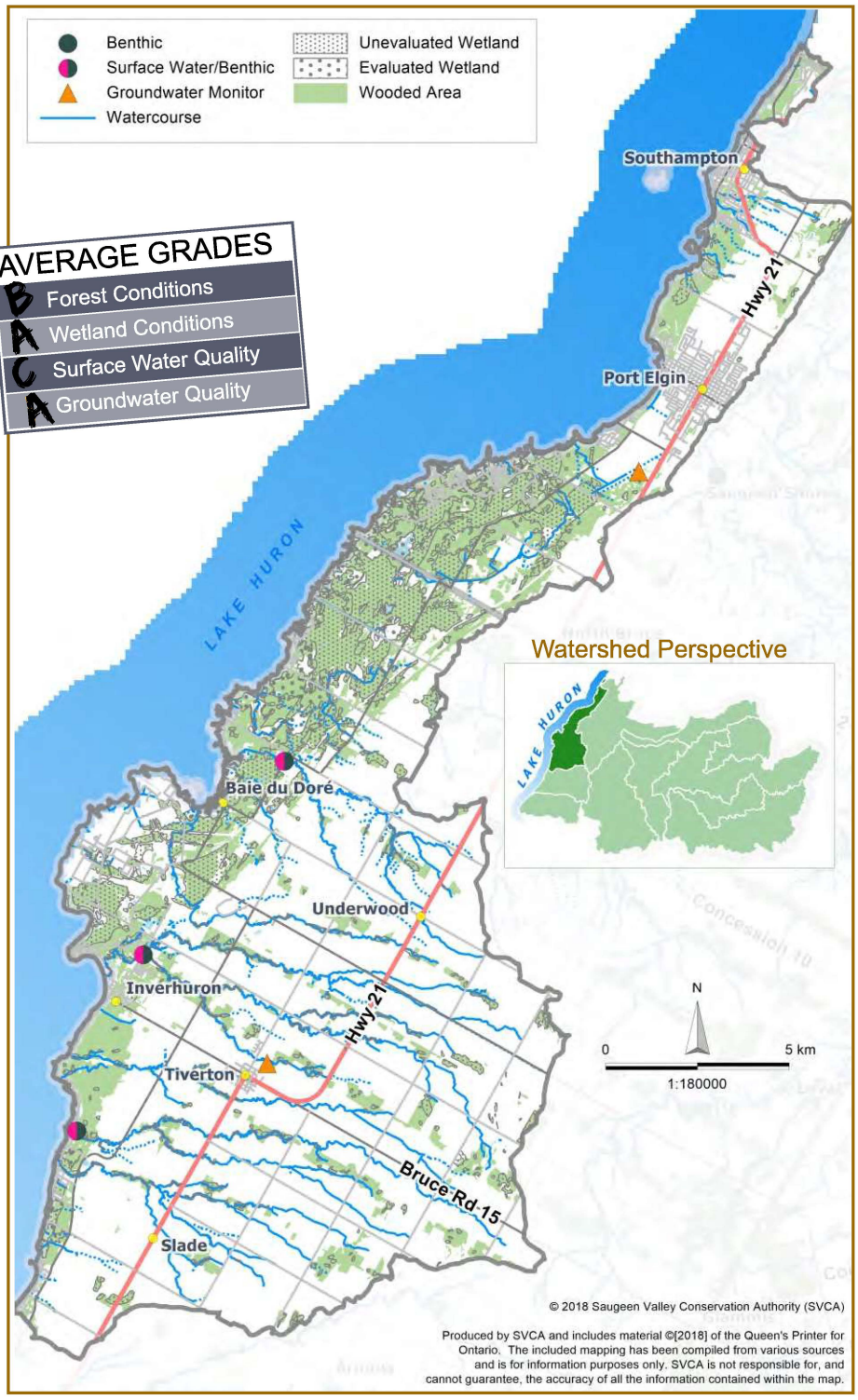
Groundwater Aquifer Sources
Salina Formation, Bass Island Formation, Bois Blanc Formation; Oriskany Formation, Detroit River Group; Onondage Formation, Lucas Formation, Glaciolacustrine Formation

Stream Flow (mean) N/A

Stream Flow (low) * N/A

Rare Species (obtained from the National Heritage Information Centre (NHIC) Website)
American Beach Grass, Barn Swallow, Beach-dune Tiger Beetle, Beaked Spike-rush, Black Meadowlark, Bobolink, Brushed-tipped Emerald, Butternut, Eastern Meadowlark, Eastern Red Damsel, Eastern Milksnake, Eastern Ribbonsnake, Lake Sturgeon, Hill's Pondweed, Pitcher's Thistle, Great Egret, Greene's Rush, Loggerhead Shrike, Dwarf Lake Iris, Great Lakes Sand Reed, Great Lakes Wild Rye, Greene's Rush, Green-striped Darner, Low Nutrush, Neglected Milk-vetch, Northern Brook Lamprey, Ocellated Darner, Prairie Dropseed, Queensnake, Ram's-head Lady Slipper, Red-shouldered Hawk, Ram's-head Lady's Slipper, Rough Dropseed, Sand-dune Wildrye, Stiff Yellow Flax, Small White Lady Slipper, Tuberous Indian-plantain, Stiff Gentian, White Perch, Williamson's Emerald, Snapping Turtle, Threespine Stickleback

* [1] 7Q10 - the lowest mean flow for seven consecutive days that has a 10-year recurrence interval period, or a 1 in 10 chance of occurring in any one year.
[2] 7Q20 - the lowest mean flow for seven consecutive days that has a 20-year recurrence interval period, or a 1 in 20 chance of occurring in any one year.



	Indicators	2002 - 2006	2007 - 2011	2012 - 2016	Indicator Description
Forest Conditions	Forest Cover (% of Area)	B 28.8	B 28.5	**B 28.4**	Forest cover is the percentage of the watershed that is forested or wooded. ***Environment Canada suggests that 30% forest cover is the minimum required to support healthy wildlife habitat.***
	Forest Interior (% of Area)	B 10.5	B 8.6	**B 8.6**	Forest interior refers to the protected core area found inside a woodlot. It is the sheltered, secluded environment away from forest edges and open habitats. ***Environment Canada recommends that a minimum of 10% of a watershed should be interior forest cover to sustain healthy plant and animal species.***
	Riparian Cover (% of Area)	C 37.0	C 29.5	**C 33.6**	Riparian Cover is the percentage of forested habitat along a given waterway. ***Environment Canada guidelines suggest that at least 75% of stream length should have 30 metre naturally vegetated buffers. Forested vegetation represents about two-thirds with the rest being marsh, meadow, and shrub thicket.***
	Average Grade	B	B	**B**	Grade B indicates good ecosystem conditions. Some areas may require enhancement.
Wetland Conditions	Wetland Cover	No Data	A 14.2	**A 14.2**	Wetland cover is the percentage of existing wetland in a watershed. ***Environment Canada suggests that 10% wetland cover is the minimum needed for a healthy watershed. Grade A indicates excellent ecosystem conditions and protection may be required. Some areas may require enhancement to maintain this level of quality.***

	Indicators	2002 - 2006	2007 - 2011	2012 - 2016	Indicator Description
Surface Water Quality	Benthic Invertebrates (FBI)	B 4.27	D 6.17	**D 6.07**	Benthos or benthic invertebrates are bottom dwelling insects, crustaceans, worms, mollusks, and related aquatic animals that live in watercourses. They are good indicators of water quality, responding quickly to environmental stressors such as pollutants. ***The Modified Family Biotic Index (FBI) using New York State tolerance values provide stream health information and values ranging from 1 (healthy) to 10 (degraded).***
	Total Phosphorus (mg/L)	A 0.010	B 0.025	**B 0.025**	Total phosphorus is indicative of nutrient levels within a watercourse. Phosphorus is required for the growth of aquatic plants and algae, however, concentrations above the Provincial Water Quality Objective may result in unhealthy stream conditions. ***The Provincial Water Quality Objective is 0.03 mg/L.***
	E. coli (cfu/100mL)	B 68	B 69	**B 59**	*E. coli* originate from the wastes of warm blooded animals, including humans, livestock, wildlife, pets and waterfowl. ***The Ontario Recreational Water Quality Guidelines suggest that waters with less than 100 CFUs/100mL are safe for swimming.***
	Average Grade	B	C	**C**	Grade C indicates ecosystem conditions that need to be enhanced.
Groundwater Quality	Nitrite + Nitrate (mg/L)	No Data	A 0.06	**A 0.04**	Nitrates are present in water as a result of decaying plant or animal material, the use of fertilizers, domestic sewage or treated wastewater, as well as geological formations containing soluble nitrogen compounds. ***The Ontario Drinking Water Standard for nitrite + nitrate is 10 mg/L.***
	Chloride (mg/L)	No Data	A 12.97	**A 13.98**	While chloride can be naturally occurring, the presence of elevated chloride may indicate contamination from road salt, industrial discharges, or landfill leachate. ***The Ontario Drinking Water Standard for chloride is only for aesthetic purposes with an objective of 250 mg/L.***
	Average Grade	No Data	A	**A**	Grade A indicates excellent ecosystem conditions and protection may be required. Some areas may require enhancement to maintain this level of quality.

Forest Conditions

With an average grade of 'B' for forest conditions, the Lake Fringe Watershed does not meet the Environment Canada guidelines of 30% forest cover and 10% forest interior. Forest Cover maintained a 'B' grade from the previous Report Cards while Forest Interior remained a 'B'. The grade for riparian cover scored a 'C' grade. The recommendation is that 50% of the 30 metre wide riparian zone should have forest cover. The Lake Fringe watershed has only 33.6% of the riparian zone forested. Tree planting along riparian zones, on dormant fields, areas too wet to farm, and on marginal farmland should be considered to ensure the forest conditions are maintained or improved.

Wetland Conditions

This report card summarizes the conditions of all wetlands. The Lake Fringe Watershed scores an 'A' grade with 14.2% wetland cover. This is just above the Environment Canada recommendation of 10% (minimum required for a healthy watershed).

It would be advisable to allow low lying or wet areas to naturalize. These are key areas and allowing them to regenerate will help to improve wetland scores.

The wetland evaluation system was created to protect important wetlands valued at a provincial level. Under the Planning Act, provincially significant wetlands are protected from development and alteration.

Surface Water Quality

This watershed scores an average grade of 'C' for *surface* water quality, indicating that ecosystem conditions need to be enhanced. The overall grade has remained a 'C' since the last set of report cards.

The average total phosphorus concentration is below the provincial water quality objective of 0.03 mg/L. The average E. coli is also below the recreational guidelines of 100 FU/100mL. The benthic invertebrate grade remained a "D' but is still a cause for concern. These low grades in the benthic invertebrate community are seen as early indicators of water quality deterioration. Efforts should continue to encourage landowners and the agricultural community to preserve and improve natural land cover. In addition to managing current land use practices, climate change and invasive species also pose significant threats.

Groundwater Quality

Groundwater quality in the two monitoring wells in this watershed continues to be excellent. It should be noted that groundwater aquifers do not conform to watershed boundaries but flow in an east to west direction through the watershed. Of note, is that there have been exceedences of the Ontario Drinking Water Standards for sodium during this study period at the Tiverton well.

Ecosystem Grade Description

A	Excellent conditions.
B	Good conditions. Some areas may require enhancement and/or improvements.
C	Conditions that warrant general improvements.
D	Poor conditions. Overall improvements necessary.
F	Degraded conditions, in need of considerable improvement.

What is being done *in this Watershed?*

✓ **Saugeen Conservation** aims to improve watershed health through virtually all its programs.

✓ Saugeen Conservation is a key player in providing assistance and technical expertise to local groups, committees, ministries etc. that work to improve the local environment.

✓ Through **Saugeen Conservation's tree planting efforts and Ontario's 50 Million Tree Program,** a total of 45,100 trees were planted in this watershed, during this report period.

✓ The **Lake Huron Fishing Club** actively stocks steelhead salmon in the Saugeen River. The club operates two hatcheries (Kincardine and Port Elgin), rearing young fish to help supplement the fishery. The School Salmon Hatchery program has grown from 10 Schools in 2012 to 47 Schools by 2016 with all the salmon being released into the Saugeen or Penetangore Rivers and fully funded by Bruce Power.

✓ **SauGREEN for the Environment** is a local environmental community group focused in the Saugeen Shores area. They implement various environmental initiatives including waste diversion, rain barrels, tree planting, Tall Tree Initiative and other eco-friendly projects.

✓ **Friends of MacGregor Provincial Park** hosts the annual Huron Fringe Birding Festival which attracts hundreds of participants each year.

✓ Saugeen Conservation works closely with **local agricultural organizations** and institutions to provide ongoing workshops and seminars for farmers on a variety of different topics relating to environmental and farm health, including soil conservation, cover crops, no-till farming, etc.

✓ **Local tourism groups and organizations** play a large part in promoting the wealth of natural resources in the Saugeen Watershed. Saugeen Conservation works closely with each of them in promoting the sustainability of the environment and its precious resources, including this area.

✓ **Grey Bruce Sustainability Network** works closely with Saugeen Conservation on several different environmental projects, ranging from green development to rain gardens, educational programs, river clean-up operations, seminars and more.

✓ The **Bruce Grey Woodlands Association** hosts various workshops and tours on forestry related topics. They also organize the annual Grey Bruce Woodlot Conference focusing on important forest-related issues and research.

What is being done *in this Watershed?*

- ✓ The **Forest Health Collaborative** includes forestry and tree professionals throughout Grey and Bruce Counties. Its objectives include educating municipalities and the public on forest health issues.

- ✓ The **Lake Huron Centre for Coastal Conservation** works with Saugeen Conservation, in providing expertise relating to Lake Huron and shoreline issues. They specialize in research, technical advice, education programs, public outreach, stewardship efforts and much more.

- ✓ **Stewardship Grey Bruce** offers support funding and technical support for landowners in the watershed who are interested in completing habitat enhancement projects focused on focused on water quality improvement.

- ✓ Special attention is provided in this watershed with regard to the **combat and control of the invasive Phragmites australis** plant that has taken over much of the shoreline area. Various groups, as well as the local municipalities have been active in this program. **Enbridge Inc.**, and **Bruce Power** have been instrumental in assisting with funding and manpower.

- ✓ Saugeen Conservation offers over **50 different hands-on conservation education programs** designed to get students outdoors and learning about the natural environment. Thirty different programs are provided by Saugeen Conservation and Bruce Power at the Bruce Nuclear Power Development, (BNPD), complex free of charge to all local schools. In addition, local schools attend both the Bruce Grey Forest Festival and the Grey Bruce Children's Water Festival.

- ✓ **Healthy Lake Huron** is an initiative of local environmental organizations, including Saugeen Conservation. Together they coordinate actions to protect and improve overall water quality along the southeast shores of Lake Huron.

- ✓ **Environmental self assessments** are now available for the rural non-farm landowner with the release of The Rural Landowner Stewardship Guide for the Lake Huron Watershed. This guide provides a framework for landowners to evaluate their property and help determine best management practices.

Recognizing our Important Partners

Appendix B

Species at Risk List – Bruce County

Appendix A – Federal and Provincial Species at Risk, Municipality of Kincardine

Table A.1 – Federal and Provincial Species at Risk with Potential Habitat in Municipality of Kincardine

Type	Species Common Name	Species Scientific Name	Federal Status	Provincial Status	Suitable Habitat in the Study Area	Reported within Study Area
Bird	Bald Eagle	*Haliaeetus leucocephalus*	Not Applicable	Special Concern	No	No
Bird	Bank Swallow	*Riparia riparia*	Threatened	Threatened	Yes	Yes
Bird	Barn Swallow	*Hirundo rustica*	Threatened	Threatened	Yes	Yes
Bird	Black Tern	*Chlidonias niger*	Not Applicable	Special Concern	Yes	Yes
Bird	Bobolink	*Dolichonyx oryzivorus*	Threatened	Threatened	Yes	Yes
Bird	Eastern Wood-pewee	*Contopus virens*	Special Concern	Special Concern	Yes	Yes
Bird	Canada Warbler	*Cardellina Canadensis*	Threatened	Special Concern	Yes	Yes
Bird	Chimney Swift	*Chaetura pelagica*	Threatened	Threatened	No	Yes
Bird	Common Nighthawk	*Chordeiles minor*	Threatened	Special Concern	Yes	Yes
Bird	Eastern Meadowlark	*Sturnella magna*	Threatened	Threatened	Yes	Yes
Bird	Eastern Whip-poor-will	*Caprimulgus vociferus*	Threatened	Threatened	No	Yes
Bird	Grasshopper Sparrow	*Ammodramus savannarum*	Special Concern	Special Concern	Yes	Yes
Bird	Least Bittern	*Ixobrychus exilis*	Threatened	Threatened	Yes	Yes
Bird	Loggerhead Shrike	*Lanius ludovicianus*	Endangered	Endangered	Yes	No

Type	Species Common Name	Species Scientific Name	Federal Status	Provincial Status	Suitable Habitat in the Study Area	Reported within Study Area
Bird	Peregrine Falcon	*Falco peregrines*	Special Concern	Special Concern	Yes	No
Bird	Red-headed Woodpecker	*Melanerpes erythrocephalus*	Threatened	Threatened	Yes	Yes
Bird	Wood Thrush	*Hylocichla mustelina*	Threatened	Special Concern	Yes	Yes
Fish	Shortnose Cisco	*Coregonus reighardi*	Endangered	Endangered	No	No
Reptile and Amphibian	Eastern Ribbonsnake (Great Lakes population)	*Thamnophis sauritius*	Special Concern	Special Concern	Yes	Yes
Reptile and Amphibian	Midland Painted Turtle	*Chrysemys picta marginata*	Special Concern	Not Applicable	Yes	Yes
Reptile and Amphibian	Eastern Milksnake	*Lampropeltis triangulum*	Special Concern	Not Applicable	Yes	Yes
Reptile and Amphibian	Snapping Turtle	*Chelydra serpentina*	Special Concern	Special Concern	Yes	Yes
Insect	Monarch	*Danaus plexippus*	Special Concern	Special Concern	Yes	Yes
Insect	Yellow Banded Bumble Bee	*Bombus terricola*	Special Concern	Special Concern	Yes	Yes
Mammal	Eastern Small-footed Myotis	*Myotis leibii*	Not Applicable	Endangered	Yes	No
Mammal	Little Brown Myotis	*Myotis lucifugus*	Endangered	Endangered	Yes	Yes
Mammal	Northern Myotis	*Myotis septentrionalis*	Endangered	Endangered	Yes	Yes
Mammal	Tri-coloured Bat	*Perimyotis subflavus*	Endangered	Endangered	Yes	No
Plant and Lichen	American Chestnut	*Castanea dentata*	Endangered	Endangered	Yes	Yes
Plant and Lichen	Butternut	*Juglans cinerea*	Endangered	Endangered	Yes	Yes

Type	Species Common Name	Species Scientific Name	Federal Status	Provincial Status	Suitable Habitat in the Study Area	Reported within Study Area
Plant and Lichen	Dwarf Lake Iris	*Iris lacustris*	Special Concern	Special Concern	Yes	Yes
Plant and Lichen	Hill's Thistle	*Cirsium hillii*	Threatened	Threatened	No	No
Plant and Lichen	Hill's Pondweed	*Potamogeton hillii*	Special Concern	Special Concern	No	No
Plant and Lichen	Pitcher's Thistle	*Cirsium pitcheri*	Special Concern	Threatened	Yes	Yes

Appendix C

Kincardine WaterCAD® Modelling Information

Municipality of Kincardine
WaterCAD Modelling for Master Plan Update
Calculations and Notes for Kincardine

Job # :	22128
Date :	October 14, 2022
Revised :	

1.0 Background

The Municipality of Kincardine is completing a water and wastewater Master Plan update process. The water supply component will include a review of servicing existing development and future development for peak hour and maximum day + fire flow demands. The purpose of these notes is to summarize data used to update the WaterCAD model, and the results of that modelling for the community of Kincardine. The model was originally created as part of BMROSS project 16130.

2.0 Analysis & Model Data

2.1 Data

Reference	Item			
22128	Existing avg. day demand		38.1	L/s
		=	3294	m^3/d
	Existing max. day demand		80.5	L/s
		=	6954	m^3/d
	From above, max. day factor		2.11	
22128	Kincardine town pop. (2021)		7728	persons
MECP	Peak hour factors			
	3,001 to 10,000 population		3.00	
	10,001 to 25,000 population		2.85	
	Existing peak hour demand		114.38	L/s
		=	9882	m³/d
DWWP	WTP High Lift			
	Pump rating (HLP1, HLP3)		130	L/s
		@	79	m TDH
	Pump rating (HLP2)		82	L/s
		@	79	m TDH
	Clearwell volume		4120	m^3
77066	Clearwell midpoint		178.7	mASL
	Pump discharge		182.4	mASL
Town info	HLP off (tower level)		39.2	m
		=	247.0	mASL
	HLP on (tower level)		37.2	m
		=	245.0	mASL

DWWP/ 78011/ 19035

Standpipe			
Total volume		3360	m^3
Usable volume		3190	m^3
Diameter		10.5	m
Top operating range		247.00	mASL
Bottom operating range		243.00	mASL
Top of foundation		207.50	mASL
BPS target discharge pressure		360.00	kPA

DWWP/ 78011/ 19035

Standpipe BPS			
Pump rating		44	L/s
	@	14.5	m TDH
		85	L/s
	@	17.5	m TDH
		170	L/s
	@	17.5	m TDH
Floor elevation		207.4	mASL

MECP Guide

Pipe C-factors

Pipe Dia. (mm)	C
150	100
200-250	110
300-600	120
>600	130

MECP Guide

Normal operating pressure range target	350 to 480	kPa
Normal operating pressure minimum	275	kPa
Fire flow system pressure minimum	140	kPa
Maximum allowable system pressure	700	kPa

2.2 Water Demands by Junction

(a) Existing Conditions

Number of junctions - existing model	356	
Average day demand per junction	0.107	L/s
Maximum day demand per junction	0.226	L/s
Peak hour demand per junction	0.321	L/s

See attached map for area junctions. Based on the data above, dividing the average day demand, maximum day demand, and peak hour demands for the system over the total number of existing model junctions would result in per junction demands of approximately 0.11 L/s, 0.23 L/s, and 0.32 L/s, respectively. Based on 2013-2015 data provided by the Municipality, the 20 largest water users connected to the system had average day demands ranging from 0.08 to 0.67 L/s each.

Design fire flow demands will vary from about 50 L/s for residential areas to 150 L/s or greater in ICI areas. Considering the relatively small demand associated with consumption as compared to fire flow, and the fact that there are few customers with significant water demand, the total system demand is distributed evenly over all model junctions.

(b) Future Conditions

85700
47300

Demands for existing development are left unchanged, and the incremental future demand for development areas is applied to the nearest model junctions within or adjacent to the development lands. Demand associated with infill is applied evenly across all junctions.

Development areas, including commitments as well as development areas for which approval is pending, are summarized below. The number of ERUs for each was established based on approved or submitted development plans where known.

Maximum day demand per ERU	1.71	m^3/unit/d
Design water demand for commercial area	28.0	m^3/ha/d
Maximum day factor	2.11	
Peak hour factor	3.00	
Peak hour demand per ERU	2.43	m^3/unit/d

Development Name	Vacant Land Area (ha)	Projected No. of ERUs	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Model Junctions to Apply Demand
Kincardine Infill		365	7.22	10.27	All
West Ridge on the Lake		383	7.58	10.77	J-1450, J-1451, J-1455, J-1460, J-1461, J-1475, J-1480
Brown Subdivision		245	4.85	6.89	J-155
CR Developers		82	1.62	2.31	J-430
Battler Subdivision		30	0.59	0.84	J-1330
Shepherd Subdivision		36	0.71	1.01	J-1335
Golf Links Townhouses		6.8	0.13	0.19	J-1330
Brigadoon		150	2.97	4.22	J-155
Inverhuron - Sundance		60	1.19	1.69	J-1690
OPF Lands		1006	19.91	28.29	J-1360, J-1345, J-1315, J-1220
9 &21 Business Park		500	9.90	14.06	J-805, J-765, J-760, J-800, J-755, J-740, J-750, J-795, J-735, J-745, J-640, J-635
1182 Queen Street		12	0.24	0.34	J-1305
O'Malley (Sutton/Gary Street)		32	0.64	0.91	J-3015
7 Mount Forest Ave.		25	0.49	0.69	J-1315
Concession 2 Industrial Park		292	5.79	8.22	J-1740
869 Kincardine Ave Trailer Park		88	1.73	2.46	J-430
7 Millennium Way		173	3.42	4.87	J-770

denotes commercial land; others are residential

Model Junction	Elevation (mASL)	Existing		Future, Incl. Infill	
		Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
J-5	179.9	0.226	0.321	0.246	0.350
J-10	190.0	0.226	0.321	0.246	0.350
J-15	191.5	0.226	0.321	0.246	0.350
J-20	195.6	0.226	0.321	0.246	0.350
J-25	198.5	0.226	0.321	0.246	0.350
J-30	195.0	0.226	0.321	0.246	0.350
J-35	194.1	0.226	0.321	0.246	0.350
J-40	193.1	0.226	0.321	0.246	0.350
J-45	194.8	0.226	0.321	0.246	0.350
J-50	177.5	0.226	0.321	0.246	0.350
J-55	181.1	0.226	0.321	0.246	0.350
J-60	192.7	0.226	0.321	0.246	0.350
J-65	188.4	0.226	0.321	0.246	0.350
J-70	188.4	0.226	0.321	0.246	0.350
J-75	188.0	0.226	0.321	0.246	0.350
J-80	192.0	0.226	0.321	0.246	0.350
J-85	198.4	0.226	0.321	0.246	0.350
J-90	195.9	0.226	0.321	0.246	0.350
J-95	195.2	0.226	0.321	0.246	0.350
J-100	198.4	0.226	0.321	0.246	0.350
J-105	193.7	0.226	0.321	0.246	0.350
J-110	195.7	0.226	0.321	0.246	0.350
J-115	195.2	0.226	0.321	0.246	0.350
J-120	196.7	0.226	0.321	0.246	0.350
J-125	199.9	0.226	0.321	0.246	0.350
J-130	199.4	0.226	0.321	0.246	0.350
J-135	198.3	0.226	0.321	0.246	0.350
J-140	198.7	0.226	0.321	0.246	0.350
J-145	200.1	0.226	0.321	0.246	0.350
J-150	200.1	0.226	0.321	0.246	0.350
J-155	200.7	0.226	0.321	8.064	8.168
J-160	198.5	0.226	0.321	0.246	0.350
J-165	196.9	0.226	0.321	0.246	0.350
J-170	198.0	0.226	0.321	0.246	0.350
J-175	199.0	0.226	0.321	0.246	0.350
J-180	198.5	0.226	0.321	0.246	0.350
J-185	194.9	0.226	0.321	0.246	0.350
J-190	195.6	0.226	0.321	0.246	0.350
J-195	195.5	0.226	0.321	0.246	0.350
J-200	197.1	0.226	0.321	0.246	0.350
J-205	196.7	0.226	0.321	0.246	0.350
J-210	197.8	0.226	0.321	0.246	0.350
J-215	197.4	0.226	0.321	0.246	0.350
J-220	197.4	0.226	0.321	0.246	0.350
J-225	197.3	0.226	0.321	0.246	0.350
J-230	196.7	0.226	0.321	0.246	0.350
J-235	200.0	0.226	0.321	0.246	0.350
J-240	200.2	0.226	0.321	0.246	0.350
J-245	181.7	0.226	0.321	0.246	0.350
J-250	192.0	0.226	0.321	0.246	0.350
J-255	191.0	0.226	0.321	0.246	0.350

Model Junction	Elevation (mASL)	Existing		Future, Incl. Infill	
		Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
J-260	197.6	0.226	0.321	0.246	0.350
J-265	191.5	0.226	0.321	0.246	0.350
J-270	191.9	0.226	0.321	0.246	0.350
J-275	194.1	0.226	0.321	0.246	0.350
J-280	200.7	0.226	0.321	0.246	0.350
J-285	197.5	0.226	0.321	0.246	0.350
J-290	197.4	0.226	0.321	0.246	0.350
J-295	200.8	0.226	0.321	0.246	0.350
J-300	200.2	0.226	0.321	0.246	0.350
J-305	198.2	0.226	0.321	0.246	0.350
J-310	199.6	0.226	0.321	0.246	0.350
J-315	198.2	0.226	0.321	0.246	0.350
J-320	199.0	0.226	0.321	0.246	0.350
J-325	191.0	0.226	0.321	0.246	0.350
J-330	196.3	0.226	0.321	0.246	0.350
J-335	192.6	0.226	0.321	0.246	0.350
J-340	194.6	0.226	0.321	0.246	0.350
J-345	194.3	0.226	0.321	0.246	0.350
J-350	199.7	0.226	0.321	0.246	0.350
J-355	201.5	0.226	0.321	0.246	0.350
J-360	201.6	0.226	0.321	0.246	0.350
J-365	194.3	0.226	0.321	0.246	0.350
J-370	194.8	0.226	0.321	0.246	0.350
J-375	196.4	0.226	0.321	0.246	0.350
J-380	198.0	0.226	0.321	0.246	0.350
J-385	196.1	0.226	0.321	0.246	0.350
J-390	195.8	0.226	0.321	0.246	0.350
J-395	195.8	0.226	0.321	0.246	0.350
J-400	195.2	0.226	0.321	0.246	0.350
J-405	200.1	0.226	0.321	0.246	0.350
J-410	196.8	0.226	0.321	0.246	0.350
J-415	192.0	0.226	0.321	0.246	0.350
J-420	191.5	0.226	0.321	0.246	0.350
J-425	195.8	0.226	0.321	0.246	0.350
J-430	199.1	0.226	0.321	3.603	3.707
J-435	195.9	0.226	0.321	0.246	0.350
J-440	195.5	0.226	0.321	0.246	0.350
J-445	193.7	0.226	0.321	0.246	0.350
J-450	192.4	0.226	0.321	0.246	0.350
J-455	195.2	0.226	0.321	0.246	0.350
J-460	196.5	0.226	0.321	0.246	0.350
J-465	196.8	0.226	0.321	0.246	0.350
J-470	193.0	0.226	0.321	0.246	0.350
J-475	195.0	0.226	0.321	0.246	0.350
J-480	196.7	0.226	0.321	0.246	0.350
J-485	197.8	0.226	0.321	0.246	0.350
J-490	201.7	0.226	0.321	0.246	0.350
J-495	189.4	0.226	0.321	0.246	0.350
J-500	196.5	0.226	0.321	0.246	0.350
J-505	196.6	0.226	0.321	0.246	0.350
J-510	196.7	0.226	0.321	0.246	0.350

Model Junction	Elevation (mASL)	Existing		Future, Incl. Infill	
		Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
J-515	196.8	0.226	0.321	0.246	0.350
J-520	198.4	0.226	0.321	0.246	0.350
J-525	197.4	0.226	0.321	0.246	0.350
J-530	198.0	0.226	0.321	0.246	0.350
J-535	195.1	0.226	0.321	0.246	0.350
J-540	196.1	0.226	0.321	0.246	0.350
J-545	197.7	0.226	0.321	0.246	0.350
J-550	197.1	0.226	0.321	0.246	0.350
J-555	198.7	0.226	0.321	0.246	0.350
J-560	197.4	0.226	0.321	0.246	0.350
J-565	198.4	0.226	0.321	0.246	0.350
J-570	198.4	0.226	0.321	0.246	0.350
J-575	199.1	0.226	0.321	0.246	0.350
J-580	197.7	0.226	0.321	0.246	0.350
J-585	197.4	0.226	0.321	0.246	0.350
J-590	198.7	0.226	0.321	0.246	0.350
J-595	197.5	0.226	0.321	0.246	0.350
J-600	197.6	0.226	0.321	0.246	0.350
J-605	202.2	0.226	0.321	0.246	0.350
J-610	201.1	0.226	0.321	0.246	0.350
J-615	203.0	0.226	0.321	0.246	0.350
J-620	199.4	0.226	0.321	0.246	0.350
J-625	204.0	0.226	0.321	0.246	0.350
J-630	204.2	0.226	0.321	0.246	0.350
J-635	205.4	0.226	0.321	1.071	1.175
J-640	209.5	0.226	0.321	1.071	1.175
J-645	199.1	0.226	0.321	0.246	0.350
J-650	203.9	0.226	0.321	0.246	0.350
J-655	204.7	0.226	0.321	0.246	0.350
J-660	205.5	0.226	0.321	0.246	0.350
J-665	205.7	0.226	0.321	0.246	0.350
J-670	201.7	0.226	0.321	0.246	0.350
J-675	205.7	0.226	0.321	0.246	0.350
J-680	205.1	0.226	0.321	0.246	0.350
J-685	205.9	0.226	0.321	0.246	0.350
J-690	206.0	0.226	0.321	0.246	0.350
J-695	206.4	0.226	0.321	0.246	0.350
J-700	205.1	0.226	0.321	0.246	0.350
J-705	205.4	0.226	0.321	0.246	0.350
J-710	206.9	0.226	0.321	0.246	0.350
J-715	206.9	0.226	0.321	0.246	0.350
J-720	206.3	0.226	0.321	0.246	0.350
J-725	208.4	0.226	0.321	0.246	0.350
J-730	209.5	0.226	0.321	0.246	0.350
J-735	205.4	0.226	0.321	1.071	1.175
J-740	206.7	0.226	0.321	1.071	1.175
J-745	207.3	0.226	0.321	1.071	1.175
J-750	206.9	0.226	0.321	1.071	1.175
J-755	207.8	0.226	0.321	1.071	1.175
J-760	212.8	0.226	0.321	1.071	1.175
J-765	210.9	0.226	0.321	1.071	1.175

Model Junction	Elevation (mASL)	Existing		Future, Incl. Infill	
		Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
J-770	210.4	0.226	0.321	3.670	3.774
J-775	207.9	0.226	0.321	0.246	0.350
J-780	209.5	0.226	0.321	0.246	0.350
J-785	209.3	0.226	0.321	0.246	0.350
J-790	210.1	0.226	0.321	0.246	0.350
J-795	209.4	0.226	0.321	1.071	1.175
J-800	210.5	0.226	0.321	1.071	1.175
J-805	211.4	0.226	0.321	1.071	1.175
J-810	176.7	0.226	0.321	0.246	0.350
J-815	181.7	0.226	0.321	0.246	0.350
J-820	180.2	0.226	0.321	0.246	0.350
J-825	190.1	0.226	0.321	0.246	0.350
J-830	197.1	0.226	0.321	0.246	0.350
J-835	197.0	0.226	0.321	0.246	0.350
J-840	197.1	0.226	0.321	0.246	0.350
J-845	191.3	0.226	0.321	0.246	0.350
J-846	187.3	0.226	0.321	0.246	0.350
J-850	197.2	0.226	0.321	0.246	0.350
J-855	197.2	0.226	0.321	0.246	0.350
J-860	200.6	0.226	0.321	0.246	0.350
J-865	196.8	0.226	0.321	0.246	0.350
J-870	201.0	0.226	0.321	0.246	0.350
J-875	197.2	0.226	0.321	0.246	0.350
J-880	197.9	0.226	0.321	0.246	0.350
J-885	198.9	0.226	0.321	0.246	0.350
J-890	201.4	0.226	0.321	0.246	0.350
J-895	201.3	0.226	0.321	0.246	0.350
J-900	194.6	0.226	0.321	0.246	0.350
J-905	181.9	0.226	0.321	0.246	0.350
J-910	183.1	0.226	0.321	0.246	0.350
J-915	180.7	0.226	0.321	0.246	0.350
J-920	182.9	0.226	0.321	0.246	0.350
J-925	192.6	0.226	0.321	0.246	0.350
J-930	193.7	0.226	0.321	0.246	0.350
J-935	182.5	0.226	0.321	0.246	0.350
J-940	186.5	0.226	0.321	0.246	0.350
J-945	190.1	0.226	0.321	0.246	0.350
J-950	197.6	0.226	0.321	0.246	0.350
J-955	197.8	0.226	0.321	0.246	0.350
J-960	192.8	0.226	0.321	0.246	0.350
J-965	192.0	0.226	0.321	0.246	0.350
J-970	191.9	0.226	0.321	0.246	0.350
J-975	199.0	0.226	0.321	0.246	0.350
J-980	198.9	0.226	0.321	0.246	0.350
J-985	188.8	0.226	0.321	0.246	0.350
J-990	191.3	0.226	0.321	0.246	0.350
J-995	179.9	0.226	0.321	0.246	0.350
J-1000	181.6	0.226	0.321	0.246	0.350
J-1005	181.8	0.226	0.321	0.246	0.350
J-1010	184.3	0.226	0.321	0.246	0.350
J-1015	184.0	0.226	0.321	0.246	0.350

Model Junction	Elevation (mASL)	Existing		Future, Incl. Infill	
		Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
J-1020	190.4	0.226	0.321	0.246	0.350
J-1025	191.0	0.226	0.321	0.246	0.350
J-1030	192.0	0.226	0.321	0.246	0.350
J-1035	192.3	0.226	0.321	0.246	0.350
J-1040	190.5	0.226	0.321	0.246	0.350
J-1045	192.1	0.226	0.321	0.246	0.350
J-1050	192.1	0.226	0.321	0.246	0.350
J-1055	194.6	0.226	0.321	0.246	0.350
J-1060	195.0	0.226	0.321	0.246	0.350
J-1065	181.6	0.226	0.321	0.246	0.350
J-1070	189.1	0.226	0.321	0.246	0.350
J-1075	189.0	0.226	0.321	0.246	0.350
J-1080	191.3	0.226	0.321	0.246	0.350
J-1085	194.0	0.226	0.321	0.246	0.350
J-1090	195.6	0.226	0.321	0.246	0.350
J-1095	198.2	0.226	0.321	0.246	0.350
J-1110	197.4	0.226	0.321	0.246	0.350
J-1115	196.2	0.226	0.321	0.246	0.350
J-1125	202.1	0.226	0.321	0.246	0.350
J-1130	205.3	0.226	0.321	0.246	0.350
J-1135	200.8	0.226	0.321	0.246	0.350
J-1140	200.5	0.226	0.321	0.246	0.350
J-1145	198.7	0.226	0.321	0.246	0.350
J-1160	198.6	0.226	0.321	0.246	0.350
J-1165	200.8	0.226	0.321	0.246	0.350
J-1170	199.9	0.226	0.321	0.246	0.350
J-1175	205.9	0.226	0.321	0.246	0.350
J-1185	202.6	0.226	0.321	0.246	0.350
J-1195	203.8	0.226	0.321	0.246	0.350
J-1205	201.7	0.226	0.321	0.246	0.350
J-1210	206.0	0.226	0.321	0.246	0.350
J-1215	205.5	0.226	0.321	0.246	0.350
J-1220	208.1	0.226	0.321	5.224	5.328
J-1225	206.7	0.226	0.321	0.246	0.350
J-1230	208.5	0.226	0.321	0.246	0.350
J-1235	207.1	0.226	0.321	0.246	0.350
J-1240	210.6	0.226	0.321	0.246	0.350
J-1245	210.9	0.226	0.321	0.246	0.350
J-1250	211.1	0.226	0.321	0.246	0.350
J-1255	209.5	0.226	0.321	0.246	0.350
J-1260	212.7	0.226	0.321	0.246	0.350
J-1265	213.3	0.226	0.321	0.246	0.350
J-1275	214.3	0.226	0.321	0.246	0.350
J-1280	215.0	0.226	0.321	0.246	0.350
J-1285	198.8	0.226	0.321	0.246	0.350
J-1290	199.4	0.226	0.321	0.246	0.350
J-1295	202.1	0.226	0.321	0.246	0.350
J-1300	202.9	0.226	0.321	0.246	0.350
J-1305	199.0	0.226	0.321	0.484	0.588
J-1310	199.8	0.226	0.321	0.246	0.350
J-1315	207.4	0.226	0.321	5.711	5.815

Model Junction	Elevation (mASL)	Existing		Future, Incl. Infill	
		Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
J-1320	210.0	0.226	0.321	0.246	0.350
J-1325	211.9	0.226	0.321	0.246	0.350
J-1330	202.9	0.226	0.321	0.975	1.078
J-1335	210.9	0.226	0.321	0.959	1.063
J-1340	210.7	0.226	0.321	0.246	0.350
J-1345	210.0	0.226	0.321	5.224	5.328
J-1350	190.8	0.226	0.321	0.246	0.350
J-1355	195.3	0.226	0.321	0.246	0.350
J-1360	201.7	0.226	0.321	5.224	5.328
J-1365	179.0	0.226	0.321	0.246	0.350
J-1370	181.8	0.226	0.321	0.246	0.350
J-1375	187.2	0.226	0.321	0.246	0.350
J-1380	189.4	0.226	0.321	0.246	0.350
J-1385	189.8	0.226	0.321	0.246	0.350
J-1390	189.9	0.226	0.321	0.246	0.350
J-1395	191.3	0.226	0.321	0.246	0.350
J-1400	190.4	0.226	0.321	0.246	0.350
J-1405	188.5	0.226	0.321	0.246	0.350
J-1410	191.7	0.226	0.321	0.246	0.350
J-1415	195.4	0.226	0.321	0.246	0.350
J-1420	195.3	0.226	0.321	0.246	0.350
J-1425	191.7	0.226	0.321	0.246	0.350
J-1430	191.1	0.226	0.321	0.246	0.350
J-1435	192.7	0.226	0.321	0.246	0.350
J-1440	195.5	0.226	0.321	0.246	0.350
J-1445	184.0	0.226	0.321	0.246	0.350
J-1450	192.2	0.226	0.321	1.329	1.433
J-1451	191.6	0.226	0.321	1.329	1.433
J-1455	190.4	0.226	0.321	1.329	1.433
J-1460	197.5	0.226	0.321	1.329	1.433
J-1461	198.6	0.226	0.321	1.329	1.433
J-1465	185.6	0.226	0.321	0.246	0.350
J-1470	189.5	0.226	0.321	0.246	0.350
J-1475	191.2	0.226	0.321	1.329	1.433
J-1480	202.4	0.226	0.321	1.329	1.433
J-1485	201.6	0.226	0.321	0.246	0.350
J-1490	203.3	0.226	0.321	0.246	0.350
J-1495	201.8	0.226	0.321	0.246	0.350
J-1500	199.5	0.226	0.321	0.246	0.350
J-1505	202.4	0.226	0.321	0.246	0.350
J-1510	189.5	0.226	0.321	0.246	0.350
J-1515	190.5	0.226	0.321	0.246	0.350
J-1520	196.9	0.226	0.321	0.246	0.350
J-1525	195.1	0.226	0.321	0.246	0.350
J-1530	185.9	0.226	0.321	0.246	0.350
J-1535	190.9	0.226	0.321	0.246	0.350
J-1540	191.7	0.226	0.321	0.246	0.350
J-1545	193.1	0.226	0.321	0.246	0.350
J-1550	196.3	0.226	0.321	0.246	0.350
J-1555	198.5	0.226	0.321	0.246	0.350
J-1560	188.9	0.226	0.321	0.246	0.350

Model Junction	Elevation (mASL)	Existing		Future, Incl. Infill	
		Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
J-1565	190.2	0.226	0.321	0.246	0.350
J-1570	198.7	0.226	0.321	0.246	0.350
J-1575	182.4	0.226	0.321	0.246	0.350
J-1580	181.7	0.226	0.321	0.246	0.350
J-1585	184.1	0.226	0.321	0.246	0.350
J-1590	201.8	0.226	0.321	0.246	0.350
J-1595	186.6	0.226	0.321	0.246	0.350
J-1600	199.9	0.226	0.321	0.246	0.350
J-1605	183.0	0.226	0.321	0.246	0.350
J-1610	189.9	0.226	0.321	0.246	0.350
J-1615	183.4	0.226	0.321	0.246	0.350
J-1620	183.3	0.226	0.321	0.246	0.350
J-1625	186.6	0.226	0.321	0.246	0.350
J-1630	186.7	0.226	0.321	0.246	0.350
J-1635	180.0	0.226	0.321	0.246	0.350
J-1640	183.7	0.226	0.321	0.246	0.350
J-1645	181.6	0.226	0.321	0.246	0.350
J-1650	182.3	0.226	0.321	0.246	0.350
J-1655	182.0	0.226	0.321	0.246	0.350
J-1660	185.8	0.226	0.321	0.246	0.350
J-1665	185.0	0.226	0.321	0.246	0.350
J-1670	182.0	0.226	0.321	0.246	0.350
J-1675	180.5	0.226	0.321	0.246	0.350
J-1680	180.5	0.226	0.321	0.246	0.350
J-1685	186.6	0.226	0.321	0.246	0.350
J-1690	184.4	0.226	0.321	1.434	1.538
J-1695	185.2	0.226	0.321	0.246	0.350
J-1700	181.6	0.226	0.321	0.246	0.350
J-1705	183.9	0.226	0.321	0.246	0.350
J-1710	184.2	0.226	0.321	0.246	0.350
J-1715	187.2	0.226	0.321	0.246	0.350
J-1720	187.0	0.226	0.321	0.246	0.350
J-1725	189.9	0.226	0.321	0.246	0.350
J-1730	195.6	0.226	0.321	0.246	0.350
J-1735	189.3	0.226	0.321	0.246	0.350
J-1740	188.5	0.226	0.321	6.033	6.137
J-3000	214.1	0.226	0.321	0.246	0.350
J-3005	212.5	0.226	0.321	0.246	0.350
J-3010	209.7	0.226	0.321	0.246	0.350
J-3015	208.9	0.226	0.321	0.888	0.991
J-3020	205.6	0.226	0.321	0.246	0.350
J-3025	206.1	0.226	0.321	0.246	0.350
J-3030	205.1	0.226	0.321	0.246	0.350
J-3035	203.4	0.226	0.321	0.246	0.350
J-3040	200.7	0.226	0.321	0.246	0.350
J-3045	201.8	0.226	0.321	0.246	0.350
J-3050	202.1	0.226	0.321	0.246	0.350
J-3055	199.5	0.226	0.321	0.246	0.350
J-3060	198.5	0.226	0.321	0.246	0.350
J-3065	198.8	0.226	0.321	0.246	0.350
Minimum	176.7	0.226	0.321	0.246	0.350
Maximum	215.0	0.226	0.321	8.064	8.168
Total		80.5	114.4	149.5	186.4

3.0 Model Results - 2023 Demands

3.1 Existing Conditions

For peak hour analysis, assume no pumps operating and standpipe water level at nominal operating level of 248.0 mASL. For fire flow analysis, use three scenarios: standpipe nominal water level of 248.0 mASL with no HLPs, standpipe low water level of 247.0 mASL with HLP3 on, and standpipe low water level of 247.0 mASL with both HLP1 and HLP3 on.

Available fire flow is below 50 L/s at various areas, specifically:

- At J-5, the southwesternmost junction in the model, on Goderich St.

- At J-435, at the dead-end of a cul-de-sac on Hunter St.

- At J-790, at the dead end of a cul-de-sac on Goldie Cr.

- Along Rowan Ave, Edgemere Ave, and Centre Ave, and along Concession Rd 7 west of Hwy. 23 (in the vicinity of Stoney Island Conservation Area)

- Much of Inverhuron

Junction	P at $Q_{PEAK-HOUR}$ (kPa)	Available Fire Flow at 140 kPa (L/s)		
		Standpipe 248.0 mASL, HLPs Off	Standpipe 247.0 mASL, HLP3 On	Standpipe 247.0 mASL, HLP1 & HLP3 On
J-5	647	45	45	47
J-10	548	89	93	97
J-15	533	90	95	99
J-20	493	83	87	91
J-25	465	73	76	80
J-30	499	85	90	94
J-35	507	83	87	90
J-40	518	99	105	109
J-45	501	76	79	82
J-50	670	59	61	63
J-55	635	109	114	117
J-60	522	100	106	111
J-65	563	100	106	110
J-70	564	103	110	114
J-75	567	105	111	116
J-80	528	101	108	112
J-85	467	138	149	155
J-90	491	123	131	136
J-95	499	93	97	100
J-100	467	193	214	224
J-105	513	193	216	227
J-110	493	128	136	141
J-115	498	190	212	223
J-120	484	186	207	217
J-125	452	76	79	83
J-130	457	175	193	202
J-135	468	181	201	211
J-140	464	133	142	148
J-145	450	93	98	102

Junction	P at $Q_{PEAK-HOUR}$ (kPa)	Available Fire Flow at 140 kPa (L/s)		
		Standpipe 248.0 mASL, HLPs Off	Standpipe 247.0 mASL, HLP3 On	Standpipe 247.0 mASL, HLP1 & HLP3 On
J-150	450	168	185	194
J-155	444	164	180	188
J-160	466	127	136	141
J-165	482	204	227	238
J-170	471	147	159	165
J-175	461	104	110	114
J-180	466	104	109	114
J-185	501	147	159	165
J-190	495	118	125	130
J-195	495	168	185	192
J-200	480	263	312	337
J-205	484	185	205	214
J-210	473	184	204	213
J-215	477	184	203	212
J-220	477	184	202	211
J-225	479	233	263	278
J-230	485	269	311	333
J-235	453	271	314	338
J-240	451	135	144	150
J-245	630	116	121	124
J-250	529	132	140	145
J-255	539	84	88	91
J-260	475	311	432	495
J-265	535	307	443	500
J-270	530	307	453	500
J-275	509	302	441	500
J-280	445	218	250	266
J-285	476	220	250	264
J-290	477	310	440	500
J-295	443	221	258	274
J-300	450	67	69	72
J-305	470	222	250	263
J-310	457	289	337	364
J-315	471	293	344	372
J-320	461	92	96	100
J-325	539	299	457	500
J-330	488	307	448	500
J-335	524	305	473	500
J-340	507	67	69	71
J-345	508	303	500	500
J-350	456	99	105	109
J-355	439	192	217	229
J-360	438	319	391	433
J-365	508	203	225	237
J-370	503	71	74	76
J-375	487	72	75	77
J-380	472	184	202	211
J-385	490	66	68	70
J-390	493	90	94	97
J-395	493	86	89	92
J-400	499	77	80	83

Junction	P at $Q_{PEAK-HOUR}$ (kPa)	Available Fire Flow at 140 kPa (L/s)		
		Standpipe 248.0 mASL, HLPs Off	Standpipe 247.0 mASL, HLP3 On	Standpipe 247.0 mASL, HLP1 & HLP3 On
J-405	451	102	107	111
J-410	485	143	153	158
J-415	530	73	75	78
J-420	535	66	68	70
J-425	493	68	71	73
J-430	461	177	194	202
J-435	497	44	44	45
J-440	498	343	415	452
J-445	517	196	212	221
J-450	529	206	222	230
J-455	502	85	88	90
J-460	489	92	96	98
J-465	487	369	437	478
J-470	524	201	218	227
J-475	504	218	238	250
J-480	488	248	276	291
J-485	475	338	420	469
J-490	435	306	432	500
J-495	559	364	459	500
J-500	490	381	452	495
J-505	489	108	112	115
J-510	488	130	136	140
J-515	489	101	104	106
J-520	473	90	93	94
J-525	482	400	500	500
J-530	477	418	500	500
J-535	503	381	487	500
J-540	494	114	119	121
J-545	479	394	500	500
J-550	484	190	204	211
J-555	469	165	176	180
J-560	482	98	101	103
J-565	471	75	78	80
J-570	471	73	75	77
J-575	464	69	70	72
J-580	479	407	500	500
J-585	482	407	500	500
J-590	471	415	500	500
J-595	482	243	262	273
J-600	481	226	243	253
J-605	436	165	175	179
J-610	446	101	105	107
J-615	429	115	120	122
J-620	463	422	500	500
J-625	418	130	137	140
J-630	417	376	443	487
J-635	407	133	139	142
J-640	367	88	91	93
J-645	466	95	98	99
J-650	422	100	102	103
J-655	413	130	134	136

Junction	P at $Q_{PEAK-HOUR}$ (kPa)	Available Fire Flow at 140 kPa (L/s)		
		Standpipe 248.0 mASL, HLPs Off	Standpipe 247.0 mASL, HLP3 On	Standpipe 247.0 mASL, HLP1 & HLP3 On
J-660	408	157	162	165
J-665	406	153	158	160
J-670	445	142	146	147
J-675	406	194	203	208
J-680	412	114	116	118
J-685	405	100	101	102
J-690	403	180	186	190
J-695	401	179	184	187
J-700	409	440	500	500
J-705	407	456	500	500
J-710	397	500	500	500
J-715	396	500	500	500
J-720	400	465	500	500
J-725	380	142	146	148
J-730	369	98	100	101
J-735	406	205	222	230
J-740	394	355	431	477
J-745	388	158	168	173
J-750	392	409	500	500
J-755	383	330	395	433
J-760	334	253	289	307
J-765	353	104	109	111
J-770	358	269	307	327
J-775	384	143	148	150
J-780	369	101	103	104
J-785	371	71	72	73
J-790	363	49	49	50
J-795	367	349	421	459
J-800	356	307	360	390
J-805	347	249	280	296
J-810	679	112	118	121
J-815	631	94	98	101
J-820	645	295	493	500
J-825	549	291	484	500
J-830	480	302	500	500
J-835	481	297	494	500
J-840	480	296	492	500
J-845	537	288	476	500
J-846	576	286	474	500
J-850	479	288	478	500
J-855	479	293	485	500
J-860	446	197	229	243
J-865	485	144	156	160
J-870	442	232	278	302
J-875	481	194	217	228
J-880	472	289	475	500
J-885	463	290	477	500
J-890	438	294	485	500
J-895	439	301	465	500
J-900	507	332	500	500
J-905	628	285	475	500

Junction	P at $Q_{PEAK-HOUR}$ (kPa)	Available Fire Flow at 140 kPa (L/s)		
		Standpipe 248.0 mASL, HLPs Off	Standpipe 247.0 mASL, HLP3 On	Standpipe 247.0 mASL, HLP1 & HLP3 On
J-910	617	285	473	500
J-915	641	285	477	500
J-920	618	283	467	500
J-925	524	287	472	500
J-930	513	287	472	500
J-935	622	281	456	500
J-940	584	281	454	500
J-945	548	281	453	500
J-950	475	279	439	500
J-955	473	291	462	500
J-960	521	282	455	500
J-965	530	273	402	458
J-970	530	271	395	448
J-975	461	265	403	500
J-980	461	250	365	452
J-985	561	97	102	106
J-990	536	210	242	256
J-995	647	140	151	155
J-1000	631	264	322	348
J-1005	629	258	303	325
J-1010	604	210	237	249
J-1015	607	203	228	239
J-1020	544	209	239	252
J-1025	539	197	224	236
J-1030	530	261	393	457
J-1035	526	256	337	372
J-1040	543	58	60	63
J-1045	528	77	81	84
J-1050	528	71	74	77
J-1055	503	146	160	166
J-1060	499	97	104	108
J-1065	630	235	270	287
J-1070	554	199	242	256
J-1075	555	197	224	235
J-1080	533	195	233	246
J-1085	514	100	104	106
J-1090	498	341	500	500
J-1095	471	223	255	271
J-1110	480	332	481	500
J-1115	491	167	182	188
J-1125	433	135	146	150
J-1130	408	59	60	62
J-1135	445	306	396	451
J-1140	449	160	176	183
J-1145	465	268	331	368
J-1160	466	247	298	325
J-1165	443	170	193	202
J-1170	452	215	252	269
J-1175	394	215	260	283
J-1185	428	125	135	140
J-1195	417	247	294	319

Junction	P at $Q_{PEAK-HOUR}$ (kPa)	Available Fire Flow at 140 kPa (L/s)		
		Standpipe 248.0 mASL, HLPs Off	Standpipe 247.0 mASL, HLP3 On	Standpipe 247.0 mASL, HLP1 & HLP3 On
J-1205	436	243	287	310
J-1210	393	206	246	266
J-1215	397	134	149	157
J-1220	372	83	89	94
J-1225	404	500	500	500
J-1230	372	55	57	59
J-1235	385	62	64	66
J-1240	351	258	326	365
J-1245	348	121	132	137
J-1250	346	257	317	353
J-1255	365	257	320	352
J-1260	331	184	213	227
J-1265	325	150	168	177
J-1275	316	235	288	318
J-1280	309	229	279	308
J-1285	463	236	336	406
J-1290	455	220	304	358
J-1295	430	167	190	200
J-1300	423	112	122	127
J-1305	458	184	240	269
J-1310	450	182	236	264
J-1315	376	76	81	87
J-1320	350	114	132	140
J-1325	332	96	108	116
J-1330	419	188	246	276
J-1335	342	86	95	101
J-1340	344	93	104	111
J-1345	351	72	78	84
J-1350	537	158	174	181
J-1355	493	113	122	127
J-1360	430	185	222	239
J-1365	654	206	228	238
J-1370	625	87	91	94
J-1375	571	94	99	102
J-1380	551	190	214	224
J-1385	547	190	214	225
J-1390	546	193	224	236
J-1395	532	192	223	235
J-1400	540	147	161	166
J-1405	558	119	128	132
J-1410	527	138	151	156
J-1415	492	190	221	234
J-1420	492	120	131	136
J-1425	528	127	137	142
J-1430	532	147	161	167
J-1435	518	73	76	80
J-1440	491	71	74	78
J-1445	602	73	75	78
J-1450	521	158	185	193
J-1451	527	155	180	190
J-1455	539	149	172	181

Junction	P at $Q_{PEAK-HOUR}$ (kPa)	Available Fire Flow at 140 kPa (L/s)		
		Standpipe 248.0 mASL, HLPs Off	Standpipe 247.0 mASL, HLP3 On	Standpipe 247.0 mASL, HLP1 & HLP3 On
J-1460	470	148	170	179
J-1461	459	155	180	191
J-1465	586	61	63	66
J-1470	546	135	153	161
J-1475	531	138	158	166
J-1480	421	136	155	163
J-1485	428	133	150	158
J-1490	411	129	146	153
J-1495	425	122	136	143
J-1500	448	119	133	139
J-1505	419	112	124	131
J-1510	544	63	65	68
J-1515	534	65	67	71
J-1520	472	104	114	120
J-1525	489	100	110	115
J-1530	578	39	40	42
J-1535	530	41	42	45
J-1540	521	57	59	62
J-1545	508	83	88	92
J-1550	477	94	102	108
J-1555	455	91	98	104
J-1560	548	47	49	51
J-1565	536	53	55	58
J-1570	452	84	90	95
J-1575	610	36	36	38
J-1580	617	39	40	42
J-1585	594	39	40	43
J-1590	421	78	83	88
J-1595	568	75	80	85
J-1600	439	75	80	85
J-1605	604	75	80	85
J-1610	536	64	66	70
J-1615	599	73	77	82
J-1620	600	73	77	81
J-1625	568	73	77	81
J-1630	567	73	77	81
J-1635	632	72	75	80
J-1640	596	69	72	76
J-1645	617	69	72	77
J-1650	610	69	72	77
J-1655	612	56	57	60
J-1660	575	56	57	60
J-1665	583	67	70	75
J-1670	612	63	66	70
J-1675	626	59	62	66
J-1680	626	58	60	64
J-1685	567	61	64	68
J-1690	588	55	57	61
J-1695	580	53	55	59
J-1700	615	49	51	53
J-1705	593	52	54	58

Junction	P at $Q_{PEAK-HOUR}$ (kPa)	Available Fire Flow at 140 kPa (L/s)		
		Standpipe 248.0 mASL, HLPs Off	Standpipe 247.0 mASL, HLP3 On	Standpipe 247.0 mASL, HLP1 & HLP3 On
J-1710	590	45	47	49
J-1715	560	52	54	58
J-1720	563	51	53	57
J-1725	535	50	52	56
J-1730	479	41	42	45
J-1735	540	48	50	54
J-1740	547	49	51	55
J-3000	317	238	293	325
J-3005	333	244	304	339
J-3010	360	251	315	354
J-3015	367	258	327	369
J-3020	399	270	348	397
J-3025	395	282	370	428
J-3030	405	292	389	455
J-3035	421	302	409	484
J-3040	447	311	430	500
J-3045	437	315	440	500
J-3050	434	321	454	500
J-3055	460	325	463	500
J-3060	469	328	470	500
J-3065	466	330	477	500
Min	309	36	36	38
Max	679	500	500	500

Notes:

denotes operating pressure less than 275 kPa

denotes operating pressure above 275 kPa but less than 350 kPa

denotes operating pressure greater than 480 kPa

denotes fire flow of less than 50 L/s at 140 kPa minimum system pressure

4.0 Model Results - 2043 Demands

4.1 Existing Watermain Conditions

Initial trial for 2043 demand conditions is performed with existing watermain installations remaining at existing diameters.

Based on the results summarized below, under future peak hour demand, pressures at all junctions are acceptable. Pressures are lowest near the northeast boundary, specifically in the following areas:

- Along Sutton St. east of Gary St., along North St., and along Knights Ct.

- Along Millennium Way and Durham St. east of Hwy. 21, due to the large demand associated with the 9 & 21 Business Park and 7 Millennium Way, and the dead-ends modelled at J-760, J-765 and J-805

Available fire flow is acceptable at the above locations, but is below 50 L/s at various other areas, specifically:

- At J-5, the southwesternmost junction in the model, on Goderich St.

- At J-435, at the dead-end of a cul-de-sac on Hunter St.

- At J-790, at the dead end of a cul-de-sac on Goldie Cr.

- Along Rowan Ave, Edgemere Ave, and Centre Ave, and along Concession Rd 7 west of Hwy. 23 (in the vicinity of Stoney Island Conservation Area)

- Much of Inverhuron

Junction	P at $Q_{PEAK-HOUR}$ (kPa)	Available Fire Flow at 140 kPa (L/s)		
		Standpipe 248.0 mASL, HLPs Off	Standpipe 247.0 mASL, HLP3 On	Standpipe 247.0 mASL, HLP1 & 3 On
J-5	619	43	45	46
J-10	520	83	91	94
J-15	506	84	92	96
J-20	466	78	85	89
J-25	437	69	75	78
J-30	471	80	87	91
J-35	480	79	85	88
J-40	490	92	102	106
J-45	473	71	77	80
J-50	642	57	60	61
J-55	607	104	112	115
J-60	494	93	104	108
J-65	536	93	103	107
J-70	537	96	107	111
J-75	540	97	108	113
J-80	501	94	105	109
J-85	439	127	144	151
J-90	464	114	128	133
J-95	471	87	94	97
J-100	439	171	200	213
J-105	485	169	199	213
J-110	466	119	131	136

Junction	P at $Q_{PEAK-HOUR}$ (kPa)	Available Fire Flow at 140 kPa (L/s)		
		Standpipe 248.0 mASL, HLPs Off	Standpipe 247.0 mASL, HLP3 On	Standpipe 247.0 mASL, HLP1 & 3 On
J-115	471	167	196	209
J-120	456	164	191	204
J-125	424	71	76	79
J-130	429	154	179	190
J-135	440	160	186	198
J-140	436	121	135	142
J-145	422	86	94	98
J-150	422	149	172	182
J-155	416	145	167	177
J-160	438	116	129	135
J-165	455	183	212	226
J-170	444	134	151	158
J-175	433	96	105	109
J-180	438	96	105	109
J-185	473	137	154	161
J-190	467	110	121	126
J-195	467	155	178	188
J-200	453	235	294	325
J-205	456	170	196	207
J-210	446	168	195	206
J-215	450	169	194	205
J-220	451	169	193	204
J-225	453	211	248	267
J-230	459	239	289	316
J-235	427	241	292	320
J-240	426	125	139	146
J-245	602	110	119	122
J-250	502	123	137	142
J-255	512	80	86	89
J-260	448	240	397	470
J-265	507	237	414	480
J-270	503	237	420	493
J-275	482	234	412	484
J-280	418	196	237	257
J-285	449	199	237	255
J-290	450	239	403	480
J-295	417	199	244	265
J-300	423	63	68	71
J-305	444	202	237	254
J-310	432	256	314	346
J-315	447	260	320	353
J-320	435	86	94	97
J-325	512	232	428	500
J-330	461	237	416	492
J-335	497	236	442	500
J-340	484	65	69	70
J-345	481	234	437	500
J-350	432	94	103	107
J-355	415	176	209	224
J-360	415	267	368	417
J-365	482	183	212	226
J-370	477	68	72	74
J-375	461	68	73	75

Junction	P at $Q_{PEAK-HOUR}$ (kPa)	Available Fire Flow at 140 kPa (L/s)		
		Standpipe 248.0 mASL, HLPs Off	Standpipe 247.0 mASL, HLP3 On	Standpipe 247.0 mASL, HLP1 & 3 On
J-380	446	166	190	202
J-385	464	62	66	68
J-390	467	84	91	94
J-395	467	81	87	89
J-400	473	73	78	80
J-405	427	95	104	108
J-410	460	134	148	154
J-415	504	70	74	76
J-420	509	63	67	68
J-425	467	65	69	71
J-430	435	160	183	193
J-435	479	42	44	44
J-440	476	294	383	432
J-445	495	184	206	217
J-450	508	193	215	226
J-455	480	82	87	89
J-460	468	88	94	97
J-465	466	302	410	456
J-470	503	187	211	223
J-475	482	203	231	244
J-480	467	230	266	284
J-485	453	272	393	450
J-490	409	237	400	481
J-495	537	280	428	496
J-500	469	305	424	472
J-505	468	102	110	113
J-510	468	123	133	138
J-515	471	97	103	105
J-520	455	87	91	93
J-525	463	313	500	500
J-530	458	326	500	500
J-535	482	295	457	500
J-540	473	108	117	120
J-545	460	307	500	500
J-550	464	178	198	208
J-555	450	156	171	179
J-560	463	93	99	101
J-565	450	72	77	78
J-570	450	70	74	76
J-575	443	66	70	71
J-580	460	318	500	500
J-585	463	318	500	500
J-590	452	325	500	500
J-595	464	229	254	268
J-600	463	212	236	249
J-605	418	155	171	178
J-610	428	97	103	105
J-615	410	109	118	121
J-620	444	329	497	500
J-625	400	123	134	138
J-630	399	337	415	464
J-635	390	124	134	138
J-640	350	82	88	90

Junction	P at $Q_{PEAK-HOUR}$ (kPa)	Available Fire Flow at 140 kPa (L/s)		
		Standpipe 248.0 mASL, HLPs Off	Standpipe 247.0 mASL, HLP3 On	Standpipe 247.0 mASL, HLP1 & 3 On
J-645	448	91	96	98
J-650	408	96	100	102
J-655	399	125	132	135
J-660	395	151	160	164
J-665	394	147	155	159
J-670	432	137	144	147
J-675	394	185	199	205
J-680	399	110	115	117
J-685	395	97	100	101
J-690	391	173	183	188
J-695	390	172	181	186
J-700	393	352	500	500
J-705	392	370	500	500
J-710	390	500	500	500
J-715	386	452	500	500
J-720	387	383	500	500
J-725	369	136	144	147
J-730	357	94	98	100
J-735	390	185	210	222
J-740	377	306	393	447
J-745	371	145	161	167
J-750	377	335	465	500
J-755	366	286	362	408
J-760	317	225	270	294
J-765	335	97	105	108
J-770	341	238	286	311
J-775	373	137	145	149
J-780	357	97	101	103
J-785	360	69	71	72
J-790	352	48	49	50
J-795	351	289	392	439
J-800	339	258	336	374
J-805	330	222	262	283
J-810	652	108	117	120
J-815	603	90	97	100
J-820	618	229	423	500
J-825	521	226	416	500
J-830	453	234	435	500
J-835	454	230	424	500
J-840	453	230	422	500
J-845	510	223	410	500
J-846	549	221	408	500
J-850	452	224	412	500
J-855	452	228	417	500
J-860	420	179	219	239
J-865	461	135	152	159
J-870	416	209	264	294
J-875	457	180	210	225
J-880	445	225	408	500
J-885	436	226	409	500
J-890	411	228	416	500
J-895	413	234	426	500
J-900	484	258	459	500

Junction	P at $Q_{PEAK-HOUR}$ (kPa)	Available Fire Flow at 140 kPa (L/s)		
		Standpipe 248.0 mASL, HLPs Off	Standpipe 247.0 mASL, HLP3 On	Standpipe 247.0 mASL, HLP1 & 3 On
J-905	601	220	406	500
J-910	590	221	406	500
J-915	613	220	408	500
J-920	591	218	396	500
J-925	497	222	406	500
J-930	486	223	406	500
J-935	595	215	384	500
J-940	556	216	384	500
J-945	521	216	383	500
J-950	448	217	374	500
J-955	446	226	396	500
J-960	494	218	388	500
J-965	501	210	360	437
J-970	502	208	355	427
J-975	433	205	342	453
J-980	432	193	310	398
J-985	531	92	100	104
J-990	507	193	231	251
J-995	618	133	147	152
J-1000	601	197	306	337
J-1005	599	192	287	314
J-1010	574	192	227	243
J-1015	576	187	218	233
J-1020	515	191	228	246
J-1025	509	180	214	230
J-1030	500	199	331	432
J-1035	497	195	314	354
J-1040	513	55	59	61
J-1045	498	73	79	82
J-1050	498	67	72	75
J-1055	472	133	153	162
J-1060	468	91	101	105
J-1065	600	185	256	278
J-1070	516	148	212	237
J-1075	516	147	203	218
J-1080	495	146	209	227
J-1085	491	95	103	105
J-1090	476	266	463	500
J-1095	446	205	244	265
J-1110	457	260	426	500
J-1115	469	156	177	186
J-1125	411	125	142	149
J-1130	392	57	60	61
J-1135	419	236	368	429
J-1140	425	148	170	181
J-1145	437	217	309	352
J-1160	438	212	279	312
J-1165	413	151	181	195
J-1170	425	192	237	260
J-1175	366	187	240	269
J-1185	405	116	132	138
J-1195	393	221	276	307
J-1205	412	218	270	299

Junction	P at $Q_{PEAK-HOUR}$ (kPa)	Available Fire Flow at 140 kPa (L/s)		
		Standpipe 248.0 mASL, HLPs Off	Standpipe 247.0 mASL, HLP3 On	Standpipe 247.0 mASL, HLP1 & 3 On
J-1210	365	179	228	253
J-1215	367	116	139	148
J-1220	341	71	81	86
J-1225	404	500	500	500
J-1230	350	52	56	57
J-1235	363	58	63	65
J-1240	329	219	299	347
J-1245	327	111	127	134
J-1250	324	219	294	337
J-1255	346	217	294	339
J-1260	310	162	201	221
J-1265	303	133	161	172
J-1275	295	202	266	304
J-1280	289	197	259	295
J-1285	432	183	285	357
J-1290	423	169	257	314
J-1295	399	139	176	191
J-1300	392	100	115	121
J-1305	422	139	198	231
J-1310	414	137	195	227
J-1315	338	62	72	76
J-1320	313	90	114	123
J-1325	295	78	96	103
J-1330	381	141	203	237
J-1335	305	69	83	89
J-1340	306	75	90	97
J-1345	312	58	68	73
J-1350	498	139	160	169
J-1355	453	101	114	119
J-1360	390	142	187	207
J-1365	618	160	215	227
J-1370	585	81	87	90
J-1375	530	85	93	96
J-1380	511	146	195	208
J-1385	507	145	194	208
J-1390	505	145	193	216
J-1395	491	144	193	215
J-1400	499	129	147	154
J-1405	517	107	119	124
J-1410	485	121	138	145
J-1415	452	143	191	211
J-1420	452	106	121	126
J-1425	488	112	127	133
J-1430	490	127	145	153
J-1435	478	67	72	75
J-1440	451	64	70	73
J-1445	559	67	72	74
J-1450	478	123	154	168
J-1451	484	121	150	164
J-1455	495	116	143	155
J-1460	426	116	143	155
J-1461	416	122	152	165
J-1465	542	56	60	62

Junction	P at $Q_{PEAK-HOUR}$ (kPa)	Available Fire Flow at 140 kPa (L/s)		
		Standpipe 248.0 mASL, HLPs Off	Standpipe 247.0 mASL, HLP3 On	Standpipe 247.0 mASL, HLP1 & 3 On
J-1470	501	106	129	138
J-1475	486	109	133	143
J-1480	376	107	130	140
J-1485	383	105	127	136
J-1490	366	102	123	132
J-1495	379	97	115	123
J-1500	401	95	112	120
J-1505	372	89	105	112
J-1510	496	56	60	63
J-1515	485	57	62	64
J-1520	424	82	96	102
J-1525	440	79	92	98
J-1530	527	36	38	39
J-1535	481	37	40	41
J-1540	470	50	54	57
J-1545	457	71	78	82
J-1550	427	74	86	91
J-1555	404	71	83	88
J-1560	498	42	45	47
J-1565	486	47	51	53
J-1570	400	66	76	80
J-1575	557	33	34	35
J-1580	564	36	38	39
J-1585	541	36	38	39
J-1590	368	61	70	74
J-1595	513	60	67	71
J-1600	385	60	67	71
J-1605	548	60	67	71
J-1610	479	54	59	61
J-1615	543	58	65	68
J-1620	544	58	64	68
J-1625	512	58	65	68
J-1630	510	58	65	68
J-1635	576	57	63	66
J-1640	539	54	60	64
J-1645	559	55	61	64
J-1650	552	55	61	64
J-1655	555	49	52	54
J-1660	517	48	51	53
J-1665	525	53	59	62
J-1670	553	50	55	58
J-1675	566	47	51	54
J-1680	565	45	50	52
J-1685	508	48	53	56
J-1690	526	43	47	50
J-1695	517	41	45	48
J-1700	552	41	45	46
J-1705	530	41	45	47
J-1710	527	39	41	43
J-1715	497	40	44	47
J-1720	499	40	43	46
J-1725	471	39	43	45
J-1730	415	33	35	37

Junction	P at $Q_{PEAK-HOUR}$ (kPa)	Available Fire Flow at 140 kPa (L/s)		
		Standpipe 248.0 mASL, HLPs Off	Standpipe 247.0 mASL, HLP3 On	Standpipe 247.0 mASL, HLP1 & 3 On
J-1735	476	38	41	44
J-1740	484	38	42	44
J-3000	296	204	271	310
J-3005	311	209	280	323
J-3010	338	214	289	335
J-3015	345	219	299	349
J-3020	377	228	317	374
J-3025	372	237	336	402
J-3030	382	245	352	426
J-3035	398	251	368	451
J-3040	425	257	384	478
J-3045	414	257	393	491
J-3050	411	258	404	500
J-3055	437	259	411	500
J-3060	447	259	417	500
J-3065	444	260	423	500
Min	289	33	34	35
Max	652	500	500	500

Notes:

denotes operating pressure less than 275 kPa

denotes operating pressure above 275 kPa but less than 350 kPa

denotes operating pressure greater than 480 kPa

denotes fire flow of less than 50 L/s at 140 kPa minimum system pressure

Appendix D

Tiverton WaterCAD® Modelling Information

Municipality of Kincardine
WaterCAD Modelling for Master Plan
Calculations and Notes for Tiverton

Job # :	22128
Date :	November 21, 2022
Revised :	

1.0 Background

The Municipality of Kincardine is completing a water and wastewater Master Plan update process. The water supply component will include a review of servicing existing development and future development for peak hour and maximum day + fire flow demands. The purpose of these notes is to summarize data used to update the WaterCAD model, and the results of that modelling for the community of Tiverton. The model was originally created as part of BMROSS project 16130.

2.0 Analysis & Model Data

2.1 Data

Reference	Item			
22128	Existing avg. day demand		2.6	L/s
		=	222	m^3/d
	Existing max. day demand		7.1	L/s
		=	616	m^3/d
22128	Tiverton town pop. (2021)		717	persons
22128	Min Tiverton town pop. (2043)		811	persons
22128	Max Tiverton town pop. (2043)		942	persons
MECP	Peak hour factor - ex. pop.		4.13	
MECP	Peak hour factor - fut. pop.		4.13	
	Ex. peak hour estimate		10.60	L/s
DWWP	Dent Well No. 2 Pump rating		4.6	L/s
		@	50.6	m TDH
	Briar Hill Well No. 1 Pump		6.1	L/s
		@	50.6	m TDH
	Briar Hill Well No. 2 Pump		8.3	L/s
		@	50.6	m TDH
Town info	Pumps off (tower level)		279.2	mASL
	Pumps on (tower level)		278.2	mASL
DWWP/	Standpipe			
78071	Total volume		1500	m^3
	Usable volume		350	m^3
	Diameter		8	m
	HWL		279.20	mASL
	Grade at base		244.30	mASL

DWWP/ 78071/ 19036	Standpipe BPS			
	Pump rating		18	L/s
		@	13	m TDH
			38	L/s
		@	13.5	m TDH
			67	L/s
		@	19.8	m TDH
	Floor elevation			mASL

MOE Guide — Pipe C-factors

Pipe Dia. (mm)	C
150	100
200-250	110
300-600	120
>600	130

MOE Guide	Normal operating pressure range target	350 to 480	kPa
MOE Guide	Normal operating pressure minimum	275	kPa
MOE Guide	Fire flow system pressure minimum	140	kPa
MOE Guide	Maximum allowable system pressure	700	kPa

2.2 Water Demands by Junction

(a) Existing Conditions

Number of junctions - existing model	57	
Average day demand per junction	0.045	L/s
Max. day demand per junction	0.125	L/s
Peak hour demand per junction	0.186	L/s

See attached map for area junctions.

Design fire flow demands will vary from about 50 L/s for residential areas to 150 L/s or greater in ICI areas. Considering the relatively small demand associated with consumption as compared to fire flow, and the fact that there are few customers with significant water demand, the total system demand is distributed evenly over all model junctions.

(b) Future Conditions

Demands for existing development are left unchanged, and the incremental future demand for development areas is applied to the nearest model junctions within or adjacent to the development lands.

With reference to 22128 Maximum Day Water Demand Projections Memo (October 28, 2022)

- Development areas are taken from Table 2C
- Demand is applied based on number of ERUs, regardless of type of development.

Average day demand per unit		0.60	m^3/ERU/d
	=	0.007	L/ERU/s
Maximum day demand per unit		1.66	m^3/ERU/d
	=	0.019	L/ERU/s
Peak hour demand per unit		2.5	m^3/ERU/d
	=	0.028	L/ERU/s

Development Name	Projected No. of ERUs	Average Day Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Model Junction to Apply Demand
Conquergood	109	0.75	2.09	3.10	J-5, J-25, J-35, J-60
Pine Tree Campground	59	0.41	1.13	1.68	J-85
Kaydan Drive	14	0.10	0.27	0.40	J-75
Maple Street	14	0.10	0.27	0.40	J-190
Rae Street (Karn Dev.)	25	0.17	0.48	0.71	J-255
Mackwade	5	0.03	0.10	0.14	J-225, J-245
Infill Allowance	30	0.21	0.58	0.85	Distributed

Model Junction	Elevation (mASL)	Existing		Future	
		Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
J-5	235.0	0.125	0.186	0.659	0.977
J-10	239.0	0.125	0.186	0.135	0.201
J-15	239.0	0.125	0.186	0.135	0.201
J-20	239.0	0.125	0.186	0.135	0.201
J-25	240.0	0.125	0.186	0.659	0.977
J-30	241.0	0.125	0.186	0.135	0.201
J-35	241.0	0.125	0.186	0.659	0.977
J-40	241.0	0.125	0.186	0.135	0.201
J-45	241.0	0.125	0.186	0.135	0.201
J-50	238.0	0.125	0.186	0.135	0.201
J-55	242.0	0.125	0.186	0.135	0.201
J-60	238.0	0.125	0.186	0.659	0.977
J-65	241.0	0.125	0.186	0.135	0.201
J-70	242.0	0.125	0.186	0.135	0.201
J-75	240.0	0.125	0.186	0.404	0.600
J-80	241.0	0.125	0.186	0.135	0.201
J-85	240.0	0.125	0.186	1.269	1.881
J-90	243.0	0.125	0.186	0.135	0.201
J-95	242.0	0.125	0.186	0.135	0.201
J-100	245.0	0.125	0.186	0.135	0.201
J-105	240.0	0.125	0.186	0.135	0.201
J-110	244.0	0.125	0.186	0.135	0.201
J-115	237.0	0.125	0.186	0.135	0.201
J-120	241.0	0.125	0.186	0.135	0.201
J-125	241.0	0.125	0.186	0.135	0.201
J-130	245.0	0.125	0.186	0.135	0.201
J-135	245.0	0.125	0.186	0.135	0.201
J-140	237.0	0.125	0.186	0.135	0.201
J-145	245.0	0.125	0.186	0.135	0.201
J-150	241.0	0.125	0.186	0.135	0.201
J-155	245.0	0.125	0.186	0.135	0.201
J-160	237.0	0.125	0.186	0.135	0.201
J-165	241.0	0.125	0.186	0.135	0.201
J-170	236.0	0.125	0.186	0.135	0.201
J-175	245.0	0.125	0.186	0.135	0.201
J-180	239.0	0.125	0.186	0.135	0.201
J-185	241.0	0.125	0.186	0.135	0.201
J-190	237.0	0.125	0.186	0.404	0.600
J-195	243.0	0.125	0.186	0.135	0.201
J-200	241.0	0.125	0.186	0.135	0.201
J-205	239.0	0.125	0.186	0.135	0.201
J-210	242.0	0.125	0.186	0.135	0.201
J-215	242.0	0.125	0.186	0.135	0.201
J-220	242.0	0.125	0.186	0.135	0.201
J-225	244.0	0.125	0.186	0.183	0.272
J-230	244.0	0.125	0.186	0.135	0.201
J-235	241.0	0.125	0.186	0.135	0.201
J-240	243.0	0.125	0.186	0.135	0.201
J-245	246.0	0.125	0.186	0.183	0.272
J-250	242.0	0.125	0.186	0.135	0.201
J-255	242.0	0.125	0.186	0.616	0.913
J-260	246.0	0.125	0.186	0.135	0.201
J-265	245.0	0.125	0.186	0.135	0.201

Model Junction	Elevation (mASL)	Existing		Future	
		Maximum Day Demand (L/s)	Peak Hour Demand (L/s)	Maximum Day Demand (L/s)	Peak Hour Demand (L/s)
J-270	247.0	0.125	0.186	0.135	0.201
J-275	245.0	0.125	0.186	0.135	0.201
J-280	245.0	0.125	0.186	0.135	0.201
J-285	240.0	0.125	0.186	0.135	0.201
Minimum	235.0	0.125	0.186	0.135	0.201
Maximum	247.0	0.125	0.186	1.269	1.881
Total		7.1	10.6	12.0	17.9

3.0 Model Results - 2023 Demands

3.1 Existing Conditions

For peak hour analysis, assume no pumps operating and standpipe water level at nominal operating level of 278.7 mASL. For fire flow analysis, use two scenarios: standpipe nominal water level of 278.7 mASL with no HLPS, and standpipe low water level of 278.2 mASL with Dent Well 2 and Briar Hill Well 1 on.

Junction	P at Q_{PEAK} (kPa)	Available Fire Flow at 140 kPa (L/s)	
		Standpipe 278.7 mASL, HLPs Off	Standpipe 278.2 mASL, DW2 & BH1 On
J-5	423	37	47
J-10	384	37	48
J-15	384	37	49
J-20	384	38	49
J-25	374	36	46
J-30	364	37	48
J-35	364	34	45
J-40	364	37	50
J-45	364	36	49
J-50	394	4	4
J-55	355	38	50
J-60	394	33	46
J-65	365	44	57
J-70	355	63	76
J-75	375	54	57
J-80	366	85	94
J-85	375	53	60
J-90	346	103	119
J-95	356	83	93
J-100	328	106	116
J-105	375	66	78
J-110	336	94	106
J-115	404	52	59
J-120	366	90	104
J-125	366	98	112
J-130	328	134	143
J-135	328	135	144
J-140	404	60	71
J-145	328	10	10
J-150	366	106	120
J-155	329	221	221
J-160	404	57	68
J-165	366	108	122
J-170	414	58	68
J-175	330	221	221
J-180	385	92	103
J-185	366	99	112
J-190	404	53	59
J-195	347	113	129
J-200	365	9	9
J-205	385	52	60
J-210	356	87	95
J-215	356	87	95
J-220	356	82	89

Junction	P at Q_{PEAK} (kPa)	Available Fire Flow at 140 kPa (L/s)	
		Standpipe 278.7 mASL, HLPs Off	Standpipe 278.2 mASL, DW2 & BH1 On
J-225	336	59	62
J-230	336	91	100
J-235	366	58	61
J-240	346	8	8
J-245	317	67	72
J-250	356	75	81
J-255	356	77	83
J-260	317	61	64
J-265	326	75	81
J-270	307	54	57
J-275	326	72	77
J-280	326	63	67
J-285	375	49	51
Min	307	4	4
Max	423	221	221

Notes:

denotes operating pressure less than 275 kPa

denotes operating pressure above 275 kPa but less than 350 kPa

denotes operating pressure greater than 480 kPa

denotes fire flow of less than 50 L/s at 140 kPa minimum system pressure

4.0 Model Results - Future Demands

4.1 Existing Conditions

For peak hour analysis, assume no pumps operating and standpipe water level at nominal operating level of 278.7 mASL. For fire flow analysis, use two scenarios: standpipe nominal water level of 278.7 mASL with no HLPS, and standpipe low water level of 278.2 mASL with Dent Well 2 and Briar Hill Well 1 on.

Junction	P at Q_{MAX} (kPa)	Available Fire Flow at 140 kPa (L/s)	
		Standpipe 278.7 mASL, HLPs Off	Standpipe 278.2 mASL, DW2 & BH1 On
J-5	410	35	45
J-10	371	35	46
J-15	371	35	46
J-20	371	35	46
J-25	361	33	44
J-30	352	34	46
J-35	352	32	43
J-40	352	35	47
J-45	352	34	46
J-50	388	4	4
J-55	342	36	48
J-60	381	31	44
J-65	354	41	54
J-70	348	60	73
J-75	369	52	56
J-80	360	82	92
J-85	368	51	58
J-90	340	99	115
J-95	350	80	90
J-100	324	103	113
J-105	368	64	75
J-110	331	90	103
J-115	397	50	57
J-120	359	87	101
J-125	360	94	109
J-130	326	131	140
J-135	326	132	142
J-140	397	57	68
J-145	326	10	10
J-150	360	102	116
J-155	329	221	221
J-160	397	55	66
J-165	360	104	119
J-170	407	56	66
J-175	330	221	221
J-180	379	89	100
J-185	360	95	108
J-190	397	51	58
J-195	342	109	124
J-200	360	9	9
J-205	378	50	58
J-210	350	84	92

Junction	P at Q_{MAX} (kPa)	Available Fire Flow at 140 kPa (L/s)	
		Standpipe 278.7 mASL, HLPs Off	Standpipe 278.2 mASL, DW2 & BH1 On
J-215	350	84	92
J-220	350	79	87
J-225	331	57	61
J-230	331	87	97
J-235	360	56	60
J-240	340	8	8
J-245	311	65	70
J-250	350	73	79
J-255	350	74	80
J-260	311	59	63
J-265	321	72	79
J-270	301	53	56
J-275	321	70	75
J-280	321	61	65
J-285	369	48	50
Min	301		
Max	410		

Notes:

denotes operating pressure less than 275 kPa

denotes operating pressure above 275 kPa but less than 350 kPa

denotes operating pressure greater than 480 kPa

denotes fire flow of less than 50 L/s at 140 kPa minimum system pressure

Appendix E

Kincardine SewerCAD® Modelling Information

Municipality of Kincardine
Kincardine Area SPS Catchments
Flow Notes for Master Plan

Job # :	22128
Date :	November 16, 2022
Revised :	December 13, 2022

1.0 Background

The Municipality of Kincardine is updating its Water & Wastewater Master Plan to evaluate water and wastewater servicing needs for Kincardine, Tiverton, and the Lakeshore Area. The original Master Plan was completed under BMROSS File No. 16130.

The purpose of these notes is to summarize catchment area and design flow information for the Connaught Park, Durham Street, Huron Terrace, Park Street, Goderich Street, and Kincardine Avenue SPSs.

2.0 Design Data

For existing and future flows, the following parameters were used. The "Persons per ERU" parameter was taken from the BMROSS draft memo entitled "Reserve Capacity Analysis for Municipality of Kincardine Major Water and Wastewater Facilities"

The previous Master Plan based residential sewage flows on "units", not Equivalent Residential Units (ERUs). For this Master Plan, existing residential units have been converted to ERUs at a 1:1 ratio (i.e., treating all units as single-family residences, which is conservative), but future developments will be implemented in terms of their actual ERUs, taken from the November 4, 2022 BMROSS memo entitled "Reserve Capacity Analysis for Municipality of Kincardine Major Water and Wastewater Facilities".

To calculate the "Per-ERU average day true sewage flow" (i.e., excluding I-I), inflows to the Kincardine WWTP from 2019 to 2021 were used. The four consecutive months with the lowest inflows in each year were selected as the most representative of "dry-weather" flow conditions. The average day flows from those months were divided by the total number of customers to determine "per household average day true sewage flow".

Reference	Item		
22128 Nov. 4 Reserve Capacity Draft Memo	Persons per ERU	2.48	p/ERU
	Number of customers for Kincardine WW System	3,780	customers
	Existing ERUs from Residential Units in SPS Catchments	3,553	ERUs
	Average "dry-weather" day flow	3,170	m^3/day
	Per customer average day true sewage flow	839	L/cust/day
	Per-ERU average day true sewage flow	839	L/ERU/day
22128 Nov. 22 Development Commitments Table	Infill Units - Kincardine-wide	365	ERUs
MECP Guidelines	I/I allowance	0.28	L/ha/s
	Industrial flow allowance	0.405	L/ha/s
	Commercial/Institutional flow allowance	0.324	L/ha/s

3.0 Connaught SPS (BMROSS 16171)

Existing areas and residential units remain unchanged from the previous Master Plan, because no new developments have been constructed in the intervening time. However, given that population densities and true sewage flows have been updated, the existing flow is slightly lower than in the previous Master Plan.

Future flow is based on the existing flow plus flow from the West Ridge on the Lake development (383 ERUs, 15.7 ha), Bradstones (Shepherd) Subdivision (36 ERUs, 1.44 ha), Golf Links Townhouses (7 ERUs, 0.15 ha), and Battler Subdivision (30 ERUs, 1.65 ha), plus a proportionate amount of the total infill ERUs (57.3 ERUs).

Item	Calc. Ex.	Obs. Ex.	Future 1	Future 2	Units
Residential Area	49.81		68.74		ha
Industrial Area	0		0		ha
Commercial/Institutional Area	0.54		0.54		ha
ERUs from Residential	552		1064		units
ERUs as percentage of Kincardine Total	16%				
Calculate					
Residential Population	1369		2638		people
Peaking factor	3.71		3.49		-
Average day residential flow	5.36		10.32		L/s
Average day industrial flow	0.00		0.00		L/s
Average day commercial/institutional flow	0.17		0.17		L/s
Average day flow; total	5.53		10.50		L/s
I/I allowance	14.098		19.400		L/s
Allocation for WWTP sludge discharge	3.500		3.500		L/s
Peak instantaneous flow; excl. I/I	20.515		36.636		L/s
Peak instantaneous flow; total incl. I/I	38.113	68.588	59.535	90.010	L/s

4.0 Durham SPS (BMROSS 79017)

Existing areas and residential units remain unchanged from the previous Master Plan, because no new developments have been constructed in the intervening time. However, given that population densities and true sewage flows have been updated, the existing flow is slightly lower than in the previous Master Plan.

Future flow is based on the Durham St. SPS Peak Design flow. The Durham St. SPS upgrade design is underway (BMROSS File No. 18033), and has recently confirmed that the 20-year peak design flow will be 83 L/s. The Durham St. SPS peak design flow was informed by the 17094 Sanitary Design Notes, which accounted for approximately 33 ha of new light industrial development north of Gary St.

Item	Calc. Ex.	Obs. Ex.	Future	Units
Residential Area	32.42			ha
Industrial Area	0			ha
Commercial/Institutional Area	20.53			ha
ERUs from Residential	409			units
ERUs as percentage of Kincardine Total	12%			
Calculate			Refer to 18033 Durham St.	
Residential Population	1014		SPS Upgrade Design Notes.	people
Peaking factor	3.80			-
Average day residential flow	3.97		SPS 20-Year Peak Design	L/s
Average day industrial flow	0.00		Flow is 83 L/s.	L/s
Average day commercial/institutional flow	6.65			L/s
Average day flow; total	10.6			L/s
I/I allowance	14.8			L/s
Peak instantaneous flow; excl. I/I	40.3			L/s
Peak instantaneous flow; total incl. I/I	55.1	39.6	83.0	L/s

5.0 Huron Terrace SPS (BMROSS 79016)

The Huron Terrace SPS service area includes its own catchment area and discharge from the Connaught and Durham SPS's. Calculate catchment area flow and then add Connaught and Durham SPS flows.

Existing areas and residential units remain unchanged from the previous Master Plan, because no new developments have been constructed in the intervening time. The Snobelen Apartment, identified as a development in 16130 Figure C1, was completed at the time of the last Master Plan. However, given that population densities and true sewage flows have been updated, the existing flow is slightly lower than in the previous Master Plan.

In the previous Master Plan, future residential area was calculated on the basis that all development lands north to Concession 5, and between Hwy. 21 and Cty. Rd. 23 would direct sanitary sewage to the Huron Terrace SPS. In this Master Plan, future flows omit lands to the north of the Urban Boundary, and include only the OPF lands (960 ERUs from residential development), 1182 Queen Street (12 ERUs), and 7 Mount Forest Avenue (25 ERUs). The OPF lands also contain approximately 3 ha of proposed institutional area. Infill ERUs (62.1 ERUs) are also included in the future flows proportionally to the catchment area's existing ERUs.

5.1 Huron Terrace Catchment Area Data

Item	Calc. Ex.	Obs. Ex.	Future 1	Future 2	Units
Residential Area	73.18		116.50		ha
Industrial Area	0		0		ha
Commercial/Institutional Area	29.23		32.06		ha
ERUs from Residential	612		1671		units
ERUs as percentage of Kincardine Total	17%				
Calculate					
Residential Population	1518		4145		people
Peaking factor	3.68		3.32		-
Average day residential flow	5.94		16.22		L/s
Average day industrial flow	0.00		0.00		L/s
Average day commercial/institutional flow	9.47		10.39		L/s
Average day flow; total	15.4		26.6		L/s

I/I allowance	28.7		41.6		L/s
Peak instantaneous flow; total excl. I/I	56.6478		88.3		L/s
Peak instantaneous flow; total incl. I/I	85.3		129.9		L/s

5.2 Huron Terrace SPS Total Flow - Catchment Area + Connaught & Durham SPS Flows

Peak instantaneous flow; total incl. I/I	178.6	274.1	272.5	368.0	L/s

6.0 Park SPS (BMROSS 75056B)

Existing areas and residential units have been updated since the last Master Plan due to the completion of the Penetangore Bluffs (27 ERUs, 3.11 ha), Pipers 1 (1 ERU, 0.12 ha) and Pipers 2 (2 ERUs, 0.18 ha) developments, the completion of the Marriott hotel in the area of the 9&21 Business Park (38 ERUs, 1.1 ha), and the partial completion of the Campbell Avenue development (53 ERUs, 1.68 ha). These numbers are reflected in the "Calculated Ex." column.

An observed peak flow of 115 L/s was observed during a precipitation event in 2013. This value will be used as the existing peak flow for the Park St. SPS for modelling purposes.

Future flow is based on the existing flow plus flow from the Campbell Ave. development (4 ERUs), the Highway 9 & 21 Business Park (in the Jones Consulting plan: 554 ERUs from Residential, 15.29 ha of residential, 3.4 ha of institutional/commercial and remaining from 08055: 28.23 ha of institutional/commercial and 20.8 ha of industrial), 7 Millennium Way (173 ERUs, 0.81 ha of residential), and a proportionate amount of infill ERUs (94.9 ERUs).

Item	Calc. Ex.	Obs. Ex.	Future 1	Future 2	Units
Residential Area	58		74.42		ha
Industrial Area	0		20.8		ha
Commercial/Institutional Area	3.99		35.62		ha
ERUs from Residential	950		1778		units
ERUs as percentage of Kincardine Total	27%				
Calculate					
Residential Population	2356		4410		people
Peaking factor	3.53		3.29508		-
Average day residential flow	9.22		17.26		L/s
Average day industrial flow	0.00		8.42		L/s
Average day commercial/institutional flow	1.29		11.54		L/s
Average day flow; total	10.51375		37.2		L/s
I/I allowance	17.4		36.6		L/s
Peak instantaneous flow; excl. I/I	37.1		122.7		L/s
Peak instantaneous flow; total incl. I/I	54.5	96.5	159.3	201.4	L/s

7.0 Goderich SPS (BMROSS 76007-2)

Existing areas and residential units have been updated since the last Master Plan due to the completion of the Lakefield Phase 1 and Phase 2 developments (39 ERUs, 3.10 ha). Due to the completion of the Lakefield developments, existing flows are slightly higher than in the previous Master Plan.

Future flow is only expected to increase due to infill (56.1 ERUs). No new developments are planned for the Goderich SPS catchment area.

Item	Calc. Ex.	Obs. Ex.	Future 1	Future 2	Units
Residential Area	62.20		62.20		ha
Industrial Area	3.89		3.89		ha
Commercial/Institutional Area	11.55		11.55		ha
ERUs from Residential	540		595		units
ERUs as percentage of Kincardine Total	15.1984%				
Calculate					
Residential Population	1339		1477		people
Peaking factor	3.71		3.68		-
Average day residential flow	5.24		5.78		L/s
Average day industrial flow	1.58		1.58		L/s
Average day commercial/institutional flow	3.74		3.74		L/s
Average day flow; total	10.6		11.1		L/s
I/I allowance	21.7		21.7		L/s
Peak instantaneous flow; excl. I/I	39.2		40.9		L/s
Peak instantaneous flow; total incl. I/I	61.0	29.0	62.6	30.7	L/s

8.0 Kincardine Avenue SPS (BMROSS 76007-2)

Existing areas and residential units have been updated since the last Master Plan due to the completion of the Stonehaven Phase 1, 2 and 3 developments (48 ERUs, 4.91 ha). Despite the increased number of ERUs, per capita flows have been updated, and the existing flow is still slightly lower than in the previous Master Plan.

Future flow is based on the existing flow plus flow from the Brown Subdivision (245 ERUs), the Brigadoon Subdivision (150 ERUs), the CR Developers project (82 ERUs from hotels and 0.6 ha of commercial land), the 869 Kincardine Ave. trailer park development (88 ERUs), and a proportionate amount of infill ERUs (51.1 ERUs).

Item	Calc. Ex.	Obs. Ex.	Future 1	Future 2	Units
Residential Area	57.48		104.51		ha
Industrial Area	0		0		ha
Commercial/Institutional Area	3.99		4.59		ha
ERUs from Residential	490		1105		units
ERUs as percentage of Kincardine Total	14%				
Calculate					
Residential Population	1215		2741		people
Peaking factor	3.74		3.48		-
Average day residential flow	4.76		10.73		L/s
Average day industrial flow	0.00		0.00		L/s
Average day commercial/institutional flow	1.29		1.49		L/s
Average day flow; total	6.0		12.2		L/s
I/I allowance	17.2		30.5		L/s
Peak instantaneous flow; excl. I/I	22.64584		42.44910		L/s
Peak instantaneous flow; total incl. I/I	39.9	28.0	73.0	61.1	L/s

Municipality of Kincardine
SewerCAD Modelling for Master Plan
Kincardine - Calculations and Notes

Job # :	22128
Date :	July 11, 2022
Revised :	December 13, 2022

1.0 Background

The Municipality of Kincardine is updating its water and wastewater Master Plan. The original Master Plan was completed under BMROSS Project No. 16130. The sewage servicing component will include a review of servicing existing development and future development. The purpose of these notes is to summarize data used to create a SewerCAD model, and the results of that modelling.

1.1 References

1 22128 - Kincardine Area SPS Catchments: Flow Notes for Master Plan
2 08055 - 17Aug29-Kincardine BP MP Sec. 4.4.9.1

2.0 Analysis & Model Data

2.1 Data

	Reference	Item		
a.	1	*Connaught SPS Catchment Area*		
		Ex. peak sewage flow	24.0	L/s
		Ex. I&I allowance	14.1	L/s
		Ex. calculated total peak flow	38.1	L/s
		Ex. "observed" peak flow	68.6	L/s
		Fut. peak sewage flow	40.2	L/s
		Fut. I&I allowance	19.4	L/s
		Future 1 total peak flow	59.6	L/s
		Future 2 total peak flow	90.0	L/s
b.	1	*Durham SPS Catchment Area*		
		Ex. peak sewage flow	40.3	L/s
		Ex. I&I allowance	14.8	L/s
		Ex. calculated total peak flow	55.1	L/s
		Ex. "observed" peak flow	39.6	L/s
		Fut. peak sewage flow		
		Fut. I&I allowance	Used 18033 DB	
		Fut. total peak flow	83.0	L/s

c. 1 *Huron Terrace SPS Catchment Area (**w/o Connaught, Durham SPSs**)*

Ex. peak sewage flow	56.6	L/s
Ex. I&I allowance	28.7	L/s
Ex. calculated total peak flow	85.3	L/s
Fut. peak sewage flow	88.4	L/s
Fut. I&I allowance	41.6	L/s
Fut. calculated total peak flow	130.0	L/s

*Huron Terrace SPS Catchment Area (**with Connaught, Durham SPSs**)*

Ex. calculated total peak flow	178.6	L/s
Ex. "observed" peak flow	274.1	L/s
Future 1 total peak flow	272.5	L/s
Future 2 total peak flow	368.0	L/s

d. 1 *Park SPS Catchment Area*

Ex. peak sewage flow	37.1	L/s
Ex. I&I allowance	17.4	L/s
Ex. calculated total peak flow	54.5	L/s
Ex. "observed" peak flow	97	L/s
Fut. peak sewage flow	122.7	L/s
Fut. I&I allowance	36.6	L/s
Future 1 total peak flow	159.3	L/s
Future 2 total peak flow	201.3	L/s

e. 1 *Goderich SPS Catchment Area*

Ex. peak sewage flow	39.2	L/s
Ex. I&I allowance	21.7	L/s
Ex. calculated total peak flow	60.9	L/s
Ex. "observed" peak flow	29.0	L/s
Fut. peak sewage flow	40.9	L/s
Fut. I&I allowance	21.7	L/s
Future 1 total peak flow	62.6	L/s
Future 2 total peak flow	30.7	L/s

f. 1 *Kincardine SPS Catchment Area*

Ex. peak sewage flow	22.6	L/s
Ex. I&I allowance	17.2	L/s
Ex. calculated total peak flow	39.8	L/s
Ex. "observed" peak flow	28.0	L/s
Fut. peak sewage flow	42.5	L/s
Fut. I&I allowance	30.5	L/s
Future 1 total peak flow	73.0	L/s
Future 2 total peak flow	61	L/s

2.2 Sewage Flows by SMH

For the existing system model, sewage flows to each sanitary maintenance hole (SMH) are calculated by dividing total peak flow for the catchment area by the number of SMHs.

For future flows, the sewage flow that is additional to existing is assigned to specific SMHs based on future service area location in relation to existing SMHs.

Reference	Item		
1	Flow per ERU	0.0097	L/ERU/s
1	Industrial flow allowance	0.405	L/ha/s
1	Commercial flow allowance	0.324	L/ha/s
1	Institutional flow allowance	0.324	L/ha/s
1	I-I allowance	0.280	L/ha/s

a. 1 *Connaught SPS Catchment Area*

Ex. No. of SMHs in model		111	SMHs		
Ex. Peak flow per SMH		0.618	L/s/SMH		
Ex. Peaking Factor		3.708			
Future Peaking Factor		3.489			
Additional future peak flow from		21.4	L/s		
Westridge		**17.4**	**L/s**		
	Res. ERUs	13.0	L/s	at	SMH-921
	ICI	0.0	L/s		
	I-I	4.4	L/s		
Shepherd		**1.6**	**L/s**		
	Res. ERUs	1.2	L/s	at	SMH-593
	ICI	0.0	L/s		
	I-I	0.4	L/s		
Golf Links		**0.3**	**L/s**		
	Res. ERUs	0.2	L/s	at	SMH-913
	ICI	0.0	L/s		
	I-I	0.0	L/s		
Battler		**1.5**	**L/s**		
	Res. ERUs	1.0	L/s	at	SMH-913
	ICI	0.0	L/s		
	I-I	0.5	L/s		
Net: Infill and Peak Reduction		**1.1**	**L/s**		
Infill	Res. ERUs	1.9	L/s	at	All MHs
PF Reduction of existing flow		-0.9	L/s		
Check:		21.8	L/s		

b. *Durham SPS Catchment Area*

Ex. No. of SMHs in model	73	SMHs
Ex. Peak flow per SMH	0.755	L/s/SMH
Ex. Peaking Factor	3.800	
Future Peaking Factor	Not broken down. Future flows from 18033.	
Additional future peak flow	27.9	L/s
Assume all applied to SMH-76A		

c. *Huron Terrace SPS Catchment Area (**w/o Connaught, Durham SPSs**)*

Ex. No. of SMHs in model	133	SMHs
Ex. Peak flow per SMH	1.131	L/s/SMH
Ex. Peaking Factor	3.676	
Future Peaking Factor	3.319	

For Connaught, add to gravity sewer on Huron Terrace per 16171 design (SMH-495)

Existing:	68.6	L/s

For Durham, add to gravity sewer at Durham & Princess (SMH-469)

Existing:	55.1	L/s
Additional future peak flow	93.9	L/s
Assume:		
Additional to SMH-495	21.4	L/s
Additional to SMH-469	27.9	L/s

Balance of Additional		44.6	L/s	
from				
OPF Lands		**45.8**	**L/s**	
	Res. ERUs	30.9	L/s	at SMH-762,
	ICI	3.0	L/s	at SMH-496
	I-I	11.8	L/s	
1182 Queen St.		**1.1**	**L/s**	
	Res. ERUs	0.4	L/s	at SMH-758
	ICI	0.0	L/s	
	I-I	0.7	L/s	
7 Mount Forest Ave.		**1.2**	**L/s**	
	Res. ERUs	0.8	L/s	at SMH-759
	ICI	0.0	L/s	
	I-I	0.4	L/s	
Net: Infill and Peak Reduction		**-3.2**	**L/s**	
Infill	Res. ERUs	2.0	L/s	at All MHs
PF Reduction of existing flow		-5.3	L/s	
Check		44.9	L/s	

d. *Park SPS Catchment Area*

Ex. No. of SMHs in model		146	SMHs		
Ex. Peak flow per SMH		0.661	L/s/SMH		
Ex. Peaking Factor		3.529			
Future Peaking Factor		3.295			
Additional future peak flow from		104.8	L/s		
Campbell Ave		**0.4**	**L/s**		
	Res. ERUs	0.1	L/s	at	SMH-128
	ICI	0.0	L/s		
	I-I	0.2	L/s		
Hwy. 9 & 21 Business Park		**98.2**	**L/s**	at	SMH-S16, SMH-S17, SMH-S18, SMH-565, MH-932, MH-S20, MH-S23, MH-S24
	Res. ERUs	17.7	L/s		
	ICI	61.5	L/s		
	I-I	19.0	L/s		
7 Millennium Way		**5.6**	**L/s**		
	Res. ERUs	5.5	L/s	at	SMH-384
	ICI	0.0	L/s		
	I-I	0.1	L/s		
Net: Infill and Peak Reduction		**0.6**	**L/s**		
Infill	Res. ERUs	3.0	L/s	at	All MHs
PF Reduction of existing flow		-2.4	L/s		
Check:		104.8	L/s		

e. *Goderich SPS Catchment Area*

Ex. No. of SMHs in model		119	SMHs		
Ex. Peak flow per SMH		0.244	L/s/SMH		
Ex. Peaking Factor		3.715			
Future Peaking Factor		3.684			
Additional future peak flow from		33.6	L/s		
Net: Infill, peak, method adjustm		**33.6**	**L/s**		
Infill	Res. ERUs	2.0	L/s		
PF Reduction of existing flow		-0.3	L/s	at	All MHs
Calc./Obs. Adjustment		31.9	L/s		

f. *Kincardine SPS Catchment Area*

Ex. No. of SMHs in model		105	SMHs		
Ex. Peak flow per SMH		0.379	L/s/SMH		
Ex. Peaking Factor		3.744			
Future Peaking Factor		3.475			
Additional future peak flow from		33.1	L/s		
Brown		**10.8**	**L/s**		
	Res. ERUs	8.3	L/s	at	SMH-832
	ICI	0.0	L/s		
	I-I	2.5	L/s		
Brigadoon		**13.5**	**L/s**		
	Res. ERUs	5.1	L/s	at	SMH-380
	ICI	0.0	L/s		
	I-I	8.4	L/s		
CR Developers		**4.0**	**L/s**		
	Res. ERUs	2.8	L/s	at	SMH-380
	ICI	0.7	L/s		
	I-I	0.6	L/s		
869 Kincardine Ave.		**4.8**	**L/s**		
	Res. ERUs	3.0	L/s	at	SMH-380
	ICI	0.0	L/s		
	I-I	1.8	L/s		
Net: Infill and Peak Reduction		**0.2**	**L/s**		
Infill	Res. ERUs	1.7	L/s	at	All MHs
PF Reduction of existing flow		-1.5	L/s		
Check:		33.3	L/s		

3.0 Validation

a. 1 *Connaught SPS Catchment Area*

	Model Input	Model Output	Difference
Existing	68.6	68.6	0.0%
Future	90.0	90.4	0.4%

b. 1 *Durham SPS Catchment Area*

	Model Input	Model Output	
Existing	55.1	55.1	0.0%
Future	83.0	83.0	0.0%

c. 1 *Huron Terrace SPS Catchment Area (**w/ Connaught, Durham SPSs**)*

	Model Input	Model Output	
Existing	274.1	274.1	0.0%
Future	368.0	368.4	0.1%

d. 1 *Park SPS Catchment Area*

	Model Input	Model Output	
Existing	97	96.5	0.0%
Future	201.3	143.8	28.6%

e. 1 *Goderich SPS Catchment Area*

	Model Input	Model Output	
Existing	29.0	29.0	0.1%
Future	62.6	62.6	0.0%

f. 1 *Kincardine SPS Catchment Area*

	Model Input	Model Output	
Existing	39.8	39.8	0.1%
Future	73.0	72.8	0.2%

Connaught SPS Results

Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
CO-1	72.919	0.001	450	68.6	94	72.9	0.001	450	90.4	124
CO-2	141.519	0.057	250	17.9	13	141.5	0.057	250	18.2	13
CO-3	92.298	0.009	300	4.3	5	92.3	0.009	300	4.4	5
CO-4	92.741	0.003	375	22.9	25	92.7	0.003	375	23.2	25
CO-5	79.125	0.002	375	23.5	30	79.1	0.002	375	23.8	30
CO-6	236.5	0.007	450	44.5	19	236.5	0.007	450	65.9	28
CO-7	122.1	0.002	450	43.9	36	122.1	0.002	450	65.3	54
CO-8	105.5	0.001	450	43.3	41	105.5	0.001	450	64.6	61
CO-9	142.6	0.003	450	42.6	30	142.6	0.003	450	64.0	45
CO-10	107.1	0.001	450	37.1	35	107.1	0.001	450	58.4	55
CO-11	100.0	0.001	450	36.5	37	100.0	0.001	450	57.7	58
CO-12	112.1	0.002	450	35.8	32	112.1	0.002	450	57.1	51
SM-9	89.9	0.002	400	33.4	37	89.9	0.002	400	54.6	61
SM-10	136.0	0.004	400	32.8	24	136.0	0.004	400	54.0	40
SM-101	28.5	0.008	200	0.6	2	28.5	0.008	200	0.6	2
SM-102	73.0	0.05	200	1.9	3	73.0	0.050	200	1.9	3
SM-104	61.5	0.004	300	1.2	2	61.5	0.004	300	1.3	2
SM-108	34.1	0.001	300	1.9	5	34.1	0.001	300	1.9	6
SM-109	43.1	0.002	300	2.5	6	43.1	0.002	300	2.5	6
SM-110	42.2	0.002	300	3.1	7	42.2	0.002	300	3.1	7
SM-111	46.7	0.002	300	3.7	8	46.7	0.002	300	3.8	8
SM-113	13.4	0.002	200	0.6	5	13.4	0.002	200	0.6	5
SM-116	20.2	0.004	200	1.2	6	20.2	0.004	200	1.3	6
SM-117	19.9	0.004	200	1.9	9	19.9	0.004	200	1.9	10
SM-119	33.1	0.003	250	15.5	47	33.1	0.003	250	15.7	47
SM-120	27.3	0.002	250	16.1	59	27.3	0.002	250	16.3	60
SM-121	22.4	0.005	200	4.3	19	22.4	0.005	200	4.4	20
SM-122	21.3	0.004	200	4.9	23	21.3	0.004	200	5.0	24
SM-123	19.2	0.003	200	5.6	29	19.2	0.003	200	5.6	29
SM-124	20.3	0.004	200	6.2	31	20.3	0.004	200	6.3	31
SM-125	26.4	0.006	200	1.2	5	26.4	0.006	200	1.3	5
SM-127	35.0	0.003	250	4.3	12	35.0	0.003	250	4.4	13
SM-128	23.3	0.005	200	2.5	11	23.3	0.005	200	2.5	11
SM-129	80.9	0.061	200	0.6	1	80.9	0.061	200	0.6	1
SM-130	108.5	0.109	200	2.5	2	108.5	0.109	200	2.5	2
SM-135	28.6	0.008	200	0.6	2	28.6	0.008	200	0.6	2

Connaught SPS Results

Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-137	32.2	0.01	200	0.6	2	32.2	0.010	200	0.6	2
SM-138	40.2	0.015	200	0.6	2	40.2	0.015	200	0.6	2
SM-139	30.2	0.008	200	2.5	8	30.2	0.008	200	2.5	8
SM-140	106.3	0.105	200	3.7	4	106.3	0.105	200	3.8	4
SM-141	35.3	0.004	250	9.3	26	35.3	0.004	250	9.4	27
SM-142	39.1	0.004	250	14.8	38	39.1	0.004	250	15.0	39
SM-143	34.8	0.003	250	4.9	14	34.8	0.003	250	5.0	14
SM-144	118.2	0.13	200	0.6	1	118.2	0.130	200	0.6	1
SM-145	47.146	0.021	200	1.2	3	47.1	0.021	200	1.3	3
SM-146	74.3	0.051	200	0.6	1	74.3	0.051	200	0.6	1
SM-148	48.3	0.022	200	1.2	3	48.3	0.022	200	1.3	3
SM-150	24.0	0.005	200	1.9	8	24.0	0.005	200	1.9	8
SM-152	35.3	0.012	200	4.9	14	35.3	0.012	200	5.0	14
SM-153	52.6	0.003	300	0.6	1	52.6	0.003	300	0.6	1
SM-154	79.5	0.059	200	4.3	5	79.5	0.059	200	4.4	6
SM-156	79.7	0.059	200	3.7	5	79.7	0.059	200	3.8	5
SM-157	39.9	0.015	200	3.1	8	39.9	0.015	200	3.1	8
SM-158	40.1	0.015	200	0.6	2	40.1	0.015	200	0.6	2
SM-160	27.8	0.007	200	0.6	2	27.8	0.007	200	0.6	2
SM-161	98.2	0.09	200	1.2	1	98.2	0.090	200	1.3	1
SM-162	33.4	0.003	250	16.7	50	33.4	0.003	250	16.9	51
SM-163	29.2	0.002	250	17.3	59	29.2	0.002	250	17.6	60
SM-238	36.2	0.012	200	2.5	7	36.2	0.012	200	4.3	12
SM-239	21.7	0.004	200	3.1	14	21.7	0.004	200	4.9	23
SM-287	48.3	0.022	200	0.6	1	48.3	0.022	200	0.6	1
SM-288	26.7	0.007	200	1.2	5	26.7	0.007	200	1.3	5
SM-289	30.1	0.008	200	1.9	6	30.1	0.008	200	1.9	6
SM-432	30.0	0.008	200	0.6	2	30.0	0.008	200	0.6	2
SM-450	103.2	0.003	375	7.4	7	103.2	0.003	375	24.9	24
SM-567	160.1	0.008	375	18.5	12	160.1	0.008	375	37.8	24
SM-572	18.7	0.003	200	1.9	10	18.7	0.003	200	1.9	10
SM-615	30.9	0.009	200	1.2	4	30.9	0.009	200	1.3	4
SM-616	29.1	0.008	200	1.9	6	29.1	0.008	200	1.9	7
SM-617	22.5	0.005	200	0.6	3	22.5	0.005	200	0.6	3
SM-618	19.2	0.003	200	3.1	16	19.2	0.003	200	3.1	16
SM-620	28.2	0.007	200	0.6	2	28.2	0.007	200	0.6	2

Connaught SPS Results

Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-621	26.5	0.007	200	3.7	14	26.5	0.007	200	3.8	14
SM-622	40.1	0.015	200	0.6	2	40.1	0.015	200	0.6	2
SM-623	25.9	0.006	200	0.6	2	25.9	0.006	200	0.6	2
SM-624	35.8	0.012	200	1.9	5	35.8	0.012	200	1.9	5
SM-625	34.8	0.011	200	2.5	7	34.8	0.011	200	2.5	7
SM-627	39.1	0.014	200	1.9	5	39.1	0.014	200	3.5	9
SM-628	43.3	0.017	200	2.5	6	43.3	0.017	200	4.1	10
SM-629	27.2	0.007	200	3.1	11	27.2	0.007	200	4.8	18
SM-630	21.8	0.004	200	7.4	34	21.8	0.004	200	9.1	42
SM-631	25.0	0.006	200	0.6	3	25.0	0.006	200	2.3	9
SM-632	23.9	0.005	200	1.2	5	23.9	0.005	200	2.9	12
SM-633	42.5	0.017	200	0.6	2	42.5	0.017	200	0.6	2
SM-634	25.2	0.006	200	1.2	5	25.2	0.006	200	1.3	5
SM-635	22.0	0.004	200	1.9	8	22.0	0.004	200	1.9	9
SM-636	24.3	0.005	200	2.5	10	24.3	0.005	200	2.5	10
SM-637	31.3	0.009	200	10.5	34	31.3	0.009	200	12.3	39
SM-734	110.0	0.004	375	30.3	28	110.0	0.004	375	51.5	47
SM-735	94.7	0.003	375	30.9	33	94.7	0.003	375	52.1	55
SM-736	108.0	0.004	375	31.5	29	108.0	0.004	375	52.7	49
SM-737	96.4	0.003	375	32.1	33	96.4	0.003	375	53.4	55
SM-778	35.0	0.011	200	1.9	5	35.0	0.011	200	3.6	10
SM-779	173.6	0.01	375	29.7	17	173.6	0.010	375	50.9	29
SM-780	177.5	0.01	375	29.0	16	177.5	0.010	375	50.2	28
SM-781	331.6	0.036	375	28.4	9	331.6	0.036	375	49.6	15
SM-782	87.7	0.003	375	24.1	28	87.7	0.003	375	45.2	52
SM-783	92.6	0.003	375	23.5	25	92.6	0.003	375	44.6	48
SM-784	79.7	0.059	200	3.7	5	79.7	0.059	200	5.5	7
SM-789	121.6	0.005	375	6.8	6	121.6	0.005	375	24.3	20
SM-790	105.9	0.004	375	19.2	18	105.9	0.004	375	38.4	36
SM-843	37.5	0.013	200	3.7	10	37.5	0.013	200	3.8	10
SM-929	29.3	0.002	250	0.0	0	29.3	0.002	250	0.0	0
SM-931	51.4	0.025	200	1.2	2	51.4	0.025	200	3.0	6
SM-932	53.8	0.027	200	0.6	1	53.8	0.027	200	2.4	4
SM-933	19.1	0.003	200	2.5	13	19.1	0.003	200	2.5	13
SM-935	29.7	0.002	250	0.6	2	29.7	0.002	250	0.6	2
SM-936	104.6	0.004	375	5.6	5	104.6	0.004	375	23.0	22

Connaught SPS Results										
Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-937	119.3	0.005	375	1.2	1	119.3	0.005	375	18.6	16
SM-938	104.5	0.004	375	0.6	1	104.5	0.004	375	18.0	17
SM-939	98.8	0.091	200	3.7	4	98.8	0.091	200	3.8	4
SM-948	23.2	0.005	200	0.6	3	23.2	0.005	200	0.6	3

Notes:

Denotes greater than 80% capacity utilized.

Denotes greater than 100% capacity utilized (i.e. surcharging).

Durham SPS Results

Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
CO-1	25.3	0.006	200	0.0	0	25.3	0.006	200	0.0	0
CO-2	67.2	0.005	300	11.3	17	67.2	0.005	300	39.2	58.4
CO-3	85.0	0.008	300	10.6	12	85.0	0.008	300	38.5	45.2
CO-4	79.7	0.007	300	9.8	12	79.7	0.007	300	37.7	47.3
CO-5	69.2	0.005	300	6.0	9	69.2	0.005	300	33.9	49.0
CO-6	63.3	0.004	300	5.3	8	63.3	0.004	300	33.2	52.4
CO-7	95.0	0.010	300	4.5	5	95.0	0.010	300	32.4	34.1
CO-8	72.4	0.006	300	3.8	5	72.4	0.006	300	31.7	43.7
CO-9	75.5	0.006	300	1.5	2	75.5	0.006	300	29.4	38.9
CO-10	78.5	0.007	300	0.8	1	78.5	0.007	300	28.6	36.5
CO-11	82.6	0.007	300	19.6	24	82.6	0.007	300	47.5	57.5
SM-7	83.6	0.065	200	0.8	1	83.6	0.065	200	0.8	0.9
SM-11	20.7	0.004	200	5.3	26	20.7	0.004	200	5.3	25.5
SM-12	21.5	0.004	200	6.0	28	21.5	0.004	200	6.0	28.1
SM-14	23.0	0.005	200	6.8	30	23.0	0.005	200	6.8	29.6
SM-15	58.4	0.032	200	7.6	13	58.4	0.032	200	7.6	12.9
SM-166	41.0	0.016	200	0.8	2	41.0	0.016	200	0.8	1.8
SM-167	28.9	0.008	200	1.5	5	28.9	0.008	200	1.5	5.2
SM-168	25.3	0.006	200	0.0	0	25.3	0.006	200	0.0	0.0
SM-169	36.0	0.012	200	0.8	2	36.0	0.012	200	0.8	2.1
SM-172	23.8	0.005	200	1.5	6	23.8	0.005	200	1.5	6.3
SM-178	20.1	0.004	200	3.0	15	20.1	0.004	200	3.0	15.0
SM-179	21.3	0.004	200	0.0	0	21.3	0.004	200	0.0	0.0
SM-182	30.8	0.009	200	0.8	2	30.8	0.009	200	0.8	2.4
SM-183	30.5	0.009	200	1.5	5	30.5	0.009	200	1.5	4.9
SM-184	31.7	0.009	200	2.3	7	31.7	0.009	200	2.3	7.1
SM-185	37.0	0.013	200	3.0	8	37.0	0.013	200	3.0	8.2
SM-186	36.7	0.012	200	3.8	10	36.7	0.012	200	3.8	10.3
SM-187	33.2	0.010	200	4.5	14	33.2	0.010	200	4.5	13.7
SM-188	20.5	0.004	200	0.8	4	20.5	0.004	200	0.8	3.7
SM-189	23.1	0.005	200	1.5	7	23.1	0.005	200	1.5	6.5
SM-190	20.7	0.004	200	2.3	11	20.7	0.004	200	2.3	10.9
SM-191	20.4	0.004	200	3.0	15	20.4	0.004	200	3.0	14.8
SM-194	22.4	0.005	200	3.8	17	22.4	0.005	200	3.8	16.8
SM-195	148.2	0.007	375	20.4	14	148.2	0.007	375	48.3	32.6
SM-196	126.2	0.005	375	21.1	17	126.2	0.005	375	49.0	38.8
SM-197	228.8	0.017	375	21.9	10	228.8	0.017	375	49.8	21.8

Durham SPS Results

Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-199	104.5	0.004	375	26.4	25	104.5	0.004	375	54.3	52.0
SM-200	119.8	0.005	375	27.2	23	119.8	0.005	375	55.1	46.0
SM-201	26.8	0.007	200	0.8	3	26.8	0.007	200	0.8	2.8
SM-202	31.7	0.009	200	2.3	7	31.7	0.009	200	2.3	7.1
SM-203	22.9	0.005	200	4.5	20	22.9	0.005	200	4.5	19.8
SM-204	22.2	0.005	200	5.3	24	22.2	0.005	200	5.3	23.8
SM-205	21.4	0.004	200	6.0	28	21.4	0.004	200	6.0	28.2
SM-206	51.2	0.024	200	3.0	6	51.2	0.024	200	3.0	5.9
SM-207	124.0	0.005	375	35.5	29	124.0	0.005	375	63.4	51.1
SM-208	190.1	0.012	375	27.9	15	190.1	0.012	375	55.8	29.4
SM-209	194.2	0.012	375	28.7	15	194.2	0.012	375	56.6	29.1
SM-210	45.6	0.019	200	1.5	3	45.6	0.019	200	1.5	3.3
SM-211	32.9	0.010	200	2.3	7	32.9	0.010	200	2.3	6.9
SM-212	124.0	0.005	375	39.3	32	124.0	0.005	375	67.1	54.1
SM-213	123.6	0.005	375	40.0	32	123.6	0.005	375	67.9	54.9
SM-214	22.8	0.005	200	0.8	3	22.8	0.005	200	0.8	3.3
SM-216	25.8	0.006	200	0.8	3	25.8	0.006	200	0.8	2.9
SM-217	52.5	0.026	200	0.0	0	52.5	0.026	200	0.0	0.0
SM-218	30.5	0.009	200	0.8	3	30.5	0.009	200	0.8	2.5
SM-219	20.2	0.004	200	0.8	4	20.2	0.004	200	0.8	3.7
SM-220	22.0	0.005	200	1.5	7	22.0	0.005	200	1.5	6.9
SM-221	19.8	0.004	200	1.5	8	19.8	0.004	200	1.5	7.6
SM-222	56.4	0.030	200	0.8	1	56.4	0.030	200	0.8	1.3
SM-223	24.8	0.006	200	3.8	15	24.8	0.006	200	3.8	15.2
SM-224	15.3	0.002	200	4.5	30	15.3	0.002	200	4.5	29.7
SM-225	20.2	0.004	200	5.3	26	20.2	0.004	200	5.3	26.2
SM-226	21.5	0.004	200	7.6	35	21.5	0.004	200	7.6	35.1
SM-228	25.2	0.006	200	2.3	9	25.2	0.006	200	2.3	9.0
SM-229	25.2	0.006	200	0.8	3	25.2	0.006	200	0.8	3.0
SM-230	122.1	0.005	375	41.5	34	122.1	0.005	375	69.4	56.8
SM-231	135.6	0.006	375	42.3	31	135.6	0.006	375	70.2	51.7
SM-232	160.8	0.008	375	43.0	27	160.8	0.008	375	70.9	44.1
SM-233	60.5	0.034	200	0.8	1	60.5	0.034	200	0.8	1.2
SM-234	44.3	0.018	200	9.8	22	44.3	0.018	200	9.8	22.1
SM-235	72.1	0.048	200	10.6	15	72.1	0.048	200	10.6	14.7
SM-236	356.9	0.041	375	55.1	15	356.9	0.041	375	83.0	23.3

Durham SPS Results

Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-237	20.8	0.004	200	8.3	40	20.8	0.004	200	8.3	39.9
SM-275	28.7	0.008	200	3.8	13	28.7	0.008	200	3.8	13.2
SM-777	40.4	0.015	200	0.8	2	40.4	0.015	200	0.8	1.9
SM-802	252.9	0.021	375	43.8	17	252.9	0.021	375	71.7	28.3

Notes:

Denotes greater than 80% capacity utilized.

Denotes greater than 100% capacity utilized (i.e. surcharging).

Huron Terrace SPS Results

Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
CO-1	401.839	0.004	600	203.4	50.6	401.8	0.004	600	271.2	67.5
CO-2	387.6	0.004	600	204.5	52.8	387.6	0.004	600	272.3	70.2
CO-3	551.1	0.008	600	218.7	39.7	551.1	0.008	600	314.1	57.0
CO-4	1130.4	0.034	600	219.8	19.4	1130.4	0.034	600	315.2	27.9
CO-5	513.0	0.007	600	11.3	2.2	513.0	0.007	600	11.1	2.2
CO-6	589.4	0.009	600	12.4	2.1	589.4	0.009	600	12.2	2.1
CO-10	489.8	0.006	600	1.1	0.2	489.8	0.006	600	1.1	0.2
CO-11	916.6	0.022	600	0.0	0.0	916.6	0.022	600	0.0	0.0
CO-12	447.1	0.005	600	2.3	0.5	447.1	0.005	600	2.2	0.5
CO-13	Introduced as a suggested upgrade in 2018 Master Plan.									
SM-97	341.5	0.027	400	274.1	80.3	341.5	0.027	400	368.4	107.9
SM-241	25.7	0.006	200	6.8	26.4	25.7	0.006	200	31.8	123.9
SM-242	26.0	0.006	200	9.0	34.8	26.0	0.006	200	34.1	131.1
SM-243	18.8	0.003	200	10.2	54.1	18.8	0.003	200	35.2	187.0
SM-244	21.0	0.004	200	30.5	145.2	21.0	0.004	200	78.0	370.7
SM-245	26.7	0.007	200	31.7	118.5	26.7	0.007	200	79.1	296.0
SM-246	18.5	0.003	200	32.8	177.4	18.5	0.003	200	80.2	433.9
SM-247	18.2	0.003	200	50.9	279.3	18.2	0.003	200	97.9	537.3
SM-248	26.6	0.007	200	52.0	195.6	26.6	0.007	200	99.0	372.3
SM-249	23.0	0.005	200	1.1	4.9	23.0	0.005	200	1.1	4.8
SM-250	21.6	0.004	200	0.0	0.0	21.6	0.004	200	0.0	0.0
SM-251	20.9	0.004	200	1.1	5.4	20.9	0.004	200	1.1	5.3
SM-256	173.9	0.010	375	5.7	3.3	173.9	0.010	375	5.5	3.2
SM-257	35.1	0.003	250	10.2	29.0	35.1	0.003	250	10.0	28.4
SM-258	37.3	0.004	250	9.0	24.3	37.3	0.004	250	8.9	23.8
SM-259	18.7	0.003	200	0.0	0.0	18.7	0.003	200	0.0	0.0
SM-260	20.8	0.004	200	1.1	5.4	20.8	0.004	200	1.1	5.3
SM-261	21.5	0.004	200	2.3	10.5	21.5	0.004	200	2.2	10.3
SM-262	19.8	0.004	200	1.1	5.7	19.8	0.004	200	1.1	5.6
SM-263	41.5	0.005	250	4.5	10.9	41.5	0.005	250	4.4	10.7
SM-264	39.0	0.004	250	6.8	17.4	39.0	0.004	250	6.6	17.0
SM-265	20.5	0.004	200	3.4	16.6	20.5	0.004	200	3.3	16.2
SM-266	20.5	0.004	200	2.3	11.0	20.5	0.004	200	2.2	10.8
SM-267	23.8	0.005	200	1.1	4.8	23.8	0.005	200	1.1	4.7
SM-270	27.1	0.007	200	2.3	8.4	27.1	0.007	200	2.2	8.2
SM-326	19.8	0.004	200	1.1	5.7	19.8	0.004	200	1.1	5.6
SM-332	38.9	0.014	200	1.1	2.9	38.9	0.014	200	1.1	2.8
SM-333	21.9	0.004	200	4.5	20.7	21.9	0.004	200	27.3	124.9
SM-334	48.9	0.022	200	1.1	2.3	48.9	0.022	200	1.1	2.3

Huron Terrace SPS Results

Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-335	22.5	0.005	200	2.3	10.1	22.5	0.005	200	2.2	9.9
SM-336	34.0	0.011	200	4.5	13.3	34.0	0.011	200	4.4	13.0
SM-337	19.8	0.004	200	10.2	51.3	19.8	0.004	200	32.9	165.6
SM-338	18.7	0.003	200	11.3	60.3	18.7	0.003	200	34.0	181.2
SM-339	22.8	0.005	200	1.1	5.0	22.8	0.005	200	1.1	4.9
SM-340	53.3	0.026	200	2.3	4.2	53.3	0.026	200	2.2	4.2
SM-341	33.2	0.010	200	14.7	44.3	33.2	0.010	200	37.3	112.4
SM-342	62.3	0.036	200	1.1	1.8	62.3	0.036	200	1.1	1.8
SM-343	40.5	0.015	200	2.3	5.6	40.5	0.015	200	2.2	5.5
SM-344	32.8	0.010	200	3.4	10.3	32.8	0.010	200	3.3	10.1
SM-345	28.6	0.008	200	4.5	15.8	28.6	0.008	200	4.4	15.5
SM-346	26.3	0.006	200	1.1	4.3	26.3	0.006	200	1.1	4.2
SM-347	18.5	0.003	200	6.8	36.7	18.5	0.003	200	6.6	35.9
SM-348	14.4	0.002	200	7.9	55.0	14.4	0.002	200	7.7	53.8
SM-349	21.4	0.004	200	5.7	26.5	21.4	0.004	200	5.5	25.9
SM-350	49.4	0.023	200	4.5	9.1	49.4	0.023	200	4.4	9.0
SM-353	21.2	0.004	200	18.1	85.3	21.2	0.004	200	40.6	191.5
SM-354	63.1	0.037	200	1.1	1.8	63.1	0.037	200	1.1	1.8
SM-355	22.4	0.005	200	15.8	70.8	22.4	0.005	200	15.5	69.3
SM-356	51.7	0.025	200	0.0	0.0	51.7	0.025	200	0.0	0.0
SM-357	46.2	0.020	200	1.1	2.4	46.2	0.020	200	1.1	2.4
SM-358	33.5	0.010	200	2.3	6.7	33.5	0.010	200	2.2	6.6
SM-359	41.0	0.016	200	1.1	2.8	41.0	0.016	200	1.1	2.7
SM-360	38.2	0.014	200	2.3	5.9	38.2	0.014	200	2.2	5.8
SM-361	33.7	0.011	200	56.6	167.9	33.7	0.011	200	103.4	307.1
SM-362	237.1	0.003	525	12.4	5.2	237.1	0.003	525	12.2	5.1
SM-363	109.2	0.001	525	13.6	12.4	109.2	0.001	525	13.3	12.2
SM-364	274.9	0.004	525	17.0	6.2	274.9	0.004	525	16.6	6.0
SM-365	142.5	0.001	525	18.1	12.7	142.5	0.001	525	17.7	12.4
SM-366	280.6	0.004	525	144.4	51.4	280.6	0.004	525	212.3	75.7
SM-367	282.3	0.004	525	145.5	51.5	282.3	0.004	525	213.4	75.6
SM-368	285.6	0.004	525	146.6	51.3	285.6	0.004	525	214.5	75.1
SM-369	85.8	0.021	250	54.5	63.5	85.8	0.021	250	54.4	63.4
SM-370	84.0	0.020	250	51.1	60.9	84.0	0.020	250	51.1	60.8
SM-371	111.3	0.035	250	50.0	44.9	111.3	0.035	250	50.0	44.9
SM-372	22.9	0.005	200	6.3	27.3	22.9	0.005	200	34.1	148.8
SM-373	12.3	0.001	200	7.4	60.0	12.3	0.001	200	35.2	286.0
SM-374	61.9	0.036	200	8.5	13.8	61.9	0.036	200	36.3	58.7
SM-375	51.1	0.024	200	9.6	18.9	51.1	0.024	200	37.4	73.2

Huron Terrace SPS Results

Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-376	51.2	0.024	200	10.8	21.1	51.2	0.024	200	38.5	75.3
SM-377	42.7	0.017	200	11.9	27.9	42.7	0.017	200	39.6	92.9
SM-378	32.2	0.010	200	13.0	40.5	32.2	0.010	200	40.7	126.6
SM-379	42.1	0.005	250	55.7	132.1	42.1	0.005	250	55.5	131.9
SM-382	19.2	0.003	200	1.1	5.9	19.2	0.003	200	1.1	5.8
SM-383	34.1	0.011	200	2.3	6.6	34.1	0.011	200	2.2	6.5
SM-384	65.8	0.040	200	3.4	5.2	65.8	0.040	200	3.3	5.0
SM-385	19.5	0.004	200	0.0	0.0	19.5	0.004	200	0.0	0.0
SM-386	24.1	0.005	200	1.1	4.7	24.1	0.005	200	1.1	4.6
SM-387	23.6	0.005	200	1.1	4.8	23.6	0.005	200	24.0	101.7
SM-388	55.3	0.028	200	2.3	4.1	55.3	0.028	200	25.1	45.4
SM-389	41.1	0.016	200	19.2	46.8	41.1	0.016	200	41.7	101.5
SM-390	24.0	0.005	200	4.5	18.8	24.0	0.005	200	4.4	18.4
SM-391	19.5	0.004	200	6.8	34.8	19.5	0.004	200	6.6	34.1
SM-392	225.5	0.003	525	9.0	4.0	225.5	0.003	525	8.9	3.9
SM-393	38.8	0.014	200	1.1	2.9	38.8	0.014	200	1.1	2.9
SM-394	34.3	0.011	200	55.4	161.8	34.3	0.011	200	102.3	298.8
SM-395	45.7	0.019	200	1.1	2.5	45.7	0.019	200	1.1	2.4
SM-396	43.7	0.005	250	13.6	31.1	43.7	0.005	250	13.3	30.4
SM-397	103.5	0.030	250	14.7	14.2	103.5	0.030	250	14.4	13.9
SM-398	36.7	0.004	250	17.0	46.3	36.7	0.004	250	16.6	45.3
SM-399	38.6	0.004	250	18.1	46.9	38.6	0.004	250	17.7	45.9
SM-400	32.4	0.003	250	19.2	59.3	32.4	0.003	250	18.8	58.0
SM-401	38.9	0.014	200	4.5	11.6	38.9	0.014	200	4.4	11.4
SM-402	48.7	0.022	200	5.7	11.6	48.7	0.022	200	5.5	11.4
SM-403	38.9	0.004	250	26.0	66.9	38.9	0.004	250	25.5	65.5
SM-404	38.7	0.004	250	27.1	70.2	38.7	0.004	250	26.6	68.7
SM-406	92.6	0.024	250	28.3	30.5	92.6	0.024	250	27.7	29.9
SM-407	123.0	0.043	250	29.4	23.9	123.0	0.043	250	28.8	23.4
SM-408	61.8	0.011	250	30.5	49.4	61.8	0.011	250	29.9	48.4
SM-409	72.4	0.015	250	31.7	43.7	72.4	0.015	250	31.0	42.8
SM-410	1056.9	0.030	600	239.1	22.6	1056.9	0.030	600	334.0	31.6
SM-411	345.3	0.003	600	237.9	68.9	345.3	0.003	600	332.9	96.4
SM-413	139.3	0.055	250	17.0	12.2	139.3	0.055	250	16.6	11.9
SM-416	77.0	0.055	200	1.1	1.5	77.0	0.055	200	1.1	1.4
SM-417	16.2	0.002	200	5.7	35.0	16.2	0.002	200	5.5	34.3
SM-418	20.6	0.004	200	1.1	5.5	20.6	0.004	200	1.1	5.4
SM-419	29.2	0.008	200	1.1	3.9	29.2	0.008	200	1.1	3.8
SM-420	32.7	0.010	200	3.4	10.4	32.7	0.010	200	3.3	10.2

Huron Terrace SPS Results

Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-421	44.2	0.018	200	1.1	2.6	44.2	0.018	200	1.1	2.5
SM-422	21.8	0.004	200	1.1	5.2	21.8	0.004	200	1.1	5.1
SM-423	24.0	0.005	200	2.3	9.4	24.0	0.005	200	2.2	9.2
SM-424	39.6	0.015	200	1.1	2.9	39.6	0.015	200	1.1	2.8
SM-425	42.6	0.017	200	3.4	8.0	42.6	0.017	200	3.3	7.8
SM-426	59.1	0.033	200	4.5	7.6	59.1	0.033	200	4.4	7.5
SM-427	21.2	0.004	200	0.0	0.0	21.2	0.004	200	0.0	0.0
SM-428	26.7	0.007	200	2.3	8.5	26.7	0.007	200	2.2	8.3
SM-429	24.6	0.006	200	17.0	69.0	24.6	0.006	200	16.6	67.6
SM-433	59.8	0.033	200	1.1	1.9	59.8	0.033	200	1.1	1.9
SM-434	46.5	0.020	200	2.3	4.9	46.5	0.020	200	2.2	4.8
SM-767	155.5	0.003	450	1.1	0.7	155.5	0.003	450	24.0	15.4
SM-768	156.9	0.003	450	2.3	1.4	156.9	0.003	450	25.1	16.0
SM-769	156.3	0.003	450	3.4	2.2	156.3	0.003	450	26.2	16.8
SM-770	20.4	0.004	200	4.5	22.1	20.4	0.004	200	28.5	139.6
SM-771	15.5	0.002	200	5.7	36.4	15.5	0.002	200	30.7	197.8
SM-808	49.8	0.007	250	15.8	31.8	49.8	0.007	250	15.5	31.1
SM-922	37.4	0.004	250	7.9	21.2	37.4	0.004	250	7.7	20.7
SM-944	1925.9	0.098	600	240.2	12.5	1925.9	0.098	600	335.1	17.4
SM-945	2378.4	0.150	600	241.3	10.1	2378.4	0.150	600	336.3	14.1
SM-951	39.1	0.004	250	5.7	14.5	39.1	0.004	250	5.5	14.2
SM-977	21.1	0.004	200	3.4	16.0	21.1	0.004	200	3.3	15.7
SM-978	38.6	0.014	200	2.3	5.9	38.6	0.014	200	2.2	5.7
SM-979	40.4	0.015	200	1.1	2.8	40.4	0.015	200	1.1	2.7

Notes:

Denotes greater than 80% capacity utilized.

Denotes greater than 100% capacity utilized (i.e. surcharging).

Park St. SPS Results

Conduit ID	Existing Conditions					Future Conditions - Russell/Millennium Sewer Capacity Base Case				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
CO-1	165.7	0.009	375	13.9	8.4	165.7	0.009	375	60.2	36.3
CO-2	139.0	0.006	375	13.2	9.5	139.0	0.006	375	59.6	42.8
CO-3	199.2	0.013	375	12.6	6.3	199.2	0.013	375	58.9	29.6
CO-4	154.0	0.008	375	11.9	7.7	154.0	0.008	375	58.2	37.8
CO-5	119.6	0.005	375	11.2	9.4	119.6	0.005	375	57.6	48.1
CO-6	99.7	0.003	375	10.6	10.6	99.7	0.003	375	56.9	57.0
CO-7	121.3	0.005	375	9.9	8.2	121.3	0.005	375	56.2	46.4
CO-8	86.2	0.002	375	9.3	10.7	86.2	0.002	375	55.6	64.4
CO-9	152.5	0.008	375	8.6	5.6	152.5	0.008	375	0.0	0.0
CO-10	72.6	0.006	300	7.9	10.9	72.6	0.006	300	0.0	0.0
CO-11	69.5	0.005	300	7.3	10.5	69.5	0.005	300	0.0	0.0
CO-12	69.4	0.005	300	6.6	9.5	69.4	0.005	300	0.0	0.0
CO-13	56.3	0.003	300	5.9	10.6	56.3	0.003	300	0.0	0.0
CO-14	69.2	0.005	300	5.3	7.6	69.2	0.005	300	0.0	0.0
CO-15	75.0	0.006	300	4.6	6.2	75.0	0.006	300	0.0	0.0
CO-16	100.8	0.011	300	4.0	3.9	100.8	0.011	300	0.0	0.0
CO-17	84.6	0.012	250	0.7	0.8	84.6	0.012	250	0.0	0.0
CO-18	121.6	0.025	250	1.3	1.1	121.6	0.025	250	0.0	0.0
CO-19	108.9	0.02	250	2.0	1.8	108.9	0.02	250	0.0	0.0
CO-20	73.8	0.009	250	2.6	3.6	73.8	0.009	250	0.0	0.0
CO-21	262.8	0.022	375	14.5	5.5	262.8	0.022	375	60.9	23.2
SM-2	76.2	0.054	200	0.7	0.9	76.2	0.054	200	0.7	0.9
SM-3	56.1	0.029	200	1.3	2.4	56.1	0.029	200	1.3	2.4
SM-6	75.7	0.053	200	2.0	2.6	75.7	0.053	200	2.0	2.6
SM-91	35.4	0.012	200	0.7	1.9	35.4	0.012	200	0.0	0.0
SM-95	36.7	0.004	250	0.7	1.8	36.7	0.004	250	0.7	1.8
SM-444	39.0	0.014	200	1.3	3.4	39.0	0.014	200	1.3	3.4
SM-445	40.6	0.015	200	2.0	4.9	40.6	0.015	200	2.0	4.9
SM-446	40.2	0.015	200	2.6	6.6	40.2	0.015	200	2.7	6.6
SM-447	39.4	0.014	200	3.3	8.4	39.4	0.014	200	3.3	8.4
SM-448	25.8	0.006	200	2.0	7.7	25.8	0.006	200	2.0	7.7
SM-449	25.1	0.006	200	1.3	5.3	25.1	0.006	200	1.3	5.3
SM-451	37.0	0.013	200	0.7	1.8	37.0	0.013	200	0.7	1.8
SM-452	26.5	0.007	200	0.0	0.0	26.5	0.007	200	0.0	0.0
SM-453	49.7	0.023	200	0.7	1.3	49.7	0.023	200	0.7	1.3
SM-454	25.9	0.006	200	1.3	5.1	25.9	0.006	200	1.3	5.1
SM-455	26.1	0.006	200	2.6	10.1	26.1	0.006	200	2.7	10.2
SM-456	27.2	0.007	200	3.3	12.2	27.2	0.007	200	3.3	12.2
SM-457	26.4	0.006	200	4.0	15.0	26.4	0.006	200	4.0	15.1

Park St. SPS Results

Conduit ID	Existing Conditions					Future Conditions - Russell/Millennium Sewer Capacity Base Case				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-458	26.7	0.007	200	4.6	17.3	26.7	0.007	200	4.7	17.5
SM-459	26.9	0.007	200	5.3	19.6	26.9	0.007	200	5.3	19.8
SM-460	25.5	0.006	200	5.9	23.4	25.5	0.006	200	6.0	23.5
SM-461	25.9	0.006	200	6.6	25.5	25.9	0.006	200	6.7	25.7
SM-462	26.7	0.007	200	1.3	4.9	26.7	0.007	200	1.3	5.0
SM-463	40.5	0.015	200	0.7	1.6	40.5	0.015	200	0.7	1.6
SM-464	33.3	0.01	200	5.9	17.9	33.3	0.01	200	6.0	18.0
SM-466	163.3	0.006	400	58.2	35.6	163.3	0.006	400	105.2	64.4
SM-467	144.3	0.005	400	63.5	44.0	144.3	0.005	400	110.5	76.6
SM-468	148.9	0.005	400	64.1	43.1	148.9	0.005	400	111.2	74.7
SM-469	130.6	0.004	400	80.6	61.7	130.6	0.004	400	127.8	97.9
SM-470	133.0	0.004	400	81.3	61.2	133.0	0.004	400	128.5	96.7
SM-471	141.2	0.005	400	82.0	58.0	141.2	0.005	400	129.2	91.5
SM-472	161.2	0.006	400	82.6	51.3	161.2	0.006	400	129.8	80.5
SM-473	137.4	0.004	400	85.3	62.1	137.4	0.004	400	132.5	96.5
SM-474	131.2	0.004	400	85.9	65.5	131.2	0.004	400	133.2	101.5
SM-475	121.9	0.003	400	86.6	71.0	121.9	0.003	400	133.8	109.8
SM-476	115.2	0.003	400	87.3	75.7	115.2	0.003	400	134.5	116.7
SM-477	175.4	0.004	450	95.8	54.7	175.4	0.004	450	143.2	81.6
SM-478	171.1	0.004	450	96.5	56.4	171.1	0.004	450	143.8	84.1
SM-479	26.4	0.006	200	0.7	2.5	26.4	0.006	200	0.7	2.5
SM-480	16.7	0.003	200	14.5	87.0	16.7	0.003	200	14.7	87.6
SM-481	27.2	0.007	200	15.9	58.3	27.2	0.007	200	16.0	58.7
SM-482	24.6	0.006	200	15.2	61.8	24.6	0.006	200	15.3	62.3
SM-483	27.1	0.007	200	2.0	7.3	27.1	0.007	200	2.0	7.4
SM-484	45.6	0.019	200	1.3	2.9	45.6	0.019	200	1.3	2.9
SM-485	22.8	0.005	200	0.7	2.9	22.8	0.005	200	0.7	2.9
SM-486	24.0	0.005	200	0.0	0.0	24.0	0.005	200	0.0	0.0
SM-487	25.7	0.006	200	0.7	2.6	25.7	0.006	200	0.7	2.6
SM-488	21.7	0.004	200	1.3	6.1	21.7	0.004	200	1.3	6.1
SM-489	27.2	0.007	200	2.0	7.3	27.2	0.007	200	2.0	7.3
SM-490	24.9	0.006	200	4.6	18.6	24.9	0.006	200	4.7	18.7
SM-491	26.7	0.007	200	2.0	7.4	26.7	0.007	200	2.0	7.5
SM-492	22.4	0.005	200	1.3	5.9	22.4	0.005	200	1.3	6.0
SM-493	21.6	0.004	200	0.7	3.1	21.6	0.004	200	0.7	3.1
SM-496	22.8	0.005	200	7.3	31.9	22.8	0.005	200	7.3	32.1
SM-497	106.1	0.105	200	7.9	7.5	106.1	0.105	200	8.0	7.5
SM-498	24.5	0.006	200	6.6	27.0	24.5	0.006	200	6.7	27.2
SM-499	27.2	0.007	200	3.3	12.1	27.2	0.007	200	3.3	12.2

Park St. SPS Results

Conduit ID	Existing Conditions					Future Conditions - Russell/Millennium Sewer Capacity Base Case				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-500	39.1	0.004	250	30.4	77.8	39.1	0.004	250	30.6	78.4
SM-501	38.0	0.013	200	0.7	1.7	38.0	0.013	200	0.7	1.8
SM-502	49.9	0.023	200	1.3	2.6	49.9	0.023	200	1.3	2.7
SM-503	26.2	0.006	200	5.3	20.2	26.2	0.006	200	5.7	21.7
SM-504	24.4	0.006	200	5.9	24.4	24.4	0.006	200	6.3	26.0
SM-509	39.2	0.014	200	0.7	1.7	39.2	0.014	200	0.7	1.7
SM-510	32.9	0.01	200	1.3	4.0	32.9	0.01	200	1.3	4.0
SM-511	32.9	0.01	200	2.0	6.0	32.9	0.01	200	2.0	6.1
SM-512	26.6	0.007	200	3.3	12.4	26.6	0.007	200	3.7	13.8
SM-513	21.0	0.004	200	0.7	3.2	21.0	0.004	200	1.0	4.9
SM-515	29.0	0.008	200	2.6	9.1	29.0	0.008	200	2.7	9.2
SM-516	38.9	0.004	250	25.1	64.5	38.9	0.004	250	25.3	65.0
SM-518	64.5	0.012	250	14.5	22.6	64.5	0.012	250	14.7	22.7
SM-519	42.1	0.005	250	15.2	36.1	42.1	0.005	250	15.3	36.4
SM-520	36.8	0.004	250	24.5	66.5	36.8	0.004	250	24.6	67.0
SM-521	31.5	0.009	200	0.7	2.1	31.5	0.009	200	0.7	2.1
SM-522	32.6	0.01	200	2.0	6.1	32.6	0.01	200	2.0	6.1
SM-523	35.9	0.012	200	2.6	7.4	35.9	0.012	200	2.7	7.4
SM-524	36.3	0.012	200	3.3	9.1	36.3	0.012	200	3.3	9.2
SM-525	40.7	0.015	200	0.7	1.6	40.7	0.015	200	0.7	1.6
SM-526	39.1	0.014	200	0.7	1.7	39.1	0.014	200	0.7	1.7
SM-527	35.9	0.012	200	1.3	3.7	35.9	0.012	200	1.3	3.7
SM-528	26.4	0.006	200	2.0	7.5	26.4	0.006	200	2.0	7.6
SM-529	26.0	0.006	200	2.6	10.2	26.0	0.006	200	2.7	10.2
SM-530	25.7	0.006	200	3.3	12.9	25.7	0.006	200	3.3	13.0
SM-531	24.4	0.006	200	7.3	29.8	24.4	0.006	200	7.3	30.1
SM-532	24.4	0.006	200	7.9	32.5	24.4	0.006	200	8.0	32.7
SM-533	26.2	0.006	200	8.6	32.8	26.2	0.006	200	8.7	33.0
SM-534	34.1	0.011	200	0.7	1.9	34.1	0.011	200	0.7	2.0
SM-535	37.6	0.013	200	1.3	3.5	37.6	0.013	200	1.3	3.5
SM-536	26.5	0.007	200	2.0	7.5	26.5	0.007	200	2.0	7.5
SM-537	28.6	0.008	200	5.9	20.8	28.6	0.008	200	6.0	21.0
SM-538	25.8	0.006	200	6.6	25.6	25.8	0.006	200	6.7	25.8
SM-539	23.1	0.005	200	7.9	34.4	23.1	0.005	200	8.0	34.6
SM-540	46.1	0.02	200	0.7	1.4	46.1	0.02	200	0.7	1.4
SM-541	33.8	0.011	200	0.7	2.0	33.8	0.011	200	0.7	2.0
SM-542	37.1	0.004	250	42.3	114.1	37.1	0.004	250	43.0	115.9
SM-543	153.5	0.005	400	43.0	28.0	153.5	0.005	400	43.6	28.4
SM-544	141.2	0.056	250	1.3	0.9	141.2	0.056	250	1.3	0.9

Park St. SPS Results

Conduit ID	Existing Conditions					Future Conditions - Russell/Millennium Sewer Capacity Base Case				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-545	51.0	0.007	250	2.0	3.9	51.0	0.007	250	2.0	3.9
SM-546	50.6	0.007	250	2.6	5.2	50.6	0.007	250	2.7	5.3
SM-547	52.7	0.008	250	4.0	7.5	52.7	0.008	250	4.0	7.6
SM-548	46.8	0.006	250	4.6	9.9	46.8	0.006	250	4.7	10.0
SM-549	51.5	0.008	250	5.3	10.3	51.5	0.008	250	5.3	10.3
SM-550	41.3	0.005	250	13.2	32.0	41.3	0.005	250	13.3	32.2
SM-551	37.4	0.004	250	13.9	37.1	37.4	0.004	250	14.0	37.4
SM-552	31.5	0.003	250	1.3	4.2	31.5	0.003	250	1.3	4.2
SM-553	29.8	0.008	200	2.0	6.6	29.8	0.008	200	2.0	6.7
SM-554	39.6	0.015	200	3.3	8.3	39.6	0.015	200	3.3	8.4
SM-555	26.6	0.007	200	4.0	14.9	26.6	0.007	200	4.0	15.0
SM-556	22.9	0.005	200	12.6	54.8	22.9	0.005	200	12.7	55.2
SM-557	42.9	0.005	250	25.8	60.2	42.9	0.005	250	26.0	60.6
SM-558	75.4	0.016	250	26.4	35.1	75.4	0.016	250	26.6	35.3
SM-559	39.3	0.014	200	0.7	1.7	39.3	0.014	200	0.7	1.7
SM-560	89.4	0.074	200	2.0	2.2	89.4	0.074	200	2.0	2.2
SM-561	36.1	0.012	200	2.6	7.3	36.1	0.012	200	2.7	7.4
SM-562	23.6	0.005	200	3.3	14.0	23.6	0.005	200	3.3	14.1
SM-563	37.4	0.013	200	0.0	0.0	37.4	0.013	200	0.0	0.0
SM-578	20.6	0.004	200	0.7	3.2	20.6	0.004	200	0.7	3.2
SM-580	31.6	0.003	250	1.3	4.2	31.6	0.003	250	1.3	4.2
SM-581	26.9	0.002	250	2.0	7.4	26.9	0.002	250	2.0	7.4
SM-582	36.8	0.004	250	3.3	9.0	36.8	0.004	250	3.3	9.0
SM-583	30.0	0.003	250	4.0	13.2	30.0	0.003	250	4.0	13.3
SM-584	30.0	0.003	250	5.3	17.6	30.0	0.003	250	5.3	17.8
SM-585	26.4	0.002	250	5.9	22.5	26.4	0.002	250	6.0	22.7
SM-607	31.4	0.003	250	0.0	0.0	31.4	0.003	250	0.0	0.0
SM-608	31.6	0.003	250	0.7	2.1	31.6	0.003	250	0.7	2.1
SM-613	47.1	0.006	250	1.3	2.8	47.1	0.006	250	1.3	2.8
SM-803	27.8	0.002	250	4.6	16.7	27.8	0.002	250	4.7	16.8
SM-804	23.4	0.002	250	2.6	11.3	23.4	0.002	250	2.7	11.4
SM-847	43.7	0.018	200	0.7	1.5	43.7	0.018	200	0.7	1.5
SM-980	48.5	0.007	250	3.3	6.8	48.5	0.007	250	3.3	6.9

Notes:

Denotes greater than 80% capacity utilized.

Denotes greater than 100% capacity utilized (i.e. surcharging).

Goderich SPS Results

Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SAN 1	33.5	0.003	250	0.2	0.7	33.5	0.003	250	0.5	1.6
SAN 2	32.5	0.003	250	5.9	18.0	32.5	0.003	250	12.6	38.8
SAN 3	24.0	0.002	250	6.1	25.4	24.0	0.002	250	13.2	54.8
SAN 4	23.2	0.005	200	5.1	22.1	23.2	0.005	200	11.0	47.6
SAN 193	32.7	0.003	250	0.5	1.5	32.7	0.003	250	1.1	3.2
SAN 194	31.4	0.003	250	11.7	37.3	31.4	0.003	250	25.2	80.5
SAN 195	26.9	0.002	250	6.3	23.6	26.9	0.002	250	13.7	50.8
SAN 278	39.4	0.014	200	4.9	12.4	39.4	0.014	200	10.5	26.7
SAN 279	18.7	0.003	200	2.7	14.4	18.7	0.003	200	5.8	31.0
SAN 280	21.0	0.004	200	2.4	11.6	21.0	0.004	200	5.3	25.1
SAN 281	32.0	0.010	200	0.2	0.8	32.0	0.010	200	0.5	1.6
SAN 282	23.5	0.005	200	0.2	1.0	23.5	0.005	200	0.5	2.2
SAN 283	21.1	0.004	200	1.5	6.9	21.1	0.004	200	3.2	14.9
SAN 284	19.7	0.004	200	0.7	3.7	19.7	0.004	200	1.6	8.0
SAN 285	20.3	0.004	200	0.5	2.4	20.3	0.004	200	1.1	5.2
SAN 286	23.0	0.005	200	0.2	1.1	23.0	0.005	200	0.5	2.3
SAN 287	23.4	0.005	200	0.2	1.0	23.4	0.005	200	0.5	2.3
SAN 288	20.7	0.004	200	0.5	2.4	20.7	0.004	200	1.1	5.1
SAN 289	20.6	0.004	200	0.7	3.6	20.6	0.004	200	1.6	7.7
SAN 290	19.1	0.003	200	1.0	5.1	19.1	0.003	200	2.1	11.0
SAN 291	20.0	0.004	200	1.2	6.1	20.0	0.004	200	2.6	13.2
SAN 292	20.0	0.004	200	1.5	7.3	20.0	0.004	200	3.2	15.8
SAN 293	19.7	0.004	200	1.0	4.9	19.7	0.004	200	2.1	10.7
SAN 294	19.2	0.003	200	1.2	6.4	19.2	0.003	200	2.6	13.7
SAN 295	25.0	0.006	200	1.7	6.8	25.0	0.006	200	3.7	14.7
SAN 296	21.2	0.004	200	1.7	8.1	21.2	0.004	200	3.7	17.4
SAN 297	20.2	0.004	200	2.0	9.7	20.2	0.004	200	4.2	20.9
SAN 298	21.3	0.004	200	2.2	10.3	21.3	0.004	200	4.7	22.2
SAN 299	22.6	0.005	200	3.4	15.1	22.6	0.005	200	7.4	32.6
SAN 300	21.0	0.004	200	0.7	3.5	21.0	0.004	200	1.6	7.5
SAN 301	21.0	0.004	200	1.0	4.6	21.0	0.004	200	2.1	10.0
SAN 302	37.5	0.013	200	1.2	3.3	37.5	0.013	200	2.6	7.0
SAN 303	23.9	0.005	200	0.5	2.0	23.9	0.005	200	1.1	4.4
SAN 304	50.8	0.024	200	0.2	0.5	50.8	0.024	200	0.5	1.0
SAN 305	25.8	0.006	200	0.5	1.9	25.8	0.006	200	1.1	4.1
SAN 306	27.5	0.007	200	0.7	2.7	27.5	0.007	200	1.6	5.7
SAN 307	34.3	0.011	200	1.0	2.8	34.3	0.011	200	2.1	6.1
SAN 311	31.9	0.009	200	2.2	6.9	31.9	0.009	200	4.7	14.8

Goderich SPS Results

Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SAN 312	34.7	0.011	200	2.4	7.0	34.7	0.011	200	5.3	15.2
SAN 313	46.6	0.020	200	2.7	5.8	46.6	0.020	200	5.8	12.4
SAN 314	20.8	0.004	200	4.9	23.5	20.8	0.004	200	10.5	50.6
SAN 315	37.5	0.004	250	1.2	3.3	37.5	0.004	250	2.6	7.0
SAN 317	57.9	0.009	250	1.5	2.5	57.9	0.009	250	3.2	5.4
SAN 321	49.3	0.023	200	1.0	2.0	49.3	0.023	200	2.1	4.3
SAN 322	25.7	0.006	200	1.2	4.7	25.7	0.006	200	2.6	10.2
SAN 323	20.9	0.004	200	1.5	7.0	20.9	0.004	200	3.2	15.1
SAN 324	20.8	0.004	200	0.5	2.4	20.8	0.004	200	1.1	5.1
SAN 325	32.7	0.010	200	0.2	0.7	32.7	0.010	200	0.5	1.6
SAN 326	46.2	0.020	200	0.2	0.5	46.2	0.020	200	0.5	1.1
SAN 327	20.9	0.004	200	2.0	9.3	20.9	0.004	200	4.2	20.1
SAN 328	85.2	0.021	250	1.7	2.0	85.2	0.021	250	3.7	4.3
SAN 329	74.4	0.016	250	2.0	2.6	74.4	0.016	250	4.2	5.7
SAN 330	28.7	0.002	250	12.4	43.4	28.7	0.002	250	26.8	93.6
SAN 331	32.7	0.003	250	12.2	37.4	32.7	0.003	250	26.3	80.5
SAN 332	31.6	0.003	250	12.0	37.8	31.6	0.003	250	25.8	81.6
SAN 333	47.2	0.006	250	6.6	14.0	47.2	0.006	250	14.2	30.1
SAN 334	20.8	0.004	200	0.2	1.2	20.8	0.004	200	0.5	2.5
SAN 341	29.4	0.008	200	0.2	0.8	29.4	0.008	200	0.5	1.8
SAN 342	27.4	0.007	200	2.0	7.1	27.4	0.007	200	4.2	15.4
SM-81	48.9	0.022	200	0.2	0.5	48.9	0.022	200	0.5	1.1
SM-82	19.9	0.004	200	0.5	2.4	19.9	0.004	200	1.1	5.3
SM-83	21.7	0.004	200	0.7	3.4	21.7	0.004	200	1.6	7.3
SM-268	21.5	0.004	200	0.5	2.3	21.5	0.004	200	1.1	4.9
SM-269	21.7	0.004	200	0.2	1.1	21.7	0.004	200	0.5	2.4
SM-271	24.0	0.005	200	0.2	1.0	24.0	0.005	200	0.5	2.2
SM-272	25.7	0.006	200	0.5	1.9	25.7	0.006	200	1.1	4.1
SM-274	18.4	0.003	200	0.7	4.0	18.4	0.003	200	1.6	8.6
SM-276	33.5	0.003	250	1.0	2.9	33.5	0.003	250	2.1	6.3
SM-277	34.3	0.003	250	1.2	3.6	34.3	0.003	250	2.6	7.7
SM-278	35.4	0.004	250	1.5	4.1	35.4	0.004	250	3.2	8.9
SM-279	31.2	0.003	250	1.7	5.5	31.2	0.003	250	3.7	11.8
SM-280	35.5	0.004	250	2.0	5.5	35.5	0.004	250	4.2	11.8
SM-281	215.8	0.006	450	27.8	12.9	215.8	0.006	450	60.0	27.8
SM-282	161.0	0.003	450	28.1	17.4	161.0	0.003	450	60.5	37.6
SM-283	146.6	0.003	450	28.3	19.3	146.6	0.003	450	61.0	41.6
SM-284	149.5	0.003	450	28.5	19.1	149.5	0.003	450	61.5	41.2

Goderich SPS Results

Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-285	137.1	0.002	450	28.8	21.0	137.1	0.002	450	62.1	45.3
SM-286	146.2	0.003	450	29.0	19.9	146.2	0.003	450	62.6	42.8
SM-294	148.1	0.007	375	14.6	9.9	148.1	0.007	375	31.6	21.3
SM-295	75.1	0.002	375	14.9	19.8	75.1	0.002	375	32.1	42.7
SM-296	138.1	0.006	375	15.1	11.0	138.1	0.006	375	32.6	23.6
SM-297	93.1	0.003	375	18.3	19.7	93.1	0.003	375	39.5	42.4
SM-298	126.8	0.005	375	18.5	14.6	126.8	0.005	375	40.0	31.5
SM-299	123.9	0.005	375	19.8	15.9	123.9	0.005	375	42.6	34.4
SM-300	246.0	0.020	375	25.4	10.3	246.0	0.020	375	54.7	22.2
SM-301	459.5	0.069	375	25.6	5.6	459.5	0.069	375	55.2	12.0
SM-302	21.9	0.004	200	2.2	10.0	21.9	0.004	200	4.7	21.7
SM-303	21.5	0.004	200	2.4	11.3	21.5	0.004	200	5.3	24.5
SM-304	21.6	0.004	200	2.7	12.4	21.6	0.004	200	5.8	26.7
SM-305	19.8	0.004	200	2.9	14.8	19.8	0.004	200	6.3	31.8
SM-306	45.5	0.019	200	2.0	4.3	45.5	0.019	200	4.2	9.3
SM-307	46.0	0.020	200	2.2	4.8	46.0	0.020	200	4.7	10.3
SM-308	55.2	0.028	200	2.4	4.4	55.2	0.028	200	5.3	9.5
SM-309	23.9	0.005	200	0.2	1.0	23.9	0.005	200	0.5	2.2
SM-310	39.8	0.004	250	0.2	0.6	39.8	0.004	250	0.5	1.3
SM-311	42.0	0.005	250	0.7	1.7	42.0	0.005	250	1.6	3.8
SM-312	167.6	0.079	250	1.0	0.6	167.6	0.079	250	2.1	1.3
SM-313	55.9	0.029	200	0.2	0.4	55.9	0.029	200	0.5	0.9
SM-314	48.6	0.022	200	1.0	2.0	48.6	0.022	200	2.1	4.3
SM-315	47.1	0.021	200	1.2	2.6	47.1	0.021	200	2.6	5.6
SM-316	21.1	0.004	200	0.2	1.2	21.1	0.004	200	0.5	2.5
SM-317	20.8	0.004	200	0.5	2.3	20.8	0.004	200	1.1	5.0
SM-327	21.3	0.004	200	0.2	1.1	21.3	0.004	200	0.5	2.5
SM-328	20.2	0.004	200	0.5	2.4	20.2	0.004	200	1.1	5.2
SM-329	20.1	0.004	200	0.7	3.6	20.1	0.004	200	1.6	7.8
SM-431	23.5	0.005	200	1.0	4.2	23.5	0.005	200	2.1	9.0
SM-570	21.5	0.004	200	1.2	5.7	21.5	0.004	200	2.6	12.3
SM-797	44.0	0.001	375	18.1	41.0	44.0	0.001	375	38.9	88.4
SM-911	47.4	0.021	200	0.2	0.5	47.4	0.021	200	0.5	1.1
SM-912	42.1	0.016	200	0.5	1.2	42.1	0.016	200	1.1	2.5
SM-913	25.8	0.006	200	0.7	2.8	25.8	0.006	200	1.6	6.1
SM-914	22.4	0.005	200	1.0	4.3	22.4	0.005	200	2.1	9.4
SM-915	33.3	0.010	200	1.2	3.7	33.3	0.010	200	2.6	7.9
SM-916	43.0	0.017	200	1.2	2.8	43.0	0.017	200	2.6	6.1

Goderich SPS Results

Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-917	46.8	0.020	200	1.0	2.1	46.8	0.020	200	2.1	4.5
SM-918	43.3	0.017	200	0.7	1.7	43.3	0.017	200	1.6	3.6
SM-919	36.7	0.013	200	0.5	1.3	36.7	0.013	200	1.1	2.9
SM-920	20.8	0.004	200	0.2	1.2	20.8	0.004	200	0.5	2.5
SM-921	13.3	0.002	200	2.7	20.2	13.3	0.002	200	5.8	43.5

Notes:

Denotes greater than 80% capacity utilized.

Denotes greater than 100% capacity utilized (i.e. surcharging).

Kincardine SPS Results

Conduit ID	Existing Conditions					Future Conditions - Brown to 832 and Brigadoon to 380				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-18	20.7	0.004	200	0.4	1.8	20.7	0.004	200	0.4	1.8
SM-19	20.6	0.004	200	0.8	3.7	20.6	0.004	200	0.8	3.7
SM-20	30.1	0.008	200	0.0	0.0	30.1	0.008	200	0.0	0.0
SM-21	21.8	0.004	200	0.4	1.7	21.8	0.004	200	0.4	1.8
SM-22	21.3	0.004	200	0.8	3.6	21.3	0.004	200	0.8	3.6
SM-23	34.8	0.011	200	1.1	3.3	34.8	0.011	200	1.1	3.3
SM-24	20.5	0.004	200	0.4	1.8	20.5	0.004	200	0.4	1.9
SM-26	48.9	0.022	200	1.9	3.9	48.9	0.022	200	1.9	3.9
SM-27	21.5	0.004	200	0.4	1.8	21.5	0.004	200	0.4	1.8
SM-28	20.6	0.004	200	0.8	3.7	20.6	0.004	200	0.8	3.7
SM-29	20.7	0.004	200	1.1	5.5	20.7	0.004	200	1.1	5.5
SM-30	31.6	0.009	200	0.4	1.2	31.6	0.009	200	0.4	1.2
SM-31	23.1	0.005	200	0.8	3.3	23.1	0.005	200	0.8	3.3
SM-32	21.6	0.004	200	1.1	5.3	21.6	0.004	200	1.1	5.3
SM-33	24.8	0.006	200	0.0	0.0	24.8	0.006	200	0.0	0.0
SM-34	13.7	0.002	200	0.4	2.8	13.7	0.002	200	0.4	2.8
SM-35	20.6	0.004	200	0.8	3.7	20.6	0.004	200	0.8	3.7
SM-36	58.4	0.032	200	1.1	1.9	58.4	0.032	200	1.1	2.0
SM-37	18.8	0.003	200	2.3	12.1	18.8	0.003	200	2.3	12.2
SM-38	19.2	0.003	200	2.7	13.8	19.2	0.003	200	2.7	13.9
SM-39	30.1	0.003	250	3.4	11.3	30.1	0.003	250	3.4	11.4
SM-40	31.9	0.003	250	3.8	11.9	31.9	0.003	250	3.8	12.0
SM-41	33.5	0.003	250	4.2	12.5	33.5	0.003	250	4.2	12.6
SM-42	30.4	0.003	250	4.5	15.0	30.4	0.003	250	4.6	15.1
SM-43	56.1	0.003	300	4.5	8.1	56.1	0.003	300	4.6	8.2
SM-44	49.4	0.003	300	4.9	10.0	49.4	0.003	300	5.0	10.1
SM-45	50.8	0.003	300	9.9	19.4	50.8	0.003	300	9.9	19.6
SM-46	50.7	0.003	300	10.2	20.2	50.7	0.003	300	10.3	20.4
SM-47	20.9	0.004	200	1.9	9.1	20.9	0.004	200	1.9	9.1
SM-48	21.8	0.004	200	2.3	10.5	21.8	0.004	200	2.3	10.5
SM-49	19.2	0.003	200	2.7	13.8	19.2	0.003	200	2.7	13.9
SM-50	21.9	0.004	200	4.9	22.5	21.9	0.004	200	5.0	22.7
SM-51	33.1	0.01	200	5.3	16.1	33.1	0.010	200	5.3	16.2
SM-52	23.2	0.005	200	1.5	6.5	23.2	0.005	200	1.5	6.6
SM-53	19.5	0.004	200	0.4	1.9	19.5	0.004	200	0.4	2.0
SM-54	20.9	0.004	200	1.1	5.4	20.9	0.004	200	1.1	5.5
SM-55	20.8	0.004	200	0.8	3.7	20.8	0.004	200	0.8	3.7
SM-56	23.4	0.005	200	0.4	1.6	23.4	0.005	200	0.4	1.6
SM-57	42.6	0.017	200	0.8	1.8	42.6	0.017	200	0.8	1.8

Kincardine SPS Results

Conduit ID	Existing Conditions					Future Conditions - Brown to 832 and Brigadoon to 380				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-58	24.1	0.005	200	1.9	7.9	24.1	0.005	200	1.9	7.9
SM-59	20.7	0.004	200	0.4	1.8	20.7	0.004	200	0.4	1.8
SM-60	20.6	0.004	200	0.8	3.7	20.6	0.004	200	0.8	3.7
SM-61	32.5	0.01	200	0.4	1.2	32.5	0.010	200	0.4	1.2
SM-62	27.6	0.007	200	1.5	5.5	27.6	0.007	200	1.5	5.5
SM-63	27.4	0.007	200	1.9	6.9	27.4	0.007	200	1.9	7.0
SM-64	24.1	0.005	200	2.3	9.4	24.1	0.005	200	2.3	9.5
SM-65	23.3	0.005	200	2.7	11.4	23.3	0.005	200	2.7	11.5
SM-67	20.8	0.004	200	3.4	16.4	20.8	0.004	200	3.4	16.6
SM-68	29.0	0.008	200	6.1	20.9	29.0	0.008	200	6.1	21.1
SM-69	30.3	0.009	200	6.4	21.2	30.3	0.009	200	6.5	21.4
SM-72	32.4	0.01	200	0.4	1.2	32.4	0.010	200	0.4	1.2
SM-73	28.6	0.008	200	0.8	2.6	28.6	0.008	200	0.8	2.7
SM-74	35.5	0.012	200	0.4	1.1	35.5	0.012	200	0.4	1.1
SM-75	26.1	0.006	200	0.8	2.9	26.1	0.006	200	0.8	2.9
SM-76	25.9	0.006	200	1.1	4.4	25.9	0.006	200	1.1	4.4
SM-77	33.7	0.011	200	0.4	1.1	33.7	0.011	200	0.4	1.1
SM-78	23.9	0.005	200	1.9	7.9	23.9	0.005	200	1.9	8.0
SM-79	24.6	0.006	200	2.3	9.3	24.6	0.006	200	2.3	9.3
SM-80	46.5	0.02	200	0.4	0.8	46.5	0.020	200	0.4	0.8
SM-84	132.3	0.006	375	23.1	17.5	132.3	0.006	375	56.4	42.6
SM-86	70.2	0.014	250	0.4	0.5	70.2	0.014	250	22.7	32.3
SM-88	80.0	0.018	250	1.1	1.4	80.0	0.018	250	23.5	29.3
SM-89	78.1	0.017	250	8.0	10.2	78.1	0.017	250	30.3	38.9
SM-90	41.4	0.005	250	8.3	20.1	41.4	0.005	250	30.7	74.2
SM-92	91.5	0.003	375	23.5	25.7	91.5	0.003	375	56.8	62.0
SM-98	102.9	0.011	300	15.9	15.5	102.9	0.011	300	16.0	15.6
SM-99	188.8	0.038	300	23.9	12.6	188.8	0.038	300	57.1	30.3
SM-576	81.2	0.019	250	0.8	0.9	81.2	0.019	250	23.1	28.4
SM-586	20.4	0.004	200	0.4	1.9	20.4	0.004	200	0.4	1.9
SM-587	20.7	0.004	200	1.9	9.1	20.7	0.004	200	1.9	9.2
SM-588	20.8	0.004	200	2.3	10.9	20.8	0.004	200	2.3	11.0
SM-589	20.7	0.004	200	2.7	12.8	20.7	0.004	200	2.7	12.9
SM-590	20.8	0.004	200	3.0	14.6	20.8	0.004	200	3.1	14.7
SM-591	20.8	0.004	200	8.3	40.1	20.8	0.004	200	8.4	40.4
SM-592	20.8	0.004	200	8.7	41.8	20.8	0.004	200	8.8	42.2
SM-593	21.1	0.004	200	11.4	53.8	21.1	0.004	200	22.2	105.1
SM-594	11.1	0.001	200	11.7	105.5	11.1	0.001	200	22.6	202.9
SM-595	49.9	0.023	200	13.6	27.3	49.9	0.023	200	24.5	49.1

Kincardine SPS Results

Conduit ID	Existing Conditions					Future Conditions - Brown to 832 and Brigadoon to 380				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-596	58.7	0.032	200	14.0	23.9	58.7	0.032	200	24.9	42.4
SM-597	43.9	0.018	200	14.4	32.8	43.9	0.018	200	25.3	57.6
SM-599	88.7	0.073	200	1.1	1.3	88.7	0.073	200	1.1	1.3
SM-810	20.5	0.004	200	1.5	7.4	20.5	0.004	200	1.5	7.4
SM-811	16.6	0.003	200	1.1	6.8	16.6	0.003	200	1.1	6.9
SM-812	31.1	0.009	200	0.8	2.4	31.1	0.009	200	0.8	2.5
SM-813	46.7	0.02	200	0.4	0.8	46.7	0.020	200	0.4	0.8
SM-814	20.8	0.004	200	2.3	10.9	20.8	0.004	200	13.0	62.6
SM-815	23.8	0.005	200	0.4	1.6	23.8	0.005	200	0.4	1.6
SM-816	21.0	0.004	200	0.8	3.6	21.0	0.004	200	0.8	3.6
SM-817	18.5	0.003	200	1.1	6.2	18.5	0.003	200	1.1	6.2
SM-818	26.1	0.006	200	1.5	5.8	26.1	0.006	200	12.3	47.1
SM-819	20.7	0.004	200	1.9	9.2	20.7	0.004	200	12.7	61.3
SM-834	17.1	0.013	150	0.4	2.2	17.1	0.013	150	0.4	2.2
SM-835	18.8	0.015	150	0.8	4.0	18.8	0.015	150	0.8	4.1
SM-841	26.6	0.007	200	3.0	11.4	26.6	0.007	200	3.1	11.5
SM-963	29.7	0.008	200	4.9	16.6	29.7	0.008	200	5.0	16.7
SM-964	21.6	0.004	200	4.5	21.1	21.6	0.004	200	4.6	21.2
SM-965	25.8	0.006	200	2.7	10.3	25.8	0.006	200	2.7	10.4
SM-966	21.2	0.004	200	2.3	10.7	21.2	0.004	200	2.3	10.8
SM-967	21.9	0.004	200	0.4	1.7	21.9	0.004	200	0.4	1.7
SM-969	45.6	0.019	200	0.4	0.8	45.6	0.019	200	0.4	0.8
SM-970	45.6	0.019	200	0.8	1.7	45.6	0.019	200	0.8	1.7
SM-971	45.0	0.019	200	1.1	2.5	45.0	0.019	200	1.1	2.5
SM-972	43.6	0.018	200	1.5	3.5	43.6	0.018	200	1.5	3.5
SM-973	42.7	0.017	200	0.4	0.9	42.7	0.017	200	0.4	0.9
SM-974	39.5	0.015	200	0.8	1.9	39.5	0.015	200	0.8	1.9
SM-975	38.8	0.014	200	1.1	2.9	38.8	0.014	200	1.1	3.0
SM-976	39.7	0.015	200	1.5	3.8	39.7	0.015	200	1.5	3.8

Notes:

Denotes greater than 80% capacity utilized.

Denotes greater than 100% capacity utilized (i.e. surcharging).

Appendix F

Tiverton SewerCAD® Modelling Information

Municipality of Kincardine
Tiverton Area SPS Catchments
Flow Notes for Master Plan

Job # :	22128
Date :	November 16, 2022
Revised :	November 30, 2022

1.0 Background

The Municipality of Kincardine is updating its Water & Wastewater Master Plan to evaluate water and wastewater servicing needs for Kincardine, Tiverton, and the Lakeshore Area. The original Master Plan was completed under BMROSS File No. 16130.

The purpose of these notes is to summarize catchment area and design flow information for the King Street SPS (Secondary) and Maple Street SPS (Main) in Tiverton.

2.0 Design Data

Reference	Item		
22128 Nov. 4 Reserve Capacity Draft Memo	Persons per household	2.48	p/ERU
	Number of customers for entire BEC wastewater system	460	customers
9 June 2022 Sewer Users Table	Number of customers for Tiverton Sewers	370	customers
This Sheet	Number of ERUs in Tiverton SPS Catchment Area	354	ERUs
2019-2021 Annual Reports for BEC Lagoon System	Average day flow to BEC Lagoons	730	m^3/day
	Average day flow from Tiverton	342	m^3/day
	Per Tiverton sewer customer wastwater flow (all year avg.)	923	L/cust/day
	Per-ERU average day flow	923	L/ERU/day
22128 Nov. 22 Development Commitments Table	Units - Tiverton-wide	30	ERUs
MECP Guidelines	I/I allowance	0.28	L/ha/s
	Industrial flow allowance	0.405	L/ha/s
	Commercial/Institutional flow allowance	0.324	L/ha/s

3.0 King Street SPS (BMROSS 74026 Briar Hill SPS)

The existing areas and residential units remain unchanged since the last Master Plan. Flow allowances per hectare and ERU have been updated.

Future flow is based on the Conquergood development (109 ERUs, 5.44 ha) and a proportionate amount of infill (4.8 ERUs).

Item	Existing	Future	Units
Residential Area	6.42	11.86	ha
Industrial Area	0	0	ha
Commercial/Institutional Area	0.82	0.82	ha
ERUs from Residential	58	172	units
ERUs from Residential as percent of Tiverton	16%		
Calculate			
Residential Population	144	426	people
Peaking factor	4.20	4.01	-
Average day residential flow	0.62	1.83	L/s
Average day industrial flow	0.00	0.00	L/s
Average day commercial/institutional flow	0.27	0.27	L/s
Average day flow; total	0.9	2.1	L/s
I/I allowance	2.02720	3.550400	L/s
Peak instantaneous flow; total incl. I/I	5.74384	11.969197	L/s

4.0 Maple Street SPS (BMROSS 74026 Main SPS)

The existing areas and residential units remain unchanged since the last Master Plan. Flow allowances per hectare and ERU have been updated. The Maple St. SPS accepts discharge from the King St. SPS.

Future flow is based on the Kaydan Drive (14 ERUs, 0.92 ha), Pine Tree Camp (59 ERUs, 8.16 ha), Rae Street (25 ERUs, 1.49 ha), Maple Street (14 ERUs, 0.82 ha) and Mackwade (5 ERUs, 0.36 ha) developments, and a proportionate amount of infill (25.2 ERUs)

4.1 Maple Street SPS Catchment Area

Item	Existing	Future	Units
Residential Area	50.19	61.96	ha
Industrial Area	0	0	ha
Commercial/Institutional Area	13.31	13.31	ha
ERUs from Residential	296	438	ERUs
ERUs from Residential as percent of Tiverton	84%		
Calculate			
Residential Population	734	1086	people
Peaking factor	3.88	3.78	
Average day residential flow	3.16	4.68	L/s
Average day industrial flow	0.00	0.00	L/s
Average day commercial/institutional flow	4.31	4.31	L/s
Average day flow; total	7.5	9.0	L/s
I/I allowance	17.780000	21.074873	L/s
Peak instantaneous flow; total incl. I/I	46.806138	55.039445	L/s

4.2 Maple Street SPS Total Flow - Catchment Area + King Street SPS Flows

Peak instantaneous flow; total incl. I/I	52.549977	67.008642	L/s

Municipality of Kincardine
SewerCAD Modelling for Master Plan
Tiverton - Calculations and Notes

Job # :	22128
Date :	November 24, 2022
Revised :	November 25, 2022

1.0 Background

The Municipality of Kincardine is completing a water and wastewater Master Plan process. The sewage servicing component will include a review of servicing existing development and future development. The purpose of these notes is to summarize data used to create a SewerCAD model, and the results of that modelling.

1 22128 - Tiverton Area SPS Catchments: Flow Notes for Master Plan

1.1 References

1 22128 - Kincardine Area SPS Catchments: Flow Notes for Master Plan

2.0 Analysis & Model Data

2.1 Data

	Reference	Item		
a.	1	*King Street SPS*		
		Ex. peak sewage flow	3.7	L/s
		Ex. I&I allowance	2.0	L/s
		Ex. total peak flow	5.7	L/s
		Fut. peak sewage flow	8.4	L/s
		Fut. I&I allowance	3.6	L/s
		Fut. total peak flow	12.0	L/s
b.	1	*Maple Street SPS Catchment Area (**w/o King Street SPSs**)*		
		Ex. peak sewage flow	29.0	L/s
		Ex. I&I allowance	17.8	L/s
		Ex. total peak flow	46.8	L/s
		Fut. peak sewage flow	34.0	L/s
		Fut. I&I allowance	21.1	L/s
		Fut. total peak flow	55.0	L/s
		*Maple Street SPS Catchment Area (**with King Street SPSs**)*		
		Ex. total peak flow	52.5	L/s
		Fut. total peak flow	67.0	L/s

2.2 Sewage Flows by Manhole

For the existing system model, sewage flows to each manhole are calculated by dividing total peak flow for the catchment area by the number of maintenance holes.

For future flows, the sewage flow that is additional to existing is assigned to specific manholes based on future service area location in relation to existing manholes.

Reference	Item		
1	Flow per ERU	0.011	L/ERU/s
1	Industrial flow allowance	0.405	L/ha/s
1	Commercial flow allowance	0.324	L/ha/s
1	Institutional flow allowance	0.324	L/ha/s
1	I-I allowance	0.280	L/ha/s

a. 1 *King Street SPS*

Ex. No. of manholes in model		21	MHs		
Ex. Peak flow per manhole		0.274	L/s/MH		
Ex. Peaking Factor		4.197			
Future Peaking Factor		4.009			
Additional future peak flow from		6.2	L/s		
Conquergood		**6.2**	**L/s**		SMH-702,
	Res. ERUs	4.7	L/s	at	SMH-704,
	ICI	0.0	L/s		SMH-707,
	I-I	1.5	L/s		SMH-719
Net: Infill and Peak Reduction		**0.0**	**L/s**		
Infill	Res. ERUs	0.2	L/s	at	All King MHs
PF Reduction of existing flow		-0.2	L/s		
Check:		6.2	L/s		

b. *Maple Street SPS Catchment Area (**w/o King Street SPSs**)*

Ex. No. of manholes in model		73	MHs		
Ex. Peak flow per manhole		0.641	L/s/MH		
Ex. Peaking Factor		3.883			
Future Peaking Factor		3.777			
For King, add to gravity sewer on King St. (SMH-672)					
	Existing:	5.7	L/s		
Additional future peak flow from		14.5	L/s		
King St. SPS		6.2		at	SMH-672

Kaydan		**0.8 L/s**		
	Res. ERUs	0.6 L/s	at	SMH-643
	ICI	0.0 L/s		
	I-I	0.3 L/s		
Pine Tree Camp		**4.7 L/s**		
	Res. ERUs	2.4 L/s	at	SMH-722
	ICI	0.0 L/s		
	I-I	2.3 L/s		
Rae Street		**1.4 L/s**		
	Res. ERUs	1.0 L/s	at	SMH-692
	ICI	0.0 L/s		
	I-I	0.4 L/s		
Maple Street		**0.8 L/s**		
	Res. ERUs	0.6 L/s	at	SMH-634, SMH-636, SMH-637
	ICI	0.0 L/s		
	I-I	0.2 L/s		
Mackwade		**0.3 L/s**		
	Res. ERUs	0.2 L/s	at	SMH-657
	ICI	0.0 L/s		
	I-I	0.1 L/s		
Net: Infill and Peak Reduction		**0.2 L/s**		
Infill	Res. ERUs	1.0 L/s	at	All Maple MHs
PF Reduction of existing flow		-0.8 L/s		
Check:		14.5 L/s		

Tiverton Combined SPS Results

Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-642	26.2	0.006	200	0.6	2.4	26.2	0.006	200	0.9	3.3
SM-643	38.7	0.014	200	1.3	3.3	38.7	0.014	200	1.7	4.5
SM-644	31.3	0.009	200	0.6	2.0	31.3	0.009	200	0.9	2.8
SM-645	42.5	0.017	200	1.3	3.0	42.5	0.017	200	1.7	4.1
SM-646	49.2	0.023	200	0.6	1.3	49.2	0.023	200	0.9	1.8
SM-647	28.8	0.008	200	0.6	2.2	28.8	0.008	200	0.9	3.0
SM-648	23.6	0.005	200	0.6	2.7	23.6	0.005	200	0.9	3.7
SM-649	36.8	0.013	200	0.6	1.7	36.8	0.013	200	0.9	2.3
SM-650	24.9	0.006	200	0.6	2.6	24.9	0.006	200	0.9	3.5
SM-651	45.3	0.019	200	0.6	1.4	45.3	0.019	200	0.9	1.9
SM-652	22.4	0.005	200	0.6	2.9	22.4	0.005	200	0.9	3.9
SM-653	35.4	0.012	200	0.6	1.8	35.4	0.012	200	0.9	2.4
SM-654	41.6	0.016	200	0.6	1.5	41.6	0.016	200	0.9	2.1
SM-655	42.3	0.017	200	0.6	1.5	42.3	0.017	200	0.9	2.0
SM-656	58.7	0.032	200	0.6	1.1	58.7	0.032	200	0.9	1.5
SM-657	30.4	0.003	250	4.5	14.7	30.4	0.003	250	7.5	24.6
SM-658	30.7	0.003	250	9.6	31.3	30.7	0.003	250	14.4	46.9
SM-659	31.5	0.009	200	0.6	2.0	31.5	0.009	200	1.1	3.6
SM-660	35.3	0.012	200	1.3	3.6	35.3	0.012	200	2.0	5.6
SM-661	182.1	0.011	375	45.5	25.0	182.1	0.011	375	72.8	40.0
SM-662	82.6	0.007	300	15.4	18.6	82.6	0.007	300	22.5	27.2
SM-663	163.6	0.009	375	47.4	29.0	163.6	0.009	375	75.7	46.2
SM-664	30.6	0.003	250	0.6	2.1	30.6	0.003	250	1.1	3.7
SM-665	39.0	0.004	250	1.3	3.3	39.0	0.004	250	2.3	5.8
SM-666	299.1	0.029	375	50.6	16.9	299.1	0.029	375	80.0	26.7
SM-667	183.8	0.008	400	52.5	28.6	183.8	0.008	400	83.1	45.2
SM-668	41.3	0.016	200	2.6	6.2	41.3	0.016	200	3.5	8.4
SM-669	44.2	0.018	200	0.6	1.5	44.2	0.018	200	0.9	2.0
SM-670	36.4	0.012	200	1.3	3.5	36.4	0.012	200	1.7	4.8
SM-671	33.1	0.010	200	1.9	5.8	33.1	0.010	200	2.6	7.8
SM-672	49.7	0.003	300	14.7	29.7	49.7	0.003	300	21.6	43.5
SM-673	49.4	0.023	200	3.8	7.8	49.4	0.023	200	5.5	11.1

Tiverton Combined SPS Results

Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-674	42.2	0.017	200	3.2	7.6	42.2	0.017	200	4.6	11.0
SM-675	29.1	0.008	200	2.6	8.8	29.1	0.008	200	3.8	12.9
SM-676	39.3	0.014	200	1.3	3.3	39.3	0.014	200	2.0	5.2
SM-677	32.3	0.010	200	3.2	9.9	32.3	0.010	200	4.3	13.4
SM-678	30.7	0.009	200	3.8	12.5	30.7	0.009	200	5.2	16.9
SM-679	32.6	0.010	200	4.5	13.8	32.6	0.010	200	6.1	18.6
SM-680	27.2	0.007	200	3.8	14.1	27.2	0.007	200	6.6	24.3
SM-681	50.6	0.024	200	1.9	3.8	50.6	0.024	200	2.6	5.1
SM-682	22.2	0.005	200	2.6	11.6	22.2	0.005	200	4.9	22.0
SM-683	65.8	0.040	200	0.5	0.8	65.8	0.040	200	0.6	1.0
SM-684	46.3	0.020	200	0.3	0.6	46.3	0.020	200	0.3	0.7
SM-685	22.9	0.005	200	0.3	1.2	22.9	0.005	200	1.9	8.1
SM-686	20.9	0.004	200	0.8	3.9	20.9	0.004	200	2.5	11.9
SM-687	24.6	0.006	200	0.3	1.1	24.6	0.006	200	1.9	7.6
SM-688	20.4	0.004	200	1.4	6.7	20.4	0.004	200	4.7	22.8
SM-689	23.5	0.005	200	2.2	9.3	23.5	0.005	200	5.6	23.8
SM-690	68.6	0.044	200	0.3	0.4	68.6	0.044	200	1.9	2.7
SM-691	21.0	0.004	200	2.7	13.0	21.0	0.004	200	7.8	37.0
SM-692	21.9	0.004	200	3.0	13.8	21.9	0.004	200	8.1	36.9
SM-693	21.8	0.004	200	3.3	15.0	21.8	0.004	200	8.4	38.4
SM-694	31.1	0.009	200	0.6	2.1	31.1	0.009	200	0.9	2.8
SM-695	21.6	0.004	200	0.6	3.0	21.6	0.004	200	0.9	4.0
SM-696	37.4	0.013	200	0.3	0.7	37.4	0.013	200	0.3	0.8
SM-697	67.9	0.043	200	0.5	0.8	67.9	0.043	200	0.6	0.9
SM-698	76.6	0.055	200	0.8	1.1	76.6	0.055	200	0.9	1.2
SM-699	65.6	0.040	200	1.4	2.1	65.6	0.040	200	1.6	2.4
SM-700	21.5	0.004	200	0.3	1.3	21.5	0.004	200	0.3	1.5
SM-701	71.5	0.014	250	8.9	12.5	71.5	0.014	250	16.3	22.8
SM-702	50.0	0.007	250	9.6	19.2	50.0	0.007	250	17.2	34.3
SM-703	69.2	0.014	250	10.2	14.8	69.2	0.014	250	18.0	26.0
SM-704	65.4	0.005	300	17.3	26.4	65.4	0.005	300	28.4	43.4
SM-705	59.5	0.004	300	17.9	30.1	59.5	0.004	300	29.2	49.1
SM-706	33.1	0.010	200	0.6	1.9	33.1	0.010	200	0.9	2.6
SM-707	31.5	0.009	200	1.3	4.1	31.5	0.009	200	1.7	5.5
SM-708	22.4	0.005	200	0.6	2.9	22.4	0.005	200	1.7	7.5
SM-709	22.2	0.005	200	1.3	5.8	22.2	0.005	200	2.6	11.5
SM-710	30.4	0.009	200	4.5	14.8	30.4	0.009	200	6.1	19.9
SM-711	39.1	0.014	200	5.1	13.1	39.1	0.014	200	6.9	17.7
SM-712	40.5	0.015	200	1.9	4.8	40.5	0.015	200	2.6	6.4

Tiverton Combined SPS Results

Conduit ID	Existing Conditions					Future Conditions				
	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)	Full-Flow Capacity (L/s)	Slope (m/m)	Diameter (mm)	Calculated Flow (L/s)	Flow/Capacity (%)
SM-713	37.5	0.013	200	2.6	6.8	37.5	0.013	200	3.5	9.2
SM-714	166.3	0.009	375	29.5	17.7	166.3	0.009	375	49.5	29.7
SM-715	119.0	0.005	375	26.9	22.6	119.0	0.005	375	41.3	34.7
SM-716	115.9	0.004	375	28.8	24.9	115.9	0.004	375	48.6	41.9
SM-717	63.0	0.004	300	8.3	13.2	63.0	0.004	300	11.2	17.9
SM-718	38.6	0.014	200	0.6	1.7	38.6	0.014	200	5.5	14.3
SM-719	25.1	0.006	200	1.3	5.1	25.1	0.006	200	6.4	25.5
SM-720	49.2	0.003	300	3.8	7.8	49.2	0.003	300	5.2	10.6
SM-721	87.5	0.008	300	5.1	5.9	87.5	0.008	300	6.9	7.9
SM-722	87.5	0.008	300	5.8	6.6	87.5	0.008	300	7.8	8.9
SM-723	84.3	0.008	300	7.7	9.1	84.3	0.008	300	10.4	12.3
SM-724	30.7	0.009	200	1.3	4.2	30.7	0.009	200	1.7	5.6
SM-727	24.2	0.005	200	3.2	13.2	24.2	0.005	200	5.8	23.8
SM-731	54.2	0.027	200	0.6	1.2	54.2	0.027	200	0.9	1.6
SM-732	37.2	0.013	200	1.3	3.4	37.2	0.013	200	1.7	4.7
SM-733	63.3	0.004	300	1.9	3.0	63.3	0.004	300	2.6	4.1
SM-761	60.6	0.034	200	0.3	0.5	60.6	0.034	200	0.3	0.5
SM-762	20.4	0.004	200	6.4	31.3	20.4	0.004	200	12.8	62.9
SM-763	23.1	0.005	200	7.0	30.4	23.1	0.005	200	13.7	59.3
SM-772	51.6	0.025	200	3.6	6.9	51.6	0.025	200	10.3	19.9
SM-773	35.8	0.004	250	3.8	10.7	35.8	0.004	250	10.6	29.6
SM-774	32.1	0.003	250	4.1	12.8	32.1	0.003	250	10.9	34.0
SM-776	27.8	0.002	250	5.8	20.7	27.8	0.002	250	12.8	46.0

Notes:

Denotes greater than 80% capacity utilized.

Denotes greater than 100% capacity utilized (i.e. surcharging).

Appendix G

Consultation Materials

MUNICIPALITY OF KINCARDINE

WATER AND WASTEWATER SERVICING MASTER PLAN UPDATE

NOTICE OF COMMENCEMENT AND OPEN HOUSE

THE PROJECT: The Municipality of Kincardine is updating the Water and Wastewater Servicing Master Plan for the communities of Kincardine, Tiverton and Lakeshore area from Kincardine to Inverhuron. The Master Plan was adopted in 2018 and since that time there has been residential and non-residential growth, additional development proposals and new and upgraded infrastructure within the systems. The updated Master Plan will involve a review of existing water treatment, storage, and supply infrastructure, and sanitary sewage collection, pumping, and treatment infrastructure. This update is being completed concurrently with a Municipal Class Environmental Assessment (MCEA) for an expansion to the Kincardine Water Treatment Plant, which is already an anticipated need based on potential community growth in combination with the potential to add Bruce Power as a water customer. Information from the Master Plan will inform and be used in the MCEA.

The Master Plan will include a review of future infrastructure needs for a 20-year period as they relate to key components of the water and wastewater systems. Upon completion, the Master Plan will serve as a strategic document for the continued provision of water and wastewater services that will integrate with other major planning, development and financing plans and policies. The Master Plan will also identify recommended projects and outline estimated timelines for implementation.

THE ENVIRONMENTAL ASSESSMENT PROCESS: The Water and Wastewater Servicing Master Plan Update is being conducted in accordance with the requirements of the Municipal Class Environmental Assessment process, dated October 2000, as amended in 2007, under the Environmental Assessment Act. Master Plan studies incorporate Phases 1 & 2 of the MCEA process and also includes consultation with the general public, community stakeholders, government review agencies and First Nation and Métis communities.

PUBLIC INVOLVEMENT & OPEN HOUSE: Public consultation is a key component of this study. Initial feedback or comments are welcome at this time. As a part of the consultation component of this project, a public open house will be held:

Tuesday November 29, 2022 from 6 PM – 8 PM
Kincardine Municipal Administration Centre, 1475 Concession 5 Kincardine ON

Any comments collected will be maintained on file for use during the project and may be included in project documentation. With the exception of personal information, all comments will become part of the public record.

For further information on this project, please contact the consulting engineers: B. M. Ross and Associates, 62 North Street, Goderich Ontario, N7A 2T4. Telephone (519) 524-2641. Fax (519) 524-4403. Attention: Lisa Courtney, Environmental Planner. E-mail: lcourtney@bmross.net

Adam Weishar, Director of Infrastructure and Development, Municipality of Kincardine
This Notice issued November 2, 2022

B. M. ROSS AND ASSOCIATES LIMITED
Engineers and Planners
62 North Street, Goderich, ON N7A 2T4
p. (519) 524-2641 **www.bmross.net**

File No. 22128

Agency letter

RE: Municipality of Kincardine
Water and Wastewater Servicing Master Plan Update

The Municipality of Kincardine is updating the Water and Wastewater Servicing Master Plan for the communities of Kincardine, Tiverton and Lakeshore area from Kincardine to Inverhuron. The Master Plan was adopted in 2018 and since that time there has been residential and non-residential growth, additional development proposals and new and upgraded infrastructure within the systems. The updated Master Plan will involve a review of existing water treatment, storage, and supply infrastructure, and sanitary sewage collection, pumping, and treatment infrastructure. This update is being completed concurrently with a Municipal Class Environmental Assessment (MCEA) for an expansion to the Kincardine Water Treatment Plant, which is already an anticipated need based on potential community growth in combination with the potential to add Bruce Power as a water customer. Information from the Master Plan will inform and be used in the MCEA.

The Master Plan will include a review of future infrastructure needs for a 20-year period as they relate to key components of the water and wastewater systems. Upon completion, the Master Plan will serve as a strategic document for the continued provision of water and wastewater services that will integrate with other major planning, development and financing plans and policies. The Master Plan will also identify recommended projects and outline estimated timelines for implementation.

This project is following the process for Master Plans under the MCEA. The proposed approach for this Master Plan (Approach 1) is a broad level assessment that will be the basis for and used in support of future investigations of specific projects. A Master Plan document will be prepared at the end of Phases 1 and 2 of the MCEA process. The study will include consultation with the public, First Nation and Métis communities, stakeholders and review agencies (see attached Public Notice). This letter is being issued to advise of the start of the Master Plan. There will be additional opportunities for input and involvement as the study progresses.

Your organization was identified as possibly having an interest in this project and we are soliciting your input. Please forward your response to the undersigned by November 23rd, 2022. If you have any questions or require further information, please contact the undersigned at lcourtney@bmross.net or by phone at 1-888-524-2641.

Yours very truly

B. M. ROSS AND ASSOCIATES LIMITED

Per _____

Lisa Courtney, RPP, MCIP
Environmental Planner

LJC:ss
Encl.
cc. Adam Weishar, Municipality of Kincardine

MUNICIPALITY OF KINCARDINE
WATER AND WASTEWATER SERVICING MASTER PLAN UPDATE
JOB. NO. 22128

REVIEW AGENCY CIRCULATION LIST

Review Agency	Contact Method	Involvement
Ministry of the Environment, Conservation and Parks (MECP) – EA Coordinator	Email: agency letter, Notice and Project Information Form (per streamlined process) Mark Badali, Environmental Resource Planner & EA Coordinator – Southwest Region Project Review Unit, Environmental Assessment Branch Email: mbadali1@ontario.ca	Mandatory Contact
Ministry of Natural Resources and Forestry - Midhurst	Mail: agency letter Address: 2284 Nursery Rd, Midhurst ON, L9X 1N8	Potential Impact on Natural Features
Ministry of Tourism, Culture and Sport	Email: agency letter, copy of Notice 401 Bay Street, Suite 1700 Toronto, ON M7A 0A7 Email: karla.barboza@ontario.ca	Potential Impact to Cultural Heritage Features and Archaeological Resources
Bruce County • Transportation and Environmental Services • Planning and Development Department	Email: agency letter, copy of Notice Address: 30 Park St. Walkerton ON N0G 2V0 - Planning & Development Department E-Mail: bcplpe@brucecounty.on.ca Public Works E-Mail: Amanda Froese, Director of Transportation and Environmental Services afroese@brucecounty.on.ca	• General information • Implications for long-term development

Review Agency	Contact Method	Involvement
Saugeen Valley Conservation Authority	Email: agency letter, copy of Notice Address: 1078 Bruce Road 12, Box 150 Formosa ON N0G 1W0 Cassandra Malo: c.malo@svca.on.ca	Potential Impact on Natural Features
Municipality of Kincardine	Email: agency letter, copy of Notice 1475 Concession 5, RR 5, Kincardine ON, N2Z 2X6 Adam Weishar, Director of Infrastructure and Development aweishar@kincardine.ca	Proponent
Saugeen, Grey Sauble, Northern Bruce Peninsula Source Water Protection	Email: agency letter, copy of Notice Carl Seider, Project Manager c.seider@waterprotection.ca	Potential Impact related to Source Water Protection
Kincardine Fire Chief	Email: agency letter, copy of Notice Address: Brad Lemaich, Fire Chief 127 Mahood-Johnston Drive Kincardine N2Z 3A2 Brad Lemaich, Fire Chief blemaich@kincardine.ca	Potential impact to service area
Bruce-Grey Public Health Unit	Mail: agency letter, copy of Notice Address: 101 17th Street East, Owen Sound ON N4K 0A5	Water quality concerns

B. M. ROSS AND ASSOCIATES LIMITED
Engineers and Planners
62 North Street, Goderich, ON N7A 2T4
p. (519) 524-2641 **www.bmross.net**

File No. 22128

October 28, 2022

Aboriginal community
(see attached list)

RE: Municipality of Kincardine
Water and Wastewater Servicing Master Plan Update

The Municipality of Kincardine is updating the Water and Wastewater Servicing Master Plan for the communities of Kincardine, Tiverton and Lakeshore area from Kincardine to Inverhuron. The Master Plan was adopted in 2018 and since that time there has been residential and non-residential growth, additional development proposals and new and upgraded infrastructure within the systems. The updated Master Plan will involve a review of existing water treatment, storage, and supply infrastructure, and sanitary sewage collection, pumping, and treatment infrastructure. This update is being completed concurrently with a Municipal Class Environmental Assessment (MCEA) for an expansion to the Kincardine Water Treatment Plant, which is already an anticipated need based on potential community growth in combination with the potential to add Bruce Power as a water customer. Information from the Master Plan will inform and be used in the MCEA.

The Master Plan will include a review of future infrastructure needs for a 20-year period as they relate to key components of the water and wastewater systems. Upon completion, the Master Plan will serve as a strategic document for the continued provision of water and wastewater services that will integrate with other major planning, development and financing plans and policies. The Master Plan will also identify recommended projects and outline estimated timelines for implementation.

This project is following the process for Master Plans under the MCEA. The proposed approach for this Master Plan (Approach 1) is a broad level assessment that will be the basis for and used in support of future investigations of specific projects. A Master Plan document will be prepared at the end of Phases 1 and 2 of the MCEA process. The study will include consultation with the public, First Nation and Métis communities, stakeholders and review agencies (see attached Public Notice). This letter is being issued to advise of the start of the Master Plan. There will be additional opportunities for input and involvement as the study progresses.

Your community was identified as possibly having an interest in this project and we are soliciting your input. Please forward your response to the undersigned by December 15, 2022.

If you have any questions or require further information, please contact the undersigned at lcourtney@bmross.net or by phone at 1-888-524-2641.

Yours very truly

B. M. ROSS AND ASSOCIATES LIMITED

Per _____ _____
Lisa Courtney, RPP, MCIP
Environmental Planner

LJC:hv
Encl.
cc. Adam Weishar, Municipality of Kincardine

MUNICIPALITY OF KINCARDINE

WATER AND WASTEWATER SERVICING MASTER PLAN UPDATE

NOTICE OF COMMENCEMENT AND OPEN HOUSE

THE PROJECT: The Municipality of Kincardine is updating the Water and Wastewater Servicing Master Plan for the communities of Kincardine, Tiverton and Lakeshore area from Kincardine to Inverhuron. The Master Plan was adopted in 2018 and since that time there has been residential and non-residential growth, additional development proposals and new and upgraded infrastructure within the systems. The updated Master Plan will involve a review of existing water treatment, storage, and supply infrastructure, and sanitary sewage collection, pumping, and treatment infrastructure. This update is being completed concurrently with a Municipal Class Environmental Assessment (MCEA) for an expansion to the Kincardine Water Treatment Plant, which is already an anticipated need based on potential community growth in combination with the potential to add Bruce Power as a water customer. Information from the Master Plan will inform and be used in the MCEA.

The Master Plan will include a review of future infrastructure needs for a 20-year period as they relate to key components of the water and wastewater systems. Upon completion, the Master Plan will serve as a strategic document for the continued provision of water and wastewater services that will integrate with other major planning, development and financing plans and policies. The Master Plan will also identify recommended projects and outline estimated timelines for implementation.

THE ENVIRONMENTAL ASSESSMENT PROCESS: The Water and Wastewater Servicing Master Plan Update is being conducted in accordance with the requirements of the Municipal Class Environmental Assessment process, dated October 2000, as amended in 2007, under the Environmental Assessment Act. Master Plan studies incorporate Phases 1 & 2 of the MCEA process and also includes consultation with the general public, community stakeholders, government review agencies and First Nation and Métis communities.

PUBLIC INVOLVEMENT & OPEN HOUSE: Public consultation is a key component of this study. Initial feedback or comments are welcome at this time. As a part of the consultation component of this project, a public open house will be held:

Tuesday November 29, 2022 from 6 PM – 8 PM
Kincardine Municipal Administration Centre, 1475 Concession 5 Kincardine ON

Any comments collected will be maintained on file for use during the project and may be included in project documentation. With the exception of personal information, all comments will become part of the public record.

For further information on this project, please contact the consulting engineers: B. M. Ross and Associates, 62 North Street, Goderich Ontario, N7A 2T4. Telephone (519) 524-2641. Fax (519) 524-4403. Attention: Lisa Courtney, Environmental Planner. E-mail: lcourtney@bmross.net

Adam Weishar, Director of Infrastructure and Development, Municipality of Kincardine
This Notice issued November 2, 2022

MUNICIPALITY OF KINCARDINE
WATER AND WASTEWATER MASTER PLAN UPDATE
BMROSS FILE 22128

ABORIGINAL COMMUNITIES CIRCULATION LIST – OCTOBER 2022

Aboriginal Community	Contact Method
Métis Nation of Ontario	Email: consultations@metisnation.org DavidD@metisnation.org
Chippewas of Saugeen	Hard Copy: Chief Conrad Ritchie Chippewas of Saugeen 6493 Highway 21, RR 1 Southampton, ON N0H 2L0 Email: critchie@saugeenfirstnation.ca
Chippewas of Nawash	Hard Copy: Chief Veronica Smith Chippewas of Nawash Unceded First Nation R.R. #5 Wiarton, ON N0H 2T0 Email: chief.veronica@nawash.ca
Great Lakes Metis Council	Hard Copy: Great Lakes Metis Council 380 9th Street East Owen Sound, ON N4K 1P1 Email: peterc1908@hotmail.com
Historic Saugeen Métis	Email: hsmlrcc@bmts.com
Saugeen Ojibway Nation Environment Office Juanita Meekins (Executive Assistant) and Emily Martin (Infrastructure and Resource Manager)	Email: manager.ri@saugeenojibwaynation.ca, cc: execassist.ri@saugeenojibwaynation.ca
Chippewas of Kettle and Stony Point First Nation	Hard copy: Chief Jason Henry Chippewas of Kettle and Stony Point First Nation 6247 Indian Lane, RR#2 Forest ON N0N 1J1 Email: Jason.henry@kettlepoint.org

Ontario

Ministry of the Environment, Conservation and Parks

Environmental Assessment Branch

1st Floor
135 St. Clair Avenue W
Toronto ON M4V 1P5
Tel.: 416 314-8001
Fax.: 416 314-8452

Ministère de l'Environnement, de la Protection de la nature et des Parcs

Direction des évaluations environnementales

Rez-de-chaussée
135, avenue St. Clair Ouest
Toronto ON M4V 1P5
Tél. : 416 314-8001
Téléc. : 416 314-8452

November 25, 2022

Adam Weishar
Director of Infrastructure and Development
Municipality of Kincardine
aweishar@kincardine.ca

BY EMAIL ONLY

Re: **Water and Wastewater Servicing Master Plan Update**
Municipality of Kincardine
Municipal Class Environmental Assessment, Master Plan (Approach #1)
Acknowledgement of Notice of Commencement

Dear Adam Weishar,

This letter is in response to the Notice of Commencement for the above noted Master Plan. The Ministry of the Environment, Conservation and Parks (MECP) acknowledges that the Municipality of Kincardine (proponent) has indicated that the study is following the approved environmental planning process for a Master Plan incorporating Phases 1 and 2 under the Municipal Class Environmental Assessment (Class EA).

The **updated (August 2022)** attached "Areas of Interest" document provides guidance regarding the ministry's interests with respect to the Class EA process. Please address all areas of interest in the EA documentation at an appropriate level for the EA study. Proponents who address all the applicable areas of interest can minimize potential delays to the project schedule. **Further information is provided at the end of the Areas of Interest document relating to recent changes to the Environmental Assessment Act through Bill 197, Covid-19 Economic Recovery Act 2020.**

The Crown has a legal duty to consult Aboriginal communities when it has knowledge, real or constructive, of the existence or potential existence of an Aboriginal or treaty right and contemplates conduct that may adversely impact that right. Before authorizing the project(s) identified in this Master Plan, the Crown must ensure that its duty to consult has been fulfilled, where such a duty is triggered. Although the duty to consult with Aboriginal peoples is a duty of the Crown, the Crown may delegate procedural aspects of this duty to project proponents while retaining oversight of the consultation process.

The proposed project(s) may have the potential to affect Aboriginal or treaty rights protected under Section 35 of Canada's *Constitution Act* 1982. Where the Crown's duty to consult is triggered in relation to the proposed project(s)**, the MECP is delegating the procedural aspects of rights-based consultation to the proponent through this letter.** The Crown intends to rely on the delegated consultation process in discharging its duty to consult and maintains the right to participate in the consultation process as it sees fit.

Based on information provided to date and the Crown`s preliminary assessment the proponent is required to consult with the following communities who have been identified as potentially affected by the proposed project(s):

- Saugeen First Nation and the Chippewas of Nawash Unceded First Nation
    - These communities work together on consultation issues and are known collectively as the Saugeen Ojibway Nation. They have requested notices be sent to the Saugeen Ojibway Nation Environment Office with a copy to the Chief and Council of Saugeen First Nation and Chippewas of Nawash Unceded First Nation.
- Métis Nation of Ontario- Lands and Resources Dept, Region 7

Steps that the proponent may need to take in relation to Aboriginal consultation for the proposed project are outlined in the "Code of Practice for Consultation in Ontario's Environmental Assessment Process". Additional information related to Ontario's Environmental Assessment Act is available online at: www.ontario.ca/environmentalassessments.

Please also refer to the attached document "A Proponent's Introduction to the Delegation of Procedural Aspects of consultation with Aboriginal Communities" for further information, including the MECP's expectations for EA report documentation related to consultation with communities.

The proponent must contact the Director of Environmental Assessment Branch (EABDirector@ontario.ca) under the following circumstances after initial discussions with the communities identified by the MECP:

- Aboriginal or treaty rights impacts are identified to you by the communities;
- You have reason to believe that your proposed project(s) may adversely affect an Aboriginal or treaty right;

- Consultation with Indigenous communities or other stakeholders has reached an impasse; or
- A Section 16 Order request is expected based on impacts to Aboriginal or treaty rights

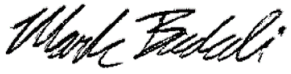
The MECP will then assess the extent of any Crown duty to consult for the circumstances and will consider whether additional steps should be taken, including what role you will be asked to play should additional steps and activities be required.

A draft copy of the report should be sent directly to me prior to the filing of the final report, allowing a minimum of 30 days for the ministry's technical reviewers to provide comments.

Please also ensure a copy of the final notice is sent to the ministry's Southwest Region EA notification email account (eanotification.swregion@ontario.ca) after the draft report is reviewed and finalized.

Should you or any members of your project team have any questions regarding the material above, please contact me at mark.badali1@ontario.ca.

Sincerely,



Mark Badali
Regional Environmental Planner – Southwest Region

Cc: John Ritchie, Manager, Owen Sound District Office, MECP
Lisa Courtney, Environmental Planner, B. M. Ross and Associates Limited

Enclosed: Areas of Interest

Attached: Client's Guide to Preliminary Screening for Species at Risk

A Proponent's Introduction to the Delegation of Procedural Aspects of Consultation with Aboriginal Communities

AREAS OF INTEREST (v. August 2022)

It is suggested that you check off each section after you have considered / addressed it.

☐ **Planning and Policy**

- Applicable plans and policies should be identified in the report, and the proponent should describe how the proposed project adheres to the relevant policies in these plans.
    - Projects located in MECP Central, Eastern or West Central Region may be subject to **A Place to Grow: Growth Plan for the Greater Golden Horseshoe (2020)**.
    - Projects located in MECP Central or Eastern Region may be subject to the **Oak Ridges Moraine Conservation Plan (2017)** or the **Lake Simcoe Protection Plan (2014)**.
    - Projects located in MECP Central, Southwest or West Central Region may be subject to the **Niagara Escarpment Plan (2017)**.
    - Projects located in MECP Central, Eastern, Southwest or West Central Region may be subject to the **Greenbelt Plan (2017)**.
    - Projects located in MECP Northern Region may be subject to the **Growth Plan for Northern Ontario (2011).**

- The **Provincial Policy Statement (2020)** contains policies that protect Ontario's natural heritage and water resources. Applicable policies should be referenced in the report, and the proponent should describe how the proposed project is consistent with these policies.

- In addition to the provincial planning and policy level, the report should also discuss the planning context at the municipal and federal levels, as appropriate.

☐ **Source Water Protection**

The *Clean Water Act*, 2006 (CWA) aims to protect existing and future sources of drinking water. To achieve this, several types of vulnerable areas have been delineated around surface water intakes and wellheads for every municipal residential drinking water system that is located in a source protection area. These vulnerable areas are known as a Wellhead Protection Areas (WHPAs) and surface water Intake Protection Zones (IPZs). Other vulnerable areas that have been delineated under the CWA include Highly Vulnerable Aquifers (HVAs), Significant Groundwater Recharge Areas (SGRAs), Event-based modelling areas (EBAs), and Issues Contributing Areas (ICAs). Source protection plans have been developed that include policies to address existing and future risks to sources of municipal drinking water within these vulnerable areas.

Projects that are subject to the Environmental Assessment Act that fall under a Class EA, or one of the Regulations, have the potential to impact sources of drinking water if they occur in designated vulnerable areas or in the vicinity of other at-risk drinking water systems (i.e.

systems that are not municipal residential systems). MEA Class EA projects may include activities that, if located in a vulnerable area, could be a threat to sources of drinking water (i.e. have the potential to adversely affect the quality or quantity of drinking water sources) and the activity could therefore be subject to policies in a source protection plan. Where an activity poses a risk to drinking water, policies in the local source protection plan may impact how or where that activity is undertaken. Policies may prohibit certain activities, or they may require risk management measures for these activities. Municipal Official Plans, planning decisions, Class EA projects (where the project includes an activity that is a threat to drinking water) and prescribed instruments must conform with policies that address significant risks to drinking water and must have regard for policies that address moderate or low risks.

- In October 2015, the MEA Parent Class EA document was amended to include reference to the Clean Water Act (Section A.2.10.6) and indicates that proponents undertaking a Municipal Class EA project must identify early in their process whether a project is or could potentially be occurring with a vulnerable area. **Given this requirement, please include a section in the report on source water protection.**

    - The proponent should identify the source protection area and should clearly document how the proximity of the project to sources of drinking water (municipal or other) and any delineated vulnerable areas was considered and assessed. Specifically, the report should discuss whether or not the project is located in a vulnerable area and provide applicable details about the area.

    - If located in a vulnerable area, proponents should document whether any project activities are prescribed drinking water threats and thus pose a risk to drinking water (this should be consulted on with the appropriate Source Protection Authority). Where an activity poses a risk to drinking water, the proponent must document and discuss in the report how the project adheres to or has regard to applicable policies in the local source protection plan. This section should then be used to inform and be reflected in other sections of the report, such as the identification of net positive/negative effects of alternatives, mitigation measures, evaluation of alternatives etc.

- While most source protection plans focused on including policies for significant drinking water threats in the WHPAs and IPZs it should be noted that even though source protection plan policies may not apply in HVAs, these are areas where aquifers are sensitive and at risk to impacts and within these areas, activities may impact the quality of sources of drinking water for systems other than municipal residential systems.

- In order to determine if this project is occurring within a vulnerable area, proponents can use Source Protection Information Atlas, which is an online mapping tool available to the public. Note that various layers (including WHPAs, WHPA-Q1 and WHPA-Q2, IPZs, HVAs, SGRAs, EBAs, ICAs) can be turned on through the “Map Legend” bar on the left. The

mapping tool will also provide a link to the appropriate source protection plan in order to identify what policies may be applicable in the vulnerable area.

- For further information on the maps or source protection plan policies which may relate to their project, proponents must contact the appropriate source protection authority. **Please consult with the local source protection authority to discuss potential impacts on drinking water. Please document the results of that consultation within the report and include all communication documents/correspondence.**

More Information

For more information on the *Clean Water Act*, source protection areas and plans, including specific information on the vulnerable areas and drinking water threats, please refer to Conservation Ontario's website where you will also find links to the local source protection plan/assessment report.

A list of the prescribed drinking water threats can be found in section 1.1 of Ontario Regulation 287/07 made under the *Clean Water Act*. In addition to prescribed drinking water threats, some source protection plans may include policies to address additional "local" threat activities, as approved by the MECP.

☐ **Climate Change**

The document "Considering Climate Change in the Environmental Assessment Process" (Guide) is now a part of the Environmental Assessment program's Guides and Codes of Practice. The Guide sets out the MECP's expectation for considering climate change in the preparation, execution and documentation of environmental assessment studies and processes. The guide provides examples, approaches, resources, and references to assist proponents with consideration of climate change in EA. Proponents should review this Guide in detail.

- **The MECP expects proponents of Class EA projects to:**

1. Consider during the assessment of alternative solutions and alternative designs, the following:
    a. the project's expected production of greenhouse gas emissions and impacts on carbon sinks (climate change mitigation); and
    b. resilience or vulnerability of the undertaking to changing climatic conditions (climate change adaptation).
2. Include a discrete section in the report detailing how climate change was considered in the EA.

How climate change is considered can be qualitative or quantitative in nature and should be scaled to the project's level of environmental effect. In all instances, both a project's impacts on climate change (mitigation) and impacts of climate change on a project (adaptation) should be considered.

- The MECP has also prepared another guide to support provincial land use planning direction related to the completion of energy and emission plans. The "Community Emissions Reduction Planning: A Guide for Municipalities" document is designed to educate stakeholders on the municipal opportunities to reduce energy and greenhouse gas emissions, and to provide guidance on methods and techniques to incorporate consideration of energy and greenhouse gas emissions into municipal activities of all types. We encourage you to review the Guide for information.

Air Quality, Dust and Noise

- If there are sensitive receptors in the surrounding area of this project, a quantitative air quality/odour impact assessment will be useful to evaluate alternatives, determine impacts and identify appropriate mitigation measures. The scope of the assessment can be determined based on the potential effects of the proposed alternatives, and typically includes source and receptor characterization and a quantification of local air quality impacts on the sensitive receptors and the environment in the study area. The assessment will compare to all applicable standards or guidelines for all contaminants of concern. **Please contact this office for further consultation on the level of Air Quality Impact Assessment required for this project if not already advised.**

- If a quantitative Air Quality Impact Assessment is not required for the project, the MECP expects that the report contain a qualitative assessment which includes:

    - A discussion of local air quality including existing activities/sources that significantly impact local air quality and how the project may impact existing conditions;
    - A discussion of the nearby sensitive receptors and the project's potential air quality impacts on present and future sensitive receptors;
    - A discussion of local air quality impacts that could arise from this project during both construction and operation; and
    - A discussion of potential mitigation measures.

- As a common practice, "air quality" should be used an evaluation criterion for all road projects.

- Dust and noise control measures should be addressed and included in the construction plans to ensure that nearby residential and other sensitive land uses within the study area are not adversely affected during construction activities.

- The MECP recommends that non-chloride dust-suppressants be applied. For a comprehensive list of fugitive dust prevention and control measures that could be applied, refer to *Cheminfo Services Inc. Best Practices for the Reduction of Air Emissions from*

Construction and Demolition Activities report prepared for Environment Canada. March 2005.

- The report should consider the potential impacts of increased noise levels during the operation of the completed project. The proponent should explore all potential measures to mitigate significant noise impacts during the assessment of alternatives.

Ecosystem Protection and Restoration

- Any impacts to ecosystem form and function must be avoided where possible. The report should describe any proposed mitigation measures and how project planning will protect and enhance the local ecosystem.

- Natural heritage and hydrologic features should be identified and described in detail to assess potential impacts and to develop appropriate mitigation measures. The following sensitive environmental features may be located within or adjacent to the study area:
  - Key Natural Heritage Features: Habitat of endangered species and threatened species, fish habitat, wetlands, areas of natural and scientific interest (ANSIs), significant valleylands, significant woodlands; significant wildlife habitat (including habitat of special concern species); sand barrens, savannahs, and tallgrass prairies; and alvars.
  - Key Hydrologic Features: Permanent streams, intermittent streams, inland lakes and their littoral zones, seepage areas and springs, and wetlands.
  - Other natural heritage features and areas such as: vegetation communities, rare species of flora or fauna, Environmentally Sensitive Areas, Environmentally Sensitive Policy Areas, federal and provincial parks and conservation reserves, Greenland systems etc.

We recommend consulting with the Ministry of Natural Resources and Forestry (MNRF), Fisheries and Oceans Canada (DFO) and your local conservation authority to determine if special measures or additional studies will be necessary to preserve and protect these sensitive features. In addition, for projects located in Central Region you may consider the provisions of the Rouge Park Management Plan if applicable.

Species at Risk

- The Ministry of the Environment, Conservation and Parks has now assumed responsibility of Ontario's Species at Risk program. Information, standards, guidelines, reference materials and technical resources to assist you are found at https://www.ontario.ca/page/species-risk.

- The Client's Guide to Preliminary Screening for Species at Risk (Draft May 2019) has been attached to the covering email for your reference and use. Please review this document for next steps.

- For any questions related to subsequent permit requirements, please contact SAROntario@ontario.ca.

Surface Water

- The report must include enough information to demonstrate that there will be no negative impacts on the natural features or ecological functions of any watercourses within the study area. Measures should be included in the planning and design process to ensure that any impacts to watercourses from construction or operational activities (e.g. spills, erosion, pollution) are mitigated as part of the proposed undertaking.

- Additional stormwater runoff from new pavement can impact receiving watercourses and flood conditions. Quality and quantity control measures to treat stormwater runoff should be considered for all new impervious areas and, where possible, existing surfaces. The ministry's Stormwater Management Planning and Design Manual (2003) should be referenced in the report and utilized when designing stormwater control methods. **A Stormwater Management Plan should be prepared as part of the Class EA process** that includes:

    - Strategies to address potential water quantity and erosion impacts related to stormwater draining into streams or other sensitive environmental features, and to ensure that adequate (enhanced) water quality is maintained
    - Watershed information, drainage conditions, and other relevant background information
    - Future drainage conditions, stormwater management options, information on erosion and sediment control during construction, and other details of the proposed works
    - Information on maintenance and monitoring commitments.

- Ontario Regulation 60/08 under the *Ontario Water Resources Act* (OWRA) applies to the Lake Simcoe Basin, which encompasses Lake Simcoe and the lands from which surface water drains into Lake Simcoe. If the proposed sewage treatment plant is listed in Table 1 of the regulation, the report should describe how the proposed project and its mitigation measures are consistent with the requirements of this regulation and the OWRA.

- Any potential approval requirements for surface water taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, except for certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16*. These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please

review the Water Taking User Guide for EASR for more information. Additionally, an Environmental Compliance Approval under the OWRA is required for municipal stormwater management works.

Groundwater

- The status of, and potential impacts to any well water supplies should be addressed. If the project involves groundwater takings or changes to drainage patterns, the quantity and quality of groundwater may be affected due to drawdown effects or the redirection of existing contamination flows. In addition, project activities may infringe on existing wells such that they must be reconstructed or sealed and abandoned. Appropriate information to define existing groundwater conditions should be included in the report.

- If the potential construction or decommissioning of water wells is identified as an issue, the report should refer to Ontario Regulation 903, Wells, under the OWRA.

- Potential impacts to groundwater-dependent natural features should be addressed. Any changes to groundwater flow or quality from groundwater taking may interfere with the ecological processes of streams, wetlands or other surficial features. In addition, discharging contaminated or high volumes of groundwater to these features may have direct impacts on their function. Any potential effects should be identified, and appropriate mitigation measures should be recommended. The level of detail required will be dependent on the significance of the potential impacts.

- Any potential approval requirements for groundwater taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, with the exception of certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16*. These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please review the Water Taking User Guide for EASR for more information.

- Consultation with the railroad authorities is necessary wherever there is a plan to use construction dewatering in the vicinity of railroad lines or where the zone of influence of the construction dewatering potentially intercepts railroad lines.

Excess Materials Management

- In December 2019, MECP released a new regulation under the Environmental Protection Act, titled "On-Site and Excess Soil Management" (O. Reg. 406/19) to support improved management of excess construction soil. This regulation is a key step to support proper management of excess soils, ensuring valuable resources don't go to waste and to provide

clear rules on managing and reusing excess soil. New risk-based standards referenced by this regulation help to facilitate local beneficial reuse which in turn will reduce greenhouse gas emissions from soil transportation, while ensuring strong protection of human health and the environment. The new regulation is being phased in over time, with the first phase in effect on January 1, 2021. For more information, please visit https://www.ontario.ca/page/handling-excess-soil.

- The report should reference that activities involving the management of excess soil should be completed in accordance with O. Reg. 406/19 and the MECP's current guidance document titled "Management of Excess Soil – A Guide for Best Management Practices" (2014).

- All waste generated during construction must be disposed of in accordance with ministry requirements

Contaminated Sites

- Any current or historical waste disposal sites should be identified in the report. The status of these sites should be determined to confirm whether approval pursuant to Section 46 of the EPA may be required for land uses on former disposal sites. We recommend referring to the MECP's D-4 guideline for land use considerations near landfills and dumps.
    - Resources available may include regional/local municipal official plans and data; provincial data on large landfill sites and small landfill sites; Environmental Compliance Approval information for waste disposal sites on Access Environment.

- Other known contaminated sites (local, provincial, federal) in the study area should also be identified in the report (Note – information on federal contaminated sites is found on the Government of Canada's website).

- The location of any underground storage tanks should be investigated in the report. Measures should be identified to ensure the integrity of these tanks and to ensure an appropriate response in the event of a spill. The ministry's Spills Action Centre must be contacted in such an event.

- Since the removal or movement of soils may be required, appropriate tests to determine contaminant levels from previous land uses or dumping should be undertaken. If the soils are contaminated, you must determine how and where they are to be disposed of, consistent with *Part XV.1 of the Environmental Protection Act* (EPA) and Ontario Regulation 153/04, Records of Site Condition, which details the new requirements related to site assessment and clean up. Please contact the appropriate MECP District Office for further consultation if contaminated sites are present.

Servicing, Utilities and Facilities

- The report should identify any above or underground utilities in the study area such as transmission lines, telephone/internet, oil/gas etc. The owners should be consulted to discuss impacts to this infrastructure, including potential spills.

- The report should identify any servicing infrastructure in the study area such as wastewater, water, stormwater that may potentially be impacted by the project.

- Any facility that releases emissions to the atmosphere, discharges contaminants to ground or surface water, provides potable water supplies, or stores, transports or disposes of waste must have an Environmental Compliance Approval (ECA) before it can operate lawfully. Please consult with MECP's Environmental Permissions Branch to determine whether a new or amended ECA will be required for any proposed infrastructure.

- We recommend referring to the ministry's environmental land use planning guides to ensure that any potential land use conflicts are considered when planning for any infrastructure or facilities related to wastewater, pipelines, landfills or industrial uses.

Mitigation and Monitoring

- Contractors must be made aware of all environmental considerations so that all environmental standards and commitments for both construction and operation are met. Mitigation measures should be clearly referenced in the report and regularly monitored during the construction stage of the project. In addition, we encourage proponents to conduct post-construction monitoring to ensure all mitigation measures have been effective and are functioning properly.

- Design and construction reports and plans should be based on a best management approach that centres on the prevention of impacts, protection of the existing environment, and opportunities for rehabilitation and enhancement of any impacted areas.

- The proponent's construction and post-construction monitoring plans must be documented in the report, as outlined in Section A.2.5 and A.4.1 of the MEA Class EA parent document.

Consultation

- The report must demonstrate how the consultation provisions of the Class EA have been fulfilled, including documentation of all stakeholder consultation efforts undertaken during the planning process. This includes a discussion in the report that identifies concerns that were raised and **describes how they have been addressed by the proponent** throughout

the planning process. The report should also include copies of comments submitted on the project by interested stakeholders, and the proponent's responses to these comments (as directed by the Class EA to include full documentation).

- Please include the full stakeholder distribution/consultation list in the documentation.

Class EA Process

- If this project is a Master Plan: there are several different approaches that can be used to conduct a Master Plan, examples of which are outlined in Appendix 4 of the Class EA. **The Master Plan should clearly indicate the selected approach for conducting the plan**, by identifying whether the levels of assessment, consultation and documentation are sufficient to fulfill the requirements for Schedule B or C projects. Please note that any Schedule B or C projects identified in the plan would be subject to Part II Order Requests under the Environmental Assessment Act, although the plan itself would not be. **Please include a description of the approach being undertaken (use Appendix 4 as a reference).**

- If this project is a Master Plan: Any identified projects should also include information on the MCEA schedule associated with the project.

- The report should provide clear and complete documentation of the planning process in order to allow for transparency in decision-making.

- The Class EA requires the consideration of the effects of each alternative on all aspects of the environment (including planning, natural, social, cultural, economic, technical). The report should include a level of detail (e.g. hydrogeological investigations, terrestrial and aquatic assessments, cultural heritage assessments) such that all potential impacts can be identified, and appropriate mitigation measures can be developed. Any supporting studies conducted during the Class EA process should be referenced and included as part of the report.

- Please include in the report a list of all subsequent permits or approvals that may be required for the implementation of the preferred alternative, including but not limited to, MECP's PTTW, EASR Registrations and ECAs, conservation authority permits, species at risk permits, MTO permits and approvals under the *Impact Assessment Act*, 2019.

- Ministry guidelines and other information related to the issues above are available at http://www.ontario.ca/environment-and-energy/environment-and-energy. We encourage you to review all the available guides and to reference any relevant information in the report.

Amendments to the EAA through the Covid-19 Economic Recovery Act, 2020
Once the EA Report is finalized, the proponent must issue a Notice of Completion providing a minimum 30-day period during which documentation may be reviewed and comment and input can be submitted to the proponent. The Notice of Completion must be sent to the appropriate MECP Regional Office email address.

The public can request a higher level of assessment on a project if they are concerned about potential adverse impacts to constitutionally protected Aboriginal and treaty rights. In addition, the Minister may issue an order on his or her own initiative within a specified time period. The Director (of the Environmental Assessment Branch) will issue a Notice of Proposed Order to the proponent if the Minister is considering an order for the project within 30 days after the conclusion of the comment period on the Notice of Completion. At this time, the Director may request additional information from the proponent. Once the requested information has been received, the Minister will have 30 days within which to make a decision or impose conditions on your project.

Therefore, the proponent cannot proceed with the project until at least 30 days after the end of the comment period provided for in the Notice of Completion. Further, the proponent may not proceed after this time if:

- a Section 16 Order request has been submitted to the ministry regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, or
- the Director has issued a Notice of Proposed order regarding the project.

Please ensure that the Notice of Completion advises that outstanding concerns are to be directed to the proponent for a response, and that in the event there are outstanding concerns regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, Section 16 Order requests on those matters should be addressed in writing to:

Minister David Piccini
Ministry of Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto ON M7A 2J3
minister.mecp@ontario.ca

and

Director, Environmental Assessment Branch
Ministry of Environment, Conservation and Parks
135 St. Clair Ave. W, 1st Floor
Toronto ON, M4V 1P5
EABDirector@ontario.ca

1078 Bruce Road 12, P.O. Box 150, Formosa ON Canada N0G 1W0
publicinfo@svca.on.ca, www.saugeenconservation.ca

SENT ELECTRONICALLY ONLY: lcourtney@bmross.net

November 23, 2022

B. M. ROSS AND ASSOCIATES LIMITED
Engineers and Planners
62 North Street, Goderich, ON N7A 2T4

ATTENTION: Lisa Courtney, Environmental Planner

Dear Ms. Courtney,

RE: Municipality of Kincardine
Water and Wastewater Servicing Master Plan Update

Further to your letter of October 28, 2022 regarding the above referenced matter, the Saugeen Valley Conservation Authority (SVCA) staff has reviewed the notice of commencement. SVCA were involved with the 2018 version of the Water and Wastewater Servicing Master Plan, and appreciate that the SVCA was included at this time.

As the matter progresses, SVCA staff will identify areas in the Master Plan where SVCA input will be required such as where the works may require SVCA permit(s) pursuant to our Ontario Regulation 169/06, as amended.

Again, SVCA staff thank you for the opportunity to provide our comment and will appreciate the opportunities to review the details of the matter as it continues. Accordingly, we request that you continue to notify the SVCA as subsequent steps arrive. If you have any questions, do not hesitate to contact our office.

Sincerely,

Michael Oberle

Michael Oberle
Environmental Planning Coordinator
Saugeen Conservation
MO\

cc: Adam Weishar, Director of Infrastructure, Municipality of Kincardine (via email)
Maureen Couture, SVCA Member representing the Municipality of Kincardine (via email)
Bill Stewart, SVCA Member representing the Municipality of Kincardine (via email)

Ministry of Citizenship and Multiculturalism

Heritage Branch
400 University Ave.
5th Floor
Toronto ON M7A 2E7
Tel.: 613.242.3743

Ministère des Affaires civiques et du Multiculturalisme

Direction du patrimoine
400, av. University
5th étage
Toronto ON M7A 2E7
Tél.: 613.242.3743

Ontario

November 14, 2022 EMAIL ONLY

Lisa J. Courtney, MSc., MCIP, RPP
B. M. Ross and Associates Limited
Engineers and Planners
62 North Street
Goderich, ON N7A 2T4
lcourtney@bmross.net

MCM File	**:**	**0018004**
Proponent	**:**	**Municipality of Kincardine**
Subject	**:**	**Notice of Commencement - Master Plan Approach 1**
Project	**:**	**Water and Wastewater Servicing Master Plan Update**
Location	**:**	**Municipality of Kincardine**

Dear Lisa J. Courtney:

Thank you for providing us with the Notice of Commencement for this project.

Please note that the responsibility for administration of the *Ontario Heritage Act* and matters related to cultural heritage recently transferred from the Ministry of Tourism, Culture and Sport (MTCS) to the Ministry of Citizenship and Multiculturalism (MCM). Individual staff roles and contact information remain unchanged. Please continue to send any notices, report and/or documentation to both Karla Barboza and myself.

MCM's interest in this master plan relates to it's mandate of conserving Ontario's cultural heritage, which includes archaeological resources, built heritage resources and cultural heritage landscapes.

MCM understands that master plans are long range plans which integrate infrastructure requirements for existing and future land use with environmental assessment planning principles. The Municipal Class Environmental Assessment (MCEA) outlines a framework for master plan and associated studies which should recognize the planning and design Process of this Class EA, and should incorporate the key principles of successful environmental assessment planning identified in Section A.1.1. The master planning process will, at minimum, address Phases 1 and 2 of the Planning and Design Process of the MCEA.

This letter provides advice on how to incorporate consideration of cultural heritage in the above-mentioned master planning process by outlining the technical cultural heritage studies and the level of detail required to address cultural heritage in master plans. In accordance with the MCEA, cultural heritage resources should be identified early in the process in order to determine known and potential resources and potential impacts.

Master Plan Summary
The Municipality of Kincardine is updating the Water and Wastewater Servicing Master Plan for the communities of Kincardine, Tiverton and Lakeshore area from Kincardine to Inverhuron. This project is following the process for Master Plans under the MCEA. The proposed approach for this Master Plan (Approach 1) is a broad level assessment that will be the basis for and used in support of future investigations of specific projects.

Identifying Cultural Heritage Resources
MCM understands that the master plan would typically be done at a broad level of assessment thereby requiring more detailed investigations at the project-specific level. Therefore, a description of the existing conditions related to cultural heritage resources needs to be included in the master plan document.

Archaeological Resources
The existing conditions sub-section should indicate if the master plan includes areas of archaeological potential or not and acknowledge that archaeological assessments will be required for future project-specific projects. The proponents should refer to an archaeological management plan or a data sharing agreement, should they exist. In their absence, MTCS's screening checklists can help determine whether archaeological assessments will be needed for subsequent project undertakings: *Criteria for Evaluating Archaeological Potential* and *Criteria for Evaluating Marine Archaeological Potential*.

A statement should be included that archaeological assessments are to be undertaken by an archaeologist licensed under the Ontario Heritage Act and that archaeological assessment reports must be submitted for MCM review prior to the completion of the environmental assessment and prior to any ground disturbance. Some municipalities may also elect to have a Stage 1 archaeological assessment undertaken for a master plan area.

Built Heritage Resources and Cultural Heritage Landscapes
MCM recommends that an Existing Conditions Report be undertaken by a qualified person, which will include a historical summary of the study area's development, identifying all known or potential built heritage resources and cultural heritage landscapes within the study area. The findings of the existing conditions report should be included in the existing conditions subsection of the master plan document.

Community input should be sought to identify locally recognized and potential cultural heritage resources. Sources include, but are not limited to, Municipal Heritage Committees, community heritage registers, historical societies and other local heritage organizations.

Cultural heritage resources are often of critical importance to Indigenous communities. Indigenous communities may have knowledge that can contribute to the identification of cultural heritage resources, and any engagement with Indigenous communities should include a discussion about known or potential cultural heritage resources that are of value to them.

Subsequent Municipal Class EA Undertakings
The recommendations outlined above can be used in support of any future technical cultural heritage studies required for any Schedule B and C MCEA undertakings identified within the master planning area. Technical cultural heritage studies are to be undertaken by a qualified person who has expertise, recent experience, and knowledge relevant to the type of cultural heritage resources being considered and the nature of the activity being proposed. Please advise MCM whether any technical cultural heritage studies will be completed for this master plan and provide them to MCM before issuing a Notice of Completion.

Thank you for consulting MCM on this project. Please continue to do so through the master plan process. Do no hesitate to contact me with any questions or clarification.

Sincerely,

Joseph Harvey
Heritage Planner
joseph.harvey@ontario.ca

From:	Coreena Smith
To:	Klarika Hamer; Lisa Courtney
Cc:	Jack Van Dorp; Amanda Froese; Claire Dodds
Subject:	RE: 22128 Notice of Study Commencement Municipality of Kincardine Water and Wastewater Master Plan
Date:	November 23, 2022 4:11:44 PM
Attachments:	image001.jpg cob_logo_482ea6ae-463f-4d00-8147-f4e02eda1e3e.png 22128-2022-10-28-BC let.pdf

---

Lisa,
Thank you for forwarding to the County's attention the Notice of Study Commencement for Kincardine's Water and Wastewater Master Plan Update. We are happy to be engaged in this project and are available to provide support to the Municipality (e.g., attendance at public meetings if required, provision of the County' current growth projection numbers in light of our current in-progress update to the County Official Plan).
Please do not hesitate to reach out.
Kind regards,

Coreena Smith
Senior Planner
Planning and Development
Corporation of the County of Bruce

Office: 519-881-1782
Direct: 226-909-6305
https://link.edgepilot.com/s/dc78aae5/W0-YuSP8QUKDbHIh2AMyEw?u=http://www.brucecounty.on.ca/

From: Klarika Hamer <KHamer@brucecounty.on.ca>
Sent: Tuesday, November 8, 2022 9:02 AM
To: Lisa Courtney <lcourtney@bmross.net>
Cc: Coreena Smith <CJSmith@brucecounty.on.ca>
Subject: RE: 22128 Notice of Study Commencement Municipality of Kincardine Water and Wastewater Master Plan

Good morning Lisa,

Thank you for your email.

We are in receipt of the above noted Notice and will provide input by November 23, 2022.

Coreena Smith is the Planner on this file and is copied on this email.

Kind regards,

Klarika Hamer

Applications Technician
Planning and Development
Corporation of the County of Bruce

Office: 226-909-3359
https://link.edgepilot.com/s/dc78aae5/W0-YuSP8QUKDbHIh2AMyEw?u=http://www.brucecounty.on.ca/

From: Lisa Courtney <lcourtney@bmross.net>
Sent: Tuesday, November 1, 2022 11:32 AM
To: Bruce County Planning - Lakeshore Hub <bcplpe@brucecounty.on.ca>; Amanda Froese <AFroese@brucecounty.on.ca>
Subject: 22128 Notice of Study Commencement Municipality of Kincardine Water and Wastewater Master Plan

Hello,
Please find attached the Notice of Study Commencement for the update to the Municipality of Kincardine Water and Wastewater Master Plan. If you have any initial questions or comments, please do not hesitate to reach out.
Thanks and cheers,

Lisa J. Courtney, MSc., MCIP, RPP
B. M. Ross and Associates Limited
Engineers and Planners
62 North Street
Goderich, ON N7A 2T4

Ph: (519) 524-2641
lcourtney@bmross.net
https://link.edgepilot.com/s/a97a679c/9GxU2F5BZU_BhHL2elfrcg?u=http://www.bmross.net/

Lisa Courtney

From: Coordinator LRC HSM <hsmlrcc@bmts.com>
Sent: November 9, 2022 9:49 AM
To: Lisa Courtney
Subject: Request for Comments - Kincardine - Water and Wastewater Servicing Master Plan Update

Kincardine Municipality (projects)

RE: File No. 22128

The Historic Saugeen Métis (HSM) Lands, Resources and Consultation Department is interested to receive further information regarding the Kincardine Water and Wastewater Servicing Master Plan Update as additional information becomes available.

Thank you for the opportunity to review this matter.

Regards,

Chris Hachey

Coordinator, Lands, Resources & Consultation
Historic Saugeen Métis
email: hsmlrcc@bmts.com
phone: 519-483-4000
site: saugeenmetis.com
address: 204 High Street Southampton, ON

THE MUNICIPALITY OF
great energy. balanced life.
KINCARDINE

BMROSS
engineering better communities

Municipality of Kincardine Water & Wastewater Servicing Master Plan Update

PUBLIC OPEN HOUSE

NOVEMBER 29, 2022

6 PM – 8 PM

1

What are Master Plans?

- Master Plans are long range plans that look at integrated infrastructure systems (like water and wastewater systems) over large geographic areas.
- Under the Municipal Class Environmental Assessment (Class EA) process, Master Plans can be customised to suit needs they can be broad in scope and general in details, or can examine strategies or alternatives in detail.
- Strategies identified in Master Plan can be incorporated into future Official Plan and Zoning By law updates.
- Can be a living document update and review on a regular basis.
- Servicing Master Plans look at infrastructure systems to identify and evaluate current and future water and wastewater needs.
  - Identify infrastructure projects, timing, and potential costs.
  - Think of a Master Plan as a roadmap or gameplan for the future, to allow the Municipality to plan and budget for projects.

2

2018 Master Plan

- Technical analyses completed in 2017 and report issued in spring of 2018.
- Examined proposed developments, growth forecasts and existing infrastructure to identify water and wastewater projects.
  - Water study areas based on treatment plant servicing area:
    - Kincardine, including Lakeshore (Kincardine north to Inverhuron)
    - Tiverton
  - Wastewater study areas based on treatment plant servicing area:
    - Kincardine
    - Bruce Energy Centre (BEC) services Tiverton, Inverhuron, BEC Business Park
- Projects identified as needed now (2018), in 3 5 years and over the longer term (depending on the progression of development).
- 2022 Master Plan will be an update to the previously completed analyses.

3

Recommended Projects – 2018 Master Plan

SYSTEM	PROJECT	TIMING (IN 2018 REPORT)	STATUS
Kincardine Water	WTP Disinfection – UV	Within 5 years	Pending plant expansion
Kincardine Water	Standpipe BPS Rehab	Within 5 years	Done
Kincardine Water	Trunk watermain – Sutton, Russell, Kincardine Ave.	2018	Done
Kincardine Water	Gary Street BPS	2018	Done
Tiverton Water	Review PTTW/MDWL discrepancy	Within 3 years	2020 PTTW renewal; capacity maintained
Tiverton Water	Standpipe BPS Rehab	Within 5 years	Done
Tiverton Water	King St. Watermain	Depend on development	Depend on development
Kincardine Wastewater	Durham St. SPS Design & Approvals	2018	Durham St. 2022 design for 2023 construction, Park St. 2023 design for 2024 construction
Kincardine Wastewater	Park St. SPS Design & Approvals	2018	
Kincardine Wastewater	Huron Terrace SPS Design	2018	Done
Kincardine Wastewater	SPS/WWTP SCADA Control	Depend on Municipal direction	Complete at most sites, and plans in place for remaining sites
Kincardine Wastewater	Durham St. sewer	Depend on development	Done
Kincardine Wastewater	Queen St. North and Kingsway sewer	Depend on development	Depend on development
Kincardine Wastewater	Russel St. sewer	Depend on development	Done
Kincardine Wastewater	Gary, Sutton, Mechanics, James sewer	2018	Done
BEC and Tiverton Wastewater	Maple St. SPS Analysis & Upgrade Design	Within 5 years	Flow study complete; no upgrades required at this time.
BEC and Tiverton Wastewater	SPS SCADA Control	Depend on Municipal direction	Complete at most sites, and plans in place for remaining sites

4

Study Areas

Study Areas are generally based on treatment plant service areas.

Water

- **Kincardine and Lakeshore Area** (north to Inverhuron)
  - Bruce Power is being considered as a potential customer. A Class EA related to treatment plant expansion is underway.
- **Tiverton**

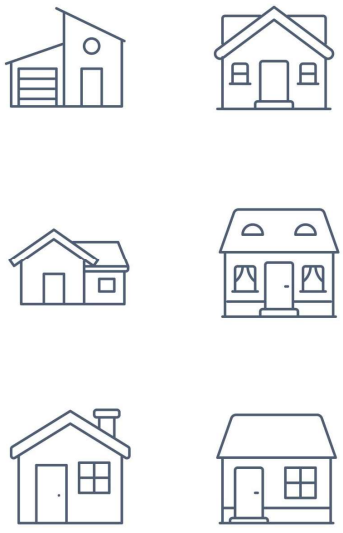
Wastewater

- **Kincardine**
- **BEC Wastewater Treatment Plant (WWTP)**
  - services Tiverton, Inverhuron, BEC Business Park and Concession 2 Industrial Lands.

5

Growth and Development

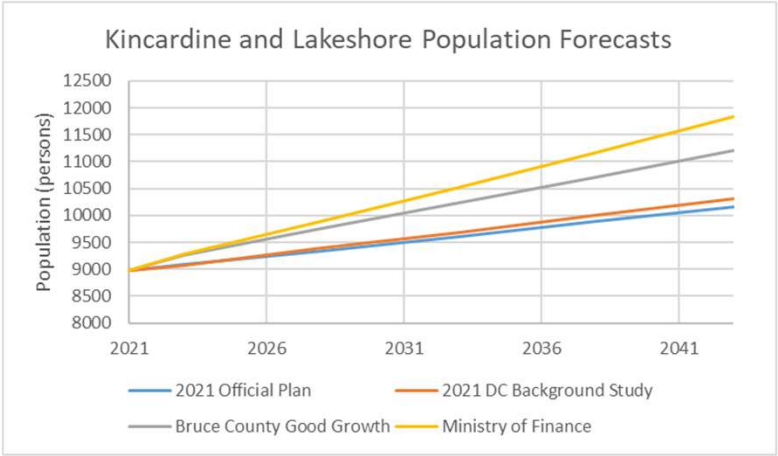
- Population and Equivalent Residential Units (ERU) forecasted
  - 1 single detached house (2.48 persons per unit) 1 ERU
  - 1 multi unit (2.01 persons per unit) 0.85 ERU
  - 1 apartment (1.38 persons per unit) 0.60 ERU
- Utilized existing forecasts:
  - 2021 Kincardine Official Plan
  - Ministry of Finance (for Bruce County)
  - 2021 Development Charge Background Study
  - Bruce County Good Growth Discussion Paper



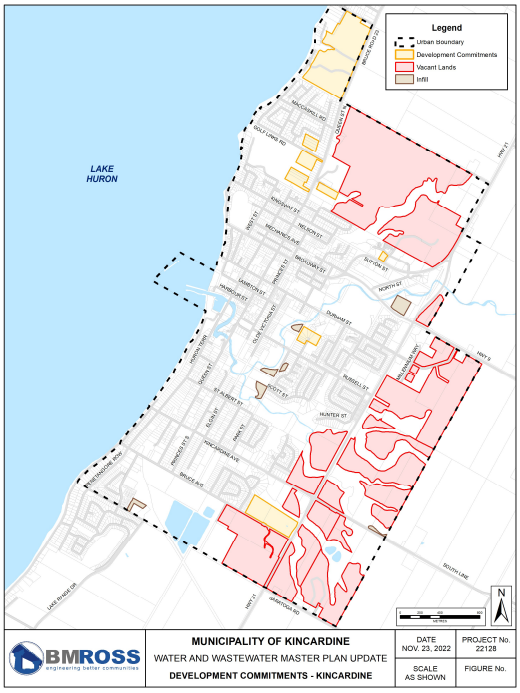
6

Kincardine + Lakeshore Growth Forecast

Source of Forecast	Rate of Growth	2043 Population	2043 ERUs
2021 Official Plan	0.56%	10,167	4,822
2021 DC Background Study	0.63%	10,321	4,679
Bruce County – "Good Growth"	1.01%	11,201	5,079
Ministry of Finance	1.28%	11,846	5,371



7

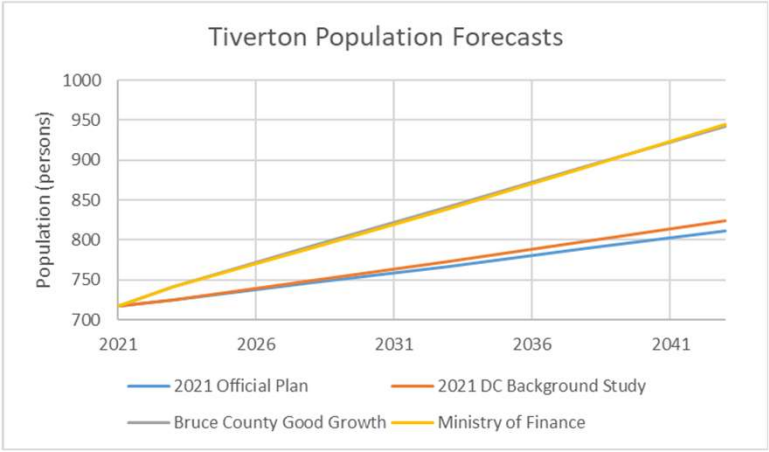


Potential Development Areas - Kincardine

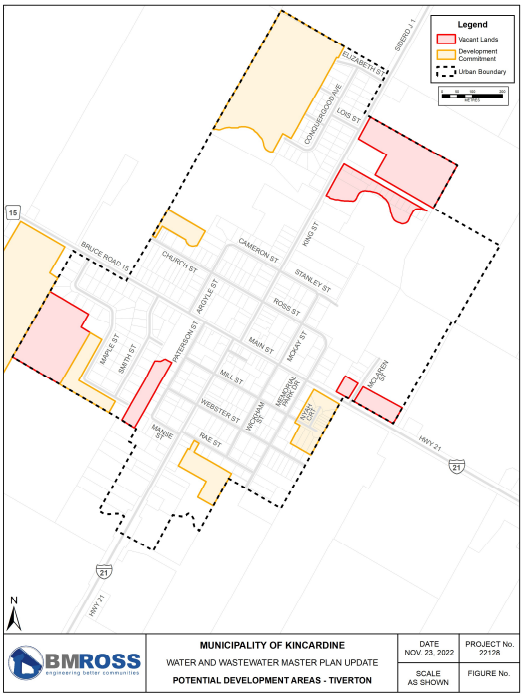
8

Tiverton Growth Forecast

SOURCE OF FORECAST	RATE OF GROWTH	2043 POPULATION	2043 ERUS
2021 Official Plan	0.56%	811	440
2021 DC Background Study	0.63%	824	427
Bruce County – "Good Growth"	1.25%	942	488
Ministry of Finance	1.28%	945	490

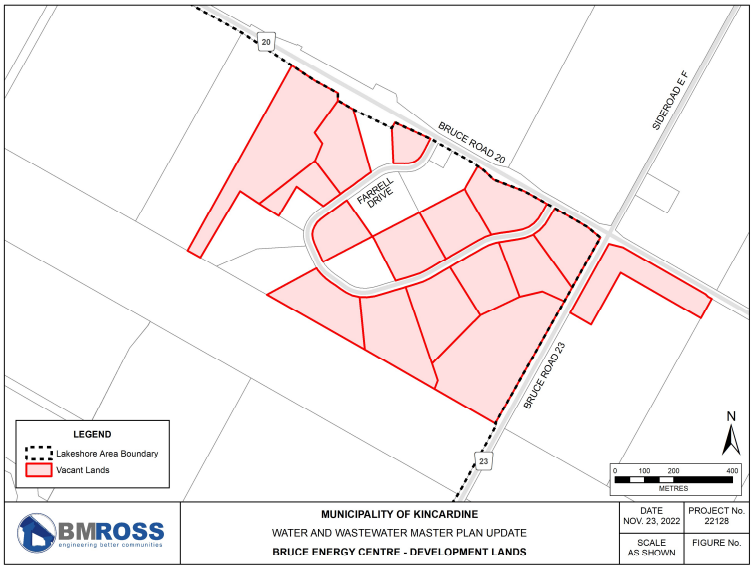


9



Potential Development Areas – Tiverton

10



Potential Development Areas – BEC

11

Kincardine Water Treatment

- Rated capacity is 11,563 m^3/day
- Current customers: 4,073 includes Kincardine, Huron Kinloss properties, and Lakeshore north to Inverhuron. Current maximum demand is 6,954 m^3/day (or 1.71 m^3/day per customer).
- Approximately 60% of capacity being utilized
- Committed capacity 1,624 ERUs x 1.71 m^3/day
  2,773 m^3/day
- Uncommitted capacity 1,836 m^3/day or 1,076 ERUs

12

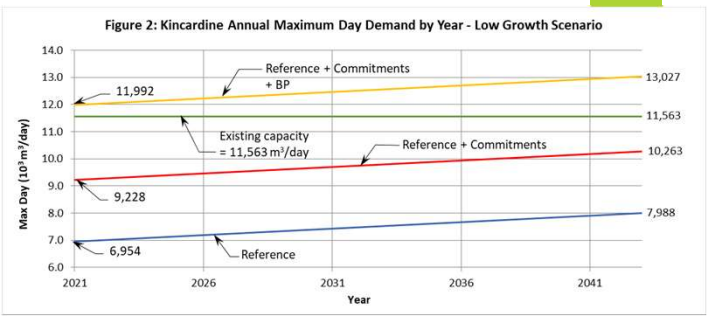
Water Supply to Bruce Power

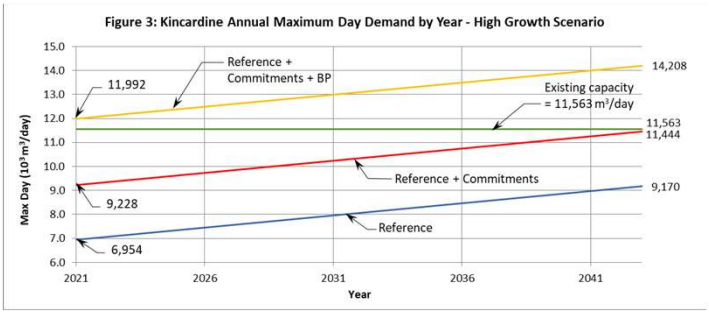
- Require approximately 2,765 m^3/day.
- Uncommitted capacity is inadequate to supply Bruce Power.
  - Servicing Bruce Power would require additional treatment capacity at the water treatment plant.
- A Municipal Class Environmental Assessment currently underway to evaluate impacts of supplying Bruce Power from the Kincardine Drinking Water System (DWS).

13

Kincardine Water Treatment – Forecasted Demand

- Capacity expected to be sufficient to handle growth & development commitments over the next 20 years for both growth scenarios, without Bruce Power as a customer.
- The Municipality could maintain the same number of commitments (i.e., inventory) as it currently has (approximately 1,140 residential units) in either scenario.
- The addition of the Bruce Power would result in committed demand immediately exceeding the capacity of the existing DWS without any added growth. In the absence of a capacity expansion no additional development could be approved.





14

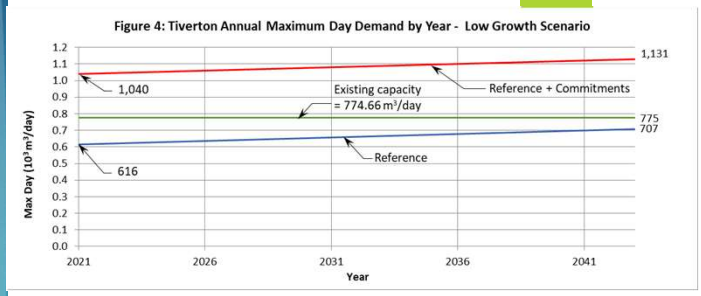
Tiverton Water Treatment

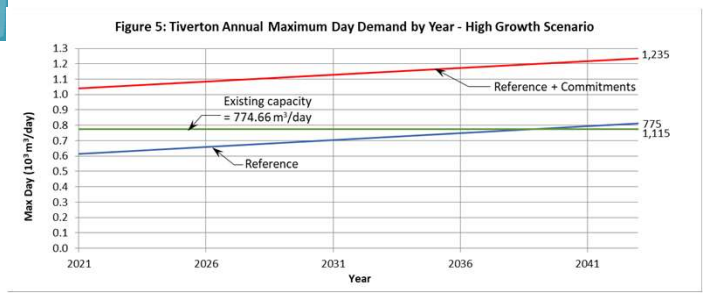
- Rated capacity 775 m^3/day (restricted by Permit to Take Water)
- Current maximum demand is 616 m^3/day for 372 customers (1.66 m^3/day per customer)
- Current usage is 80% of capacity.
- Current commitments 256 units or 424 m^3/day
- Uncommitted reserve 265 m^3/day or 160 ERU
- For reference, the current maximum day demand is less than the value of 659 m^3/day reported in the 2018 Master Plan

15

Tiverton Water Treatment – Forecasted Demand

- Based on the development ERUs considered, the system is over committed. However:
  - Under the low growth scenario, capacity will be adequate for the entire 20 year period considered.
  - Under the high growth scenario, capacity will be adequate until approximately 2039.
- Therefore, actual timing of growth will be a key consideration.





16

Facility	Total Volume (m^3)	Effective Volume (m^3)
Kincardine WTP Reservoir	4,120	1,700
Kincardine Standpipe	3,360	3,005
Kincardine Totals	**7,480**	**4,705**

Scenario	Total Volume Required (m^3)
Existing	4,650
Existing + Commitments	5,789
Existing + Commitments + Bruce Power	6,650

- Storage is used for equalization of peak demands, fire protection, and emergencies
- Currently there is sufficient water storage
- Modifications at the WTP could increase total effective volume to 7,090 m^3
  - Would be sufficient for commitments + Bruce Power
  - Modifications being examined as part of Bruce Power Water Supply EA

Water Storage - Kincardine

17

Kincardine Water Storage – Future Growth

- Current effective volume is slightly above recommended value. Under either growth scenario, the recommended volume will exceed effective volume within several years.
- With WTP modifications, storage would be sufficient for existing plus development commitments and Bruce Power needs.

Figure 6: Kincardine Total Storage Required - Low Growth Scenario

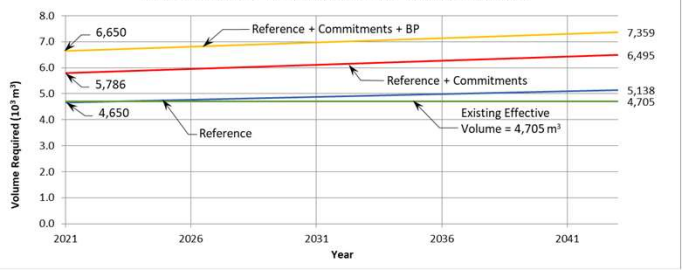
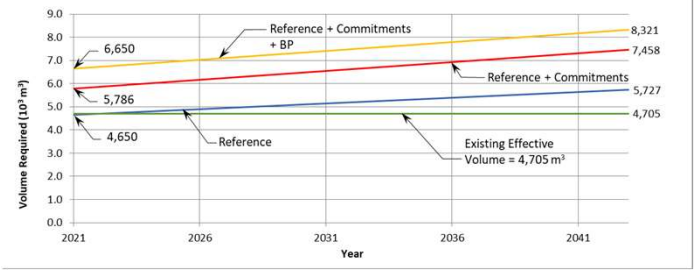


Figure 7: Kincardine Total Storage Required - High Growth Scenario



18

Water Storage – Tiverton

Facility	Total Volume (m^3)	Effective Volume (m^3)
Tiverton Standpipe	1,500	1,390

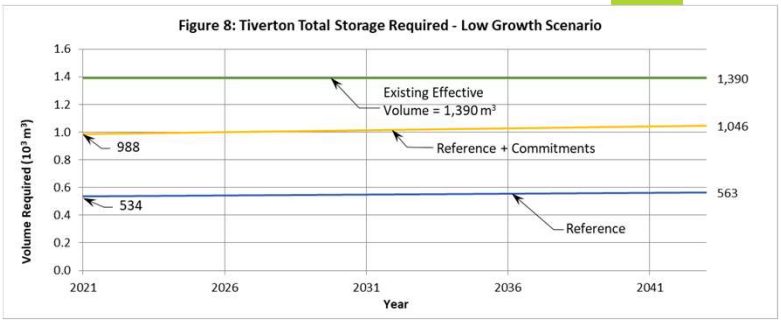
Scenario	Total Volume Required (m^3)
Existing	534
Existing + Commitments	988

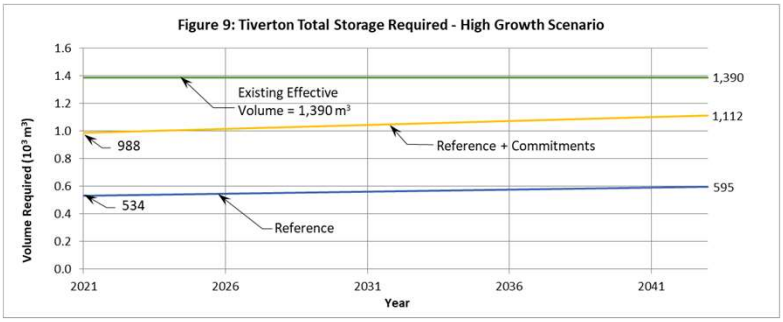
- Have sufficient storage capacity
- Current effective storage is also sufficient for development commitments

19

Tiverton Water Storage – Future Growth

- The effective volume of the Tiverton standpipe is sufficient for providing the recommended storage for current needs, as well as both high and low growth forecasts beyond 20 years.





20

Kincardine WWTP

- Rated capacity is 5,910 m^3/day
- Current average flow 3,828 m^3/day for 3,780 customers (1.01 m^3/day per customer)
- Current usage is approximately 65%
- Committed capacity 1,132 units or 1,146 m^3/day
- Uncommitted reserve capacity 936 m^3/day or 924 units

- For reference, the current average day flow is similar to the value of 3,811 m^3/day reported in the 2018 Master Plan

21

Kincardine WWTP – Forecasted Flows

- Under the low growth scenario, the existing rated capacity of the Kincardine WWTP will be sufficient for existing plus development commitments for the next 20 years.
- Under the high growth scenario, the existing rated capacity of the Kincardine WWTP will be fully committed by approximately 2037.

Figure 10: Kincardine Annual Average Wastewater Flow by Year - Low Growth Scenario

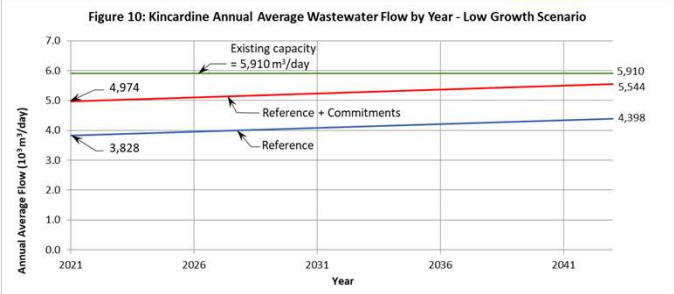
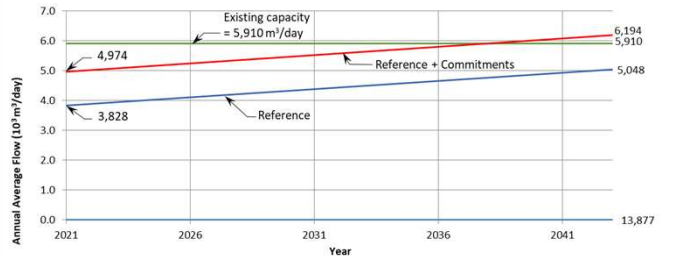


Figure 11: Kincardine Annual Average Wastewater Flow by Year - High Growth Scenario



22

BEC WWTP

- Current rated capacity 2,200 m^3/day.
- Current average flow 729 m^3/day by 460 customers (1.58 m^3/day per customer)
- Current usage 33%
- Current commitments 699 units or 1,108 m^3/day
- Uncommitted Reserve 363 m^3/day

- For reference, the current average day flow is less than the value of 805 m^3/day reported in the 2018 Master Plan.
- Additional development within the BEC will need to consider industry specific wastewater servicing needs and associated impacts to reserve capacity. MECP Guideline values for industrial lands would project flows for all vacant BEC lands to exceed the plant capacity, however it is probable that Guideline values are unrealistically high.

23

BEC WWTP – Forecasted Flows

- Under both growth scenarios, the existing rated capacity of the BEC WWTP will be sufficient for the next 20 years.
- Addition of BEC and Concession 2 industrial lands has potential to over commit the plant capacity.
- Based on our experience, it is unlikely that all industrial land would be developed with industry for which the shown allowance applies. Ultimately the actual sewage flows generated will be industry specific.

Figure 12: BEC Annual Average Wastewater Flow by Year - Low Growth Scenario

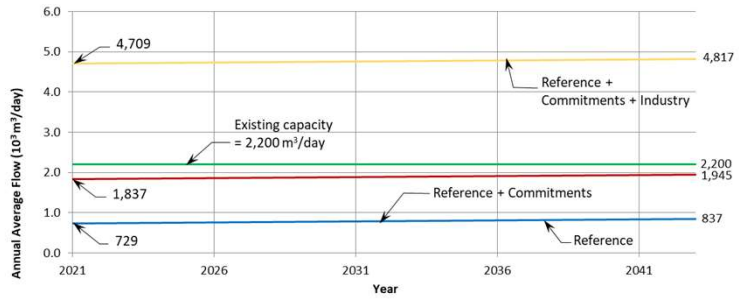
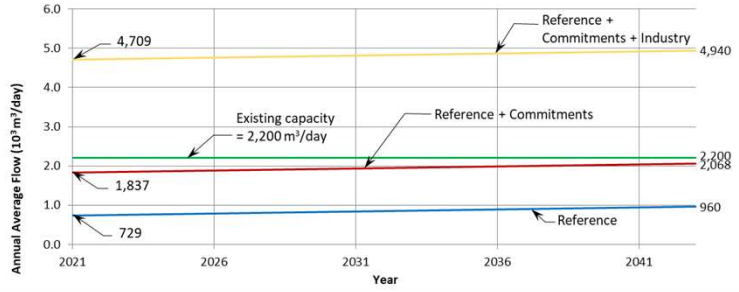


Figure 13: BEC Annual Average Wastewater Flow by Year - High Growth Scenario



24

Water Distribution

- Kincardine and Tiverton distribution systems were each modelled to evaluate predicted pressures and available fire flows, for both existing and 20 year growth scenarios.
- No issues were identified related to available pressure. A limited number of locations have low fire flow; these locations are associated with dead ends and/or at the extremities of the distribution systems.
- Water supply to Bruce Power would result in the need for a booster pumping station (BPS) along the Lakeshore watermain. Identification of a preferred location is part of the current Class EA for the water supply expansion.

25

Sewer Collection

- Six major Sewage Pumping Station (SPS) catchment areas in Kincardine, and two in Tiverton, were modelled.

Community	Total Number of Pipes in Models (All Catchment Areas)	Number of Pipes at >100% Capacity for Existing Development	Number of Pipes at >100% Capacity for Future Development
Kincardine	705	5 (0.7%)	35 (5%)[1]
Tiverton	101	0	0

- In general, no significant capacity issues of urgent need. Replacement of undersized sewer for future development should be timed for development.

1. Park St. SPS catchment area is still under review.

26

Sewage Pumping Stations

SPS	Rated Capacity (L/s)	Estimated Current Peak (L/s)	Projected 20 Year Peak (L/s)
In Kincardine			
Connaught Park	89	38	60
Durham St.	27[1]	55	120
Goderich St.	46	61[3]	63
Huron Terrace	300[2]	179	310
Kincardine Ave.	49	40	73
Park St.	99	53	~200[5]
In Tiverton			
King St.	14	6	12
Maple St.	30	53[4]	67

1. Durham St. SPS expansion under design, for 2023 tender.
2. Huron Terrace SPS expansion is under construction.
3. Despite estimated peak > rated capacity, no bypasses in last 3 years.
4. Flows appear to have subsided in 2022.
5. Park St. SPS catchment area is still under review.

27

Alternative Solutions - Water

- In general, Limit Growth and Do Nothing are always alternatives. Additionally:

Kincardine	Tiverton
Water Treatment	**Water Treatment**
• Increase WTP Capacity	• Pursue PTTW increase
• New WTP	• Additional well
Water Storage	• Connect to Kincardine system
• WTP disinfection modifications	
• New storage facility	
Water Distribution – upgrades in response to development needs	

28

Alternative Solutions - Wastewater

- In general, Limit Growth and Do Nothing are always alternatives. Additionally:

Kincardine	BEC/Tiverton
Wastewater Treatment	**Wastewater Treatment**
• Increase WWTP Capacity	• Increase WWTP Capacity
• New WWTP	• New WWTP
• Monitor flows	• Monitor flows
Sewage Pumping	**Sewage Pumping**
• Durham St., Park St. a. Larger pumps and/or forcemain b. New station	• Maple St. a. Monitor flows
• Goderich St. a. Monitor flows	
Sewer Collection – upgrades in response to development needs	

29

Recommended Solutions - Water

Facility	Recommended Solution	Timing/Class EA Notes
Kincardine WTP	Increase WTP Capacity	Class EA is underway
Kincardine water storage	WTP disinfection modifications	Under review as part of Class EA process
Tiverton water treatment	Further study of additional well vs. connection to Kincardine	Demands have not increased in 5 years, and system has significant storage, therefore no apparent urgency. Recommend to regularly update reserve capacity calculations. New well or connection to Kincardine will require Schedule B Class EA.
Water distribution – both communities	Upgrades as needed for new development	In response to development timing

30

Recommended Solutions - Wastewater

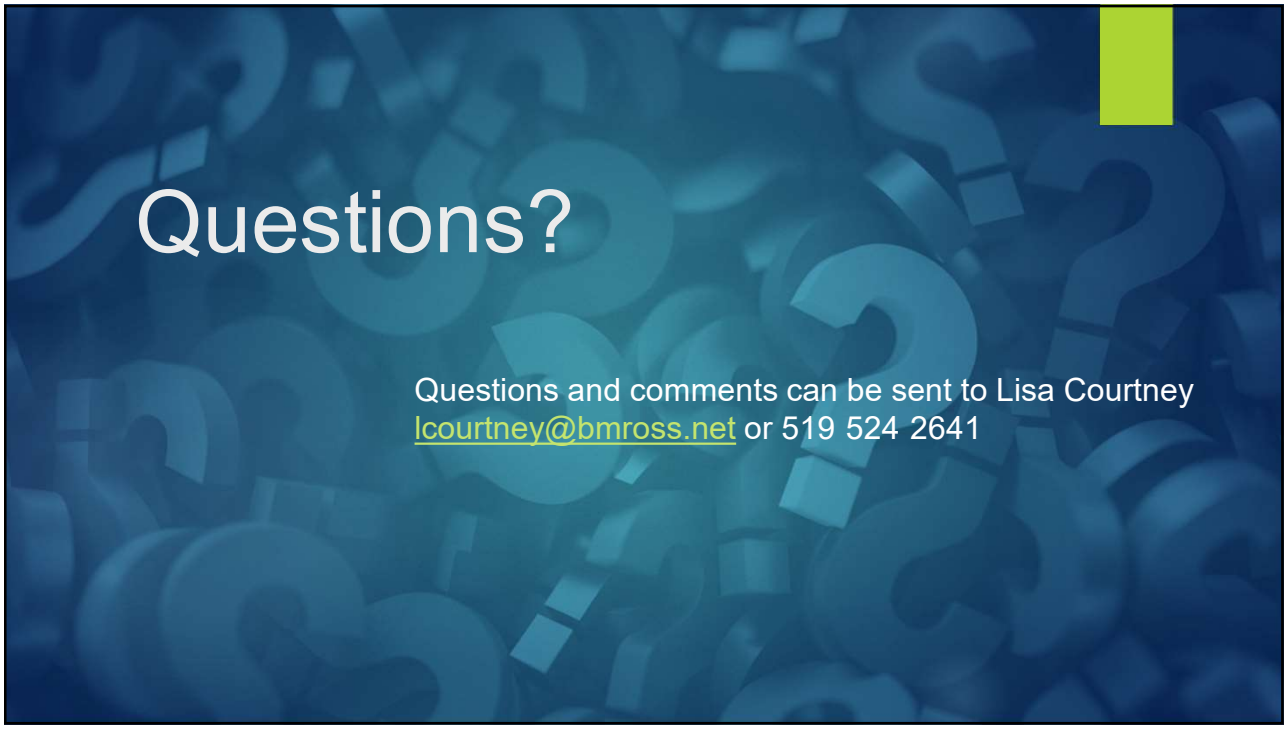
Facility	Recommended Solution	Timing/Class EA/Other Notes
Kincardine WWTP BEC WWTP	Increase WWTP Capacity	Flows have not changed significantly in 5 years. Recommend to regularly update reserve capacity calculations. Capacity increase will require Schedule C Class EA.
Durham St. and Park St. SPS	Larger pumps (short-term) Larger forcemain (long-term)	Design of Durham station pump upgrades for 2023 construction, and Park for 2024. Forcemain replacement at later date when required.
Goderich St. and Maple St.	Monitor flows	Ongoing. Despite estimated peaks greater than station capacity, flows/bypasses have subsided.
Wastewater collection – Kincardine	Upgrades as needed for new development	In response to development timing

31

Next Steps

- Incorporate feedback received from this meeting into draft Master Plan Update document
- Present draft Master Plan to Council
- Issue Notice of Completion
- 30 day public review period

32


Questions?
Questions and comments can be sent to Lisa Courtney
lcourtney@bmross.net or 519 524 2641

33

Ministry of the Environment, Conservation and Parks

Environmental Assessment Branch

1st Floor
135 St. Clair Avenue W
Toronto ON M4V 1P5
Tel.: 416 314-8001
Fax.: 416 314-8452

Ministère de l'Environnement, de la Protection de la nature et des Parcs

Direction des évaluations environnementales

Rez-de-chaussée
135, avenue St. Clair Ouest
Toronto ON M4V 1P5
Tél. : 416 314-8001
Téléc. : 416 314-8452

Via E-mail Only

May 31, 2023

Lisa Courtney
Environmental Planner
B. M. Ross and Associates Limited
lcourtney@bmross.net

Re: 2022 Water and Wastewater Servicing Master Plan Update
Municipality of Kincardine
Municipal Class Environmental Assessment – Master Plan (Approach #1)
Project Review Unit Comments – Draft Master Plan Update

Dear Lisa Courtney,

Thank you for providing the ministry with an opportunity to comment on the draft Master Plan Update Report (Report) for the above noted Class Environmental Assessment (EA) project. Our understanding is that in order to address impacts to the water and wastewater systems from local growth and development, the Municipality of Kincardine (the proponent) has determined that the preferred alternatives include: expanding the Kincardine Water Treatment Plant (WTP) capacity; Kincardine WTP disinfection modifications, to increase the effective available volume of water from the existing reservoir; further study of well improvements, an additional well, or connection to Kincardine for the Tiverton Drinking Water System; Durham Street Sewage Pumping Station (SPS) pump upgrades and related works; Park Street SPS pump upgrades and related works; regular updates of the reserve capacity calculations; and sewer upgrades as needed for new development. The Ministry of the Environment, Conservation and Parks (ministry) provides the following comments for your consideration.

General

1) Section ES 2.1 of the Report references ERUs, which are defined later in the Report as Equivalent Residential Units (ERUs). The ministry recommends that acronyms in the Report be defined at the first instance of their use.

2) Given that Section 1.3.2 of the Report describes the project schedules outlined in the 2023-amended version of the Municipal Class EA (MCEA), the ministry recommends that Figure 1.1, which references Schedule A/A+ projects from the 2015-amended MCEA, be replaced by the equivalent figure "Exhibit A.2" in the 2023-amended MCEA.

Evaluation of Alternatives

3) Section 9.0 of the Report states, "*Alternative solutions to the above-noted problems and opportunities were evaluated. Based on the evaluations undertaken, the following solutions were recommended*." I note that alternative solutions are not very clearly identified and evaluated for each of the problems/opportunities presented in the report, and the traceability of decision-making for how the recommended/preferred solutions were evaluated and selected could be improved. However, the ministry acknowledges that this Approach #1 Master Plan consists of only preliminary completion of Phases 1 and 2 of the Municipal Class EA process, rather than a fulsome completion of these phases. Please ensure that subsequent Schedule B and C projects that are supported by this Master Plan complete the entirety of the applicable phases of the Municipal Class EA process, including identification of all reasonable and feasible alternative solutions to the problem, identification of the magnitude of the net positive and negative effects of each alternative solution and mitigating measures, and an evaluation of all reasonable alternative solutions.

Thank you for circulating this draft Report for the ministry's consideration. Please document the provision of the draft Report to the ministry as well as this Project Review Unit Comments letter in the final Report. A copy of the final Notice of Master Plan should be sent to the ministry's Southwest Region EA notification email account (eanotification.swregion@ontario.ca).

Should you or any members of your project team have any questions regarding the material above, please contact me at mark.badali1@ontario.ca.

Sincerely,

Mark Badali, Senior Project Evaluator
Environmental Assessment Program Support, Environmental Assessment Branch
Ontario Ministry of the Environment, Conservation and Parks

cc John Ritchie, Manager, Owen Sound District Office, MECP