MUNICIPALITY OF KINCARDINE

2022 Water and Wastewater Servicing Master Plan Update

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MUNICIPALITY OF KINCARDINE
2022 WATER AND WASTEWATER SERVICING
MASTER PLAN UPDATE

June 9, 2023

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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.

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1.0 INTRODUCTION

1.1 Purpose of the Master Plan

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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.

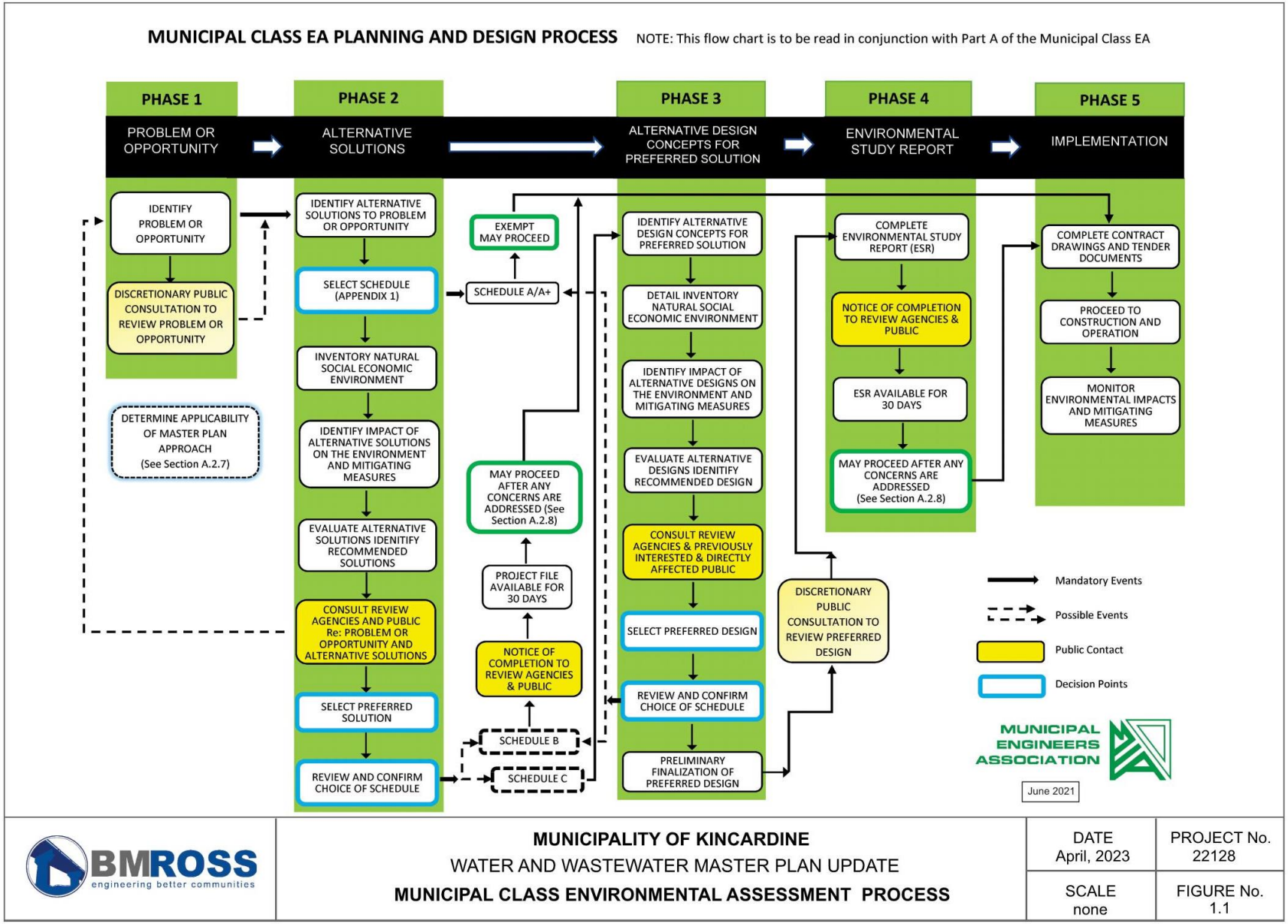
- Phase 1 - Problem or Opportunity identification;
- Phase 2 - Evaluation of alternative solutions to the defined problems and selection of a preferred solution;
- Phase 3 - Identification and evaluation of alternative design concepts and selection of a preferred design concept;
- Phase 4 - Preparation 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.

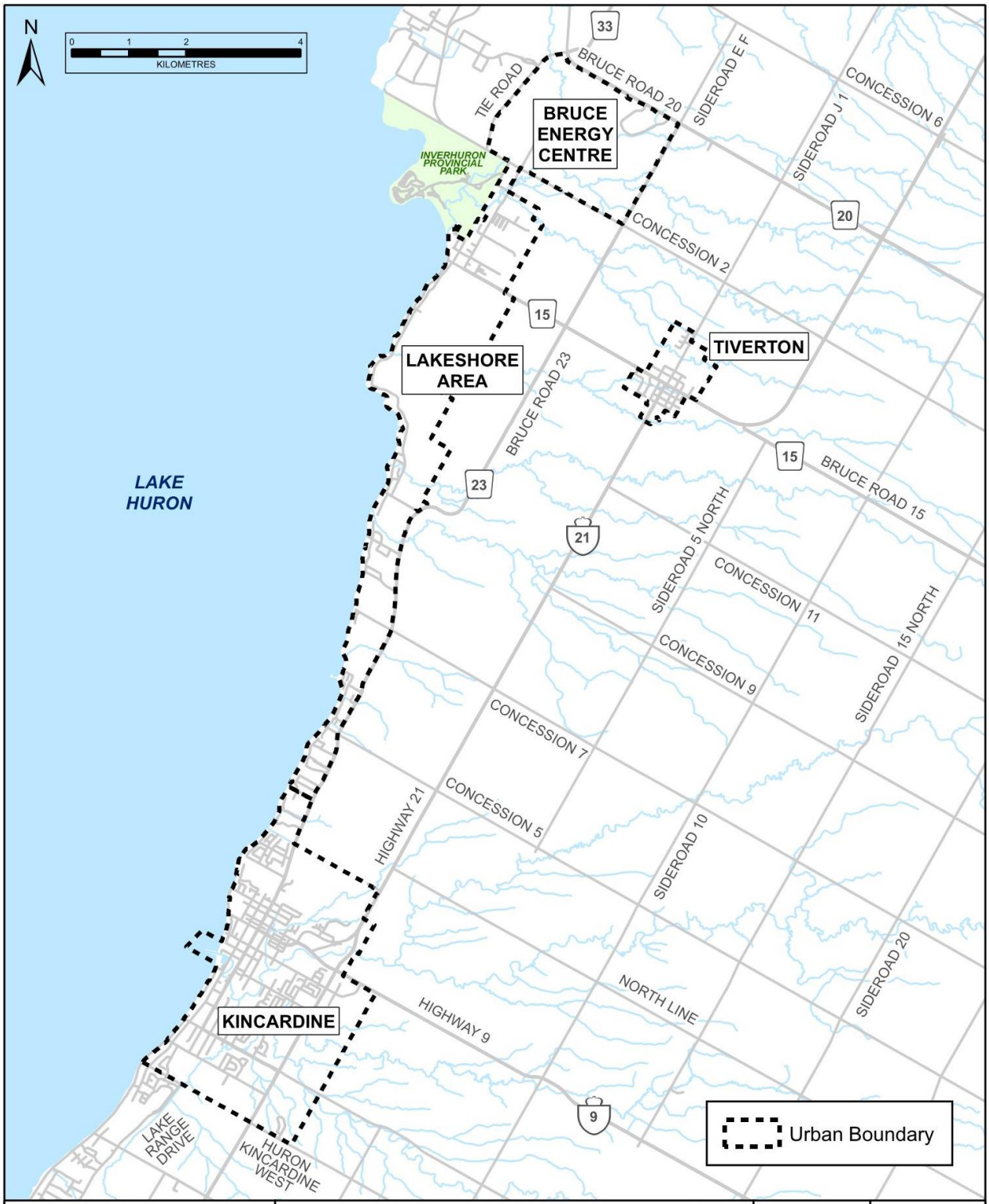
The former Town of Kincardine roughly extends from Saratoga Road north to Wickham Cove Lane, and east from Lake Huron to the Kincardine Business Park, located on the east side of the Bluewater Highway (Highway 21). Majority of existing development within Kincardine is located between the Bluewater Highway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

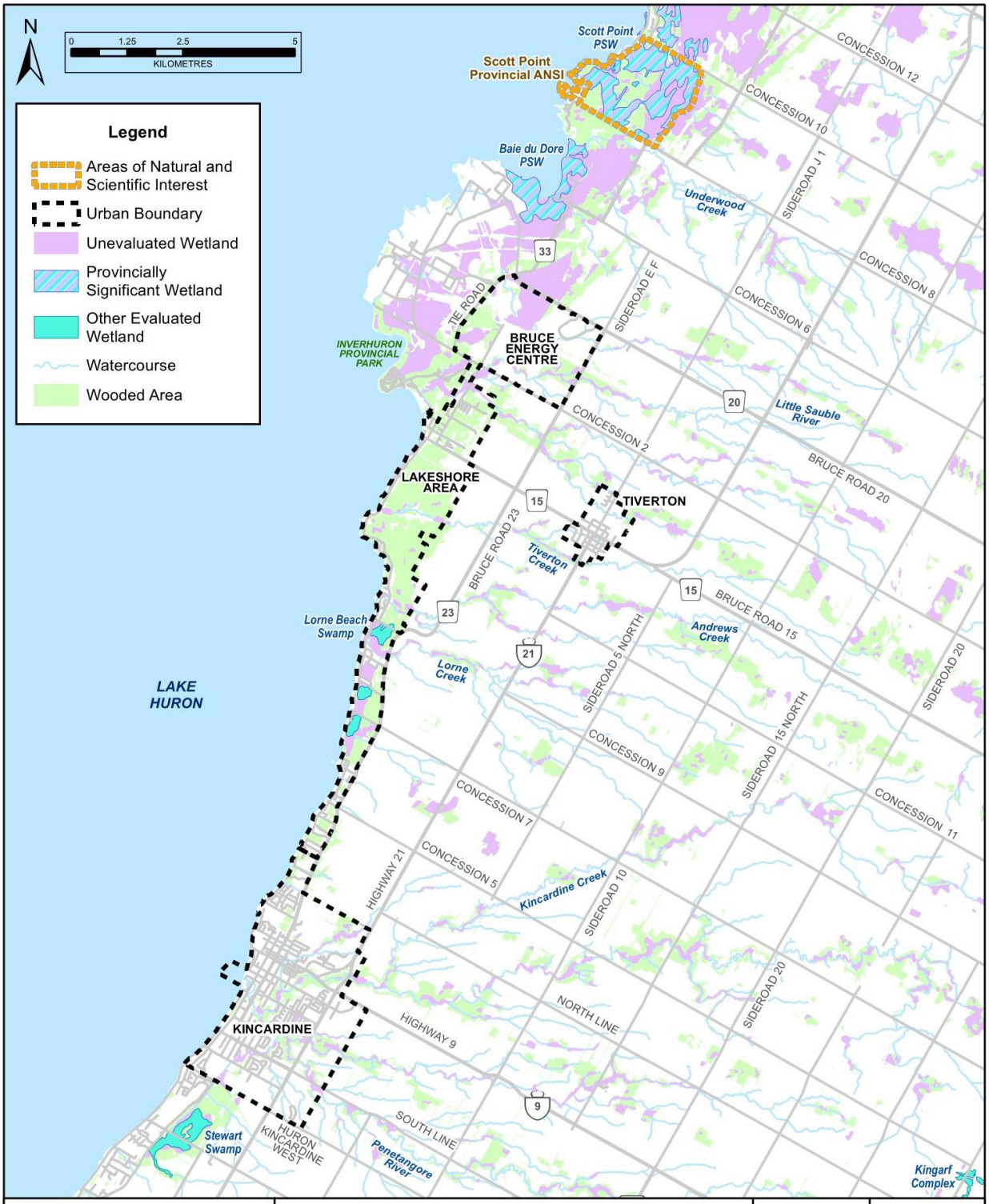
The Lake Fringe watershed is a narrow strip of land located along Lake Huron from Kincardine to Southampton. The watershed consists of small tributaries, including Lorne, Andrews, and Tiverton Creeks which discharge into Lake Huron. The watershed drains approximately 254 km^2 of land which mainly consists 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

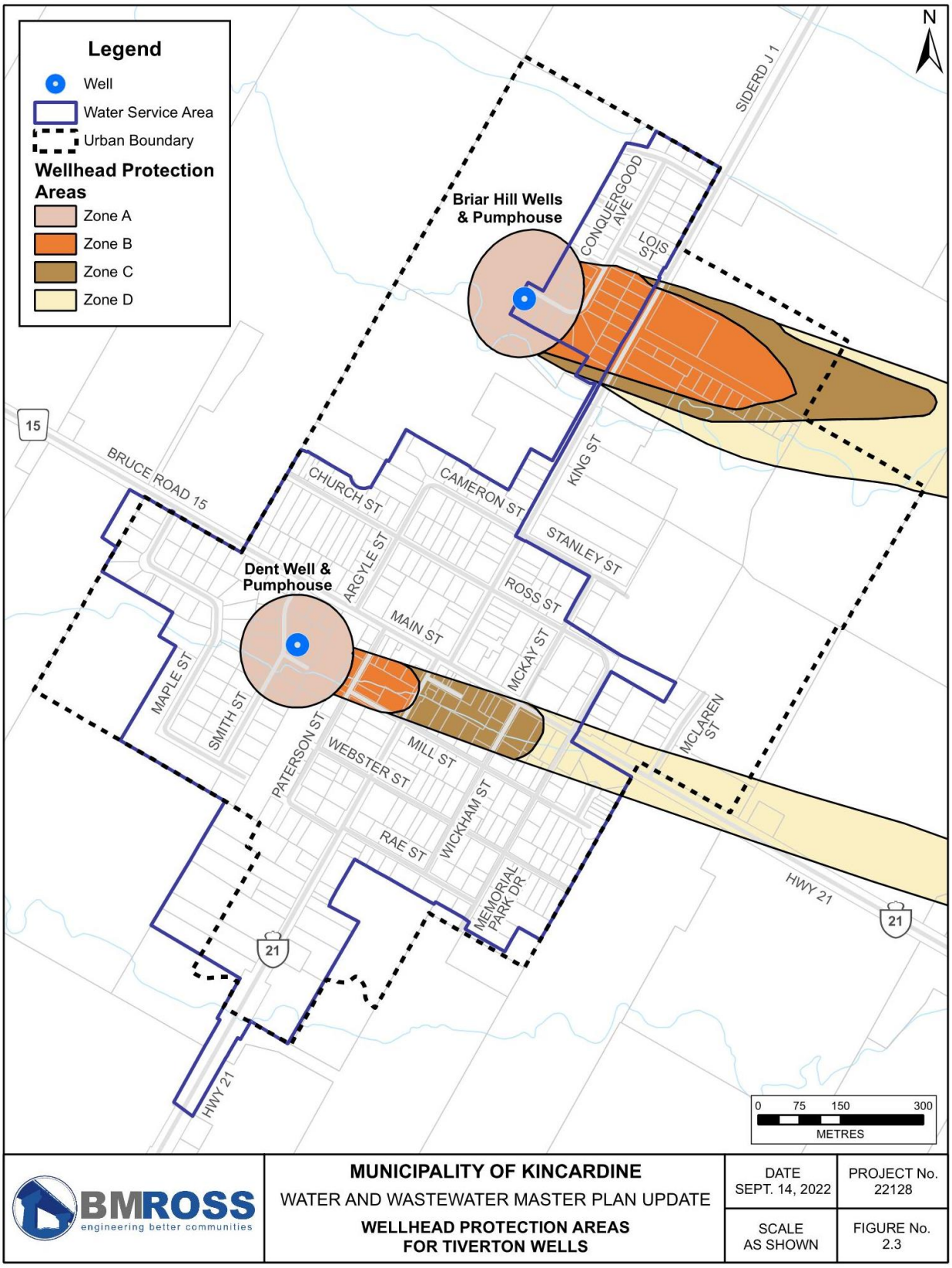


Figure 2.4 – Intake Protection Zones for Kincardine Water Intake

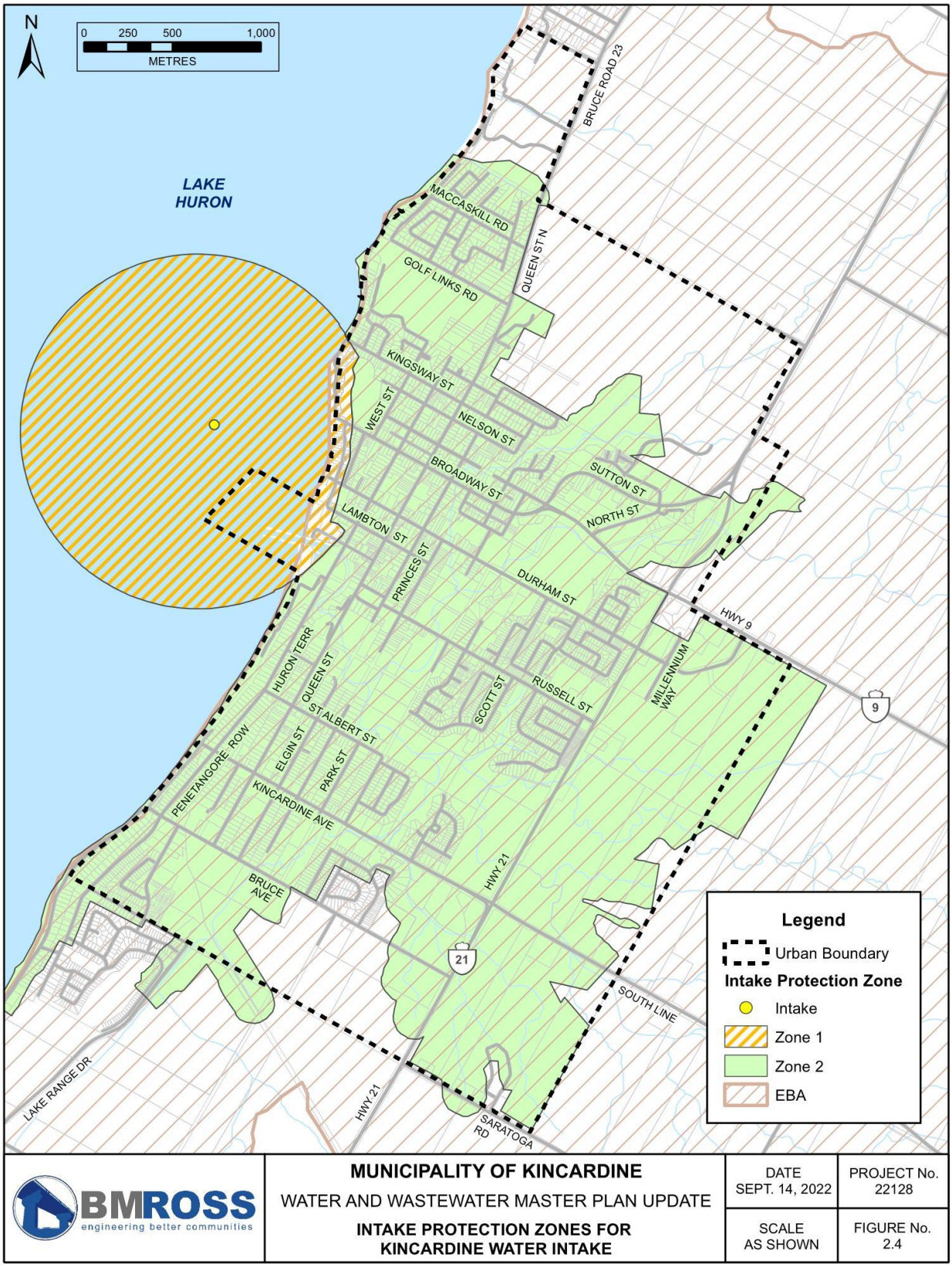


Table 2.2 – Source Water Policies Relating to the Water and Wastewater Servicing

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

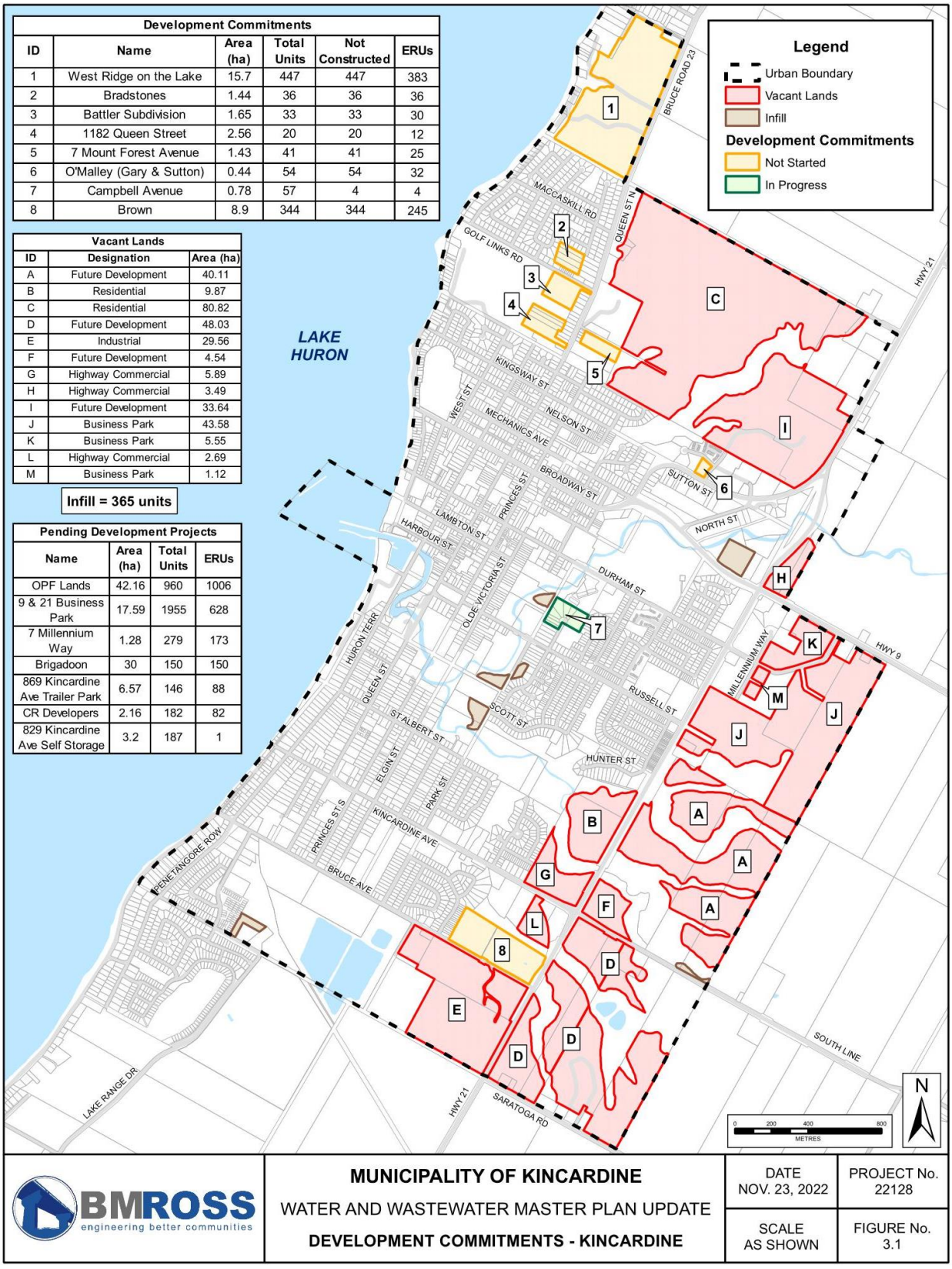
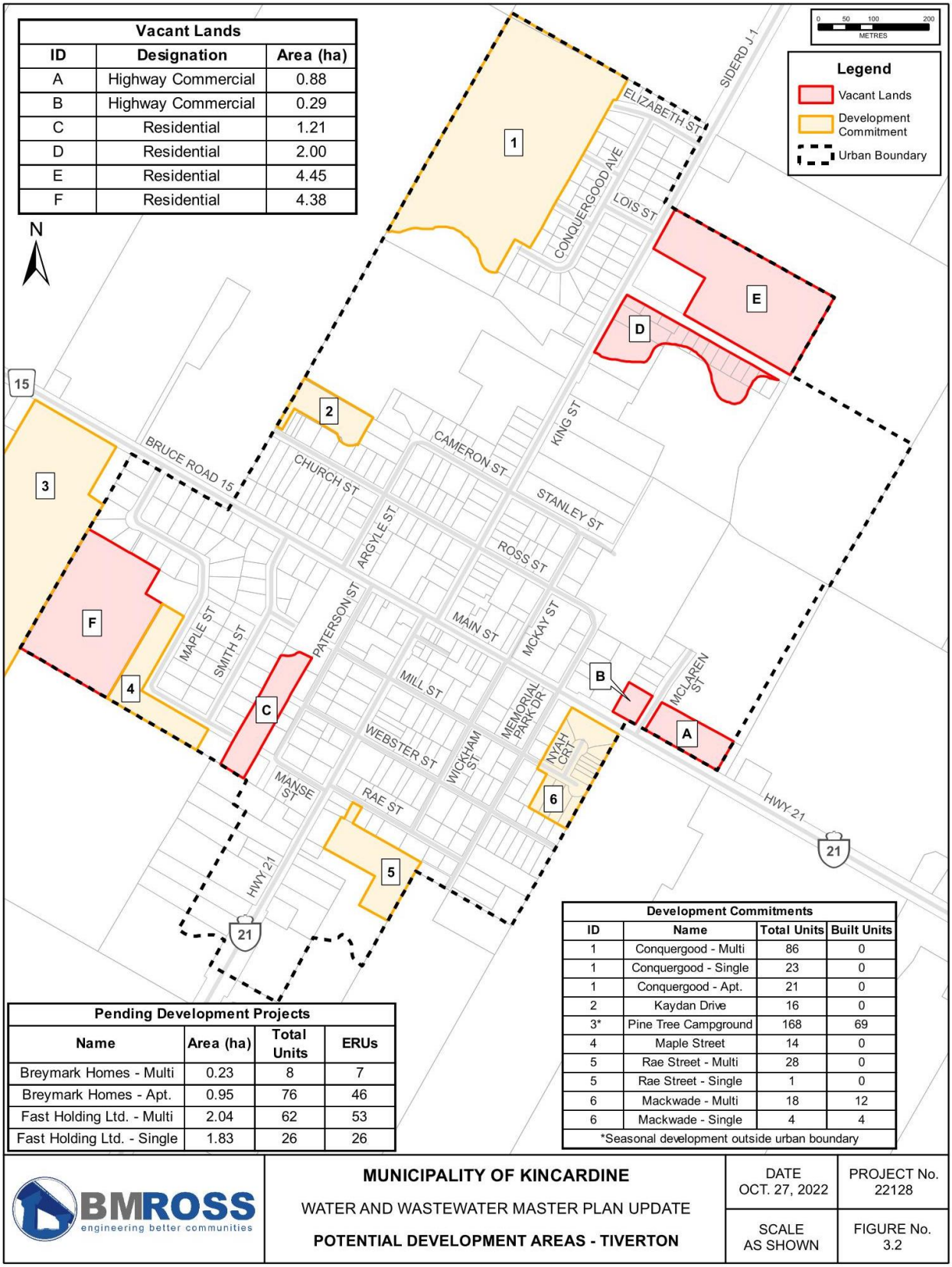


Figure 3.2 – Tiverton Potential Development Areas



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

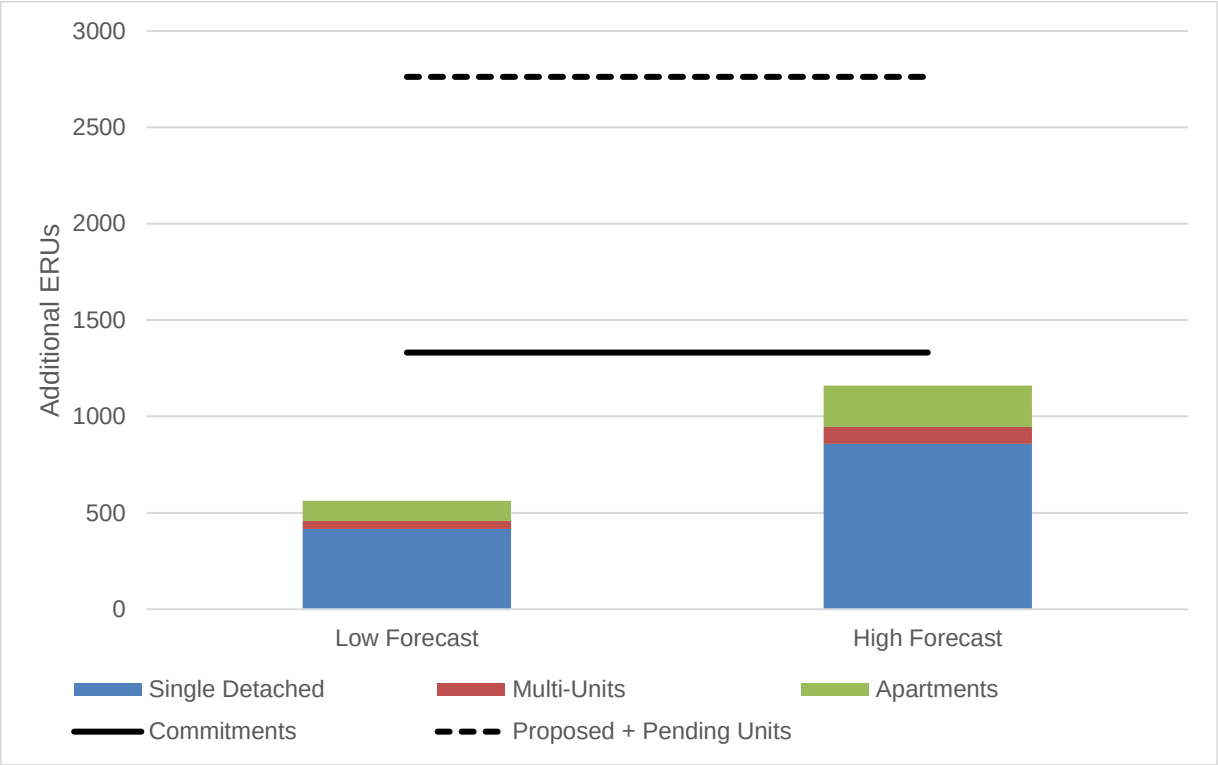
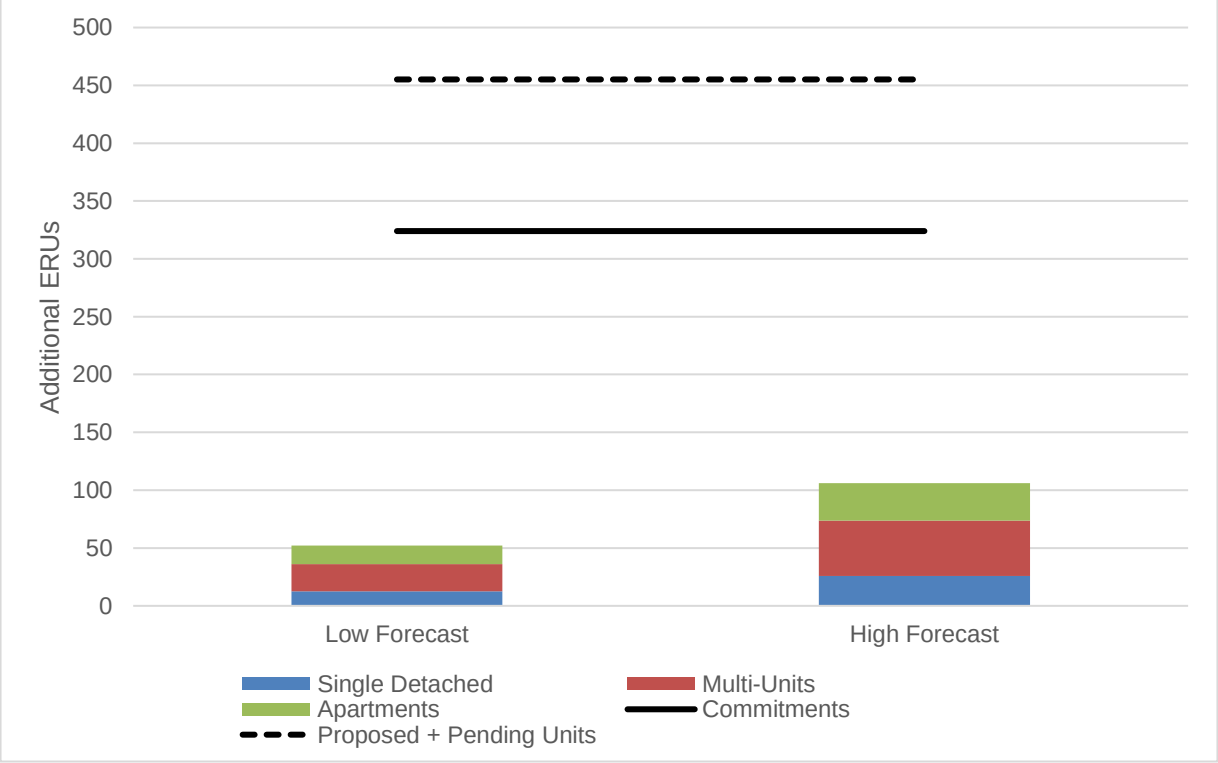


Figure 3.4 – Tiverton's Forecasted ERUs for Growth Scenarios and Developments Commitments & Pending/Proposed Units



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

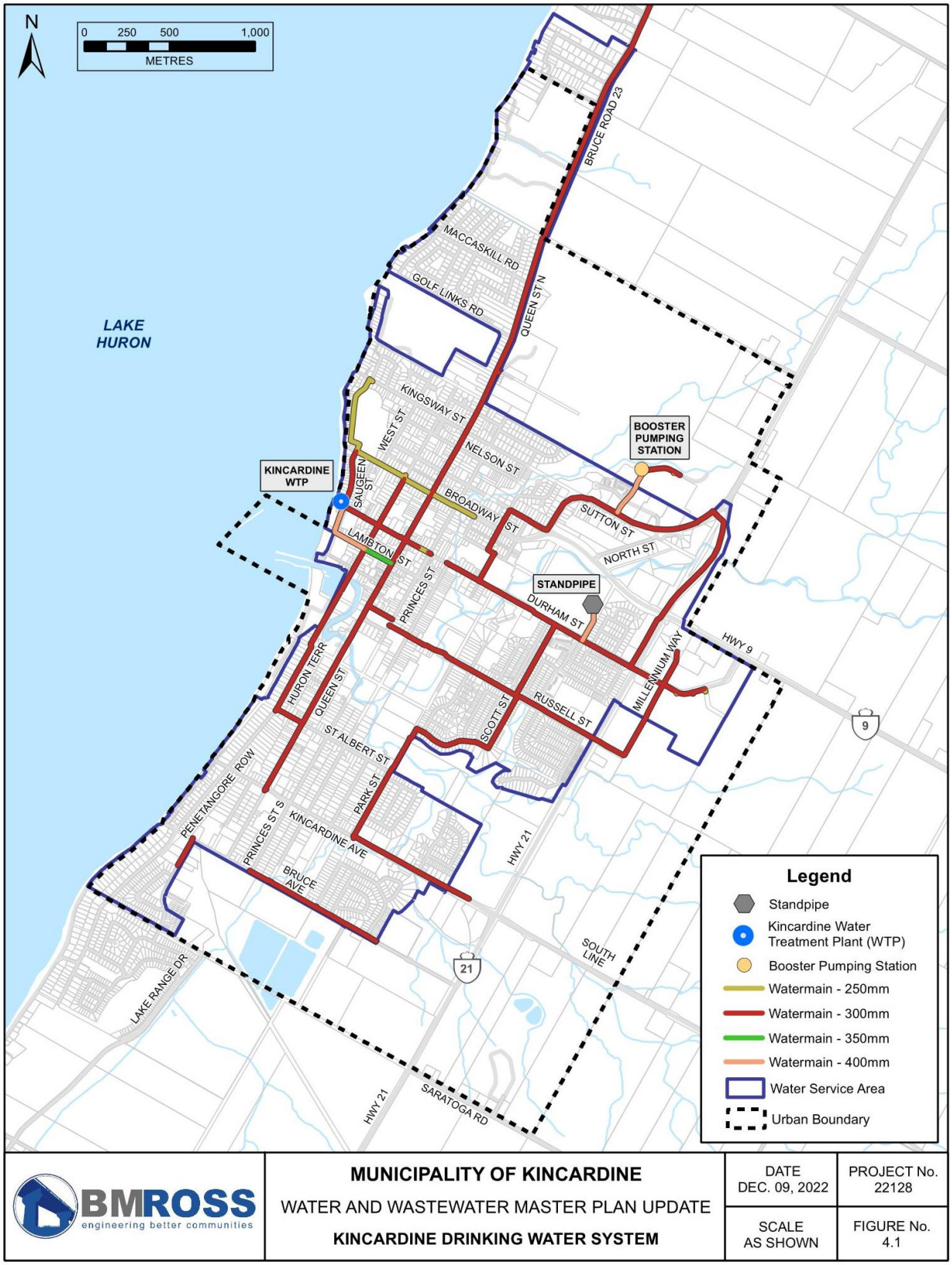
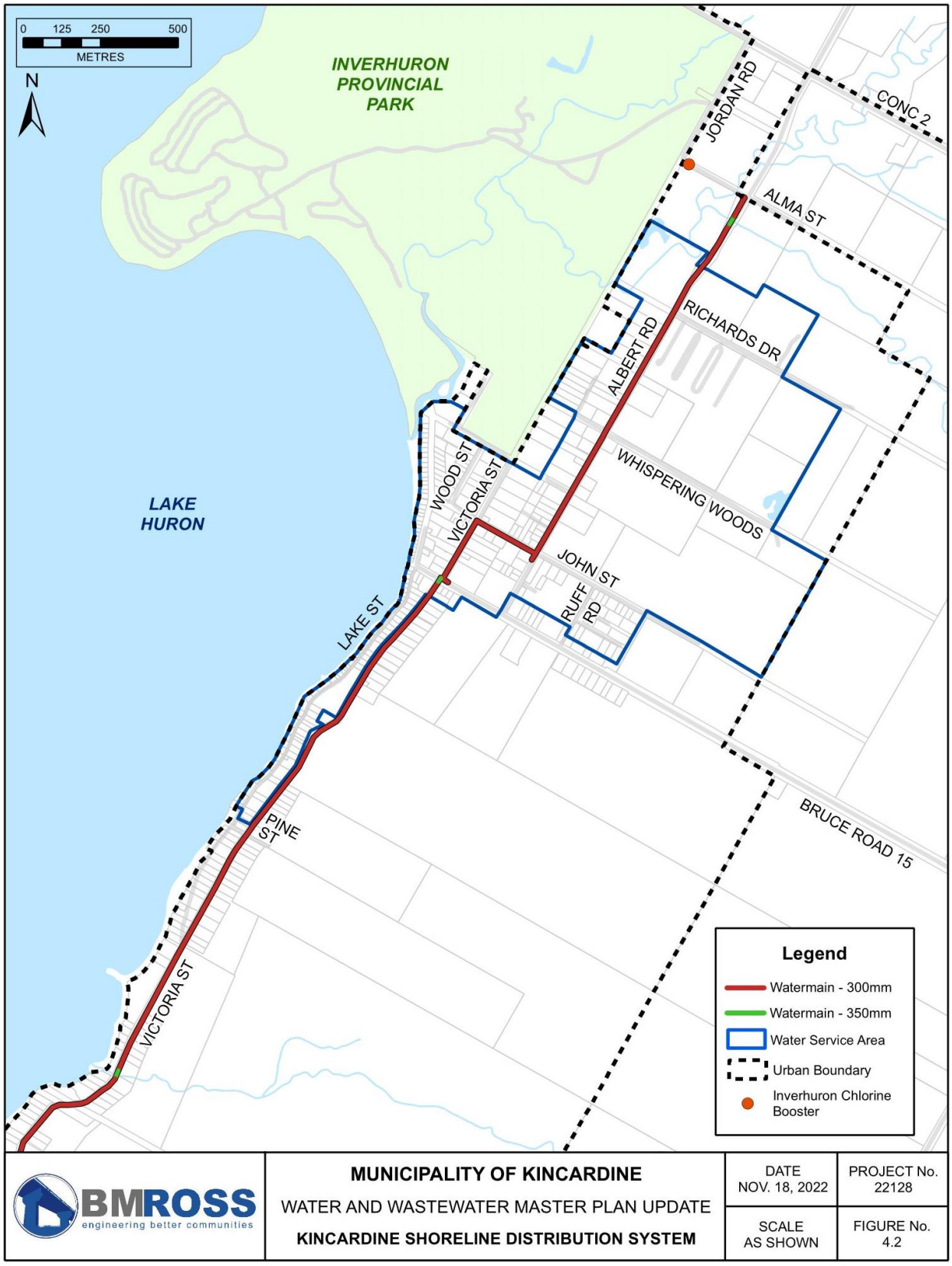


Figure 4.2 – Kincardine Shoreline Distribution System



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

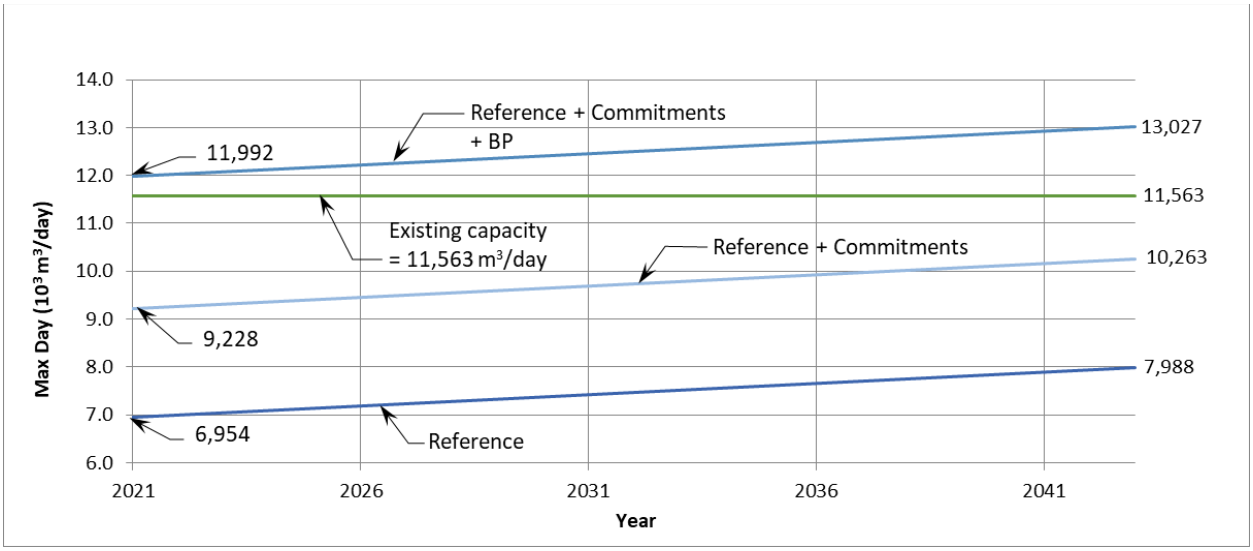
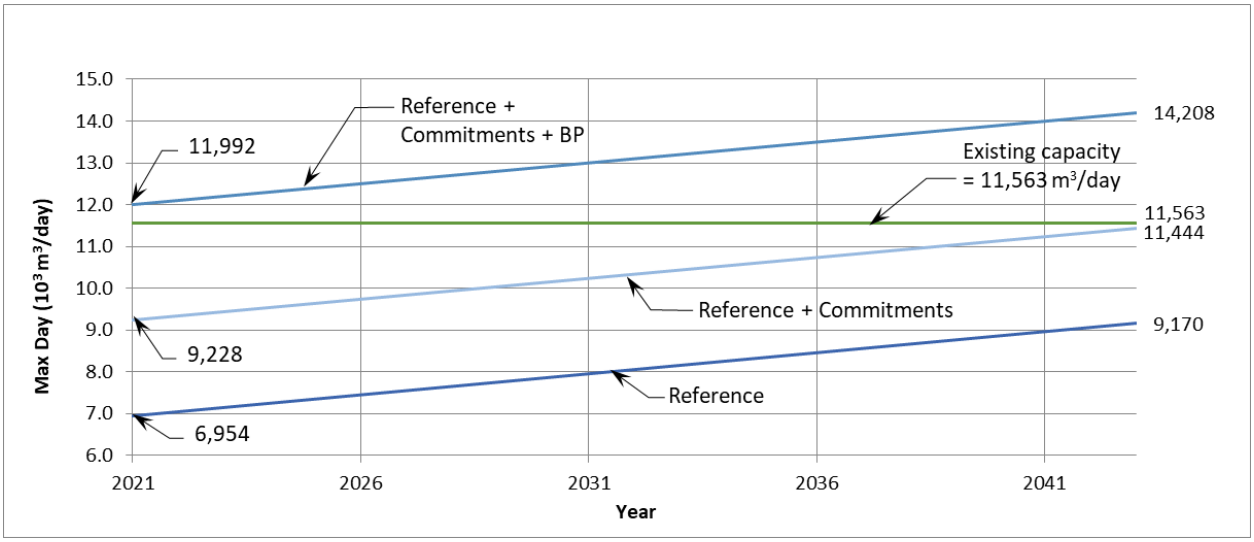


Figure 4.4 – Kincardine Annual Maximum Day Demand – High Growth Scenario



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

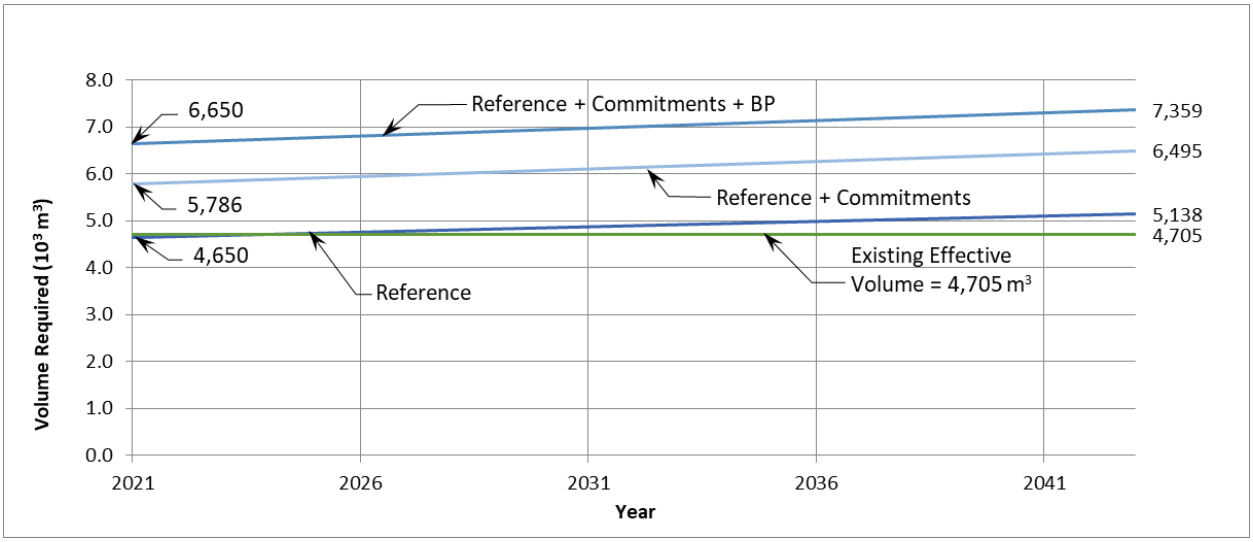
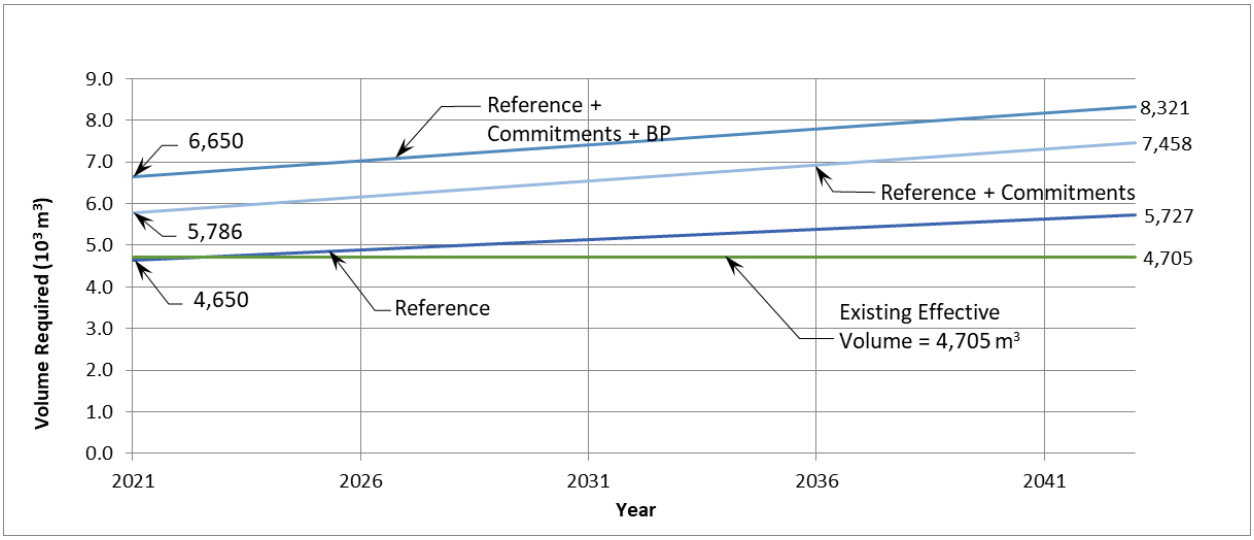


Figure 4.6 – Kincardine Water Storage Requirements – High Growth Scenario



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.

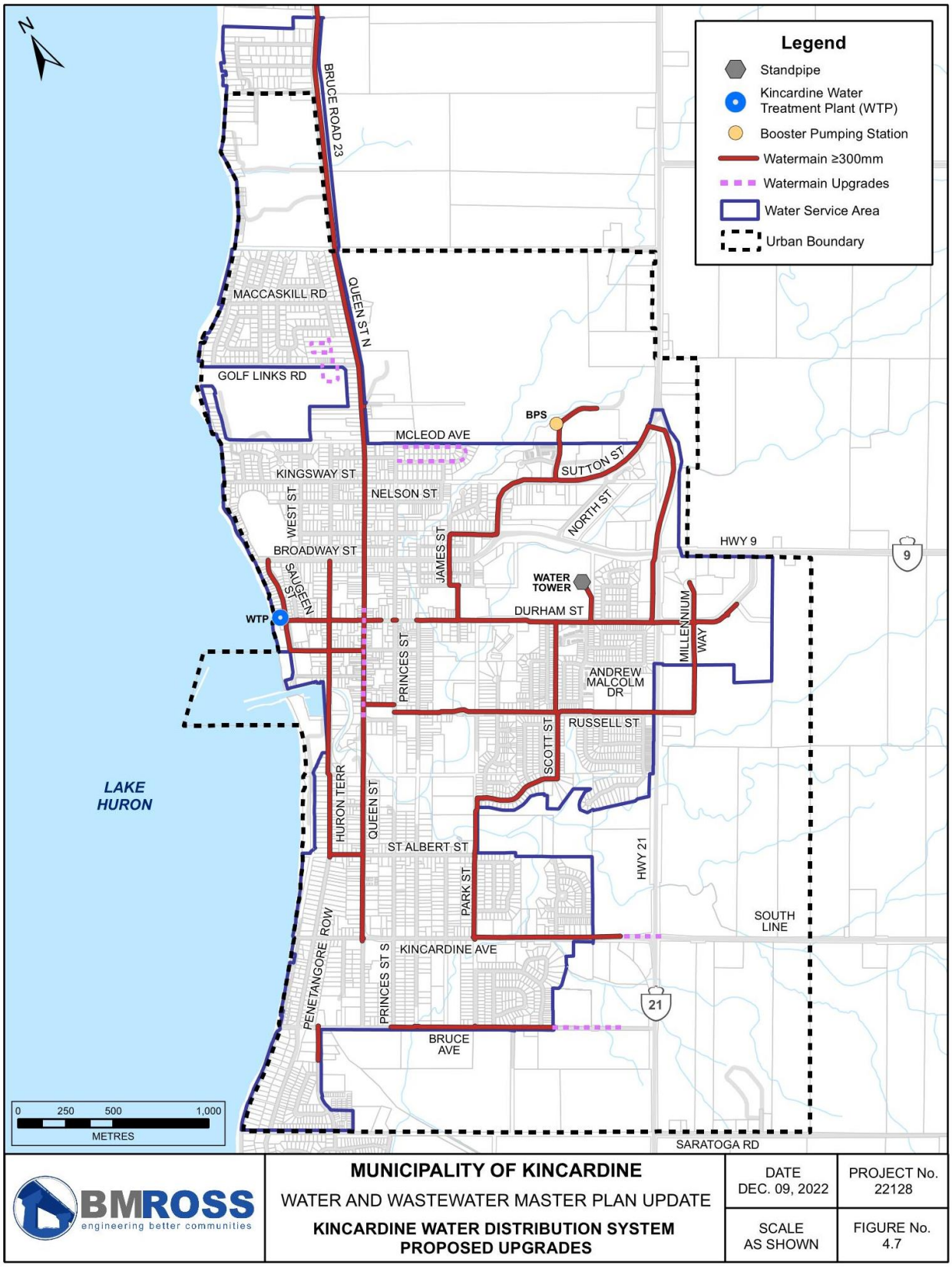
A relatively short watermain extension on Bruce Avenue, east of the current watermain limit, is proposed to service proposed development within that vicinity. The exact route and size of the watermain is currently under review but, based on current planning, the watermain extension will likely remain 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

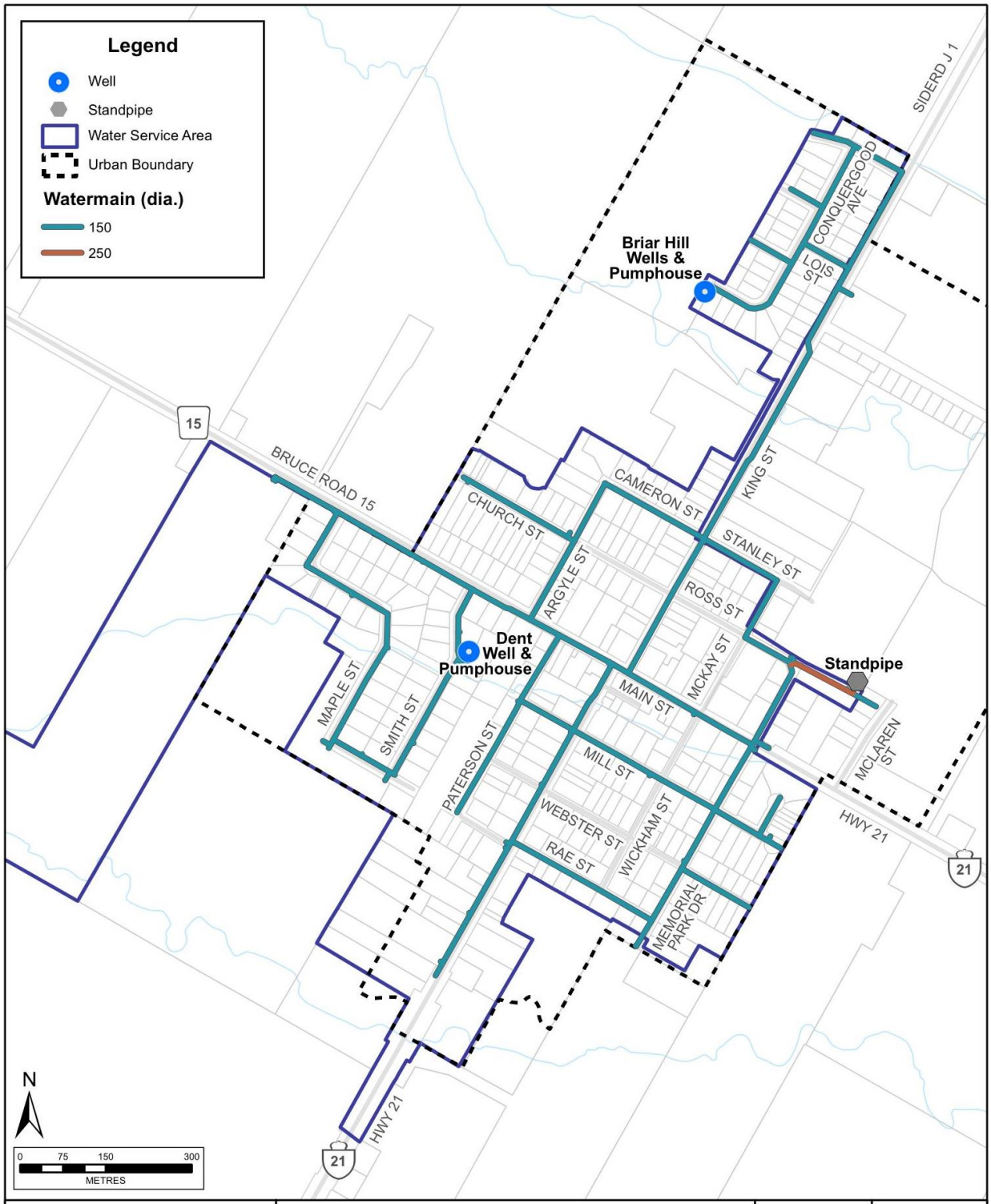
The TDWS is approved by the MECP and described within DWWP No. 088-204 Issue No. 3 and MDWL No. 088-104 Issue No. 3. The rated capacity of the TDWS is limited by the Permit to Take Water (PTTW) value of approximately 775 m^3/day.

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

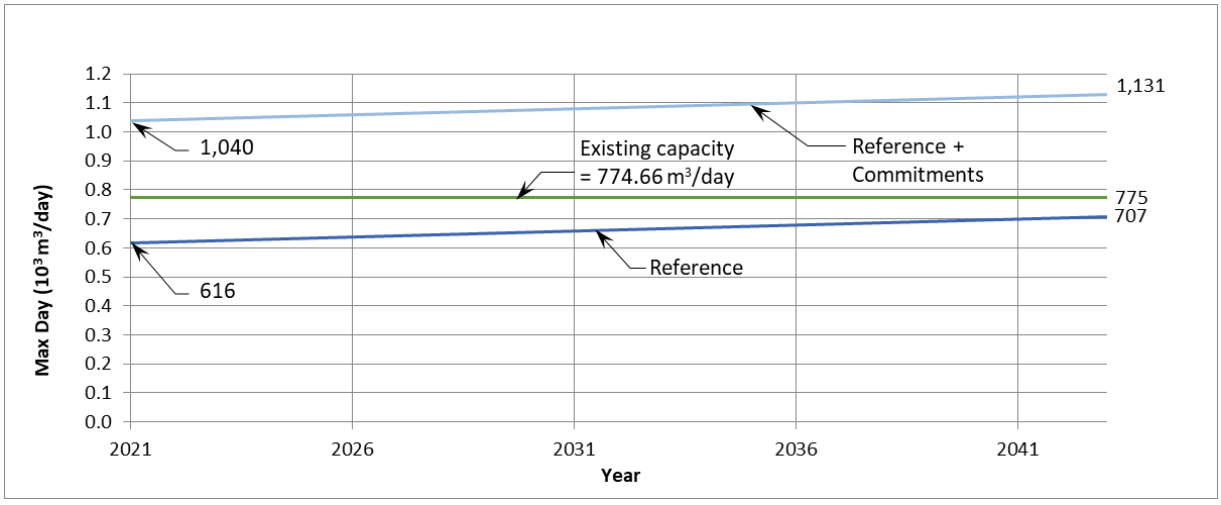
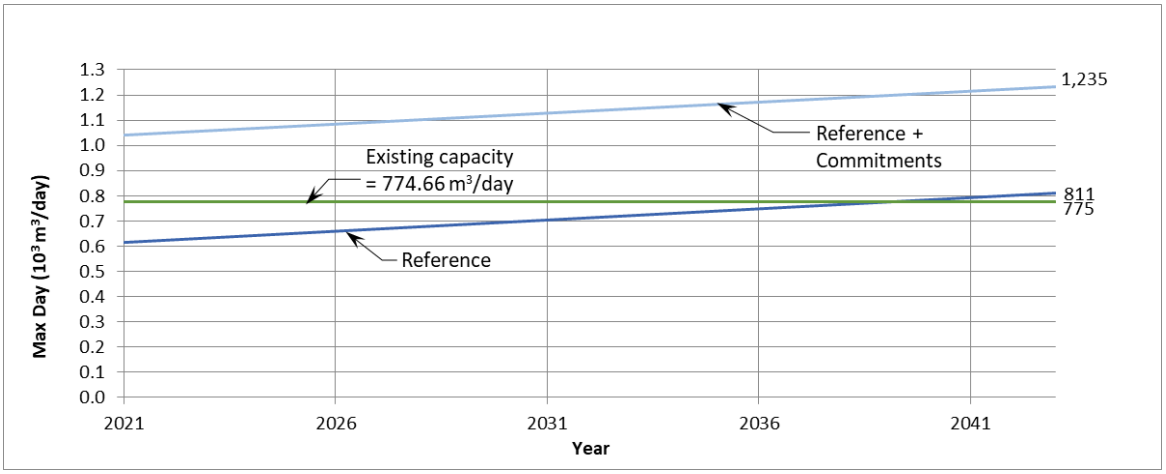


Figure 4.10 – Tiverton Annual Maximum Day Demand – High Growth Scenario



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

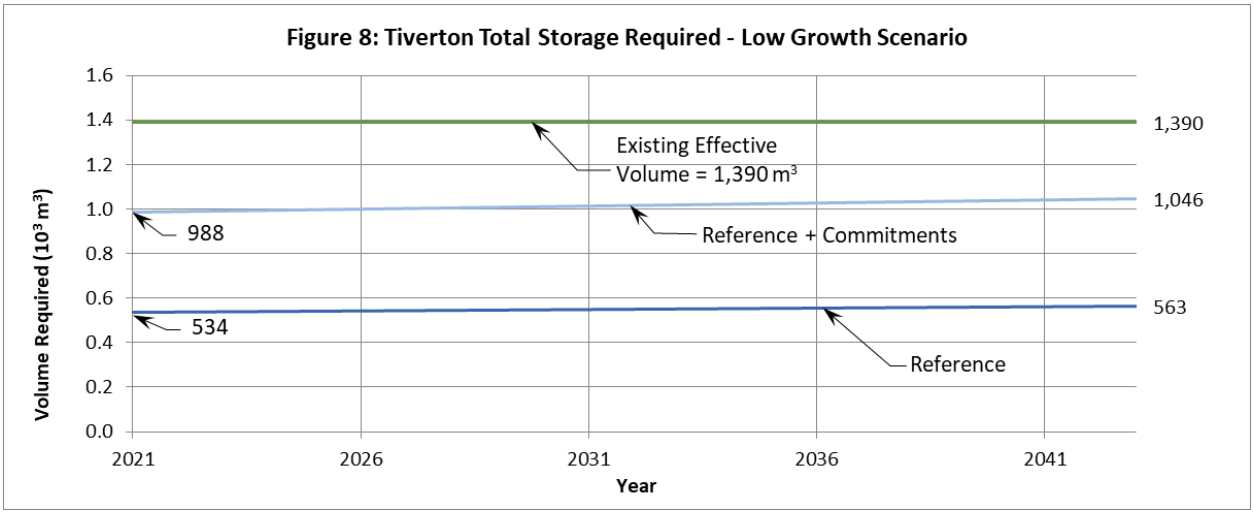
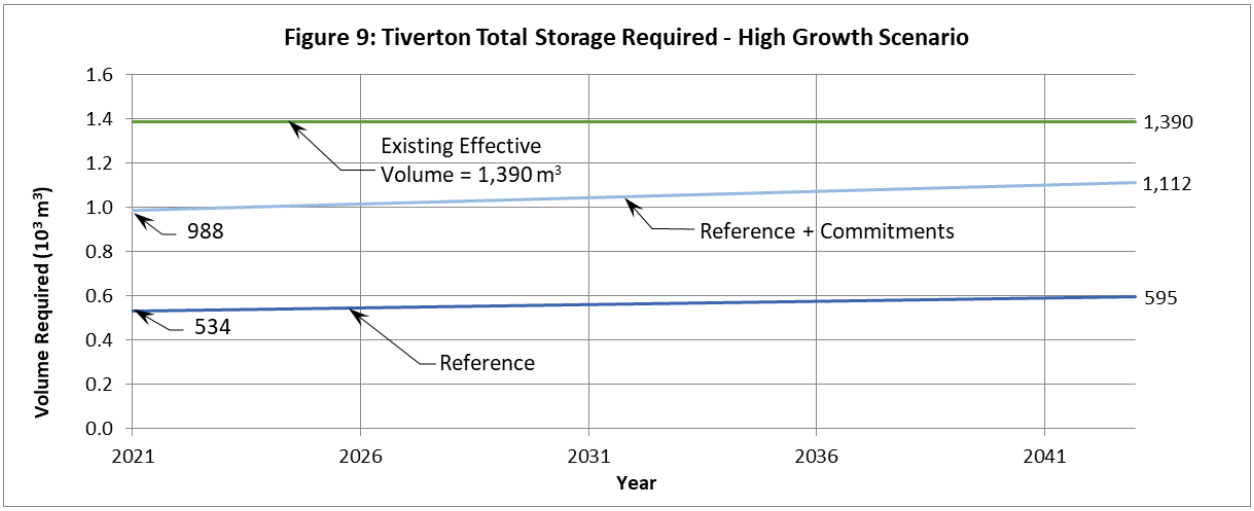


Figure 4.12 – Tiverton Total Storage Required – High Growth Scenario



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.

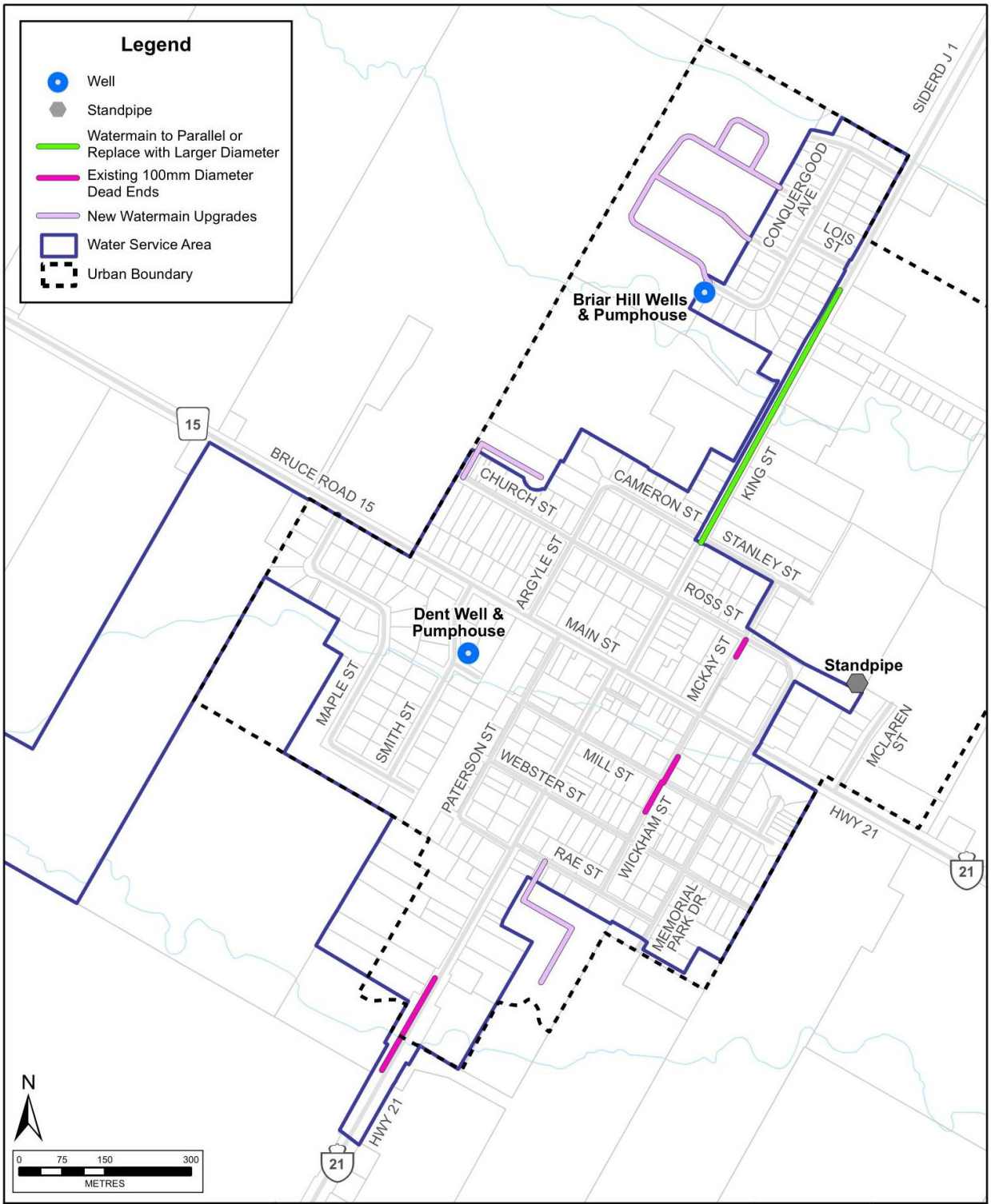
The future condition was examined by adding approved and proposed development within the existing urban area to the existing system model. Conclusions and recommendations for the future system are as follows:

- 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.

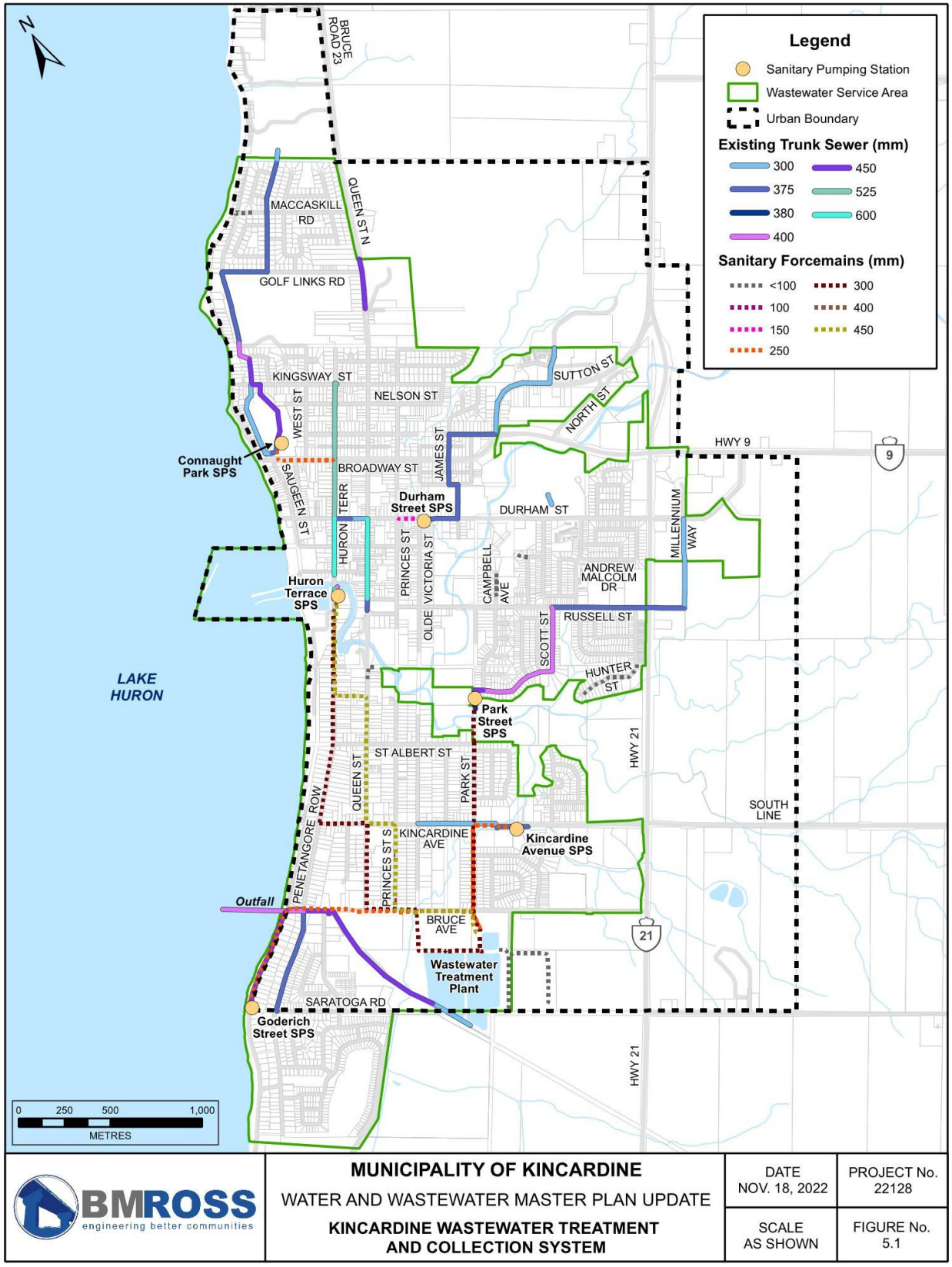
The hydraulic or volumetric capacity of the existing WWTP is established by ECA No. 4648-8DVSSR. The Kincardine WWTP has a rated capacity of 5,910 m^3/d on an annual average basis.

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

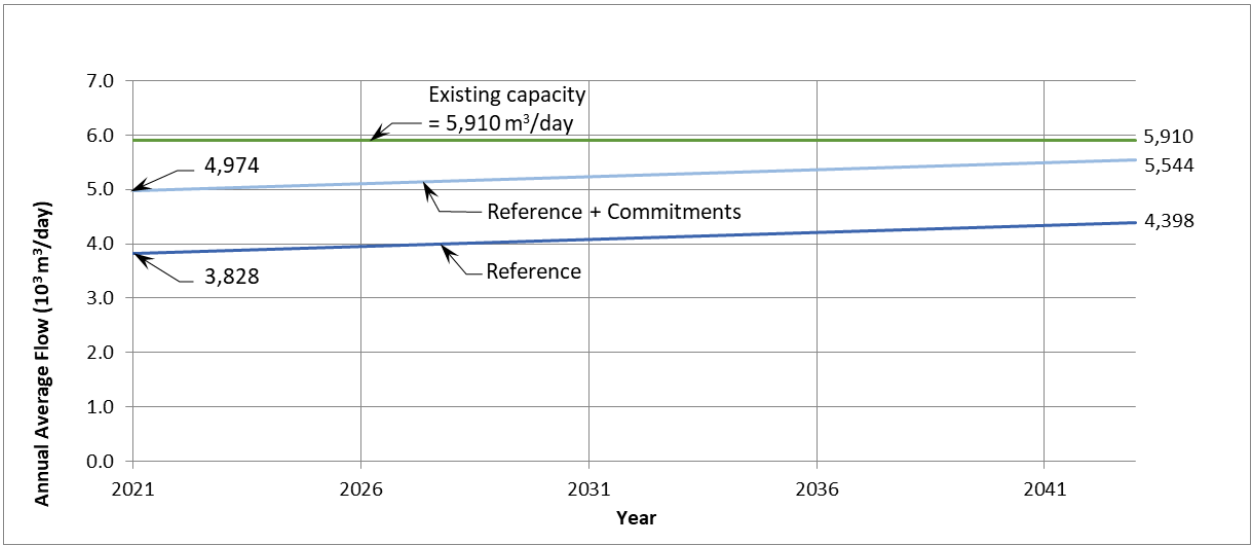
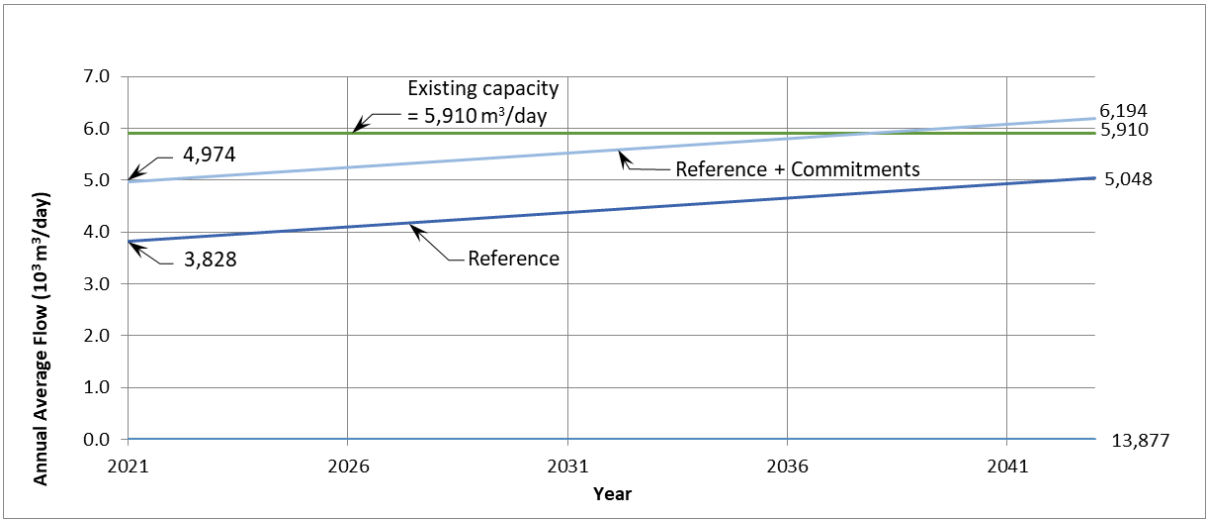


Figure 5.3 – Kincardine Annual Average Day Sewage Flow - High Growth Scenario



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.

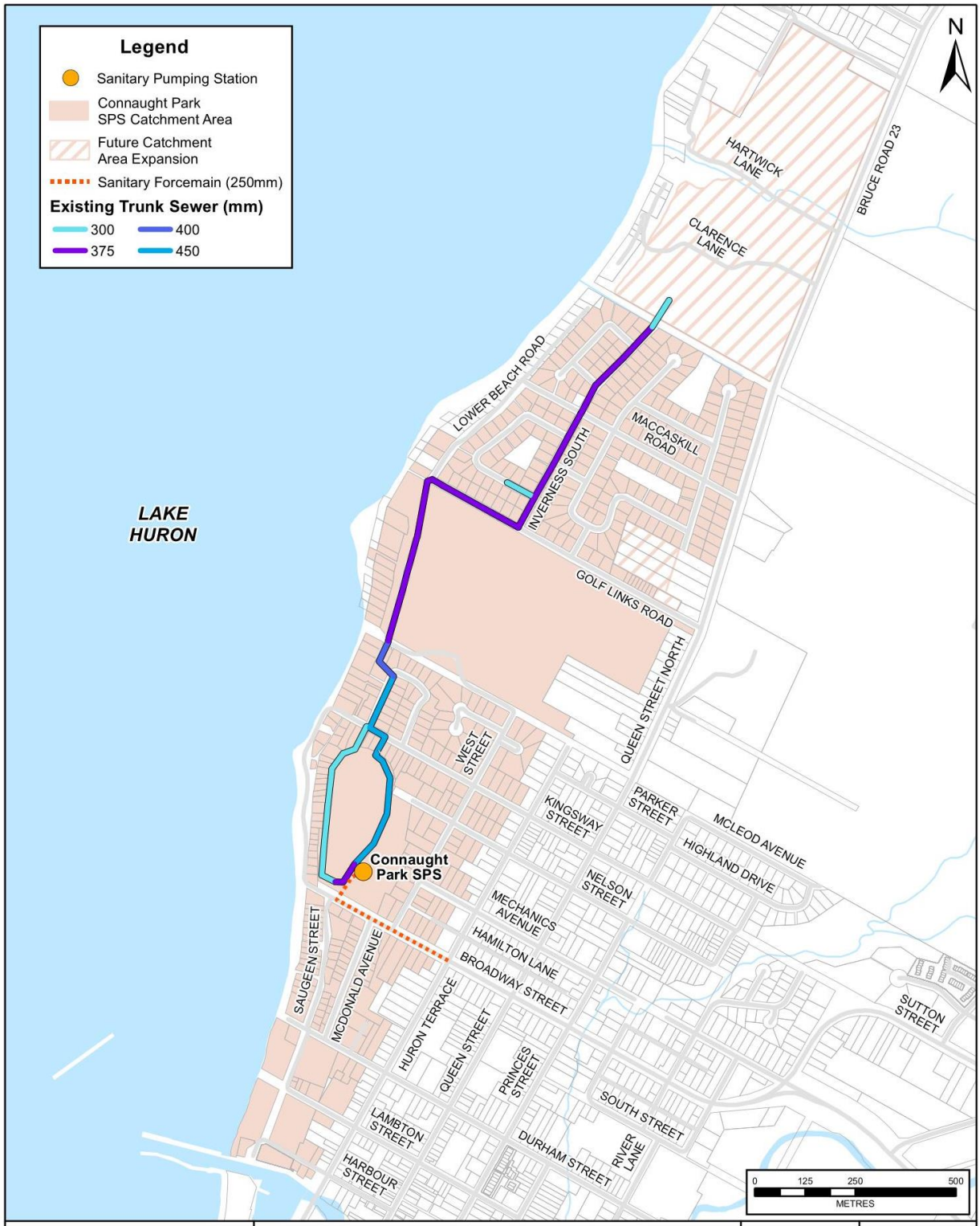
The future system model was analyzed on the basis of including existing flow plus flow from the West Ridge on the Lake development (383 ERUs, 15.7 ha), Bradstones (Shepherd) Subdivision (36 ERUs, 1.44 ha), Golf Links Townhouses (7 ERUs, 0.15 ha), and Battler Subdivision (30 ERUs, 1.65 ha), plus a proportionate 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.

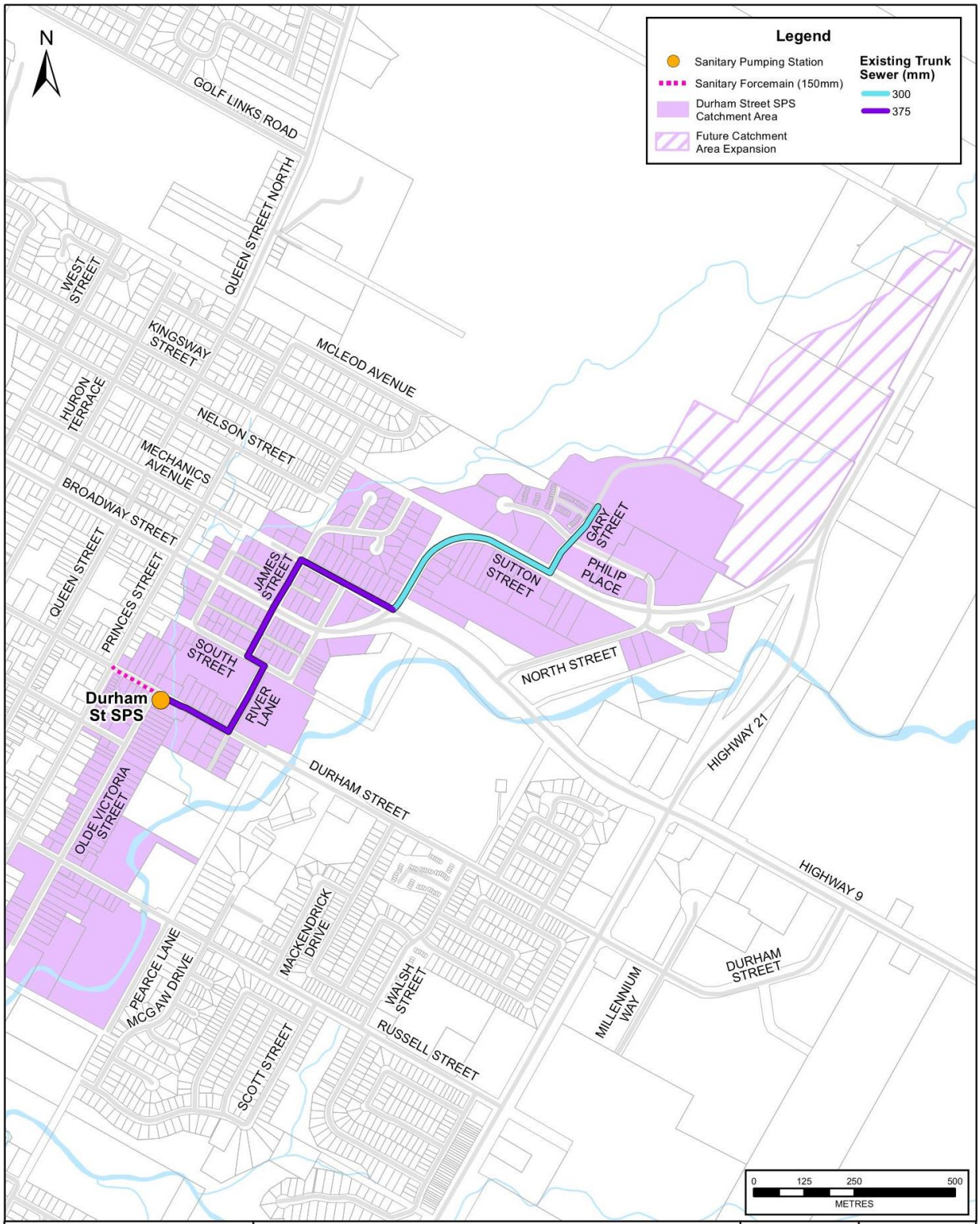
The future system model was analyzed on the basis of including existing flow plus approximately 33 ha of new light industrial development north of Gary Street. Figure 5.5 illustrates the existing and future catchment areas for the Durham Street SPS.

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



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		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

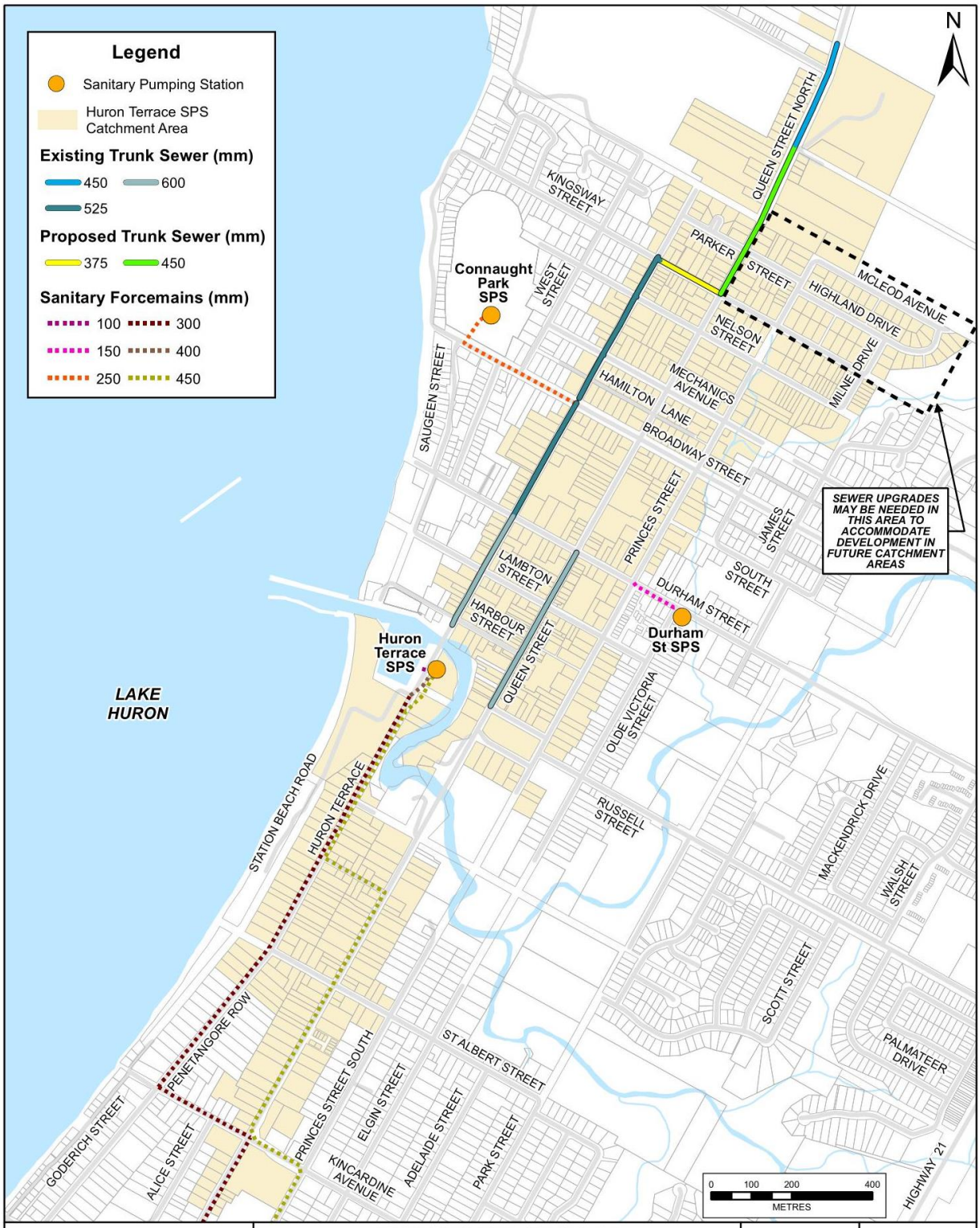
Analysis and Criteria	Existing System and Flows	Future System and Flows – All Areas Developed
Approximate No. of pipes with flow <80% design capacity	130	128
Approximate No. of pipes with flow >80% and <100% design capacity	2	2
Approximate No. of pipes with flow >100% design capacity	8	24

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



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		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

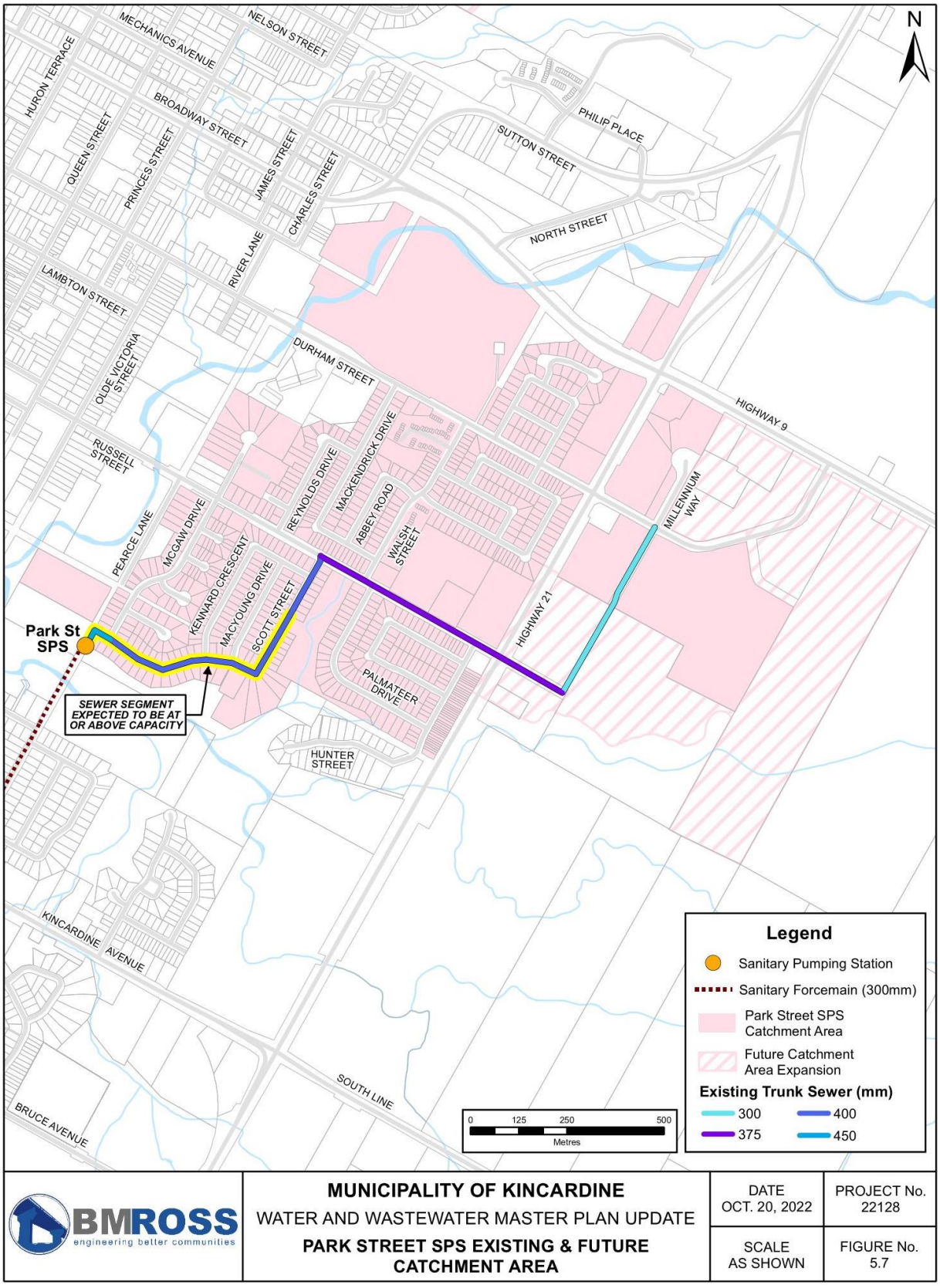


Figure 5.8 – Goderich Street SPS Existing and Future Catchment Area

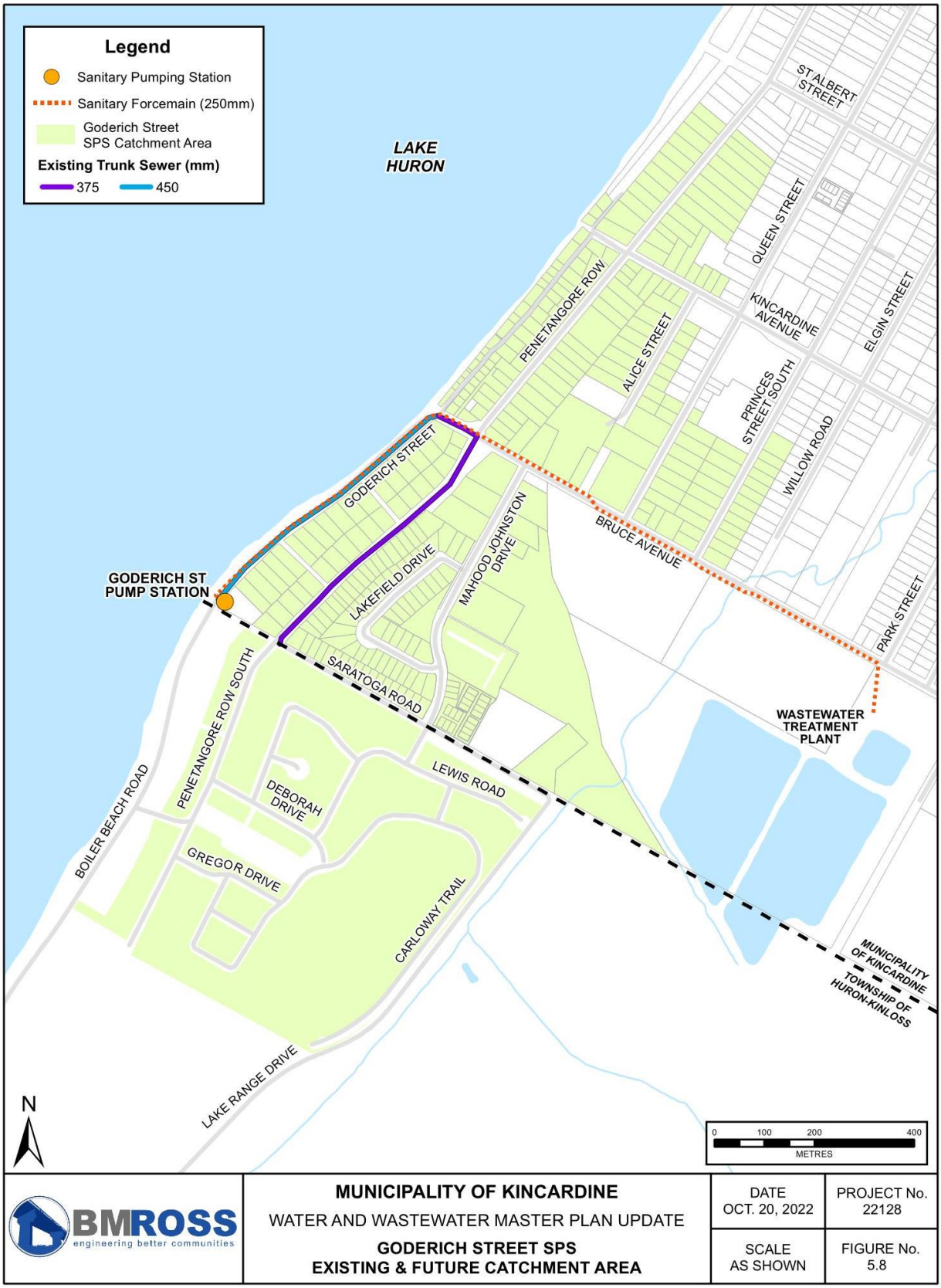


Table 5.6 – Goderich Street SPS Summary of Sewer Analysis

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.

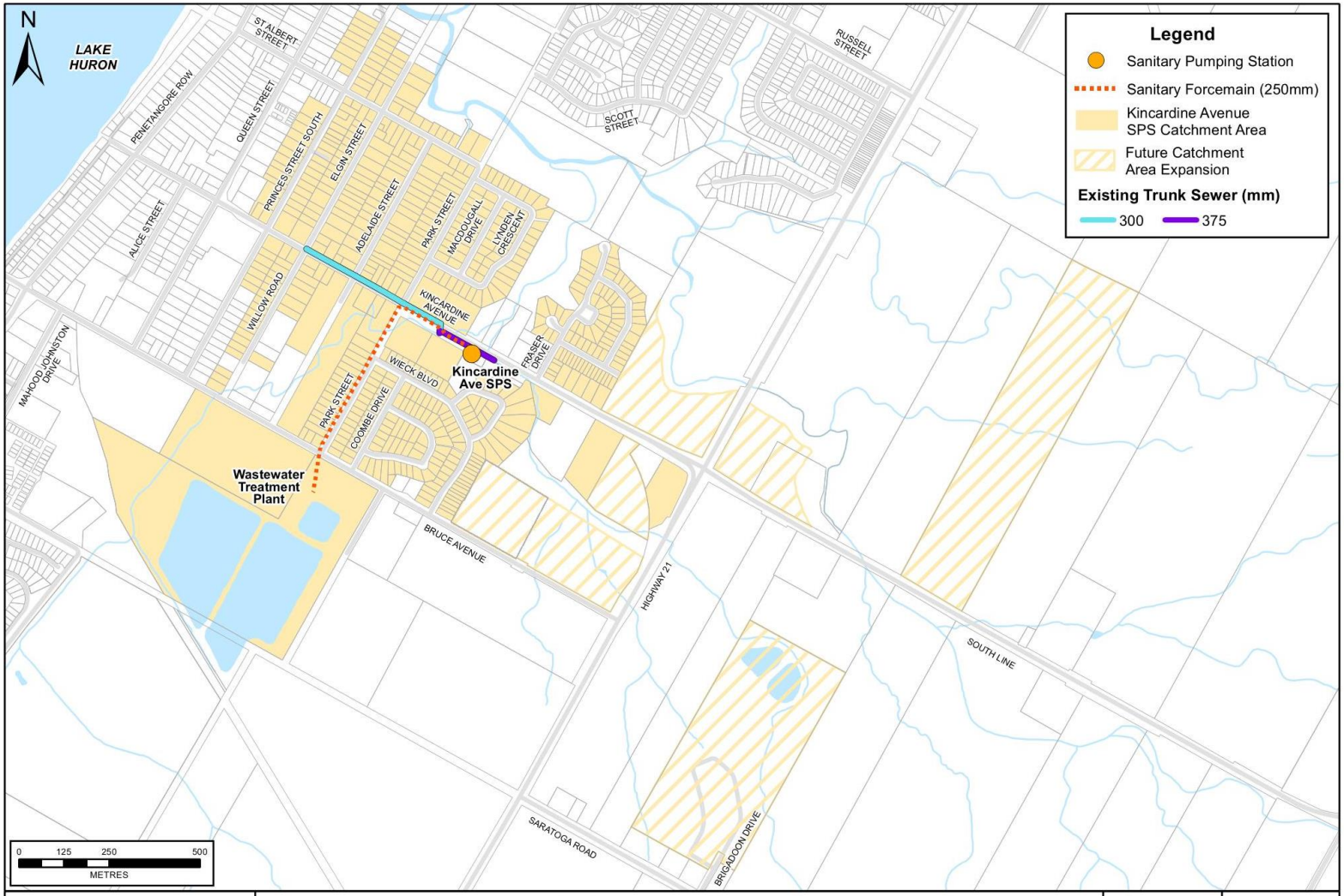
The future system model was analyzed using existing flow plus flow from Brown Subdivision (245 ERUs), Brigadoon Subdivision (150 ERUs), CR Developers project (82 ERUs from hotels and 0.6 ha of commercial land), 869 Kincardine Avenue trailer park development (88 ERUs), and a proportionate amount of infill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



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		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

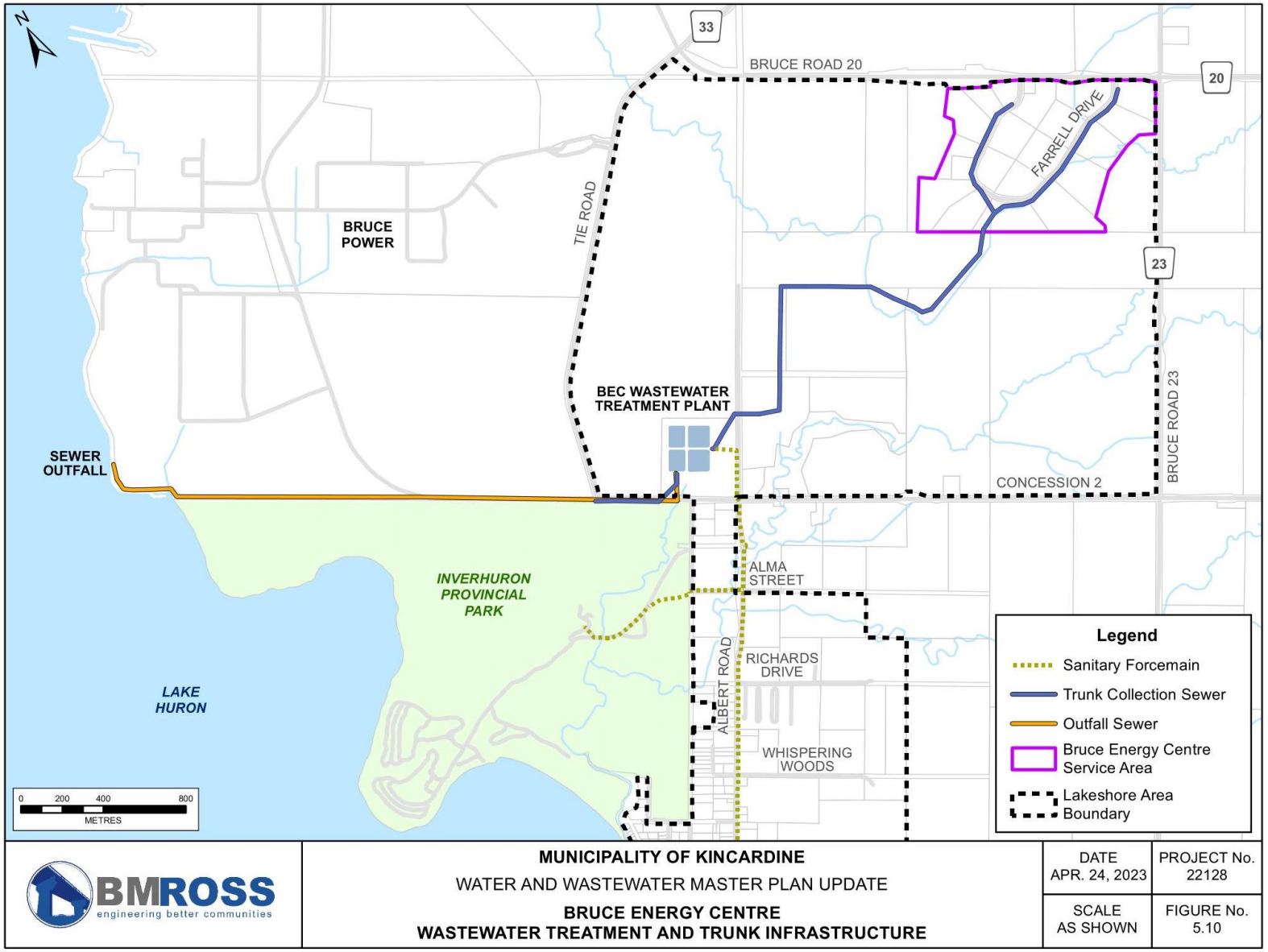
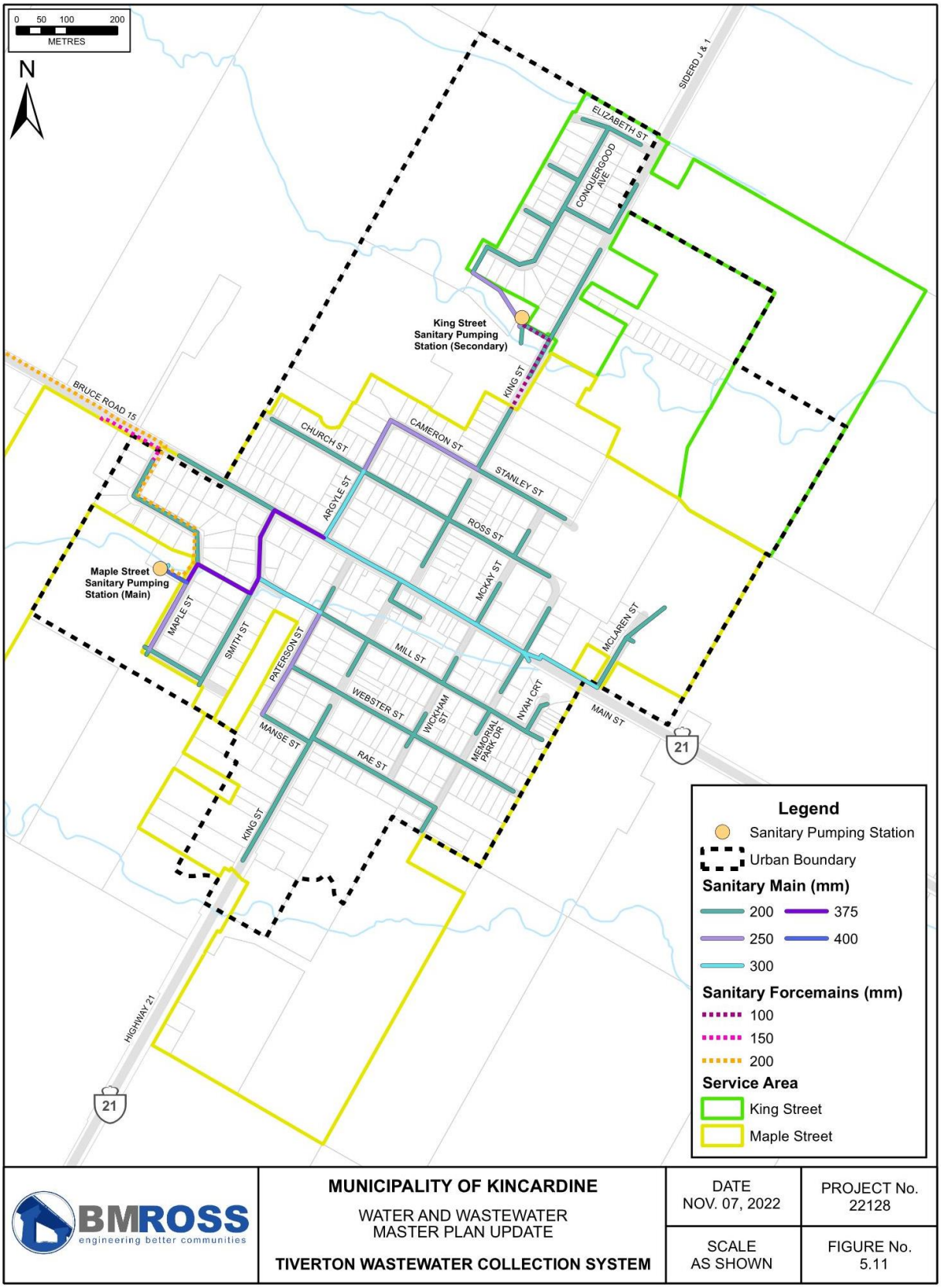


Figure 5.11 – Tiverton Wastewater Collection System



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

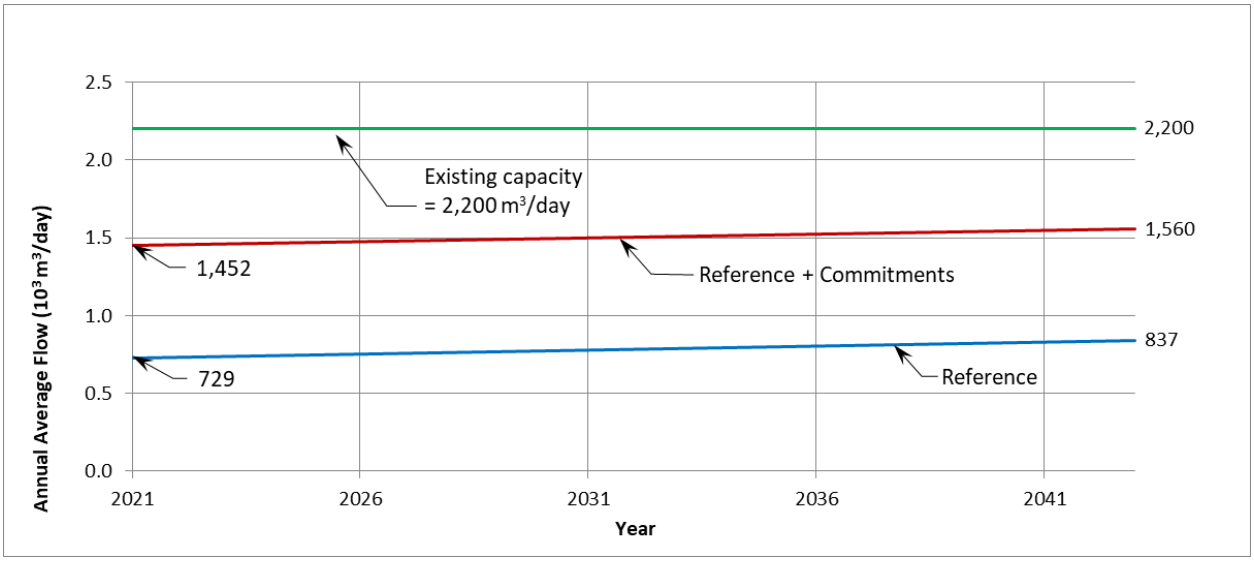
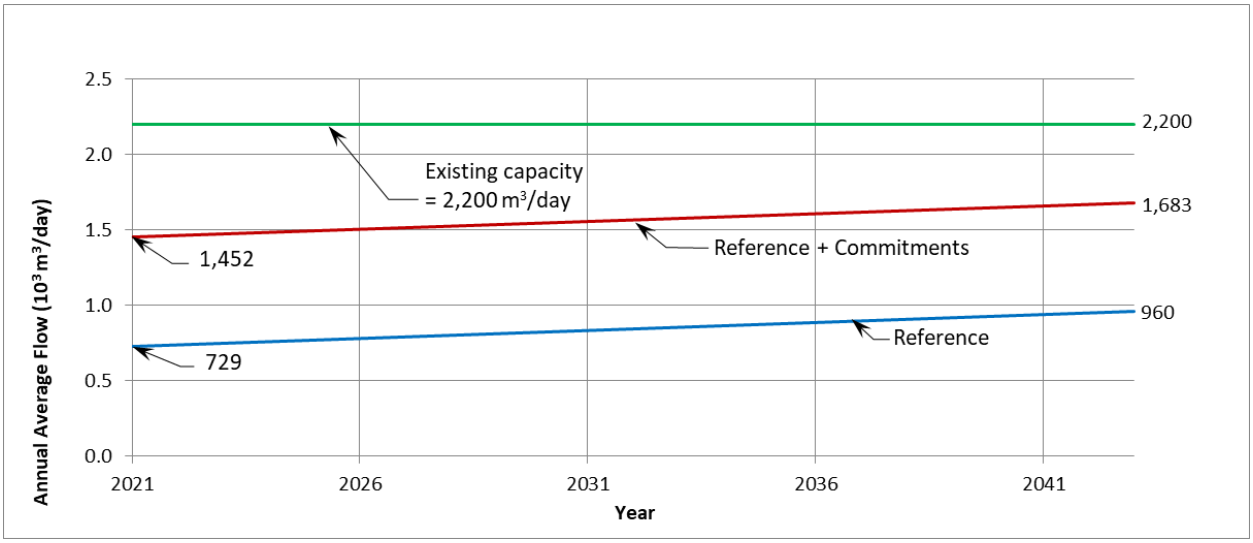


Figure 5.13 – BEC Annual Average Day Sewage Flow - High Growth Scenario



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.

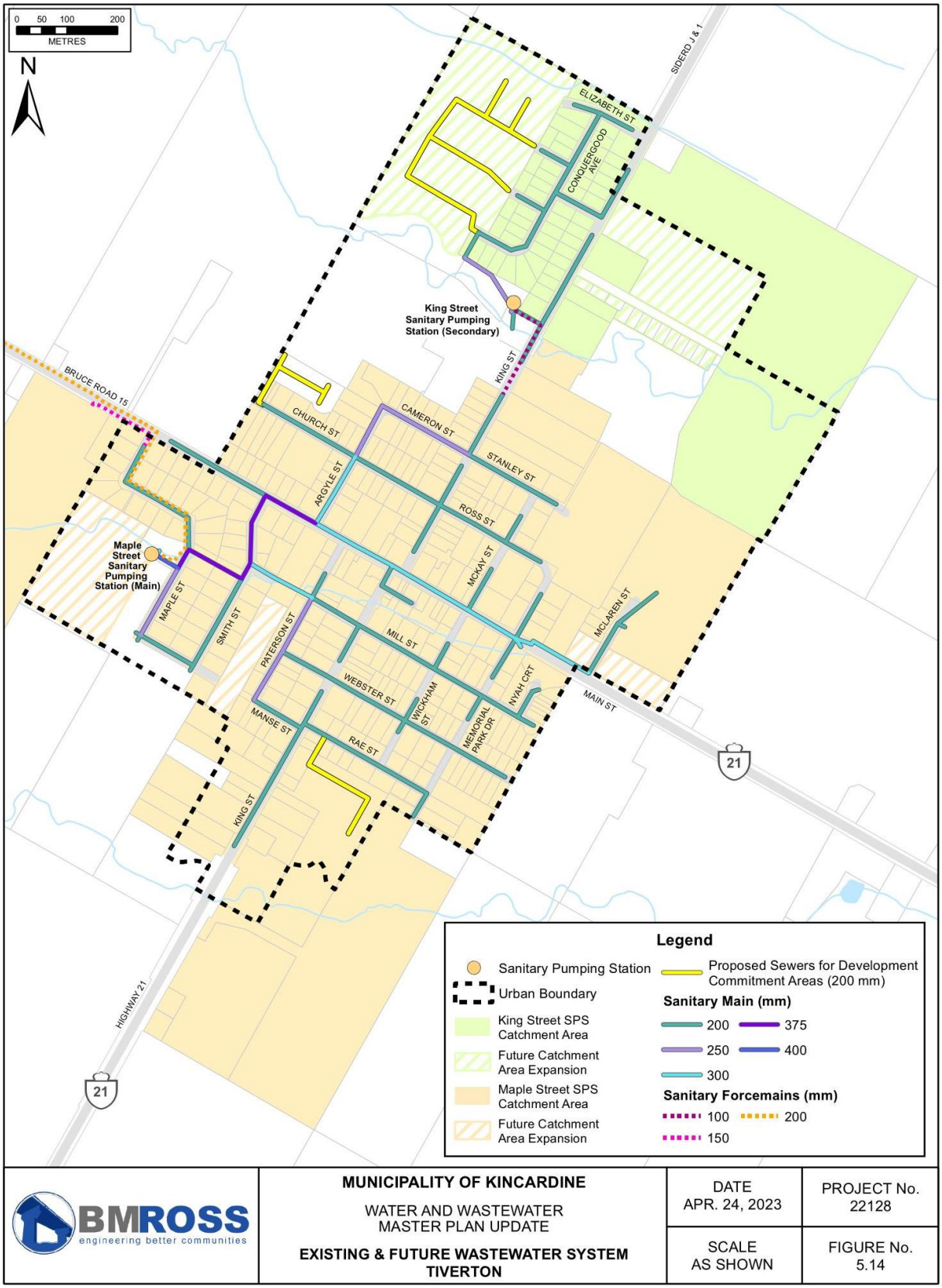
Table 5.9 – Maple and King Street SPSs Summary of Sewer Analysis

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.

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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).