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Orillia Water Master Plan Update

FINAL REPORT

City of Orillia

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1	March 7, 2022	Draft Report
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3	November 8, 2022	Final Report

(SWG) Errata pages added January 18, 2023: page 33 of the Final Report and pages 14 and 15 of Appendix C, per the letter appended at the end of the document

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Executive Summary

This Water Master Plan (WMP) updates the 2015 City of Orillia Water System Master Plan and presents a plan for the expansion and improvement of the drinking water system to adequately service the City's existing and future customers.

PROBLEM STATEMENT

The WMP Update needs to identify the infrastructure and studies required to optimize, upgrade, and expand the City's drinking water supply, distribution, storage and pumping systems to accommodate growth and intensification to the year 2050.

EXISTING DRINKING WATER SYSTEM

Most of the City is serviced by the Orillia Drinking Water System, which is supplied by three groundwater wells and an intake into Lake Couchiching. Raw water from the lake and from Wells Nos. 1 and 2 is treated at the Water Filtration Plant (WFP). Groundwater from the West Orillia Well (WOW) is chlorinated at its pumphouse.

The water distribution system has three pressure zones. Water treated at the WFP is stored in a clearwell, from where it is pumped by two sets of high lift pumps that supply each of Pressure Zone 1 (PZ1) and PZ2. Three reservoirs provide floating storage: the two in-ground Rosemary Road Reservoirs that support PZ1; and the above-grade Harvie Hill Reservoir that supports PZ2. PZ3 is supplied from PZ2 with a Zone 3 booster pumping station. Under low pressure conditions, pressure reducing valves allow water to flow from PZ3 to PZ2 and from PZ2 to PZ1. Disinfected groundwater from the West Orillia Well supplements PZ2.

RELEVANT EXISTING ENVIRONMENTAL AND ARCHAEOLOGICAL CONDITIONS

The City has an extensive shoreline with Lake Couchiching and Lake Simcoe and contains numerous environmentally protected areas. Municipal water facilities, such as the WFP and the WOW, are close to but not within environmental protected areas. The Rosemary Road water reservoirs and Zone 3 booster pumping station are in residential areas.

The Harvie Hill Reservoir site consists of maintained lawn with landscape trees, with a small Poplar Woodland on the north side. No provincially rare wildlife species or species at risk were found on the property, which is also not considered potential habitat for species at risk.

The WFP was originally built in 1914 and the original portion is designated as a historical building. Other municipal water infrastructure facilities and sites have not been identified as historically significant.

An archaeological assessment of the Harvie Hill reservoir site determined that although there was potential for archaeological deposits related to early post-contact settlement, the site was previously disturbed by construction. No archaeological resources of any description were encountered on the reservoir site.

POPULATION AND WATER DEMAND PROJECTIONS

The City's residential population of 33,411 in 2021 is planned to grow to 41,000 by 2031. If a linear growth rate is maintained, the projected population by 2050 will be 53,456. Considering the projected population for all lands planned for residential development within the City limits, the build-out population is estimated at 57,669. The City has approximately 196 ha of employment lands, which could increase to 432 ha if all planned industrial and commercial zoned lands are developed.

The City produces an average of 4 million m^3/year of treated drinking water. This production has not significantly changed in the past five years. On average, residential customers utilize 50% of the water, and industrial, commercial and institutional customers utilize 32% of the water. The remainder is sold as bulk water (0.4%) and is unaccounted for (17%).

The highest daily flow (Maximum Day Demand) in the past five years was 16,797 m^3/day in the summer of 2018, and the 5-year Average Day Demand met by the City's water facilities was 11,067 m^3/day.

The 5-year average residential water usage is 232 L/person/day. Considering that high seasonal peak water usage is expected to continue because of climate change effects, and that water consumption has been constant in the past five years, this WMP update was based on a consumption of 250 L/person/day for new residential developments, and 275 L/person/day for existing developments. The average water consumption attributed to non-residential customers is 18,707 L/ha/day. This WMP Update utilized an average non-residential water consumption of 20,000 L/ha/day.

The total projected water demands to be met by the municipal water system at build-out is 21,964 m^3/day (average day) and 33,553 m^3/day (maximum day).

WATER SUPPLY AND TREATMENT ISSUES, ALTERNATIVES AND RECOMMENDATIONS

Water Supply

Although the City has an approved raw water supply capacity of 39,714 m^3/day, the total firm raw water supply capacity is currently limited to 29,337 m^3/day due to equipment and electrical constraints and the absence of a stand-by well at the West Orillia Well. This firm supply capacity is sufficient to meet the projected water needs to approximately year 2045, but not the build-out scenario.

The approved water treatment capacity is 39,592 m^3/day however the firm treatment capacity is 31,859 m^3/day if one of the filters at the WFP is off-line. Therefore, there is a small shortfall to meet the projected maximum day water demands of the build-out scenario.

To address the future firm supply capacity shortfalls, two alternatives were assessed:

1. Build additional groundwater wells to increase the firm raw water supply capacity.
2. Optimize the WFP and/or increase the capacity of the WFP.

The recommended solutions are to construct two stand-by wells to increase the firm groundwater supply, and to conduct a WFP treatment process and operation optimization study to determine if filtered water capacity can be increased. A detailed groundwater supply study and a Schedule B Class EA must be conducted to identify the preferred location and configuration of the stand-by wells. One well should be near the WOW, and the other well should be close to the PZ1/PZ2 boundary to allow connections to the distribution systems in both pressure zones.

Treated Water Quality

The WFP and WOW consistently produce water that meets the drinking water quality standards. However, the water produced at the WFP has a seasonal earthy taste and odour caused by residual levels of naturally produced MIB. Complaints about taste and odour associated with chlorine have also been received. The treated water does not consistently meet the MECP's Operational Guideline for Aluminium.

There is a risk, because of climate change effects, that if the lake water quality deteriorates concurrently with higher demands for treated water, the WFP may not have sufficient capacity to produce high quality drinking water.

To address treatment capacity, aesthetic water quality concerns, and resiliency to climate change, studies and additional monitoring are recommended. These include a comprehensive coagulation, flocculation, filtration and GAC processes optimization study; a climate change WFP resiliency detailed evaluation; and a secondary chlorination optimization study.

WATER PUMPING AND STORAGE ISSUES, ALTERNATIVES AND RECOMMENDATIONS

Water Storage

The Orillia water system has sufficient treated water storage volume to meet the needs of the current population, however, there will be a deficit as population grows. Approximately 3,000 m^3 of additional storage will be needed in the near future, increasing to 9,000 m^3 at build-out. These storage deficits are calculated to be in PZ2 and in PZ3. Further, the standpipe at Harvie

Hill Settlement Road is in poor condition and is operated at a lower water level because of structural concerns. This has affected available water pressures and fire protection flows in PZ2.

After screening alternative solutions to increase water storage, three alternative solutions were compared and evaluated based on natural heritage, cultural, and socio-economic environments and technical criteria:

1. Do Nothing.
2. Build 3 new 3,700 m^3 standpipes at the Harvie Hill site and decommission the Harvie Hill Reservoir.
3. Build 3 new 3,500 m^3 standpipes at the Harvie Hill site and 1 37 m elevated tank at a site in PZ3 and decommission the Harvie Hill Reservoir.

Constructing all the additional storage on the Harvie Hill Reservoir site (Alternative 2) is preferred because the disadvantages of building storage in PZ3 outweigh the benefits. Locating all storage tanks at the Harvie Hill site and operating them at the original hydraulic grade line will result in improved water pressures throughout the water distribution system, with few exceptions. It will increase fire protection in PZ2 and PZ3. Building multiple tanks over time that are like the existing tank, is not expected to result in negative visual impacts, nor further disruption to the existing land use.

Water Pumping

The high lift pumps at the WFP and at the WOW have adequate capacity to meet the future water demands in PZ1 and PZ2. However, since the WOW system only has one pump, there is no backup capacity if the well is taken offline. The WFP's high lift pumps could make up some of the firm capacity deficit until the recommended additional stand-by wells are established.

The existing pumping capacity at Zone 3 BPS is insufficient to meet the future water demands of the projected growth in PZ3. Occasional high summer water demands are currently straining the booster pumps capacity, therefore the timeline for the planned expansion of the Zone 3 BPS must be advanced.

Expansion of the Zone 3 BPS is recommended to be undertaken in two phases: first adding a third 25 L/s booster pump; then replacing the two existing booster pumps with larger, 25 L/s pumps.

WATER DISTRIBUTION SYSTEM

The City's updated water distribution system hydraulic model was the primary tool to assess and predict performance under various normal and emergency scenarios, and to plan enhancements to the system.

The Orillia water distribution system is a well-configured and looped system that can supply water pressures and fire flows that meet City standards and MECP guidelines to most areas, maintain adequate chlorine residuals, and distribute water for the projected developments and growth.

Issues and areas where the system could be improved are summarized below:

- Properties at high elevations in PZ2 around Harvie Settlement Road, Esther Anne Drive and Charles Road have pressures below 275 kPa (40 psi) under existing conditions.
- Available fire flows are less than the minimum fire flow requirement of 100 L/s at dead end watermains and around Esther Anne Drive, Charles Road, and Karen Crescent.
- There are undersized (100 mm diameter) watermains throughout the system, mainly in the older, developed parts of PZ1, and on small streets.
- Watermains with water that could be more than 4 days old are in the southern part of PZ2, including the newly developed area south of Diana Drive; residential areas bordered by Mary Street, Westmount Drive and Highway 11; and the southern portion of Memorial Avenue.
- Many of the trunk watermains have exceeded their expected useful life and are considered at higher risk of failure.
- The area immediately north of Fittons Rd E. and the northern-most part of PZ2 are at high risk in the event of a watermain break because they rely on a single watermain on Laclie Street for the supply of water.
- Pressure set points at the pressure reducing valves are not consistently set at the correct hydraulic grade line, allowing water to flow to the lower pressure zone when not required to do so.

Recommended upgrades and modifications to the water distribution system are as follows:

- Upsize the watermains on Esther Anne Drive, Charles Road and Karen Crescent from 150 mm diameter to 200 mm diameter. In conjunction with the increased hydraulic grade line set by the recommended new Harvie Hill standpipe, this work will improve water pressures and increase the available fire flows.
- Loop the dead end watermain extending from Goldie Drive and servicing the car dealerships on Commerce Road, with the watermain on Mariposa Drive. This work will increase available fire flows and improve redundancy and resiliency at the northern-most end of PZ2 and improve flows to the growth area on Sundial Drive.
- Extend the 200 mm diameter watermain from the south end of Commerce Road near the Kubota facility to the secondary service of Kubota near Goldie Drive. This will provide an additional route for water to reach the north end of PZ2.
- Twin the 350 mm diameter watermain on Laclie Street from Stanton Drive to Hillside Drive to provide redundancy in the event of a watermain break.

- Adjust the PRV set points to achieve a consistent hydraulic grade line at each pressure zone boundary.
- When opportunities arise such as in conjunction with a road reconstruction project:
  - Loop dead end watermains.
  - Replace the 100 mm diameter watermains with 150 mm diameter or larger pipes.
  - Replace the watermains with a high risk factor.

CONSULTATION

Public and agency consultation was an integral part of the development of the WMP Update. The public, property owners, relevant government agencies, adjacent municipalities, Indigenous organizations, and stakeholders, were notified of the project (Notice of Study Commencement, July 10, 2020), then invited to provide input on the preliminary findings and alternative solutions at a virtual Public Information Centre posted on the City's website on August 11, 2021. Further attempts at contacting First Nations and Metis Council were made in October 2021. The Final Draft Report was made available for review, with the Notice of Study Completion, on July 27, 2022. All comments and input received were taken into consideration in the evaluation of the alternatives and the updating of the Master Plan.

SUMMARY OF RECOMMENDED PROJECTS

Recommended Projects and Estimated Costs by Projected Timeline

NO	PROJECT	2022-2030	2031-2040	2041-2050
C1	Harvie Hill standpipe (Phase 1)	$5,000,000		
C4	Zone 3 BPS Expansion (Phase 2)	$350,000		
C6	Watermain Replacement on Esther Anne Dr., Charles Rd. & Karen Cres.	$3,700,000		
S1	Hydrogeological and Groundwater Supply Study	$400,000		
S2	Coagulation, Flocculation and Filtration and GAC Optimization Study	$250,000		
S3	Secondary Chlorination Optimization Study	$100,000		
S4	Climate Change Resiliency Detailed Evaluation	$100,000		
S5	Water Conservation and Efficiency Plan Update	$50,000		
S6	Rosemary Road Reservoirs Mixing Study	$100,000		
C1	Standby supply wells		$1,500,000	
C2	Harvie Hill standpipe (Phase 2)		$5,000,000	
C5	Zone 3 BPS Expansion (Phase 3)		$750,000	
C7	Connecting Watermains to Mariposa Dr.		$800,000	
C8	Connecting Watermains on Commerce Dr.		$1,900,000	
C9	Twin Watermains on Laclie St.		$1,100,000	
C3	Harvie Hill standpipe (Phase 3)			$4,700,000
	Total	**$10,050,000**	**$11,050,000**	**$4,700,000**

1 Introduction

1.1 MASTER PLAN GOALS AND OBJECTIVES

The City of Orillia (City) retained Tatham Engineering Limited (Tatham) to update the 2015 City of Orillia Water System Master Plan (2015 WSMP) and develop a plan for the expansion and improvement of the drinking water system to adequately service the City's existing and future customers. This Water Master Plan Update (WMP Update) was initiated in 2020 and completed in 2022.

The main goals of the WMP Update are to:

- Identify the water system upgrades that will be needed to serve the City's existing and future residents and businesses for the next 30 years to the year 2050.
- Update the City's plans to optimize the water supply and distribution system to:
  - continue to reliably produce and distribute drinking water that meets or exceeds Ontario drinking water quality standards;
  - improve its resiliency and reliability; and
  - improve the level of service (pressure, fire protection, water quality) where feasible.

More specifically, the WMP Update's objectives are to:

- Update the assessment of the City's existing water infrastructure, including its condition, capacity, performance and operation.
- Update the projected water demands, considering current water consumption and projected population and employment lands.
- Determine the additional water infrastructure needed to meet the future water demands and maintain or improve system performance, operation, reliability and resiliency.
- Prioritize and estimate the costs of recommended water infrastructure projects.
- Consult with the public, agencies and stakeholders on alternative solutions and on the WMP Update.

1.2 REPORT ORGANIZATION

The WMP Update report is organized as follows:

- Chapter 2 describes the project approach under the Master Plan Class Environmental Assessment process.

- Chapter 3 presents the current regulatory context in which the WMP Update was undertaken.
- Chapter 4 provides a general description of the City of Orillia and summarizes the population and employment projections.
- Chapter 5 reviews the historical water demands to derive water consumption criteria for planning. It presents the projected water demands that will need to be accommodated in the future.
- Chapter 6 presents the assessment of the capacity and performance of the City's water supply and treatment systems, and recommended upgrades and detailed studies.
- Chapter 7 focuses on the City's water pumping and storage facilities, reviews alternative solutions to address shortfalls, and presents the recommended expansions.
- Chapter 8 presents the detailed assessment of the water distribution system, using hydraulic models and risk evaluations, and the recommended upgrades and operational improvements.
- Chapter 9 describes the public, stakeholder and agency consultation process and the comments that were received and considered in the preparation of this report.
- Chapter 10 summarizes the recommendations of this WMP Update, the estimated project costs and the suggested timelines for implementation.

2 Class EA Process

2.1 MASTER PLAN CLASS EA PROCESS

The WMP Update was developed under the Municipal Engineers Association (MEA) Municipal Class EA process for Master Plans and following Approach #2. Requirements for Schedule A, A+ and B projects were fulfilled and the Notice of Completion of the Master Plan EA, including these projects, will be issued upon completion of the study.

The Municipal Class EA is a planning and design process to identify, compare and evaluate alternative solutions to a problem. It applies to all municipal road, water and wastewater projects, and significant private projects. It considers the potential impacts on all aspects of the environment: natural, social, cultural and economic, and involves consultation with the public, affected parties and review agencies throughout the process.

Master plans are long-range plans that integrate infrastructure requirements for existing and future land uses with environmental assessment planning principles.

The WMP Update proceeded through the first two phases of the Class EA process that generally encompass the following:

Phase 1: Problem or opportunity identification.

Phase 2: Identification and assessment, at a strategic level, of alternative solutions, then recommendation of the preferred solutions that can be implemented as separate subsequent projects, and reporting.

Projects that are considered Schedule A, A+, or B undertakings under the Municipal Class EA process can then move to implementation once the Notice of Completion of the Master Plan Class EA has been issued. Projects that are considered Schedule C undertakings need to proceed with separate and more detailed investigations to fulfill the documentation requirements of the Class EA process, including the completion of Phases 3 and 4 of the Class EA.

2.2 PUBLIC, STAKEHOLDER AND AGENCY CONSULTATION PROGRAM

Public and agency consultation was an integral part of the development of the WMP Update. The public, property owners, relevant government agencies, adjacent municipalities, Indigenous organizations, and stakeholders, were notified of the project, then invited to provide input on the preliminary findings and alternative solutions at a virtual Public Information Centre posted on the City's website. Comments and input received were taken into consideration for the evaluation of the alternatives and the updating of the Master Plan. The consultation program and the input received are presented in Chapter 9.

2.3 PROBLEM STATEMENT

The WMP Update will identify the infrastructure needs to optimize, upgrade and expand the City's drinking water supply, distribution, storage and pumping systems to accommodate growth and intensification to the year 2050.

Details of the infrastructure needs are described in more detail in the following chapters.

3 Regulatory Framework

The City's drinking water system is governed by provincial legislation and policy. Planning for future servicing infrastructure must consider the municipal, County and provincial planning documents, which are briefly described in this chapter.

3.1 PLANNING

3.1.1 Orillia Official Plan

The Orillia Official Plan (OP) is the principal document used to guide future growth and development in the City to the year 2031. The Orillia OP was adopted by Council in March 2010 and approved by the Ontario Municipal Board in March 2013. The most recent consolidation of the OP to Official Plan Amendment #12 is dated February 9, 2021. The OP's policies are based on the principles of managing growth responsibly and efficiently, ensuring the sustainability and integrity of the environment, promoting a strong and diverse employment base in a complete community. The OP presents an "emphasis on intensification, environmental responsibility, and the efficient and cost-effective use of infrastructure". The OP anticipates the City will accommodate a population of 41,000 persons and 21,000 jobs by the year 2031.

3.1.2 Provincial Planning

Growth Plan for the Greater Golden Horseshoe

Developed under the authority of the *Places to Grow Act*, 2005, the Growth Plan for the Greater Golden Horseshoe (2019, Office Consolidation 2020) provides a framework for infrastructure investment, including water and wastewater infrastructure, in the Greater Golden Horseshoe area so that existing and future investments are optimized to serve growth to the year 2051. The Growth Plan sets future population and employment targets for each municipality, including the City of Orillia (population of 49,000 and 26,000 jobs by 2051), and prioritizes growth through "intensification and higher densities in strategic growth areas to make efficient use of land and infrastructure". It also "integrates climate change considerations into planning and managing growth such as planning for more resilient communities and infrastructure".

Provincial Policy Statement

The Provincial Policy Statement (PPS, 2014) is the statement of the province's policies on land use and development planning, made under the *Planning Act*, 1990. The PPS establishes the City's role in planning for growth, intensification, and redevelopment through the City's Official Plan. The PPS identifies that planning for sewage and water services must accommodate

expected growth in a manner that promotes the efficient use of existing municipal and private communal sewage and water services.

3.1.3 Other Municipal Master Plans

Multi-Modal Transportation Master Plan

The City completed its Multi-Modal Transportation Master Plan (MMTP) in 2019 to provide a long-range city-wide transportation plan for growth to the year 2036. The planned transportation network considered multiple future scenarios for various modes of transportation. The population and employment growth projections and locations in the 2019 MMTP were taken into consideration in the development of the WMP Update.

Wastewater System Master Plan

The City's Wastewater System Master Plan update was initiated in 2018 and completed in 2021. Although the wastewater and water master plan updates partially overlapped, their objectives and timeframes were distinct, and the reports were not planned to be coordinated.

3.2 DRINKING WATER

The provision of drinking water is regulated under the *Safe Drinking Water Act*, 2002 (SDWA) and the Drinking Water Systems Regulation (O. Reg. 170/03 as amended). The SDWA deals with matters related to the treatment and distribution of drinking water, including the control and regulation of drinking water systems. The treatment and testing requirements for the water systems that supply drinking water to the City are specified under O. Reg. 170/03 and the water quality standards are specified in O. Reg. 169/03.

The *Clean Water Act*, 2006 (CWA) mandates the protection of municipal drinking water sources. Under CWA and its regulations, Source Water Protection plans have been developed to protect the groundwater and surface water sources of municipal drinking water. Any new municipal intake or groundwater well for the supply of water must meet the requirements of the CWA and be managed under a source protection plan. The policies that apply to the City's municipal water sources are outlined in the South Georgian Bay Lake Simcoe Source Protection Plan, which came into effect July 1, 2015.

The Orillia Drinking Water system operates under Municipal Drinking Water License No. 125-101 and Drinking Water Works Permit No. 125-201. Water taking from the groundwater wells and from Lake Couchiching is permitted by Permits To Take Water.

4 City of Orillia Profile

4.1 SOCIO-ECONOMIC FEATURES

The City of Orillia, a single-tier municipality, is located on the shore of both Lake Simcoe and Lake Couchiching. Land uses within the City's boundaries are outlined on Schedule A plan of the Official Plan.

The City's current development plans, and the lands that are anticipated to be developed in the future and at build-out, for residential and for industrial, commercial or institutional uses, are shown on Figure 1. More details are provided in Appendix A, Population and Water Demands Technical Report (Tatham, June 2021).

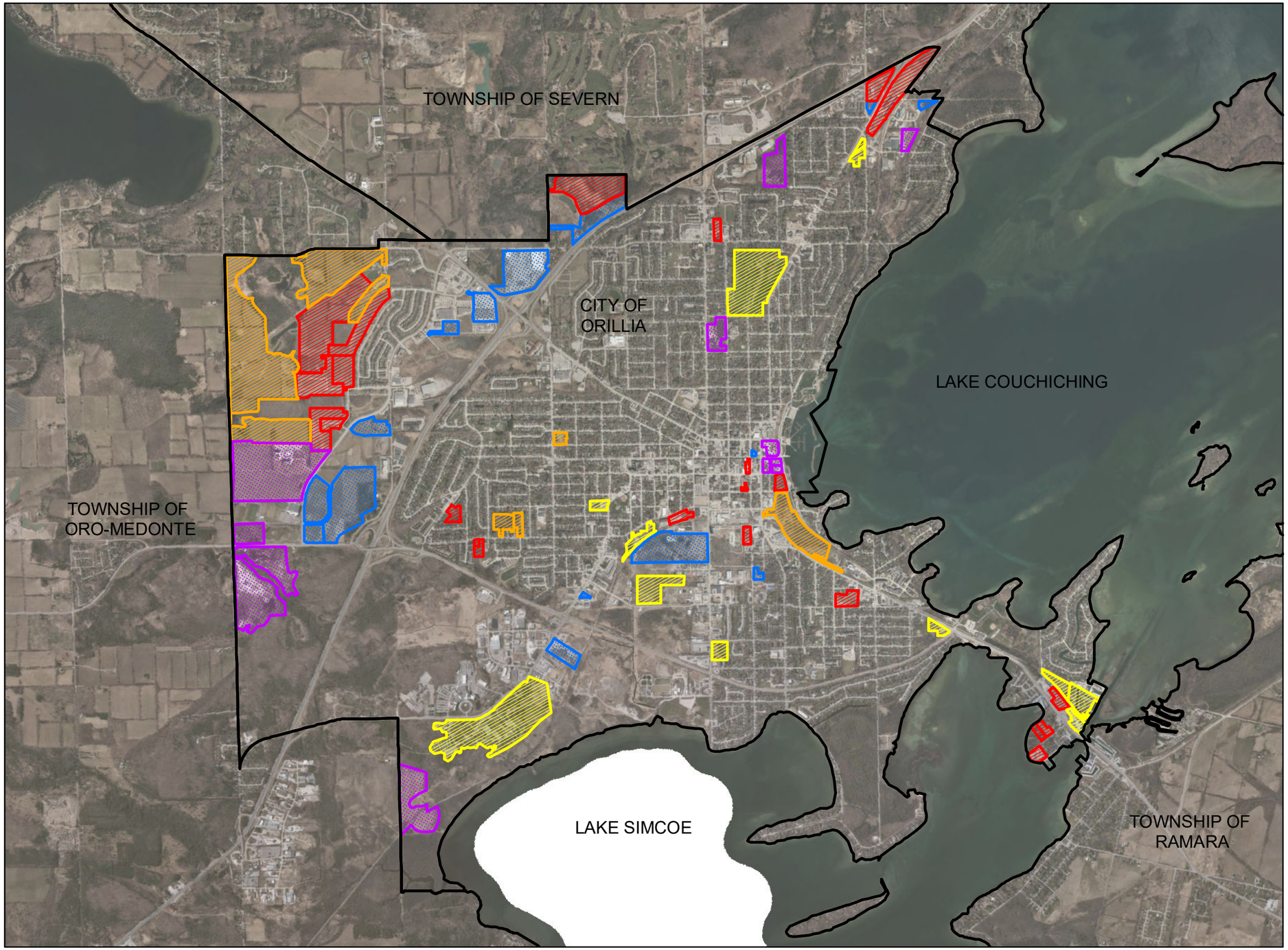
4.1.1 Residential Population

The City's residential population in 2016 was 31,166 and increased to 33,411 in 2021 (Statistics Canada). The population of Orillia is projected to grow at an average rate of 656 person per year, which meets the residential population target of 41,000 by 2031 set in the City's OP and exceeds the population target in the 2020 Growth Plan for the Greater Golden Horseshoe of 49,000 by 2051. As shown in Table 1, at this linear growth rate, the projected population by 2050 will be 53,456.

Table 1: Historical and Projected Populations

YEAR	POPULATION PROJECTIONS
2016 (Census)	31,166
2021 (Census)	33,411
2031	41,000
2040	46,900
2050	53,456

The City's Planning Division provided information on areas that are planned for residential development or redevelopment in the future. These areas were categorized in three development timelines as follows:



N

LEGEND

- CITY LIMITS
- RESIDENTIAL (NEAR FUTURE)
- RESIDENTIAL (FUTURE LANDS)
- RESIDENTIAL (BUILD-OUT)
- ICI (NEAR FUTURE)
- ICI (BUILD-OUT)

DEVELOPMENTS IDENTIFIED IN THE LIST OF VACANT LANDS AVAILABLE ON DECEMBER 31, 2019 FROM THE CITY OF ORILLIA ARE NOT SHOWN ON THIS MAP.

0 0.35 0.7 1.4 2.1 2.8 3.5 Kilometers

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ORILLIA WATER MASTER PLAN UPDATE

DEVELOPMENT AREAS

FIG. No. **FIG-1**

DATE: APR/21

JOB NO. 120063

- Near Future, which are lands to be built soon and were in the process of application or under construction in 2020 as per the City's 2019 Development Control Plan (DCP).
- Future lands are areas that are anticipated to be developed further into the future.
- Build-out areas are potential development areas up to the City limits as per the OP's Schedule A, some of which may be developed or redeveloped later than within the planning horizon of this Master Plan (2050).

The Near Future, Future, and Build-out areas are shown on Figure 1 (excluding vacant lands as detailed mapping wasn't available). Much of the anticipated residential growth is located west of Highway 11, in the north-west portion of the City.

The projected residential populations associated with these developments are summarized in Table 2. A detailed compilation of all the developments and a figure showing the development lands locations are provided in the Population and Water Demands Technical Report attached in Appendix A. The total projected build-out population of 57,669 exceeds the projected population to the year 2050 of 53,456 persons.

4.1.2 Employment

The City's current employment is mostly in manufacturing, tourism and service industry, retail, and the public sector. The Ontario Provincial Police is headquartered in Orillia. Other major employers include Casino Rama in the adjacent Chippewas of Rama First Nation. The City has a major health center, the Soldiers' Memorial Hospital, and three high schools.

Existing employment lands (commercial, institutional and industrial (ICI)) are estimated to cover approximately 196 ha based on Schedule A of the OP. Considering all areas that the City has planned for ICI developments or intensification, the total employment land area at build-out could increase to 432 ha. Table 2 shows the projected ICI land increases associated with each of the City's development planning categories.

The number of employees is expected to increase to 20,389 by the year 2031, based on the Development Charges Background Study (Hemson, 2017). An estimated number of employees by 2050 is not available.

Table 2: Projected Residential Populations and Employment Lands

DEVELOPMENT CATEGORY	PROJECTED POPULATION	PROJECTED ICI LANDS (ha)
Existing (2020)	32,987	196
Near Future (DCP) Lands	4,647	78
Future Lands	12,430	69
Build-out Areas	7,604	90
Total	**57,669**	**432**

4.2 SERVICING INFRASTRUCTURE

4.2.1 Drinking Water System Overview

Most of the City is serviced by the Orillia Drinking Water System. Only limited areas at Victoria Point and at the edges of the City are not connected to the municipal water distribution system.

The drinking water system is comprised of three groundwater wells and a surface water supply; a Water Filtration Plant and the West Orillia Well chlorination system; three water storage reservoirs; one booster pumping station; and watermains that distribute drinking water throughout the City. The locations of these facilities are shown on the overall plan of the City's water distribution system (Figure 2).

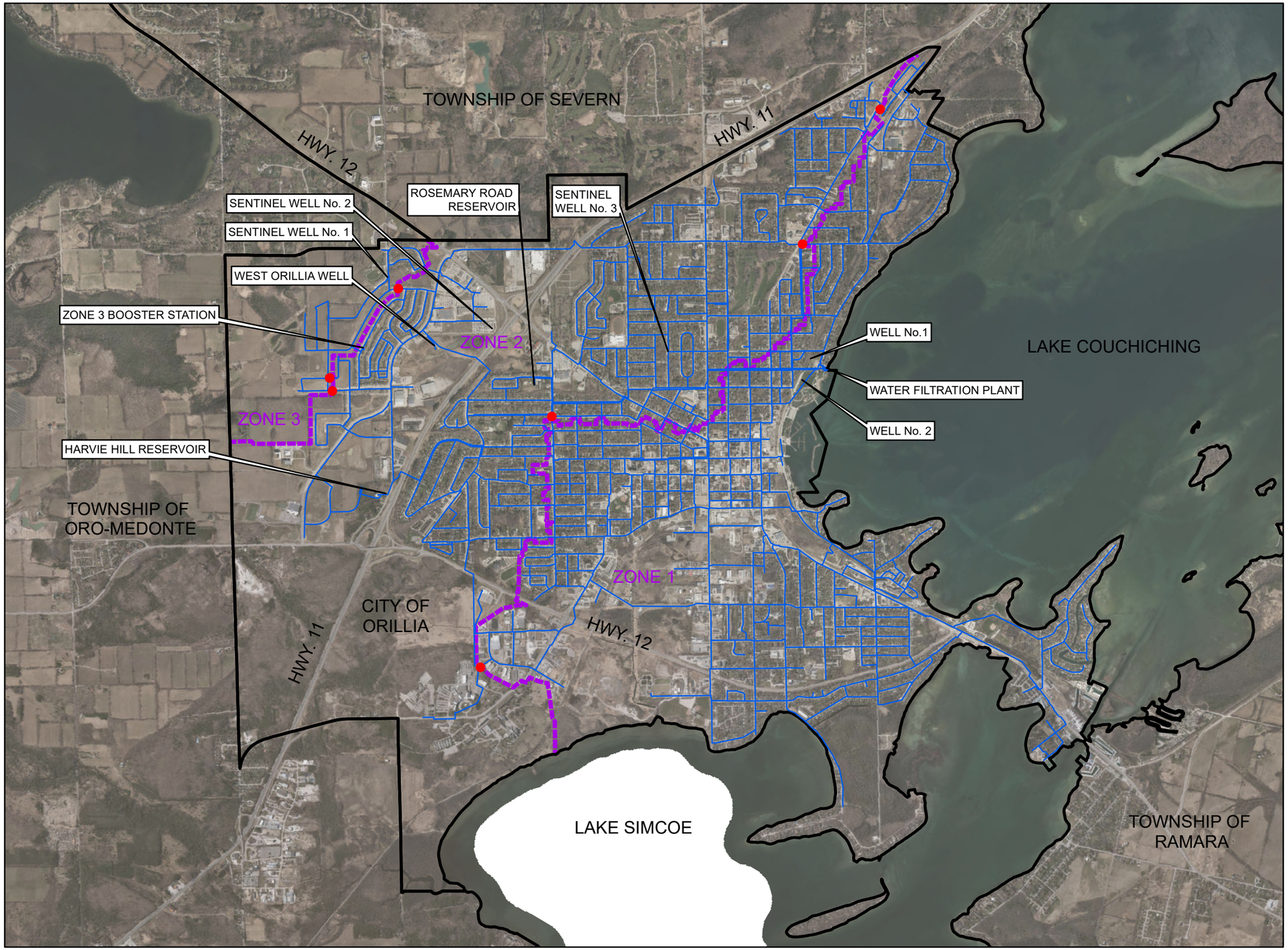
The water distribution system is divided into three pressure zones. The pressure zones are connected by pressure relief valves (PRV) that open under low pressure conditions to allow flow from pressure zone 3 (PZ3) to pressure zone 2 (PZ2) and from PZ2 to pressure zone 1 (PZ1).

The Water Filtration Plant (WFP) is located at 200 Bay Street and treats raw water from Lake Couchiching and from Well Nos. 1 and 2. Treated water is stored in an in-ground clearwell. Two sets of high lift pumps at the WFP supply each of PZ1 and PZ2.

Disinfected groundwater from the West Orillia Well (WOW) supplements PZ2.

PZ3 is supplied from PZ2 with a Zone 3 booster pumping station located on Emperor Drive.

Three reservoirs provide floating storage: two in-ground Rosemary Road Reservoirs that support PZ1; and the above-grade Harvie Hill Reservoir that supports PZ2.



N

LEGEND

- PRESSURE RELIEF VALVE
- EXISTING WATERMAIN
- PRESSURE ZONE BOUNDARY
- CITY LIMITS

0 0.35 0.7 1.4 2.1 2.8 3.5 Kilometers

TATHAM ENGINEERING

ORILLIA WATER MASTER PLAN UPDATE

OVERALL WATER DISTRIBUTION SYSTEM

FIG. No. **FIG-2**

DATE: SEP/22

JOB NO. 120063

4.2.2 Wastewater System

The City has a wastewater collection system with multiple sewage pumping stations that convey wastewater to the Orillia Wastewater Treatment Centre. Treated effluent is discharged to Ben's Creek, which drains to Lake Simcoe. The Wastewater Treatment Centre's effluent therefore discharges to a different water body than the WFP's water intake.

4.3 NATURAL ENVIRONMENT FEATURES

4.3.1 City Wide Environmental Features

The City has an extensive shoreline with Lake Couchiching and Lake Simcoe. As shown on Schedule A of the OP, the City also contains numerous environmentally protected areas that include: Scout Valley, a 93 ha forest; the Orillia Filtration swamp, which spans from Highway 11 to Lake Simcoe and is drained by Mill Creek and Ben's Ditch; the Bass Lake drainage area to the north west; the Wilson Point wetland in the north; the Victoria Point wetland in the south east; and the Bluff's Creek wetland in the south.

4.3.2 Natural Features at/near Water Facilities

The Water Filtration Plant, as well as Wells 1 and 2, are located on the shore of Lake Couchiching, immediately adjacent to Couchiching Beach Park, a grassed area used for recreational activities.

The West Orillia Well is in an open space area, not environmentally protected, that is within the Silver Creek watershed.

The Rosemary Road reservoir and the Zone 3 booster pumping station are built in residential areas and are not in proximity to any significant natural features.

The site of the Harvie Hill reservoir was the subject of a natural environmental investigation for this WMP Update. As described in the report attached in Appendix B, the reservoir site consists mainly of maintained lawn with landscape trees. The northern portion of the property consists of a Poplar Woodland that extends into adjacent lands. Due to its size (1 ha), this woodland is not considered significant. No Butternut trees, Barn Swallow nests, provincially rare wildlife species, or species at risk (SAR), were found on the property. The Harvie Hill site is not considered a potential habitat for SAR.

4.4 CULTURAL ENVIRONMENT FEATURES

4.4.1 Overall Heritage Resources

Orillia has a rich history. The town site was originally a Huron-Wendat settlement and later inhabited by the Ojibwe people. For thousands of years, it was a gathering place for the Huron, Chippewas and Iroquois Nations. The historic Mnjikaning Fish Weirs, located at the Narrows

between Lake Simcoe and Lake Couchiching, were used over 4,000 years ago. The area was later occupied by European settlers and was on the fur trading route. Orillia was founded as a village in 1867, became a town in 1875, and was incorporated as a city in 1969. The City is often known as the Sunshine City; the summer home of Stephen Leacock is now a National Historic Site.

Orillia celebrates its historical and cultural heritage. OP policies were developed to preserve and enhance the City's heritage resources, including the downtown area's Historic Main Street. Orillia has an active Arts District, and an active music scene, including the annual Mariposa Folk festival, and numerous other festivals.

4.4.2 Heritage Resources at Water Facilities

The Water Filtration Plant was originally built in 1914 and is located adjacent to Couchiching Beach Park. The original portion of the WFP is designated as a historical building.

Other water infrastructure facilities and sites have not been identified as historically significant.

An archaeological assessment (Stages 1 and 2) of the Harvie Hill reservoir site on Harvie Hill Settlement Road was conducted by AMICK in 2020 (see report in Appendix B.). The original property, of which the current site was part of, was owned by Alex Harvie and was settled as of 1871. Although there was the potential for archaeological deposits related to early post-contact settlement, the site was previously disturbed due to construction of the existing standpipe. No archaeological resources of any description were encountered anywhere on the reservoir site during the Stage 2 property assessment.

5 Water Demand Projections

Projections of future water needs were established based on recent water production and consumption records. Detailed data is presented in the Population and Water Demands Technical Report in Appendix A. A summary of the analysis of historical water demands and projections of future water demands are presented in this chapter.

5.1 HISTORICAL WATER PRODUCTION AND CONSUMPTION

Historical water production and water consumption were determined from:

- Daily and monthly volumes of treated water supplied from the WFP and WOW to the distribution system for the period of 2010 to 2020.
- Monthly volumes of treated water consumed, obtained from:
  - water billing records for 2015 to 2018; and
  - water meter data for 2019 and 2020.
- Bulk water sales records for 2015 to 2020.

5.1.1 Water Supply

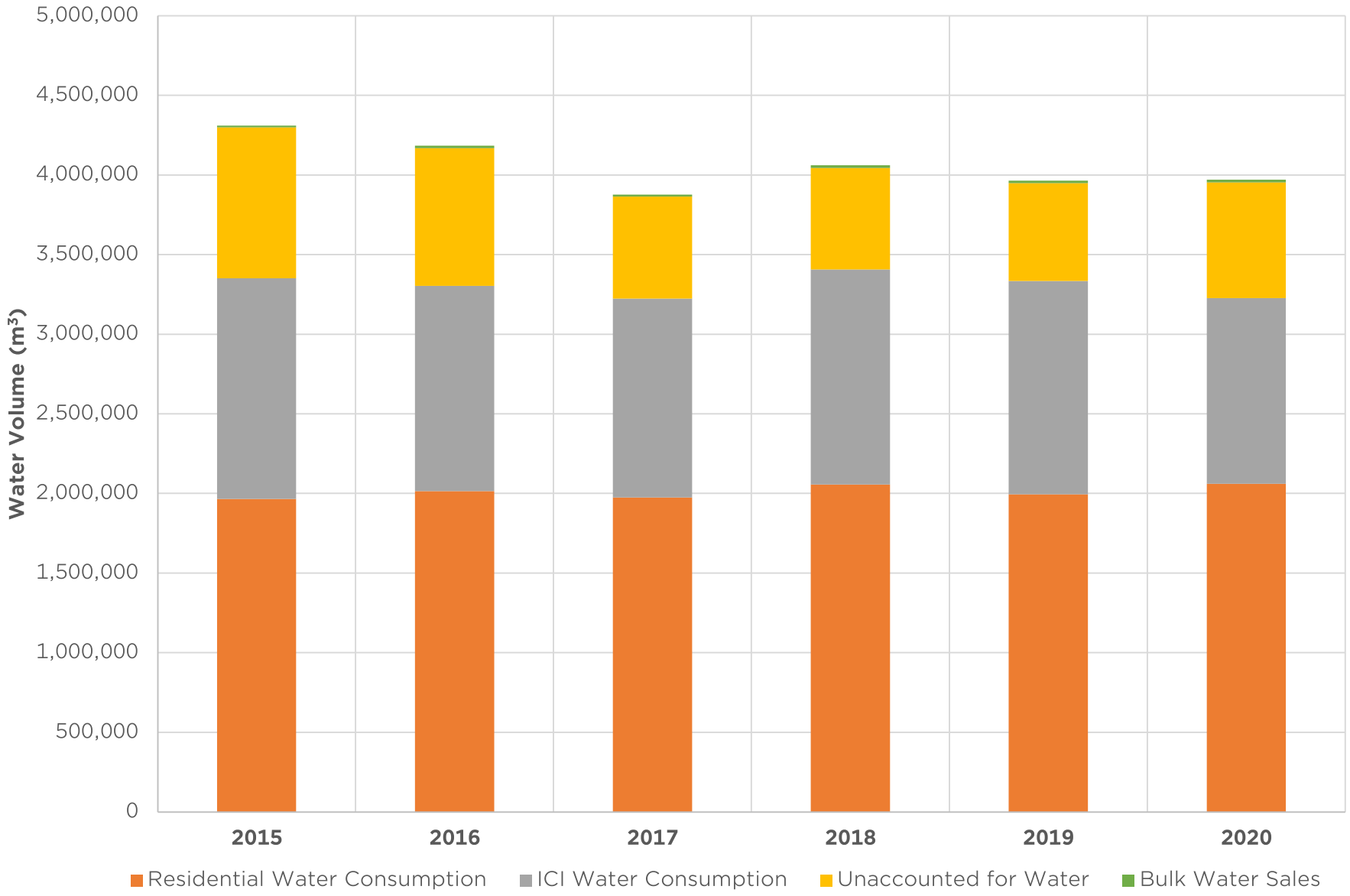
The City's water supply records for 2016 to 2020 show that most (75% on average in past 5 years) of the raw water supply is from Lake Couchiching. The remaining 25% is supplied from the groundwater wells: 4% from Wells 1 and 2, and 21% from the WOW, on average. The annual volume of water drawn from the WOW varied significantly from year to year, ranging from 16% to 30% of the total annual supply.

5.1.2 Water Production and Consumption

Water production and water consumption data, summarized in Table 3 and in Figure 3, indicate:

- The annual treated water production has not significantly changed in the past five years, averaging at 4 million m^3/year.
- On average, residential customers, including multi-storey residential buildings, utilized 50% of the water produced, and non-residential (ICI) customers utilized 32% of the water produced.
- The proportion of water used by each type of consumer has been relatively constant. From year to year, the annual volumes attributed to residential consumers varied by less than 3%; the annual volumes attributed to non-residential customers varied by less than 9%.

Figure 3: Historical Water Production, Consumption and Losses



Note: Total water production per year is the sum of the consumption, bulk water sales, and unaccounted for water

- Bulk water sales comprised only 0.4% of the total volume of water produced annually.
- On average during the past 5 years, 17% of the water produced was unaccounted for. It comprises water to unbilled customers, water usage for watermain flushing and fire protection, and watermain leaks.

Table 3: Annual Water Production, Consumption and Loss (2015 to 2020)

YEAR	TOTAL PRODUCTION (m^3)	WATER CONSUMPTION (m^3)			UNACCOUNTED FOR WATER (m^3)
		BULK WATER	RESIDENTIAL	ICI	
2015	4,310,403	10,813	1,965,628	1,385,433	948,529
2016	4,184,544	16,827	2,014,038	1,289,964	863,716
2017	3,876,791	12,608	1,975,185	1,248,223	640,755
2018	4,061,407	17,037	2,056,690	1,349,311	638,369
2019	3,964,830	15,649	1,994,202	1,339,373	615,606
2020	3,970,390	16,508	2,060,965	1,165,779	727,138
5-yr Avg	4,011,592	15,726	2,020,216	1,278,530	697,121

5.1.3 Daily Water Demands

Over the past five years (2016-2020), the highest daily volume of drinking water (Maximum Day Demand, or MDD) supplied by the WFP was 15,748 m^3/day in the summer of 2016. The WOW supplied its highest MDD of 5,314 m^3/day during the summer of 2018.

The total MDD supplied by both sources in the past five years was recorded at 16,797 m^3/day in the summer of 2018. The 5-year total Average Day Demand (ADD) met by the City's water facilities was 11,067 m^3/day.

From 2016 to 2020, the overall Maximum Day Factor (MDF, ratio of MDD to ADD) ranged from 1.3 to 1.5. However, water demands at the Zone 3 booster pumping station during the summer of 2021 indicated a higher local MDF of 1.8.

5.2 WATER DEMAND PROJECTIONS

Projections of future water demands are calculated by applying per unit water consumption rates to the projected populations and non-residential areas.

Selecting the appropriate unit water consumption rates for master planning took in consideration historical data, the municipal water conservation program, and climate change effects.

5.2.1 Historical Residential Water Consumption

Residential water consumption rates for the past five years were calculated from the annual water billing records and using estimated annual serviced populations.

In the absence of accurate annual population counts, the number of residential customers was estimated assuming the population from the 2016 Census increased linearly at an annual rate of 656 persons per year (see Section 4.1.1).

As presented in Appendix A, the calculated residential per capita water usage ranged between 227 L/person/day and 253 L/person/day, with a 5-year average of 232 L/person/day.

Although there is uncertainty with the accuracy of these calculated per capita values because they are based on estimated rather than actual serviced populations, the per unit rates are in line with water consumption values calculated by other local municipalities such as the Town of Innisfil and the City of Barrie.

The 2015 WSMP was developed based on a per capita water consumption rate of 250 L/person/day for new developments, and 350 L/person/day for residential areas that were 10 years or older.

5.2.2 Historical Non-Residential Water Consumption

The water consumption volume attributed to ICI customers was calculated based on the estimated existing ICI area of 196 ha in 2019. The average water consumption rate was 18,707 L/ha/day.

5.2.3 Water Conservation and Efficiency Plan

The City has had a water efficiency and conservation program since 1997. In 2014, the City prepared a Water Conservation and Efficiency Plan that reviewed measures to date and recommended water consumption reduction measures for residents, industrial, commercial, and institutional customers, and measures to reduce non-revenue water usage (unbilled water).

The 2014 Water Conservation and Efficiency Plan recommends the City continue to implement the watermain leak detection program (every five years); the annual pipe replacement program; public and in-school education; rain barrel subsidies; and water metering.

The 2014 Plan is a well-prepared document that presents valid recommendations to continue and enhance current efforts. Considering that residential water consumption has been consistently low in the past five years, focusing efforts on commercial and industrial consumers as well as on

municipal activities is an appropriate direction for future water conservation activities. It is recommended that the 2014 Plan and the estimated implementation costs and schedule, be updated for the next budgetary planning.

5.2.4 Fire Protection Flows

The City of Orillia's Engineering Design Criteria document (revised in 2015) does not specify minimum fire flow requirements; however, it refers to MECP Design Guidelines and the 1999 Fire Underwriters Survey (FUS) document entitled "Water Supply for Public Fire Protection".

The FUS guidelines outline a methodology for estimating the fire flow requirements for municipal fire protection on a building by building basis, based on materials of construction, size, fire protection, proximity to other buildings, etc. Although the required fire flows calculated using the FUS approach can vary significantly, the FUS guidelines include a simplified approach for detached and small two-family dwellings that provides useful guidance for planning for fire flows. FUS suggests that adequate fire flows for small detached and semi-detached homes could range from 33 L/s to 100 L/s.

For this WMP Update, available fire flows of 38 L/s to 100 L/s were considered adequate for existing and proposed residential areas: lower values for low density areas, and higher values for higher density areas. Available fire flow rates for multiple/attached townhomes, apartment buildings and non-residential buildings, need to be higher and should be calculated using the FUS methodology based on the specific characteristics of the proposed buildings.

For the City's overall water distribution system, due to the large population served, the MECP Design Guidelines' suggested criteria were used, ranging from 348 L/s for 5 hours to 454 L/s for 6 hours, for population of 33,000 to 57,000 persons, to assess the adequacy of the water storage facilities.

5.2.5 Water Consumption Criteria for Master Planning

As climate change is causing higher average temperatures, which are expected to result in higher seasonal peak water usage (as was observed in the summer of 2021 at the Zone 3 booster pumping station), and as there has not been a noticeable reduction trend in the per capita water consumption in the past five years, planning for water infrastructure in this WMP Update was based on a per capita value of 250 L/person/day for new residential developments, and 275 L/person/day for existing developments. These criteria are considered sufficiently conservative to ensure the City's infrastructure plans can meet existing and future water supply needs.

The water needs of non-residential customers can vary significantly based on the specifics of their operation, and on economic or market factors. Considering criteria used by other area

municipalities and the calculated value for 2019 from the Orillia billing records of 18,707 m^3/ha/day, this WMP Update utilized an average ICI water consumption of 20,000 L/ha/day.

Water consumption data will be reviewed when the WMP is updated in five years to determine if the water consumption criteria should be adjusted, depending on the observed impacts of enhanced water conservation measures and climate change effects.

The criteria that will be used for the WMP Update are summarized in Table 4.

Table 4: Water Consumption Criteria Summary

	CRITERIA
Residential Existing (Average)	275 L/p/day
Residential Development (Average)	250 L/p/day
Non-Residential (ICI) (Average)	20,000 L/ha/day
Maximum Day Factor for PZ1 and PZ2	1.5
Maximum Day Factor for PZ3	1.8

5.2.6 Projected Water Demands

Applying the above water consumption criteria to the projected populations and ICI lands results in the projected future water demands summarized in Tables 5 and 6 overleaf.

Table 5: Existing and Projected Water Demands

	POPULATION	RESIDENTIAL DEMAND		EMPLOYMENT (ICI) LAND (ha)	ICI DEMAND		TOTAL DEMAND	
		ADD (m^3/day)	MDD (m^3/day)		ADD (m^3/day)	MDD (m^3/day)	ADD (m^3/day)	MDD (m^3/day)
Existing (2020)	32,987	7,144	10,912	196	3,923	5,885	11,067	16,797
Near Future (2031)	4,647	1,162	1,824	78	1,554	2,331	2,716	4,155
Future (2045)	12,430	3,108	4,940	69	1,382	2,123	4,490	7,063
Build-out (post-2050)	7,604	1,901	2,852	90	1,791	2,686	3,692	5,538
Total	**57,669**	**13,314**	**20,528**	**432**	**8,650**	**13,025**	**21,964**	**33,553**

Table 6: Projected Growth to Build-out and Associated Water Demands by Pressure Zone

PRESSURE ZONE	GROWTH POPULATION	RESIDENTIAL DEMAND		GROWTH ICI LANDS (ha)	ICI DEMAND		TOTAL DEMAND	
		ADD (m^3/day)	MDD (m^3/day)		ADD (m^3/day)	MDD (m^3/day)	ADD (m^3/day)	MDD (m^3/day)
PZ1	8,189	2,047	3,071	72	1,431	2,147	3,478	5,218
PZ2	11,688	2,922	4,383	156	3,128	4,693	6,050	9,076
PZ3	4,805	1,201	2,162	8	167	301	1,368	2,463
Total	**24,682**	**6,170**	**9,616**	**236**	**4,727**	**7,140**	**10,897**	**16,756**

6 Water Supply and Treatment

The assessment of the City's water treatment facilities, including their condition, performance, capacity to meet the water demands and drinking water standards, and resiliency to the potential risks posed by climate change, is summarized in this chapter. Recommendations are provided for further data collection and studies to optimize their operation and performance.

Details are presented in the Water Filtration Plant and Other Treatment Facilities Assessment Report in Appendix C.

6.1 RAW WATER SUPPLY

6.1.1 Existing Capacity

The City's raw water supply sources are Lake Couchiching, Wells 1 and 2, and the WOW, as shown on Figure 2.

Their approved water taking capacities are documented in the MECP Permits To Take Water (PTTW), as follows:

- Lake Couchiching: 36,368 m^3/day as per PTTW No. 2865-BVER7T.
- Well 1 and Well 2: combined 5,760 m^3/day as per PTTW No. P-300-5069408381.
- WOW: 7,920 m^3/day as per PTTW No. P-300-5069408381.

However, the capacities of the pumps that draw water from these sources limit the amount of raw water that can supply the Orillia Drinking Water System.

At the WFP, the intake pipe is rated at 29,312 m^3/day and the low lift pumps have a firm rated capacity of 27,280 m^3/day in the Drinking Water Works Permit (DWWP). However, the actual firm low lift pumping capacity to the WFP was established at 303 L/s (26,719 m^3/day) by City operators in 2021.

Well 1 is equipped with a 30.3 L/s (2,618 m^3/day) well pump, and Well 2 has a 37.8 L/s (3,266 m^3/day) well pump. Currently, the two well pumps cannot operate concurrently because of limitations with the capacity of the transformer. Therefore, the current firm capacity from Wells 1 and 2 is limited to 2,618 m^3/day. Addressing this bottleneck is planned for 2022.

The WOW is equipped with a pump rated at 75.8 L/s (6,550 m^3/day). Although less than the PTTW rate, upon preliminary review of the well construction and testing records, there is concern that the well is currently pumped above the well screen's capacity, which could affect the performance of the well in the future. This was considered when assessing alternatives for increasing the groundwater supply capacity.

As tabulated in Table 7, the total DWWP-approved raw water supply capacity is 39,714 m^3/day. However, the total firm supply capacity is currently limited to 29,337 m^3/day due to equipment and electrical constraints at Wells 1 and 2 and the absence of a stand-by well at the WOW.

Table 7: Raw Water Supply Capacities – Rated and Firm

SOURCE	RAW WATER SUPPLY CAPACITY (m^3/day)		
	PTTW	DWWP	Current Firm
Lake Couchiching	36,368		
WTP Low Lift Pumps		27,280	26,179
Well 1	5,760	2,618	2,618
Well 2		3,266	
West Orillia Well	7,920	6,550	0
Total	**50,048**	**39,714**	**28,797**

6.1.2 Supply Capacity vs Projected Water Demands

The currently available firm raw water supply capacity is sufficient to meet the projected future water demands to approximately year 2045. However, it will not meet the projected demands of 33,553 m^3/day for the build-out scenario. The projected supply shortfall is 4,756 m^3/day.

The firm capacity shortfall is mainly caused by the absence of a stand-by well for the WOW.

The current inability to run both Wells 1 and 2 concurrently also limits the amount of treated water that can be produced at the WFP, since the total raw water supply capacity of 29,337 m^3/day is less than the total WFP treatment capacity of 33,042 m^3/day.

6.2 WATER FILTRATION PLANT ASSESSMENT

6.2.1 Description and Condition

The Orillia WFP treats raw water by coagulation and flocculation, multi-media filtration, ultraviolet (UV) disinfection and gas chlorination.

The WFP was originally built in 1914 and more recently underwent multiple major upgrades and expansions from 1976 to 2009. A condition assessment completed in 2017 (attached in Appendix D) found that the WFP is in good overall condition, including its structure despite the age of the original building. Most of the process mechanical equipment was replaced or refurbished in recent years. Recommended repairs to the low lift pumps vacuum priming system, to Filters 1

and 2's drain valves, and to the boiler pumps, were completed. The City has been replacing or refurbishing small equipment and instrumentation as it reaches the end of its useful life. To date, the following recommended work remains to be completed, however is included in the City's capital budgets at the appropriate timelines:

- Replacement of the low lift pumps with self priming pumps.
- Resolving the poor seal of the flocculation tanks' mud valves with a work around solution.
- Replacing damaged PRVs and assessing the removed PRVs to determine the cause of the damage.
- Upgrading the chlorination room. The upgrades are planned to be implemented in 2022.
- Updating the MCCs, PLCs, I/O modules, and communication modules, as required based on the ongoing detailed study and SCADA Master Plan.

The WFP's generator building on Jarvis Street, inspected in 2020, was also found to be in good condition. Minor concerns with noted roof leakage have been resolved by the City.

6.2.2 WFP and Unit Operation Capacity

The WFP is rated at a capacity of 27,280 m^3/day upstream of the chlorine contact chamber and 33,042 m^3/day at the chlorine contact chamber. A review of the capacity of each process unit at the WFP was completed and is documented in the Water Filtration Plant and Other Treatment Facilities Assessment Report attached in Appendix C. Table 8 summarizes the rated or calculated capacities of all the WFP's pumping and treatment unit operations.

In summary, at the WFP, if all treatment equipment is online, the rated capacity of the WFP can be met. However, there is insufficient redundancy in the number of filters. With one of the higher capacity filters off-line, the WFP can only produce 72% of its rated capacity.

The WFP unit operation assessment also considered the limitations of the WFP to an expansion beyond its current rated capacity. It was concluded that most unit operations and facilities would need to be expanded, including the low lift pumps, raw water screens, flocculation tanks, filters, and filter backwash wastewater holding tank.

The capacity of the flocculation tanks could be increased if operated at shorter retention times. Similarly, operating the filters at a higher filtration rate, even for a short period of time, could mitigate the loss in capacity when one filter is off-line. Stress testing and optimizing the coagulation, flocculation and filtration processes need to be completed to assess if these approaches are viable solutions, i.e., will not result in deterioration of the filtered water quality, and the extent of the capacity gained.

Table 8: WFP Unit Operation Capacity Summary

PROCESS	DETAILS	CAPACITY (m^3/day)		
		Rated	Reported	Calc'd
WFP	Upstream of chlorine contact chamber	27,280		
	Downstream of chlorine contact chamber	33,042		
Intakes	Main intake crib	77,274		
	Main intake pipe	29,312		133,808
	Back-up intake pipe			56,512
Screens	Bar screen, travelling screen, bypass		29,300	
Low Lift Pumping	Low lift pumps (firm, with 3 pumps)	27,280	26,179	
	Low lift pumps (total, with 4 pumps)	40,850		
Coagulation	Coagulant dosing pumps (6.2 mg/L dose)			27,280
	In-line flash mixer	45,460		
Flocculation	Flocculation tanks at 30 min retention time			27,280
Filtration	Filters (firm, with 3 filters)			19,553
	Filters (total, with 4 filters)	27,286		
	Backwash pumps (each)	34,992		
Disinfection	Chlorination & contact time for virus inactivation @ chlorine residual of 0.25 mg/L 2.2 mg/L			33,042 43,665
	UV disinfection units, each	35,000		
High Lift Pumping	Zone 1 pumps (firm with 2 pumps)			19,993
	Zone 1 pumps (total with 3 pumps)	29,989		
	Zone 2 pumps (firm with 2 pumps)			16,001
	Zone 2 pumps (total with 3 pumps)	24,002		

Although the capacity of the in-line mixer for the coagulation process is not limiting, the WFP operates with a single mixer in the raw water header. Failure of the mixer could significantly affect the performance and operation of the treatment process. Installing a back-up mixer would address this risk.

The volume of the filter backwash wastewater holding tank is a physical constraint that limits the number and frequency of filter backwashes. A plant expansion would require an expansion of this tank.

The existing disinfection system is not a limiting factor for a WFP expansion because adjustments in chlorine dose can be used to maintain the required level of disinfection.

6.2.3 WFP Treatment Performance

The Orillia WFP produces drinking water that meets or exceeds all Ontario Drinking Water Quality Standards (O.Reg.169/03). Filtered water turbidity is consistently below the WFP's compliance limit of 0.3 NTU. Based on data for the past three years, all regulated and monitored organic and inorganic compounds were either below detection limits or well below the water quality standards.

The treated water meets the Operational Guidelines and Aesthetic Objectives of the MECP Technical Support Document for Ontario Drinking Water Quality Standards, Objectives and Guidelines, except for sodium and aluminium. Sodium levels are below the Aesthetic Objective, however, they are above 20 mg/L, which requires notification to the Medical Officer of Health. Aluminium levels are slightly above the Operational Guideline.

Disinfection

The WFP effectively disinfects the raw water: there are no *E. Coli* or Total Coliforms in any of the treated water samples.

The WFP treated and disinfected water contains low levels of disinfection by-products, including trihalomethanes (THM) and haloacetic acids (HAA), well below the current standards. The performance data indicates optimization of the disinfection process to minimize the formation of disinfection byproducts at the WFP is not necessary.

The WFP maintains chlorine residuals in the treated water within an acceptable range in accordance with typical values and with O. Reg. 170/03. However, consumer complaints have been received that are believed to be associated with chlorine levels in the distribution system.

Taste and Odour Control (Revised January 17, 2023)

Lake Couchiching water has an earthy taste and odour in late summer and early fall because of the decomposition of algae in the lake that produces chemical compounds, geosmin and methyl-iso-borneol (MIB), which have very low odour thresholds.

The WFP filters reduce the raw water's geosmin content by 75% (2018 data) to well below its odour threshold concentration of 4 ng/L. However, the raw water concentrations of MIB are reduced to a lesser extent (58% in 2018). MIB residuals in the treated water are at times above its odour threshold concentration of 9 ng/L, resulting in the noticeable taste and odour and customer complaints.

6.2.4 Climate Change Resiliency

A resiliency assessment of the WFP was completed to determine the potential impacts of climate change on the facility, identify potentially vulnerable components, and recommend measures to improve climate change resiliency. The assessment followed the framework outlined in Infrastructure Canada's Climate Lens (2019) guidance document. The assessment approach and findings are summarized in the Water Filtration Plant and Other Treatment Facilities Assessment Report attached in Appendix C.

This climate change risk assessment concluded the WFP building is not at risk from severe storm events and flooding, and other risk factors were low, however it identified areas of higher vulnerability that should be reviewed to determine ways to increase the WFP's resiliency to climate change effects. The climate change effects that are the most likely to affect the WFP are:

- Deterioration of the raw water quality, which could cause a deterioration of the treated water quality if the coagulation/flocculation and filtration processes cannot be adjusted or modified as necessary.
- Increases in water demands for extended periods, potentially above the currently projected maximum day demands, combined with poorer raw water quality noted above, could exceed the WFP's capacity to produce drinking water that meets all quality standards and objectives.

6.3 OTHER WATER TREATMENT FACILITIES

6.3.1 Wells 1 and 2 and Air Scrubbers

Groundwater from Wells 1 and 2 is treated through air scrubbers, located in a dedicated scrubber building, then through chlorination and UV disinfection at the WFP, jointly with the filtered water.

The air scrubbers effectively remove TCE and PCE in the raw groundwater to well below the ODWS.

Wells 1 and 2 and the well pumps and motors were refurbished in 2020.

Well 1, Well 2 and scrubber buildings were inspected in 2020. The Well 1 building, constructed in 1939, showed signs of deterioration, however there were no major structural concerns. The Well 2 building, constructed in 1940, was also considered to be generally in acceptable and serviceable condition, although corroded lintels should be replaced. The scrubber building and equipment, built in 2007, were found to be in very good condition and well maintained, although the City reported reduced flows through one scrubber.

6.3.2 West Orillia Well

Pumped raw groundwater from the WOW is chlorinated with sodium hypochlorite within the pumphouse. Following chlorine contact time in a 900 mm diameter contact pipe, disinfected groundwater is discharged into the water distribution system of PZ2. The chlorination system is set to maintain chlorine residuals in the range of 1.2 mg/L to 1.6 mg/L.

6.4 ISSUES SUMMARY

Review of the Orillia water supply and treatment systems found that the main issues to be addressed in the WMP Update are as follows.

Water Supply and Treatment Capacity Deficit

The current firm raw water supply capacity and the firm capacity to produce treated water are less than the projected maximum day water demands of the build-out scenario (see Table 9).

The capacity shortfalls are caused by the absence of a stand-by well at the WOW, and by the limited capacity of the WFP's filtration process if one of the filters is off-line. In a worst-case scenario in which the WOW system is offline concurrently with a filter down at the WFP, the water production capacity shortfall would be 8,244 m^3/day under the build-out scenario.

Water Treatment

Although the WFP and WOW consistently produce water that meets the drinking water quality standards, the water produced at the WFP has a seasonal earthy taste and odour caused by residual levels of MIB that are above its odour threshold concentration. It also does not meet the Operational Guideline for Aluminium.

Table 9: Raw and Treated Water Supply Capacity vs Projected Water Demands

	FUTURE DEMANDS AT BUILD-OUT (m^3/d)	SUPPLY			TREATMENT		
		Approved (DWWP)	Current Firm	Firm Capacity Shortfall	Approved (DWWP)	Current Firm	Firm Capacity Shortfall
WFP		27,280	26,719		33,042	25,309	
Wells 1 & 2		5,884	2,618				
WOW		6,550	0		6,550	6,550	
Total	33,553	39,714	29,337	4,216	39,592	31,859	1,694

Climate Change Resiliency

There is a risk, because of climate change effects, that if the lake water quality deteriorates concurrently with higher demands for treated water, the WFP may not have sufficient capacity to produce high quality drinking water.

6.5 ALTERNATIVES AND RECOMMENDATIONS

6.5.1 Addressing the Water Supply Capacity Deficit

To address the projected shortfall in the firm supply and treatment capacity to meet the projected water demands, the following alternatives were considered:

1. Build additional groundwater wells to increase the firm raw water supply capacity.
2. Optimize the WFP and/or increase the capacity of the WFP.

Achieving a substantial expansion of the WFP is not a feasible solution because it would require extensive modifications and an expansion of the building. The WFP site does not have capacity for a building expansion. However, the WFP existing treatment processes and operation could be optimized to achieve increases in filtered water capacity, the extent of which could be determined following an optimization study. Process optimization measures only cannot increase the WFP's capacity to bridge the projected shortfall.

Increasing the firm groundwater supply is a more viable solution for many reasons. It would directly address the source of the firm capacity deficit, which is the absence of a stand-by well at the WOW site. Groundwater is a water source that is more consistent, aesthetically pleasing, and less vulnerable to climate change effects, than lake water. Although groundwater is harder and contains more minerals, it is unlikely to require a high level of treatment, based on the quality of the WOW groundwater.

Appropriate municipal well locations are determined based on the groundwater aquifer yields and considering interference with the existing municipal wells and the vulnerability of the aquifer in the capture zones to potential water quality and quantity threats. A detailed hydrogeological investigation and groundwater supply study and a Schedule B Class EA must be conducted to identify the preferred well location(s) and configuration.

In discussion with City staff, it was determined that a new stand-by well, which would normally supply PZ2, could also provide an emergency groundwater supply to PZ1. Therefore, an important criterion in identifying alternative well locations will be the proximity to the PZ1/PZ2 boundary and trunk watermains to facilitate the connection to the water distribution systems in both pressure zones.

On this basis, it is recommended that a detailed hydrogeological and groundwater supply study be conducted. Preliminary recommendations are for the construction of two additional groundwater wells, each with a minimum pumping capable of 38 L/s, to provide a total capacity equivalent to the WOW, thus providing a firm capacity of 6,550 m^3/day (75.8 L/s). Subject to the findings of the hydrogeological investigation, one well should preferably be constructed in the WOW field, while the other should be constructed on municipal land near the boundary of PZ1 and PZ2.

6.5.2 Addressing the Treatment Capacity and Water Quality Concerns

The following studies and measures are recommended based on the assessment of the WFP and other water treatment facilities. Most recommendations involve further studies and monitoring to assess the feasibility of increasing the water treatment capacity, improving the aesthetic quality of the treated water, and increasing the facilities' resiliency to climate change. Only minor capital projects are recommended at this time.

Studies

- Conduct a study to determine if the filters' filtration rate can be increased while still maintaining the effluent turbidity below the minimum requirements. This study should be coordinated with the optimization study of the coagulation and flocculation processes.
- Conduct an optimization study of the coagulation and flocculation processes to identify feasible and cost-effective process improvements that can reduce the residual aluminium concentration, reduce the dissolved organic content, and improve the aesthetic quality of the drinking water.
- Review the feasibility of installing a stand-by flash mixer on the low lift pumps discharge header.

- Conduct a study to review the WFP chlorination dosages for secondary disinfection and the chlorine residuals in the water distribution system and assess the feasibility and benefits of reducing the WFP secondary disinfection chlorine residual target and adding top-up chlorination stations at municipal facilities, to optimize chlorine dosing, achieve more consistent chlorine residuals, and address localized taste and odour concerns.
- Review the filter GAC specifications, depth, and frequency of GAC replacement, to identify opportunities to improve the adsorption of seasonal taste and odour compounds.
- Develop options to address the physical limitations to increasing the frequency of filter backwashes, such as the capacity of the wastewater holding tank.

Climate Change Resiliency Preparedness

To advance developing climate change resiliency, it is recommended the City increase its monitoring of raw water quality and conduct studies as follows:

- Increase monitoring of raw water quality parameters such as microcystin, geosmin and MIB, to identify raw water quality trends related to air and water temperatures. It is also recommended that monitoring of treated water taste and odour compounds (MIB and geosmin) be conducted more frequently to verify performance of the GAC system.
- Review the limiting factors in the capacity of the WFP to produce safe drinking water under conditions of deteriorating raw water quality concurrently with high maximum day demands.
- Review and update the standard operating response in the event of an algae bloom near the WFP intake.
- Review the generator's fuel tank volume to determine if it is sufficient in the event of a main power failure that lats for an extended period such as one week.
- Refine the definition of climate change risk hazards and update the risk assessment with Operations staff as more information becomes available.

Capital Projects

- At the WFP, implement the previously recommended upgrades to the low lift pumps, MCCs and electric heaters.
- Incorporate Wells 1 and 2 into the WFP SCADA system to allow automatic operation during the planned WFP SCADA system review and upgrade.
- Complete structural repairs to the Wells 1 and 2 buildings and the WOW building.
- At the WOW, install spill containment for the chlorine barrels.

7 Water Pumping and Storage

The capacity and condition of the municipal water storage and pumping facilities, and the alternative solutions to address projected capacity shortfalls, are presented in this chapter.

7.1 WATER STORAGE FACILITIES

7.1.1 Description and Condition

The City's water system operates with three treated water storage facilities:

- The clearwells at the WFP provide treated water storage for the high lift pumps to PZ1 and PZ2 of the water distribution system, as well as process water for backwashing the WFP filters, and chlorine contact volume when required.
- In the distribution system, two reservoir facilities provide floating storage:
  - Rosemary Road Reservoirs (East and West), located at 25 Rosemary Road, are two partially buried reservoirs that service PZ1. The two reservoirs are interconnected and can be isolated from each other.
  - Harvie Hill Reservoir, located at 550 Harvie Settlement Road, is an above-ground standpipe that services PZ2 and PZ3.

Rosemary Road Reservoirs

The Rosemary Road Reservoirs were inspected in 2017 by Landmark Municipal Services. The condition assessment reports are attached in Appendix D.

The East Rosemary Road Reservoir was built in 1983 as a cast-in-place cylindrical concrete structure. It is 8.5 m tall and 14.6 m in diameter, and over half of its height is below ground level. The 2017 inspection indicated there was minimal sediment build-up and no leaking cracks, nor was there any efflorescence, spalling or delamination of the concrete. The roof had no active cracks. However, the piping within the reservoir was extremely corroded and needed to be sandblasted/painted or replaced. This repair work remains to be completed.

The West Rosemary Road Reservoir was added in 1996. It is also a cast-in-place cylindrical concrete structure partially built below ground level, 8.2 m tall and 37.8 m in diameter. In 2017, there was minimal sediment build-up, and no active cracks on the outside concrete surfaces. However, the roof had many hairline cracks that could allow water to enter the concrete, freeze and cause spalling and corrosion of the reinforcement steel. Application of a waterproofing membrane was recommended. Some areas of the cementitious coating on the interior surface were delaminated. The exterior roof joint required replacement. The cast iron flanges within the

reservoir were extremely corroded. To date, the City has replaced the exterior roof joint but has not undertaken other repairs.

Harvie Hill Reservoir

The Harvie Hill Reservoir, built in 1968, is a gunite standpipe with a diameter of 24 m and total height of 22.8 m. The exterior of the tank was over-coated with paint in 2007 and re-painted in 2020. During an inspection in 2017 (see Appendix D), the tank interior, re-lined with a cementitious waterproofing coating, was found to be in good condition. There was a small amount of sediment build-up. Delaminating areas were found on the sides of the tank; these are a structural concern as they are susceptible to freezing. In 2011, the City reduced the maximum operating water level in the tank by 2.8 m and continues to operate the reservoir at a reduced level.

WFP Clearwells

The WFP clearwells were constructed in 2006. No structural concerns were identified in the WFP Condition Assessment Report completed in 2017. An interior inspection was completed in 2020 and there were no issues of concern.

7.1.2 Storage Needs

The total and usable storage volume in each reservoir is summarized in Table 10.

Table 10: Existing Treated Water Storage Volume

RESERVOIR	TOTAL STORAGE VOLUME (m^3)	USABLE STORAGE VOLUME (m^3)
WFP Clearwell	3,000	1,500[1]
Rosemary Reservoirs	10,500	10,367
Harvie Hill Reservoir	7,800	1,531[2]
Total	**21,300**	**13,398**

1. Assuming half of the clearwell volume is reserved for chlorine contact time.
2. Based on the reduced operating depth of 3.5 m (from low level alarm to high operating level).

The currently available storage volume is compared to the required storage volume for each development timeline in Table 11. The required water storage volumes were calculated in accordance with the MECP Design Guidelines for Drinking-Water Systems (2008) for the drinking water system as a whole. They include volume for fire protection; for the build-out scenario, this volume was calculated for a flow of 454 L/s for 6 hours.

Table 11: Water Storage Requirements for Each Growth Timeline

DEVELOPMENT TIMELINE	PROJECTED CUMULATIVE TOTAL MDD (m^3/day)	REQUIRED CUMULATIVE TOTAL WATER STORAGE (m^3)	STORAGE CAPACITY SURPLUS OR DEFICIT (m^3)
Existing	16,797	13,078	320
Near Future (2031)	20,952	16,480	-3,082
Future (2045)	28,016	20,125	-6,727
Build-out (post 2050)	33,553	22,736	-9,338

As shown in Table 11, there is sufficient water storage volume in the existing facilities to service the current populations in Orillia. However, a storage deficit of 3,082 m^3 is projected for the anticipated growth in the near future (by 2031). Ultimately an additional storage volume of 9,338 m^3 will be required to support the build-out projections.

The availability of water storage for the anticipated growth at build-out considering each pressure zone individually, is presented in Table 12. This analysis indicates that the storage shortfall is in PZ2 and in PZ3. The calculated storage volumes below do not consider the connectivity of the water distribution system that enables water to move from the higher pressure zones to the lower pressure zones. Stored water at Harvie Hill Reservoir in PZ2 can supplement storage at the Rosemary Reservoirs in PZ1, but not vice-versa. Calculation of storage requirements for the City as a whole is considered sufficiently conservative and the analysis on a local level below was not used to establish the actual required storage volumes.

Table 12: Approximate Water Storage Needs by Pressure Zone at Build-out

PRESSURE ZONE	ASSUMED AVAILABLE RESERVOIRS	AVAILABLE STORAGE VOLUME (m^3)	REQUIRED STORAGE VOLUME AT BUILD-OUT (m^3)	STORAGE CAPACITY SURPLUS (+) OR DEFICIT (-) (m^3)
PZ1	WFP Clearwell + Rosemary Reservoirs	11,117	11,109	8
PZ2	WFP Clearwell + Harvie Hill Reservoir	2,281	12,555	-10,274
PZ3		0	1,778	-1,778

7.1.3 Water Quality

The quality of the water stored in the reservoirs is not monitored by City operators. However, in September 2021, the City operators measured low chlorine residuals, in the order of 0.2 mg/L, at a hydrant adjacent to the connecting piping to the Rosemary reservoirs. Potential causes are stagnant water in the reservoir and low flows in the watermains leading to the reservoir. The City operators flushed the watermains and adjusted the operating band in the reservoir. These measures increased the chlorine residual to 0.7 – 0.8 mg/L. Using the Orillia WaterCAD model, the reduced water level (6.5 m) was confirmed to be adequate to maintain the required water pressures and provide the required water storage volume.

Based on this occurrence, a review of water mixing in the Rosemary reservoirs, through modelling or a tracer study, should be conducted to determine if a mixing system should be added to ensure uniform water quality in the tanks.

7.2 PUMPING FACILITIES

7.2.1 Description and Condition

The Orillia water distribution system operates with three pumping facilities:

- At the WFP, two sets of three high lift pumps pump treated water to the distribution system's PZ1 (Z1 HLPs) and PZ2 (Z2 HLPs). Each pressure zone is supplied by a dedicated set of pumps.
- The WOW's vertical turbine well pump supplies PZ2 with chlorinated groundwater.
- Zone 3 Booster Pumping Station (Z3 BPS) draws from the PZ2 water distribution system to supply the required water pressure to PZ3.

WOW Pumphouse

The WOW is located within a pumphouse built in 2005/2006 in the Champlain Industrial Park. The well is equipped with a vertical turbine well pump rated at 75.8 L/s (6,550 m^3/day). The pumphouse has a connection for the supply of bulk water.

The structural condition of the WOW pump house was assessed in October 2020. Minor structural issues were noted, including some of the exterior untreated plywood at grade that was rotting and loose, efflorescence and spalling on the lower courses of the building's architectural block from water damage, and cracks in the concrete floor.

The City noted that spill containment needs to be added.

Zone 3 BPS

The Z3 BPS was constructed in 2017 and commissioned the year after. The building, disguised as a house, is set in a residential neighbourhood on Emperor Drive. A condition assessment conducted by Tatham in October 2020 found the exterior to be in very good condition with only minor damage to the gate near the road and some scaling of the concrete driveway. There were no observed deficiencies on the main pumping floor, attic or lower level bunker.

7.2.2 Existing Pumping Capacity

The total capacity (all pumps running) and firm capacities (largest pump out of service) of each pumping facility are summarized in Table 13. The 2020 annual average pumped flows are presented for comparison with the available pumping capacities.

Table 13: Existing Pumping Facilities Capacities

		WFP HLPs		WOW	Z3 BPS
		ZONE 1	ZONE 2		
No. of Pumps		3	3	1	4
Pump Capacity (L/s)		115.7	92.6	75.8	2 x 10 2 x 100
Overall Capacity (L/s)		347	278	75.8	220
Firm Capacity	(L/s)	231	185	0	120
	(m^3/day)	19,993	16,001	0	10,368
2020 Avg. Pumped Flows (m^3/day)		5,514	3,560	1,763	193

During the summer of 2021, the Zone 3 BPS could not consistently maintain its discharge pressure setpoint due to water demands that temporarily exceeded the booster pumps' capacity. A peak flow of 14.7 L/s was recorded in July 2021, requiring both booster pumps (10 L/s each) to run to meet the demand. This flow was significantly higher than in previous years. Accordingly, the planned expansion of the BPS by adding and replacing pumps needs to be implemented in the very short term.

The firm booster pumping capacity of each pumping facility was compared with the projected maximum day water demands to be met under each development timeline, to calculate the pumping deficits. As PZ2 is supplied by both the Z2 HLPs and the WOW, 2019 and 2020 pumping data were used to calculate an average split of 60% supply by Z2 HLPs and 40% supply by the

WOW. As shown in Table 14, the high lift pumps at the WFP have adequate capacity to meet the future water demands to the build-out scenario. The WOW needs additional capacity to provide firm pumping capacity. The Zone 3 BPS needs to be expanded in the very short term.

Table 14: Pumping Capacity Requirements for Growth

	FACILITIES CAPACITIES			
	Z1 HLPs (m^3/day)	Z2 HLPs[2] (m^3/day)	WOW[2] (m^3/day)	Z3 BPS[1] (L/s)
Existing				
Required MDD (m^3/day) or PHD (L/s)	7,720	4,984	2,468	14.7
Firm Capacity Surplus or Deficit	12,273	11,017	-2,468	-4.7
Near Future (by 2031)				
Required MDD (m^3/day) or PHD (L/s)	9,637	6,736	3,551	19.3
Firm Capacity Surplus or Deficit	10,356	9,266	-3,551	-9.3
Future (by 2045)				
Required MDD (m^3/day) or PHD (L/s)	12,390	8,151	4,471	48.8
Firm Capacity Surplus or Deficit	7,603	7,850	-4,471	-38.8
Build-out (post-2050)				
Required MDD (m^3/day) or PHD (L/s)	13,489	10,842	6,219	48.8
Firm Capacity Surplus or Deficit	6,504	5,160	-6,219	-38.8

1. Required pumping capacity at Zone 3 BPS is for PHD.
2. Assumes PZ2 is supplied 60% by the Z2 HLPs and 40% by the WOW.

7.3 ISSUES SUMMARY

7.3.1 Storage Facilities

The Orillia water system has sufficient treated water storage volume to meet the needs of the current population. A storage volume deficit of 3,082 m^3 is projected in the near future. The projected storage deficit for the build-out scenario is 9,338 m^3. These storage deficits are calculated to be in PZ2 and in PZ3. However, provision of additional storage in PZ2 would be

available to PZ3 through the Zone 3 BPS, which has the capacity to pump peak hour and fire flows.

The existing water storage tank at Harvie Hill Settlement Road is in poor condition and is operated at a lower water level than required because of concerns with its structural integrity. This lowers the available water pressures and fire protection flows in PZ2.

Low chlorine residuals in proximity to the Rosemary Reservoirs are an indicator of potential stagnant water in the reservoirs.

7.3.2 Pumping Facilities

The high lift pumps at the WFP have adequate capacity to meet the future water demands in PZ1 and PZ2.

The WOW has sufficient capacity to meet the projected water demands in PZ2, in conjunction with the Z2HLPs. However, since the WOW only has one pump, there is no backup capacity if the well is taken offline. The Z2 HLPs at the WFP could make up part of the firm capacity deficit until stand-by wells are established.

The existing pumping capacity at the Zone 3 BPS is insufficient to meet the future water demands due to the projected growth in PZ3. Further, occasional high summer water demands are currently straining the booster pumps capacity, therefore advancing the timeline for the planned expansion of the Zone 3 BPS.

7.4 ALTERNATIVES AND RECOMMENDATIONS

7.4.1 Alternatives to Address the Storage Deficit

A long list of five alternative solutions and multiple sub-options was initially considered to address the projected storage volume deficits in PZ2, as follows:

- Do Nothing.
- Keep the existing Harvie Hill Reservoir and build additional storage at the Harvie Hill site with:
  - Similarly configured standpipes.
  - Elevated standpipes.
  - In-ground reservoir and booster pumping station (BPS).
- Decommission the existing Harvie Hill Reservoir and build additional storage at the Harvie Hill site with:
  - Similarly configured standpipes.

  - Elevated standpipes.
  - In-ground reservoir and BPS.
- Keep the existing Harvie Hill Reservoir and build additional storage at the Harvie Hill site and at a site in PZ3 with:
  - Similarly configured standpipes.
  - Elevated standpipes.
  - In-ground reservoir and BPS.
- Decommission the existing Harvie Hill Reservoir and build additional storage at the Harvie Hill site and at a new site in PZ3 with:
  - Similarly configured standpipes at the Harvie Hill site and an elevated tank in PZ3.
  - Elevated standpipes at Harvie Hill and an elevated tank in PZ3.

These alternative solutions were screened to reduce the list to three alternatives to be assessed in more detail. The screening considered the following factors:

- The Harvie Hill Reservoir is over 50 years old and has a long history of repairs and structural deficiencies. Due to its current condition, it cannot be operated at its full volume. Major repairs and ongoing maintenance are required. Utilizing the existing reservoir is not considered a viable and cost-effective alternative.
- An in-ground reservoir with a BPS at the Harvie Hill site is not hydraulically efficient considering the configuration and operation of the Orillia water distribution system with floating storage. A BPS at the Harvie Hill site would work against the WFP high lift pumps and WOW, causing inefficient use of existing facilities. This sub-option was eliminated.
- There is no available site near the Zone 3 BPS on which to build an in-ground reservoir.
- Elevated tanks are beneficial in that all the water stored is usable and can flow by gravity to meet the required demands and pressures, compared to a standpipe in which the volume of water in the lower portion of the tank cannot be used. However, they are significantly more costly than standpipes. Considering there has not been any issues with the water quality in the existing Harvie Hill standpipe, and that a mixing system is a low-cost measure to keep the entire standpipe content well mixed, the option of an elevated tank at the Harvie Hill site was screened out.

The following three alternative solutions were compared and evaluated:

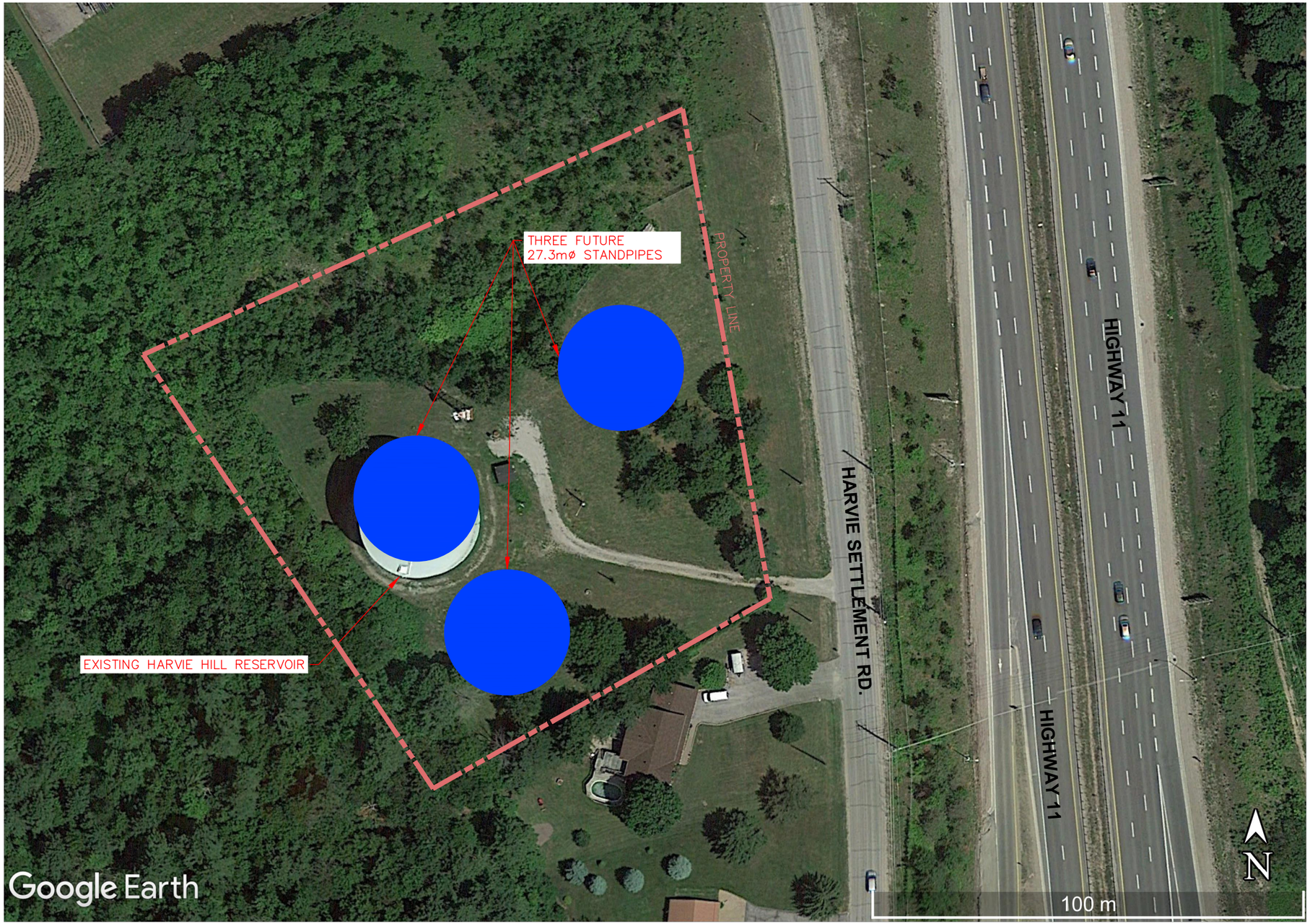
3. Do Nothing.
4. Build new standpipes at the Harvie Hill site and decommission the Harvie Hill Reservoir.
5. Build new standpipes at the Harvie Hill site and an elevated tank at a site in PZ3 and decommission the Harvie Hill Reservoir.

Alternative 2 involves the construction of a glass-fused-to-steel (GFS) standpipe, 18.5 m tall and 27.3 m in diameter (closest standpipe available dimensions for required volume and height). The existing Harvie Hill Reservoir would be taken out of service but kept in place for emergency service. As population and associated water demands increase, up to two additional GFS standpipes of the same dimensions would be built on the existing site and the old reservoir would be demolished. This approach allows the storage volume to be increased in phases, one standpipe per phase, when required. Each selected standpipe would provide an operating volume of 3,683 m^3, and three standpipes would have a total operating volume of 11,049 m^3. Each tank would be equipped with a mixing system to maintain uniform water quality. The standpipes would operate at a hydraulic grade 2.8 m higher than the current level, which would restore the original hydraulic grade line, and thus improve pressures and available fire flow throughout PZ2.

Figure 4 presents a preliminary site plan of the Harvie Hill Reservoir site to show the potential standpipe configuration. This layout of the standpipes on the site will be resolved at the design stage. Table 15 presents the resulting total available storage volumes, by expansion phase.

Table 15: Water Storage Alternative 2 Phasing

	USABLE STORAGE VOLUME (m^3)			
	Existing	Phase 1	Phase 2	Phase 3
WFP Clearwell	1,500	1,500	1,500	1,500
Rosemary Reservoirs	10,367	10,367	10,367	10,367
Harvie Hill Reservoirs	1,531	3,683	7,366	11,049
Total	13,398	15,550	19,233	22,916



TATHAM ENGINEERING

ORILLIA WATER MASTER PLAN UPADATE

ULTIMATE CONFIGURATION OF STORAGE ALTERNATIVE 2

FIG. No. **FIG-4**

DATE: JUN/2022

JOB NO. 120063

Drawing Name: 120063–FIG.dwg, Plotted: Jun 27, 2022

Alternative 3 is similar to Alternative 2 in that up to three additional standpipes would be built in phases and the existing Harvie Hill standpipe would be demolished. However, the new standpipes at the Harvie Hill site would be slightly smaller (18.5 m tall and 26.5 m in diameter, each with an operating volume of 3,457 m^3) because some of the required storage volume would be provided in PZ3. A 37 m tall, elevated tank would be constructed at the Clayt French Park to provide more localized storage in PZ3. Clayt French Park is the only available municipally owned site in PZ3 that would be at the appropriate location and elevation for an elevated tank to provide the required pressures throughout the pressure zone. The operating water level in the elevated tank would be set to match the pressure provided by the Zone 3 BPS. Accordingly, the evaluation of alternative 3 is based on that location.

7.4.2 Assessment of Alternative Storage Solutions

The alternative solutions, including Do Nothing, were assessed on the basis of natural heritage, cultural environment, socio-economic environment and technical criteria. The evaluation matrix is presented in Table 16.

Constructing all the additional required storage on the Harvie Hill Reservoir site (Alternative 2) is preferred over Alternative 3 because the disadvantages of building storage in PZ3 outweigh the benefits.

Alternative 3 would have potential negative visual impacts on residents due to the very tall structure. An elevated tank in the Clayt French Park would also reduce the recreational space. An additional water storage facility would increase the City's operation and maintenance costs, and result in higher total construction costs. The benefit is that a water storage tank in PZ3 would result in less variation in pressures in PZ3 in high water demand situations because of the proximity of water storage to the high water usage.

Alternative 2 is the preferred storage solution. Locating all storage tanks at the Harvie Hill site and operating them at the original hydraulic grade line will result in improved water pressures throughout the water distribution system, with few exceptions. It will increase fire protection in PZ2 and PZ3. The site has sufficient area. Building multiple tanks over time that are like the existing tank, is not expected to result in negative visual impacts, nor further disruption or change to the existing land use. Construction will require removal of landscaping trees only that can be replaced at a different location on site.

Table 16: Preliminary Assessment of Alternative Storage Solutions

EVALUATION CRITERIA	DESCRIPTION OF EVALUATION CRITERIA	ALT. 1 DO NOTHING	ALT. 2 BUILD STANDPIPES AT HARVIE HILL SITE AND DECOMMISSION HARVIE HILL STANDPIPE	ALT. 3 BUILD STANDPIPES AT HARVIE HILL AND ELEVATED TANK IN PZ 3, AND DECOMMISSION HARVIE HILL STANDPIPE
Infrastructure		None	Ultimately, 3 – 18.5 m tall and 27.3 m diameter standpipes.	At Harvie Hill: ultimately 3 – 18.5 m tall and 26.5 m diameter standpipes. At Clayt French Park: 1 - 37 m tall, elevated tank.
Satisfies the Problem Statement	Provides required water storage and pressures?	Does not address the need for additional storage.	Can provide the required storage volume and system pressures.	Can provide the required storage volume and system pressures.
		Negative	Very positive	Very positive
Natural Heritage Criteria				
Terrestrial Vegetation and Wetlands	Impacts significant vegetation features, woodlands and wetlands?	No potential impact on significant vegetation features, woodlands and wetlands.	A small deciduous woodland borders and extends into north of Harvie Hill site. Woodland tree removal would not be required. Some landscape trees would be removed for construction.	A small deciduous woodland borders and extends into north of Harvie Hill site. Woodland tree removal would not be required. Some landscape trees would be removed for construction. No natural vegetation at Clayt French Park.
		No impact	Minor negative	Minor negative
Groundwater Resources	Impacts groundwater aquifers and their uses?	No potential impact on groundwater.	Highly vulnerable aquifer at Harvie Hill site. Above grade and shallow construction would not impact groundwater aquifer.	Highly vulnerable aquifer at Harvie Hill site and near Clayt French Park. Above grade and shallow construction would not impact groundwater.
		No impact	No impact	No impact
Surface Water Resources and Fisheries	Impacts surface water (quality, quantity, or fish habitat)?	No potential impact on surface water bodies.	No surface water bodies near the Harvie Hill site.	No surface water bodies near the Harvie Hill site and Clayt French Park.
		No impact	No impact	No impact
Wildlife and Habitat	Impacts significant, threatened, or endangered wildlife species or habitat?	No potential impact on wildlife species or habitat.	No Species at Risk or provincially rare species were found on the Harvie Hill site.	No Species at Risk or provincially rare species were found on the Harvie Hill site, nor expected at the Clayt French Park.
		No impact	No impact	No impact
Cultural Environmental Criteria				
Archaeological Resources	Affect areas of archaeological potential?	No potential impact on areas of archaeological potential.	Harvie Hill site has archaeological potential, but no archaeological sites or resources found in Stage 2 assessment.	Harvie Hill site has archaeological potential, but no archaeological sites or resources found in Stage 2 assessment. No archaeological resources expected at Clayt French Park, as it is a disturbed area.
		No impact	No impact	No impact
Heritage Resources	Affects heritage structure or landscape significant to community?	No potential impact on heritage resources.	There are no heritage resources on the Harvie Hill site.	There are no heritage resources on the Harvie Hill site or at the Clayt French Park.
		No impact	No impact	No impact
Socio-Economic Environment Criteria				
Land Uses	Affects surrounding land uses?	No potential impact on surrounding land uses.	Public facilities and infrastructure permitted. New standpipes would not affect surrounding land uses.	Public facilities and infrastructure are permitted. New standpipes/elevated tank would not affect surrounding land uses.

Table 16: Preliminary Assessment of Alternative Storage Solutions

EVALUATION CRITERIA	DESCRIPTION OF EVALUATION CRITERIA	ALT. 1 DO NOTHING	ALT. 2 BUILD STANDPIPES AT HARVIE HILL SITE AND DECOMMISSION HARVIE HILL STANDPIPE	ALT. 3 BUILD STANDPIPES AT HARVIE HILL AND ELEVATED TANK IN PZ 3, AND DECOMMISSION HARVIE HILL STANDPIPE
		No impact	No impact	No impact
Community and Recreational Facilities	Affects existing community or recreational facilities?	No potential impact on community or recreational facilities.	The Harvie Hill site is not near any community or recreational facilities.	Harvie Hill site is not near any community or recreational facilities. An elevated tank and access would reduce available recreation space at Clayt French Park. Parking space would be needed for maintenance.
		No impact	No impact	Minor negative
Property Impacts	Impacts adjacent or other properties, visually or access, parking, or property value?	No potential property impacts.	Additional standpipes would have visual impact to adjacent properties and across Highway 11. No impacts to access, parking, or property values of nearby properties.	Additional standpipes would have visual impact to adjacent properties and across Highway 11. No impacts to access, parking, or property values of nearby properties. Elevated tank at Clayt French Park would be highly visible to homes in adjacent and surrounding area.
		No impact	Minor negative	Negative
Existing Water Supply	Increases level of service to customers (more reliably and rapidly, higher pressure, better water quality)?	No improvement to level of service.	Additional storage at set water elevation would maintain pressures and increase fire protection and emergency supply for existing and future customers. Stored water would take longer to reach PZ3.	Additional storage at set water elevation at Harvie Hill site would maintain pressures and increase fire protection and emergency supply for existing and future customers. Elevated tank in PZ3 would bring water more rapidly and reliably to PZ3 in an emergency.
		Negative	Positive	Very Positive
Proposed Development	Provides water servicing to proposed developments?	Does not provide required water storage in support of new developments.	Proposed developments in all pressure zones would benefit from additional water storage at Harvie Hill site.	Proposed developments in all pressure zones would benefit from additional water storage at Harvie Hill site. Elevated tank in PZ3 would bring water more rapidly and reliably to high-growth area in PZ3.
		Negative	Positive	Very positive
Construction	Causes significant disruption or inconvenience during construction?	No construction impacts.	Construction at Harvie Hill site would have temporary impacts and minor disruption on Harvie Settlement Road, which is a dead end.	Construction at Harvie Hill site would have temporary impacts and minor disruption on Harvie Settlement Road, which is a dead end. Construction in Clayt French Park would temporarily restrict pedestrian access to some areas. Construction of connecting watermains would cause minor disruption on Atlantis Dr.
		No impact	Minor negative	Negative
Property Requirements	How much land area is required for the solution?	No land requirements.	No additional land area required to build additional standpipes on Harvie Hill property.	No additional land area required to build additional standpipes on Harvie Hill property. Approx. 500 m^2 in Clayt French Park would be needed for elevated tank site.
		No impact	No impact	Minor negative
Project Costs	Estimated capital and engineering costs.	Repair costs.	Estimated costs of demolishing 1 standpipe and constructing 3 standpipes in one phase: $13.5 M.	Estimated costs of demolishing 1 standpipe and constructing 3 standpipes and 1 elevated tank in one phase: $16.8 M.
		Minor negative	Negative impact	Negative impact
Annual Operating Costs	Estimated annual operating and maintenance costs.	Ongoing maintenance costs.	Lower maintenance costs for new structures.	Lower maintenance costs for new structures. Higher for 2 sites
		Minor negative	Positive	Minor Negative

Table 16: Preliminary Assessment of Alternative Storage Solutions

EVALUATION CRITERIA	DESCRIPTION OF EVALUATION CRITERIA	ALT. 1 DO NOTHING	ALT. 2 BUILD STANDPIPES AT HARVIE HILL SITE AND DECOMMISSION HARVIE HILL STANDPIPE	ALT. 3 BUILD STANDPIPES AT HARVIE HILL AND ELEVATED TANK IN PZ 3, AND DECOMMISSION HARVIE HILL STANDPIPE
Technical Criteria				
Existing Water Distribution System Impacts	Requires modifications to water distribution system?	Original water level and system pressures cannot be reinstated	Minor yard piping modifications required for multiple standpipes.	Minor yard piping modifications required at Harvie Hill site for multiple standpipes. Requires connection to watermain on Atlantis Drive.
		Negative impact	Minor negative	Minor negative
Reliability	Increases reliability of water supply and distribution system?	No improvements to system reliability.	Additional standpipes would increase system reliability by maintaining system pressure and providing gravity supply for fire and emergency.	Adding water storage at Harvie Hill site (PZ2) and in PZ3 would increase system reliability because of proximity of storage to service areas.
		Negative impact	Positive	Very positive
Expandability	Easily expandable to service additional areas?	Additional storage could be added in the future.	Multiple standpipes allow addition of storage in phased manner when needed as service population grows. Existing Harvie Hill reservoir would be demolished once 2 new standpipes are commissioned. Additional standpipes and connecting piping can be added.	Multiple standpipes allow addition of storage in phased manner when needed as service population grows. Existing Harvie Hill reservoir would be demolished once 2 new standpipes are commissioned. Additional standpipes and connecting piping can be added. Space available at Clayt French Park to construct additional elevated tank.
		No impact	Very positive	Positive
Complexity of Operations	Level of operational complexity of mechanical systems.	No change in existing system operation.	Simple hydraulic system to operate. Some added complexity in yard piping.	Simple hydraulic system to operate. Some added complexity in yard piping.
		No impact	Positive	Positive
Maintenance Requirements	Maintenance: painting, equipment replacement, property management.	Increasing maintenance needed on deteriorating tank.	New facilities and equipment with limited O&M requirements, except for regular tank inspection and cleaning, and property management.	New facilities and equipment with limited O&M requirements, except for regular tank inspection and cleaning, and property management.
		Negative impact	Positive	Positive
Ease of Construction	Construction difficulty from site characteristics.	No construction required.	Harvie Hill site area sufficient to construct two new standpipes while maintaining existing standpipe in operation.	Harvie Hill site area sufficient to construct two new standpipes while maintaining existing standpipe in operation. No site and soil constraints anticipated at Clayt French Park for construction of elevated tank.
		No impact	Positive	Positive

Legend

	Description
	Very positive
	Positive
	No impact
	Minor negative
	Negative

7.4.3 Solution to Address the Pumping Deficit

The lack of firm capacity at the WOW will be addressed by establishing stand-by wells with a total pumping capacity equal to the WOW, as described in Section 6.5.1.

To address the pumping capacity deficit in PZ3, it is recommended to expand the Zone 3 BPS, as this facility was designed for a phased expansion. The projected water demands to be met by the Zone 3 BPS are summarized in Table 17.

Considering the range of projected water demands to be met, the Zone 3 BPS expansion should be completed in two phases:

- Phase 1: Add a third booster pump to increase the firm capacity and meet the peak hour water demands projected for the near future developments.
- Phase 2: Replace the two existing booster pumps with larger pumps to meet the projected ultimate peak hour demands.

Table 17: Zone 3 BPS Projected Water Demands

TIMELINE	POPULATION	DESIGN WATER DEMANDS (L/s)		
		ADD	MDD	PHD
Existing (2021)	701	2.2	7.4	14.7
Near Future (by 2031)	1,784	5.4	9.7	19.3
Future (by 2045)	5,506	18.1	32.5	48.8

The two existing high flow pumps do not need to be replaced as they can provide a fire flow of 100 L/s.

The Zone 3 BPS was built with adequate provision for a third booster pump. To eliminate the need for a future replacement of this third pump, it is recommended that in Phase 1, the third booster pump be sized such that it can operate at a flow range that bridges the current water demands to the future water demands. As the ultimate PHD is projected to be just below 50 L/s, ultimately three 25 L/s pumps will be required to provide a firm capacity of 50 L/s. The third booster pump to be installed in Phase 1 should therefore have a minimum capacity of 25 L/s. Table 18 summarizes the recommended future pump capacities.

Table 18: Recommended Zone 3 BPS Pump Capacities

PUMPS	PROPOSED PUMP CAPACITIES (L/s)		
	Existing	Phase 1	Ultimate
Booster Pump #1 (lead)	9.5	9.5	25
Booster Pump #2 (standby)	9.5	9.5	25
Booster Pump #3 (lag)	-	25	25
High Flow Pump #1 (duty)	100	100	100
High Flow Pump #2 (standby)	100	100	100

8 Water Distribution System

The performance of the Orillia water distribution system was assessed under existing and future (build-out) water demand conditions in terms of the operating pressure, available fire flows, configuration, sizing, and resiliency.

The City's updated water distribution system hydraulic model was the primary tool to conduct this assessment, predict performance under various normal and emergency scenarios, and plan enhancements to the system.

The existing water distribution system and existing pipe diameters are shown on Figure 5.

8.1 HYDRAULIC WATER MODEL UPDATE AND CALIBRATION

The hydraulic water model of Orillia's water distribution system uses Bentley's WaterCAD software program. The City provided steady state hydraulic models of Existing, DCP (Near Future) and Future scenarios.

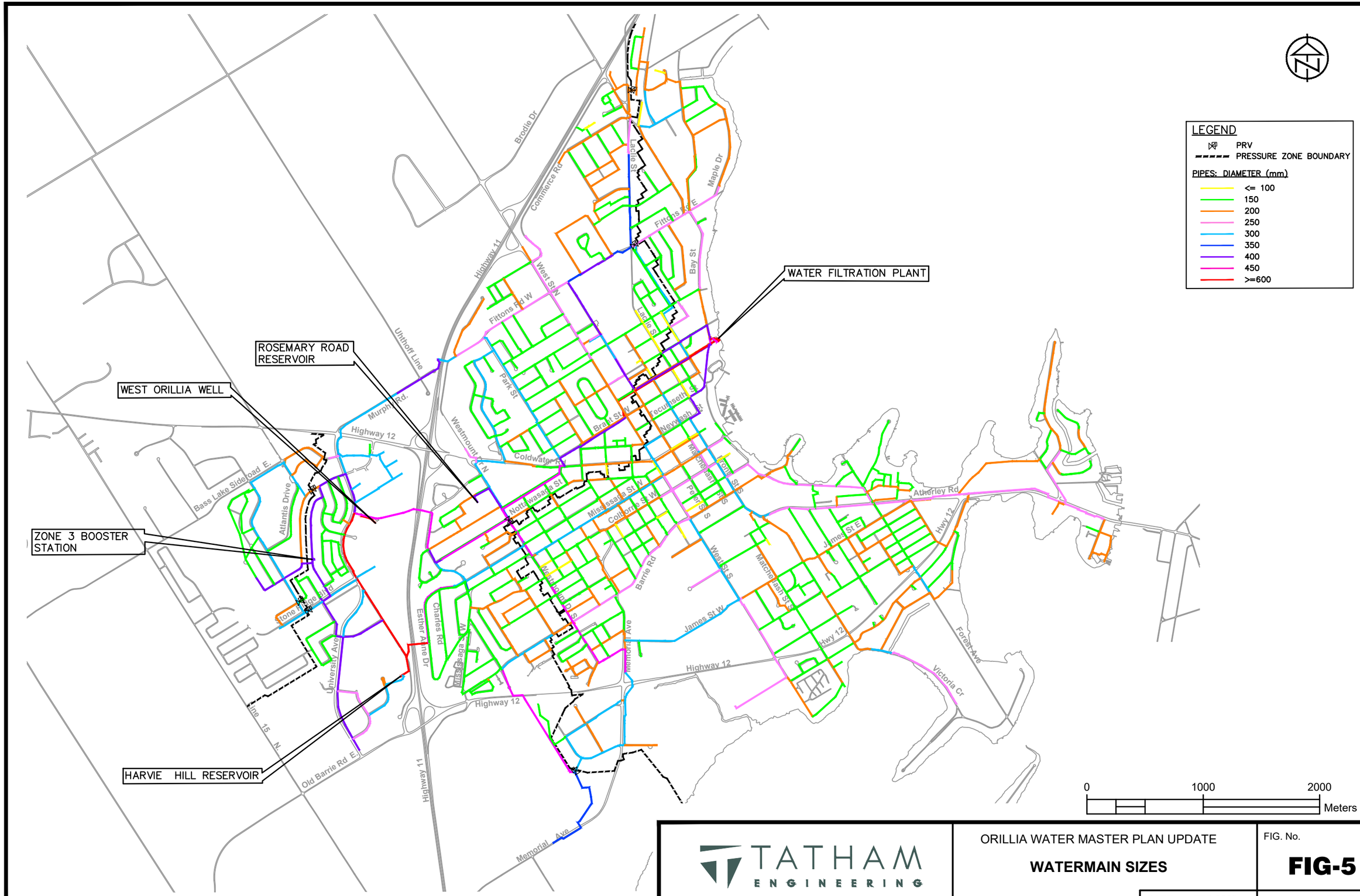
The City's Existing scenario model was updated to 2020 based on population and infrastructure information provided by the City, and water demand criteria in the model were adjusted to the per capita residential water demands and the per hectare ICI water demands listed in Table 4. The updated Existing scenario model was then calibrated, as described below.

Two models of future scenarios were set-up - Near Future (DCP) and Build-out – from the calibrated Existing model. All updated development plans (populations and areas), anticipated to be built in each timeline were added based on detailed information obtained from the City (see detailed tables in the Population and Water Demands Technical Report in Appendix A). The Build-out model includes all the projected population growth beyond the Near Future timeline (post-2031).

The hydraulic water models were set-up for three demand conditions: Average Day Demand, Maximum Day Demand, and Maximum Day Demand plus Fire Flow.

No changes were made to the existing water infrastructure under the future scenarios to analyze the performance of the existing water distribution system and determine where upgrades are required.

Once the recommended upgrades were identified, additional modelling scenarios were set up to simulate the upgraded system and confirm that performance met the City's requirements.



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ORILLIA WATER MASTER PLAN UPDATE

WATERMAIN SIZES

FIG. No. **FIG-5**

DATE: FEB/2022

JOB NO. 120063

Drawing Name: 120063–FIG.dwg, Plotted: Feb 18, 2022

Calibration of the Existing Scenario Model

The City's model of existing conditions was calibrated to improve its accuracy. Hydrant flow tests were conducted at 15 locations throughout the City in September 2020 (see test locations in Appendix E). System pressures during the flow tests were monitored. Concurrent flow and pressure data at the pumping facilities and water level data at the storage facilities were recorded. The hydrant test results, and concurrent system monitoring data were inputted to the model. The model flow parameters were adjusted until the model outputs were within an acceptable range of deviation of the monitored results. Specifically, the calibration was conducted to reduce the difference between the measured and modelled hydraulic grade line at the hydrant test locations.

Under the static test results, the deviation post-calibration was 3.7 m on average. The AWWA Manual M32 (Computer Modeling of Water Distribution Systems) suggests that approximately 3 m of deviation can be used for models used for master planning purposes. The residual pressure test results had a higher deviation because of the steady state model's inability to simulate the flow from a hydrant. The model was calibrated mainly by adjusting the water demands at each node by 17%, which is the 5-year average percentage volume of unaccounted for water.

Improvements to the model calibration could be achieved by conducting a larger number of fire hydrant tests, to achieve a higher coverage of the water distribution system.

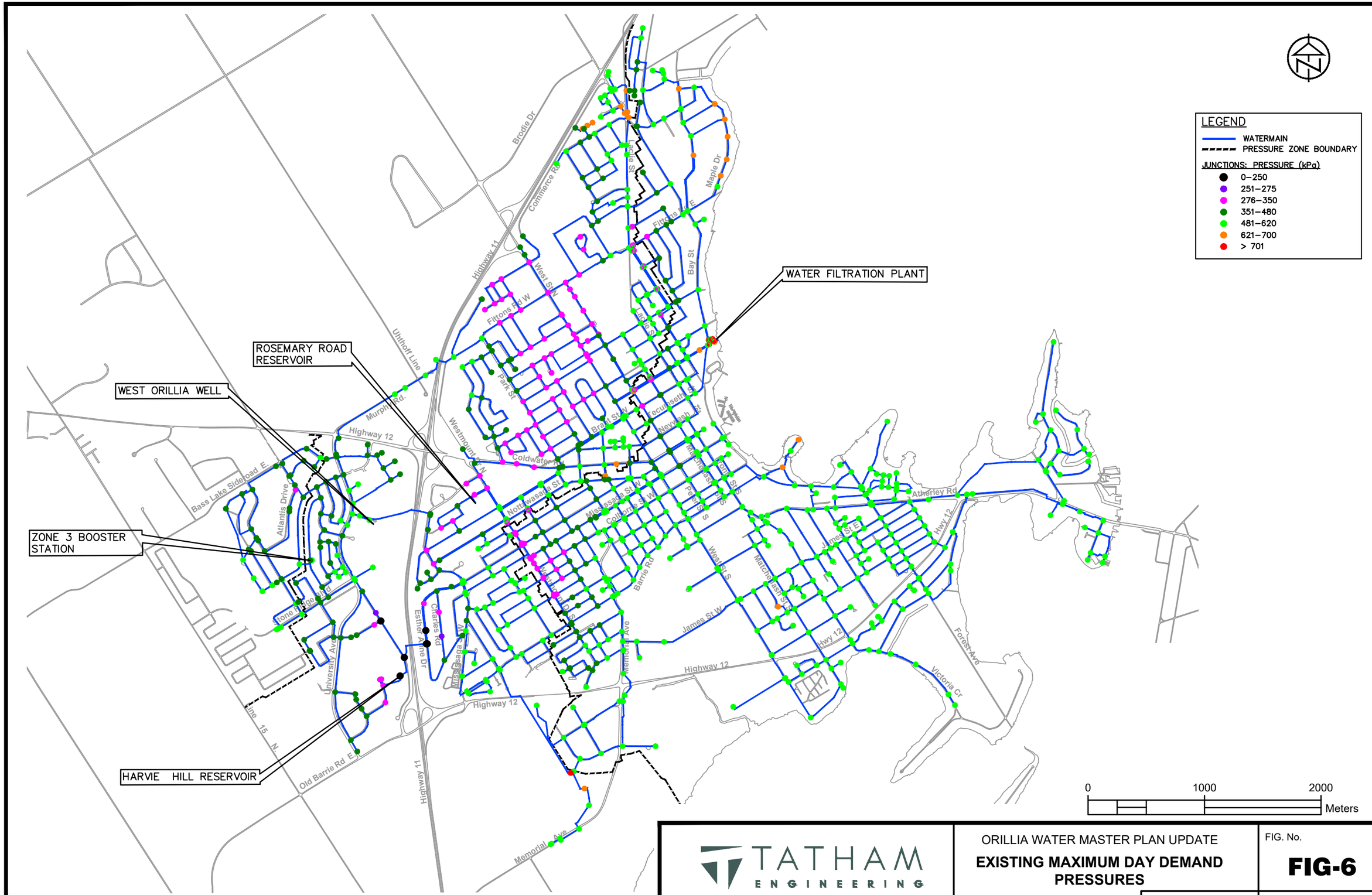
8.2 WATER DISTRIBUTION SYSTEM ANALYSIS

The water distribution system was assessed under two scenarios: Existing and Build-out. The Near Future model was not used because it was determined early on that the Near Future (DCP) scenario was not significantly different from the Existing scenario and did not provide useful information on the need for future system upgrades.

8.2.1 Pressures and Available Fire Flows

The range of operating pressures in the existing water distribution system under existing Average Day (ADD) and Maximum Day (MDD) demands, and the residual pressure and available fire flows under MDD and Fire Flow (FF) are summarized in Table 19.

With the exception noted below, all areas in the water distribution system have pressures that meet the City's standards under the Existing and Build-out scenarios. Water pressures under MDD in Existing Scenario are shown on Figure 6.



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ORILLIA WATER MASTER PLAN UPDATE

EXISTING MAXIMUM DAY DEMAND PRESSURES

FIG. No. **FIG-6**

DATE: FEB/2022

JOB NO. 120063

Drawing Name: 120063–FIG.dwg, Plotted: Feb 18, 2022

Table 19: System Operating Pressures and Available Fire Flows under Existing Scenarios

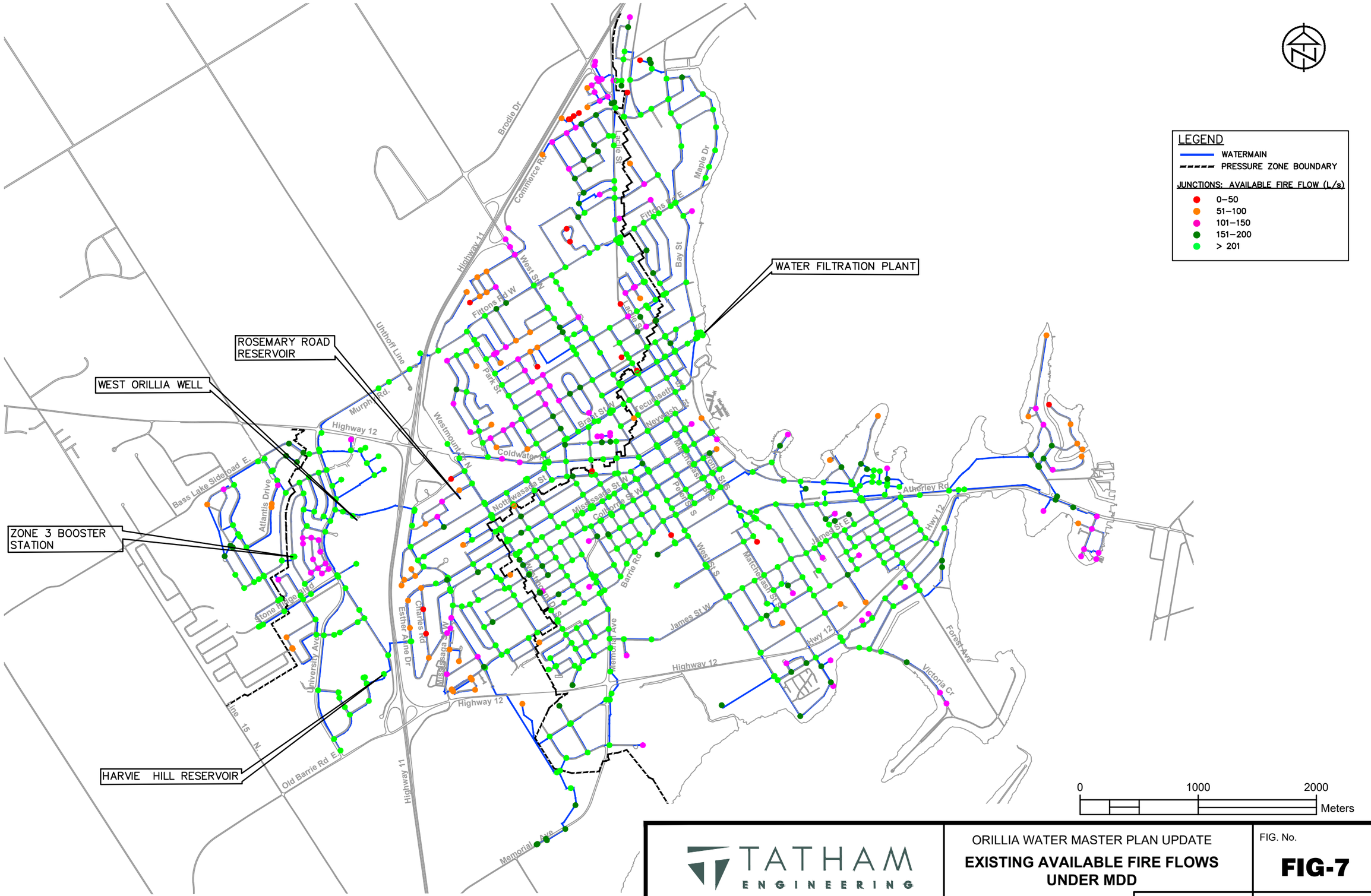
DEMAND CONDITIONS	PRESSURE ZONE	PRESSURES		AVAILABLE FIRE FLOWs (L/s)
		kPa	Psi	
ADD and MDD	PZ1	286 to 672	41 to 97	-
	PZ2	153 to 702	22 to 101	-
	PZ3	343 to 574	50 to 83	-
MDD+FF	PZ1	Minimum residual: 140	20	5 to > 200
	PZ2			1 to > 200
	PZ3			83 to > 200

The model predicts, under both Existing and Build-out MDD scenarios, that pressures are below 275 kPa (40 psi) for areas in PZ2 that are above approximately 280 m in elevation. These areas are near the Harvie Hill Reservoir and Harvie Settlement Road, and in the residential areas of Esther Anne Drive, Charles Road and Karen Crescent. In these areas, pressures under MDD range from 153 kPa (22 psi) at the reservoir to 251 kPa (36 psi) on Harvie Settlement Road and Charles Road.

Water pressures in PZ2 will be improved with the proposed replacement standpipes at the Harvie Hill reservoir site operating 2.8 m higher than the current water level.

Similarly, Table 20 summarizes the range of operating pressures of the existing water distribution system under the build-out future ADD and MDD, and residual pressures and available fire flows under MDD plus fire flows.

Modelled available fire flows under MDD conditions were compared to a minimum fire flow requirement of 100 L/s. As shown in Tables 19 and 20, the model predicted that available fire flows can be low in PZ1 and PZ2 mostly at watermain dead ends and in long loops. Areas of concern are at the north end of Orillia, near the end of Mariposa Drive and Highway 11, and in the residential area of Esther Anne Drive, Charles Road and Karen Crescent. In most of the City's watermains, available fire flows are adequate. The available fire flows under MDD conditions in the Existing scenario are shown on Figure 7.



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ORILLIA WATER MASTER PLAN UPDATE

EXISTING AVAILABLE FIRE FLOWS UNDER MDD

FIG. No. **FIG-7**

DATE: FEB/2022

JOB NO. 120063

Drawing Name: 120063–FIG.dwg, Plotted: Feb 18, 2022

Table 20: System Operating Pressures and Available Fire Flows under Build-out Scenario

DEMAND CONDITIONS	PRESSURE ZONE	PRESSURES		AVAILABLE FIRE FLOW (L/s)
		kPa	Psi	
ADD and MDD	PZ1	282 to 667	41 to 97	-
	PZ2	153 to 698	22 to 101	-
	PZ3	336 to 573	49 to 83	-
MDD+FF	PZ1	Minimum residual 140	20	5 to > 200
	PZ2			1 to > 200
	PZ3			80 to > 200

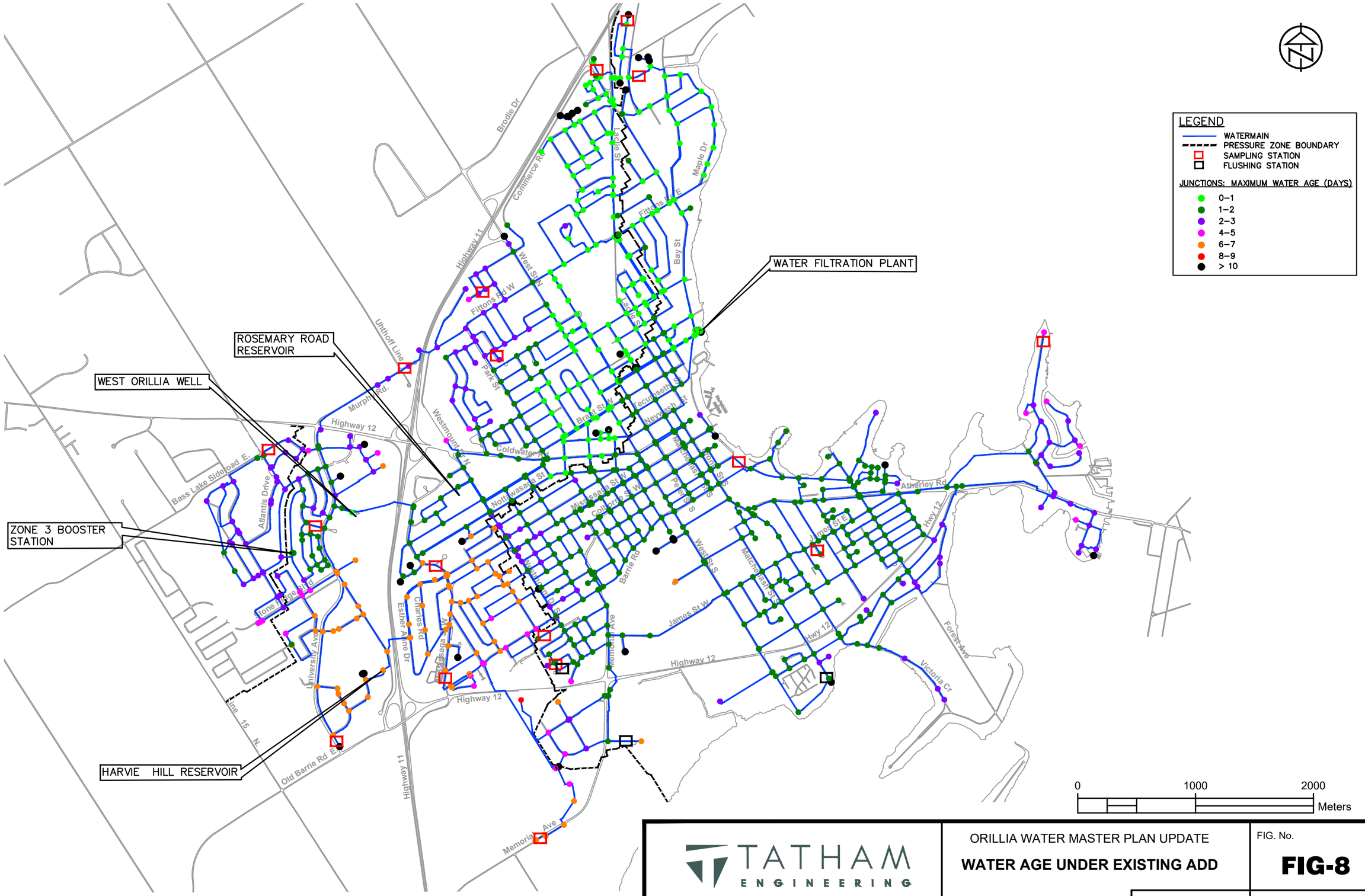
8.2.2 Water Age

The hydraulic model was used to predict water age in the watermains. Water age is a parameter used to assess the potential for water quality deterioration, because chlorine used to disinfect drinking water will decay over time, which allows for the potential of bacterial growth. Water age is typically higher in areas of low water demands.

Water age was analyzed in the Existing model under ADD conditions over a period of 9 days. The model results show that 67% of the water distribution system contains water that is less than 2 days old, as shown on Figure 8. As expected, the model predicted that the water age is highest at dead ends or long stretches of watermain with low demands. Areas where water age is greater than 4 days are at the south of PZ2, including: the newly developed institutional and commercial areas south of Diana Drive; the residential areas bordered by Mary Street, Westmount Drive and Highway 11; and parts of Memorial Avenue serviced by PZ2.

8.2.3 Distribution Water Quality

The City maintains free chlorine residuals in the water distribution system within the range regulated by the MECP and specified in the *Procedure for Disinfection of Drinking Water in Ontario, 2006*, and above the City's critical control point of 0.2 mg/L. Free chlorine measurements from approximately 30 locations, including 16 water sampling stations, scattered throughout the distribution system and three pressure zones between January 2019 to April 2020 were analyzed. The average chlorine residuals s at each location ranged between 0.76 mg/L and 1.71 mg/L.



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ORILLIA WATER MASTER PLAN UPDATE

WATER AGE UNDER EXISTING ADD

FIG. No. **FIG-8**

DATE: FEB/2022

JOB NO. 120063

Drawing Name: 120063–FIG.dwg, Plotted: Feb 18, 2022

The City has numerous flushing stations throughout the system, as shown on Figure 8, that assist in preventing chlorine decay at dead ends and in areas of low water demands. Additional flushing stations do not appear to be required. There are water quality sampling stations where long water age and low chlorine residuals are expected to occur. Data at these stations indicate that chlorine residuals are maintained above the critical point. The City is adding several water quality sampling stations to facilitate the microbiological quality sampling requirements.

The City monitors the concentration of Trihalomethanes (THM) and Haloacetic acids (HAA) in the distribution water. THMs and HAAs are by-products of chlorination and are formed when chlorine reacts with organics over time. Test results from 2017 to 2019 show THM annual running averages levels were 0.03 mg/L to 0.05 mg/L, below the ODWS of 0.1 mg/L. HAAs annual running averages ranged from 0.02 mg/L to 0.04 mg/L, below the ODWS of 0.08 mg/L. Formation of disinfection by-products in the distribution system is not a concern based on the available water quality data.

Low THM concentrations correlate well with the low water age (low residence time) calculated by the hydraulic model. Sampling stations could be added where the model predicts the residence time exceeds 10 days as shown on Figure 8, which are mostly at dead ends such as at Orchard Point. A sampling station should be included in the Harvie Hill reservoir upgrade project.

Lead concentrations in the distribution system are monitored in accordance with O. Reg. 170/03. Test data taken at multiple locations in the distribution system in 2018 and 2019 show that lead levels were very low, averaging 0.00013 mg/L and 0.00001 mg/L respectively, well below the ODWS of 0.01 mg/L.

8.2.4 Redundancy and Resiliency

The hydraulic model was used to assess the resiliency of the existing water distribution system in the event of breaks in trunk watermains and in high-risk areas such as where watermain serve critical customers, to determine if redundancy or resiliency could be improved. With the model, watermain breaks at 15 critical locations were simulated. These locations were selected based on their size, their importance in the distribution of water, and the extent of potential impacts.

Few areas of concern were found because the water distribution system is well looped and interconnected, allowing water to flow through alternate pipes if a main is offline.

A break in one of the two trunk watermains that cross Highway 11, one from the WOW and the other to/from the Harvie Hill reservoir, would have wide ranging but not critical impacts. Reductions in available fire flows are predicted, however not to a critical level. Water pressures would be maintained because of the availability and location of the water reservoirs.

However, two areas in PZ2 were identified where single pipes service large areas. Redundancy or increased connectivity in those areas would improve the system's resiliency. Specifically:

- Only one 350 mm diameter watermain on Laclie Street feeds PZ2 north of Fittons Road E.
- Only one 200 mm diameter watermain on Laclie Street between Sundial Drive and Goldie Drive feeds the northernmost part of PZ2. This area has plans for future residential developments and employment areas.

8.2.5 Undersized Watermains

As shown on Figure 9, there are numerous watermains that are smaller than 150 mm in diameter, which is the minimum watermain size for fire protection as outlined in the MECP Design Guidelines. However, typically these small diameter watermains are located near pipes that are larger than 150 mm in diameter such that they are not essential to convey flows for fire protection.

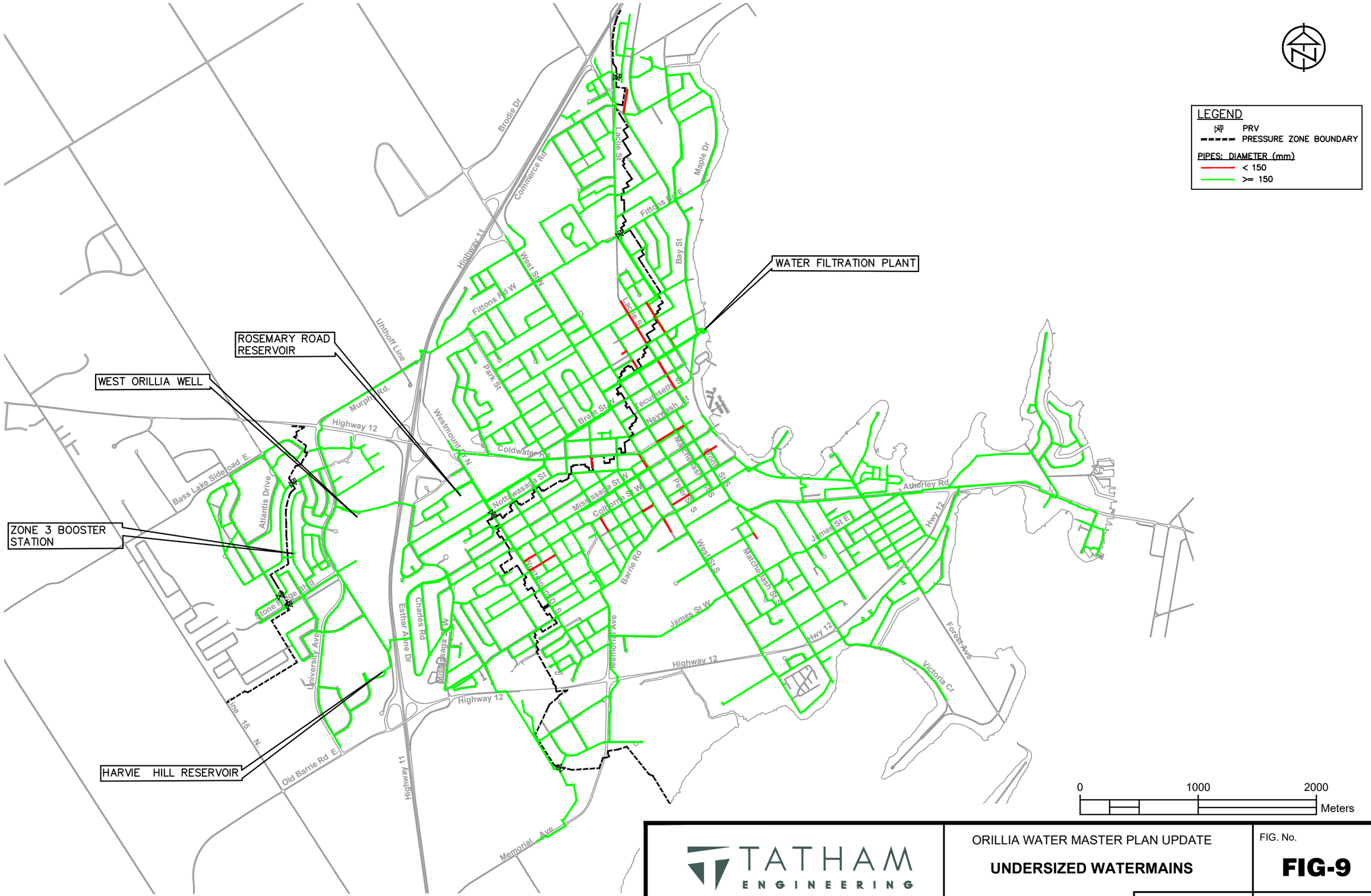
Replacement of these undersized watermains should be undertaken if redevelopment and/or intensification is proposed in the areas they serve, to ensure adequate fire protection and operating pressures.

8.3 WATERMAIN RISK ANALYSIS UPDATE

The watermain risk analysis that was completed for the 2015 WSMP was updated to include additional information and changes to the water distribution system. The watermain risk assessment approach was also revised.

The risk rating of each pipe was calculated as a combination of the probability of failure and the consequences of this failure.

- The probability of failure was quantified within a range of 1 to 10, as a function of the pipe's age relative to its expected useful life (based on pipe material), and to a lesser extent, its history of breaks and repairs. As there isn't a complete historical database of watermain breaks (some pipes are over 100 years old), a weight of only 10% was assigned to the number of breaks.
- The consequence of failure was quantified within a range of 1 to 3. The larger the pipe diameter, the more significant the consequence of a pipe failure. Two other factors were considered important to assess consequences: the presence of critical customers directly served by the watermain (10% weight); and if the watermain is located under a highway or arterial road (10%).



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ORILLIA WATER MASTER PLAN UPDATE

UNDERSIZED WATERMAINS

FIG. No. **FIG-9**

DATE: FEB/2022

JOB NO. 120063

Drawing Name: 120063–FIG.dwg, Plotted: Feb 18, 2022

The watermains' risk ratings were categorized as either Low Risk, Medium Risk, or High Risk. Figure 10 shows the results of the updated risk assessment. The risk assessment spreadsheet is attached in Appendix F.

The risk assessment indicates 13 pipes have the highest risk rating, and over 150 pipes have a medium-high risk rating, as calculated using the criteria defined above. These pipes are the older, large diameter trunk pipes, mostly cast iron or ductile iron pipes, located in downtown Orillia.

This risk assessment does not replace the City's asset management approach for watermains but is a useful tool to develop pipe replacement strategies and prioritization plans.

8.4 LEAK DETECTION PROGRAM

An acoustic leak detection survey was conducted in September 2018 at all fire hydrants in the water distribution system. Eight leaks were found (two at fire hydrants, three at service lines, one at a curb stop, and two at valves on the watermains). Although the small number of leaks is an indicator that the water distribution system is tight, the survey only looked for leak noises at hydrants, and the distribution system has a high percentage of PVC pipes, which do not transmit leak noises well.

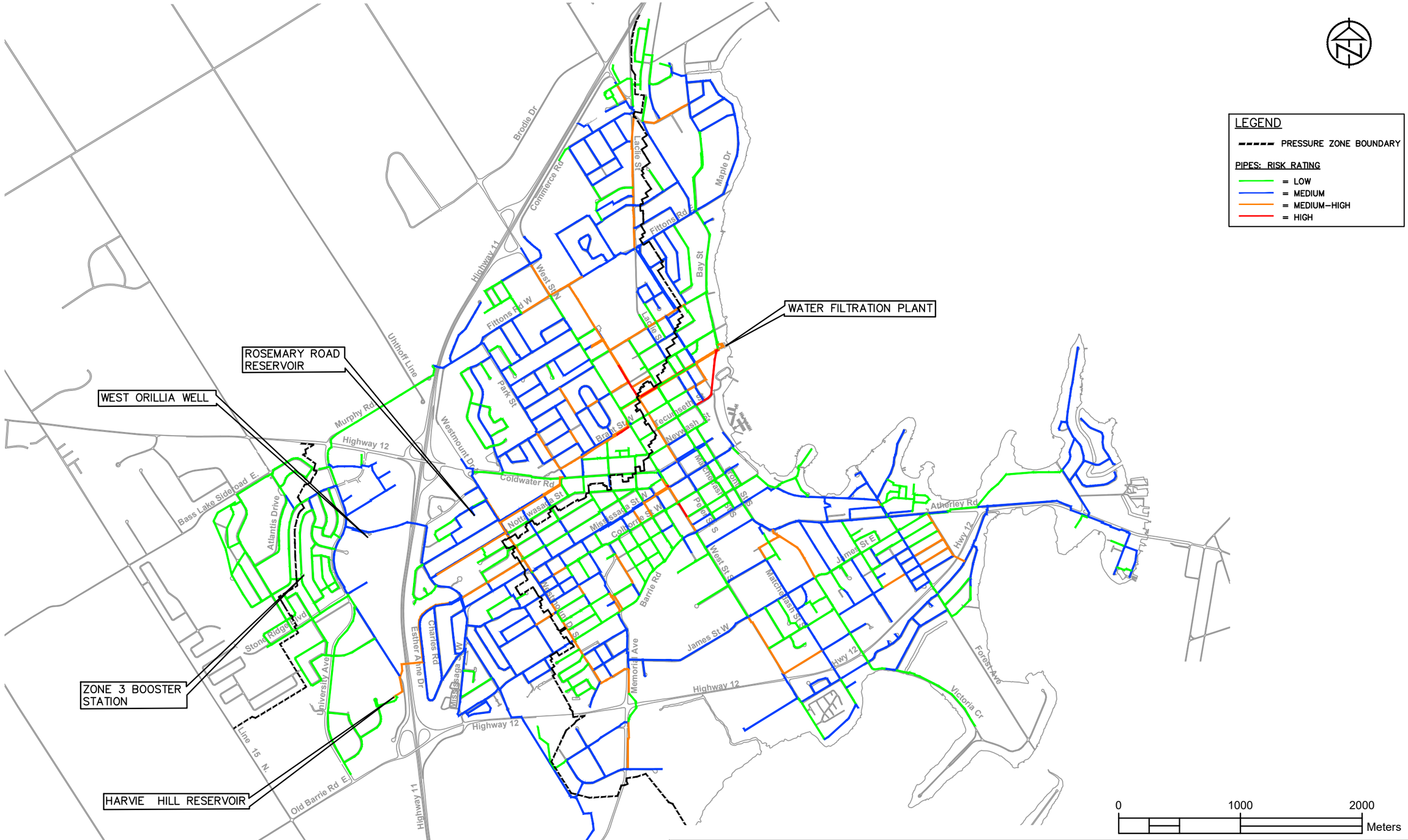
The City plans to conduct a leak detection program every five years. The next program should be expanded to include acoustic surveys at main valves as well as at hydrants to obtain a more comprehensive coverage.

8.5 OPERATIONAL CONCERNS

City staff identified concerns over the operation of the pressure reducing valves (PRV) at the pressure zone boundaries. They noted that some PRVs, such as the one at Laclie Street and Fittons Road E., do not control the pressures as intended; they open frequently, and large amounts of water pass through to the lower pressure zone under normal conditions.

PRVs separate pressure zones under normal operating conditions and allow water in the higher-pressure zone to flow to the lower pressure zone when the pressure on the lower side drops below a specified set point, typically under fire or emergency conditions. Pressure zone boundaries should be separated along the same hydraulic grade line at each PRV.

The pressure settings for each of the seven PRVs were reviewed, and it was determined that they were not set to open at the same hydraulic grade line. The PRVs at the PZ1/PZ2 boundary should be set to open at a hydraulic grade line of approximately 280 m, and the PRVs at the PZ2/PZ3 boundary should be set to open at a hydraulic grade line of approximately 300 m. The existing and recommended PRV settings are summarized in Table 21.



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ORILLIA WATER MASTER PLAN UPADATE

WATERMAIN RISK ANALYSIS

FIG. No. **FIG-10**

DATE: JUN/2022

JOB NO. 120063

Drawing Name: 120063–FIG.dwg, Plotted: Jun 21, 2022

Table 21: Recommended PRV Set Points

PRV LOCATION	ZONE BOUNDARY	EXISTING SET POINT (kPa)	RECOMMENDED SET POINT (kPa)	RECOMMENDED HGL (m)
OPP Headquarters	PZ1/PZ2	262	469	280
Westmount Dr. @ Homewood Ave.	PZ1/PZ2	331	331	281
Laclie St at Fittons Rd. E	PZ1/PZ2	276	276	281
Laclie St at Danny Dr.	PZ1/PZ2	413	345	278
Stone Ridge Blvd	PZ2/PZ3	345	345	299
Isabella Dr.	PZ2/PZ3	386	345	302
Monarch Dr.	PZ2/PZ3	421	345	303

8.6 ISSUES SUMMARY

In summary, the Orillia water distribution system is a well-configured and looped system that can supply water pressures and fire flows that meet City standards and MECP guidelines to most areas, maintain adequate chlorine residuals, and distribute water for the projected developments and growth.

However, some issues, or areas where the system could be improved, were identified based on the modelling results, as summarized below:

- Areas with low water pressures under current conditions. High elevation properties in PZ2 around Harvie Settlement Road, Esther Anne Drive and Charles Road have pressures less than 275 kPa (40 psi) under existing MDD conditions.
- Areas with low available fire flows. Available fire flows are less than 100 L/s at dead end watermains and around Esther Anne Drive, Charles Road, and Karen Crescent.
- Undersized watermains. There are 100 mm diameter watermains throughout the system, mainly in the older, developed parts of PZ1, and on small streets.
- Areas where water is more than 4 days old. This occurs in the southern part of PZ2, including the newly developed area south of Diana Drive; residential areas bordered by Mary Street, Westmount Drive and Highway 11, and the southern portion of Memorial Avenue.
- Higher risk watermains. Many of the trunk watermains have exceeded their expected life. Although there is no indication that they are not in good condition, their eventual failure would impact the distribution of water.

- System resiliency. The area immediately north of Fittons Rd E. and the northern-most part of PZ2 are at high risk in the event of a watermain break because they rely on a single watermain on Laclie Street for the supply of water.
- Pressure control at PRVs. Pressure set points at the PRVs are not consistently set at the correct hydraulic grade line, allowing water to flow to the lower pressure zone when not required to do so.

8.7 RECOMMENDATIONS

Measures to address the issues and improve the operation and performance of the water distribution system were considered and discussed with City staff. The solutions are straightforward and there were not multiple approaches to address the issues.

Recommended upgrades and modifications to the water distribution system are as follows:

- Upsize the watermains on Esther Anne Drive, Charles Road and Karen Crescent from 150 mm diameter to 200 mm diameter. In conjunction with the increase in the hydraulic grade line set by the recommended new Harvie Hill standpipe, this work will improve water pressures and increase the available fire flows in this high elevation area.
- Loop the dead end watermain extending from Goldie Drive and servicing the car dealerships on Commerce Road, with the watermain on Mariposa Drive. The watermains can be connected through the Mariposa Parkette by a 150 mm diameter watermain. This work will increase available fire flows and improve redundancy and resiliency at the northern-most end of PZ2 and improve flows to the growth area on Sundial Drive.
- Extend the 200 mm diameter watermain from the south end of Commerce Road near the Kubota facility to the secondary service of Kubota near Goldie Drive. This will provide an additional route for water to reach the north end of PZ2.
- Twin the 350 mm diameter watermain on Laclie Street from Stanton Drive to Hillside Drive to provide redundancy in the event of a watermain break.
- Adjust the PRV set points to achieve a consistent hydraulic grade line at each pressure zone boundary.

The following upgrades to the water distribution system should be completed when the opportunities arise, such as in conjunction with a road reconstruction project:

- Loop dead end watermains.
- Replace the 100 mm diameter watermains with 150 mm diameter or larger pipes.
- Replace the watermains with a high risk factor.

9 Consultation

9.1 STUDY COMMENCEMENT

The Notice of Study Commencement was mailed, and in some cases e-mailed, on July 10, 2020, to all stakeholders on the initial mailing list. The Notice of Study Commencement and the initial mailing list are attached in Appendix G.

The Notice was also posted on the City of Orillia Weekly Bulletin, which is distributed in the Orillia Today (on-line newspaper) and available to subscribers on July 16 and 23, 2020.

The City created a project-specific webpage, Water Master Plan, on which it posted the Notice of Study Commencement, and can receive comments.

The Notice and the Streamline EA Project Information Form were submitted to the MECP Central Region on August 4, 2021.

Comments received in response to the Notice of Study Commencement are summarized in Table 22. Numerous requests to be added to the mailing list were also received. All correspondence is attached in Appendix G.

Table 22: Summary of Comments Received during Phase 1

DATE	FROM	COMMENT	RESPONSE
July 24, - 2020	Sharday James, Rama First Nation	Interested in hearing more about the project.	Added to mailing list
July 14, 2020	Peter Dorton, Ministry of Transportation	Requested we confirm no works are proposed on, or crossing, or in proximity to provincial highways ROW.	Correspondence during Phase 2 once projects are defined.
August 14, 2020	Rick Evans	Requested clarifications on sources of water for different parts of the City.	E-mail response on August 18, 2020.

9.2 PUBLIC INFORMATION CENTRE

The public, and stakeholders, agencies and interested parties on the updated mailing list were invited to a virtual Public Information Centre (PIC). The Notice of Virtual Public Information Centre was mailed and e-mailed on August 11, 2021. It was also posted on the City's Water Master Plan webpage on August 11, 2021, and on the Weekly Bulletin where it remained for two weeks.

The PIC was a narrated PowerPoint presentation that was posted on the City's Water Master Plan webpage on August 25, 2021. The PIC presentation remained on the webpage for the duration of the study. The PIC presented the objectives of the WMP Update, described the existing water infrastructure and issues, the projected growth and water demands, and the preliminary proposed solutions. Comments were requested by September 24, 2021.

Comments and input received during Phase 2, following the PIC, are summarized in Table 23. All correspondence and responses are attached in Appendix G.

Table 23: Summary of Comments Received during Phase 2

DATE	FROM	COMMENT	RESPONSE
Aug. 11, 2021	Peter Dorton, Ministry of Transportation	Requested clarification on proposed watermains near highways. Recommends that the proposed future watermain on Commerce Dr. be located on the east side to avoid potential conflicts if Highway 11 is ever widened.	E-mail correspondence from Aug. 11 to Sept. 16, 2021
Sept. 22, 2021	Robin Cadeau, City of Orillia Environmental Advisory Committee	The master plan needs to be coordinated and integrated with other municipal planning. It should establish conservation goals and address education re water conservation. It should prioritize rectifying old infrastructure and address the leak detection program. It should address the water's aesthetic quality. It should reference timelines, annual budgeting, and rate setting, and identify priorities.	Response letter on Sept. 28, 2021, addressing comments that were within the scope of the WMP
Sept. 22, 2021	Jane Bonsteel	Questions per capita water demands used in analysis. Planning should be less conservative. Treated water's taste and odour needs to improve; a GAC process review should be completed. A comprehensive coagulation, flocculation and filtration review should be completed. Questions on Wells 1 and 2, unaccounted for water and leak detection. Source Water Protection should be addressed. Drinking water, stormwater and wastewater master planning should be integrated. Questions how Master Plan fits with asset management, capital project planning and financial planning.	Response letter on Sept. 29, 2021

DATE	FROM	COMMENT	RESPONSE
Sept. 24, 2021	Michele Ten Eyck, Wasauksing First Nation	No concerns/comments. Wants to continue to receive information on progress and results. Consider that their protocol requires at least 90 days for review.	Contact added to the mailing list.
Dec. 20, 2021	Chunmei Liu, MECP Central Region	Provides guidance on the areas of interest to the MECP during the EA and duty to consult Aboriginal communities.	

As very limited responses were received from Aboriginal organizations and First Nations following the PIC, Tatham reached out by phone in early October 2021 all the First Nations and Metis Councils on the project mailing list. Voice messages were left, and subsequent emails were sent. No further comments on the project were received.

9.3 NOTICE OF STUDY COMPLETION

The Notice of Study Completion was published in the City's Weekly Bulletin, posted on the Water Master Plan webpage, and mailed and emailed to the updated mailing list, including the MECP Central Region on July 27, 2022.

The notice stated that the Final Draft of the Water Master Plan Update Report was available for review for a 30-day period until September 1, 2022. It presented the list of recommended projects, their Class EA schedules and which project need to have further public notification.

The correspondence received because of the Notice of Study Completion is summarized in Table 24 and included in Appendix G. Comments received were addressed in this Final Report.

9.4 SECTION 16 ORDER

As stated in the Notice of Study Completion, within the 30-day review period, the public can request a higher level of assessment on a specific project if concerned about potential adverse impacts to constitutionally protected Aboriginal and Treaty rights. The Minister of the Environment, Conservation and Parks can also issue a Notice of Proposed Order within 30 days after conclusion of the 30-day public review period.

Table 24: Summary of Comments Received after Notice of Completion

DATE	FROM	COMMENT	RESPONSE
Aug. 2, 2022	Peter Dorton, Ministry of Transportation	No further comments because the Final Draft Report states the alignment of future watermains on Commerce Road will consider the future widening of Highway 11.	None required.
Aug. 26, 2022	Jane Bonsteel	Identified corrections and clarifications to text. Questions related to the City's Water Conservation Plan and to the calculated flocculation time. Suggested adding WFP optimization to reduce dissolved organics, and planning for higher cyanobacteria and by-products that may occur due to climate change.	E-mail response on October 12, 2022. Revisions to report to add clarity and suggestions.
October 19, 2022	Jane Bonsteel	Requested further clarification on flocculation tank configuration and contact time.	E-mail response with explanatory calculations provided on October 20, 2022.

10 Recommended Projects

The projects listed and described in this section are recommended to address the issues that were identified with the drinking water system under existing conditions and when considering the anticipated future growth and water needs.

This chapter summarizes and justifies the recommended projects, presents a recommended implementation plan and timeline, with associated estimated costs. The major recommended projects are shown on Figure 11.

10.1 LISTS OF RECOMMENDED PROJECTS

10.1.1 Recommended Major Capital Projects

The recommended major capital projects are listed in Table 25, with the trigger and approximate timeline, construction cost, and Class EA requirement. A brief description and justification for each project follows.

Project Descriptions

1. Construct one glass-fused to steel standpipe and take out of service the Harvie Hill standpipe (Phase 1 expansion).

   Construction of one glass-fused-to-steel (GFS) standpipe, 18.5 m tall and 27.3 m in diameter, providing an operating volume of 3,700 m^3, and including a mixing system. This is the first phase of the storage volume expansion and addresses the need to replace the existing structurally compromised standpipe that is operating at a reduced water level. The new standpipe will operate at the original water level, which will improve pressures and available fire flows throughout the pressure zone. The project includes construction of a new feed pipe and valve chamber.

2. Construct additional GFS standpipe (Phase 2 expansion).

   Construction of the second GFS standpipe, with the same volume and configuration as, and adjacent to, the Phase 1 standpipe. The addition of a second standpipe will be needed when the City's total maximum day water demands approach 19,000 m^3/day. The project includes demolition of the existing Harvie Hill standpipe.

3. Construct additional GFS standpipe (Phase 3 expansion).

   Construction of the third GFS standpipe, with the same volume and configuration as, and adjacent to, the other standpipes on the Harvie Hill site. The addition of a third standpipe will be needed when the City's total maximum day water demands approach 27,000 m^3/day.

WHEN OPPORTUNITIES ARISE:

- LOOP WATERMAINS IN DEAD ENDS
- REPLACE 100mmø WATERMAINS WITH 150mmø PIPES
- REPLACE AGED WATERMAINS DURING ROAD RECONSTRUCTION PROJECTS
- ADJUST PRESSURE REDUCING VALVE SETTINGS
- INCREASE FREQUENCY OF MAINTENANCE ON CRITICAL VALVES

CONNECT WATERMAINS THROUGH MARIPOSA DR.

CONNECT WATERMAINS THROUGH COMMERCE RD.

TWIN WATERMAINS ON LACLIE ST. AT HILLSIDE DR.

NEW SUPPLY WELL NEAR THE PRESSURE ZONE BOUNDARY THAT SUPPLIES PZ2 WITH A MAINTENANCE BY-PASS LINE TO PZ1

WATER FILTRATION PLANT

TO IMPROVE AESTHETIC QUALITY OF DRINKING WATER AND FILTRATION CAPACITY, CONDUCT:
- WFP OPTIMIZATION STUDIES ON FILTRATION, GAC AND COAGULANT DOSING
- FEASIBILITY STUDY ON RE-CHLORINATION STATIONS

ROSEMARY ROAD RESERVOIR

WEST ORILLIA WELL

ADD STAND-BY SUPPLY WELL IN WEST ORILLIA WELL FIELD

ZONE 3 BOOSTER STATION

EXPAND ZONE 3 BPS

HARVIE HILL RESERVOIR

REPLACE HARVIE HILL STANDPIPES AND ADD SIMILARLY-CONFIGURED STANDPIPES ON SITE AS NEEDED

REPLACE THE WATERMAINS ON CHARLES RD., ESTHER ANNE DR. AND KAREN CRES. WITH LARGER PIPES

LEGEND

- PRV
- PRESSURE ZONE BOUNDARY
- PROPOSED SUPPLY WELL

PIPES: DIAMETER (mm)

- <= 100
- 150
- 200
- 250
- 300
- 350
- 400
- 450
- >=600

0 1000 2000 Meters

TATHAM ENGINEERING

ORILLIA WATER MASTER PLAN UPDATE

SUMMARY OF RECOMMENDED UPGRADES

FIG. No. **FIG-11**

DATE: FEB/2022

JOB NO. 120063

Drawing Name: 120063-FIG.dwg, Plotted: Feb 18, 2022

Table 25: List of Recommended Capital Projects

NO.	PROJECT	TIMELINE OR TRIGGER	ESTIMATED COSTS ($2022)	CLASS EA STATUS
C1	Build 1 glass-fused to steel standpipe (Phase 1)	Short-term (2024)	$5,000,000	Completed
C2	Construct 1 additional GFS standpipe at Harvie Hill site and demolish the existing Harvie Hill standpipe (Phase 2)	When MDD reaches 19,000 m^3/day (2031)	$5,000,000	Completed
C3	Construct 1 additional GFS standpipe at Harvie Hill site (Phase 3)	When MDD reaches 27,000 m^3/day (2045)	$4,700,000	Completed
C4	Expand the Zone 3 BPS by adding 1 pump (Phase 2)	Short-term (2022)	$350,000	Completed
C5	Expand the Zone 3 BPS by replacing 2 pumps (Phase 3)	When PHD reaches 25 L/s (by 2031)	$750,000	Completed
C6	Replace watermains on Esther Ann Dr., Charles Rd., and Karen Cres. with 200 mm pipes	Short term (2023)	$3,700,000	Schedule A+
C7	Add connecting watermain from Goldie Dr. service main to Mariposa Dr.	Developments north of Fittons Rd. (by 2031)	$800,000	Schedule A+
C8	Add connecting watermain on Commerce Rd. from Kubota to Goldie Dr.	Developments north of Fittons Rd. (by 2031)	$1,900,000	Schedule A+
C9	Twin watermain on Laclie St. from Stanton Dr. to Hillside Dr.	With road reconstruction	$1,100,000	Schedule A+
C10	Construct stand-by supply wells at WOW and at PZ1/PZ2 boundary	Medium term (by 2031) or no later than when MDD reaches 29,000 m^3/day	$1,500,000	Schedule B

4. Expand the Zone 3 Booster Pumping Station by adding one booster pump (Phase 2)

   Addition of a third booster pump at the Zone 3 BPS to maintain the required system pressures under high seasonal water demands. This expansion is required in 2022. The project includes the addition of one 11 kW pump and motor with VFD, minor piping and control modifications, and an additional MCC.

5. Expand the Zone 3 BPS by replacing two booster pumps (Phase 3).

   Replacement of booster pumps Nos. 1 and 2 with pumps of the same capacity as booster pump No. 3, equipped with VFDs. No major electrical upgrades are required. This expansion will be needed when the peak water demands in Pressure Zone 3 approach 35 L/s (equivalent to 4,500 persons).

6. Replace watermains on Esther Ann Drive, Charles Road, and Karen Crescent.

   Replacement of approximately 1,700 m of 150 mm diameter watermains with 200 mm diameter PVC watermains. Project is required to improve available fire flows and pressures. The project is currently included in the capital forecast but will require a budget increase.

7. Add connecting watermain from Goldie Drive service to Mariposa Drive.

   Installation of approximately 200 m of 150 mm diameter PVC watermain to loop the dead end watermain extending from Goldie Dr. and servicing the car dealerships on Commerce Rd., with the watermain on Mariposa Dr., through the Mariposa Parkette. This project is required to increase available fire flows and improve redundancy and resiliency at the northern-most end of Pressure Zone 2 and improve flows to the growth area on Sundial Drive.

8. Add connecting watermain on Commerce Road from Kubota to Goldie Drive.

   Installation of approximately 750 m of 200 mm diameter watermain from the south end of Commerce Rd. near the Kubota facility to the secondary service of Kubota near Goldie Dr. This project will improve the water distribution system for the supply of water to the north end of PZ2. The watermain alignment will consider future MTO widening of Highway 11.

9. Twin the watermain on Laclie Street from Stanton Drive to Hillside Drive.

   Installation of approximately 300 m of 350 mm diameter watermain on Laclie St. to twin the watermain from Stanton Dr. to Hillside Dr. This project will provide redundancy in the event of a break in this critical cast iron watermain that was installed in 1959. This project will be included in future road reconstruction plans.

10. Construct stand-by supply wells at WOW and at PZ1/PZ2 boundary with chlorination system and stand-by generator.

    Construction of two or more stand-by groundwater supply wells. The details of this project will follow a hydrogeological water supply investigation and Class EA to establish the supply well locations, capacities, and configuration. Wells constructed outside of the WOW site will require a pump house with chlorination system, stand-by power, and connection to the PZ1 and PZ2 distribution system. The new wells are required to provide stand-by supply capacity of 76 L/s when the WOW is offline for pump or well maintenance/rehabilitation. The availability of a standby well is important for system operation and resiliency. This project is recommended to be implemented by 2030.

Project Triggers and Timelines

The timing of implementation of most projects will be determined based on the rate of population and employment growth and the associated increase in water demands. The suggested timelines for the capital projects in Table 24 are based on the conservative population growth forecasts presented in Chapter 4 and the associated water demands presented in Chapter 5.

Although timeframes are suggested, the implementation of the water projects may be triggered by other factors such as actual development proposals, road reconstruction projects, actual increases in water demands, funding opportunities, changes in condition of the infrastructure, and financial considerations.

Estimated Project Costs

The estimated project costs for the recommended major capital projects are included in Table 25. The project cost estimates are based on preliminary concepts, our database of recent tender prices, and budgetary pricing from suppliers. The cost estimates should be considered as opinions of probable costs in 2022, developed for budgeting purposes and subject to refinement following detailed design. Appropriate inflation factors should be applied to project costs beyond the year 2022. All cost estimates include allowances for contingencies (30%) and engineering (15%).

Municipal Class EA Requirements

The Class EA Schedule B requirements for the expansion of the water storage tanks and the Zone 3 booster pumping station are satisfied by the assessments conducted in this WMP Update.

Watermain replacements and extensions are considered pre-approved under the Class EA process. As Schedule A+ activities, the public is to be advised of the project prior to construction.

The construction of new groundwater wells is a Schedule B activity that will require completion of a Class EA study.

10.1.2 Recommended Minor Capital Projects

Minor capital works were recommended throughout this WMP update. These are listed below; however, they have been previously identified by City staff and incorporated in the 10-year capital forecast.

- Modify programming for the automatic operation of Wells 1 and 2. This involves upgrading the instrumentation and controls at the Wells 1 and 2 pumphouses to control and monitor the well pumps' operation through the WFP's SCADA. This project is required to enable the automatic operation of each or both well pumps and maximize the raw water supply to the WFP.
- Complete the outstanding WFP equipment upgrades recommended in the WFP condition assessment report.
- Complete structural repairs to Well 1, Well 2 and WOW buildings. Only minor repairs are required as the buildings are structurally sound.
- Install chlorine storage containment in the WOW building to prevent chlorine spills.
- Replace 100 mm diameter watermains with 150 mm or larger pipes.
- Loop dead end watermains.
- Add water sampling stations at Orchard Point, Harvie Hill reservoir and other dead ends.

10.1.3 Recommended Studies

Detailed studies that are beyond the scope of a master plan are recommended. These studies will identify the specific measures and capital projects that are required to address the needs and issues outlined in this report. The studies are summarized in Table 26, with suggested budgets.

1. Hydrogeological and Groundwater Supply Study

   Detailed groundwater supply investigation, including the required Source Water Protection assessment, under the municipal Class EA process for Schedule B undertakings, to determine the preferred locations and configurations for stand-by wells for the single WOW. This work will involve the drilling of boreholes and test wells at alternative locations near the PZ1/PZ2 boundary to confirm well yields, groundwater quality and aquifer characteristics, as well as groundwater modelling in support of well head protection area delineation.

Table 26: List of Recommended Studies

NO	PROJECT	ESTIMATED COSTS
S1	Hydrogeological and Groundwater Supply Study and Class EA	$400,000
S2	Coagulation, Flocculation and Filtration and GAC Processes Optimization Study	$250,000
S3	Secondary Chlorination Optimization Study	$100,000
S4	Climate Change Resiliency Detailed Evaluation	$100,000
S5	Water Conservation and Efficiency Plan Update	$50,000
S6	Rosemary Road Reservoirs Water Mixing Study	$100,000

2. Coagulation, Flocculation and Filtration and GAC Processes Optimization Study

   Study to assess and optimize the capacity and performance of the main treatment processes at the WFP. The study objectives listed below could be achieved in separate studies, however because of the interconnection between the processes, a single comprehensive study is recommended.

   - Determine if the filters' filtration rate can be increased while maintaining the required effluent turbidity. This will include filter stress tests and optimization of the filtration and backwash processes and equipment.
   - Identify measures to optimize the coagulation and flocculation processes to reduce residual aluminium levels, dissolved organics, and improve the aesthetic quality of the drinking water.
   - Review the filter GAC specifications, depth, and frequency of replacement, to identify opportunities to improve the adsorption of seasonal taste and odour compounds.
   - Develop options to address the physical limitations to increasing the frequency of filter backwashes, such as the capacity of the wastewater holding tank.
   - Review the feasibility of installing a stand-by flash mixer on the low lift pumps discharge header.

3. Secondary Chlorination Optimization Study

   Review of the WFP chlorination dosages for secondary disinfection and the chlorine residuals in the water distribution system. It includes an assessment of the feasibility and

benefits of installing top-up chlorination stations at municipal facilities in the distribution system to achieve consistent chlorine residuals and address localized taste and odour concerns.

4. Climate Change WFP Resiliency Detailed Evaluation

   Study to identify the WFP unit processes and operation that limit the WFP's capacity to produce safe drinking water under conditions of deteriorating raw water quality concurrently with high water demands and recommend measures to improve the WFP resiliency. It includes a facility review to assess other vulnerabilities under emergency conditions.

5. Water Conservation and Efficiency Plan Update

   Update to the 2014 Plan to bring back to the forefront the previously recommended water conservation measures and update the estimated costs and target implementation schedule.

6. Rosemary Road Reservoirs Water Mixing Study

   Study to assess the need for mixing in the Rosemary Road reservoirs, using tracer study or modelling tool, to reduce chlorine decay and water quality issues.

10.1.4 Operation and Monitoring Recommendations

Upon review of the operation and performance of the water treatment and distribution system and discussions with the City's operation staff, recommendations for additional monitoring and operational activities were identified, as follows:

- Increase monitoring of taste and odour compounds (MIB and geosmin) in WFP-treated water to verify performance of the GAC system and trigger the replacement of the GAC before taste and odour complaints.
- Increase the frequency of GAC media replacement in accordance with the recommendations of the GAC optimization study.
- Increase monitoring of raw lake water quality parameters such as microcystin, geosmin and MIB, to identify raw water quality trends related to air and water temperatures. The data will support planning the WFP climate change resiliency measures.
- Review and update the standard operating response in the event of an algae bloom near the WFP intake.
- Adjust pressure setpoints on four pressure reducing valves to ensure water flow between pressure zones occurs only when needed.

- Establish an annual program to exercise valves on watermains that cross the highways to mitigate negative effects of watermain breaks.
- Expand the scope of the leak detection program conducted every five years to include acoustic surveys at hydrants and main valves.

10.2 CAPITAL BUDGETING

10.2.1 Summary of Capital Costs

The estimated costs of the recommended capital projects are presented in three 10-year timelines (2021 - 2030, 2031 - 2040 and 2041 - 2050) in Table 27.

10.2.2 City's Capital Budget for Water Projects

The project list in the City's 10-year capital budget (2021-2030) was reviewed based on the analysis completed for this WMP update. Comments and recommendations on the water projects that are relevant to the WMP are presented in Table 28. Numerous recommendations of this WMP Update are in the 10-year capital forecast. Some projects are no longer recommended, while the descriptions and assigned budgets of others should be modified to reflect the analysis and recommendations of this WMP update.

Table 27: Recommended Projects and Estimated Costs by Projected Timeline

NO	PROJECT	2022 - 2030	2031- 2040	2041 - 2050
C1	Harvie Hill standpipe (Phase 1)	$5,000,000		
C4	Zone 3 BPS Expansion (Phase 2)	$350,000		
C6	Watermain Replacement on Esther Anne Dr., Charles Rd. & Karen Cres.	$3,700,000		
S1	Hydrogeological and Groundwater Supply Study	$400,000		
S2	Coagulation, Flocculation and Filtration and GAC Optimization Study	$250,000		
S3	Secondary Chlorination Optimization Study	$100,000		
S4	Climate Change Resiliency Detailed Evaluation	$100,000		
S5	Water Conservation and Efficiency Plan Update	$50,000		
S6	Rosemary Road Reservoirs Mixing Study	$100,000		
C10	Standby supply wells		$1,500,000	
C2	Harvie Hill standpipe (Phase 2)		$5,000,000	
C5	Zone 3 BPS Expansion (Phase 3)		$750,000	
C7	Connecting Watermains to Mariposa Dr.		$800,000	
C8	Connecting Watermains on Commerce Dr.		$1,900,000	
C9	Twin Watermains on Laclie St.		$1,100,000	
C3	Harvie Hill standpipe (Phase 3)			$4,700,000
	Total	**$10,050,000**	**$11,050,000**	**$4,700,000**

Table 28: Comments on City's Capital Forecast for Water Projects

REF	CAPITAL FORECAST PROJECT	RECOMMENDATION		
		STATUS	WMP PROJECT	BUDGET
99	WOW Standby Groundwater Well – Investigation, EA and PTTW	Keep	Project S1	Increase to $400,000
100	Harvie Hill Booster Pumping Station	Remove. Not recommended based on water distribution system hydraulics		
101	Replace Watermains on Esther Anne Dr., Karen Cr. and Charles Rd.	Keep	Project C6	Increase to $3,700,000
102	Harvie Hill Standpipe Exterior Repairs	Keep. Conduct repairs as required until replacement of standpipe		Keep at $100,000
105	WFP Comprehensive Performance Evaluation and Testing	Modify as recommended	Project S2	Increase to $200,000
116	WFP Desktop THM and Aluminum Investigation	Modify as recommended	Project S2	Included above
117	Zone 3 Booster Pumping Station – Phase 3 Expansion	Keep	Project C5	Increase to $750,000
118	Harvie Hill Standpipe	Keep	Project C1	Increase to $5,000,000
119	Replace Wells and Pumphouses for Wells #1 and #2	Modify. Conduct building repairs and well rehabilitation as needed.		Reduce to $150,000
120	Victoria Crescent Servicing	Keep		Local improvement project.
121	West Orillia Standby Groundwater Well	Keep	Project C10	Keep at $1,500,000
122	WFP Upgrades	Modify to upgrades recommended in WFP optimization studies		Reduce to $500,000

REF	CAPITAL FORECAST PROJECT	RECOMMENDATION		
		STATUS	WMP PROJECT	BUDGET
229	Expansion of Sentinel Well Monitoring Network	Keep		Increase to $100,000
242	WFP and WWTC Facilities and Equipment Rehabilitation	Keep		Keep annual budget by City
243	WFP and WWTC Control System Rehabilitation	Keep		Keep annual budget by City
244	Collection/Distribution System Rehabilitation Program	Keep		Keep annual budget by City
246	Water Conservation and Efficiency Plan - Rebate Program	Modify to update the 2014 Water Conservation Report	Project S5	Increase to $50,000
247	WFP Chlorine Room and Infrastructure - Phases 1 and 2	Keep		Increase to $2,000,000
248	Reservoirs Cleaning and Inspection	Keep		Keep 5-year budget by City
249	WFP MCC Replacements	Keep		Keep at $625,000
250	GAC Replacement	Modify to increase GAC replacement frequency if recommended during GAC review		Increase to $450,000 for all filters

11 References

The following background documents were reviewed for the development of the WMP Update. Other background materials not listed include drawings of the facilities, historical water flow data, water quality data and water consumption data, and operational data.

- City of Orillia Water System Master Plan, R.V. Anderson Associates Limited, December 2015.
- City of Orillia Official Plan, Consolidation February 9, 2021
- City of Orillia Development Charges Background Study, Hemson Consulting Ltd., December 8, 2017.
- A Place to Grow, Office Consolidation August 2020.
- City of Orillia Memo Development Control Program Update for 2019, November 18, 2020.
- City of Orillia Development Status Map, January 2020.
- City of Orillia Development Status Summary, January 2020.
- City of Orillia Multi-Modal Transportation Master Plan Final Report, Stantec, November 2019.
- City of Orillia Budget Committee Meeting re Initial Presentation, November 16, 2020.
- City of Orillia Engineering Design Criteria, C.C. Tatham & Associates, revised February 2015.
- City of Orillia Water Conservation and Efficiency Plan, 2014.
- City of Orillia Water Financial Plan, Hemson, September 2020.
- Water Filtration Plant Operations Manual, City of Orillia, revised February 2018.
- Zone 3 Booster Pumping Station Process Control Narrative, City of Orillia September 2017.
- 2020 Management Review Raw Water Supply & Drinking Water Quality Trends, City of Orillia, April 2020.
- City of Orillia 2018 Annual Drinking Water System and Summary Report, revised May 2019.
- City of Orillia 2019 Annual Drinking Water System and Summary Report, February 2020.
- City of Orillia Drinking Water System 2016 Summary Report.
- City of Orillia Drinking Water System 2017 Summary Report.
- Drinking-Water Systems Regulation O. Reg. 170/03 Annual Reports for 2015, 2016 and 2017.
- City of Orillia Report to Council Committee on Drinking Water Taste and Odour, June 15, 2021.

- Water System Leak Detection Program, Flowmetrix Technical Services Inc., September 2018.
- City of Orillia Water Filtration Plant Condition Assessment, Ainley Group, October 2017.
- Harvie Hill Reservoir Letter to City of Orillia, R. V. Anderson Associates Limited, January 7, 2010.
- Orillia – Harvie Hill Gunite Standpipe Remote Inspection & Report, Landmark, October 11, 2017.
- Orillia Rosemary Reservoir #1 Clean Inspection & Report, Landmark, October 15, 2017.
- Orillia Rosemary Reservoir #2 Clean Inspection & Report, Landmark, December 1, 2017.
- Drinking Water Works Permit Number 125-201 Issue No. 2 and Schedule C Issue No. 1.
- Municipal Drinking Water Licence Number 125-01 Issue No. 5.
- Permit to Take Water Ground Water No. P-300-5069408381, April 20, 2020.
- Permit to Take Water Surface Water No. 2803-8FEPKK, April 11, 2011.
- Permit to Take Water Application Water Supply Wells 1,2 and West Orillia Well, GHD, November 8, 2019.
- City of Orillia – Source Water Protection, Sentinel Well Construction and Testing, Golder Associates, June 2010.
- North Simcoe Groundwater Study, WHPA – City of Orillia, Appendix E, Golder Associates, May 2005.
- West Orillia Well, Oliver Mangione, McCalla & Associates Limited, November 1997.
- Climate Lens General guidance, Version 1.2, Infrastructure Canada, September 6, 2019.
- AWWA Manual M32, Computer Modeling of Water Distribution Systems.
- Procedure for Disinfection of Drinking Water in Ontario, revised June 4, 2006.

Appendix A: Population and Water Demands Technical Report

TATHAM ENGINEERING

Enhancing our communities

Water Master Plan Update

POPULATION AND WATER DEMANDS TECHNICAL REPORT

City of Orillia

File 120063 | June 23, 2021

Document Control

File:

120063

Date:

June 23, 2021

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Issue	Date	Description
1	September 29, 2020	Draft Report
2	March 19, 2021	Revised Draft
3	June 1, 2021	Final Report

Document Contents

1 Introduction 1

2 Water System Description 2

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1 Introduction

Tatham Engineering Limited (Tatham) has been retained by the City of Orillia (City) to update the 2015 City of Orillia Water System Master Plan (2015 WSMP) to develop a plan for the maintenance, expansion and improvement of the water system to adequately service the City's existing and future customers.

This technical report presents the projected serviced population and associated water demands that will be used to prepare the 2020-2021 Water Master Plan Update (WMP Update). Specifically, it includes the following:

- Updated residential population and employment lands projections to the year 2050 and to build-out.
- Review of historical residential and non-residential water consumption.
- Projected water demands from residential and non-residential users, considering the City's development plans.

2 Water System Description

The Orillia Drinking Water System is comprised of groundwater wells and a surface water supply, a Water Filtration Plant and chlorination systems, two water storage facilities, one booster pumping station, and watermains that distribute drinking water throughout the City of Orillia. The water system is divided into three pressure zones.

The Water Filtration Plant (WFP) is located at 200 Bay Street and treats raw water from Lake Couchiching and from two groundwater wells, Well Nos. 1 and 2. Treated water is stored in an in-ground clearwell. Two sets of high lift pumps at the WFP supply each of Pressure Zone 1 (PZ1) and Pressure Zone 2 (PZ2). Disinfected groundwater from the West Orillia Well (WOW) supplements PZ2. Pressure Zone 3 (PZ3) is supplied from PZ2 with a booster pumping station located on Emperor Drive. Three reservoirs provide floating storage: the two Rosemary Road Reservoirs that support PZ1; and the Harvie Hill Reservoir that supports PZ2 and PZ3. Seven pressure relief valves (PRV) located along the boundaries of PZ1 and PZ2, and PZ2 and PZ3, are used for emergency and high demand conditions.

A plan of the City's water distribution system (Figure 1) can be found at the end of this report.

3 Population and Employment Growth

3.1 RESIDENTIAL POPULATION

From the 2016 census, the total population of the City of Orillia in 2016 was 31,166 (Statistics Canada).

The population of Orillia is projected to grow at an average rate of 656 person per year (ppy), which meets the residential population target of 41,000 by 2031 set in the City's Official Plan and the Growth Plan for the Greater Golden Horseshoe. Other sources that were considered to identify a rate of growth include the 2015 Water Supply Master Plan (R.V. Anderson Associates Limited), the Development Charges Background Study by Hemson Consulting Ltd. (Hemson), and the 2019 Multi-Modal Transportation Master Plan (Stantec Inc.).

Considering only a small portion of the residences in Orillia are not serviced by the City's water distribution system, the total projected population was used as the total serviced population for the WMP Update. Table 1 shows the projected populations up to 2050 assuming a growth rate of 656 ppy.

Table 1: Historical and Projected Populations

YEAR	POPULATION PROJECTIONS
2016 (Census)	31,166
2021	34,444
2031	41,000
2040	46,900
2050	53,456

3.2 DEVELOPMENT AREAS AND DENSITIES

The City's Planning Division provided information on areas that are planned for residential development or redevelopment in the future. These areas were categorized in three development timelines as follows:

- Development Control Plan (DCP) lands are to be built soon and were in the process of application or under construction in 2020.
- Future lands are areas that are anticipated to be developed further into the future.

- Build-out areas are potential development areas up to the City limits as per the Official Plan Schedule A (see Appendix A), some of which may be developed or redeveloped later than within the planning horizon of this Master Plan (2050).

The DCP, Future lands and Build-out areas are shown on Figure 2 (excluding vacant lands). Much of the anticipated residential growth is located west of Highway 11, in the north-west portion of the City. Various small parcels of lands in the established areas of the City are also planned for new development or intensification.

Although the City's Engineering Design Criteria Manual (rev. 2015) specify a residential occupancy of 2.95 persons per unit (ppu), the City's Planning Division suggested that a residential occupancy of 2.2 ppu be utilized based on the preliminary Residential Lands Needs Assessment prepared by Hemson.

The City's Planning Division also specified residential densities of 42 persons per ha, and 22 and 90 residential units per ha for certain lands identified on planning maps, during internal discussions for the 2019 Development Control Plan.

The projected residential populations associated with these developments are summarized in Table 2. A detailed compilation of all the developments and a figure showing the development lands locations are provided in Appendix B. The total projected build-out population exceeds the projected population to the year 2050.

Table 2: Projected Residential Populations and Employment Lands

DEVELOPMENT TIMELINE	PROJECTED POPULATION	PROJECTED ICI LANDS (ha)
Existing (2020)	32,987	196
DCP	4,647	78
Future Lands	12,430	69
Build-out Areas	7,604	90
Total	**57,669**	**432**

3.3 EMPLOYMENT AND ICI AREAS

According to the Development Charges Background Study (Hemson, 2017), employment in Orillia is projected to increase by 1,140 employees by 2026, and another 1,872 by 2031 for an overall 2031 employee population of 20,389.

Existing Industrial, Commercial and Institutional (ICI) lands are estimated to cover approximately 196 ha based on the existing Employment Lands shown on the Official Plan Schedule A.

The City's Planning Division provided information on areas that are planned for ICI development or intensification in the future, and Build-out lands were identified to the City limits as per the Official Plan Schedule A. In total, a total increase in ICI lands of 236 ha above the existing 196 ha is projected, as shown in Table 2. Most of the ICI land growth is expected to be west of Highway 11, mainly surrounding University Avenue or in proximity to Highway 12, as shown on Figure 2.

4 Historical Water Demands

4.1 WATER PRODUCTION AND WATER CONSUMPTION

The amount of treated water that was produced and supplied to the water distribution system for the period of 2010 to 2020 was obtained from monthly average and daily maximum pumping records from the WFP and WOW.

The volume of treated water that was consumed was obtained from the City's residential and non-residential water consumption records from 2015 to 2018, and from the City's water metering data collected at all homes and businesses in 2019 and 2020. As well, bulk water sales from 2015 to 2020 were compiled.

The annual volumes of water produced, water consumed, and water sold in the past five years are summarized in Table 3. Figure 3 presents the historical water production data since 2010 and the water consumption data since 2015. For the analysis, water consumption records were compiled to align with the annual water production records. Water production data, water consumption data, water meter data, and bulk water data as received from the City can be found in Appendix C.

Table 3: Historical Water Production, Consumption and Loss

YEAR	SYSTEM TOTAL PRODUCTION (m^3)	WATER CONSUMPTION (m^3)			UNACCOUNTED FOR WATER (m^3)
		BULK WATER	RESIDENTIAL [1.]	ICI	
2015	4,310,403	10,813	1,965,628	1,385,433	948,529
2016	4,184,544	16,827	2,014,038	1,289,964	863,716
2017	3,876,791	12,608	1,975,185	1,248,223	640,755
2018	4,061,407	17,037	2,056,690	1,349,311	638,369
2019	3,964,830	15,649	1,994,202	1,339,373	615,606
2020	3,970,390	16,508	2,060,965	1,165,779	727,138
5-yr Avg	4,011,592	15,726	2,020,216	1,278,530	697,121

1. 24.66% of ICI water metering data from 2015 to 2020 is for multi residential buildings, therefore it was considered Residential for the WMP Update.

The historical water production and water consumption data indicate that:

- The annual treated water production has not significantly changed in the past 5 years, averaging at 4 million m^3/year. The effect of population increases may have been counteracted by water efficiency measures and changes in industrial water usage.
- On average, residential customers utilized 50% of the water produced, and non-residential customers utilized 32% of the water produced.
- Bulk water sales comprised only 0.4% of the total volume of water produced annually.
- The balance of the water produced is unbilled. Although the 5-year average of unaccounted for water is 17%, the data show a slight declining trend. This significant volume of unaccounted for water is generally attributed to unbilled customers, water usage for watermain flushing and for fire protection, watermain leaks, etc.

The City's water supply and production records for 2016 to 2020 show that:

- Most of the raw water supply is from Lake Simcoe (5-year average of 75%). The remainder is from groundwater: on average, Wells Nos 1 and 2 supplied 4% and the WOW supplied 21% of the water.
- The annual volume of water drawn from the WOW varies from year to year, ranging from 16% to 30% of the total annual supply.

4.2 DAILY WATER DEMANDS

Table 4 presents the historical yearly Average Day Demand (ADD), Maximum Day Demand (MDD) and the calculated Max Day Factor (MDF) using the treated water production data from the WFP and the WOW.

Over the past five years, the WFP supplied an MDD of 16,797 m^3/day, which occurred in the summer of 2018. The WOW supplied an MDD of 5,314 m^3/day, which occurred in the summer of 2018. The MDF ranged from 1.3 to 1.5.

Table 4: Historical Water Demands

YEAR	WATER FILTRATION PLANT		WEST ORILLIA WELL		TOTAL		
	ADD (m^3/day)	MDD (m^3/day)	ADD (m^3/day)	MDD (m^3/day)	ADD (m^3/day)	MDD (m^3/day)	MDF
2015	8,385	12,557	3,425	5,254	11,809	14,492	1.2
2016	9,514	15,748	1,950	4,767	11,465	15,748	1.4
2017	8,553	12,394	2,068	4,589	10,621	14,767	1.4
2018	7,799	13,240	3,329	5,314	11,127	16,797	1.5
2019	8,455	13,316	2,468	3,257	10,922	14,337	1.3
2020	9,374	13,612	1,825	2,561	11,199	15,221	1.4
5-Year AVERAGE	**8,739**	**-**	**2,328**	**-**	**11,067**	**-**	**-**
5-Year MAXIMUM	**-**	**15,748**	**-**	**5,314**	**-**	**16,797**	**1.5**

5 Water Demand Projections

5.1 RESIDENTIAL WATER CONSUMPTION RATE

The historical per capita residential water consumption was calculated from the water billing records and using annual serviced populations estimated using a linear growth rate of 656 ppy. Table 5 shows the calculated per capita water consumption from 2016 to 2020 averaged 232 L/p/day. As this calculation of per capita water consumption used estimated rather than actual serviced population, the resulting value is not a fully accurate determination of the existing residential per capita water use.

Table 5: Calculated Residential Water Consumption Rate from Billing Records

YEAR	ESTIMATED POPULATION [1.]	RESIDENTIAL CONSUMPTION (m^3)	PER CAPITA CONSUMPTION (L/p/day)
2016	31,166	2,014,038	253
2017	31,596	1,975,185	227
2018	32,026	2,056,690	231
2019	32,456	1,994,202	220
2020	32,987	2,060,965	232
5-Year Average			**232**

1. Population estimated from 2016 Census plus an annual growth rate of 656 ppy.

There is a trend of declining per capita water demands because of water conservation measures such as low flow fixtures and increased public awareness. Other municipalities such as Barrie, Bradford and Innisfil, upon review of their recent water consumption data, are planning their water infrastructure using criteria of 225 L/p/day to 250 L/p/day. The Orillia 2015 WSMP was developed using a criterion of 250 L/p/day for new developments.

Considering the historical data in Orillia and in other municipalities, a water demand criterion of 250 L/p/day is recommended for estimating water demands from new developments and for master planning.

A more conservative per capita water demand is sometimes used for existing/older residential areas to account for less efficient water fixtures and larger lots. The Orillia 2015 WSMP used 350 L/p/day for residential areas that were 10 years or older. Innisfil uses 275 L/p/day for existing areas. The City's Engineering Design Criteria Manual specifies a domestic water demand of 300

L/p/day. In our opinion, considering the analysis of the Orillia historical water consumption data, a water consumption criterion for existing developments of 275 L/p/day is sufficiently conservative and should be used for this Master Plan Update.

5.2 NON-RESIDENTIAL WATER CONSUMPTION RATE

To determine the current ICI water consumption rate, the 2019 water consumption volume attributed to ICI customers was divided by the estimated existing ICI area of 196 ha, resulting in an average areal rate of 18,707 L/ha/day.

Water consumption for ICI land uses varies significantly due to the range of water needs. Orillia's Engineering Design Criteria Manual specify an average day flow for commercial/institutional and industrial lands of 28,000 L/ha/day and 36,000 L/ha/day, respectively. Other municipalities such as Innisfil and Bradford utilized rates of 20,000 L/ha/day and 8,000 L/ha/day respectively for their master planning.

Considering the calculated value from the Orillia billing records, it is suggested that the WMP Update utilize an average ICI water consumption of 20,000 L/ha/day.

5.3 WATER USAGE CRITERIA SUMMARY

The criteria that will be used for the WMP Update are summarized in Table 6.

Table 6: Water Consumption Criteria Summary

	CRITERIA
Residential Existing (Average)	275 L/p/day
Residential Development (Average)	250 L/p/day
Non-Residential (ICI) (Average)	20,000 L/ha/day
Maximum Day Factor	1.5

5.4 PROJECTED WATER DEMANDS

Residential and ICI water demands during each of the DCP, Future Lands, and Build-out timelines were calculated utilizing the criteria in Table 6, and the future growth outlined in Table 2 and Figure 2. These calculations can be found in Appendix B and are summarized in Table 7. The projected total MDD at build-out is 33,143 m^3/day.

The projected increases in water demands within each pressure zone are presented in Table 8.

Table 7: Existing and Projected Water Demands

	POPULATION	RESIDENTIAL DEMAND		EMPLOYMENT (ICI) LAND (ha)	ICI DEMAND		TOTAL DEMAND	
		ADD (m^3/day)	MDD (m^3/day)		ADD (m^3/day)	MDD (m^3/day)	ADD (m^3/day)	MDD (m^3/day)
Existing (2020)	32,987	7,144	10,912	196	3,923	5,885	11,067	16,797
DCP	4,647	1,162	1,743	78	1,554	2,331	2,716	4,074
Future	12,430	3,108	4,661	69	1,382	2,073	4,490	6,734
Build-out	7,604	1,901	2,852	90	1,791	2,686	3,692	5,538
Total	**57,669**	**13,314**	**20,168**	**432**	**8,650**	**12,975**	**21,964**	**33,143**

Table 8: Projected Growth and Demands to Build-out by Pressure Zone

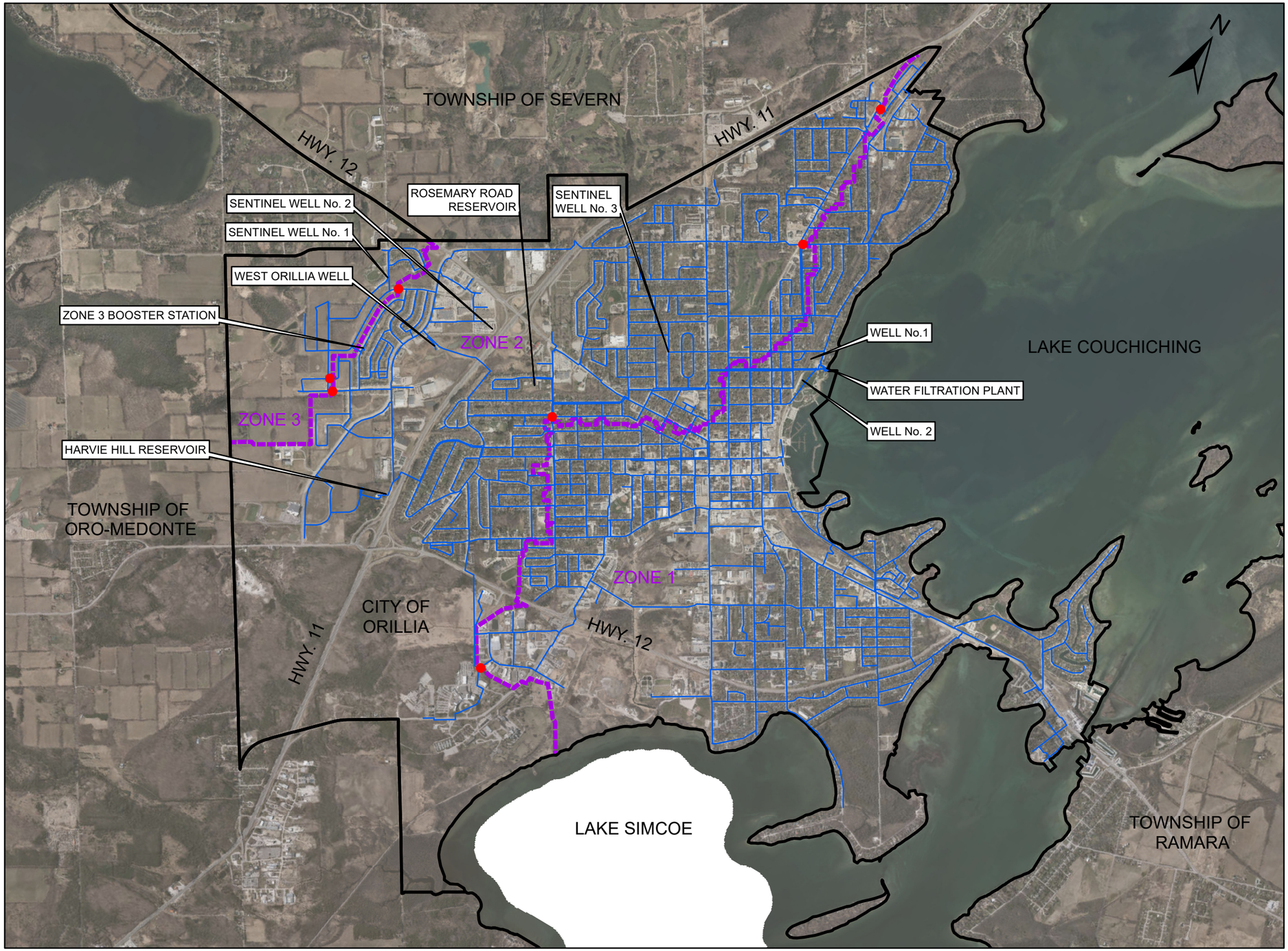
PRESSURE ZONE	GROWTH POP.	RESIDENTIAL DEMAND		GROWTH ICI LANDS (ha)	ICI DEMAND		TOTAL	
		ADD (m^3/day)	MDD (m^3/day)		ADD (m^3/day)	MDD (m^3/day)	ADD (m^3/day)	MDD (m^3/day)
PZ1	8,189	2,047	3,071	72	1,431	2,147	3,478	5,218
PZ2	11,688	2,922	4,383	156	3,128	4,693	6,050	9,076
PZ3	4,805	1,201	1,802	8	167	251	1,368	2,052
Total	**24,682**	**6,170**	**9,256**	**236**	**4,727**	**7,090**	**10,897**	**16,346**

6 Summary

Review and analysis of the historical water production and consumption and of the projected residential and ICI growth to build-out were completed in order to establish the projected water demands for the Orillia Water Master Plan Update.

The results are summarized below:

- The City's anticipated population growth was estimated based on a linear growth rate of 656 ppy.
  - The projected 2031 population is 41,000, in accordance with the Growth Plan.
  - The projected 2050 population is 53,456.
  - The total projected population including all prospective build-out lands is 57,669.
- The existing land area for industrial, commercial and institutional land uses is estimated at 196 ha. ICI lands are projected to increase to 432 ha at build-out.
- Historical water records indicate that the average treated water production in the past 5 years has been 4 million m^3/year or on average, 11,067 m^3/day. The water production has not increased with population growth.
- Based on water billing records, in the past 5 years on average, residential customers utilized 50% of the water produced, and non-residential customers utilized 32% of the water produced.
- Estimated water losses or unaccounted water represent 17% on average of the total water production.
- The 5-year average water consumption rates, based on estimated serviced populations and ICI areas, are 232 L/person/day and 18,700 L/ha/day. For planning purposes, the proposed residential water consumption rates are 250 L/p/day for new developments and 275 L/p/day for existing homes, and the proposed rate for ICI areas is 20,000 L/ha/day.
- Water demands are projected to increase from a 2020 MDD of 16,797 m^3/day to a MDD of 33,143 m^3/day at build-out.



0 0.35 0.7 1.4 2.1 2.8 3.5 Kilometers

LEGEND

- PRESSURE RELIEF VALVE
- EXISTING WATERMAIN
- PRESSURE ZONE BOUNDARY
- CITY LIMITS

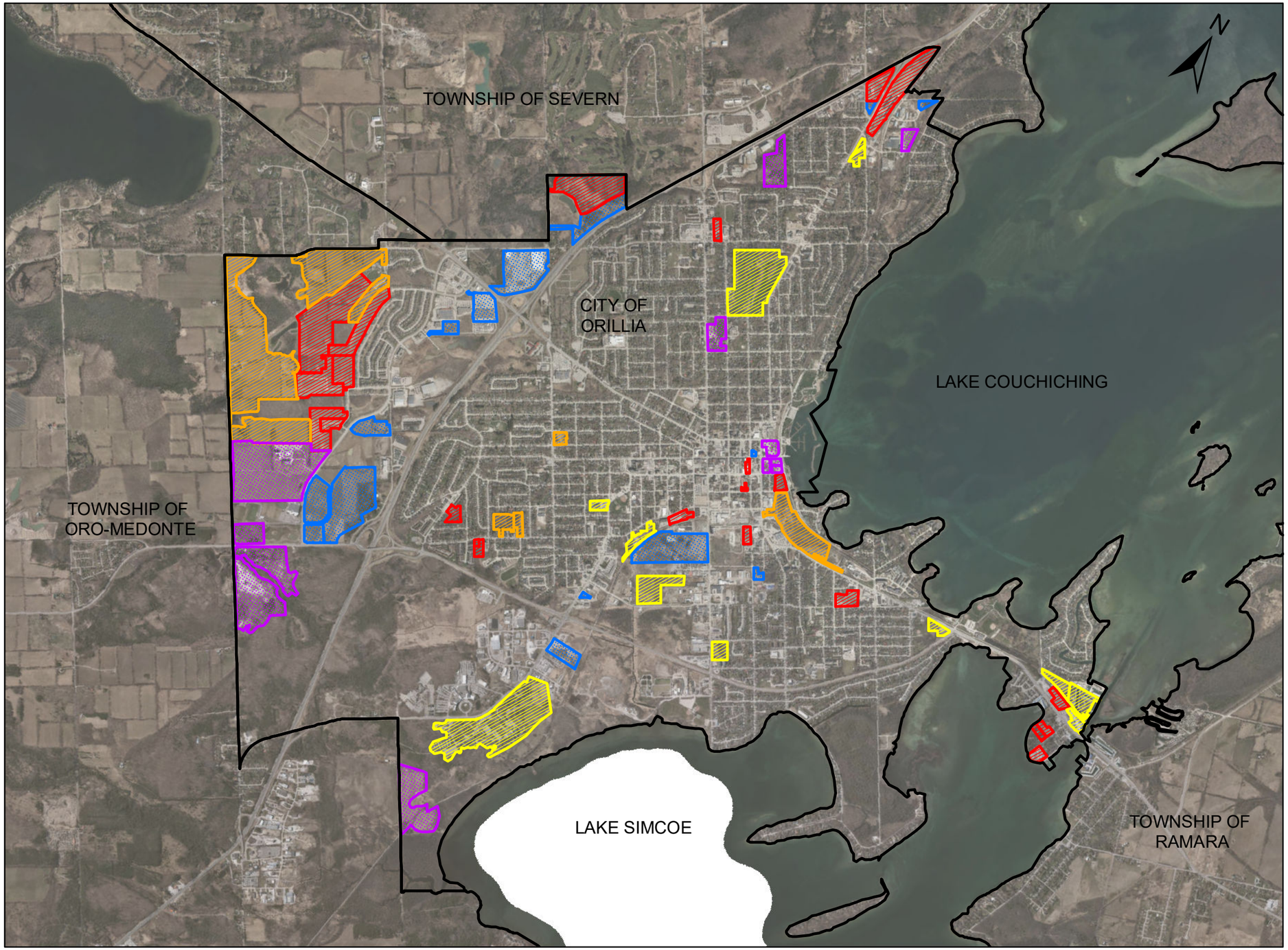
TATHAM ENGINEERING

ORILLIA WATER MASTER PLAN UPDATE

WATER DISTRIBUTION SYSTEM

DWG. No. **FIG 1**

SCALE: 1:35000	DRAWN: SD	DATE: SEPT. 29/20	JOB No. 120063



0 0.35 0.7 1.4 2.1 2.8 3.5 Kilometers

LEGEND

- CITY LIMITS
- RESIDENTIAL (DCP)
- RESIDENTIAL (FUTURE LANDS)
- RESIDENTIAL (BUILD-OUT)
- ICI (DCP)
- ICI (BUILD-OUT)

DEVELOPMENTS IDENTIFIED IN THE LIST OF VACANT LANDS AVAILABLE ON DECEMBER 31, 2019 FROM THE CITY OF ORILLIA ARE NOT SHOWN ON THIS MAP.

TATHAM ENGINEERING

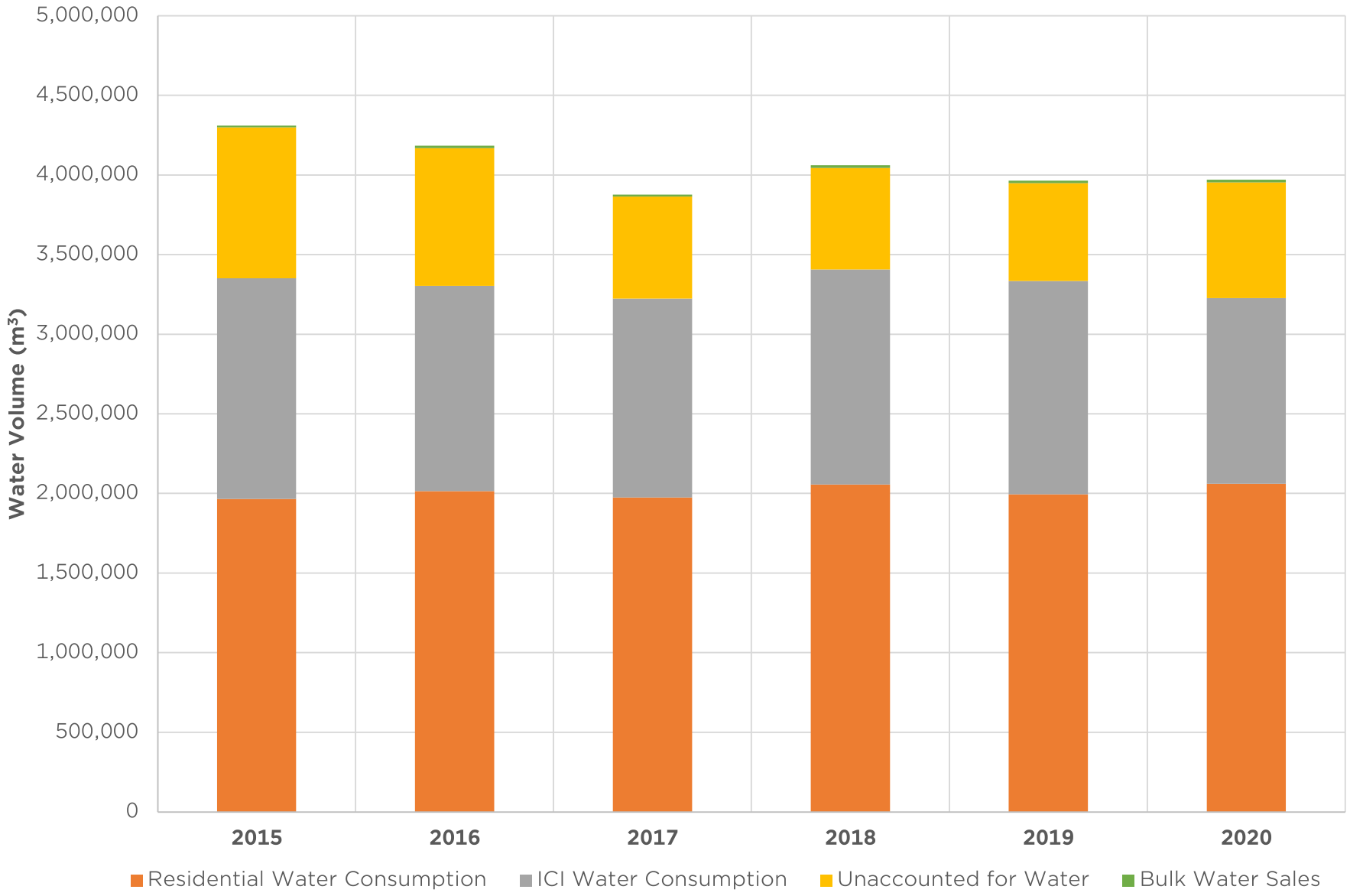
ORILLIA WATER MASTER PLAN UPDATE

DEVELOPMENT AREAS

DWG. No. **FIG 2**

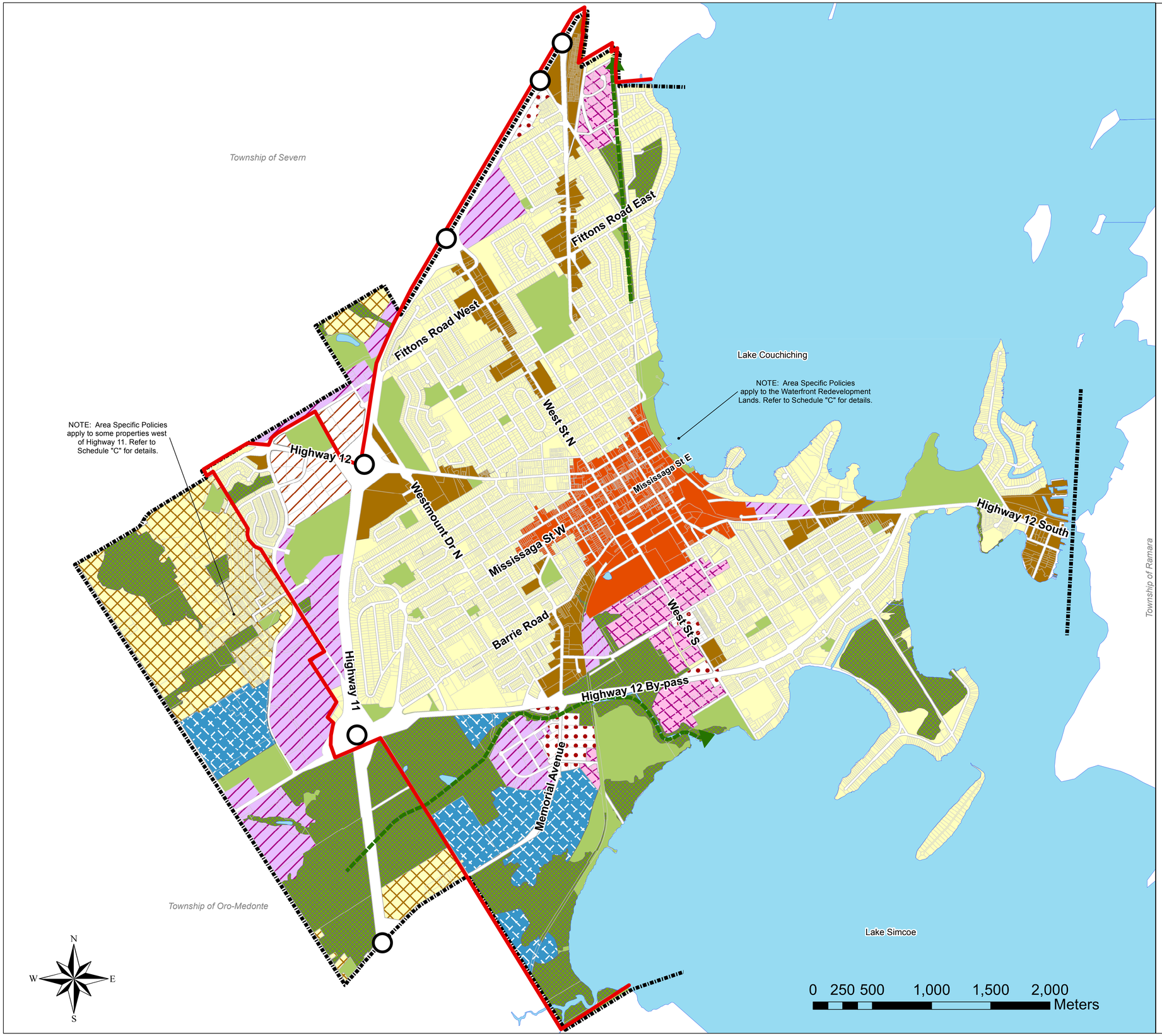
SCALE: 1:35000	DRAWN: SD	DATE: APRIL 26/21	JOB No. 120063

Figure 3: Historical Water Production, Consumption and Losses



Note: Total water production per year is the sum of the consumption, bulk water sales, and unaccounted for water

Appendix A:
Official Plan Schedule A



ORILLIA

City of Orillia Official Plan

Schedule A
Land Use

Downtown Area

- Downtown Area (See Schedule 'B' for designations)

Living Area

- Stable Neighbourhood
- Neighbourhood Greenfield
- Intensification Area

Employment Lands

- Business Park/Industrial
- Light Industrial Services
- Major Institutional
- Community Commercial
- Arterial Commercial

The Environment/Open Space

- Parkland and Major Open Space
- Environmental Protection Area

- Potential Environmental Linkages
- Highway Interchanges

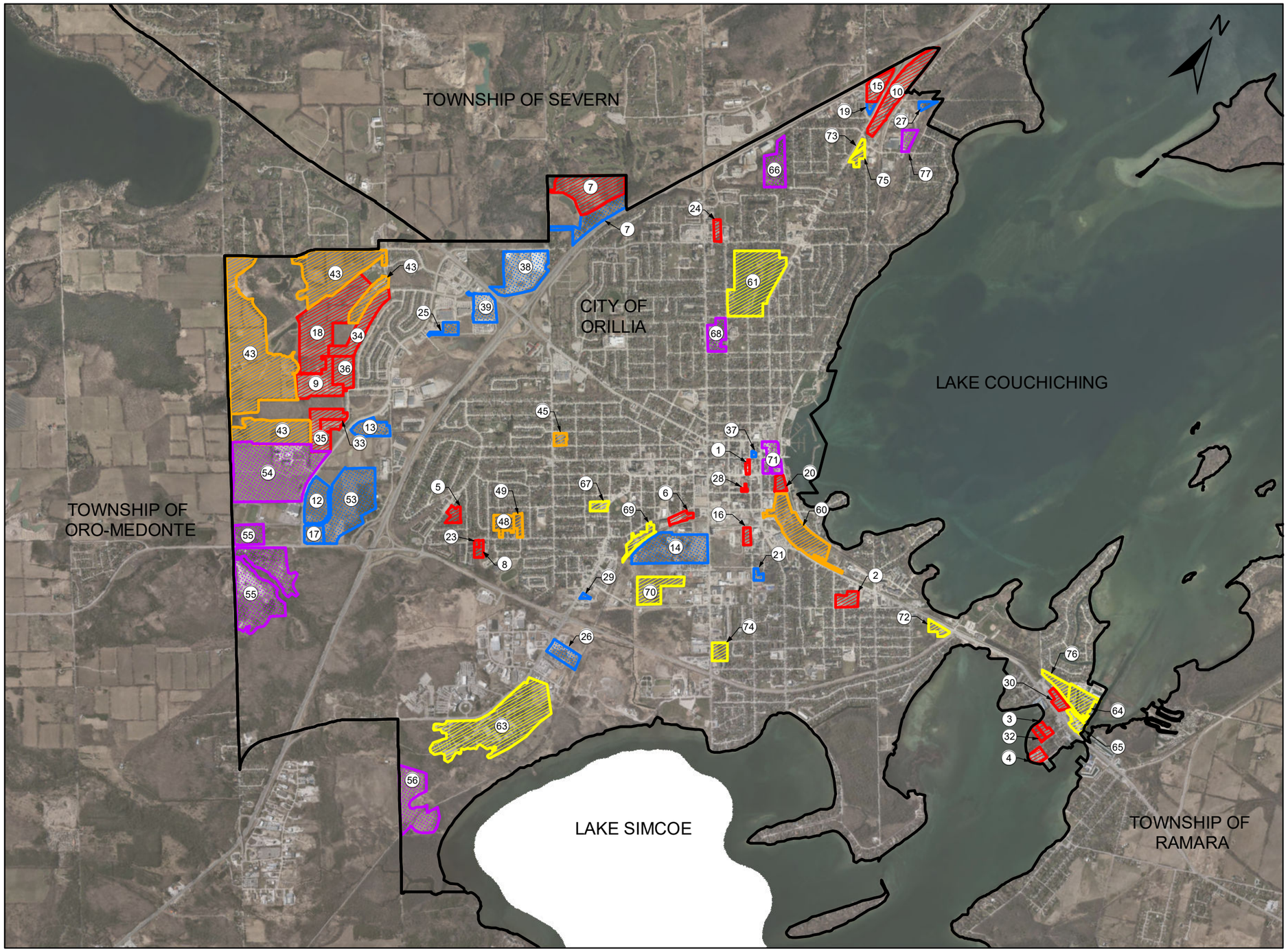
- City Boundary
- Built Boundary

(defined in accordance with Policy 2.2.3.5 of the Growth Plan for the Greater Golden Horseshoe, 2006 issued on April 2, 2008)

Date Approved by Council: March 9, 2010
Date Approved/Modified: March 17, 2011
Date Approved by OMB: August 23, 2013

Consolidation Date: March 4, 2019

Appendix B:
Development Plans



0 0.35 0.7 1.4 2.1 2.8 3.5 Kilometers

LEGEND

- CITY LIMITS
- RESIDENTIAL (DCP)
- RESIDENTIAL (FUTURE LANDS)
- RESIDENTIAL (BUILD-OUT)
- ICI (DCP)
- ICI (BUILD-OUT)
- (1) PARCEL ID

DEVELOPMENTS IDENTIFIED IN THE LIST OF VACANT LANDS AVAILABLE ON DECEMBER 31, 2019 FROM THE CITY OF ORILLIA ARE NOT SHOWN ON THIS MAP.

TATHAM ENGINEERING

ORILLIA WATER MASTER PLAN UPDATE

DEVELOPMENT PLANS MAP

DWG. No. **B-1**

SCALE: 1:35000	DRAWN: SD	DATE: APRIL 26/21	JOB No. 120063

Projected Population and Demands for DCP, Future and Build-out Timelines

The Parcel Identifiers in this table should be read in conjunction with Drawing No. B-1 appended in the Water Demands Technical Report.

Parcel Identifier or Street Address	Type of Development	Pressure Zone	Residential						Estimated Population	ICI Area (ha)				Residential Demand		ICI Demand	
			Unit Types				Density Criteria	Land Area (ha)		IND.	COMM.	INST.	TOTAL	ADD (m^3/day)	MDD (m^3/day)	ADD (m^3/day)	MDD (m^3/day)
			SD	TH	AU	RLU											
1	DCP Mixed Use	1	-	-	73	-			215	-	0.1	-	0.1	54	81	2	3
2	DCP Residential	1	-	65	-	-			192	-	-	-	-	48	72	-	-
3	DCP Residential	1	-	23	-	-			68	-	-	-	-	17	25	-	-
4	DCP Residential	1	-	-	138	-			407	-	-	-	-	102	153	-	-
5	DCP Residential	2	22	-	-	-			65	-	-	-	-	16	24	-	-
6	DCP Residential	1	-	-	148	-			437	-	-	-	-	109	164	-	-
7	DCP Mixed Use	2	169	-	-	-			499	3.9	-	-	3.9	125	187	78	116
8	DCP Residential	2	-	-	65	-			192	-	-	-	-	48	72	-	-
9	DCP Residential	3	-	30	-	-			89	-	-	-	-	22	33	-	-
10	DCP Residential	1	-	58	-	-			171	-	-	-	-	43	64	-	-
12	DCP ICI	2	-	-	-	-			-	6.6	-	-	6.6	-	-	133	199
13	DCP ICI	2	-	-	-	-			-	-	4.5	-	4.5	-	-	90	135
14	DCP ICI	1	-	-	-	-			-	-	-	14.5	14.5	-	-	289	434
15	DCP Residential	2	-	-	-	65			98	-	-	-	-	24	37	-	-
16	DCP Residential	1	-	-	39	31			146	-	1.2	-	1.2	37	55	24	36
17	DCP ICI	2	-	-	-	-			-	-	-	2.0	2.0	-	-	40	60
18	DCP Residential	3	229	-	-	-			676	-	-	-	-	169	253	-	-
19	DCP ICI	2	-	-	-	-			-	-	-	0.5	0.5	-	-	10	15
20	DCP Residential	1	-	60	-	-			177	-	-	-	-	44	66	-	-
21	DCP Residential	1	4	-	-	-			12	-	0.4	-	0.4	3	4	8	12
23	DCP Residential	2	-	-	30	-			89	-	-	-	-	22	33	-	-
24	DCP Residential	2	-	43	-	-			127	-	-	-	-	32	48	-	-
25	DCP ICI	2	-	-	-	-			-	-	1.6	-	1.6	-	-	33	49
26	DCP ICI	1	-	-	-	-			-	-	3.4	-	3.4	-	-	68	102
27	DCP ICI	1	-	-	-	-			-	0.2	-	-	0.2	-	-	5	7
28	DCP Residential	1	-	-	27	-			80	-	-	-	-	20	30	-	-
29	DCP ICI	1	-	-	-	-			-	-	0.3	-	0.3	-	-	5	8
30	DCP Residential	1	-	-	-	-			-	-	-	1.5	1.5	-	-	30	45
32	DCP Residential	2	-	-	21	-			62	-	-	-	-	16	23	-	-
33	DCP Residential	2					42 persons/ha	1.7	74				-	19	28	-	-
34	DCP Residential	3					42 persons/ha	7.6	319				-	80	120	-	-
35	DCP Residential	2					42 persons/ha	6.3	267				-	67	100	-	-
36	DCP Residential	2					42 persons/ha	4.5	189				-	47	71	-	-
37	DCP ICI	1					-	-	-				0.1	-	-	3	4
38	DCP ICI	2					-	-	-				12.8	-	-	257	385
39	DCP ICI	2					-	-	-				4.7	-	-	94	142
43	Future Residential	3	1,459				-	-	3,210	-	-	-	8.4	802	1,204	167	251
45	Future Residential	1					-	1.1	-				-	-	-	-	-
48	Future Residential	2					42 persons/ha	2.4	102				-	26	38	-	-
49	Future Residential	2					42 persons/ha	1.3	54				-	14	20	-	-
53	DCP ICI	2					-	-	-				19.3	-	-	386	579
54	Build-out ICI	2					-	-	-				33.8	-	-	676	1,014
55	Build-out ICI	2					-	-	-				30.8	-	-	617	925
56	Build-out ICI	2					-	-	-				11.0	-	-	220	329
60	Future Mixed Use	1	900				-	-	1,980	-	-	-	0.36	495	743	7	11
61 *	Build-out Residential	2	827				-	-	1,819	-	-	-	-	455	682	-	-
63 *	Build-out Residential	2					42 persons/ha	80.0	3,360	-	-	-	-	840	1,260	-	-
64	Build-out Residential	1					42 persons/ha	5.0	210	-	-	-	-	53	79	-	-
65	Build-out Residential	1					42 persons/ha	1.5	63	-	-	-	-	16	24	-	-
66	Build-out ICI	2					-	-	-	-	-	-	5.4	-	-	108	162
67	Build-out Residential	2					42 persons/ha	1.0	42	-	-	-	-	11	16	-	-
68 *	Build-out Mixed Use	1	180				-	-	396	-	-	-	0.13	99	149	3	4
69	Build-out Residential	1					42 persons/ha	1.7	72	-	-	-	-	18	27	-	-
70	Build-out ICI	1					-	-	-	-	-	-	6.4	-	-	128	192
71 *	Build-out Mixed Use	1	614				-	-	1,351	-	-	-	0.27	338	507	5	8
72	Build-out Residential	1					42 persons/ha	1.3	55	-	-	-	-	14	21	-	-

Projected Population and Demands for DCP, Future and Build-out Timelines

The Parcel Identifiers in this table should be read in conjunction with Drawing No. B-1 appended in the Water Demands Technical Report.

Parcel Identifier or Street Address	Type of Development	Pressure Zone	Residential						Estimated Population	ICI Area (ha)				Residential Demand		ICI Demand	
			Unit Types				Density Criteria	Land Area (ha)		IND.	COMM.	INST.	TOTAL	ADD (m^3/day)	MDD (m^3/day)	ADD (m^3/day)	MDD (m^3/day)
			SD	TH	AU	RLU											
73	Build-out Residential	1					42 persons/ha	0.5	21	-	-	-	-	5	8	-	-
74 *	Build-out Residential	2					42 persons/ha	2.0	84	-	-	-	-	21	32	-	-
75	Build-out Residential	2					42 persons/ha	1.1	47	-	-	-	-	12	18	-	-
76	Build-out Residential	1					42 persons/ha	2.0	84	-	-	-	-	21	32	-	-
77	Build-out ICI	1					-	-	-	-	-	-	1.7	-	-	34	51
654 ATHERLEY RD	Future ICI	1					-	-	-	-	-	-	0.1	-	-	3	4
481 LACLIE ST	Future ICI	2					-	-	-	-	-	-	0.1	-	-	3	4
100 FITTONS RD W	Future ICI	2					-	-	-	-	-	-	0.4	-	-	9	13
375 ATHERLEY RD	Future ICI	1					-	-	-	-	-	-	1.3	-	-	26	40
359 ATHERLEY RD	Future ICI	1					-	-	-	-	-	-	0.3	-	-	5	8
76 VICTORIA ST	Future ICI	1					-	-	-	-	-	-	0.03	-	-	1	1
76 VICTORIA ST	Future ICI	1					-	-	-	-	-	-	0.1	-	-	2	4
58 ALBERT ST S	Future ICI	1					-	-	-	-	-	-	0.05	-	-	1	1
60 ALBERT ST S	Future ICI	1					-	-	-	-	-	-	0.1	-	-	2	3
WYANDOTTE ST W between 24 & 26	Future ICI	1					-	-	-	-	-	-	0.1	-	-	1	2
24 WYANDOTTE ST	Future ICI	1					-	-	-	-	-	-	0.1	-	-	2	2
14 DUNLOP ST	Future ICI	1					-	-	-	-	-	-	0.2	-	-	5	7
54 DUNLOP ST	Future ICI	1					-	-	-	-	-	-	0.05	-	-	1	1
12 ALBERT ST S	Future ICI	1					-	-	-	-	-	-	0.1	-	-	1	2
109 MISSISSAGA ST E REAR	Future ICI	1					-	-	-	-	-	-	0.01	-	-	0.2	0.3
130 MISSISSAGA ST E	Future ICI	1					-	-	-	-	-	-	0.02	-	-	0.4	1
22 MATCHEDASH ST S	Future ICI	2					-	-	-	-	-	-	0.2	-	-	4	5
60 WESTERN AVE	Future ICI	1					-	-	-	-	-	-	0.05	-	-	1	1
53 COLBORNE ST E	Future ICI	1					-	-	-	-	-	-	0.1	-	-	2	3
130 COLBORNE ST E	Future ICI	1					-	-	-	-	-	-	0.3	-	-	6	10
35 GLENCOE AVE	Future ICI	1					-	-	-	-	-	-	0.3	-	-	7	10
190 MEMORIAL AVE	Future ICI	1					-	-	-	-	-	-	0.2	-	-	4	6
220 GILL ST	Future ICI	1					-	-	-	-	-	-	0.02	-	-	0.5	1
163 MISSISSAGA ST W	Future ICI	1					-	-	-	-	-	-	0.1	-	-	1	2
169 MISSISSAGA ST W	Future ICI	1					-	-	-	-	-	-	0.1	-	-	1	2
65 COMMERCE RD	Future ICI	2					-	-	-	-	-	-	0.2	-	-	5	7
467 WEST ST N	Future ICI	2					-	-	-	-	-	-	0.02	-	-	0.5	1
570 LACLIE ST	Future ICI	2					-	-	-	-	-	-	0.5	-	-	10	16
410 LACLIE ST	Future ICI	2					-	-	-	-	-	-	0.1	-	-	2	3
388 WEST ST N	Future ICI	2					-	-	-	-	-	-	0.6	-	-	12	18
371A WEST ST N	Future ICI	2					-	-	-	-	-	-	0.1	-	-	2	2
139 TECUMSETH ST	Future ICI	1					-	-	-	-	-	-	0.4	-	-	7	11
NEYWASH ST at east terminus	Future ICI	1					-	-	-	-	-	-	0.1	-	-	3	4
112 COLBORNE ST E	Future ICI	1					-	-	-	-	-	-	0.1	-	-	1	2
75 FRONT ST S	Future ICI	1					-	-	-	-	-	-	0.1	-	-	1	2
122 FRONT ST S	Future ICI	1					-	-	-	-	-	-	0.1	-	-	1	2
121 FRONT ST S	Future ICI	1					-	-	-	-	-	-	0.03	-	-	1	1
65 KING ST	Future ICI	1					-	-	-	-	-	-	0.6	-	-	12	19
208 MEMORIAL AVE	Future ICI	1					-	-	-	-	-	-	0.2	-	-	4	6
279 MEMORIAL AVE	Future ICI	1					-	-	-	-	-	-	0.01	-	-	0.2	0.3
21 JAMES CRT	Future ICI	1					-	-	-	-	-	-	0.2	-	-	3	5
15 JAMES CRT	Future ICI	1					-	-	-	-	-	-	0.1	-	-	2	4
61 PETER ST S	Future ICI	1					-	-	-	-	-	-	0.5	-	-	10	15
79 WEST ST S	Future ICI	1					-	-	-	-	-	-	0.2	-	-	5	7
480 WEST ST S	Future ICI	1					-	-	-	-	-	-	0.4	-	-	8	13
15 SIMCOE ST	Future ICI	1					-	-	-	-	-	-	0.1	-	-	1	2
20 FRONT ST S	Future ICI	1					-	-	-	-	-	-	0.7	-	-	14	21
QUEEN ST adjacent to 5 King St	Future ICI	1					-	-	-	-	-	-	1.0	-	-	20	30
250 WEST ST S	Future ICI	1					-	-	-	-	-	-	2.8	-	-	55	83
60 POUGHKEEPSIE ST	Future ICI	1					-	-	-	-	-	-	0.4	-	-	8	12
45 COCHRANE ST	Future ICI	1					-	-	-	-	-	-	1.6	-	-	33	49

Projected Population and Demands for DCP, Future and Build-out Timelines

The Parcel Identifiers in this table should be read in conjunction with Drawing No. B-1 appended in the Water Demands Technical Report.

Parcel Identifier or Street Address	Type of Development	Pressure Zone	Residential						Estimated Population	ICI Area (ha)				Residential Demand		ICI Demand	
			Unit Types				Density Criteria	Land Area (ha)		IND.	COMM.	INST.	TOTAL	ADD (m^3/day)	MDD (m^3/day)	ADD (m^3/day)	MDD (m^3/day)
			SD	TH	AU	RLU											
371 WEST ST S	Future ICI	1					-	-	-	-	-	-	0.1	-	-	1	2
452 WEST ST S	Future ICI	1					-	-	-	-	-	-	0.1	-	-	2	4
460 WEST ST S	Future ICI	1					-	-	-	-	-	-	2.0	-	-	40	61
185 MEMORIAL AVE	Future ICI	1					-	-	-	-	-	-	0.1	-	-	1	2
183 MEMORIAL AVE	Future ICI	1					-	-	-	-	-	-	0.1	-	-	1	2
485 SUNDIAL DR	Future ICI	1					-	-	-	-	-	-	1.1	-	-	22	33
436 COUCHICHING PT RD	Future ICI	1					-	-	-	-	-	-	2.0	-	-	40	60
225 BARRIE RD	Future ICI	1					-	-	-	-	-	-	0.04	-	-	1	1
WESTMOUNT	Future ICI	2					-	-	-	-	-	-	1.4	-	-	28	42
along Huronia Road	Future ICI	1					-	-	-	-	-	-	0.5	-	-	9	14
10 MULCAHY CRT	Future ICI	2					-	-	-	-	-	-	2.2	-	-	44	65
160 JAMES ST	Future ICI	1					-	-	-	-	-	-	1.0	-	-	20	30
39 ONTARIO ST	Future ICI	1					-	-	-	-	-	-	0.3	-	-	6	10
60 PROGRESS DR	Future ICI	1					-	-	-	-	-	-	0.1	-	-	2	3
60 PROGRESS DR	Future ICI	1					-	-	-	-	-	-	0.1	-	-	2	3
69 PROGRESS DR	Future ICI	1					-	-	-	-	-	-	1.0	-	-	20	30
PROGRESS DR between 11 & 15	Future ICI	2					-	-	-	-	-	-	0.2	-	-	4	6
6 ONTARIO ST	Future ICI	1					-	-	-	-	-	-	0.3	-	-	6	10
66 PROGRESS DR	Future ICI	1					-	-	-	-	-	-	0.3	-	-	6	10
5 UNITED DR	Future ICI	1					-	-	-	-	-	-	0.3	-	-	6	10
135 WEST ST S	Future ICI	1					-	-	-	-	-	-	0.3	-	-	6	8
INDUSTRIAL ST along Atherley	Future ICI	1					-	-	-	-	-	-	0.7	-	-	13	20
1 INDUSTRIAL ST	Future ICI	1					-	-	-	-	-	-	0.2	-	-	3	5
17 BRAMMER DR	Future ICI	1					-	-	-	-	-	-	0.4	-	-	9	13
20 BRAMMER DR	Future ICI	1					-	-	-	-	-	-	0.3	-	-	7	10
21 BRAMMER DR	Future ICI	1					-	-	-	-	-	-	0.6	-	-	12	18
4535 HURONIA RD	Future ICI	1					-	-	-	-	-	-	0.2	-	-	4	6
5 BRAMMER DR	Future ICI	1					-	-	-	-	-	-	0.2	-	-	4	6
11 BRAMMER DR	Future ICI	1					-	-	-	-	-	-	0.2	-	-	5	7
15 BRAMMER DR	Future ICI	1					-	-	-	-	-	-	0.3	-	-	7	10
10 PRECISION DR	Future ICI	1					-	-	-	-	-	-	0.4	-	-	9	13
276 MEMORIAL	Future ICI	1					-	-	-	-	-	-	0.4	-	-	9	13
10 JAMES CRT	Future ICI	1					-	-	-	-	-	-	0.8	-	-	16	24
147 CEDAR ISLAND RD	Future ICI	1					-	-	-	-	-	-	0.8	-	-	16	24
155 WEST ST S	Future ICI	1					-	-	-	-	-	-	0.7	-	-	15	22
122 NORWELD DR	Future ICI	1					-	-	-	-	-	-	0.1	-	-	2	3
128 NORWELD DR	Future ICI	1					-	-	-	-	-	-	0.1	-	-	1	2
105 NORWELD DR	Future ICI	1					-	-	-	-	-	-	0.1	-	-	2	3
372 WEST ST S	Future ICI	1					-	-	-	-	-	-	0.6	-	-	11	17
163 BARRIE RD	Future ICI	1					-	-	-	-	-	-	0.3	-	-	6	10
200 JAMES ST	Future ICI	1					-	-	-	-	-	-	1.8	-	-	35	53
196 JAMES ST	Future ICI	1					-	-	-	-	-	-	0.3	-	-	6	8
190 JAMES ST	Future ICI	1					-	-	-	-	-	-	1.1	-	-	23	34
12 KITCHENER ST	Future ICI	1					-	-	-	-	-	-	1.1	-	-	23	34
55 JAMES ST W	Future ICI	1					-	-	-	-	-	-	3.0	-	-	60	90
499 WEST ST S	Future ICI	1					-	-	-	-	-	-	2.0	-	-	41	61
600 HURONIA RD	Future ICI	1					-	-	-	-	-	-	0.3	-	-	6	9
4425 HURONIA DR	Future ICI	1					-	-	-	-	-	-	0.3	-	-	7	10
4510 UHTHOFF LINE	Future ICI	2					-	-	-	-	-	-	4.8	-	-	96	145
50 MURPHY RD	Future ICI	2					-	-	-	-	-	-	0.03	-	-	1	1
PROGRESS DR between 27 & 29	Future ICI	2					-	-	-	-	-	-	0.2	-	-	3	5
725 UNIVERSITY AVE	Future ICI	2					-	-	-	-	-	-	0.4	-	-	8	12
700 HARVIE SETTLEMENT	Future ICI	2					-	-	-	-	-	-	0.1	-	-	2	3
610 HARVIE SETTLEMENT	Future ICI	2					-	-	-	-	-	-	2.4	-	-	49	73
600-650 HARVIE SETTLEMENT RD	Future ICI	2					-	-	-	-	-	-	1.9	-	-	38	58
8051 HIGHWAY 12	Future ICI	2					-	-	-	-	-	-	0.3	-	-	5	8

Projected Population and Demands for DCP, Future and Build-out Timelines

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Parcel Identifier or Street Address	Type of Development	Pressure Zone	Residential						Estimated Population	ICI Area (ha)				Residential Demand		ICI Demand	
			Unit Types				Density Criteria	Land Area (ha)		IND.	COMM.	INST.	TOTAL	ADD (m^3/day)	MDD (m^3/day)	ADD (m^3/day)	MDD (m^3/day)
			SD	TH	AU	RLU											
116 NORWELD DR	Future ICI	1					-	-	-	-	-	-	0.1	-	-	2	3
325 MATCHEDASH ST	Future ICI	2					-	-	-	-	-	-	0.2	-	-	3	5
42 JAMES ST E	Future ICI	1					-	-	-	-	-	-	0.1	-	-	2	4
22 BRAMMER DR	Future ICI	1					-	-	-	-	-	-	0.3	-	-	7	10
UNIVERSITY AVE	Future ICI	2					-	-	-	-	-	-	1.3	-	-	27	40
UNIVERSITY AVE	Future ICI	2					-	-	-	-	-	-	1.6	-	-	33	49
600 LACLIE ST	Future Residential	2	37				-	-	81	-	-	-	-	20	31	-	-
26 GOLDIE DR	Future Residential	2					22 RU/ha	0.03	2	-	-	-	-	1	1	-	-
38 GOLDIE DR	Future Residential	2					22 RU/ha	0.1	7	-	-	-	-	2	3	-	-
34 BOUNDARY RD E/S	Future Residential	2					22 RU/ha	0.5	23	-	-	-	-	6	9	-	-
146 LANDON ST	Future Residential	1					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
327 OLD MUSKOKA RD	Future Residential	1					22 RU/ha	0.2	9	-	-	-	-	2	3	-	-
325 PETER ST N	Future Residential	2					22 RU/ha	0.1	3	-	-	-	-	1	1	-	-
26 FITTON HTS	Future Residential	2					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
85 FITTONS RD W	Future Residential	2					22 RU/ha	0.5	25	-	-	-	-	6	9	-	-
44 SOUTH ST	Future Residential	2					22 RU/ha	0.1	5	-	-	-	-	1	2	-	-
168 BORLAND ST E	Future Residential	1					22 RU/ha	0.02	1	-	-	-	-	0.3	0.4	-	-
168 BORLAND ST E	Future Residential	1					22 RU/ha	0.009	1	-	-	-	-	0.3	0.4	-	-
49 FOWLIE ST	Future Residential	2					22 RU/ha	0.04	3	-	-	-	-	1	1	-	-
235 PETER ST N	Future Residential	2					22 RU/ha	0.1	6	-	-	-	-	2	2	-	-
246 PETER ST N	Future Residential	2					22 RU/ha	0.1	6	-	-	-	-	2	2	-	-
306 PETER ST N	Future Residential	2					22 RU/ha	0.004	1	-	-	-	-	0.3	0.4	-	-
463 ATHERLEY RD	Future Residential	1					22 RU/ha	0.2	9	-	-	-	-	2	3	-	-
397 COLLINS DR	Future Residential	1					22 RU/ha	0.1	7	-	-	-	-	2	3	-	-
381 COLLINS DR	Future Residential	1					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
376 COLLINS DR	Future Residential	1					22 RU/ha	0.6	30	-	-	-	-	8	11	-	-
313 DELIA ST	Future Residential	1					22 RU/ha	0.1	6	-	-	-	-	2	2	-	-
338 HILDA ST	Future Residential	1					22 RU/ha	0.1	3	-	-	-	-	1	1	-	-
340 HILDA ST	Future Residential	1					22 RU/ha	0.1	3	-	-	-	-	1	1	-	-
342 HILDA ST	Future Residential	1					22 RU/ha	0.1	3	-	-	-	-	1	1	-	-
344 HILDA ST	Future Residential	1					22 RU/ha	0.1	3	-	-	-	-	1	1	-	-
346 HILDA ST	Future Residential	1					22 RU/ha	0.1	3	-	-	-	-	1	1	-	-
493 ATHERLEY RD	Future Residential	1					22 RU/ha	0.6	27	-	-	-	-	7	10	-	-
342 OXFORD ST	Future Residential	1					22 RU/ha	0.1	6	-	-	-	-	2	2	-	-
225 BAY ST	Future Residential	1					22 RU/ha	0.7	36	-	-	-	-	9	14	-	-
454 BAY ST	Future Residential	1					22 RU/ha	0.2	9	-	-	-	-	2	3	-	-
473 BAY ST	Future Residential	1					22 RU/ha	0.1	6	-	-	-	-	2	2	-	-
475 BAY ST	Future Residential	1					22 RU/ha	0.1	7	-	-	-	-	2	3	-	-
WOODSIDE DR -Proposed	Future Residential	2					22 RU/ha	0.5	23	-	-	-	-	6	9	-	-
477 BAY ST	Future Residential	1					22 RU/ha	0.1	6	-	-	-	-	2	2	-	-
WOODSIDE DR -Proposed	Future Residential	2					22 RU/ha	0.3	16	-	-	-	-	4	6	-	-
122 MISSISSAGA ST W	Future Residential	1					22 RU/ha	0.1	3	-	-	-	-	1	1	-	-
75 VICTORIA ST	Future Residential	1					22 RU/ha	0.02	2	-	-	-	-	1	1	-	-
67 VICTORIA ST	Future Residential	1					22 RU/ha	0.04	3	-	-	-	-	1	1	-	-
60 SOUTH ST	Future Residential	2					22 RU/ha	0.1	8	-	-	-	-	2	3	-	-
145 WEST ST N	Future Residential	2					22 RU/ha	0.03	2	-	-	-	-	1	1	-	-
142 MISSISSAGA ST W	Future Residential	1					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
18 DUNLOP ST	Future Residential	1					22 RU/ha	0.1	5	-	-	-	-	1	2	-	-
51 DUNLOP ST	Future Residential	1					22 RU/ha	0.1	5	-	-	-	-	1	2	-	-
175 VICTORIA ST	Future Residential	1					22 RU/ha	0.04	2	-	-	-	-	1	1	-	-
212 COLBORNE ST W	Future Residential	1					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
206 COLBORNE ST W	Future Residential	1					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
35 DUNEDIN ST	Future Residential	1					22 RU/ha	0.2	8	-	-	-	-	2	3	-	-
201 MISSISSAGA ST W	Future Residential	1					22 RU/ha	0.1	5	-	-	-	-	1	2	-	-
207 MISSISSAGA ST W	Future Residential	1					22 RU/ha	0.1	3	-	-	-	-	1	1	-	-
211 MISSISSAGA ST W	Future Residential	1					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-

Projected Population and Demands for DCP, Future and Build-out Timelines

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Parcel Identifier or Street Address	Type of Development	Pressure Zone	Residential						Estimated Population	ICI Area (ha)				Residential Demand		ICI Demand	
			Unit Types				Density Criteria	Land Area (ha)		IND.	COMM.	INST.	TOTAL	ADD (m^3/day)	MDD (m^3/day)	ADD (m^3/day)	MDD (m^3/day)
			SD	TH	AU	RLU											
44 FOREST HEIGHTS CRES	Future Residential	2					22 RU/ha	0.02	2	-	-	-	-	1	1	-	-
42 FOREST HEIGHTS CRES	Future Residential	2					22 RU/ha	0.03	2	-	-	-	-	1	1	-	-
34 FOREST HEIGHTS CRES	Future Residential	2					22 RU/ha	0.02	1	-	-	-	-	0.3	0.4	-	-
36 FOREST HEIGHTS CRES	Future Residential	2					22 RU/ha	0.02	1	-	-	-	-	0.3	0.4	-	-
10 WYANDOTTE ST	Future Residential	1					22 RU/ha	0.02	1	-	-	-	-	0.3	0.4	-	-
102 DUNLOP ST	Future Residential	1					22 RU/ha	0.03	2	-	-	-	-	1	1	-	-
374 ARTHUR ST	Future Residential	2					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
365 ARTHUR ST	Future Residential	2					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
27 TOBOGGAN HILL DR	Future Residential	2					22 RU/ha	0.05	3	-	-	-	-	1	1	-	-
388 ARTHUR ST	Future Residential	2					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
388 HOMEWOOD AVE	Future Residential	2					22 RU/ha	0.1	5	-	-	-	-	1	2	-	-
390 HOMEWOOD AVE	Future Residential	2					22 RU/ha	0.1	5	-	-	-	-	1	2	-	-
18 ASHTON ST	Future Residential	2					22 RU/ha	0.05	3	-	-	-	-	1	1	-	-
381 MARY ST	Future Residential	1					22 RU/ha	0.05	3	-	-	-	-	1	1	-	-
21 SANDRA DR	Future Residential	2					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
33 ESTHER ANNE DR	Future Residential	2					22 RU/ha	0.1	8	-	-	-	-	2	3	-	-
21 KAREN CRES	Future Residential	2					22 RU/ha	0.2	9	-	-	-	-	2	3	-	-
2B KAREN CRES	Future Residential	2					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
30 ROSE AVE	Future Residential	1					22 RU/ha	0.1	3	-	-	-	-	1	1	-	-
303 MARY ST	Future Residential	1					22 RU/ha	0.1	3	-	-	-	-	1	1	-	-
309 COLBORNE ST W	Future Residential	1					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
136 MEMORIAL AVE	Future Residential	1					22 RU/ha	0.2	9	-	-	-	-	2	3	-	-
238 BARRIE RD	Future Residential	1					22 RU/ha	0.05	3	-	-	-	-	1	1	-	-
42 ALBANY AVE A	Future Residential	1					22 RU/ha	0.1	3	-	-	-	-	1	1	-	-
43 ELMER AVE A	Future Residential	1					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
273 CEDARMERE RD	Future Residential	1					22 RU/ha	0.05	3	-	-	-	-	1	1	-	-
249 JAMES ST E	Future Residential	1					22 RU/ha	0.03	2	-	-	-	-	1	1	-	-
113A MAPLE LEAF AVE	Future Residential	1					22 RU/ha	0.2	11	-	-	-	-	3	4	-	-
316 PARK ST	Future Residential	2					22 RU/ha	0.1	3	-	-	-	-	1	1	-	-
100 GOLDIE DR	Future Residential	2					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
4 GRACE AVE	Future Residential	2					22 RU/ha	0.1	8	-	-	-	-	2	3	-	-
19 DANCY DR	Future Residential	2					22 RU/ha	0.1	3	-	-	-	-	1	1	-	-
155 FITTONS RD W	Future Residential	2					22 RU/ha	0.4	20	-	-	-	-	5	8	-	-
467 WEST ST N	Future Residential	2					22 RU/ha	1.0	48	-	-	-	-	12	18	-	-
56 MAPLE DR	Future Residential	1					22 RU/ha	0.2	8	-	-	-	-	2	3	-	-
264 FITTONS RD E	Future Residential	1					22 RU/ha	0.2	9	-	-	-	-	2	3	-	-
260 FITTONS RD E	Future Residential	1					22 RU/ha	0.2	9	-	-	-	-	2	3	-	-
240 FITTONS RD E	Future Residential	1					22 RU/ha	0.2	8	-	-	-	-	2	3	-	-
479 BAY ST	Future Residential	1					22 RU/ha	0.1	7	-	-	-	-	2	3	-	-
444 SUNDIAL DR	Future Residential	1					22 RU/ha	0.2	12	-	-	-	-	3	5	-	-
30 FREE DR	Future Residential	1					22 RU/ha	0.1	8	-	-	-	-	2	3	-	-
10 FIRST ST	Future Residential	2					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
1 COWEN	Future Residential	1					22 RU/ha	0.1	3	-	-	-	-	1	1	-	-
150 CEDAR ISLAND RD	Future Residential	1					22 RU/ha	0.1	6	-	-	-	-	2	2	-	-
347 MISSISSAGA ST W	Future Residential	2					22 RU/ha	0.1	7	-	-	-	-	2	3	-	-
274 HARVEY ST	Future Residential	2					22 RU/ha	0.1	7	-	-	-	-	2	3	-	-
430 HOMEWOOD AVE	Future Residential	2					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
63 WOODSIDE DR	Future Residential	2					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
389 GRENVILLE AVE	Future Residential	2					22 RU/ha	0.6	31	-	-	-	-	8	12	-	-
351 BIRCH ST	Future Residential	2					22 RU/ha	0.1	5	-	-	-	-	1	2	-	-
263 CEDARMERE RD	Future Residential	1					22 RU/ha	0.1	5	-	-	-	-	1	2	-	-
254 CEDARMERE RD	Future Residential	1					22 RU/ha	0.2	12	-	-	-	-	3	5	-	-
45 GEORGE ST	Future Residential	2					22 RU/ha	0.2	9	-	-	-	-	2	3	-	-
215 MISSISSAGA ST W	Future Residential	1					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
100 POWLEY ST	Future Residential	1					22 RU/ha	0.1	6	-	-	-	-	2	2	-	-
190 CEDAR ISLAND RD	Future Residential	1					22 RU/ha	0.2	11	-	-	-	-	3	4	-	-

Projected Population and Demands for DCP, Future and Build-out Timelines

The Parcel Identifiers in this table should be read in conjunction with Drawing No. B-1 appended in the Water Demands Technical Report.

Parcel Identifier or Street Address	Type of Development	Pressure Zone	Residential						Estimated Population	ICI Area (ha)				Residential Demand		ICI Demand	
			Unit Types				Density Criteria	Land Area (ha)		IND.	COMM.	INST.	TOTAL	ADD (m^3/day)	MDD (m^3/day)	ADD (m^3/day)	MDD (m^3/day)
			SD	TH	AU	RLU											
146 DAVEY DR	Future Residential	2					22 RU/ha	0.1	3	-	-	-	-	1	1	-	-
309 EAST ST	Future Residential	1					22 RU/ha	0.1	5	-	-	-	-	1	2	-	-
110 JAMES ST	Future Residential	1					22 RU/ha	0.1	5	-	-	-	-	1	2	-	-
370 MILLARD ST	Future Residential	1					22 RU/ha	0.003	1	-	-	-	-	0.3	0.4	-	-
507 GILL ST	Future Residential	1					22 RU/ha	0.1	3	-	-	-	-	1	1	-	-
4-8 VICTORIA CRES	Future Residential	1					22 RU/ha	0.2	12	-	-	-	-	3	5	-	-
680 BROADVIEW AVE	Future Residential	1					22 RU/ha	0.1	3	-	-	-	-	1	1	-	-
662 STANLEY CRES	Future Residential	1					22 RU/ha	0.1	7	-	-	-	-	2	3	-	-
188 OXFORD ST	Future Residential	1					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
100 CHURCH ST	Future Residential	1					22 RU/ha	0.7	35	-	-	-	-	9	13	-	-
27 JAMES ST E	Future Residential	1					22 RU/ha	0.4	19	-	-	-	-	5	7	-	-
29 JAMES ST E	Future Residential	1					22 RU/ha	0.03	2	-	-	-	-	1	1	-	-
425A HIGH ST	Future Residential	1					22 RU/ha	0.05	3	-	-	-	-	1	1	-	-
450 SUNDIAL DR	Future Residential	1					22 RU/ha	0.2	9	-	-	-	-	2	3	-	-
764 BROADVIEW AVE	Future Residential	1					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
768 BROADVIEW AVE	Future Residential	1					22 RU/ha	0.1	5	-	-	-	-	1	2	-	-
313 WESTMOUNT DR S	Future Residential	1					22 RU/ha	0.02	1	-	-	-	-	0.3	0.4	-	-
311 MACISAAC DR	Future Residential	1					22 RU/ha	0.3	13	-	-	-	-	3	5	-	-
331 MACISAAC DR	Future Residential	1					22 RU/ha	0.1	7	-	-	-	-	2	3	-	-
499 BAY ST	Future Residential	1					22 RU/ha	0.2	8	-	-	-	-	2	3	-	-
10 SECOND ST	Future Residential	2					22 RU/ha	0.1	4	-	-	-	-	1	2	-	-
4 SKYLINE DR	Future Residential	2					22 RU/ha	0.01	1	-	-	-	-	0.3	0.4	-	-
27 LAWSON AVE	Future Residential	2					22 RU/ha	0.2	11	-	-	-	-	3	4	-	-
71 WOODSIDE DR	Future Residential	2					22 RU/ha	0.1	5	-	-	-	-	1	2	-	-
1 LAURENTIAN LANE	Future Residential	2					22 RU/ha	0.01	1	-	-	-	-	0.3	0.4	-	-
54 DUFFERIN ST	Future Residential	1					22 RU/ha	0.1	5	-	-	-	-	1	2	-	-
70 JAMES ST E	Future Residential	1					22 RU/ha	0.1	5	-	-	-	-	1	2	-	-
356 BREWERY LANE N/S	Future Residential	1					22 RU/ha	0.5	23	-	-	-	-	6	9	-	-
374 BREWERY LANE	Future Residential	1					22 RU/ha	0.2	10	-	-	-	-	3	4	-	-
339 BREWERY LANE	Future Residential	1					22 RU/ha	0.4	19	-	-	-	-	5	7	-	-
1046 MISSISSAGA ST W	Future Residential	2					22 RU/ha	0.1	5	-	-	-	-	1	2	-	-
39 CINDY LEE CRES	Future Residential	2					22 RU/ha	0.01	1	-	-	-	-	0.3	0.4	-	-
240 WESTMOUNT DR S	Future Residential	1					22 RU/ha	0.1	7	-	-	-	-	2	3	-	-
50 WOODLAND DR	Future Residential	2					22 RU/ha	18.2	879	-	-	-	-	220	330	-	-
36 MARLISA DR	Future Residential	2					42 persons/ha	0.1	3	-	-	-	-	1	1	-	-
544 HIGH ST	Future Residential	1					42 persons/ha	0.1	3	-	-	-	-	1	1	-	-
145 ATLANTIS DR	Future Residential	3					42 persons/ha	0.2	11	-	-	-	-	3	4	-	-
128 ATLANTIS DR	Future Residential	3					42 persons/ha	0.003	1	-	-	-	-	0.3	0.4	-	-
LINE 15 N	Future Residential	2					42 persons/ha	2.5	105	-	-	-	-	26	39	-	-
2977 ANNALYSSE DR	Future Residential	3					42 persons/ha	0.05	2	-	-	-	-	1	1	-	-
600 UNIVERSITY AVE	Future Residential	2					42 persons/ha	1.1	49	-	-	-	-	12	18	-	-
HARVIE SETTLEMENT RD	Future Residential	2					42 persons/ha	3.5	149	-	-	-	-	37	56	-	-
3200 BASS LAKE SD RD E	Future Residential	3					42 persons/ha	0.8	32	-	-	-	-	8	12	-	-
3001 BASS LAKE SIDE RD E	Future Residential	3					42 persons/ha	2.8	118	-	-	-	-	30	44	-	-
653 ATHERLEY RD	Future Residential	1					90 RU/ha	0.2	38	-	-	-	-	10	14	-	-
34 ORCHARD POINT RD	Future Residential	1					90 RU/ha	0.1	21	-	-	-	-	5	8	-	-
51 ORCHARD POINT RD	Future Residential	1					90 RU/ha	0.3	57	-	-	-	-	14	21	-	-
63 CLIFFORD ST	Future Residential	1					90 RU/ha	0.1	25	-	-	-	-	6	9	-	-
625 ATHERLEY RD	Future Residential	1					90 RU/ha	0.6	109	-	-	-	-	27	41	-	-
413 WEST ST N	Future Residential	2					90 RU/ha	0.1	16	-	-	-	-	4	6	-	-
417 WEST ST N	Future Residential	2					90 RU/ha	0.1	16	-	-	-	-	4	6	-	-
354 ATHERLEY RD	Future Residential	1					90 RU/ha	0.4	85	-	-	-	-	21	32	-	-
348 HILDA ST	Future Residential	1					90 RU/ha	0.1	12	-	-	-	-	3	5	-	-
350 HILDA ST	Future Residential	1					90 RU/ha	0.1	12	-	-	-	-	3	5	-	-
352 HILDA ST	Future Residential	1					90 RU/ha	0.1	14	-	-	-	-	4	5	-	-
354 HILDA ST	Future Residential	1					90 RU/ha	0.04	8	-	-	-	-	2	3	-	-

Projected Population and Demands for DCP, Future and Build-out Timelines

The Parcel Identifiers in this table should be read in conjunction with Drawing No. B-1 appended in the Water Demands Technical Report.

Parcel Identifier or Street Address	Type of Development	Pressure Zone	Residential						Estimated Population	ICI Area (ha)				Residential Demand		ICI Demand	
			Unit Types				Density Criteria	Land Area (ha)		IND.	COMM.	INST.	TOTAL	ADD (m^3/day)	MDD (m^3/day)	ADD (m^3/day)	MDD (m^3/day)
			SD	TH	AU	RLU											
356 HILDA ST	Future Residential	1					90 RU/ha	0.1	15	-	-	-	-	4	6	-	-
355 HILDA ST	Future Residential	1					90 RU/ha	0.1	12	-	-	-	-	3	5	-	-
353 HILDA ST	Future Residential	1					90 RU/ha	0.1	18	-	-	-	-	5	7	-	-
351 HILDA ST	Future Residential	1					90 RU/ha	0.1	13	-	-	-	-	3	5	-	-
349 HILDA ST	Future Residential	1					90 RU/ha	0.1	13	-	-	-	-	3	5	-	-
347 HILDA ST	Future Residential	1					90 RU/ha	0.1	13	-	-	-	-	3	5	-	-
345 HILDA ST	Future Residential	1					90 RU/ha	0.1	13	-	-	-	-	3	5	-	-
WOODSIDE DR -Proposed	Future Residential	2					90 RU/ha	12.0	2,382	-	-	-	-	596	893	-	-
145 ATHERLEY RD	Future Residential	1					90 RU/ha	0.3	60	-	-	-	-	15	23	-	-
504 LACLIE ST	Future Residential	2					90 RU/ha	0.2	48	-	-	-	-	12	18	-	-
425 LACLIE ST	Future Residential	2					90 RU/ha	0.6	110	-	-	-	-	28	41	-	-
61 FRONT ST S	Future Residential	1					90 RU/ha	0.04	8	-	-	-	-	2	3	-	-
58 SCOTT ST	Future Residential	1					90 RU/ha	0.05	10	-	-	-	-	3	4	-	-
261 COLDWATER RD	Future Residential	2					90 RU/ha	0.6	126	-	-	-	-	32	47	-	-
249 COLDWATER RD	Future Residential	2					90 RU/ha	0.1	24	-	-	-	-	6	9	-	-
233 COLDWATER RD	Future Residential	2					90 RU/ha	0.8	150	-	-	-	-	38	56	-	-
201A BARRIE RD	Future Residential	1					90 RU/ha	1.1	218	-	-	-	-	55	82	-	-
107 WEST ST S	Future Residential	1					90 RU/ha	1.1	213	-	-	-	-	53	80	-	-
181 BARRIE RD	Future Residential	1					90 RU/ha	0.1	11	-	-	-	-	3	4	-	-
201 BARRIE RD	Future Residential	1					90 RU/ha	0.3	64	-	-	-	-	16	24	-	-
679 ATHERLEY RD	Future Residential	1					90 RU/ha	1.1	226	-	-	-	-	57	85	-	-
679 ATHERLEY RD	Future Residential	1					90 RU/ha	0.5	99	-	-	-	-	25	37	-	-
3210 BASS LAKE SR	Future Residential	3					90 RU/ha	1.8	348	-	-	-	-	87	131	-	-
56 ORCHARD POINT RD	Future Residential	1					90 RU/ha	0.2	32	-	-	-	-	8	12	-	-
BARRIE RD behind 201	Future Residential	1					90 RU/ha	0.1	22	-	-	-	-	6	8	-	-
TOTAL	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	**24,682**	**-**	**-**	**-**	**236**	**6,170**	**9,256**	**4,727**	**7,090**

Notes:

** The assumed build-out development is not supported by the current land use and zoning. Agreed with by City.*

Parcel identifiers between 1 and 32 align with the numbers in the DCP developments as provided by the City.

Parcels 33 through 77 were added by Tatham after reviewing the various provided information for DCP and Vacant Lands, and potential Build-out areas.

SUMMARY OF DEMAND PROJECTIONS

			Residential Demand		ICI Demand	
Development Timeline	Population	ICI Area (ha)	ADD (m3/day)	MDD (m3/day)	ADD (m3/day)	MDD (m3/day)
DCP PZ1	1,904	22	476	714	434	651
DCP PZ2	1,660	56	415	623	1,120	1,680
DCP PZ3	1,083	0	271	406	0	0
DCP Total	**4,647**	**78**	**1,162**	**1,743**	**1,554**	**2,331**
Future PZ1	4,033	41	1,008	1,512	827	1,241
Future PZ2	4,675	19	1,169	1,753	388	582
Future PZ3	3,722	8	930	1,396	167	251
Future Total	**12,430**	**69**	**3,108**	**4,661**	**1,382**	**2,073**
Build-out PZ1	2,252	9	563	844	170	255
Build-out PZ2	5,352	81	1,338	2,007	1,621	2,431
Build-out PZ3	0	0	0	0	0	0
Build-out Total	**7,604**	**90**	**1,901**	**2,852**	**1,791**	**2,686**
TOTAL	**24,682**	**236**	**6,170**	**9,256**	**4,727**	**7,090**

Appendix C: Historical Water Production and Consumption Data

MONTHLY WATER DATA SUMMARY

Notes: Entries in blue are calculated values.

1. *Production Flows sourced from background documents provided by the City.*
2. *Bulk Water sourced from background documents provided by the City.*
3. *Water Meter Readings sourced from background documents provided by the City.*
4. *Cycle 5 water meter data is for ICI and multi-storey residential. City confirm that 24.66% of Cycle 5 billings are for multi-storey residential. Applied in table of Produced vs Consumed vs Unaccounted.*

DATE	WATER PRODUCTION [1.]								SYSTEM TOTAL PRODUCTION (m3)	BULK WATER (m3) [2.]	WATER CONSUMPTION									
	WATER FILTRATION PLANT					WEST ORILLIA WELL					WATER METER READINGS (m3) [3.]									
											Cycle 1 (Res)		Cycle 2 (Res)		Cycle 3 (Res)		Cycle 4 (Res)		Cycle 5 (ICI + Multi-storey Residential)	
	WELL 1 & 2 PRODUCTION (m3)	SURFACE WATER PRODUCTION (m3)	TOTAL WFP PRODUCTION (m3)	ADD (m3/day)	MDD m3/day)	TOTAL WOW PRODUCTION (m3)	ADD (m3/day)	MDD (m3/day)			As Given	Averaged per mo.	As Given	Averaged per mo.	As Given	Averaged per mo.	As Given	Averaged per mo.	As Given	Averaged per mo.
Apr-14																35,563		22,541		
May-14												26,201		24,719		35,563		22,541		151,708
Jun-14											104,805	26,201	98,877	24,719	248,941	35,563	157,787	22,541		151,708
Jul-14												26,201		24,719		35,563		22,541		151,708
Aug-14												26,201		24,719		35,563		22,541		151,708
Sep-14												32,836		22,905		35,563		22,541		151,708
Oct-14												32,836		22,905		35,563		22,541	1,820,490	151,708
Nov-14												32,836		22,905		49,629		29,081		151,708
Dec-14											295,523	32,836		22,905		49,629		29,081		151,708
Jan-15	16,775	225,663	242,438		9,076	113,869		4,733	356,307	198		32,836		22,905		49,629		29,081		151,708
Feb-15	7,431	225,148	232,579		12,298	97,372		5,254	329,951	183		32,836	274,865	22,905	248,147	49,629	145,406	29,081		151,708
Mar-15	7,841	261,658	269,499		10,903	107,117		4,760	376,616	201		32,836		22,905		49,629		29,081		151,708
Apr-15	12,422	238,875	251,297		10,873	108,315		4,683	359,612	376		32,836		22,905		36,259		23,185		151,708
May-15	6,149	291,276	297,425		12,557	97,724		4,457	395,149	1,801		25,712		22,905		36,259		23,185		154,010
Jun-15	28,754	233,013	261,767	8,385	10,741	116,486	3,425	5,175	378,253	2,745	102,846	25,712		22,905		36,259		23,185		154,010
Jul-15	10,517	269,875	280,392		10,797	109,675		4,634	390,067	1,933		25,712		22,905	253,811	36,259	162,294	23,185		154,010
Aug-15	7,097	267,931	275,028		12,345	105,371		4,127	380,399	964		25,712		22,905		36,259		23,185		154,010
Sep-15	6,421	256,325	262,746		11,087	100,007		4,346	362,753	741		36,902		34,795		36,259		23,185		154,010
Oct-15	3,832	241,457	245,289		11,286	97,538		4,253	342,827	635		36,902		34,795		36,259		23,185	1,848,116	154,010
Nov-15	6,894	208,171	215,065		8,811	99,819		4,116	314,884	455		36,902		34,795		48,355		29,493		154,010
Dec-15	7,128	219,720	226,848		10,212	96,737		3,705	323,585	581	295,215	36,902	278,361	34,795	241,776	48,355	147,463	29,493		154,010
Jan-16	6,901	234,310	241,211		10,614	100,907		3,976	342,118	158		36,902		34,795		48,355		29,493		154,010
Feb-16	8,665	221,927	230,592		10,828	86,654		3,870	317,246	103		36,902		34,795		48,355		29,493		154,010
Mar-16	6,421	219,350	225,771		9,729	106,256		4,100	332,027	186		36,902		34,795		48,355		29,493		154,010
Apr-16	4,834	226,142	230,976		9,189	99,255		4,236	330,231	224		36,902		34,795		37,257		25,465		154,010
May-16	7,379	267,564	274,943		11,450	94,551		4,767	369,494	1,463		25,008		23,474		37,257		25,465		137,019
Jun-16	12,790	288,245	301,035	9,514	12,076	87,743	1,950	3,894	388,778	3,043	100,032	25,008	93,895	23,474	260,802	37,257	178,255	25,465		137,019
Jul-16	22,114	287,152	309,266		13,231	87,643		4,266	396,909	4,502		25,008		23,474		37,257		25,465		137,019
Aug-16	48,889	347,574	396,463		15,748	3,987		2,878	400,450	4,443		25,008		23,474		37,257		25,465		137,019
Sep-16	46,218	300,573	346,791		13,587	5,037		3,140	351,828	1,125		37,366		34,937		37,257		25,465		137,019
Oct-16	26,996	268,302	295,298		11,699	39,823		2,956	335,121	806		37,366		34,937		37,257		25,465	1,644,226	137,019
Nov-16	15,045	291,606	306,651		11,081	0		0	306,651	472		37,366		34,937		46,002		28,641		137,019
Dec-16	13,087	300,604	313,691		11,087	0		0	313,691	302	298,927	37,366	279,495	34,937	230,012	46,002	143,205	28,641		137,019
Jan-17	19,226	302,969	322,195		11,328	0		0	322,195	204		37,366		34,937		46,002		28,641		137,019
Feb-17	18,664	266,316	284,980		11,073	0		0	284,980	80		37,366		34,937		46,002		28,641		137,019
Mar-17	7,759	300,996	308,755		11,034	0		0	308,755	105		37,366		34,937		46,002		28,641		137,019
Apr-17	6,810	297,051	303,861		10,794	0		0	303,861	345		37,366		34,937		40,955		21,438		137,019
May-17	3,548	261,397	264,945		11,047	56,561		4,085	321,506	1,487		33,971		23,844		40,955		21,438		138,589
Jun-17	2,535	225,501	228,036	8,553	9,061	99,941	2,068	4,225	327,977	2,675	101,914	33,971	95,376	23,844	245,729	40,955	150,067	21,438		138,589
Jul-17	20,473	239,345	259,818		12,394	90,182		3,986	350,000	1,937		33,971		23,844		40,955		21,438		138,589
Aug-17	35,355	225,050	260,405		9,741	95,473		4,275	355,878	2,514		30,811		23,844		40,955		21,438		138,589
Sep-17	31,744	192,933	224,677		10,957	108,907		4,443	333,584	1,062		30,811		32,534		40,955		21,438		138,589
Oct-17	33,025	193,064	226,089		10,851	100,702		4,257	326,791	598		30,811		32,534		42,655		21,438	1,663,067	138,589
Nov-17	24,031	196,695	220,726		9,295	95,037		4,589	315,763	1,005		30,811		32,534		42,655		24,118		138,589
Dec-17	5,171	212,302	217,473		10,452	108,028		4,322	325,501	596	277,303	30,811	260,275	32,534	255,928	42,655	144,707	24,118		138,589
Jan-18	3,713	227,659	231,372		10,087	101,038		4,161	332,410	376		30,811		32,534		42,655		24,118		138,589
Feb-18	1,389	207,215	208,604		9,699	88,670		4,075	297,274	462		30,811		32,534		42,655		24,118		138,589
Mar-18	1,176	220,136	221,312		10,166	105,559		4,230	326,871	270		30,811		32,534		42,655		24,118		138,589
Apr-18	4,833	208,897	213,730		9,001	100,916		4,324	314,646	555		30,811		32,534		46,106		24,118		138,589
May-18	14,542	233,539	248,081		10,812	112,639		4,367	360,720	1,945		33,245		30,219		46,106		26,819		154,576
Jun-18	42,125	220,649	262,774	7,799	12,254	106,999	3,329	4,564	369,773	2,352		33,245		30,219		46,106		26,819		154,576
Jul-18	40,876	244,739	285,615		13,240	117,603		5,314	403,218	2,803		33,245		30,219		46,106		26,819		154,576
Aug-18	37,093	211,987	249,080		11,733	111,927		4,419	361,007	4,328		33,245		30,219		46,106		26,819		154,576
Sep-18	35,250	203,379	238,629		10,473	108,713		4,712	347,342	2,039	398,943 *For May 2018 to May 2019	33,245	362,627 *For May 2018 to May 2019	30,219	553,277 *For April 2018 to April 2019	46,106	321,824 *For April 2018 to April 2019	26,819	1,854,909 *For May 2018 to May 2019	154,576
Oct-18	25,273	191,332	216,605		9,742	107,314		4,615	323,919	1,000		33,245		30,219		46,106		26,819		154,576
Nov-18	7,392	226,558	233,950		10,258	79,232		1,232	313,182	483		33,245		30,219		46,106		26,819		154,576
Dec-18	5,511	231,198	236,709		10,519	74,336		3,914	311,045	424		33,245		30,219		46,106		26,819		154,576
Jan-19	4,042	255,588	259,630		11,471	75,658			335,288	123		31,177		29,177		44,524		24,772		148,148
Feb-19	1,900	229,115	231,015		11,569	64,445			295,460	168		31,177		29,177		44,524		24,772		148,148
Mar-19	3,247	251,491	254,738		11,490	72,371			327,109	107		31,177		29,177		44,524		24,772		148,148
Apr-19	4,115	241,386	245,501		11,526	66,173			311,674	556		31,177		29,177		44,524		24,772		148,148
May-19	4,393	246,029	250,422		12,315	87,390			337,812	870		31,177		29,177		44,524		24,772		148,148
Jun-19	5,375	264,460	269,835	8,408	12,796	76,517	2,454	3,239	346,352	2,825	374,127	31,177	350,127	29,177	534,291	44,524	297,259	24,772	1,777,771	148,148
Jul-19	19,164	267,817	286,981		13,316	79,753			366,734	4,178		31,177		29,177		44,524		24,772		148,148
Aug-19	29,511	263,472	292,983		12,955	67,331			360,314	2,954		31,177		29,177		44,524		24,772		148,148
Sep-19	11,342	260,495	271,837		11,536	52,310			324,147	1,613		31,177		29,177		44,524		24,772		148,148
Oct-19	15,110	220,544	235,654		10,953	98,899			334,553	1,190		31,177		29,177		44,524		24,772		148,148
Nov-19	6,202	214,453	220,655		9,068	88,467			309,122	815		31,177		29,177		44,524		24,772		148,148
Dec-19	6,322	243,446	249,768		10,819	66,498			316,266	250		31,177		29,177		44,524		24,772		148,148
Jan-20	11,944	270,610	282,554		11,545	42,344			324,898	231		32,576		30,471		50,286		26,616		128,946
Feb-20	8,692	228,073	236,765		10,094	66,761			303,526	174		32,576		30,471		50,286		26,616		128,946
Mar-20	11,292	249,795	261,087		10,785	62,006			323,093	244		32,576		30,471		50,286		26,616		128,946
Apr-20	11,741	202,786	214,527		10,202	62,437			276,964	322		32,576		30,471		50,286		26,616		128,946
May-20	9,909	205,868	215,777		10,503	103,654			319,431	2,594		32,576		30,471		50,286		26,616		128,946
Jun-20	12,628	285,414	298,042	9,118	11,797	55,980	1,730	2,428	354,022	4,115	390,914	32,576	365,654	30,471	603,427	50,286	319,392	26,616	1,547,357	128,946
Jul-20	9,481	332,501	341,982		13,355	49,408			391,390	3,810		32,576		30,471		50,286		26,616		128,946
Aug-20	13,404	307,705	321,109		13,612	48,790			369,899	1,893		32,576		30,471		50,286		26,616		128,946
Sep-20	12,372	311,093	323,465		11,847	57,171			380,636	1,356		32,576		30,471		50,286		26,616		128,946
Oct-20	4,926	287,003	291,929		10,985	32,442			324,371	906		32,576		30,471		50,286		26,616		128,946
Nov-20	8,129	277,154	285,283		11,214	13,617			298,900	568		32,576		30,471		50,286		26,616		128,946
Dec-20	7,320	257,308	264,628		10,969	38,632			303,260	295		32,576		30,471		50,286		26,616		128,946
Monthly Min				**7,799**	**8,811**		**1,730**													
Monthly Average				**8,629**	**11,167**		**2,493**													
Monthly Max				**9,514**	**15,748**		**3,425**	**5,314**												

Appendix B:
Natural Environment and Archaeology Assessment Reports
Harvie Settlement Road

AZIMUTH ENVIRONMENTAL CONSULTING, INC.
Environmental Assessments & Approvals

October 18, 2021 AEC 20-101

Tatham Engineering Limited
115 Sandford Fleming Drive, Suite 200
Collingwood, Ontario
L9Y 5A6

Attention: Suzanne Troxler,
Director, Manager – Water and Wastewater Engineering

Re: **Natural Environment Letter Report for Orillia Water Master Plan Update – 500 Harvie Settlement Road, City of Orillia, County of Simcoe.**

Dear Ms. Troxler:

Azimuth Environmental Consulting, Inc. (Azimuth) was retained by Tatham Engineering Limited to prepare a Natural Environment Letter Report for proposed works at 500 Harvie Settlement Road in the City of Orillia (Attachment 1). This letter report summarizes investigations undertaken in summer 2020 to characterize the natural environmental features, and identify natural heritage features and functions, including Species at Risk (SAR), associated with the property.

1.0 STUDY APPROACH

The proposed development is located at 500 Harvie Settlement Road within the western-most area of the City of Orillia. The property is located directly adjacent to Highway 11 [within 50 meters (m)]. The study area encompasses the entire property (500 Harvie Settlement Road – see Attachment 1) and lands that are directly adjacent to this property [*i.e.*, within 120 meters (m) of the parcel boundary].

Azimuth undertook the following tasks for the purpose of this assessment:

- Reviewed background documents for information on site characteristics, habitat, wildlife, rare species and communities and general land use aspects of the study area; and
- Conducted a site visit on July 27, 2020 to identify existing conditions and potential natural heritage constraints, including those related to SAR.

The site visit noted above consisted of a general terrestrial field assessment of the property. This inspection included a general classification of vegetation communities within the study area to aid in the identification of natural heritage features of concern, such as Significant Woodland. This assessment included consideration of the habitat requirements of SAR with potential to occur in the area, and a search for Butternut, an Endangered tree protected under Ontario's *Endangered Species Act*, 2007 (ESA).

2.0 EXISTING CONDITIONS

2.1 General Site Description

The property is located within western-most portion of the City of Orillia. A water tower exists within the northwestern corner of the property, and lands are largely maintained and are secured with perimeter fencing. Surrounding lands to the north, east and south consist of urban development including commercial buildings, Highway 11 and residential homes. Adjacent lands to the west have been recently cleared of tree cover for development (Attachment 2). Site photographs are attached in Attachment 3.

2.2 Vegetation

The property is largely maintained lawn with landscape trees including but not limited to Balsam Poplar (*Populus balsamifera*), Eastern White Pine (*Pinus strobus*) and White Ash (*Fraxinus americana*) (Attachment 1; Attachment 3, Photographs 1-2). The northern portion of the property consists of a Fresh-Moist Poplar Deciduous Woodland (WODM5-1; Photographs 3-4) that extends into adjacent lands. This community is dominated by young Trembling Aspen (*Populus tremuloides*) with lesser amounts of Balsam Poplar, Eastern Hop-hornbeam (*Ostrya virginiana*) and Manitoba Maple (*Acer negundo*). Herbaceous ground cover consists of early-successional species such as Black Medic (*Medicago lupulina*), English Plantain (*Plantago lanceolata*), Common Mullein (*Verbascum thapsus*), Oregano (*Origanum vulgare*), Tufted Vetch (*Vicia cracca*), Wild Strawberry (*Fragaria virginiana*), Smooth Brome (*Bromus inermis*) and Orchard Grass (*Dactylis glomerata*). A Sumac Deciduous Shrub Thicket (THDM2-1) exists along the western property boundary (Photograph 5) that consists largely of Staghorn Sumac (*Rhus typhina*) and Riverbank Grape (*Vitis riparia*). Lastly, a thin band of trees, remnant from

a larger woodland that previously extended into adjacent lands, exists along the western boundary near the southern corner of the property (Photograph 6).

2.2.1 Woodland

Historic aerial imagery depicts a relatively large woodland feature [~5.5 hectares (ha) in size] that occurred in surrounding lands to the north, west and southwest, and extended onto the property (Google Earth; Attachment 2). The majority of this feature was recently cleared sometime between 2018 and 2020, reducing the woodland to a small cultural community that occurs primarily to the north of the property (~1.0ha).

Within the City of Orillia, forest cover is approximately 19.5% according to provincial mapping. Therefore, as per the Natural Heritage Reference Manual (MNR, 2010), when woodland cover is between 15-30% of the land cover, woodlands 20ha in size or larger should be considered significant. The remnant woodland is significantly smaller than this size threshold and thus, is not considered significant. As such, Significant Woodland is not considered further in this report.

2.3 Wildlife

While no species-specific surveys were completed as part of this investigation, twelve bird species were documented during Azimuth's field work including the following: American Goldfinch (*Spinus tristis*), American Robin (*Turdus migratorius*), Black-capped Chickadee (*Poecile atricapillus*), Blue Jay (*Cyanocitta cristata*), Cedar Waxwing (*Bombycilla cedrorum*), Chipping Sparrow (*Spizella passerine*), European Starling (*Sturnus vulgaris*), Gray Catbird (*Dumetella carolinensis*), House Wren (*Colaptes auratus*), Northern Flicker (*Colaptes auratus*), Song Sparrow (*Melospiza melodia*) and Turkey Vulture (*Cathartes aura*). Additionally, one mammal, Eastern Gray Squirrel (*Sciurus carolinensis*) was observed on the property. No SAR or provincially rare species were documented on the property.

2.4 Species at Risk

Care was taken during the field investigation to detect any provincially designated SAR, with a primary focus on the potential occurrence of Butternut (listed as Endangered under the ESA). Butternut was not observed on or adjacent to the property. Further, no Barn Swallow nests were documented on the structures present on-site (Barn Swallow are listed as Threatened under the ESA).

3.0 PROPOSED DEVELOPMENT

It is our understanding that the City of Orillia is considering two alternatives for the Orillia Water Master Plan project. The first alternative includes installing two standpipes at the locations depicted in Attachment 3; the second alternative includes installing three standpipes (see Attachment 3).

4.0 IMPACT ASSESSMENT

Based on the environmental site conditions and the landscape setting of the property, no significant natural heritage features or functions are present on the property. As such, the proposed works will result in no negative impacts to natural heritage features and functions at either location.

The proposed re-development has no potential to impact individuals or habitat of Endangered or Threatened species.

5.0 MITIGATION AND RECOMMENDATIONS

- Clear shrubs and trees outside of the bird nesting season generally defined as the time between April 1 and August 31 – *i.e.*, clear trees between September 1 and March 30;
- Consider utilization of native plants in the landscape design for the development (http://nanps.org/native-plant-database/); and,
- Avoid using plants in the landscape plan considered to be invasive (http://www.invadingspecies.com/plants/ and http://www.ontarioinvasiveplants.ca/resources/grow-me-instead/).

6.0 CONCLUSIONS

Proposed re-development of the property can be achieved with no negative impacts to significant natural heritage features and functions of the property and adjacent lands including habitat of SAR.

If you have any questions or require further information, please do not hesitate to contact the undersigned.

Regards,

AZIMUTH ENVIRONMENTAL CONSULTING, INC.

Alexa Pompilio, H.B.Sc
Terrestrial Ecologist

Attach:
Attachment 1 Environmental Features
Attachment 2 Historical Mapping
Attachment 3 Photograph Log
Attachment 4 Alternative Site Locations

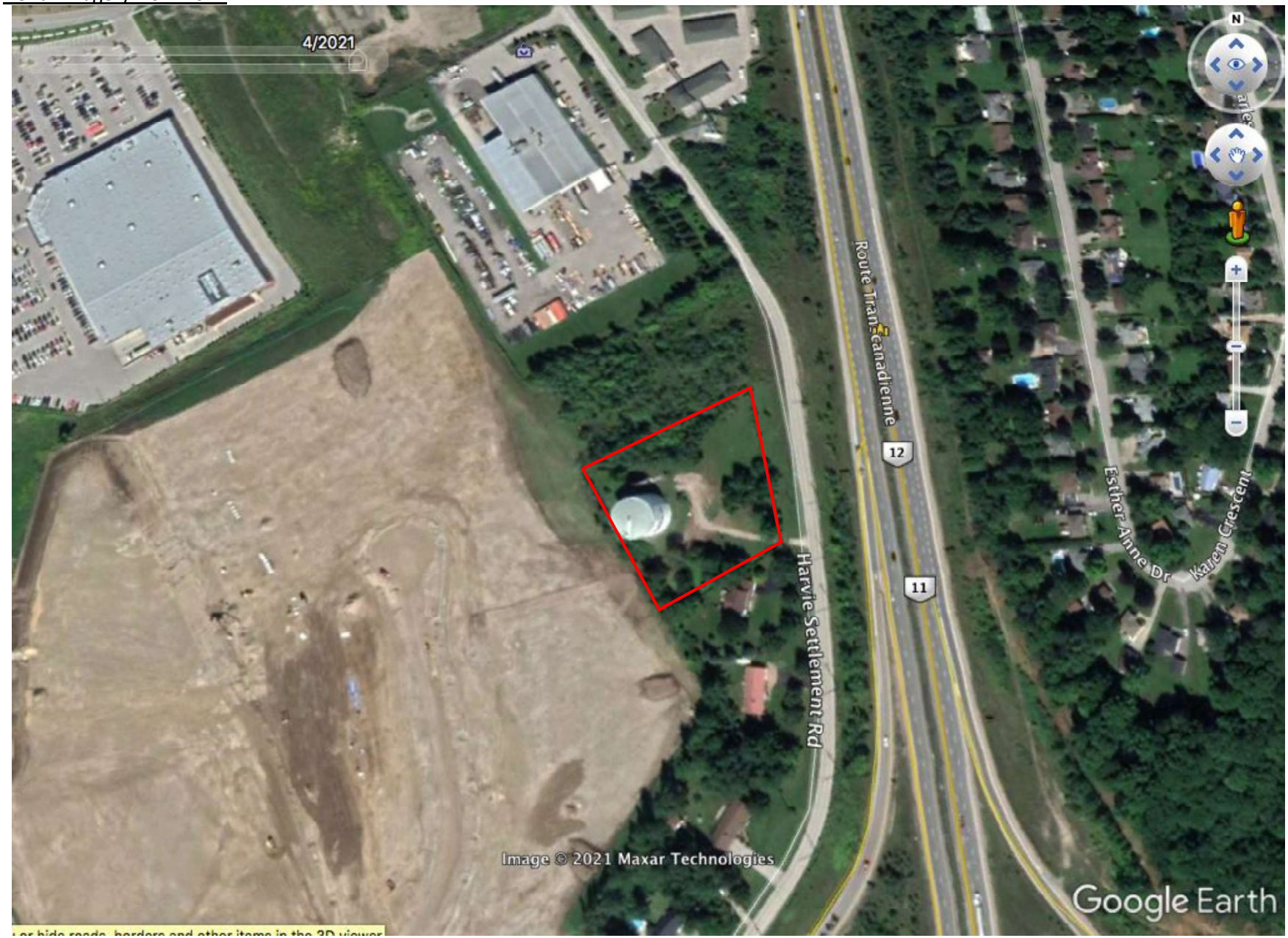
7.0 REFERENCES

Ministry of Natural Resources (MNR). 2010. Natural Heritage Reference Manual for Natural Heritage Policies of the Provincial Policy Statement, 2005 (Second Edition).

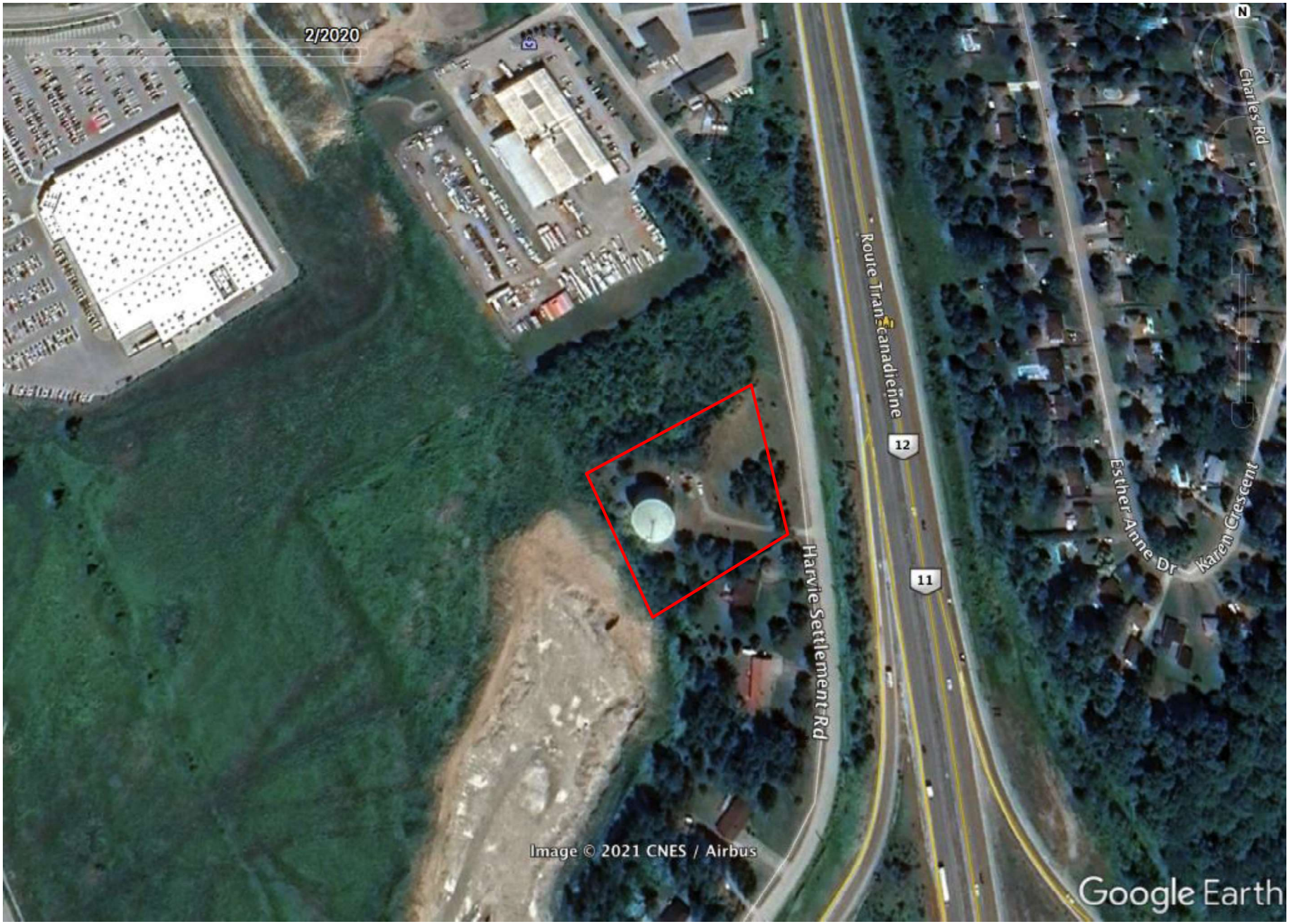
Attachment 1: Environmental Features
Orillia Water Master Plan

Attachment 2: Historical Mapping (*approximate property boundary in red polygon*)

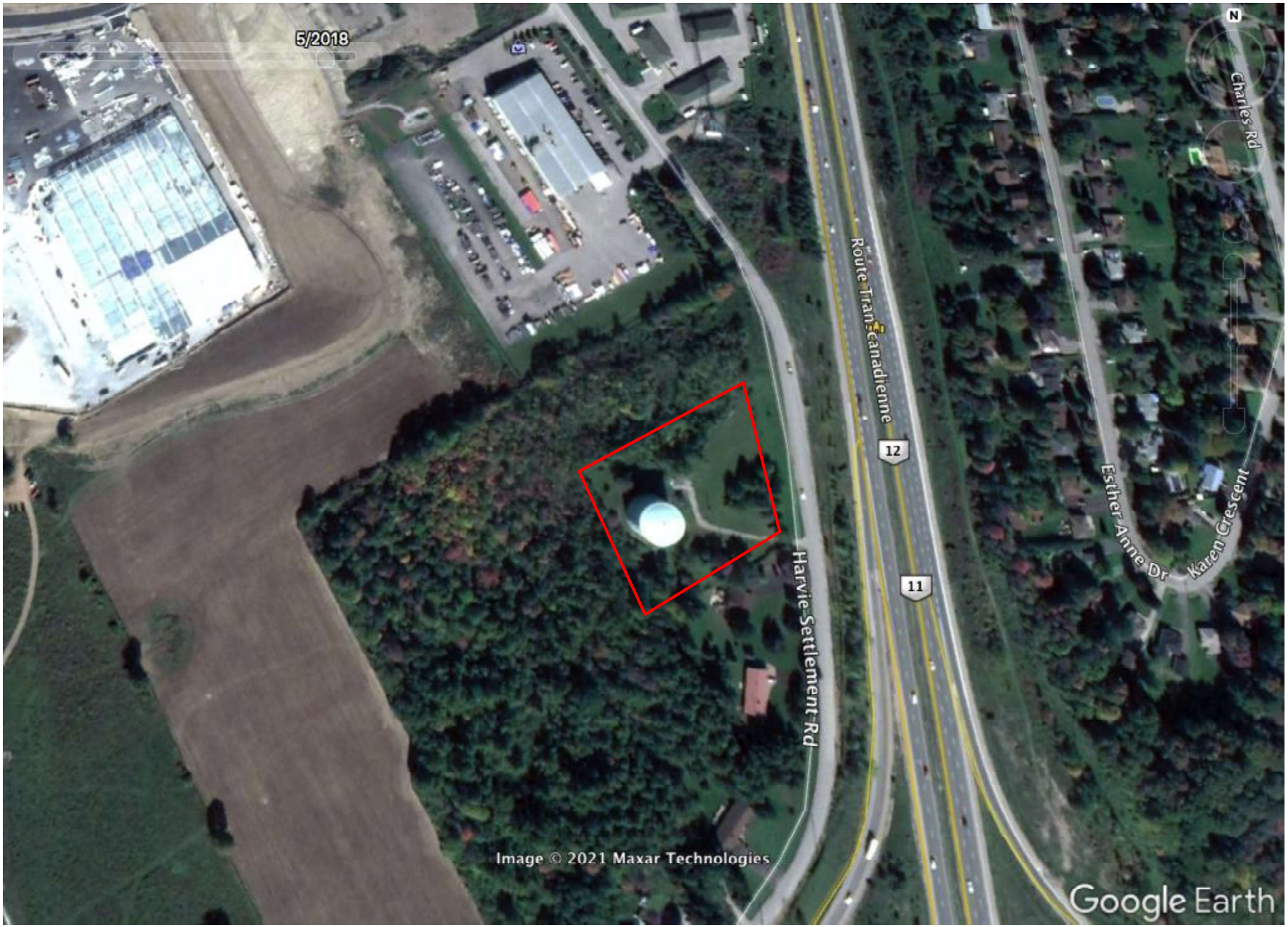
Aerial Imagery from 2021



Aerial Imagery from 2020



Aerial Imagery from 2018



Photograph 1: Looking at the maintained area from the southeast corner of the property (facing north) (July 27, 2020)

Photograph 2: Looking towards the maintained area from the southern end of the property (facing north) (July 27, 2020).

Photograph 3: Looking at the Fresh-Moist Poplar Deciduous Woodland (WODM5-1) from the northeast corner of the property (facing west) (July 27, 2020)

Photograph 4: Looking at the WODM5-1 from the northwest corner of the property (facing east) (July 27, 2020).

Photograph 5: Looking towards the Sumac Deciduous Thicket (THDM2-1) from the northwest corner (facing south) (July 27, 2020).

Photograph 6: Looking towards the THDM2-1 and the remnant woodland along the western property boundary (facing southwest) (July 27, 2020).

Harvie Hill Site
27.5 m diameter standpipes
Legend
Circle Measure
Harvie Hill Site
Property Line
2 x 27.5 m
diameter
standpipes
12
Route Transcanadienne
11
Harvie Settlement Rd
N
100 m
Google Earth
© 2021 Google

Harvie Hill Site
22.5 m diameter standpipes
Legend
Circle Measure
Harvie Hill Site
Property Line
3 x 22.5 m
diameter
standpipes
12
Route Transcanadienne
11
Harvie Settlement Rd
N
100 m
Google Earth
© 2021 Google

1.0 PROJECT REPORT COVER PAGE

LICENSEE INFORMATION:

Contact Information:	Marilyn E. Cornies BA CAHP Southwestern District Office 553 Dufferin Avenue London, ON N6B 2A5 Phone: (419) 432-4435 Email: mcornies@amick.ca www.amick.ca
Licensee:	Marilyn E. Cornies BA CAHP
Ontario Archaeology Licence:	P038

PROJECT INFORMATION:

Corporate Project Number:	2020007
MHSTCI Project Number:	P038-1009-2020
Investigation Type:	Stage 1-2 Archaeological Property Assessment
Project Name:	Orillia Water Reservoir
Project Location:	Harvie Settlement Road, Part of Lot 9, Concession 2 Southern Division of Orillia, (Geographic Township of South Orillia, County of Simcoe), City of Orillia, County of Simcoe
Project Designation Number:	Not Currently Available

MHSTCI FILING INFORMATION:

Site Record/Update Form(s):	N/A
Date of Report Filing:	20 November 2020
Type of Report:	**ORIGINAL**

2.0 EXECUTIVE SUMMARY

This report describes the results of the 2020 Stage 1-2 Archaeological Assessment of Harvie Settlement Road, Part of Lot 9, Concession 2 Southern Division of Orillia, (Geographic Township of South Orillia, County of Simcoe), City of Orillia, County of Simcoe, conducted by AMICK Consultants Limited. This study was conducted under Professional Archaeologist License #P038 issued to Marilyn Cornies by the Minister of Heritage, Sport, Tourism and Culture Industries for the Province of Ontario. This assessment was undertaken as a requirement under the Environmental Assessment Act (RSO 1990) and the Provincial Policy Statement (2020) as a component study of a Municipal Class Environmental Assessment (EA) for the proposed undertaking as part of the pre-submission process. Within the land use planning and development context, Ontario Regulation 544/06 under the Planning Act (1990b) requires an evaluation of archaeological potential and, where applicable, an archaeological assessment report completed by an archaeologist licensed by the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI). Policy 2.6 of the Provincial Policy Statement (PPS 2020) addresses archaeological resources. All work was conducted in conformity with Ontario Ministry of Tourism and Culture (MTC) Standards and Guidelines for Consultant Archaeologists (MTC 2011), the Ontario Heritage Act (RSO 1990a).

AMICK Consultants Limited was engaged by the proponent to undertake a Stage 1-2 Archaeological Assessment of lands potentially affected by the proposed undertaking and was granted permission to carry out archaeological fieldwork. The entirety of the study area was subject to property inspection and photographic documentation concurrently with the Stage 2 Property Assessment by high intensity test pit methodology at 5 metre intervals and by test pit survey at a ten-metre interval to confirm disturbance on 14 August 2020. All records, documentation, field notes, photographs and artifacts (as applicable) related to the conduct and findings of these investigations are held at the Lakelands District corporate offices of AMICK Consultants Limited until such time that they can be transferred to an agency or institution approved by the Ontario Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) on behalf of the government and citizens of Ontario.

STAGE 2 RECOMMENDATIONS:

As a result of the Stage 2 Property Assessment of the study area, no archaeological resources were encountered. Consequently, the following recommendations are made:

1. *No further archaeological assessment of the study area is warranted;*
2. *The Provincial interest in archaeological resources with respect to the proposed undertaking has been addressed;*
3. *The proposed undertaking is clear of any archaeological concern.*

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5.0 PROJECT CONTEXT

5.1 DEVELOPMENT CONTEXT

This report describes the results of the 2020 Stage 1-2 Archaeological Assessment of Harvie Settlement Road, Part of Lot 9, Concession 2 Southern Division of Orillia, (Geographic Township of South Orillia, County of Simcoe), City of Orillia, County of Simcoe, conducted

by AMICK Consultants Limited. This study was conducted under Professional Archaeologist License #P038 issued to Marilyn Cornies by the Minister of Heritage, Sport, Tourism and Culture Industries for the Province of Ontario. This assessment was undertaken as a requirement under the Environmental Assessment Act (RSO 1990) and the Provincial Policy Statement (2020) as a component study of a Municipal Class Environmental Assessment (EA) for the proposed undertaking as part of the pre-submission process. Within the land use planning and development context, Ontario Regulation 544/06 under the Planning Act (1990b) requires an evaluation of archaeological potential and, where applicable, an archaeological assessment report completed by an archaeologist licensed by the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI). Policy 2.6 of the Provincial Policy Statement (PPS 2020) addresses archaeological resources. All work was conducted in conformity with Ontario Ministry of Tourism and Culture (MTC) Standards and Guidelines for Consultant Archaeologists (MTC 2011), the Ontario Heritage Act (RSO 1990a).

AMICK Consultants Limited was engaged by the proponent to undertake a Stage 1-2 Archaeological Assessment of lands potentially affected by the proposed undertaking and was granted permission to carry out archaeological fieldwork. The entirety of the study area was subject to property inspection and photographic documentation concurrently with the Stage 2 Property Assessment by high intensity test pit methodology at 5 metre intervals and by test pit survey at a ten metre interval to confirm disturbance on 14 August 2020. All records, documentation, field notes, photographs and artifacts (as applicable) related to the conduct and findings of these investigations are held at the Lakelands District corporate offices of AMICK Consultants Limited until such time that they can be transferred to an agency or institution approved by the Ontario Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) on behalf of the government and citizens of Ontario.

The proposed development of the study area includes an additional water reservoir and a booster pumping station. A preliminary plan of the proposed development has been submitted together with this report to MHSTCI for review and reproduced within this report as Map 4. It must be noted that the angle the aerial image for the conceptual plan was taken on distorts the image of the water reservoir to make it look larger. See Map 5 for an accurate aerial image.

5.2 HISTORICAL CONTEXT

5.2.1 PRE-CONTACT LAND-USE OUTLINE

What follows is an outline of Aboriginal occupation in the area during the Pre-Contact Era from the earliest known period, about 9000 B.C. up to approximately 1650 AD.

5.2.1.1 PALAEO-INDIAN PERIOD (APPROXIMATELY 9000-7500 B.C.)

North of Lake Ontario, evidence suggests that early occupation began around 9000 B.C. People probably began to move into this area as the glaciers retreated and glacial lake levels

began to recede. The early occupation of the area probably occurred in conjunction with environmental conditions that would be comparable to modern Sub-Arctic conditions. Due to the great antiquity of these sites, and the relatively small populations likely involved, evidence of these early inhabitants is sparse and generally limited to tools produced from stone or to by-products of the manufacture of these implements. Some sites of this earliest period of First Nations occupation of Simcoe County have been documented to the south and to the west of Kempenfelt Bay.

5.2.1.2 ARCHAIC PERIOD (APPROXIMATELY 8000-1000 B.C.)

By about 8000 B.C. the gradual transition from a post glacial tundra-like environment to an essentially modern environment was largely complete. Prior to European clearance of the landscape for timber and cultivation, the area was characterized by forest. The Archaic Period is the longest and the most apparently stable of the cultural periods identified through archaeology. The Archaic Period is divided into the Early, Middle and Late Sub-Periods, each represented by specific styles in projectile point manufacture. Many more sites of this period are found throughout Ontario, than of the Palaeo-Indian Period. This is probably a reflection of two factors: the longer period of time reflected in these sites, and a greater population density. The greater population was likely the result of a more diversified subsistence strategy carried out in an environment offering a greater variety of abundant resources. (Smith 2002:58-59)

Current interpretations suggest that the Archaic Period populations followed a seasonal cycle of resource exploitation. Although similar in concept to the practices speculated for the big game hunters of the Palaeo-Indian Period, the Archaic populations utilized a much broader range of resources, particularly with respect to plants. It is suggested that in the spring and early summer, bands would gather at the mouths of rivers and at rapids to take advantage of fish spawning runs. Later in the summer and into the fall season, smaller groups would move to areas of wetlands to harvest nuts and wild rice. During the winter, they would break into yet smaller groups probably based on the nuclear family and perhaps some additional relatives to move into the interior for hunting. The result of such practices would be to create a distribution of sites across much of the landscape. (Smith 2002: 59-60).

The material culture of this period is much more extensive than that of the Palaeo-Indians. Stylistic changes between Sub-Periods and cultural groups are apparent, although the overall quality in production of chipped lithic tools seems to decline. This period sees the introduction of ground stone technology in the form of celts (axes and adzes), manos and metates for grinding nuts and fibres, and decorative items like gorgets, pendants, birdstones, and bannerstones. Bone tools are also evident from this time period. Their presence may be a result of better preservation from these more recent sites rather than a lack of such items in earlier occupations. In addition, copper and exotic chert types appear during the period and are indicative of extensive trading (Smith 2002: 58-59).

Three First Nations trails known as the Rouge Trail, the Don Trail, and the Humber Trail began on the north shore of Lake Ontario in the Toronto area and terminated on the two

branches of the Holland River (Myers 1977: 2). These trails form part of a long established trade and communications network that linked the upper and lower Great Lakes. The route followed the Holland River into the southern end of Lake Simcoe. Also, the route followed the western shore of Lake Simcoe northward to Kempenfelt Bay, and then westward to the end of the bay. A portage was then undertaken to the Nottawasaga River and this river was followed into Georgian Bay at the present location of the Town of Wasaga Beach. This network of trade and communication had been long established by the time Europeans began to operate in the area. The presence of artifacts dating to the Early Archaic Period in clos proximity to the upper and lower landings on the Holland River east branch suggests that the use of this system most likely dates back to at least that period.

5.2.1.3 WOODLAND PERIOD (APPROXIMATELY 1000 B.C.-1650 A.D.)

The primary difference in archaeological assemblages that differentiates the beginning of the Woodland Period from the Archaic Period is the introduction of ceramics to Ontario populations. This division is probably not a reflection of any substantive cultural changes, as the earliest sites of this period seem to be in all other respects a continuation of the Archaic mode of life with ceramics added as a novel technology. The seasonally based system of resource exploitation and associated population mobility persists for at least 1500 years into the Woodland Period. (Smith 2002: 61-62)

The Early Woodland Sub-Period dates from about 1000-400 B.C. Many of the artifacts from this time are similar to the late Archaic and suggest a direct cultural continuity between these two temporal divisions. The introduction of pottery represents and entirely new technology that was probably acquired through contact with more southerly populations from which it likely originates. (Smith 2002:62)

The Middle Woodland Sub-Period dates from about 400 B.C.-800 A.D. Within the region including the study area, a complex emerged at this time termed “Point Peninsula”. Point Peninsula pottery reflects a greater sophistication in pottery manufacture compared with the earlier industry. The paste and temper of the new pottery is finer and new decorative techniques such as dentate and pseudo-scallop stamping appear. There is a noted Hopewellian influence in southern Ontario populations at this time. Hopewell influences from south of the Great Lakes include a widespread trade in exotic materials and the presence of distinct Hopewell style artifacts such as platform pipes, copper or silver panpipe covers and shark’s teeth. The populations of the Middle Woodland participated in a trade network that extended well beyond the Great Lakes Region.

The Late Woodland Sub-Period dates from about 500-1650 A.D. The Late Woodland includes four separate phases: Princess Point, Early Ontario Iroquoian, Middle Ontario Iroquoian and Late Ontario Iroquoian.

The Princess Point phase dates to approximately 500-1000 A.D. Pottery of this phase is distinguished from earlier technology in that it is produced by the paddle method instead of coil and the decoration is characterized by the cord wrapped stick technique. Ceramic

smoking pipes appear at this time in noticeable quantities. Princess Point sites cluster along major stream valleys and wetland areas. Maize cultivation is introduced by these people to Ontario. These people were not fully committed to horticulture and seemed to be experimenting with maize production. They generally adhere to the seasonal pattern of occupation practiced by earlier occupations, perhaps staying at certain locales repeatedly and for a larger portion of each year (Smith 2002: 65-66)

The Early Ontario Iroquoian stage dates to approximately 950-1050 A.D. This stage marks the beginning of a cultural development that led to the historically documented Ontario Iroquoian groups that were first contacted by Europeans during the early 1600s (Petun, Neutral, and Huron). At this stage formal semi-sedentary villages emerge. The Early stage of this cultural development is divided into two cultural groups in southern Ontario. The areas occupied by each being roughly divided by the Niagara Escarpment. To the west were located the Glen Meyer populations, and to the east were situated the Pickering people (Smith 2002: 67).

The Middle Ontario Iroquoian stage dates to approximately 1300-1400 A.D. This stage is divided into two sub-stages. The first is the Uren sub-stage lasting from approximately 1300-1350 A.D. The second of the two sub-stages is known as the Middleport sub-stage lasting from roughly 1350-1400 A.D. Villages tend to be larger throughout this stage than formerly (Smith 2002: 67).

The Late Ontario Iroquoian stage dates to approximately 1400-1650 A.D. During this time the cultural divisions identified by early European explorers are under development and the geographic distribution of these groups within southern Ontario begins to be defined. During this period the Huron and Petun become established in their respective homelands familiar to early explorers, traders and missionaries.

5.2.2 General Historical Outline

In the seventeenth century Simcoe County was home to the Huron. With the arrival of French priests and Jesuits, missions were established near Georgian Bay. After the destruction of the missions by the Iroquois and the British, Algonquin speaking peoples occupied the area. After the war of 1812, the government began to invest in the military defences of Upper Canada, through the extension of Simcoe's Yonge Street from Lake Simcoe to Penetanguishene on Georgian Bay (Garbutt 2010).

The County of Simcoe was named after Lieutenant Governor of Upper Canada John Graves Simcoe. After its establishment as a County in 1798, it existed for military enlistment purposes. In 1823 it became a separate constituency for elections. As of 1837, the Townships within Simcoe County consisted of Adjala, Essa, Flos, West Gwillimbury, Innisfil, Mara, Matchedash, Medonte, Nottawasaga, Orillia (North and South Divisions), Oro, Rama, Sunnidale, Tay, Tecumseth, Tiny, Tosorontio, and Vespra (Wikipedia 2020).

Located at the meeting point of Lake Simcoe and Lake Couchiching, Orillia was founded in 1867 and incorporated as a town in 1875. The area was an important part of the fur trade, with several landing places, now incorporated within the city proper, along the north shore of Lake Ontario. There was a trading post located at the narrows where the two lakes meet. This area had also been a long time stop over point and camp and resources for natives as evidenced by the still existing weirs. The first white settler is said to have settled the area in 1833 and by 1836 there were as many as eight settlers in the area of the city of Orillia (waynecook.com 2010).

Map 2 is a facsimile segment from the Historical County Map of Simcoe County (J.T.R. Ralph 1871). Map 2 illustrates the location of the study area and environs as of 1871. The study area is shown to belong to Alex Harvie; there are no structures within the study area or within Lot 9. The lands to the west of Lot 9 indicate that the Harvie's owned a large majority of land in the area. There is also a saw and oat mill and several structures within the lots to the west and south of the study area. This demonstrates that the original property of which the study area is a part was settled by the time that the atlas data was compiled. Accordingly, it has been determined that there is potential for archaeological deposits related to early Post-Contact settlement within the study area. In addition, this map illustrates a settlement road adjacent to the study area to the east. This road is the current Harvie Settlement Road, which received its name form the Harvie family who settled the area based on this map. There is also a pond to the south of the study area named Mill Pond. The saw and oatmeal mill depicted in this map is connected to Mill Pond. It must be noted that the Mill Pond is not seen on the 1881 Simcoe Supplement map in the Illustrated Atlas of the Dominion of Canada. There are two small ponds seen in Map 1 of this report but neither are named, however, they appear in a similar location as the Mill Pond in Map 2 so it is likely the pond dried up and these two small ponds seen today are remnants of the larger pond in the past.

Map 3 is a facsimile segment of the Simcoe Supplement in the Illustrated Atlas of the Dominion of Canada (H. Belden 1881). Map 3 illustrates the location of the study area and environs as of 1881. The study area is shown to belong to J.S. Wood; there are no structures shown within the study area but there is a schoolhouse depicted at the southeast corner of the lot. This map also shows that the Harvie's who owned the land as of 1871 are still owners of some lots to the west and southwest of the study area. In addition, this map illustrates a settlement road adjacent to the study area to the east. This road is the current Harvie Settlement Road. As noted earlier, the Mill Pond is not seen on this map, however the stream used for the saw and oatmeal mill is still there and is shown as a tributary of Shingle's Bay.

It must be borne in mind that inclusion of names of property owners and depictions of structures and other features within properties on these maps were sold by subscription. Property owners paid to include information or details about their properties. While information included within these maps may provide information about the occupation of a property at a specific moment in time when the information was collected, the absence of such information does not necessarily indicate that the property was not occupied.

5.2.3 CURRENT CONDITIONS

The present use of the study area is as municipal land for the Orillia Water Reservoir. The study area is roughly 0.85 hectares in area. The study area includes within it mostly disturbed lands. The study area contains within it the Orillia water reservoir, a utility shed, a gravel laneway and a satellite tower. The study area is bounded on the north by woodlot, on the east by a small section of lawn and the Harvie Settlement Road, on the west by wood lot and on the south by a residential lot. The study area is approximately 457 metres to the northeast of the intersection of Harvie Settlement Road and Old Barrie Road East. A plan of the study area is included within this report as Map 4. Current conditions encountered during the Stage 1-2 Property Assessment are illustrated in Maps 5 & 6.

5.2.4 SUMMARY OF HISTORICAL CONTEXT

The brief overview of readily available documentary evidence indicates that the study area is situated within an area that was close to historic transportation routes and in an area well populated during the nineteenth century and therefore has potential for sites relating to early Post-Contact settlement in the region.

5.3 ARCHAEOLOGICAL CONTEXT

The Archaeological Sites Database administered by the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) indicates that there is seven (7) previously documented sites within 1 kilometre of the study area. However, it must be noted that this is based on the assumption of the accuracy of information compiled from numerous researchers using different methodologies over many years. AMICK Consultants Limited assumes no responsibility for the accuracy of site descriptions, interpretations such as cultural affiliation, or location information derived from the Archaeological Sites Database administered by MHSTCI. In addition, it must also be noted that a lack of formerly documented sites does not indicate that there are no sites present as the documentation of any archaeological site is contingent upon prior research having been conducted within the study area.

On the basis of information supplied by MHSTCI, no archaeological assessments have been conducted within 50 metres of the study area. AMICK Consultants Limited assumes no responsibility for the accuracy of previous assessments, interpretations such as cultural affiliation, or location information derived from the Archaeological Sites Database administered by MHSTCI. In addition, it must also be noted that the lack of formerly documented previous assessments does not indicate that no assessments have been conducted.

Data contained in previous archaeological reports in close proximity to the study area that is relevant to Stage 1 Background Study is defined within the Standards and Guidelines for Consultant Archaeologists in Section 7.5.8 Standard 4 as follows:

> *"Provide descriptions of previous archaeological fieldwork carried out within the limits of, or immediately adjacent to the project area,* ***as documented by all available reports that include archaeological fieldwork carried out on the lands to be impacted by this project, or where reports document archaeological sites immediately adjacent (i.e., within 50 m) to those lands****."*
>
> (MTCS 2011: 126 Emphasis Added)

In accordance with data supplied by MHSTCI for the purposes of completing this study, there are no previous reports detailing, *"archaeological fieldwork carried out on the lands to be impacted by this project"*, nor do any previous reports document known archaeological sites within 50 metres of the study area.

The Standards and Guidelines for Consultant Archaeologists stipulates that the necessity to summarize the results of previous archaeological assessment reports, or to cite MHSTCI File Numbers in references to other archaeological reports, is reserved for reports that are directly relevant to the fieldwork and recommendations for the study area (S & Gs 7.5.7, Standard 2, MTC 2011: 125). This is further refined and elaborated upon in Section 7.5.8, Standards 4 & 5, MTC 2011:

> *"4. Provide descriptions of previous archaeological fieldwork carried out within the limits of, or immediately adjacent to the project area, as documented by all available* ***reports that include archaeological fieldwork carried out on the lands to be impacted by this project, or where reports document archaeological sites immediately adjacent (i.e., within 50m) to those lands."***
>
> *"5.* ***If previous findings and recommendations are relevant*** *to the current stage of work, provide the following:*
>
> a. *a brief summary of previous findings and recommendations*
> b. *documentation of any differences in the current work from the previously recommended work*
> c. *rationale for the differences from the previously recommended work"*
>
> ***(Emphasis Added)***

The study area is situated within an area subject to an archaeological master plan or a similar regional overview study. The *County of Simcoe Archaeological Master Plan* was endorsed by County Council on 4 December 2019. The study involved the delineation of areas of archaeological potential within the County of Simcoe. A facsimile segment of the archaeological potential map within the plan is reproduced within this report as Map 7. The study area is within an area of potential as indicated on Map 7 (ASI 2019).

It must be further noted that there are no relevant plaques associated with the study area, which would suggest an activity or occupation within, or in close proximity to, the study area that may indicate potential for associated archaeological resources of significant CHVI.

In addition, archaeological sites data is also used to determine if any archaeological resources had been formerly documented within or in close proximity to the study area and if these same resources might be subject to impacts from the proposed undertaking. This data was also collected in order to establish the relative significance of any resources that might be encountered during the conduct of the present study. For example, the relative rarity of a site can be used to assign an elevated level of significance to a site that is atypical for the immediate vicinity. The requisite archaeological sites data of previously registered archaeological sites was collected from the MHSTCI and the corporate research library of AMICK Consultants Limited. The Stage 1 Background Research methodology also includes a review of the most detailed available topographic maps, historical settlement maps, archaeological management plans (where applicable) and commemorative plaques or monuments. When previous archaeological research documents lands to be impacted by the proposed undertaking or archaeological sites within 50 metres of the study area, the reports documenting this earlier work are reviewed for pertinent information. AMICK Consultants Limited will often modify this basic methodology based on professional judgment to include additional research (such as, local historical works or documents and knowledgeable informants).

5.3.1 PRE-CONTACT REGISTERED SITES

A summary of registered and/or known archaeological sites within a 1-kilometre radius of the study area was gathered from the Archaeological Sites Database, administered by MHSTCI. As a result it was determined that five (5) archaeological sites relating directly to Pre-Contact habitation/activity had been formally registered within the immediate vicinity of the study area. However, the lack of formally documented archaeological sites does not mean that Pre-Contact people did not use the area; it more likely reflects a lack of systematic archaeological research in the immediate vicinity. Even in cases where one or more assessments may have been conducted in close proximity to a proposed landscape alteration, an extensive area of physical archaeological assessment coverage is required throughout the region to produce a representative sample of all potentially available archaeological data in order to provide any meaningful evidence to construct a pattern of land use and settlement in the past. All previously registered Pre-Contact sites are briefly described below in Table 1:

TABLE 1 PRE-CONTACT SITES WITHIN 1KM

Site Name	Borden #	Site Type	Time Period and Cultural Affiliation
Cuppage	BdGu-40	Camp/Campsite	Pre-Contact (Aboriginal)
Hunters South Orillia #14	BdGu-38	Village	Late Woodland (Huron-Wendat)
Alia Kendra IV	BdGu-26	N/A	Late Woodland
Alia Kendra III	BdGu-25	N/A	Late Woodland (Aboriginal)
Alia Kendra II	BdGu-20	N/A	Late Woodland (Aboriginal)

Three of the above noted archaeological sites (BdGu-25, BdGu-26, BdGu-38) are situated within 300 metres of the study area. Therefore, they demonstrate archaeological potential for further archaeological resources related to Pre-Contact activity and occupation with respect to the archaeological assessment of the proposed undertaking.

Table 2 illustrates the chronological development of cultures within southern Ontario prior to the arrival of European cultures to the area at the beginning of the 17th century. This general cultural outline is based on archaeological data and represents a synthesis and summary of research over a long period of time. It is necessarily generalizing and is not necessarily representative of the point of view of all researchers or stakeholders. It is offered here as a rough guideline and as a very broad outline to illustrate the relationships of broad cultural groups and time periods.

TABLE 2 PRE-CONTACT CULTURAL CHRONOLOGY FOR SOUTHERN ONTARIO

Years ago	Period	Southern Ontario
250	Terminal Woodland	Ontario and St. Lawrence Iroquois Cultures
1000 2000	Initial Woodland	Princess Point, Saugeen, Point Peninsula, and Meadowood Cultures
3000 4000 5000 6000	Archaic	Laurentian Culture
7000 8000 9000 10000 11000	Palaeo-Indian	Plano and Clovis Cultures
		(Wright 1972)

5.3.2 POST-CONTACT REGISTERED SITES

A summary of registered and/or known archaeological sites within a 1-kilometre radius of the study area was gathered from the Archaeological Sites Database, administered by MHSTCI. As a result it was determined that one (1) archaeological site relating directly to Post-Contact habitation/activity had been formally registered within the immediate vicinity of the study area. All previously registered Post-Contact sites are briefly described below in Table 3:

TABLE 3 POST-CONTACT SITES WITHIN 1KM

Site Name	Borden #	Site Type	Cultural Affiliation
Allen	BdGu-39	Cemetery	Late Woodland (Huron-Wendat)

None of the above noted archaeological sites are situated within 300 metres of the study area. Therefore, they have no impact on determinations of archaeological potential for further

archaeological resources related to Post-Contact activity and occupation with respect to the archaeological assessment of the proposed undertaking.

5.3.3 Unknown Cultural Affiliation Registered Sites

A summary of registered and/or known archaeological sites within a 1-kilometre radius of the study area was gathered from the Archaeological Sites Database, administered by MHSTCI. As a result it was determined that one (1) archaeological site relating directly to unknown cultural affiliation had been formally registered within the immediate vicinity of the study area. All previously registered unknown cultural affiliation sites are briefly described below in Table 4:

Table 4 Unknown Cultural Affiliation Sites within 1km

Site Name	Borden #	Site Type	Cultural Affiliation
Campus	BdGu-36	N/A	N/A

The above noted archaeological site is situated within 300 metres of the study area. Therefore, it demonstrates archaeological potential for further archaeological resources.

5.3.4 Location and Current Conditions

The study area is described as Harvie Settlement Road, Part of Lot 9, Concession 2 Southern Division of Orillia, (Geographic Township of South Orillia, County of Simcoe), City of Orillia, County of Simcoe. The study area was subject to this assessment as a requirement under the Environmental Assessment Act (RSO 1990) and the Provincial Policy Statement (2020) as a component study of a Municipal Class Environmental Assessment (EA) for the proposed undertaking as part of the pre-submission process

The present use of the study area is as municipal land for the Orillia Water Reservoir. The study area is roughly 0.85 hectares in area. The study area includes within it mostly disturbed lands. The study area contains within it the Orillia water reservoir, a utility shed, a gravel laneway and a satellite tower. The study area is bounded on the north by woodlot, on the east by a small section of lawn and the Harvie Settlement Road, on the west by wood lot and on the south by a residential lot. The study area is approximately 457 metres to the northeast of the intersection of Harvie Settlement Road and Old Barrie Road East. A plan of the study area is included within this report as Map 4. Current conditions encountered during the Stage 1-2 Property Assessment are illustrated in Maps 5 & 6.

5.3.5 Physiographic Region

The study area is situated within the Simcoe Uplands physiographic region. The Simcoe Uplands is described as a series of broad, rolling till plains separated by steep-sided, flat-floored valleys, indicating they were islands in Lake Algonquin. The till is composed of mainly Precambrian rock, the texture of which is a gritty loam that becomes sandier toward

the north; more calcareous till occurs near Lake Simcoe and near Midland. Although the dominant soil in the uplands is a sandy loam, smaller areas near the sandy ridges of the Oro Moraine and the Hendrie forest feature extremely pervious soil areas, sometimes with dry depressions many feet in depth. The loose sandy texture of the surface soil is conducive to wind erosion when vegetation has been removed (Chapman and Putnam 1984: 182-183).

5.3.6 Surface Water

Sources of potable water, access to waterborne transportation routes, and resources associated with watersheds are each considered, both individually and collectively to be the highest criteria for determination of the potential of any location to support extended human activity, land use, or occupation. Accordingly, proximity to water is regarded as the primary indicator of archaeological resource potential. The Standards and Guidelines for Consultant Archaeologists stipulates that undisturbed lands within 300 metres of a water source are considered to have archaeological potential (MTC 2011: 21).

There is no surface water within the study area or within close proximity to the study area.

5.3.7 Current Property Conditions Context

Current characteristics encountered within an archaeological research study area determine if property Assessment of specific portions of the study area will be necessary and in what manner a Stage 2 Property Assessment should be conducted, if necessary. Conventional assessment methodologies include pedestrian survey on ploughable lands and test pit methodology within areas that cannot be ploughed. For the purpose of determining where property Assessment is necessary and feasible, general categories of current landscape conditions have been established as archaeological conventions. These include:

5.3.7.1 Buildings and Structural Footprints

A building, for the purposes of this particular study, is a structure that exists currently or has existed in the past in a given location. The footprint of a building is the area of the building formed by the perimeter of the foundation. Although the interior area of building foundations would often be subject to property Assessment when the foundation may represent a potentially significant historic archaeological site, the footprints of existing structures are not typically assessed. Existing structures commonly encountered during archaeological assessments are often residential-associated buildings (houses, garages, sheds), and/or component buildings of farm complexes (barns, silos, greenhouses). In many cases, even though the disturbance to the land may be relatively shallow and archaeological resources may be situated below the disturbed layer (e.g. a concrete garage pad), there is no practical means of assessing the area beneath the disturbed layer. However, if there were evidence to suggest that there are likely archaeological resources situated beneath the disturbance, alternative methodologies may be recommended to study such areas.

The study area contains a water reservoir, a utility shed and a satellite tower. These structures take up approximately 10% of the study area. Maps 5 & 6 of this report illustrate the locations of these features.

5.3.7.2 DISTURBANCE

Areas that have been subjected to extensive and deep land alteration that has severely damaged the integrity of archaeological resources are known as land disturbances. Examples of land disturbances are areas of past quarrying, major landscaping, and sewage and infrastructure development (MTC 2011: 18), as well as driveways made of gravel or asphalt or concrete, in-ground pools, and wells or cisterns. Surfaces paved with interlocking brick, concrete, asphalt, gravel and other surfaces meant to support heavy loads or to be long wearing hard surfaces in high traffic areas, must be prepared by the excavation and removal of topsoil, grading, and the addition of aggregate material to ensure appropriate engineering values for the supporting matrix and also to ensure that the installations shed water to avoid flooding or moisture damage. All hard surfaced areas are prepared in this fashion and therefore have no or low archaeological potential. Major utility lines are conduits that provide services such as water, natural gas, hydro, communications, sewage, and others. These major installations should not be confused with minor below ground service installations not considered to represent significant disturbances removing archaeological potential, such as services leading to individual structures which tend to be comparatively very shallow and vary narrow corridors. Areas containing substantial and deeply buried services or clusters of below ground utilities are considered areas of disturbance, and may be excluded from Stage 2 Property Assessment. Disturbed areas are excluded from Stage 2 Property Assessment due to no or low archaeological potential and often because they are also not viable to assess using conventional methodology.

> *"Earthwork is one of the major works involved in road construction. This process includes excavation, material removal, filling, compaction, and construction. Moisture content is controlled, and compaction is done according to standard design procedures. Normally, rock explosion at the road bed is not encouraged. While filling a depression to reach the road level,* ***the original bed is flattened after the removal of the topsoil.*** *The fill layer is distributed and compacted to the designed specifications. This procedure is repeated until the compaction desired is reached. The* ***fill material should not contain organic elements,*** *and possess a low index of plasticity. Fill material can include gravel and decomposed rocks of a particular size, but should not consist of huge clay lumps. Sand clay can be used. The area is considered to be adequately compacted when the roller movement does not create a noticeable deformation.* ***The road surface finish is reliant on the economic aspects, and the estimated usage."*** *[Emphasis Added]*
>
> (Goel 2013)

The supporting matrix of a hard paved surface cannot contain organic material which is subject to significant compression, decay and moisture retention. Topsoil has no engineering value and must be removed in any construction application where the surface finish at grade

requires underlying support.

Installation of sewer lines and other below ground services associated with infrastructure development often involves deep excavation that can remove archaeological potential. This consideration does not apply to relatively minor below ground services that connect structures and facilities to services that support their operation and use. Major servicing corridors will be situated within adjacent road allowances with only minor, narrow and relatively shallow underground services entering into the study area to connect existing structures to servicing mainlines. The relatively minor, narrow and shallow services buried within a residential property do not require such extensive ground disturbance to remove or minimize archaeological potential within affected areas.

The study area contains previous disturbance as indicated by the gravel laneway into the study area off of Harvie Settlement Road, as well as from the grading and construction of the water reservoir. The lawn portion of the study area is entirely disturbed. Approximately 9-% of the study area is disturbed. Maps 5 & 6 of this report illustrate the locations of these features.

5.3.7.3 Low-Lying and Wet Areas

Landscape features that are covered by permanently wet areas, such as marshes, swamps, or bodies of water like streams or lakes, are known as low-lying and wet areas. Low-lying and wet areas are excluded from Stage 2 Property Assessment due to inaccessibility.

The study area does not contain low-lying and wet areas.

5.3.7.4 Steep Slope

Landscape which slopes at a greater than (>) 20 degree change in elevation, is known as steep slope. Areas of steep slope are considered uninhabitable, and are excluded from Stage 2 Property Assessment.

Generally, steep slopes are not assessed because steep slopes are interpreted to have low potential, not due to viability to assess, except in cases where the slope is severe enough to become a safety concern for archaeological field crews. In such cases, the Occupational Health and Safety Act takes precedence as indicated in the introduction to the Standards and Guidelines. AMICK Consultant Limited policy is to assess all slope areas whenever it is safe to do so. Assessment of slopes, except where safety concerns arise, eliminates the invariably subjective interpretation of what might constitute a steep slope in the field. This is done to minimize delays due to conflicts in such interpretations and to increase the efficiency of review.

The study area does not contain areas of steep slope.

5.3.7.5 Wooded Areas

Areas of the property that cannot be ploughed, such as natural forest or woodlot, are known as wooded areas. These wooded areas qualify for Stage 2 Property Assessment, and are required to be assessed using test pit survey methodology.

The study area contains a very small section of wooded area on the northern and western borders. These wooded areas consist of small shrubs and a mix of deciduous and coniferous trees. Approximately 10% of the study area is wooded. Maps 5 & 6 of this report illustrate the locations of these features.

5.3.7.6 Ploughable Agricultural Lands

Areas of current or former agricultural lands that have been ploughed in the past are considered ploughable agricultural lands. Ploughing these lands regularly turns the soil, which in turn brings previously buried artifacts to the surface, which are then easily identified during visual inspection. Furthermore, by allowing the ploughed area to weather sufficiently through rainfall, soil is washed off of exposed artifacts at the surface and the visibility of artifacts at the surface of recently worked field areas is enhanced markedly. Pedestrian survey of ploughed agricultural lands is the preferred method of physical assessment because of the greater potential for finding evidence of archaeological resources if present.

The study area does not contain any ploughable lands.

5.3.7.7 Lawn, Pasture, Meadow

Landscape features consisting of former agricultural land covered in low growth, such as lawns, pastures, meadows, shrubbery, and immature trees. These are areas that may be considered too small to warrant ploughing, (i.e. less than one hectare in area), such as yard areas surrounding existing structures, and land-locked open areas that are technically workable by a plough but inaccessible to agricultural machinery. These areas may also include open area within urban contexts that do not allow agricultural tillage within municipal or city limits or the use of urban roadways by agricultural machinery. These areas are required to be assessed using test pit survey methodology.

The study area contains mostly disturbed lawn. It is likely it was disturbed from the grading necessary for the construction of the water reservoir. Approximately 80% of the study area is lawn. Maps 5 & 6 of this report illustrate the locations of these features.

5.3.8 Summary

Background research indicates the vicinity of the study area has potential for archaeological resources of Native origins based on proximity to previously registered archaeological sites of Pre-Contact origins. Background research also suggests potential for archaeological

resources of Post-Contact origins based on proximity to a historic roadway, and proximity to areas of documented historic settlement.

Current conditions within the study area indicate that some areas of the property may have no or low archaeological potential and do not require Stage 2 Property Assessment or should be excluded from Stage 2 Property Assessment. These areas would include the footprint of existing structures and areas under gravel. A significant proportion of the study area does exhibit archaeological potential and therefore a Stage 2 Property Assessment is required.

Archaeological potential does not indicate that there are necessarily sites present, but that environmental and historical factors suggest that there may be as yet undocumented archaeological sites within lands that have not been subject to systematic archaeological research in the past.

6.0 FIELD WORK METHODS AND WEATHER CONDITIONS

This report confirms that the study area was subject to Stage 2 Property Assessment by high intensity test pit methodology at a five-metre interval between individual test pits and by test pit survey at a ten metre interval to confirm disturbance on 14 August 2020.

The fieldwork undertaken as a component of this study was conducted according to the archaeological fieldwork standards and guidelines (including weather and lighting conditions). Weather conditions were appropriate for the necessary fieldwork required to complete the Stage 2 Property Assessment and to create the documentation appropriate to this study. The locations from which photographs were taken and the directions toward which the camera was aimed for each photograph are illustrated in Maps 5 & 6 of this report. Upon completion of the property inspection of the study area, it was determined that select areas would require Stage 2 Property Assessment.

It must be noted that AMICK Consultants Limited has been retained to assess lands as specified by the proponent. As such, AMICK Consultants Limited is constrained by the terms of the contract in place at the time of the Archaeological Assessment and can only enter into lands for which AMICK Consultants Limited has received consent from the owner or their agent(s). The proponent has been advised that the entire area within the planning application must be subject to archaeological assessment and that portions of the planning application may only be excluded if they are of low potential, are not viable to assess, or are subject to planning provisions that would restrict any such areas from any form of ground altering activities.

6.1 PROPERTY INSPECTION

A detailed examination and photo documentation was carried out on the study area in order to document the existing conditions of the study area to facilitate the Stage 2 Property Assessment. All areas of the study area were visually inspected and select features were photographed as a representative sample of each area defined within Maps 5 & 6.

Observations made of conditions within the study area at the time of the inspection were used to inform the requirement for Stage 2 Property Assessment for portions of the study area as well as to aid in the determination of appropriate Stage 2 Property Assessment strategies. The locations from which photographs were taken and the directions toward which the camera was aimed for each photograph are illustrated in Maps 5 & 6 of this report.

6.2 TEST PIT SURVEY

In accordance with the Standards and Guidelines for Consultant Archaeologists, test pit survey is required to be undertaken for those portions of the study area where deep prior disturbance had not occurred prior to assessment or which were accessible to survey. Test pit survey is only used in areas that cannot be subject to ploughing or cultivation. This report confirms that the conduct of test pit survey within the study area conformed to the following standards:

1. Test pit survey only on terrain where ploughing is not possible or viable, as in the following examples:

a. wooded areas
[All wooded areas were test pit surveyed at an interval of 5 m between individual test pits]

b. pasture with high rock content
[Not Applicable - The study area does not contain any pastures with high rock content]

c. abandoned farmland with heavy brush and weed growth
[Not Applicable - The study area does not contain any abandoned farmland with heavy brush and weed growth]

d. orchards and vineyards that cannot be strip ploughed (planted in rows 5 m apart or less), gardens, parkland or lawns, any of which will remain in use for several years after the survey
[Not Applicable - The study area does not contain any of the above-mentioned circumstances]

e. properties where existing landscaping or infrastructure would be damaged. The presence of such obstacles must be documented in sufficient detail to demonstrate that ploughing or cultivation is not viable.
[The study area is to be maintained as land for the Harvie Hill Reservoir with the addition of a second reservoir. The land within the study area is mostly disturbed and ploughing would not be viable based on size and existence of the water reservoir as well as satellite tower and utility shed. The disturbed land was test pitted at 10 metre intervals to confirm disturbance and by high intensity test pit methodology in the wooded areas.]

f. narrow (10 m or less) linear survey corridors (e.g., water or gas pipelines, road widening). This includes situations where there are planned impacts 10 m or less beyond the previously impacted limits on both sides of an existing linear corridor (e.g., two linear survey corridors on either side of an existing roadway). Where at the time of fieldwork the lands within the linear corridor meet the standards as stated under the above section on pedestrian survey land preparation, pedestrian survey must be carried out. Space test pits at maximum intervals of 5 m (400 test pits per hectare) in areas less than 300 m from any feature of archaeological potential.
[Not Applicable – The study area does not contain any linear corridors]

2. *Space test pits at maximum intervals of 5 m (400 test pits per hectare) in areas less than 300 m from any feature of archaeological potential.*
[All test pits were spaced at an interval of 5m between individual test pits in the wooded areas of the study area and by ten-metre intervals where lands were disturbed.]

3. *Space test pits at maximum intervals of 10 m (100 test pits per hectare) in areas more than 300 m from any feature of archaeological potential.*
[Test pits were spaced 5 metres between individual test pits within the wooded areas and spaced 10 metres between individual test pits within the disturbed areas.]

4. *Test pit to within 1 m of built structures (both intact and ruins), or until test pits show evidence of recent ground disturbance.*
[Test pits were placed within 1m of all built structures]

5. *Ensure that test pits are at least 30 cm in diameter.*
[All test pits were at least 30 cm in diameter]

6. *Excavate each test pit, by hand, into the first 5 cm of subsoil and examine the pit for stratigraphy, cultural features, or evidence of fill.*
[Regardless of the interval between individual test pits, all test pits were excavated by hand into the first 5 cm of subsoil where possible and examined for stratigraphy, cultural features, or evidence of fill. In areas where topsoil was not present, test pits were excavated to ensure that suspected subsoils, if present, were not layers of fill or waterborne materials overlying buried topsoil. If these areas consisted of fill soils, test pits were also excavated below grade in order to ensure disturbance extended below even deep topsoil layers such as those encountered in agricultural fields to ensure that the depth of disturbance was sufficient to remove archaeological potential in most contexts. Where other evidence indicates locations of potentially significant archaeological sites that may include cultural deposits below fill soils, alternative strategies to explore beneath the fill layers found in some areas may be necessary to complete the Stage 2 Property Assessment. In such cases, further Stage 2 Property Assessment may be

recommended following completion of the property survey under conventional methodologies.]

7. *Screen soil through mesh no greater than 6 mm.*
   [All soil was screened through mesh no greater than 6 mm]

8. *Collect all artifacts according to their associated test pit.*
   [Not Applicable - No archaeological resources were encountered]

9. *Backfill all test pits unless instructed not to by the landowner.*
   [All test pits were backfilled]

(MTC 2011: 31-32)

"*A combination of property inspection and test pitting may be used when initial Stage 2 results determine that all or part of the project area may in fact be disturbed. The Stage 2 survey may then consists of a detailed inspection (equivalent to Stage 1), combined with test pitting."*

1. *If it was not done as part of Stage 1, inspect and document the disturbed areas according to the standards described for Stage 1 property inspections.*
   [The disturbed areas of the study area were inspected and documented as per the standards described for Stage 1 property inspections. Areas of suspected disturbance where test pit survey was viable were shovel tested as described below. The area of suspected disturbance included the entire lawn. This is likely from the grading and construction of the water reservoir within the study area.

   Standard archaeological survey methodologies employed in Ontario for Stage 2 Archaeological Property Assessment (i.e. pedestrian survey and test pit survey) cannot determine if deeply buried cultural remains are or are not present. The purpose of Stage 2 Property Assessment is not to test for deeply buried deposits. The Standards and Guidelines for Consultants Archaeologists recognize this fact and have a whole separate section covering this specific issue. The only way to determine if deeply buried remains are present is to follow those standards not via a standard Stage 1-2 Archaeological Property Assessment.

   In most cases, unless there is documentation or evidence to the contrary, areas where grading has exceeded topsoil depth are areas considered to have no or low archaeological potential because in most cases removal of the topsoil will remove archaeological sites. While archaeological sites are popularly thought of as being deeply buried, archaeological sites begin on the surface of the ground and for most of humanity's history involved no substantial excavations or significant landscape alterations. Only with the rise of urbanization and sedentary settlement do sites begin to accumulate depth. This is a result of continuous building and rebuilding over top of earlier settlements. Deep archaeological sites are created by adding to the surface of an area and building the landform up. Deeply buried archaeological

deposits are relatively rare outside of urban environments in Ontario and even within urban contexts, this seldom occurs outside of the historic core of the community where redevelopment has occurred since initial settlement.

If an area was not occupied during a period of potential archaeological significance, there is no potential to locate deeply buried significant archaeological resources. There are only a few very rare exceptions related to historical significance that is not tied to the time period of activity or occupation of a site but to certain historical events and/or personalities.

Areas of suspected disturbance where test pit survey was viable were shovel tested as described below.

2. *Place Stage 2 test pits throughout the disturbed areas according to professional judgment (and where physically viable) as to confirm that these areas have been completely disturbed.*
*[*An area of suspected disturbance was identified during the Property Inspection conducted as part of the Stage 2 Property Assessment. This area consists of the entire lawn area. Test pits were excavated every 10 metres across the entirety of this portion of the study area. The intensity of test pit survey conducted is far in excess of the minimum standard required. AMICK Consultants Limited tested the suspected disturbed area at a 10-metre interval to confirm disturbance in a manner consistent with the objectives to ensure that the area is accurately delimited and properly identified. There is no requirement to systematically examine such areas. The Standards and Guidelines require only judgmental testing based on the professional judgment of the investigating archaeologist. In most typical archaeological assessments the entire area of presumed disturbance will be written off as an area of no archaeological potential without thorough testing to demonstrate that the entire area is disturbed or it will be tested at subjective, irregular and inconsistent intervals, and consequently such testing cannot verify that the entire area contained within the presumed limits of disturbance are, in fact, disturbed. The methodology employed here by AMICK Consultants Limited exceeds any requirements of the Standards and Guidelines and that which is generally applied within the industry.

The excavated soil and the profiles of these test pits were examined to determine if each represented an area of disturbance. Test pits were excavated below grade in order to ensure that test pits were excavated to depths below the surrounding natural grade. This procedure demonstrated that the entire study area consists of fill deposited within a deeply disturbed context. There is no archaeological potential within this area.]

(MTC 2011: 38)

7.0 RECORD OF FINDS

Section 7.8.2 of the Standards and Guidelines for Consultant Archaeologists (MTC 2011: 137-138) outlines the requirements of the Record of Finds component of a Stage 2 report:

1. *For all archaeological resources and sites that are identified in Stage 2, provide the following:*
    a. *a general description of the types of artifacts and features that were identified*
    b. *a general description of the area within which artifacts and features were identified, including the spatial extent of the area and any relative variations in density*
    c. *a catalogue and description of all artifacts retained*
    d. *a description of the artifacts and features left in the field (nature of material, frequency, other notable traits).*
2. *Provide an inventory of the documentary record generated in the field (e.g. photographs, maps, field notes).*
3. *Submit information detailing exact site locations on the property separately from the project report, as specified in section 7.6. Information on exact site locations includes the following:*
    a. *table of GPS readings for locations of all archaeological sites*
    b. *maps showing detailed site location information.*

7.1 ARCHAEOLOGICAL RESOURCES

No archaeological resources of any description were encountered anywhere within the study area.

7.2 ARCHAEOLOGICAL FIELDWORK DOCUMENTATION

The documentation produced during the field investigation conducted in support of this report includes: one sketch map, one page of photo log, one page of field notes, and 18 digital photographs.

8.0 ANALYSIS AND CONCLUSIONS

AMICK Consultants Limited was engaged by the proponent to undertake a Stage 1-2 Archaeological Assessment of lands potentially affected by the proposed undertaking and was granted permission to carry out archaeological fieldwork. The entirety of the study area was subject to property inspection and photographic documentation concurrently with the Stage 2 Property Assessment on 14 August 2020, consisting of high-intensity test pit survey at an interval of five metres between individual test pits and by test pit methodology at 10 metre intervals to confirm disturbance. All records, documentation, field notes, photographs and artifacts (as applicable) related to the conduct and findings of these investigations are held at the Lakelands District corporate offices of AMICK Consultants Limited until such time that they can be transferred to an agency or institution approved by the Ontario Ministry

of Heritage, Sport, Tourism and Culture Industries (MHSTCI) on behalf of the government and citizens of Ontario.

8.1 STAGE 1 ANALYSIS AND CONCLUSIONS

As part of the present study, background research was conducted in order to determine the archaeological potential of the proposed project area.

"A Stage 1 background study provides the consulting archaeologist and Ministry report reviewer with information about the known and potential cultural heritage resources within a particular study area, prior to the start of the field assessment." (OMCzCR 1993)

The evaluation of potential is further elaborated Section 1.3 of the Standards and Guidelines for Consultant Archaeologist (2011) prepared by the Ontario Ministry of Tourism and Culture:

" The Stage 1 background study (and, where undertaken, property inspection) leads to an evaluation of the property's archaeological potential. If the evaluation indicates that there is archaeological potential anywhere on the property, the next step is a Stage 2 assessment." (MTC 2011: 17)

Features or characteristics that indicate archaeological potential when documented within the study area, or within close proximity to the study area (as applicable), include:

" - previously identified archaeological sites

- *water sources (It is important to distinguish types of water and shoreline, and to distinguish natural from artificial water sources, as these features affect site locations and types to varying degrees.):*
    - *primary water sources (lakes, rivers, streams, creeks)*
    - *secondary water sources (intermittent streams and creeks, springs, marshes, swamps)*
    - *features indicating past water sources (e.g., glacial lake shorelines indicated by the presence of raised sand or gravel beach ridges, relic river or stream channels indicated by clear dip or swale in the topography, shorelines of drained lakes or marshes, cobble beaches)*
    - *accessible or inaccessible shoreline (e.g., high bluffs, swamp or marsh fields by the edge of a lake, sandbars stretching into marsh)*
- *elevated topography (e.g., eskers, drumlins, large knolls, plateaux)*
- *pockets of well-drained sandy soil, especially near areas of heavy soil or rocky ground*
- *distinctive land formations that might have been special or spiritual places, such as waterfalls, rock outcrops, caverns, mounds, and promontories and their bases. There may be physical indicators of their use, such as burials, structures, offerings, rock paintings or carvings.*
- *resource areas, including:*

  - *food or medicinal plants (e.g., migratory routes, spawning areas, prairie)*
  - *scarce raw materials (e.g., quartz, copper, ochre or outcrops of chert)*
  - *early Post-contact industry (e.g., fur trade, logging, prospecting, mining)*
- *areas of early Post-contact settlement. These include places of early military or pioneer settlement (e.g., pioneer homesteads, isolated cabins, farmstead complexes), early wharf or dock complexes, pioneer churches and early cemeteries. There may be commemorative markers of their history, such as local, provincial, or federal monuments or heritage parks.*
- *Early historical transportation routes (e.g., trails, passes, roads, railways, portage routes)*
- *property listed on a municipal register or designated under the Ontario Heritage Actor that is a federal, provincial or municipal historic landmark or site*
- *property that local histories or informants have identified with possible archaeological sties, historical events, activities, or occupations"*

(MTC 2011: 17-18)

The evaluation of potential does not indicate that sites are present within areas affected by proposed development. Evaluation of potential considers the possibility for as yet undocumented sites to be found in areas that have not been subject to systematic archaeological investigation in the past. Potential for archaeological resources is used to determine if property assessment of a study area or portions of a study area is required.

> *"Archaeological resources not previously documented may also be present in the affected area. If the alternative areas being considered, or the preferred alternative selected, exhibit either high or medium potential for the discovery of archaeological remains an archaeological assessment will be required."*
>
> (MCC & MOE 1992: 6-7)

> *"The Stage 1 background study (and, where undertaken, property inspection) leads to an evaluation of the property's archaeological potential. If the evaluation indicates that there is archaeological potential anywhere on the property, the next step is a Stage 2 assessment."*
>
> (MTC 2011: 17)

In addition, archaeological sites data is also used to determine if any archaeological resources had been formerly documented within or in close proximity to the study area and if these same resources might be subject to impacts from the proposed undertaking. This data was also collected in order to establish the relative cultural heritage value or interest of any resources that might be encountered during the conduct of the present study. For example, the relative rarity of a site can be used to assign an elevated level of cultural heritage value or interest to a site that is atypical for the immediate vicinity. The requisite archaeological sites data of previously registered archaeological sites was collected from the Programs and Services Branch, Culture Programs Unit, MHSTCI and the corporate research library of AMICK Consultants Limited. The Stage 1 Background Research methodology also includes a review of the most detailed available topographic maps, historical settlement maps,

archaeological management plans (where applicable) and commemorative plaques or monuments. When previous archaeological research documents lands to be impacted by the proposed undertaking or archaeological sites within 50 metres of the study area, the reports documenting this earlier work are reviewed for pertinent information. AMICK Consultants Limited will often modify this basic methodology based on professional judgment to include additional research (such as, local historical works or documents and knowledgeable informants).

Section 7.7.3 of the Standards and Guidelines for Consultant Archaeologists (MTC 2011: 132) outlines the requirements of the Analysis and Conclusions component of a Stage 1 Background Study.

1) *"Identify and describe areas of archaeological potential within the project area.*
2) *Identify and describe areas that have been subject to extensive and deep land alterations. Describe the nature of alterations (e.g., development or other activity) that have severely damaged the integrity of archaeological resources and have removed archaeological potential."*

CHARACTERISTICS INDICATING ARCHAEOLOGICAL POTENTIAL

Section 1.3.1 of the Standards and Guidelines for Consultant Archaeologists specifies the property characteristics that indicate archaeological potential (MTC 2011: 17-18). Factors that indicate archaeological potential are features of the local landscape and environment that may have attracted people to either occupy the land or to conduct activities within the study area. One or more of these characteristics found to apply to a study area would necessitate a Stage 2 Property Assessment to determine if archaeological resources are present. These characteristics are listed below together with considerations derived from the conduct of this study.

1) *Previously Identified Archaeological Sites*
   Previously registered archaeological sites have not been documented within 300 metres of the study area.

2) *Water Sources*
   Primary water sources are described as including lakes, rivers streams and creeks. Close proximity to primary water sources (300 metres) indicates that people had access to readily available sources of potable water and routes of waterborne trade and communication should the study area have been used or occupied in the past.

   There are no identified primary water sources within 300 metres of the study area.

   Secondary water sources are described as including intermittent streams and creeks, springs, marshes, and swamps. Close proximity (300 metres) to secondary water sources indicates that people had access to readily available sources of potable water, at least on a seasonal basis, and in some cases seasonal access to routes of waterborne

trade and communication should the study area have been used or occupied in the past.

There are no identified secondary water sources within 300 metres of the study area.

3) *Features Indicating Past Water Sources*
Features indicating past water resources are described as including glacial lake shorelines indicated by the presence of raised sand or gravel beach ridges, relic river or stream channels indicated by clear dip or swale in the topography, shorelines of drained lakes or marshes, and cobble beaches. Close proximity (300 metres) to features indicating past water sources indicates that people had access to readily available sources of potable water, at least on a seasonal basis, and in some cases seasonal access to routes of waterborne trade and communication should the study area have been used or occupied in the past.

There are no identified features indicating past water sources within 300 metres of the study area.

4) *Accessible or Inaccessible Shoreline*
This form of landscape feature would include high bluffs, swamp or marsh fields by the edge of a lake, sandbars stretching into marsh, etc.

There are no shorelines within 300 metres of the study area.

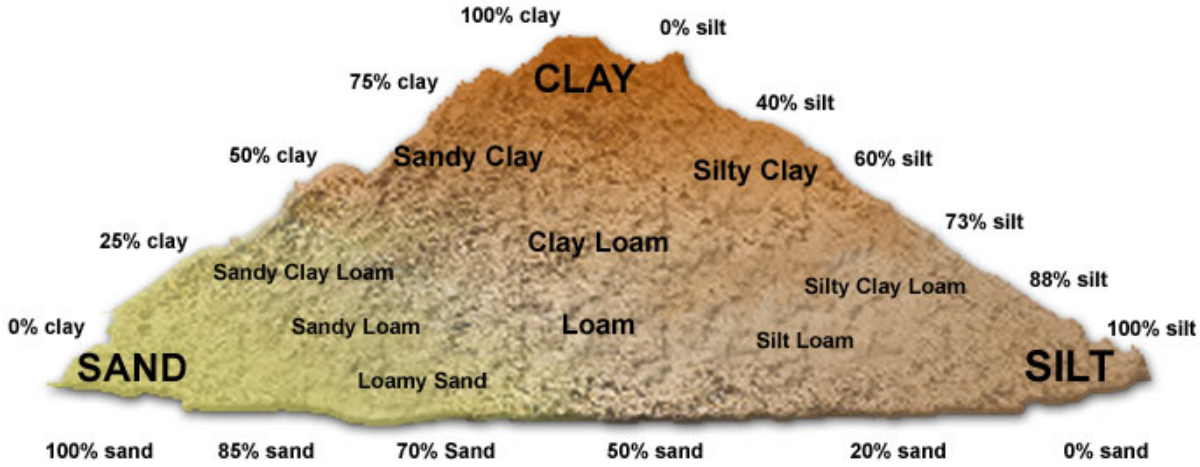
5) *Elevated Topography*
Features of elevated topography that indicate archaeological potential include eskers, drumlins, large knolls, and plateaux.

There are no identified features of elevated topography within the study area.

6) *Pockets of Well-drained Sandy Soil*
Pockets of sandy soil are considered to be especially important near areas of heavy soil or rocky ground.

The soil throughout the study area is medium brown sandy loam, which is consistent with the wider area surrounding the property. Therefore, the presence of this soil has no impact on potential within the study area.

The image below (Kuhlmann, Stacy 2017) shows the consistencies of soil types and how they compare to one another. The soil found within the study area was a sandy loam, which contains a higher percentage of sand with a lower percentage of loam. The lower percentage of clay allows the soil to break up from the action of ploughing alone when not compacted or bound by extensive root masses.



(Kuhlmann, Stacy 2017)

7) *Distinctive Land Formations*

These are landscape features that might have been special or spiritual places, such as waterfalls, rock outcrops, caverns, mounds, and promontories and their bases. There may be physical indicators of their use, such as burials, structures, offerings, rock paintings or carvings.

There are no identified distinctive land formations within the study area.

8) *Resource Areas*

Resource areas that indicate archaeological potential include food or medicinal plants (e.g., migratory routes, spawning areas, and prairie), scarce raw materials (e.g., quartz, copper, ochre or outcrops of chert) and resources of importance to early Post-contact industry (e.g., logging, prospecting, and mining).

There are no identified resource areas within the study area.

9) *Areas of Early Post-Contact Settlement*

These include places of early military or pioneer settlement (e.g., pioneer homesteads, isolated cabins, and farmstead complexes), early wharf or dock complexes, pioneer churches and early cemeteries. There may be commemorative markers of their history, such as local, provincial, or federal monuments or heritage parks.

The study area is situated in close proximity to a historic schoolhouse and sawmill identified on the historic county maps of 1871 and 1881 (as seen in Maps 2 and 3).

10) *Early Historical Transportation Routes*

This includes evidence of trails, passes, roads, railways, portage routes.

The study area is situated within 100 metres of an early settlement road that appears on the Historic County Map's of Simcoe County from 1871 and 1881. This historic road corresponds to the road presently known as Harvie Settlement Road, which is adjacent to the study area.

11) *Heritage Property*
Property listed on a municipal register or designated under the *Ontario Heritage Act* or is a federal, provincial or municipal historic landmark or site.

There are no listed or designated heritage buildings or properties that form a part of the study area. There are no listed or designated heritage buildings or properties that are adjacent to the study area.

12) *Documented Historical or Archaeological Sites*
This includes property that local histories or informants have identified with possible archaeological sites, historical events, activities, or occupations. These are properties which have not necessarily been formally recognized or for which there is additional evidence identifying possible archaeological resources associated with historic properties in addition to the rationale for formal recognition.

There are no known heritage features, or known historic sites, or known archaeological sites within the study area in addition to those formally documented with the appropriate agencies or previously noted under a different criterion.

CHARACTERISTICS INDICATING REMOVAL OF ARCHAEOLOGICAL POTENTIAL

Section 1.3.2 of the Standards and Guidelines for Consultant Archaeologists specifies the property characteristics which indicate no archaeological potential or for which archaeological potential has been removed (MTC 2011: 18-19). These characteristics are listed below together with considerations derived from the conduct of this study.
The introduction of Section 1.3.2 (MTC 2011: 18) notes that *"Archaeological potential can be determined not to be present for either the entire property or a part(s) of it when the area under consideration has been subject to extensive and deep land alterations that have severely damaged the integrity of any archaeological resources. This is commonly referred to as 'disturbed' or 'disturbance', and may include:"*

1) *Quarrying*
There is no evidence to suggest that quarrying operations were ever carried out within the study area.

2) *Major Landscaping Involving Grading Below Topsoil*
Unless there is evidence to suggest the presence of buried archaeological deposits, such deeply disturbed areas are considered to have lost their archaeological potential. Properties that do not have a long history of Post-Contact occupation can have archaeological potential removed through extensive landscape alterations that

penetrate below the topsoil layer. This is because most archaeological sites originate at grade with relatively shallow associated excavations into the soil. Pre-Contact sites and early historic sites are vulnerable to extensive damage and complete removal due to landscape modification activities. In urban contexts where a lengthy history of occupation has occurred, properties may have deeply buried archaeological deposits covered over and sealed through redevelopment activities that do not include the deep excavation of the entire property for subsequent uses. Buildings are often erected directly over older foundations preserving archaeological deposits associated with the earlier occupation.

There is evidence to suggest that major landscaping operations involving grading below topsoil were carried out within the study area as there is a gravel laneway and grading occurred for the construction of the water reservoir. Surfaces paved with interlocking brick, concrete, asphalt, gravel and other surfaces meant to support heavy loads or to be long wearing hard surfaces in high traffic areas, must be prepared by the excavation and removal of topsoil, grading, and the addition of aggregate material to ensure appropriate engineering values for the supporting matrix and also to ensure that the installations shed water to avoid flooding or moisture damage. All hard surfaced areas are prepared in this fashion and therefore have no or low archaeological potential. Disturbed areas are excluded from Stage 2 Property Assessment due to no or low archaeological potential and often because they are also not viable to assess using conventional methodology.

3) *Building Footprints*

Typically, the construction of buildings involves the deep excavation of foundations, footings and cellars that often obliterate archaeological deposits situated close to the surface.

There are several buildings within the study area. These include the water reservoir, the utility shed and the satellite tower.

4) *Sewage and Infrastructure Development*

Installation of sewer lines and other below ground services associated with infrastructure development often involves deep excavation that can remove archaeological potential.

There is evidence to suggest that substantial below ground services have resulted in significant impacts to any significant portion of the study area due to the existence of the watermain that cuts through the eastern border of the study area and to the centre of the water reservoir. Major utility lines are conduits that provide services such as water, natural gas, hydro, communications, sewage, and others. These major installations should not be confused with minor below ground service installations not considered to represent significant disturbances removing archaeological potential, such as services leading to individual structures which tend to be comparatively very shallow and vary narrow corridors. Areas containing substantial and deeply buried

services or clusters of below ground utilities are considered areas of disturbance, and may be excluded from Stage 2 Property Assessment. Although these areas may be excluded from the Stage 2 Assessment, test pitting still occurred to exhibit due diligence.

"Activities such as agricultural cultivation, gardening, minor grading and landscaping do not necessarily affect archaeological potential."

(MTC 2011: 18)

"Archaeological potential is not removed where there is documented potential for deeply buried intact archaeological resources beneath land alterations, or where it cannot be clearly demonstrated through background research and property inspection that there has been complete and intensive disturbance of an area. Where complete disturbance cannot be demonstrated in Stage 1, it will be necessary to undertake Stage 2 assessment."

(MTC 2011: 18)

SUMMARY

Table 5 summarizes the evaluation criteria of the Ministry of Heritage, Sport, Tourism and Culture Industries (MHSTCI) together with the results of the Stage 1 Background Study for the proposed undertaking. Based on the criteria, the property is deemed to have archaeological potential on the basis of proximity to historic settlement structures, proximity to early historic settlement roads adjacent to the study area, and proximity to previously registered archaeological sites.

TABLE 5 EVALUATION OF ARCHAEOLOGICAL POTENTIAL

FEATURE OF ARCHAEOLOGICAL POTENTIAL		YES	NO	N/A	COMMENT
1	Known archaeological sites within 300m	**Y**			If Yes, potential determined
PHYSICAL FEATURES					
2	Is there water on or near the property?		**N**		If Yes, what kind of water?
2a	Primary water source within 300 m. (lakeshore, river, large creek, etc.)		**N**		If Yes, potential determined
2b	Secondary water source within 300 m. (stream, spring, marsh, swamp, etc.)		**N**		If Yes, potential determined
2c	Past water source within 300 m. (beach ridge, river bed, relic creek, etc.)		**N**		If Yes, potential determined
2d	Accessible or Inaccessible shoreline within 300 m. (high bluffs, marsh, swamp, sand bar, etc.)		**N**		If Yes, potential determined
3	Elevated topography (knolls, drumlins, eskers, plateaus, etc.)		**N**		If Yes, and Yes for any of 4-9, potential determined
4	Pockets of sandy soil in a clay or rocky area		**N**		If Yes and Yes for any of 3, 5-9, potential determined
5	Distinctive land formations (mounds, caverns, waterfalls, peninsulas, etc.)		**N**		If Yes and Yes for any of 3-4, 6-9, potential determined
HISTORIC/PREHISTORIC USE FEATURES					
6	Associated with food or scarce resource harvest areas (traditional fishing locations, agricultural/berry extraction areas, etc.)		**N**		If Yes, and Yes for any of 3-5, 7-9, potential determined.
7	Early Post-Contact settlement area within 300 m.	**Y**			If Yes, and Yes for any of 3-6, 8-9, potential determined
8	Historic Transportation route within 100 m. (historic road, trail, portage, rail corridors, etc.)	**Y**			If Yes, and Yes for any 3-7 or 9, potential determined
9	Contains property designated and/or listed under the Ontario Heritage Act (municipal heritage committee, municipal register, etc.)		**N**		If Yes and, Yes to any of 3-8, potential determined
APPLICATION-SPECIFIC INFORMATION					
10	Local knowledge (local heritage organizations, Pre-Contact, etc.)		**N**		If Yes, potential determined
11	Recent disturbance not including agricultural cultivation (post-1960-confirmed extensive and intensive including industrial sites, aggregate areas, etc.)	**Y**			If Yes, no potential or low potential in affected part (s) of the study area.

If **YES** to any of 1, 2a-c, or 10 Archaeological Potential is **confirmed**
If **YES** to 2 or more of 3-9, Archaeological Potential is **confirmed**
If **YES** to 11 or No to 1-10 Low Archaeological Potential is **confirmed** for at least a portion of the study area.

8.2 Stage 2 Analysis and Conclusions

Section 7.8.3 of the Standards and Guidelines for Consultant Archaeologists (MTC 2011: 138-139) outlines the requirements of the Analysis and Conclusions component of a Stage 2 Property Assessment.

1. *Summarize all finding from the Stage 2 survey, or state that no archaeological sites were identified.*
2. *For each archaeological site, provide the following analysis and conclusions:*
   a. *A preliminary determination, to the degree possible, of the age and cultural affiliation of any archaeological sites identified.*
   b. *A comparison against the criteria in 2 Stage 2: Property Assessment to determine whether further assessment is required*
   c. *A preliminary determination regarding whether any archaeological sites identified in Stage 2 show evidence of a high level cultural heritage value or interest and will thus require Stage 4 mitigation.*

No archaeological sites or resources were found during the Stage 2 survey of the study area.

9.0 Recommendations

9.1 Stage 2 Recommendations

Under Section 7.8.4 of the Standards and Guidelines for Consultant Archaeologists (MTC 2011: 139) the recommendations to be made as a result of a Stage 2 Property Assessment are described.

1) For each archaeological site, provide a statement of the following:
   a. Borden number or other identifying number
   b. Whether or not it is of further cultural heritage value or interest
   c. Where it is of further cultural heritage value or interest, appropriate Stage 3 assessment strategies

2) Make recommendations only regarding archaeological matters. Recommendations regarding built heritage or cultural heritage landscapes should not be included.

3) If the Stage 2 survey did not identify any archaeological sites requiring further assessment or mitigation of impacts, recommend that no further archaeological assessment of the property be required.

As a result of the Stage 2 Property Assessment of the study area, no archaeological resources were encountered. Consequently, the following recommendations are made:

4. *No further archaeological assessment of the study area is warranted;*

5. *The Provincial interest in archaeological resources with respect to the proposed undertaking has been addressed;*
6. *The proposed undertaking is clear of any archaeological concern.*

10.0 ADVICE ON COMPLIANCE WITH LEGISLATION

While not part of the archaeological record, this report must include the following standard advisory statements for the benefit of the proponent and the approval authority in the land use planning and development process:

a. *This report is submitted to the Minister of Heritage, Sport, Tourism and Culture Industries as a condition of licensing in accordance with Part VI of the Ontario Heritage Act, R.S.O. 1990, c. 0.18. The report is reviewed to ensure that it complies with the standards and guidelines issued by the Minister, and that the archaeological fieldwork and report recommendations ensure the conservation, protection and preservation of the cultural heritage of Ontario. When all matters relating to archaeological sites within the project area of a development proposal have been addressed to the satisfaction of the Ministry of Tourism and Culture, a letter will be issued by the ministry stating that there are no further concerns with regard to alterations to archaeological sites by the proposed development.*

b. *It is an offence under Sections 48 and 69 of the Ontario Heritage Act for any party other than a licensed archaeologist to make any alteration to a known archaeological site or to remove any artifact or other physical evidence of past human use or activity from the site, until such time as a licensed archaeologist has completed archaeological fieldwork on the site, submitted a report to the Minister stating that the site has no further cultural heritage value or interest, and the report has been filed in the Ontario Public Register of Archaeological Reports referred to in Section 65.1 of the Ontario Heritage Act.*

c. *Should previously undocumented archaeological resources be discovered, they may be a new archaeological site and therefore subject to Section 48 (1) of the Ontario Heritage Act. The proponent or person discovering the archaeological resources must cease alteration of the site immediately and engage a licensed archaeologist to carry out archaeological fieldwork, in compliance with sec. 48 (1) of the Ontario Heritage Act.*

d. *The Cemeteries Act, R.S.O. 1990, c. C.4 and the Funeral, Burial and Cremation Services Act, 2002, S.O. 2002, c.33 (when proclaimed in force) require that any person discovering human remains must notify the police or coroner and the Registrar of Cemeteries at the Ministry of Consumer Services.*

e. *Archaeological sites recommended for further archaeological fieldwork or protection remain subject to Section 48 (1) of the Ontario Heritage Act and may not be altered, or have artifacts removed from them, except by a person holding an archaeological licence.*

11.0 BIBLIOGRAPHY AND SOURCES

ASI. (2019) *County of Simcoe Archaeological Management Plan.* ASI, Toronto. Retrieved from URL: https://www.simcoe.ca/dpt/plan/AMP

Belden, H. (1881). *Simcoe Supplement in Illustrated Atlas of the Dominion of Canada.* H. Belden, Toronto

Chapman, L.J. & D.F. Putnam. (1984). *The Physiography of Southern Ontario (Third Edition).* Ontario Geological Survey, Special Report #2. Ontario Ministry of Natural Resources, Toronto.

Esri. "Topographic" [basemap]. Scale Not Given. "World Topographic Map". April 12, 2018. http://www.arcgis.com/home/item.html?id=30e5fe3149c34df1ba922e6f5bbf808f. (April 12, 2018).

Garbutt, Mary. (2010). About Simcoe County. *Simcoe County Branch- Ontario Genealogical Society*. Retrieved 12 May 2010, from URL: http://www.simcoebogs.com/About/ab_simcoe.html

Goel, Tarun (2013). Road Construction: History and Procedure. Bright Hub Engineering. Retrieved 24 May 2015 from URL: http://www.brighthubengineering.com/structural-engineering/59665-road-construction-history-and-procedure/

Google Earth (Version 6.0.3.2197) [Software]. (2009). Available from http://www.google.com/earth/index.html.

Google Maps. (2012). Available from: http://maps.google.ca/?utm_campaign =en&utm_source=en-ha-na-ca-bk-gm&utm_medium=ha&utm_term =google%20maps.

Kuhlmann, Stacy. (2017). *Types of Soil.* Diagram of Soil Types available from http://www.tes.com/lessons/AKChU3fbfZKo9g/types-of-soil.

Myers, Jay (1977). *The Great Canadian Road: A History of Yonge Street*. Red Rock Publishing Company, Toronto.

Ontario Heritage Act, RSO 1990a, Government of Ontario. (Queen's Printer, Toronto).

Ontario Heritage Amendment Act, SO 2005, Government of Ontario. (Queen's Printer, Toronto).

Ontario Ministry of Citizenship, Culture and Recreation (OMCzCR). (1993). *Archaeological Assessment Technical Guidelines, Stages 1-3 and Reporting Format.* (Queen's Printer for Ontario 1993)

Ontario Ministry of Culture (MCL). (2005). *Conserving a Future for Our Past: Archaeology, Land Use Planning & Development in Ontario (An Educational Primer and Comprehensive Guide for Non-Specialists).* (Heritage & Libraries Branch, Heritage Operations Unit: Toronto).

Ontario Ministry of Culture and Communications (MCC) & Ministry of Environment (MOE). (1992). *Guideline for Preparing the Cultural Heritage Resource Component of Environmental Assessments.* (Cultural Programs Branch, Archaeology and Heritage Planning: Toronto).

Ontario Ministry of Tourism and Culture (MTC). (2011). *Standards and Guidelines for Consultant Archaeologist.* (Programs and Services Branch: Culture Programs Unit, Toronto).

Ontario Planning Act, RSO 1990b, Government of Ontario. (Queen's Printer, Toronto).

Provincial Policy Statement (2020). Government of Ontario. (Queen's Printer, Toronto).

Ralph, J.T.R. (1871) *Historical County Map of Simcoe County.* J.T.R. Ralph, Toronto

Smith, David G. (2002). "Ten Thousand Years: Aboriginal Heritage in Mississauga." In *Mississauga: The First 10,000 Years*. Frank Dieterman, Ed. Mississauga Heritage Foundation, Eastendbooks, Toronto.

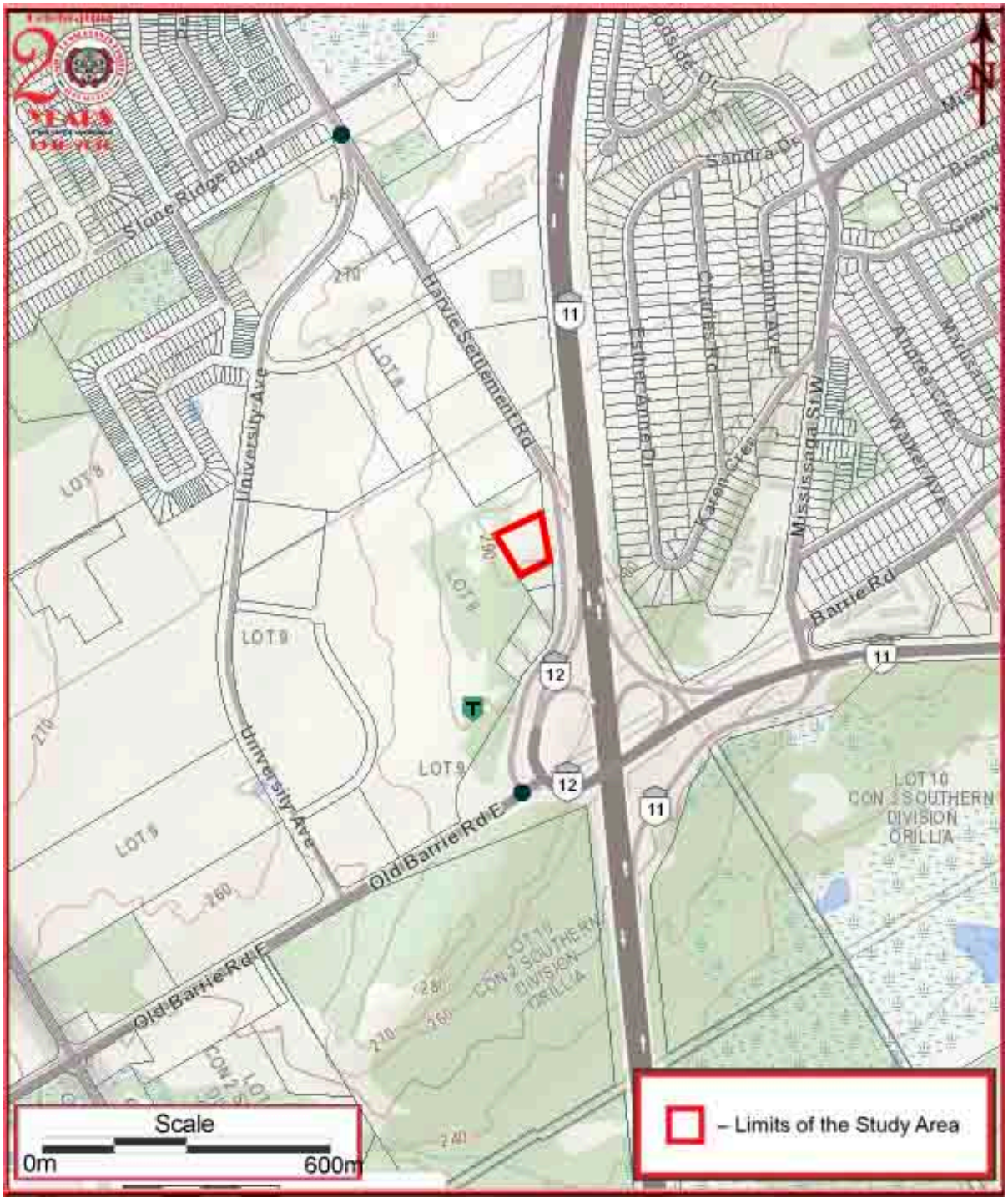
R.V. Anderson Associates Limited. (2020). *Harvie Hill Conceptual Site Plan, Orillia Water Sytem Master Plan, City of Orillia Properties*. R.V. Anderson Associates Limited, Toronto

waynecook.com. (2010). *SEVERN #15 Formerly Matchedash and Orillia Townships*. URL: http://www.waynecook.com/zsevern.html#historyb, as of November 2, 2011.

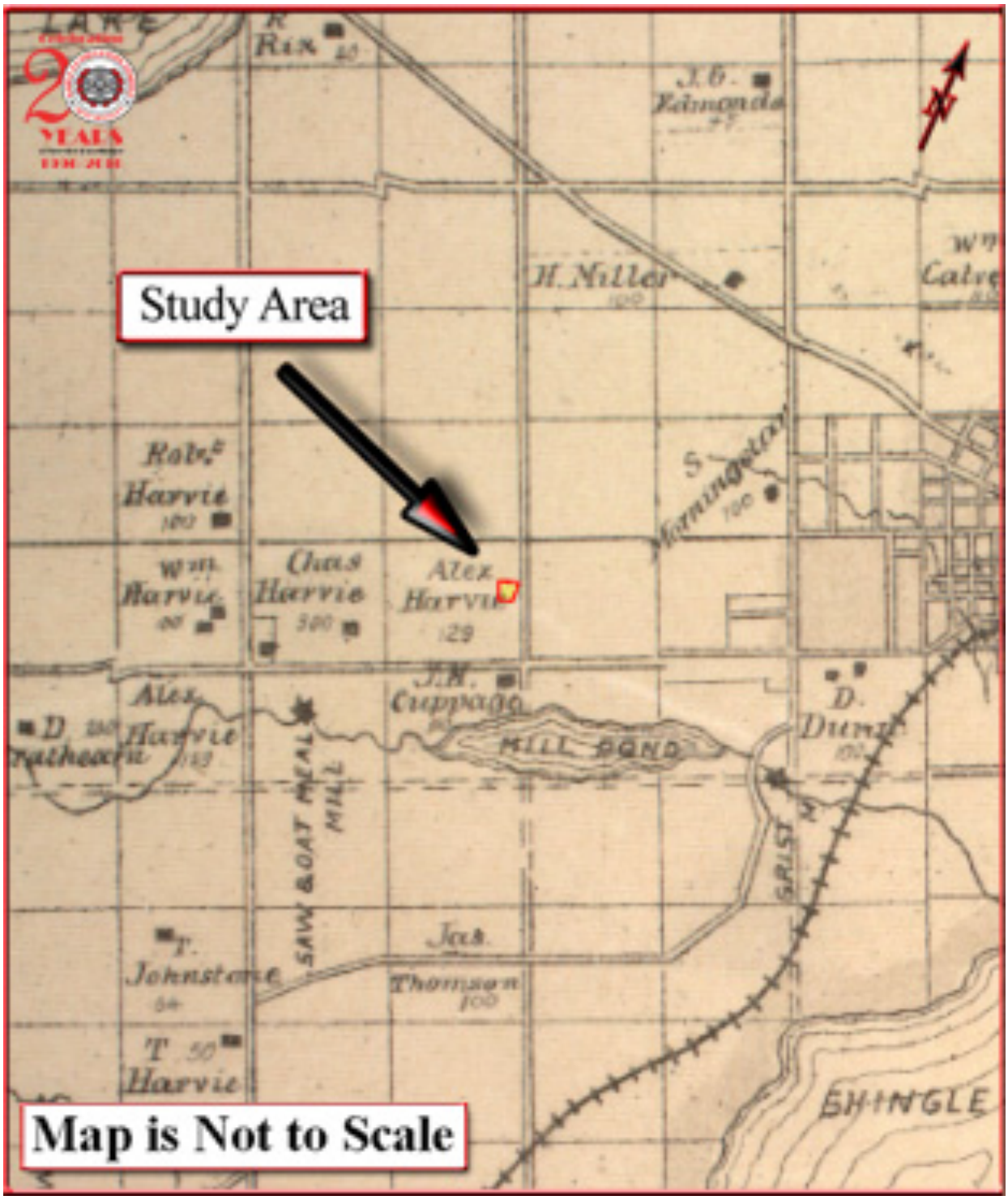
Wikipedia. (2020). *Simcoe County: History.* Retrieved from URL: https://en.wikipedia.org/wiki/Simcoe_County#:~:text=The%20County%2C%20named%20by%20Lieutenant,Legislative%20Assembly%20of%20Upper%20Canada.

Wright, J.V. (1972). *Ontario Prehistory: an Eleven-thousand-year Archaeological Outline*. Archaeological Survey of Canada. National Museum of Man, Ottawa.

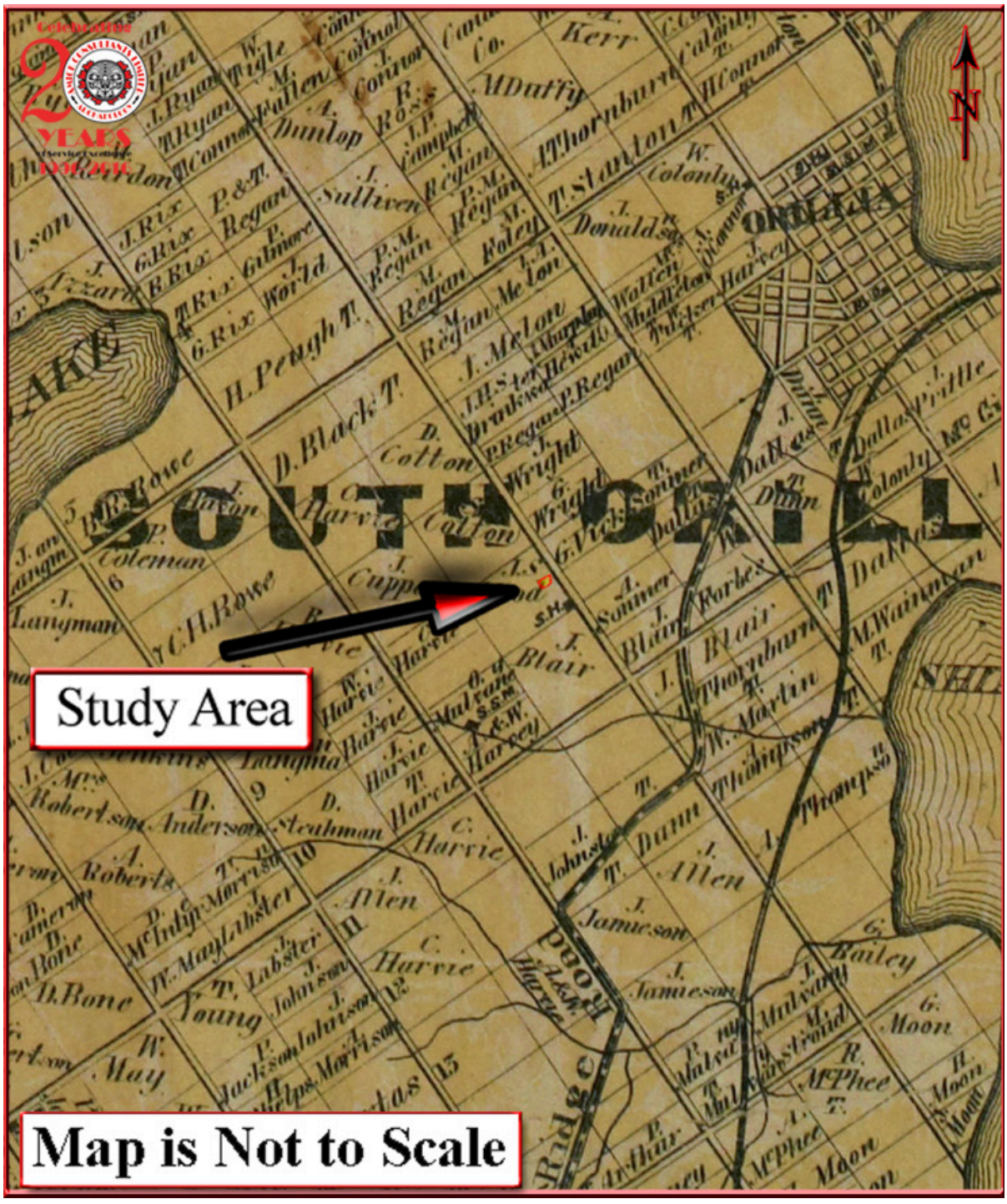
12.0 MAPS



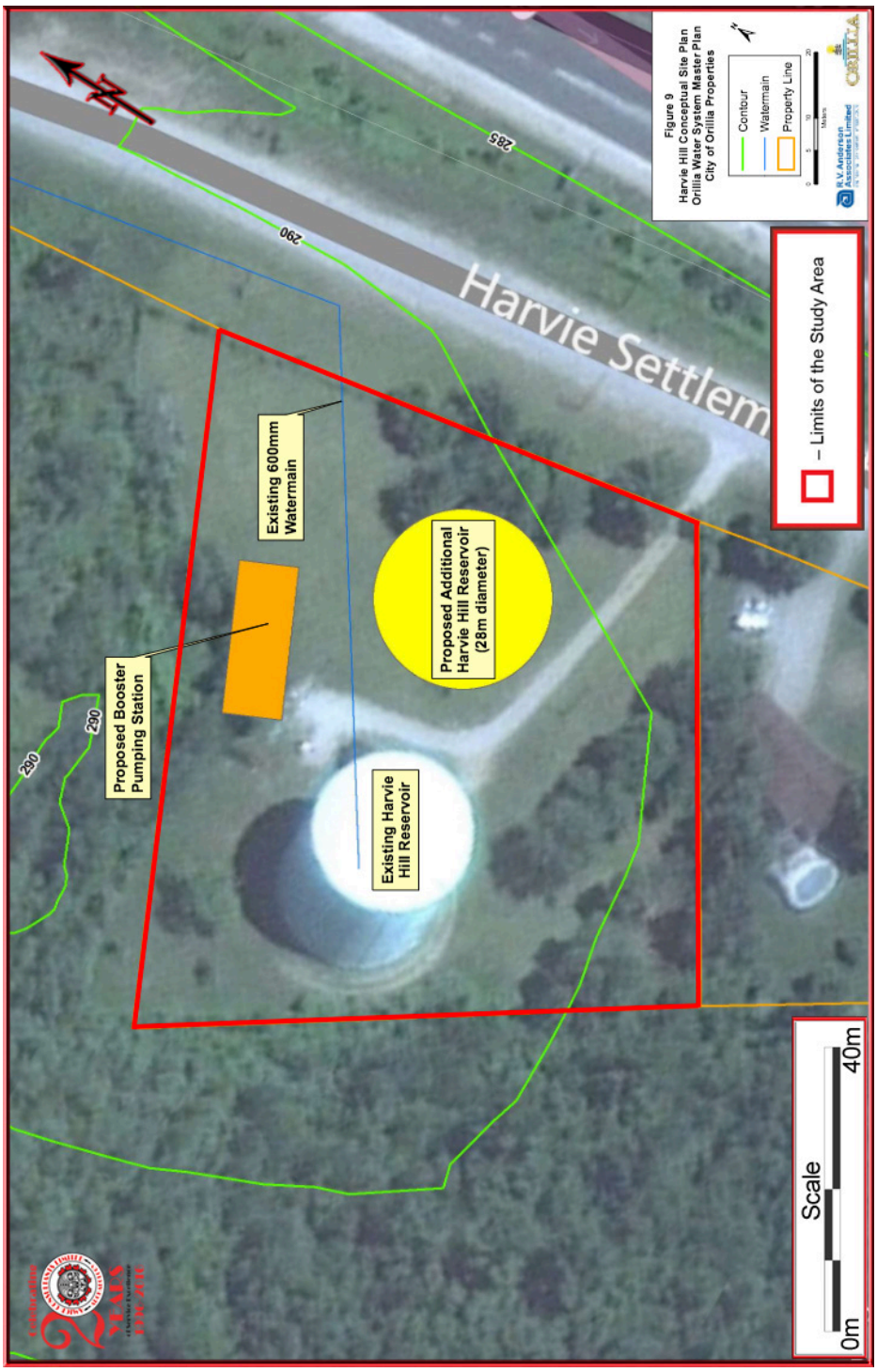
MAP 1 LOCATION OF THE STUDY AREA (ESRI 2020)



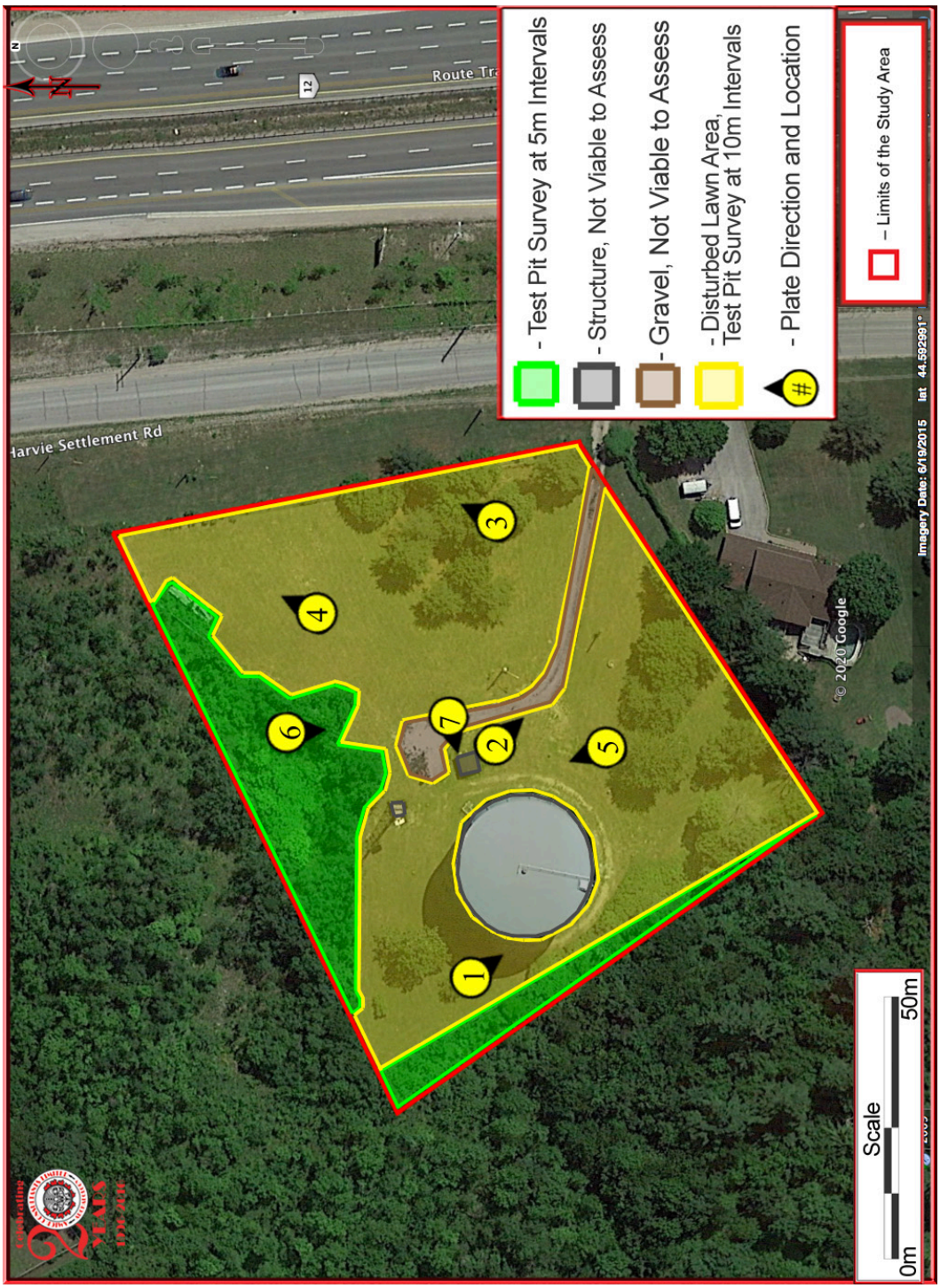
MAP 2 FACSIMILE SEGMENT OF THE HISTORICAL COUNTY MAP OF SIMCOE COUNTY (J.T.R. RALPH 1871)



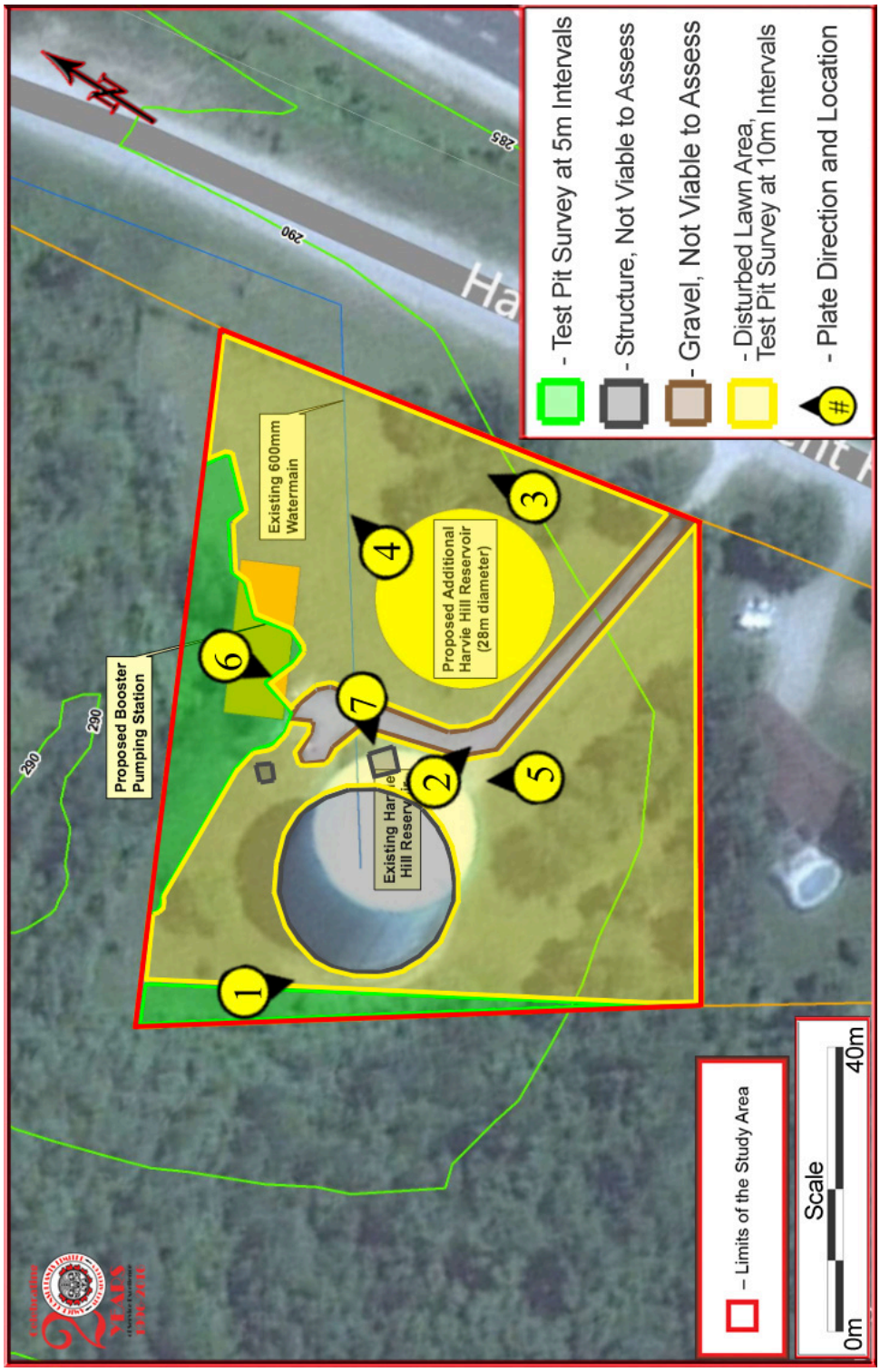
MAP 3 FACSIMILE SEGMENT OF THE SIMCOE SUPPLEMENT IN THE ILLUSTRATED ATLAS OF THE DOMINION OF CANADA (H. BELDEN 1881)



MAP 4 CONCEPTUAL SITE PLAN (R.V. ANDERSON ASSOCIATES LIMITED 2020)



MAP 5 AERIAL PHOTO OF THE STUDY AREA (GOOGLE EARTH 2020)



MAP 6 DETAILED PLAN OF STUDY AREA

MAP 7 FACSIMILE SEGMENT OF THE COMPOSITE ARCHAEOLOGICAL POTENTIAL LAYER AND STUDY AREA (ASI 2019)

13.0 IMAGES

IMAGE 1 EVIDENCE OF GRADING AND WATER RESERVOIR

IMAGE 2 GRAVEL LANEWAY

IMAGE 3 DISTURBED LAWN

IMAGE 4 DISTURBED TEST PIT

IMAGE 5 SATELLITE TOWER AND RESERVOIR

IMAGE 6 WOODED AREA CONDITIONS

IMAGE 7 UTILITY SHED

Appendix C: Water Filtration Plant and Other Treatment Facilities Report

TATHAM ENGINEERING

Enhancing our communities

Orillia Water Master Plan Update

WATER FILTRATION PLANT AND OTHER TREATMENT FACILITIES

City of Orillia

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3	June 24, 2022	Final
4	October 12, 2022	Revised Final

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Appendix A: WFP Unit Operation Capacity Calculations
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1 Introduction

1.1 INTRODUCTION

Tatham Engineering Limited (Tatham) has been retained by the City of Orillia (City) to update the 2015 City of Orillia Water System Master Plan (2015 WSMP) to develop a plan for the maintenance, expansion, and improvement of the water system to adequately service the City's existing and future customers.

This technical report presents an assessment of the City's water treatment facilities, including their condition, performance, capacity, and capability to meet the water demands and drinking water standards. It also presents an assessment of the potential risks posed by climate change. Recommendations are provided for further data collection and studies to optimize the operation, performance, and condition of the facilities.

The water treatment facilities reviewed in this report are the Water Filtration Plant (WFP), Wells 1 and 2 scrubbers, and the West Orillia Well (WOW) pumphouse.

1.2 BACKGROUND DOCUMENTS AND SITE VISITS

The following background documents were reviewed or referenced in this report:

- Drawings of the WFP, from the 1975 expansion through to the 2009 upgrades.
- Design Memorandum for Clearwell and Disinfection Upgrades (MMM, 2002).
- Water System Master Plan – Final Report (RVA, December 2015).
- Water Filtration Plant Operations Manual (City of Orillia, 2018).
- Water Filtration Plant Condition Assessment (Ainley, October 2017).
- Orillia Water Filtration Plant Chlorine Room Assessment (D.M. Wills, November 2020).
- CT Calculation Worksheets (City of Orillia).
- Annual Drinking Water System and Summary Reports from 2015 to 2020 (City of Orillia).
- Water quality data (in-house monitoring and laboratory analysis) from 2017 to 2019 inclusive.
- Municipal Drinking Water Licence No. 125-101, Issue No. 5 and Drinking Water Works Permit No. 125-201, Issue No. 2.
- Permit to Take Water Nos. 2803-8FEPKK (Surface Water) and P-300-5069408381 (Wells).
- 2020 Management Review - Raw Water Supply and Drinking Water Quality Trends (City of Orillia).

- climateatlas.ca, Environment and Climate Change Canada climate model projections for Representative Concentration Pathways (RCP) RCP2.6 and RCP8.5.

Tatham visited the WFP and met with the City's Superintendent of Water Treatment and Supply on July 8, 2020, to obtain additional information and discuss the WFP's performance, operational issues, and capacity constraints. Tatham also visited the well scrubber buildings, the generator building, the WOW pumphouse and the Zone 3 booster pumping station in October 2020.

2 WFP Unit Operations Capacity

This section presents an assessment of the treatment and hydraulic capacity of each unit process at the Orillia WFP and identifies the processes that may limit the overall capacity of the WFP. The capacity assessment calculations are attached in Appendix A.

The assessment of treatment and hydraulic capacity is based on the Design Guidelines for Drinking-Water Systems (MOE, 2008). Information on unit operations' capacity was obtained from the O&M Manual and the Drinking Water Works Permit (DWWP).

2.1 WFP OVERVIEW

The Orillia WFP was originally built in 1914 and more recently underwent multiple major upgrades and expansions from 1976 to 2009. The WFP treats raw water from Lake Couchiching and from Wells 1 and 2. Treated water is stored in an in-ground clearwell. Two sets of high lift pumps supply each of Pressure Zone 1 (PZ1) and Pressure Zone 2 (PZ2).

The WFP capacity analysis was conducted for the following main unit operations:

- Intakes in Lake Couchiching
- Raw water screens
- Low lift pumps
- Coagulant dosing pumps and mixer
- Flocculation tanks
- Filters 1 through 4
- Filter backwash supply pumps
- Filter backwash wastewater holding tank
- Chlorine and UV disinfection
- Chlorine contact tanks and clearwell
- High lift pumps

2.2 WFP RATED CAPACITY

The Municipal Drinking Water Licence (MDWL) lists the rated capacity (maximum daily volume) of the WFP as follows:

WFP	=	27,280 m^3/day
Wells 1 and 2	=	5,762 m^3/day
Total	=	33,042 m^3/day

Water from Wells 1 and 2 is introduced into the WFP at Chlorine Contact Chamber #1. Therefore, the rated capacity of all unit operations upstream of the chlorine contact chambers is 27,280 m^3/day. The rated capacity downstream of and including the chlorine contact chambers, is 33,042 m^3/day.

The PTTW for the City's groundwater supplies allows a maximum taking per day from Wells 1 and 2 combined of 5,760 m^3/day and a taking of 7,920 m^3/day from the West Orillia Well. The PTTW for the lake water supply permits a maximum daily taking of 36,368 m^3/day.

2.3 UNIT OPERATIONS CAPACITY ASSESSMENT

2.3.1 Intakes

The WFP has two surface water intakes into Lake Couchiching, each equipped with an intake crib structure:

The main intake pipe has two sections:

- a 364 m long and 1,000 mm diameter section; and
- a 10 m long, 800 mm diameter section at the low lift building.

The backup intake pipe (original intake) is 84.6 m long and 600 mm in diameter. The DWWP rates the intake at 29,312 m^3/day. The calculated full flow capacity of the main intake, using Manning's formula, is significantly higher than the intake's rated capacity and the WFP's rated capacity.

According to the DWWP and O&M Manual, the main intake crib has a capacity of 77,274 m^3/day. No information is available for the backup intake crib.

Chlorine is injected at the intake in the summer. This pre-chlorination is reviewed in section 2.3.9.

2.3.2 Raw Water Screens

The WFP is equipped with a stationary bar screen and a mechanical travelling screen. In addition, if the travelling screen is out of service, a bypass screen can be manually installed.

Each of the three screens has a capacity of 29,300 m^3/day (O&M Manual), which is 7% greater than the WFP's rated capacity.

2.3.3 Low Lift Pumping

The two intake pipes discharge into a low lift pump well, equipped with four low lift pumps.

The pump well has an available storage volume of 125.3 m^3.

Three pumps are rated at 105 L/s at 7.60 m TDH; they were installed in 1978. The fourth pump is rated at 157.8 L/s at 7.65 m TDH and was installed in 1989. All pumps were fully refurbished between 2010 and 2012.

With the largest pump out of service, the firm low lift pumping capacity is 303 L/s, or 26,179 m^3/day, as measured by City Operators in 2021. The pumps' firm capacity is 4% less than the WFP's rated capacity.

2.3.4 Coagulant Dosing Pumps and Mixer

The WFP is equipped with two coagulant dosing pumps (duty/standby), each rated at 11.3 L/hour. WFP staff indicate the typical polyaluminum chloride dosage is 5.85 mg/L to 6.8 mg/L, depending on lake conditions.

Based on a coagulant solution strength of 52% and a specific gravity of 1.205, each dosing pump has capacity to dose up to 6.2 mg/L at the rated capacity of 27,280 m^3/day and can apply the typical dose of 5.85 mg/L at a capacity of 28,944 m^3/day. The dosing pumps are therefore adequate unless a higher coagulant dose is required in the future.

The in-line mechanical flash mixer on the 450 mm diameter raw water header has a capacity range of 9,090 m^3/day to 45,460 m^3/day, based on the DWWP and the O&M Manual. It is designed for the WFP's rated capacity however it could serve an expansion.

WFP staff noted that the absence of a standby mixer is a potential failure point in the system.

2.3.5 Flocculation Tanks

There are three, flocculation tanks, each with two-cells and a volume of 190 m^3, providing a total volume of 570 m^3. If operating at the WFP's rated capacity, the detention time in each flocculation tank is 10 minutes, for a total of 30 minutes for three tanks.

The Design Guidelines for Drinking-Water Systems suggest a detention time of 15 minutes or less is typical when followed by filtration. However, a longer detention time is required in the winter when the water is colder.

Therefore, the flocculation tanks are not considered to have spare capacity, and all three tanks should be in operation during the winter if operating at the WFP's rated capacity.

2.3.6 Filters

The WFP operates with four gravity flow multi-media filters, as follows:

- Original Filters 1 and 2 are dual media (GAC and sand) filters, each with a surface area of 36.4 m^2 and a capacity of 89.5 L/s, or 7,733 m^3/day. When operating at capacity, the filtration rate is 8.8 m/hour. Filters 1 and 2 use a surface water wash.
- Filters 3 and 4 (1995) are dual media (GAC and sand) filters, each with a surface area of 33.5 m^2 and a capacity of 68.4 L/s, or 5,910 m^3/day. When operating at capacity, the filtration rate is 7.4 m/hour. Filters 3 and 4 use an air scour during backwash.

Combined, the four filters have a total capacity of 27,286 m^3/day, or 316 L/s, matching the WFP's rated capacity. The firm filtration capacity (with the largest filter offline) is 19,553 m^3/day.

WFP staff noted that if all four low lift pumps are in operation, pumping 473 L/s to the WFP, the filters back up as they are only currently operated and controlled to filter a maximum rate of 316 L/s.

The Design Guidelines for Drinking-Water Systems suggest a maximum filtration rate of 11.7 m/hour for traditional dual media filters. If the required turbidity levels can be maintained when the filters are operated at a higher filtration rate, the capacity of the filters could be increased. Assuming an increased filtration rate of 11.7 m/hour, the filtration capacities could reach 10,228 m^3/day for each of Filters 1 and 2 and 9,404 m^3/day for each of Filters 3 and 4, for a total capacity of 39,264 m^3/day (454 L/s) and a firm capacity of 29.036 m^3/day (336 L/s).

Subject to stress testing to confirm performance, the filters could be operated at a higher filtration rate to achieve a higher firm capacity.

2.3.7 Filter Backwash Pumps

The filters are backwashed using two filter backwash supply pumps (duty/standby), each rated at 405 L/s. At this pumped flow, each filter is backwashed at the following rates:

- Filters 1 and 2: 40.0 m^3/m^2/hour
- Filters 3 and 4: 43.5 m^3/m^2/hour

The backwash pumps are adequate as they can supply backwash water at near the maximum rate specified for the filters (45 m/hour) and within the recommended range of 37 m/hour to 50 m/hour in the Design Guidelines for Drinking-Water Systems.

2.3.8 Wastewater Holding Tanks and Pumps

The filter backwash wastewater holding tank has a usable volume of 335 m^3, and is equipped with two wastewater pumps: one rated at 30 L/s and the other at 14.5 L/s, for a total capacity of 44.5 L/s.

According to WFP staff, the filter backwash sequence for each filter is as follows, producing a total wastewater volume of 202 m^3 per backwash:

1. Low Flow: 240 L/s for 60 seconds = 14.4 m^3
2. High Flow: 395 L/s for 420 seconds = 165.9 m^3
3. Low Flow: 240 L/s for 90 seconds = 21.6 m^3

   Total = 201.9 m^3

The wastewater holding tank can therefore contain 1.7 filter backwashes before needing to be emptied. At the available capacity of the wastewater pumps, it takes approximately 2 hours to pump out the wastewater tank. Based on the above, only one filter can be backwashed at a time, with approximately 2 hours needed between backwashes to pump out the wastewater holding tank.

2.3.9 Disinfection

The WFP's disinfection process includes five gas chlorinators and a UV disinfection system.

The five gas chlorinators are used for the following:

- Pre-chlorination, to the intake crib in the summer, and into the low lift pump well in the winter. The pre-chlorination gas chlorinator is rated at 96 kg/day.
- Post-chlorination to the chlorine contact tanks. The post-chlorination gas chlorinator is rated at 96 kg/day.
- Post-post-chlorination to each of the PZ1 and PZ2 high lift pump headers. The two gas chlorinators are each rated at 48 kg/day.
- Stand-by chlorination to service any one of the above chlorination steps. The stand-by gas chlorinator is rated at 96 kg/day.

Each 96 kg/day chlorinator can chlorinate 43,573 m^3/day at a chlorine dose of 2.2 mg/L.

Chlorine contact time is provided in:

- Chlorine contact chamber #1 with a volume of 620 m^3.
- Chlorine contact chamber #2 with a volume of 490 m^3.

- Clearwell: a volume of 1,500 m^3 is assumed to be available for chlorine contact based on the O & M Manual (total clearwell volume is 3,000 m^3).

The UV disinfection system consists of three UV reactors, one for PZ1, one for PZ2 and one spare, each rated for up to 405 L/s (34,992 m^3/day).

The DWWP states that the WFP must meet the log removal/inactivation listed in Table 1. Table 2 shows the log removal/inactivation credits assigned to the WFP treatment processes.

Table 1: Minimum Log Removal and Inactivation Requirements

	MINIMUM LOG REMOVAL REQUIRED		
	Crypto	**Giardia**	**Viruses**
WFP	2	3	4
Wells 1 and 2	0	0	2

Table 2: Log Removal and Inactivation Credits

PROCESS	LOG REMOVAL CREDITS		
	Crypto	**Giardia**	**Viruses**
Direct Filtration	2	2	1
UV	2	3	2
Chlorination	0	0	2
Total	**4**	**5**	**5**

The direct filtration and UV disinfection processes provide the required Crypto and Giardia removals. The UV and chlorine disinfection processes address the required 4-log virus inactivation, each contributing 2-log removal.

To achieve the 2-log virus inactivation, the chlorination system must provide a CT of 6. With an average baffle factor of 0.5 (as per the O & M Manual), and assuming a water temperature of 0.5°C and a pH of 6 – 9, a CT of 6 can be met in the two chlorine contact chambers at the rated capacity of 33,042 m^3/day (WFP and Wells 1 and 2) with a chlorine residual of 0.25 mg/L leaving the chlorine contact chambers. WFP staff indicated the typical chlorine residual leaving the WFP is 1.8 mg/L to 2.0 mg/L.

A CT of 6 can be maintained in the two chlorine contact chambers at higher flow rates by increasing the chlorine residual. For example, the existing gas chlorinators could dose up to 2.2 mg/L to a flow rate of 43,665 m^3/day and achieve a CT of 6 in the existing chambers. Flows up to 293,000 m^3/day could be disinfected in the existing chlorine contact chambers if the gas chlorinators were upsized.

In the unlikely event that all three UV units are off-line, then chlorination would need to provide 1-log inactivation of Giardia and 3-log inactivation of viruses (the remaining log removals are achieved by filtration). This level of disinfection would require a CT of 115. With the volume of both contact chambers and 50% of the clearwell volume, the required CT of 115 could be met at the rated capacity of 33,042 m^3/day (WFP and Wells 1 and 2) with a chlorine residual of 2.03 mg/L.

To provide additional capacity under this emergency scenario, the chlorine residual would need to be increased beyond 2 mg/L, to the point where it would be quite noticeable in the distribution system and likely result in taste and odour complaints from consumers.

Therefore, under normal conditions the WFP can provide the required level of disinfection at its rated capacity and could disinfect a higher flow rate by applying higher chlorine dosages. However, if only chlorination equipment is available for disinfection, the WFP cannot treat more than its rated capacity without affecting the aesthetic quality of the water.

2.3.10 High Lift Pumps

The WFP has two sets of three high lift pumps that pump treated water to PZ1 and to PZ2, as follows:

- To Zone 1: 3 pumps each rated at 115.7 L/s at 72 m TDH.
- To Zone 2: 3 pumps each rated at 92.6 L/s at 95 m TDH.

With one pump out of service in each PZ, the total firm high lift pumping capacity is 35,994 m^3/day, which is 8% greater than the WFP's rated capacity.

- Zone 1: 231 L/s, or 19,993 m^3/day
- Zone 2: 185 L/s, or 16,001 m^3/day

  Total: 417 L/s, or 35,994 m^3/day

The HLPs are designed to meet the Maximum Day Demand in the distribution system. Flow equalization for peak hour demands and fire protection are provided by the storage reservoirs (Harvie Hill and Rosemary Road).

2.4 CAPACITY SUMMARY

Table 3 overleaf summarizes the rated, and firm capacities of the WFP and unit operations. In summary:

- The firm capacity of the low lift pumps to pump water from the lake to the WFP is less than the rated capacity of the WFP.
- The firm capacity of Wells 1 and 2 to convey groundwater to the WFP are less than the rated capacity listed in the DWWP for the groundwater sources.
- If all WFP treatment equipment is online, the rated capacity of the WFP can be met.
- There is insufficient redundancy in the number of filters. With one of the higher capacity filters off-line, the WFP can only produce 19,553 m^3/day or 72% of its filtration capacity.

The WFP assessment also considered the limitations of the WFP to an expansion beyond its current rated capacity. The unit operations that present limitations are:

- Raw water screens.
- Low lift pumps, although larger or additional pumps could be installed in the pump well.
- Coagulant dosing pumps, although larger capacity pumps could easily be installed.
- Flocculation tanks unless shorter detention time is found to be effective.
- Filters, unless good performance can be achieved at a higher filtration rate.
- Filter backwash wastewater holding tank volume, which limits the number and frequency of filter backwashes.
- Disinfection system if all the UV units are offline and only chlorination is available.

As the WFP operates with a single in-line mixer in the raw water header, performance and operation would be negatively affected if the mixer failed.

Table 3: Unit Operation Capacity Summary

PROCESS	DETAILS	CAPACITY (m^3/day)		
		Rated	Reported	Calc'd
WFP	Upstream of chlorine contact chamber	27,280		
	Downstream of chlorine contact chamber	33,042		
Intakes	Main intake crib	77,274		
	Main intake pipe	29,312		133,808
	Back-up intake pipe			56,512
Screens	Bar screen, travelling screen, bypass each		29,300	
Low Lift Pumping	Low lift pumps (firm, with 3 pumps)	27,280	26,179	
	Low lift pumps (total, with 4 pumps)	40,850		
Coagulation	Coagulant doing pumps (6.2 mg/L dose)			27,280
	In-line flash mixer	45,460		
Flocculation	Flocculation tanks at 30 min retention time			27,280
Filtration	Filters (firm, with 3 filters)			19,553
	Filters (total, with 4 filters)	27,286		
	Backwash pumps (each)	34,992		
Disinfection	Chlorination & contact time for virus inactivation, at chlorine residual of 0.25 mg/L 2.2 mg/L			33,042 43,665
	UV disinfection units, each	34,992		
High Lift Pumping	Zone 1 pumps (firm with 2 pumps)			19,993
	Zone 1 pumps (total with 3 pumps)	29,989		
	Zone 2 pumps (firm with 2 pumps)			16,001
	Zone 2 pumps (total with 3 pumps)	24,002		

3 WFP Performance

A desktop review of the raw and treated water quality at the WFP for the years 2017 to 2019 was conducted to assess the recent treatment performance of the WFP and identify opportunities for treatment optimization.

Treatment performance of the air scrubbers at Wells 1 and 2 and the chlorination system at the West Orillia Well is reviewed in section 6.

3.1 RAW WATER QUALITY

The primary raw water source for the WFP is Lake Couchiching. Water from Wells 1 and 2 enters the WFP for disinfection only. Raw water quality for Wells 1 and 2 is reviewed in section 6.1.

Lake Couchiching is a shallow lake, characterized by seasonal temperature fluctuations, high organics, and varying microbiological content and turbidity from year to year, as is typical of a surface water source. Annual average raw water quality for Lake Couchiching for the past 3 years is summarized in Table 4.

Table 4: Lake Couchiching Raw Water Quality

PARAMETER	2017	2018	2019
Turbidity range (NTU)	0.41 - 0.67	0.08 – 0.73	0.33 - 0.58
Average Total Organic Carbon (mg/L)	4.7	4.3	4.2
Average Geosmin (ng/L)	N/A	5.9	N/A
Average MIB (ng/L)	N/A	10	N/A
E. Coli range (counts/100 mL)	0 - 14	0 - 7	0 – 11
Total Coliforms range (counts/100 mL)	0 - 206	0 - 840	0 – 420

3.2 TREATED WATER QUALITY

3.2.1 Turbidity

Turbidity is an important indicator of filter efficiency. Turbidity can cause interference with disinfection and be a source of disease-causing organisms. Schedule C of the City's MDWL requires effective filter backwash procedures and continuous turbidity monitoring to ensure that filtered water turbidity is less than or equal to 0.3 NTU in 95% of the measurements each month.

Table 5 indicates that filter effluent turbidity has remained consistently below the compliance limit of 0.3 NTU over the past 3 years.

Table 5: WFP Filtered Water Turbidity

FILTER #	FILTERED TURBIDITY (NTU)		
	2017	2018	2019
Filter 1	0.06 - 0.22	0.06 - 0.21	0.06 - 0.18
Filter 2	0.06 - 0.18	0.07 - 0.25	0.05 - 0.23
Filter 3	0.06 - 0.21	0.01 - 0.22	0.05 - 0.20
Filter 4	0.06 - 0.22	0.06 - 0.23	0.01 - 0.19

3.2.2 Disinfection and By-product Formation

Disinfection and disinfection by-product parameters, as measured in the treated water leaving the WFP, are summarized in Table 6, along with the Ontario Drinking Water Standard (ODWS) limit for each parameter.

The WFP maintained chlorine residuals in the treated water within an acceptable range in accordance with typical values and O. Reg. 170. There were no occurrences of E. Coli or Total Coliforms. The data indicates that there is no concern with the formation of disinfection by-products at the WFP. However, the City has indicated receiving occasional complaints of chlorine taste in the drinking water.

Table 6: WFP Treated Water Quality - Disinfection and Disinfection By-Products

PARAMETER	2017	2018	2019	ODWS
Min. Chlorine Residual (mg/L)	1.62	1.61	0.86	0.2
Max. Chlorine Residual (mg/L)	2.10	2.34	2.78	4.0
E. Coli (counts/100 mL)	0	0	0	0
Total Coliforms (counts/100 mL)	0	0	0	0

3.2.3 Inorganics and Organics

Treated water inorganic and organic parameter concentrations, which were measured at above the laboratory detection limits, are summarized in Table 7.

Data for the years 2017 to 2019 show no inorganic or organic quality concerns in the treated water. All parameters were well below the ODWS.

Table 7: WFP Treated Water Quality – Inorganics and Organics

PARAMETER	2017	2018	2019	ODWS
Lead (µg/L)	<DL	0.15	N/A-	10
Fluoride (mg/L)	0.1	0.06	0.07	1.5
TCE (µg/L)	0.4	0.44	0.44	5
PCE (µg/L)	0.5	0.35	0.35	10
Arsenic (µg/L)	0.6	0.5	1.4	10
Barium (µg/L)	58.0	59.5	38.4	1,000
Boron (µg/L)	20	35	20	5,000
Chromium (µg/L)	2.0	0.6	0.2	50
Selenium (µg/L)	1.0	0.3	0.1	50
Uranium (µg/L)	0.3	0.3	0.3	20

Note: <DL: Below Laboratory Detection Limit

3.3 OPERATIONAL AND AESTHETIC OBJECTIVES (REVISED JANUARY 17, 2023)

The WFP treated water quality aesthetic and operational parameters are summarized in Table 8.

Sodium levels were within the Aesthetic Objectives (AO) listed in the MECP Technical Support Document for Ontario Drinking Water Quality Standards, Objectives and Guidelines (ODWSOG), but above the 20 mg/L level requiring notification of the local Medical Officer of Health.

Aluminium levels were slightly higher than the Operational Guideline (OG) in the ODWSOG, and this is caused by the aluminium-based coagulant that is added to comply with the turbidity criterion. Optimization of the coagulation and flocculation processes to potentially reduce the aluminium-based coagulant dosage and thus reduce the residual aluminum concentration in the treated water, should be undertaken. This study should consider the use of alternative coagulants and coagulant aids, improvements to mixing, flocculation and filtration.

On average in 2018, the WFP reduced the geosmin content by 75% to well below its odour threshold concentration of 4 ng/L and reduced the MIB concentration to a lesser extent (58%),

but below its odour threshold concentration of 9 ng/L. It is recommended that the filters' GAC media specifications be reviewed to determine if the GAC is effective at removing MIB and geosmin. GAC media replacement frequency could be increased to ensure the WFP does not operate with spent GAC that has no remaining adsorption capacity.

Table 8: WFP Treated Water Quality – Operational Guidelines and Aesthetic Objectives

	2017	2018	2019	OBJECTIVE OR GUIDELINE	ODOUR TRESHOLD
Dissolved Organic Carbon (mg/L)	3.8	3.5	3.0	5	-
Sodium (mg/L)	42.6	38.6	33.7	< 20-200	-
Aluminum (mg/L)	**0.14**	**0.11**	-	0.1	-
Geosmin (ng/L)	-	1.5	-	-	4
MIB (ng/L)	-	**4.2**	-	-	9

Although the WFP's treated water contains chlorine residuals that typically do not exceed 2.8 mg/L (see Table 6), which is within the O. Reg. 170/03 permitted range, the chlorine in the drinking water is noticeable, particularly at the higher concentrations and for customers that are near the WFP. Customer complaints of poor water taste have been received that the City attributes to chlorine. Currently, the WFP and the WOW are the only application point for chlorine throughout the distribution system.

A detailed review of chlorine levels in the distribution system and feasibility assessment of options should be conducted to determine if the target secondary disinfection chlorine residual at the WFP could be reduced concurrently with the addition of chlorine top-up injection points at existing municipal facilities such as at the reservoirs, at the Zone 3 BPS and other locations where low residuals have been noted. The objective of the study will be to optimize the dosing of chlorine, achieve more consistent chlorine residuals in the distribution system, and address concerns with the aesthetic quality of the drinking water.

3.4 WFP PERFORMANCE SUMMARY

The Orillia WFP produces drinking water that meets all Ontario Drinking Water Standards.

The disinfected water contains low levels of THMs and HAAs, well below the current standards. Optimization of the disinfection processes to minimize the formation of disinfection byproducts is not necessary.

Although the secondary disinfection chlorination dosages are within typical range and O. Reg. 170 requirements, chlorine taste complaints have been received.

The treated water aesthetic quality does not meet all the ODWS aesthetic objectives and operational guidelines.

- Sodium levels are below the Aesthetic Objective; however, they are above 20 mg/L, which requires notification to the Medical Officer of Health.
- Aluminium levels are slightly above the Operational Guideline. Optimization of the coagulation and flocculation processes is recommended.
- Residual levels of MIB are at times above its odour threshold concentration, therefore causing customer complaints of taste and odour. Review of the GAC specifications and frequency of GAC replacement is recommended.

4 WFP and Generator Building Condition

4.1 WATER FILTRATION PLANT

A condition assessment of the WFP was completed in 2017 (Water Filtration Plant Condition Assessment, Ainley Group). The study included a condition grading and assessment of the consequence of failure and the probability of failure, as well as estimates of the equipment's remaining useful life. Given the relatively recent completion of this condition assessment, it was agreed an updated assessment was not required for this WMP update.

Based on the 2017 assessment, the WFP is in good overall condition. Most of the process mechanical equipment was replaced or refurbished in recent years. Recommended repairs to the low lift pumps vacuum priming system, to Filters 1 and 2's drain valves, and to the boiler pumps, were completed. The WFP structure is in good condition despite the age of the original building. Electrical system upgrades and updating of the MCCs, PLCs and transformer were recommended, as well as ongoing replacement of instrumentation as the equipment reaches the end of its useful life.

Of the recommended work, the following items remain to be addressed:

- Replacement of the low lift pumps with self priming pumps, by 2037.
- Resolving the poor seal of the flocculation tanks' mud valves. A work around solution is required.
- Replacing damaged PRVs and assessing the removed PRVs to determine the cause of the damage.
- Replacing the chlorinators and upgrading the chlorination room. The upgrades are planned to be implemented in 2022.
- Updating the MCCs, PLCs, I/O modules, and communication modules, as required based on the ongoing detailed study and SCADA master plan.
- Replacing electrical heaters as needed or by 2032.

The condition assessment of the WFP indicates that ongoing equipment replacement and refurbishing, as the equipment reaches the end of its useful life, and ongoing maintenance of the facility, will address the current issues. The City maintains replacement and maintenance budgets for this purpose.

4.2 GENERATOR BUILDING

The emergency generator that provides stand by power to the WFP is in a separate building on Jarvis Street. The generator building was constructed around 1999/2000. It is a flat-roofed building with split face architectural block walls, which are in good condition. In 2020, no deficiencies were noted in the building interior except in the generator area where there was evidence of roof leakage. The City has confirmed the issue was resolved since the inspection in July 2020.

5 WFP Climate Change Resiliency

As the City's primary water treatment facility, the WFP is of critical importance. Climate change could create risks that could have potential impacts on the operation and performance of the WFP and affect its capability to supply safe drinking water.

A resiliency assessment of the WFP was completed to determine the potential impacts of climate change on the facility, identify potentially vulnerable components, and recommend measures to improve climate change resiliency. The assessment followed the framework outlined in Infrastructure Canada's Climate Lens (2019) guidance document.

The assessment considered risks to the infrastructure and the operation and maintenance of the WFP and its major components. The assessment considered potential impacts of future climate change for the next 50 years, matching the expected lifespan of the WFP's major equipment.

5.1 IDENTIFICATION OF CLIMATE HAZARDS

The potential climate hazards for the Lake Simcoe region by 2070 are predicted to be as summarized in Table 9. The information was obtained from Environment and Climate Change Canada climate model projections.

Table 9: Summary of Climate Change Effects Expected for the Lake Simcoe Region

	CLIMATE EVENT	EXPECTED CHANGE BY 2070
Temperature	Annual mean air temperature	Increase of 2.9°C to 4.3°C
	Number of very hot days (max. temperature ≥30°C)	Increase of 24 to 40 days per year
	Number of heat waves (3 or more days with max. temp. ≥30°C)	Increase of 3 to 5 per year
	Average heat wave duration	Increase of 3 to 5 days
	Longer summers and shorter winters Higher maximum temperatures in summer Higher minimum temperatures in winter Fewer very cold days in winter	
Precipitation	Total precipitation	Increase of 8% to 10% per year
	Heavy precipitation days (>10 mm/day)	Increase of 3.3 to 3.8 days per year

	CLIMATE EVENT	EXPECTED CHANGE BY 2070
	No significant increase in the number of dry days per year.	
Storm Events	Severe storms; winter storms	Not quantified. Likely to increase in intensity and frequency
	Tornadoes	
	Severe flooding	

These climate events were considered in terms of potential effects on lake water levels and ice formation.

Increases in precipitation and frequency of heavy precipitation days could result in an increase in lake water levels, and potentially flood the WFP site. However, as Lake Couchiching is part of the Trent-Severn Waterway, the lake's water levels are actively controlled by Parks Canada. Therefore, an increase in water level beyond the control elevations to a flooding elevation at the WFP has a very low probability of occurrence. Further, as no significant increase in the number of dry days per year are expected, lower lake water levels are not expected to be a significant climate change effect. Therefore, lower or higher lake water levels beyond Parks Canada's control set points were not considered to be significant climate change risks.

As a result of shorter winters and longer summers, there will be fewer days per year when temperatures are significantly below freezing and when conditions are good for ice formation. The date of freeze-up of Lake Couchiching is trending later and the date of ice break-up is trending earlier resulting in a reduced period of ice cover over the winter. Therefore, negative impact from increased ice depth at the intake is not considered to be a significant climate change risk.

5.2 ASSESSMENT OF CLIMATE HAZARDS

5.2.1 Risk Assessment Approach

To determine the WFP components that are at the highest risk, and the likely effect of individual climate events on the components, a qualitative risk assessment was conducted in a matrix format. The methodology was based on the Public Infrastructure Engineering Vulnerability Committee protocol developed by Natural Resources Canada and Engineers Canada (August 2005).

For each climate change effect, we determined whether there is a potential climate/infrastructure interaction and if it should be considered further.

For each interaction considered further, a risk value was derived after assigning a probability factor and a severity factor. Since, we could not predict the probability of climate change effects occurring, the probability factor was defined as the probability that a climate change effect will negatively impact the infrastructure, assuming the predicted climate change effect does occur. Probability factors were assigned a value of 1, for Improbable, to 5, for 'certain or highly probable'. Severity factors were determined assuming the climate-infrastructure interaction has occurred. They were assigned a value of 1 for 'measurable but unlikely', to 5 for 'frequent and continual loss of infrastructure asset'. The risk factor was determined by multiplying the probability and the severity.

Following the determination of the risk factor, the climate-infrastructure interactions were prioritized into three categories as follows:

- Low risk if the score is less than 10. Low risk interactions present a very low potential for vulnerability of the infrastructure component to the climate change effect.
- Moderate risk if the score ranges from 10 to 15. There is a potential for the infrastructure component to be vulnerable to the climate change effect. Further engineering assessment is recommended to clearly understand the extent of the vulnerability.
- High risk if the score is greater than 15. The infrastructure component has an identified vulnerability to the climate change effect and short-term action is required.

5.2.2 Risk Assessment

The following summarizes the results of the risk assessment and documents the rationale for determining the probability of a negative impact occurring and the severity of the impact considering that it has occurred. The risk assessment matrix is attached in Appendix B.

Increase in Annual Mean Temperature

Generally warmer air temperatures could lead to earlier spring seasons and snowmelt, an increase in rain on top of snow events, and earlier ice breakups on Lake Couchiching. A milder climate may promote development and population growth in the watershed, leading to an increase in wastewater discharges and a negative impact on source (lake) water quality. Increase in air temperature is expected to cause an increase in the average lake water temperature. The probability that the increase in air and water temperatures will affect the raw water quality, through increased algae growth and formation of toxic by-products and taste and odours compounds from algae decomposition, is moderate, and will have a measurable impact on source water quality. Deterioration of the raw water quality could require a change in the coagulation/flocculation process and affect the performance of the filters.

Increase in the Number, Length, and Duration of Heat Waves

An increase in the frequency and duration of very hot summer days may also promote an increase in organics, algae growth, and the risk of cyanobacteria blooms in Lake Couchiching, negatively impacting water quality. As a result, the City may experience an increase in the number of taste and odour complaints. The treatment system may lose some capability to consistently produce aesthetically pleasing drinking water during the summer months.

Extreme temperatures typically result in increased water demands. More frequent and longer duration heat waves would be expected to increase the number of high demand days, where the WFP is required to operate at or close to its maximum capacity. This will likely require more operation and maintenance on pumps and equipment, more frequent filter backwashing, and possible reduction in production capacity.

Prolonged periods of extreme temperature could result in an increase in power consumption (due to the use of air conditioners and fans). It is possible this would cause more frequent power outages, which would be handled by the emergency generator, resulting in an increase in diesel consumption, operation and maintenance.

Increase in Precipitation Volume, Frequency and Intensity

An increase in the frequency and intensity of rain events could result in increased sedimentation and raw water turbidity spikes due to runoff to the Lake. Such spikes in turbidity may require an increase in the filter backwash frequency but may only rarely impact the WFP's ability to meet water demands.

Increase in Severe Storm Events

An increase in the frequency and severity of severe storm events such as tornadoes, hailstorms, ice storms and blizzards, is possible. Due to the nature of such storms, major impacts to infrastructure are expected to be localized. There is a remote possibility of some physical impact to the WFP facility, resulting in loss of operation. More typically, power lines, roadways, and access to the WFP would be impacted. For a severe ice storm or tornado, it is possible that an extended period of reduced capacity to produce treated water could occur, even with backup power systems in place.

5.2.3 Risk Assessment Summary

This climate change risk assessment resulted in a calculation of risk factors ranging from 0 to 8, which are considered low. However, the assessment points to areas of the WFP that should be reviewed to increase its resiliency to climate change.

The highest vulnerabilities of the WFP to the predicted effects of climate change are:

- Deterioration of the raw water quality, which could cause a deterioration of the treated water quality if adjustments to the coagulation/flocculation and filtration processes are not implemented.
- Increase in water demands for extended periods, potentially above the expected maximum day demands, combined with poorer raw water quality, could make it difficult to produce the required volume and quality of treated water.

The WFP building is not considered to be at risk from severe storm events and flooding.

5.3 RESILIENCY IMPROVEMENT MEASURES

To mitigate the potential climate change risks identified above, the following measures are recommended:

- Monitor raw water quality parameters such as microcystin, geosmin, MIB, to identify any trends in water quality related to air and water temperatures.
- Review and update its standard operating response in the event of an algae bloom near the WFP intake.
- Monitor the treated water's taste and odour compounds to verify performance of the GAC.
- Refine the definition of risk hazards as more information becomes available.
- Refine the risk assessment, following a similar approach as presented herein, with Operations staff.
- Review the limiting factors in the capacity of the WFP to produce safe drinking water from deteriorating raw water quality concurrently with higher maximum day demands, to identify measures to increase resiliency. Optimization of the coagulation, flocculation and filtration processes, and stress testing of the filters to assess their capability to achieve the required effluent turbidity at higher filtration rates and at higher influent turbidity, are recommended. It is also recommended that options be developed to address the limitation in the frequency of filter backwashes.
- Review the fuel tank volume for the emergency generator to determine if it is sufficient in the event of an extended main power failure.

6 Other Water Treatment Facilities

6.1 WELLS 1 AND 2

Wells 1 and 2, located near the WFP, each in a building, are used as additional sources of raw water. Groundwater from Wells 1 and 2 is treated through air scrubbers, located in a dedicated scrubber building, then through chlorination and UV disinfection at the WFP, jointly with the filtered surface water. Tatham completed a condition assessment of these buildings in 2020.

6.1.1 Wells and Well Pumps

Wells 1 and 2 are each equipped with two-stage vertical turbine pumps, with a capacity of 30.3 L/s and 37.8 L/s, respectively. The wells and well pump motors were rehabilitated in 2019/2020.

Only one of the two wells can run at a time, as the main power supply transformer is undersized to run both. A new transformer is planned to be installed in 2022. The two well pumps are started manually as there is no automatic or SCADA control. The City plans to implement automatic controls when it completes its overall review of the SCADA system.

6.1.2 Well 1 Building Condition

The Well 1 building was constructed in 1939. The building exterior walls consist of metal cladding over deteriorated clay brick. The building has a flat roof. The interior brick walls show minor cracks. The concrete floor is old but in acceptable condition. No major structural concerns were noted.

6.1.3 Well 2 Building Condition

The Well 2 building is a flat-roofed limestone block building constructed in 1940. The interior walls are lined with old clay bricks that are in acceptable condition. The concrete floor is cracked but in serviceable condition. The steel lintels over the window openings are very corroded and need to be replaced. The building entrance is very close to the Rotary Train tracks in Couchiching Beach Park, which is a safety concern.

6.1.4 Scrubber Building Condition

The scrubber building was built in 2007. The building and equipment were found to be in very good condition and well maintained. Minor wear was noticed on the interior floor, and two areas of leakage stains were noted on the interior walls suggesting moisture infiltration through the roof or flashing.

The City reported reduced flows through Scrubber 2 from fouling of the sieve trays, which are difficult to clean mechanically or chemically. This issue is being addressed by the City.

6.1.5 Scrubber Performance

Groundwater from Wells 1 and 2 is treated in two scrubber tanks, one for each well and each with a capacity of 37.8 L/s, that were designed to remove trace amounts of trichloroethylene (TCE) and tetrachloroethylene (PCE) by air stripping.

The scrubbers effectively remove TCE and PCE as intended, to well below the ODWS. Tables 10 and 11 summarize the raw groundwater quality from Wells 1 and 2, respectively. The TCE and PCE levels after air stripping are summarized in Table 12. No issues with the operation of the scrubbers were noted by the operators.

Table 10: Well 1 Raw Water Quality

PARAMETER	2017	2018	2019
Turbidity (NTU)	0.06 - 0.09	0.08	0.05 - 0.07
Alkalinity (mg/L)	304	316	334
Hardness (mg/L)			407
Nitrate (mg/L)	3.30	3.05	3.29
TCE (µg/L)	31.1	18.0	19.5
PCE (µg/L)	11.1	5.7	7.4
E. Coli (counts/100 mL)	0	0	0
Total Coliforms (counts/100 mL)	0 – 19	0 – 107	0

Table 11: Well 2 Raw Water Quality

PARAMETER	2017	2018	2019
Turbidity (NTU)	0.05 - 0.14	0.08 - 0.09	0.06 - 0.09
Alkalinity (mg/L)	284	326	323
Hardness (mg/L)			433
Nitrate (mg/L)	2.70	3.17	3.30
TCE (µg/L)	25.2	19.0	14.0
PCE (µg/L)	11.0	8.5	6.6
E. Coli (counts/100 mL)	0	0	0
Total Coliforms (counts/100 mL)	0 - 3	0	0

Table 12: Wells 1 and 2 Scrubbers TCE and PCE Performance

PARAMETER	2017	2018	2019	ODWS
Well 1				
TCE (µg/L)	2.5	1.0	1.4	5
PCE (µg/L)	0.7	0.4	0.5	10
Well 2				
TCE (µg/L)	1.1	0.9	0.6	5
PCE (µg/L)	0.5	0.4	0.4	10

6.2 WEST ORILLIA WELL

6.2.1 Groundwater Chlorination System

Groundwater pumped at the West Orillia Well (WOW) is chlorinated with sodium hypochlorite injected by two (duty/standby) chlorine metering pumps located within the pumphouse. Following chlorine contact time in a 900 mm diameter contact pipe, disinfected groundwater is discharged into the water distribution system of PZ2.

6.2.2 Pump House Condition

The structural condition of the pump house was assessed in October 2020. Minor structural issues were noted, including:

- on the exterior: the untreated plywood at grade, covering insulation on the foundation projection, is rotting and loose; there is efflorescence on lower courses of architectural block at northwest corner of building; and beside the door, there is spalling of the lower courses of block from water damage caused by incorrect flashing installation.
- in the interior, cracks in the concrete floor were noted, however they are not a structural concern.

The City noted that spill containment for the chlorine storage tanks needs to be added.

6.2.3 Groundwater and Treated Water Quality

Recent groundwater quality from the WOW is summarized in Table 13. Raw water is free of bacteria and volatile organics and has low turbidity. The raw water contains about 3 mg/L nitrate, which is well below the ODWS. It also contains sodium and chlorides at slightly elevated concentrations.

Chlorine residuals leaving the pump house is typically around 1.2 mg/L to 1.6 mg/L.

Table 13: West Orillia Well - Raw Water Quality

PARAMETER	2017	2018	2019
Turbidity range (NTU)	0.06 - 0.24	0.06 - 0.20	0.04 - 0.16
Nitrate (mg/L)	3.0	3.03	3.08
Sodium (mg/L)			29.5
Chloride (mg/L)			93.9
Alkalinity (mg/L)		-	262
Hardness (mg/L)		-	368
Colour (TCU)			0.7
E. Coli (counts/100 mL)	0	0	0
Total Coliforms (counts/100 mL)	0	0	0

7 Summary and Recommendations

7.1 SUMMARY

7.1.1 Water Filtration Plant

Capacity

The WFP has a rated capacity of 27,280 m^3/day up to the chlorine contact tanks, and 33,042 m^3/day at the chlorine contact tanks, as it receives the flow from Wells 1 and 2. The WFP's firm capacity is considered to be 25,309 m^3/day, with one of the largest filters offline.

Increasing the rated capacity of the WFP would involve expanding or modifying most unit processes, facilities and pumping systems. However, the WFP's firm capacity could be increased if the filters could be operated at higher filtration rates.

Performance

The WFP produces drinking water that meets or exceeds all Ontario Drinking Water Standards, including achieving low levels of THMs and HAAs.

The treated water's aesthetic quality does not meet the Operational Guideline for aluminium.

Treated water has an occasional earthy taste and odour caused by levels of MIB that are at times above MIB's odour threshold concentration. Other taste and odour complaints have been received, likely attributed to chlorine.

Condition

The WFP is in good overall condition. Most of the process mechanical equipment was replaced or refurbished in recent years. Replacement or refurbishing of the low lift pumps, chlorinators, MCCs and controls, and electrical heaters is planned in the City's capital forecast.

Climate Change Resiliency

The WFP is considered to have a low risk of being negatively impacted by climate change. However, the risk assessment identified the highest risk factors, which should be focused on to improve the WFP's resiliency to climate change effects. These include deterioration of lake water quality, which could cause a deterioration of the treated water quality if the treatment processes are not adjusted accordingly. Compounded with potential increases in water demands for extended periods, these effects could make it difficult for the WFP to produce the required volume of safe drinking water.

7.1.2 Groundwater Supplies

Wells 1 and 2

Wells 1 and 2 are operated manually and are not incorporated in the water SCADA system. They cannot be run concurrently due to power supply constraints, which limits the City's ability to use the wells to their full rated capacity.

Although the two buildings in which the wells are housed do not have major structural issues, they require repairs.

The air stripping system is effective at removing TCE and PCE to well below the ODWS.

West Orillia Well

There are no concerns with the operation of the West Orillia Well's chlorination system. However, there are minor structural issues with the building, and the need for spill containment has been identified.

7.2 RECOMMENDATIONS

The following summarizes the recommendations of the assessment of the Water Filtration Plant and other water treatment facilities. Most recommendations involve further studies and monitoring to assess the feasibility of increasing the water treatment capacity, improving the aesthetic quality of the treated water, and increasing the facilities' resiliency to climate change.

- Conduct a pilot study to determine if the filters' filtration rate can be increased while still maintaining the effluent turbidity below the minimum requirements. This study should be coordinated with the optimization study of the coagulation and flocculation processes.
- Conduct an optimization study of the coagulation and flocculation processes to identify feasible and cost-effective process improvements that can reduce the residual aluminium concentration, reduce the dissolved organic content, and improve the aesthetic quality of the drinking water.
- Review the feasibility of installing a stand-by flash mixer on the low lift pumps discharge header.
- Conduct a study to review the WFP chlorination dosages for secondary disinfection and the chlorine residuals in the water distribution system and assess the feasibility and benefits of reducing the WFP secondary disinfection chlorine residual target and adding top-up chlorination stations at municipal facilities, to optimize chlorine dosing, achieve more consistent chlorine residuals, and address localized taste and odour concerns.

- Review the filter GAC specifications, depth, and frequency of GAC replacement, to identify opportunities to improve the adsorption of seasonal taste and odour compounds.
- Increase monitoring of treated water taste and odour compounds (MIB and geosmin) to verify performance of the GAC system.
- At the WFP, implement the previously recommended upgrades to the low lift pumps, chlorinators, MCCs and electric heaters.
- Increase monitoring of raw water quality parameters such as microcystin, geosmin and MIB, to identify raw water quality trends related to air and water temperatures.
- Review and update the standard operating response in the event of an algae bloom near the WFP intake.
- Review the limiting factors in the capacity of the WFP to produce safe drinking water under conditions of deteriorating raw water quality concurrently with high maximum day demands.
- Develop options to address the physical limitations to increasing the frequency of filter backwashes, such as the capacity of the wastewater holding tank.
- Review the generator's fuel tank volume to determine if it is sufficient in the event of an extended main power failure.
- Refine the definition of climate change risk hazards and update the risk assessment with Operations staff as more information becomes available.
- Incorporate Wells 1 and 2 into the WFP SCADA system to allow automatic operation.
- Complete structural repairs to the Wells 1 and 2 buildings and the WOW building.
- At the WOW, install spill containment.

8 Glossary of Abbreviations

The abbreviations and acronyms used in this report are escribed in Table 14.

Table 14: Abbreviations

ABBREVIATION	DESCRIPTION
ADD	Average Day Demand
BPS	Booster Pumping Station
CT	Chlorine concentration x Contact time
DL	Laboratory Detection Limit
DWWP	Drinking Water Works Permit
GAC	Granular Activate Carbon
HAA	Haloacetic Acids
HLP	High Lift Pump
LLP	Low Lift Pump
MDD	Maximum Day Demand
MDWL	Municipal Drinking Water License
MECP	Ontario Ministry of the Environment, Conservation and Parks
MIB	Methylisoborneol
MOE	Ministry of the Environment (previous name for MECP)
O&M	Operation and Maintenance
ODWS	Ontario Drinking Water Standards
NTU	Nephelometric Turbidity Unit
PCE	Perchloroethylene or tetrachloroethylene
PTTW	Permit To Take Water

ABBREVIATION	DESCRIPTION
TCE	Trichloroethylene
TDH	Total Dynamic Head
THM	Trihalomethane
TOC	Total Organic Carbon
UV	Ultraviolet disinfection
WFP	Water Filtration Plant
WOW	West Orillia Well
mg/L	Milligrams per liter
ng/L	Nanograms per liter
µg/L	Micrograms per liter

Appendix A: WFP Unit Operation Capacity Calculations

PROJECT	Orillia Water Master Plan Update	FILE	120063
		DATE	August 18, 2020
SUBJECT	WFP Unit Operations Capacity Review	NAME	RL
		PAGE	1 OF 8

Background

Part of the Water Master Plan (WMP) Update includes a review of the existing treatment and hydraulic capacity of each treatment process at the WFP (pre and post chlorination, screening, coagulation and flocculation, filtration, and UV disinfection) and at Wells 1 and 2 (air stripping), and a review to confirm the WFP's capacity to achieve the disinfection requirements (CT) under normal and emergency conditions. The overall production capacity of the WFP, and the WFP's processes that limit the overall capacity, will be identified.

This review is based on our site visit and meeting with WFP staff on July 8, 2020, and a review of available drawings, design reports, O & M Manuals, MDWL, DWWP, PTTW.

Treatment and hydraulic capacity requirements are based on the MOE Design Guidelines for Drinking-Water Systems, 2008.

The MDWL lists the rated capacity of the plant as follows:

WFP	=	27,280	m^3/day
Well 1 + 2	=	5,762	m^3/day
		33,042	m^3/day

Intakes

The WFP is equipped with two intakes as follows:

Main Intake:	364	m long x	1	m Ø, connected to	10	m long x	0.8	m Ø
Backup Intake:	84.6	m long x	0.6	m Ø				

The main intake crib has a reported capacity 77,274 m^3/day. Not enough design or construction information exists to perform a calculation to confirm this capacity.

Using Manning's formula, the intake pipes have the following full flow capacity:

Main Intake (1 m Ø section):

Pipe Diameter	1000 mm	Elev. at LLP Well	216.63 m	(from O & M Manual)
Manning's Value	0.013	Inv. Elev. at Lake	211.50 m	(from O & M Manual)
		Pipe Length	374 m	(from O & M Manual)
Pipe Slope	1.37%			
Full Flow Velocity	3.58 m/s			
Full Flow Capacity	2.81 m^3/s, or	242,611 m^3/day		

Main Intake (0.8 m Ø sectior

Pipe Diameter	800 mm	Pipe Length	10 m	(from O & M Manual)
Manning's Value	0.013			

Pipe Slope	1.37%	(assume same slope as main section)
Full Flow Velocity	3.08 m/s	
Full Flow Capacity	1.55 m^3/s, or	133,808 m^3/day

Backup Intake:

Pipe Diameter	600 mm	Elev. at LLP Well	216.72 m	(from O & M Manual)
Manning's Value	0.013	Inv. Elev. at Lake	215.76 m	(from O & M Manual)
		Pipe Length	84.6 m	(from O & M Manual)

Pipe Slope	1.13%	
Full Flow Velocity	2.31 m/s	
Full Flow Capacity	0.65 m^3/s, or	56,512 m^3/day

Raw Water Screens

The WFP is equipped with a stationary bar screen and a travelling screen. If the travelling screen is out of service, a by-pass screen can be manually installed.

According to the O & M Manual, all three screens have a capacity 29,300 m^3/day. Not enough design or construction information exists to perform a calculation to confirm this capacity.

Low Lift Pumps

According to the O & M Manual, the low lift pump well has an available storage volum 125.3 m^3.

The WFP is equipped with four low lift pumps, with the following capacities:

3 pumps at	105	L/s at	7.6	m TDH	(Installed in 1978)	(Refurbished between 2010 - 2012
1 pump at	158	L/s at	7.65	m TDH	(Installed in 1989)	

All four pumps are included in the duty rotation program (DWWP lists one pump as standby).

With the largest pump out of service, the firm low lift pumping capacity 315 L/s, or 27,216 m^3/day

Coagulant Dosing Pumps and Mixer

Coagulant Dosing Pumps

According to the O & M Manual, the WFP is equipped with two coagulant dosing pumps (duty/standby), each with a capacity o 11.3 L/hour. WFP staff indicated the typical coagulant dosage is 5.85 mg/L to 6.8 mg/L, depending on lake conditions.

What flow and dosage rate can these pumps accommodate?

Based on a coagulant solution strength 52% and a specific gravity of 1.205 (Kemira SternPAC)

Flow Rate		Pump Sizing (L/hr) at a Dosage Rate of (mg/L)				
(L/s)	(m^3/day)	5.85	6.2	7	8	9
316	27,280	10.6	11.3	12.7	14.5	16.4
335	28,944	11.3	12.0	13.5	15.4	17.4
750	64,800	25.3	26.8	30.2	34.5	38.8
1,000	86,400	33.7	35.7	40.3	46.0	51.8

According to the O & M Manual, the in-line mechanical flash mixer is a Lightnin Model 8-LBC-200 with a capacity range of 9,090 - 45,460 m^3/day

This is the only coagulant mixer and identified as a fail point by operations staff.

Flocculation Tanks

According to the O & M Manual, there a 3 - 2 cell floc tanks. Each cell has the following dimensions:

Length:	3.81 m	Volume of each cell is	95.1 m^3
Width:	3.81 m	Volume of each tank is	190 m^3
Depth:	6.55 m	Total volume of tanks is	570 m^3

Detention time in each floc tank at WFP rated capacity is 10 minutes
Detention time in all floc tanks at WFP rated capacity is 30 minutes

The MOE 2008 Guidelines suggest detention times of 25 to 30 minutes, when sedimentation is included, and 30 to 40 minutes for colder water temperatures.

Filters

Filters 1 and 2 are dual media (GAC and sand) gravity filters. Each filter has the following dimensions:

Length: 8.53 m
Width 4.27 m
Depth: 3.81 m
Area: 36.4 m^2

According to the O & M Manual and DWWP, each filter has a capacity of 89.5 L/s, or 7,733 m^3/day

The resultant filtration rate i 8.8 m/hour.

MOE 2008 Guidelines suggest a maximum filtration rate c 11.7 m/hour. Therefore, each filter could treat a maximum flow of 10,228 m^3/day; 2 filters total c 20,455 m^3/day

Filters 3 and 4 are dual media (GAC and sand) gravity filters. Each filter has the following dimensions:

Length: 3.66 m
Width 9.15 m
Depth: 3.5 m
Area: 33.5 m^2

According to the O & M Manual and DWWP, each filter has a capacity of 68.4 L/s, or 5,910 m^3/day

The resultant filtration rate i 7.4 m/hour.

MOE 2008 Guidelines suggest a maximum filtration rate c 11.7 m/hour. Therefore, each filter could treat a maximum flow of 9,404 m^3/day; 2 filters total c 18,807 m^3/day

Therefore, the 4 filters have a combined capacity of 27,285 m^3/day, but could be operated at 39,263 m^3/day at a higher filtration rate c 11.7 m/hour if the req. turbidity level can be maintained.

Filter Backwash Pumps

According to the O & M Manual, the filters require a maximum backwash flow rate of 45 m/hour

This equates to the following flow rates:

Filters 1 and 2: 39,337 m^3/day, or 455 L/s
Filters 3 and 4: 36,168 m^3/day, or 419 L/s

According to the O & M Manual, the WFP is equipped with two filter backwash supply pumps, each rated at 405 L/s, or 34,992 m^3/day At this flow rate, the actual backwash rate is:

Filters 1 and 2: 40.0 m/hour.
Filters 3 and 4: 43.5 m/hour.

This is within the MOE 2008 Guidelines suggested backwash rate range of 37 to 50 m/hour.

Filter Backwash Wastewater Holding Tank

According to the WFP staff, the backwash sequence for each filter is as follows:

1. Low Flow: 240 L/s for 60 seconds = 14,400 L
2. High Flow: 395 L/s for 420 seconds = 165,900 L
3. Low Flow: 240 L/s for 90 seconds = 21,600 L

} = 201.9 m^3

According to the O & M Manual, the volume of the wastewater holding tar 335 m^3. Therefore, the holding tank has sufficient volume to accommodate the backwash (1.7 filters at a time.

According to the O & M Manual, the holding tank is equipped with two wastewater discharge pumps, rated as follows:

			Time to empty a full tank:	
Pump 1:	30 L/s	= 44.5 L/s	125 minutes, or	2.09 hours
Pump 2:	14.5 L/s			

Disinfection

The WFP's disinfection process includes the following:

Gas Chlorination:

Pre-chlorination:	to the intake structure in summer, into the LLP well in winte	96	kg/d
Post-chlorination:	to the chlorine contact tanks	96	kg/d
Post-post-chlorination	to Zone 1 HLP discharge header	48	kg/d
	to Zone 2 HLP discharge header	48	kg/d
Standby-chlorination:	can service any of the above	96	kg/d

Chlorine Contact Chamber #1:	620	m^3	Baffle Factor: 0.5	(From O & M Manual. 2002 Design Report used 0.7)
Chlorine Contact Chamber #2:	490	m^3		
Clearwell (total volume):	3,000	m^3	Assume 50% of total vol. is available for chlorine contact	

UV:

3 flow through UV reactors (one for Zone 1, one for Zone 2, one spare), each rated at
243 L/s, or 20,995 m^3/day (maximum current design capacity)
405 L/s, or 34,992 m^3/day (maximum ultimate design capacity)

According to the City's DWWP - Issue 5 (March 2018), the WFP must meet the following log removals/inactivation:

Minimum Log Removal/Inactivation Requirements	Crypto	Giardia	Viruses
WFP	2	3	4
Wells 1 and 2	0	0	2

The DWWP assigns the following log removal/inactivation credits:

Log Removal/Inactivation Credits	Crypto	Giardia	Viruses	
Direct Filtration	2	2	1	Filtration and UV address Crypto and Giardia.
UV	2	3	2	UV addresses 2 of 4-log viruses.
Chlorination	0	0	2	+ Chlorination must address remaining 2-log viruses.
Total	**4**	**5**	**5**	

What is the maximum flow that can be accommodated by the chlorine contact chambers to achieve 2-log virus removal/inactivation?

WFP staff indicated the typical chlorine residual leaving the WFP is 1.8 mg/L to 2 mg/L and that approx. 30% residual is lost through the UV units. This suggests that chlorine dosage into the chlorine contact chambers is between 2.34 mg/L and 2.6 mg/L.

CT = Concentration (mg/L) x Time (minutes)

CT = 6 for 2-log virus removal/inactivation at 0.5°C and pH of 6 - 9.

With "Average" baffle factor = 0.5 (per O & M Manual)

		Chlorine Residual Concentrations (mg/L)							
		0.25	1.6	1.8	2	2.2	2.4	2.6	2.8
		Chlorine Contact Time (minutes)							
		48.0	7.5	6.7	6.0	5.5	5.0	4.6	4.3
Chamber	Volume	Flow (m^3/day)							
#1	620	18,600	119,040	133,920	148,800	163,680	178,560	193,440	208,320
#2	490	14,700	94,080	105,840	117,600	129,360	141,120	152,880	164,640
Total	**1,110**	**33,300**	**213,120**	**239,760**	**266,400**	**293,040**	**319,680**	**346,320**	**372,960**

What is the maximum flow rate that the existing gas chlorinators can treat at a dos 2.2 mg/L

$$\text{Flow (MGD)} = \frac{\text{Feed Rate (lbs/day)}}{\text{Dosage (mg/L) x 8.34 (density of water)}}$$

$$\text{Flow (MGD)} = \frac{211.2 \text{ (lbs/day)}}{2.2 \text{ mg/L x } 8.34}$$

Flow =	11.51	MGD
=	11,510,791	GPD
=	43,573,088	L/day
=	43,573	m^3/day

What if all UV units are off-line?

Then chlorination must provide 1-log removal/inactivation of Giardia and 3-log removal/inactivation of Viruses. 1-log Giardia is the critical removal/inactivation requirement.

What is the maximum flow that can be accommodated by the chlorine contact chambers and 50% of the clearwell volume to achieve this?

CT = Concentration (mg/L) x Time (minutes)

CT for 1-log Giardia at 0.5°C and pH of 8 =

Chlorine Concentration (mg/L)	0.4	0.6	0.8	1.0	1.2	1.4	1.6	1.8	2.03	2.23	2.43	2.63	2.83	3.0
CT for 1-log Giardia	92	95	98	101	104	107	110	113	115	118	120	123	125	127
Chlorine Contact Time (minutes)	460	317	245	202	173	153	138	126	114	106	99	93.7	88.5	84
Volume 2,610 Flow (m^3/day)	8,170	11,869	15,340	18,606	21,683	24,588	27,334	29,934	33,090	35,434	37,976	40,105	42,470	44,760

High Lift Pumps

The WFP is equipped with six high lift pumps, with the following capacities:

Zone 1:	3 pumps at	115.7	L/s at	72	m TDH
Zone 2:	3 pumps at	92.6	L/s at	95	m TDH

With one pump out of service in each Zone, the firm high lift pumping capacity for each Zone is:

Zone 1:	231	L/s, or	19,993	m^3/day
Zone 2:	185	L/s, or	16,001	m^3/day
Total:	417	L/s, or	35,994	m^3/day

Appendix B: Climate Change Risk Assessment Matrix

TATHAM ENGINEERING

PROJECT	Orillia Water Master Plan	FILE	120063
		DATE	21/09/2021
SUBJECT	Climate Change Risk Assessment	NAME	JRC/ST
		PAGE	1 OF 2

CLIMATE EVENTS

WFP Component	Mean air temperature increase				Increase in # of very hot days, and length & duration of heat waves				Increase in precipitation volume, frequency and intensity				Increase in severe storm events (freezing rain, hail, blizzards, tornadoes, etc.)			
	Y/N	**P**	**S**	**R**	**Y/N**	**P**	**S**	**R**	**Y/N**	**P**	**S**	**R**	**Y/N**	**P**	**S**	**R**
Source Water - Lake Couchiching	Y	3	2	6	Y	3	2	6	Y	2	2	4	N			
Source Water - Wells 1 & 2	N				N				N				N			
Intakes & Low Lift Pumping	N				Y	4	2	8	N				N			
Coagulation / Flocculation	Y	3	2	6	Y	4	2	8	Y	2	2	4	N			
Filtration	Y	3	2	6	Y	4	2	8	Y	2	3	6	N			
Disinfection	N				N				N				N			
Storage	N				N				N				N			
High Lift Pumping	N				Y	4	2	8	N				N			
Wastewater Management	N				Y	4	2	8	Y	2	2	4	N			
Building Facilities	N				N				N				Y	2	2	4
Power Supply and Backup Generator	N				Y	2	2	4	N			4	Y	2	2	4

Legend

Y/N	Applicability
P	Probability Factor
S	Severity Factor
R	Risk = Probability x Severity

Probability Factor Scale

Probability	Description	Scale
Very Low	Improbable or highly unlikel	1
Low	Remote or occasional	2
Moderate	Moderate, possible	3
High	Probable or often	4
Very High	Certain or highly probable	5

Severity Factor Scale

Severity	Description	Scale
Measurable	Measurable change but rare or unlikely	1
Minor/Moderate	Marginal change in serviceability or occasional loss of capal	2
Major	Moderate loss of some capacity	3
Serious/Hazardous	Regular or major loss of capacity and loss of function	4
Extreme	Frequent or continual, loss of infrastructure asset	5

Appendix D:
WFP and Reservoirs Condition Assessment Reports

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October 13, 2017

City of Orillia
50 Andrew Street South, Suite 300
Orillia, ON L3V 7T5

Attn: **Stephen Gendron, P.Eng., Can-CESEC**
Manager of Environmental Services and Compliance

Ref: **Water Filtration Plant Condition Assessment**

Dear Mr. Gendron:

We are pleased to provide our final report for the Water Filtration Plant Condition Assessment and trust that the submission meets your expectations.

Yours truly,

AINLEY & ASSOCIATES LIMITED

Gary Scott, M.Sc., P.Eng.
Senior Project Advisor

Encl.

City of Orillia

Water Filtration Plant
Condition Assessment

October 2017

Ainley GROUP
CONSULTING ENGINEERS & PLANNERS

Water Filtration Plant
Condition Assessment

Project No. 117051

Prepared for:
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Appendix A: Condition Assessment Database
Appendix B: Long Term Budgeting Tool

1.0 Introduction

The Orillia Water Filtration Plant (WFP), located on 200 Bay Street, Orillia, was originally constructed in 1914, around the outset of the first world war. At this time, Orillia was considered a transportation technology hub as it was connected by train to Military training camps and surrounding communities. In the years that followed, increased tourism and population growth created the demand for a high capacity waterworks system. In 1976, the WFP underwent a major facility expansion with process upgrades to direct filtration treatment. Following the first expansion, an additional two filters were constructed at the plant in 1996 within the original 1914 building footprint. The most recent plant upgrades were completed in 2006 and included the establishment of a new high lift pumping station attached to the North side of the building along with a new two-cell clear well.

In an effort to define a capital plan for the facility, the City of Orillia solicited the services of Ainley Group to conduct an Asset Condition Assessment. The condition assessment consists of a non-intrusive visual inspection of all plant assets, the development of a comprehensive asset database, and the development of an upgrade and replacement plan for existing assets.

This report documents the methodology followed to determine the state of the City's WFP assets. The report defines the asset condition rating system, the consequence of failure rating system and probability of failure rating system used to assess the risk associated with each asset. Also provided in the report is an outline of capital projects identified during the assessment along with the associated timeframe within which they should be completed.

1.1 Study Objectives

The primary objective of the WFP Asset Condition Assessment is the development of a long-term investment strategy for the facility that is designed to mitigate risk and maintain the plant in good working condition. The study objectives are defined by the overall assessment process and are defined in general by the following:

- Establish a comprehensive asset listing for the facility;
- Conduct a non-intrusive visual inspection of all assets where possible;
- Conduct a desktop evaluation of unobservable assets;
- Determine probability and consequence of failure for all assets;
- Determine the replacement costs of each asset; and
- Develop a strategic investment plan for the plant.

2.0 Asset Condition Assessment Guidelines and Assumptions

2.1 Asset Condition Assessment Grading System

2.1.1 Grading System Overview

This section provides an overview of the Asset Condition Grading System that was used to assess and establish the condition of assets for the WFP assets. The condition rating provides a general high-level assessment of the current condition of the asset. The rating assigned in the database is predominantly based on visual inspection conducted on the assets.

The overall risk of an asset failure was defined by the probability of an asset failure multiplied by the consequence of the asset failure. When defining the consequence of asset failure, specific attention was made to the impacts the failure of the asset has on the overall ability of the plant to maintain overall capacity. In many cases, failure of an individual asset was inconsequential due to pre-existing contingency measures in place. Moreover, modes of failure were considered when evaluating each asset. In essence, the occurrence of an asset

failure; together with the mode of failure, were used to determine the overall consequence of failure of individual assets.

Asset age and condition were used as primary indicators of the potential for asset failure. Moreover, Ainley's experience with similar assets was used as part of the final asset assessment.

2.2 Condition Grading System

Asset condition assessment was facilitated by the use of a condition grading system that projected remaining useful life, as well as to identify and prioritize the renewal requirements for assets.

The Condition Grading System (Table 1) used was developed from a number of industry asset grading standards with focus on standards in the following reports:

1. Managing Public Infrastructure Assets report, by the Association of Metropolitan Sewerage Agencies
2. Ministry of Infrastructure's Municipal Infrastructure Strategy Asset Management Tool Kit

Table 1: General Condition Rating Guideline

Grade	Condition	Soundness (Physical Condition)	Performance / Functionality	Maintenance Requirements/ Risk of Failure	Age
1	**Very Good**	▪ Sound	▪ As Intended ▪ Operable & well-maintained ▪ Asset expected to perform adequately with routine maintenance.	▪ Limited deterioration on systems ▪ To perform adequately with routine maintenance for at least another 80 % the life cycle	▪ New – **90%** estimated useful life remaining
2	**Good**	▪ Sound	▪ As Intended ▪ Shows minor wear that has minimal impact on performance ▪ Potential for deterioration or impaired performance.	▪ Acceptable minor work (if any) required ▪ Minimum short-term failure risk	▪ Mid-Range of Expected Life – **70%** estimated useful life remaining
3	**Fair**	▪ Signs of deterioration ▪ Functionally sound but showing wear and diminished performance	▪ Lower than intended ▪ Potential for further deterioration and diminished performance.	▪ Exceeding acceptable levels. ▪ Renewal or major component replacement expected within next 5yrs. ▪ Minor work required but asset is serviceable. Moderate short-term failure risk	▪ Later Stage of Expected Life – **50%** estimated useful life remaining
4	**Poor**	▪ Signs of deterioration ▪ Asset requires high level of maintenance to remain operational	▪ Much lower than intended ▪ Likely to have significant deterioration in performance	▪ Significantly above normal levels ▪ Substantial work required, asset barely serviceable ▪ High risk of short-term failure	▪ Approaching End of Expected Life – **20%** estimated useful life remaining
5	**Critical**	▪ Unsound ▪ Asset failed or failure is imminent	▪ Not performing as intended ▪ Significant health and safety hazard.	▪ Costs unacceptable & rehabilitation not cost effective ▪ Excessive maintenance required and no further service life expectancy	▪ Past End of Life – less than **10%** estimated useful life remaining

2.3 Consequence of Failure Assessment

The consequence of failure assessment system (Table 2) focused on the impact to service delivery based on the ability of the filtration plant to operate when the asset being assessed has failed. The impact on the processed water quality, reduction to plant capacity, and the availability of back-up systems were also considered. The consequence of failure for each asset was evaluated or ranked from 1 to 5 as:

Table 2: Consequence of Failure Rating Guideline

Grade	Consequence of Failure	Interpretation
1	Insignificant	No or very minor impact on the facility performance or service delivery
2	Minor	Limited loss of performance of the facility or service delivery
3	Medium	Moderate loss of performance or service delivery which can be accommodated on the odd occurrence
4	Major	Significant loss of performance or service delivery which could result in serious damage
5	Extreme	Unable to provide performance or deliver service for an extended period of time

2.4 Probability of Failure Assessment

The probability of failure assessment system (Table 3) was based on the historical rate of failure of similar assets that operate under similar conditions, and the current life stage of the asset. Systems that are sensitive to changes in operating condition were assigned a higher probability of failure. The probability of failure for each asset was evaluated or ranked from 1 to 5 as:

Table 3: Probability of Failure Rating Guideline

Grade	Probability of Failure	Interpretation
1	Rare	May occur in exceptional circumstances
2	Unlikely	Could occur is circumstances change
3	Possible	Might occur under current circumstances
4	Likely	Will probably occur in most circumstances
5	Almost Certain	Is expected to occur unless circumstances change

The product of the probability number multiplied by the consequence number determines the level of risk to the facility and was used to prioritize and schedule the required upgrades.

2.5 Specific Asset Condition Assessment Guidelines

2.5.1 Water Filtration Plant Assets Condition Assessment

Condition Rating: The condition rating of the assets in the filtration plant were based on a combination of age, useful life, operating condition and visual inspection. Assets that were not directly accessible during the field inspection were assessed based on age, useful life and staff opinion on operating conditions.

Consequence of Failure: The impact to service delivery was assessed based on the ability of the filtration plant to operate when a particular asset has failed. The impact on the quality of the processed water, reduction to plant capacity and the availability of back-up systems were considered.

Probability of Failure: The failure probability score was largely based on the historical rate of failure of similar assets operating under similar conditions. The probability ranking also takes into account the current life stage of the individual assets. Systems that are generally more sensitive to changes in the operating condition (pressure, electrical current, etc.) are assigned a higher probability of failure.

2.6 Other Asset Condition Assessment Assumption and Guidelines

2.6.1 Replacement Costs

Ainley's extensive history within the water treatment industry has allowed for the development of a detailed inventory of contract tender documents. Replacement cost estimates were largely based on similar projects with other clients, market rates, and consultation with equipment suppliers.

Our approach involved consultation with equipment suppliers to develop a more precise understanding of the value of each individual asset. Otherwise, the replacement cost of assets in the water filtration plant was based primarily on the inflated historical cost. Typical installation costs were used for assets that had no available historical cost. Adjustments were made for those assets for which inflated historical costs were considered to be unreasonable.

2.6.2 Estimated Useful Life

The useful life of the assets in each asset category for the Water Filtration Plant that are assumed in the report are framed below. The useful lives of assets are primarily based on the historical useful life of similar assets operating under similar conditions. They were confirmed after further review with the Operations staff.

To start the useful life assessment for each asset type, a baseline assumption was used to guide the overall assessment. Table 4 provides a non-exhaustive listing of major assets types that are within the WFP. The assumed useful lives in the table were used in the assessment of failure potential and for capital planning.

Table 4: Asset Useful Life Assumptions

Asset Type	Useful Life (years)
Concrete Structures	100
Large Pumps	50
Small Pumps	30
Chemical Pumps	20
Pipes	90
Motors	50
Electrical Actuators	40
Blowers	50

Valves	50
MCC	40
PLC	20
Instruments	15

3.0 Asset Organizational Structure

3.1 Asset Management Database Overview

This section provides an overview of the Asset Management Databased developed to assist with asset maintenance and replacement planning. The WFP assets have been organized in a two-part structure that identifies high-level infrastructure and processes, which is broken down into asset categories as seen in Section 3.2 below. Moreover, the database also includes asset identification and labeling, and long term capital forecasting for asset replacement costs.

3.2 Infrastructure and Asset Categories

To make the database useable and manageable, defining a clear organizational structure is important to ensure individual assets can be located without difficulty. Ainley has identified nine (9) distinctive asset categories as listed below:

1. Facilities
2. Low Lift Pumping/ Intake
3. Flocculation
4. Filtration
5. High Lift Pumping/Discharge
6. Disinfection
7. Clearwell Chambers
8. Wastewater Management
9. Backup Power Generation

Each infrastructure category will be separated into asset categories. Ainley has identified five (5) asset categories that will be used to further organize the assets within the database. It should be noted that each asset category does not necessarily apply to each infrastructure category.
The asset categories that will be used in the database are listed below:

1. Process Mechanical
2. Electrical
3. Structural
4. Building Mechanical
5. Instrumentation

3.3 Asset Distinction, Capital Forecasting, and Maintenance

To further distinguish assets, the database includes a succinct labeling and identification system for each asset. Where available, SCADA tags or equipment IDs were used to individually label each asset within the database. Desktop and onsite reviews were used to ensure that where applicable, each asset was correctly labeled. For assets without a pre-assigned SCADA tag or ID, an asset ID was generated by Ainley.

In addition to the labeling system, assets were further identified by manufacturer, description of equipment (size and type), equipment category, and location. Where manufacturer label and description information were unavailable, the respective fields in the database were left blank.

In addition to asset identification, capital forecasting and a replacement plan was developed from the assessment. Using the assessment methods established in Section 2, the replacement plan uses the year of asset acquisition, asset age, useful life, and remaining useful life, to determine when an asset may be required to be replaced and the respective capital cost. This component of the assessment database provides valuable insight on future capital planning and may provide guidance on future asset replacement projects.
Costs presented within the report and database are limited to capital works outside of the day-to-day maintenance completed at the plant by the operations staff. The internal maintenance program is managed through the use of the Antero maintenance management system.

The database includes a full condition assessment for each asset. Each asset within the database received a desktop or site review where soundness, performance/ functionality, maintenance requirements/ risk of failure, and age were considered in establishing an asset condition rating. Moreover, a risk assessment was performed on each asset based on the asset condition from the desktop and site reviews, and interviews with Operations and Maintenance staff. The information assembled in the database can be used as a guide for prioritizing assets to be maintained or replaced in future capital projects.

In essence, the Asset Condition Assessment database aims to provide a holistic overview of assets present within each WFP process, current asset condition, remaining useful life, and major maintenance and/or replacement needs to develop a detailed capital forecast and replacement plan.

4.0 WFP Asset Condition

4.1 Asset Condition Assessment Findings

The site inspection was conducted from July 17th to July 28th and included the visual review of 89% of the total assets identified at the plant. The remaining 11% of identified assets were subjected to a desktop review. Where possible each asset was inspected visually for outward signs of deterioration and loss of performance/ functionality. Feedback from Operations staff, the age of the asset, and asset repair history were taken into account in the documentation of condition.

The treatment plant has been developed over a 100 year period to reach the current state. As such, there are very divergent recommendations for separate aspects of the plant. In general, major requirements at the plant within the next 25 years are limited to the low lift pumping station, electrical systems, and control systems. The low lift station was constructed in 1976 and is therefore over 40 years of age. The age of mechanical assets is clustered primarily within three age rages corresponding with major upgrades at the plant, as show in Figure 1 below. This trend generally holds over each asset type.

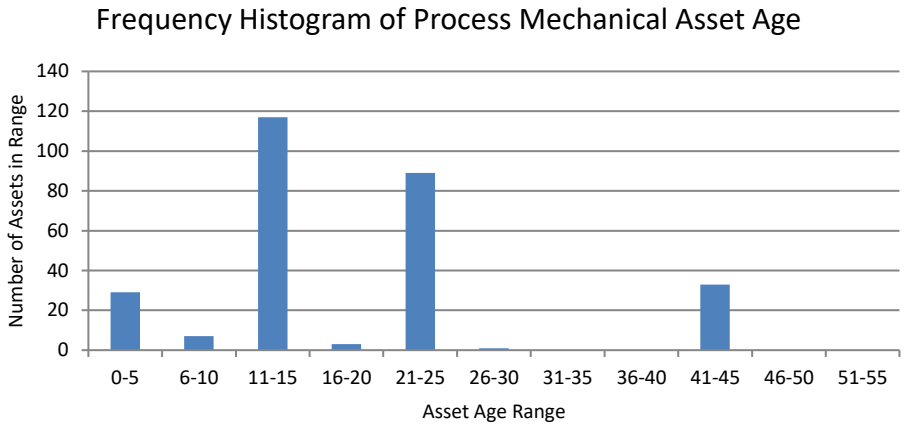

Figure 1 – Process Mechanical Asset Age Histogram

Overall, the Orillia Water Filtration Plant is in good condition with minimal near-term risks to service delivery. A comprehensive asset listing was developed and is provided in hard copy in Appendix A along with an electronic copy provided to the City separate from the report. The asset condition rating provides high-level insight into the condition of the plant components. An overview of asset conditions by asset type is provided in Figure 2. The data is re-presented by process in Figure 3.

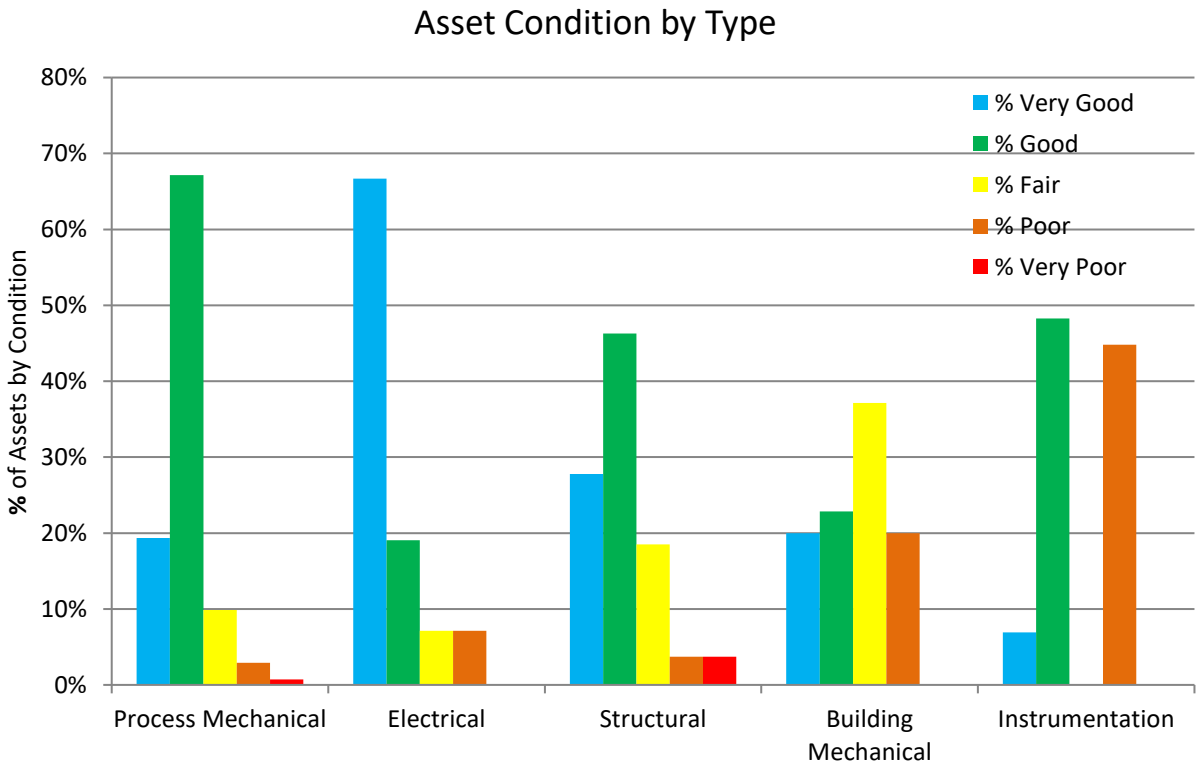

Figure 2 - Asset Condition Rating Summary by Asset Type

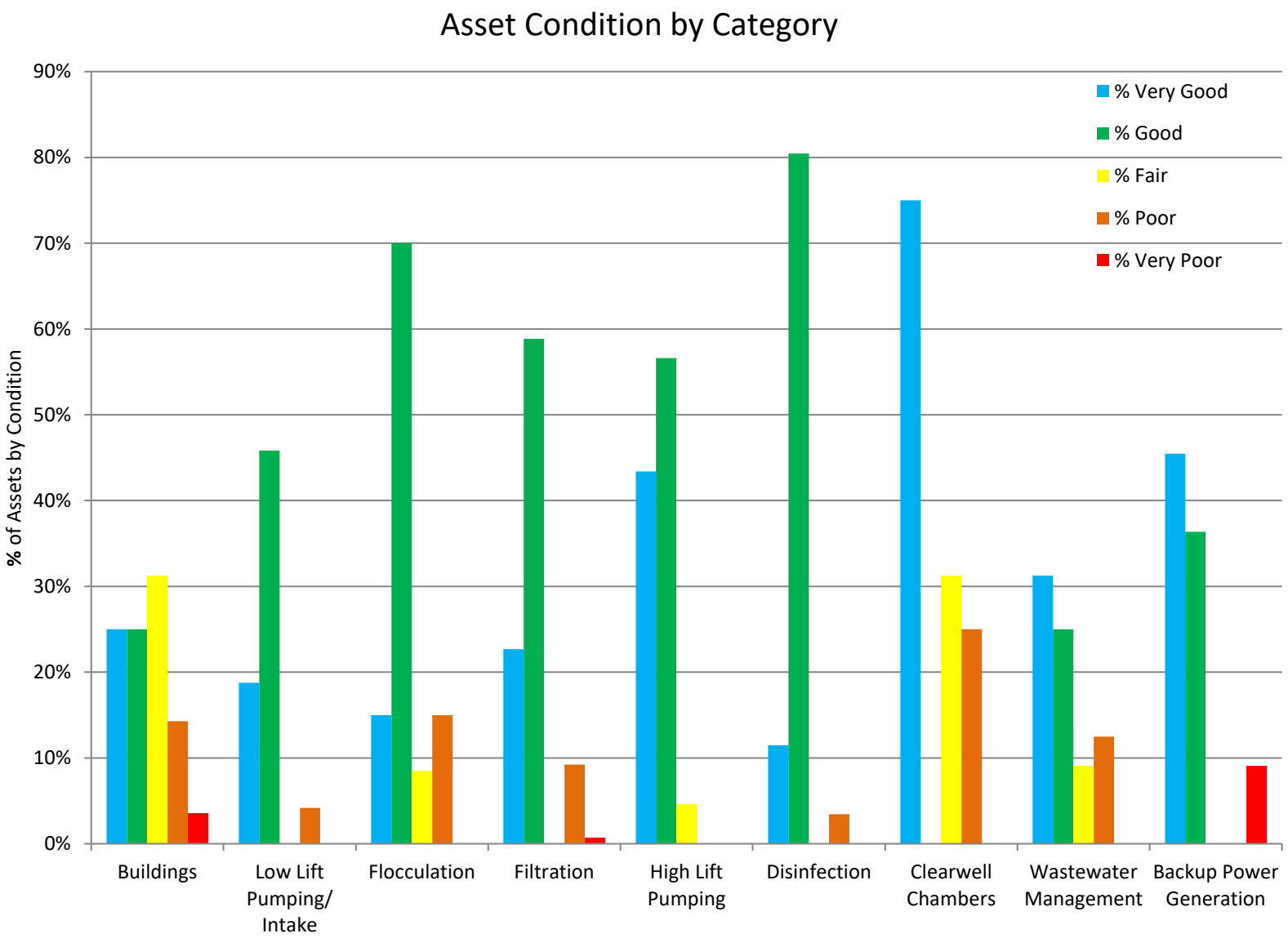

Figure 3 – Asset Condition Summary by Process

5.0 Capital Maintenance Activities / Replacement Requirements

5.1 Overview

This section summarizes the critical capital maintenance activities and immediate replacement requirements identified during the exercise of determining the City of Orillia's state WFP assets. The ultimate goal for the assessment was to identify critical infrastructure projects that will address urgent public health and safety issues and maintain public health and safety in the long-term.

As previously stated, the day-to-day maintenance requirements at the plant are managed within the Antero Maintenance Management System and are not reflected in this analysis.

Our assessment defined the capital replacement costs for all assets within the plant. In total, we estimate that the value of the existing treatment plant overall is approximately $39 million. Capital needs identified at the plant over the next 15-20 years amount to approximately 1.4 million or 3.5% of the total plant value. The total capital requirements are relatively low and are reflective of the fact that the majority of the assets at the plant are relatively new and in good overall condition. The City should anticipate acceleration in investment requirements to maintain the plant over time.

The current needs amount to an investment of approximately $100,000/year on average to manage the upcoming capital maintenance needs. The projects selected and outlined within the following sections were developed through the risk assessment process documented within the asset database attached in Appendix A and provided to the City electronically separate to this report.

5.2 Process Mechanical

The majority of process mechanical equipment is in good condition at the WFP. The plant has undergone a series of upgrades in recent years that have included replacement or refurbishment of many components. The only process mechanical assets within the plant in critical condition are the Filter 1 and Filter 2 drain valves which remain from the 1976 expansion. These valves have deteriorated beyond repair.

Figure 4 – Filter 1 Drain Valve

The pumps used to distribute hot water from the boiler through the plant have developed heavy corrosion on the pump housing. This is particularly true for Boiler Pump # 2. It is recommended that these pumps be refurbished to prevent further deterioration of the pump housing.

Figure 5 – Hot Water Distribution Pump #2

The vacuum priming system for the low lift pumps is currently in good working condition with minimal exterior signs of deterioration. This asset is critical to the operation of the low lift as each pump requires priming before operation. As there is currently no operational back-up for this component it is critical to the operation of the plant. It is recommended that close attention is paid to this asset. It is recommended that the asset is serviced regularly and refurbished within 5-10 years.

The low lift pumps were originally installed in 1976 and have been in service for over 40 years. Typical useful life for pumps is considered to be 50 years for large pumps of this nature. The low lift pumps underwent a full rebuild in 2012 with all internal components replaced, it is likely a full refurbishment will extend the useful life of the pumps by 10 years with the pumps ultimately needing replacement by 2037. Replacement of the low lift pumps with self-priming pumps would ultimately provide substantial risk reduction to the plant by eliminating reliance on the single vacuum priming system.

Figure 6 – Low Lift Pump #1

The flocculation tank mud valves remain in working condition however they are a cause for special consideration. The valves cause difficulty achieving a proper seal and will cause issues with the operation of the wastewater holding tank in cases where the seal is faulty and the tank is put back into operation. Replacement of these valves may prove to be difficult and costly as they are encased in the concrete of the flocculation tank floor. It is recommended that the City seek out a valve supplier to inspect this aspect of the plant and provide potential work-around solutions to valve replacement.

While the high lift pumping station is a relatively new asset, two issues were apparent during the field investigation. As identified by the operations staff, the PRVs on the high lift discharge were not properly sized during the initial construction. The result of the under sizing of the PRVs was a rapid degeneration of the valve internals caused by cavitation. The PRVs are undergoing replacement concurrently with this study. Additional

to the issue identified with the PRVs, the check valves on the Zone 1 high lift discharge all show a similar degeneration pattern on the valve bonnet (See Figure 7). The degeneration is suspected to be the result of transients during the pump start up. While the replacement of the PRVs may reduce or eliminate this issue, it is recommended that a transient analysis study be conducted on this system to ensure the proper PRVs are being installed and that it will ultimately resolve any issues occurring to eliminate further premature degeneration of these assets.

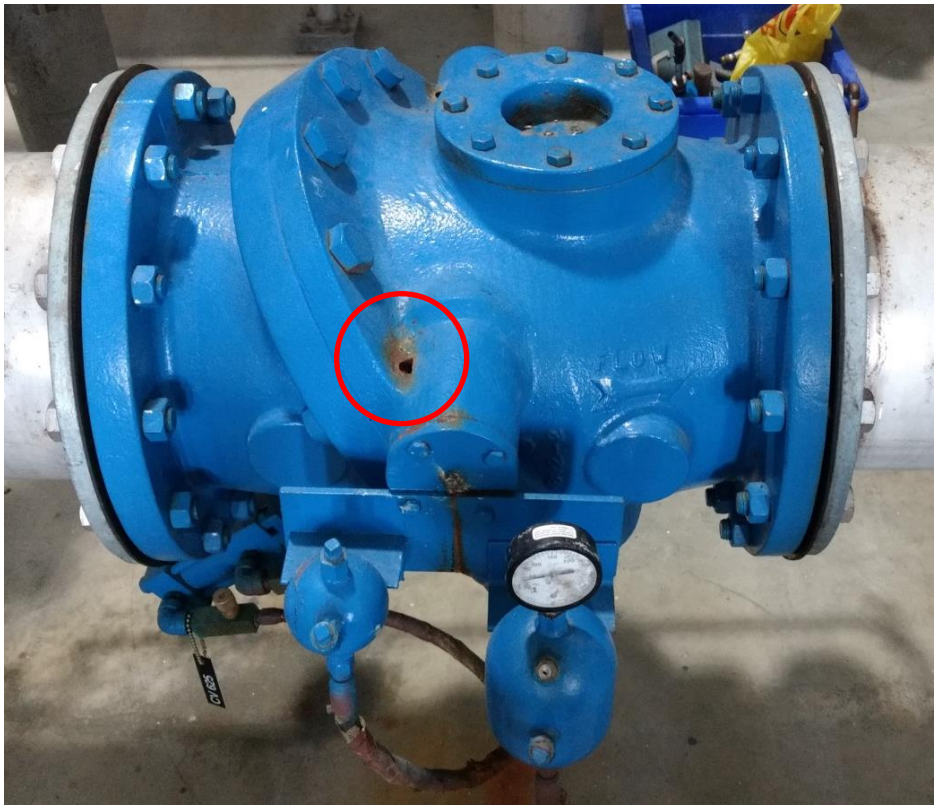

Figure 7 – High Lift Pump #2 Discharge Check Valve

Table 5: Process Mechanical Asset Maintenance Activities

	Asset	Deficiency	Critical Activity & Timing	Cost Estimate ($ '000)
1	Filter 1 & Filter 2 Drain Valve Replacement	Rusted beyond repair	1 year	$ 2,000
2	Boiler Pumps 1 & 2 Refurbishment	Heavy corrosion on pump housing	1 – 3 years	$ 30,000
3	Low Lift Pumps Replacement	Critical assets gradually reaching the end of useful life	15 – 20 years	$ 160,000
4	Vacuum Priming System (Low Lift) Refurbishment	Critical asset with no backup, essential to maintain with current pumps. Refurbish to ensure working condition.	5 – 10 years	$ 20,000

5	Flocculation Tank Mud Valves Replacement Study	Issues aligning valve when closing to achieve seal. Plan for eventual replacement.	5 – 10 years	$ 5,000
6	High Lift Discharge Transient Analysis Study	Unnaturally rapid degeneration of discharge check valves	1 – 2 years	$40,000
7	Chlorinators (Stand-by, Zone 1 & Zone 2 Post)	Reaching the end of useful life	3 – 5 years	$45,000
			Total	**$ 302,000**

5.3 Electrical

There is currently significant opportunity for improvement in the state of electrical equipment at the WFP. The useful life for electrical assets is generally lower than other assets and deterioration poses significant risk to the plant for both service delivery and health and safety. A number of recommendations have been identified for the improvement of electrical assets at the facility.

The low lift MCC was installed in 1976 with the first major treatment plant expansion. It is recommended that the City replace MCC-1 at the Low Lift Pumping Station within 3 years. In addition, operators should carry out routine inspections on this over 40 years old MCC, and consider preparing the spare parts such as circuit breaker, fuses, motor starters, control relay and pilot lights in advance due to the fact that these products are discontinued and get harder to find on market.

Figure 8 – Low Lift MCC

Also installed in 1976, the 45kVA 600:120/208V dry type transformer at Low Lift Pumping Station should be replaced within 3 years. Operations staff should endeavour to carry out infrared temperature scans on this 40 years old transformer at least twice per year; once during the late spring and once during the late fall.

Figure 9 – Low Lift Dry Type Transformer

MCC-3 at Old High Lift Pumping Area should be replaced within 3 years. Carry out routine inspections on this over 40 years old MCC, and consider preparing the spare parts such as circuit breaker, fuses, motor starters, control relay and pilot lights in advance due to the fact that these products are discontinued and get harder to find on market.

Figure 10 – Filter 3 & 4 Room MCC

The I/O panels of PLC-1 and PLC-2 should be replaced within 5 years. These I/O modules and other panel components such as relays, fuses, and terminals etc. were originally installed in 1995 and are approaching the end of lifespan. The programmable logic controllers of PLC-1 and Filter PLC-2 (both are AB SLC-5/05) were

installed in 2006, and the PLC and SCADA system was upgraded to Ethernet based network. Although the PLC systems are currently in working conditions and functioning properly, the PLC hardware and components have been discontinued in production, and substituted by the CompactLogix or ControLogix. It is recommended to replace the entire PLC systems including PLC processors, I/O modules and associated communication modules within 5 years.

Figure 11 – PLC-1 and PLC 2

Table 6: Electrical Asset Maintenance Activities

Asset		Deficiency	Critical Activity & Timing	Cost Estimate ($ '000)
1	Low Lift MCC Replacement	Unit has exceeded typical useful life	1 - 3 years	$ 400,000
2	Dry-Type Transformer Replacement	Unit has exceeded typical useful life	1 – 3 years	$ 45,000
3	Filter 3 & 4 Room MCC	Unit has exceeded typical useful life	1 – 3 years	$ 20,000
4	PLC-1 & PLC-2 & I/O Modules Replacement	Asset approaching the end of useful life	3 – 5 years	$ 270,000
			Total	**$ 735,000**

5.4 Structural

The Orillia WFP has undergone a series of expansions over its life and, as such, there is a significant age discrepancy between some of the major structural elements. Given the long useful life for concrete structural

elements, the age of these structures ultimately plays a key role in the recommendations. The original plant, established in 1914 now houses the current Filter 3 and Filter 4, and chlorine contact tank 2. The first major expansion established the current low lift pumping station, the flocculation tanks, Filter 1 and Filter 2, and chlorine contact tank 1. In 1996, filter 3 and filter 4 were constructed within the original 1914 building. In 2006, the final major expansion was completed establishing the current high lift pumping station, and the clearwells.

Despite the age of the original building, there structure remains in good working condition. An inspection of the original clearwell (now chlorine contact tank 2) was conducted in 2013 and uncovered a significant leak which was repaired. Other than the leak, the structure was sound. Regardless, this structure is currently 103 years old and careful attention should be paid to this component to maintain its integrity.

While there were no major structural issues identified during the inspection, a series of minor repairs have been recommended and are outlined in Table 7.

Table 7: Structural Asset Maintenance Activities

Asset		Deficiency	Critical Activity & Timing	Cost Estimate ($ '000)
1	Generator Building	Graffiti on exterior, weather-stripping on door in need of replacement.	1 – 3 years	$ 1,200
2	High Lift Pump Room	Crack in concrete floor	2 – 5 years	$ 1,200
3	Chlorine Contact Valve Chamber	Concrete crack repair Concrete spalling repair	1 year	$ 8,000
4	Filter 3 & Filter 4	Concrete crack in filter wall Concrete spalling to filter wall Concrete floor repair	1 – 3 years	$ 13,000
5	1914 Building	Repointing exterior brick mortar Exterior masonry sealing (siloxane)	1 – 2 years	$ 10,000
6	Low Lift	Repaint metal doors Repair crack in tile floor Repair stairway from low lift pump room to Filter 1 & 2	1 – 3 years	$ 12,000
7	1914 / 1976 Buildings	Replace rubberised roofing	2 – 5 years	$ 80,000
			Total	**$ 117,400**

5.5 Building Mechanical

The access hatches to the clearwells, outside of the WFP building adjacent to the high lift are seized shut and need to be repaired or replaced.

There is no ladder or stair case between the 1976 building roof and the 2006 building roof creating an access restriction to the HVAC unit and high lift roof. A staircase or ladder should be added.

The electrical heaters throughout the plant are aging and will need replacement within 10-15 years.

Table 8: Building Mechanical Asset Maintenance Activities

Asset		Deficiency	Critical Activity & Timing	Cost Estimate ($ '000)
1	Clearwell Access Hatches	Seized shut	1 – 5 years	$ 10,000
2	Staircase between 1976 to 2006 building roofs	Non existent	1 – 5 years	$ 10,000
4	Electrical Heaters	Approaching the end of useful life	10 – 15 years	$ 40,000
			Total	**$ 60,000**

5.6 Instrumentation

A significant portion of the instrumentation at the WFP has exceeded the estimated useful life. It is suggested that the City set aside a budget for instrumentation replacement on a yearly basis. It is suggested that instruments that have exceeded estimated useful life be replaced gradually over time.

Table 9: Instrumentation Asset Maintenance Activities

Asset		Deficiency	Critical Activity & Timing	Cost Estimate ($ '000)
1	Instrumentation Replacement Program	Instruments in the plant exceeding useful life	1 – 10 years (yearly)	$15,000 / year
			Total	**$ 150,000**

5.7 Site Works

The main gate to the treatment plant is broken and in need of replacement.

Table 10: Site Works Asset Maintenance Activities

Asset		Deficiency	Critical Activity & Timing	Cost Estimate ($ '000)
1	Access Gate	Broken beyond repair	1 – 2 years	$ 5,000
			Total	**$ 5,000**

6.0 Conclusions and Recommendations

The Orillia WFP is in good overall condition however, due to the age of some assets there are deficiencies that should be addressed. This report has identified a series of projects, covering all asset categories, which should be completed over the next 25 years at the WFP. Also recommended within the report are additional studies to investigate issues outside of the scope of the condition assessment process. A summary of the total value of work recommended under each asset type is provided in Table 11.

Table 11: Cost Summary of Capital Project Recommendations

Asset Type	$ Value (2017)
Process Mechanical	$ 257,000
Electrical	$ 735,000
Structural	$ 117,400
Building Mechanical	$ 60,000
Instrumentation	$ 150,000
Site Works	$ 5,000
Total:	**$1,324,400**

A summary of the total value of the studies recommended is provided in Table 12.

Table 12: Cost Summary of Recommended Studies

Asset Type	$ Value (2017)
Transient Analysis Study	$ 40,000
Assessment of Flocculation Mud Valve Replacement Options	$ 5,000
Total:	**$45,000**

In addition, a “Long Term Budgeting” tool was created to assist with capital planning for the City. The tool is provided in the form of a excel spreadsheet and is provided electronically to the City to assist with capital planning. Capital projects can be added to the spreadsheet along with the 2017 capital cost taken from the asset database. A hard copy of the spreadsheet is provided in ***Appendix B.***

Appendix - A

Condition Assessment Database

Orillia Water Filtration Plant Asset Condition Assessment Database

ASSET HIERARCHY			INDEX/ASSET LABELING				IDENTIFICATION				ASSET REPLACEMENT PLANNING					ASSET CONDITION ASSESSMENT					
CILITY / PROCESS LEVEL / ASSET CATEGORY / ASSET ATTRIBUTES	Line Index	SCADA Tag	Equipment ID	Ainley Assigned ID	Manufacturer	Equipment Description	Equipment Category	Location	Year of Acquisition	Asset Age	Useful Life (Years)	Remaining Useful Life (years)	Total Replacement Cost (2017 $)	Condition Rating	Assessment Method	Probability of Failure	Consequence of Failure	Risk/ Criticality	Additional Comments
ILLIA WATER FILTRATION PLANT	1																		
FACILITIES	2																		
ELECTRICAL	3																		
	4			ELEC-01		STANDBY INCOMING POWER TRANSFORMER	ELECTRICAL	NEAR CHLORINE ACCESS DRIVEWAY	2006	11	50	39	$ 42,750.00	2	SITE REVIEW	1	5	5	
STRUCTURAL	5																		
	6			SW-01		PAVED PARKING LOT	STRUCTURAL	PLANT EXTERIOR	2006	11	30	19	$ 37,500.00	2	SITE REVIEW	1	1	1	
	7			ACCESS-01		HIGH LIFT ACCESS - ROLL UP GARAGE DOOR	STRUCTURAL	HIGH LIFT	2006	11	30	19	$ 6,000.00	1	SITE REVIEW	1	1	1	
	8			SW-02		CHLROINE ROOM PAVED DRIVEWAY	STRUCTURAL	PLANT EXTERIOR	2006	11	30	19	$ 15,000.00	2	SITE REVIEW	1	1	1	
	9			ACCESS-02		CHLORINE ROOM ACCESS DOORS	STRUCTURAL	PLANT EXTERIOR	2011	6	30	24	$ 6,000.00	3	SITE REVIEW	3	3	9	
	10			CS-01		CHLORINE CONTACT VALVE CHAMBER	STRUCTURAL	PLANT EXTERIOR	1976	41	100	59	$ 3,000.00	2	SITE REVIEW	2	2	4	
	11			CS-02		CLEAR WELL INLET VALVE CHAMBER	STRUCTURAL	PLANT EXTERIOR	2006	11	100	89	$ 3,000.00	1	SITE REVIEW	1	2	2	
	12			ACCESS-03		CLEAR WELL ACCESS HATCH (2)	STRUCTURAL	PLANT EXTERIOR	2006	11	30	19	$ 15,000.00	5	SITE REVIEW	5	1	5	HATCH DOORS ARE SEIZED
	13			ACCESS-04		MAIN ACCESS FENCING AND GATE	STRUCTURAL	PLANT EXTERIOR	2006	11	30	19	$ 22,500.00	5	SITE REVIEW	5	1	5	MAIN GATE IS BROKEN
	14			SW-03		PARKING LOT BOLLARDS	STRUCTURAL	PLANT EXTERIOR	2006	11	50	39	$ 8,400.00	1	SITE REVIEW	1	1	1	
	15			SW-04		CHLORINE ROOM ACCESS GATE TO DRIVEWAY	STRUCTURAL	PLANT EXTERIOR	2006	11	30	19	$ 1,800.00	2	SITE REVIEW	2	1	2	
	16			SW-05		CHLORINE ROOM ACCESS FENCING	STRUCTURAL	PLANT EXTERIOR	2006	11	40	29	$ 1,050.00	1	SITE REVIEW	1	1	1	
	17			SW-06		CHLROINE ROOM ACCESS RETAINING WALL	STRUCTURAL	PLANT EXTERIOR	2006	11	50	39	$ 7,500.00	1	SITE REVIEW	1	1	1	
	18			ACCESS-05		FLOCCULATION TANK ROOF ACCESS DOORS	STRUCTURAL	FLOCCULATION TANK ROOF	1996	21	40	19	$ 13,500.00	2	SITE REVIEW	1	1	1	
	19			SW-07		FLOCCULATION TANK FENCING - CHLORINE ROOM SIDE	STRUCTURAL	FLOCCULATION TANK ROOF	1996	21	40	19	$ 450.00	4	SITE REVIEW	4	2	8	
	20			SW-08		FLOCCULATION TANK FENCING - PARKING LOT SIDE	STRUCTURAL	FLOCCULATION TANK ROOF	2006	11	40	29	$ 1,200.00	1	SITE REVIEW	1	2	2	
	21			ACCESS-06		FILTER 1/2 ROOF ACCESS LADDER	STRUCTURAL	FILTER 1 & 2 ROOF	2006	11	50	39	$ 4,500.00	1	SITE REVIEW	1	1	1	
	22			SHED		STORAGE SHED	STRUCTURAL	FLOCCULATION TANK ROOF	2006	11	30	19	$ 6,750.00	2	SITE REVIEW	1	1	1	
	23			SW-09		HIGH LIFT EXTERIOR FAÇADE - BRICK	STRUCTURAL	HIGH LIFT	2006	11	100	89	$ 60,000.00	1	SITE REVIEW	1	1	1	
	24			SW-10		OLD PLANT EXTERIOR FAÇADE - BRICK	STRUCTURAL	FILTER 3 & 4 BUILDING	1914	103	100	-3	$ 15,000.00	3	SITE REVIEW	3	3	9	
	25			SW-11		FLOCCULATION TANK/ LAKE FACING LOW LIFT WALL EXTERIOR FAÇADE - PAINTED CONCRETE	STRUCTURAL	PLANT EXTERIOR	1976	41	75	34	$ 7,500.00	2	SITE REVIEW	2	1	2	
	26			ROOF-01		HIGH LIFT ROOF	STRUCTURAL	HIGH LIFT	2006	11	50	39	$ 75,000.00	1	SITE REVIEW	1	2	2	
	27			ROOF-02		LOW LIFT ROOF	STRUCTURAL	LOW LIFT	1976	41	50	9	$ 45,000.00	3	SITE REVIEW	2	4	8	
	28			ROOF-03		OLD HIGH LIFT ROOF	STRUCTURAL	FILTER 3 & 4 BUILDING	1976	41	50	9	$ 75,000.00	3	SITE REVIEW	2	4	8	
	29			ROOF-04		FLOCCULATION TANK ROOF	STRUCTURAL	FLOCCULATION TANK ROOF	1976	41	50	9	$ 37,500.00	1	SITE REVIEW	1	3	3	
	30			SW-12		OLD PLANT - WINDOWS	STRUCTURAL	FILTER 3 & 4 BUILDING	1976	41	50	9	$ 15,000.00	1	SITE REVIEW	1	2	2	
	31			SW-13		HIGH LIFT EXPANSION - WINDOWS	STRUCTURAL	HIGH LIFT	2006	11	50	39	$ 18,000.00	3	SITE REVIEW	1	2	2	
	32			ACCESS-07		LOW LIFT BAY DOORS	STRUCTURAL	LOW LIFT PUMPING	1976	41	30	-11	$ 7,500.00	3	SITE REVIEW	1	2	2	
	33			BLDG-01		OLD HIGH LIFT BUILDING	STRUCTURAL	FILTER 3 & 4 BUILDING	1914	103	100	-3	$ 975,000.00	3	SITE REVIEW	3	4	12	
	34			BLDG-02		LOW LIFT BUILDING	STRUCTURAL	LOW LIFT	1976	41	100	59	$ 1,290,000.00	2	SITE REVIEW	2	4	8	
	35			BLDG-03		HIGH LIFT BUILDING	STRUCTURAL	HIGH LIFT	2006	11	100	89	$ 1,050,000.00	1	SITE REVIEW	1	4	4	
BUILDING MECHANICAL	36																		
	37			HVAC-01	CARRIER	AIR CONDITIONER UNIT 1	BUILDING MECHANICAL	HIGH LIFT ROOF	1993	24	50	26	$ 30,000.00	3	SITE REVIEW	3	2	6	
	38			HVAC-02	TRANE	AIR CONDITIONER UNIT 2	BUILDING MECHANICAL	HIGH LIFT ROOF	2006	11	50	39	$ 30,000.00	2	SITE REVIEW	1	2	2	
	39			HVAC-03	MITSUBISHI MOTOR	FAN UNIT	BUILDING MECHANICAL	HIGH LIFT ROOF	2006	11	50	39	$ 22,500.00	2	SITE REVIEW	2	1	2	
	40			ACCESS-08		ROOF ACCESS HATCH (7)	BUILDING MECHANICAL	HIGH LIFT ROOF	2006	11	50	39	$ 13,500.00	2	SITE REVIEW	1	1	1	
	41			HVAC-04		ROOF VENTS (2)	BUILDING MECHANICAL	HIGH LIFT ROOF	2006	11	50	39	$ 7,500.00	3	SITE REVIEW	2	2	4	
	42			HVAC-05		GAS HEATER (4)	BUILDING MECHANICAL	HIGH LIFT PUMP STATION	2006	11	15	4	$ 7,200.00	1	SITE REVIEW	1	2	2	
	43			HVAC-06	BEACOM MORRIS	HOT WATER SPACE HEATER, 1/8HP, 120V	BUILDING MECHANICAL	LOW LIFT PUMPING	1996	21	50	29	$ 2,250.00	3	SITE REVIEW	2	2	4	
	44			HVAC-07	FEDERAL PIONEER	ELECTRIC HEATER, 1/8HP, 120V	BUILDING MECHANICAL	LOW LIFT PUMPING	1976	41	50	9	$ 1,500.00	4	SITE REVIEW	3	2	6	
	45			HVAC-08	BEACOM MORRIS	HOT WATER SPACE HEATER, 1/8HP, 120V	BUILDING MECHANICAL	LOW LIFT PUMPING	1996	21	50	29	$ 2,250.00	3	SITE REVIEW	2	2	4	
	46			HVAC-09	FEDERAL PIONEER	ELECTRIC HEATER, 1/8HP, 120V	BUILDING MECHANICAL	LOW LIFT PUMPING	1976	41	50	9	$ 1,500.00	4	SITE REVIEW	3	2	6	
	47			HVAC-10	LOCHINVAR	BOILER UNIT	BUILDING MECHANICAL	LOW LIFT PUMPING	2016	1	50	49	$ 97,500.00	1	SITE REVIEW	1	3	3	
	48			HVAC-11	ARMSTRONG	BOILER PUMP 1, 5.4L/SEC, 17.7M HEAD, 1800RPM	BUILDING MECHANICAL	LOW LIFT PUMPING	1996	21	30	9	$ 19,500.00	2	SITE REVIEW	2	2	4	
	49			HVAC-12	ARMSTRONG	BOILER PUMP 2, 5.4L/SEC, 17.7M HEAD, 1800RPM	BUILDING MECHANICAL	LOW LIFT PUMPING	1996	21	30	9	$ 19,500.00	3	SITE REVIEW	3	2	6	OXIDATION ON PUMP PRESENT
	50			HVAC-13		BOILER RUST PREVENTION SYSTEM	BUILDING MECHANICAL	LOW LIFT PUMPING	1996	21	50	29	$ 15,000.00	3	SITE REVIEW	3	2	6	
	51			HVAC-14	FEDERAL PIONEER	ELECTRIC SPACE HEATERS (2), 600V, 1.1Amps	BUILDING MECHANICAL	FILTER 1/2 ROOM	1976	41	50	9	$ 3,000.00	4	SITE REVIEW	3	2	6	
	52			HVAC-15	BEACOM MORRIS	HOT WATER SPACE HEATER (2), 1/8HP, 120V	BUILDING MECHANICAL	LOW LIFT PUMPING	1996	21	50	29	$ 4,500.00	3	SITE REVIEW	2	2	4	
	53			HVAC-16	FEDERAL PIONEER	ELECTRIC SPACE HEATER (2), 600V, 1.1Amps	BUILDING MECHANICAL	CHLORINE ROOM	1976	41	50	9	$ 3,000.00	4	SITE REVIEW	3	2	6	
	54			HVAC-17	BEACOM MORRIS	HOT WATER SPACE HEATER, 1/8HP, 120V	BUILDING MECHANICAL	LOW LIFT PUMPING	1996	21	50	29	$ 2,250.00	3	SITE REVIEW	2	2	4	
	55			HVAC-18	FEDERAL PIONEER	ELECTRIC SPACE HEATER, 600V, 1.1Amps	BUILDING MECHANICAL	LOW LIFT PUMPING	1976	41	50	9	$ 1,500.00	4	SITE REVIEW	3	2	6	
	56			HVAC-19	BEACOM MORRIS	HOT WATER SPACE HEATER, 1/8HP, 120V	BUILDING MECHANICAL	LOW LIFT PUMPING	1996	21	50	29	$ 2,250.00	3	SITE REVIEW	2	2	4	
	57			HVAC-20	FEDERAL PIONEER	ELECTRIC SPACE HEATER, 600V, 1.1Amps	BUILDING MECHANICAL	ALUM ROOM	1976	41	50	9	$ 1,500.00	4	SITE REVIEW	3	2	6	
	58			HVAC-21	BEACOM MORRIS	HOT WATER SPACE HEATER, 1/8HP, 120V	BUILDING MECHANICAL	LOW LIFT PUMPING	1996	21	50	29	$ 2,250.00	3	SITE REVIEW	2	2	4	
	59			HVAC-22	FEDERAL PIONEER	ELECTRIC HEATER, 600V, 1.1Amps	BUILDING MECHANICAL	CHLROINE CONTACT INLET/ DISCHARGE HEADER	1976	41	50	9	$ 1,500.00	4	SITE REVIEW	3	2	6	
	60			HVAC-23	BEACOM MORRIS	HOT WATER SPACE HEATER, 1/8HP, 120V	BUILDING MECHANICAL	LOW LIFT PUMPING	1996	21	50	29	$ 2,250.00	3	SITE REVIEW	2	2	4	
INSTRUMENTATION	61																		
	62					LABORATORY EQUIPMENT	INSTRUMENTATION	LABORATORY	N/A	N/A	N/A	N/A	$ 75,000.00	2	SITE REVIEW	2	5	10	
LOW LIFT PUMPING/ INTAKE	63																		
PROCESS MECHANICAL	64																		
	65			PIPING-01		RAW WATER INLET PIPING, 900mm, 370m LONG	PIPING	LOW LIFT PUMPING	1996	21	90	69	$ 2,175,000.00	2	DESKTOP REVIEW	2	3	6	
	66			PIPING-02		RAW WATER INLET PIPING, 750mm,	PIPING	LOW LIFT PUMPING	1976	41	90	49	$ 138,375.00	3	DESKTOP REVIEW	3	1	3	
	67		SG134			INLET SLUICE GATE, 600mm x 600mm RAW WATER INLET	VALVE	LOW LIFT PUMPING	1976	41	50	9	$ 22,500.00	3	DESKTOP REVIEW	3	1	3	
	68			MVA-01		INLET SLUICE GATE ACTUATOR, 600mm x 600mm RAW WATER INLET	ACTUATOR	LOW LIFT PUMPING	1976	41	40	-1	$ 24,000.00	3	DESKTOP REVIEW	3	1	3	
	69		SG135			INLET SLUICE GATE, 750mm x 750mm RAW WATER INLET	VALVE	LOW LIFT PUMPING	1996	21	50	29	$ 28,200.00	2	DESKTOP REVIEW	2	3	6	
	70			MVA-02		INLET SLUICE GATE ACTUATOR, 750mm x 750mm RAW WATER INLET	ACTUATOR	LOW LIFT PUMPING	1996	21	40	19	$ 24,000.00	2	DESKTOP REVIEW	2	3	6	
	71			SCREEN-01		MANUAL BAR SCREEN, 45.5 ML/d RAW WATER INLET	SCREEN	LOW LIFT PUMPING	1996	21	100	79	$ 12,000.00	2	DESKTOP REVIEW	1	2	2	
	72			SCREEN-02	REXNORD	TRAVELING WATER SCREEN, 27.27 ML/d RAW WATER INLET	SCREEN	LOW LIFT PUMPING	1976	41	80	39	$ 60,000.00	3	SITE REVIEW	3	2	6	
	73			MOTOR-01	REXNORD	TRAVELING WATER SCREEN MOTOR, 600V, 3015 Amps	MOTOR	LOW LIFT PUMPING	1976	41	50	9	$ 15,000.00	3	SITE REVIEW	3	2	6	
	74			SP-01	MYERS	SAMPLE PUMP 1, 0.33HP, 115V, 9Amps	PUMP	LOW LIFT PUMPING	1997	20	30	10	$ 7,500.00	2	SITE REVIEW	3	1	3	
	75	LLP101	LLP-1		BRIER HYDRAULICS	LOW LIFT PUMP 1, 9.09 ML/d, 25 ft HEAD, 1200 RPM	PUMP	LOW LIFT PUMPING	1976	41	50	9	$ 24,900.00	3	SITE REVIEW	3	2	6	REFURBISHED 2012
	76			MOTOR-02	US MOTORS	LOW LIFT PUMP 1 - ELECTRIC MOTOR, 25 HP, 575V, 25.2Amps	MOTOR	LOW LIFT PUMPING	2017	0	50	50	$ 15,000.00	3	SITE REVIEW	3	2	6	
	77		LLCV1		JENKINS	LOW LIFT PUMP 1 - DISCHARGE CHECK VALVE, 450mm	VALVE	LOW LIFT PUMPING	1996	21	50	29	$ 13,200.00	2	SITE REVIEW	3	2	6	
	78	BFV121	BV			LOW LIFT PUMP 1 - DISCHARGE BUTTERFLY VALVE, 450mm	VALVE	LOW LIFT PUMPING	1996	21	50	29	$ 5,250.00	2	SITE REVIEW	2	2	4	
	79		MV-501		AUMA	LOW LIFT PUMP 1 - DISCHARGE MOTORIZED ACTUATOR, 575 V, 1.1 Amps	ACTUATOR	LOW LIFT PUMPING	1996	21	40	19	$ 24,000.00	1	SITE REVIEW	2	2	4	
	80	LLP102	LLP-2		BRIER HYDRAULICS	LOW LIFT PUMP 2, 9.09 ML/d, 25 ft HEAD, 1200 RPM	PUMP	LOW LIFT PUMPING	1976	41	50	9	$ 24,900.00	3	SITE REVIEW	3	2	6	REFURBISHED 2012
	81			MOTOR-03	US MOTORS	LOW LIFT PUMP 2 - ELECTRIC MOTOR, 25 HP, 575V, 25.2Amps	MOTOR	LOW LIFT PUMPING	2017	0	50	50	$ 15,000.00	3	SITE REVIEW	3	2	6	
	82		LLCV2		JENKINS	LOW LIFT PUMP 2 - DISCHARGE CHECK VALVE, 450mm	VALVE	LOW LIFT PUMPING	1996	21	50	29	$ 13,200.00	2	SITE REVIEW	2	2	4	
	83	BFV122	BV			LOW LIFT PUMP 2 - DISCHARGE BUTTERFLY VALVE, 450mm	VALVE	LOW LIFT PUMPING	1996	21	50	29	$ 5,250.00	2	SITE REVIEW	2	2	4	
	84		MV-502		AUMA	LOW LIFT PUMP 2 - DISCHARGE MOTORIZED ACTUATOR, 575 V, 1.1 Amps	ACTUATOR	LOW LIFT PUMPING	1996	21	40	19	$ 24,000.00	1	SITE REVIEW	1	2	2	
	85	LLP103	LLP-3		BRIER HYDRAULICS	LOW LIFT PUMP 3, 9.09 ML/d, 25 ft HEAD, 1200 RPM, 10.55 INCHES - 270mm	PUMP	LOW LIFT PUMPING	1976	41	50	9	$ 24,900.00	3	SITE REVIEW	3	2	6	REFURBISHED 2012
	86			MOTOR-04	US MOTORS	LOW LIFT PUMP 3 - ELECTRIC MOTOR, 25 HP, 575V, 25.2 Amps	MOTOR	LOW LIFT PUMPING	2017	0	50	50	$ 15,000.00	3	SITE REVIEW	3	2	6	
	87		LLCV3		JENKINS	LOW LIFT PUMP 3 - DISCHARGE CHECK VALVE, 450mm	VALVE	LOW LIFT PUMPING	1996	21	50	29	$ 13,200.00	2	SITE REVIEW	2	2	4	
	88	BFV123	BV			LOW LIFT PUMP 3 - DISCHARGE BUTTERFLY VALVE, 450mm	VALVE	LOW LIFT PUMPING	1996	21	50	29	$ 5,250.00	2	SITE REVIEW	2	2	4	SLIGHT LEAK WHEN PUMP ON AND VALVE OPEN
	89		MV-503		AUMA	LOW LIFT PUMP 3 - DISCHARGE MOTORIZED ACTUATOR, 575 V, 1.1 Amps	ACTUATOR	LOW LIFT PUMPING	2017	0	50	50	$ 24,000.00	1	SITE REVIEW	1	2	2	
	90	LLP104	LLP-4		BRIER HYDRAULICS	LOW LIFT PUMP 4, 13.64 ML/d, 25 ft HEAD, 1200 RPM, 10.55 INCHES - 270mm	PUMP	LOW LIFT PUMPING	1976	41	50	9	$ 24,900.00	3	SITE REVIEW	3	2	6	REFURBISHED 2012
	91			MOTOR-05	LEESON	LOW LIFT PUMP 4 - ELECTRIC MOTOR, 25 HP, 575V, 25.2 Amps	MOTOR	LOW LIFT PUMPING	2012	5	50	45	$ 15,000.00	3	SITE REVIEW	3	2	6	
	92		LLCV4		JENKINS	LOW LIFT PUMP 4 - DISCHARGE CHECK VALVE, 450mm	VALVE	LOW LIFT PUMPING	1996	21	50	29	$ 13,200.00	2	SITE REVIEW	2	2	4	
	93	BFV124	BV			LOW LIFT PUMP 4 - DISCHARGE BUTTERFLY VALVE, 450mm	VALVE	LOW LIFT PUMPING	1996	21	50	29	$ 5,250.00	2	SITE REVIEW	2	2	4	
	94		MV-504		AUMA	LOW LIFT PUMP 4 - DISCHARGE MOTORIZED ACTUATOR, 575V, 1.1 Amps	ACTUATOR	LOW LIFT PUMPING	2012	5	40	35	$ 24,000.00	1	SITE REVIEW	1	2	2	
	95			MIXER-01		LOW LIFT TO FLOCCULATION - INLINE PACL MIXER	WATER QUALITY MANAGEMENT	LOW LIFT PUMPING	1996	21	50	29	$ 75,000.00	2	SITE REVIEW	5	3	15	HOWEVER, ISSUE HAS BEEN RESOLVED THROUG
	96			PIPING-02		LOW LIFT DISCHARGE PIPING, 450 mm	PIPING	LOW LIFT PUMPING	1996	21	90	69	$ 75,000.00	1	SITE REVIEW	2	4	8	
	97			GV-01	JENKINS	LOW LIFT DISCHARGE TO INLET PIPING - GATE VALVE, 450mm	VALVE	LOW LIFT PUMPING	1976	41	50	9	$ 27,900.00	2	SITE REVIEW	3	1	3	L WORKS TO CLEAR FRAZZELICE FROM OLD INLET
	98			VAC-01		VACUUM PUMP PRIMING SYSTEM	PROCESS MACHANICAL	LOW LIFT PUMPING	1976	41	50	9	$ 60,000.00	3	SITE REVIEW	3	5	15	
ELECTRICAL	99																		
	100			GEN-01		NOT IN USE - OLD DIESEL GENERATOR	GENERATOR	LOW LIFT PUMPING	1976	N/A	25	N/A	$ -	N/A	SITE REVIEW	5	5	25	
	101	N/A	T1		HAMMOND	DRY TYPE TRANSFORMER, 300KVA, 4160V:600/347V, NEMA 12	600V POWER	LLF PS ROOM	2014	11	30	19	$ 67,500.00	1	SITE REVIEW	1	5	5	
	102	N/A	MTS1		SCHNEIDER (SQUAR	400A, 600V MANUAL TRANSFER SWITCH, DOUBLE THROW, S/N 402813400	600V POWER	LLF PS ROOM	2014	3	30	27	$ 6,000.00	1	SITE REVIEW	1	4	4	
	103	N/A	MCC-1		SIEMENS	MOTOR CONTROL CENTER (MCC), 600A, 600V, 3P 3W, MODE 8PG02	600V POWER	LLF PS ROOM	1975	42	30	0	$ 600,000.00	4	SITE REVIEW	3	5	15	PRODUCTS DISCONTINUED
	104	N/A	XFMR		CANADIAN GENERA	DRY TYPE TRANSFORMER, 45KVA, 600V:208/120V, 2.4%, 115°C, NEMA 1	120/208V POWER	LLF PS ROOM	1975	42	30	0	$ 4,500.00	4	SITE REVIEW	4	4	16	
	105	N/A	LP-P		FEDERAL PIONEER	LIGHTING PANEL, 225A 208/120V, 3P 4W, W/ MCB 40A, 42 CCT. MODEL NBLP42-4L	120/208V POWER	LLF PS ROOM	1995	22	30	8	$ 7,500.00	2	SITE REVIEW	2	3	6	
	106	N/A	LP-A		FEDERAL PIONEER	LIGHTING PANEL, 225A 208/120V, 3P 4W, W/ MCB 40A, 30 CCT. MODEL NBLP42-4L	120/208V POWER	LLF PS ROOM	1995	22	30	8	$ 7,500.00	2	SITE REVIEW	2	3	6	
STRUCTURAL	107																		
	108			CS-03		RAW WATER WET WELL	STRUCTURAL	LOW LIFT PUMPING	1976	41	100	59	$ 45,000.00	3	SITE REVIEW	2	5	10	
	109			CRIB-01		PRIMARY INTAKE PIPING CRIB	STRUCTURAL	OUTSIDE	1976	41	50	9	$ 30,000.00	2	DESKTOP REVIEW	2	3	6	
	110			CRIB-02		SECONDARY INTAKE PIPING CRIB	STRUCTURAL	OUTSIDE	1976	41	50	9	$ 30,000.00	2	DESKTOP REVIEW	2	3	6	
BUILDING MECHANICAL	113																		
	114			BM-01	VESTIL	MOBILE HOIST	BUILDING MECHANICAL	LOW LIFT PUMPING	2012	5	100	95	$ 7,500.00	1	SITE REVIEW	1	2	2	
	115			BM-02		LOUVERS	BUILDING MECHANICAL	LOW LIFT PUMPING	1976	41	100	59	$ 1,500.00	2	SITE REVIEW	2	2	4	

	INSTRUMENTATION	116																					
		117		LIT 190		PROSONIC	ULTRASONIC LEVEL TRANSDUCER	INSTRUMENTATION	LOW LIFT PUMPING	1996	21	15	-6	$	4,500.00	2	SITE REVIEW	3	2	6			
		118			INST-01	HACH	TURBIDITY METER	INSTRUMENTATION	LOW LIFT PUMPING	1996	21	15	-6	$	8,250.00	1	SITE REVIEW	3	2	6			
		119			INST-02	BALLEY	PRESSURE METER	INSTRUMENTATION	LOW LIFT PUMPING	1996	21	15	-6	$	12,000.00	2	SITE REVIEW	3	2	6			
FLOCCULATION		120																					
	PROCESS MECHANICAL	121																					
		122			PIPING-03		FLOCCULATION TANK PIPING, 450mm	PIPING	LOW LIFT PUMPING	1996	21	90	69	$	12,000.00	1	SITE REVIEW	1	4	4			
		123			BFV-01		LOW LIFT TO FLOCCULATION TANK 1 - INLET BUTTERFLY VALVE, 300mm	VALVE	LOW LIFT PUMPING	1994	23	50	27	$	3,300.00	2	SITE REVIEW	2	2	4			
		124			MVA-03		LOW LIFT TO FLOCCULATION TANK 1 - INLET MANUAL ACTUATOR-GEARED,	ACTUATOR	LOW LIFT PUMPING	1994	23	50	27	$	24,000.00	2	SITE REVIEW	2	2	4			
		125		PLV222			FLOCCULATION TANK TRAIN 1 - PLUG VALVE, 200mm	VALVE	FLOCCULATION BASINS	1976	41	50	9	$	2,100.00	4	SITE REVIEW	3	2	6	ETE, NOTED DIFFICULTY IN ACHIEVING A SEAL WHE		
		126			BFV-02		LOW LIFT TO FLOCCULATION TANK 2 - INLET BUTTERFLY VALVE, 300mm	VALVE	LOW LIFT PUMPING	1994	23	50	27	$	3,300.00	2	SITE REVIEW	2	2	4			
		127			MVA-04		LOW LIFT TO FLOCCULATION TANK 2 - MANUAL ACTUATOR-GEARED,	ACTUATOR	LOW LIFT PUMPING	1994	23	50	27	$	24,000.00	2	SITE REVIEW	2	2	4			
		128		PLV221			FLOCCULATION TANK TRAIN 2 - PLUG VALVE, 200mm	VALVE	FLOCCULATION BASINS	1976	41	50	9	$	2,100.00	4	SITE REVIEW	3	2	6	ETE, NOTED DIFFICULTY IN ACHIEVING A SEAL WHE		
		129			BFV-03		LOW LIFT TO FLOCCULATION TANK 3 - INLET BUTTERFLY VALVE, 300mm	VALVE	LOW LIFT PUMPING	1994	23	50	27	$	3,300.00	2	SITE REVIEW	2	2	4			
		130			MVA-04		LOW LIFT TO FLOCCULATION TANK 3 - MANUAL ACTUATOR-GEARED,	ACTUATOR	LOW LIFT PUMPING	1994	23	50	27	$	24,000.00	2	SITE REVIEW	2	2	4			
		131		PLV220			FLOCCULATION TANK TRAIN 3 - PLUG VALVE, 200mm	VALVE	FLOCCULATION BASINS	1976	41	50	9	$	2,100.00	4	SITE REVIEW	3	2	6	ETE, NOTED DIFFICULTY IN ACHIEVING A SEAL WHE		
	STRUCTURAL	132																					
		133			CS-04		CONCRETE FLOCCULATION TANKAGE 1, 9.09 ML/d	TANK	FLOCCULATION BASINS	1976	41	100	59	$	796,200.00	2	DESKTOP REVIEW	2	2	4			
		134			CS-05		CONCRETE FLOCCULATION TANKAGE 2, 9.09 ML/D	TANK	FLOCCULATION BASINS	1976	41	100	59	$	796,200.00	2	DESKTOP REVIEW	2	2	4			
		135			CS-06		CONCRETE FLOCCULATION TANKAGE 3, 9.09 ML/d	TANK	FLOCCULATION BASINS	1976	41	100	59	$	796,200.00	2	DESKTOP REVIEW	2	2	4			
		136			CS-07		CONCRETE FLOCCULATED WATER CONDUIT TO FILTER 1/2	STRUCTURAL	FLOCCULATION BASINS	1976	41	100	59	$	235,200.00	2	DESKTOP REVIEW	2	5	10			
		137			CS-08		CONCRETE FLOCCULATED WATER CONDUIT TO FILTER 3/4	STRUCTURAL	FLOCCULATION BASINS	1976	41	100	59	$	235,200.00	2	DESKTOP REVIEW	2	2	4			
		138			ST-01	*MODEL # Y5C072AV	POTASSIUM HYDROXIDE HOLDING TANK	STRUCTURAL	ALUM ROOM	1988	29	80	51	$	90,000.00	2	SITE REVIEW	1	3	3	REFURBISHED 2010		
		139			ST-02		PACL STORAGE TANK, 5000GAL	STRUCTURAL	ALUM ROOM	1976	41	80	39	$	90,000.00	1	SITE REVIEW	2	4	8			
		140			CS-09		PACL TANK CONTAINMENT WALL	STRUCTURAL	ALUM ROOM	1976	41	100	59	$	15,000.00	1	SITE REVIEW	2	4	8			
	BUILDING MECHANICAL	141																					
		142					FLOCCULATION TANK HATCHES (6)	BUILDING MECHANICAL	OUTDOORS - ABOVE TANKS	1976	41	50	9	$	9,000.00	2	SITE REVIEW	2	1	2			
	INSTRUMENTATION	143																					
		144					MAGNETIC FLOW METER, 450mm	INSTRUMENTATION	LOW LIFT PUMPING	2012	5	15	10	$	24,000.00	2	SITE REVIEW	3	2	6			
FILTRATION		145																					
	PROCESS MECHANICAL	146																					
		147		SG311			FILTER 1 - INLET SLUICE GATE, 600X600mm	GATE	FILTER 1/2 ROOM	1976	41	50	9	$	22,500.00	3	DESKTOP REVIEW	2	3	6	TOP IS RUSTED		
		148		SG311		AUMA	FILTER 1 - MOTORIZED ACTUATOR, 2.9Amps, 575V	ACTUATOR	FILTER 1/2 ROOM	2016	1	40	39	$	24,000.00	1	SITE REVIEW	1	3	3			
		149			BFV-04		FILTER 1 - SURFACE AGITATOR INLET BUTTERFLY VALVE, 200mm	VALVE	FILTER 1/2 ROOM	2011	6	50	44	$	1,800.00	1	SITE REVIEW	1	5	5			
		150		BFV 361		ROTORK	FILTER 1 - SURFACE AGITATOR MOTORIZED ACTUATOR, 575v, 1.3 Amps	ACTUATOR	FILTER 1/2 ROOM	2011	6	50	44	$	24,000.00	1	SITE REVIEW	1	5	5			
		151		BFV361			FILTER 1 - SURFACE AGITATORS (2)	AGITATOR	FILTER 1/2 ROOM	1976	41	80	39	$	30,000.00	2	SITE REVIEW	2	3	6			
		152			FLTR-01		FILTER 1 - WASHWATER TROUGHS (4)	TROUGH	FILTER 1/2 ROOM	1976	41	80	39	$	6,000.00	3	SITE REVIEW	3	3	9	ALL HAVE MINOR LEAKS		
		153			MEDIA-01		FILTER 1 MEDIA - GRANULAR ACTIVATED CARBON	CHEMICALS / CONSUMABLES	FILTER 1	2006	11	40	29	$	600,000.00	2	DESKTOP REVIEW	2	5	10			
		154		SG391			FILTER 1 - WASTE WATER OUTLET - SLUICE GATE	GATE	FILTER 1/2 ROOM	2010	7	50	43	$	22,500.00	3	DESKTOP REVIEW	2	2	4			
		155		SG391		ROTORK	FILTER 1 WASTE WATER OUTLET - MOTORIZED ACTUATOR, 3.32Amps, 575V	ACTUATOR	FILTER 1/2 ROOM	2016	1	40	39	$	24,000.00	1	SITE REVIEW	2	2	4			
		156		BFV351			FILTER 1 BACKWASH SUPPLY - BUTTERFLY VALVE, 18INCHES - 450mm	VALVE	FILTER 1/2 PIPING GALLERY	1994	23	50	27	$	5,250.00	2	SITE REVIEW	1	2	2			
		157		BFV351			FILTER 1 BACKWASH SUPPLY MOTORIZED ACTUATOR, 575V, 1.3 Amps	ACTUATOR	FILTER 1/2 PIPING GALLERY	2017	0	40	40	$	24,000.00	1	SITE REVIEW	1	2	2			
		158			GV-02	JENKINS	FILTER 1 DRAIN - GATE VALVE, 4INCHES--100mm	VALVE	FILTER 1/2 PIPING GALLERY	1994	23	50	27	$	1,200.00	4	SITE REVIEW	4	3	12			
		159		BFV321			FILTER 1 DISCHRAGE BUTTERFLY VALVE, 12INCHES - 300mm	VALVE	FILTER 1/2 PIPING GALLERY	1994	23	50	27	$	3,300.00	1	SITE REVIEW	1	2	2			
		160		BFV321		ROTORK	FILTER 1 DISCHARGE MOTORIZED ACTUATOR, 1.1 Amps, 575V	ACTUATOR	FILTER 1/2 PIPING GALLERY	1994	23	40	17	$	24,000.00	2	SITE REVIEW	2	2	4			
		161		BFV331		KENNEDY	FILTER 1 TO CHLORINE CONACT BUTTERFLY VALVE, 12 INCHES - 300mm	VALVE	FILTER 1/2 PIPING GALLERY	1994	23	50	27	$	3,300.00	2	SITE REVIEW	2	2	4			
		162		BFV331		ROTORK	FILTER 1 TO CHLORINE CONTACT ACTUATOR, 1.35Amps, 575V	ACTUATOR	FILTER 1/2 PIPING GALLERY	1994	23	40	17	$	24,000.00	2	SITE REVIEW	2	2	4			
		163		BFV341		KENNEDY	FILTER 1 TO WASTE BUTTERFLY VALVE, 12INCHES - 300mm	VALVE	FILTER 1/2 PIPING GALLERY	1994	23	50	27	$	3,300.00	2	SITE REVIEW	2	2	4			
		164		BFV341		ROTORK	FILTER 1 TO WASTE ACTUATOR, 1.35 Amps, 575V	ACTUATOR	FILTER 1/2 PIPING GALLERY	1994	23	40	17	$	24,000.00	2	SITE REVIEW	2	2	4			
		165			FLTR-02	LEOPOLD CLAY TILE	FILTER 1 - UNDER DRAIN	DRAIN	FILTER 1/2 PIPING GALLERY	1994	23	40	17	$	210,000.00	3	DESKTOP REVIEW	2	2	4			
		166		SG312			FILTER 2 - INLET SLUICE GATE, 600X600mm	GATE	FILTER 1/2 ROOM	1976	41	50	9	$	22,500.00	3	DESKTOP REVIEW	2	3	6			
		167		SG312		ROTORK	FILTER 2 - MOTORIZED ACTUATOR, 2.9Amps, 575V	ACTUATOR	FILTER 1/2 ROOM	2006	11	40	29	$	24,000.00	1	SITE REVIEW	1	3	3			
		168			BFV-05		FILTER 2 - SURFACE AGITATOR INLET BUTTERFLY VALVE, 200mm	VALVE	FILTER 1/2 ROOM	2011	6	50	44	$	1,800.00	1	SITE REVIEW	1	5	5			
		169		BFV 362		ROTORK	FILTER 2 - SURFACE AGITATOR MOTORIZED ACTUATOR, 575V, 1.3Amps	ACTUATOR	FILTER 1/2 ROOM	2011	6	50	44	$	24,000.00	1	SITE REVIEW	1	5	5			
		170		BFV 362			FILTER 2 - SURFACE AGITATORS (2)	AGITATOR	FILTER 1/2 ROOM	1976	41	80	39	$	30,000.00	2	SITE REVIEW	2	3	6			
		171			FLTR-03		FILTER 2 - WASHWATER TROUGHS (4)	TROUGH	FILTER 1/2 ROOM	1976	41	80	39	$	6,000.00	3	SITE REVIEW	3	3	9	ALL HAVE MINOR LEAKS		
		172			MEDIA-02		FILTER 2 MEDIA - GRANULAR ACTIVATED CARBON	CHEMICALS / CONSUMABLES	FILTER 2	2006	11	40	29	$	600,000.00	2	DESKTOP REVIEW	2	5	10			
		173		SG392			FILTER 2 - WASTE WATER OUTLET - SLUICE GATE, 600X600mm	GATE	FILTER 1/2 ROOM	2010	7	50	43	$	22,500.00	3	DESKTOP REVIEW	2	2	4			
		174		SG392		ROTORK	FILTER 2 WASTE WATER OUTLET - MOTORIZED ACTUATOR, 3.32Amps, 575V	ACTUATOR	FILTER 1/2 ROOM	2016	1	40	39	$	24,000.00	1	SITE REVIEW	2	2	4			
		175		BFV352			FILTER 2 BACKWASH SUPPLY BUTTERFLY VALVE, 18 INCHES -450mm	VALVE	FILTER 1/2 PIPING GALLERY	1994	23	50	27	$	5,250.00	2	SITE REVIEW	1	2	2			
		176		BFV352		AUMA	FILTER 2 BACKWASH SUPPLY ACTUATOR, 1.3 Amps, 575V	ACTUATOR	FILTER 1/2 PIPING GALLERY	2017	0	40	40	$	24,000.00	1	SITE REVIEW	1	2	2			
		177			GV-03		FILTER 2 DRAIN - GATE VALVE, 4INCHES - 100mm	VALVE	FILTER 1/2 PIPING GALLERY	1994	23	50	27	$	1,200.00	5	SITE REVIEW	4	3	12	RUSTING APART, APPEARS SEIZED		
		178		BFV332		KENNEDY	FILTER 2 TO CHLORINE CONTACT BUTTERFLY VALVE, 12 INCHES - 300mm	VALVE	FILTER 1/2 PIPING GALLERY	1994	23	50	27	$	3,300.00	2	SITE REVIEW	2	2	4			
		179		BFV332		ROTORK	FILTER 2 TO CHLORINE CONTACT ACTUATOR, 1.35Amps, 575V	ACTUATOR	FILTER 1/2 PIPING GALLERY	1994	23	40	17	$	24,000.00	2	SITE REVIEW	2	2	4			
		180		BFV342		KENNEDY	FILTER 2 TO WASTE BUTTERFLY VALVE, 12INCHES - 300mm	VALVE	FILTER 1/2 PIPING GALLERY	1994	23	50	27	$	3,300.00	2	SITE REVIEW	2	2	4			
		181		BFV342		ROTORK	FILTER 2 TO WASTE ACTUATOR, 1.35 Amps, 575V	ACTUATOR	FILTER 1/2 PIPING GALLERY	1994	23	40	17	$	24,000.00	2	SITE REVIEW	2	2	4			
		182			FLTR-04	LEOPOLD CLAY TILE	FILTER 2 - UNDER DRAIN	DRAIN	FILTER 1/2 PIPING GALLERY	1994	23	40	17	$	210,000.00	3	DESKTOP REVIEW	2	2	4			
		183		BFV880		VALMATIC	FILTER 1/2 TO WASTE DISCHARGE - BUTTERFLY VALVE, 18INCHES - 450mm	VALVE	FILTER 1/2 PIPING GALLERY	1994	23	50	27	$	5,250.00	2	SITE REVIEW	2	2	4			
		184		BFV800		AUMA	FILTER 1/2 TO WASTE COMMON DISCHARGE - MOTORIZED ACTUATOR, 575V, 1.3Amps,	ACTUATOR	FILTER 1/2 PIPING GALLERY	1994	23	40	17	$	24,000.00	1	SITE REVIEW	2	2	4			
		185		BFV881			FILTER 1/2 TO WASTE RETURN TO LOW LIFT INLET - BUTTERFLY VALVE, 6INCHES - 150mm	VALVE	FILTER 1/2 PIPING GALLERY	1994	23	50	27	$	1,350.00	2	SITE REVIEW	2	2	4			
		186		BFV 881			FILTER 1/2 TO WASTE RETURN TO LOW LIFT INLET - MOTORIZED ACTUATOR, 0.4 Amp, 575V	ACTUATOR	FILTER 1/2 PIPING GALLERY	1994	23	40	17	$	24,000.00	1	SITE REVIEW	2	2	4			
		187			PIPING-04		FILTER 1/2 - PIPING	PIPING	FILTER 1/2 PIPING GALLERY	1994	23	90	67	$	60,000.00	1	SITE REVIEW	1	2	2			
		188		BFV362		VALMATIC	AGITATOR WATER SUPPLY TO FILTER 1/2 BUTTERFLY VALVE, 6INCH - 150mm	VALVE	FILTER 1/2 PIPING GALLERY	1994	23	50	27	$	1,350.00	1	SITE REVIEW	1	2	2			
		189		BFV362		ROTORK	AGITATOR WATER SUPPLY TO FILTER 1/2 AGITATORS, MOTORIZED ACTUATOR	ACTUATOR	FILTER 1/2 PIPING GALLERY	1994	23	40	17	$	24,000.00	1	SITE REVIEW	1	2	2			
		190		BFV361		VALMATIC	AGITATOR WATER SUPPLY TO FILTER 1/2 BUTTERFLY VALVE, 6INCH - 150mm	VALVE	FILTER 1/2 PIPING GALLERY	1994	23	50	27	$	1,350.00	1	SITE REVIEW	1	2	2			
		191		BFV361		ROTORK	AGITATOR WATER SUPPLY TO FILTER 1/2 AGITATORS, MOTORIZED ACTUATOR	ACTUATOR	FILTER 1/2 PIPING GALLERY	1994	23	40	17	$	24,000.00	1	SITE REVIEW	1	2	2			
		192			CV-01	VALMATIC	AGITATOR WATER SUPPLY TO FILTER 1/2 AGITATORS - GLOBE CHECK VALVE	CHLROINE CONTACT INLET/ DISC	FILTER 1/2 PIPING GALLERY	1994	23	50	27	$	3,000.00	2	SITE REVIEW	2	3	6			
		193		MV301			FILTER 3 - INLET SLUICE GATE, 600X600mm	GATE	FILTER 3/4 ROOM	1994	23	50	27	$	22,500.00	1	DESKTOP REVIEW	1	3	3			
		194		MV301		AUMA	FILTER 3 - INLET MOTORIZED ACTUATOR, 1.3Amps, 575V	ACTUATOR	FILTER 3/4 ROOM	2013	4	40	36	$	24,000.00	1	SITE REVIEW	2	3	6			
		195			FLTR-05		FILTER 3 - WASHWATER TROUGH 1-4	TROUGH	FILTER 3/4 ROOM	1994	23	80	57	$	6,000.00	2	DESKTOP REVIEW	3	3	9			
		196			MEDIA-03		FILTER 3 MEDIA - GRANULAR ACTIVATED CARBON	CHEMICALS / CONSUMABLES	FILTER 3	2006	11	40	29	$	600,000.00	2	DESKTOP REVIEW	2	5	10			
		197			SG-01		FILTER 3 - DISCHARGE SLUICE GATE, 600X600mm	VALVE	FILTER 3/4 ROOM	1994	23	50	27	$	22,500.00	3	DESKTOP REVIEW	2	2	4			
		198		MV306		ROTORK	FILTER 3 - DISCHARGE MOTORIZED ACTUATOR, 0.93Amps, 575V,	ACTUATOR	BLOWER ROOM	2016	1	40	39	$	24,000.00	1	SITE REVIEW	1	2	2			
		199			BFV-06	PRATT	FILTER 3 DISCHARGE BEFORE FLOW METER - BUTTERFLY VALVE, 10 INCHES - 250mm	VALVE	FILTER 3/4 PIPING GALLERY	1997	20	50	30	$	2,400.00	2	SITE REVIEW	2	2	4			
		200			MVA-05	PRATT	FILTER 3 DISCHARGE BEFORE FLOW METER - MANUAL ACTUATOR-GEARED	ACTUATOR	FILTER 3/4 PIPING GALLERY	1997	20	50	30	$	24,000.00	2	SITE REVIEW	2	2	4			
		201		MV302		PRATT	FILTER 3 DISCHARGE DOWN STREAM FROM FLOW METER - BUTTERFLY VALVE, 10INCHES - 250mm	VALVE	FILTER 3/4 PIPING GALLERY	1994	23	50	27	$	2,400.00	2	SITE REVIEW	2	2	4			
		202			MA-01	ROTORK	FILTER 3 DISCHARGE DOWN STREAM OF FLOW METER - MOTORIZED ACTUATOR	ACTUATOR	FILTER 3/4 PIPING GALLERY	1994	23	40	17	$	24,000.00	2	SITE REVIEW	2	2	4			
		203		MV304		PRATT	FILTER 3 TO WASTE - BUTTERFLY VALVE, 10 INCHES - 250mm	VALVE	FILTER 3/4 PIPING GALLERY	1994	23	50	27	$	2,400.00	2	SITE REVIEW	2	2	4			
		204			MA-02	ROTORK	FILTER 3 TO WASTE - MOTORIZED ACTUATOR	ACTUATOR	FILTER 3/4 PIPING GALLERY	1994	23	40	17	$	24,000.00	2	SITE REVIEW	2	2	4			
		205		MV303		PRATT	FILTER 3 TO CHLORINE CONTACT TANK 1 - BUTTERFLY VALVE, 12INCHES - 300mm	VALVE	FILTER 3/4 PIPING GALLERY	1994	23	50	27	$	3,300.00	2	SITE REVIEW	2	2	4			
		206			MA-03	ROTORK	FILTER 3 TO CHLORINE CONTACT TANK 1 - MOTORIZED ACTUATOR	ACTUATOR	FILTER 3/4 PIPING GALLERY	1994	23	40	17	$	24,000.00	2	SITE REVIEW	2	2	4			
		207			ARV-01	VALMATIC	FILTER 3 DISCHARGE AIR RELEASE VALVE, 2INCHES - 50mm	VALVE	FILTER 3/4 PIPING GALLERY	1994	23	50	27	$	3,450.00	1	SITE REVIEW	1	2	2			
		208		MV305		PRATT	FILTER 3 BACKWASH SUPPLY - BUTTERFLY VALVE, 12INCHES - 300mm	VALVE	FILTER 3/4 PIPING GALLERY	1994	23	50	27	$	3,300.00	2	SITE REVIEW	2	2	4			
		209		MV305		ROTORK	FILTER 3 BACKWASH SUPPLY - MOTORIZED ACTUATOR	ACTUATOR	FILTER 3/4 PIPING GALLERY	1994	23	40	17	$	24,000.00	2	SITE REVIEW	2	2	4			
		210			GV-04	KENNEDY	FILTER 3 - DRAIN VALVE, 100mm	VALVE	FILTER 3/4 PIPING GALLERY	1994	23	50	27	$	1,200.00	2	SITE REVIEW	2	3	6			
		211			FLTR-06	EINCO FLEX SCOUR	FILTER 3 - UNDER DRAIN	DRAIN	FILTER 1/2 PIPING GALLERY	1994	23	40	17	$	210,000.00	2	DESKTOP REVIEW	2	2	4			
		212	SG414	SG414/ MSG	MV-401		FILTER 4 - INLET SLUICE GATE, 600X600mm	GATE	FILTER 3/4 ROOM	1994	23	50	27	$	22,500.00	2	DESKTOP REVIEW	2	3	6			
		213		SG414/ MSG	MV-401	ROTORK	FILTER 4 - INLET MOTORIZED ACTUATOR	ACTUATOR	FILTER 3/4 ROOM	2016	1	40	39	$	24,000.00	1	SITE REVIEW	1	3	3			
		214			FLTR-07		FILTER 4 - WASHWATER TROUGH 1-4	TROUGH	FILTER 3/4 ROOM	1994	23	50	27	$	6,000.00	2	DESKTOP REVIEW	2	3	6			
		215			MEDIA-03		FILTER 4 MEDIA - GRANULAR ACTIVATED CARBON	CHEMICALS / CONSUMABLES	FILTER 4	2006	11	40	29	$	600,000.00	2	DESKTOP REVIEW	2	5	10			
		216	SG424	SG242/ MSG	MV-406		FILTER 4 - DISCHARGE SLUICE GATE, 600X600mm	GATE	FILTER 3/4 ROOM	1994	23	50	27	$	22,500.00	1	DESKTOP REVIEW	2	2	4			
		217		SG242/ MSG	MV-406	AUMA	FILTER 4 - DISCHARGE MOTORIZED ACTUATOR	ACTUATOR	FILTER 3/4 ROOM	2016	1	40	39	$	24,000.00	1	SITE REVIEW	2	2	4			
		218			MA-04	PRATT	FILTER 4 DISCHARGE BEFORE FLOW METER - BUTTERFLY VALVE, 10 INCHES - 250mm	VALVE	FILTER 3/4 PIPING GALLERY	1994	23	50	27	$	2,400.00	2	SITE REVIEW	2	2	4			
		219			MVA-06	PRATT	FILTER 4 DISCHARGE BEFORE FLOW METER - MANUAL ACTUATOR-GEARED	ACTUATOR	FILTER 3/4 PIPING GALLERY	1994	23	50	27	$	24,000.00	2	SITE REVIEW	2	2	4			
		220		MV402		PRATT	FILTER 4 DISCHARGE DOWN STREAM FLOW METER - BUTTERFLY VALVE, 10INCHES - 250mm	VALVE	FILTER 3/4 PIPING GALLERY	1994	23	50	27	$	2,400.00	2	SITE REVIEW	2	2	4			
		221			MA-05	ROTORK	FILTER 4 DISCHARGE DOWN STREAM OF FLOW METER - MOTORIZED ACTUATOR	ACTUATOR	FILTER 3/4 PIPING GALLERY	1994	23	40	17	$	24,000.00	2	SITE REVIEW	2	2	4			
		222		MV404		PRATT	FILTER 4 TO WASTE - BUTTERFLY VALVE, 10 INCHES - 250mm	VALVE	FILTER 3/4 PIPING GALLERY	1994	23	50	27	$	2,400.00	2	SITE REVIEW	2	2	4			
		223			MA-06	ROTORK	FILTER 4 TO WASTE - MOTORIZED ACTUATOR	ACTUATOR	FILTER 3/4 PIPING GALLERY	1994	23	40	17	$	24,000.00	2	SITE REVIEW	2	2	4			
		224		MV403		PRATT	FILTER 4 TO CHLORINE CONTACT 1 TANK- BUTTERFLY VALVE, 300mm	VALVE	FILTER 3/4 PIPING GALLERY	1994	23	50	27	$	3,300.00	2	SITE REVIEW	2	3	6			
		225			MA-07	ROTORK	FILTER 4 TO CHLORINE CONTACT 1 - MOTORIZED ACTUATOR	ACTUATOR	FILTER 3/4 PIPING GALLERY	1994	23	40	17	$	24,000.00	2	SITE REVIEW	2	3	6			
		226			ARV-02	VALMATIC	FILTER 4 DISCHARGE AIR RELEASE VALVE, 50mm	RELEASE	FILTER 3/4 PIPING GALLERY	1994	23	50	27	$	3,450.00	1	SITE REVIEW	1	2	2			
		227		MV405		PRATT	FILTER 4 BACKWASH SUPPLY - BUTTERFLY VALVE, 12 INCHES - 300mm	VALVE	FILTER 3/4 PIPING GALLERY	1994	23	50	27	$	3,300.00	2	SITE REVIEW	2	2	4			
		228		MV405		ROTORK	FILTER 4 BACKWASH SUPPLY - MOTORIZED ACTUATOR	ACTUATOR	FILTER 3/4 PIPING GALLERY	1994	23	40	17	$	24,000.00	2	SITE REVIEW	2	2	4			
		229			GV-05	KENNEDY	FILTER 4 DRAIN VALVE - GATE VALVE, 4 INCHES	VALVE	FILTER 3/4 PIPING GALLERY	1994	23	50	27	$	1,200.00	2	SITE REVIEW	2	3	6			
		230			FLTR-08	EINCO FLEX SCOUR	FILTER 4 - UNDER DRAIN	DRAIN	FILTER 1/2 PIPING GALLERY	1994	23	40	17	$	210,000.00	2	DESKTOP REVIEW	2	2	4			
		231			BFV-06	PRATT	FILTER 3/4 - FLOCCULATION CHANNEL ISOLATION VALVE, 400mm	VALVE	FILTER 3/4 PIPING GALLERY	1994	23	50	27	$	5,250.00	2	SITE REVIEW	2	4	8			
		232			MVA-07	PRATT	FILTER 3/4 - FLOCCULATION CHANNEL ISOLATION MANUAL ACTUATOR-GEARED	ACTUATOR	FILTER 3/4 PIPING GALLERY	1994	23	50	27	$	24,000.00	2	SITE REVIEW	2	4	8			
		233	CB401	CB401		DRESSER INDUSTRI	FILTER 3/4 - AIR BLOWER, 2448m3/h @ 28 kPa	AIR BLOWER	BLOWER ROOM	1994	23	50	27	$	48,000.00	2	SITE REVIEW	2	3	6			
		234			BLOWER-01	WEG	FILTER 3/4 - AIR BLOWER MOTOR, 40HP, 1770RPM, 575V, 38.4 Amps	MOTOR	BLOWER ROOM	1994	23	50	27	$	24,000.00	2	SITE REVIEW	2	3	6			
		235			BFV-07	PRATT	FILTER 3 - AIR BLOWER DISCHARGE BUTTERFLY VALVE, 10INCHES - 250mm	VALVE	BLOWER ROOM	1994	23	50	27	$	2,400.00	2	SITE REVIEW	2	2	4			
		236			MVA-08	ROTORK	FILTER 3 - AIR BLOWER DISCHARGE ACTUATOR	ACTUATOR	BLOWER ROOM	1994	23	40	17	$	24,000.00	2	SITE REVIEW	2

			239			PIPING-05		FILTER 3/4 - PIPING	PIPING	BLOWER ROOM	1994	23	90	67	$	60,000.00	1	SITE REVIEW	1	3	3	
			240	BWP69	BWP690/BWP690		GOULDS	BACKWASH PUMP 1 - VERTICAL TURBINE PUMP, 12.8m HEAD, 405L/SEC	PUMP	HIGH LIFT PUMP STATION	2004	13	50	37	$	64,500.00	2	SITE REVIEW	2	3	6	
			241		BWP690/BWP690		NEMA	BACKWASH PUMP 1 - MOTOR, 125HP, 115 Amps,1190RPM	MOTOR	HIGH LIFT PUMP STATION	2004	13	50	37	$	31,500.00	2	SITE REVIEW	2	3	6	
			242		PRV694		SINGER	BACKWASH PUMP 1 - PRESSURE RELEASE VALVE, 10INCHES - 250mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	19,950.00	2	SITE REVIEW	2	3	6	
			243	PCV694	CV695		VALMATIC	BACKWASH PUMP 1 - DISCHARGE CHECK VALVE, 450mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	13,200.00	2	SITE REVIEW	2	3	6	
			244		BFV696		VALMATIC	BACKWASH PUMP 1 - DISCHARGE MANUAL ACTUATOR-GEARED	ACTUATOR	HIGH LIFT PUMP STATION	2004	13	50	37	$	24,000.00	2	SITE REVIEW	2	3	6	
			245		BFV696		VALMATIC	BACKWASH PUMP 1 - DISCHARGE BUTTERFLY VALVE, 450mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	5,250.00	2	SITE REVIEW	2	3	6	
			246	BWP68	BWP680/BWP680		GOULDS	BACKWASH PUMP 2 - VERTICAL TURBINE PUMP, 12.8m HEAD, 405L/SEC	PUMP	HIGH LIFT PUMP STATION	2004	13	50	37	$	64,500.00	2	SITE REVIEW	2	3	6	
			247		BWP680/BWP680		NEMA	BACKWASH PUMP 2 - MOTOR, 125HP, 115Amps, 1190RPM	MOTOR	HIGH LIFT PUMP STATION	2004	13	50	37	$	31,500.00	2	SITE REVIEW	2	3	6	
			248		PRV684		SINGER	BACKWASH PUMP 2 - PRESSURE RELEASE VALVE, 10INCHES - 250mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	19,950.00	2	SITE REVIEW	2	3	6	
			249		CV685		VALMATIC	BACKWASH PUMP 2 - DISCHARGE CHECK VALVE, 450mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	13,200.00	2	SITE REVIEW	2	3	6	
			250	PCV684	BFV686		VALMATIC	BACKWASH PUMP 2 - DISCHARGE MANUAL ACTUATOR-GEARED	ACTUATOR	HIGH LIFT PUMP STATION	2004	13	50	37	$	24,000.00	2	SITE REVIEW	2	3	6	
			251		BFV686		VALMATIC	BACKWASH PUMP 2 - DISCHARGE BUTTERFLY VALVE, 450mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	5,250.00	2	SITE REVIEW	2	3	6	
			252		BFV672/672		VALMATIC	BACKWASH STATION PUMP 1/2 COMMON DISCHARGE - BUTTERFLY VALVE, 450mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	5,250.00	2	SITE REVIEW	2	4	8	
			253		BFV672/672		ROTORK	BACKWASH STATION PUMP 1/2 COMMON DISCHARGE - MOTORIZED ACTUATOR	ACTUATOR	HIGH LIFT PUMP STATION	2004	13	40	27	$	24,000.00	2	SITE REVIEW	2	4	8	
			254			PIPING-06		BACKWASH SUPPLY PIPE, 450mm	PIPING	HIGH LIFT PUMP STATION	1994	23	90	67	$	67,500.00	2	DESKTOP REVIEW	2	4	8	
			255			CHEM-01		POLYMER INJECTION SYSTEM (DELTA PUMPS INCLUDED)	CHEMICALS / CONSUMABLES	ALUM ROOM	2006	11	20	9	$	112,500.00	2	SITE REVIEW	2	4	8	
	ELECTRICAL		256																						
			257	N/A	MCC-2		SIEMENS	MOTOR CONTROL CENTER (MCC), 600A, 600V, 3P 3W, MODE 8PX2	600V POWER	BLOWER ROOM	1995	22	30	8	$	22,500.00	2	SITE REVIEW	2	4	8	
			258	N/A	PLT-B		SIEMENS	DRY TYPE TRANSFORMER, 30KVA, 600V:208/120V, 5.5%, 150°C, NEMA 1	120/208V POWER	BLOWER ROOM	1995	22	30	8	$	6,000.00	2	SITE REVIEW	2	4	8	
			259	N/A	PLP-B		SIEMENS	LIGHTING PANEL, 100A 208/120V, 3P 4W, 30 CCT, MODEL EQ, HLAB430C100BQ	120/208V POWER	BLOWER ROOM	1995	22	30	8	$	7,500.00	2	SITE REVIEW	2	4	8	
			260	N/A	PLP-C		FEDERAL PIONEER	LIGHTING PANEL, 100A 208/120V, 3P 4W, 24 CCT, MODEL NBC324	120/208V POWER	BLOWER ROOM	1995	22	30	8	$	6,000.00	2	SITE REVIEW	2	4	8	
			261	N/A	MCC-3		SIEMENS	MOTOR CONTROL CENTER (MCC), 1000A, 600V, 3P 3W, MODE 8PG02	600V POWER	FILTER 3/4 PIPING GALLERY	1975	42	30	0	$	22,500.00	4	SITE REVIEW	3	3	9	PRODUCTS DISCONTINUED
			262	N/A	PLC-1		ALLEN BRADLEY	MAIN PLC, MODEL SLC-5/05	CONTROL	CONTROL ROOM	2006	11	25	14	$	52,500.00	1	SITE REVIEW	1	5	5	
			263	N/A	I/O OF PLC-1		ALLEN BRADLEY	I/O PANEL OF MAIN PLC. 1746 SERIES I/O MODULES	CONTROL	CONTROL ROOM	1995	22	25	3	$	150,000.00	3	SITE REVIEW	2	4	8	
			264	N/A	PLC-2		ALLEN BRADLEY	FILTER 3&4 PLC, MODEL SLC-5/05	CONTROL	CONTROL ROOM	2006	11	25	14	$	52,500.00	1	SITE REVIEW	1	5	5	
			265	N/A	I/O OF PLC-2		ALLEN BRADLEY	I/O PANEL OF FILTER 3 & 4. 1746 SERIES I/O MODULES	CONTROL	CONTROL ROOM	1995	22	25	3	$	150,000.00	3	SITE REVIEW	2	4	8	
	STRUCTURAL		266																						
			267			CS-10		FILTER 1 CONCRETE FILRATION BASIN, 7.7ML/d	STRUCTURAL	FILTER 1/2 ROOM	1976	41	100	59	$	313,500.00	2	SITE REVIEW	2	3	6	
			268			CS-11		FILTER 2 CONCRETE FILRATION BASIN, 7.7 ML/d	STRUCTURAL	FILTER 1/2 ROOM	1976	41	100	59	$	313,500.00	2	SITE REVIEW	2	3	6	
			269			CS-12		FILTER 3 CONCRETE FILRATION BASIN, 5.9ML/d	STRUCTURAL	FILTER 3/4 ROOM	1996	21	100	79	$	363,000.00	2	SITE REVIEW	2	3	6	
			270			CS-13		FILTER 4 CONCRETE FILRATION BASIN, 5.9ML/d	STRUCTURAL	FILTER 3/4 ROOM	1996	21	100	79	$	363,000.00	2	SITE REVIEW	2	3	6	
			271			HS-01		FILTER 1/2 - HANDRAILS	STRUCTURAL	FILTER 1/2 ROOM	1996	21	100	79	$	1,500.00	1	SITE REVIEW	1	1	1	MISSING KICK-PLATES ON FILTERS 1/2
			272			CS-14		FILTER 1/2 BACKWASH DISCHARGE CONDUIT	STRUCTURAL	FILTER 1/2 ROOM	1976	41	100	59	$	235,200.00	3	DESKTOP REVIEW	2	4	8	
	BUILDING MECHANICAL		273																						
			274			ACCESS-09		FILTER 3 - ACCESS HATCH, 750mm	HATCH	FILTER 3/4 ROOM	1994	23	50	27	$	1,500.00	1	SITE REVIEW	1	1	1	
			275			ACCESS-10		FILTER 4 - ACCESS HATCH, 600mm	HATCH	FILTER 3/4 ROOM	1994	23	50	27	$	1,500.00	1	SITE REVIEW	1	1	1	
	INSTRUMENTATION		276																						
			277		AIT 303			FILTER 1 - TURBIDITY METER	INSTRUMENTATION	FILTER 1/2 PIPING GALLERY	2009	8	15	7	$	8,250.00	2	SITE REVIEW	2	3	6	
			278		AIT 304			FILTER 2 - TURBIDITY METER	INSTRUMENTATION	FILTER 1/2 PIPING GALLERY	2009	8	15	7	$	8,250.00	2	SITE REVIEW	2	3	6	
			279		AIT403		MICROTOL	FILTER 3 - TURBIDITY METER	INSTRUMENTATION	FILTER 3/4 PIPING GALLERY	2009	8	15	7	$	8,250.00	2	SITE REVIEW	2	3	6	
			280		AIT404		MICROTOL	FILTER 4 - TURBIDITY METER	INSTRUMENTATION	FILTER 3/4 PIPING GALLERY	2009	8	15	7	$	8,250.00	2	SITE REVIEW	2	3	6	
			281			INST-03		FILTER 1 - FLOAT SWITCH LEVEL INDICATOR	INSTRUMENTATION	FILTER 1/2 ROOM	1994	23	15	-8	$	750.00	4	SITE REVIEW	4	3	12	
			282			INST-04		FILTER 1 - ULTRASONIC LEVEL TRANSDUCER	INSTRUMENTATION	FILTER 1/2 ROOM	1994	23	15	-8	$	4,500.00	4	SITE REVIEW	4	3	12	
			283			INST-05		FILTER 2 - FLOAT SWITCH LEVEL INDICATOR	INSTRUMENTATION	FILTER 1/2 ROOM	1994	23	15	-8	$	750.00	4	SITE REVIEW	4	3	12	
			284			INST-06		FILTER 2 - ULTRASONIC LEVEL TRANSDUCER	INSTRUMENTATION	FILTER 1/2 ROOM	1994	23	15	-8	$	4,500.00	4	SITE REVIEW	4	3	12	
			285		FIT301		ENDRESS+HAUSER	FILTER 1 DISCHARGE MAGNETIC FLOW METER	INSTRUMENTATION	FILTER 1/2 PIPING GALLERY	1994	23	15	-8	$	12,000.00	4	SITE REVIEW	4	3	12	
			286		FIT301		ENDRESS+HAUSER	FILTER 2 DISCHARGE MAGNETIC FLOW METER	INSTRUMENTATION	FILTER 1/2 PIPING GALLERY	1994	23	15	-8	$	12,000.00	4	SITE REVIEW	4	3	12	
			287			INST-07		AGITATOR WATER SUPPLY TO FILTER 1/2 AGITATORS MAGNETIC FLOW METER	INSTRUMENTATION	FILTER 1/2 PIPING GALLERY	1994	23	15	-8	$	12,000.00	4	SITE REVIEW	4	3	12	
			288			INST-08		AGITATOR WATER SUPPLY TO FILTER 1/2 AGITATORS MAGNETIC FLOW METER	INSTRUMENTATION	FILTER 1/2 PIPING GALLERY	1994	23	15	-8	$	12,000.00	4	SITE REVIEW	4	3	12	
			289			INST-09	KROHNE	FILTER 3 DISCHARGE MAGENTIC FLOW METER	INSTRUMENTATION	FILTER 3/4 PIPING GALLERY	1994	23	15	-8	$	6,000.00	4	SITE REVIEW	4	3	12	
			290			INST-10	KROHNE	FILTER 4 DISCHARGE MAGNETIC FLOW METER	INSTRUMENTATION	FILTER 3/4 PIPING GALLERY	1994	23	15	-8	$	6,000.00	4	SITE REVIEW	4	3	12	
			291		FIT737			BACKWASH STATION PUMP 1/2 COMMON DISCHARGE - MAGNETIC FLOW METER	INSTRUMENTATION	HIGH LIFT PUMP STATION	2004	13	15	2	$	6,000.00	4	SITE REVIEW	4	3	12	
HIGH LIFT PUMPING/ DISCHARGE			292																						
	PROCESS MECHANICAL		293																						
			294	HLP601	HLP601		GOULDS	HIGH LIFT PUMP 1 - VERTICAL TURBINE PUMP, 10 ML/day	PUMP	HIGH LIFT PUMP STATION	2004	13	50	37	$	412,500.00	2	SITE REVIEW	2	3	6	
			295			MOTOR-06	US MOTORS	HIGH LIFT PUMP 1 - MOTOR, 150HP, 4160V, 19.5 Amps, 1709RPM	MOTOR	HIGH LIFT PUMP STATION	2004	13	50	37	$	206,250.00	2	SITE REVIEW	2	3	6	
			296		PCV614		SINGER	HIGH LIFT PUMP 1 - DISCHARGE PRESSURE RELEASE VALVE (DEEP WELL CONTROL VALVE), 150mm	VALVE	HIGH LIFT PUMP STATION	2017	0	50	50	$	9,750.00	1	SITE REVIEW	2	3	6	
			297		CV615		VALMATIC	HIGH LIFT PUMP 1 - DISCHARGE CHECK VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	5,850.00	2	SITE REVIEW	2	3	6	
			298			MVA-07	VALMATIC	HIGH LIFT PUMP 1 - DISCHARGE MANUAL ACTUATOR-GEARED	ACTUATOR	HIGH LIFT PUMP STATION	2004	13	50	37	$	24,000.00	2	SITE REVIEW	2	3	6	
			299		BFV616		VALMATIC	HIGH LIFT PUMP 1 - DISCHARGE BUTTERFLY VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	3,300.00	2	SITE REVIEW	2	3	6	
			300	HLP602	HLP602		GOULDS	HIGH LIFT PUMP 2 - VERTICAL TURBINE PUMP, 8ML/day	PUMP	HIGH LIFT PUMP STATION	2004	13	50	37	$	412,500.00	2	SITE REVIEW	2	3	6	
			301			MOTOR-07	US MOTORS	HIGH LIFT PUMP 2 - MOTOR, 150HP, 4160V, 19.5 Amps, 17.09RPM	MOTOR	HIGH LIFT PUMP STATION	2004	13	50	37	$	206,250.00	2	SITE REVIEW	2	3	6	
			302		PCV624		SINGER	HIGH LIFT PUMP 2 - DISCHARGE PRESSURE RELEASE VALVE (DEEP WELL CONTROL VALVE), 150mm	VALVE	HIGH LIFT PUMP STATION	2017	0	50	50	$	9,750.00	1	SITE REVIEW	1	3	3	
			303		CV625		VALMATIC	HIGH LIFT PUMP 2 - DISCHARGE CHECK VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	5,850.00	2	SITE REVIEW	2	3	6	RUST PATTERN ON EXTERIOR
			304			MVA-08	VALMATIC	HIGH LIFT PUMP 2 - DISCHARGE MANUAL ACTUATOR-GEARED	ACTUATOR	HIGH LIFT PUMP STATION	2004	13	50	37	$	24,000.00	2	SITE REVIEW	2	3	6	
			305		BFV626		VALMATIC	HIGH LIFT PUMP 2 - DISCHARGE BUTTERFLY VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	3,300.00	2	SITE REVIEW	2	3	6	
			306	HLP603	HLP603		GOULDS	HIGH LIFT PUMP 3 - VERTICAL TURBINE PUMP, 10 ML/d	PUMP	HIGH LIFT PUMP STATION	2004	13	50	37	$	412,500.00	2	SITE REVIEW	2	3	6	
			307			MOTOR-08	US MOTORS	HIGH LIFT PUMP 3 - MOTOR, 150HP, 4160V, 19.5 Amps, 1709RPM	MOTOR	HIGH LIFT PUMP STATION	2004	13	50	37	$	206,250.00	2	SITE REVIEW	2	3	6	
			308		PCV634		SINGER	HIGH LIFT PUMP 3 - DISCHARGE PRESSURE RELEASE VALVE (DEEP WELL CONTROL VALVE), 150mm	VALVE	HIGH LIFT PUMP STATION	2017	0	50	50	$	9,750.00	1	SITE REVIEW	1	3	3	
			309		CV635		VALMATIC	HIGH LIFT PUMP 3 - DISCHARGE CHECK VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	5,850.00	2	SITE REVIEW	2	3	6	
			310			MVA-09	VALMATIC	HIGH LIFT PUMP 3 - DISCHARGE MANUAL ACTUATOR-GEARED	ACTUATOR	HIGH LIFT PUMP STATION	2004	13	50	37	$	24,000.00	2	SITE REVIEW	2	3	6	
			311		BFV636		VALMATIC	HIGH LIFT PUMP 3 - DISCHARGE BUTTERFLY VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	3,300.00	2	SITE REVIEW	2	3	6	
			312	HLP604	HLP604		GOULDS	HIGH LIFT PUMP 4 - VERTICAL TURBINE PUMP, 10ML/day, 72M HEAD	PUMP	HIGH LIFT PUMP STATION	2004	13	50	37	$	412,500.00	2	SITE REVIEW	2	3	6	
			313			MOTOR-09	US MOTORS	HIGH LIFT PUMP 4 - MOTOR, 150HP, 4160V, 19.5 Amps, 17.09RPM	MOTOR	HIGH LIFT PUMP STATION	2004	13	50	37	$	206,250.00	2	SITE REVIEW	2	3	6	
			314		PCV644		SINGER	HIGH LIFT PUMP 4 - DISCHARGE PRESSURE RELEASE VALVE (DEEP WELL CONTROL VALVE), 150mm	VALVE	HIGH LIFT PUMP STATION	2017	0	50	50	$	9,750.00	1	SITE REVIEW	1	3	3	
			315		CV645		VALMATIC	HIGH LIFT PUMP 4 - DISCHARGE CHECK VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	5,850.00	2	SITE REVIEW	2	3	6	RUST PATTERN ON EXTERIOR
			316			MVA-10	VALMATIC	HIGH LIFT PUMP 4 - DISCHARGE MANUAL ACTUATOR-GEARED	ACTUATOR	HIGH LIFT PUMP STATION	2004	13	50	37	$	24,000.00	2	SITE REVIEW	2	3	6	
			317		BFV646/BFV646		VALMATIC	HIGH LIFT PUMP 4 - DISCHARGE BUTTERFLY VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	3,300.00	2	SITE REVIEW	2	3	6	
			318	HLP605	HLP605/HLP605		GOULDS	HIGH LIFT PUMP 5 - VERTICAL TURBINE PUMP, 92.6L/SEC, 96M HEAD	PUMP	HIGH LIFT PUMP STATION	2004	13	50	37	$	412,500.00	2	SITE REVIEW	2	3	6	
			319			MOTOR-10	US MOTORS	HIGH LIFT PUMP 5 - MOTOR, 150HP, 4160V, 19.5 Amps, 17.09RPM	MOTOR	HIGH LIFT PUMP STATION	2004	13	50	37	$	206,250.00	2	SITE REVIEW	2	3	6	
			320		PCV654		SINGER	HIGH LIFT PUMP 3 - DISCHARGE PRESSURE RELEASE VALVE (DEEP WELL CONTROL VALVE), 150mm	VALVE	HIGH LIFT PUMP STATION	2017	0	50	50	$	9,750.00	1	SITE REVIEW	1	3	3	
			321		CV655/CV655		VALMATIC	HIGH LIFT PUMP 5 - DISCHARGE CHECK VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	5,850.00	2	SITE REVIEW	2	3	6	
			322			MVA-10	VALMATIC	HIGH LIFT PUMP 5 - DISCHARGE MANUAL ACTUATOR-GEARED	ACTUATOR	HIGH LIFT PUMP STATION	2004	13	50	37	$	24,000.00	2	SITE REVIEW	2	3	6	
			323		BFV656/BFV656		VALMATIC	HIGH LIFT PUMP 5 - DISCHARGE BUTTERFLY VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	3,300.00	2	SITE REVIEW	2	3	6	
			324	HLP606	HLP606/ HLP606		GOULDS	HIGH LIFT PUMP 6 - VERTICAL TURBINE PUMP, 115.7L/SEC, 72M HEAD	PUMP	HIGH LIFT PUMP STATION	2004	13	50	37	$	412,500.00	2	SITE REVIEW	2	3	6	
			325			MOTOR-11	US MOTORS	HIGH LIFT PUMP 6 - MOTOR, 150HP, 4160V, 19.5 Amps, 17.09RPM	MOTOR	HIGH LIFT PUMP STATION	2004	13	50	37	$	206,250.00	2	SITE REVIEW	2	3	6	
			326		PCV664		SINGER	HIGH LIFT PUMP 6 - DISCHARGE PRESSURE RELEASE VALVE (DEEP WELL CONTROL VALVE), 150mm	VALVE	HIGH LIFT PUMP STATION	2017	0	50	50	$	9,750.00	1	SITE REVIEW	1	3	3	
			327		CV665/CV665		VALMATIC	HIGH LIFT PUMP 6 - DISCHARGE TILTED DISK CHECK VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	5,850.00	2	SITE REVIEW	2	3	6	RUST PATTERN ON EXTERIOR
			328			MVA-11	VALMATIC	HIGH LIFT PUMP 6 - DISCHARGE MANUAL ACTUATOR-GEARED	ACTUATOR	HIGH LIFT PUMP STATION	2004	13	50	37	$	24,000.00	2	SITE REVIEW	2	3	6	
			329		BFV666/BFV666		VALMATIC	HIGH LIFT PUMP 6 - DISCHARGE BUTTERFLY VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2004	13	50	37	$	3,300.00	2	SITE REVIEW	2	3	6	
			330			PIPING-07		HIGH LIFT DISCHARGE PIPING	PIPING	HIGH LIFT PUMP STATION	2004	13	90	77	$	99,000.00	1	SITE REVIEW	1	4	4	
	ELECTRICAL		331																						
			332	N/A	MTS2		SCHNEIDER (SQUAR	600A, 600V MANUAL TRANSFER SWITCH, DOUBLE THROW	600V POWER	HLF PS CORRIDOR	2014	3	30	27	$	6,000.00	1	SITE REVIEW	1	4	4	
			333	N/A	DP		SCHNEIDER (SQUAR	800A, 600/347V, 3P 4W UTILITY BACKUP DISTRIBUTION PANEL	600V POWER	HLF PS CORRIDOR	2014	3	30	27	$	37,500.00	1	SITE REVIEW	1	2	2	
			334	N/A	T-2		HAMMOND	DRY TYPE TRANSFORMER, 500KVA, 4160V:600/347V, S/N DB04J181, NEMA 12	600V POWER	HLF PS ROOM	2006	11	30	19	$	82,500.00	1	SITE REVIEW	1	5	5	
			335	N/A	MCC-6		SCHNEIDER (SQUAR	MOTOR CONTROL CENTER (MCC), 1200A, 600V, 3P 3W, SQUARE D MODE 6, S/N 18212660-001	600V POWER	HLF PS ROOM	2006	11	30	19	$	375,000.00	1	SITE REVIEW	2	2	4	
			336	N/A	TX-A		HAMMOND	DRY TYPE TRANSFORMER, 75KVA, 600V:208/120V, Part # NPK075PBKH4, NEMA 4	600V POWER	HLF PS ROOM	2006	11	30	19	$	15,000.00	1	SITE REVIEW	1	4	4	
			337	N/A	PANEL A		SCHNEIDER (SQUAR	400A, 208/120V, 3P 4W, 84 CCT W/ MCB 400A, NEMA 3R. CAT #MH77WP	120/208V POWER	HLF PS ROOM	2006	11	30	19	$	7,500.00	1	SITE REVIEW	1	3	3	
			338	N/A	REMOTE I/O #3		ALLEN BRADLEY	MCC6 CONTROL PANELL, FLEX-IO SERIES I/O MODULES	CONTROL	NEW HLP ROOM	2006	11	25	14	$	97,500.00	1	SITE REVIEW	1	4	4	
			339	N/A	HLP1		BENSHAW	4160V SOFT STARTER, MODEL CFMVRSM18-400-4160,	PUMP STARTER	FILTER 3/4 ROOM	2006	11	25	14	$	75,000.00	1	SITE REVIEW	1	3	3	
			340	N/A	HLP2		BENSHAW	4160V SOFT STARTER, MODEL CFMVRSM18-400-4160,	PUMP STARTER	FILTER 3/4 ROOM	2006	11	25	14	$	75,000.00	1	SITE REVIEW	1	3	3	
			341	N/A	HLP3		BENSHAW	4160V SOFT STARTER, MODEL CFMVRSM18-400-4160,	PUMP STARTER	FILTER 3/4 ROOM	2006	11	25	14	$	75,000.00	1	SITE REVIEW	1	3	3	
			342	N/A	HLP4		BENSHAW	4160V SOFT STARTER, MODEL CFMVRSM18-400-4160,	PUMP STARTER	FILTER 3/4 ROOM	2006	11	25	14	$	75,000.00	1	SITE REVIEW	1	3	3	
			343	N/A	HLP5		BENSHAW	4160V SOFT STARTER, MODEL CFMVRSM18-400-4160,	PUMP STARTER	FILTER 3/4 ROOM	2006	11	25	14	$	75,000.00	1	SITE REVIEW	1	3	3	
			344	N/A	HLP6		BENSHAW	4160V SOFT STARTER, MODEL CFMVRSM18-400-4160,	PUMP STARTER	FILTER 3/4 ROOM	2006	11	25	14	$	75,000.00	1	SITE REVIEW	1	3	3	
			345	N/A	DS-3		BENSHAW	4160V FUSED DISCONNECT SWITCH. MODEL CFMVATL2H-400-4160-1, C0970-0038B	4160V POWER	FILTER 3/4 ROOM	2006	11	25	14	$	37,500.00	1	SITE REVIEW	1	3	3	
			346	N/A	DS-4		BENSHAW	4160V FUSED DISCONNECT SWITCH. MODEL CFMVATL2H-400-4160-1, C0970-0038A	4160V POWER	FILTER 3/4 ROOM	2006	11	25	14	$	37,500.00	1	SITE REVIEW	1	3	3	
			347	N/A	DS-5		BENSHAW	4160V FUSED DISCONNECT SWITCH. MODEL CFMVATL2H-250-4160-1, C0970-0038B	4160V POWER	FILTER 3/4 ROOM	2006	11	25	14	$	37,500.00	1	SITE REVIEW	1	3	3	
DISINFECTION			348																						
	PROCESS MECHANICAL		349																						
			350			ST-03	N/A	CHLORINE CONTAINERS 1-6, 1 TON	TANK	CHLORINE ROOM	N/A	N/A	N/A	N/A	$	15,300.00	N/A	SITE REVIEW	1	5	5	
			351			CHEM-02	DE NORA	CHLORINE CONTAINER - PRIMARY VACUUM GUAGE AND ISOLATION VALVE	VALVE	CHLORINE ROOM	2016	1	50	49	$	7,500.00	1	SITE REVIEW	1	5	5	
			352			CHEM-03	DE NORA	CHLORINE CONTAINER - STANDBY VACUUM GUAGE AND ISOLATION VALVE	VALVE	CHLORINE ROOM	2016	1	50	49	$	7,500.00	1	SITE REVIEW	1	5	5	
			353			CHEM-04	DE NORA	PRE-CHLORINATOR,	WATER QUALITY MANAGEMENT	CHLORINE ROOM	2017	0	15	15	$	22,500.00	1	SITE REVIEW	1	3	3	
			354			CHEM-05	SEVERN TRENT	STAND-BY CHLORINATOR,	WATER QUALITY MANAGEMENT	CHLORINE ROOM	2005	12	15	3	$	22,500.00	2	SITE REVIEW	1	3	3	
			355			CHEM-06	DE NORA	POST-CHLORINATOR,	WATER QUALITY MANAGEMENT	CHLORINE ROOM	2017	0	15	15	$	22,500.00	1	SITE REVIEW	1	3	3	
			356			CHEM-07	SEVERN TRENT	ZONE 1 POST-POST-CHLORINATOR	WATER QUALITY MANAGEMENT	CHLORINE ROOM	2005	12	15	3	$	22,500.00	2	SITE REVIEW	1	3	3	
			357			CHEM-08	SEVERN TRENT	ZONE 2 POST-POST-CHLORINATOR	WATER QUALITY MANAGEMENT	CHLORINE ROOM	2005	12	15	3	$	22,500.00	2	SITE REVIEW	1	3	3	
			358		CP1025		BERKELY	BOOSTER PUMP 1, 26GAL/MIN, 480FT HEAD	PUMP	CHLORINE ROOM	2005

			363		BFV550		ROTORK	WELL WATER DISCHARGE - MOTORIZED ACTUATOR, 1Amp, 575V	ACTUATOR	FILTER 3/4 PIPING GALLERY	2006	11	40	29	$	24,000.00	2	SITE REVIEW	1	1	1	
			364			ARV-03		WELL WATER DISCHARGE TO CHLORINE CONTACT TANK 1 - AIR RELEASE VALVE	VALVE	FILTER 3/4 PIPING GALLERY	2006	11	50	39	$	9,750.00	N/A	SITE REVIEW	1	2	2	
			365		BFV 511		VALMATIC	CHLORINE CONTACT CHAMBER 1 - INLET BUTTERFLY VALVE, 36INCHES-914.4mm	VALVE	CHLORINE CONTACT INLET/ DISCHARGE HEADER	2006	11	50	39	$	22,350.00	4	SITE REVIEW	2	2	4	NORMAL OPERATING POSITION OPEN
			366		BFV511		VALMATIC	CHLORINE CONTACT CHAMBER 1 - INLET MANUAL ACUTATOR - GEARED	ACTUATOR	CHLORINE CONTACT INLET/ DISCHARGE HEADER	2006	11	50	39	$	24,000.00	4	SITE REVIEW	2	3	6	
			367		BFV512/BFV512		VALMATIC	CHLORINE CONTACT CHAMBER 1 DISCHARGE TO CHLORINE CONTACT HEADER - MANUAL ACTUATOR-GEARED	ACTUATOR	CHLORINE CONTACT INLET/ DISCHARGE HEADER	2006	11	50	39	$	24,000.00	2	SITE REVIEW	2	2	4	
			368		BFV512/BFV512		VALMATIC	CHLORINE CONTACT CHAMBER 1 - DISCHARGE BUTTERFLY VALVE, 30INCHES-762mm	VALVE	CHLORINE CONTACT INLET/ DISCHARGE HEADER	2006	11	50	39	$	19,200.00	2	SITE REVIEW	2	2	4	NORMAL OPERATING POSITION OPEN
			369		BFV513/BFV513		VALMATIC	CHLORINE CONTACT CHAMBER 1 - DISCHARGE MANUAL ACTUATOR-GEARED	ACTUATOR	CHLORINE CONTACT INLET/ DISCHARGE HEADER	2006	11	50	39	$	24,000.00	2	SITE REVIEW	2	1	2	
			370		BFV513/BFV513		VALMATIC	CHLORINE CONTACT CHAMBER 1 TO CHLORINE CONTACT 2 ISOLATION BUTTERFLY VALVE, 30INCHES-762mm	VALVE	CHLORINE CONTACT INLET/ DISCHARGE HEADER	2006	11	50	39	$	19,200.00	2	SITE REVIEW	2	1	2	
			371		BFV514/BFV514			CHLORINE CONTACT HEADER TO CHLORINE CONTACT 2 ISOLATION MANUAL ACTUATOR-GEARED	ACTUATOR	CHLORINE CONTACT INLET/ DISCHARGE HEADER	2006	11	50	39	$	24,000.00	2	SITE REVIEW	2	2	4	
			372		BFV514/BFV514			CHLORINE CONTACT CHAMBER 1 - DISCHARGE BUTTERFLY VALVE, 30INCHES	VALVE	CHLORINE CONTACT INLET/ DISCHARGE HEADER	2006	11	50	39	$	19,200.00	2	SITE REVIEW	2	2	4	NORMAL OPERATING POSITION OPEN
			373		BFV515		VALMATIC	CHLORINE CONTACT 2 TO CLEARWELL BUTTERFLY VALVE, 30 INCHES– 750mm	VALVE	CHLORINE CONTACT INLET/ DISCHARGE HEADER	2006	11	50	39	$	19,200.00	2	SITE REVIEW	2	3	6	
			374		BFV515		VALMATIC	CHLORINE CONTACT 2 TO CLEARWELL MANUAL ACTUATOR-GEARED	ACTUATOR	CHLORINE CONTACT INLET/ DISCHARGE HEADER	2006	11	50	39	$	24,000.00	2	SITE REVIEW	2	2	4	
			375		BFV516		VALMATIC	CHLORINE CONTACT CHAMBER 2 - DISCHARGE MANUAL ACTUATOR-GEARED	ACTUATOR	CHLORINE CONTACT INLET/ DISCHARGE HEADER	2006	11	50	39	$	24,000.00	2	SITE REVIEW	2	2	4	NORMAL OPERATING POSITION CLOSED
			376		BFV516/BFV516			CHLORINE CONTACT CHAMBER 2 - DISCHARGE BUTTERFLY VALVE, 750mm	VALVE	CHLORINE CONTACT INLET/ DISCHARGE HEADER	2006	11	50	39	$	19,200.00	2	SITE REVIEW	2	2	4	
			377		BFV517/BFV517			CHLORINE CONTACT CHAMBER 2 - DISCHARGE MANUAL ACTUATOR-GEARED	ACTUATOR	CHLORINE CONTACT INLET/ DISCHARGE HEADER	2006	11	50	39	$	24,000.00	2	SITE REVIEW	2	3	6	
			378		BFV517/BFV517			CHLORINE CONTACT CHAMBER 2 TO CLEARWELL - DISCHARGE BUTTERFLY VALVE, 300mm	VALVE	CHLORINE CONTACT INLET/ DISCHARGE HEADER	2006	11	50	39	$	3,300.00	2	SITE REVIEW	2	3	6	NORMAL OPERATING POSITION CLOSED
			379			SP-02		CHLORINE CONTACT CHAMBER 1/2 - SAMPLING PUMP	PUMP	CHLORINE CONTACT INLET/ DISCHARGE HEADER	2006	11	30	19	$	7,500.00	2	SITE REVIEW	2	1	2	
			380			CHEM-13	MET PRO	POTASSIUM HYDROXIDE PUMP, 5HP, 1.9GAL/MIN, 50FT HEAD	PUMP	ALUM ROOM	2016	1	30	29	$	52,500.00	2	SITE REVIEW	2	3	6	
			381			CHEM-14	US MOTORS	POTASSIUM HYDROXIDE MOTOR, 5HP, 575V, 5.4Amps,	MOTOR	ALUM ROOM	1988	29	50	21	$	37,500.00	2	SITE REVIEW	2	3	6	REBUILT 2016
			382			BFV-09	VALMATIC	ZONE 1 DISCHRAGE TO STANDBY UV BYPASS - BUTTERFLY VALVE, 600mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	5,550.00	2	SITE REVIEW	2	2	4	
			383			MVA-12	VALMATIC	ZONE 1 DISCHARGE TO STANDBY UV BYPASS - MANUAL ACTATOR-GEARED	ACTUATOR	HIGH LIFT PUMP STATION	2006	11	50	39	$	24,000.00	2	SITE REVIEW	2	2	4	
			384			BFV-10	VALMATIC	ZONE 2 DISCHARGE TO STANDBY UV BYPASS - BUTTERFLY VALVE, 600mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	5,550.00	2	SITE REVIEW	2	2	4	
			385			MVA-13	VALMATIC	ZONE 2 DISCHARGE TO STANDBY UV BYPASS - MANUAL ACTUATOR-GEARED	ACTUATOR	HIGH LIFT PUMP STATION	2006	11	50	39	$	1,500.00	2	SITE REVIEW	2	2	4	
			386			ARV-04		ZONE 1 DISCHARGE TO STANDBY UV BYPASS - AIR RELEASE VALVE	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	9,750.00	2	SITE REVIEW	2	2	4	
			387			ARV-05		ZONE 2 DISCHARGE TO STANDBY UV BYPASS - AIR RELEASE VALVE	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	9,750.00	2	SITE REVIEW	2	2	4	
			388		BFV713		VALMATIC	UV DISINFECTION HEADER TO ZONE 1 UV SYSTEM - DISCHARGE BUTTERFLY VALVE, 450mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	5,250.00	2	SITE REVIEW	2	3	6	
			389		BFV713		ROTORK	UV DINSINFECTION HEADER TO ZONE 1 UV SYSTEM - DISCHARGE MOTORIZED ACTUATOR	ACTUATOR	HIGH LIFT PUMP STATION	2006	11	40	29	$	24,000.00	2	SITE REVIEW	2	3	6	
			390	UV701	UV701/UV701			ZONE 1 ULTRAVIOLET DISINFECTION UNIT	DISINFECTION	HIGH LIFT PUMP STATION	2006	11	30	19	$	818,100.00	1	SITE REVIEW	2	3	6	AVG. LIFE OF UV BULB IS 375 DAYS
			391		BFV701		AUMA	UV DISINFECTION 1 TO ZONE 1 DISCHARGE - MOTORIZED ACTUATOR DISPLAY	ACTUATOR	HIGH LIFT PUMP STATION	2006	11	40	29	$	4,500.00	2	SITE REVIEW	2	3	6	
			392		BFV701		AUMA	UV DISINFECTION 1 TO ZONE 1 DISCHARGE - MOTORIZED ACTUATOR	ACTUATOR	HIGH LIFT PUMP STATION	2006	11	40	29	$	12,300.00	2	SITE REVIEW	2	3	6	
			393		BFV701		VALMATIC	ULTRAVIOLET TREATMENT 1 - DISCHARGE BUTTERFLY VALVE, 450mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	5,250.00	2	SITE REVIEW	2	3	6	
			394	UV702	UV702/UV702			ZONE 2 ULTRAVIOLET DISINFECTION UNIT	DISINFECTION	HIGH LIFT PUMP STATION	2006	11	30	19	$	818,100.00	2	SITE REVIEW	2	3	6	AVG. LIFE OF UV BULB IS 375 DAYS
			395			MA-08	AUMA	UV DISINFECTION 2 TO ZONE 2 DISCHARGE - MOTORIZED ACTUATOR DISPLAY	ACTUATOR	HIGH LIFT PUMP STATION	2006	11	40	29	$	12,000.00	2	SITE REVIEW	2	3	6	
			396		BFV717/BFV717		AUMA	UV DISINFECTION 2 TO ZONE 2 DISCHARGE - MOTORIZED ACTUATOR	ACTUATOR	HIGH LIFT PUMP STATION	2006	11	40	29	$	24,000.00	2	SITE REVIEW	2	3	6	
			397	SV755	SV755/755		VALMATIC	ULTRAVIOLET TREATMENT 2 - DISCHARGE BUTTERFLY VALVE, 450mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	5,250.00	2	SITE REVIEW	2	3	6	
			398	UV703	UV703			ZONE 1/2 STANDBY ULTRAVIOLET DISINFECTION UNIT	DISINFECTION	HIGH LIFT PUMP STATION	2006	11	30	19	$	818,100.00	2	SITE REVIEW	1	4	4	AVG. LIFE OF UV BULB IS 375 DAYS
			399		BFV718/BFV717		AUMA	UV STANDBY DISINFECTION TO ZONE 1/2 DISCHARGE - MOTORIZED ACTUATOR DISPLAY	ACTUATOR	HIGH LIFT PUMP STATION	2006	11	40	29	$	12,000.00	2	SITE REVIEW	2	3	6	
			400		BFV718/BFV718		AUMA	UV STANDBY DISINFECTION TO ZONE 1/2 DISCHARGE - MOTORIZED ACTUATOR	ACTUATOR	HIGH LIFT PUMP STATION	2006	11	40	29	$	24,000.00	2	SITE REVIEW	2	3	6	
			401		BFV718/BFV719		VALMATIC	STANDBY ULTRAVIOLET TREATMENT - DISCHARGE BUTTERFLY VALVE, 450mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	5,250.00	2	SITE REVIEW	2	3	6	
			402			BFV-11	VALMATIC	STANDBY ULTRAVIOLET TREATEMENT TO ZONE 1 DISCHARGE - BUTTERFLY VALVE, 600mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	5,550.00	2	SITE REVIEW	2	3	6	
			403			MVA-14	VALMATIC	STANDBY ULTRAVIOLET TREATEMENT TO ZONE 1 DISCHARGE - MOTORIZED ACTUATOR	ACTUATOR	HIGH LIFT PUMP STATION	2015	2	50	48	$	24,000.00	2	SITE REVIEW	2	3	6	
			404			BFV-12	VALMATIC	STANDBY ULTRAVIOLET TREATEMENT TO ZONE 2 DISCHARGE - BUTTERFLY VALVE, 600mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	5,550.00	2	SITE REVIEW	2	3	6	
			405			MVA-15	VALMATIC	STANDBY ULTRAVIOLET TREATEMENT TO ZONE 2 DISCHARGE - MOTORIZED ACTUATOR	ACTUATOR	HIGH LIFT PUMP STATION	2015	2	50	48	$	24,000.00	2	SITE REVIEW	2	3	6	
			406			BFV-13	VALMATIC	ULTRAVIOLET TREATMENT SYSTEM 1 TO ZONE 1 - BUTTERFLY VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	3,300.00	2	SITE REVIEW	2	3	6	
			407			MA-09	VALMATIC	ULTRAVIOLET TREATMENT SYSTEM 1 TO ZONE 1 - MOTORIZED ACTUATOR-GEARED, 300mm	ACTUATOR	HIGH LIFT PUMP STATION	2015	2	40	38	$	24,000.00	2	SITE REVIEW	2	3	6	
			408			BFV-14	VALMATIC	ZONE 1 DISCHARGE TO DISTRIBUTION SYSTEM - BUTTERFLY VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	3,300.00	2	SITE REVIEW	2	4	8	
			409			MA-10	VALMATIC	ZONE 1 DISCHARGE TO DISTRIBUTION SYSTEM - MOTORIZED ACTUATOR-GEARED, 300mm	ACTUATOR	HIGH LIFT PUMP STATION	2006	11	40	29	$	24,000.00	2	SITE REVIEW	2	4	8	
			410			BFV-15	VALMATIC	ULTRAVIOLET TREATMENT SYSTEM 1 TO CLEARWELL - DISCHARGE BUTTERFLY VALVE, 200mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	1,950.00	2	SITE REVIEW	2	3	6	
			411			MA-11	VALMATIC	ULTRAVIOLET TREATMENT SYSTEM 1 TO CLEARWELL - PRESSURE RELIEF VALVE, 150mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	9,750.00	2	SITE REVIEW	2	2	4	
			412			BFV-16	VALMATIC	ULTRAVIOLET TREATMENT SYSTEM 2 TO ZONE 2 - BUTTERFLY VALVE, 450mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	5,250.00	2	SITE REVIEW	2	3	6	
			413			MA-12	VALMATIC	ULTRAVIOLET TREATMENT SYSTEM 2 TO ZONE 2 - MOTORIZED ACTUATOR-GEARED, 450mm	ACTUATOR	HIGH LIFT PUMP STATION	2006	11	40	29	$	24,000.00	2	SITE REVIEW	2	3	6	
			414			BFV-17	VALMATIC	ZONE 2 DISCHARGE TO DISTRIBUTION SYSTEM - BUTTERFLY VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	3,300.00	2	SITE REVIEW	2	4	8	
			415			MA-13	VALMATIC	ZONE 2 DISCHARGE TO DISTRIBUTION SYSTEM - MOTORIZED ACTUATOR-GEARED, 300mm	ACTUATOR	HIGH LIFT PUMP STATION	2006	11	40	29	$	24,000.00	2	SITE REVIEW	2	4	8	
			416			BFV-18	VALMATIC	ULTRAVIOLET TREATMENT SYSTEM 2 TO CLEARWELL - DISCHARGE BUTTERFLY VALVE, 200mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	1,950.00	2	SITE REVIEW	2	2	4	
			417			PRV-01	VALMATIC	ULTRAVIOLET TREATMENT SYSTEM 2 TO CLEARWELL - PRESSURE RELIEF VALVE, 150mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	9,750.00	2	SITE REVIEW	2	2	4	
			418			BFV-19	VALMATIC	ZONE 1 DISCHARGE TO AGITATOR LINE - BUTTERFLY VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	3,300.00	2	SITE REVIEW	2	2	4	
			419			BFV-20	VALMATIC	ZONE 2 DISCHARGE TO AGITATOR LINE - BUTTERFLY VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	3,300.00	2	SITE REVIEW	2	2	4	
			420			CV-02	VALMATIC	ZONE 1/2 AGITATOR LINE - CHECK VALVE, 300mm	VALVE	HIGH LIFT PUMP STATION	2006	11	50	39	$	5,850.00	2	SITE REVIEW	2	2	4	
			421			PIPING-09		UV & CHLROINE DISINFECTION/ DISTRIBUTION - PIPING	PIPING	HIGH LIFT PUMP STATION	2006	11	50	39	$	231,000.00	2	SITE REVIEW	1	2	2	
ELECTRICAL			422																					
			423	N/A	UV701		CALGON CARBON C	UV CONTROL PANEL, 600V 60Hz, 3P 51A. MODEL CU1-8	UV SYSTEM	HIGH LIFT PUMP STATION	2006	11	25	14	$	150,000.00	1	SITE REVIEW	2	3	6	
			424	N/A	UV702		CALGON CARBON C	UV CONTROL PANEL, 600V 60Hz, 3P 51A. MODEL CU1-8	UV SYSTEM	HIGH LIFT PUMP STATION	2006	11	25	14	$	150,000.00	1	SITE REVIEW	2	3	6	
			425	N/A	UV703		CALGON CARBON C	UV CONTROL PANEL, 600V 60Hz, 3P 51A. MODEL CU1-8	UV SYSTEM	HIGH LIFT PUMP STATION	2006	11	25	14	$	150,000.00	1	SITE REVIEW	2	3	6	
STRUCTURAL			426																					
			427			CS-15		CONCRETE CONTACT CHAMBER 1	STRUCTURAL	CHLORINE CONTACT TANK	1976	41	100	59	$	660,000.00	3	DESKTOP REVIEW	2	3	6	
			428			CS-16		CONCRETE CONTACT CHAMBER 2	STRUCTURAL	CHLORINE CONTACT TANK	1914	103	100	-3	$	660,000.00	4	DESKTOP REVIEW	3	3	9	REFURBISHED 2014
BUILDING MECHANICAL			429																					
			430			CHEM-15		CHLORINE SCRUBBER SUCTION HEADER	BUILDING MECHANICAL	CHLORINE ROOM	1990	27	80	53	$	37,500.00	1	SITE REVIEW	1	4	4	
			431			CHEM-16		CHLORINE SCRUBBER UNIT	BUILDING MECHANICAL	FLOCCULATION BASIN ROOF	1990	27	80	53	$	67,500.00	1	SITE REVIEW	1	4	4	
			432			HOIST-01	RICHARD-WILCOX	HOIST	BUILDING MECHANICAL	CHLORINE ROOM	1914	103	100	-3	$	15,600.00	3	SITE REVIEW	3	5	15	
			433			HOIST-02	RICHARD-WILCOX	HOIST	BUILDING MECHANICAL	CHLROINE CONTACT INLET/ DISCHARGE HEADER	1976	41	100	59	$	7,800.00	3	SITE REVIEW	2	2	4	
			434			SP-03		SUMP PUMP	BUILDING MECHANICAL	CHLROINE CONTACT INLET/ DISCHARGE HEADER	2006	11	30	19	$	7,500.00	2	SITE REVIEW	1	3	3	
			435			HVAC-24		LOUVER	BUILDING MECHANICAL	ALUM ROOM	1976	41	100	59	$	4,500.00	2	SITE REVIEW	2	2	4	
INSTRUMENTATION			436																					
			437			INST-11		CHLORINE CONTACT TANK 1 - ULTRASONIC LEVEL TRANSMITTER 1	INSTRUMENTATION	FILTER 1/2 PIPING GALLERY	2006	11	15	4	$	4,500.00	2	SITE REVIEW	2	2	4	
			438			INST-12		CHLORINE CONTACT TANK 1 - ULTRASONIC LEVEL TRANSMITTER 2	INSTRUMENTATION	FILTER 1/2 PIPING GALLERY	2006	11	15	4	$	4,500.00	2	SITE REVIEW	2	2	4	
			439			INST-13		CHLROINE CONTACT TANK 2 - ULTRASONIC LEVEL TRANSMITTER 3	INSTRUMENTATION	FILTER 3/4 PIPING GALLERY	2006	11	15	4	$	4,500.00	2	SITE REVIEW	2	2	4	
			440			INST-14		CHLORINE CONTACT TANK 2 - ULTRASONIC LEVEL TRANSMITTER 4	INSTRUMENTATION	FILTER 3/4 PIPING GALLERY	2006	11	15	4	$	4,500.00	2	SITE REVIEW	2	2	4	
			441			INST-15		ULTRAVIOLET TREATMENT SYSTEM 1 TO ZONE 1 - MAGNETIC FLOW METER	FLOW MEASUREMENT	HIGH LIFT PUMP STATION	2004	13	15	2	$	12,000.00	2	SITE REVIEW	2	3	6	
			442			INST-16		ULTRAVIOLET TREATMENT SYSTEM 2 TO ZONE 2 - MAGNETIC FLOW METER	FLOW MEASUREMENT	HIGH LIFT PUMP STATION	2004	13	15	2	$	12,000.00	2	SITE REVIEW	2	3	6	
CLEARWELL CHAMBERS			443																					
PROCESS MECHANICAL			444																					
			445		BFV842			CLEARWELL CELL 1 - INLET MANUAL BUTTERFLY VALVE, 300mm	VALVE	CLEARWELL CHAMBERS	2006	11	50	39	$	3,300.00	1	SITE REVIEW	1	3	3	
			446			PIPING-10		CLEARWELL CELL 1 - DISCHARGE OVERFLOW PIPE TO LOW-LIFT PUMP STATION, 300mm	PIPING	CLEARWELL CHAMBERS	2006	11	90	79	$	15,000.00	1	SITE REVIEW	1	2	2	
			447			SG-02		CLEARWELL CELL 1/2 - SLUICE GATE, 600X600mm	GATE	CLEARWELL CHAMBERS	2006	11	50	39	$	22,500.00	1	SITE REVIEW	1	2	2	
			448		BFV852			CLEARWELL CELL 2 - INLET BUTTERFLY VALVE, 300mm	VALVE	CLEARWELL CHAMBERS	2006	11	50	39	$	3,300.00	1	SITE REVIEW	1	3	3	
STRUCTURAL			449																					
			450			CS-17		CONCRETE CLEARWELL CELL 1	STRUCTURAL	CLEARWELL CHAMBERS	2006	11	100	89	$	1,732,500.00	1	DESKTOP REVIEW	1	3	3	
			451			CS-18		CONCRETE CLEARWELL CELL 2	STRUCTURAL	CLEARWELL CHAMBERS	2006	11	100	89	$	2,194,500.00	1	DESKTOP REVIEW	1	3	3	
INSTRUMENTATION			452																					
			453	LIT531	LIT531			CLEAR WELL CELL 1 - ULTRASONIC LEVEL TRANSMITTER	INSTRUMENTATION	CLEARWELL CHAMBER 1	2006	11	15	3	$	4,500.00	4	SITE REVIEW	2	2	4	
			454	LIT532	LIT532			CLEAR WELL CELL 2 - ULTRASONIC LEVEL TRANSMITTER	INSTRUMENTATION	CLEARWELL CHAMBER 2	2006	11	15	3	$	4,500.00	4	SITE REVIEW	2	2	4	
WASTEWATER MANAGEMENT			455																					
PROCESS MECHANICAL			456																					
			457	WWP80	PWWP801		GORMAN RUPP	HOLDING TANK WASTEWATER CENTRIFUGAL PUMP 1, 4.5ML/d	PUMP	FILTER 1/2 PIPING GALLERY	1976	41	50	9	$	52,500.00	3	SITE REVIEW	3	3	9	
			458			PUMP-01	BROOK CORP	HOLDING TANK PUMP 1 - MOTOR, 10HP, 575V, 10.3Amps, 1170 RPM	MOTOR	FILTER 1/2 PIPING GALLERY	1976	41	50	9	$	37,500.00	4	SITE REVIEW	2	3	6	
			459			GV-06	MUELLER	HOLDING TANK WASHWATER PUMP 1 - GATE VALVE, 100mm	VALVE	FILTER 1/2 PIPING GALLERY	1976	41	50	9	$	1,200.00	3	SITE REVIEW	2	3	6	
			460		PRV113			HOLDING TANK WASHWATER PUMP 1 - PRESSURE RELIEF VALVE, 25mm	VALVE	FILTER 1/2 PIPING GALLERY	1976	41	50	9	$	3,450.00	4	SITE REVIEW	2	3	6	
			461		CV811		MUELLER	HOLDING TANK WASHWATER PUMP 1 - DISCHARGE CHECK VALVE, 100mm	VALVE	FILTER 1/2 PIPING GALLERY	1976	41	50	9	$	1,800.00	3	SITE REVIEW	2	3	6	
			462		BFV812		MUELLER	HOLDING TANK WASHWATER PUMP 1 - DISCHARGE GATE VALVE, 100mm	VALVE	FILTER 1/2 PIPING GALLERY	1976	41	50	9	$	1,200.00	3	SITE REVIEW	2	3	6	
			463	WWP80	PWWP802		GORMAN RUPP	HOLDING TANK WASHWATER CENTRIFUGAL PUMP 2, 4.5ML/d	PUMP	FILTER 1/2 PIPING GALLERY	2010	7	50	43	$	52,500.00	2	DESKTOP REVIEW	2	4	8	
			464			PUMP-02	NEMA	HOLDING TANK PUMP 2 MOTOR, 5HP, 575V, 4.99Amp, 1170 RPM	MOTOR	FILTER 1/2 PIPING GALLERY	1976	41	50	9	$	37,500.00	3	SITE REVIEW	2	4	8	
			465			GV-07	AVK	HOLDING TANK WASHWATER PUMP 2 - GATE VALVE, 75mm	VALVE	FILTER 1/2 PIPING GALLERY	1976	41	50	9	$	1,050.00	1	SITE REVIEW	1	3	3	
			466		PRV123		GORMAN RUPP	HOLDING TANK WASHWATER PUMP 2 - PRESSURE RELIEF VALVE, 25mm	VALVE	FILTER 1/2 PIPING GALLERY	1976	41	50	9	$	3,450.00	1	SITE REVIEW	1	3	3	
			467		CV821			HOLDING TANK WASHWATER PUMP 2 - DISCHARGE CHECK VALVE, 75mm	VALVE	FILTER 1/2 PIPING GALLERY	1976	41	50	9	$	1,350.00	1	SITE REVIEW	1	3	3	
			468		BFV822			HOLDING TANK WASHWATER PUMP 2 - MANUAL GATE VALVE, 75mm	VALVE	FILTER 1/2 PIPING GALLERY	1976	41	50	9	$	1,050.00	1	SITE REVIEW	1	3	3	
			469			VAC-02	VALVE & PRIMER CO	NOT INUSE - VACUUM PRIMING SYSTEM	PRIMING SYSTEM	FILTER 1/2 PIPING GALLERY	1976	41	N/A	N/A	$	60,000.00	N/A	SITE REVIEW	0	0	0	
			470			PIPING-11		HOLDING TANK - DISCHARGE PIPING, 100mm	PIPING	FILTER 1/2 PIPING GALLERY	1976	41	90	49	$	30,000.00	2	DESKTOP REVIEW	2	5	10	
STRUCTURAL			471																					
			472			CS-19		HOLDING TANK, GROSS VOL 502m^3, USEABLE VOL 210m^3	STRUCTURAL	FILTER 1/2 PIPING GALLERY	1976	41	100	59	$	2,557,500.00	2	SITE REVIEW	2	4	8	
			473			CS-20		CONCRETE OVERFLOW BASIN, XXm^3	STRUCTURAL	OUTDOORS BY CHLORINE ROOM ACCESS	1976	41	100	59	$	45,000.00	2	SITE REVIEW	2	2	4	
INSTRUMENTATION			474																					
			475			INST-17	KROHME	HOLDING TANK DISCHARGE HEADER TO SEWER - FLOW METER, 150mm	INSTRUMENTATION	FILTER 1/2 PIPING GALLERY	1994	23	15	-8	$	6,000.00	1	SITE REVIEW	2	2	4	
BACKUP POWER GENERATION			476																					
PROCESS MECHANICAL			477																					
			478					DIESEL GENERATOR COOLING ASSEMBLY	COOLING ASSEMBLY		1994	23	50	27	$	30,000.00	5	SITE REVIEW	4	5	20	
ELECTRICAL			479																					
			480	N/A	SWG		FEDERAL PIONEER	MAIN SWITCHGEAR 4160V, 1200A, 3PHASE, 3 WIRE, S/N 13735429-014	4160V POWER	GENERATOR ROOM	2006	11	30	19	$	420,000.00	1	SITE REVIEW	1	5	5	
			481	N/A	DS-2		FEDERAL PIONEER	4160V FEEDER SWITCH PANEL 4160V, 600A, 3PHASE, S/N 13735429-015	4160V POWER	GENERATOR ROOM	2006	11	30	19	$	67,500.00	1	SIT

			486	N/A	REMOTE I/O #2	ALLEN BRADLEY	(OLD) HLP MCC CONTROL PANEL, 1746 SERIES I/O MODULES	CONTROL	GENERATOR ROOM	1995	22	25	3	$ 52,500.00	3	SITE REVIEW	2	4	8		
	STRUCTURAL		487																		
			488		BLDG-04		GENERATOR BUILDING	STRUCTURAL	GENERATOR BUILDING	1994	23	60	37	$ 450,000.00	2	SITE REVIEW	1	1	1		
			489		SW-14		GENERATOR BUILDING EXTERIOR - BRICK	STRUCTURAL	GENERATOR BUILDING	1994	23	60	37	$ 67,500.00	2	SITE REVIEW	1	1	1		
			490		ACCESS-11		GENERATOR BUILDING - MAN DOOR ACCESS	STRUCTURAL	GENERATOR BUILDING	1994	23	60	37	$ 600.00	2	SITE REVIEW	2	3	6		

Appendix - B

Long Term Budgeting Tool

Orillia Water Filtration Plant Condition Assessment

Discount Rate: 4%
Inflation Rate 1%

Upgrade Description	NPV Total	2018	2019	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029
Filter Media Replacement	$ 2,100,000	$ 350,000					$ 350,000					$ 350,000	
Filter 1 & 2 Kick Plate Installation	$ 20,000		$ 20,000										
Conduct Transitent Analysis Study on the High Lift, Enact Recommendations	$ 40,000												
Low Lift MCC & Dry-Type Transformer Replacement	$ 445,000			$ 445,000									
Filter 3 & 4 Piping Gallery MCC Replacement	$ 20,000			$ 20,000									
PLC-1/PLC-2 I/O Modules and Panel Replacement (Control Room)	$ 270,000				$ 270,000								
Vacuum Priming System Inspection/Refurbishment	$ 20,000							$ 20,000					
Low Lift Pump/Motor Replacement	$ 160,000												
Site Works Upgrades (Fencing, Concrete Repairs, Roof Access Stairs, Access Hatches)	$ 55,000		$ 55,000										
Flocculation Tank Mud Valves Upgrade	$ 20,000												
Boiler Pump Refurbushment	$ 20,000				$ 20,000								
Roof Membrane Replacement	$ 80,000				$ 80,000								
Chlorinators (Post-Post Zone 1, Post-Post Zone 2, Stand-by) Replacement	$ 45,000		$ 45,000										
Concrete Repairs Plant Interior	$ 30,000		$ 30,000										
Electric Space Heaters Replacement	$ 40,000												$ 20,000
Electrical System Review	$ 20,000										$ 20,000		
Instrumentation Upgrades	$ 225,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000	$ 15,000
Concrete Inspection/ Repairs	$ 240,000			$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000
Current Year Sub-total	$ 3,810,000	$ 365,000	$ 165,000	$ 490,000	$ 395,000	$ 25,000	$ 375,000	$ 45,000	$ 25,000	$ 25,000	$ 45,000	$ 375,000	$ 45,000
Inflation Adjusted	$ 4,299,822	$ 372,337	$ 170,000	$ 509,896	$ 415,149	$ 26,538	$ 402,051	$ 48,729	$ 27,342	$ 27,616	$ 50,205	$ 422,559	$ 51,214
NPV	$ 2,773,147	$ 344,246	$ 151,129	$ 435,861	$ 341,222	$ 20,973	$ 305,526	$ 35,605	$ 19,210	$ 18,656	$ 32,612	$ 263,929	$ 30,758

Orillia Water Filtration Plant Condition Assessment

Discount Rate: 4%
Inflation Rate 1%

Upgrade Description	NPV Total	2030	2031	2032	2033	2034	2035	2036	2037	2038	2039	2040	2041	2042	2043
Filter Media Replacement	$ 2,100,000				$ 350,000					$ 350,000					$ 350,000
Filter 1 & 2 Kick Plate Installation	$ 20,000														
Conduct Transitent Analysis Study on the High Lift, Enact Recommendations	$ 40,000														
Low Lift MCC & Dry-Type Transformer Replacement	$ 445,000														
Filter 3 & 4 Piping Gallery MCC Replacement	$ 20,000														
PLC-1/PLC-2 I/O Modules and Panel Replacement (Control Room)	$ 270,000														
Vacuum Priming System Inspection/Refurbishment	$ 20,000														
Low Lift Pump/Motor Replacement	$ 160,000								$ 160,000						
Site Works Upgrades (Fencing, Concrete Repairs, Roof Access Stairs, Access Hatches)	$ 55,000														
Flocculation Tank Mud Valves Upgrade	$ 20,000					$ 20,000									
Boiler Pump Refurbushment	$ 20,000														
Roof Membrane Replacement	$ 80,000														
Chlorinators (Post-Post Zone 1, Post-Post Zone 2, Stand-by) Replacement	$ 45,000														
Concrete Repairs Plant Interior	$ 30,000														
Electric Space Heaters Replacement	$ 40,000	$ 20,000													
Electrical System Review	$ 20,000														
Instrumentation Upgrades	$ 225,000	$ 15,000	$ 15,000	$ 15,000											
Concrete Inspection/ Repairs	$ 240,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000
Current Year Sub-total	$ 3,810,000	$ 45,000	$ 25,000	$ 25,000	$ 360,000	$ 30,000	$ 10,000	$ 10,000	$ 170,000	$ 360,000	$ 10,000	$ 10,000	$ 10,000	$ 10,000	$ 360,000
Inflation Adjusted	$ 4,299,822	$ 51,726	$ 29,024	$ 29,314	$ 426,350	$ 35,884	$ 12,081	$ 12,202	$ 209,507	$ 448,098	$ 12,572	$ 12,697	$ 12,824	$ 12,953	$ 470,955
NPV	$ 2,773,147	$ 29,871	$ 16,116	$ 15,651	$ 218,876	$ 17,714	$ 5,734	$ 5,569	$ 91,939	$ 189,077	$ 5,101	$ 4,954	$ 4,811	$ 4,672	$ 163,335

LANDMARK
Elevating Expectations

Orillia Rosemary Reservoir #1
Clean Inspection & Report
October 15, 2017

Landmark Municipal Services

3091 Harrison Court
Burlington, ON CAN L7M 0W4
905.319.7700 Phone
905.319.7706 Fax

www.teamlandmark.com

January 31, 2018

City of Orillia
40 Kitchener Street
Orillia, ON
L3V 6Z9

Att: **Mr. John Hoos**
Manager Water Treatment and Supply
jhoos@orillia.ca

Ph: 705.325.4521

Re: LMS Job #17033: Clean Inspection and Report
Orillia Rosemary Rd - Reservoir # 1; Potable Water Storage Facility

Mr. Hoos;

A tank cleaning and inspection was performed at the above mentioned potable water storage facility on October 13th, 2017. Internal surfaces were cleaned via moderate pressure (2500 psi) and later disinfected in accordance with AWWA C652-11 Method #2.

The inspection was performed by LMS inspection crew. The editing, rendering and reporting was completed by the writer – David Baker NACE Certified Coatings Inspector – Level 2, CIP #329173.

This report has been prepared in order to provide the facility owner with a detailed description of the following:

1) Site works
2) Structural (surface) condition
3) Appurtenances

Landmark has not performed a design review, an ultrasonic, x-ray, or destructive and/or non-destructive testing. Comments and recommendations are based on visual inspection only and represents Landmark's professional judgement in reference to industry standards and best practices. This report may be based on information provided to Landmark which has not been independently verified. Its accuracy is limited to the time period and circumstances in which it was made. It was prepared for the specific purposes described in the report.

Any estimates regarding construction costs represent Landmark's judgement in light of our experience. Since Landmark has no control over market conditions, we do not make any representations or guarantees whatsoever with respect to such estimates or their potential variance from actual construction costs or schedules. Landmark accepts no responsibility for any potential losses.

In the case of subsurface, environmental or geotechnical conditions, the report is based on the assumption that such conditions are uniform and not variable either geographically or over time. Landmark makes no other representations or warranties whatsoever and accepts no responsibility for any events that may have occurred since the report was prepared.

Facility Information:

The City of Orillia Water distribution system includes two water storage reservoirs located on Rosemary Road (east of Highway 11). The east (small) reservoir has a capacity of approximately 1,365 m3. The west (large) reservoir has a capacity of approximately 9,100m3.

East and West reservoirs are inter-connected at-grade concrete tanks and are capable of being isolated using the Rosemary Road valve chamber.

East Reservoir

Location:	25 Rosemary Rd, Orillia, ON
Owner:	City of Orillia
Year Built:	1983
Engineer:	Ainley & Associates Ltd.
Constructor:	Unknown
Capacity:	1,365 m3
Dimensions:	48 ft diameter x 28 ft tall
Lining system:	Evidence of a lining system only present at concrete joints and at floor to sidewall connection.
Fill Line:	400mm (16”) Ductile Iron fill line from valve chamber
Discharge Line:	400mm (16”) Ductile Iron discharge line to valve chamber
Discharge Line Elev:	272.830 (Approximately 1 ft above floor slab)
Overflow:	400mm (16”) Ductile Iron (discharge approximately 4’-6” below grade)
Overflow Elevation:	280.550
Finished Grade Elev:	248.00 +/-

This reservoir consists of a cast-in-place cylindrical concrete structure of which over half of its height is below ground level.

The roof of the tank is also cast in place reinforced concrete which is approximately 8 inches thick at the outer perimeter and is supported by a single concrete centre column.

The following are our findings in relation to the current condition of the reservoir:

Site works

The reservoir is properly back-filled and there is no visible soil erosion, under-cutting or other signs of leaking. The grade is properly sloped away from the tank.

There is an enclosure box which houses the electrical panel and operational equipment. The hinges and interior of the enclosure is corroded including incoming conduits and Unistrut support. We'd recommend replacing the enclosure within 2-4 years with a new NEMA 4 type enclosure.

The below grade valve chamber is in good condition. There is water present along the floor, however, the floor is adequately sloped towards the sump pump basin.

-The access ladder and associated brackets are in good condition. The rung width measures 15" whereas code requirement is 16".

-All piping within the pit is in good condition, with minor surface corrosion present. Due to the fairly corrosive environment (high humidity), a maintenance coat will be required within the next 2 years.

Security fence is present and in good condition. There is no barbed wire present, but adequate signage is posted.

Cell Condition

Sediment levels were minimal, with just a light layer visible on the bottom before the last 8 inches of water was pumped out. There do not appear to be any active cracks that might be leaking, and the floor to side joint appears to be sound. The roof has only minor hairline cracks which are a result of curing and are self-healed, and not active. (Photos 51 - 56).

The concrete itself is in good condition, with no noticeable cracks, efflorescence, spalling or de-lamination.

The exterior roof joint seam has deteriorated and requires replacement. The gap is approximately ¾" wide x ½" deep x 152 ft long.

Appurtenances

There are two 12" galvanized steel and painted gooseneck vents on this reservoir, which are in good condition (Photos 45 - 49).

Ductile iron piping within the reservoir is extremely corroded and should be sandblasted / painted or replaced. (Photos 79 - 81).

The aluminum handrail on the roof is in good condition, except that it requires approximately 40 linear feet of 5" kickplate (Photo 59).

The access ladders into this reservoir are of aluminum construction, and are in good condition except that they are only 15 inches wide, rather than the minimum 15 ¾", contrary to MOL guidelines (Photos 36 – 37, 63 – 71, 100).

The intermediate landing is in good condition except that it requires 5 inch tall kickplate on two of its sides.

The 47" x 47" access reservoir hatch is of aluminum construction, and is in good condition (Photos 60 - 62). The same size valve pit lid hatch is also in good condition.

Recommendations

1. Replace electrical panel enclosure and associated conduits within 2 – 4 years

2. Apply maintenance coat to valves / piping in below grade chamber within 2 years

3. Remove exterior roof joint seam and apply elastomeric, polyurethane type sealant
   $ 10,000

4. Abrasive blast clean and the re-coat ductile iron piping with an NSF 61 approved epoxy. Or remove and replace. Budget $40,000

5. Supply and install kickplate on rooftop handrail
   $ 1,500

6. Power wash exterior walls and re-apply 'Orillia' Lettering
   $ 30,000

7. During next shutdown – Recommended in 2021 - Budgetary pricing (2018 $) for concrete repairs / crack injection – if found

	Unit Rate
Vertical Joint Repair	$ 60.00 per LF
Horizontal Joint Repair	$ 50.00 per LF
Concrete Repairs	$ 700.00 per ft2
Injection Team	$ 4,000 per day
	20m of injecting is achievable in 1 day

Please review enclosed photographic journal and video for additional details.
Should you have any questions or comments regarding the content of this report, please contact us at 905 319 7700.

Yours Sincerely,
LANDMARK MUNICIPAL SERVICES

Dave Baker
NACE Coatings Inspector – Level 2, CIP #329173
Encl.

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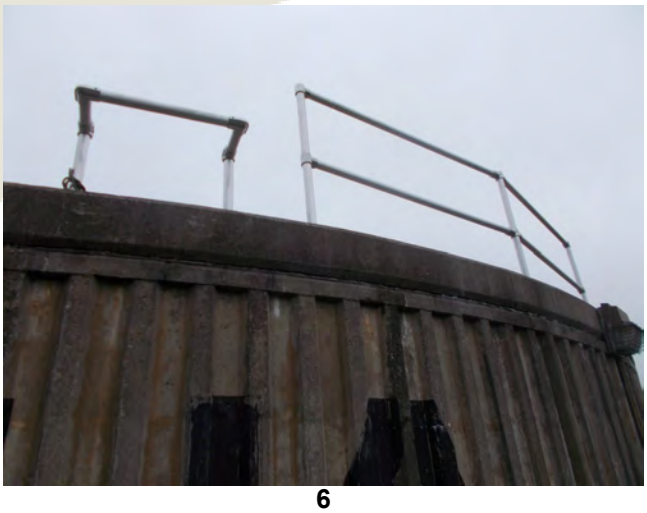

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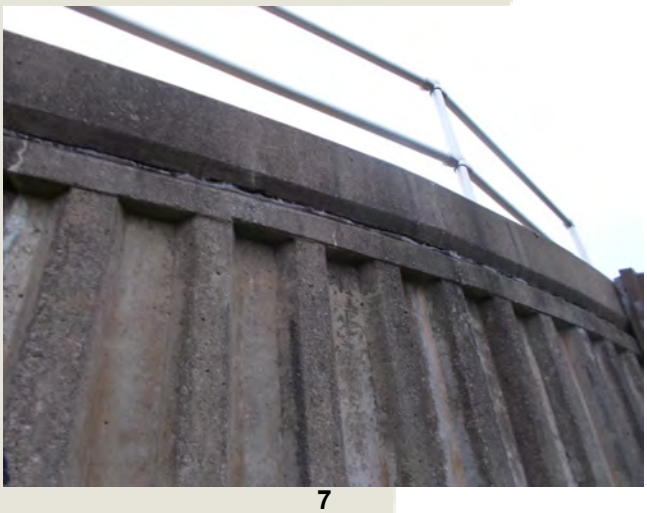

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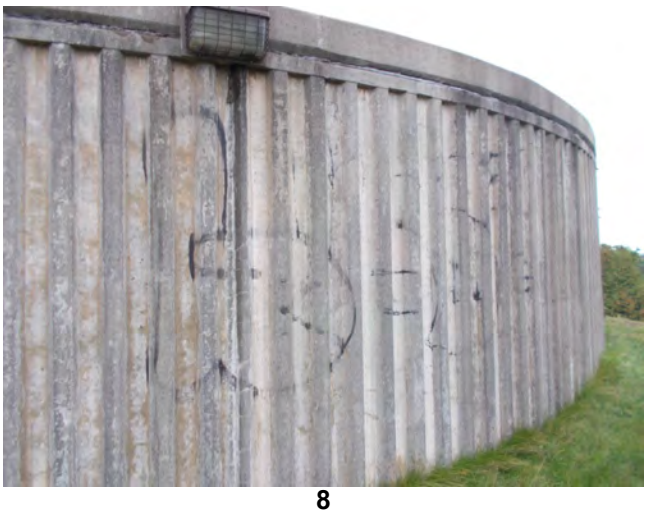

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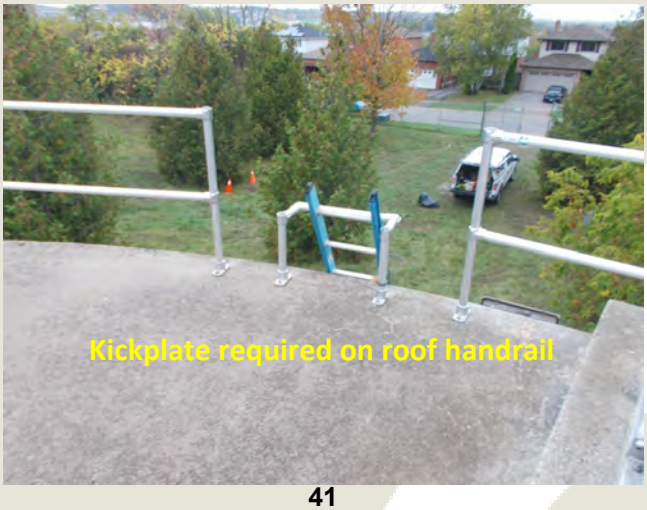

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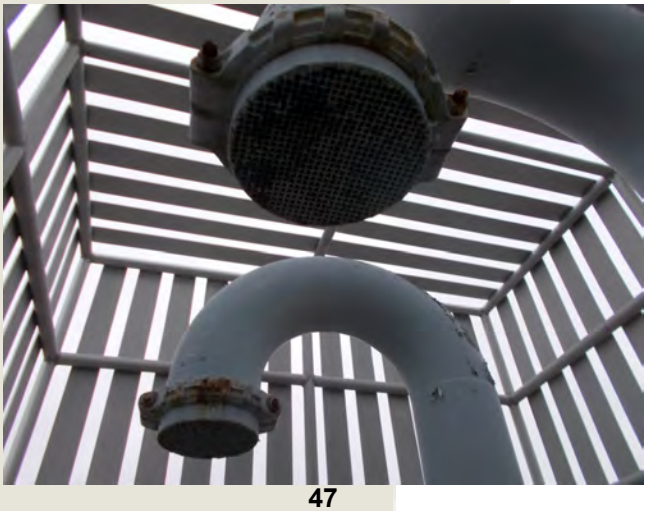

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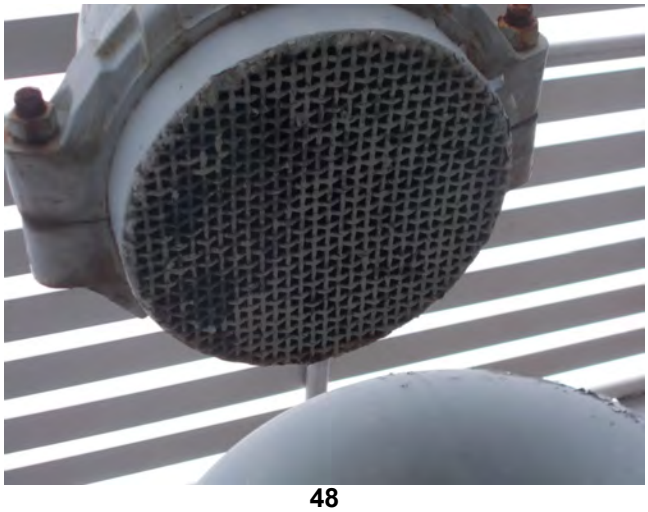

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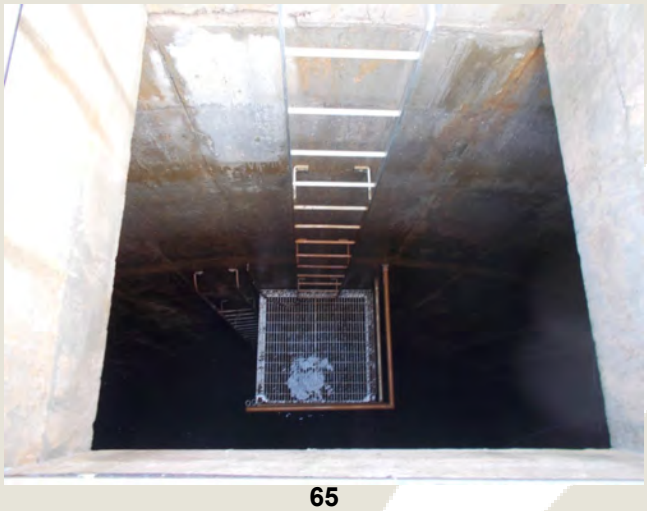

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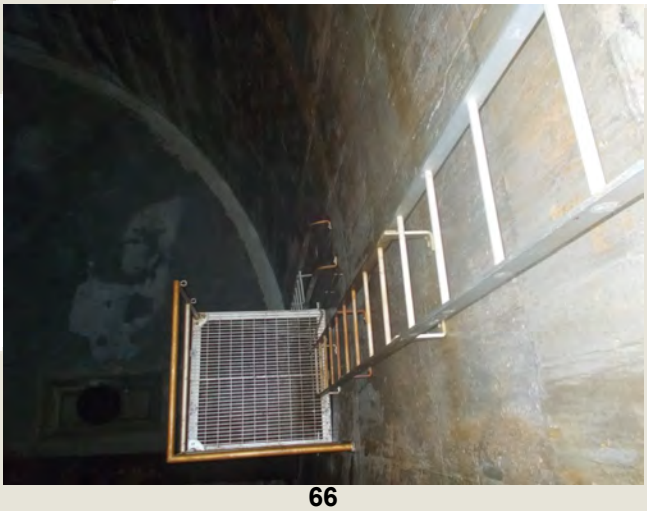

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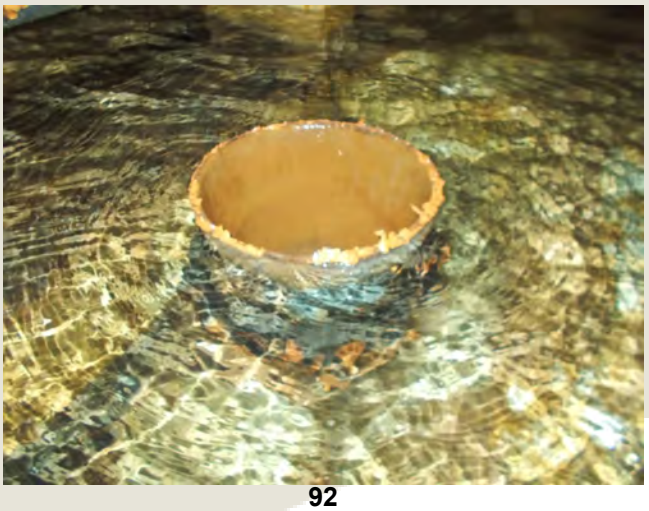

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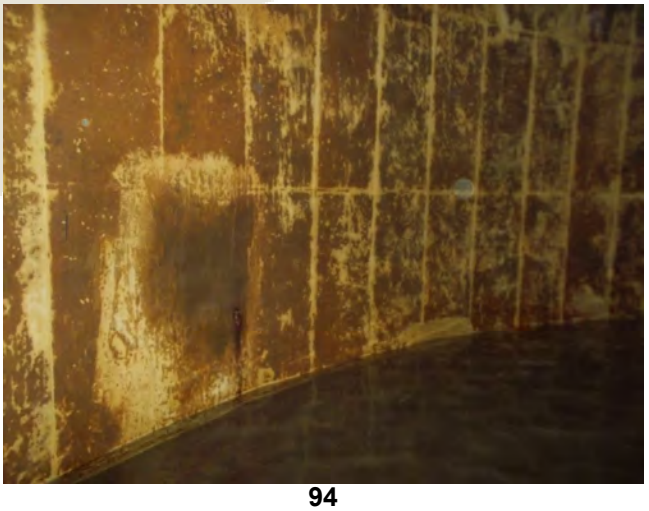

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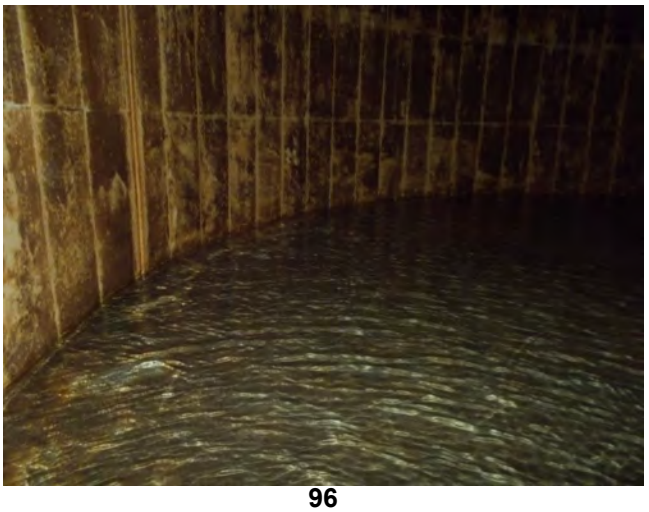

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ORILLIA ROSEMARY RESERVOIR #1- CLEAN INSPECTION & REPORT: OCTOBER 13, 2017

LANDMARK
Elevating Expectations

Orillia Rosemary Reservoir #2
Clean Inspection & Report
December 1, 2017

Landmark Municipal Services

3091 Harrison Court
Burlington, ON CAN L7M 0W4
905.319.7700 Phone
905.319.7706 Fax

www.teamlandmark.com

January 31, 2018

City of Orillia
40 Kitchener Street
Orillia, ON
L3V 6Z9

Att: **Mr. John Hoos**
Manager Water Treatment and Supply
jhoos@orillia.ca

Ph: 705.325.4521

Re: LMS Job #17033: Clean Inspection and Report
Orillia Rosemary Rd - Reservoir # 2; Potable Water Storage Facility

Mr. Hoos;

A tank cleaning and inspection was performed at the above mentioned potable water storage facility on December 1st, 2017. Internal surfaces were cleaned via moderate pressure (2500 psi) and later disinfected in accordance with AWWA C652-11 Method #2.

The inspection was performed by LMS inspection crew. The editing, rendering and reporting was completed by the writer – David Baker NACE Certified Coatings Inspector – Level 2, CIP #329173.

This report has been prepared in order to provide the facility owner with a detailed description of the following:

1) Site works
2) Structural (surface) condition
3) Appurtenances

Landmark has not performed a design review, an ultrasonic, x-ray, or destructive and/or non-destructive testing. Comments and recommendations are based on visual inspection only and represents Landmark's professional judgement in reference to industry standards and best practices. This report may be based on information provided to Landmark which has not been independently verified. Its accuracy is limited to the time period and circumstances in which it was made. It was prepared for the specific purposes described in the report.

Any estimates regarding construction costs represent Landmark's judgement in light of our experience. Since Landmark has no control over market conditions, we do not make any representations or guarantees whatsoever with respect to such estimates or their potential variance from actual construction costs or schedules. Landmark accepts no responsibility for any potential losses.

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Facility Information:

The City of Orillia Water distribution system includes two water storage reservoirs located on Rosemary Road (east of Highway 11). The east (small) reservoir has a capacity of approximately 1,365 m3. The west (large) reservoir has a capacity of approximately 9,100m3.

East and West reservoirs are inter-connected at-grade concrete tanks and are capable of being isolated using the Rosemary Road valve chamber.

West Reservoir

Location:	25 Rosemary Rd, Orillia, ON
Owner:	City of Orillia
Year Built:	1996
Engineer:	Ainley & Associates Ltd.
Constructor:	Unknown
Capacity:	9,100 m3
Dimensions:	124 ft diameter x 27 ft tall
Lining system:	Seam sealant applied at floor to wall interface
Fill Line:	400mm (16”) Ductile Iron fill line from valve chamber
Discharge Line:	400mm (16”) Ductile Iron discharge line to valve chamber
Drain sump Elev:	272.175
Tank Floor Elev:	272.680
HWL:	280.400
Edge of Tank Roof Elev:	281.150
Top of Roof Elev:	281.350

This reservoir consists of a cast-in-place cylindrical concrete structure of which half of its height is below ground level.

The roof of the tank is also cast in place reinforced concrete which is approximately 8 inches thick at the outer perimeter and is supported by 9 columns.

The following are our findings in relation to the current condition of the reservoir:

Site works

The reservoir is properly back-filled and there is no visible soil erosion, under-cutting or other signs of leaking. The grade is properly sloped away from the tank.

As mentioned in the 'East' reservoir report…

There is an enclosure box which houses the electrical panel and operational equipment. The hinges and interior of the enclosure is corroded including incoming conduits and Unistrut support. We'd recommend replacing the enclosure within 2-4 years with a new NEMA 4 type enclosure.

The below grade valve chamber is in good condition. There is water present along the floor, however, the floor is adequately sloped towards the sump pump basin.

-The access ladder and associated brackets are in good condition. The rung width measures 15" whereas code requirement is 16".

-All piping within the pit is in good condition, with minor surface corrosion present. Due to the fairly corrosive environment (high humidity), a maintenance coat will be required within the next 2 years.

Security fence is present and in good condition. There is no barbed wire present, but adequate signage is posted.

Cell Condition

Sediment levels were minimal, with just a light layer visible on the bottom before the last few inches of water was drained out. The outside concrete surfaces have approximately 290 linear feet of surface cracks, none of which appears active and which may have 'self-healed'. The outside roof has many minor hairline cracks which are a result of curing. These small cracks may allow ingress of water into the concrete, which can freeze and expand causing spalling and corrosion to the reinforcement steel (Photos 8, 18 - 22). The roof should have an elastomeric waterproofing membrane applied.

The interior concrete surfaces are in good condition, with no spalling or de-lamination. There is some type of troweled-on cementitious coating on the interior wall surfaces, and there are a few small areas where this has delaminated down to the concrete.

The exterior roof joint seam has deteriorated and requires replacement. The gap varies in width and continues around the entire circumference (Photo 10 – 14).

Appurtenances

There are two 13 inch galvanized and painted steel gooseneck vents on this reservoir, which are in good condition. (Photos 36 - 37).

Cast iron pipe flanges within the reservoir are extremely corroded (Photo 46).

The aluminum handrail on the roof is in good condition, except that it requires approximately 30 linear feet of 5" kickplate (Photos 27 - 28).

The access ladders into this reservoir are of aluminum construction, and are in fair condition with some oxidation, but they are only 15 inches wide, rather than the minimum 15 ¾", contrary to MOL guidelines (Photos 40).

The 48" x 48" access reservoir hatch is of aluminum construction, and is in good condition (Photo 38). The same size valve pit lid hatch is also in good condition.

Recommendations

As mentioned in the 'East' reservoir report…

1. Replace electrical panel enclosure and associated conduits within 2 – 4 years

2. Apply maintenance coat to valves / piping in below grade chamber within 2 years

Specific to the 'West' reservoir

3. Remove exterior roof joint seam and apply elastomeric, polyurethane type sealant
   $ 25,000

4. Surface prepare and re-coat corroded fittings within reservoir with NSF 61 approved epoxy.
   $ 15,000

5. Supply and install kickplate on rooftop handrail
   $ 1,500

6. Surface prepare and apply elastomeric waterproofing membrane to the tank roof
   Budget $7 / ft2 x 13,000 ft2 = **$90 – 100,000**

7. During next shutdown – Recommended in 2021 - Budgetary pricing (2018 $) for concrete repairs / crack injection – if found

	Unit Rate
Vertical Joint Repair	$ 60.00 per LF
Horizontal Joint Repair	$ 50.00 per LF
Concrete Repairs	$ 700.00 per ft2
Injection Team	$ 4,000 per day
	20m of injecting is achievable in 1 day

Please review enclosed photographic journal and video for additional details.

Should you have any questions or comments regarding the content of this report, please contact us at 905 319 7700.

Yours Sincerely,
LANDMARK MUNICIPAL SERVICES

Dave Baker
NACE Coatings Inspector – Level 2, CIP #329173

Encl.

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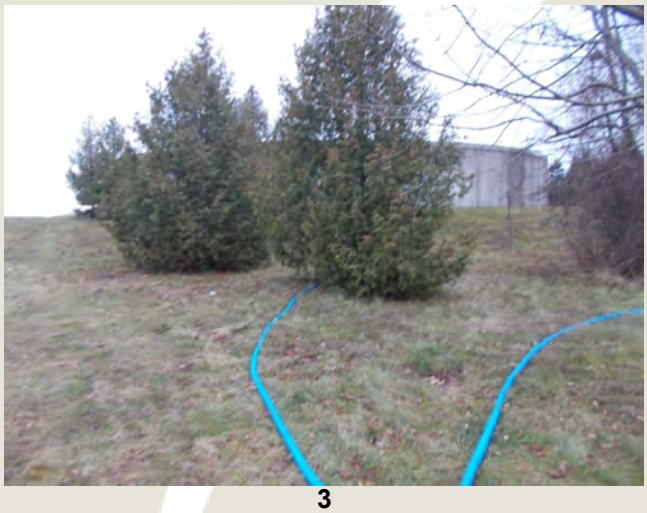

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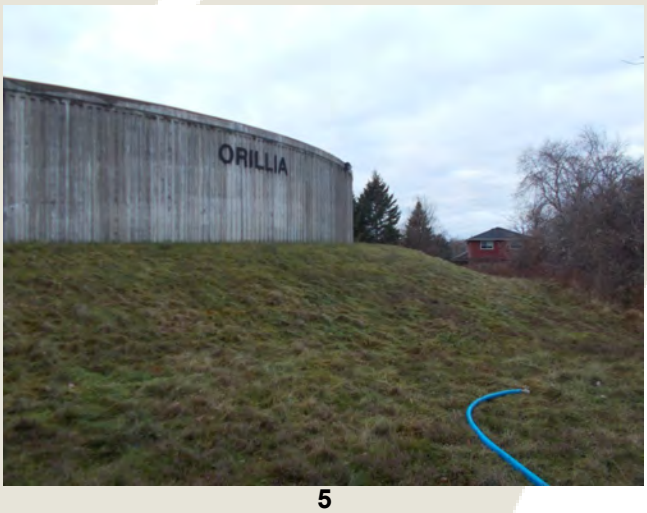

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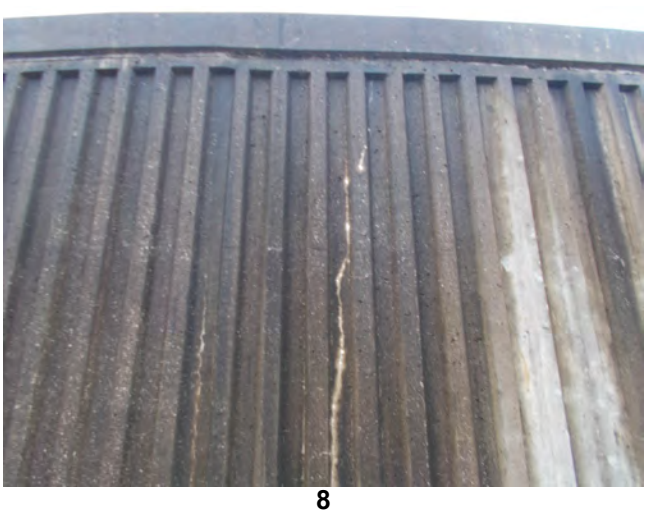

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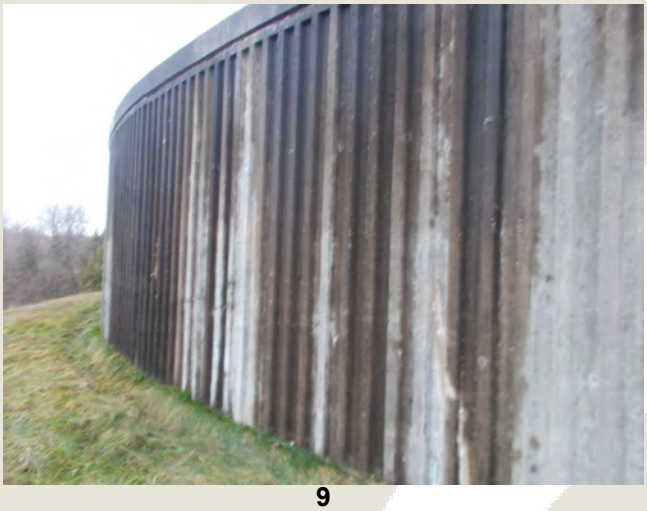

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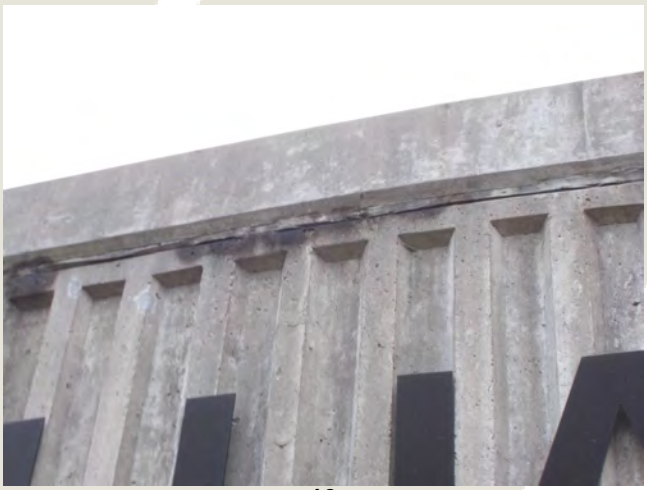

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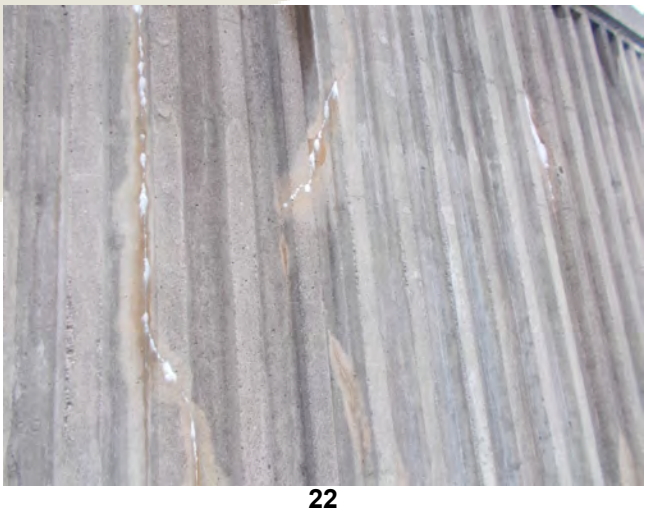

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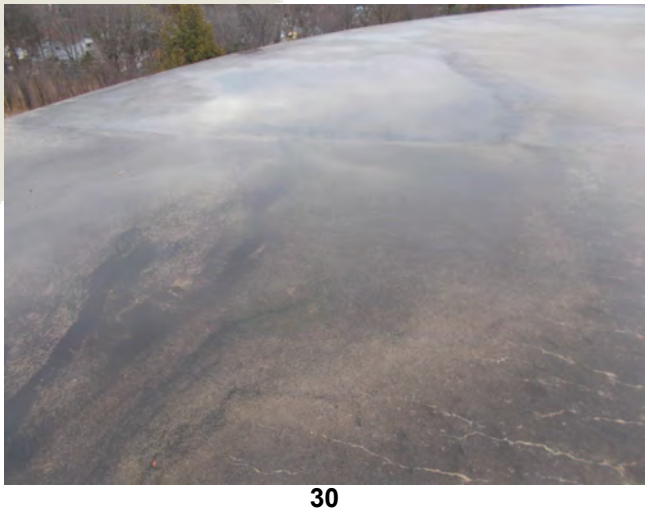

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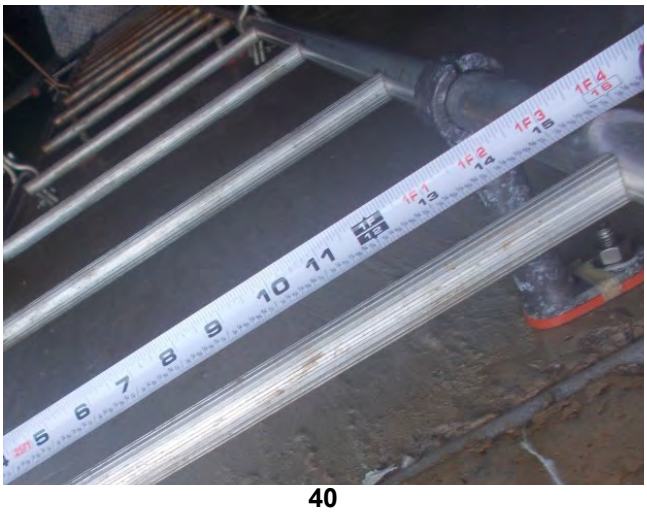

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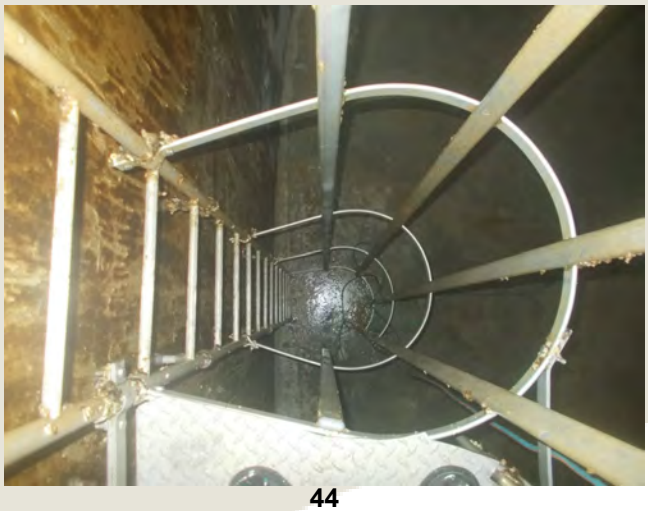

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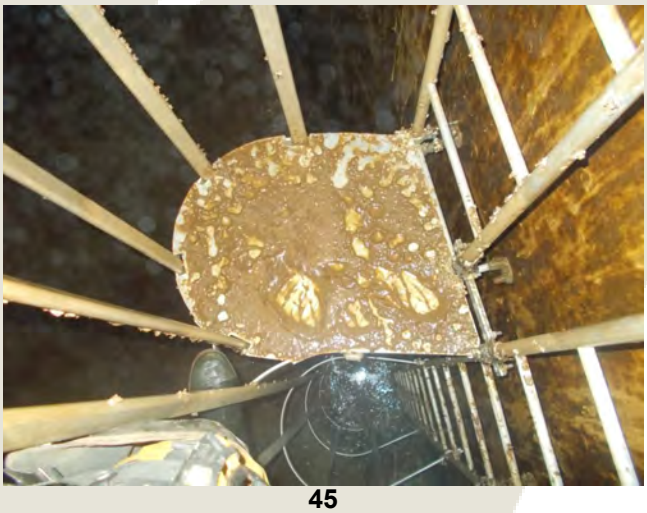

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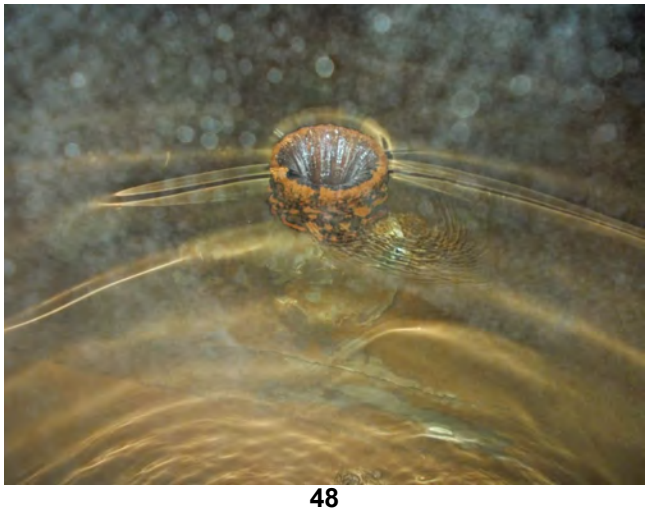

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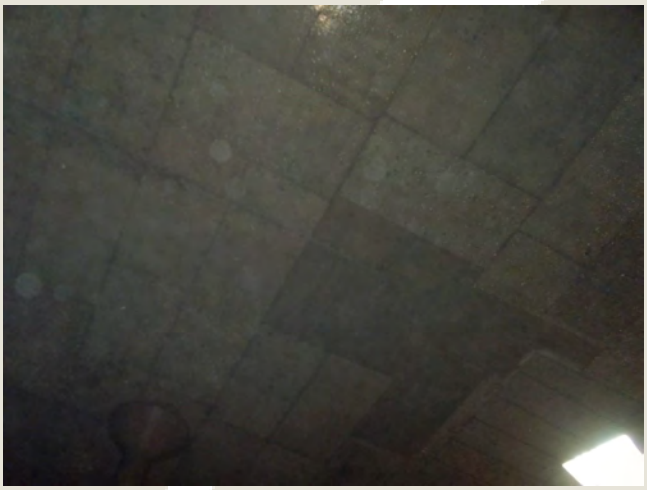

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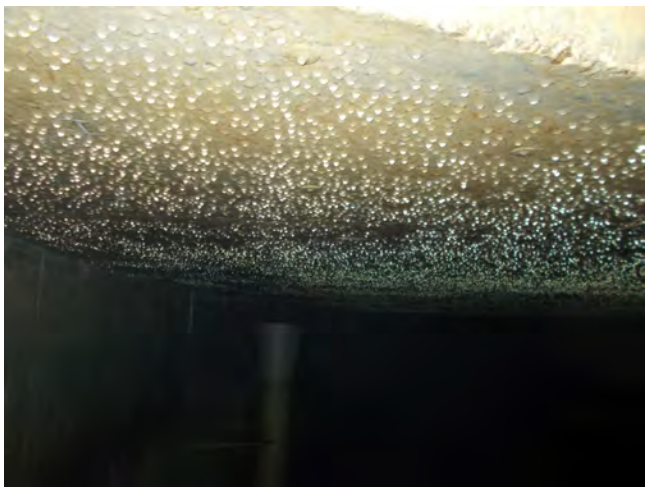

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ORILLIA ROSEMARY RESERVOIR #2- CLEAN INSPECTION & REPORT: DECEMBER 1, 2017

LANDMARK
Elevating Expectations

Orillia - Harvie Hill Gunite Standpipe
Remote Inspection & Report
October 11, 2017

Landmark Municipal Services

3091 Harrison Court
Burlington, ON CAN L7M 0W4
905.319.7700 Phone
905.319.7706 Fax

www.teamlandmark.com

January 31, 2018

City of Orillia
40 Kitchener Street
Orillia, ON L3V 6Z9

Att: **Mr. John Hoos**
Manager Water Treatment and Supply
jhoos@orillia.ca

Ph: 705.325.4521

Re: LMS Job #LM17036: Remote, Inspection & Report:
Orillia Harvie Hill Gunite Standpipe; Potable Water Storage Facility

Dear Mr. Lauber:

An ROV underwater camera tank inspection was performed at the above mentioned potable water storage facility on October 11, 2017. The ROV unit and tether cable were disinfected in accordance with AWWA-C652-11 Method #2 guidelines (200ppm solution) prior to entry into the tank interior. Landmark's ROV equipment is designated for potable water use only.

A thorough inspection of the existing structure including ladders, landings, handrails, appurtenances and the protective coating and lining system was completed.

Please find a comprehensive report enclosed as follows;

1) Gunite Standpipe Inspection Report Pages 1 – 4
2) Photographic Record of Report Pages 5 - 20
- Photographs are numbered in accordance with the corresponding numbers throughout the report.
3) Coatings & Linings Report
4) Quotation #17219 for all recommended upgrades & repairs.

Should you have any questions or comments regarding the content of this report, please contact us at 905 319 7700.

Yours sincerely,
LANDMARK MUNICIPAL SERVICES

Brent Marini

Encl.

Fall Arrest System Update

Effective December 1, 2016, the CSA Group updated its standards relating to fall arresters and rigid rail systems. The update has resulted in the previous standard, Z259.2.1-98 (2011) (the "2011 CSA Standard"), being separated into two new standards: (a) CSA-Z259.2.4-15 – Fall Arresters and Vertical Rigid Rails; and (b) CAN/CSA-Z259.2.5-12(2016) – Fall Arresters and Vertical Lifelines.

The impetus for the changes to the 2011 CSA Standard was driven by an incident in which a worker was critically injured while using a rigid rail type of fall protection system in 2014 – a copy of this notice is included at the end of this report. The Ontario Ministry of Labour's investigation into the matter revealed a weakness in the design of some Class Frontal-Fixed Rail Ladder Fall Protection Systems, which may not adequately protect workers who fall backwards or who squat and roll backwards into a fall while connected by a body harness to the trolley which slides along the vertical rail.

Particular to our review of the subject potable water storage facility is CSA-Z259.2.4-15 – Fall Arresters and Vertical Rigid Rails ("2016 CSA Standard"). Generally, the revisions included in the 2016 Standard fall into 3 categories: (i) increased compatibility requirements between fall arresters, harnesses, and vertical rigid rail systems. These changes can primarily be found in sections 4.3.5, 4.4, and 4.5; (ii) the addition of 4 new mandatory testing requirements for rigid rail systems, which can be found in sections 5.3 through 6.4; and (iii) new marking requirements in sections 7.1, 7.2, and 7.3.

As per section 5.3.1, all new testing requirements must be met in order for the rigid rail system to be certified as compliant under the 2016 CSA Standard.

Landmark has followed up with the CSA Group in an attempt to determine the status of TS Group's compliance. In the case of fall arresters and vertical rigid rails, it appears that the TS Group has not been certified by the CSA Group with respect to the new 2016 Standard.

Please refer to quotation #Q17219 for pricing to remove and replace the existing fall arrest system with Honeywell Safety Products – "Soll GlideLoc" who are compliant with the new 2016 Standard.

This report has been prepared by Landmark Municipal Services for the City of Orillia.

This report has been prepared in order to provide the facility owner with a detailed description of the following:

The present condition of interior and exterior coatings, any pitting and/or corrosion on the interior of the water retaining vessel, the apparent condition of exposed foundations and the status of and recommendations for upgrades on safety equipment and other facility appurtenances.

Landmark Municipal Services has not performed a design review, an ultrasonic, x-ray, or destructive and/or non-destructive testing unless stated in the report. Comments and recommendations are based on visual inspection only and represents Landmark's professional judgement in reference to industry standards and best practices. This report may be based on information provided to Landmark which has not been independently verified. Its accuracy is limited to the time period and circumstances in which it was made. It was prepared for the specific purposes described in the report.

Any estimates regarding construction costs represent Landmark's judgement in light of our experience. Since Landmark has no control over market conditions, we do not make any representations or guarantees whatsoever with respect to such estimates or their potential variance from actual construction costs or schedules. Landmark accepts no responsibility for any potential losses.

In the case of subsurface, environmental or geotechnical conditions, the report may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time. Landmark makes no other representations or warranties whatsoever and accepts no responsibility for any events that may have occurred since the report was prepared.

3091 Harrison Court, Burlington ON L7M 0W4
Tel: (905) 319-7700 Fax: (905) 319-1373
www.teamlandmark.com

GUNITE STANDPIPE TANK INSPECTION REPORT

Landmark Contract No.	Inspection Date	Last Inspection Date
LM17036	11-Oct-17	Unknown
Inspector	**Report Date**	**Inspected By**
P. Furtado	27-Nov-17	Unknown

OWNER / CONTACT

Owner	**City of Orillia**	**Contact**	**Mr. John Hoos**
Project Location	Harvie Hill Gunnite Standpipe	**Title**	Manager Water Treatment and Supply
		Phone	705.325.4521
Address	546 Harvie Settlement Road Orillia, ON	**Fax:**	--
		Email	jhoos@orillia.ca

TANK DESCRIPTION

Constructor	The Canada Gunite Company	**Tank Capacity**	2,000,000 imperial gallons
Tank Type	AWWA D110 Type II Prestressed Gunite Tank	**Year Built**	1968
Dwg's Available	Yes	**Tank Diameter**	79'
Dwg's Reviewed	Yes	**Tank Floor Elevation**	955.0'
Exterior Surfaces	Acrylic type of material	**Grade Elevation**	964.0'
Lining System	Cem-kote Flex ST	**Overflow Elevation**	57.64'
Age of Paint	Ext. overcoat & Interior membrane - 8 years (2009)	**Roof Type**	Concrete dome

Note

The attached report has been prepared in order to provide the tower owner with a detailed description of the following: The present condition of interior and exterior coatings, any pitting and/or corrosion on the interior of the water retaining vessel, the apparent condition of exposed foundations and the status of and recommendations for upgrades on safety equipment and other appurtenances.

Landmark Municipal Services has not performed a design review, an ultrasonic, x-ray, or destructive and/or non-destructive testing. Comments and recommendations are based on visual inspection only.

REPORT SUMMARY

Legend:

URGENT! Immediate attention required	Separate Report Available
Repairs strongly recommended	Repairs Completed During Inspection

Repairs Made During Inspection	Photo No.
Watertight cap installed on rescue port	85
	--
	--

Recommended Repairs

	Photo No.
Siteworks	
Maintain gravel driveway and 'overgrowth' around fence	--
	--
	--
Security	
Install security gate at bottom of vertical ladder	51
Padlock required on hatch to tank interior	63
	--
Valve Chamber	
Surface prepare and paint valves and pipes	16 - 24
Remove and replace ladder to valve pit	13 - 15
	--
Foundations	
	--
	--
Support Structure	
Separate Report available	--
	--
	--
Anchorage	
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	--
Accessories	
Apply anti-slip surface to smooth ladder rungs	56
Remove and replace handrail kickplate with 5"	53
Extend overflow pipe to grade level c/w spillway	61
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	Photo No.
Mixing System	
	--
	--
	--
Fall Arrest System	
Remove and replace fall arrest system on vertical ladder	52
Please review cover letter for latest information regarding CSA Standard CSA-Z259.2.4-15 (Fall arresters and Vertical Rigid Rails)	
D' ring required at top of vertical ladder	60
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Confined Space & Rescue System	
Rescue port base required at top of vertical ladder	63
Surface prepare and paint rescue port base on tank roof	86
	--
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Protective coating / lining system(s)	
Separate Report available	--
Surface prepare and paint roof handrail and hatch frame	88 - 91
Replace corroded bolt sets, flanges, fittings on Mixing System	109 - 115
Repair delaminated areas on exterior sidewalls	33 - 39
	--
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	--

Thank you for allowing Landmark Municipal Services to assist you in the maintenance of your water storage facility.
To maintain the integrity of your facility we recommend that you schedule your next:

Safety inspection and report	**2018**
Clean, inspect and report	**2020**
Remote Inspection & Report	**2024** ***3 yrs after CIR***

		Photo No.
SITEWORKS		
EXTERIOR VALVE CHAMBER	None - below grade valve pit present	11
DRIVEWAY / WALKWAYS	Fair; gravel driveway should be maintained	1 - 2
OVERFLOW SPILLWAY	None - Overflow discharges at High Water level	61

REPAIRS OR MAINTENANCE REQUIRED

SECURITY		
FENCE & GATES	Good, warning signs posted; Maintain overgrowth around fence line	2 - 4
VERTICAL LADDER	Ladder does not have security gate; starts approximately 10ft from grade level	51
HATCH LOCKS	None	63

REPAIRS OR MAINTENANCE REQUIRED

Install security gate at bottom of vertical ladder

Padlock required on hatch to tank interior

VALVE CHAMBER / PIT		
CONDITION OF VALVE CHAMBER / PIT	Good	13 - 28
CONDITION OF PIPING	Moderate surface corrosion throughout	16 - 24
CONDITION OF VALVES	Moderate surface corrosion throughout	16 - 24
ARE THERE ANY INDICATIONS OF SETTLEMENT (Exterior)?	No	16 - 24
IS THE CONCRETE IN THE CHAMBER CRACKED, SPALLED OR LEAKING?	No	16 - 24
IS THERE ANY INDICATION OF PIPE MOVEMENT?	No	16 - 24

REPAIRS OR MAINTENANCE REQUIRED

Surface prepare and paint valves and pipes

Remove and replace ladder to valve pit

FOUNDATIONS		
ARE THERE ANY INDICATIONS OF FOUNDATION SETTLEMENT?	No	44 - 50
IS CONCRETE CHIPPED OR CRACKED	No	44 - 50
IS THE SOIL AT THE BASE SATURATED OR IS THERE PONDED WATER?	No	44 - 50
IS THERE ANY INDICATION OF UNDERGROUND PIPE LEAKAGE?	No	44 - 50
IS SOIL AT BASE ERODED?	No	44 - 50
HOW FAR DOES THE FOUNDATION EXTEND OUT OF GROUND?	N/A	44 - 50

REPAIRS OR MAINTENANCE REQUIRED

SUPPORT STRUCTURE		
CONDITION OF TANK FLOOR	Good	105 - 116
SIDEWALLS OF TANK	Good	30 - 34
ROOF CONDITION	Good	79 - 82

REPAIRS OR MAINTENANCE REQUIRED

Separate report available

ANCHORAGE		
IS BASE PLATE DETERIORATED OR IN POOR CONDITION?	N/A	--
ARE ANCHOR BOLTS & NUTS DETERIORATED OR IN POOR CONDITION?	N/A	--
ARE ANCHOR BOLT CHAIRS DETERIORATED OR IN POOR CONDITION?	N/A	--
ARE ANCHOR BOLTS TIGHT?	N/A	--
CONDITION OF STRAP ANCHORS?	N/A	--

REPAIRS OR MAINTENANCE REQUIRED

N/A for 'not applicable' or N/I for 'not inspected'.

ACCESSORIES			Photo No.
LADDERS	*To Top Landing	Good (anti-slip surface required on smooth ladder rungs)	51 - 59
	* On Roof	Cast-in place rungs are present on conrete roof (7pcs)	72 - 75
	* To Tank Interior	Minor oxidation / corrosion present. Further inspect during next shutdown	94 - 96
REST SEATS		None	57
ROOF HATCHES	* Size	3'-6" sq Aluminum hatch Cover; 2'-6" sq opening	89 - 91
	* Condition	Fair - Moderate surface corrosion to hatch frame	87 - 91
VENT	* Type	24" dia dome vent on tank roof; 2'-6" x 4' Ventilation opening at sidewall of tank	76 - 78 35 - 36
	* Condition	Fair; top of vent has been damaged; Good	76 - 78 35 - 36
ROOF HANDRAIL		Fair - kickplate is only 3" tall (code requirement is 5") Surface corrosion throughout	65 - 71
GROUND LEVEL TANK ACCESS		18" x 12" manway	41 - 43
OVERFLOW PIPE		Overflow pipe should extend to grade level c/w spillway	61
CATHODIC PROTECTION	* Type	None	--
	* Manufacturer	--	--
CHLORINE ANALYSIS / DEAD ZONE TESTING		Recommended	--
MIXING SYSTEM		S.S. Tideflex system - Corroded boltsets, flanges, victaulic coupling	108 - 115

REPAIRS OR MAINTENANCE REQUIRED

Apply anti-slip surface to smooth ladder rungs

Remove and replace handrail kickplate with 5"

Surface prepare and paint roof handrail and hatch frame

Extend overflow pipe to grade level c/w spillway

Replace corroded bolt sets, flanges, fittings on Mixing System

FALL ARREST SYSTEM

LADDER LOCATION	SYSTEM TYPE	COMMENTS	
* To Roof	Alumin TS Rail	Remove and replace FRL system	52
* On Roof	N/A	--	--

REPAIRS / UPGRADES OR MAINTENANCE REQUIRED

Remove and replace fall arrest system on vertical ladder

***Please review cover letter for latest information regarding CSA Standard CSA-Z259.2.4-15**

(Fall arresters and Vertical Rigid Rails)

TRANSFER STATION 'D' RINGS

LOCATION	YES / NO		CONDITION	
* To Roof	No		Good	60
* On Roof	Cast-in place ladder rungs		Good	63, 65

REPAIRS OR MAINTENANCE REQUIRED

D' ring required at top of vertical ladder

CONFINED SPACE & RESCUE

RESCUE PORT BASE

LOCATION	YES / NO		CONDITION	
* At Valve Pit	No		Use Tri-pod rescue system	13
* At Top of Vertical Ladder	No		--	63
* At Hatch to tank interior	Yes		Fair - new cap installed	86

REPAIRS OR MAINTENANCE REQUIRED

Rescue port base required at top of vertical ladder

Surface prepare and paint rescue port base on tank roof

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Maintain gravel driveway

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Maintain overgrowth around fence line

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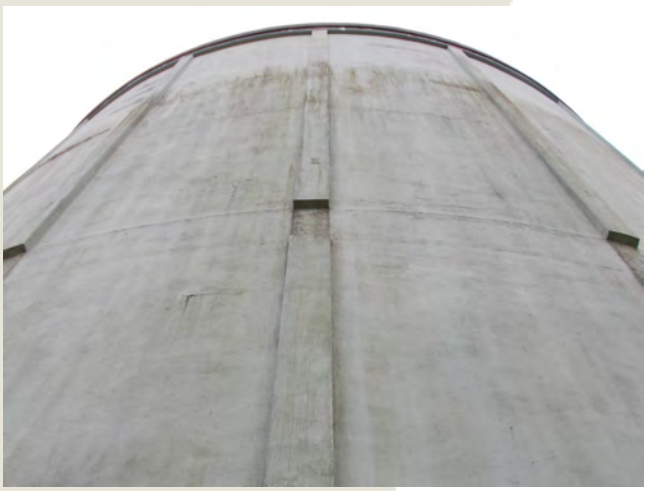

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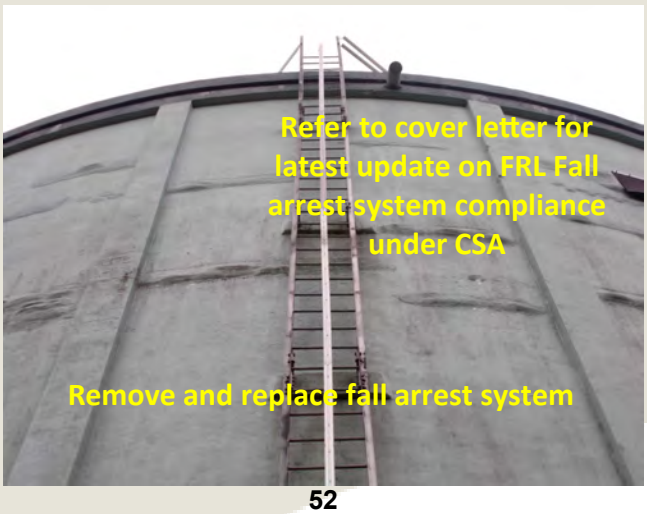

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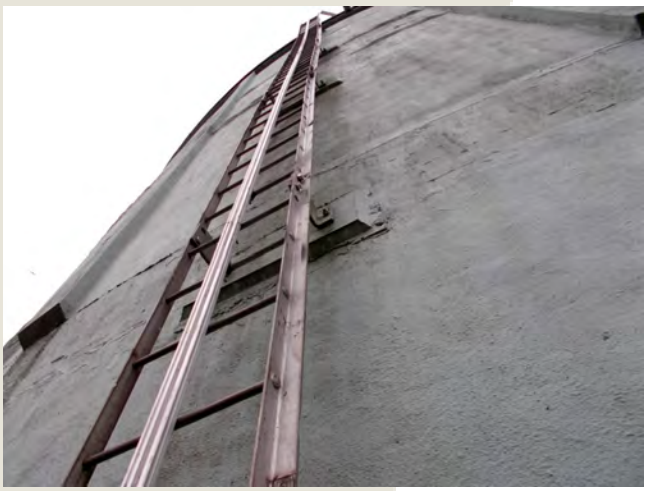

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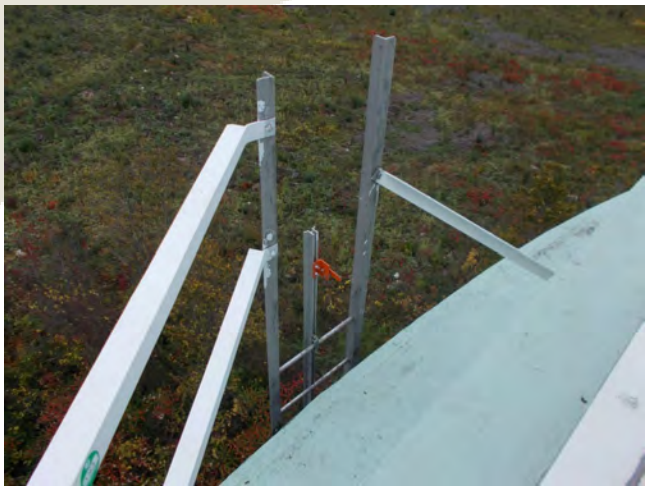

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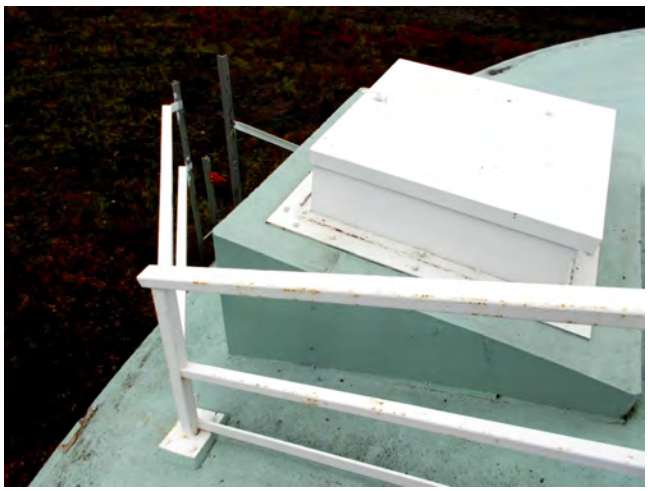

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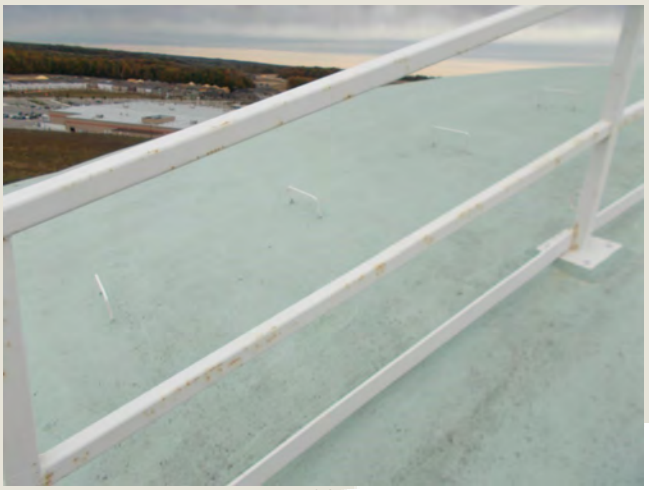

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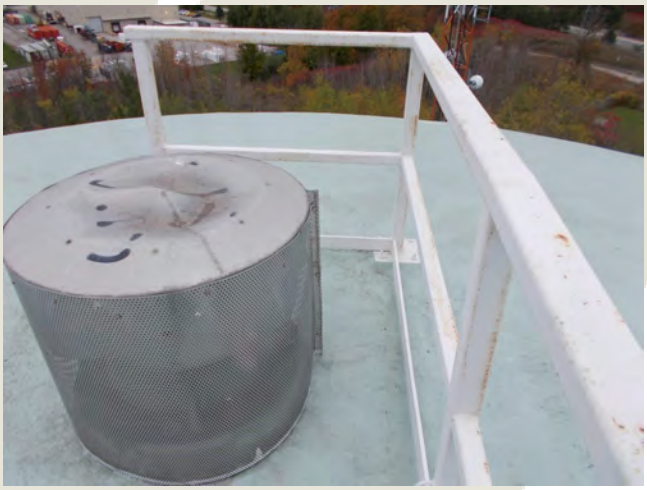

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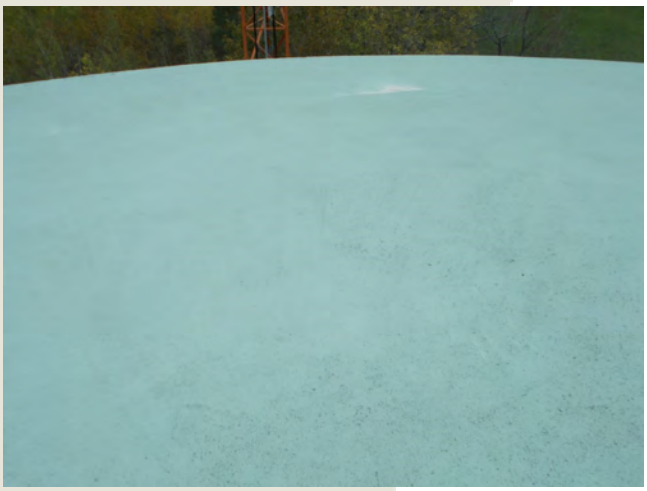

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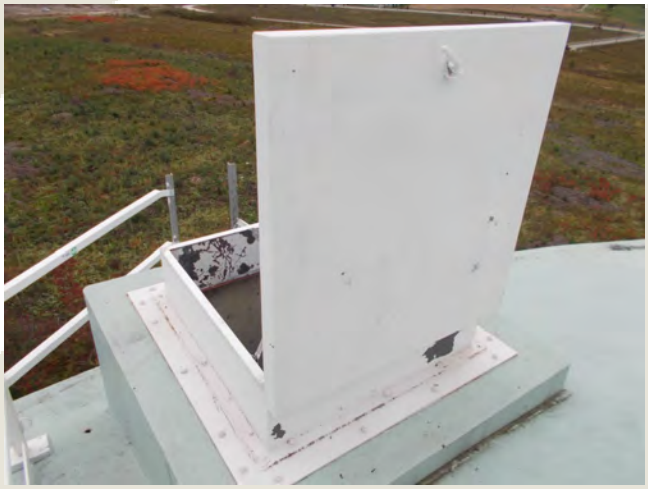

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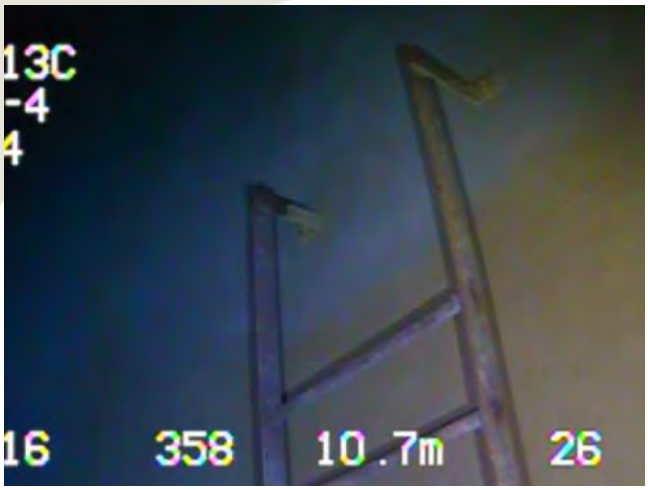

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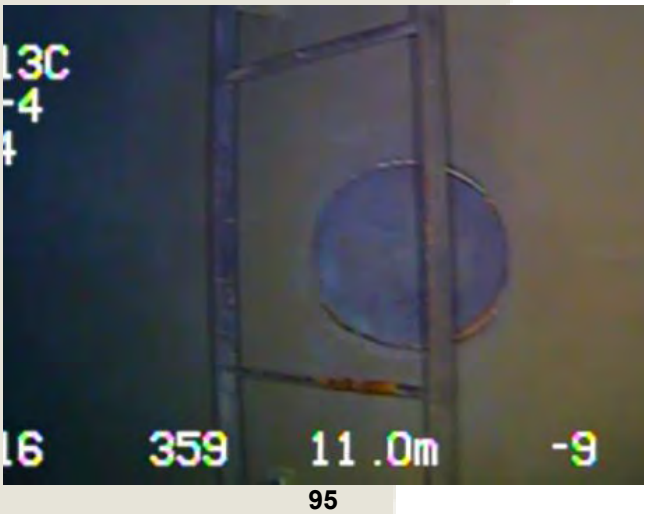

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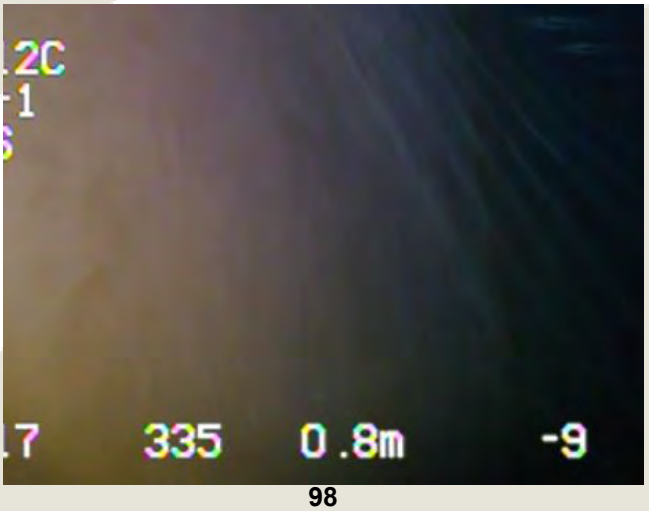

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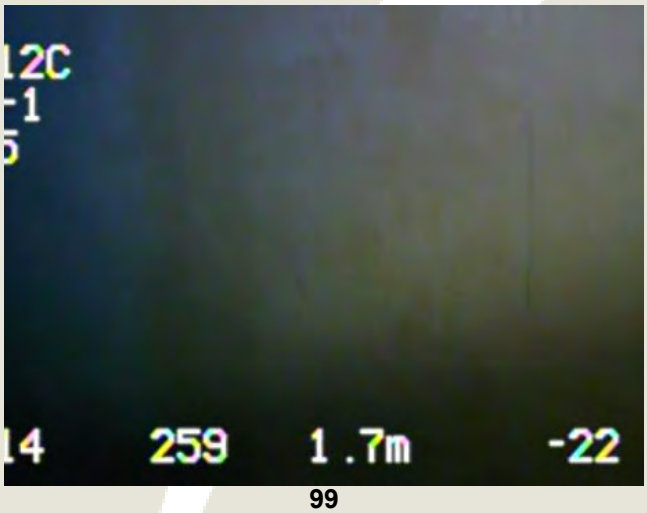

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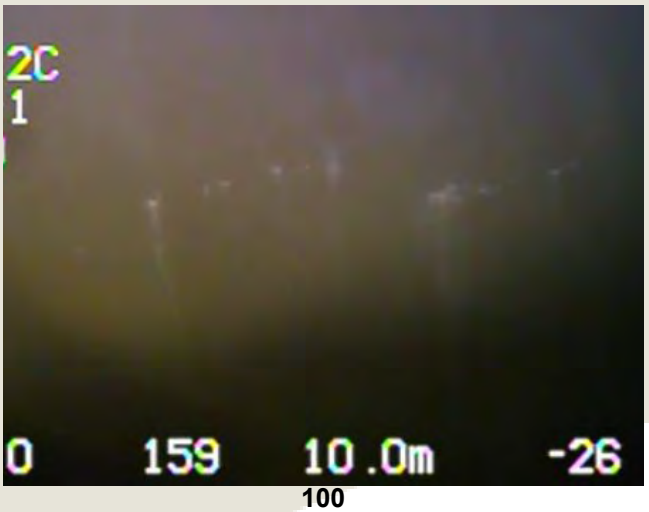

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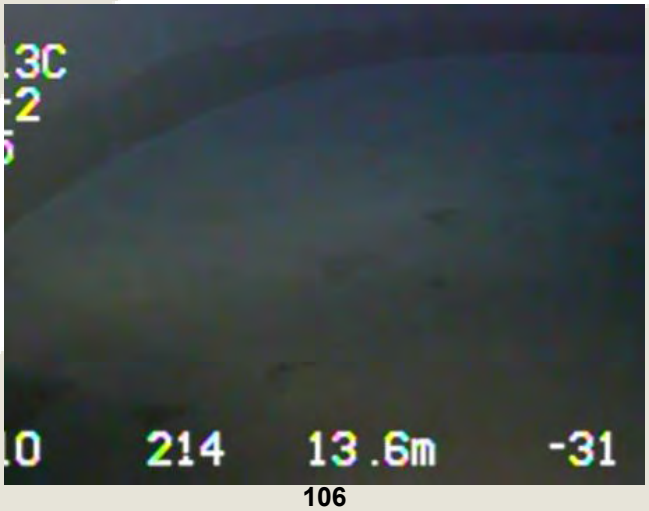

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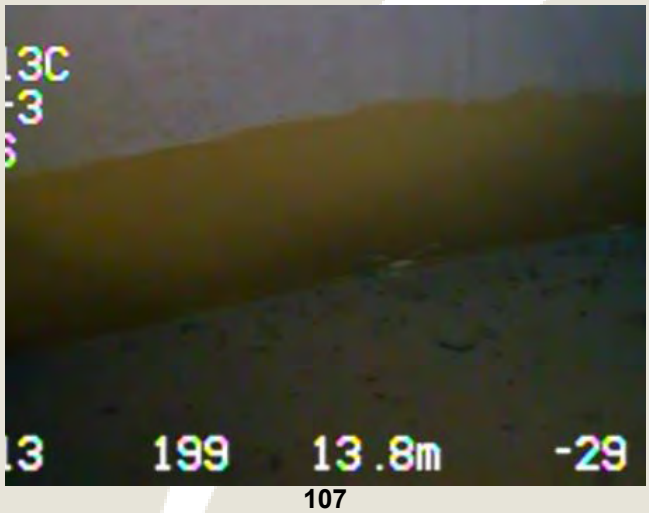

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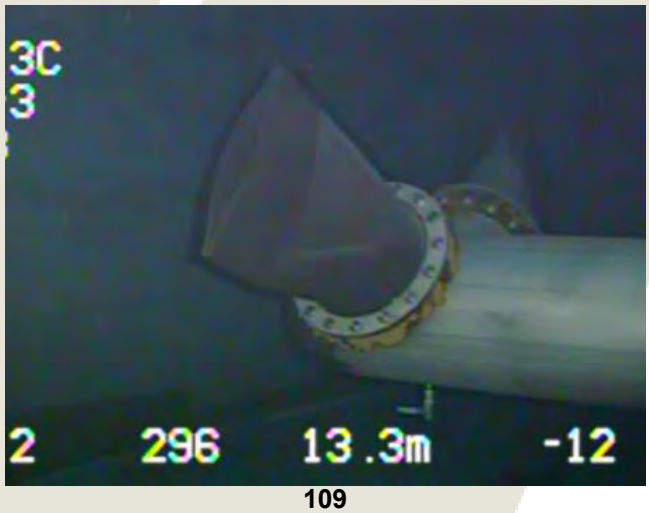

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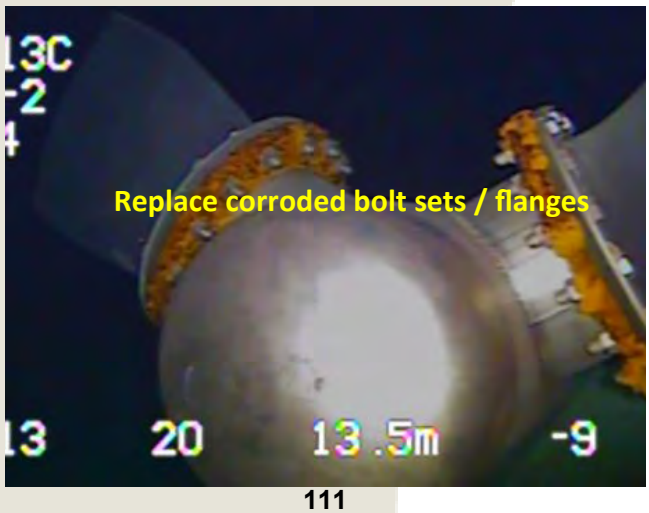

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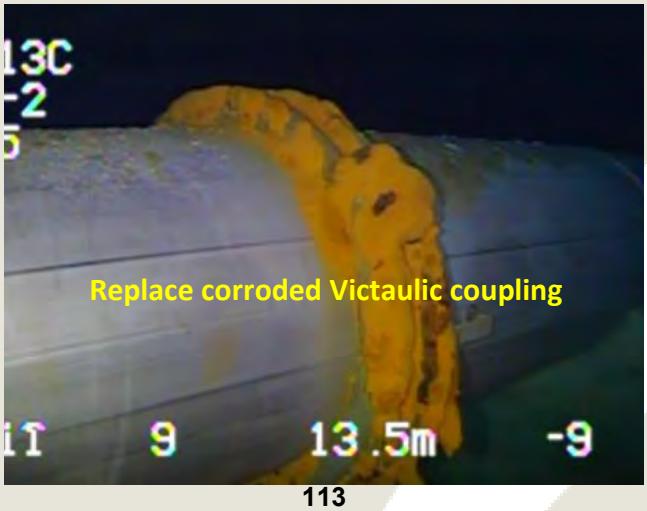

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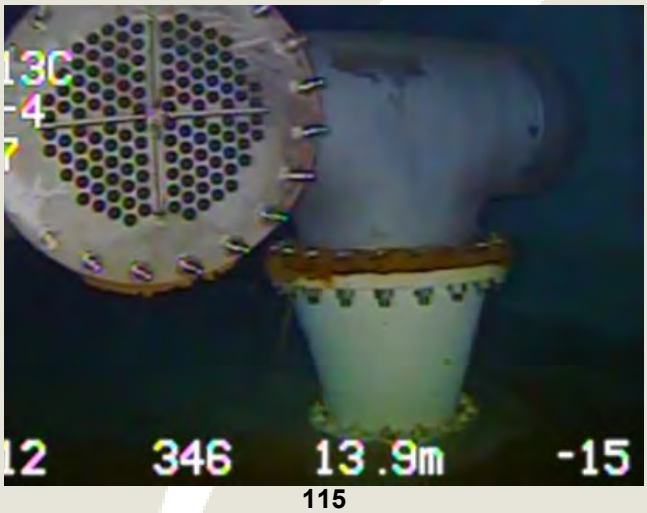

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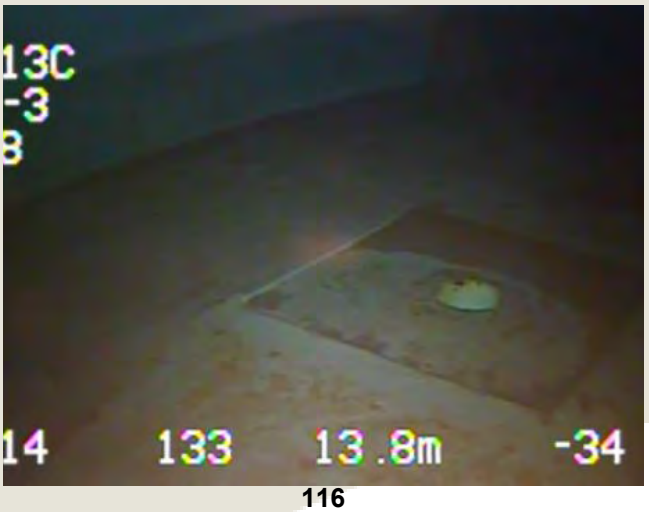

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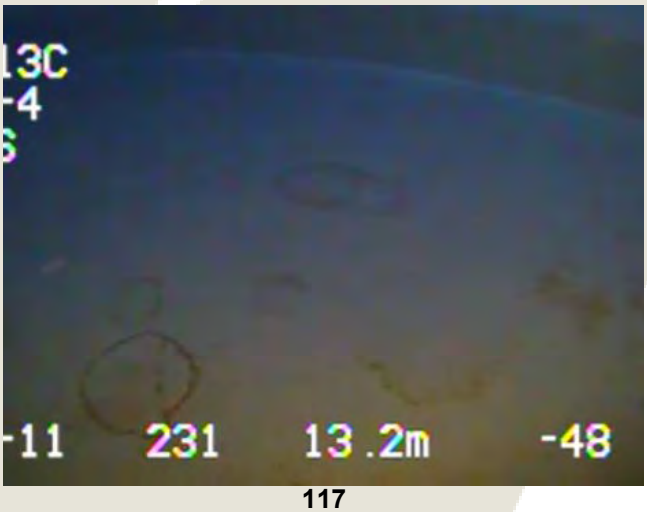

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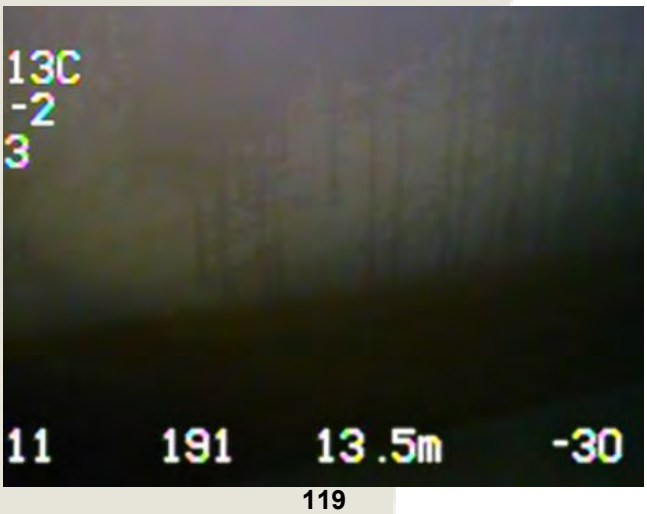

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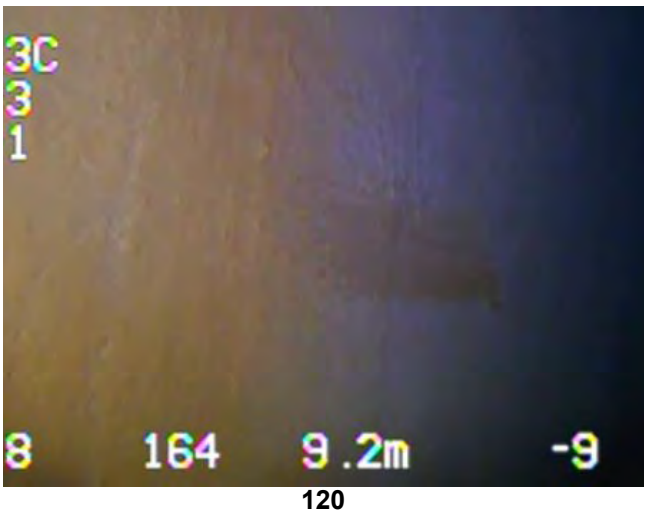

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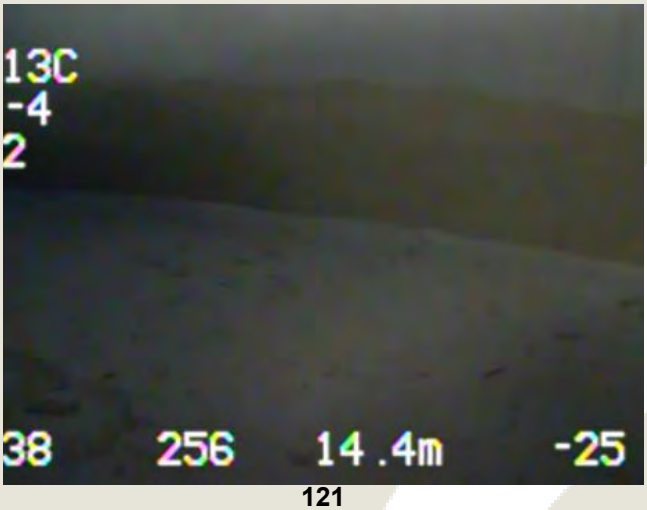

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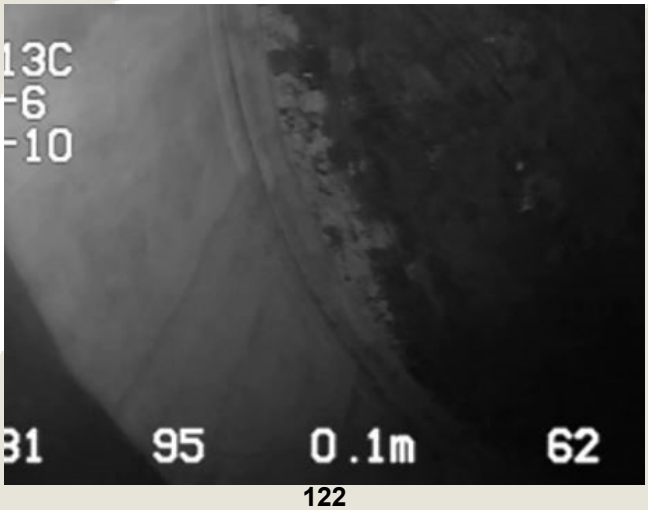

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Landmark Municipal Services

3091 Harrison Court
Burlington, ON CAN L7M 0W4
905.319.7700 Phone
905.319.7706 Fax

www.teamlandmark.com

November 27, 2017

Att: **Mr. John Hoos**
Manager Water Treatment and Supply
jhoos@orillia.ca

Ph: 705.325.4521

Re: LMS Job #LM17036: Orillia Harvie Hill Gunite Tank;
Interior / Exterior Coating Assessment

Dear Mr. Lauber;

An ROV underwater camera tank inspection was performed at the above mentioned potable water storage facility on October 11th, 2017. The ROV unit and tether cable were disinfected in accordance with AWWA-C652-11 Method #2 guidelines (200ppm solution) prior to entry into the tank interior. Landmark's ROV equipment is designated for potable water use only.

Note: Possible issues and defects can only be visually assessed with the ROV.

The following are our findings in relation to the current condition of the protective surfaces of the potable water storage tank:

The Harvie Hill Reservoir is AWWA D110 Type II Prestressed Gunite tank with a capacity of approximately 2.0 million gallons (imperial). Our records indicate that the reservoir was constructed in approximately 1968 by The Canada Gunite Company.

- Diameter: 79' (24.08m)
- Tank Floor elevation: 955.0' (291.08m)
- Grade elevation: 964.0' (293.83m)
- Overflow elevation: 1012.64' (308.65m - 17.57m AGL)

Landmark was advised that the both exterior and interior surfaces were repaired in 2007.

Exterior Surfaces

The exterior of this tower is of Gunite (spray-crete) construction which had been over-coated in 2007 with some type of acrylic paint which is in fair condition. There is some de-lamination around the top of the base ring where water has pooled, as well as numerous small areas on the sides of the tank. Some of these areas have peeled because the original coating over which it was applied has de-laminated.

There is no visible evidence of active cracking, efflorescence or hollow areas.

Concrete surfaces on the tank roof are sound, with no cracks observed. Steel components on the roof (handrail, hatch) are exhibit some minor surface corrosion.

Interior

The interior of this tank was re-lined in 2009 with Cem-Kote Flex ST which is a cementitious waterproofing coating, and it appears to be in good condition with no signs of cracks, de-lamination, spalling or blistering. There is about 2 cm's of light sediment buildup on the floor.

Recommendations

The roof handrail system and hatch collar should be touched up within the next year or 2.

The delaminating areas on the side of the tank are currently more of an aesthetic concern, rather than structural. However, over time, these areas will be susceptible to freeze/thaw and will begin to undercut and spread if they aren't repaired. We recommend repairing these areas within the next 2 years.

The interior lining is not in need of any maintenance at this point, however, since the cementitious waterproofing is over 10 years old, regular repair and maintenance should take place at 3-5 year intervals. We suggest a drained inspection in 2020 to further evaluate and repair.

Yours Sincerely,
Landmark Municipal Services

David Baker,
NACE Certified Coating Inspector –Level 2, CIP #329173

Landmark Municipal Services

3091 Harrison Court
Burlington, ON CAN L7M 0W4
905.319.7700 Phone
905.319.7706 Fax

www.teamlandmark.com

January 15, 2018

City of Orillia
40 Kitchener Street
Orillia, ON L3V 6Z9

Att: **Mr. John Hoos**
Manager Water Treatment and Supply
jhoos@orillia.ca

Ph: 705.325.4521

Quote #17219: Orillia Harvie Hill Gunite Standpipe

The following is budgetary pricing for all recommended upgrades & repairs at the above mentioned potable water storage facility; **HST not included*

Siteworks

1) Maintain gravel driveway and 'overgrowth' around fence line — **$ Upon Request**

Security

2) Install ladder security gate at bottom of vertical ladder — **$ 1,700**

3) Install keyed padlock on hatch to tank interior — **$ No Charge**

Valve Chamber

4) Surface prepare and paint valves and pipes — **$ 6,300**

5) Remove and replace ladder to valve pit — **$ 2,500**

Accessories

6) Apply anti-slip surface to ladder rungs — **$ 1,000**

7) Remove and replace kickplate on roof handrail — **$ 4,000**

8) Extend overflow pipe to grade level c/w 10 ft Gabion stone spillway — **$ 22,500**

Fall Arrest System

9) Remove and replace FRL fall arrest system on vertical ladder — **$ 3,200**

   - *Fall arrest trolleys are available for $675 ea*

10) Dismount post required at top of vertical ladder — **$3,600**

Confined Space & Rescue

11) Rescue port base required at top of vertical ladder **$ 2,500**

12) Surface prepare and re-paint rescue port base on tank roof **$ 400**

Protective Coating / Linings systems - (refer to separate report)

13) Surface prepare and re-paint roof handrail and hatch frame **$ 3,200**

14) Repair delaminated areas on exterior sidewalls **$ 40,000 - $50,000**

15) During next tank shutdown – replace all corroded bolt sets, flanges, Fittings, Victaulic couplings on Mixing system piping (to be performed on A time and material basis) – Budget $5,000 - $7,500

Ontario
MINISTRY OF LABOUR

Print This Page

Fixed Rail Ladder (FRL) Fall Protection System

Issued: May 20, 2014

Content last reviewed: May 2014

Disclaimer: This resource has been prepared to help the workplace parties understand some of their obligations under the Occupational Health and Safety Act (OHSA) and regulations. It is not legal advice. It is not intended to replace the OHSA or the regulations. FOR FURTHER INFORMATION PLEASE SEE FULL DISCLAIMER

Hazard summary

A worker descending a vertical ladder on a water tower in 2014 was critically injured after falling five metres while properly using a Class Frontal-Fixed Rail Ladder (Class FRL) Fall Protection System. A Class FRL Fall Protection System is a type of vertical fall protection using a permanently installed metal rail anchoring system with an automatic fall arresting device called the "trolley" or "carriage".

The investigation revealed a weakness in the design of some Class FRL Fall Protection Systems, which may not adequately protect workers who fall backward or who squat and roll backwards into a fall while connected by a body harness to the trolley which slides along the vertical rail. If a worker leans back, the trolley's internal braking system can be pulled off the rail, allowing the trolley to slide down the rail. If a worker falls backwards or squats and rolls backward into a fall (as opposed to falling straight down or inwards towards the ladder) the trolley may not lock, allowing a worker to fall freely. In the 2014 incident, the worker fell from a water tower ladder as shown in Figure 1.

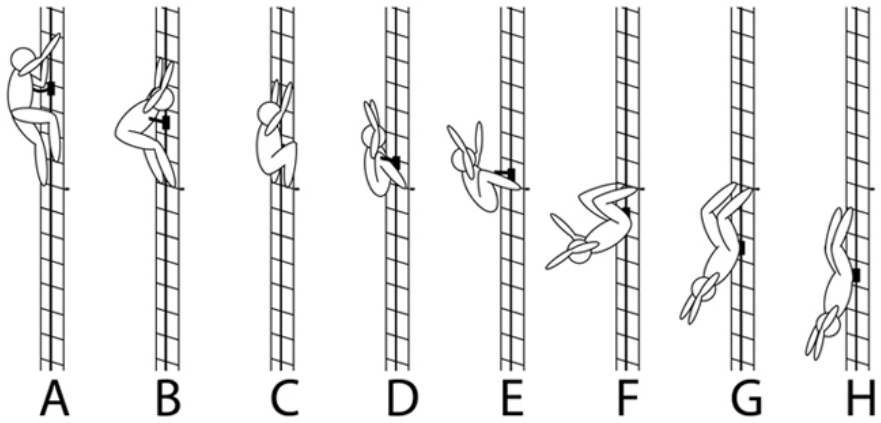

Figure 1: How the water tower worker fell

A. The worker is descending properly using the fall protection system.
B. The worker bends at the waist.
C. The worker's legs fold into a squat position while the worker's hands catch the next rung. The squat position allows the trolley to travel below the height of the worker's knees.
D. As the worker begins to roll backward their hands release from rung, and the tension in the trolley connection increases enough to remove all the slack out of the full body harness and slide the chest D-ring towards the waist.
E. This tension in the connection to the trolley forces the worker into a tight squatting position while rotating around the rung that the worker's feet are on.
F. The trolley connection remains in tension as the trolley travels below the rung that the worker's feet are on.
G. The connection to the trolley, now in tension between the worker's legs prevents the engagement of the braking mechanism that would stop the workers motion.
H. The worker, with back to the ladder, continues to fall head first while still attached to the fall protection system.

In 2010, the Ministry of Labour published a similar Alert, Class Frontal Fixed Rail Ladder (FRL) Fall Protection System, Alert #26/0510, after a worker was injured after falling back, then down 20 metres from a ladder attached to a tower while using a Class FRL Fall Protection System. In 2010, the investigation determined that the Class FRL Fall Protection System might not adequately protect workers who fall backward in a standing position.

Locations and sectors

Class FRL Fall Protection Systems are used on vertical access ladders which normally do not have a cage, such as the ladders on communication towers, chimneys and water tanks (towers).

Precautions

Even though a Class FRL Fall Protection System may be currently certified to CSA standards and/or have a CSA standards stamp on the side of the trolley unit, this should not be interpreted to guarantee worker safety and employers should not rely on such a stamp. Further investigations into the system are needed to ensure the system protects against a squatting position/rollback fall or a fall backwards.

Class FRL Fall Protection Systems whose design characteristics require the connection between the worker and the trolley to be in tension and where the trolley remains disengaged regardless of the tension force applied should not be used. Employers must take reasonable precautions to protect workers in these circumstances. This may include using alternative fall protection or access systems, as appropriate, for the adequate protection of the health and safety of workers using vertical access ladders.

Employers who own or rent structures which have a Class FRL Fall Protection System installed must ensure that the Class FRL Fall Protection System is capable of protecting a worker in the case of a squatting position/rollback fall or a fall backwards. The Ministry recommends that employers contact the manufacturer to ensure that the particular Class FRL Fall Protection System is capable of protecting a worker from any type of fall (including a backward fall and falling from a squatting position) before it is used.

Note: This Alert replaces the Class FRL Fall Protection System, Alert #26/0510 published in 2010 by the Ministry of Labour.

Resources

For more information contact:

Infrastructure Health and Safety Association
www.ihsa.ca

Or contact the Ministry of Labour Health & Safety Contact Centre toll-free at 1-877-202-0008.

For further reference see also:

Ministry of Labour
Ontario.ca/labour

ServiceOntario e-laws
www.e-laws.gov.on.ca

Remember that while complying with occupational health and safety laws, you are also required to comply with applicable environmental laws.

Please photocopy Ministry of Labour Alerts, distribute them widely and post them where people will see them.

ISSN: 1195-5228

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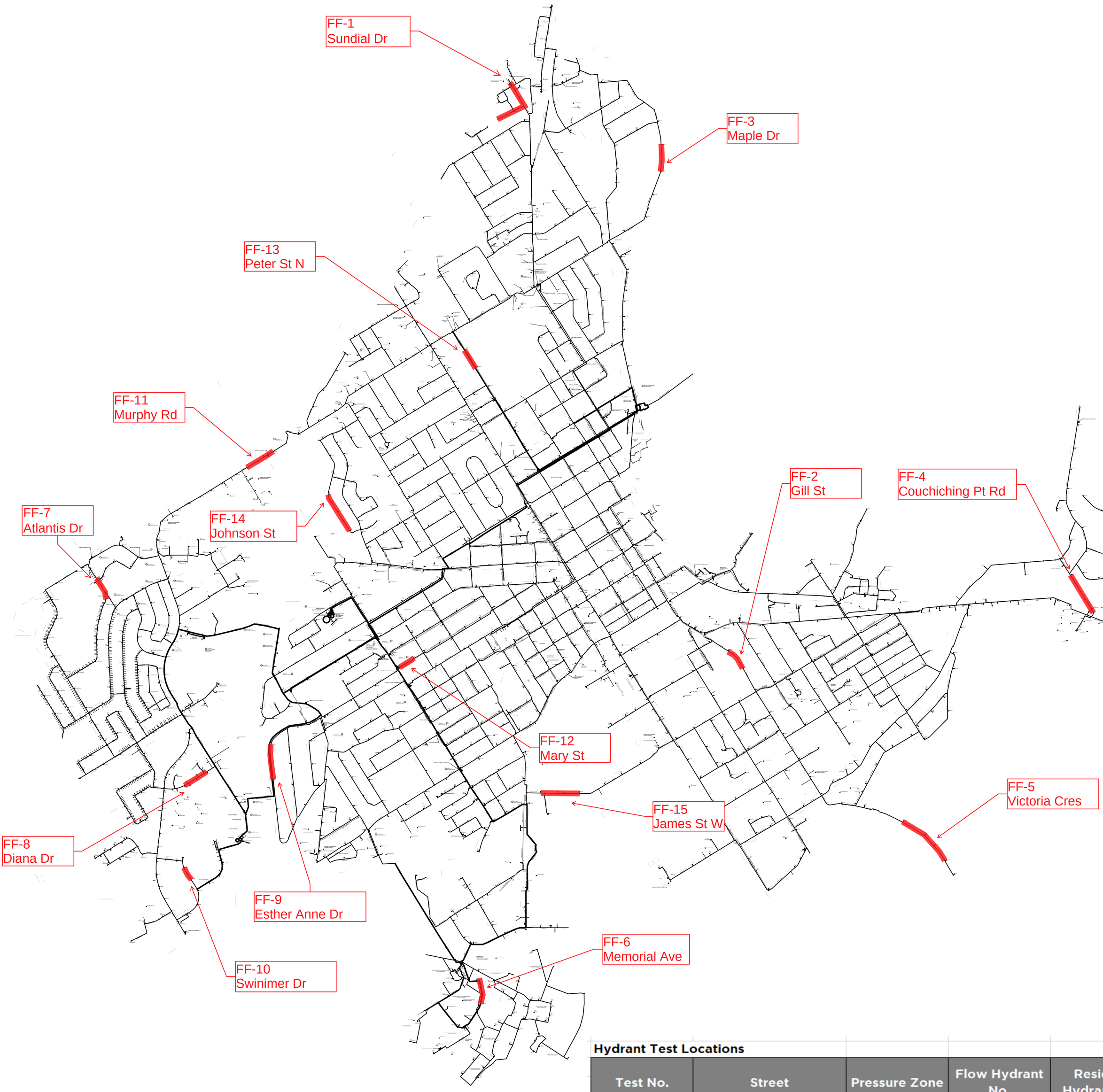
HARVIE HILL GUNITE STANDPIPE - REMOTE INSPECTION & REPORT: OCTOBER 11, 2017

Appendix E:
Fire Hydrant Test Locations

Orillia WMP Update
Hydrant Test Locations
Tatham Engineering Ltd.



Hydrant Test Locations

Test No.	Street	Pressure Zone	Flow Hydrant No.	Residual Hydrant No.
FF-1	Sundial Drive	2	538	546
FF-2	Gill St	1	41	299
FF-3	Maple Dr	1	460	461
FF-4	Couchiching Point Rd	1	144	185
FF-5	Victoria Cres	1	741	738
FF-6	Memorial Ave	2	628	627
FF-7	Altantis Dr	3	800	752
FF-8	Diana Dr	2	907	905
FF-9	Esther Anne Dr	2	332	404
FF-10	Swinimer Dr	2	882	881
FF-11	Murphy Rd	2	831	833
FF-12	Mary St	1	128	785
FF-13	Peter St N	2	541	211
FF-14	Johnson St	2	657	659
FF-15	James St W	1	493	571

Appendix F:
Watermain Risk Assessment

2021 Orillia Water Master Plan Update
Watermain Risk Assessment
Jun-22

Colour coded legend

Generated by WaterCAD
Calculated
Bulk of data from 2016 watermain asset management sheet, including updates for 2021 determined values

Year of Analysis 2022

															Probability of Failure Factors			Consequence of Failure Factors					
ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
1603	TRUE	P-42	Tecumseth St - Laclie St to Parkview Ave	400	75	1941	Cast iron	3	1	0.89	81	65	1.25	Local		7.7	7	7.7	2.75	1	1	2.4	18.38	High
6739	TRUE	P-1508(1)	Peter St N - Benner St to Fowlie St	400	216	1939	Cast iron	1	2	0.89	83	65	1.28	Local		7.9	2	7.3	2.75	1	1	2.4	17.54	High
5262	TRUE	P-2404	Jarvis St at Bay St	400	9	1938	Cast iron	0	1	0.89	84	65	1.29	Local		8.0	1	7.3	2.75	1	1	2.4	17.49	High
5263	TRUE	P-2405	Tecumseth St - Parkview Ave to WFP	400	450	1938	Cast iron	0	1	0.89	84	65	1.29	Local		8.0	1	7.3	2.75	1	1	2.4	17.49	High
5244	TRUE	P-2392	Jarvis St at Bay St	400	6.5	1938	Cast iron	0	1	0.89	84	65	1.29	Local		8.0	1	7.3	2.75	1	1	2.4	17.49	High
2040	TRUE	P-2118	ZONE 1 TRUNK: Jarvis St - Matchedash St N t	400	163.5	1938	Cast iron	0	1	0.89	84	65	1.29	Local		8.0	1	7.3	2.75	1	1	2.4	17.49	High
1781	TRUE	P-1196	Peter St N at Jarvis St	400	22	1939	Cast iron	0	2	0.89	83	65	1.28	Local		7.9	1	7.2	2.75	1	1	2.4	17.30	High
1084	TRUE	P-1208	Peter St N - Jarvis St to Fowlie St	400	89	1939	Cast iron	0	2	0.89	83	65	1.28	Local		7.9	1	7.2	2.75	1	1	2.4	17.30	High
1081	TRUE	P-1214	Jarvis St- Parkview Ave to Laclie St	200	76	1914	Cast iron	0	1	0.44	108	65	1.66	Local	Victoria House	10.0	1	9.1	1.75	1	3	1.8	16.38	High
2137	TRUE	P-2171	ZONE 2 TRUNK: Brant St W at West St N	400	121	1956	Cast iron	0	2	0.89	66	65	1.02	Local	Lions Oval PS	6.5	1	5.9	2.75	1	3	2.6	15.40	High
1573	TRUE	P-126	ZONE 1 TRUNK: West St at Mississaga St	300	20	1933	Cast iron	0	1	0.67	89	65	1.37	Local		8.4	1	7.7	2.25	1	1	2.0	15.33	High
1572	TRUE	P-128	ZONE 1 TRUNK: West St at Mississaga St	300	4	1933	Cast iron	0	1	0.67	89	65	1.37	Local		8.4	1	7.7	2.25	1	1	2.0	15.33	High
1536	TRUE	P-208	West St S - Colborne St to Elgin St	250	144.5	1933	Cast iron	2	1	0.56	89	65	1.37	Arterial		8.4	5	8.1	2.00	2	1	1.9	15.32	High
1541	TRUE	P-194	West St S - Western Ave to Elgin St	250	77	1933	Cast iron	1	1	0.56	89	65	1.37	Arterial		8.4	2	7.8	2.00	2	1	1.9	14.75	Medium-High
1575	TRUE	P-122	West St S - Mississaga St W to Colborne St	250	146	1933	Cast iron	1	1	0.56	89	65	1.37	Arterial		8.4	2	7.8	2.00	2	1	1.9	14.75	Medium-High
1094	TRUE	P-1180	Jarvis St - Bay St to Canice St	200	210	1914	Cast iron	1	1	0.44	108	65	1.66	Local		10.0	2	9.2	1.75	1	1	1.6	14.72	Medium-High
6740	TRUE	P-1508(2)	Peter St N - Benner St to Fowlie St	300	238.5	1939	Cast iron	1	2	0.67	83	65	1.28	Local		7.9	2	7.3	2.25	1	1	2.0	14.62	Medium-High
1543	TRUE	P-190	West St S - Barrie Rd to Western Ave	250	63	1933	Cast iron	0	1	0.56	89	65	1.37	Arterial		8.4	1	7.7	2.00	2	1	1.9	14.56	Medium-High
1544	TRUE	P-188	West St S at King St	250	5	1933	Cast iron	0	1	0.56	89	65	1.37	Arterial		8.4	1	7.7	2.00	2	1	1.9	14.56	Medium-High
1810	TRUE	P-1580	Jarvis St - Peter St N to Matchedash St N	200	164.5	1914	Cast iron	0	1	0.44	108	65	1.66	Local		10.0	1	9.1	1.75	1	1	1.6	14.56	Medium-High
2038	TRUE	P-2116	Jarvis St at Matchedash St N	200	7.5	1914	Cast iron	0	1	0.44	108	65	1.66	Local		10.0	1	9.1	1.75	1	1	1.6	14.56	Medium-High
1083	TRUE	P-1210	Jarvis St - Parkview Ave to Canice St	200	95	1914	Cast iron	0	1	0.44	108	65	1.66	Local		10.0	1	9.1	1.75	1	1	1.6	14.56	Medium-High
1078	TRUE	P-1220	Jarvis St - Laclie St to Matchedash St N	200	183.5	1914	Cast iron	0	1	0.44	108	65	1.66	Local		10.0	1	9.1	1.75	1	1	1.6	14.56	Medium-High
2068	TRUE	P-2131	ZONE 2 TRUNK : Brant St W - Patrick St to Pa	400	445	1956	Cast iron	1	2	0.89	66	65	1.02	Local		6.5	2	6.0	2.75	1	1	2.4	14.46	Medium-High
1178	TRUE	P-986	Laclie St - Galley Ave to Hillside Dr	350	75.5	1959	Cast iron	0	2	0.78	63	65	0.97	Arterial	Trillium Manor	6.2	1	5.7	2.50	2	3	2.5	14.24	Medium-High
1177	TRUE	P-988	Laclie St - Galley Ave to Stanton Dr; Proposed	350	184	1959	Cast iron	0	2	0.78	63	65	0.97	Arterial	Couchiching Hei	6.2	1	5.7	2.50	2	3	2.5	14.24	Medium-High
2138	TRUE	P-2172	ZONE 2 TRUNK: Brant St W at Patrick St	400	97	1956	Cast iron	0	2	0.89	66	65	1.02	Local		6.5	1	5.9	2.75	1	1	2.4	14.22	Medium-High
1095	TRUE	P-1176	ZONE 1 TRUNK: Jarvis St at Canice St	400	223	1956	Cast iron	0	1	0.89	66	65	1.02	Local		6.5	1	5.9	2.75	1	1	2.4	14.22	Medium-High
6906	TRUE	P-1510(2)(1)	Peter St N - Fittons Rd E to the south	400	141	1959	Cast iron	1	2	0.89	63	65	0.97	Local		6.2	2	5.8	2.75	1	1	2.4	13.91	Medium-High
6752	TRUE	P-1510(1)	Peter St N - Fittons Rd E to the south	400	251	1959	Cast iron	1	2	0.89	63	65	0.97	Local		6.2	2	5.8	2.75	1	1	2.4	13.91	Medium-High
6907	TRUE	P-1510(2)(2)	Peter St N - Fittons Rd E to the south	400	75.5	1959	Cast iron	1	2	0.89	63	65	0.97	Local		6.2	2	5.8	2.75	1	1	2.4	13.91	Medium-High
955	TRUE	P-1512	Peter St N - south of Fittons Rd E to Benner S	400	69	1959	Cast iron	0	2	0.89	63	65	0.97	Local		6.2	1	5.7	2.75	1	1	2.4	13.67	Medium-High
1184	TRUE	P-972	Fittons Rd E- Peter St N to Jamieson Dr	350	134	1959	Cast iron	0	2	0.78	63	65	0.97	Collector	Monsignor Lee S	6.2	1	5.7	2.50	1	3	2.4	13.67	Medium-High
1741	TRUE	P-1882	Laclie St - Frontier Ave to south of Murray St	350	301	1959	Cast iron	1	2	0.78	63	65	0.97	Arterial		6.2	2	5.8	2.50	2	1	2.3	13.33	Medium-High
1175	TRUE	P-992	Laclie St - Stanton Dr to Fittons Rd E; Propose	350	171.5	1959	Cast iron	1	2	0.78	63	65	0.97	Arterial		6.2	2	5.8	2.50	2	1	2.3	13.33	Medium-High
1016	TRUE	P-1366	Homewood Ave at Westmount Dr N	450	8	1967	Cast iron	0	2	1.00	55	65	0.85	Local		5.5	1	5.1	3.00	1	1	2.6	13.24	Medium-High
1608	TRUE	P-32	Peter St N - Brant Brant St to Tecumseth St	200	144.5	1938	Cast iron	0	1	0.44	84	65	1.29	Local	Tudhope Manor	8.0	1	7.3	1.75	1	3	1.8	13.11	Medium-High
1740	TRUE	P-1880	Laclie St - Hillside Dr to Frontier Ave	350	67.5	1959	Cast iron	0	2	0.78	63	65	0.97	Arterial		6.2	1	5.7	2.50	2	1	2.3	13.10	Medium-High
1625	TRUE	P-10	Memorial Ave - south of Glencoe Ave	450	199	1972	Ductile Iron	1	1	1.00	50	65	0.77	Arterial		5.13	2	4.8	3.00	2	1	2.7	13.00	Medium-High
3620	TRUE	P-2300	ZONE 1 TRUNK: Westmount Dr N - Mary St to	450	146	1974	Ductile Iron	2	1	1.00	48	65	0.74	Collector		5.0	5	5.0	3.00	1	1	2.6	12.91	Medium-High
929	TRUE	P-684	Westmount Dr S- Argyle Ave to Elmer Ave	450	187.5	1974	Ductile Iron	2	1	1.00	48	65	0.74	Collector		5.0	5	5.0	3.00	1	1	2.6	12.91	Medium-High
901	TRUE	P-1566	ZONE 2 TRUNK : Esther Anne Dr to Harview S	600	281.5	1968	Concrete	0	2	1.00	54	75	0.72	Highway or highway crossing		4.9	1	4.5	3.00	3	1	2.8	12.52	Medium-High
1135	TRUE	P-1074	Fowlie St - Peter St N to Matchedash St N	200	187.5	1932	Cast iron	0	2	0.44	90	65	1.38	Local		8.5	1	7.7	1.75	1	1	1.6	12.38	Medium-High
1782	TRUE	P-1204	Peter St N - Jarvis St to Brant St	200	174	1938	Cast iron	2	1	0.44	84	65	1.29	Local		8.0	5	7.7	1.75	1	1	1.6	12.30	Medium-High
1025	TRUE	P-1338	ZONE 2 TRUNK: Harvey St - Douglas St to Em	450	278.5	1967	Concrete	0	2	1.00	55	75	0.73	Arterial		4.9	1	4.5	3.00	2	1	2.7	12.25	Medium-High
1430	TRUE	P-440	Bayview Pkwy - Oxford St to Delia St	200	80	1939	Cast iron	2	1	0.44	83	65	1.28	Local		7.9	5	7.6	1.75	1	1	1.6	12.18	Medium-High
1919	TRUE	P-2046	ZONE 1 TRUNK: Westmount Dr N - John St to	450	110.5	1974	Ductile Iron	1	1	1.00	48	65	0.74	Collector		5.0	2	4.7	3.00	1	1	2.6	12.13	Medium-High
1360	TRUE	P-588	Poughkeepsie St - Front St to Gill St	150	102.5	1932	Cast iron	5	1	0.33	90	65	1.38	Local		8.5	10	8.6	1.50	1	1	1.4	12.09	Medium-High
1089	TRUE	P-1188	Canice St - Jarvis St to Parkview Ave	200	256	1940	Cast iron	2	1	0.44	82	65	1.26	Local		7.8	5	7.5	1.75	1	1	1.6	12.05	Medium-High
1563	TRUE	P-146	ZONE 1 TRUNK: Mississaga St W - Albert St S	300	122.5	1960	Cast iron	2	1	0.67	62	65	0.95	Collector		6.1	5	6.0	2.25	1	1	2.0	12.04	Medium-High
936	TRUE	P-1226	ZONE 2 TRUNK: Jarvist St at Peter St N to We	500	328.5	1976	Cast iron	0	2	1.00	46	65	0.71	Arterial		4.8	1	4.4	3.00	2	1	2.7	11.91	Medium-High
981	TRUE	P-1450	ZONE 2 TRUNK: Esther Anne - Sandra Dr to s	450	655	1968	Concrete	1	2	1.00	54	75	0.72	Local		4.9	2	4.6	3.00	1	1	2.6	11.89	Medium-High
5125	TRUE	P-2387	Westmount Dr S - Elmer Ave to Barrie Rd	450	22	1974	Ductile Iron	0	1	1.00	48	65	0.74	Collector		5.0	1	4.6	3.00	1	1	2.6	11.87	Medium-High
3621	TRUE	P-2301	ZONE 1 TRUNK: Westmount Dr N at Mississag	450	1	1974	Ductile Iron	0	1	1.00	48	65	0.74	Collector		5.0	1	4.6	3.00	1	1	2.6	11.87	Medium-High
5126	TRUE	P-2388	Westmount Dr S - Elmer Ave to Barrie Rd	450	89	1974	Ductile Iron	0	1	1.00	48	65	0.74	Collector		5.0	1	4.6	3.00	1	1	2.6	11.87	Medium-High
6385	TRUE	P-2721	Westmount s of Homewood	450	8.5	1974	Ductile Iron	0	2	1.00	48	65	0.74	Collector		5.0	1	4.6	3.00	1	1	2.6	11.87	Medium-High
928	TRUE	P-1592	Westmount Dr S - Grenville Ave to the north c	450	173	1974	Ductile Iron	0	1	1.00	48	65	0.74	Collector		5.0	1	4.6	3.00	1	1	2.6	11.87	Medium-High
1024	TRUE	P-1344	Westmount Dr N - Homewood Ave to Nottaw	450	13.5	1974	Ductile Iron	0	1	1.00	48	65	0.74	Collector		5.0	1	4.6	3.00	1	1	2.6	11.87	Medium-High
1920	TRUE	P-2047	ZONE 1 TRUNK: Westmount Dr N at John St	450	15	1974	Ductile Iron	0	1	1.00	48	65	0.74	Collector		5.0	1	4.6	3.00	1	1	2.6	11.87	Medium-High
2133	TRUE	P-2169	ZONE 1 TRUNK: Westmount Dr N - John St to	450	92	1974	Ductile Iron	0	1	1.00	48	65	0.74	Collector		5.0	1	4.6	3.00	1	1	2.6	11.87	Medium-High

2021 Orillia Water Master Plan Update
Watermain Risk Assessment
Jun-22

Colour coded legend

Generated by WaterCAD
Calculated
Bulk of data from 2016 watermain asset management sheet, including updates for 2021 determined values

Year of Analysis 2022

															Probability of Failure Factors			Consequence of Failure Factors					
ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
1005	TRUE	P-1400	Westmount Dr S - Mississaga St W to Grenvill	450	201	1974	Ductile Iron	0	1	1.00	48	65	0.74	Collector		5.0	1	4.6	3.00	1	1	2.6	11.87	Medium-High
6386	TRUE	P-2722	Westmount s of Homewood	450	1.5	1974	Ductile Iron	0	2	1.00	48	65	0.74	Collector		5.0	1	4.6	3.00	1	1	2.6	11.87	Medium-High
1481	TRUE	P-326	West St S- James St to Bond St	250	313.5	1960	Cast iron	3	1	0.56	62	65	0.95	Arterial		6.1	7	6.2	2.00	2	1	1.9	11.82	Medium-High
1060	TRUE	P-1270	Peter St N - Tecumseth St to Neywash St	200	157	1938	Cast iron	1	1	0.44	84	65	1.29	Local		8.0	2	7.4	1.75	1	1	1.6	11.82	Medium-High
1568	TRUE	P-136	ZONE 1 TRUNK: Mississaga St W - West St S	300	118.5	1960	Cast iron	0	1	0.67	62	65	0.95	Collector	Historic Downto	6.1	1	5.6	2.25	1	2	2.1	11.81	Medium-High
1885	TRUE	P-2014	Homewood Ave - Westmount Dr N to easeme	450	233	1967	Concrete	0	2	1.00	55	75	0.73	Local		4.9	1	4.5	3.00	1	1	2.6	11.80	Medium-High
2128	TRUE	P-2166	ZONE 2 TRUNK: Harvey St - McKenzie St to D	450	198	1967	Concrete	0	2	1.00	55	75	0.73	Local		4.9	1	4.5	3.00	1	1	2.6	11.80	Medium-High
1886	TRUE	P-2016	Homewood Ave - Woodside Dr to easement	450	431.5	1967	Concrete	0	2	1.00	55	75	0.73	Local		4.9	1	4.5	3.00	1	1	2.6	11.80	Medium-High
2129	TRUE	P-2167	ZONE 2 TRUNK: Harvey St - Westmount Dr N	450	312.5	1967	Concrete	0	2	1.00	55	75	0.73	Collector		4.9	1	4.5	3.00	1	1	2.6	11.80	Medium-High
1423	TRUE	P-454	Memorial Ave - Elmer Pk to Barrie Rd	200	140.5	1943	Cast iron	0	1	0.44	79	65	1.22	Arterial		7.6	1	6.9	1.75	2	1	1.7	11.74	Medium-High
1418	TRUE	P-464	Memorial Ave - Albany Ave to Elmer Pk	200	35.5	1943	Cast iron	0	1	0.44	79	65	1.22	Arterial		7.6	1	6.9	1.75	2	1	1.7	11.74	Medium-High
5259	TRUE	P-2402	ZONE 2 TRUNK at WFP	600	46.5	1976	Ductile Iron	1	2	1.00	46	65	0.71	Local		4.8	2	4.5	3.00	1	1	2.6	11.73	Medium-High
2198	TRUE	P-2199	ZONE 2 TRUNK : Jarvis St at Bay St	600	100	1976	Ductile Iron	1	2	1.00	46	65	0.71	Local		4.8	2	4.5	3.00	1	1	2.6	11.73	Medium-High
1690	TRUE	P-1794	Westmount Dr S at Barrie Rd	450	72	1975	Ductile Iron	0	1	1.00	47	65	0.72	Collector		4.9	1	4.5	3.00	1	1	2.6	11.67	Medium-High
1691	TRUE	P-1796	Westmount Dr S - Barrie Rd to Christine Pl	450	58	1975	Ductile Iron	0	1	1.00	47	65	0.72	Collector		4.9	1	4.5	3.00	1	1	2.6	11.67	Medium-High
5117	TRUE	P-2382	Glencoe Ave - Carleton St to Westmount Dr S	450	8.5	1975	Ductile Iron	0	1	1.00	47	65	0.72	Local		4.9	1	4.5	3.00	1	1	2.6	11.67	Medium-High
1790	TRUE	P-1388	Glencoe Ave - Memorial Ave to Carleton St	450	156.5	1975	Ductile Iron	0	1	1.00	47	65	0.72	Local		4.9	1	4.5	3.00	1	1	2.6	11.67	Medium-High
5116	TRUE	P-2381	Glencoe Ave - Carleton St to Westmount Dr S	450	98	1975	Ductile Iron	0	1	1.00	47	65	0.72	Local		4.9	1	4.5	3.00	1	1	2.6	11.67	Medium-High
1687	TRUE	P-664	Westmount Dr S - Cindy Lee Cr to Cindy Lee	450	84	1975	Ductile Iron	0	1	1.00	47	65	0.72	Collector		4.9	1	4.5	3.00	1	1	2.6	11.67	Medium-High
1686	TRUE	P-666	Westmount Dr S - Cindy Lee Cr to Rose Ave	450	60.5	1975	Ductile Iron	0	1	1.00	47	65	0.72	Collector		4.9	1	4.5	3.00	1	1	2.6	11.67	Medium-High
1323	TRUE	P-676	Westmount Dr S - Rose Ave to Glencoe Ave	450	121.5	1975	Ductile Iron	0	1	1.00	47	65	0.72	Collector		4.9	1	4.5	3.00	1	1	2.6	11.67	Medium-High
1061	TRUE	P-1268	Peter St N at Neywash St	200	3.5	1938	Cast iron	0	1	0.44	84	65	1.29	Local		8.0	1	7.3	1.75	1	1	1.6	11.66	Medium-High
1617	TRUE	P-14	Peter St N at Brant St	200	1	1938	Cast iron	0	1	0.44	84	65	1.29	Local		8.0	1	7.3	1.75	1	1	1.6	11.66	Medium-High
1588	TRUE	P-78	Peter St N at Coldwater St	200	5	1938	Cast iron	0	1	0.44	84	65	1.29	Local		8.0	1	7.3	1.75	1	1	1.6	11.66	Medium-High
1107	TRUE	P-1144	Peter St N - Neywash St to Coldwater St	200	139	1938	Cast iron	0	1	0.44	84	65	1.29	Local		8.0	1	7.3	1.75	1	1	1.6	11.66	Medium-High
1589	TRUE	P-76	Peter St N at Coldwater St	200	15	1938	Cast iron	0	1	0.44	84	65	1.29	Local		8.0	1	7.3	1.75	1	1	1.6	11.66	Medium-High
5822	TRUE	P-2488	ZONE 2 TRUNK: Harvie Hill Reservoir	600	193.5	1968	Concrete	0	2	1.00	54	75	0.72	Local		4.9	1	4.5	3.00	1	1	2.6	11.63	Medium-High
5823	TRUE	P-2489	ZONE 2 TRUNK: Harvie Hill Reservoir	600	20.5	1968	Concrete	0	2	1.00	54	75	0.72	Local		4.9	1	4.5	3.00	1	1	2.6	11.63	Medium-High
1100	TRUE	P-1164	Forest Ave N - Lightfoot Trail to Industrial St	250	59.5	1949	Cast iron	0	1	0.56	73	65	1.12	Local		7.1	1	6.5	2.00	1	1	1.8	11.62	Medium-High
1438	TRUE	P-424	Bayview Pkwy - James to Franklin St	200	76	1939	Cast iron	0	1	0.44	83	65	1.28	Local		7.9	1	7.2	1.75	1	1	1.6	11.54	Medium-High
1436	TRUE	P-428	Bayview Pkwy - Franklin to Crawford St	200	85	1939	Cast iron	0	1	0.44	83	65	1.28	Local		7.9	1	7.2	1.75	1	1	1.6	11.54	Medium-High
1434	TRUE	P-432	Bayview Pkwy - Crawford St to Hilda St	200	81.5	1939	Cast iron	0	1	0.44	83	65	1.28	Local		7.9	1	7.2	1.75	1	1	1.6	11.54	Medium-High
1236	TRUE	P-862	Lawrence Ave - Gerald Ave to Borland St	200	146	1950	Cast iron	4	2	0.44	72	65	1.11	Local		7.0	9	7.2	1.75	1	1	1.6	11.49	Medium-High
2021	TRUE	P-2109	ZONE 2 TRUNK: Jarvis St at Matchedash St N	500	672.5	1976	Ductile Iron	0	2	1.00	46	65	0.71	Local		4.8	1	4.4	3.00	1	1	2.6	11.47	Medium-High
5264	TRUE	P-2406	WFP	450	41.5	1976	Ductile Iron	0	1	1.00	46	65	0.71	Local		4.8	1	4.4	3.00	1	1	2.6	11.47	Medium-High
5260	TRUE	P-2403	WFP	600	20	1976	Ductile Iron	0	2	1.00	46	65	0.71	Local		4.8	1	4.4	3.00	1	1	2.6	11.47	Medium-High
5250	TRUE	P-2396	Bay St at WFP	450	14	1976	Ductile Iron	0	1	1.00	46	65	0.71	Local		4.8	1	4.4	3.00	1	1	2.6	11.47	Medium-High
5256	TRUE	P-2400	WFP	600	35	1976	Ductile Iron	0	2	1.00	46	65	0.71	Local		4.8	1	4.4	3.00	1	1	2.6	11.47	Medium-High
5258	TRUE	P-2401	ZONE 2 TRUNK	600	1.5	1976	Ductile Iron	0	2	1.00	46	65	0.71	Local		4.8	1	4.4	3.00	1	1	2.6	11.47	Medium-High
1029	TRUE	P-1330	Park St - Martin Dr to Brant St	300	109	1960	Cast iron	1	2	0.67	62	65	0.95	Local		6.1	2	5.7	2.25	1	1	2.0	11.44	Medium-High
1121	TRUE	P-1108	Hughes Rd - Sundial Dr to Huronia Rd	300	148	1959	Cast iron	0	1	0.67	63	65	0.97	Local		6.2	1	5.7	2.25	1	1	2.0	11.40	Medium-High
1123	TRUE	P-1104	Hughes Rd at Sundial Dr	300	7	1959	Cast iron	0	1	0.67	63	65	0.97	Local		6.2	1	5.7	2.25	1	1	2.0	11.40	Medium-High
1120	TRUE	P-1110	Hughes Rd - Huronia Rd to Precision Dr	300	103	1959	Cast iron	0	1	0.67	63	65	0.97	Local		6.2	1	5.7	2.25	1	1	2.0	11.40	Medium-High
1119	TRUE	P-1112	Hughes Rd - Precision Dr to Drinkwater Dr	300	162.5	1959	Cast iron	0	1	0.67	63	65	0.97	Local		6.2	1	5.7	2.25	1	1	2.0	11.40	Medium-High
1179	TRUE	P-984	Laclie St at Galley Ave	350	3	1969	Cast iron	0	2	0.78	53	65	0.82	Arterial		5.4	1	4.9	2.50	2	1	2.3	11.37	Medium-High
1245	TRUE	P-844	Park St - Martin Dr to June Dr	300	121.5	1960	Cast iron	0	2	0.67	62	65	0.95	Local		6.1	1	5.6	2.25	1	1	2.0	11.24	Medium-High
1243	TRUE	P-848	Park St - June Dr to Collegiate Dr	300	120.5	1960	Cast iron	0	2	0.67	62	65	0.95	Local		6.1	1	5.6	2.25	1	1	2.0	11.24	Medium-High
1185	TRUE	P-970	Fittons Rd E- West St N to Peter St N	250	174	1960	Cast iron	0	2	0.56	62	65	0.95	Collector	Monsignor Lee S	6.1	1	5.6	2.00	1	3	2.0	11.24	Medium-High
952	TRUE	P-1518	Benner St- mid street to Peter St N	300	114	1961	Cast iron	0	2	0.67	61	65	0.94	Local		6.1	1	5.5	2.25	1	1	2.0	11.09	Medium-High
998	TRUE	P-1412	Westmount Dr N - Arthur St to Rosemary Rd	300	193.5	1961	Cast iron	0	2	0.67	61	65	0.94	Collector		6.1	1	5.5	2.25	1	1	2.0	11.09	Medium-High
1451	TRUE	P-394	Oxford St - East St to Raymond Ave	150	222	1948	Cast iron	2	1	0.33	74	65	1.14	Local	St. Bernard's CS	7.1	5	6.9	1.50	1	3	1.6	11.09	Medium-High
953	TRUE	P-1516	Benner St- mid street to Peter St N	250	109.5	1953	Cast iron	0	2	0.56	69	65	1.06	Local		6.7	1	6.2	2.00	1	1	1.8	11.07	Medium-High
1425	TRUE	P-450	Elmer Pk at Memorial Ave	200	23	1943	Cast iron	0	1	0.44	79	65	1.22	Local		7.6	1	6.9	1.75	1	1	1.6	11.05	Medium-High
1747	TRUE	P-1098	Laclie St - Hughes Rd to Murray St	250	83	1959	Cast iron	1	2	0.56	63	65	0.97	Arterial		6.2	2	5.8	2.00	2	1	1.9	11.02	Medium-High
1022	TRUE	P-1350	Harvey St - Douglas St to Emily St	150	171	1932	Cast iron	1	2	0.33	90	65	1.38	Local		8.5	2	7.8	1.50	1	1	1.4	10.97	Medium-High
1500	TRUE	P-284	Matchedash St S - Cochrane St to Poughkeep	150	201	1932	Cast iron	1	1	0.33	90	65	1.38	Local		8.5	2	7.8	1.50	1	1	1.4	10.97	Medium-High
1422	TRUE	P-456	Memorial Ave - Elmer Pk to Elmer Ave	150	47.5	1943	Cast iron	2	1	0.33	79	65	1.22	Arterial		7.6	5	7.3	1.50	2	1	1.5	10.96	Medium-High
3207	TRUE	P-2232	North St E - Old Muskoka Rd to Cowan St	150	14.5	1933	Cast iron	1	2	0.33	89	65	1.37	Local		8.4	2	7.8	1.50	1	1	1.4	10.87	Medium-High
1134	TRUE	P-1076	North St E - Cowan St to Highland Ave	150	27.5	1933	Cast iron	1	1	0.33	89	65	1.37	Local		8.4	2	7.8	1.50	1	1	1.4	10.87	Medium-High
1018	TRUE	P-1360	Westmount Dr N - Harvey St to Homewood A	300	107.5	1964	Cast iron	1	2	0.67	58	65	0.89	Collector		5.8	2	5.4	2.25	1	1	2.0	10.84	Medium-High

2021 Orillia Water Master Plan Update
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Colour coded legend

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Calculated
Bulk of data from 2016 watermain asset management sheet, including updates for 2021 determined values

Year of Analysis 2022

															Probability of Failure Factors			Consequence of Failure Factors					
ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
1730	TRUE	P-1858	Laclie St - Murray St to Goldie Dr	250	239.5	1959	Cast iron	0	2	0.56	63	65	0.97	Arterial		6.2	1	5.7	2.00	2	1	1.9	10.83	Medium-High
1082	TRUE	P-1212	Jarvis St at Parkview Ave	200	9.5	1945	Cast iron	0	1	0.44	77	65	1.18	Local		7.4	1	6.8	1.75	1	1	1.6	10.81	Medium-High
1381	TRUE	P-542	Bayview Pkwy - Delia St to Collins Dr	200	104	1955	Cast iron	0	1	0.44	67	65	1.03	Highway or highway crossing		6.6	1	6.0	1.75	3	1	1.8	10.80	Medium-High
3208	TRUE	P-2233	North St E - Old Muskoka Rd to Cowan St	150	63	1933	Cast iron	0	1	0.33	89	65	1.37	Local		8.4	1	7.7	1.50	1	1	1.4	10.73	Medium-High
1148	TRUE	P-1048	North St E- Laclie St to St Jean St	150	87.5	1933	Cast iron	0	2	0.33	89	65	1.37	Local		8.4	1	7.7	1.50	1	1	1.4	10.73	Medium-High
1133	TRUE	P-1078	North St E- St Jean St to Canice St	150	91.5	1933	Cast iron	0	2	0.33	89	65	1.37	Local		8.4	1	7.7	1.50	1	1	1.4	10.73	Medium-High
1154	TRUE	P-1034	North St E- Peter St N to Matchedash St N	150	178	1933	Cast iron	0	2	0.33	89	65	1.37	Local		8.4	1	7.7	1.50	1	1	1.4	10.73	Medium-High
1131	TRUE	P-1082	North St E - Highland Ave to Old Muskoka Rd	150	91	1933	Cast iron	0	2	0.33	89	65	1.37	Local		8.4	1	7.7	1.50	1	1	1.4	10.73	Medium-High
1153	TRUE	P-1036	North St E - Matchedash St N to Laclie St	150	180.5	1933	Cast iron	0	2	0.33	89	65	1.37	Local		8.4	1	7.7	1.50	1	1	1.4	10.73	Medium-High
1480	TRUE	P-330	West St S - Bond St to Simcoe St	250	243	1960	Cast iron	0	1	0.56	62	65	0.95	Arterial		6.1	1	5.6	2.00	2	1	1.9	10.68	Medium-High
994	TRUE	P-1422	Mary St - Woodside Dr to Allan St	300	243	1964	Cast iron	0	2	0.67	58	65	0.89	Local		5.8	1	5.3	2.25	1	1	2.0	10.64	Medium-High
1017	TRUE	P-1362	Westmount Dr N at Homewood Ave	300	7	1964	Cast iron	0	2	0.67	58	65	0.89	Collector		5.8	1	5.3	2.25	1	1	2.0	10.64	Medium-High
999	TRUE	P-1410	Westmount Dr N- Arthur St to Harvey St	300	16.5	1964	Cast iron	0	2	0.67	58	65	0.89	Collector		5.8	1	5.3	2.25	1	1	2.0	10.64	Medium-High
3170	TRUE	P-2210	Mary St - Allan St to Hammond Ave	300	321.5	1964	Ductile Iron	0	2	0.67	58	65	0.89	Local		5.8	1	5.3	2.25	1	1	2.0	10.64	Medium-High
3171	TRUE	P-2211	Mary St at Hammond Ave	300	35.5	1964	Ductile Iron	0	1	0.67	58	65	0.89	Local		5.8	1	5.3	2.25	1	1	2.0	10.64	Medium-High
1073	TRUE	P-1240	ZONE 2 TRUNK: Brant St W at West St N	400	8	1976	Cast iron	0	2	0.89	46	65	0.71	Local		4.8	1	4.4	2.75	1	1	2.4	10.59	Medium-High
1569	TRUE	P-134	Mississaga St W- Andrew St N to West St N	200	136.5	1960	Cast iron	3	1	0.44	62	65	0.95	Collector	Historic Downtov	6.1	7	6.2	1.75	1	2	1.7	10.58	Medium-High
1478	TRUE	P-334	Simcoe St - West St S to High St	150	370.5	1959	Cast iron	5	1	0.33	63	65	0.97	Local	Independent Sui	6.2	10	6.6	1.50	1	3	1.6	10.56	Medium-High
1421	TRUE	P-458	Memorial Ave - Elmer Ave to Barrie Rd	150	95	1943	Cast iron	1	1	0.33	79	65	1.22	Arterial		7.6	2	7.0	1.50	2	1	1.5	10.51	Medium-High
1819	TRUE	P-1584	Brant St W - Patrick to West St N	200	150	1953	Cast iron	2	2	0.44	69	65	1.06	Local		6.7	5	6.6	1.75	1	1	1.6	10.48	Medium-High
1432	TRUE	P-436	Bayview Pkwy - Hilda St to Oxford St	200	81	1948	Cast iron	0	1	0.44	74	65	1.14	Local		7.1	1	6.5	1.75	1	1	1.6	10.45	Medium-High
1562	TRUE	P-148	Albert St N- Mississaga St W to Colborne St W	150	134	1936	Cast iron	0	1	0.33	86	65	1.32	Local		8.2	1	7.4	1.50	1	1	1.4	10.41	Medium-High
1815	TRUE	P-104	Mississaga St W and Albert St N	150	11.5	1936	Cast iron	0	1	0.33	86	65	1.32	Collector		8.2	1	7.4	1.50	1	1	1.4	10.41	Medium-High
1431	TRUE	P-438	Oxford St - Forest Ave S to Bayview Pkwy	150	280	1948	Cast iron	5	1	0.33	74	65	1.14	Local		7.1	10	7.4	1.50	1	1	1.4	10.40	Medium-High
980	TRUE	P-1452	Esther Anne Dr at middle	250	7	1958	Cast iron	0	2	0.56	64	65	0.98	Local		6.3	1	5.8	2.00	1	1	1.8	10.39	Medium-High
1249	TRUE	P-836	Borland St - Dalton to Dalton	200	101.5	1954	Cast iron	2	2	0.44	68	65	1.05	Local		6.6	5	6.5	1.75	1	1	1.6	10.36	Medium-High
1841	TRUE	P-1376	Memorial Ave - Progress Dr to Progress Dr & F	300	388	1980	Ductile Iron	4	1	0.67	42	65	0.65	Arterial		4.5	9	4.9	2.25	2	1	2.1	10.31	Medium-High
1253	TRUE	P-828	Belmoral Dr - Martin Dr to June Dr	200	122.5	1960	Cast iron	4	2	0.44	62	65	0.95	Local		6.1	9	6.4	1.75	1	1	1.6	10.28	Medium-High
1433	TRUE	P-434	Hilda St - Forest Ave S to Bayview Pkwy	150	281.5	1948	Cast iron	4	1	0.33	74	65	1.14	Local		7.1	9	7.3	1.50	1	1	1.4	10.26	Medium-High
958	TRUE	P-1506	Peter St N - North St E to Borland St & Borlan	250	476.5	1959	Cast iron	0	2	0.56	63	65	0.97	Local		6.2	1	5.7	2.00	1	1	1.8	10.26	Medium-High
954	TRUE	P-1514	Peter St N - Benner St to North St E	250	108	1959	Cast iron	0	2	0.56	63	65	0.97	Local		6.2	1	5.7	2.00	1	1	1.8	10.26	Medium-High
1707	TRUE	P-280	West St N - Fittons Rd W to Skyline Dr	250	307	1963	Cast iron	0	2	0.56	59	65	0.91	Arterial		5.9	1	5.4	2.00	2	1	1.9	10.25	Medium-High
965	TRUE	P-1492	Wyandotte St - Mississaga St W to Colborne S	150	132	1939	Cast iron	1	1	0.33	83	65	1.28	Local		7.9	2	7.3	1.50	1	1	1.4	10.23	Medium-High
1429	TRUE	P-442	Dunedin St - Edward St to Elmer Pk	150	282	1943	Cast iron	2	1	0.33	79	65	1.22	Local		7.6	5	7.3	1.50	1	1	1.4	10.23	Medium-High
1412	TRUE	P-476	Dallas St - McKinnell St to Argyle Ave	150	91	1943	Cast iron	2	1	0.33	79	65	1.22	Local		7.6	5	7.3	1.50	1	1	1.4	10.23	Medium-High
6764	TRUE	P-580(1)	Gill St - Poughkeepsie St to James	200	126.5	1950	Cast iron	0	1	0.44	72	65	1.11	Collector		7.0	1	6.4	1.75	1	1	1.6	10.21	Medium-High
2089	TRUE	P-2144	Gill St - Atherley Rd to Poughkeepsie St	200	21.5	1950	Cast iron	0	1	0.44	72	65	1.11	Collector		7.0	1	6.4	1.75	1	1	1.6	10.21	Medium-High
2090	TRUE	P-2145	Gill St - Atherley Rd to Poughkeepsie St	200	63	1950	Cast iron	0	1	0.44	72	65	1.11	Collector		7.0	1	6.4	1.75	1	1	1.6	10.21	Medium-High
6875	TRUE	P-580(2)(1)	Gill St - Poughkeepsie St to James	200	153	1950	Cast iron	0	1	0.44	72	65	1.11	Collector		7.0	1	6.4	1.75	1	1	1.6	10.21	Medium-High
6876	TRUE	P-580(2)(2)	Gill St - Poughkeepsie St to James	200	183	1950	Cast iron	0	1	0.44	72	65	1.11	Collector		7.0	1	6.4	1.75	1	1	1.6	10.21	Medium-High
1235	TRUE	P-864	Lawrence Ave - North St W to Gerald Ave	200	110.5	1950	Cast iron	0	2	0.44	72	65	1.11	Local		7.0	1	6.4	1.75	1	1	1.6	10.21	Medium-High
1203	TRUE	P-932	Fittons Rd W - Alexander Rd to West St N	250	277.5	1960	Cast iron	0	2	0.56	62	65	0.95	Collector		6.1	1	5.6	2.00	1	1	1.8	10.12	Medium-High
1571	TRUE	P-130	West St S - Mississaga St W to Market St	100	80	1933	Cast iron	1	1	0.22	89	65	1.37	Arterial		8.4	2	7.8	1.25	2	1	1.3	10.09	Medium-High
3162	TRUE	P-2208	George St - Westmount Dr S to Lakeview Ave	150	181.5	1963	Cast iron	6	2	0.33	59	65	0.91	Local	Harriett Todd Pu	5.9	10	6.3	1.50	1	3	1.6	10.07	Medium-High
3701	TRUE	P-2312	Sundial Dr - Mariposa Dr to Commerce Rd	200	151.5	1962	Cast iron	4	2	0.44	60	65	0.92	Local		6.0	9	6.3	1.75	1	1	1.6	10.03	Medium-High
1605	TRUE	P-38	Brant St - Laclie St to Parkview Ave	150	73	1941	Cast iron	1	1	0.33	81	65	1.25	Local		7.7	2	7.2	1.50	1	1	1.4	10.02	Medium-High
1399	TRUE	P-504	Colborne St W - Hammond Ave to Dallas St	150	135.5	1946	Cast iron	0	1	0.33	76	65	1.17	Arterial		7.3	1	6.7	1.50	2	1	1.5	10.02	Medium-High
1464	TRUE	P-366	Forest Ave S- Bennett to Delia St	150	80.5	1948	Cast iron	3	1	0.33	74	65	1.14	Local		7.1	7	7.1	1.50	1	1	1.4	9.98	Medium
1463	TRUE	P-368	Forest Ave S- Delia St to Oxford St	150	76.5	1948	Cast iron	3	1	0.33	74	65	1.14	Local		7.1	7	7.1	1.50	1	1	1.4	9.98	Medium
1065	TRUE	P-1260	West St S - Coldwater St to Market St	100	61	1933	Cast iron	0	1	0.22	89	65	1.37	Arterial		8.4	1	7.7	1.25	2	1	1.3	9.96	Medium
1561	TRUE	P-150	Mississaga St W - Andrew St N to Albert St N	200	109.5	1960	Cast iron	3	1	0.44	62	65	0.95	Collector		6.1	7	6.2	1.75	1	1	1.6	9.96	Medium
1196	TRUE	P-948	Collegiate Dr - Coldwater Rd to Lewis Dr	300	131.5	1969	Ductile Iron	0	2	0.67	53	65	0.82	Local		5.4	1	4.9	2.25	1	1	2.0	9.88	Medium
1149	TRUE	P-1044	Cedar - Laclie St to St Jean St	150	85.5	1941	Cast iron	0	2	0.33	81	65	1.25	Local		7.7	1	7.1	1.50	1	1	1.4	9.88	Medium
3198	TRUE	P-2226	Cedar - Canice St to St Jean St	150	69	1941	Cast iron	0	2	0.33	81	65	1.25	Local		7.7	1	7.1	1.50	1	1	1.4	9.88	Medium
3199	TRUE	P-2227	Cedar - Canice St to St Jean St	150	21.5	1941	Cast iron	0	2	0.33	81	65	1.25	Local		7.7	1	7.1	1.50	1	1	1.4	9.88	Medium
1020	TRUE	P-1354	Harvey St at Douglas St	150	12.5	1941	Cast iron	0	2	0.33	81	65	1.25	Local		7.7	1	7.1	1.50	1	1	1.4	9.88	Medium
1601	TRUE	P-46	Brant St at Parkview Ave	150	14	1941	Cast iron	0	1	0.33	81	65	1.25	Local		7.7	1	7.1	1.50	1	1	1.4	9.88	Medium
1604	TRUE	P-40	Parkview Ave - Brant St to Tecumseth St	150	136.5	1941	Cast iron	0	1	0.33	81	65	1.25	Local		7.7	1	7.1	1.50	1	1	1.4	9.88	Medium
1363	TRUE	P-582	Millard St - Atherley Rd to James	150	487.5	1949	Cast iron	3	1	0.33	73	65	1.12	Local		7.1	7	7.1	1.50	1	1	1.4	9.88	Medium
949	TRUE	P-1524	Benner St - West St N to the east	200	73.5	1953	Cast iron	0	2	0.44	69	65	1.06	Local		6.7	1	6.2	1.75	1	1	1.6	9.84	Medium

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ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
1258	TRUE	P-818	Brant St - Cameron St to Belmoral Dr	200	24.5	1953	Cast iron	0	2	0.44	69	65	1.06	Local		6.7	1	6.2	1.75	1	1	1.6	9.84	Medium
1255	TRUE	P-824	Brant St - Belmoral Dr to Lawrence Ave	200	111	1953	Cast iron	0	2	0.44	69	65	1.06	Local		6.7	1	6.2	1.75	1	1	1.6	9.84	Medium
1252	TRUE	P-830	Brant St - Easement to Lawrence Ave	200	163	1953	Cast iron	0	2	0.44	69	65	1.06	Local		6.7	1	6.2	1.75	1	1	1.6	9.84	Medium
1822	TRUE	P-934	Brant St E at West St N	200	19	1953	Cast iron	0	2	0.44	69	65	1.06	Local		6.7	1	6.2	1.75	1	1	1.6	9.84	Medium
1307	TRUE	P-710	Barrie Rd - Jameson St to Lexington Ave	300	214	1971	Ductile Iron	1	2	0.67	51	65	0.78	Collector		5.2	2	4.9	2.25	1	1	2.0	9.78	Medium
1264	TRUE	P-806	Cameron St - Coldwater Rd to Penetang St	150	141.5	1942	Cast iron	0	2	0.33	80	65	1.23	Local		7.6	1	7.0	1.50	1	1	1.4	9.78	Medium
1259	TRUE	P-816	Cameron St - Brant St to Penetang St	150	40.5	1942	Cast iron	0	2	0.33	80	65	1.23	Local		7.6	1	7.0	1.50	1	1	1.4	9.78	Medium
1250	TRUE	P-834	Dalton - southwest Borland St to Easement	150	250	1954	Cast iron	7	2	0.33	68	65	1.05	Local		6.6	10	7.0	1.50	1	1	1.4	9.77	Medium
1377	TRUE	P-550	Collins Dr - Bayview Pkwy to MacIsaac Dr	200	148.5	1955	Cast iron	1	1	0.44	67	65	1.03	Local		6.6	2	6.1	1.75	1	1	1.6	9.76	Medium
1308	TRUE	P-708	Birch St - Jameson St to Lexington Ave	200	409	1968	Ductile Iron	2	2	0.44	54	65	0.83	Local	Twin Lakes SS	5.5	5	5.4	1.75	1	3	1.8	9.75	Medium
1574	TRUE	P-124	Mississaga St E- West St to Peter St	200	172	1960	Cast iron	1	1	0.44	62	65	0.95	Collector	Historic Downtov	6.1	2	5.7	1.75	1	2	1.7	9.73	Medium
1586	TRUE	P-84	Mississaga St E - Front St to Matchedash St	200	80	1960	Cast iron	1	1	0.44	62	65	0.95	Collector	Historic Downtov	6.1	2	5.7	1.75	1	2	1.7	9.73	Medium
1247	TRUE	P-840	Borland St - Lawrence Ave to Dalton	200	110	1954	Cast iron	0	2	0.44	68	65	1.05	Local		6.6	1	6.1	1.75	1	1	1.6	9.72	Medium
1232	TRUE	P-870	Borland St - West St N to Dalton	200	121.5	1954	Cast iron	0	2	0.44	68	65	1.05	Local		6.6	1	6.1	1.75	1	1	1.6	9.72	Medium
1230	TRUE	P-874	Park St - Collegiate Dr to Gerald Ave	300	119.5	1976	Ductile Iron	0	2	0.67	46	65	0.71	Local	Orillia SS	4.8	1	4.4	2.25	1	3	2.2	9.71	Medium
1220	TRUE	P-894	Park St - South St to York St	300	114	1976	Ductile Iron	0	2	0.67	46	65	0.71	Local	Samuel-de-Cham	4.8	1	4.4	2.25	1	3	2.2	9.71	Medium
1486	TRUE	P-314	Oxford St - Gill St to Millard St	150	157.5	1948	Cast iron	2	1	0.33	74	65	1.14	Local		7.1	5	6.9	1.50	1	1	1.4	9.70	Medium
1462	TRUE	P-370	Forest Ave S- Oxford St to Hilda St	150	86	1948	Cast iron	2	1	0.33	74	65	1.14	Local		7.1	5	6.9	1.50	1	1	1.4	9.70	Medium
6287	TRUE	P-2691	Laclie - n of Goldie	200	54.5	1959	Ductile Iron	0	2	0.44	63	65	0.97	Arterial		6.2	1	5.7	1.75	2	1	1.7	9.69	Medium
6288	TRUE	P-2692	Laclie -n of Goldie	200	27.5	1959	Cast iron	0	2	0.44	63	65	0.97	Arterial		6.2	1	5.7	1.75	2	1	1.7	9.69	Medium
1750	TRUE	P-1894	Dallas St - Grenville Ave to McKinnell St	150	90.5	1943	Cast iron	0	1	0.33	79	65	1.22	Local		7.6	1	6.9	1.50	1	1	1.4	9.67	Medium
1415	TRUE	P-470	Dallas St - Argyle Ave to Albany Ave	150	97.5	1943	Cast iron	0	1	0.33	79	65	1.22	Local		7.6	1	6.9	1.50	1	1	1.4	9.67	Medium
1511	TRUE	P-258	Dunedin St - Colborne St W to Edward St	150	99	1943	Cast iron	0	1	0.33	79	65	1.22	Local		7.6	1	6.9	1.50	1	1	1.4	9.67	Medium
1428	TRUE	P-444	Dunedin St - Elmer Pk to Barrie Rd	150	112.5	1943	Cast iron	0	1	0.33	79	65	1.22	Local		7.6	1	6.9	1.50	1	1	1.4	9.67	Medium
1152	TRUE	P-1038	Laclie St - North St N to Cedar	100	152.5	1936	Cast iron	0	2	0.22	86	65	1.32	Arterial		8.2	1	7.4	1.25	2	1	1.3	9.67	Medium
1079	TRUE	P-1218	Laclie St - Jarvis St to Brant St	100	161.5	1936	Cast iron	0	1	0.22	86	65	1.32	Arterial		8.2	1	7.4	1.25	2	1	1.3	9.67	Medium
1611	TRUE	P-26	Laclie St - Brant St to Tecumseth St	100	138.5	1936	Cast iron	0	1	0.22	86	65	1.32	Arterial		8.2	1	7.4	1.25	2	1	1.3	9.67	Medium
6391	TRUE	P-2725	Laclie -Borland to Cedar	100	45	1936	Cast iron	0	2	0.22	86	65	1.32	Arterial		8.2	1	7.4	1.25	2	1	1.3	9.67	Medium
6392	TRUE	P-2726	Laclie -Borland to Cedar	100	107.5	1936	Cast iron	0	2	0.22	86	65	1.32	Arterial		8.2	1	7.4	1.25	2	1	1.3	9.67	Medium
1234	TRUE	P-866	North St W- Lawrence Ave to West St N	150	334	1955	Cast iron	8	2	0.33	67	65	1.03	Local		6.6	10	6.9	1.50	1	1	1.4	9.66	Medium
1241	TRUE	P-852	Belmoral Dr - June Dr to Collegiate Dr	200	121	1960	Cast iron	2	2	0.44	62	65	0.95	Local		6.1	5	6.0	1.75	1	1	1.6	9.64	Medium
1248	TRUE	P-838	Dalton - southeast Borland St to Easement	150	249.5	1954	Cast iron	4	2	0.33	68	65	1.05	Local		6.6	9	6.9	1.50	1	1	1.4	9.63	Medium
1631	TRUE	P-90	ZONE 1 TRUNK: Mississaga St W -O'Brien St t	300	98.5	1976	Ductile Iron	2	1	0.67	46	65	0.71	Collector		4.8	5	4.8	2.25	1	1	2.0	9.62	Medium
1180	TRUE	P-980	Orma Dr - Grace Ave along Jamieson Dr to Fit	200	818	1969	Cast iron	2	2	0.44	53	65	0.82	Local	Patrick Fogarty (	5.4	5	5.3	1.75	1	3	1.8	9.61	Medium
1784	TRUE	P-1342	Harvey St - Westmount Dr N to McKenzie St	150	402	1945	Cast iron	1	2	0.33	77	65	1.18	Local		7.4	2	6.9	1.50	1	1	1.4	9.60	Medium
1411	TRUE	P-480	Linwood Ave - Hammond Ave to Dallas St	150	133.5	1949	Cast iron	2	1	0.33	73	65	1.12	Local		7.1	5	6.9	1.50	1	1	1.4	9.60	Medium
997	TRUE	P-1414	Westmount Dr N - Rosemary Rd to Woodside	300	125	1971	Ductile Iron	0	2	0.67	51	65	0.78	Collector		5.2	1	4.8	2.25	1	1	2.0	9.58	Medium
1309	TRUE	P-706	Barrie Rd - Marlisa Dr to Jameson St	300	56	1971	Ductile Iron	0	2	0.67	51	65	0.78	Collector		5.2	1	4.8	2.25	1	1	2.0	9.58	Medium
1305	TRUE	P-714	Barrie Rd - Lexington Ave to Lakeview Ave	300	86.5	1971	Ductile Iron	0	2	0.67	51	65	0.78	Collector		5.2	1	4.8	2.25	1	1	2.0	9.58	Medium
916	TRUE	P-716	Barrie Rd - WalkerAve to Marlisa Dr	300	177.5	1971	Ductile Iron	0	2	0.67	51	65	0.78	Collector		5.2	1	4.8	2.25	1	1	2.0	9.58	Medium
1581	TRUE	P-108	Mississaga St E at Peter St	200	11	1960	Cast iron	0	1	0.44	62	65	0.95	Collector	Historic Downtov	6.1	1	5.6	1.75	1	2	1.7	9.56	Medium
1580	TRUE	P-110	MississagaSt E - Peter St to Matchedash St	200	182.5	1960	Cast iron	0	1	0.44	62	65	0.95	Collector	Historic Downtov	6.1	1	5.6	1.75	1	2	1.7	9.56	Medium
1660	TRUE	P-1720	Regent St - Oxford St south to end	150	280	1956	Cast iron	5	1	0.33	66	65	1.02	Local		6.5	10	6.8	1.50	1	1	1.4	9.55	Medium
1745	TRUE	P-1890	Goldie Dr - Fourth St to Third St	200	144.5	1961	Cast iron	2	2	0.44	61	65	0.94	Local		6.1	5	5.9	1.75	1	1	1.6	9.51	Medium
1737	TRUE	P-1874	Murray St - Second St to First St	200	145.5	1961	Cast iron	2	2	0.44	61	65	0.94	Local		6.1	5	5.9	1.75	1	1	1.6	9.51	Medium
2001	TRUE	P-2094	James St - West St S to Keith St	200	131	1961	Ductile Iron	2	1	0.44	61	65	0.94	Local		6.1	5	5.9	1.75	1	1	1.6	9.51	Medium
1181	TRUE	P-978	Orma Dr - Fittons Rd E to Grace Ave	200	308	1961	Cast iron	2	2	0.44	61	65	0.94	Local		6.1	5	5.9	1.75	1	1	1.6	9.51	Medium
6767	TRUE	P-556(1)	Couchiching Pt Rd - Atherley Rd to Broadview	250	33.5	1966	Cast iron	1	1	0.56	56	65	0.86	Local		5.6	2	5.3	2.00	1	1	1.8	9.48	Medium
6881	TRUE	P-556(2)(1)	Couchiching Pt Rd - Atherley Rd to Broadview	250	292	1966	Cast iron	1	1	0.56	56	65	0.86	Local		5.6	2	5.3	2.00	1	1	1.8	9.48	Medium
6882	TRUE	P-556(2)(2)	Couchiching Pt Rd - Atherley Rd to Broadview	250	13	1966	Cast iron	1	1	0.56	56	65	0.86	Local		5.6	2	5.3	2.00	1	1	1.8	9.48	Medium
919	TRUE	P-1124	Drinkwater Dr - Hughes Rd to Bridget Dr	200	173	1968	Cast iron	5	1	0.44	54	65	0.83	Local		5.5	10	5.9	1.75	1	1	1.6	9.47	Medium
1289	TRUE	P-748	Colborne St W - Westmount Dr S to Hammon	100	133.5	1946	Cast iron	3	1	0.22	76	65	1.17	Arterial		7.3	7	7.3	1.25	2	1	1.3	9.46	Medium
1600	TRUE	P-48	Parkview Ave - Brant St to Jarvis St	150	164.5	1945	Cast iron	0	1	0.33	77	65	1.18	Local		7.4	1	6.8	1.50	1	1	1.4	9.46	Medium
1106	TRUE	P-1146	Neywash St - Peter St N to Matchedash St N	150	186.5	1945	Ductile Iron	0	1	0.33	77	65	1.18	Local		7.4	1	6.8	1.50	1	1	1.4	9.46	Medium
1592	TRUE	P-64	Neywash St at Matchedash St N	150	6	1945	Ductile Iron	0	1	0.33	77	65	1.18	Local		7.4	1	6.8	1.50	1	1	1.4	9.46	Medium
1477	TRUE	P-336	High St - Simcoe St to Shannon St	150	279	1958	Cast iron	1	1	0.33	64	65	0.98	Highway or highway crossing		6.3	2	5.9	1.50	3	1	1.6	9.40	Medium
1402	TRUE	P-498	ZONE 1 TRUNK: Mississaga St W - McKenzie S	300	56.5	1978	Ductile Iron	0	1	0.67	44	65	0.68	Collector	Oak Terrace Lon	4.6	1	4.3	2.25	1	3	2.2	9.37	Medium
1708	TRUE	P-328	West St N - north of Skyline Dr	200	76	1963	Cast iron	1	2	0.44	59	65	0.91	Arterial		5.9	2	5.5	1.75	2	1	1.7	9.34	Medium
1634	TRUE	P-804	ZONE 1 TRUNK at Rosemary Reservoir	400	545.5	1983	Ductile Iron	0	1	0.89	39	65	0.60	Collector		4.2	1	3.9	2.75	1	1	2.4	9.32	Medium
1639	TRUE	P-1550	Broadview Ave - Couchiching Pt Rd to Moone	250	75.5	1966	Ductile Iron	0	1	0.56	56	65	0.86	Local		5.6	1	5.2	2.00	1	1	1.8	9.30	Medium

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															Probability of Failure Factors			Consequence of Failure Factors					
ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
1640	TRUE	P-1552	Broadview Ave - Mooney Cr to Dale Dr	250	130.5	1966	Ductile Iron	0	1	0.56	56	65	0.86	Local		5.6	1	5.2	2.00	1	1	1.8	9.30	Medium
1446	TRUE	P-408	Forest Ave S- James St to Franklin St	150	80.5	1948	Cast iron	1	1	0.33	74	65	1.14	Local		7.1	2	6.6	1.50	1	1	1.4	9.28	Medium
1485	TRUE	P-316	Oxford St - Millard St to Regent St	150	179.5	1948	Cast iron	1	1	0.33	74	65	1.14	Local		7.1	2	6.6	1.50	1	1	1.4	9.28	Medium
1457	TRUE	P-384	Oxford St - Raymond Ave to Forest Ave S	150	129.5	1948	Cast iron	1	1	0.33	74	65	1.14	Local		7.1	2	6.6	1.50	1	1	1.4	9.28	Medium
1442	TRUE	P-416	Forest Ave S - Crawford St to Hilda St	150	85	1948	Cast iron	1	1	0.33	74	65	1.14	Local		7.1	2	6.6	1.50	1	1	1.4	9.28	Medium
1709	TRUE	P-346	Commerce Rd - west of West St N	250	331.5	1973	Ductile Iron	0	2	0.56	49	65	0.75	Local	Kubota Materials	5.0	1	4.6	2.00	1	3	2.0	9.28	Medium
1729	TRUE	P-1856	Murray St - First St to Sundial Dr	200	36.5	1959	Cast iron	1	2	0.44	63	65	0.97	Local		6.2	2	5.8	1.75	1	1	1.6	9.28	Medium
1409	TRUE	P-484	McKinnell St - Dallas St to Bleeker St	150	107	1947	Cast iron	0	1	0.33	75	65	1.15	Local		7.2	1	6.6	1.50	1	1	1.4	9.25	Medium
1408	TRUE	P-486	McKinnell St - Bleeker St to Frederick St	150	93.5	1947	Cast iron	0	1	0.33	75	65	1.15	Local		7.2	1	6.6	1.50	1	1	1.4	9.25	Medium
3722	TRUE	P-2325	Forest Ave N- Industrial St to Atherley Rd	150	81.5	1949	Cast iron	1	1	0.33	73	65	1.12	Local		7.1	2	6.6	1.50	1	1	1.4	9.18	Medium
1766	TRUE	P-1484	Millard St- Oxford St to the north	150	160	1949	Cast iron	1	1	0.33	73	65	1.12	Local		7.1	2	6.6	1.50	1	1	1.4	9.18	Medium
1097	TRUE	P-1170	Forest Ave N- Lightfoot Trail to Industrial St	150	60.5	1949	Cast iron	1	1	0.33	73	65	1.12	Local		7.1	2	6.6	1.50	1	1	1.4	9.18	Medium
1345	TRUE	P-620	Forest Ave N- Brewery Ln to Lightfoot Trail	150	20	1949	Cast iron	1	1	0.33	73	65	1.12	Local		7.1	2	6.6	1.50	1	1	1.4	9.18	Medium
6447	TRUE	P-2748	West St N at Hwy 12 overpass	200	75.5	1963	Cast iron	0	2	0.44	59	65	0.91	Arterial		5.9	1	5.4	1.75	2	1	1.7	9.17	Medium
1254	TRUE	P-826	Belmoral Dr - Brant St to Martin Dr	200	99	1960	Cast iron	1	2	0.44	62	65	0.95	Local		6.1	2	5.7	1.75	1	1	1.6	9.16	Medium
1717	TRUE	P-1696	Grace Ave - Laclie St west to easement	150	292.5	1960	Cast iron	1	2	0.33	62	65	0.95	Local	Trillium Manor	6.1	2	5.7	1.50	1	3	1.6	9.16	Medium
1021	TRUE	P-1352	Douglas St - Harvey St to Nottawasaga St	150	117.5	1948	Cast iron	0	2	0.33	74	65	1.14	Local		7.1	1	6.5	1.50	1	1	1.4	9.14	Medium
1452	TRUE	P-386	Oxford St - Regent St to East St	150	91.5	1948	Cast iron	0	1	0.33	74	65	1.14	Local		7.1	1	6.5	1.50	1	1	1.4	9.14	Medium
1440	TRUE	P-420	Forest Ave S- Franklin St to Crawford St	150	83.5	1948	Cast iron	0	1	0.33	74	65	1.14	Local		7.1	1	6.5	1.50	1	1	1.4	9.14	Medium
1237	TRUE	P-860	Lawrence Ave - Borland St to Brant St	150	308.5	1956	Cast iron	3	2	0.33	66	65	1.02	Local		6.5	7	6.5	1.50	1	1	1.4	9.13	Medium
951	TRUE	P-1520	Peter St N - Champlain St to Benner St	200	105	1959	Cast iron	0	2	0.44	63	65	0.97	Local		6.2	1	5.7	1.75	1	1	1.6	9.12	Medium
1661	TRUE	P-1722	Simcoe St - Gill St east to end	150	151.5	1959	Cast iron	0	1	0.33	63	65	0.97	Local	Regent Park Pub	6.2	1	5.7	1.50	1	3	1.6	9.12	Medium
1124	TRUE	P-1102	Sundial Dr- Hughes Rd to Galley Ave	200	573	1967	Ductile Iron	3	1	0.44	55	65	0.85	Local		5.5	7	5.7	1.75	1	1	1.6	9.11	Medium
1170	TRUE	P-1002	Fittons Rd E- Harmon Rd to Tallwood Dr	250	99.5	1969	Cast iron	1	1	0.56	53	65	0.82	Collector		5.4	2	5.0	2.00	1	1	1.8	9.07	Medium
1202	TRUE	P-936	Collegiate Dr - Rosslyn Rd to Lindsay Cr	200	88	1969	Ductile Iron	1	2	0.44	53	65	0.82	Local	Orillia Secondary	5.4	2	5.0	1.75	1	3	1.8	9.07	Medium
3723	TRUE	P-2326	Forest Ave N - Industrial St to Atherley Rd	150	23	1949	Cast iron	0	1	0.33	73	65	1.12	Local		7.1	1	6.5	1.50	1	1	1.4	9.04	Medium
3631	TRUE	P-2308	Westmount Dr S- Mississaga St W to Colborne	150	48	1949	Cast iron	0	1	0.33	73	65	1.12	Collector		7.1	1	6.5	1.50	1	1	1.4	9.04	Medium
1003	TRUE	P-1402	ZONE 1 TRUNK- Westmount Dr N at Mississag	150	8	1949	Cast iron	0	1	0.33	73	65	1.12	Collector		7.1	1	6.5	1.50	1	1	1.4	9.04	Medium
6170	TRUE	P-2640	Westmount -n of Colborne	150	54.5	1949	Cast iron	0	1	0.33	73	65	1.12	Collector		7.1	1	6.5	1.50	1	1	1.4	9.04	Medium
1361	TRUE	P-586	Moffat St - Atherley Rd to James	150	383.5	1949	Cast iron	0	1	0.33	73	65	1.12	Local		7.1	1	6.5	1.50	1	1	1.4	9.04	Medium
1319	TRUE	P-686	Linwood Ave - Hammond Ave to Westmount	150	223	1949	Cast iron	0	1	0.33	73	65	1.12	Collector		7.1	1	6.5	1.50	1	1	1.4	9.04	Medium
1288	TRUE	P-750	Westmount Dr S - Colborne St W to Grenville	150	97	1949	Cast iron	0	1	0.33	73	65	1.12	Collector		7.1	1	6.5	1.50	1	1	1.4	9.04	Medium
1738	TRUE	P-1876	Boundary Rd - Third St to Second St	200	142	1961	Cast iron	1	2	0.44	61	65	0.94	Local		6.1	2	5.6	1.75	1	1	1.6	9.03	Medium
2002	TRUE	P-2095	James St - West St S to Keith St	200	121	1961	Ductile Iron	1	1	0.44	61	65	0.94	Local		6.1	2	5.6	1.75	1	1	1.6	9.03	Medium
1539	TRUE	P-202	Victoria St - Andrew St S to Albert St S	100	119.5	1935	Cast iron	0	1	0.22	87	65	1.34	Local		8.2	1	7.5	1.25	1	1	1.2	9.01	Medium
1267	TRUE	P-798	Patrick St - Coldwater Rd to Nottawasaga St	100	97	1935	Cast iron	0	2	0.22	87	65	1.34	Local		8.2	1	7.5	1.25	1	1	1.2	9.01	Medium
1228	TRUE	P-878	Belmoral Dr - Collegiate Dr to Gerald Ave	200	111	1960	Cast iron	0	2	0.44	62	65	0.95	Local		6.1	1	5.6	1.75	1	1	1.6	9.00	Medium
3448	TRUE	P-2280	West St S - Shannon St to Olive Cr & Olive Cr	150	393.5	1967	Ductile Iron	6	1	0.33	55	65	0.85	Arterial		5.5	10	6.0	1.50	2	1	1.5	8.99	Medium
1205	TRUE	P-928	Fittons Rd W- Park St to Derby St	250	211	1975	Ductile Iron	0	2	0.56	47	65	0.72	Collector	Champlain Mano	4.9	1	4.5	2.00	1	3	2.0	8.98	Medium
1502	TRUE	P-278	James St at West St S	250	31	1970	Cast iron	1	1	0.56	52	65	0.80	Local		5.3	2	5.0	2.00	1	1	1.8	8.94	Medium
3973	TRUE	P-2343	Hoover Cr - High St to James	150	156	1958	Cast iron	3	1	0.33	64	65	0.98	Local		6.3	7	6.4	1.50	1	1	1.4	8.92	Medium
1644	TRUE	P-1568	Glen Cr - Dale Dr north to Pipe Change	200	179.5	1966	Cast iron	2	1	0.44	56	65	0.86	Local		5.6	5	5.6	1.75	1	1	1.6	8.91	Medium
922	TRUE	P-1620	Arthur St - Westmount Dr N west to mid	200	399.5	1966	Ductile Iron	2	2	0.44	56	65	0.86	Local		5.6	5	5.6	1.75	1	1	1.6	8.91	Medium
1306	TRUE	P-712	Lakeview Ave - George St to Barrie Rd	200	274	1966	Cast iron	2	2	0.44	56	65	0.86	Local		5.6	5	5.6	1.75	1	1	1.6	8.91	Medium
2070	TRUE	P-2132	Fittons Rd E - east of Bay	250	7	1969	Ductile Iron	0	1	0.56	53	65	0.82	Collector		5.4	1	4.9	2.00	1	1	1.8	8.89	Medium
2071	TRUE	P-2133	Fittons Rd E- east of Bay	250	342.5	1969	Cast iron	0	1	0.56	53	65	0.82	Collector		5.4	1	4.9	2.00	1	1	1.8	8.89	Medium
1171	TRUE	P-1000	Fittons Rd E- Highland Ave to Harmon Rd	250	95	1969	Cast iron	0	1	0.56	53	65	0.82	Collector		5.4	1	4.9	2.00	1	1	1.8	8.89	Medium
1169	TRUE	P-1004	Fittons Rd E- Tallwood Dr to Stanton Dr	250	51.5	1969	Cast iron	0	1	0.56	53	65	0.82	Collector		5.4	1	4.9	2.00	1	1	1.8	8.89	Medium
1172	TRUE	P-998	Fittons Rd E - Old Muskoka Rd to Highland Av	250	137	1969	Ductile Iron	0	1	0.56	53	65	0.82	Collector		5.4	1	4.9	2.00	1	1	1.8	8.89	Medium
1728	TRUE	P-1854	First St - Goldie Dr to Murray St	150	207	1961	Cast iron	4	2	0.33	61	65	0.94	Local		6.1	9	6.3	1.50	1	1	1.4	8.89	Medium
1719	TRUE	P-1790	Fourth St - Lahay Ave to Boundary Rd	200	96.5	1961	Ductile Iron	0	2	0.44	61	65	0.94	Local		6.1	1	5.5	1.75	1	1	1.6	8.87	Medium
1735	TRUE	P-1868	Goldie Dr - Third St to west of Second St	200	88.5	1961	Cast iron	0	2	0.44	61	65	0.94	Local		6.1	1	5.5	1.75	1	1	1.6	8.87	Medium
1734	TRUE	P-1866	Goldie Dr - east of Third St to Second St	200	57.5	1961	Cast iron	0	2	0.44	61	65	0.94	Local		6.1	1	5.5	1.75	1	1	1.6	8.87	Medium
1663	TRUE	P-1728	James St - Keith St to High St	200	93.5	1961	Ductile Iron	0	1	0.44	61	65	0.94	Local		6.1	1	5.5	1.75	1	1	1.6	8.87	Medium
1727	TRUE	P-1846	Goldie Dr - Second St to First St	200	145	1961	Cast iron	0	2	0.44	61	65	0.94	Local		6.1	1	5.5	1.75	1	1	1.6	8.87	Medium
1725	TRUE	P-1842	Second St- Boundary Rd to Murray St	200	64.5	1961	Ductile Iron	0	2	0.44	61	65	0.94	Local		6.1	1	5.5	1.75	1	1	1.6	8.87	Medium
1721	TRUE	P-1828	Boundary Rd - Fourth St to Third St	200	145	1961	Cast iron	0	2	0.44	61	65	0.94	Local		6.1	1	5.5	1.75	1	1	1.6	8.87	Medium
1746	TRUE	P-982	Goldie Dr - Sundial Dr to First St	200	181.5	1961	Cast iron	0	2	0.44	61	65	0.94	Local		6.1	1	5.5	1.75	1	1	1.6	8.87	Medium
2145	TRUE	P-2175	Park St - Johnson St to Fittons Rd W	300	45	1976	Ductile Iron	0	2	0.67	46	65	0.71	Local		4.8	1	4.4	2.25	1	1	2.0	8.82	Medium
2146	TRUE	P-2176	Park St - Johnson St to Fittons Rd W	300	98.5	1976	Ductile Iron	0	2	0.67	46	65	0.71	Local		4.8	1	4.4	2.25	1	1	2.0	8.82	Medium

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1633	TRUE	P-594	ZONE 1 TRUNK: Mississaga St W at O'Brien	300	14.5	1976	Ductile Iron	0	1	0.67	46	65	0.71	Collector		4.8	1	4.4	2.25	1	1	2.0	8.82	Medium
1224	TRUE	P-886	Park St - North St W to Gerald Ave	300	112.5	1976	Ductile Iron	0	2	0.67	46	65	0.71	Local		4.8	1	4.4	2.25	1	1	2.0	8.82	Medium
1223	TRUE	P-888	Park St - York St to North St W	300	107.5	1976	Ductile Iron	0	2	0.67	46	65	0.71	Local		4.8	1	4.4	2.25	1	1	2.0	8.82	Medium
1215	TRUE	P-908	Park St - Calverley St to South St	300	143.5	1976	Ductile Iron	0	2	0.67	46	65	0.71	Local		4.8	1	4.4	2.25	1	1	2.0	8.82	Medium
1212	TRUE	P-914	Park St - Johnson St to Calverley St	300	146.5	1976	Ductile Iron	0	2	0.67	46	65	0.71	Local		4.8	1	4.4	2.25	1	1	2.0	8.82	Medium
1015	TRUE	P-1368	Homewood Ave - Westmount Dr N to Woods	150	678	1963	Cast iron	5	2	0.33	59	65	0.91	Local		5.9	10	6.3	1.50	1	1	1.4	8.81	Medium
1112	TRUE	P-1128	Maple Dr - Francis Rd to Bay St	200	168.5	1963	Cast iron	1	1	0.44	59	65	0.91	Local		5.9	2	5.5	1.75	1	1	1.6	8.79	Medium
1842	TRUE	P-380	Memorial Ave - Progress Dr to Progress Dr & I	300	197	1979	Ductile Iron	0	1	0.67	43	65	0.66	Arterial		4.5	1	4.2	2.25	2	1	2.1	8.79	Medium
1594	TRUE	P-60	Coldwater Rd - Front St to Matchedash St	100	94.5	1945	Cast iron	0	1	0.22	77	65	1.18	Arterial		7.4	1	6.8	1.25	2	1	1.3	8.78	Medium
1590	TRUE	P-72	Coldwater Rd - Peter St N to Matchedash St	100	182.5	1945	Cast iron	0	1	0.22	77	65	1.18	Arterial		7.4	1	6.8	1.25	2	1	1.3	8.78	Medium
914	TRUE	P-1638	Walker Ave EXTENSION Barrie Rd to OPP	450	1,134.50	1993	Ductile Iron	0	2	1.00	29	65	0.45	Highway or highway crossing		3.4	1	3.1	3.00	3	1	2.8	8.76	Medium
3702	TRUE	P-2313	Sundial Dr at Cantebury Circle	200	27.5	1962	Cast iron	0	2	0.44	60	65	0.92	Local		6.0	1	5.5	1.75	1	1	1.6	8.75	Medium
6286	TRUE	P-2690	Sundial - Laclie to Mariposa	200	66	1962	Cast iron	0	2	0.44	60	65	0.92	Local		6.0	1	5.5	1.75	1	1	1.6	8.75	Medium
1711	TRUE	P-1848	Fittons Heights - Fittons Rd E north to Y	150	243.5	1960	Cast iron	3	2	0.33	62	65	0.95	Local		6.1	7	6.2	1.50	1	1	1.4	8.71	Medium
6566	TRUE	P-2822	Brewary - Forest Ave N to end	150	174	1960	Ductile Iron	3	1	0.33	62	65	0.95	Local		6.1	7	6.2	1.50	1	1	1.4	8.71	Medium
3974	TRUE	P-2344	Hoover Cr - High St to James	150	86.5	1958	Cast iron	2	1	0.33	64	65	0.98	Local		6.3	5	6.2	1.50	1	1	1.4	8.64	Medium
3771	TRUE	P-2341	Drinkwater Dr - Hughes Rd to Francis Rd	200	2.5	1963	Cast iron	0	1	0.44	59	65	0.91	Local		5.9	1	5.4	1.75	1	1	1.6	8.63	Medium
3772	TRUE	P-2342	Drinkwater Dr - Hughes Rd to Francis Rd	200	118	1963	Cast iron	0	1	0.44	59	65	0.91	Local		5.9	1	5.4	1.75	1	1	1.6	8.63	Medium
1114	TRUE	P-1122	Hughes Rd at Drinkwater Dr	200	7	1963	Cast iron	0	1	0.44	59	65	0.91	Local		5.9	1	5.4	1.75	1	1	1.6	8.63	Medium
1207	TRUE	P-924	Leach St - Fittons Rd W to Calverley St	150	316	1961	Cast iron	3	2	0.33	61	65	0.94	Local		6.1	7	6.1	1.50	1	1	1.4	8.61	Medium
1684	TRUE	P-1780	Andrew St S - Barrie Rd south to end	100	136.5	1941	Cast iron	1	1	0.22	81	65	1.25	Local		7.7	2	7.2	1.25	1	1	1.2	8.59	Medium
1035	TRUE	P-1318	Old Muskoka Rd - Landon St to Delta St	300	232	1979	Ductile Iron	1	2	0.67	43	65	0.66	Local		4.5	2	4.3	2.25	1	1	2.0	8.57	Medium
2124	TRUE	P-2164	Elmer Ave at Memorial Ave	150	71	1943	PVC	0	1	0.33	79	75	1.05	Local		6.7	1	6.1	1.50	1	1	1.4	8.56	Medium
1168	TRUE	P-1006	Highland Ave- Fittons Rd E to Delta St	150	214.5	1959	Cast iron	2	1	0.33	63	65	0.97	Local		6.2	5	6.1	1.50	1	1	1.4	8.54	Medium
1164	TRUE	P-1014	Highland Ave - Harmon Rd to Tallwood Dr	150	104.5	1959	Cast iron	2	1	0.33	63	65	0.97	Local		6.2	5	6.1	1.50	1	1	1.4	8.54	Medium
893	TRUE	P-310	Simcoe St - High St to Gill St	150	267.5	1959	Cast iron	2	1	0.33	63	65	0.97	Local		6.2	5	6.1	1.50	1	1	1.4	8.54	Medium
978	TRUE	P-1456	ZONE 1 TRUNK: Mississaga St W - Douglas St	300	58.5	1978	Ductile Iron	0	1	0.67	44	65	0.68	Collector		4.6	1	4.3	2.25	1	1	2.0	8.52	Medium
2078	TRUE	P-2137	ZONE 1 TRUNK: Mississaga St W: Volunteer D	300	50	1978	Ductile Iron	0	1	0.67	44	65	0.68	Collector		4.6	1	4.3	2.25	1	1	2.0	8.52	Medium
975	TRUE	P-1462	ZONE 1 TRUNK: Mississaga St at O'Brien	300	90.5	1978	Ductile Iron	0	1	0.67	44	65	0.68	Collector		4.6	1	4.3	2.25	1	1	2.0	8.52	Medium
1401	TRUE	P-500	ZONE 1 TRUNK: Mississaga St W - McKenzie S	300	71.5	1978	Ductile Iron	0	1	0.67	44	65	0.68	Collector		4.6	1	4.3	2.25	1	1	2.0	8.52	Medium
2077	TRUE	P-2136	ZONE 1 TRUNK: Mississaga St W - Frederick S	300	128	1978	Ductile Iron	0	1	0.67	44	65	0.68	Collector		4.6	1	4.3	2.25	1	1	2.0	8.52	Medium
1395	TRUE	P-512	ZONE 1 TRUNK: Mississaga St W - Douglas St	300	159	1978	Ductile Iron	0	1	0.67	44	65	0.68	Collector		4.6	1	4.3	2.25	1	1	2.0	8.52	Medium
1339	TRUE	P-632	James St- James Ct to Memorial Ave	300	120.5	1978	Ductile Iron	0	1	0.67	44	65	0.68	Local		4.6	1	4.3	2.25	1	1	2.0	8.52	Medium
932	TRUE	P-752	ZONE 1 TRUNK: Mississaga St W - Hammond	300	108.5	1978	Ductile Iron	0	1	0.67	44	65	0.68	Collector		4.6	1	4.3	2.25	1	1	2.0	8.52	Medium
1251	TRUE	P-832	Brant St to Dalton Cr S on easement	150	86	1954	Cast iron	0	2	0.33	68	65	1.05	Local		6.6	1	6.1	1.50	1	1	1.4	8.51	Medium
1231	TRUE	P-872	Dalton (north) - Borland St to Borland St	150	379.5	1954	Cast iron	0	2	0.33	68	65	1.05	Local		6.6	1	6.1	1.50	1	1	1.4	8.51	Medium
6567	TRUE	P-2823	Brewary - Forest Ave N to end	150	436	1960	Ductile Iron	2	1	0.33	62	65	0.95	Local		6.1	5	6.0	1.50	1	1	1.4	8.43	Medium
1239	TRUE	P-856	Rosslyn Rd - Martin Dr to Collegiate Dr	150	242	1960	Cast iron	2	2	0.33	62	65	0.95	Local		6.1	5	6.0	1.50	1	1	1.4	8.43	Medium
3234	TRUE	P-2248	Fittons Rd E - Laclie St to Old Muskoka Rd	250	5.5	1983	Ductile Iron	4	1	0.56	39	65	0.60	Collector		4.2	9	4.7	2.00	1	1	1.8	8.43	Medium
3158	TRUE	P-2206	Barrie Rd - Lakeview Ave to Westmount Dr S	200	181.5	1966	Cast iron	1	2	0.44	56	65	0.86	Collector		5.6	2	5.3	1.75	1	1	1.6	8.43	Medium
1009	TRUE	P-1386	Progress Dr - Ontario St to Memorial Ave	300	360.5	1980	Ductile Iron	1	1	0.67	42	65	0.65	Local		4.5	2	4.2	2.25	1	1	2.0	8.42	Medium
1290	TRUE	P-746	Grenville Ave - Westmount Dr S to Hammond	100	130	1947	Cast iron	2	1	0.22	75	65	1.15	Local		7.2	5	7.0	1.25	1	1	1.2	8.41	Medium
1113	TRUE	P-1126	Hughes Rd - Drinkwater Rd to Bridget Dr	150	254.5	1963	Ductile Iron	3	1	0.33	59	65	0.91	Local		5.9	7	6.0	1.50	1	1	1.4	8.39	Medium
1105	TRUE	P-170	Front St at Elgin St	250	10	1976	Cast iron	0	1	0.56	46	65	0.71	Arterial		4.8	1	4.4	2.00	2	1	1.9	8.38	Medium
1013	TRUE	P-1378	Progress Dr - Ontario St to southwest corner	300	192.5	1979	Ductile Iron	0	1	0.67	43	65	0.66	Local		4.5	1	4.2	2.25	1	1	2.0	8.37	Medium
1032	TRUE	P-1324	Old Muskoka Rd - Delta St to the south of Fitt	300	156.5	1979	Ductile Iron	0	1	0.67	43	65	0.66	Local		4.5	1	4.2	2.25	1	1	2.0	8.37	Medium
1056	TRUE	P-1278	Canice St - Borland St to North St E	300	124	1979	Ductile Iron	0	1	0.67	43	65	0.66	Local		4.5	1	4.2	2.25	1	1	2.0	8.37	Medium
1030	TRUE	P-1328	Old Muskoka Rd - Fittons Rd E to south	300	48	1979	Ductile Iron	0	1	0.67	43	65	0.66	Local		4.5	1	4.2	2.25	1	1	2.0	8.37	Medium
1093	TRUE	P-1178	Canice St - Borland St to Jarvis St	300	144.5	1979	Ductile Iron	0	1	0.67	43	65	0.66	Local		4.5	1	4.2	2.25	1	1	2.0	8.37	Medium
1058	TRUE	P-1274	Canice St - Cedar to Borland St	300	162	1979	Ductile Iron	0	1	0.67	43	65	0.66	Local		4.5	1	4.2	2.25	1	1	2.0	8.37	Medium
1040	TRUE	P-1310	Old Muskoka Rd - Landon St to North St E & N	300	300.5	1979	Ductile Iron	0	1	0.67	43	65	0.66	Local		4.5	1	4.2	2.25	1	1	2.0	8.37	Medium
1092	TRUE	P-1182	Canice St at Jarvis St	300	5.5	1979	Ductile Iron	0	1	0.67	43	65	0.66	Local		4.5	1	4.2	2.25	1	1	2.0	8.37	Medium
1720	TRUE	P-1812	Third St - Boundary Rd to Goldie Dr	150	270	1961	Cast iron	2	2	0.33	61	65	0.94	Local		6.1	5	5.9	1.50	1	1	1.4	8.33	Medium
972	TRUE	P-1472	Mississaga St W - Volunteer Dr to O'Brien St	200	81	1967	Cast iron	1	1	0.44	55	65	0.85	Collector		5.5	2	5.2	1.75	1	1	1.6	8.31	Medium
1358	TRUE	P-592	Atherley Rd to Industrial Easement at Moffat S	150	173.5	1956	Cast iron	0	1	0.33	66	65	1.02	Local		6.5	1	5.9	1.50	1	1	1.4	8.29	Medium
1482	TRUE	P-324	Regent St - James St to Oxford St	150	341	1956	Cast iron	0	1	0.33	66	65	1.02	Local		6.5	1	5.9	1.50	1	1	1.4	8.29	Medium
1354	TRUE	P-602	Lightfoot Trail south to Industrial St Easement	150	90.5	1956	Cast iron	0	1	0.33	66	65	1.02	Local		6.5	1	5.9	1.50	1	1	1.4	8.29	Medium
1226	TRUE	P-882	North St W - Leonard Dr to Lawrence Ave	150	108.5	1956	Cast iron	0	2	0.33	66	65	1.02	Local		6.5	1	5.9	1.50	1	1	1.4	8.29	Medium
1225	TRUE	P-884	North St W - Park St to Leonard Dr	150	230	1956	Cast iron	0	2	0.33	66	65	1.02	Local		6.5	1	5.9	1.50	1	1	1.4	8.29	Medium
1166	TRUE	P-1010	Harmon Rd - Fittons Rd E to Highland Ave	150	494	1968	Cast iron	5	1	0.33	54	65	0.83	Local		5.5	10	5.9	1.50	1	1	1.4	8.28	Medium

2021 Orillia Water Master Plan Update
Watermain Risk Assessment
Jun-22

Colour coded legend

Generated by WaterCAD
Calculated
Bulk of data from 2016 watermain asset management sheet, including updates for 2021 determined values

Year of Analysis 2022

															Probability of Failure Factors			Consequence of Failure Factors					
ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
1317	TRUE	P-690	Lakeview Ave - Grenville Ave to Adair St	200	76	1966	Cast iron	0	2	0.44	56	65	0.86	Local		5.6	1	5.2	1.75	1	1	1.6	8.27	Medium
3159	TRUE	P-2207	Barrie Rd - Lakeview Ave to Westmount Dr S	200	22	1966	Cast iron	0	1	0.44	56	65	0.86	Collector		5.6	1	5.2	1.75	1	1	1.6	8.27	Medium
923	TRUE	P-1448	Arthur St - Woodside Dr east to Easement	200	326.5	1966	Cast iron	0	2	0.44	56	65	0.86	Local		5.6	1	5.2	1.75	1	1	1.6	8.27	Medium
1641	TRUE	P-1558	Mooney Cr - Broadview Ave east to Pipe Char	200	125.5	1966	Cast iron	0	1	0.44	56	65	0.86	Local		5.6	1	5.2	1.75	1	1	1.6	8.27	Medium
1316	TRUE	P-692	Lakeview Ave - Adair St to George St	200	99	1966	Cast iron	0	2	0.44	56	65	0.86	Local		5.6	1	5.2	1.75	1	1	1.6	8.27	Medium
1314	TRUE	P-696	Adair St- Lakeview Ave to George St	200	377.5	1966	Cast iron	0	2	0.44	56	65	0.86	Local		5.6	1	5.2	1.75	1	1	1.6	8.27	Medium
1204	TRUE	P-930	Fittons Rd W - Leach St to Alexander Rd	250	97	1975	Cast iron	1	2	0.56	47	65	0.72	Collector		4.9	2	4.6	2.00	1	1	1.8	8.26	Medium
985	TRUE	P-1440	Homewood Ave at Woodside Dr	400	60.5	1989	Ductile Iron	0	2	0.89	33	65	0.51	Local		3.7	1	3.4	2.75	1	1	2.4	8.23	Medium
3733	TRUE	P-2333	Progress Dr - southwest corner northwest to (	300	233.5	1980	Ductile Iron	0	1	0.67	42	65	0.65	Local		4.5	1	4.1	2.25	1	1	2.0	8.22	Medium
1011	TRUE	P-1382	Progress Dr at Ontario St	300	11	1980	Ductile Iron	0	1	0.67	42	65	0.65	Local		4.5	1	4.1	2.25	1	1	2.0	8.22	Medium
3732	TRUE	P-2332	Progress Dr - southwest corner northwest to (	300	200.5	1980	Ductile Iron	0	1	0.67	42	65	0.65	Local		4.5	1	4.1	2.25	1	1	2.0	8.22	Medium
1330	TRUE	P-652	Dunn Ave - Memorial Ave to Clinton St	150	215	1962	Cast iron	2	1	0.33	60	65	0.92	Local		6.0	5	5.9	1.50	1	1	1.4	8.22	Medium
1336	TRUE	P-638	Memorial Ave - James St to Glencoe Ave	200	78.5	1972	Ductile Iron	1	1	0.44	50	65	0.77	Arterial		5.1	2	4.8	1.75	2	1	1.7	8.19	Medium
967	TRUE	P-1486	Mississaga St W at O'Brien St	200	29	1967	Cast iron	0	1	0.44	55	65	0.85	Collector		5.5	1	5.1	1.75	1	1	1.6	8.15	Medium
968	TRUE	P-1482	Mississaga St W - Albert St N to O'Brien St	200	328	1967	Ductile Iron	0	1	0.44	55	65	0.85	Collector		5.5	1	5.1	1.75	1	1	1.6	8.15	Medium
1632	TRUE	P-114	Mississaga St W at O-Brien	200	16	1967	Ductile Iron	0	1	0.44	55	65	0.85	Collector		5.5	1	5.1	1.75	1	1	1.6	8.15	Medium
1324	TRUE	P-670	Rose Ave - Westmount Dr S to Carleton St	200	101.5	1967	Ductile Iron	0	1	0.44	55	65	0.85	Local		5.5	1	5.1	1.75	1	1	1.6	8.15	Medium
1315	TRUE	P-694	Grenville Ave - Lakeview Ave to Brandon Cr	200	38	1967	Ductile Iron	0	2	0.44	55	65	0.85	Local		5.5	1	5.1	1.75	1	1	1.6	8.15	Medium
1297	TRUE	P-732	Grenville Ave - Andrea Cr to Marlisa Dr	200	74	1967	Ductile Iron	0	2	0.44	55	65	0.85	Local		5.5	1	5.1	1.75	1	1	1.6	8.15	Medium
1293	TRUE	P-740	Grenville Ave - Mississaga St W to Andrea Cr	200	76.5	1967	Ductile Iron	0	2	0.44	55	65	0.85	Local		5.5	1	5.1	1.75	1	1	1.6	8.15	Medium
1282	TRUE	P-766	Grenville Ave - Marlisa Dr to Brandon Cr	200	79.5	1967	Ductile Iron	0	2	0.44	55	65	0.85	Local		5.5	1	5.1	1.75	1	1	1.6	8.15	Medium
1279	TRUE	P-772	Grenville Ave - Brandon Cr to Brandon Cr	200	247	1967	Ductile Iron	0	2	0.44	55	65	0.85	Local		5.5	1	5.1	1.75	1	1	1.6	8.15	Medium
1167	TRUE	P-1008	Highland Ave - Delta St to Harmon Rd	150	208	1959	Cast iron	1	1	0.33	63	65	0.97	Local		6.2	2	5.8	1.50	1	1	1.4	8.12	Medium
1158	TRUE	P-1026	Highland Ave - Tallwood Dr to North St E	150	98	1959	Cast iron	1	1	0.33	63	65	0.97	Local		6.2	2	5.8	1.50	1	1	1.4	8.12	Medium
1313	TRUE	P-698	George St - Lakeview Ave to Edna St	150	273	1963	Cast iron	2	2	0.33	59	65	0.91	Local		5.9	5	5.8	1.50	1	1	1.4	8.11	Medium
1487	TRUE	P-312	High St - Bond St to Simcoe St	150	237	1958	Cast iron	0	1	0.33	64	65	0.98	Local		6.3	1	5.8	1.50	1	1	1.4	8.08	Medium
1701	TRUE	P-1824	Fittons Rd W- Park St to Dancy Dr	250	293	1975	Ductile Iron	0	2	0.56	47	65	0.72	Collector		4.9	1	4.5	2.00	1	1	1.8	8.08	Medium
1163	TRUE	P-1016	Fittons Rd E- Stanton Dr to Sundial Dr	250	117	1975	Cast iron	0	1	0.56	47	65	0.72	Collector		4.9	1	4.5	2.00	1	1	1.8	8.08	Medium
1162	TRUE	P-1018	Fittons Rd E- Sundial Dr to Bay	250	46	1975	Ductile Iron	0	1	0.56	47	65	0.72	Collector		4.9	1	4.5	2.00	1	1	1.8	8.08	Medium
1206	TRUE	P-926	Fittons Rd W - Derby St to Leach St	250	113.5	1975	Cast iron	0	2	0.56	47	65	0.72	Collector		4.9	1	4.5	2.00	1	1	1.8	8.08	Medium
5739	TRUE	P-2474	Charles Rd - Sandra Dr to Karen Cr	150	207.5	1970	Cast iron	6	2	0.33	52	65	0.80	Local		5.3	10	5.8	1.50	1	1	1.4	8.07	Medium
6891	TRUE	P-1454(2)(2)	Esther Anne Dr - Charles Rd to mid Esther An	150	114.5	1970	Cast iron	12	2	0.33	52	65	0.80	Local		5.3	10	5.8	1.50	1	1	1.4	8.07	Medium
5740	TRUE	P-2475	Charles Rd - Sandra Dr to Karen Cr	150	206.5	1970	Cast iron	6	2	0.33	52	65	0.80	Local		5.3	10	5.8	1.50	1	1	1.4	8.07	Medium
961	TRUE	P-1498	Esther Anne Dr - mid Esther Anne Dr to Karer	150	533	1970	Cast iron	7	2	0.33	52	65	0.80	Local		5.3	10	5.8	1.50	1	1	1.4	8.07	Medium
6761	TRUE	P-1454(1)	Esther Anne Dr - Charles Rd to mid Esther An	150	157.5	1970	Cast iron	12	2	0.33	52	65	0.80	Local		5.3	10	5.8	1.50	1	1	1.4	8.07	Medium
6890	TRUE	P-1454(2)(1)	Esther Anne Dr - Charles Rd to mid Esther An	150	233.5	1970	Cast iron	12	2	0.33	52	65	0.80	Local		5.3	10	5.8	1.50	1	1	1.4	8.07	Medium
5736	TRUE	P-2472	Charles Rd - Sandra Dr to Karen Cr	150	182	1970	Cast iron	6	2	0.33	52	65	0.80	Local		5.3	10	5.8	1.50	1	1	1.4	8.07	Medium
1300	TRUE	P-726	Walker Ave- Eleanor Rd to Mississaga St W	150	404	1970	Cast iron	5	2	0.33	52	65	0.80	Local		5.3	10	5.8	1.50	1	1	1.4	8.07	Medium
1277	TRUE	P-778	Quinn Ave - Mississaga St W to Karen Cr	150	464	1970	Cast iron	7	2	0.33	52	65	0.80	Local		5.3	10	5.8	1.50	1	1	1.4	8.07	Medium
1376	TRUE	P-552	Collins Dr - MacIsaac Dr to Atherley Rd	200	359	1969	Ductile Iron	1	1	0.44	53	65	0.82	Local		5.4	2	5.0	1.75	1	1	1.6	8.07	Medium
982	TRUE	P-1446	Woodside Dr - Laurentian Ln to Homewood A	400	131.5	1990	Ductile Iron	0	2	0.89	32	65	0.49	Local		3.6	1	3.4	2.75	1	1	2.4	8.05	Medium
1724	TRUE	P-1840	Lahay Ave /Second St - Third St to Boundary	200	235	1968	Ductile Iron	0	2	0.44	54	65	0.83	Local		5.5	1	5.0	1.75	1	1	1.6	8.03	Medium
1722	TRUE	P-1836	Lahay Ave - Fourth St to Third St	200	146.5	1968	Ductile Iron	0	2	0.44	54	65	0.83	Local		5.5	1	5.0	1.75	1	1	1.6	8.03	Medium
1338	TRUE	P-634	Memorial Ave - James St to Rose Ave	200	93.5	1972	Ductile Iron	0	1	0.44	50	65	0.77	Arterial		5.1	1	4.7	1.75	2	1	1.7	8.02	Medium
1712	TRUE	P-1850	Fittons Heights - to left side of Y	150	173.5	1960	Cast iron	1	2	0.33	62	65	0.95	Local		6.1	2	5.7	1.50	1	1	1.4	8.01	Medium
1713	TRUE	P-1852	Fittons Heights - to right side of Y	150	163.5	1960	Cast iron	1	2	0.33	62	65	0.95	Local		6.1	2	5.7	1.50	1	1	1.4	8.01	Medium
3177	TRUE	P-2214	Mississaga St W - Westmount Dr west to Ease	150	221.5	1964	Cast iron	2	2	0.33	58	65	0.89	Collector		5.8	5	5.7	1.50	1	1	1.4	8.01	Medium
3217	TRUE	P-2236	Delta St - Old Muskoka Rd to Highland Ave	150	129	1959	Cast iron	0	2	0.33	63	65	0.97	Local		6.2	1	5.7	1.50	1	1	1.4	7.98	Medium
3218	TRUE	P-2237	Delta St - Old Muskoka Rd to Highland Ave	150	21.5	1959	Cast iron	0	1	0.33	63	65	0.97	Local		6.2	1	5.7	1.50	1	1	1.4	7.98	Medium
971	TRUE	P-1476	ZONE 1 TRUNK: Mississaga St W - Dunlop St (	300	66.5	1983	Ductile Iron	1	1	0.67	39	65	0.60	Collector		4.2	2	4.0	2.25	1	1	2.0	7.97	Medium
1326	TRUE	P-660	Rose Ave - Carleton St to Clinton St	200	89.5	1974	Cast iron	2	1	0.44	48	65	0.74	Local		5.0	5	5.0	1.75	1	1	1.6	7.94	Medium
1751	TRUE	P-1896	Grenville Ave - Hammond Ave to Dallas St	100	133.5	1947	Cast iron	0	1	0.22	75	65	1.15	Local		7.2	1	6.6	1.25	1	1	1.2	7.93	Medium
6479	TRUE	P-2768	Trillium Manor LTC Service	150	214	1969	Ductile Iron	0	2	0.33	53	65	0.82	Local	Trillium Manor	5.4	1	4.9	1.50	1	3	1.6	7.91	Medium
6879	TRUE	P-2478(2)	Maple Dr- south of Bay St	200	149	1969	Ductile Iron	0	1	0.44	53	65	0.82	Local		5.4	1	4.9	1.75	1	1	1.6	7.91	Medium
6749	TRUE	P-2479(1)	Maple Dr- south of Bay St	200	197.5	1969	Ductile Iron	0	1	0.44	53	65	0.82	Local		5.4	1	4.9	1.75	1	1	1.6	7.91	Medium
6750	TRUE	P-2479(2)	Maple Dr- south of Bay St	200	151	1969	Ductile Iron	0	1	0.44	53	65	0.82	Local		5.4	1	4.9	1.75	1	1	1.6	7.91	Medium
6878	TRUE	P-2478(1)	Maple Dr- south of Bay St	200	100	1969	Ductile Iron	0	1	0.44	53	65	0.82	Local		5.4	1	4.9	1.75	1	1	1.6	7.91	Medium
1199	TRUE	P-942	Collegiate Dr - Rynard Dr to Lindsay Cr	200	129.5	1969	Ductile Iron	0	2	0.44	53	65	0.82	Local		5.4	1	4.9	1.75	1	1	1.6	7.91	Medium
1744	TRUE	P-1888	Fourth St - Boundary Rd to Goldie Dr	150	267.5	1961	Cast iron	1	2	0.33	61	65	0.94	Local		6.1	2	5.6	1.50	1	1	1.4	7.91	Medium
1495	TRUE	P-290	James St - Matchedash St S to Hoover Cr	150	133.5	1961	Cast iron	1	1	0.33	61	65	0.94	Local		6.1	2	5.6	1.50	1	1	1.4	7.91	Medium

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Bulk of data from 2016 watermain asset management sheet, including updates for 2021 determined values

Year of Analysis 2022

															Probability of Failure Factors			Consequence of Failure Factors					
ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
1116	TRUE	P-1118	Francis Rd - Drinkwater Dr to Maple Dr	150	315	1961	Cast iron	1	1	0.33	61	65	0.94	Local		6.1	2	5.6	1.50	1	1	1.4	7.91	Medium
1716	TRUE	P-1692	Grace Ave tp Orma Dr easement	150	66	1960	Ductile Iron	0	2	0.33	62	65	0.95	Local		6.1	1	5.6	1.50	1	1	1.4	7.87	Medium
1229	TRUE	P-876	Gerald Ave - Park St to Belmoral Dr	150	229.5	1960	Cast iron	0	2	0.33	62	65	0.95	Local		6.1	1	5.6	1.50	1	1	1.4	7.87	Medium
1227	TRUE	P-880	Gerald Ave - Belmoral Dr to Lawrence Ave	150	112	1960	Cast iron	0	2	0.33	62	65	0.95	Local		6.1	1	5.6	1.50	1	1	1.4	7.87	Medium
1642	TRUE	P-1560	Mooney Cr - Pipe Change east to end	150	327	1966	Cast iron	2	1	0.33	56	65	0.86	Local		5.6	5	5.6	1.50	1	1	1.4	7.80	Medium
1546	TRUE	P-182	King St - Peter St S to Matchedash St S	200	180.5	1970	Cast iron	0	1	0.44	52	65	0.80	Collector		5.3	1	4.9	1.75	1	1	1.6	7.79	Medium
1470	TRUE	P-352	Carey Ln - Shannon St to Lankin Blvd	200	97	1970	Ductile Iron	0	1	0.44	52	65	0.80	Local		5.3	1	4.9	1.75	1	1	1.6	7.79	Medium
1678	TRUE	P-1766	Lankin Blvd - Victoria Cr to Carey Ln	200	419	1970	Ductile Iron	0	1	0.44	52	65	0.80	Local		5.3	1	4.9	1.75	1	1	1.6	7.79	Medium
2058	TRUE	P-2127	Lankin Blvd- Carey Ln to Rodger Rd	200	259.5	1970	Ductile Iron	0	1	0.44	52	65	0.80	Local		5.3	1	4.9	1.75	1	1	1.6	7.79	Medium
1551	TRUE	P-172	King St - Matchedash St S to Front St	200	79.5	1970	Cast iron	0	1	0.44	52	65	0.80	Collector		5.3	1	4.9	1.75	1	1	1.6	7.79	Medium
1777	TRUE	P-186	King St - West St S to Peter St S	200	184.5	1970	Ductile Iron	0	1	0.44	52	65	0.80	Collector		5.3	1	4.9	1.75	1	1	1.6	7.79	Medium
970	TRUE	P-1478	ZONE 1 TRUNK: Mississaga St W - William St	300	54	1983	Ductile Iron	0	1	0.67	39	65	0.60	Collector		4.2	1	3.9	2.25	1	1	2.0	7.77	Medium
969	TRUE	P-1480	ZONE 1 TRUNK: Mississaga St W - Wyandotte	300	107.5	1983	Ductile Iron	0	1	0.67	39	65	0.60	Collector		4.2	1	3.9	2.25	1	1	2.0	7.77	Medium
1370	TRUE	P-566	Gill St - Front St to Atherley Rd	300	105	1983	Ductile Iron	0	1	0.67	39	65	0.60	Collector		4.2	1	3.9	2.25	1	1	2.0	7.77	Medium
5428	TRUE	P-2419	Goldie to Commerce Service	150	83.5	1961	Cast iron	0	2	0.33	61	65	0.94	Local		6.1	1	5.5	1.50	1	1	1.4	7.77	Medium
1494	TRUE	P-294	James St- Hoover Cr to Gill St	150	131	1961	Cast iron	0	1	0.33	61	65	0.94	Local		6.1	1	5.5	1.50	1	1	1.4	7.77	Medium
1726	TRUE	P-1844	Second St - Murray St to Goldie Dr	150	207	1961	Ductile Iron	0	2	0.33	61	65	0.94	Local		6.1	1	5.5	1.50	1	1	1.4	7.77	Medium
6389	TRUE	P-2724	Stanton w of Laclie	150	236	1961	Cast iron	0	1	0.33	61	65	0.94	Local		6.1	1	5.5	1.50	1	1	1.4	7.77	Medium
3242	TRUE	P-2253	Stanton Dr - Laclie St to Fittons Rd E	150	22	1961	Cast iron	0	2	0.33	61	65	0.94	Local		6.1	1	5.5	1.50	1	1	1.4	7.77	Medium
3597	TRUE	P-2295	Stanton Dr - Laclie St to Fittons Rd E	150	15.5	1961	Cast iron	0	1	0.33	61	65	0.94	Local		6.1	1	5.5	1.50	1	1	1.4	7.77	Medium
5432	TRUE	P-2421	Goldie to Commerce Service	150	89.5	1961	Cast iron	0	2	0.33	61	65	0.94	Local		6.1	1	5.5	1.50	1	1	1.4	7.77	Medium
6388	TRUE	P-2723	Stanton w of Laclie	150	73.5	1961	Cast iron	0	1	0.33	61	65	0.94	Local		6.1	1	5.5	1.50	1	1	1.4	7.77	Medium
1866	TRUE	P-1814	WOW across Hwy 11	450.00	625.5	1998	Ductile Iron	0	2	1.00	24	65	0.37	Highway or highway crossing		2.9	1	2.7	3.00	3	1	2.8	7.70	Medium
918	TRUE	P-1632	Bridget Dr - Drinkwater Dr to Hughes Rd	150	132	1963	Cast iron	1	1	0.33	59	65	0.91	Local		5.9	2	5.5	1.50	1	1	1.4	7.69	Medium
6168	TRUE	P-2639	Forest Ave S -Lanklin Blve to MacIsaac Dr at F	150	55.5	1963	Ductile Iron	1	1	0.33	59	65	0.91	Local		5.9	2	5.5	1.50	1	1	1.4	7.69	Medium
1378	TRUE	P-548	MacIsaac Dr - Rodger Rd to Collins Dr	150	300	1963	Cast iron	1	1	0.33	59	65	0.91	Local		5.9	2	5.5	1.50	1	1	1.4	7.69	Medium
2087	TRUE	P-2143	Front St - Gill St to Poughkeepsie St	200	90	1976	Cast iron	1	1	0.44	46	65	0.71	Arterial		4.8	2	4.5	1.75	2	1	1.7	7.67	Medium
1328	TRUE	P-656	Dunn Ave - Carleton St to Clinton St	150	94	1962	Cast iron	0	1	0.33	60	65	0.92	Local		6.0	1	5.5	1.50	1	1	1.4	7.66	Medium
1847	TRUE	P-276	Skyline Dr - west to corner	150	278.5	1962	Cast iron	0	2	0.33	60	65	0.92	Local		6.0	1	5.5	1.50	1	1	1.4	7.66	Medium
1325	TRUE	P-662	Dunn Ave - Westmount Dr S to Carleton St	150	106	1962	Cast iron	0	1	0.33	60	65	0.92	Local		6.0	1	5.5	1.50	1	1	1.4	7.66	Medium
1295	TRUE	P-736	Karen Cr - Mississaga St W to Quinn Ave	150	50.5	1970	Cast iron	3	2	0.33	52	65	0.80	Local		5.3	7	5.5	1.50	1	1	1.4	7.65	Medium
1294	TRUE	P-738	Karen Cr - Quinn Ave to Charles Rd	150	266	1970	Cast iron	3	2	0.33	52	65	0.80	Local		5.3	7	5.5	1.50	1	1	1.4	7.65	Medium
902	TRUE	P-1666	Coldwater Rd - Matchedash St to Front St	200	84	1975	Ductile Iron	0	1	0.44	47	65	0.72	Arterial		4.9	1	4.5	1.75	2	1	1.7	7.63	Medium
6616	TRUE	P-2854	Coldwater St -West St N to Matchedash St N	200	183	1975	Ductile Iron	0	1	0.44	47	65	0.72	Arterial		4.9	1	4.5	1.75	2	1	1.7	7.63	Medium
1064	TRUE	P-1262	Coldwater Rd - West St N to Peter St N	200	184.5	1975	Ductile Iron	0	1	0.44	47	65	0.72	Arterial		4.9	1	4.5	1.75	2	1	1.7	7.63	Medium
6615	TRUE	P-2853	Coldwater St -West St N to Matchedash St N	200	10.5	1975	Ductile Iron	0	1	0.44	47	65	0.72	Arterial		4.9	1	4.5	1.75	2	1	1.7	7.63	Medium
992	TRUE	P-1426	Woodside Dr at Mary St	300	14.5	1984	Ductile Iron	0	2	0.67	38	65	0.58	Local		4.1	1	3.8	2.25	1	1	2.0	7.62	Medium
991	TRUE	P-1428	Sandra Dr - Woodside Dr to the west	300	115.5	1984	Ductile Iron	0	2	0.67	38	65	0.58	Local		4.1	1	3.8	2.25	1	1	2.0	7.62	Medium
3178	TRUE	P-2215	Mississaga St W- Westmount Dr west to Ease	150	55.5	1964	Cast iron	1	1	0.33	58	65	0.89	Collector		5.8	2	5.4	1.50	1	1	1.4	7.59	Medium
5511	TRUE	P-2432	George St at Westmount Dr S	150	18	1963	Cast iron	0	2	0.33	59	65	0.91	Local		5.9	1	5.4	1.50	1	1	1.4	7.55	Medium
1312	TRUE	P-700	George St - Marlisa Dr to Edna St	150	83	1963	Ductile Iron	0	2	0.33	59	65	0.91	Local		5.9	1	5.4	1.50	1	1	1.4	7.55	Medium
1441	TRUE	P-418	Crawford St - Raymond Ave to Forest Ave S	200	131	1972	Ductile Iron	0	1	0.44	50	65	0.77	Local		5.1	1	4.7	1.75	1	1	1.6	7.54	Medium
1449	TRUE	P-400	Crawford St - Leslie St to Raymond Ave	200	134.5	1972	Ductile Iron	0	1	0.44	50	65	0.77	Local		5.1	1	4.7	1.75	1	1	1.6	7.54	Medium
6505	TRUE	P-2784	Barrie Rd - Eleanor Rd to Walker Ave	150	148	1975	Cast iron	10	2	0.33	47	65	0.72	Collector		4.9	10	5.4	1.50	1	1	1.4	7.54	Medium
6504	TRUE	P-2783	Barrie Rd - Eleanor Rd to Walker Ave	150	188.5	1975	Cast iron	10	2	0.33	47	65	0.72	Collector		4.9	10	5.4	1.50	1	1	1.4	7.54	Medium
6494	TRUE	P-2777	Barrie Rd - Eleanor Rd to Walker Ave	150	230	1975	Cast iron	10	2	0.33	47	65	0.72	Collector		4.9	10	5.4	1.50	1	1	1.4	7.54	Medium
1380	TRUE	P-544	Collins Dr - east of Forest Ave S	150	347.5	1965	Cast iron	1	1	0.33	57	65	0.88	Local		5.7	2	5.3	1.50	1	1	1.4	7.48	Medium
990	TRUE	P-1432	Mississaga St W- Woodside Dr to Allan St	150	276.5	1964	Ductile Iron	0	2	0.33	58	65	0.89	Collector		5.8	1	5.3	1.50	1	1	1.4	7.45	Medium
911	TRUE	P-1644	Mississaga St W at Quinn Ave	150	4.5	1964	Ductile Iron	0	2	0.33	58	65	0.89	Collector		5.8	1	5.3	1.50	1	1	1.4	7.45	Medium
989	TRUE	P-1430	Woodside Dr - Mississaga St W to Mary St	150	82	1964	Cast iron	0	2	0.33	58	65	0.89	Local		5.8	1	5.3	1.50	1	1	1.4	7.45	Medium
1284	TRUE	P-762	Mississaga St W - Allan St west to Easement	150	110.5	1964	Cast iron	0	2	0.33	58	65	0.89	Collector		5.8	1	5.3	1.50	1	1	1.4	7.45	Medium
912	TRUE	P-776	Mississaga St W at Quinn Ave	150	13.5	1964	Cast iron	0	2	0.33	58	65	0.89	Collector		5.8	1	5.3	1.50	1	1	1.4	7.45	Medium
1311	TRUE	P-702	Marlisa Dr- George St to Andrea Cr	200	183	1973	Ductile Iron	0	2	0.44	49	65	0.75	Local		5.0	1	4.6	1.75	1	1	1.6	7.42	Medium
1117	TRUE	P-1116	Drinkwater Dr - Francis Rd to Bay St	200	131.5	1973	Ductile Iron	0	1	0.44	49	65	0.75	Local		5.0	1	4.6	1.75	1	1	1.6	7.42	Medium
1837	TRUE	P-378	Bennett St - Forest Ave S to Raymond at Delia	200	214	1973	Ductile Iron	0	1	0.44	49	65	0.75	Local		5.0	1	4.6	1.75	1	1	1.6	7.42	Medium
1310	TRUE	P-704	Marlisa Dr - Andrea Cr to Barrie Rd	200	95	1973	Ductile Iron	0	2	0.44	49	65	0.75	Local		5.0	1	4.6	1.75	1	1	1.6	7.42	Medium
1298	TRUE	P-730	Marlisa Dr - Grenville Ave to George St	200	227.5	1973	Ductile Iron	0	2	0.44	49	65	0.75	Local		5.0	1	4.6	1.75	1	1	1.6	7.42	Medium
2083	TRUE	P-2140	Atherley Rd - Gill St to the east	300	59	1993	Ductile Iron	2	1	0.67	29	65	0.45	Arterial		3.4	5	3.5	2.25	2	1	2.1	7.41	Medium
6486	TRUE	P-2772	Mississaga St W - Eleanor Rd to Karen Cr	150	191.5	1975	Cast iron	4	2	0.33	47	65	0.72	Collector		4.9	9	5.3	1.50	1	1	1.4	7.40	Medium
1702	TRUE	P-1826	Fittons Rd W- Dancy Dr to west of Highway N	300	170	1990	Ductile Iron	0	2	0.67	32	65	0.49	Highway or highway crossing		3.6	1	3.4	2.25	3	1	2.2	7.38	Medium

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ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
3180	TRUE	P-2216	Grenville Ave - Westmount Dr S to Lakeview A	150	185.5	1966	Cast iron	1	2	0.33	56	65	0.86	Local		5.6	2	5.3	1.50	1	1	1.4	7.38	Medium
1645	TRUE	P-1570	Glen Cr - Pipe Change to north end	150	262.5	1966	Cast iron	1	1	0.33	56	65	0.86	Local		5.6	2	5.3	1.50	1	1	1.4	7.38	Medium
1643	TRUE	P-1562	Dale Dr - Broadview Ave to Glen	150	236.5	1966	Cast iron	1	1	0.33	56	65	0.86	Local		5.6	2	5.3	1.50	1	1	1.4	7.38	Medium
2098	TRUE	P-2150	Glen Cr - Dale Dr south to end	150	70.5	1966	Cast iron	1	1	0.33	56	65	0.86	Local		5.6	2	5.3	1.50	1	1	1.4	7.38	Medium
1476	TRUE	P-338	Shannon St - High St to Gill St	150	268	1966	Cast iron	1	1	0.33	56	65	0.86	Local		5.6	2	5.3	1.50	1	1	1.4	7.38	Medium
1238	TRUE	P-858	Collegiate Dr - Park St to Rosslyn Rd	150	88	1966	Cast iron	1	2	0.33	56	65	0.86	Local		5.6	2	5.3	1.50	1	1	1.4	7.38	Medium
6773	TRUE	P-630(1)	James St - West St S to James Ct	300	739	1986	Ductile Iron	0	1	0.67	36	65	0.55	Local		4.0	1	3.7	2.25	1	1	2.0	7.31	Medium
6774	TRUE	P-630(2)	James St - West St S to James Ct	300	234.5	1986	Ductile Iron	0	1	0.67	36	65	0.55	Local		4.0	1	3.7	2.25	1	1	2.0	7.31	Medium
2116	TRUE	P-2160	Shannon St - Gill St to Carey Ln	200	203	1974	Ductile Iron	0	1	0.44	48	65	0.74	Local		5.0	1	4.6	1.75	1	1	1.6	7.30	Medium
1771	TRUE	P-1556	Broadview Ave - Moberley Ave to Dale Rd	200	198	1974	Cast iron	0	1	0.44	48	65	0.74	Local		5.0	1	4.6	1.75	1	1	1.6	7.30	Medium
2115	TRUE	P-2159	Shannon St - Gill St to Carey Ln	200	92.5	1974	Ductile Iron	0	1	0.44	48	65	0.74	Local		5.0	1	4.6	1.75	1	1	1.6	7.30	Medium
1773	TRUE	P-402	Raymond Ave - Hilda St To Crawford St	200	82.5	1974	Ductile Iron	0	1	0.44	48	65	0.74	Local		5.0	1	4.6	1.75	1	1	1.6	7.30	Medium
1637	TRUE	P-1364	Broadview Ave - Moberley Ave to Welland St	200	155	1974	Cast iron	0	1	0.44	48	65	0.74	Local		5.0	1	4.6	1.75	1	1	1.6	7.30	Medium
2110	TRUE	P-2156	Shannon St - Gill St to Carey Ln	200	232.5	1974	Ductile Iron	0	1	0.44	48	65	0.74	Local		5.0	1	4.6	1.75	1	1	1.6	7.30	Medium
6525	TRUE	P-2796	Shannon St - Carey Ln to Forest Ave S	200	103.5	1974	Ductile Iron	0	1	0.44	48	65	0.74	Local		5.0	1	4.6	1.75	1	1	1.6	7.30	Medium
6526	TRUE	P-2797	Shannon St - Carey Ln to Forest Ave S	200	184.5	1974	Ductile Iron	0	1	0.44	48	65	0.74	Local		5.0	1	4.6	1.75	1	1	1.6	7.30	Medium
1460	TRUE	P-374	Raymond Ave - Hilda St to Oxford St	200	88	1974	Cast iron	0	1	0.44	48	65	0.74	Local		5.0	1	4.6	1.75	1	1	1.6	7.30	Medium
1459	TRUE	P-376	Raymond Ave - Oxford St to Delia St	200	76	1974	Cast iron	0	1	0.44	48	65	0.74	Local		5.0	1	4.6	1.75	1	1	1.6	7.30	Medium
1443	TRUE	P-414	Leslie St- Franklin St to Crawford St	200	86	1974	Ductile Iron	0	1	0.44	48	65	0.74	Local		5.0	1	4.6	1.75	1	1	1.6	7.30	Medium
1337	TRUE	P-636	Rose Ave - Clinton St to Memorial Ave	200	136.5	1974	Cast iron	0	1	0.44	48	65	0.74	Local		5.0	1	4.6	1.75	1	1	1.6	7.30	Medium
1417	TRUE	P-466	Memorial Ave - Albany Ave to McKinnell St	200	193.5	1978	Ductile Iron	0	1	0.44	44	65	0.68	Arterial		4.6	1	4.3	1.75	2	1	1.7	7.24	Medium
5574	TRUE	P-2452	Southwood Circle	150	87	1966	Ductile Iron	0	1	0.33	56	65	0.86	Local		5.6	1	5.2	1.50	1	1	1.4	7.24	Medium
1240	TRUE	P-854	Martin Dr - Park St to Rosslyn Rd	150	88.5	1966	Cast iron	0	2	0.33	56	65	0.86	Local		5.6	1	5.2	1.50	1	1	1.4	7.24	Medium
1635	TRUE	P-1174	Couchiching Pt Rd - Broadview Ave to Mober	150	110.5	1966	Cast iron	0	1	0.33	56	65	0.86	Local		5.6	1	5.2	1.50	1	1	1.4	7.24	Medium
1242	TRUE	P-850	Collegiate Dr - Park St to Belmoral Dr	150	242	1966	Cast iron	0	2	0.33	56	65	0.86	Local		5.6	1	5.2	1.50	1	1	1.4	7.24	Medium
3181	TRUE	P-2217	Grenville Ave - Westmount Dr S to Lakeview A	150	15.5	1966	Cast iron	0	1	0.33	56	65	0.86	Local		5.6	1	5.2	1.50	1	1	1.4	7.24	Medium
1246	TRUE	P-842	Martin Dr - Park St to Belmoral Dr	150	242	1966	Cast iron	0	2	0.33	56	65	0.86	Local		5.6	1	5.2	1.50	1	1	1.4	7.24	Medium
1244	TRUE	P-846	June Dr - Park St to Belmoral Dr	150	241.5	1966	Cast iron	0	2	0.33	56	65	0.86	Local		5.6	1	5.2	1.50	1	1	1.4	7.24	Medium
1761	TRUE	P-1906	Westmount Dr S - Glencoe Ave to Rachael Rd	200	72	1975	Ductile Iron	0	1	0.44	47	65	0.72	Collector		4.9	1	4.5	1.75	1	1	1.6	7.18	Medium
1103	TRUE	P-1156	King St - Front St to Cedar Island Rd	200	320	1975	Ductile Iron	0	1	0.44	47	65	0.72	Collector		4.9	1	4.5	1.75	1	1	1.6	7.18	Medium
5120	TRUE	P-2384	Westmount Dr S- Glencoe Ave to south	200	102.5	1975	Ductile Iron	0	1	0.44	47	65	0.72	Collector		4.9	1	4.5	1.75	1	1	1.6	7.18	Medium
5119	TRUE	P-2383	Westmount Dr S - Glencoe Ave to south	200	52.5	1975	Ductile Iron	0	1	0.44	47	65	0.72	Collector		4.9	1	4.5	1.75	1	1	1.6	7.18	Medium
1791	TRUE	P-1152	Carleton St - Rose Ave to Glencoe Ave	150	130.5	1968	Ductile Iron	1	1	0.33	54	65	0.83	Local		5.5	2	5.1	1.50	1	1	1.4	7.16	Medium
996	TRUE	P-1416	Westmount Dr N - Woodside Dr to Coldwater	300	128.5	1987	Ductile Iron	0	2	0.67	35	65	0.54	Collector		3.9	1	3.6	2.25	1	1	2.0	7.16	Medium
1871	TRUE	P-1992	Woodside Dr at Arthur St	450	183.5	1998	Ductile Iron	0	2	1.00	24	65	0.37	Local		2.9	1	2.7	3.00	1	1	2.6	7.15	Medium
6723	TRUE	P-1996(1)	Woodside Dr at Toboggan Hill Dr	450	125	1998	Ductile Iron	0	2	1.00	24	65	0.37	Local		2.9	1	2.7	3.00	1	1	2.6	7.15	Medium
6724	TRUE	P-1996(2)	Woodside Dr at Toboggan Hill Dr	450	12.5	1998	Ductile Iron	0	2	1.00	24	65	0.37	Local		2.9	1	2.7	3.00	1	1	2.6	7.15	Medium
1795	TRUE	P-1816	Utility Corridor at Mulcahy Ct	450	66.5	1998	Ductile Iron	0	2	1.00	24	65	0.37	Local		2.9	1	2.7	3.00	1	1	2.6	7.15	Medium
2156	TRUE	P-2181	Mary St at Woodside Dr	150	10	1967	Cast iron	0	2	0.33	55	65	0.85	Local		5.5	1	5.1	1.50	1	1	1.4	7.13	Medium
1019	TRUE	P-1356	Douglas St @ Harvey St	150	11	1967	Ductile Iron	0	2	0.33	55	65	0.85	Local		5.5	1	5.1	1.50	1	1	1.4	7.13	Medium
2155	TRUE	P-2180	Mary St at Woodside Dr	150	5.5	1967	Cast iron	0	2	0.33	55	65	0.85	Local		5.5	1	5.1	1.50	1	1	1.4	7.13	Medium
6487	TRUE	P-2773	Mississaga St W - Eleanor Rd to Karen Cr	150	210.5	1975	Cast iron	3	2	0.33	47	65	0.72	Collector		4.9	7	5.1	1.50	1	1	1.4	7.12	Medium
1332	TRUE	P-648	Memorial Ave- south of Highway 12	200	19.5	1979	Cast iron	0	1	0.44	43	65	0.66	Arterial		4.5	1	4.2	1.75	2	1	1.7	7.12	Medium
1498	TRUE	P-288	MatchedashSt S - Cochrane St to James	200	331	1977	Cast iron	1	1	0.44	45	65	0.69	Local		4.7	2	4.4	1.75	1	1	1.6	7.10	Medium
1331	TRUE	P-650	Memorial Ave - Rose Ave to Dunn Ave	150	167.5	1972	Cast iron	0	1	0.33	50	65	0.77	Arterial		5.1	1	4.7	1.50	2	1	1.5	7.07	Medium
1373	TRUE	P-560	Memorial Ave - Barrie Rd to Dunn Ave	150	153	1972	Cast iron	0	1	0.33	50	65	0.77	Arterial		5.1	1	4.7	1.50	2	1	1.5	7.07	Medium
1475	TRUE	P-340	West St S - Simcoe St to Kitchener St	250	235.5	1989	Ductile Iron	1	1	0.56	33	65	0.51	Highway or highway crossing		3.7	2	3.5	2.00	3	1	2.0	7.06	Medium
913	TRUE	P-1646	Woodside Dr - Mary St to Mississaga St W	350	95	1992	Ductile Iron	0	2	0.78	30	65	0.46	Local		3.4	1	3.2	2.50	1	1	2.2	7.05	Medium
3430	TRUE	P-2270	Harvie Settl Rd -at West Ridge Blvd	600	218	1995	Concrete	0	2	1.00	27	75	0.36	Local		2.9	1	2.7	3.00	1	1	2.6	7.03	Medium
5816	TRUE	P-2486	Harvie Settl Rd - tower to the north	600	82.5	1995	Concrete	0	2	1.00	27	75	0.36	Local		2.9	1	2.7	3.00	1	1	2.6	7.03	Medium
5817	TRUE	P-2487	Harvie Settl Rd - tower to the north	600	372	1995	Concrete	0	2	1.00	27	75	0.36	Local		2.9	1	2.7	3.00	1	1	2.6	7.03	Medium
1327	TRUE	P-658	Carleton St - Dunn Ave to Rose Ave	150	145	1968	Cast iron	0	1	0.33	54	65	0.83	Local		5.5	1	5.0	1.50	1	1	1.4	7.02	Medium
6184	TRUE	P-2649	Stanton n of Fittons	150	133.5	1968	Cast iron	0	1	0.33	54	65	0.83	Local		5.5	1	5.0	1.50	1	1	1.4	7.02	Medium
3233	TRUE	P-2247	Fittons Rd E - Laclie St to Old Muskoka Rd	250	5.5	1983	Ductile Iron	0	1	0.56	39	65	0.60	Collector		4.2	1	3.9	2.00	1	1	1.8	6.99	Medium
3238	TRUE	P-2251	Fittons Rd E at Old Muskoka Rd	250	9.5	1983	Ductile Iron	0	2	0.56	39	65	0.60	Collector		4.2	1	3.9	2.00	1	1	1.8	6.99	Medium
3237	TRUE	P-2250	Fittons Rd E at Old Muskoka Rd	250	9	1983	Ductile Iron	0	1	0.56	39	65	0.60	Collector		4.2	1	3.9	2.00	1	1	1.8	6.99	Medium
3230	TRUE	P-2245	Fittons Rd E at Laclie St	250	2.5	1983	Ductile Iron	0	2	0.56	39	65	0.60	Collector		4.2	1	3.9	2.00	1	1	1.8	6.99	Medium
3231	TRUE	P-2246	Fittons Rd E at Laclie St	250	18.5	1983	Ductile Iron	0	2	0.56	39	65	0.60	Collector		4.2	1	3.9	2.00	1	1	1.8	6.99	Medium
1028	TRUE	P-1332	ZONE 2 TRUNK: Park St - Brant St to Coldwat	400	76	1992	PVC	0	2	0.89	30	75	0.40	Local		3.1	1	2.9	2.75	1	1	2.4	6.96	Medium
3244	TRUE	P-2254	Galley Ave - Laclie St to Free Dr	150	277	1970	Cast iron	1	1	0.33	52	65	0.80	Local		5.3	2	5.0	1.50	1	1	1.4	6.95	Medium

2021 Orillia Water Master Plan Update
Watermain Risk Assessment
Jun-22

Colour coded legend

Generated by WaterCAD
Calculated
Bulk of data from 2016 watermain asset management sheet, including updates for 2021 determined values

Year of Analysis 2022

															Probability of Failure Factors			Consequence of Failure Factors					
ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
1276	TRUE	P-780	Sandra Dr - Charles Rd to Woodside Dr	150	234.5	1970	Cast iron	1	2	0.33	52	65	0.80	Local		5.3	2	5.0	1.50	1	1	1.4	6.95	Medium
2205	TRUE	P-2203	Colborne St E at Scott St	100	68	1969	Ductile Iron	2	1	0.22	53	65	0.82	Arterial		5.4	5	5.3	1.25	2	1	1.3	6.94	Medium
1127	TRUE	P-1092	Sundial Dr - Fittons Rd E to Galley Ave	200	292	1977	Ductile Iron	0	1	0.44	45	65	0.69	Local		4.7	1	4.3	1.75	1	1	1.6	6.94	Medium
1195	TRUE	P-950	Collegiate Dr - Lewis Dr to Rynard Dr	150	76.5	1969	Cast iron	0	2	0.33	53	65	0.82	Local		5.4	1	4.9	1.50	1	1	1.4	6.92	Medium
2120	TRUE	P-2162	Hilda St at East St	150	75.5	1961	PVC	0	1	0.33	61	75	0.81	Local		5.4	1	4.9	1.50	1	1	1.4	6.90	Medium
1595	TRUE	P-58	Coldwater Rd - Front St to Plaza	150	70.5	1975	Cast iron	1	1	0.33	47	65	0.72	Arterial		4.9	2	4.6	1.50	2	1	1.5	6.88	Medium
894	TRUE	P-1642	OPP on Memorial Dr	350	200	1993	Ductile Iron	0	2	0.78	29	65	0.45	Local		3.4	1	3.1	2.50	1	1	2.2	6.88	Medium
1843	TRUE	P-74	United Drive - Memorial to end	200	283	1979	Ductile Iron	1	1	0.44	43	65	0.66	Local		4.5	2	4.3	1.75	1	1	1.6	6.86	Medium
977	TRUE	P-1458	Frederick St - Colborne St W to Mississaga St	200	118	1978	Ductile Iron	0	1	0.44	44	65	0.68	Local		4.6	1	4.3	1.75	1	1	1.6	6.82	Medium
974	TRUE	P-1464	O'Brien St - Mississaga St W to Mary St	200	125	1978	Ductile Iron	0	1	0.44	44	65	0.68	Local		4.6	1	4.3	1.75	1	1	1.6	6.82	Medium
973	TRUE	P-1466	Volunteer Dr at Mississaga St W	200	10	1978	Ductile Iron	0	1	0.44	44	65	0.68	Local		4.6	1	4.3	1.75	1	1	1.6	6.82	Medium
3617	TRUE	P-2298	Mississaga St W - Westmount Dr to the east	200	32	1978	Ductile Iron	0	1	0.44	44	65	0.68	Collector		4.6	1	4.3	1.75	1	1	1.6	6.82	Medium
1407	TRUE	P-488	Frederick St - Colborne St W to McKinnell St	200	198.5	1978	Ductile Iron	0	1	0.44	44	65	0.68	Local		4.6	1	4.3	1.75	1	1	1.6	6.82	Medium
1115	TRUE	P-1120	Maple Dr - Francis Rd to Hughes Rd	150	251	1970	Cast iron	0	1	0.33	52	65	0.80	Local		5.3	1	4.9	1.50	1	1	1.4	6.81	Medium
915	TRUE	P-1636	Walker Ave at Barrie Rd	150	19.50	1970	Ductile Iron	0	2	0.33	52	65	0.80	Local		5.3	1	4.9	1.50	1	1	1.4	6.81	Medium
1710	TRUE	P-1100	King's Ct - Landon St south to end	150	106	1970	Ductile Iron	0	2	0.33	52	65	0.80	Local		5.3	1	4.9	1.50	1	1	1.4	6.81	Medium
3245	TRUE	P-2255	Galley Ave - Laclie St to Free Dr	150	7.5	1970	Cast iron	0	2	0.33	52	65	0.80	Local		5.3	1	4.9	1.50	1	1	1.4	6.81	Medium
1444	TRUE	P-412	Leslie St - James St to Franklin St	150	78.5	1970	Cast iron	0	1	0.33	52	65	0.80	Local		5.3	1	4.9	1.50	1	1	1.4	6.81	Medium
1304	TRUE	P-718	Walker Ave- Eleanor Rd to Barrie Rd	150	100	1970	Cast iron	0	2	0.33	52	65	0.80	Local		5.3	1	4.9	1.50	1	1	1.4	6.81	Medium
1296	TRUE	P-734	Andrea Cr - Grenville Ave to Marlisa Dr	150	502.5	1970	Ductile Iron	0	2	0.33	52	65	0.80	Local		5.3	1	4.9	1.50	1	1	1.4	6.81	Medium
1564	TRUE	P-144	Andrew St N- Mississaga St W to Colborne St	150	140.5	1978	Cast iron	3	1	0.33	44	65	0.68	Local		4.6	7	4.9	1.50	1	1	1.4	6.81	Medium
6888	TRUE	P-1792(2)	Progress Dr to OPP on Memorial	350	249	1993	PVC	0	2	0.78	29	75	0.39	Local	OPP Headquarte	3.0	1	2.8	2.50	1	3	2.4	6.80	Medium
6887	TRUE	P-1792(1)	Progress Dr to OPP on Memorial	350	173.5	1993	PVC	0	2	0.78	29	75	0.39	Local	OPP Headquarte	3.0	1	2.8	2.50	1	3	2.4	6.80	Medium
1458	TRUE	P-382	Delia St - Raymond Ave to Forest Ave S	150	129	1972	Ductile Iron	1	1	0.33	50	65	0.77	Local		5.1	2	4.8	1.50	1	1	1.4	6.74	Medium
984	TRUE	P-1442	Woodside Dr - Homewood Ave to Laurentian	300	73	1990	Ductile Iron	0	2	0.67	32	65	0.49	Local		3.6	1	3.4	2.25	1	1	2.0	6.71	Medium
988	TRUE	P-1434	Woodside Dr - Mary St to Laurentian Ln	300	234	1990	Ductile Iron	0	2	0.67	32	65	0.49	Local		3.6	1	3.4	2.25	1	1	2.0	6.71	Medium
1346	TRUE	P-618	Forest Ave N - Cedarmere Rd to Brewery Ln	150	150.5	1971	Ductile Iron	0	1	0.33	51	65	0.78	Local		5.2	1	4.8	1.50	1	1	1.4	6.71	Medium
1129	TRUE	P-1088	Old Muskoka Rd - south of Fittons Rd E to Del	150	168.5	1979	Cast iron	3	2	0.33	43	65	0.66	Local		4.5	7	4.8	1.50	1	1	1.4	6.70	Medium
1091	TRUE	P-1184	Jarvis St at Canice St	200	7	1979	Ductile Iron	0	1	0.44	43	65	0.66	Local		4.5	1	4.2	1.75	1	1	1.6	6.70	Medium
1329	TRUE	P-654	Clinton St - Dunn Ave to Rose Ave	150	143.5	1973	Cast iron	1	1	0.33	49	65	0.75	Local		5.0	2	4.7	1.50	1	1	1.4	6.63	Medium
1497	TRUE	P-292	High St - Hoover Cr to James	150	152	1977	Cast iron	2	1	0.33	45	65	0.69	Local		4.7	5	4.7	1.50	1	1	1.4	6.63	Medium
1126	TRUE	P-1094	Galley Ave - Free Dr to Sundial Dr	150	140	1972	Cast iron	0	1	0.33	50	65	0.77	Local		5.1	1	4.7	1.50	1	1	1.4	6.60	Medium
1461	TRUE	P-372	Hilda St - Forest Ave S to Raymond Ave	150	130	1972	Ductile Iron	0	1	0.33	50	65	0.77	Local		5.1	1	4.7	1.50	1	1	1.4	6.60	Medium
1382	TRUE	P-540	Delia St - Forest Ave S to Bayview Pkwy	150	279.5	1972	Cast iron	0	1	0.33	50	65	0.77	Local		5.1	1	4.7	1.50	1	1	1.4	6.60	Medium
6454	TRUE	P-2753	Orchard Park PS Service	150	327	1980	Ductile Iron	0	2	0.33	42	65	0.65	Local	Orchard Park Sc	4.5	1	4.1	1.50	1	3	1.6	6.58	Medium
1685	TRUE	P-1782	Ontario St - Progress Dr north to end	200	177	1980	Ductile Iron	0	1	0.44	42	65	0.65	Local		4.5	1	4.1	1.75	1	1	1.6	6.58	Medium
1010	TRUE	P-1384	Ontario St - Progress Dr to Progress Dr	200	286	1980	Ductile Iron	0	1	0.44	42	65	0.65	Local		4.5	1	4.1	1.75	1	1	1.6	6.58	Medium
1542	TRUE	P-192	Western Ave - West St S to Peter St S	100	186.5	1970	Cast iron	3	1	0.22	52	65	0.80	Local		5.3	7	5.5	1.25	1	1	1.2	6.56	Medium
921	TRUE	P-1624	Huronia Rd - Hughes Rd to Brammer Dr	300	314.5	1991	Ductile Iron	0	1	0.67	31	65	0.48	Local		3.5	1	3.3	2.25	1	1	2.0	6.56	Medium
1636	TRUE	P-1256	Moberley Ave - Couchiching Pt Rd to Broadvi	150	286	1974	Cast iron	1	1	0.33	48	65	0.74	Local		5.0	2	4.7	1.50	1	1	1.4	6.53	Medium
1473	TRUE	P-344	West St S at Kitchener St	250	6.5	1989	Ductile Iron	0	1	0.56	33	65	0.51	Arterial		3.7	1	3.4	2.00	2	1	1.9	6.52	Medium
1145	TRUE	P-1054	Landon St - King's Ct to Parkhurst Cr	150	14	1973	Ductile Iron	0	2	0.33	49	65	0.75	Local		5.0	1	4.6	1.50	1	1	1.4	6.49	Medium
1143	TRUE	P-1058	Landon St - Parkhurst Cr to Old Muskoka Rd	150	85	1973	Ductile Iron	0	2	0.33	49	65	0.75	Local		5.0	1	4.6	1.50	1	1	1.4	6.49	Medium
1699	TRUE	P-1820	Woodside Dr - Westmount Dr N westward	150	133	1973	Ductile Iron	0	2	0.33	49	65	0.75	Local		5.0	1	4.6	1.50	1	1	1.4	6.49	Medium
1146	TRUE	P-1052	Landon St - St Jean St to King's Ct	150	83	1973	Ductile Iron	0	2	0.33	49	65	0.75	Local		5.0	1	4.6	1.50	1	1	1.4	6.49	Medium
3425	TRUE	P-2268	Colbourne St - Front St to Scott St	100	71	1969	Cast iron	0	1	0.22	53	65	0.82	Arterial		5.4	1	4.9	1.25	2	1	1.3	6.42	Medium
1693	TRUE	P-1800	South - Leonard Dr to Garden Ct	150	121.5	1975	Cast iron	1	2	0.33	47	65	0.72	Local		4.9	2	4.6	1.50	1	1	1.4	6.42	Medium
6456	TRUE	P-2754	South St- Garden Ct to West St N	150	251.5	1975	Ductile Iron	1	2	0.33	47	65	0.72	Local		4.9	2	4.6	1.50	1	1	1.4	6.42	Medium
6457	TRUE	P-2755	South St- Garden Ct to West St N	150	69	1975	Ductile Iron	1	2	0.33	47	65	0.72	Local		4.9	2	4.6	1.50	1	1	1.4	6.42	Medium
2096	TRUE	P-2149	Welland St - Broadview Ave to Stanley Cr	150	124	1975	Ductile Iron	1	1	0.33	47	65	0.72	Local		4.9	2	4.6	1.50	1	1	1.4	6.42	Medium
1299	TRUE	P-728	Mississaga St W - Karen Cr to Walker Ave	150	88.5	1975	Cast iron	1	2	0.33	47	65	0.72	Collector		4.9	2	4.6	1.50	1	1	1.4	6.42	Medium
1292	TRUE	P-742	Mississaga St W - Walker Ave to Genville	150	106.5	1975	Cast iron	1	2	0.33	47	65	0.72	Collector		4.9	2	4.6	1.50	1	1	1.4	6.42	Medium
1211	TRUE	P-916	Johnson St- Park St to Carmichael Ct	300	105.5	1992	Ductile Iron	0	2	0.67	30	65	0.46	Local		3.4	1	3.2	2.25	1	1	2.0	6.41	Medium
1210	TRUE	P-918	Johnson St - Carmichael Ct to Lewis Dr	300	90	1992	Ductile Iron	0	2	0.67	30	65	0.46	Local		3.4	1	3.2	2.25	1	1	2.0	6.41	Medium
1187	TRUE	P-966	Lewis Dr- Carter Cr to Johnson St	300	337.5	1992	Ductile Iron	0	2	0.67	30	65	0.46	Local		3.4	1	3.2	2.25	1	1	2.0	6.41	Medium
2118	TRUE	P-2161	Gaudaur Ct at Shannon St	150	47.5	1974	Ductile Iron	0	1	0.33	48	65	0.74	Local		5.0	1	4.6	1.50	1	1	1.4	6.39	Medium
2113	TRUE	P-2158	Kehoe Ct at Shannon St	150	39.5	1974	Ductile Iron	0	1	0.33	48	65	0.74	Local		5.0	1	4.6	1.50	1	1	1.4	6.39	Medium
1638	TRUE	P-1474	Broadview Ave - Welland St north to end	200	626.5	1983	Ductile Iron	1	1	0.44	39	65	0.60	Local		4.2	2	4.0	1.75	1	1	1.6	6.37	Medium
1807	TRUE	P-1926	Dunlop St - Mississaga St W to Colborne St W	200	8	1982	Ductile Iron	0	1	0.44	40	65	0.62	Local		4.3	1	4.0	1.75	1	1	1.6	6.33	Medium
1806	TRUE	P-1488	Dunlop St - Mississaga St W to Colborne St W	200	128	1982	Ductile Iron	0	1	0.44	40	65	0.62	Local		4.3	1	4.0	1.75	1	1	1.6	6.33	Medium

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Colour coded legend

Generated by WaterCAD
Calculated
Bulk of data from 2016 watermain asset management sheet, including updates for 2021 determined values

Year of Analysis 2022

															Probability of Failure Factors			Consequence of Failure Factors					
ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
1506	TRUE	P-268	Queen St E - West St S to Front St	150	459	1976	Cast iron	1	1	0.33	46	65	0.71	Local		4.8	2	4.5	1.50	1	1	1.4	6.32	Medium
6452	TRUE	P-2751	Calverley St - Leach St to West St N	150	238	1980	Ductile Iron	2	2	0.33	42	65	0.65	Local		4.5	5	4.5	1.50	1	1	1.4	6.31	Medium
1700	TRUE	P-1822	Westmount Dr N- Coldwater St northward	250	178.5	1988	Ductile Iron	0	2	0.56	34	65	0.52	Collector		3.8	1	3.5	2.00	1	1	1.8	6.31	Medium
1349	TRUE	P-612	Lightfoot Trail - Cedarmere Rd west to Easem	250	194.5	1988	Ductile Iron	0	1	0.56	34	65	0.52	Local		3.8	1	3.5	2.00	1	1	1.8	6.31	Medium
1347	TRUE	P-616	Lightfoot Trail - Cedarmere Rd to Forest Ave	250	240.5	1988	Ductile Iron	0	1	0.56	34	65	0.52	Local		3.8	1	3.5	2.00	1	1	1.8	6.31	Medium
1357	TRUE	P-596	Easement east of East - Atherley Rd to Indust	200	89	1988	Ductile Iron	0	1	0.44	34	65	0.52	Local	Embury Co.	3.8	1	3.5	1.75	1	3	1.8	6.31	Medium
6501	TRUE	P-2781	Condo Barrie & Walker	150	99.5	1975	Ductile Iron	0	2	0.33	47	65	0.72	Local		4.9	1	4.5	1.50	1	1	1.4	6.28	Medium
2149	TRUE	P-2178	Calverley St - Park St to Derby St	150	93	1975	Ductile Iron	0	2	0.33	47	65	0.72	Local		4.9	1	4.5	1.50	1	1	1.4	6.28	Medium
6497	TRUE	P-2779	Condo Barrie & Walker	150	22	1975	Ductile Iron	0	2	0.33	47	65	0.72	Local		4.9	1	4.5	1.50	1	1	1.4	6.28	Medium
6499	TRUE	P-2780	Condo Barrie & Walker	150	198.5	1975	Ductile Iron	0	2	0.33	47	65	0.72	Local		4.9	1	4.5	1.50	1	1	1.4	6.28	Medium
6502	TRUE	P-2782	Condo Barrie & Walker	150	187	1975	Ductile Iron	0	2	0.33	47	65	0.72	Local		4.9	1	4.5	1.50	1	1	1.4	6.28	Medium
6506	TRUE	P-2785	Condo Barrie & Walker	150	19.5	1975	Ductile Iron	0	2	0.33	47	65	0.72	Local		4.9	1	4.5	1.50	1	1	1.4	6.28	Medium
1501	TRUE	P-282	Cochrane St - West St S to Matchedash St S	150	381	1975	Cast iron	0	1	0.33	47	65	0.72	Local		4.9	1	4.5	1.50	1	1	1.4	6.28	Medium
6570	TRUE	P-2825	Calverley St - Park St to Derby St	150	24.5	1975	Ductile Iron	0	2	0.33	47	65	0.72	Local		4.9	1	4.5	1.50	1	1	1.4	6.28	Medium
6571	TRUE	P-2826	Calverley St - Park St to Derby St	150	79	1975	Ductile Iron	0	2	0.33	47	65	0.72	Local		4.9	1	4.5	1.50	1	1	1.4	6.28	Medium
1278	TRUE	P-774	Mississaga St W - Quinn Ave to Grenville Ave	150	125.5	1975	Cast iron	0	2	0.33	47	65	0.72	Collector		4.9	1	4.5	1.50	1	1	1.4	6.28	Medium
1219	TRUE	P-896	South - Park St to Leonard Dr	150	229.5	1975	Ductile Iron	0	2	0.33	47	65	0.72	Local		4.9	1	4.5	1.50	1	1	1.4	6.28	Medium
1333	TRUE	P-646	Memorial Ave - south of Highway 12	200	12.5	1980	PVC	0	1	0.44	42	75	0.56	Arterial		4.0	1	3.7	1.75	2	1	1.7	6.27	Medium
6461	TRUE	P-2758	Private Southwould Place	150	408	1968	PVC	0	2	0.33	54	75	0.72	Local		4.9	1	4.5	1.50	1	1	1.4	6.26	Medium
910	TRUE	P-1648	PRV Progress Dr TO OPP	300	120.5	1993	Ductile Iron	0	1	0.67	29	65	0.45	Local		3.4	1	3.1	2.25	1	1	2.0	6.25	Medium
909	TRUE	P-1650	PRV PIPE WITH CHECK VAL southwest corne	300	31	1993	Ductile Iron	0	2	0.67	29	65	0.45	Local		3.4	1	3.1	2.25	1	1	2.0	6.25	Medium
1621	TRUE	P-1716	Progress Dr - southwest corner to OPP	300	5.5	1993	Ductile Iron	0	1	0.67	29	65	0.45	Local		3.4	1	3.1	2.25	1	1	2.0	6.25	Medium
1491	TRUE	P-302	High St - Hoover Cr to Bond St	150	160	1977	Cast iron	1	1	0.33	45	65	0.69	Local		4.7	2	4.4	1.50	1	1	1.4	6.21	Medium
1213	TRUE	P-912	Calverley St - Derby St to Leach St	150	101.5	1981	Ductile Iron	2	2	0.33	41	65	0.63	Local		4.4	5	4.4	1.50	1	1	1.4	6.21	Medium
1567	TRUE	P-138	Andrew St N- Market St to Mississaga St W	150	72.5	1976	Ductile Iron	0	1	0.33	46	65	0.71	Local		4.8	1	4.4	1.50	1	1	1.4	6.18	Medium
6528	TRUE	P-2798	Sweetland Circle	150	53.5	1976	Ductile Iron	0	1	0.33	46	65	0.71	Local		4.8	1	4.4	1.50	1	1	1.4	6.18	Medium
1283	TRUE	P-764	Allan St- Mississaga St W to Mary St	150	80	1976	Cast iron	0	2	0.33	46	65	0.71	Local		4.8	1	4.4	1.50	1	1	1.4	6.18	Medium
1222	TRUE	P-890	York St - Park St to Leonard Dr	150	228.5	1976	Ductile Iron	0	2	0.33	46	65	0.71	Local		4.8	1	4.4	1.50	1	1	1.4	6.18	Medium
1221	TRUE	P-892	Leonard Dr - York St to North St W	150	110	1976	Ductile Iron	0	2	0.33	46	65	0.71	Local		4.8	1	4.4	1.50	1	1	1.4	6.18	Medium
1218	TRUE	P-898	Leonard Dr - South St to York St	150	113.5	1976	Ductile Iron	0	2	0.33	46	65	0.71	Local		4.8	1	4.4	1.50	1	1	1.4	6.18	Medium
1826	TRUE	P-1764	Kitchener St - West St S to end	250	529	1989	Ductile Iron	0	1	0.56	33	65	0.51	Local		3.7	1	3.4	2.00	1	1	1.8	6.17	Medium
1479	TRUE	P-332	Simcoe St at West St S	250	3.5	1989	Ductile Iron	0	1	0.56	33	65	0.51	Local		3.7	1	3.4	2.00	1	1	1.8	6.17	Medium
2084	TRUE	P-2141	Atherley Rd - Gill St to the east	250	177.5	1993	Ductile Iron	1	1	0.56	29	65	0.45	Arterial		3.4	2	3.2	2.00	2	1	1.9	6.13	Medium
1582	TRUE	P-106	Peter St N - Coldwater Rd to Mississaga St E	200	143	1985	Cast iron	1	1	0.44	37	65	0.57	Local		4.0	2	3.8	1.75	1	1	1.6	6.13	Medium
1785	TRUE	P-1374	McKenzie St - Harvey St to Nottawasaga St	150	110.5	1978	Cast iron	1	2	0.33	44	65	0.68	Local		4.6	2	4.4	1.50	1	1	1.4	6.11	Medium
1658	TRUE	P-1714	Forest Ave N - Cedarmere Rd to North Forest	150	153.5	1978	Ductile Iron	1	1	0.33	44	65	0.68	Local		4.6	2	4.4	1.50	1	1	1.4	6.11	Medium
1398	TRUE	P-506	McKenzie St - Mary St to Mississaga St W	150	122.5	1978	Ductile Iron	1	1	0.33	44	65	0.68	Local		4.6	2	4.4	1.50	1	1	1.4	6.11	Medium
905	TRUE	P-1662	Matchedash St N - Mississaga St E to the sout	300	10.5	1994	Ductile Iron	0	1	0.67	28	65	0.43	Local		3.3	1	3.1	2.25	1	1	2.0	6.10	Medium
904	TRUE	P-1664	Matchedash St N - Mississaga St E to the nort	300	26.5	1994	Ductile Iron	0	1	0.67	28	65	0.43	Local		3.3	1	3.1	2.25	1	1	2.0	6.10	Medium
897	TRUE	P-1688	West Ridge Blvd - at Frost Ct	600	396	2003	PVC	0	2	1.00	19	75	0.25	Local	Spencer House	2.3	1	2.2	3.00	1	3	2.8	6.10	Medium
1410	TRUE	P-482	Hammond Ave - Grenville Ave to Linwood Av	150	90	1977	Ductile Iron	0	1	0.33	45	65	0.69	Local		4.7	1	4.3	1.50	1	1	1.4	6.07	Medium
6523	TRUE	P-2795	High St at Olive	150	37	1977	Ductile Iron	0	1	0.33	45	65	0.69	Local		4.7	1	4.3	1.50	1	1	1.4	6.07	Medium
1291	TRUE	P-744	Hammond Ave - Colborne St W to Grenville A	150	91	1977	Ductile Iron	0	1	0.33	45	65	0.69	Local		4.7	1	4.3	1.50	1	1	1.4	6.07	Medium
1201	TRUE	P-938	Lindsay Cr - Collegiate Dr to Rynard Dr	150	281	1977	Ductile Iron	0	2	0.33	45	65	0.69	Local		4.7	1	4.3	1.50	1	1	1.4	6.07	Medium
1200	TRUE	P-940	Rynard Dr - Lindsay Cr to Collegiate Dr	150	92.5	1977	Ductile Iron	0	2	0.33	45	65	0.69	Local		4.7	1	4.3	1.50	1	1	1.4	6.07	Medium
1579	TRUE	P-112	Peter St S - Mississaga St E to Colborne St E	150	145	1985	Cast iron	3	1	0.33	37	65	0.57	Local		4.0	7	4.3	1.50	1	1	1.4	6.06	Medium
1947	TRUE	P-2064	Monarch - Julia to Vanessa	400	91	1998	PVC	0	2	0.89	24	75	0.32	Local		2.7	1	2.5	2.75	1	1	2.4	6.02	Medium
1948	TRUE	P-2065	Vanessa Dr - Monarch Dr to Emperor Dr	400	99	1998	PVC	0	2	0.89	24	75	0.32	Local		2.7	1	2.5	2.75	1	1	2.4	6.02	Medium
1801	TRUE	P-1920	Monarch - Julia to West Ridge	400	92	1998	PVC	0	2	0.89	24	75	0.32	Local		2.7	1	2.5	2.75	1	1	2.4	6.02	Medium
1800	TRUE	P-1916	Monarch - Vanessa to West Ridge	400	71	1998	PVC	0	2	0.89	24	75	0.32	Local		2.7	1	2.5	2.75	1	1	2.4	6.02	Medium
1391	TRUE	P-520	Douglas St - John St to Mary St	150	134	1978	Cast iron	0	1	0.33	44	65	0.68	Local		4.6	1	4.3	1.50	1	1	1.4	5.97	Medium
1400	TRUE	P-502	Hammond Ave - Mississaga St W to Colborne	150	120	1978	Ductile Iron	0	1	0.33	44	65	0.68	Local		4.6	1	4.3	1.50	1	1	1.4	5.97	Medium
1677	TRUE	P-1762	Maple Leaf Ave - High St east to end	150	93	1978	Ductile Iron	0	1	0.33	44	65	0.68	Local		4.6	1	4.3	1.50	1	1	1.4	5.97	Medium
5445	TRUE	P-2425	James Ct - James St south to end	150	142.5	1978	Ductile Iron	0	1	0.33	44	65	0.68	Local		4.6	1	4.3	1.50	1	1	1.4	5.97	Medium
6397	TRUE	P-2729	McKenzie -John to Nottawasaga	150	95.5	1978	Cast iron	0	1	0.33	44	65	0.68	Local		4.6	1	4.3	1.50	1	1	1.4	5.97	Medium
6398	TRUE	P-2730	McKenzie -John to Nottawasaga	150	9.5	1978	Cast iron	0	1	0.33	44	65	0.68	Local		4.6	1	4.3	1.50	1	1	1.4	5.97	Medium
1403	TRUE	P-496	Dallas St - Mississaga St W to Colborne St W	150	121	1978	Ductile Iron	0	1	0.33	44	65	0.68	Local		4.6	1	4.3	1.50	1	1	1.4	5.97	Medium
1396	TRUE	P-510	Douglas St - Mary St to Mississaga St W	150	112	1978	Ductile Iron	0	1	0.33	44	65	0.68	Local		4.6	1	4.3	1.50	1	1	1.4	5.97	Medium
1394	TRUE	P-514	McKenzie St- John St to Mary St	150	118.5	1978	Cast iron	0	1	0.33	44	65	0.68	Local		4.6	1	4.3	1.50	1	1	1.4	5.97	Medium
1348	TRUE	P-614	Cedarmere Rd - Lightfoot Trail to Forest Ave	150	201.5	1978	Ductile Iron	0	1	0.33	44	65	0.68	Local		4.6	1	4.3	1.50	1	1	1.4	5.97	Medium

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															Probability of Failure Factors			Consequence of Failure Factors					
ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
1362	TRUE	P-584	Atherley Rd - Millard St to Moffat St	250	178	1993	Ductile Iron	0	1	0.56	29	65	0.45	Arterial		3.4	1	3.1	2.00	2	1	1.9	5.94	Medium
6453	TRUE	P-2752	Calverley St - Leach St to West St N	150	139	1980	Ductile Iron	1	2	0.33	42	65	0.65	Local		4.5	2	4.2	1.50	1	1	1.4	5.89	Medium
3205	TRUE	P-2231	Canice St at North St E	150	21.5	1979	Ductile Iron	0	1	0.33	43	65	0.66	Local		4.5	1	4.2	1.50	1	1	1.4	5.86	Medium
3211	TRUE	P-2234	Landon St at Old Muskoka Rd	150	4.5	1979	Ductile Iron	0	2	0.33	43	65	0.66	Local		4.5	1	4.2	1.50	1	1	1.4	5.86	Medium
3212	TRUE	P-2235	Landon St at Old Muskoka Rd	150	4.5	1979	Ductile Iron	0	1	0.33	43	65	0.66	Local		4.5	1	4.2	1.50	1	1	1.4	5.86	Medium
3220	TRUE	P-2238	Delta St at Old Muskoka Rd	150	3.5	1979	Cast iron	0	2	0.33	43	65	0.66	Local		4.5	1	4.2	1.50	1	1	1.4	5.86	Medium
1132	TRUE	P-1080	North St E at Canice St	150	3	1979	Cast iron	0	2	0.33	43	65	0.66	Local		4.5	1	4.2	1.50	1	1	1.4	5.86	Medium
1036	TRUE	P-1316	Old Muskoka Rd - Landon St to Delta St	150	219.5	1979	Cast iron	0	2	0.33	43	65	0.66	Local		4.5	1	4.2	1.50	1	1	1.4	5.86	Medium
3221	TRUE	P-2239	Delta St at Old Muskoka Rd	150	8	1979	Cast iron	0	2	0.33	43	65	0.66	Local		4.5	1	4.2	1.50	1	1	1.4	5.86	Medium
3204	TRUE	P-2230	Canice St at North St E	150	5.5	1979	Ductile Iron	0	2	0.33	43	65	0.66	Local		4.5	1	4.2	1.50	1	1	1.4	5.86	Medium
1033	TRUE	P-1322	Delta St at Old Muskoka Rd	150	17.5	1979	Cast iron	0	2	0.33	43	65	0.66	Local		4.5	1	4.2	1.50	1	1	1.4	5.86	Medium
1038	TRUE	P-1084	Old Muskoka Rd at Landon St	150	8	1979	Cast iron	0	2	0.33	43	65	0.66	Local		4.5	1	4.2	1.50	1	1	1.4	5.86	Medium
1130	TRUE	P-1086	Old Muskoka Rd- south of Fittons Rd E	150	35.5	1979	Cast iron	0	2	0.33	43	65	0.66	Local		4.5	1	4.2	1.50	1	1	1.4	5.86	Medium
1037	TRUE	P-1312	Old Muskoka Rd - Landon St to North St E	150	176	1979	Cast iron	0	2	0.33	43	65	0.66	Local		4.5	1	4.2	1.50	1	1	1.4	5.86	Medium
1050	TRUE	P-1290	Canice St at Borland St	150	9	1979	Ductile Iron	0	1	0.33	43	65	0.66	Local		4.5	1	4.2	1.50	1	1	1.4	5.86	Medium
3223	TRUE	P-2240	Fittons Rd E at Old Muskoka Rd	150	6.5	1979	Cast iron	0	1	0.33	43	65	0.66	Collector		4.5	1	4.2	1.50	1	1	1.4	5.86	Medium
3224	TRUE	P-2241	Fittons Rd E at Old Muskoka Rd	150	12	1979	Cast iron	0	2	0.33	43	65	0.66	Collector		4.5	1	4.2	1.50	1	1	1.4	5.86	Medium
1111	TRUE	P-1130	Bay St - Drinkwater Dr to Maple Dr	200	325	1986	Ductile Iron	0	1	0.44	36	65	0.55	Local		4.0	1	3.7	1.75	1	1	1.6	5.85	Medium
1739	TRUE	P-1878	Hillside Dr - Laclie St west to end	150	137.5	1981	Ductile Iron	1	2	0.33	41	65	0.63	Local		4.4	2	4.1	1.50	1	1	1.4	5.79	Medium
5227	TRUE	P-2390	Forest Ave at Atherley Rd	250	18.5	1992	Ductile Iron	0	1	0.56	30	65	0.46	Local		3.4	1	3.2	2.00	1	1	1.8	5.76	Medium
5226	TRUE	P-2389	Forest Ave N - Museum Dr to Atherley Rd	250	81.5	1992	Ductile Iron	0	1	0.56	30	65	0.46	Local		3.4	1	3.2	2.00	1	1	1.8	5.76	Medium
1703	TRUE	P-1830	Dancy Dr - Fittons Rd E north to end	200	572.5	1987	Ductile Iron	0	2	0.44	35	65	0.54	Local		3.9	1	3.6	1.75	1	1	1.6	5.73	Medium
1108	TRUE	P-1140	Lightfoot Trail - Davey Dr east to Easement	250	141	1988	PVC	0	1	0.56	34	75	0.45	Local		3.4	1	3.2	2.00	1	1	1.8	5.69	Medium
1102	TRUE	P-1160	Lightfoot Trail - Davey Dr to Cedar Island Rd	250	278.5	1988	PVC	0	1	0.56	34	75	0.45	Local		3.4	1	3.2	2.00	1	1	1.8	5.69	Medium
1972	TRUE	P-2079	West Ridge Blvd - at Frost Ct	600	101	2003	PVC	0	2	1.00	19	75	0.25	Local		2.3	1	2.2	3.00	1	1	2.6	5.67	Medium
1973	TRUE	P-2080	West Ridge Blvd - at Mulcahy Ct	600	104	2003	PVC	0	2	1.00	19	75	0.25	Local		2.3	1	2.2	3.00	1	1	2.6	5.67	Medium
1208	TRUE	P-922	Derby St - Fittons Rd W to Calverley St	150	323	1981	Ductile Iron	0	2	0.33	41	65	0.63	Local		4.4	1	4.0	1.50	1	1	1.4	5.65	Medium
1670	TRUE	P-1744	Shannon St - West St S to Korlea Cr	150	134	1975	PVC	0	1	0.33	47	75	0.63	Local		4.3	1	4.0	1.50	1	1	1.4	5.62	Medium
1673	TRUE	P-1754	Shannon St - Korlea Cr to Korlea Cr	150	148.5	1975	PVC	0	1	0.33	47	75	0.63	Local		4.3	1	4.0	1.50	1	1	1.4	5.62	Medium
1674	TRUE	P-1756	Shannon St - Korlea Cr (East) to High St	150	92	1975	PVC	0	1	0.33	47	75	0.63	Local		4.3	1	4.0	1.50	1	1	1.4	5.62	Medium
1647	TRUE	P-1574	Orchard Point Rd - Atherley Rd to Driftwood I	200	114	1988	Ductile Iron	0	1	0.44	34	65	0.52	Local		3.8	1	3.5	1.75	1	1	1.6	5.61	Medium
6481	TRUE	P-2769	Brandon Cr - Kevin Ct to Grenville Ave	200	5.5	1988	Ductile Iron	0	2	0.44	34	65	0.52	Local		3.8	1	3.5	1.75	1	1	1.6	5.61	Medium
6482	TRUE	P-2770	Brandon Cr - Kevin Ct to Grenville Ave	200	80	1988	Ductile Iron	0	2	0.44	34	65	0.52	Local		3.8	1	3.5	1.75	1	1	1.6	5.61	Medium
1286	TRUE	P-758	Easement - Mississaga St W to Brandon Cr	200	115.5	1988	Ductile Iron	0	2	0.44	34	65	0.52	Local		3.8	1	3.5	1.75	1	1	1.6	5.61	Medium
1285	TRUE	P-760	Brandon Cr - Easement to Kevin Ct	200	54	1988	Ductile Iron	0	2	0.44	34	65	0.52	Local		3.8	1	3.5	1.75	1	1	1.6	5.61	Medium
2092	TRUE	P-2146	Atherley Rd - Forest Ave west to Easement	250	308	1993	PVC	1	1	0.56	29	75	0.39	Arterial		3.0	2	2.9	2.00	2	1	1.9	5.58	Medium
1344	TRUE	P-622	Atherley Rd - Forest Ave to east of Bayview F	250	484	1993	PVC	1	1	0.56	29	75	0.39	Arterial		3.0	2	2.9	2.00	2	1	1.9	5.58	Medium
1194	TRUE	P-952	Lewis Dr - Collegiate Dr to Watson Ct	300	104.5	1994	PVC	0	2	0.67	28	75	0.37	Local		3.0	1	2.8	2.25	1	1	2.0	5.54	Medium
1193	TRUE	P-954	Lewis Dr - Watson Ct to Carter Cr	300	80	1994	PVC	0	2	0.67	28	75	0.37	Local		3.0	1	2.8	2.25	1	1	2.0	5.54	Medium
1192	TRUE	P-956	Lewis Dr - Carter Cr to Carter Cr	300	286.5	1994	PVC	0	2	0.67	28	75	0.37	Local		3.0	1	2.8	2.25	1	1	2.0	5.54	Medium
1051	TRUE	P-1288	Canice St at Borland St	150	1.5	1976	PVC	0	1	0.33	46	75	0.61	Local		4.3	1	3.9	1.50	1	1	1.4	5.53	Medium
1671	TRUE	P-1748	Korlea Cr - Shannon St to Kris Ct (West)	150	84.5	1976	PVC	0	1	0.33	46	75	0.61	Local		4.3	1	3.9	1.50	1	1	1.4	5.53	Medium
1672	TRUE	P-1750	Korlea Cr - Shannon St to Kris Ct (East)	150	210.5	1976	PVC	0	1	0.33	46	75	0.61	Local		4.3	1	3.9	1.50	1	1	1.4	5.53	Medium
898	TRUE	P-1682	Hunter Valley Rd- West Ridge Blvd to the end	300	188	1995	PVC	0	2	0.67	27	75	0.36	Local		2.9	1	2.7	2.25	1	1	2.0	5.41	Medium
1359	TRUE	P-590	Atherley Rd - Moffat St to East St	250	50	1993	PVC	0	1	0.56	29	75	0.39	Arterial		3.0	1	2.8	2.00	2	1	1.9	5.39	Medium
1356	TRUE	P-598	Atherley Rd - East St to Easement east of Eas	250	72	1993	PVC	0	1	0.56	29	75	0.39	Arterial		3.0	1	2.8	2.00	2	1	1.9	5.39	Medium
1355	TRUE	P-600	Atherley Rd - East St west to Easement	250	118.5	1993	PVC	0	1	0.56	29	75	0.39	Arterial		3.0	1	2.8	2.00	2	1	1.9	5.39	Medium
1836	TRUE	P-1616	Toboggan Hill Dr	200	189.5	1990	Ductile Iron	0	2	0.44	32	65	0.49	Local		3.6	1	3.4	1.75	1	1	1.6	5.37	Medium
924	TRUE	P-1622	Toboggan Hill Dr to Arthur St easement	200	102	1990	Ductile Iron	0	2	0.44	32	65	0.49	Local		3.6	1	3.4	1.75	1	1	1.6	5.37	Medium
926	TRUE	P-1608	Rosemary Rd - Toboggan Hill Dr to the east	200	175.5	1990	Ductile Iron	0	2	0.44	32	65	0.49	Local		3.6	1	3.4	1.75	1	1	1.6	5.37	Medium
1778	TRUE	P-198	Barrie Rd- Andrew St S to West St S	250	120.5	1995	Ductile Iron	0	1	0.56	27	65	0.42	Collector		3.2	1	3.0	2.00	1	1	1.8	5.36	Medium
3713	TRUE	P-2320	Mariposa Dr - Sundial Dr west to end	150	117.5	1984	Ductile Iron	0	2	0.33	38	65	0.58	Local		4.1	1	3.8	1.50	1	1	1.4	5.33	Medium
3712	TRUE	P-2319	Mariposa Dr - Sundial Dr west to end	150	76	1984	Ductile Iron	0	2	0.33	38	65	0.58	Local		4.1	1	3.8	1.50	1	1	1.4	5.33	Medium
3718	TRUE	P-2323	Centennial Dr- Mississaga St E to north	150	148.5	1984	Ductile Iron	0	1	0.33	38	65	0.58	Local		4.1	1	3.8	1.50	1	1	1.4	5.33	Medium
3202	TRUE	P-2229	Canice St - Cedar to North St E	100	151	1976	Cast iron	0	2	0.22	46	65	0.71	Local		4.8	1	4.4	1.25	1	1	1.2	5.29	Medium
2140	TRUE	P-2173	Canice St - Cedar to Borland St	100	155.5	1976	Cast iron	0	1	0.22	46	65	0.71	Local		4.8	1	4.4	1.25	1	1	1.2	5.29	Medium
1090	TRUE	P-1186	Canice St at Jarvis St	100	3	1976	Cast iron	0	1	0.22	46	65	0.71	Local		4.8	1	4.4	1.25	1	1	1.2	5.29	Medium
1088	TRUE	P-1190	Canice St - Jarvis St to Lavallee Cr	100	74	1976	Cast iron	0	1	0.22	46	65	0.71	Local		4.8	1	4.4	1.25	1	1	1.2	5.29	Medium
1087	TRUE	P-1192	Canice St - Lavallee Cr to Borland St	100	73.5	1976	Cast iron	0	1	0.22	46	65	0.71	Local		4.8	1	4.4	1.25	1	1	1.2	5.29	Medium
5558	TRUE	P-2445	Mississaga St E - Front St to Esplanade	250	171	1994	PVC	0	1	0.56	28	75	0.37	Collector	Historic Downto	3.0	1	2.8	2.00	1	2	1.9	5.26	Medium

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															Probability of Failure Factors			Consequence of Failure Factors					
ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
5559	TRUE	P-2446	Mississaga St E - Front St to Esplanade	250	17.5	1994	PVC	0	1	0.56	28	75	0.37	Collector	Historic Downto	3.0	1	2.8	2.00	1	2	1.9	5.26	Medium
1144	TRUE	P-1056	Parkhurst Ave - Landon St to St Jean St	150	333.5	1986	Ductile Iron	1	2	0.33	36	65	0.55	Local		4.0	2	3.8	1.50	1	1	1.4	5.26	Medium
917	TRUE	P-1634	Drinkwater Dr at Bridget Dr thur easement to	200	182	1991	Ductile Iron	0	1	0.44	31	65	0.48	Local		3.5	1	3.3	1.75	1	1	1.6	5.25	Medium
6442	TRUE	P-2745	Brammer Dr - north of easement to end	200	48	1991	Ductile Iron	0	1	0.44	31	65	0.48	Local		3.5	1	3.3	1.75	1	1	1.6	5.25	Medium
6443	TRUE	P-2746	Brammer Dr - north of easement to end	200	32.5	1991	Ductile Iron	0	1	0.44	31	65	0.48	Local		3.5	1	3.3	1.75	1	1	1.6	5.25	Medium
1769	TRUE	P-1582	Victoria Cr - Lankin Blvd to the west	300	86.5	2001	Ductile Iron	1	1	0.67	21	65	0.32	Local		2.7	2	2.6	2.25	1	1	2.0	5.24	Medium
2181	TRUE	P-2195	West Ridge Blvd - at Monarch Dr	400	142.5	2003	PVC	0	2	0.89	19	75	0.25	Local		2.3	1	2.2	2.75	1	1	2.4	5.23	Medium
2180	TRUE	P-2194	West Ridge Blvd- at Monarch Dr	400	115.5	2003	PVC	0	2	0.89	19	75	0.25	Local		2.3	1	2.2	2.75	1	1	2.4	5.23	Medium
1696	TRUE	P-1808	West Ridge Blvd -at Mulcahy Ct	400	92	2003	PVC	0	2	0.89	19	75	0.25	Local		2.3	1	2.2	2.75	1	1	2.4	5.23	Medium
2158	TRUE	P-2182	West Ridge Blvd at Bass Lake SR	400	20.5	2003	PVC	0	2	0.89	19	75	0.25	Local		2.3	1	2.2	2.75	1	1	2.4	5.23	Medium
1804	TRUE	P-1922	WestSt N - Orchard Park School entrance to (	250	106.5	1996	PVC	1	2	0.56	26	75	0.35	Arterial		2.8	2	2.7	2.00	2	1	1.9	5.20	Medium
1698	TRUE	P-1818	Utility Corridor - north through SWM Facility	900	100.5	2006	PVC	0	2	1.00	16	75	0.21	Local		2.1	1	2.0	3.00	1	1	2.6	5.16	Medium
1874	TRUE	P-2000	WOW	900	12	2006	PVC	0	2	1.00	16	75	0.21	Local		2.1	1	2.0	3.00	1	1	2.6	5.16	Medium
2101	TRUE	P-2152	Atherley Rd - west of Highway 12	250	80	1997	PVC	0	1	0.56	25	75	0.33	Highway or highway crossing		2.7	1	2.6	2.00	3	1	2.0	5.15	Medium
1646	TRUE	P-1572	Atherley Rd - Oak to Orchard Point Rd	250	227	1997	PVC	0	1	0.56	25	75	0.33	Highway or highway crossing		2.7	1	2.6	2.00	3	1	2.0	5.15	Medium
1652	TRUE	P-1604	Atherley Rd - Tudhope Park to Couchiching P	250	822.5	1997	PVC	0	1	0.56	25	75	0.33	Highway or highway crossing		2.7	1	2.6	2.00	3	1	2.0	5.15	Medium
1651	TRUE	P-1602	Atherley Rd - Highway 12 east to Tudhope Pa	250	48.5	1997	PVC	0	1	0.56	25	75	0.33	Highway or highway crossing		2.7	1	2.6	2.00	3	1	2.0	5.15	Medium
1341	TRUE	P-628	Atherley Rd- Couchiching Pt Rd to Oak	250	166.5	1997	PVC	0	1	0.56	25	75	0.33	Highway or highway crossing		2.7	1	2.6	2.00	3	1	2.0	5.15	Medium
1371	TRUE	P-564	Front St - Queen St E to Gill St	300	87.5	2002	Ductile Iron	0	1	0.67	20	65	0.31	Arterial		2.6	1	2.4	2.25	2	1	2.1	5.14	Medium
3729	TRUE	P-2330	Lakeside Village - Leacock Ln to Forest Ave N	200	203.5	1993	PVC	0	1	0.44	29	75	0.39	Local	Leacock Care Ce	3.0	1	2.8	1.75	1	3	1.8	5.10	Medium
1183	TRUE	P-974	Fittons Rd E- Jamieson Dr to Fittons Heights	400	237.5	2004	PVC	0	2	0.89	18	75	0.24	Collector		2.2	1	2.1	2.75	1	1	2.4	5.07	Medium
1182	TRUE	P-976	Fittons Rd E- Fittons Heights to Orma Dr	400	81	2004	PVC	0	2	0.89	18	75	0.24	Collector		2.2	1	2.1	2.75	1	1	2.4	5.07	Medium
1101	TRUE	P-1162	Industrial St - Forest Ave N west to Easement	150	262.5	1988	PVC	0	1	0.33	34	75	0.45	Local	Embury Co.	3.4	1	3.2	1.50	1	3	1.6	5.06	Medium
1176	TRUE	P-990	Fittons Rd E- Orma Dr to Laclie St	350	182	2004	Cast iron	0	2	0.78	18	65	0.28	Collector		2.4	1	2.3	2.50	1	1	2.2	5.05	Medium
6136	TRUE	P-2620	Commercial Rd to 3275 Monarch rear	300	127	1998	PVC	0	2	0.67	24	75	0.32	Local		2.7	1	2.5	2.25	1	1	2.0	5.01	Medium
6139	TRUE	P-2622	Commercial Rd to 3275 Monarch rear	300	114.5	1998	PVC	0	2	0.67	24	75	0.32	Local		2.7	1	2.5	2.25	1	1	2.0	5.01	Medium
6141	TRUE	P-2623	Commercial Rd to 3275 Monarch rear	300	119.5	1998	PVC	0	2	0.67	24	75	0.32	Local		2.7	1	2.5	2.25	1	1	2.0	5.01	Medium
5923	TRUE	P-2069	Monarch to Atlantis Dr	300	130.5	1998	PVC	0	3	0.67	24	75	0.32	Local		2.7	1	2.5	2.25	1	1	2.0	5.01	Medium
6126	TRUE	P-2614	West Ridge Place - West Ridge to Monarch	300	294	1998	PVC	0	2	0.67	24	75	0.32	Local		2.7	1	2.5	2.25	1	1	2.0	5.01	Medium
6131	TRUE	P-2617	Commercial Rd- Monarch to 3305	300	86.5	1998	PVC	0	2	0.67	24	75	0.32	Local		2.7	1	2.5	2.25	1	1	2.0	5.01	Medium
6134	TRUE	P-2619	Commercial Rd-3305 to 3315 Monarch	300	45	1998	PVC	0	2	0.67	24	75	0.32	Local		2.7	1	2.5	2.25	1	1	2.0	5.01	Medium
6142	TRUE	P-2624	West Ridge -3225	300	385	1998	PVC	0	2	0.67	24	75	0.32	Local		2.7	1	2.5	2.25	1	1	2.0	5.01	Medium
6144	TRUE	P-2625	20 Mulcahy	300	94	1998	PVC	0	2	0.67	24	75	0.32	Local		2.7	1	2.5	2.25	1	1	2.0	5.01	Medium
6146	TRUE	P-2626	West Ridge-3225	300	92.5	1998	PVC	0	2	0.67	24	75	0.32	Local		2.7	1	2.5	2.25	1	1	2.0	5.01	Medium
6315	TRUE	P-2699	Orchard Point Rd - Driftwood Rd west to end	200	183.5	1993	Ductile Iron	0	1	0.44	29	65	0.45	Local		3.4	1	3.1	1.75	1	1	1.6	5.00	Medium
6316	TRUE	P-2700	Orchard Point Rd - Driftwood Rd west to end	200	66	1993	Ductile Iron	0	1	0.44	29	65	0.45	Local		3.4	1	3.1	1.75	1	1	1.6	5.00	Medium
6318	TRUE	P-2701	Driftwood Rd - Orchard Point Rd to Clifford S	200	276.5	1993	Ductile Iron	0	1	0.44	29	65	0.45	Local		3.4	1	3.1	1.75	1	1	1.6	5.00	Medium
6319	TRUE	P-2702	Driftwood Rd - Orchard Point Rd to Clifford S	200	57.5	1993	Ductile Iron	0	1	0.44	29	65	0.45	Local		3.4	1	3.1	1.75	1	1	1.6	5.00	Medium
903	TRUE	P-1668	Matchedash St N - Mississaga St E to Coldwat	250	119.5	1994	PVC	0	1	0.56	28	75	0.37	Local		3.0	1	2.8	2.00	1	1	1.8	4.98	Low
3424	TRUE	P-2267	Matchedash St S - Mississaga St E to Colborne	250	132.5	1994	PVC	0	1	0.56	28	75	0.37	Local		3.0	1	2.8	2.00	1	1	1.8	4.98	Low
1648	TRUE	P-1576	Driftwood Rd - Orchard Point Rd west to end	150	124	1988	Ductile Iron	0	1	0.33	34	65	0.52	Local		3.8	1	3.5	1.50	1	1	1.4	4.91	Low
1099	TRUE	P-1166	Lightfoot Trail at Forest Ave N	150	7	1988	Ductile Iron	0	1	0.33	34	65	0.52	Local		3.8	1	3.5	1.50	1	1	1.4	4.91	Low
1385	TRUE	P-534	O'Brien St - Nottawasaga St to Douglas St	150	71.5	1988	Ductile Iron	0	1	0.33	34	65	0.52	Local		3.8	1	3.5	1.50	1	1	1.4	4.91	Low
1384	TRUE	P-536	O'Brien St - Douglas St to Mary St	150	108	1988	Ductile Iron	0	1	0.33	34	65	0.52	Local		3.8	1	3.5	1.50	1	1	1.4	4.91	Low
1281	TRUE	P-768	Brandon Cr - Grenville Ave to Easement	150	317	1988	Ductile Iron	0	2	0.33	34	65	0.52	Local		3.8	1	3.5	1.50	1	1	1.4	4.91	Low
2026	TRUE	P-2113	Matchedash St N -Jarvis St to Brant St E	300	154	2005	PVC	2	1	0.67	17	75	0.23	Local		2.2	5	2.4	2.25	1	1	2.0	4.90	Low
2100	TRUE	P-2151	Atherley Rd - west of Highway 12	250	261.5	1997	PVC	0	1	0.56	25	75	0.33	Arterial		2.7	1	2.6	2.00	2	1	1.9	4.89	Low
1537	TRUE	P-206	Barrie Rd - Albert St S to Andrew St S	250	127.5	1995	PVC	0	1	0.56	27	75	0.36	Collector		2.9	1	2.7	2.00	1	1	1.8	4.87	Low
1526	TRUE	P-228	Barrie Rd - Wyandotte St to Albert St S	250	115	1995	PVC	0	1	0.56	27	75	0.36	Collector		2.9	1	2.7	2.00	1	1	1.8	4.87	Low
2093	TRUE	P-2147	Atherley Rd - Forest Ave west to Easement	200	11.5	1993	PVC	0	1	0.44	29	75	0.39	Arterial		3.0	1	2.8	1.75	2	1	1.7	4.82	Low
1161	TRUE	P-1020	Bay St - Fittons Rd E to Southwood Circle	250	131.5	1997	PVC	1	1	0.56	25	75	0.33	Local		2.7	2	2.7	2.00	1	1	1.8	4.81	Low
5579	TRUE	P-2455	Laurentian Ln- Woodside to Woodside Dr	150	326.5	1989	Ductile Iron	0	2	0.33	33	65	0.51	Local		3.7	1	3.4	1.50	1	1	1.4	4.80	Low
5582	TRUE	P-2457	Chelsea Ct at Laurentian Ln	150	53	1989	Ductile Iron	0	2	0.33	33	65	0.51	Local		3.7	1	3.4	1.50	1	1	1.4	4.80	Low
5585	TRUE	P-2458	Laurentian Ln - Woodside Dr to Woodside Dr	150	103	1989	Ductile Iron	0	2	0.33	33	65	0.51	Local		3.7	1	3.4	1.50	1	1	1.4	4.80	Low
5586	TRUE	P-2459	Laurentian Ln- Woodside Dr to Woodside Dr	150	109.5	1989	Ductile Iron	0	2	0.33	33	65	0.51	Local		3.7	1	3.4	1.50	1	1	1.4	4.80	Low
5588	TRUE	P-2460	Chestnut Pl at Laurentian Ln	150	68	1989	Ductile Iron	0	2	0.33	33	65	0.51	Local		3.7	1	3.4	1.50	1	1	1.4	4.80	Low
6484	TRUE	P-2771	Kevin Ct	150	92.5	1989	Ductile Iron	0	2	0.33	33	65	0.51	Local		3.7	1	3.4	1.50	1	1	1.4	4.80	Low
6160	TRUE	P-2635	Bass Lake SR Atlantis Dr to west	300	339.5	2000	PVC	0	3	0.67	22	75	0.29	Local		2.5	1	2.4	2.25	1	1	2.0	4.75	Low
2184	TRUE	P-2197	Brammer Dr- Huronia Rd to easement	200	226.5	1991	PVC	0	1	0.44	31	75	0.41	Local		3.2	1	3.0	1.75	1	1	1.6	4.75	Low
1838	TRUE	P-1612	Toboggan Hill Dr	150	116.5	1990	Ductile Iron	0	2	0.33	32	65	0.49	Local		3.6	1	3.4	1.50	1	1	1.4	4.70	Low

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ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
927	TRUE	P-1606	Rosemary Rd- Westmount Dr N to the west	150	122.5	1990	Ductile Iron	0	2	0.33	32	65	0.49	Local		3.6	1	3.4	1.50	1	1	1.4	4.70	Low
1667	TRUE	P-1738	Dorset Dr - Bond St south to End	150	205.5	1990	Ductile Iron	0	1	0.33	32	65	0.49	Local		3.6	1	3.4	1.50	1	1	1.4	4.70	Low
925	TRUE	P-1610	Rosemary Rd - Toboggan Hill Dr west to corn	150	283.5	1990	Ductile Iron	0	2	0.33	32	65	0.49	Local		3.6	1	3.4	1.50	1	1	1.4	4.70	Low
2004	TRUE	P-2096	Bond St - West St S to Dorset Dr	150	151	1990	Ductile Iron	0	1	0.33	32	65	0.49	Local		3.6	1	3.4	1.50	1	1	1.4	4.70	Low
1609	TRUE	P-30	Tecumseth St - Matchedash St N to Peter St N	150	191	1990	Ductile Iron	0	1	0.33	32	65	0.49	Local		3.6	1	3.4	1.50	1	1	1.4	4.70	Low
1770	TRUE	P-1628	Victoria Cr - Shannon St to the south	200	173	2001	Ductile Iron	2	1	0.44	21	65	0.32	Local		2.7	5	2.9	1.75	1	1	1.6	4.68	Low
1682	TRUE	P-1776	West St S- Norweld Dr to James	300	304.5	2005	Ductile Iron	0	1	0.67	17	65	0.26	Arterial		2.4	1	2.2	2.25	2	1	2.1	4.66	Low
1174	TRUE	P-994	Fittons Rd E at Laclie St	350	12.5	2004	PVC	0	2	0.78	18	75	0.24	Collector		2.2	1	2.1	2.50	1	1	2.2	4.65	Low
3429	TRUE	P-2269	West Ridge Blvd to Harvie Settl Rd	600	114	2009	PVC	0	2	1.00	13	75	0.17	Local		1.9	1	1.8	3.00	1	1	2.6	4.64	Low
2171	TRUE	P-2190	West Ridge Blvd at University Ave	600	16.5	2009	PVC	0	2	1.00	13	75	0.17	Local		1.9	1	1.8	3.00	1	1	2.6	4.64	Low
5909	TRUE	P-2336	University Ave at Old Barrie Rd	400	112	2009	PVC	0	2	0.89	13	75	0.17	Local	Lakehead Univer	1.9	1	1.8	2.75	1	3	2.6	4.64	Low
5907	TRUE	P-2338	University Ave at LU	400	467.5	2009	PVC	0	2	0.89	13	75	0.17	Local	Lakehead Univer	1.9	1	1.8	2.75	1	3	2.6	4.64	Low
5908	TRUE	P-2339	University Ave north of Rotary Place	400	442.5	2009	PVC	0	2	0.89	13	75	0.17	Local	Lakehead Univer	1.9	1	1.8	2.75	1	3	2.6	4.64	Low
2043	TRUE	P-2120	James St at East St	200	9.5	1996	Ductile Iron	0	1	0.44	26	65	0.40	Local		3.1	1	2.9	1.75	1	1	1.6	4.64	Low
1760	TRUE	P-1902	Barrie Rd - Memorial Ave to Westmount Dr S	250	152.5	1997	PVC	0	1	0.56	25	75	0.33	Collector		2.7	1	2.6	2.00	1	1	1.8	4.63	Low
1759	TRUE	P-1900	Barrie Rd - Memorial Ave to Westmount Dr S	250	268	1997	PVC	0	1	0.56	25	75	0.33	Collector		2.7	1	2.6	2.00	1	1	1.8	4.63	Low
1160	TRUE	P-1022	Bay St - Southwood Circle to North St E	250	576.5	1997	PVC	0	1	0.56	25	75	0.33	Local		2.7	1	2.6	2.00	1	1	1.8	4.63	Low
1679	TRUE	P-1770	Victoria Cr - Lankin Blvd to east of Bridge	300	101	2001	PVC	0	1	0.67	21	75	0.28	Local		2.5	1	2.3	2.25	1	1	2.0	4.62	Low
1945	TRUE	P-2063	Atlantis Dr - Bass Lake SR to Cleopatra	300	125	2001	PVC	0	3	0.67	21	75	0.28	Local		2.5	1	2.3	2.25	1	1	2.0	4.62	Low
1957	TRUE	P-2070	Atlantis Dr - s of Cleopatra to easement	300	92	2001	PVC	0	3	0.67	21	75	0.28	Local		2.5	1	2.3	2.25	1	1	2.0	4.62	Low
5122	TRUE	P-2385	Cindy Lee Cr - north half	150	250.5	1991	Ductile Iron	0	1	0.33	31	65	0.48	Local		3.5	1	3.3	1.50	1	1	1.4	4.59	Low
5123	TRUE	P-2386	Cindy Lee Cr - north half	150	116	1991	Ductile Iron	0	1	0.33	31	65	0.48	Local		3.5	1	3.3	1.50	1	1	1.4	4.59	Low
1689	TRUE	P-674	Cindy Lee Cr - south half	150	222.5	1991	Ductile Iron	0	1	0.33	31	65	0.48	Local		3.5	1	3.3	1.50	1	1	1.4	4.59	Low
1718	TRUE	P-1788	Fourth St - Frontier Ave to Lahay Ave	200	142	1993	PVC	0	2	0.44	29	75	0.39	Local		3.0	1	2.8	1.75	1	1	1.6	4.54	Low
1742	TRUE	P-1884	Frontier Ave - Laclie St to Fourth St	200	285.5	1993	PVC	0	2	0.44	29	75	0.39	Local		3.0	1	2.8	1.75	1	1	1.6	4.54	Low
1656	TRUE	P-1708	Courtyard Village - Museum Dr to Pipe Chang	200	23	1993	PVC	0	1	0.44	29	75	0.39	Local		3.0	1	2.8	1.75	1	1	1.6	4.54	Low
6540	TRUE	P-2806	Museum Dr - Forest Ave N to Leacock Ln	200	68.5	1993	PVC	0	1	0.44	29	75	0.39	Local		3.0	1	2.8	1.75	1	1	1.6	4.54	Low
6547	TRUE	P-2810	Museum Dr - Forest Ave N to Leacock Ln	200	59	1993	PVC	0	1	0.44	29	75	0.39	Local		3.0	1	2.8	1.75	1	1	1.6	4.54	Low
6552	TRUE	P-2813	Museum Dr - Forest Ave N to Leacock Ln	200	60.5	1993	PVC	0	1	0.44	29	75	0.39	Local		3.0	1	2.8	1.75	1	1	1.6	4.54	Low
6553	TRUE	P-2814	Museum Dr - Forest Ave N to Leacock Ln	200	112	1993	PVC	0	1	0.44	29	75	0.39	Local		3.0	1	2.8	1.75	1	1	1.6	4.54	Low
1775	TRUE	P-530	East of Leacock Ln	200	104.5	1993	PVC	0	1	0.44	29	75	0.39	Local		3.0	1	2.8	1.75	1	1	1.6	4.54	Low
1007	TRUE	P-1392	Westmount Dr S at Barrie Rd	200	21.5	1997	Ductile Iron	0	1	0.44	25	65	0.38	Collector		3.0	1	2.8	1.75	1	1	1.6	4.52	Low
1683	TRUE	P-1778	Norweld Dr - West St S to end	250	295	1998	PVC	0	1	0.56	24	75	0.32	Local		2.7	1	2.5	2.00	1	1	1.8	4.51	Low
995	TRUE	P-1418	Coldwater Rd - Westmount Dr S to Collegiate	300	257.5	2006	Ductile Iron	0	2	0.67	16	65	0.25	Arterial		2.3	1	2.1	2.25	2	1	2.1	4.50	Low
966	TRUE	P-1490	William St - Mississaga St W to Mary St	200	134.5	1995	PVC	1	1	0.44	27	75	0.36	Local		2.9	2	2.8	1.75	1	1	1.6	4.49	Low
1454	TRUE	P-392	East St- Crawford St to Hilda St	200	80	1995	PVC	1	1	0.44	27	75	0.36	Local		2.9	2	2.8	1.75	1	1	1.6	4.49	Low
1450	TRUE	P-398	Crawford St - East St to Leslie St	200	84.5	1995	PVC	1	1	0.44	27	75	0.36	Local		2.9	2	2.8	1.75	1	1	1.6	4.49	Low
1189	TRUE	P-962	Carter Cr- Johnson St to Lewis Dr	150	88	1992	Ductile Iron	0	2	0.33	30	65	0.46	Local		3.4	1	3.2	1.50	1	1	1.4	4.48	Low
1188	TRUE	P-964	Johnson St - Carter Cr north to corner	150	271.5	1992	Ductile Iron	0	2	0.33	30	65	0.46	Local		3.4	1	3.2	1.50	1	1	1.4	4.48	Low
1186	TRUE	P-968	Johnson St- corner east to Lewis Dr	150	94.5	1992	Ductile Iron	0	2	0.33	30	65	0.46	Local		3.4	1	3.2	1.50	1	1	1.4	4.48	Low
1424	TRUE	P-452	Barrie Rd - Memorial Ave to Dunedin St	250	184	2000	PVC	1	1	0.56	22	75	0.29	Collector		2.5	2	2.5	2.00	1	1	1.8	4.46	Low
1811	TRUE	P-1158	Cedar Island Rd -Davey Dr to trail	200	187.5	2000	PVC	2	1	0.44	22	75	0.29	Local		2.5	5	2.8	1.75	1	1	1.6	4.44	Low
6478	TRUE	P-2767	Grace Ave to Frontier Ave easement	200	115	1994	PVC	0	2	0.44	28	75	0.37	Local		3.0	1	2.8	1.75	1	1	1.6	4.43	Low
3174	TRUE	P-2212	Ashton St at Westmount Dr N	200	34	1994	PVC	0	2	0.44	28	75	0.37	Local		3.0	1	2.8	1.75	1	1	1.6	4.43	Low
6477	TRUE	P-2766	Grace Ave to Frontier Ave easement	200	92.5	1994	PVC	0	2	0.44	28	75	0.37	Local		3.0	1	2.8	1.75	1	1	1.6	4.43	Low
1165	TRUE	P-1012	Tallwood Dr - Fittons Rd E to Highland Ave	200	654.5	1994	PVC	0	1	0.44	28	75	0.37	Local		3.0	1	2.8	1.75	1	1	1.6	4.43	Low
1664	TRUE	P-1730	Keith St - James St south to end	200	224.5	1994	PVC	0	1	0.44	28	75	0.37	Local		3.0	1	2.8	1.75	1	1	1.6	4.43	Low
1839	TRUE	P-1654	Ashton St at Westmount Dr N	200	417	1994	PVC	0	2	0.44	28	75	0.37	Local		3.0	1	2.8	1.75	1	1	1.6	4.43	Low
1098	TRUE	P-1168	Industrial St at Forest Ave	150	7.5	1988	PVC	0	1	0.33	34	75	0.45	Local		3.4	1	3.2	1.50	1	1	1.4	4.43	Low
1350	TRUE	P-610	Forest Ave S- Atherley Rd to James	150	134.5	1994	Ductile Iron	1	1	0.33	28	65	0.43	Local		3.3	2	3.2	1.50	1	1	1.4	4.41	Low
1521	TRUE	P-238	Barrie Rd - Wyandotte St to Dunlop St	250	117	1999	PVC	0	1	0.56	23	75	0.31	Collector		2.6	1	2.4	2.00	1	1	1.8	4.39	Low
1483	TRUE	P-322	James St - Regent St to Moffat St	200	57.5	1996	PVC	1	1	0.44	26	75	0.35	Local		2.8	2	2.7	1.75	1	1	1.6	4.38	Low
5228	TRUE	P-2391	Forest Ave at Atherley Rd	150	8.5	1993	Ductile Iron	0	1	0.33	29	65	0.45	Local		3.4	1	3.1	1.50	1	1	1.4	4.38	Low
1714	TRUE	P-1132	Free Dr - Galley Ave north to end	150	211	1993	Ductile Iron	0	1	0.33	29	65	0.45	Local		3.4	1	3.1	1.50	1	1	1.4	4.38	Low
895	TRUE	P-1706	West Ridge Blvd - Monarch Dr to Bass Lake S	300	165.5	2003	PVC	0	2	0.67	19	75	0.25	Local		2.3	1	2.2	2.25	1	1	2.0	4.36	Low
1453	TRUE	P-396	East St - Hilda St to Oxford St	200	91	1995	PVC	0	1	0.44	27	75	0.36	Local		2.9	1	2.7	1.75	1	1	1.6	4.33	Low
1272	TRUE	P-788	William St- Nottawasaga St to Mary St	200	89.5	1995	PVC	0	1	0.44	27	75	0.36	Local		2.9	1	2.7	1.75	1	1	1.6	4.33	Low
5248	TRUE	P-2394	Bay St- Borland St to Jarvis St	450	51	2011	PVC	0	1	1.00	11	75	0.15	Local		1.7	1	1.7	3.00	1	1	2.6	4.30	Low
1681	TRUE	P-1774	West St S - Cochrane St to Norweld Dr	300	23.5	2005	PVC	0	1	0.67	17	75	0.23	Arterial		2.2	1	2.0	2.25	2	1	2.1	4.30	Low
6785	TRUE	P-2259(1)	Murphy Rd to Hwy 11	400	192	2009	PVC	0	2	0.89	13	75	0.17	Local		1.9	1	1.8	2.75	1	1	2.4	4.29	Low

2021 Orillia Water Master Plan Update
Watermain Risk Assessment
Jun-22

Colour coded legend

Generated by WaterCAD
Calculated
Bulk of data from 2016 watermain asset management sheet, including updates for 2021 determined values

Year of Analysis 2022

															Probability of Failure Factors			Consequence of Failure Factors					
ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
6900	TRUE	P-2259(2)(1)	Murphy Rd to Hwy 11	400	205	2009	PVC	0	2	0.89	13	75	0.17	Local		1.9	1	1.8	2.75	1	1	2.4	4.29	Low
6901	TRUE	P-2259(2)(2)	Murphy Rd to Hwy 11	400	104	2009	PVC	0	2	0.89	13	75	0.17	Local		1.9	1	1.8	2.75	1	1	2.4	4.29	Low
1518	TRUE	P-244	Barrie Rd - Dunlop St to Dufferin St	250	125	2000	PVC	0	1	0.56	22	75	0.29	Collector		2.5	1	2.4	2.00	1	1	1.8	4.28	Low
1420	TRUE	P-460	Barrie Rd at Memorial Ave	250	31.5	2000	PVC	0	1	0.56	22	75	0.29	Collector		2.5	1	2.4	2.00	1	1	1.8	4.28	Low
3444	TRUE	P-2277	Bass Lake SR e of West Ridge Blvd	250	91.5	2000	PVC	0	2	0.56	22	75	0.29	Local		2.5	1	2.4	2.00	1	1	1.8	4.28	Low
1427	TRUE	P-446	Barrie Rd - Dunedin St to Dufferin St	250	119.5	2000	PVC	0	1	0.56	22	75	0.29	Collector		2.5	1	2.4	2.00	1	1	1.8	4.28	Low
1419	TRUE	P-462	Barrie Rd at Memorial Ave	250	18	2000	PVC	0	1	0.56	22	75	0.29	Collector		2.5	1	2.4	2.00	1	1	1.8	4.28	Low
1695	TRUE	P-1804	Garden Ct - South St south to end	150	141.5	1994	Ductile Iron	0	2	0.33	28	65	0.43	Local		3.3	1	3.1	1.50	1	1	1.4	4.27	Low
3175	TRUE	P-2213	Ashton St at Westmount Dr N	150	12.5	1994	Ductile Iron	0	1	0.33	28	65	0.43	Local		3.3	1	3.1	1.50	1	1	1.4	4.27	Low
3183	TRUE	P-2218	Douglas St - Nottawasaga St to John St	200	44.5	1996	PVC	0	2	0.44	26	75	0.35	Local		2.8	1	2.6	1.75	1	1	1.6	4.22	Low
3184	TRUE	P-2219	Douglas St - Nottawasaga St to John St	200	83	1996	PVC	0	1	0.44	26	75	0.35	Local		2.8	1	2.6	1.75	1	1	1.6	4.22	Low
6611	TRUE	P-2850	James St- Leslie St to Forest Ave S	200	95	1996	PVC	0	1	0.44	26	75	0.35	Local		2.8	1	2.6	1.75	1	1	1.6	4.22	Low
6612	TRUE	P-2851	James St- Leslie St to Forest Ave S	200	171	1996	PVC	0	1	0.44	26	75	0.35	Local		2.8	1	2.6	1.75	1	1	1.6	4.22	Low
1456	TRUE	P-388	James St - Regent St to East St	200	89	1996	PVC	0	1	0.44	26	75	0.35	Local		2.8	1	2.6	1.75	1	1	1.6	4.22	Low
1448	TRUE	P-404	James St - East St to Leslie St	200	85.5	1996	PVC	0	1	0.44	26	75	0.35	Local		2.8	1	2.6	1.75	1	1	1.6	4.22	Low
1387	TRUE	P-528	Nottawasaga St - Emily St to Cameron St	200	135	1996	PVC	0	2	0.44	26	75	0.35	Local		2.8	1	2.6	1.75	1	1	1.6	4.22	Low
2008	TRUE	P-2099	Elgin St - Front St to Scott St	250	68	2005	Ductile Iron	1	1	0.56	17	65	0.26	Local		2.4	2	2.3	2.00	1	1	1.8	4.18	Low
1503	TRUE	P-274	West St S - Queen St E to Cochrane St	300	282.5	2006	PVC	0	1	0.67	16	75	0.21	Arterial		2.1	1	2.0	2.25	2	1	2.1	4.16	Low
1508	TRUE	P-264	West St S - King St to Queen St E	300	152	2006	PVC	0	1	0.67	16	75	0.21	Arterial		2.1	1	2.0	2.25	2	1	2.1	4.16	Low
1507	TRUE	P-266	West St S- Queen St E to Queen St W	300	56	2006	PVC	0	1	0.67	16	75	0.21	Arterial		2.1	1	2.0	2.25	2	1	2.1	4.16	Low
6770	TRUE	P-1554(1)	Victoria Cr - Lankin Blvd bridge to the south	250	240.5	2001	PVC	0	1	0.56	21	75	0.28	Local		2.5	1	2.3	2.00	1	1	1.8	4.16	Low
6884	TRUE	P-1554(2)(1)	Victoria Cr - Lankin Blvd bridge to the south	250	389	2001	PVC	0	1	0.56	21	75	0.28	Local		2.5	1	2.3	2.00	1	1	1.8	4.16	Low
6885	TRUE	P-1554(2)(2)	Victoria Cr - Lankin Blvd bridge to the south	250	107.5	2001	PVC	0	1	0.56	21	75	0.28	Local		2.5	1	2.3	2.00	1	1	1.8	4.16	Low
1704	TRUE	P-1832	Carmicheal Ct - Johnson St south to end	150	155.5	1991	PVC	0	2	0.33	31	75	0.41	Local		3.2	1	3.0	1.50	1	1	1.4	4.15	Low
1268	TRUE	P-796	Nottawasaga St - O'Brien St to Patrick St	200	159.5	1997	PVC	0	1	0.44	25	75	0.33	Local		2.7	1	2.6	1.75	1	1	1.6	4.12	Low
1465	TRUE	P-364	Forest Ave S - Collins Dr to Bennett	300	118.5	2010	Ductile Iron	0	1	0.67	12	65	0.18	Highway or highway crossing		1.9	1	1.8	2.25	3	1	2.2	4.05	Low
1808	TRUE	P-1928	Colbourne St W - Dufferins St to Dunlop st	200	106	2000	PVC	0	1	0.44	22	75	0.29	Arterial		2.5	1	2.4	1.75	2	1	1.7	4.04	Low
2080	TRUE	P-2138	Colborne St W - Dufferin St to Dunlop St	200	10.5	2000	PVC	0	1	0.44	22	75	0.29	Arterial		2.5	1	2.4	1.75	2	1	1.7	4.04	Low
1488	TRUE	P-308	Gill St - Simcoe St to Oxford St	200	174.5	2007	PVC	3	1	0.44	15	75	0.20	Collector		2.0	7	2.5	1.75	1	1	1.6	4.03	Low
1069	TRUE	P-1250	ZONE 1 TRUNK: Neywash St at Peter St N to	300	455	2009	Ductile Iron	0	1	0.67	13	65	0.20	Arterial		2.0	1	1.9	2.25	2	1	2.1	4.03	Low
2105	TRUE	P-2153	James St- Millard St to Moffat St	200	80.5	1998	PVC	0	1	0.44	24	75	0.32	Local		2.7	1	2.5	1.75	1	1	1.6	4.01	Low
6401	TRUE	P-2732	Monarch Dr - Vanessa Dr to 150m W easemer	200	78.5	1998	PVC	0	3	0.44	24	75	0.32	Local		2.7	1	2.5	1.75	1	1	1.6	4.01	Low
1840	TRUE	P-1652	Louise Ln at Ashton St	200	230.5	1998	PVC	0	2	0.44	24	75	0.32	Local		2.7	1	2.5	1.75	1	1	1.6	4.01	Low
2106	TRUE	P-2154	James St- Millard St to Moffat St	200	58.5	1998	PVC	0	1	0.44	24	75	0.32	Local		2.7	1	2.5	1.75	1	1	1.6	4.01	Low
1675	TRUE	P-1758	High St - Maple Leaf Ave to Olive Cr	200	158	1998	PVC	0	1	0.44	24	75	0.32	Local		2.7	1	2.5	1.75	1	1	1.6	4.01	Low
1676	TRUE	P-1760	High St - Shannon St to Maple Leaf Ave	200	87	1998	PVC	0	1	0.44	24	75	0.32	Local		2.7	1	2.5	1.75	1	1	1.6	4.01	Low
1974	TRUE	P-2081	Julia Cr to West Ridge Blvd easement	200	69	1998	PVC	0	2	0.44	24	75	0.32	Local		2.7	1	2.5	1.75	1	1	1.6	4.01	Low
6400	TRUE	P-2731	Monarch Dr - Vanessa Dr to 150m W easemer	200	68.5	1998	PVC	0	2	0.44	24	75	0.32	Local		2.7	1	2.5	1.75	1	1	1.6	4.01	Low
1492	TRUE	P-300	James St- Gill St to Millard St	200	142.5	1998	PVC	0	1	0.44	24	75	0.32	Local		2.7	1	2.5	1.75	1	1	1.6	4.01	Low
2009	TRUE	P-2100	Elgin St - Scott St to Cedar Island Rd	250	334.5	2005	Ductile Iron	0	1	0.56	17	65	0.26	Local		2.4	1	2.2	2.00	1	1	1.8	4.00	Low
2041	TRUE	P-2119	ZONE 1 TRUNK: Jarvis St at Laclie St	400	359.5	2011	PVC	0	1	0.89	11	75	0.15	Local		1.7	1	1.7	2.75	1	1	2.4	3.97	Low
5253	TRUE	P-2398	Borland St E - Laclie St to Bay St & Bay St sou	400	584.5	2011	PVC	0	2	0.89	11	75	0.15	Local		1.7	1	1.7	2.75	1	1	2.4	3.97	Low
2175	TRUE	P-2193	Emperor Dr at Stone Ridge Blvd	400	101.5	2011	PVC	0	2	0.89	11	75	0.15	Local		1.7	1	1.7	2.75	1	1	2.4	3.97	Low
1692	TRUE	P-1798	Christine Pl - Westmount Dr S west to end	150	226.5	1993	PVC	0	1	0.33	29	75	0.39	Local		3.0	1	2.8	1.50	1	1	1.4	3.97	Low
3730	TRUE	P-2331	Leacock Ln - Museum Dr towards Atherley Rd	150	86	1993	PVC	0	1	0.33	29	75	0.39	Local		3.0	1	2.8	1.50	1	1	1.4	3.97	Low
1655	TRUE	P-1700	Leacock Ln - Museum Dr to Lakeside Court	150	36	1993	PVC	0	1	0.33	29	75	0.39	Local		3.0	1	2.8	1.50	1	1	1.4	3.97	Low
1705	TRUE	P-1834	Watson Ct - Lewis Dr east to end	150	122.5	1993	PVC	0	2	0.33	29	75	0.39	Local		3.0	1	2.8	1.50	1	1	1.4	3.97	Low
6537	TRUE	P-2804	Leacock	150	99	1993	PVC	0	1	0.33	29	75	0.39	Local		3.0	1	2.8	1.50	1	1	1.4	3.97	Low
6542	TRUE	P-2807	Museum Condo	150	97	1993	PVC	0	1	0.33	29	75	0.39	Local		3.0	1	2.8	1.50	1	1	1.4	3.97	Low
6544	TRUE	P-2808	Museum Condo	150	52	1993	PVC	0	1	0.33	29	75	0.39	Local		3.0	1	2.8	1.50	1	1	1.4	3.97	Low
6550	TRUE	P-2812	Museum Condo	150	58	1993	PVC	0	1	0.33	29	75	0.39	Local		3.0	1	2.8	1.50	1	1	1.4	3.97	Low
6559	TRUE	P-2817	Museum Condo	150	53	1993	PVC	0	1	0.33	29	75	0.39	Local		3.0	1	2.8	1.50	1	1	1.4	3.97	Low
6560	TRUE	P-2818	Museum Condo	150	48	1993	PVC	0	1	0.33	29	75	0.39	Local		3.0	1	2.8	1.50	1	1	1.4	3.97	Low
6562	TRUE	P-2820	Museum	150	170.5	1993	PVC	0	1	0.33	29	75	0.39	Local		3.0	1	2.8	1.50	1	1	1.4	3.97	Low
6568	TRUE	P-2824	Museum condo	150	76	1993	PVC	0	1	0.33	29	75	0.39	Local		3.0	1	2.8	1.50	1	1	1.4	3.97	Low
6167	TRUE	P-2638	Forest Ave S -Lanklin Blve to MacIsaac Dr at F	200	386.5	2003	Ductile Iron	1	1	0.44	19	65	0.29	Local		2.5	2	2.5	1.75	1	1	1.6	3.95	Low
1776	TRUE	P-1672	Cindy Lee Cr to Courtney Cr: Easement	200	83	2002	Ductile Iron	0	1	0.44	20	65	0.31	Local		2.6	1	2.4	1.75	1	1	1.6	3.91	Low
6782	TRUE	P-2609(1)	Cleopatra Ct	200	173.5	1999	PVC	0	3	0.44	23	75	0.31	Local		2.6	1	2.4	1.75	1	1	1.6	3.91	Low
1767	TRUE	P-1504	Millard St - James St to the south	200	184	1999	PVC	0	1	0.44	23	75	0.31	Local		2.6	1	2.4	1.75	1	1	1.6	3.91	Low
6783	TRUE	P-2609(2)	Cleopatra Ct	200	14	1999	PVC	0	3	0.44	23	75	0.31	Local		2.6	1	2.4	1.75	1	1	1.6	3.91	Low

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Year of Analysis 2022

															Probability of Failure Factors			Consequence of Failure Factors					
ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
6120	TRUE	P-2610	Sphinx Ct	200	96.5	1999	PVC	0	3	0.44	23	75	0.31	Local		2.6	1	2.4	1.75	1	1	1.6	3.91	Low
6121	TRUE	P-2611	Sphinx Ct to Cleopatra Ct	200	105.5	1999	PVC	0	3	0.44	23	75	0.31	Local		2.6	1	2.4	1.75	1	1	1.6	3.91	Low
5436	TRUE	P-2422	Gill St - Simcoe St to Shannon St	200	243.5	2007	Ductile Iron	1	1	0.44	15	65	0.23	Highway or highway crossing		2.2	2	2.2	1.75	3	1	1.8	3.90	Low
1553	TRUE	P-166	Matchedash St S- Colborne St E to Elgin St	150	146	1994	PVC	0	1	0.33	28	75	0.37	Local		3.0	1	2.8	1.50	1	1	1.4	3.88	Low
1191	TRUE	P-958	Carter Cr - Lewis Dr to Lewis Dr	150	524	1994	PVC	0	2	0.33	28	75	0.37	Local		3.0	1	2.8	1.50	1	1	1.4	3.88	Low
6755	TRUE	P-960(1)	Johnson St- Lewis Dr to Carter Cr	150	124	1994	PVC	0	2	0.33	28	75	0.37	Local		3.0	1	2.8	1.50	1	1	1.4	3.88	Low
6909	TRUE	P-960(2)(1)	Johnson St- Lewis Dr to Carter Cr	150	280.5	1994	PVC	0	2	0.33	28	75	0.37	Local		3.0	1	2.8	1.50	1	1	1.4	3.88	Low
6910	TRUE	P-960(2)(2)	Johnson St- Lewis Dr to Carter Cr	150	83.5	1994	PVC	0	2	0.33	28	75	0.37	Local		3.0	1	2.8	1.50	1	1	1.4	3.88	Low
5591	TRUE	P-2461	Louise Ln at end	150	87.5	1998	Ductile Iron	0	2	0.33	24	65	0.37	Local		2.9	1	2.7	1.50	1	1	1.4	3.85	Low
2035	TRUE	P-2114	Matchedash St N at Brant St E	300	7.5	2007	PVC	0	1	0.67	15	75	0.20	Local		2.0	1	1.9	2.25	1	1	2.0	3.83	Low
1613	TRUE	P-22	Matchedash St N- Brant St to Tecumseth St	300	142	2007	PVC	0	1	0.67	15	75	0.20	Local		2.0	1	1.9	2.25	1	1	2.0	3.83	Low
1597	TRUE	P-54	Matchedash St N - Tecumseth St to Neywash	300	161.5	2007	PVC	0	1	0.67	15	75	0.20	Local		2.0	1	1.9	2.25	1	1	2.0	3.83	Low
6736	TRUE	P-2438(1)	Memorial at Georgian College -825	350	84.5	2013	PVC	0	2	0.78	9	75	0.12	Arterial	Georgian College	1.6	1	1.5	2.50	2	3	2.5	3.81	Low
6737	TRUE	P-2438(2)	Memorial at Georgian College -825	350	8.5	2013	PVC	0	2	0.78	9	75	0.12	Arterial	Georgian College	1.6	1	1.5	2.50	2	3	2.5	3.81	Low
5543	TRUE	P-2436	Memorial at Georgian College -825	350	182.5	2013	PVC	0	2	0.78	9	75	0.12	Arterial	Georgian College	1.6	1	1.5	2.50	2	3	2.5	3.81	Low
5545	TRUE	P-2437	Memorial at Georgian College -825	350	15.5	2013	PVC	0	2	0.78	9	75	0.12	Arterial	Georgian College	1.6	1	1.5	2.50	2	3	2.5	3.81	Low
1772	TRUE	P-478	Invermara Ct at Atherley Rd -south to end	200	168	2000	PVC	0	1	0.44	22	75	0.29	Local		2.5	1	2.4	1.75	1	1	1.6	3.80	Low
3591	TRUE	P-2291	Bass Lake SR - e of Atlantis	200	261	2000	PVC	0	3	0.44	22	75	0.29	Local		2.5	1	2.4	1.75	1	1	1.6	3.80	Low
2126	TRUE	P-2165	Courtney Cr at end	200	65.5	2000	PVC	0	1	0.44	22	75	0.29	Local		2.5	1	2.4	1.75	1	1	1.6	3.80	Low
2047	TRUE	P-2121	Courtney Cr - Rachael Rd to Rachael Rd	200	209	2000	PVC	0	1	0.44	22	75	0.29	Local		2.5	1	2.4	1.75	1	1	1.6	3.80	Low
1763	TRUE	P-1236	Courtney Cr - Westmount Dr S to Rachael Rd	200	42	2000	PVC	0	1	0.44	22	75	0.29	Local		2.5	1	2.4	1.75	1	1	1.6	3.80	Low
2048	TRUE	P-2122	Courtney Cr at Rachael Rd	200	7.5	2000	PVC	0	1	0.44	22	75	0.29	Local		2.5	1	2.4	1.75	1	1	1.6	3.80	Low
1752	TRUE	P-1898	Dallas St - Colborne St W to Grenville Ave	200	91	2000	PVC	0	1	0.44	22	75	0.29	Local		2.5	1	2.4	1.75	1	1	1.6	3.80	Low
1978	TRUE	P-2084	Keith St to Bond St -easement	200	105	2000	PVC	0	1	0.44	22	75	0.29	Local		2.5	1	2.4	1.75	1	1	1.6	3.80	Low
3590	TRUE	P-2290	Bass Lake SR - e of Sphix	200	145	2000	PVC	0	3	0.44	22	75	0.29	Local		2.5	1	2.4	1.75	1	1	1.6	3.80	Low
1706	TRUE	P-900	Alexander Rd- Fittons Rd W to Lawson	200	162.5	2003	Ductile Iron	0	2	0.44	19	65	0.29	Local		2.5	1	2.4	1.75	1	1	1.6	3.79	Low
1626	TRUE	P-640	Memorial Ave - across Highway 12	300	228.5	2010	PVC	0	1	0.67	12	75	0.16	Highway or highway crossing		1.8	1	1.7	2.25	3	1	2.2	3.79	Low
1269	TRUE	P-794	Nottawasaga St - Patrick St to William St	150	34.5	1997	PVC	1	1	0.33	25	75	0.33	Local		2.7	2	2.7	1.50	1	1	1.4	3.74	Low
1829	TRUE	P-1904	Dallas St - Albany Ave to Barrie Rd	200	92	2001	PVC	0	1	0.44	21	75	0.28	Local		2.5	1	2.3	1.75	1	1	1.6	3.70	Low
1787	TRUE	P-1806	Cedar Island Rd - Davey Dr north to pipe char	200	171.5	2001	PVC	0	1	0.44	21	75	0.28	Local		2.5	1	2.3	1.75	1	1	1.6	3.70	Low
1828	TRUE	P-1938	Dallas St - Albany Ave to Barrie Rd	200	85	2001	PVC	0	1	0.44	21	75	0.28	Local		2.5	1	2.3	1.75	1	1	1.6	3.70	Low
6307	TRUE	P-2697	Ferguson Rd	50	207	1980	PVC	0	1	0.11	42	75	0.56	Local		4.0	1	3.7	1.00	1	1	1.0	3.69	Low
2057	TRUE	P-2126	Lankin Blvd - Carey Ln to Rodger Rd	300	44.5	2010	Ductile Iron	0	1	0.67	12	65	0.18	Local		1.9	1	1.8	2.25	1	1	2.0	3.68	Low
1468	TRUE	P-358	Forest Ave S- Shannon St to Rodger Rd	300	105.5	2010	Ductile Iron	0	1	0.67	12	65	0.18	Local		1.9	1	1.8	2.25	1	1	2.0	3.68	Low
1466	TRUE	P-362	Forest Ave S at Collins Dr	300	8.5	2010	Ductile Iron	0	1	0.67	12	65	0.18	Local		1.9	1	1.8	2.25	1	1	2.0	3.68	Low
4160	TRUE	P-2372	Emporer- BPS to Pearl	400	255.5	2013	PVC	0	2	0.89	9	75	0.12	Local		1.6	1	1.5	2.75	1	1	2.4	3.66	Low
4170	TRUE	P-2379	Stone Ridge- Isabella to Emperor	400	80	2013	PVC	0	2	0.89	9	75	0.12	Local		1.6	1	1.5	2.75	1	1	2.4	3.66	Low
4167	TRUE	P-2377	Lacey -w Of Sierra	400	98	2013	PVC	0	3	0.89	9	75	0.12	Local		1.6	1	1.5	2.75	1	1	2.4	3.66	Low
5941	TRUE	P-2570	Emperor Dr BPS to Monarch Dr easement	400	138	2013	PVC	0	3	0.89	9	75	0.12	Local		1.6	1	1.5	2.75	1	1	2.4	3.66	Low
4171	TRUE	P-2380	Isabella @ Diana	400	134	2013	PVC	0	2	0.89	9	75	0.12	Local		1.6	1	1.5	2.75	1	1	2.4	3.66	Low
4161	TRUE	P-2373	Emperor Dr - Vanessa Dr to BPS	400	583.5	2013	PVC	0	2	0.89	9	75	0.12	Local		1.6	1	1.5	2.75	1	1	2.4	3.66	Low
4129	TRUE	P-2354	Diana -Univeristy to Isabella	400	63	2013	PVC	0	2	0.89	9	75	0.12	Local		1.6	1	1.5	2.75	1	1	2.4	3.66	Low
4133	TRUE	P-2356	Isabella - Stone Ridge to Diana Dr	400	200.5	2013	PVC	0	2	0.89	9	75	0.12	Local		1.6	1	1.5	2.75	1	1	2.4	3.66	Low
6081	TRUE	P-2585	Lacey @ Orion	400	49.5	2013	PVC	0	3	0.89	9	75	0.12	Local		1.6	1	1.5	2.75	1	1	2.4	3.66	Low
6082	TRUE	P-2586	Lacey @ Sierra	400	47.5	2013	PVC	0	3	0.89	9	75	0.12	Local		1.6	1	1.5	2.75	1	1	2.4	3.66	Low
6084	TRUE	P-2587	Orion @ Lacey	400	2	2013	PVC	0	3	0.89	9	75	0.12	Local		1.6	1	1.5	2.75	1	1	2.4	3.66	Low
6157	TRUE	P-2633	Isabella- no of Stone Ridge	400	39.5	2013	PVC	0	2	0.89	9	75	0.12	Local		1.6	1	1.5	2.75	1	1	2.4	3.66	Low
6218	TRUE	P-2661	WEST ORILLIA PROPOSED	400	134.5	2013	PVC	0	3	0.89	9	75	0.12	Local		1.6	1	1.5	2.75	1	1	2.4	3.66	Low
933	TRUE	P-1588	Coldwater Rd - Rynard Dr to the east	200	156.5	2006	Ductile Iron	0	2	0.44	16	65	0.25	Arterial		2.3	1	2.1	1.75	2	1	1.7	3.65	Low
1628	TRUE	P-80	Coldwater Rd - west of Albert St N	200	112	2006	Ductile Iron	0	2	0.44	16	65	0.25	Arterial		2.3	1	2.1	1.75	2	1	1.7	3.65	Low
1197	TRUE	P-946	Coldwater Rd - Collegiate Dr to Rynard Dr	200	121	2006	Ductile Iron	0	2	0.44	16	65	0.25	Arterial		2.3	1	2.1	1.75	2	1	1.7	3.65	Low
947	TRUE	P-1526	West St N - Calverley St to Champlain St	250	88.5	2007	PVC	0	2	0.56	15	75	0.20	Arterial		2.0	1	1.9	2.00	2	1	1.9	3.64	Low
6449	TRUE	P-2749	West St N - Fittons Rd W to Calverley St	250	9	2007	PVC	0	2	0.56	15	75	0.20	Arterial		2.0	1	1.9	2.00	2	1	1.9	3.64	Low
1157	TRUE	P-1028	West St N - North St W to North St E	250	41	2007	PVC	0	2	0.56	15	75	0.20	Arterial		2.0	1	1.9	2.00	2	1	1.9	3.64	Low
6460	TRUE	P-2757	West St N - North St E to Benner St	250	82.5	2007	PVC	0	2	0.56	15	75	0.20	Arterial		2.0	1	1.9	2.00	2	1	1.9	3.64	Low
6450	TRUE	P-2750	West St N - Fittons Rd W to Calverley St	250	219	2007	PVC	0	2	0.56	15	75	0.20	Arterial		2.0	1	1.9	2.00	2	1	1.9	3.64	Low
6459	TRUE	P-2756	West St N - North St E to Benner St	250	25.5	2007	PVC	0	2	0.56	15	75	0.20	Arterial		2.0	1	1.9	2.00	2	1	1.9	3.64	Low
948	TRUE	P-902	West St N - Champlain St to South St	250	47	2007	PVC	0	2	0.56	15	75	0.20	Arterial		2.0	1	1.9	2.00	2	1	1.9	3.64	Low
1216	TRUE	P-906	West St S - South St to Benner St	250	70.5	2007	PVC	0	2	0.56	15	75	0.20	Arterial		2.0	1	1.9	2.00	2	1	1.9	3.64	Low
1334	TRUE	P-644	Memorial Ave - south of Highway 12	300	55	2010	PVC	0	1	0.67	12	75	0.16	Arterial		1.8	1	1.7	2.25	2	1	2.1	3.61	Low

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ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
2052	TRUE	P-2123	Nottawasaga St - William St to Albert St N	150	18	1997	PVC	0	1	0.33	25	75	0.33	Local		2.7	1	2.6	1.50	1	1	1.4	3.60	Low
2053	TRUE	P-2124	Nottawasaga St - William St to Albert St N	150	165.5	1997	PVC	0	1	0.33	25	75	0.33	Local		2.7	1	2.6	1.50	1	1	1.4	3.60	Low
1765	TRUE	P-1468	Rachael Rd - Courtney Cr to Courtney Cr	200	218.5	2002	PVC	0	1	0.44	20	75	0.27	Local		2.4	1	2.2	1.75	1	1	1.6	3.59	Low
1809	TRUE	P-1470	Volunteer Dr - Mississaga St W to Colborne St	200	128	2002	PVC	0	1	0.44	20	75	0.27	Local		2.4	1	2.2	1.75	1	1	1.6	3.59	Low
5906	TRUE	P-2272	University Ave at West Ridge Blvd	300	459	2009	PVC	0	2	0.67	13	75	0.17	Local		1.9	1	1.8	2.25	1	1	2.0	3.57	Low
1969	TRUE	P-2077	Julia Cr - East leg Monarch to easement	150	389.5	1998	PVC	0	2	0.33	24	75	0.32	Local		2.7	1	2.5	1.50	1	1	1.4	3.51	Low
2163	TRUE	P-2184	Vanessa Dr - easement to Pearl	150	150.5	1998	PVC	0	2	0.33	24	75	0.32	Local		2.7	1	2.5	1.50	1	1	1.4	3.51	Low
1774	TRUE	P-1704	Lakeside Village - Leacock Ln	150	178	1998	PVC	0	1	0.33	24	75	0.32	Local		2.7	1	2.5	1.50	1	1	1.4	3.51	Low
1966	TRUE	P-2076	Vanessa Dr to Julia Cr easement	150	91.5	1998	PVC	0	2	0.33	24	75	0.32	Local		2.7	1	2.5	1.50	1	1	1.4	3.51	Low
1970	TRUE	P-2078	Julia Cr - south loop between easements	150	155.5	1998	PVC	0	2	0.33	24	75	0.32	Local		2.7	1	2.5	1.50	1	1	1.4	3.51	Low
2164	TRUE	P-2185	Vanessa - Pearl to West Ridge	150	164.5	1998	PVC	0	2	0.33	24	75	0.32	Local		2.7	1	2.5	1.50	1	1	1.4	3.51	Low
1965	TRUE	P-2075	Julia Cr - west leg Monarch Dr to easement	150	310	1998	PVC	0	2	0.33	24	75	0.32	Local		2.7	1	2.5	1.50	1	1	1.4	3.51	Low
1961	TRUE	P-2072	Vanessa Dr - Emperor Dr to easement	150	144	1998	PVC	0	2	0.33	24	75	0.32	Local		2.7	1	2.5	1.50	1	1	1.4	3.51	Low
6129	TRUE	P-2616	West Ridge Pl-Monarch to 3300	150	91	1998	PVC	0	2	0.33	24	75	0.32	Local		2.7	1	2.5	1.50	1	1	1.4	3.51	Low
1849	TRUE	P-1946	Alexander Red - Skyline Dr to Lawson Ave	200	154	2003	PVC	0	2	0.44	19	75	0.25	Local		2.3	1	2.2	1.75	1	1	1.6	3.49	Low
6123	TRUE	P-2612	Murphy Rd- Hwy 12 to Walmart	300	646	2010	PVC	0	2	0.67	12	75	0.16	Local		1.8	1	1.7	2.25	1	1	2.0	3.44	Low
6124	TRUE	P-2613	West Ridge -Hwy 12 to Bass Lake SR	300	151	2010	PVC	0	2	0.67	12	75	0.16	Local		1.8	1	1.7	2.25	1	1	2.0	3.44	Low
1820	TRUE	P-1230	West St N - Jarvis St to Brant St	200	147.5	2007	PVC	1	2	0.44	15	75	0.20	Arterial		2.0	2	2.0	1.75	2	1	1.7	3.43	Low
934	TRUE	P-1502	Coldwater Rd - Emily St to the west	150	215.5	2006	PVC	0	2	0.33	16	75	0.21	Arterial	Atrium Retireme	2.1	1	2.0	1.50	2	3	1.7	3.37	Low
3186	TRUE	P-2220	Coldwater Rd at Albert St N	200	2	2006	PVC	0	2	0.44	16	75	0.21	Arterial		2.1	1	2.0	1.75	2	1	1.7	3.37	Low
3187	TRUE	P-2221	Coldwater Rd at Albert St N	200	2	2006	PVC	0	1	0.44	16	75	0.21	Arterial		2.1	1	2.0	1.75	2	1	1.7	3.37	Low
1063	TRUE	P-1264	Coldwater Rd - Albert St N to West St N	200	185.5	2006	PVC	0	1	0.44	16	75	0.21	Arterial		2.1	1	2.0	1.75	2	1	1.7	3.37	Low
1627	TRUE	P-12	Coldwater Rd- east of Patrick St	200	103.5	2006	PVC	0	2	0.44	16	75	0.21	Arterial		2.1	1	2.0	1.75	2	1	1.7	3.37	Low
1266	TRUE	P-800	Coldwater Rd - Cameron St to Patrick St	200	211.5	2006	PVC	0	2	0.44	16	75	0.21	Arterial		2.1	1	2.0	1.75	2	1	1.7	3.37	Low
1027	TRUE	P-1334	Park St at Coldwater St	400	10	2015	PVC	0	2	0.89	7	75	0.09	Local		1.4	1	1.4	2.75	1	1	2.4	3.34	Low
6779	TRUE	P-2544(1)	Diana- Harvie Settlement to Costco	400	51.5	2015	PVC	0	2	0.89	7	75	0.09	Local		1.4	1	1.4	2.75	1	1	2.4	3.34	Low
6894	TRUE	P-2544(2)(2)	Diana- Harvie Settlement to Costco	400	66	2015	PVC	0	2	0.89	7	75	0.09	Local		1.4	1	1.4	2.75	1	1	2.4	3.34	Low
5882	TRUE	P-2543	Diana- University to Costco	400	87.5	2015	PVC	0	2	0.89	7	75	0.09	Local		1.4	1	1.4	2.75	1	1	2.4	3.34	Low
6893	TRUE	P-2544(2)(1)	Diana- Harvie Settlement to Costco	400	174.5	2015	PVC	0	2	0.89	7	75	0.09	Local		1.4	1	1.4	2.75	1	1	2.4	3.34	Low
1848	TRUE	P-1948	Skyline Dr - west to corner	150	92	2003	Ductile Iron	0	2	0.33	19	65	0.29	Local		2.5	1	2.4	1.50	1	1	1.4	3.32	Low
2134	TRUE	P-2170	Westmount Dr N at Mary St	300	30	2011	PVC	0	1	0.67	11	75	0.15	Collector		1.7	1	1.7	2.25	1	1	2.0	3.31	Low
2172	TRUE	P-2191	Stone Ridge- West Ridge to Emperor	300	273	2011	PVC	0	2	0.67	11	75	0.15	Local		1.7	1	1.7	2.25	1	1	2.0	3.31	Low
1715	TRUE	P-1396	Bay St- south of Drinkwater Dr	200	168.5	2007	Ductile Iron	0	1	0.44	15	65	0.23	Local		2.2	1	2.1	1.75	1	1	1.6	3.31	Low
5437	TRUE	P-2423	Gill St - Simcoe St to Shannon St	200	37.5	2007	Ductile Iron	0	1	0.44	15	65	0.23	Collector		2.2	1	2.1	1.75	1	1	1.6	3.31	Low
2025	TRUE	P-2112	Matchedash St N at Jarvis St	200	8	2005	PVC	0	1	0.44	17	75	0.23	Local		2.2	1	2.0	1.75	1	1	1.6	3.28	Low
1576	TRUE	P-120	Colborne St E - Peter St S to West St S	250	184	2010	PVC	0	1	0.56	12	75	0.16	Arterial		1.8	1	1.7	2.00	2	1	1.9	3.27	Low
1566	TRUE	P-140	Colborne St W - Andrew St to West St S	250	115	2010	PVC	0	1	0.56	12	75	0.16	Arterial		1.8	1	1.7	2.00	2	1	1.9	3.27	Low
1814	TRUE	P-1228	West St N - Borland St E to Jarvis St	200	153.5	2007	PVC	0	2	0.44	15	75	0.20	Arterial		2.0	1	1.9	1.75	2	1	1.7	3.26	Low
1233	TRUE	P-868	West St N - North St E to Borland St	200	258	2007	PVC	0	2	0.44	15	75	0.20	Arterial		2.0	1	1.9	1.75	2	1	1.7	3.26	Low
1548	TRUE	P-178	Peter St S - Elgin St to Western Ave	150	74	2007	PVC	2	1	0.33	15	75	0.20	Local		2.0	5	2.3	1.50	1	1	1.4	3.24	Low
1788	TRUE	P-1202	Cedar Island Rd - pipe change to end	150	116.5	2001	PVC	0	1	0.33	21	75	0.28	Local		2.5	1	2.3	1.50	1	1	1.4	3.23	Low
5275	TRUE	P-2407	Atlantis Dr - s of Cleopatra	150	41.5	2001	PVC	0	3	0.33	21	75	0.28	Local		2.5	1	2.3	1.50	1	1	1.4	3.23	Low
5276	TRUE	P-2408	Atlantis Dr- s of Cleopatra	150	166.5	2001	PVC	0	3	0.33	21	75	0.28	Local		2.5	1	2.3	1.50	1	1	1.4	3.23	Low
6617	TRUE	P-2855	Matchedash at Coldwater	150	16	2004	Ductile Iron	0	1	0.33	18	65	0.28	Local		2.4	1	2.3	1.50	1	1	1.4	3.21	Low
3622	TRUE	P-2302	Mississaga St at Westmount Dr S	200	1.5	2008	Ductile Iron	0	1	0.44	14	65	0.22	Collector		2.1	1	2.0	1.75	1	1	1.6	3.19	Low
6079	TRUE	P-2584	Lacey - reducer near ties - BPS to Orion	400	212	2016	PVC	0	3	0.89	6	75	0.08	Local		1.4	1	1.3	2.75	1	1	2.4	3.19	Low
6242	TRUE	P-2675	Orion at Monarch	400	5.5	2016	PVC	0	3	0.89	6	75	0.08	Local		1.4	1	1.3	2.75	1	1	2.4	3.19	Low
1887	TRUE	P-2018	Easement Louise Ln to Homewood Ave	200	92.5	2006	PVC	0	2	0.44	16	75	0.21	Local		2.1	1	2.0	1.75	1	1	1.6	3.17	Low
1577	TRUE	P-118	Colborne St E - Peter St N to Matchedash St S	250	167	2011	PVC	0	1	0.56	11	75	0.15	Arterial		1.7	1	1.7	2.00	2	1	1.9	3.14	Low
906	TRUE	P-1658	Colborne St W - Matchedash St S to Front St	250	90	2011	PVC	0	1	0.56	11	75	0.15	Arterial		1.7	1	1.7	2.00	2	1	1.9	3.14	Low
907	TRUE	P-92	Colborne St E at Matchedash St S	250	7	2011	PVC	0	1	0.56	11	75	0.15	Arterial		1.7	1	1.7	2.00	2	1	1.9	3.14	Low
2108	TRUE	P-2155	Joshua Ct at James St E	150	120	2005	Ductile Iron	0	1	0.33	17	65	0.26	Local		2.4	1	2.2	1.50	1	1	1.4	3.11	Low
1159	TRUE	P-1024	North St E - Highland Ave to Bay	150	194.5	2004	PVC	1	1	0.33	18	75	0.24	Local		2.2	2	2.2	1.50	1	1	1.4	3.10	Low
1540	TRUE	P-200	Andrew St S- Barrie Rd to Victoria St	150	147	2004	PVC	1	1	0.33	18	75	0.24	Local		2.2	2	2.2	1.50	1	1	1.4	3.10	Low
2074	TRUE	P-2135	Bay St -north of Fittons Rd E	200	506.5	2007	PVC	0	1	0.44	15	75	0.20	Local		2.0	1	1.9	1.75	1	1	1.6	3.07	Low
1489	TRUE	P-306	Gill St - Bond St to Oxford St	200	66	2007	PVC	0	1	0.44	15	75	0.20	Collector		2.0	1	1.9	1.75	1	1	1.6	3.07	Low
1570	TRUE	P-132	Market St - West St N to Andrew St N	150	122	2009	PVC	2	1	0.33	13	75	0.17	Local		1.9	5	2.2	1.50	1	1	1.4	3.06	Low
1844	TRUE	P-1940	Ward Ave - Skyline Dr to Lawson Ave	150	151.5	2003	PVC	0	2	0.33	19	75	0.25	Local		2.3	1	2.2	1.50	1	1	1.4	3.05	Low
1845	TRUE	P-1942	Lawson Ave - Alexander Rd to Ward Ave	150	88.5	2003	PVC	0	2	0.33	19	75	0.25	Local		2.3	1	2.2	1.50	1	1	1.4	3.05	Low
1054	TRUE	P-1282	Lavallee Cr - Canice St to Borland St	150	145	2003	PVC	0	1	0.33	19	75	0.25	Local		2.3	1	2.2	1.50	1	1	1.4	3.05	Low

2021 Orillia Water Master Plan Update
Watermain Risk Assessment
Jun-22

Colour coded legend

Generated by WaterCAD
Calculated
Bulk of data from 2016 watermain asset management sheet, including updates for 2021 determined values

Year of Analysis 2022

															Probability of Failure Factors			Consequence of Failure Factors					
ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
2150	TRUE	P-2179	Mary St at Hammond Ave	150	284.5	2003	PVC	0	2	0.33	19	75	0.25	Local		2.3	1	2.2	1.50	1	1	1.4	3.05	Low
6572	TRUE	P-2827	Cole Ct	150	92.5	2003	PVC	0	2	0.33	19	75	0.25	Local		2.3	1	2.2	1.50	1	1	1.4	3.05	Low
6575	TRUE	P-2828	Skyline Dr - corner to Lawson Ave	150	219	2003	PVC	0	2	0.33	19	75	0.25	Local		2.3	1	2.2	1.50	1	1	1.4	3.05	Low
6576	TRUE	P-2829	Skyline Dr - corner to Lawson Ave	150	68	2003	PVC	0	2	0.33	19	75	0.25	Local		2.3	1	2.2	1.50	1	1	1.4	3.05	Low
6577	TRUE	P-2830	Lawon	150	99	2003	PVC	0	2	0.33	19	75	0.25	Local		2.3	1	2.2	1.50	1	1	1.4	3.05	Low
6191	TRUE	P-2654	Stone Ridge- Orion to Isabella	300	41	2013	PVC	0	3	0.67	9	75	0.12	Local		1.6	1	1.5	2.25	1	1	2.0	3.05	Low
6192	TRUE	P-2655	Stone Ridge- Orion to Isabella	300	148.5	2013	PVC	0	2	0.67	9	75	0.12	Local		1.6	1	1.5	2.25	1	1	2.0	3.05	Low
4137	TRUE	P-2358	Stone Ridge - Orion to Annalyse	300	211	2013	PVC	0	3	0.67	9	75	0.12	Local		1.6	1	1.5	2.25	1	1	2.0	3.05	Low
4143	TRUE	P-2361	WEST ORILLIA PROPOSED	300	107	2013	PVC	0	3	0.67	9	75	0.12	Local		1.6	1	1.5	2.25	1	1	2.0	3.05	Low
5776	TRUE	P-2481	WEST ORILLIA PROPOSED	300	370	2013	PVC	0	3	0.67	9	75	0.12	Local		1.6	1	1.5	2.25	1	1	2.0	3.05	Low
5778	TRUE	P-2482	WEST ORILLIA PROPOSED	300	27.5	2013	PVC	0	3	0.67	9	75	0.12	Local		1.6	1	1.5	2.25	1	1	2.0	3.05	Low
5779	TRUE	P-2483	WEST ORILLIA PROPOSED	300	87	2013	PVC	0	3	0.67	9	75	0.12	Local		1.6	1	1.5	2.25	1	1	2.0	3.05	Low
6085	TRUE	P-2588	Orion @ Lacey	300	279.5	2013	PVC	0	3	0.67	9	75	0.12	Local		1.6	1	1.5	2.25	1	1	2.0	3.05	Low
6161	TRUE	P-2636	Bass Lake SR Atlantis Dr to west	300	62	2013	PVC	0	3	0.67	9	75	0.12	Local		1.6	1	1.5	2.25	1	1	2.0	3.05	Low
1606	TRUE	P-36	West St N - Brant St to Tecumseth St	200	157.5	2009	PVC	0	2	0.44	13	75	0.17	Arterial		1.9	1	1.8	1.75	2	1	1.7	3.04	Low
1578	TRUE	P-116	Peter St S at Colborne St E	250	10	2011	PVC	0	1	0.56	11	75	0.15	Local		1.7	1	1.7	2.00	1	1	1.8	2.98	Low
5249	TRUE	P-2395	Bay St - Borland St to Jarvis St	200	129	2011	PVC	0	1	0.44	11	75	0.15	Local	Birchmere Retire	1.7	1	1.7	1.75	1	3	1.8	2.98	Low
960	TRUE	P-1346	Coldwater Rd - Emily St to Park St	150	30	2006	PVC	0	2	0.33	16	75	0.21	Arterial		2.1	1	2.0	1.50	2	1	1.5	2.97	Low
1026	TRUE	P-1336	Coldwater Rd- Park St to Cameron St	150	147.5	2006	PVC	0	2	0.33	16	75	0.21	Arterial		2.1	1	2.0	1.50	2	1	1.5	2.97	Low
6445	TRUE	P-2747	Brammer Service	50	95	1991	PVC	0	1	0.11	31	75	0.41	Local		3.2	1	3.0	1.00	1	1	1.0	2.97	Low
1534	TRUE	P-212	Albert St S - Colborne St W to Victoria St	150	141.5	2004	PVC	0	1	0.33	18	75	0.24	Local		2.2	1	2.1	1.50	1	1	1.4	2.96	Low
1535	TRUE	P-210	Andrew St S - Colborne St W to Victoria St	150	135.5	2004	PVC	0	1	0.33	18	75	0.24	Local		2.2	1	2.1	1.50	1	1	1.4	2.96	Low
1593	TRUE	P-62	Matchedash St N- Neywash St to Coldwater S	150	141	2004	PVC	0	1	0.33	18	75	0.24	Local		2.2	1	2.1	1.50	1	1	1.4	2.96	Low
1383	TRUE	P-538	Mary St - Douglas St to O'Brien St	150	335.5	2006	PVC	1	1	0.33	16	75	0.21	Local		2.1	2	2.1	1.50	1	1	1.4	2.92	Low
1538	TRUE	P-204	Albert St S- Victoria St to Barrie Rd	150	179	2005	PVC	0	1	0.33	17	75	0.23	Local		2.2	1	2.0	1.50	1	1	1.4	2.87	Low
1520	TRUE	P-240	Dunlop St - Powley St to Barrie Rd	150	108	2005	PVC	0	1	0.33	17	75	0.23	Local		2.2	1	2.0	1.50	1	1	1.4	2.87	Low
1110	TRUE	P-1134	John St- Westmount Dr N to McKenzie St	150	212	2005	PVC	0	1	0.33	17	75	0.23	Local		2.2	1	2.0	1.50	1	1	1.4	2.87	Low
1549	TRUE	P-176	Elgin St - Peter St S to Matchedash St S	150	172	2005	PVC	0	1	0.33	17	75	0.23	Local		2.2	1	2.0	1.50	1	1	1.4	2.87	Low
1522	TRUE	P-236	Dunlop St - Victoria St to Powley St	150	132.5	2005	PVC	0	1	0.33	17	75	0.23	Local		2.2	1	2.0	1.50	1	1	1.4	2.87	Low
6604	TRUE	P-2846	East St - Clayborne Pl to James	150	55.5	2005	PVC	0	1	0.33	17	75	0.23	Local		2.2	1	2.0	1.50	1	1	1.4	2.87	Low
6605	TRUE	P-2847	East St - Clayborne Pl to James	150	106	2005	PVC	0	1	0.33	17	75	0.23	Local		2.2	1	2.0	1.50	1	1	1.4	2.87	Low
1393	TRUE	P-516	John St - McKenzie St to Douglas St	150	212	2005	PVC	0	1	0.33	17	75	0.23	Local		2.2	1	2.0	1.50	1	1	1.4	2.87	Low
1386	TRUE	P-532	John St - Douglas St to O'Brien St	150	338	2005	PVC	0	1	0.33	17	75	0.23	Local		2.2	1	2.0	1.50	1	1	1.4	2.87	Low
1353	TRUE	P-604	East St - Atherley Rd to Clayborne Pl	150	146.5	2005	PVC	0	1	0.33	17	75	0.23	Local		2.2	1	2.0	1.50	1	1	1.4	2.87	Low
2062	TRUE	P-2129	Penetang St - Albert St to West at Tecumseth	200	239	2009	PVC	0	2	0.44	13	75	0.17	Local		1.9	1	1.8	1.75	1	1	1.6	2.86	Low
5509	TRUE	P-2430	Westmount Dr S - north of Argyle Ave to Alba	150	3	2009	Ductile Iron	1	1	0.33	13	65	0.20	Collector		2.0	2	2.0	1.50	1	1	1.4	2.82	Low
1530	TRUE	P-220	Colborne St W - Dunlop St to Wyandotte St	200	114.5	2011	PVC	0	1	0.44	11	75	0.15	Arterial		1.7	1	1.7	1.75	2	1	1.7	2.81	Low
1512	TRUE	P-256	Colborne St W - Dufferin St to Dunedin St	200	89.5	2011	PVC	0	1	0.44	11	75	0.15	Arterial		1.7	1	1.7	1.75	2	1	1.7	2.81	Low
1565	TRUE	P-142	Colborne St W - Andrew St to Albert St	200	122	2011	PVC	0	1	0.44	11	75	0.15	Arterial		1.7	1	1.7	1.75	2	1	1.7	2.81	Low
1531	TRUE	P-218	Colborne St W - Albert St to Wyandotte St	200	107	2011	PVC	0	1	0.44	11	75	0.15	Arterial		1.7	1	1.7	1.75	2	1	1.7	2.81	Low
3451	TRUE	P-2282	Colbourne St W at Volunteer Dr	200	60.5	2011	PVC	0	1	0.44	11	75	0.15	Arterial		1.7	1	1.7	1.75	2	1	1.7	2.81	Low
1343	TRUE	P-624	Atherley Rd- east of Bayview Pkwy	200	167.5	2011	PVC	0	1	0.44	11	75	0.15	Arterial		1.7	1	1.7	1.75	2	1	1.7	2.81	Low
3614	TRUE	P-2296	Westmount Dr at Mississaga St W	150	6.5	2008	Ductile Iron	0	1	0.33	14	65	0.22	Collector		2.1	1	2.0	1.50	1	1	1.4	2.79	Low
6171	TRUE	P-2641	Westmount -s of Mississaga	150	8	2008	Ductile Iron	0	1	0.33	14	65	0.22	Collector		2.1	1	2.0	1.50	1	1	1.4	2.79	Low
6590	TRUE	P-2837	Condo Westridge	150	53	2006	PVC	0	2	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
6903	TRUE	P-2004(2)(1)	Mary St - Westmount Dr N to McKenzie St	150	114.5	2006	PVC	0	1	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
6758	TRUE	P-2004(1)	Mary St - Westmount Dr N to McKenzie St	150	72.5	2006	PVC	0	1	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
6598	TRUE	P-2842	Condo Westridge	150	77.5	2006	PVC	0	2	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
6904	TRUE	P-2004(2)(2)	Mary St - Westmount Dr N to McKenzie St	150	25.5	2006	PVC	0	1	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
6588	TRUE	P-2836	Condo Westridge	150	109.5	2006	PVC	0	2	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
1533	TRUE	P-214	Victoria St- Albert St S to Wyandotte St	150	106.5	2006	PVC	0	1	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
1527	TRUE	P-226	Victoria St - Dunlop St to Wyandotte St	150	115.5	2006	PVC	0	1	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
6582	TRUE	P-2833	Condo Westridge	150	72.5	2006	PVC	0	2	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
6584	TRUE	P-2834	Condo Westridge	150	68.5	2006	PVC	0	2	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
6586	TRUE	P-2835	Condo Westridge	150	99	2006	PVC	0	2	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
6592	TRUE	P-2838	Condo Westridge	150	68	2006	PVC	0	2	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
6594	TRUE	P-2839	Condo Westridge	150	55	2006	PVC	0	2	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
6596	TRUE	P-2840	Condo Westridge	150	86.5	2006	PVC	0	2	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
6597	TRUE	P-2841	Condo Westridge	150	184.5	2006	PVC	0	2	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
6599	TRUE	P-2843	Condo Westridge	150	69.5	2006	PVC	0	2	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low

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Year of Analysis 2022

															Probability of Failure Factors			Consequence of Failure Factors					
ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
1397	TRUE	P-508	Mary St - McKenzie St to Douglas St	150	220	2006	PVC	0	1	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
1274	TRUE	P-784	Mary St - William St to Albert St N	150	156.5	2006	PVC	0	1	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
1273	TRUE	P-786	Mary St - O'Brien St to William St	150	172.5	2006	PVC	0	1	0.33	16	75	0.21	Local		2.1	1	2.0	1.50	1	1	1.4	2.78	Low
1758	TRUE	P-2032	Tudhope Park - Atherley Rd to couchiching Pt	200.00	827.5	2010	PVC	0	1	0.44	12	75	0.16	Local		1.8	1	1.7	1.75	1	1	1.6	2.75	Low
1014	TRUE	P-1372	Nottawasaga St - Westmount Dr N to McKenz	200	209	2010	PVC	0	2	0.44	12	75	0.16	Local		1.8	1	1.7	1.75	1	1	1.6	2.75	Low
5541	TRUE	P-2435	Cedar - Canice St to Cowan St & Cowan St - C	250	339	2013	PVC	0	1	0.56	9	75	0.12	Local		1.6	1	1.5	2.00	1	1	1.8	2.74	Low
5911	TRUE	P-2340	University Ave (3100 Old Barrie Rd)	250	173.5	2013	PVC	0	2	0.56	9	75	0.12	Local		1.6	1	1.5	2.00	1	1	1.8	2.74	Low
6186	TRUE	P-2651	Cedar at Canice	250	5.5	2013	PVC	0	1	0.56	9	75	0.12	Local		1.6	1	1.5	2.00	1	1	1.8	2.74	Low
6342	TRUE	P-2714	University Ave (3100 Old Barrie Rd)	250	277.5	2013	PVC	0	2	0.56	9	75	0.12	Local		1.6	1	1.5	2.00	1	1	1.8	2.74	Low
6896	TRUE	P-2715(1)(1)	University Ave (3100 Old Barrie Rd)	250	76.5	2013	PVC	0	2	0.56	9	75	0.12	Local		1.6	1	1.5	2.00	1	1	1.8	2.74	Low
6897	TRUE	P-2715(1)(2)	University Ave (3100 Old Barrie Rd)	250	92.5	2013	PVC	0	2	0.56	9	75	0.12	Local		1.6	1	1.5	2.00	1	1	1.8	2.74	Low
6777	TRUE	P-2715(2)	University Ave (3100 Old Barrie Rd)	250	47.5	2013	PVC	0	2	0.56	9	75	0.12	Local		1.6	1	1.5	2.00	1	1	1.8	2.74	Low
1668	TRUE	P-1740	West St S - Kitchener St to Shannon St	200	46	2012	PVC	0	1	0.44	10	75	0.13	Arterial		1.7	1	1.6	1.75	2	1	1.7	2.70	Low
3447	TRUE	P-2279	West St S - Shannon St to Olive Cr	200	360	2012	PVC	0	1	0.44	10	75	0.13	Arterial		1.7	1	1.6	1.75	2	1	1.7	2.70	Low
1555	TRUE	P-162	Elgin St - Front St to Matchedash St S	150	81.5	2007	PVC	0	1	0.33	15	75	0.20	Local		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
962	TRUE	P-1496	Peter St S at Elgin St	150	145.5	2007	PVC	0	1	0.33	15	75	0.20	Local		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
1528	TRUE	P-224	Dunlop St - Colborne St W to Victoria St	150	125	2007	PVC	0	1	0.33	15	75	0.20	Local		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
1616	TRUE	P-16	Brant St - Peter St N to Matchedash St N	150	177.5	2007	PVC	0	1	0.33	15	75	0.20	Local		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
1545	TRUE	P-184	Peter St N - Western Ave to King St	150	66	2007	PVC	0	1	0.33	15	75	0.20	Local		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
964	TRUE	P-196	Elgin St - West St S to Peter St S	150	187.5	2007	PVC	0	1	0.33	15	75	0.20	Local		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
1612	TRUE	P-24	Brant St - Matchedash St N to Laclie St	150	181.5	2007	PVC	0	1	0.33	15	75	0.20	Local		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
3987	TRUE	P-2351	Gill St - James St to Bond St	150	181	2007	PVC	0	1	0.33	15	75	0.20	Collector		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
1552	TRUE	P-168	Matchedash St S - Elgin St to Western Ave	150	81	2007	PVC	0	1	0.33	15	75	0.20	Local		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
3988	TRUE	P-2352	Gill St - James St to Bond St	150	118.5	2007	PVC	0	1	0.33	15	75	0.20	Collector		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
1550	TRUE	P-174	Matchedash St S- Western Ave to King St	150	63.5	2007	PVC	0	1	0.33	15	75	0.20	Local		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
1547	TRUE	P-180	Western Ave - Peter St N to Matchedash St N	150	182	2007	PVC	0	1	0.33	15	75	0.20	Local		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
6321	TRUE	P-2704	Elgin at Matchedash	150	15.5	2007	PVC	0	1	0.33	15	75	0.20	Local		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
6509	TRUE	P-2787	Penetang St - Patrick St to Albert St N	150	102.5	2007	PVC	0	2	0.33	15	75	0.20	Local		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
6519	TRUE	P-2792	Penetang St - Patrick St to Albert St N	150	49.5	2007	PVC	0	2	0.33	15	75	0.20	Local		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
6520	TRUE	P-2793	Penetang St - Patrick St to Albert St N	150	71.5	2007	PVC	0	2	0.33	15	75	0.20	Local		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
1607	TRUE	P-34	Tecumseth St - West St N to Peter St N	150	130	2007	PVC	0	2	0.33	15	75	0.20	Local		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
1263	TRUE	P-808	Penetang St - Cameron St to Patrick St	150	214.5	2007	PVC	0	2	0.33	15	75	0.20	Local		2.0	1	1.9	1.50	1	1	1.4	2.68	Low
1509	TRUE	P-262	Colborne St W - Volunteer Dr to Frederick St	150	129.5	2009	PVC	0	1	0.33	13	75	0.17	Arterial		1.9	1	1.8	1.50	2	1	1.5	2.68	Low
1406	TRUE	P-490	Colborne St W - Bleeker St to Frederick St	150	111	2009	PVC	0	1	0.33	13	75	0.17	Arterial		1.9	1	1.8	1.50	2	1	1.5	2.68	Low
1404	TRUE	P-494	Colborne St W - Dallas St to Bleeker St	150	105	2009	PVC	0	1	0.33	13	75	0.17	Arterial		1.9	1	1.8	1.50	2	1	1.5	2.68	Low
1599	TRUE	P-50	Laclie St - Tecumseth St to Front St	400	260.5	2020	PVC	0	1	0.89	2	75	0.03	Arterial		1.1	1	1.1	2.75	2	1	2.5	2.66	Low
6730	TRUE	P-2599(1)	Stone Ridge- w of Annalyse	300	2.96	2016	PVC	0	3	0.67	6	75	0.08	Local		1.4	1	1.3	2.25	1	1	2.0	2.66	Low
6731	TRUE	P-2599(2)	Stone Ridge- w of Annalyse	300	5.34	2016	PVC	0	3	0.67	6	75	0.08	Local		1.4	1	1.3	2.25	1	1	2.0	2.66	Low
6105	TRUE	P-2601	Orion Blvd	300	105	2016	PVC	0	3	0.67	6	75	0.08	Local		1.4	1	1.3	2.25	1	1	2.0	2.66	Low
6240	TRUE	P-2673	Orion -Annalyse to Monarch	300	237	2016	PVC	0	3	0.67	6	75	0.08	Local		1.4	1	1.3	2.25	1	1	2.0	2.66	Low
1052	TRUE	P-1286	Bay St- Borland St to North St E	200	320.5	2011	PVC	0	1	0.44	11	75	0.15	Local		1.7	1	1.7	1.75	1	1	1.6	2.65	Low
1529	TRUE	P-222	Dunlop St @ Colborne St W	200	15	2011	PVC	0	1	0.44	11	75	0.15	Local		1.7	1	1.7	1.75	1	1	1.6	2.65	Low
1439	TRUE	P-422	James St - Forest Ave S to Bayview Pkwy	200	287	2011	PVC	0	1	0.44	11	75	0.15	Local		1.7	1	1.7	1.75	1	1	1.6	2.65	Low
6475	TRUE	P-2765	Kubota Svc	200	137.5	2014	PVC	0	2	0.44	8	75	0.11	Local	Kubota Materials	1.5	1	1.5	1.75	1	3	1.8	2.63	Low
6296	TRUE	P-2696	Lucy -n of Lily (n)	200	129	2014	PVC	0	2	0.44	8	75	0.11	Local	Sundial Lakeview	1.5	1	1.5	1.75	1	3	1.8	2.63	Low
1743	TRUE	P-1886	Laclie St - North St E north to end	100	124	2007	PVC	1	2	0.22	15	75	0.20	Arterial		2.0	2	2.0	1.25	2	1	1.3	2.62	Low
1076	TRUE	P-1224	Jarvis St - Peter St N to West St N	150	185.5	2008	PVC	0	2	0.33	14	75	0.19	Local		1.9	1	1.9	1.50	1	1	1.4	2.59	Low
1426	TRUE	P-448	Elmer Pk - Memorial Ave to Dunedin St	200	182	2012	PVC	0	1	0.44	10	75	0.13	Local		1.7	1	1.6	1.75	1	1	1.6	2.54	Low
1559	TRUE	P-154	Nottawasaga St - Albert St N to Andrew St N	150	110.5	2009	PVC	0	1	0.33	13	75	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.50	Low
1558	TRUE	P-156	Albert St N - Coldwater Rd to Nottawasaga St	150	129.5	2009	PVC	0	1	0.33	13	75	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.50	Low
2006	TRUE	P-2098	Michelle Dr - James St to Bond St	150	306.5	2009	PVC	0	1	0.33	13	75	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.50	Low
1560	TRUE	P-152	Albert St N- Mary St to Mississaga St W	150	122.5	2009	PVC	0	1	0.33	13	75	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.50	Low
1490	TRUE	P-304	Bond St - High St to Gill St	150	264.5	2009	PVC	0	1	0.33	13	75	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.50	Low
1416	TRUE	P-468	Albany Ave - Memorial Ave to Dallas St	150	183.5	2009	PVC	0	1	0.33	13	75	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.50	Low
1812	TRUE	P-1142	Davey Dr - Cedar Island Rd south to end	150	194.5	2009	PVC	0	1	0.33	13	75	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.50	Low
2010	TRUE	P-2101	Scott St - Colborne St E to Elgin St	150	161	2009	PVC	0	1	0.33	13	75	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.50	Low
1610	TRUE	P-28	Tecumseth St - Matchedash St N to Laclie St	150	185	2009	PVC	0	1	0.33	13	75	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.50	Low
1414	TRUE	P-472	Albany Ave - west of Dallas St	150	143	2009	PVC	0	1	0.33	13	75	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.50	Low
1405	TRUE	P-492	Bleeker St - Colborne St W to McKinnell St	150	183.5	2009	PVC	0	1	0.33	13	75	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.50	Low
1321	TRUE	P-680	Albany - Westmount Dr S to mid Albany	150	217	2009	PVC	0	1	0.33	13	75	0.17	Collector		1.9	1	1.8	1.50	1	1	1.4	2.50	Low

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															Probability of Failure Factors			Consequence of Failure Factors					
ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
1271	TRUE	P-790	Mary St at Albert St N	150	8.5	2009	PVC	0	1	0.33	13	75	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.50	Low
1262	TRUE	P-810	Patrick - Coldwater Rd to Penetang St	150	142	2009	PVC	0	2	0.33	13	75	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.50	Low
1260	TRUE	P-814	Albert St- Penetang St to Coldwater Rd	150	150	2009	PVC	0	2	0.33	13	75	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.50	Low
1257	TRUE	P-820	Patrick - Brant Brant St to Penetang St	150	139	2009	PVC	0	2	0.33	13	75	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.50	Low
6284	TRUE	P-2689	Lacliie -Danny to n of Goldie	200	184.5	2014	PVC	0	2	0.44	8	75	0.11	Arterial		1.5	1	1.5	1.75	2	1	1.7	2.48	Low
3714	TRUE	P-2321	Cantebury Circle to Mariposa Dr easement	150	86.5	2011	Ductile Iron	0	2	0.33	11	65	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.47	Low
3709	TRUE	P-2317	Cantebury Circle	150	68	2011	Ductile Iron	0	2	0.33	11	65	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.47	Low
3710	TRUE	P-2318	Cantebury Circle	150	117.5	2011	Ductile Iron	0	2	0.33	11	65	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.47	Low
3704	TRUE	P-2314	Cantebury Circle at Sundial Dr	150	69	2011	Ductile Iron	0	2	0.33	11	65	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.47	Low
3707	TRUE	P-2316	Cantebury Circle	150	43	2011	Ductile Iron	0	2	0.33	11	65	0.17	Local		1.9	1	1.8	1.50	1	1	1.4	2.47	Low
2037	TRUE	P-2115	Matchedash St N - Jarvis St to Brant St	200	160	2013	PVC	0	1	0.44	9	75	0.12	Local		1.6	1	1.5	1.75	1	1	1.6	2.44	Low
1137	TRUE	P-1070	Matchedash St N - Borland St to Fowlie St	200	52	2013	PVC	0	2	0.44	9	75	0.12	Local		1.6	1	1.5	1.75	1	1	1.6	2.44	Low
4158	TRUE	P-2371	Lacey -Atlantis easement south to reducer	200	583	2013	PVC	0	3	0.44	9	75	0.12	Local		1.6	1	1.5	1.75	1	1	1.6	2.44	Low
6330	TRUE	P-2709	Sundial to Laclie As built required	200	147	2013	PVC	0	2	0.44	9	75	0.12	Local		1.6	1	1.5	1.75	1	1	1.6	2.44	Low
6331	TRUE	P-2710	Sundial to Laclie As built required	200	31.5	2013	PVC	0	2	0.44	9	75	0.12	Local		1.6	1	1.5	1.75	1	1	1.6	2.44	Low
6332	TRUE	P-2711	Sundial to Laclie	200	3	2013	PVC	0	2	0.44	9	75	0.12	Local		1.6	1	1.5	1.75	1	1	1.6	2.44	Low
6395	TRUE	P-2728	Borland -Matchedash to Laclie	150	84.5	2010	PVC	0	2	0.33	12	75	0.16	Local		1.8	1	1.7	1.50	1	1	1.4	2.41	Low
6394	TRUE	P-2727	Borland -Matchedash to Laclie	150	93	2010	PVC	0	2	0.33	12	75	0.16	Local		1.8	1	1.7	1.50	1	1	1.4	2.41	Low
1390	TRUE	P-522	Nottawasaga St - McKenzie St to Douglas St	150	214.5	2010	PVC	0	2	0.33	12	75	0.16	Local		1.8	1	1.7	1.50	1	1	1.4	2.41	Low
1388	TRUE	P-526	Nottawasaga St - Douglas St to Emily St	150	171.5	2010	PVC	0	2	0.33	12	75	0.16	Local		1.8	1	1.7	1.50	1	1	1.4	2.41	Low
2086	TRUE	P-2142	Front St - Gill St to Poughkeepsie St	150	89	2012	PVC	0	1	0.33	10	75	0.13	Arterial		1.7	1	1.6	1.50	2	1	1.5	2.38	Low
1556	TRUE	P-160	Front St - Colborne St E to Elgin St	300	141	2019	PVC	0	1	0.67	3	75	0.04	Arterial		1.1	1	1.1	2.25	2	1	2.1	2.38	Low
1104	TRUE	P-1148	Front St - Elgin St to King St	300	134	2019	PVC	0	1	0.67	3	75	0.04	Arterial		1.1	1	1.1	2.25	2	1	2.1	2.38	Low
1505	TRUE	P-270	Front St - King St to Queen St E	300	155.5	2019	PVC	0	1	0.67	3	75	0.04	Arterial		1.1	1	1.1	2.25	2	1	2.1	2.38	Low
1151	TRUE	P-1040	Matchedash St N - North St E to Cedar St	200	152	2014	PVC	0	2	0.44	8	75	0.11	Local		1.5	1	1.5	1.75	1	1	1.6	2.33	Low
6404	TRUE	P-2734	Danny Dr e of Laclie St	200	3	2014	PVC	0	1	0.44	8	75	0.11	Local		1.5	1	1.5	1.75	1	1	1.6	2.33	Low
6406	TRUE	P-2735	Lucy- Lily (s) to Lily (n)	200	68	2014	PVC	0	1	0.44	8	75	0.11	Local		1.5	1	1.5	1.75	1	1	1.6	2.33	Low
6407	TRUE	P-2736	Lucy- Lily (s) to Lily (n)	200	207.5	2014	PVC	0	1	0.44	8	75	0.11	Local		1.5	1	1.5	1.75	1	1	1.6	2.33	Low
6293	TRUE	P-2694	Lucy -n of Lily (n)	200	33	2014	PVC	0	2	0.44	8	75	0.11	Local		1.5	1	1.5	1.75	1	1	1.6	2.33	Low
5414	TRUE	P-2414	Matchedash St N - Cedar to Borland St	200	38.5	2014	PVC	0	2	0.44	8	75	0.11	Local		1.5	1	1.5	1.75	1	1	1.6	2.33	Low
5415	TRUE	P-2415	Matchedash St N - Cedar to Borland St	200	112.5	2014	PVC	0	2	0.44	8	75	0.11	Local		1.5	1	1.5	1.75	1	1	1.6	2.33	Low
6265	TRUE	P-2678	Danny -w of Lucy	200	42	2014	PVC	0	1	0.44	8	75	0.11	Local		1.5	1	1.5	1.75	1	1	1.6	2.33	Low
6275	TRUE	P-2683	Lacy n of Lily	200	181.5	2014	PVC	0	1	0.44	8	75	0.11	Local		1.5	1	1.5	1.75	1	1	1.6	2.33	Low
6279	TRUE	P-2686	Luccy- n of Lily (n)	200	86	2014	PVC	0	1	0.44	8	75	0.11	Local		1.5	1	1.5	1.75	1	1	1.6	2.33	Low
6403	TRUE	P-2733	Danny Dr e of Laclie St	200	25	2014	PVC	0	2	0.44	8	75	0.11	Local		1.5	1	1.5	1.75	1	1	1.6	2.33	Low
6112	TRUE	P-2605	Pearl- Emperor to south TH access road	150	143	2011	PVC	0	2	0.33	11	75	0.15	Local		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
1901	TRUE	P-2037	Bay St- north of Fittons Rd E	150	507	2011	PVC	0	1	0.33	11	75	0.15	Local		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
1934	TRUE	P-2056	Westmount Dr S at Argyle Ave	150	26	2011	PVC	0	1	0.33	11	75	0.15	Collector		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
1755	TRUE	P-1046	St Jean St - Cedar St to north	150	96.5	2011	PVC	0	2	0.33	11	75	0.15	Local		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
5555	TRUE	P-2443	Dufferin St - Powley St to Barrie Rd	150	5.5	2011	PVC	0	1	0.33	11	75	0.15	Local		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
1150	TRUE	P-1042	Cedar - Matchedash St N to Laclie St	150	179.5	2011	PVC	0	2	0.33	11	75	0.15	Local		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
2122	TRUE	P-2163	Edward St at Dunedin St	150	81.5	2011	PVC	0	1	0.33	11	75	0.15	Local		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
1147	TRUE	P-1050	St Jean St - Landon St to North St E	150	182	2011	PVC	0	2	0.33	11	75	0.15	Local		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
1053	TRUE	P-1284	Borland St - Lavallee Cr to Bay St	150	168	2011	PVC	0	1	0.33	11	75	0.15	Local		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
1049	TRUE	P-1292	Borland St at Canice St	150	6.5	2011	PVC	0	1	0.33	11	75	0.15	Local		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
1048	TRUE	P-1294	Borland St - Parkview Ave to Canice St	150	94	2011	PVC	0	1	0.33	11	75	0.15	Local		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
1047	TRUE	P-1296	Borland St - Canice St to Lavallee Cr	150	104.5	2011	PVC	0	1	0.33	11	75	0.15	Local		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
1888	TRUE	P-2022	St Jean St - North St E to south	150	56.5	2011	PVC	0	2	0.33	11	75	0.15	Local		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
1519	TRUE	P-242	Powley St - Dunlop St to Dufferin St	150	114.5	2011	PVC	0	1	0.33	11	75	0.15	Local		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
6115	TRUE	P-2607	Pearl - Between TH access roads	150	263	2011	PVC	0	2	0.33	11	75	0.15	Local		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
6579	TRUE	P-2831	Pearl - N TH access road to Vanessa	150	118.5	2011	PVC	0	2	0.33	11	75	0.15	Local		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
6580	TRUE	P-2832	Pearl - N TH access road to Vanessa	150	47	2011	PVC	0	2	0.33	11	75	0.15	Local		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
1265	TRUE	P-802	Cameron St - Coldwater Rd to Nottawasaga S	150	127	2011	PVC	0	2	0.33	11	75	0.15	Local		1.7	1	1.7	1.50	1	1	1.4	2.32	Low
1080	TRUE	P-1216	Laclie St - Borland St to Jarvis St	150	226	2013	PVC	0	1	0.33	9	75	0.12	Arterial		1.6	1	1.5	1.50	2	1	1.5	2.29	Low
5567	TRUE	P-2449	Front St - Poughkeepsie St to Cochrane St- C	150	93	2013	PVC	0	1	0.33	9	75	0.12	Arterial		1.6	1	1.5	1.50	2	1	1.5	2.29	Low
5566	TRUE	P-2448	Front St - Poughkeepsie St to Cochrane St - C	150	113.5	2013	PVC	0	1	0.33	9	75	0.12	Arterial		1.6	1	1.5	1.50	2	1	1.5	2.29	Low
2015	TRUE	P-2105	Front St - Mississaga St E to Colborne St E	300	145.5	2020	PVC	0	1	0.67	2	75	0.03	Arterial		1.1	1	1.1	2.25	2	1	2.1	2.24	Low
1596	TRUE	P-56	Front St - Neywash St to Coldwater Rd	300	147	2020	PVC	0	1	0.67	2	75	0.03	Arterial		1.1	1	1.1	2.25	2	1	2.1	2.24	Low
1591	TRUE	P-70	Front St at Coldwater St	300	12.5	2020	PVC	0	1	0.67	2	75	0.03	Arterial		1.1	1	1.1	2.25	2	1	2.1	2.24	Low
1587	TRUE	P-82	Front St - Coldwater Rd to Mississaga St E	300	142	2020	PVC	0	1	0.67	2	75	0.03	Arterial		1.1	1	1.1	2.25	2	1	2.1	2.24	Low

2021 Orillia Water Master Plan Update
Watermain Risk Assessment
Jun-22

Colour coded legend

- Generated by WaterCAD
- Calculated
- Bulk of data from 2016 watermain asset management sheet, including updates for 2021 determined values

Year of Analysis 2022

															Probability of Failure Factors			Consequence of Failure Factors					
ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
3192	TRUE	P-2223	Brant St - Peter St N to West St N	200	3.5	2015	PVC	0	2	0.44	7	75	0.09	Local		1.4	1	1.4	1.75	1	1	1.6	2.23	Low
3191	TRUE	P-2222	Brant St - Peter St N to West St N	200	56.5	2015	PVC	0	1	0.44	7	75	0.09	Local		1.4	1	1.4	1.75	1	1	1.6	2.23	Low
1075	TRUE	P-1234	Brant St - Peter St N to West St N	200	104	2015	PVC	0	2	0.44	7	75	0.09	Local		1.4	1	1.4	1.75	1	1	1.6	2.23	Low
3735	TRUE	P-2334	Progress to OPP (Hwy 12)	150	515.5	2012	PVC	0	1	0.33	10	75	0.13	Local		1.7	1	1.6	1.50	1	1	1.4	2.23	Low
1659	TRUE	P-1718	Clayborne Pl- East St east to end	150	91	2012	PVC	0	1	0.33	10	75	0.13	Local		1.7	1	1.6	1.50	1	1	1.4	2.23	Low
1932	TRUE	P-2054	Argyle Ave - Westmount Dr S to Dallas St	150	245	2012	PVC	0	1	0.33	10	75	0.13	Local		1.7	1	1.6	1.50	1	1	1.4	2.23	Low
1155	TRUE	P-1032	North St E - West St N to Peter St N	150	183	2012	PVC	0	2	0.33	10	75	0.13	Local		1.7	1	1.6	1.50	1	1	1.4	2.23	Low
1302	TRUE	P-722	Eleanor Rd - MississagaSt W to Walker Ave	150	309	2012	PVC	0	2	0.33	10	75	0.13	Local		1.7	1	1.6	1.50	1	1	1.4	2.23	Low
1976	TRUE	P-2082	Bond St - Dorset Dr to High St	150	97	2014	Ductile Iron	0	1	0.33	8	65	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.16	Low
2005	TRUE	P-2097	Bond St - West St S to Dorset Dr	150	52.5	2014	Ductile Iron	0	1	0.33	8	65	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.16	Low
1977	TRUE	P-2083	Bond St - Dorset Dr to High St	150	72.5	2014	Ductile Iron	0	1	0.33	8	65	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.16	Low
1138	TRUE	P-1068	Parkview Ave- Borland St to Jarvis St	150	147.5	2013	PVC	0	1	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
946	TRUE	P-1528	Champlain St - West St N to Peter St N	150	184.5	2013	PVC	0	2	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
1523	TRUE	P-234	Powley St - Wyandotte St to Dunlop St	150	113	2013	PVC	0	1	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
6198	TRUE	P-2659	Annalyse- Orion to Isabella	150	7.5	2013	PVC	0	2	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
5830	TRUE	P-2491	WEST ORILLIA PROPOSED	150	97.5	2013	PVC	0	3	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
5550	TRUE	P-2440	Dufferin St - Powley St to Victoria St	150	13.5	2013	PVC	0	1	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
1435	TRUE	P-430	Crawford St - Forest Ave S to Bayview Pkwy	150	282	2013	PVC	0	1	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
5552	TRUE	P-2441	Dufferin St - Victoria St to Colborne St W	150	9	2013	PVC	0	1	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
6230	TRUE	P-2668	WEST ORILLIA PROPOSED	150	346	2013	PVC	0	3	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
6337	TRUE	P-2713	Orion to WO proposed	150	102	2013	PVC	0	3	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
6727	TRUE	P-2376(1)	Atlantis Dr -e of Orion	150	28.5	2013	PVC	0	3	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
6728	TRUE	P-2376(2)	Atlantis Dr -e of Orion	150	462.5	2013	PVC	0	3	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
5805	TRUE	P-2484	LU on University Ave	150	552.5	2013	PVC	0	2	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
5831	TRUE	P-2492	WEST ORILLIA PROPOSED	150	468.5	2013	PVC	0	3	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
5833	TRUE	P-2494	WEST ORILLIA PROPOSED	150	297	2013	PVC	0	3	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
5834	TRUE	P-2495	WEST ORILLIA PROPOSED	150	465	2013	PVC	0	3	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
1515	TRUE	P-250	Victoria St - Dufferin St to Dunlop St	150	113	2013	PVC	0	1	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
6733	TRUE	P-2602(1)	Diana N of Valeriana	150	8.5	2013	PVC	0	2	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
6734	TRUE	P-2602(2)	Diana N of Valeriana	150	104.5	2013	PVC	0	2	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
6109	TRUE	P-2603	Diana- w of Isabella	150	288.5	2013	PVC	0	2	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
6158	TRUE	P-2634	Isabella- Annalyse to Stone Ridge	150	301	2013	PVC	0	2	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
6195	TRUE	P-2657	Annalyse- Orion to Isabella	150	285	2013	PVC	0	2	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
6197	TRUE	P-2658	Annalyse- Orion to Isabella	150	17	2013	PVC	0	3	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
6219	TRUE	P-2662	WEST ORILLIA PROPOSED	150	181.5	2013	PVC	0	3	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
6232	TRUE	P-2669	Sierra Drive	150	24.5	2013	PVC	0	3	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
6233	TRUE	P-2670	WEST ORILLIA PROPOSED	150	118.5	2013	PVC	0	3	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
1445	TRUE	P-410	Franklin St - Leslie St to Forest Ave S	150	266.5	2013	PVC	0	1	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
1437	TRUE	P-426	Franklin St - Forest Ave S to Bayview Pkwy	150	282	2013	PVC	0	1	0.33	9	75	0.12	Local		1.6	1	1.5	1.50	1	1	1.4	2.13	Low
6347	TRUE	P-2717	Horne Expansion	300	151	2020	PVC	0	2	0.67	2	75	0.03	Local		1.1	1	1.1	2.25	1	1	2.0	2.13	Low
6345	TRUE	P-2716	Horne Expansion	300	201	2020	PVC	0	2	0.67	2	75	0.03	Local		1.1	1	1.1	2.25	1	1	2.0	2.13	Low
6601	TRUE	P-2845	Horne Expansion	300	197	2020	PVC	0	2	0.67	2	75	0.03	Local		1.1	1	1.1	2.25	1	1	2.0	2.13	Low
6099	TRUE	P-2597	Annalyse- Stone Ridge to Orion	200	329.5	2016	PVC	0	3	0.44	6	75	0.08	Local		1.4	1	1.3	1.75	1	1	1.6	2.12	Low
1830	TRUE	P-1786	Elmer Ave Dallas St to west	200	139	2016	PVC	0	1	0.44	6	75	0.08	Local		1.4	1	1.3	1.75	1	1	1.6	2.12	Low
1320	TRUE	P-682	Elmer Ave - Westmount Dr S westward	200	129	2016	PVC	0	1	0.44	6	75	0.08	Local		1.4	1	1.3	1.75	1	1	1.6	2.12	Low
3989	TRUE	P-2353	Taylor Dr - Gill St to easement	150	142	2014	PVC	0	1	0.33	8	75	0.11	Local		1.5	1	1.5	1.50	1	1	1.4	2.04	Low
3983	TRUE	P-2349	Taylor Dr easement to end	150	79	2014	PVC	0	1	0.33	8	75	0.11	Local		1.5	1	1.5	1.50	1	1	1.4	2.04	Low
3982	TRUE	P-2348	Hoover Cr to Taylor Dr easement	150	74.5	2014	PVC	0	1	0.33	8	75	0.11	Local		1.5	1	1.5	1.50	1	1	1.4	2.04	Low
5561	TRUE	P-2447	Mississaga St E -215	150	76	2014	PVC	0	1	0.33	8	75	0.11	Collector		1.5	1	1.5	1.50	1	1	1.4	2.04	Low
6280	TRUE	P-2687	Lily Dr	150	400.5	2014	PVC	0	1	0.33	8	75	0.11	Local		1.5	1	1.5	1.50	1	1	1.4	2.04	Low
959	TRUE	P-1500	Emily St - Harvey St to Coldwater Rd	150	45.5	2015	PVC	0	2	0.33	7	75	0.09	Local		1.4	1	1.4	1.50	1	1	1.4	1.95	Low
1023	TRUE	P-1348	Emily St- Harvey St to Nottawasaga St	150	118	2015	PVC	0	2	0.33	7	75	0.09	Local		1.4	1	1.4	1.50	1	1	1.4	1.95	Low
6410	TRUE	P-2738	Laclie to Lucy	200	43	2019	PVC	0	1	0.44	3	75	0.04	Arterial		1.1	1	1.1	1.75	2	1	1.7	1.92	Low
1524	TRUE	P-232	Wyandotte St - Powley St to Victoria St	200	133	2018	PVC	0	1	0.44	4	75	0.05	Local		1.2	1	1.2	1.75	1	1	1.6	1.91	Low
6325	TRUE	P-2706	Queen St W	200	189.79	2018	PVC	0	1	0.44	4	75	0.05	Local		1.2	1	1.2	1.75	1	1	1.6	1.91	Low
6327	TRUE	P-2707	Royce at Queen St W	200	12.5	2018	PVC	0	1	0.44	4	75	0.05	Local		1.2	1	1.2	1.75	1	1	1.6	1.91	Low
1525	TRUE	P-230	Wyandotte St - Powley St to Barrie Rd	200	91	2018	PVC	0	1	0.44	4	75	0.05	Local		1.2	1	1.2	1.75	1	1	1.6	1.91	Low
6320	TRUE	P-2703	Orchard Point Rd to Clifford St	200	133.5	2018	PVC	0	1	0.44	4	75	0.05	Local		1.2	1	1.2	1.75	1	1	1.6	1.91	Low
6324	TRUE	P-2705	Queen St W	200	120.21	2018	PVC	0	1	0.44	4	75	0.05	Local		1.2	1	1.2	1.75	1	1	1.6	1.91	Low
1455	TRUE	P-390	East St- James St to Crawford St	200	164.5	2018	PVC	0	1	0.44	4	75	0.05	Local		1.2	1	1.2	1.75	1	1	1.6	1.91	Low

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															Probability of Failure Factors			Consequence of Failure Factors					
ID	Is Active?	Label	Notes	Diameter (mm)	Length (m)	Installation Year	Material	Number of Breaks	Zone	Critical Diameter Ratio	Age (Years)	Typical Useful Life (Years)	Pipe Age/Years of Useful Life Ratio	Road Class	Critical Customers	Pipe Age/Years of Useful Life	Number of Breaks	Probability of Failure Score	Critical Diameter	Road Type	Critical Customer	Consequence of Failure Score	Risk Rating	Risk Category
6515	TRUE	P-2790	Forest Heights	150	73	2016	PVC	0	2	0.33	6	75	0.08	Local		1.4	1	1.3	1.50	1	1	1.4	1.86	Low
6492	TRUE	P-2776	Condo 1038 Mississauga	150	177.5	2016	PVC	0	2	0.33	6	75	0.08	Local		1.4	1	1.3	1.50	1	1	1.4	1.86	Low
6511	TRUE	P-2788	Forest Heights	150	51.5	2016	PVC	0	2	0.33	6	75	0.08	Local		1.4	1	1.3	1.50	1	1	1.4	1.86	Low
6513	TRUE	P-2789	Forest Heights	150	36	2016	PVC	0	2	0.33	6	75	0.08	Local		1.4	1	1.3	1.50	1	1	1.4	1.86	Low
6517	TRUE	P-2791	Forest Heights	150	23.5	2016	PVC	0	2	0.33	6	75	0.08	Local		1.4	1	1.3	1.50	1	1	1.4	1.86	Low
6521	TRUE	P-2794	Forest Heights	150	51.5	2016	PVC	0	2	0.33	6	75	0.08	Local		1.4	1	1.3	1.50	1	1	1.4	1.86	Low
1598	TRUE	P-52	Neywash St - Matchedash St N to Front St	150	84.5	2016	PVC	0	1	0.33	6	75	0.08	Local		1.4	1	1.3	1.50	1	1	1.4	1.86	Low
1379	TRUE	P-546	Rodger Rd - Forest Ave S to MacIsaac Dr	150	308.5	2016	PVC	0	1	0.33	6	75	0.08	Local		1.4	1	1.3	1.50	1	1	1.4	1.86	Low
5417	TRUE	P-2416	Matchedash St N -255	100	49.5	2014	Ductile Iron	0	2	0.22	8	65	0.12	Local		1.6	1	1.5	1.25	1	1	1.2	1.85	Low
6408	TRUE	P-2737	Huronia Wilson to Brammer	200	308	2019	PVC	0	1	0.44	3	75	0.04	Local		1.1	1	1.1	1.75	1	1	1.6	1.81	Low
5556	TRUE	P-2444	Dufferin St - Powley St to Barrie Rd	150	150	2017	PVC	0	1	0.33	5	75	0.07	Local		1.3	1	1.3	1.50	1	1	1.4	1.77	Low
5549	TRUE	P-2439	Dufferin St - Powley St to Victoria St	150	117.5	2017	PVC	0	1	0.33	5	75	0.07	Local		1.3	1	1.3	1.50	1	1	1.4	1.77	Low
5569	TRUE	P-2450	Front St S - Cochrane St to end	50	57.5	2012	PVC	0	1	0.11	10	75	0.13	Arterial		1.7	1	1.6	1.00	2	1	1.1	1.75	Low
6426	TRUE	P-2741	Horne Park	200	55.5	2020	PVC	0	2	0.44	2	75	0.03	Local		1.1	1	1.1	1.75	1	1	1.6	1.70	Low
6351	TRUE	P-2719	Horne Expansion	200	14	2020	PVC	0	2	0.44	2	75	0.03	Local		1.1	1	1.1	1.75	1	1	1.6	1.70	Low
6600	TRUE	P-2844	Horne Expansion	200	67.5	2020	PVC	0	2	0.44	2	75	0.03	Local		1.1	1	1.1	1.75	1	1	1.6	1.70	Low
1532	TRUE	P-216	Wyandotte St - Victoria St to Colborne St W	150	141	2018	PVC	0	1	0.33	4	75	0.05	Local		1.2	1	1.2	1.50	1	1	1.4	1.68	Low
6607	TRUE	P-2848	Condo 228 James	150	58	2019	PVC	0	1	0.33	3	75	0.04	Local		1.1	1	1.1	1.50	1	1	1.4	1.58	Low
6613	TRUE	P-2852	Condo James at East	150	96	2019	PVC	0	1	0.33	3	75	0.04	Local		1.1	1	1.1	1.50	1	1	1.4	1.58	Low
6609	TRUE	P-2849	Condo 228 James	150	131.5	2019	PVC	0	1	0.33	3	75	0.04	Local		1.1	1	1.1	1.50	1	1	1.4	1.58	Low
6173	TRUE	P-2642	Matchedash -Jarvis to Fowlie	50	74.5	2013	PVC	0	2	0.11	9	75	0.12	Local		1.6	1	1.5	1.00	1	1	1.0	1.52	Low
5553	TRUE	P-2442	Dufferin St - Victoria St to Colborne St W	100	132	2017	PVC	0	1	0.22	5	75	0.07	Local		1.3	1	1.3	1.25	1	1	1.2	1.51	Low

Appendix G: Consultation Notices, PIC and Correspondence

G1- Notice of Study Commencement

CITY OF ORILLIA WATER MASTER PLAN 2020 UPDATE
CLASS ENVIRONMENTAL ASSESSMENT

NOTICE OF STUDY COMMENCEMENT

The City of Orillia is undertaking a Class Environmental Assessment (Class EA) to update the Water System Master Plan (2015). The Water Master Plan 2020 Update will identify the infrastructure needs to optimize, upgrade and expand the municipal drinking water supply, distribution, storage and pumping systems to accommodate growth and intensification to the year 2050.

The Water Master Plan 2020 Update will be prepared in accordance with the requirements of the MEA Municipal Class Environmental Assessment for Master Plans (October 2000, amended in 2007, 2011 & 2015). This study will meet the Class EA requirements for the Schedule B projects identified.

To ensure that anyone interested in this study has the opportunity to get involved and provide input, public consultation will take place over the course of the study. A virtual Public Information Center (PIC) will be held to present the water system needs and alternative solutions considered and to receive public input. At the completion of the planning process, the Water Master Plan 2020 Update will be available for public review and comments.

Residents and interested parties are encouraged to regularly visit the City of Orillia website's Weekly Bulletin Board and project webpage (www.orillia.ca/en/city-hall/watermasterplan.aspx#) for updates and notices.

If you have any questions or concerns, and/or would like to be added to the study's direct mailing list, please contact one of the study representatives listed below:

Stephen Gendron
City of Orillia
Manager of Environmental Engineering,
Assets and Capital Projects
50 Andrew Street South, Suite 300
Orillia, Ontario, L3V 7T5
Tel: 705-325-2212
Email: sgendron@orillia.ca

Suzanne Troxler
Tatham Engineering Limited
Manager of Water & Wastewater Engineering
115 Sandford Fleming Drive, Suite 200
Collingwood, Ontario, L9Y 5A6
Tel: 705-444-2565
Email: stroxler@tathameng.com

Comments and information received during this Class Environmental Assessment are collected in accordance with the *Municipal Freedom of Information and Protection of Privacy Act*. All comments will be part of the public record.

This notice first issued on July 10, 2020

120063 Orillia WMP Update 2020 Mailing List

Last Updated: July 16, 2020

Municipalities	Job Title	Contact Suffix	Contact First Name	Contact Last Name	Address	Mailing	City	PC	Phone	Email
County of Simcoe	Director of Legislative Services/County Clerk	Ms.	Brenda	Clark	Administration Centre	1110 Highway #26	MIDHURST	L9X 1N6	705-726-9300	service@simcoe.ca
Township of Oro-Medonte	Director of Corporate Services/Clerk	Ms.	Donna	Hewitt	148 Line 7 South	Box 100	ORO	L0L 2X0	705-487-2171 ext. 2132	dhewitt@oro-medonte.ca
Township of Ramara	Chief Administrative Officer	Mr.	John	Pinsent	2297 Highway 12	Box 130	BRECHIN	L0K 1B0	705-484-5374 ext. 222	jpinsent@ramara.ca
Township of Severn	Clerk	Ms.	Alison	Gray	1024 Hurlwood Lane	Box 159	ORILLIA	L3V 6J3	705-325-2315 ext. 232	agray@townshipofsevern.com
Township of Springwater - Public Works	Director of Public Works	Ms.	Heather	Coleman	2231 Nursery Road		MINESING	L9X 1A8	705-728-4784 ext. 2051	heather.coleman@springwater.ca
City of Orillia - Development Services and Engineering	Manager of Engineering and Transportation	Mr.	Wesley	Cyr	50 Andrew Street South	Suite 300	ORILLIA	L3V 7T5	705-325-2221	wcyr@orillia.ca
City of Orillia - Development Services and Engineering	General Manager of Developmental Services and Engineering	Mr.	Ian	Sugden	50 Andrew Street South	Suite 300	ORILLIA	L3V 7T5	705-329-7256	isugden@orillia.ca
City of Orillia - Environment and Infrastructure Services Department	General Manager Environment and Infrastructure Services Departme	Mr.	Andrew	Schell	50 Andrew Street South	Suite 300	ORILLIA	L3V 7T5	705-325-7551	aschell@orillia.ca
City of Orillia - Fire Department	Fire Chief	Mr.	Brent	Thomas	50 Andrew Street South	Suite 300	ORILLIA	L3V 7T5	705-325-5889	bthomas@orillia.ca
City of Orillia - Waste and Environmental Management Advisory Committee	Assistant Clerk		Robin	Cadeau	50 Andrew Street South	Suite 300	ORILLIA	L3V 7T5	705-329-2452	rcadeau@orillia.ca
Local Agencies	**Job Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Simcoe County District School Board	Manager of Planning	Mr.	Andrew	Keuken	1170 Highway 26		MIDHURST	L0L 1X0	705-734-6363 ext. 11513	akeuken@scdsb.on.ca
Simcoe Muskoka Catholic District School Board	Manager of Planning and Properties	Ms.	Jennifer	Sharpe	46 Alliance Boulevard		BARRIE	L4M 5K3	705-722-3555 ext. 351	jsharpe@smcdsb.on.ca
Lake Simcoe Region Conservation Authority	Director, Planning & Development Services	Mr.	Rob	Baldwin	120 Bayview Parkway	Box 282	NEWMARKET	L3Y 4X1	905-895-1281	r.baldwin@lsrca.on.ca
Simcoe Muskoka District Health Unit	Medical Officer of Health	Mr.	Charles	Gardner	15 Sperling Drive		BARRIE	L4M 6K9	705-721-7520 ext. 6515	Charles.Gardner@smdhu.org
Orillia and District Construction Association				Sir/Madam	PO Box 235		ORILLIA	L3V 6J3	705-326-1844	
Provincial Agencies	**Job Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Ministry of the Environment, Conservation and Parks - Barrie District Office	Distrinct Manager	Ms.	Cindy	Hood	54 Cedar Pointe Drive	Unit 1201	BARRIE	L4N 5R7	705-309-5874	cindy.hood@ontario.ca
Ministry of the Environment, Conservation and Parks - Barrie District Office	Senior Environmental Officer	Mr.	Brad	Allen	54 Cedar Pointe Drive	Unit 1201	BARRIE	L4N 5R7	705-333-4346	brad.allen@ontario.ca
Ministry of the Environment, Conservation and Parks	Drinking Water Inspector	Ms.	Donna	Staniscia	54 Cedar Pointe Drive	Unit 1201	BARRIE	L4N 5R7	705-220-1773	donna.staniscia@ontario.ca
Ministry of the Environment, Conservation and Parks	Environmental Resource Planner & EA Coordinator	Ms.	Chunmei	Liu	135 St Clair Ave W	8th	TORONTO	M4V 1P5	416-326-4886	chunmei.liu@ontario.ca
Ministry of Municipal Affairs and Housing	Team Lead, Community Planning and Development	Mr.	Aldo	Ingraldi	8 Estate Lane		KINGSTON	K7M 9A8	416-585-6048	aldo.ingraldi@ontario.ca
Ministry of Natural Resources - Midhurst District	District Manager	Mr.	Dan L.	Thompson	2284 Nursery Road		MIDHURST	L9X 1N8	705-725-7561	dan.l.thompson@ontario.ca
Ministry of Natural Resources - Midhurst District	District Planner	Ms.	Kim	Benner	2284 Nursery Road		MIDHURST	L9X 1N8	705-725-7534	kim.benner@ontario.ca
Ministry of Transportation	Corridor Management Section, Central Region	Mr.	Peter	Dorton	1201 Wilson Avenue	7th Floor, Building D	DOWNSVIEW	M3M 1J8	416-235-4280	Peter.Dorton@ontario.ca
Ministry of Transportation	Project Engineer	Mr.	Justin	White	1202 Wilson Avenue	7th Floor, Building D	DOWNSVIEW	M3M 1J8	416.235.5609	justin.white@ontario.ca
Ministry of Transportation - Legal Services	Director	Ms.	Mary	Gersht	1203 Wilson Avenue	7th Floor, Building D	DOWNSVIEW	M3M 1J8	416-235-4406	mary.gersht@ontario.ca
Ministry of Indigenous Affairs - Indigenous Relations and Programs Division	Executive Advisor		Ayn	Cooney	160 Bloor St E	4th Floor	TORONTO	M7A 2E6	416-325-1067	ayn.cooney@ontario.ca
Ministry of Health and Long-term Care				Sir/Madam	393 University Ave.	21st Floor	TORONTO	M7A 2S1	416-326-3115	environmentalhealth@ontario.ca
Ministry of Heritage, Sport, Tourism and Culture - Sport, Recreation and Commur	Assistant Deputy Minister	Mr.	Steve	Harlow	777 Bay St, College Park 18th Flr		TORONTO	M7A 1S5	416-212-7397	steve.harlow@ontario.ca
Ontario Heritage Trust				Sir/Madam	10 Adelaide Street E	Suite 203	TORONTO	M5C 1J3	416-325-5000 *General Inquiries	
Infrastructure Ontario	President, Real Estate	Mr.	Toni	Rossi	1 Dundas Street West	Suite 2000	TORONTO	M5G 1Z3	416-314-0314	toni.rossi@infrastructureontario.ca
Federal Agencies	**Job Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Indigenous Services Canada - Sustainable Infrastructure Planning, Regional	Program Manager	Mr.	Derek	Nadeau	10 Wellington Street, North Tower,	18th floor	Gatineau, QC	K1A 0H4	613-608-8637	derek.nadeau@canada.ca
Environment and Climate Change Canada	Manager	Mr.	Rob	Dobos	867 Lakeshore Road	Box 5050	BURLINGTON	L7S 1A1	905-336-4953	
Fisheries and Oceans Canada, Eastern Ontario District - Small Craft Harbours	Regional Manager	Ms.	Chantal	Larochelle	867 Lakeshore Rd.		BURLINGTON	L7S 1A1	905-315-5280	chantal.larochelle@dfo-mpo.gc.ca
Parks Canada c/o Trent-Severn Waterway	Resource Management Officer II	Ms.	Hillary	Knack	34 Beckwith Street		SMITHS FALLS	K7A 2A8	613-283-7199 ext. 272	
Parks Canada c/o Trent-Severn Waterway	Senior Realty Advisor	Ms.	Beth	McEachern	2155 Ashburnham Drive		PETERBOROUGH	K9J 1P8	705-750-4924	
Transport Canada - Ontario Region (PHE)					4900 Yonge Street		NORTH YORK	M2N 6A5	416-952-0490	
Utilities	**Job Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Orillia Power Corporation				Sir/Madam	360 West Street South		ORILLIA	L3V 5G8		
Hydro One				Sir/Madam	483 Bay Street	10th Floor Reception	TORONTO	M5G 2P5		
Bell Canada	Manager	Ms.	Angela	Taylor	136 Bayfield Street, 2nd Floor		BARRIE	L4M 3B1	705-722-2442	angela.taylor@bell.ca
Union Gas				Sir/Madam	425 Memorial Avenue		ORILLIA	L3V6K2		
Rogers Cable Inc				Sir/Madam	1 Sperling Drive		BARRIE	L4M 6B8		
FIRST NATIONS GROUPS	**Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Beausoleil First Nation	Chief		Guy	Monague	11 O'Gemaa Miikaans		CHRISTIAN ISLAND	L0K1C0	705-247-2051	bfnchief@chimnissing.ca
Chippewas of Georgina Island	Chief		Donna	Big Canoe	R.R. #2	P.O. Box N-13	SUTTON WEST	L0E 1R0	705-437-1337	donna.bigcanoe@georginaisland.com
Chippewas of Mnjikaning First Nation (Rama)	Chief		Rodney	Noganosh	5884 Rama Road	Suite 200	RAMA	L3V 6H6	705-325-3611	rodneyn@ramafirstnation.ca
Curve Lake First Nation	Chief		Emily	Whetung-MacInnes	22 Winookeeda Road		CURVE LAKE	K0L 1R0	705-657-8045	EmilyW@curvelake.ca
Hiawatha First Nation	Chief		Laurie	Carr	123 Paudash Street		HIAWATHA	K0L 2G0	705-295-4421	chiefcarr@hiawathafn.ca
Mississaugas of Scugog Island First Nation	Chief		Kelly	LaRocca	22521 Island Road	RR# 5	PORT PERRY	L9L 1B6	905-441-4836	klarocca@scugogfirstnation.com
Moose Deer Point First Nation	Chief		Barron	King	3719 Twelve Mile Bay Road	PO BOX 119	MACTIER	P0C 1H0	705-375-5209	barron.king@moosedeerpoint.com
Wahta Mohawk Territory	Chief		Philip	Franks	2664 Muskoka Rd #38	PO BOX 260	BALA	P0C 1A0	705-762-2354	philip.franks@wahtamohawkscouncil.ca
Wasauksing First Nation	Chief		Warren	Tabobondung	PO Box 250	1508 Lane "G" Geewadin R	PARRY SOUND	P2A 2X4	705-746-2531	chief@wasauksing.ca
Georgian Bay Métis Council	President	Mr.	Greg	Garratt	355 Cranston Crescent	PO BOX 4	MIDLAND	L4R 4K6	705-526-6335	greggarratt@gmail.com
Moon River Métis Council	President	Mr.	Tony	Muscat	385A Bethune Drive North		GRAVENHURST	P1P 1B8	705-681-0782	tonymuscat@rogers.com
Williams Treaty First Nation	Coordinator/Barrister, Solicitor	Ms.	Karry	Sandy-McKenzie	8 Creswick Court		BARRIE	L4M 2J7	705-792-5087	k.a.sandy-mckenzie@rogers.com
OTHER	**Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Charter Construction Limited (Mariposa Homes)		Mr.	Henry	Glavic	650 Harvie Settlement Rd		ORILLIA	L3V 6H2	705-329-1992	hglavic@charterconstruction.ca
Inch Farm Lands Ltd.		Mr.		Yang	7300 Warden Avenue	Suite 405	MARKHAM	L3R 9Z6		hnzydq123@yahoo.ca
Titan Homes		Mr.	Lawrence	Saltzman	600 Laclie St		ORILLIA	L3V 7A8		ljsaltzman@rogers.com
Landen Homes		Mr.	Dennis	Bottero	248 James St E		ORILLIA	L3V 1M3		bottero@rogers.com

From:	Henry Glavic
To:	Suzanne Troxler
Subject:	CITY OF ORILLIA WATER MASTER PLAN 2020 UPDATE CLASS ENVIRONMENTAL ASSESSMENT
Date:	July 13, 2020 2:27:57 PM

Thank you for the notice of study commencement. Could you please add me to the study's direct mailing list.
Thank you
Henry Glavic
Charter Construction

From:	Dorton, Peter (MTO)
To:	Suzanne Troxler
Cc:	SGendron@orillia.ca; Shen, Rey (MTO); Pilla, Angelo (MTO); Kandiah, Nanda (MTO); Vandenberg, Robert (MTO)
Subject:	RE: Orillia Water Master Plan 2020 Update - Notice of Study Commencement (120063)
Date:	July 14, 2020 4:33:55 PM
Attachments:	image001.png image002.png Notice of Study Commencement.pdf

Hi Suzanne:

While MTO has no concerns with this water master plan update, please confirm that there are no associated works proposed on or crossing any provincial highway ROWs or in proximity of any provincial highways.

Thanks,
Peter Dorton
Senior Project Manager
Highway Corridor Management Section – Central Region
Ministry of Transportation
159 Sir William Hearst Avenue, 7th Floor
Toronto, ON M3M 0B7
Tel. (416) 235 - 4280
E-Mail: peter.dorton@ontario.ca
Web: www.mto.gov.on.ca/english/engineering/management/corridor

---

From: Suzanne Troxler <stroxler@tathameng.com>
Sent: July 10, 2020 4:04 PM
To: Andrew Schell <aschell@orillia.ca>; Angela Taylor <angela.taylor@bell.ca>; Cooney, Ayn (IAO) <Ayn.Cooney@ontario.ca>; Barron King <barron.king@moosedeerpoint.com>; Bill Kemeny <Bill.Kemeny@smdhu.org>; Allen, Brad (MECP) <Brad.Allen@ontario.ca>; Brenda Clark <service@simcoe.ca>; Brent Thomas <bthomas@orillia.ca>; Chantal Larochelle <chantal.larochelle@dro-mpo.gc.ca>; Liu, Chunmei (MECP) <Chunmei.Liu@ontario.ca>; Hood, Cindy (MECP) <cindy.hood@ontario.ca>; Thompson, Dan L. (MNRF) <Dan.L.Thompson@ontario.ca>; Lyons, Darryl (MMAH) <Darryl.Lyons@ontario.ca>; Dennis Bottero <bottero@rogers.com>; Derek Nadeau <derek.nadeau@canada.ca>; Donna Big Canoe <donna.bigcanoe@georginaisland.com>; Donna Hewitt <dhewitt@oro-medonte.ca>; Staniscia, Donna (MECP) <Donna.Staniscia@ontario.ca>; Emily Whetung-MacInnes <EmilyW@curvelake.ca>; Greg Garratt <greggarratt@gmail.com>; Guy Monague <bfnchief@chimnissing.ca>; Heather Coleman <heather.coleman@springwater.ca>; Holly Spacek <hspacek@scdsb.on.ca>; Ian Sugden <isugden@orillia.ca>; John Pinsent <jpinsent@ramara.ca>; White, Justin (MTO) <Justin.White@ontario.ca>; Karry Sandy-McKenzie <k.a.sandy-mckenzie@rogers.com>; Kelly LaRocca <klarocca@scugogfirstnation.com>; Benner, Kim (MNRF) <kim.benner@ontario.ca>; Kristin Pechkovsky <kdpechkovsky@smcdsb.on.ca>; Laurie Carr <chiefcarr@hiawathafn.ca>; Lawrence Saltzman <ljsaltzman@rogers.com>; Gersht, Mary (MTO) <Mary.Gersht@ontario.ca>; Patrick Grace <patrick.grace@ontario.ca>; Dorton, Peter (MTO) <Peter.Dorton@ontario.ca>; Phil Hammell <phammell@mariposahomes.ca>; Philip Franks

<philip.franks@wahtamohawkscouncil.ca>; Rob Baldwin <r.baldwin@lsrca.on.ca>; Rob Dobos <rob.dobos@ec.gc.ca>; Robin Cadeau <rcadeau@orilia.ca>; Rodney Noganosh <rodneyn@ramafirstnation.ca>; Sharon Goerke <sgoerke@townshipofsevern.com>; Harlow, Steve (MHSTCI) <Steve.Harlow@ontario.ca>; Tom Hogenbirk <t.hogenbirk@lsrca.on.ca>; Tony Amalfa <tony.amalfa@ontario.ca>; Tony Muscat <tonymuscat@rogers.com>; Warren Tabobondung <chief@wasauksing.ca>; Wesley Cyr <wcyr@orillia.ca>; Yang <hnzydq123@yahoo.ca>
Cc: Stephen Gendron <SGendron@orillia.ca>
Subject: Orillia Water Master Plan 2020 Update - Notice of Study Commencement (120063)

CAUTION -- EXTERNAL E-MAIL - Do not click links or open attachments unless you recognize the sender.

Hello,

The City of Orillia has initiated a Class EA study to update its Water Master Plan. Please find attached the Notice of Study Commencement.

We welcome all questions, concerns and input as we proceed with the study.

Please advise if further notices should be sent to a different contact within your organization or if you do not want to receive any further notices of this study.

Regards,

Suzanne Troxler, B.Eng., M.Sc., P.Eng.
Director, Manager – Water & Wastewater Engineering

Tatham Engineering Limited
115 Sandford Fleming Drive, Suite 200 | Collingwood | Ontario | L9Y 5A6
T 705-444-2565 x2089 | **C** 705-888-0898 | stroxler@tathameng.com | tathameng.com

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From: Suzanne Troxler
To: sgendron@orillia.ca
Subject: RE: Orillia Water Master Plan 2020
Date: July 27, 2020 9:06:00 AM

Good morning Stephen.
I will contact Mr James today.
Suzanne

From: Sharday James <shardayj@ramafirstnation.ca>
Sent: Friday, July 24, 2020 1:49 PM
To: sgendron@orillia.ca; Suzanne Troxler <stroxler@tathameng.com>
Subject: Orillia Water Master Plan 2020

Hello,

I am sending this email in regards to a notice dated July 10th about the undertaking of an EA to update the Water System Master Plan. Thank you for contacting us. We are very much interested in the project and we would like to hear more. If you could please contact me at your convenience I would be grateful.

Thank you,
Sharday James

Sharday James
Community Consultation Worker, Communications
Chippewas of Rama First Nation
(ph) 705-325-3611,1633
(cell)
(fax)
(url) www.ramafirstnation.ca

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By submitting your or another individual's personal information to Chippewas of Rama First Nation, its service providers and agents, you agree and confirm your authority from such other individual, to our collection, use and disclosure of such personal information in accordance with our privacy policy.

Please consider the environment before printing this e-mail.

Deb Fitzsimmons

From: Suzanne Troxler
Sent: Tuesday, August 18, 2020 12:02 PM
To: [redacted]
Cc: Stephen Gendron; Laura Smit; Tim Lauer; Pat Hehn
Subject: Orillia Water Master Plan 2020 Update (120063)

Mr. Evans,

Thank you for contacting the City regarding the Orillia Water Master Plan study.

Although there was a slight delay to start the study this spring, the project is being actively worked on, including: reviewing the projected needs for the next 30 years, reviewing the condition of the existing water infrastructure, and updating the hydraulic model that will be used to assess potential infrastructure improvements. This is background work that we need to do before we can start presenting material to the public and seeking input. We will post updates to this large study on the webpage.

Most of the City's water is drawn from Lake Couchiching and is blended with groundwater from two supply wells at the Water Filtration Plant near Couchiching Beach Park. The water is treated using sand and activated carbon filters to remove the seasonal taste and odour, and disinfected by chlorination and UV. Treated water from the Water Filtration Plant is pumped to all parts of the City. The Water Filtration Plant supply is supplemented, based on operational needs and availability, with chlorinated groundwater from a supply well on the west side of Highway 11.

The algae-produced compounds that cause taste and odour in the lake water have been higher than usual this year because of the warm summer. Although the treatment plant achieves good reductions in these compounds, the remaining very low concentrations are detectable to some. The treated water is tested regularly and frequently to ensure it meets all the drinking water quality standards set by the Ministry of the Environment, Conservation and Parks.

We have added your contact info to the mailing list. There will be a virtual public information meeting later this year, and we hope that it will provide clear explanations on the existing situation and future upgrades to the City's water infrastructure.

Please do not hesitate to send me or Stephen Gendron any other questions and comments.

Sincerely,

Suzanne Troxler, B.Eng., M.Sc., P.Eng.
Director, Manager – Water & Wastewater Engineering

Tatham Engineering Limited
115 Sandford Fleming Drive, Suite 200 | Collingwood | Ontario | L9Y 5A6
T 705-444-2565 x2089 | **C** 705-888-0898 | stroxler@tathameng.com | tathameng.com

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-----Original Message-----
From: Rick <grayapprentice@sympatico.ca>
Sent: Friday, August 14, 2020 11:07
To: Stephen Gendron <SGendron@orillia.ca>
Cc: Tim Lauer <tlauer@sympatico.ca>; Pat Hehn <pmhehn5@gmail.com>
Subject: Water Master Plan 2020 Update - Mailing List

Mr. Gendron, would you please add my name to the study's direct mailing list.

As directed by the Orillia notice in the "Orillia Today" newspaper, I have looked to "orillia.ca/watermasterplan" for updates and notices and found virtually nothing. Has the CoVID19 pandemic stalled the project? Or am I looking in the wrong place?

My interest in this project partially arises from what seems to be different treatment for different citizens. As I understand the situation, some drinking water is drawn from Lake Couchiching and some from wells. Where I live, it seems our water comes solely from the lake because it always has the unpleasant taste of dead, chlorinated algae. Whereas in other parts of the city, that unpleasant taste is missing. Hopefully the work on the water master plan will help me understand the actual situation as well as plans for the future.

Sincerely,

[redacted]
[redacted]
356 Bay Street
Orillia, L3V 3X4

From:	Robin Deduro
To:	eanotification.cregion@ontario.ca
Cc:	Suzanne Troxler; Stephen Gendron
Subject:	City of Orillia, MEA Class EA, Orillia
Date:	August 4, 2021 5:45:11 PM
Attachments:	treamlined_ea_project_information_form_2 - Orillia Water Master Plan Update (Tatham File 120063)R.xlsx image001.png image002.jpg image003.jpg image004.gif Notice of Study Commencement.pdf

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Good afternoon,

The City of Orillia is undertaking a Class EA to update their Water System Master Plan. The Water Master Plan 2021 Update will identify the infrastructure needs to optimize, upgrade and expand the municipal drinking water supply, distribution, storage and pumping systems to accommodate growth and intensification to the year 2050.

Please find attached the Project Information Form and the Notice of Study Commencement that was issued July 10, 2020.

If you have any questions or comments, you may direct them to Stephen Gendron (contact information can be found in the form) and/or Suzanne Troxler, Manager of Water & Wastewater Engineering at Tatham Engineering Ltd by email at stroxler@tathameng.com or by phone at 705-444-2565.

Thank you,

Robin

Robin Gayle Deduro, B.Eng., EIT
Intern Engineer

Tatham Engineering Limited
115 Sandford Fleming Drive, Suite 200 | Collingwood | Ontario | L9Y 5A6
T 705-444-2565 x2162 | rdeduro@tathameng.com | tathameng.com

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1. Electronic documents made available by Tatham Engineering Limited are supplied for the recipient's use only under authorization from the current owner and with the consent of Tatham Engineering Limited. It is the responsibility of the recipient to determine the accuracy, completeness and the appropriateness of the information provided.

2. It is agreed that only those hard copy documents bearing the professional seal and signature of the Tatham Engineering Limited project engineer will govern the work of the project. In the event of any dispute concerning an electronic document, the appropriately dated hard copy will be the document used by Tatham Engineering Limited to govern and resolve the dispute.

G2 - PIC

CITY OF ORILLIA WATER MASTER PLAN 2021 UPDATE
CLASS ENVIRONMENTAL ASSESSMENT

NOTICE OF
VIRTUAL PUBLIC INFORMATION CENTRE

The City of Orillia is undertaking a Class Environmental Assessment (Class EA) to update the Water System Master Plan (2015). The Water Master Plan 2021 Update will identify the infrastructure needs to optimize, upgrade, and expand the municipal drinking water supply, distribution, storage, and pumping systems to accommodate Orillia's growth and intensification to the year 2050.

The Water Master Plan 2021 Update is being completed in accordance with the requirements of the MEA Municipal Class Environmental Assessment for Master Plans (October 2000, amended in 2007, 2011 and 2015). This study will meet the Class EA requirements for the Schedule B projects identified.

A virtual Public Information Centre (PIC) will be held to present the water infrastructure needs, alternative water storage solutions under consideration, and preliminary recommendations, and to receive public input. To prevent the spread of COVID-19, the PIC will be conducted digitally. A PowerPoint presentation will be posted on the City's website at **orillia.ca/watermasterplan** starting on Aug. 25, 2021. Comments can be submitted using the online comment form or by e-mail to the contacts below. Comments will be accepted for a 30-day period, until Sept. 24, 2021. Following the PIC and upon review of comments from the public, stakeholders and review agencies, the Water Master Plan 2021 Update report will be prepared and will be available for public review and comments.

If you have any questions, comments or concerns, and/or would like to be added to the study's direct mailing list, please contact one of the study representatives listed below:

Stephen Gendron
City of Orillia
Manager of Environmental Engineering,
Assets and Capital Projects
50 Andrew St. S, Suite 300
Orillia, ON, L3V 7T5

Suzanne Troxler
Tatham Engineering Limited
Manager - Water & Wastewater
Engineering
115 Sandford Fleming Dr., Suite 200
Collingwood, ON, L9Y 5A6

This notice first issued on Aug. 11, 2021

Tel: 705-325-2212
Email: sgendron@orillia.ca

Tel: 705-444-2565
Email: stroxler@tathameng.com

Comments and information received during this Class Environmental Assessment are collected in accordance with the *Municipal Freedom of Information and Protection of Privacy Act*. All comments will be part of the public record.

This notice first issued on Aug. 11, 2021

120063 Orillia WMP Update 2020 Mailing List
Last Updated: August 18, 2021

Municipalities	Job Title	Contact Suffix	Contact First Name	Contact Last Name	Address	Mailing	City	PC	Phone	Email
County of Simcoe	Director of Legislative Services/County Clerk	Ms.	Brenda	Clark	Administration Centre	1110 Highway #26	MIDHURST	L9X 1N6	705-726-9300	service@simcoe.ca
Township of Oro-Medonte	Director of Operations & Community Services	Mr.	Shawn	Binns	148 Line 7 South	Box 100	ORO	L0L 2X0	705-487-2171 ext. 2127	sbinns@oro-medonte.ca
Township of Oro-Medonte	Director of Corporate Services/Clerk	Ms.	Donna	Hewitt	148 Line 7 South	Box 100	ORO	L0L 2X0	705-487-2171 ext. 2132	dhewitt@oro-medonte.ca
Township of Ramara	Chief Administrative Officer	Mr.	John	Pinsent	2297 Highway 12	Box 130	BRECHIN	L0K 1B0	705-484-5374 ext. 222	jpinsent@ramara.ca
Township of Severn	Clerk	Ms.	Alison	Gray	1024 Hurlwood Lane	Box 159	ORILLIA	L3V 6J3	705-325-2315 ext. 232	agray@townshipofsevern.com
Township of Springwater - Public Works	Director of Public Works	Ms.	Heather	Coleman	2231 Nursery Road		MINESING	L9X 1A8	705-728-4784 ext. 2051	heather.coleman@springwater.ca
City of Orillia - Development Services and Engineering	Manager of Engineering and Transportation	Mr.	Wesley	Cyr	50 Andrew Street South	Suite 300	ORILLIA	L3V 7T5	705-325-2221	wcyr@orillia.ca
City of Orillia - Development Services and Engineering	General Manager of Developmental Services and Engineering	Mr.	Ian	Sugden	50 Andrew Street South	Suite 300	ORILLIA	L3V 7T5	705-329-7256	isugden@orillia.ca
City of Orillia - Environment and Infrastructure Services Department	General Manager Environment and Infrastructure Services Departmei	Mr.	Andrew	Schell	50 Andrew Street South	Suite 300	ORILLIA	L3V 7T5	705-325-7551	aschell@orillia.ca
City of Orillia - Fire Department	Fire Chief	Mr.	Brent	Thomas	50 Andrew Street South	Suite 300	ORILLIA	L3V 7T5	705-325-5889	bthomas@orillia.ca
City of Orillia - Waste and Environmental Management Advisory Committee	Assistant Clerk		Robin	Cadeau	50 Andrew Street South	Suite 300	ORILLIA	L3V 7T5	705-329-2452	rcadeau@orillia.ca
City of Orillia - Environmental Advisory Committee			Jane	Bonsteel	50 Andrew Street South	Suite 300	ORILLIA	L3V 7T5	705-329-2452	jmbonsteel@gmail.com
Local Agencies	**Job Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Simcoe County District School Board	Manager of Planning	Mr.	Andrew	Keuken	1170 Highway 26		MIDHURST	L0L 1X0	705-734-6363 ext. 11513	akeuken@scdsb.on.ca
Simcoe Muskoka Catholic District School Board	Manager of Planning and Properties	Ms.	Jennifer	Sharpe	46 Alliance Boulevard		BARRIE	L4M 5K3	705-722-3555 ext. 351	jsharpe@smcdsb.on.ca
Lake Simcoe Region Conservation Authority	Director, Planning & Development Services	Mr.	Rob	Baldwin	120 Bayview Parkway	Box 282	NEWMARKET	L3Y 4X1	905-895-1281	r.baldwin@lsrca.on.ca
Simcoe Muskoka District Health Unit	Medical Officer of Health	Mr.	Charles	Gardner	15 Sperling Drive		BARRIE	L4M 6K9	705-721-7520 ext. 6515	Charles.Gardner@smdhu.org
Orillia and District Construction Association				Sir/Madam	PO Box 235		ORILLIA	L3V 6J3	705-326-1844	
Provincial Agencies	**Job Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Ministry of the Environment, Conservation and Parks - Barrie District Office	Distrinct Manager	Ms.	Cindy	Hood	54 Cedar Pointe Drive	Unit 1201	BARRIE	L4N 5R7	705-309-5874	cindy.hood@ontario.ca
Ministry of the Environment, Conservation and Parks - Barrie District Office	Senior Environmental Officer	Mr.	Brad	Allen	54 Cedar Pointe Drive	Unit 1201	BARRIE	L4N 5R7	705-333-4346	brad.allen@ontario.ca
Ministry of the Environment, Conservation and Parks	Drinking Water Inspector	Ms.	Donna	Staniscia	54 Cedar Pointe Drive	Unit 1201	BARRIE	L4N 5R7	705-220-1773	donna.staniscia@ontario.ca
Ministry of the Environment, Conservation and Parks	Environmental Resource Planner & EA Coordinator	Ms.	Chunmei	Liu	135 St Clair Ave W	8th	TORONTO	M4V 1P5	416-326-4886	chunmei.liu@ontario.ca
Ministry of Municipal Affairs and Housing	Team Lead, Community Planning and Development	Mr.	Aldo	Ingraldi	8 Estate Lane		KINGSTON	K7M 9A8	613-545-2119	aldo.ingraldi@ontario.ca
Ministry of Natural Resources - Midhurst District	District Manager	Mr.	Dan L.	Thompson	2284 Nursery Road		MIDHURST	L9X 1N8	705-725-7561	dan.l.thompson@ontario.ca
Ministry of Natural Resources - Midhurst District	District Planner	Ms.	Kim	Benner	2284 Nursery Road		MIDHURST	L9X 1N8	705-725-7534	kim.benner@ontario.ca
Ministry of Transportation	Corridor Management Section, Central Region	Mr.	Peter	Dorton			DOWNSVIEW		416-235-4280	Peter.Dorton@ontario.ca
Ministry of Transportation	Project Engineer	Mr.	Justin	White	1202 Wilson Avenue	7th Floor, Building D	DOWNSVIEW	M3M 1J8	416.235.5609	justin.white@ontario.ca
Ministry of Transportation - Legal Services	Director	Ms.	Mary	Gersht	1203 Wilson Avenue	7th Floor, Building D	DOWNSVIEW	M3M 1J8	416-235-4406	mary.gersht@ontario.ca
Ministry of Indigenous Affairs - Indigenous Relations and Programs Division	Executive Advisor		Ayn	Cooney	160 Bloor St E	4th Floor	TORONTO	M7A 2E6	416-325-1067	ayn.cooney@ontario.ca
Ministry of Health and Long-term Care				Sir/Madam	393 University Ave.	21st Floor	TORONTO	M7A 2S1	416-326-3115	environmentalhealth@ontario.ca
Ministry of Heritage, Sport, Tourism and Culture - Sport, Recreation and Communi	Assistant Deputy Minister	Mr.	Steve	Harlow	777 Bay St, College Park 18th Flr		TORONTO	M7A 1S5	416-212-7397	steve.harlow@ontario.ca
Ontario Heritage Trust				Sir/Madam	10 Adelaide Street E	Suite 203	TORONTO	M5C 1J3	416-325-5000 *General Inquiries	
Infrastructure Ontario	President, Real Estate	Mr.	Toni	Rossi	1 Dundas Street West	Suite 2000	TORONTO	M5G 1Z3	416-314-0314	toni.rossi@infrastructureontario.ca
Federal Agencies	**Job Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Indigenous Services Canada - Sustainable Infrastructure Planning, Regional	Program Manager	Mr.	Derek	Nadeau	10 Wellington Street, North Tower,	18th floor	Gatineau, QC	K1A 0H4	613-608-8637	derek.nadeau@canada.ca
Environment and Climate Change Canada	Manager	Mr.	Rob	Dobos	867 Lakeshore Road	Box 5050	BURLINGTON	L7S 1A1	905-336-4953	
Fisheries and Oceans Canada, Eastern Ontario District - Small Craft Harbours	Regional Manager	Ms.	Chantal	Larochelle	867 Lakeshore Rd.		BURLINGTON	L7S 1A1	905-315-5280	chantal.larochelle@dfo-mpo.gc.ca
Parks Canada c/o Trent-Severn Waterway	Resource Management Officer II	Ms.	Hillary	Knack	34 Beckwith Street		SMITHS FALLS	K7A 2A8	613-283-7199 ext. 272	
Parks Canada c/o Trent-Severn Waterway	Senior Realty Advisor	Ms.	Beth	McEachern	2155 Ashburnham Drive		PETERBOROUGH	K9J 1P8	705-750-4924	
Transport Canada - Ontario Region (PHE)					4900 Yonge Street		NORTH YORK	M2N 6A5	416-952-0490	
Utilities	**Job Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Orillia Power Corporation				Sir/Madam	360 West Street South		ORILLIA	L3V 5G8		
Hydro One				Sir/Madam	483 Bay Street	10th Floor Reception	TORONTO	M5G 2P5		
Bell Canada	Manager	Ms.	Angela	Taylor	136 Bayfield Street, 2nd Floor		BARRIE	L4M 3B1	705-722-2442	angela.taylor@bell.ca
Union Gas				Sir/Madam	425 Memorial Avenue		ORILLIA	L3V6K2		
Rogers Cable Inc				Sir/Madam	1 Sperling Drive		BARRIE	L4M 6B8		
FIRST NATIONS GROUPS	**Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Beausoleil First Nation	Chief		Guy	Monague	11 O'Gemaa Miikaans		CHRISTIAN ISLAND	L0K1C0	705-247-2051	bfnchief@chimnissing.ca
Chippewas of Georgina Island	Chief		Donna	Big Canoe	R.R. #2	P.O. Box N-13	SUTTON WEST	L0E 1R0	705-437-1337	donna.bigcanoe@georginaisland.com
Chippewas of Mnjikaning First Nation (Rama)	Chief		Rodney	Noganosh	5884 Rama Road	Suite 200	RAMA	L3V 6H6	705-325-3611	rodneyn@ramafirstnation.ca
Curve Lake First Nation	Chief		Emily	Whetung-MacInnes	22 Winookeeda Road		CURVE LAKE	K0L 1R0	705-657-8045	EmilyW@curvelake.ca
Hiawatha First Nation	Chief		Laurie	Carr	123 Paudash Street		HIAWATHA	K0L 2G0	705-295-4421	chiefcarr@hiawathafn.ca
Mississaugas of Scugog Island First Nation	Chief		Kelly	LaRocca	22521 Island Road	RR# 5	PORT PERRY	L9L 1B6	905-441-4836	klarocca@scugogfirstnation.com
Moose Deer Point First Nation	Chief		Barron	King	3719 Twelve Mile Bay Road	PO BOX 119	MACTIER	P0C 1H0	705-375-5209	barron.king@moosedeerpoint.com
Wahta Mohawk Territory	Chief		Philip	Franks	2664 Muskoka Rd #38	PO BOX 260	BALA	P0C 1A0	705-762-2354	philip.franks@wahtamohawkscouncil.ca
Wasauksing First Nation	Chief		Warren	Tabobondung	PO Box 250	1508 Lane "G" Geewadin R	PARRY SOUND	P2A 2X4	705-746-2531	chief@wasauksing.ca
Georgian Bay Métis Council	President	Mr.	Greg	Garratt	355 Cranston Crescent	PO BOX 4	MIDLAND	L4R 4K6	705-526-6335	greggarratt@gmail.com
Moon River Métis Council	President	Mr.	Tony	Muscat	385A Bethune Drive North		GRAVENHURST	P1P 1B8	705-681-0782	tonymuscat@rogers.com
Williams Treaty First Nation	Coordinator/Barrister, Solicitor	Ms.	Karry	Sandy-McKenzie	8 Creswick Court		BARRIE	L4M 2J7	705-792-5087	k.a.sandy-mckenzie@rogers.com
OTHER	**Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Charter Construction Limited (Mariposa Homes)		Mr.	Henry	Glavic	650 Harvie Settlement Rd		ORILLIA	L3V 6H2	705-329-1992	hglavic@charterconstruction.ca
Inch Farm Lands Ltd.		Mr.		Yang	7300 Warden Avenue	Suite 405	MARKHAM	L3R 9Z6		hnzydq123@yahoo.ca
Titan Homes		Mr.	Lawrence	Saltzman			ORILLIA			ljsaltzman@rogers.com
Landen Homes		Mr.	Dennis	Bottero			ORILLIA			bottero@rogers.com

Orillia Water Master Plan Update
Class Environmental Assessment

PUBLIC INFORMATION CENTRE

ORILLIA

August 25, 2021

The **GOAL** is to update the 2015 Water System Master Plan (WMP) to:

- Identify water infrastructure upgrades needed to service existing customers and planned growth and intensification to the year 2050
- Optimize the water supply and distribution system to:
  - Continue to meet or exceed drinking water quality standards
  - Improve the system's resiliency and reliability
  - Improve the level of service (pressure, fire protection, water quality) where feasible

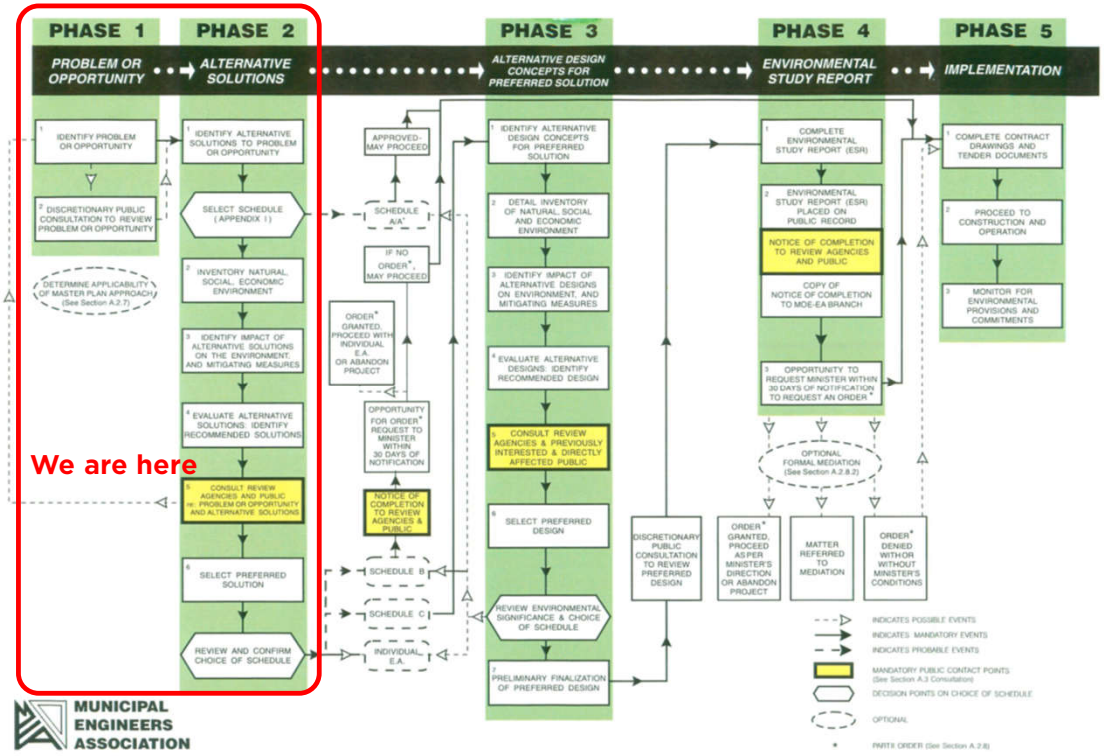
WMP UPDATE GOAL

OBJECTIVES

- Update the assessment of the City's existing water infrastructure (capacity, performance, condition and operation)
- Update the projected water demands to the year 2050
- Update and calibrate the hydraulic model of the water distribution system
- Determine the infrastructure needed to meet future water demands and maintain or improve system performance, operation, reliability and resiliency
- Prioritize and estimate costs of recommended water infrastructure projects
- Consult with the public, agencies and stakeholders on alternative solutions

The Orillia WMP Class EA is proceeding through Phases 1 and 2 of the MEA Municipal Class EA process

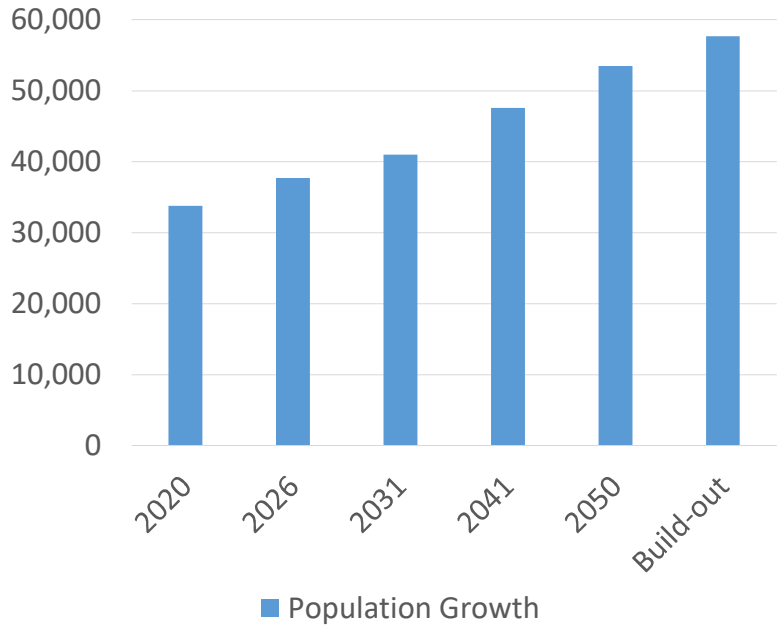
- Phase 1:
  - Serviced population and employment land projections
  - Projected water demands
  - Infrastructure assessment
- Phase 2:
  - Servicing solutions
  - Recommended infrastructure upgrades
  - Master Plan Report

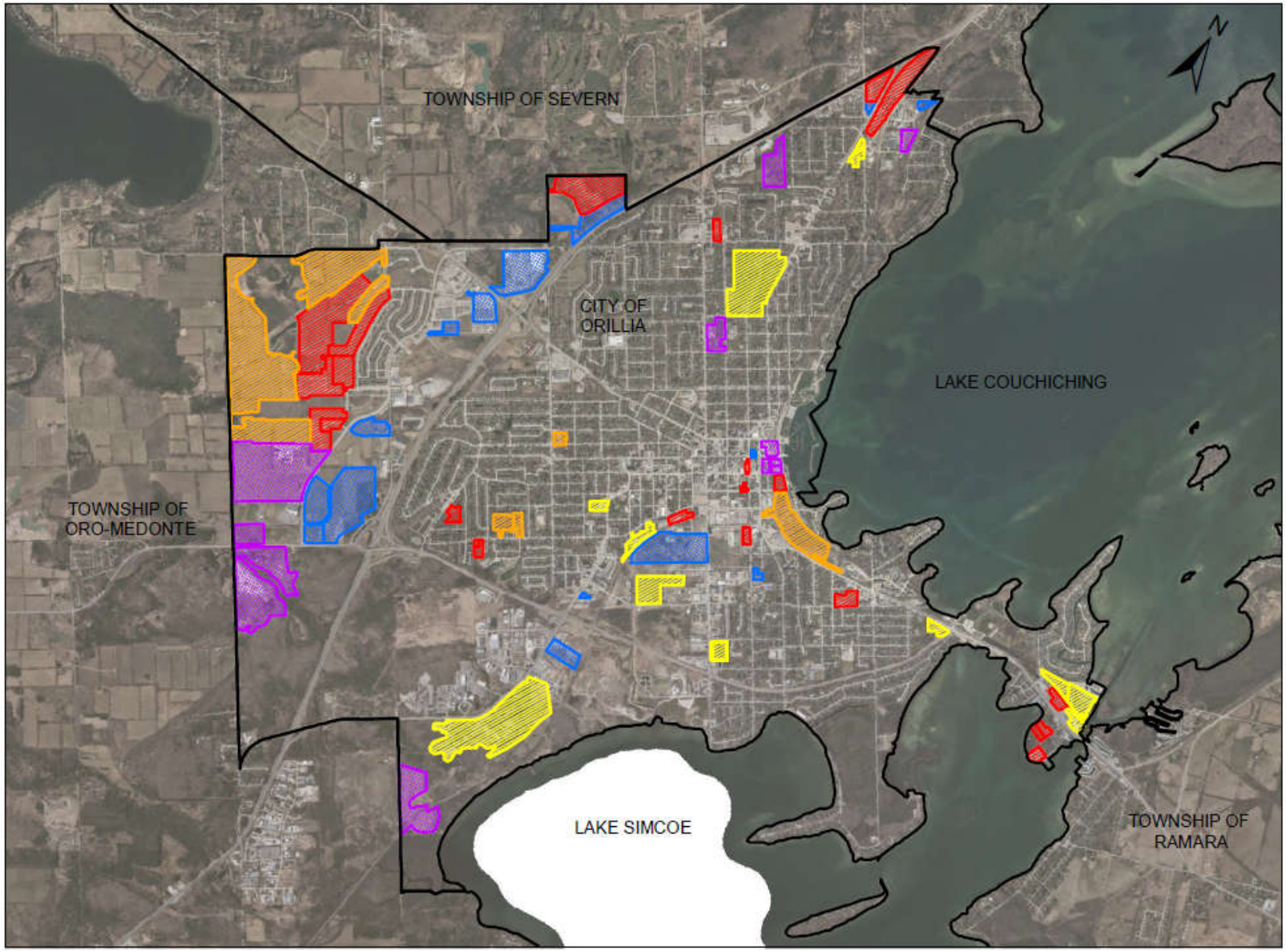


MASTER PLAN CLASS EA PROCESS

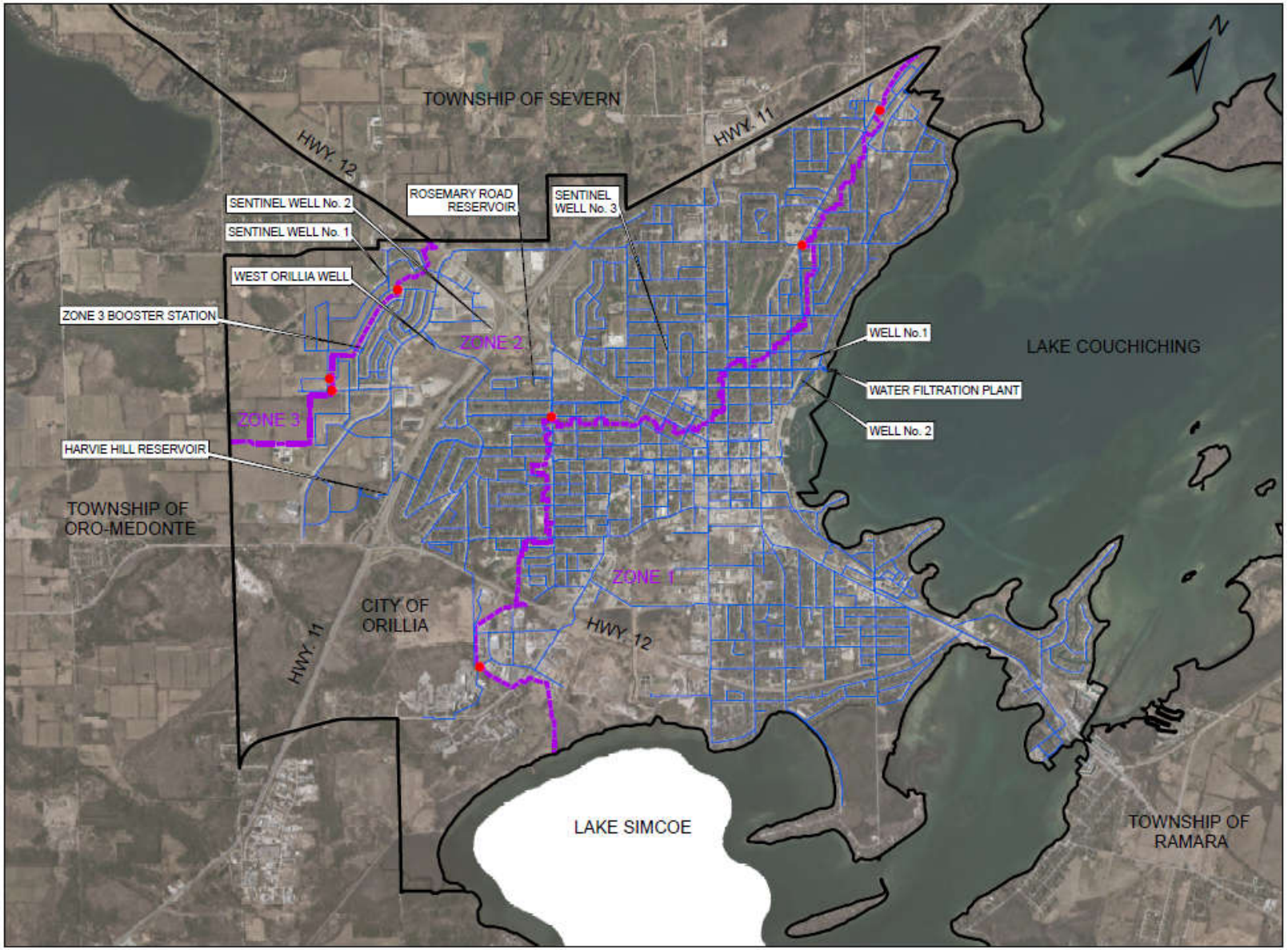
Existing and growth projection for population and employment lands

- Existing:
  - Approx. 33,000 residents
  - 200 ha of employment lands
- By 2050:
  - Population of 53,500
  - 392 ha of employment lands
- At build-out (all potential growth):
  - Population of 57,670
  - 432 ha of employment lands





AREAS OF POTENTIAL FUTURE GROWTH



EXISTING WATER INFRASTRUCTURE

Raw water sources and treatment

- Lake Couchiching, Well No. 1 and Well No. 2 – treated at the Water Filtration Plant
- West Orillia Well – treated by chlorination at the well

Treated water reservoirs

- Water Filtration Plant clearwell
- Rosemary Road Reservoirs
- Harvie Hill Reservoir

Water distribution system

- 3 pressure zones
- 185 km of watermains
- 1 booster pumping station
- 7 pressure reducing valves

EXISTING WATER INFRASTRUCTURE

Historical water production and consumption (2016 to 2020)

- Residential consumption: 232 L/p/day
- Non-residential consumption: 18,700 L/ha/day

- Average Day Demand: 11,067 m^3/day
- Max. Day Demand: 16,797 m^3/day

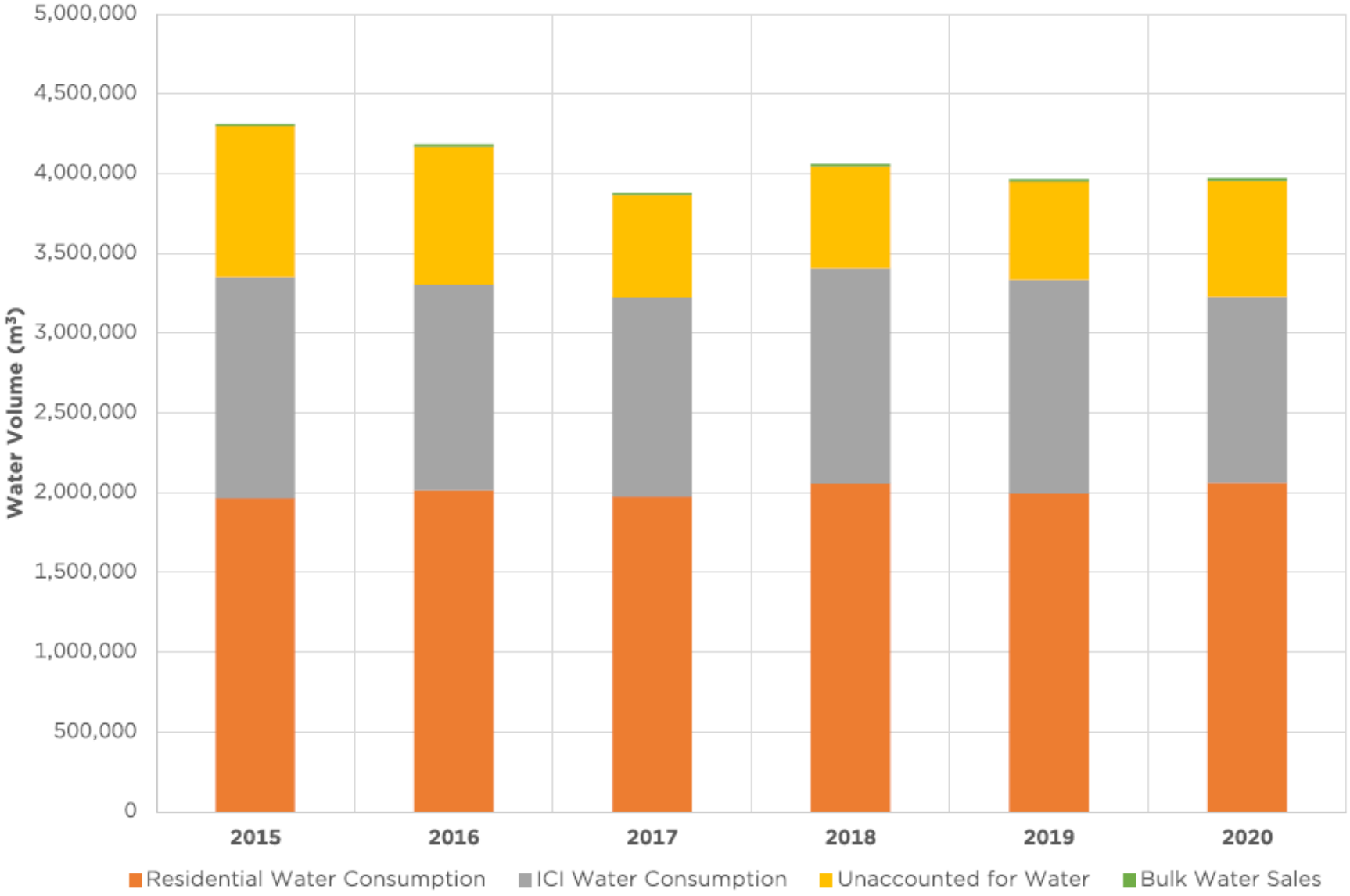
Design water consumption rates

- Residential: 250 L/p/day
- Employment lands: 20,000 L/ha/day

Projected water demands at build-out

- Average Day Demand: 21,964 m^3/day
- Max. Day Demand: 33,143 m^3/day
- Doubling of current water demands

HISTORICAL AND PROJECTED WATER DEMANDS



HISTORICAL WATER PRODUCTION, CONSUMPTION AND LOSSES

Water Supply

- The Orillia Water Filtration Plant (WFP) and West Orillia Well (WOW) can supply the projected water demands to build out

Issue

- Existing water supply firm capacity (with WOW and largest filter at WFP out of service) is insufficient to meet future projected maximum day demands

	Ex. Total Capacity (m^3/day)	Ex. Firm Capacity (m^3/day)	Future Capacity Needed (m^3/day)	Firm Capacity Shortfall (m^3/day)
WFP	33,042	25,309		
WOW	6,550	0		
TOTAL	39,592	25,309	33,143	**7,834**

Potential solutions

- Build additional groundwater wells
- Expand WFP

Considerations

- WFP cannot be expanded without major modifications; very limited space on site
- Firm capacity shortfall is caused by absence of stand-by well for WOW

Preliminary preferred solutions

- Add two wells: one in the WOW well field; one near boundary of Pressure Zones 1 and 2. Locations to be confirmed by detailed groundwater supply study
- Optimize filtration process to increase WFP capacity when one filter is off-line

Estimated project costs: $1.3 M

WATER SUPPLY - NEEDS/ISSUES AND POTENTIAL SOLUTIONS

Water Treatment

- WFP produces safe drinking water that meets or exceeds all requirements of the Municipal Drinking Water License and Ontario Drinking Water Quality Standards

Issues

- Taste and odour from chlorine and in late summer. Taste and odour producing compounds from lake are noticeable at very low concentrations
- Residual level of aluminium (from coagulant addition) is slightly above the operational objective

Preliminary preferred solution

- Optimize type, depth and replacement frequency of granular activated carbon (GAC) filter media to maintain high level of taste and odour reduction
- Optimize coagulant dosage
- Optimize chlorine dosage at WFP and evaluate feasibility of rechlorination stations

Estimated project costs: $150,000

WATER TREATMENT - NEEDS/ISSUES AND POTENTIAL SOLUTIONS

Pumping

- WFP's high lift pumps to Pressure Zones (PZ) 1 and 2 and reservoirs have sufficient firm capacity to supply projected future water demands
- Zone 3 Booster Pumping Station (BPS) constructed in 2017, was designed to be expanded when needed

Issue

- Expansion of Zone 3 BPS will be needed to meet future water demands in PZ 3

Preliminary preferred solution

- Expand Zone 3 BPS in 2 phases

Estimated project costs: $1,050,000

Left: Zone 3 Booster Pumping Station

PUMPING - NEEDS/ISSUES AND POTENTIAL SOLUTIONS

Water Storage

- The water reservoirs and WFP clearwell provide sufficient usable storage volume for the existing serviced population

Issues

- There will be a storage volume shortage of approximately 8,000 m^3 for the build-out population
- The Harvie Hill standpipe is in poor structural condition and cannot be utilized to its full height
- There is no water storage reservoir in PZ 3, which relies primarily on the Harvie Hill reservoir for peak water demands and fire protection

WATER STORAGE - NEEDS/ISSUES AND POTENTIAL SOLUTIONS

Alternative solutions

1. Do Nothing
2. Replace Harvie Hill standpipe and add 18 m tall standpipes on site when needed
3. Replace Harvie Hill standpipe and add standpipes on site when needed, and build a 38 m tall standpipe in Clayt French Park

Above: Example for Alt. 2 (Standpipe installed in Colborne DWS)

Right: Example for Alt. 3 (Tall standpipe installed in East Linton DWS)

Screened Out Alternatives	Rationale
Refurbish Harvie Hill standpipe	Needs extensive repairs and ongoing maintenance
Build an in-ground reservoir and booster pumping station at Harvie Hill site	Not hydraulically compatible with existing water distribution system with floating storage
Build an in-ground reservoir at Zone 3 BPS	No available space at site

Preliminary Evaluation of Storage Alternatives

ALTERNATIVES	1	2	3
Criteria	**Do Nothing**	**3 Standpipes at Harvie Hill**	**3 Standpipes at Harvie Hill & 1 Standpipe in Clayt French Park**
Addresses Problem	No	Yes	Yes
Environmental Impacts	None	Removal of landscaping trees	As per Alt. 2 None at the Park
Cultural Impacts	None	No archaeological resources	No archaeological resources
Impacts on Residents	None	Visual impact from more standpipes	As per Alt 2 and tall tank highly visible and reduces recreation space at Park
Water Supply Impacts	No improvement to water system pressures	Improves water pressures and fire & emergency supply in PZ2 and PZ3	As per Alt. 2 and minimizes delay for supply of emergency water to PZ3
Operation & Maintenance	Structural repairs and ongoing O & M	Low O & M requirements	Additional O & M
Estimated Costs	Repair costs	$7.8M	$8.8M
		Preliminary Preferred	

Legend

- Very positive
- Positive
- No impact
- Minor negative
- Negative

WATER STORAGE – ASSESSMENT OF ALTERNATIVES

Water Distribution System

- Supplies water pressures that meet City standards and Ministry of the Environment, Conservation and Parks (MECP) guidelines
- Can supply fire flows that meet City requirements and exceed Fire Underwriters Survey (FUS) guidelines
- Maintains adequate chlorine residuals
- Is adequate to distribute water for the projected developments and growth

Issues

- Some areas with lower water pressure and available fire flows
- Some watermain dead ends with lower available fire flows and stagnant water
- Some undersized watermains
- Some areas with critical customers vulnerable to a watermain break
- Some operational concerns with pressure control between pressure zones

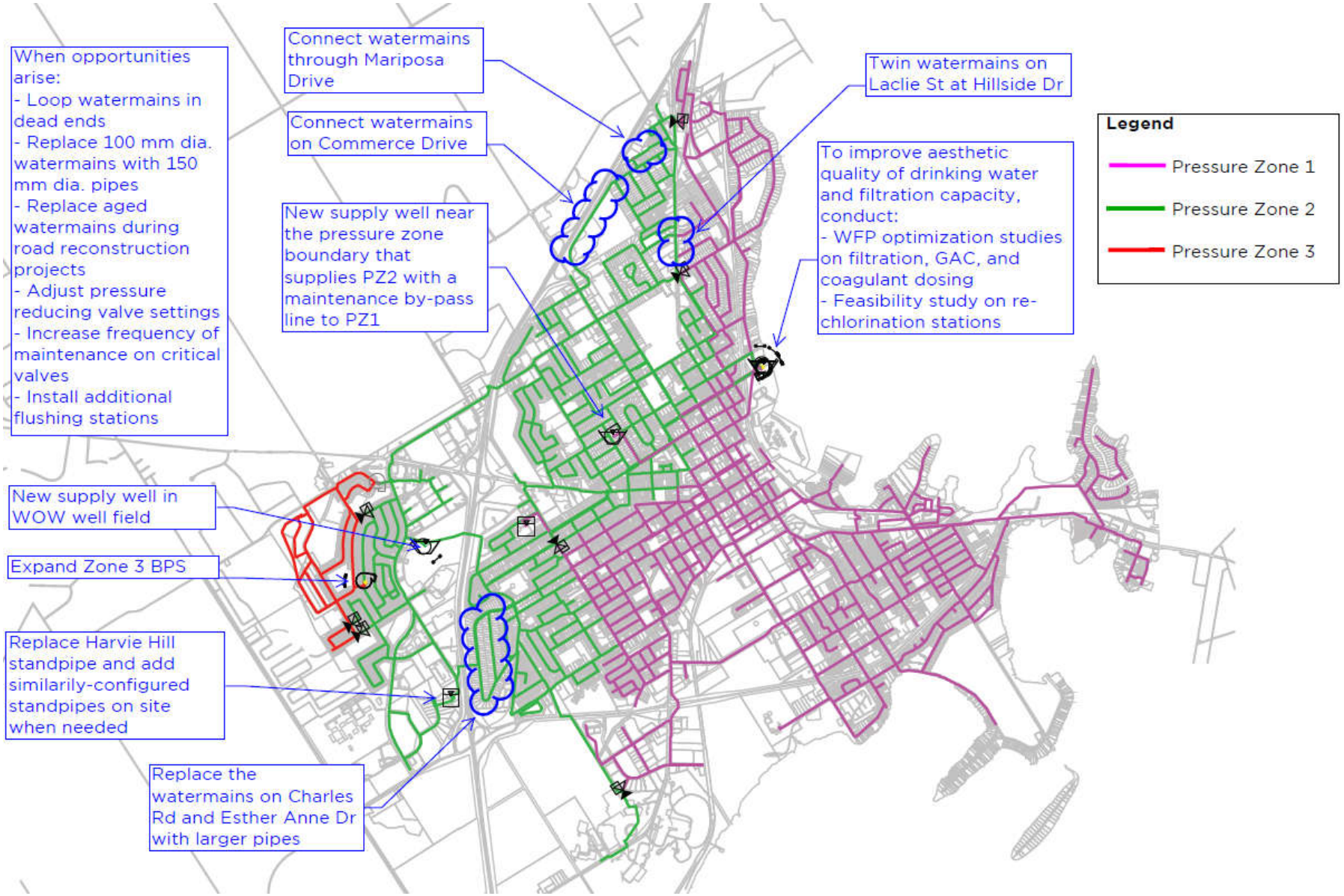
Preliminary preferred solutions

- Replace watermains on Charles Road & Esther Anne Drive with 200 mm diam. pipes
- Improve system resiliency by:
  - Connecting watermains through Mariposa Drive
  - Connecting watermains on Commerce Drive around Kubota
  - Replacing or twinning watermains on Laclie Street at Hillside Drive
  - Adding groundwater supply line from future well to PZ1

Estimated project costs: $2.5 M

Other recommendations:

- Loop watermains where/when opportunities arise
- Replace 100 mm diam. watermains with 150 mm diam. watermains
- Replace aged watermains during road reconstruction projects
- Adjust pressure reducing valve settings
- Increase frequency of maintenance on critical valves
- Install additional flushing stations



SUMMARY OF PROPOSED UPGRADES

Next steps in Class EA process

- Obtain and review comments from the public, agencies and stakeholders
- Incorporate comments into assessment of alternative solutions
- Prepare draft Water Master Plan Update Report – October 2021
- Issue WMP Report and Notice of Completion
- 30-day public and agency review period

Please fill in a comment sheet and submit to us by September 24, 2021

THANK YOU FOR YOUR INPUT!

From:	Suzanne Troxler
To:	Dorton, Peter (MTO)
Cc:	"SGendron@orillia.ca"; Akhtar, Usman (MTO); Robin Deduro
Subject:	RE: Orillia Water Master Plan Update - Notice of PIC (120063)
Date:	September 16, 2021 4:20:00 PM
Attachments:	image003.png image004.png image005.gif image006.png image007.png

Peter,
Thank you for your input. We will include this consideration in the Master Plan Report so that it is taken into account when it reaches the design stage.

Suzanne

Suzanne Troxler, B.Eng., M.Sc., P.Eng.
Manager – Water & Wastewater Engineering

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From: Dorton, Peter (MTO) <Peter.Dorton@ontario.ca>
Sent: Thursday, September 16, 2021 3:04 PM
To: Suzanne Troxler <stroxler@tathameng.com>
Cc: 'SGendron@orillia.ca' <SGendron@orillia.ca>; Akhtar, Usman (MTO) <Usman.Akhtar@ontario.ca>
Subject: RE: Orillia Water Master Plan Update - Notice of PIC (120063)

Hi Suzanne:

I had a look at the presentation materials and the only comment I have concerns the future WM on Commerce Dr.. As this road parallels Highway 11, we recommend, and assume, that the future WM will be located on the east side (non – highway side), to avoid any potential

future conflicts should Highway 11 ever be widened (there are no current plans for widening). Please share with us future detail design drawings for these works on Commerce Dr..

Thanks,
Peter Dorton
Senior Project Manager
Ministry of Transportation
Central Operations, Highway Corridor Management Section
159 Sir William Hearst Avenue, 7th Floor
Toronto, ON M3M 0B7
Cell: (437) 833 - 9396
E-Mail: peter.dorton@ontario.ca
Web: www.mto.gov.on.ca/english/engineering/management/corridor

---

From: Suzanne Troxler <stroxler@tathameng.com>
Sent: August 11, 2021 3:39 PM
To: Dorton, Peter (MTO) <Peter.Dorton@ontario.ca>
Cc: 'SGendron@orillia.ca' <SGendron@orillia.ca>
Subject: RE: Orillia Water Master Plan Update - Notice of PIC (120063)

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Peter,

Thank you for getting back to us.

In the list of proposed infrastructure upgrades, there are no works proposed on or crossing Highway 11 or Highway 12.
The closest to the highways is a project to install watermains on Commerce Road, which is immediately to the east of Highway 11 at the north end of the City. The general location of this project is shown on a figure in the PIC presentation slides.

Sincerely,

Suzanne

Suzanne Troxler, B.Eng., M.Sc., P.Eng.
Manager – Water & Wastewater Engineering

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From: Dorton, Peter (MTO) <Peter.Dorton@ontario.ca>
Sent: Wednesday, August 11, 2021 3:04 PM
To: Suzanne Troxler <stroxler@tathameng.com>
Cc: 'SGendron@orillia.ca' <SGendron@orillia.ca>
Subject: RE: Orillia Water Master Plan Update - Notice of PIC (120063)

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Hi Suzanne.

Before I have a look at the PIC materials (after Aug. 25), could you please confirm / respond to comments I sent in attached email.

Thanks,
Peter Dorton
Senior Project Manager
Ministry of Transportation
Central Operations, Highway Corridor Management Section
159 Sir William Hearst Avenue, 7th Floor
Toronto, ON M3M 0B7
Cell: (437) 833 - 9396
E-Mail: peter.dorton@ontario.ca
Web: www.mto.gov.on.ca/english/engineering/management/corridor

From: Suzanne Troxler <stroxler@tathameng.com>
Sent: August 11, 2021 11:43 AM
To: Ingraldi, Aldo (MMAH) <Aldo.Ingraldi@ontario.ca>; Alison Gray <agray@townshipofsevern.com>; Andrew Keuken <akeuken@scdsb.on.ca>; Andrew Schell <aschell@orillia.ca>; Angela Taylor <angela.taylor@bell.ca>; Cooney, Ayn (IAO) <Ayn.Cooney@ontario.ca>; Barron King <barron.king@moosedeerpoint.com>; Allen, Brad (MECP) <Brad.Allen@ontario.ca>; Brenda Clark <service@simcoe.ca>; Brent Thomas <bthomas@orillia.ca>; Chantal Larochelle <chantal.larochelle@dfo-mpo.gc.ca>; Charles Gardner <Charles.Gardner@smdhu.org>; Liu, Chunmei (MECP) <Chunmei.Liu@ontario.ca>; Hood, Cindy (MECP) <cindy.hood@ontario.ca>; Thompson, Dan L. (MNRF) <Dan.L.Thompson@ontario.ca>; Dennis Bottero <bottero@rogers.com>; Derek Nadeau <derek.nadeau@canada.ca>; Donna Big Canoe <donna.bigcanoe@georginaisland.com>; Donna Hewitt <dhewitt@oro-medonte.ca>; Staniscia, Donna (MECP) <Donna.Staniscia@ontario.ca>; Emily Whetung-MacInnes <EmilyW@curvelake.ca>; Greg Garratt <greggarratt@gmail.com>; Guy Monague <bfnchief@chimnissing.ca>; Heather Coleman <heather.coleman@springwater.ca>; Henry Glavic <hglavic@charterconstruction.ca>; Ian Sugden <isugden@orillia.ca>; Jane Bonsteel <jmbonsteel@gmail.com>; Jennifer Sharpe <jsharpe@smcdsb.on.ca>; John Pinsent <jpinsent@ramara.ca>; White, Justin (MTO) <Justin.White@ontario.ca>; Karry Sandy-McKenzie <k.a.sandy-mckenzie@rogers.com>; Kelly LaRocca <klarocca@scugogfirstnation.com>; Benner, Kim (MNRF) <kim.benner@ontario.ca>; Laurie Carr <chiefcarr@hiawathafn.ca>; Lawrence Saltzman <ljsaltzman@rogers.com>; Gersht, Mary (MTO) <Mary.Gersht@ontario.ca>; @MOH-G-Environmental Health <EnvironmentalHealth@ontario.ca>; Dorton, Peter (MTO) <Peter.Dorton@ontario.ca>; Philip Franks <philip.franks@wahtamohawkscouncil.ca>; Rick Evans <grayapprentice@sympatico.ca>; Rob Baldwin <r.baldwin@lsrca.on.ca>; Robin Cadeau <rcadeau@orillia.ca>; Rodney Noganosh <rodneyn@ramafirstnation.ca>; Shawn Binns <sbinns@oro-medonte.ca>; Harlow, Steve (MHSTCI) <Steve.Harlow@ontario.ca>; Rossi, Toni (IO) <Toni.Rossi@infrastructureontario.ca>; Tony Muscat <tonymuscat@rogers.com>; Warren Tabobondung <chief@wasauksing.ca>; Wesley Cyr <wcyr@orillia.ca>; Yang <hnzydq123@yahoo.ca>
Cc: Stephen Gendron <SGendron@orillia.ca>; Robin Deduro <rdeduro@tathameng.com>; Brooke Forward <bforward@orillia.ca>
Subject: Orillia Water Master Plan Update - Notice of PIC (120063)

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The City of Orillia is undertaking a Master Plan Class EA study to update its Water Master Plan.

A virtual PIC will be posted on the City's website on August 25, 2021 for 30 days, as per the attached Notice.

We look forward to receiving your comments and/or questions on the study findings and preliminary conclusions. Comments can be provided on the on-line comment form or by email to the project contacts. Comments received up to September 24, 2021 will be considered in the study.

Regards,

Suzanne Troxler, B.Eng., M.Sc., P.Eng.
Manager – Water & Wastewater Engineering

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115 Sandford Fleming Drive, Suite 200 | Collingwood | Ontario | L9Y 5A6
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ORILLIA

Corporate Services Department
Clerk's Division

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50 Andrew St. S., Suite 300,
Orillia, ON L3V 7T5

To: Stephen Gendron, Manager of Environmental Engineering, Assets and Capital Projects

Copy to: Wes Cyr, Manager of Engineering and Transportation
Ian Sugden, General Manager of Development Services and Engineering
Andrew Schell, General Manager of Environment and Infrastructure Services

From: Robin Cadeau, Assistant Clerk
on behalf of the **Environmental Advisory Committee**

Date: September 22, 2021

Subject: **Water Master Plan**

The following is a copy of a recommendation adopted by the Environmental Advisory Committee (EAC) at its meeting held on September 21, 2021:

> *"THAT, further to the City of Orillia Notice dated August 11, 2021 regarding the Class Environmental Assessment for the Water Master Plan, the Environmental Advisory Committee provides the following comments:*
>
> - *The master plan needs to consider water services using a coordinated, integrated and holistic approach with other municipal planning (eg. asset management planning, climate change planning, wastewater and stormwater management planning)*
> - *It should consider establishing conservation goals (i.e. per capita/per day targets/thresholds) and address things like education regarding the efficient use of water, water conservation practices for all users – residential, commercial and industrial/institutional users*
> - *It should plan and prioritize to address and rectify old infrastructure that impacts number of breaks, unaccounted water and ensure the plan references and measures the appropriateness of the existing leak detection program*
> - *The plan should address water quality considerations (i.e. improved appearance, odour and taste)*
> - *Timelines, annual budgeting and rate-setting could be referenced and priorities could be identified within the plan to allow for consideration of the possibility of moving improvements forward more quickly"*

The Committee would like to formally submit these comments to the ongoing Class Environmental Assessment process and to be included in future notifications.

Thank you for attending to discuss this matter with the Committee.

:rc

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File 120063

September 28, 2021

Robin Cadeau
Assistant Clerk
Environmental Advisory Committee
City of Orillia
50 Andrew Street S., Suite 300
Orillia, Ontario L3V 7T5
clerks@orillia.ca

Re: Orillia Water Master Plan Update,
Response to Comments on PIC

Members of EAC:

Thank you for taking the time to review the Public Information Centre presentation for the Orillia Water Master Plan Update and to submit comments. We have reviewed the EAC's comments and discussed them with the study team. We wish to respond to the EAC's comments, attached for reference, as follows.

Comments Bullet 1. The Water Master Plan Update is being prepared as an update to the 2015 Water System Master Plan. In accordance with the specified scope, the Water Master Plan Update's main goal is to review the drinking water supply and distribution system and identify how the system will need to be upgraded and optimized to continue to serve its customers as the City grows. It is not intended to also encompass stormwater and wastewater planning. We understand that the City is considering preparing concurrent water and wastewater master plan updates for the next iteration, and a Stormwater Master Plan is currently underway. The Water Master Plan Update report, which is currently in preparation, will address climate change and asset management.

Comments Bullet 2. This Water Master Plan Update reviewed water consumption data from 2016 to 2020 to establish appropriate criteria for planning infrastructure upgrades. Although there has been a general trend of gradually lower domestic water consumption, there are also variations from year to year that are caused by the weather; hot and dry summers often result in more water use, which is reflected in the annual average water consumption. Infrastructure

planning cannot be based on a water consumption goal that may not be met because of factors that are outside the City's control. It must be based on realistic but slightly conservative criteria to ensure that the water supply infrastructure meets the needs of its customers. The Water Master Plan Update will comment on the City's 2014 Water Conservation and Efficiency Plan's recommendations and suggest they be implemented to reduce water consumption and delay the need for growth-based additional infrastructure.

Comments Bullet 3. As part of the Water Master Plan Update, the 2015 watermain database and risk assessment, which assigns a risk factor to each watermain based on multiple criteria, was updated. Watermains with high risk factor are prioritized for repair and replacement. The City's plans for road reconstruction projects will also include watermain replacements and upgrades where needed. The Water Master Plan Update report will comment on the City's leak detection program and make recommendations.

Comment Bullet 4. The Water Master Plan Update has reviewed the performance of the City's water treatment systems against the Ontario Drinking Water Quality Standards as well as aesthetic, non-health-related objectives. The report will include recommendations for optimization of the treatment systems to improve the taste and odour of the drinking water.

Comment Bullet 5. The Water Master Plan Update Report will present the estimated project costs for all recommendations and their priority, from immediate to when required based on growth/water demands, capacity and condition. It is not in the scope of the Water Master Plan Update to set water rates; this is completed by economic consultants and City staff as part of the City of Orillia Financial Plan.

We will take all your comments in consideration in the preparation of the Water Master Plan Update Report. The final draft of the Report will be made available for comments. We look forward to your input at that time.

Please do not hesitate to contact us or Stephen Gendron at sgendron@orillia.ca or 705-325-2212 if you have any further comments or questions.

Yours truly,
Tatham Engineering Limited

Suzanne Troxler, B.Eng., M.Sc., P. Eng.
Manager of Water & Wastewater Engineering
st:pt

copy:	Stephen Gendron	City of Orillia	sgendron@orillia.ca
	Greg Preston	City of Orillia	gpreston@orillia.ca
	Laura Smit	City of Orillia	lsmit@orillia.ca

I:\2020 Projects\120063 - Orillia Water Master Plan Update\Documents\Consultation\PIC\Responses to Comments\EAC Response.docx

ORILLIA

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To: Stephen Gendron, Manager of Environmental Engineering, Assets and Capital Projects

Copy to: Wes Cyr, Manager of Engineering and Transportation
Ian Sugden, General Manager of Development Services and Engineering
Andrew Schell, General Manager of Environment and Infrastructure Services

From: Robin Cadeau, Assistant Clerk
on behalf of the **Environmental Advisory Committee**

Date: September 22, 2021

Subject: **Water Master Plan**

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> *"THAT, further to the City of Orillia Notice dated August 11, 2021 regarding the Class Environmental Assessment for the Water Master Plan, the Environmental Advisory Committee provides the following comments:*
>
> - *The master plan needs to consider water services using a coordinated, integrated and holistic approach with other municipal planning (eg. asset management planning, climate change planning, wastewater and stormwater management planning)*
> - *It should consider establishing conservation goals (i.e. per capita/per day targets/thresholds) and address things like education regarding the efficient use of water, water conservation practices for all users – residential, commercial and industrial/institutional users*
> - *It should plan and prioritize to address and rectify old infrastructure that impacts number of breaks, unaccounted water and ensure the plan references and measures the appropriateness of the existing leak detection program*
> - *The plan should address water quality considerations (i.e. improved appearance, odour and taste)*
> - *Timelines, annual budgeting and rate-setting could be referenced and priorities could be identified within the plan to allow for consideration of the possibility of moving improvements forward more quickly"*

The Committee would like to formally submit these comments to the ongoing Class Environmental Assessment process and to be included in future notifications.

Thank you for attending to discuss this matter with the Committee.

:rc

From: Jane Bonsteel
To: SGendron@orillia.ca; Suzanne Troxler
Subject: Orillia Water Master Plan comments
Date: September 22, 2021 11:17:16 AM
Attachments: Water Master Plan comments Sept 2021.docx

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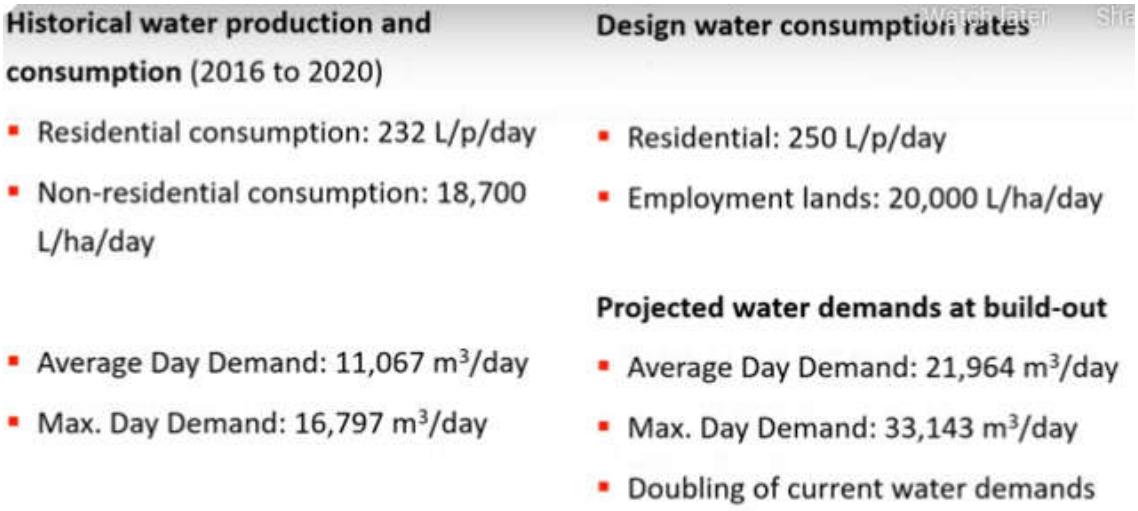
I have attached my comments on this stage of the Water Master Plan review.

Best regards,
Jane Bonsteel

Comments regarding Orillia's Water Master Plan Update - September 2021

From: Jane Bonsteel

1. **Water Use**



Why are the per capita water use rate and the employment land water use projected to rise? Even without a water efficiency education campaign, per capita water demands are falling as water efficient appliances replace older models. With a water efficiency campaign, water use can be reduced further. The Region of Waterloo plan predicts a decrease in water use from 202 to 168 litres per capita per day by 2025. Likewise, commercial, institutional and industrial water use is falling as the benefits of water efficiency are realized.

Although the population is expected to increase, there should certainly not be a doubling of water demand, as this slide suggests - per capita water use and commercial/institutional/industrial water use per hectare should actually fall. Maximum Day could also be reduced significantly with public education.

I understand that planning has to be somewhat conservative, but predicting an increase, or even using current levels is unnecessary. I suggest a recalculation of water demands based on more sustainable water use goals, especially in light of the 'Orillia's Climate Future' project currently underway.

2. **Water quality and Consumer Confidence**

My background is in water treatment process design and optimization and I believe there are opportunities for improvement at the WTP. There seems to be widespread dissatisfaction with the taste and odour of Orillia's (surface) water at certain times of the year. I have noticed taste and odour issues not only in late summer/fall, but also in mid-winter when there is a thaw. T&O research has advanced since the GAC was added to the filters over 20 years ago. A process review and study should be undertaken by a process specialist to determine the optimal path forward with regard to T&O and natural organic matter control in order to improve the aesthetic quality of the water and restore consumer confidence.

The presentation mentions reducing coagulant use in response to aluminum residuals, but a comprehensive review including testing of other coagulants, coagulant aids, enhanced coagulation

for NOM control, modified filter operations, biological filtration, flocculation operations etc. would seem to be in order.

There is no information in the Master Plan and very little in any of the publicly available reports on-line about Wells 1 and 2. How much are these wells used? What is the raw water quality of these wells? What is the status of the contaminants: are they legacy contaminants? Are the levels increasing or decreasing over time? How effective are the aerators? Is the treated water quality of the well water acceptable or is blending used to produce acceptable water quality?

3. **Unaccounted for Water**

There is no information in the presentation about unaccounted-for water. What is the current percentage of unaccounted-for water? What is the watermain breakage rate? Is the current leak detection program sufficient? Should there be a cost-benefit analysis of reducing leaks?

4. **Integrated Planning**

Drinking water planning should not be done in isolation. Stormwater, which has a big impact on the Lake Couchiching source, should be integrated with water planning. Source Water Protection should also be addressed in the Water Master Plan. Wastewater and drinking water planning, so closely linked, should also be integrated.

5. **Asset Management**

How does the Master Plan fit with asset management, capital project plans and with the Financial Plan?

Deb Fitzsimmons

From: Suzanne Troxler
Sent: Wednesday, September 29, 2021 5:40 PM
To: Jane Bonsteel
Cc: Stephen Gendron; Laura Smit; Greg Preston
Subject: Water Master Plan Update PIC - Comments (120063)
Attachments: Bonsteel Response.pdf

Ms Bonsteel,

Thank you for your comments. Please find attached our responses to your comments.

Please do not hesitate to contact me if you have any further comments or questions.

Sincerely,

Suzanne Troxler, B.Eng., M.Sc., P.Eng.
Manager – Water & Wastewater Engineering

Tatham Engineering Limited
115 Sandford Fleming Drive, Suite 200 | Collingwood | Ontario | L9Y 5A6
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TATHAM ENGINEERING

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File 120063

September 28, 2021

Jane Bonsteel
jmbonsteel@gmail.com

Re: Orillia Water Master Plan Update,
Response to Comments on PIC

Dear Ms. Bonsteel:

Thank you for your comments on the Public Information Centre presentation for the Orillia Water Master Plan Update. We have reviewed your comments, attached for reference, and discussed them with the study team. Our responses are as follows. We note that further information and analysis will be presented in the Water Master Plan Update Report, which will be available for review upon completion of the Class EA study.

1. Water Use

The Water Master Plan Update is not based on a projection that the per capita water consumption is rising. It is based on the water consumption data from 2016 to 2020 that varied annually between 253 L/c/day and 220 L/c/day. A criterion of 250 L/c/day was selected to calculate the infrastructure needs as it reflected recent data and was slightly conservative for planning purposes. Although there has been a general trend of gradually lower water consumption, there are also variations from year to year, some of which are caused by the weather; hot and dry summers often result in more water use, which is reflected in the annual average water consumption. The water demand maximum day factor in Orillia has ranged from 1.3 to 1.5 in the past five years. This is a low value based on the City's population and is not expected to lower until the population increases significantly. The ICI water consumption for 2016 to 2020 was analyzed and found to vary by up to 10% from year to year. The historical variations were considered in the selection of the criteria for planning purposes. Overall, lower than recent average values were not assumed for planning future infrastructure needs because

it could put at risk the City's ability and responsibility to meet the drinking water needs of its customers.

The Water Master Plan will be updated in five years, at which time recent trends in water consumption will be re-evaluated, the needs for additional infrastructure and their timeline will be re-assessed, and the overall plan will be adjusted as needed.

2. Water Quality and Consumer Confidence

The Water Master Plan Update has reviewed the performance of the City's water treatment systems against the Ontario Drinking Water Quality Standards as well as aesthetic, non-health-related objectives. We agree that there are opportunities for optimization of the water treatment processes to improve the treated water quality. Optimization studies will be recommended in the Water Master Plan Update Report.

The Report will present information on Wells 1 and 2 and the West Orillia Well. As brief answers to your questions, water from Wells 1 and 2 contribute 4% and the West Orillia Well contributes 21% of the raw water supply, on average. The groundwater from Wells 1 and 2 has good quality except for TCE and PCE, which are effectively removed through air strippers to below the ODWS. Treated groundwater from Wells 1 and 2 is chlorinated at the Water Filtration Plant. Groundwater at the West Orillia Well only needs chlorination.

3. Unaccounted for Water

Between 2016 and 2020, the annual volume of unaccounted water ranged from 615,000 m^3 to 863,000 m^3. On average, the volume of unaccounted water represented 17% of the total volume of water produced. It is attributed to unbilled customers, watermain flushing and fire protection and watermain leaks. The Water Master Plan Update report will comment on the City's leak detection program and make recommendations.

4. Integrated Planning

The Water Master Plan Update is being prepared as an update to the 2015 Water System Master Plan. In accordance with the specified scope, the Water Master Plan Update's main goal is to review the drinking water supply and distribution system and identify how the system will need to be upgraded and optimized to continue to serve its customers as the City grows. It is not intended to also encompass stormwater and wastewater planning. We understand that the

City is considering preparing concurrent water and wastewater master plan updates for the next iteration.

We appreciate your comment regarding the link between stormwater and wastewater management and source water protection; it will be made in the Report. We note however that source water protection was not a specified issue of this Water Master Plan Update because there are no proposed changes to the Lake Couchiching water taking and the proposed increase in groundwater taking will be the subject of a separate Class EA study, which will include updated source water protection modelling and assessments.

5. Asset Management

The Water Master Plan Update is updating the previous watermain database and risk assessment, as well as project prioritization. The Report will present detailed descriptions and the estimated project costs for all recommended projects. These will be used by the City for its budgetary process. The City's Water Financial Plan, prepared in 2020, will be reviewed and incorporated in the Waster Master Plan Update.

We will take all your comments in consideration in the preparation of the Water Master Plan Update Report. We look forward to your comments on the final draft of the Report, expected to be completed later this fall.

Please do not hesitate to contact us or Stephen Gendron at sgendron@orillia.ca or 705-325-2212 if you have any further comments or questions.

Yours truly,
Tatham Engineering Limited

S. Troxler

Suzanne Troxler, B.Eng., M.Sc., P. Eng.
Manager of Water & Wastewater Engineering
st:pt

copy:	Stephen Gendron	City of Orillia	sgendron@orillia.ca
	Greg Preston	City of Orillia	gpreston@orillia.ca
	Laura Smit	City of Orillia	lsmit@orillia.ca

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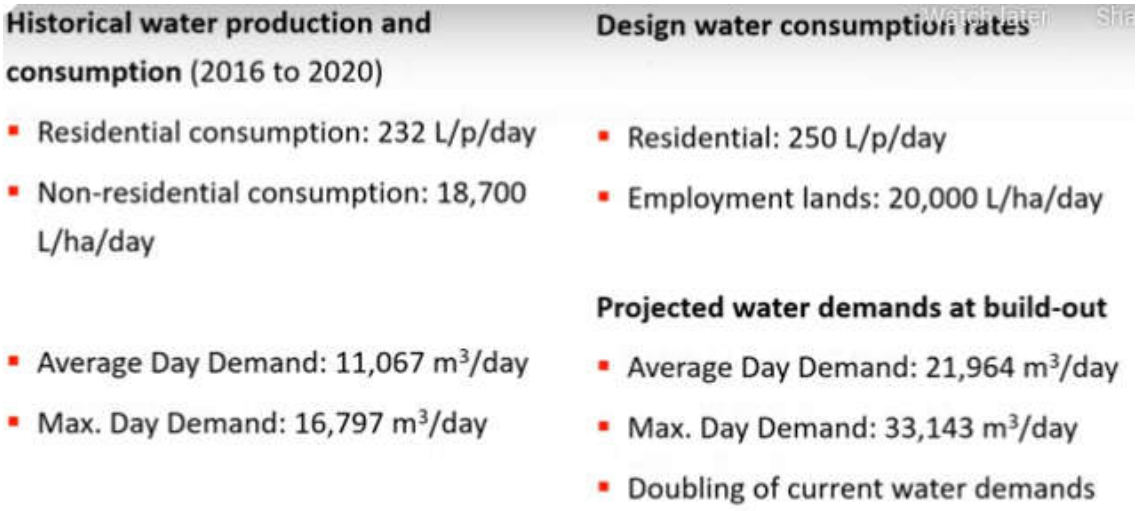
Comments regarding Orillia's Water Master Plan Update - September 2021

From: Jane Bonsteel

1. **Water Use**



Why are the per capita water use rate and the employment land water use projected to rise? Even without a water efficiency education campaign, per capita water demands are falling as water efficient appliances replace older models. With a water efficiency campaign, water use can be reduced further. The Region of Waterloo plan predicts a decrease in water use from 202 to 168 litres per capita per day by 2025. Likewise, commercial, institutional and industrial water use is falling as the benefits of water efficiency are realized.

Although the population is expected to increase, there should certainly not be a doubling of water demand, as this slide suggests - per capita water use and commercial/institutional/industrial water use per hectare should actually fall. Maximum Day could also be reduced significantly with public education.

I understand that planning has to be somewhat conservative, but predicting an increase, or even using current levels is unnecessary. I suggest a recalculation of water demands based on more sustainable water use goals, especially in light of the 'Orillia's Climate Future' project currently underway.

2. **Water quality and Consumer Confidence**

My background is in water treatment process design and optimization and I believe there are opportunities for improvement at the WTP. There seems to be widespread dissatisfaction with the taste and odour of Orillia's (surface) water at certain times of the year. I have noticed taste and odour issues not only in late summer/fall, but also in mid-winter when there is a thaw. T&O research has advanced since the GAC was added to the filters over 20 years ago. A process review and study should be undertaken by a process specialist to determine the optimal path forward with regard to T&O and natural organic matter control in order to improve the aesthetic quality of the water and restore consumer confidence.

The presentation mentions reducing coagulant use in response to aluminum residuals, but a comprehensive review including testing of other coagulants, coagulant aids, enhanced coagulation

for NOM control, modified filter operations, biological filtration, flocculation operations etc. would seem to be in order.

There is no information in the Master Plan and very little in any of the publicly available reports on-line about Wells 1 and 2. How much are these wells used? What is the raw water quality of these wells? What is the status of the contaminants: are they legacy contaminants? Are the levels increasing or decreasing over time? How effective are the aerators? Is the treated water quality of the well water acceptable or is blending used to produce acceptable water quality?

3. **Unaccounted for Water**

There is no information in the presentation about unaccounted-for water. What is the current percentage of unaccounted-for water? What is the watermain breakage rate? Is the current leak detection program sufficient? Should there be a cost-benefit analysis of reducing leaks?

4. **Integrated Planning**

Drinking water planning should not be done in isolation. Stormwater, which has a big impact on the Lake Couchiching source, should be integrated with water planning. Source Water Protection should also be addressed in the Water Master Plan. Wastewater and drinking water planning, so closely linked, should also be integrated.

5. **Asset Management**

How does the Master Plan fit with asset management, capital project plans and with the Financial Plan?

WASAUKSING

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September 21, 2021

City of Orillia
Stephen Gendron
Manager of Environmental Engineering,
Assets and Capital Projects
50 Andrew St. S., Suite 300
Orillia, Ontario
L3V 7T5

sgendron@orillia.ca

Dear Mr. Gendron,

RE: City of Orillia Water Master Plan 2021 Update: Class Environmental Assessment

Please accept this letter as confirmation that Wasauksing First Nation has received correspondence on August 18, 2021 in regards to the above Class Environmental Assessment.

Wasauksing First Nation and our citizens rely upon, and shall continue to rely upon, the health of the natural environment within our Wasauksing-Anishinaabe Territory for the wellbeing and survival of all and are recognized stewards of the land and waters, as stated in our *Wasauksing First Nation External Consultation and Accommodation Protocol, 2016.*

Wasauksing First Nation does not currently have any concerns and/or comments to submit in response to Class Environmental Assessment and we wish to continue to receive information on progress and results, as they become available. It is also incumbent upon me to inform you that the Wasauksing First Nation External Protocol stipulates, "Time constraint demands of ninety (90) days or less are not considered an acceptable practice and will not be honored by Wasauksing First Nation" (WFN External Protocol, Sec. 10.0 Time Constraints. ss 10.2).

Should there be any negative residual effects or any impacts to our Aboriginal and/or Treaty Rights and lands or resources within our Wasauksing-Anishinaabe Territory, Wasauksing First Nation reserves the right to seek accommodation and mitigation measures from Tatham Engineering Limited and the City of Orillia.

Thank you for extending invitation for engagement to Wasauksing First Nation. Should you have any questions or concerns, please do not hesitate to contact me by email at ccc@wasauksing.ca or via telephone (705) 746-2531 ext. 2260.

Sincerely,

Michele Ten Eyck
Community Consultation Coordinator
Wasauksing First Nation

Cc: Ryan Tabobandung, Director of Public Works/A/Chief Executive Director
Daniella Baker, Lands Manager

Ministry of the Environment, Conservation and Parks

Environmental Assessment Branch

1st Floor
135 St. Clair Avenue W
Toronto ON M4V 1P5
Tel.: 416 314-8001
Fax.: 416 314-8452

Ministère de l'Environnement, de la Protection de la nature et des Parcs

Direction des évaluations environnementales

Rez-de-chaussée
135, avenue St. Clair Ouest
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Ontario

December 20, 2021 File No.: EA 01-06-02

BY EMAIL ONLY
Stephen Gendron
City of Orillia
50 Andrew Street South, Suite 300
Orillia, Ontario, L3V 7T5
705-325-2212
sgendron@orillia.ca

Re: **Water System Update**
City of Orillia
Municipal Class EA

Dear Stephen Gendron,

The Ministry of the Environment, Conservation and Parks (MECP) acknowledges that the City of Orillia (proponent) has indicated that the study is following the approved environmental planning process for a Master Plan project under the Municipal Class Environmental Assessment (Class EA).

The attached "Areas of Interest" document provides guidance regarding the ministry's interests with respect to the Class EA process. Please address all areas of interest in the EA documentation at an appropriate level for the EA study. Proponents who address all the applicable areas of interest can minimize potential delays to the project schedule. **Further information is provided at the end of the Areas of Interest document relating to recent changes to the *Environmental Assessment Act* through Bill 197, Covid-19 Economic Recovery Act 2020.**

The Crown has a legal duty to consult Aboriginal communities when it has knowledge, real or constructive, of the existence or potential existence of an Aboriginal or treaty right and contemplates conduct that may adversely impact that right. Before authorizing this project, the Crown must ensure that its duty to consult has been fulfilled, where such a duty is triggered. Although the duty to consult with Aboriginal peoples is a duty of the Crown, the Crown may delegate procedural aspects of this duty to project proponents while retaining oversight of the consultation process.

The proposed project may have the potential to affect Aboriginal or treaty rights protected under Section 35 of Canada's *Constitution Act* 1982. Where the Crown's duty to consult is triggered in relation to the proposed project**, the MECP is delegating the procedural aspects of rights-based consultation to the proponent through this letter.** The Crown intends to rely on the delegated consultation process in discharging its duty to consult and maintains the right to participate in the consultation process as it sees fit.

Based on information provided to date and the Crown`s preliminary assessment the proponent is required to consult with the following communities who have been identified as potentially affected by the proposed project:

- The following Williams Treaties Communities with copy to the Williams Treaties coordinator Karry Sandy McKenzie:
    - Chippewas of Georgina Island
    - Chippewas of Rama First Nation (Mnjikaning)
    - Beausoleil First Nation
- If there are archaeological impacts then the other 4 Williams Treaties communities should also be included:
    - Hiawatha First Nation
    - Curve Lake First Nation
    - Alderville First Nation
    - Mississauga's of Scugog Island First Nation
- Huron-Wendat Nation (If there are potential archeological impacts).

Steps that the proponent may need to take in relation to Aboriginal consultation for the proposed project are outlined in the "Code of Practice for Consultation in Ontario's Environmental Assessment Process". Additional information related to Ontario's Environmental Assessment Act is available online at: www.ontario.ca/environmentalassessments.

Please also refer to the attached document "A Proponent's Introduction to the Delegation of Procedural Aspects of consultation with Aboriginal Communities" for further information, including the MECP's expectations for Class EA documentation related to consultation with communities.

The proponent must contact the Director of Environmental Assessment Branch (EABDirector@ontario.ca) under the following circumstances subsequent to initial discussions with the communities identified by MECP:

- Aboriginal or treaty rights impacts are identified to you by the communities
- You have reason to believe that your proposed project may adversely affect an Aboriginal or treaty right
- Consultation with Indigenous communities or other stakeholders has reached an impasse
- A Section 16 Order request is expected on the basis of impacts to Aboriginal or treaty rights

The MECP will then assess the extent of any Crown duty to consult for the circumstances and will consider whether additional steps should be taken, including what role you will be asked to play, and should additional steps and activities be required.

Should you or any members of your project team have any questions regarding the material above, please contact me at chunmei.liu@ontario.ca.

Yours truly,

Chunmei Liu
Regional Environmental Planner – Central Region

cc Katy Potter, Supervisor, Environmental Assessment Services, MECP
Cindy Hood, Manager, Barrie District Office, MECP
Suzanne Troxler, Manager of Water & Wastewater Engineering, Tatham Engineering Ltd

Attach: Areas of Interest
A Proponent's Introduction to the Delegation of Procedural Aspects of Consultation with Aboriginal Communities
Draft Guide to Preliminary Screening for Species at Risk

AREAS OF INTEREST (v. August 2021)

It is suggested that you check off each section after you have considered / addressed it.

☐ **Planning and Policy**

- Projects located in MECP Central Region are subject to **A Place to Grow: Growth Plan for the Greater Golden Horseshoe (2020).** Parts of the study area may also be subject to the Oak Ridges Moraine Conservation Plan (2017), Niagara Escarpment Plan (2017), Greenbelt Plan (2017) or Lake Simcoe Protection Plan (2014). Applicable plans and the applicable policies should be identified in the report, and the proponent should describe how the proposed project adheres to the relevant policies in these plans.

- Additionally, if the project is located within the boundaries of the Lake Simcoe Protection Plan, we also strongly recommend that the project team review the information and resources available on the province's website related to protecting Lake Simcoe found here: https://www.ontario.ca/page/protecting-lake-simcoe, including the Lake Simcoe phosphorus reduction strategy.

- The **Provincial Policy Statement (2020)** contains policies that protect Ontario's natural heritage and water resources. Applicable policies should be referenced in the report, and the proponent should describe how the proposed project is consistent with these policies.

- In addition to the provincial planning and policy level, the report should also discuss the planning context at the municipal and federal levels, as appropriate.

☐ **Source Water Protection**

The *Clean Water Act*, 2006 (CWA) aims to protect existing and future sources of drinking water. To achieve this, several types of vulnerable areas have been delineated around surface water intakes and wellheads for every municipal residential drinking water system that is located in a source protection area. These vulnerable areas are known as a Wellhead Protection Areas (WHPAs) and surface water Intake Protection Zones (IPZs). Other vulnerable areas that have been delineated under the CWA include Highly Vulnerable Aquifers (HVAs), Significant Groundwater Recharge Areas (SGRAs), Event-based modelling areas (EBAs), and Issues Contributing Areas (ICAs). Source protection plans have been developed that include policies to address existing and future risks to sources of municipal drinking water within these vulnerable areas.

Projects that are subject to the Environmental Assessment Act that fall under a Class EA, or one of the Regulations, have the potential to impact sources of drinking water if they occur in designated vulnerable areas or in the vicinity of other at-risk drinking water systems (i.e. systems that are not municipal residential systems). MEA Class EA projects may include activities that, if located in a vulnerable area, could be a threat to sources of drinking water (i.e. have the potential to adversely affect the quality or quantity of drinking water sources) and the activity could therefore be subject to policies in a source protection plan. Where an activity poses a risk to drinking water, policies in the local source protection plan may impact how or where that activity is undertaken. Policies may prohibit certain activities, or they may require risk management measures for these activities. Municipal Official Plans, planning decisions, Class EA projects (where the project includes an activity that is a threat to drinking water) and prescribed instruments must conform with policies that address significant risks to drinking water and must have regard for policies that address moderate or low risks.

- In October 2015, the MEA Class EA document was amended to include reference to the Clean Water Act (Section A.2.10.6) and indicates that proponents undertaking a Municipal Class EA project must identify early in their process whether a project is or could potentially be occurring with a vulnerable area. **Given this requirement, please include a section in the report on source water protection.**

    - The proponent should identify the source protection area and should clearly document how the proximity of the project to sources of drinking water (municipal or other) and any delineated vulnerable areas was considered and assessed. Specifically, the report should discuss whether or not the project is located in a vulnerable area and provide applicable details about the area.

    - If located in a vulnerable area, proponents should document whether any project activities are prescribed drinking water threats and thus pose a risk to drinking water (this should be consulted on with the appropriate Source Protection Authority). Where an activity poses a risk to drinking water, the proponent must document and discuss in the report how the project adheres to or has regard to applicable policies in the local source protection plan. This section should then be used to inform and be reflected in other sections of the report, such as the identification of net positive/negative effects of alternatives, mitigation measures, evaluation of alternatives etc.

- While most source protection plans focused on including policies for significant drinking water threats in the WHPAs and IPZs it should be noted that even though source protection plan policies may not apply in HVAs, these are areas where aquifers are sensitive and at risk to impacts and within these areas, activities may impact the quality of sources of drinking water for systems other than municipal residential systems.

- In order to determine if this project is occurring within a vulnerable area, proponents can use this mapping tool: http://www.applications.ene.gov.on.ca/swp/en/index.php. Note that various layers (including WHPAs, WHPA-Q1 and WHPA-Q2, IPZs, HVAs, SGRAs, EBAs, ICAs) can be turned on through the “Map Legend” bar on the left. The mapping tool will also provide a link to the appropriate source protection plan in order to identify what policies may be applicable in the vulnerable area.

- For further information on the maps or source protection plan policies which may relate to their project, proponents must contact the appropriate source protection authority. **Please consult with the local source protection authority to discuss potential impacts on drinking water. Please document the results of that consultation within the report and include all communication documents/correspondence.**

More Information
For more information on the *Clean Water Act*, source protection areas and plans, including specific information on the vulnerable areas and drinking water threats, please refer to Conservation Ontario’s website where you will also find links to the local source protection plan/assessment report.

A list of the prescribed drinking water threats can be found in section 1.1 of Ontario Regulation 287/07 made under the *Clean Water Act*. In addition to prescribed drinking water threats, some source protection plans may include policies to address additional “local” threat activities, as approved by the MECP.

- **Climate Change**

The document "Considering Climate Change in the Environmental Assessment Process" (Guide) is now a part of the Environmental Assessment program's Guides and Codes of Practice. The Guide sets out the MECP's expectation for considering climate change in the preparation, execution and documentation of environmental assessment studies and processes. The guide provides examples, approaches, resources, and references to assist proponents with consideration of climate change in EA. Proponents should review this Guide in detail.

- **The MECP expects proponents of Class EA projects to:**

1. Consider during the assessment of alternative solutions and alternative designs, the following:
    a. the project's expected production of greenhouse gas emissions and impacts on carbon sinks (climate change mitigation); and
    b. resilience or vulnerability of the undertaking to changing climatic conditions (climate change adaptation).
2. Include a discrete section in the report detailing how climate change was considered in the EA.

How climate change is considered can be qualitative or quantitative in nature and should be scaled to the project's level of environmental effect. In all instances, both a project's impacts on climate change (mitigation) and impacts of climate change on a project (adaptation) should be considered.

- The MECP has also prepared another guide to support provincial land use planning direction related to the completion of energy and emission plans. The "Community Emissions Reduction Planning: A Guide for Municipalities" document is designed to educate stakeholders on the municipal opportunities to reduce energy and greenhouse gas emissions, and to provide guidance on methods and techniques to incorporate consideration of energy and greenhouse gas emissions into municipal activities of all types. We encourage you to review the Guide for information.

Air Quality, Dust and Noise

- If there are sensitive receptors in the surrounding area of this project, a quantitative air quality/odour impact assessment will be useful to evaluate alternatives, determine impacts and identify appropriate mitigation measures. The scope of the assessment can be determined based on the potential effects of the proposed alternatives, and typically includes source and receptor characterization and a quantification of local air quality impacts on the sensitive receptors and the environment in the study area. The assessment will compare to all applicable standards or guidelines for all contaminants of concern. **Please contact this office for further consultation on the level of Air Quality Impact Assessment required for this project if not already advised.**

- If a quantitative Air Quality Impact Assessment is not required for the project, the MECP expects that the report contain a qualitative assessment which includes:

    - A discussion of local air quality including existing activities/sources that significantly impact local air quality and how the project may impact existing conditions;
    - A discussion of the nearby sensitive receptors and the project's potential air quality impacts on present and future sensitive receptors;
    - A discussion of local air quality impacts that could arise from this project during both construction and operation; and
    - A discussion of potential mitigation measures.

- As a common practice, "air quality" should be used an evaluation criterion for all road projects.

- Dust and noise control measures should be addressed and included in the construction plans to ensure that nearby residential and other sensitive land uses within the study area are not adversely affected during construction activities.

- The MECP recommends that non-chloride dust-suppressants be applied. For a comprehensive list of fugitive dust prevention and control measures that could be applied, refer to *Cheminfo Services Inc. Best Practices for the Reduction of Air Emissions from Construction and Demolition Activities* report prepared for Environment Canada. March 2005.

- The report should consider the potential impacts of increased noise levels during the operation of the completed project. The proponent should explore all potential measures to mitigate significant noise impacts during the assessment of alternatives.

Ecosystem Protection and Restoration

- Any impacts to ecosystem form and function must be avoided where possible. The report should describe any proposed mitigation measures and how project planning will protect and enhance the local ecosystem.

- Natural heritage and hydrologic features should be identified and described in detail to assess potential impacts and to develop appropriate mitigation measures. The following sensitive environmental features may be located within or adjacent to the study area:
  - Key Natural Heritage Features: Habitat of endangered species and threatened species, fish habitat, wetlands, areas of natural and scientific interest (ANSIs), significant valleylands, significant woodlands; significant wildlife habitat (including habitat of special concern species); sand barrens, savannahs, and tallgrass prairies; and alvars.
  - Key Hydrologic Features: Permanent streams, intermittent streams, inland lakes and their littoral zones, seepage areas and springs, and wetlands.
  - Other natural heritage features and areas such as: vegetation communities, rare species of flora or fauna, Environmentally Sensitive Areas, Environmentally Sensitive Policy Areas, federal and provincial parks and conservation reserves, Greenland systems etc.

We recommend consulting with the Ministry of Natural Resources and Forestry (MNRF), Fisheries and Oceans Canada (DFO) and your local conservation authority to determine if special measures or additional studies will be necessary to preserve and protect these sensitive features. In addition, you may consider the provisions of the Rouge Park Management Plan if applicable.

Species at Risk

- The Ministry of the Environment, Conservation and Parks has now assumed responsibility of Ontario's Species at Risk program. Information, standards, guidelines, reference materials and technical resources to assist you are found at https://www.ontario.ca/page/species-risk.

- The Client's Guide to Preliminary Screening for Species at Risk (Draft May 2019) has been attached to the covering email for your reference and use. Please review this document for next steps.

- For any questions related to subsequent permit requirements, please contact SAROntario@ontario.ca.

Surface Water

- The report must include enough information to demonstrate that there will be no negative impacts on the natural features or ecological functions of any watercourses within the study area. Measures should be included in the planning and design process to ensure that any impacts to watercourses from construction or operational activities (e.g. spills, erosion, pollution) are mitigated as part of the proposed undertaking.

- Additional stormwater runoff from new pavement can impact receiving watercourses and flood conditions. Quality and quantity control measures to treat stormwater runoff should be considered for all new impervious areas and, where possible, existing surfaces. The ministry's Stormwater Management Planning and Design Manual (2003) should be referenced in the report and utilized when designing stormwater control methods. **A Stormwater Management Plan should be prepared as part of the Class EA process** that includes:

  - Strategies to address potential water quantity and erosion impacts related to stormwater draining into streams or other sensitive environmental features, and to ensure that adequate (enhanced) water quality is maintained
  - Watershed information, drainage conditions, and other relevant background information

- Future drainage conditions, stormwater management options, information on erosion and sediment control during construction, and other details of the proposed works
- Information on maintenance and monitoring commitments.

- Ontario Regulation 60/08 under the *Ontario Water Resources Act* (OWRA) applies to the Lake Simcoe Basin, which encompasses Lake Simcoe and the lands from which surface water drains into Lake Simcoe. If the proposed sewage treatment plant is listed in Table 1 of the regulation, the report should describe how the proposed project and its mitigation measures are consistent with the requirements of this regulation and the OWRA.

- Any potential approval requirements for surface water taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, except for certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16*. These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please review the Water Taking User Guide for EASR for more information. Additionally, an Environmental Compliance Approval under the OWRA is required for municipal stormwater management works.

Groundwater

- The status of, and potential impacts to any well water supplies should be addressed. If the project involves groundwater takings or changes to drainage patterns, the quantity and quality of groundwater may be affected due to drawdown effects or the redirection of existing contamination flows. In addition, project activities may infringe on existing wells such that they must be reconstructed or sealed and abandoned. Appropriate information to define existing groundwater conditions should be included in the report.

- If the potential construction or decommissioning of water wells is identified as an issue, the report should refer to Ontario Regulation 903, Wells, under the OWRA.

- Potential impacts to groundwater-dependent natural features should be addressed. Any changes to groundwater flow or quality from groundwater taking may interfere with the ecological processes of streams, wetlands or other surficial features. In addition, discharging contaminated or high volumes of groundwater to these features may have direct impacts on their function. Any potential effects should be identified, and appropriate mitigation measures should be recommended. The level of detail required will be dependent on the significance of the potential impacts.

- Any potential approval requirements for groundwater taking or discharge should be identified in the report. A Permit to Take Water (PTTW) under the OWRA will be required for any water takings that exceed 50,000 L/day, with the exception of certain water taking activities that have been prescribed by the Water Taking EASR Regulation – *O. Reg. 63/16*. These prescribed water-taking activities require registration in the EASR instead of a PTTW. Please review the Water Taking User Guide for EASR for more information.

- Consultation with the railroad authorities is necessary wherever there is a plan to use construction dewatering in the vicinity of railroad lines or where the zone of influence of the construction dewatering potentially intercepts railroad lines.

Excess Materials Management

- In December 2019, MECP released a new regulation under the Environmental Protection Act, titled "On-Site and Excess Soil Management" (O. Reg. 406/19) to support improved management of excess construction soil. This regulation is a key step to support proper management of excess soils,

ensuring valuable resources don't go to waste and to provide clear rules on managing and reusing excess soil. New risk-based standards referenced by this regulation help to facilitate local beneficial reuse which in turn will reduce greenhouse gas emissions from soil transportation, while ensuring strong protection of human health and the environment. The new regulation is being phased in over time, with the first phase in effect on January 1, 2021. For more information, please visit https://www.ontario.ca/page/handling-excess-soil.

- The report should reference that activities involving the management of excess soil should be completed in accordance with O. Reg. 406/19 and the MECP's current guidance document titled "Management of Excess Soil – A Guide for Best Management Practices" (2014).

- All waste generated during construction must be disposed of in accordance with ministry requirements

Contaminated Sites

- Any current or historical waste disposal sites should be identified in the report. The status of these sites should be determined to confirm whether approval pursuant to Section 46 of the EPA may be required for land uses on former disposal sites. We recommend referring to the MECP's D-4 guideline for land use considerations near landfills and dumps.
  - Resources available may include regional/local municipal official plans and data; provincial data on large landfill sites and small landfill sites; Environmental Compliance Approval information for waste disposal sites on Access Environment.

- Other known contaminated sites (local, provincial, federal) in the study area should also be identified in the report (Note – information on federal contaminated sites is found on the Government of Canada's website).

- The location of any underground storage tanks should be investigated in the report. Measures should be identified to ensure the integrity of these tanks and to ensure an appropriate response in the event of a spill. The ministry's Spills Action Centre must be contacted in such an event.

- Since the removal or movement of soils may be required, appropriate tests to determine contaminant levels from previous land uses or dumping should be undertaken. If the soils are contaminated, you must determine how and where they are to be disposed of, consistent with *Part XV.1 of the Environmental Protection Act* (EPA) and Ontario Regulation 153/04, Records of Site Condition, which details the new requirements related to site assessment and clean up. Please contact the appropriate MECP District Office for further consultation if contaminated sites are present.

Servicing, Utilities and Facilities

- The report should identify any above or underground utilities in the study area such as transmission lines, telephone/internet, oil/gas etc. The owners should be consulted to discuss impacts to this infrastructure, including potential spills.

- The report should identify any servicing infrastructure in the study area such as wastewater, water, stormwater that may potentially be impacted by the project.

- Any facility that releases emissions to the atmosphere, discharges contaminants to ground or surface water, provides potable water supplies, or stores, transports or disposes of waste must have an Environmental Compliance Approval (ECA) before it can operate lawfully. Please consult with MECP's Environmental Permissions Branch to determine whether a new or amended ECA will be required for any proposed infrastructure.

- We recommend referring to the ministry's environmental land use planning guides and proposed land use compatibility guidelines to ensure that any potential land use conflicts are considered when planning for any infrastructure or facilities related to wastewater, pipelines, landfills or industrial uses.

Mitigation and Monitoring

- Contractors must be made aware of all environmental considerations so that all environmental standards and commitments for both construction and operation are met. Mitigation measures should be clearly referenced in the report and regularly monitored during the construction stage of the project. In addition, we encourage proponents to conduct post-construction monitoring to ensure all mitigation measures have been effective and are functioning properly.

- Design and construction reports and plans should be based on a best management approach that centres on the prevention of impacts, protection of the existing environment, and opportunities for rehabilitation and enhancement of any impacted areas.

- The proponent's construction and post-construction monitoring plans must be documented in the report, as outlined in Section A.2.5 and A.4.1 of the MEA Class EA.

Consultation

- The report must demonstrate how the consultation provisions of the Class EA have been fulfilled, including documentation of all stakeholder consultation efforts undertaken during the planning process. This includes a discussion in the report that identifies concerns that were raised and **describes how they have been addressed by the proponent** throughout the planning process. The report should also include copies of comments submitted on the project by interested stakeholders, and the proponent's responses to these comments (as directed by the Class EA to include full documentation).

- Please include the full stakeholder distribution/consultation list in the documentation.

Class EA Process

- If this project is a Master Plan: there are several different approaches that can be used to conduct a Master Plan, examples of which are outlined in Appendix 4 of the Class EA. **The Master Plan should clearly indicate the selected approach for conducting the plan**, by identifying whether the levels of assessment, consultation and documentation are sufficient to fulfill the requirements for Schedule B or C projects. Please note that any Schedule B or C projects identified in the plan would be subject to Section 16 Order Requests under *the Environmental Assessment Act*, although the plan itself would not be. **Please include a description of the approach being undertaken (use Appendix 4 as a reference).**

- If this project is a Master Plan: Any identified projects should also include information on the MCEA schedule associated with the project.

- The report should provide clear and complete documentation of the planning process in order to allow for transparency in decision-making.

- The Class EA requires the consideration of the effects of each alternative on all aspects of the environment (including planning, natural, social, cultural, economic, technical). The report should include a level of detail (e.g. hydrogeological investigations, terrestrial and aquatic assessments, cultural heritage assessments) such that all potential impacts can be identified, and appropriate

mitigation measures can be developed. Any supporting studies conducted during the Class EA process should be referenced and included as part of the report.

- Please include in the report a list of all subsequent permits or approvals that may be required for the implementation of the preferred alternative, including but not limited to, MECP's PTTW, EASR Registrations and ECAs, conservation authority permits, species at risk permits, MTO permits and approvals under the *Impact Assessment Act*, 2019.

- Ministry guidelines and other information related to the issues above are available at http://www.ontario.ca/environment-and-energy/environment-and-energy. We encourage you to review all the available guides and to reference any relevant information in the report.

Amendments to the EAA through the Covid-19 Economic Recovery Act, 2020

Once the EA Report is finalized, the proponent must issue a Notice of Completion providing a minimum 30-day period during which documentation may be reviewed and comment and input can be submitted to the proponent. The Notice of Completion must be sent to the appropriate MECP Regional Office email address (for projects in MECP Central Region, the email is eanotification.cregion@ontario.ca).

The public has the ability to request a higher level of assessment on a project if they are concerned about potential adverse impacts to constitutionally protected Aboriginal and treaty rights. In addition, the Minister may issue an order on his or her own initiative within a specified time period. The Director (of the Environmental Assessment Branch) will issue a Notice of Proposed Order to the proponent if the Minister is considering an order for the project within 30 days after the conclusion of the comment period on the Notice of Completion. At this time, the Director may request additional information from the proponent. Once the requested information has been received, the Minister will have 30 days within which to make a decision or impose conditions on your project.

Therefore, the proponent cannot proceed with the project until at least 30 days after the end of the comment period provided for in the Notice of Completion. Further, the proponent may not proceed after this time if:

- a Section 16 Order request has been submitted to the ministry regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, or
- the Director has issued a Notice of Proposed order regarding the project.

Please ensure that the Notice of Completion advises that outstanding concerns are to be directed to the proponent for a response, and that in the event there are outstanding concerns regarding potential adverse impacts to constitutionally protected Aboriginal and treaty rights, Section 16 Order requests on those matters should be addressed in writing to:

Minister
Ministry of the Environment, Conservation and Parks
777 Bay Street, 5th Floor
Toronto ON M7A 2J3
minister.mecp@ontario.ca

and

Director, Environmental Assessment Branch
Ministry of Environment, Conservation and Parks
135 St. Clair Ave. W, 1st Floor
Toronto ON, M4V 1P5
EABDirector@ontario.ca

The s.16 order request information has officially been updated on the Ontario Class EA Website: https://www.ontario.ca/page/class-environmental-assessments-section-16-order

This should help provide greater clarity on the s.16 order request processes and scope.

A PROPONENT'S INTRODUCTION TO THE DELEGATION OF PROCEDURAL ASPECTS OF CONSULTATION WITH ABORIGINAL COMMUNITIES

DEFINITIONS

The following definitions are specific to this document and may not apply in other contexts:

Aboriginal communities – the First Nation or Métis communities identified by the Crown for the purpose of consultation.

Consultation – the Crown's legal obligation to consult when the Crown has knowledge of an established or asserted Aboriginal or treaty right and contemplates conduct that might adversely impact that right. This is the type of consultation required pursuant to s. 35 of the *Constitution Act, 1982*. Note that this definition does not include consultation with Aboriginal communities for other reasons, such as regulatory requirements.

Crown – the Ontario Crown, acting through a particular ministry or ministries.

Procedural aspects of consultation – those portions of consultation related to the process of consultation, such as notifying an Aboriginal community about a project, providing information about the potential impacts of a project, responding to concerns raised by an Aboriginal community and proposing changes to the project to avoid negative impacts.

Proponent – the person or entity that wants to undertake a project and requires an Ontario Crown decision or approval for the project.

I. PURPOSE

The Crown has a legal duty to consult Aboriginal communities when it has knowledge of an existing or asserted Aboriginal or treaty right and contemplates conduct that may adversely impact that right. In outlining a framework for the duty to consult, the Supreme Court of Canada has stated that the Crown may delegate procedural aspects of consultation to third parties. This document provides general information about the Ontario Crown's approach to delegation of the procedural aspects of consultation to proponents.

This document is not intended to instruct a proponent about an individual project, and it does not constitute legal advice.

II. WHY IS IT NECESSARY TO CONSULT WITH ABORIGINAL COMMUNITIES?

The objective of the modern law of Aboriginal and treaty rights is the *reconciliation* of Aboriginal peoples and non-Aboriginal peoples and their respective rights, claims and interests. Consultation is an important component of the reconciliation process.

The Crown has a legal duty to consult Aboriginal communities when it has knowledge of an existing or asserted Aboriginal or treaty right and contemplates conduct that might adversely impact that right. For example, the Crown's duty to consult is triggered when it considers issuing a permit,

authorization or approval for a project which has the potential to adversely impact an Aboriginal right, such as the right to hunt, fish, or trap in a particular area.

The scope of consultation required in particular circumstances ranges across a spectrum depending on both the nature of the asserted or established right and the seriousness of the potential adverse impacts on that right.

Depending on the particular circumstances, the Crown may also need to take steps to accommodate the potentially impacted Aboriginal or treaty right. For example, the Crown may be required to avoid or minimize the potential adverse impacts of the project.

III. THE CROWN'S ROLE AND RESPONSIBILITIES IN THE DELEGATED CONSULTATION PROCESS

The Crown has the responsibility for ensuring that the duty to consult, and accommodate where appropriate, is met. However, the Crown may delegate the procedural aspects of consultation to a proponent.

There are different ways in which the Crown may delegate the procedural aspects of consultation to a proponent, including through a letter, a memorandum of understanding, legislation, regulation, policy and codes of practice.

If the Crown decides to delegate procedural aspects of consultation, the Crown will generally:

- Ensure that the delegation of procedural aspects of consultation and the responsibilities of the proponent are clearly communicated to the proponent;
- Identify which Aboriginal communities must be consulted;
- Provide contact information for the Aboriginal communities;
- Revise, as necessary, the list of Aboriginal communities to be consulted as new information becomes available and is assessed by the Crown;
- Assess the scope of consultation owed to the Aboriginal communities;
- Maintain appropriate oversight of the actions taken by the proponent in fulfilling the procedural aspects of consultation;
- Assess the adequacy of consultation that is undertaken and any accommodation that may be required;
- Provide a contact within any responsible ministry in case issues arise that require direction from the Crown; and
- Participate in the consultation process as necessary and as determined by the Crown.

IV. THE PROPONENT'S ROLE AND RESPONSIBILITIES IN THE DELEGATED CONSULTATION PROCESS

Where aspects of the consultation process have been delegated to a proponent, the Crown, in meeting its duty to consult, will rely on the proponent's consultation activities and documentation of those activities. The consultation process informs the Crown's decision of whether or not to approve a proposed project or activity.

A proponent's role and responsibilities will vary depending on a variety of factors including the extent of consultation required in the circumstance and the procedural aspects of consultation the Crown has delegated to it. Proponents are often in a better position than the Crown to discuss a project and

its potential impacts with Aboriginal communities and to determine ways to avoid or minimize the adverse impacts of a project.

A proponent can raise issues or questions with the Crown at any time during the consultation process. If issues or concerns arise during the consultation that cannot be addressed by the proponent, the proponent should contact the Crown.

a) What might a proponent be required to do in carrying out the procedural aspects of consultation?

Where the Crown delegates procedural aspects of consultation, it is often the proponent's responsibility to provide notice of the proposed project to the identified Aboriginal communities. The notice should indicate that the Crown has delegated the procedural aspects of consultation to the proponent and should include the following information:

- a description of the proposed project or activity;
- mapping;
- proposed timelines;
- details regarding anticipated environmental and other impacts;
- details regarding opportunities to comment; and
- any changes to the proposed project that have been made for seasonal conditions or other factors, where relevant.

Proponents should provide enough information and time to allow Aboriginal communities to provide meaningful feedback regarding the potential impacts of the project. Depending on the nature of consultation required for a project, a proponent also may be required to:

- provide the Crown with copies of any consultation plans prepared and an opportunity to review and comment;
- ensure that any necessary follow-up discussions with Aboriginal communities take place in a timely manner, including to confirm receipt of information, share and update information and to address questions or concerns that may arise;
- as appropriate, discuss with Aboriginal communities potential mitigation measures and/or changes to the project in response to concerns raised by Aboriginal communities;
- use language that is accessible and not overly technical, and translate material into Aboriginal languages where requested or appropriate;
- bear the reasonable costs associated with the consultation process such as, but not limited to, meeting hall rental, meal costs, document translation(s), or to address technical & capacity issues;
- provide the Crown with all the details about potential impacts on established or asserted Aboriginal or treaty rights, how these concerns have been considered and addressed by the proponent and the Aboriginal communities and any steps taken to mitigate the potential impacts;
- provide the Crown with complete and accurate documentation from these meetings and communications; and
- notify the Crown immediately if an Aboriginal community not identified by the Crown approaches the proponent seeking consultation opportunities.

b) What documentation and reporting does the Crown need from the proponent?

Proponents should keep records of all communications with the Aboriginal communities involved in the consultation process and any information provided to these Aboriginal communities.

As the Crown is required to assess the adequacy of consultation, it needs documentation to satisfy itself that the proponent has fulfilled the procedural aspects of consultation delegated to it. The documentation required would typically include:

- the date of meetings, the agendas, any materials distributed, those in attendance and copies of any minutes prepared;
- the description of the proposed project that was shared at the meeting;
- any and all concerns or other feedback provided by the communities;
- any information that was shared by a community in relation to its asserted or established Aboriginal or treaty rights and any potential adverse impacts of the proposed activity, approval or disposition on such rights;
- any proposed project changes or mitigation measures that were discussed, and feedback from Aboriginal communities about the proposed changes and measures;
- any commitments made by the proponent in response to any concerns raised, and feedback from Aboriginal communities on those commitments;
- copies of correspondence to or from Aboriginal communities, and any materials distributed electronically or by mail;
- information regarding any financial assistance provided by the proponent to enable participation by Aboriginal communities in the consultation;
- periodic consultation progress reports or copies of meeting notes if requested by the Crown;
- a summary of how the delegated aspects of consultation were carried out and the results; and
- a summary of issues raised by the Aboriginal communities, how the issues were addressed and any outstanding issues.

In certain circumstances, the Crown may share and discuss the proponent's consultation record with an Aboriginal community to ensure that it is an accurate reflection of the consultation process.

c) Will the Crown require a proponent to provide information about its commercial arrangements with Aboriginal communities?

The Crown may require a proponent to share information about aspects of commercial arrangements between the proponent and Aboriginal communities where the arrangements:

- include elements that are directed at mitigating or otherwise addressing impacts of the project;
- include securing an Aboriginal community's support for the project; or
- may potentially affect the obligations of the Crown to the Aboriginal communities.

The proponent should make every reasonable effort to exempt the Crown from confidentiality provisions in commercial arrangements with Aboriginal communities to the extent necessary to allow this information to be shared with the Crown.

The Crown cannot guarantee that information shared with the Crown will remain confidential. Confidential commercial information should not be provided to the Crown as part of the consultation record if it is not relevant to the duty to consult or otherwise required to be submitted to the Crown as part of the regulatory process.

V. WHAT ARE THE ROLES AND RESPONSIBILITIES OF ABORIGINAL COMMUNITIES' IN THE CONSULTATION PROCESS?

Like the Crown, Aboriginal communities are expected to engage in consultation in good faith. This includes:

- responding to the consultation notice;
- engaging in the proposed consultation process;
- providing relevant documentation;
- clearly articulating the potential impacts of the proposed project on Aboriginal or treaty rights; and
- discussing ways to mitigates any adverse impacts.

Some Aboriginal communities have developed tools, such as consultation protocols, policies or processes that provide guidance on how they would prefer to be consulted. Although not legally binding, proponents are encouraged to respect these community processes where it is reasonable to do so. Please note that there is no obligation for a proponent to pay a fee to an Aboriginal community in order to enter into a consultation process.

To ensure that the Crown is aware of existing community consultation protocols, proponents should contact the relevant Crown ministry when presented with a consultation protocol by an Aboriginal community or anyone purporting to be a representative of an Aboriginal community.

VI. WHAT IF MORE THAN ONE PROVINCIAL CROWN MINISTRY IS INVOLVED IN APPROVING A PROPONENT'S PROJECT?

Depending on the project and the required permits or approvals, one or more ministries may delegate procedural aspects of the Crown's duty to consult to the proponent. The proponent may contact individual ministries for guidance related to the delegation of procedural aspects of consultation for ministry-specific permits/approvals required for the project in question. Proponents are encouraged to seek input from all involved Crown ministries sooner rather than later.

G3 – Notice of Study Completion

CITY OF ORILLIA WATER MASTER PLAN UPDATE
CLASS ENVIRONMENTAL ASSESSMENT

NOTICE OF STUDY COMPLETION

The City of Orillia has completed a Class Environmental Assessment (Class EA) to update the Water System Master Plan (2015). The Water Master Plan Update (2022) identifies the infrastructure needed to optimize, upgrade and expand the municipal drinking water supply, storage, pumping and distribution systems to accommodate growth and intensification to the year 2050.

The Water Master Plan Update was prepared in accordance with the requirements of the MEA Municipal Class EA for Master Plans (October 2000, amended in 2007, 2011 and 2015). This study met the Class EA requirements for the Schedule B projects identified, with one exception. The list of recommended projects and studies, with their Class EA Schedules, is shown below.

The Final Draft of the Water Master Plan Update is posted for review and comments on the City's website at orillia.ca/watermasterplan. Comments can be submitted using the online comment form or by e-mail to the contacts below. Comments will be accepted until September 1, 2022 and will be taken into consideration and included in the Final Report. Comments are received are collected in accordance with the *Municipal Freedom of Information and Protection of Privacy Act* and will be part of the public record.

Stephen Gendron
City of Orillia
Manager of Environmental Engineering,
Assets and Capital Projects
50 Andrew St. S, Suite 300
Orillia, ON, L3V 7T5
Tel: 705-325-2212
Email: sgendron@orillia.ca

Suzanne Troxler
Tatham Engineering Limited
Manager of Water & Wastewater
Engineering
115 Sandford Fleming Dr., Suite 200
Collingwood, ON, L9Y 5A6
Tel: 705-444-2565
Email: stroxler@tathameng.com

If concerns that this Water Master Plan Update may have potential adverse impacts on protected Aboriginal and treaty rights that cannot be resolved in discussions with the City of Orillia, a person or party may request the Minister of the Environment, Conservation and

Parks (MECP) issue an order for a project to comply with Part II of the *Environmental Assessment Act* (Section 16(6)) or meet further conditions. Section 16(6) Order requests must be sent to the Minister and the Director of Environmental Assessment Branch at the addresses below. A copy of the request must also be sent to the contacts above.

Minister, MECP
77 Bay Street, 5th Floor
Toronto, ON, M7A 2J3
Minister.mecp@ontario.ca

Director, Environmental Assessment Branch, MECP
135 St. Clair Avenue West, 1st Floor
Toronto, ON, M4V 1P5
EABDirectort@ontario.ca

If there is no Section 16(6) Order request received by September 1, 2022, the recommended projects of the Water Master Plan Update will proceed to further Class EA, design and implementation as proposed in the Final Water Master Plan Update Report.

RECOMMENDED PROJECT	CLASS EA SCHEDULE	CLASS EA STATUS
Build 1 glass-fused to steel standpipe at Harvie Hill (Phase 1)	B	Completed in WMP Update
Build 1 second standpipe at Harvie Hill site and demolish the existing Harvie Hill standpipe (Phase 2)	B	Completed in WMP Update
Build 1 third standpipe at Harvie Hill site (Phase 3)	B	Completed in WMP Update
Expand Zone 3 BPS by adding 1 pump (Phase 2)	A	Completed in WMP Update
Expand Zone 3 BPS by replacing 2 pumps (Phase 3)	A	Completed in WMP Update
Replace watermains on Esther Ann Dr., Charles Rd., and Karen Cres. with 200 mm pipes	A+	Public will be advised prior to implementation
Add connecting watermain from Goldie Dr. service main to Mariposa Dr.	A+	Public will be advised prior to implementation
Add connecting watermain on Commerce Rd. from Kubota to Goldie Dr.	A+	Public will be advised prior to implementation
Twin watermain on Laclie St. from Stanton Dr. to Hillside Dr.	A+	Public will be advised prior to implementation
Construct stand-by supply wells at WOW and at PZ1/PZ2 boundary	B	Groundwater Supply Study and Class EA to be completed

120063 Orillia WMP Update 2020 Mailing List

Last Updated: July 25, 2022

Municipalities	Job Title	Contact Suffix	Contact First Name	Contact Last Name	Address	Mailing	City	PC	Phone	Email
County of Simcoe	Director of Legislative Services/County Clerk	Ms.	Brenda	Clark	Administration Centre	1110 Highway #26	MIDHURST	L9X 1N6	705-726-9300	service@simcoe.ca
Township of Oro-Medonte	Director of Operations & Community Services	Mr.	Shawn	Binns	148 Line 7 South	Box 100	ORO	L0L 2X0	705-487-2171 ext. 2127	sbinns@oro-medonte.ca
Township of Oro-Medonte	Director of Corporate Services/Clerk	Ms.	Donna	Hewitt	148 Line 7 South	Box 100	ORO	L0L 2X0	705-487-2171 ext. 2132	dhewitt@oro-medonte.ca
Township of Oro-Medonte	Manager of Environmental Services	Ms.	Michelle	Jakobi	148 Line 7 South		ORO	L0L 2E0	705-487-2171 ext. 2503	mjakobi@oro-medonte.ca
Township of Ramara	Chief Administrative Officer	Mr.	John	Pinsent	2297 Highway 12	Box 130	BRECHIN	L0K 1B0	705-484-5374 ext. 222	jpinsent@ramara.ca
Township of Severn	Clerk	Ms.	Alison	Gray	1024 Hurlwood Lane	Box 159	ORILLIA	L3V 6J3	705-325-2315 ext. 232	agray@townshipofsevern.com
Township of Springwater - Public Works	Director of Public Works	Ms.	Heather	Coleman	2231 Nursery Road		MINESING	L9X 1A8	705-728-4784 ext. 2051	heather.coleman@springwater.ca
City of Orillia - Development Services and Engineering	Manager of Engineering and Transportation	Mr.	Wesley	Cyr	50 Andrew Street South	Suite 300	ORILLIA	L3V 7T5	705-325-2221	wcyr@orillia.ca
City of Orillia - Development Services and Engineering	General Manager of Developmental Services and Engineering	Mr.	Ian	Sugden	50 Andrew Street South	Suite 300	ORILLIA	L3V 7T5	705-329-7256	isugden@orillia.ca
City of Orillia - Environment and Infrastructure Services Department	General Manager Environment and Infrastructure Services Departmer	Mr.	Andrew	Schell	50 Andrew Street South	Suite 300	ORILLIA	L3V 7T5	705-325-7551	aschell@orillia.ca
City of Orillia - Fire Department	Fire Chief	Mr.	Brent	Thomas	50 Andrew Street South	Suite 300	ORILLIA	L3V 7T5	705-325-5889	bthomas@orillia.ca
City of Orillia - Environmental Advisory Committee	Assistant Clerk		Robin	Cadeau	50 Andrew Street South	Suite 300	ORILLIA	L3V 7T5	705-329-2452	rcadeau@orillia.ca
City of Orillia - Environmental Advisory Committee			Jane	Bonsteel	50 Andrew Street South	Suite 300	ORILLIA	L3V 7T5	705-329-2452	jmbonsteel@gmail.com
Local Agencies	**Job Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Simcoe County District School Board	Manager of Planning	Mr.	Andrew	Keuken	1170 Highway 26		MIDHURST	L0L 1X0	705-734-6363 ext. 11513	akeuken@scdsb.on.ca
Simcoe Muskoka Catholic District School Board	Manager of Planning and Properties	Ms.	Christine	Hyde	46 Alliance Boulevard		BARRIE	L4M 5K3	705-722-3555 x 249	chyde@smcdsb.on.ca
Simcoe Muskoka Catholic District School Board	Senior Planner	Mr.	Jeremy	Rand	46 Alliance Boulevard		BARRIE	L4M 5K3		jrand@smcdsb.on.ca
Lake Simcoe Region Conservation Authority	Director, Planning & Development Services	Mr.	Rob	Baldwin	120 Bayview Parkway	Box 282	NEWMARKET	L3Y 4X1	905-895-1281	r.baldwin@lsrca.on.ca
Simcoe Muskoka District Health Unit	Medical Officer of Health	Mr.	Charles	Gardner	15 Sperling Drive		BARRIE	L4M 6K9	705-721-7520 ext. 6515	Charles.Gardner@smdhu.org
Orillia and District Construction Association				Sir/Madam	PO Box 235		ORILLIA	L3V 6J3	705-326-1844	
Provincial Agencies	**Job Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Ministry of the Environment, Conservation and Parks - Barrie District Office	Manager	Mr.	Chris	Hyde	54 Cedar Pointe Drive	Unit 1201	BARRIE	L4N 5R7	705-739-6441	chris.hyde@ontario.ca
Ministry of the Environment, Conservation and Parks										eanotification.cregion@ontario.ca
Ministry of the Environment, Conservation and Parks - Barrie District Office	Senior Environmental Officer	Mr.	Brad	Allen	54 Cedar Pointe Drive	Unit 1201	BARRIE	L4N 5R7	705-333-4346	brad.allen@ontario.ca
Ministry of the Environment, Conservation and Parks	Drinking Water Inspector	Mr.	Aarne	Salojarvi	54 Cedar Pointe Drive	Unit 1201	BARRIE	L4N 5R7	705-220-1773	aarne.salojarvi@ontario.ca
Ministry of the Environment, Conservation and Parks	Environmental Resource Planner & EA Coordinator	Ms.	Chunmei	Liu	135 St Clair Ave W	8th	TORONTO	M4V 1P5	416-326-4886	chunmei.liu@ontario.ca
Ministry of Municipal Affairs and Housing	Team Lead, Community Planning and Development	Mr.	Aldo	Ingraldi	8 Estate Lane		KINGSTON	K7M 9A8	613-545-2119	aldo.ingraldi@ontario.ca
Ministry of Natural Resources - Midhurst District	District Manager	Mr.	Dan L.	Thompson	2284 Nursery Road		MIDHURST	L9X 1N8	705-725-7561	dan.l.thompson@ontario.ca
Ministry of Natural Resources - Midhurst District	District Planner	Ms.	Kim	Benner	2284 Nursery Road		MIDHURST	L9X 1N8	705-725-7534	kim.benner@ontario.ca
Ministry of Transportation	Corridor Management Section, Central Region	Mr.	Peter	Dorton			DOWNSVIEW		416-235-4280	Peter.Dorton@ontario.ca
Ministry of Transportation	Project Engineer	Mr.	Justin	White	1202 Wilson Avenue	7th Floor, Building D	DOWNSVIEW	M3M 1J8	416.235.5609	justin.white@ontario.ca
Ministry of Transportation - Legal Services	Director	Ms.	Mary	Gersht	1203 Wilson Avenue	7th Floor, Building D	DOWNSVIEW	M3M 1J8	416-235-4406	mary.gersht@ontario.ca
Ministry of Indigenous Affairs - Indigenous Relations and Programs Division	Executive Advisor		Ayn	Cooney	160 Bloor St E	4th Floor	TORONTO	M7A 2E6	416-325-1067	ayn.cooney@ontario.ca
Ministry of Health and Long-term Care				Sir/Madam	393 University Ave.	21st Floor	TORONTO	M7A 2S1	416-326-3115	environmentalhealth@ontario.ca
Ministry of Heritage, Sport, Tourism and Culture - Sport, Recreation and Communi	Assistant Deputy Minister	Mr.	Steve	Harlow	777 Bay St, College Park 18th Flr		TORONTO	M7A 1S5	416-212-7397	steve.harlow@ontario.ca
Ontario Heritage Trust				Sir/Madam	10 Adelaide Street E	Suite 203	TORONTO	M5C 1J3	416-325-5000 *General Inquiries	
Infrastructure Ontario	President, Real Estate	Mr.	Toni	Rossi	1 Dundas Street West	Suite 2000	TORONTO	M5G 1Z3	416-314-0314	toni.rossi@infrastructureontario.ca
Federal Agencies	**Job Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Indigenous Services Canada - Sustainable Infrastructure Planning, Regional	Program Manager	Mr.	Derek	Nadeau	10 Wellington Street, North Tower,	18th floor	Gatineau, QC	K1A 0H4	613-608-8637	derek.nadeau@canada.ca
Environment and Climate Change Canada	Manager	Mr.	Rob	Dobos	867 Lakeshore Road	Box 5050	BURLINGTON	L7S 1A1	905-336-4953	
Fisheries and Oceans Canada, Eastern Ontario District - Small Craft Harbours	Regional Manager	Ms.	Chantal	Larochelle	867 Lakeshore Rd.		BURLINGTON	L7S 1A1	905-315-5280	chantal.larochelle@dfo-mpo.gc.ca
Parks Canada c/o Trent-Severn Waterway	Resource Management Officer II	Ms.	Hillary	Knack	34 Beckwith Street		SMITHS FALLS	K7A 2A8	613-283-7199 ext. 272	
Parks Canada c/o Trent-Severn Waterway	Senior Realty Advisor	Ms.	Beth	McEachern	2155 Ashburnham Drive		PETERBOROUGH	K9J 1P8	705-750-4924	
Transport Canada - Ontario Region (PHE)					4900 Yonge Street		NORTH YORK	M2N 6A5	416-952-0490	
Utilities	**Job Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Orillia Power Corporation				Sir/Madam	360 West Street South		ORILLIA	L3V 5G8		
Hydro One				Sir/Madam	483 Bay Street	10th Floor Reception	TORONTO	M5G 2P5		
Bell Canada	Manager	Ms.	Angela	Taylor	136 Bayfield Street, 2nd Floor		BARRIE	L4M 3B1	705-722-2442	angela.taylor@bell.ca
Union Gas				Sir/Madam	425 Memorial Avenue		ORILLIA	L3V6K2		
Rogers Cable Inc				Sir/Madam	1 Sperling Drive		BARRIE	L4M 6B8		
FIRST NATIONS GROUPS	**Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Beausoleil First Nation	Chief		Joanne	Sandy	11 O'Gemaa Miikaans		CHRISTIAN ISLAND	L0K1C0	705-247-2051	jsandy@chimnissing.ca
Chippewas of Georgina Island	Chief		Donna	Big Canoe	R.R. #2	P.O. Box N-13	SUTTON WEST	L0E 1R0	705-437-1337	donna.bigcanoe@georginaisland.com
Chippewas of Mnjikaning First Nation (Rama)	Chief		Ted	Williams	5884 Rama Road	Suite 200	RAMA	L0K 1T0	705-325-3611	tedw@ramafirstnation.ca
Chippewas of Rama First Nation	Community Consultation Worker, Communications		Sharday	James					705-325-3611	shardayj@ramafirstnation.ca
Curve Lake First Nation	Chief		Emily	Whetung-MacInnes	22 Winookeeda Road		CURVE LAKE	K0L 1R0	705-657-8045	EmilyW@curvelake.ca
Hiawatha First Nation	Chief		Laurie	Carr	431 Hiawatha Line		HIAWATHA	K9J 0E6	705-295-4421	chiefcarr@hiawathafn.ca
Mississaugas of Scugog Island First Nation	Chief		Kelly	LaRocca	22521 Island Road	RR# 5	PORT PERRY	L9L 1B6	905-985-1940	klarocca@scugogfirstnation.com
Moose Deer Point First Nation	Chief		Rhonda	Williams-Lovett	3719 Twelve Mile Bay Road	PO BOX 119	MACTIER	P0C 1H0	705-375-5209	Rhonda.Williams-Lovett@mdpfn.com
Wahta Mohawk Territory	Chief		Philip	Franks	2664 Muskoka Rd #38	PO BOX 260	MACTIER	P0C 1H0	705-762-2354	philip.franks@wahtamohawkscouncil.ca
Wasauksing First Nation	Chief		Warren	Tabobondung	PO Box 250	1508 Lane "G" Geewadin R/	PARRY SOUND	P2A 2X4	705-746-2531	chief@wasauksing.ca
Georgian Bay Métis Council	President	Mr.	Greg	Garratt	355 Cranston Crescent	PO BOX 4	MIDLAND	L4R 4K6	705-526-6335	gbmccontact@gmail.com
Moon River Métis Council	President	Mr.	Tony	Muscat	385A Bethune Drive North		GRAVENHURST	P1P 1B8	705-681-0782	tonymuscat@rogers.com
Williams Treaties First Nations	Coordinator/Barrister, Solicitor	Ms.	Karry	Sandy-McKenzie	8 Creswick Court		BARRIE	L4M 2J7	705-792-5087	k.a.sandy-mckenzie@rogers.com
OTHER	**Title**	**Contact Suffix**	**Contact First Name**	**Contact Last Name**	**Address**	**Mailing**	**City**	**PC**	**Phone**	**Email**
Charter Construction Limited (Mariposa Homes)		Mr.	Henry	Glavic	650 Harvie Settlement Rd		ORILLIA	L3V 6H2	705-329-1992	hglavic@charterconstruction.ca
Inch Farm Lands Ltd.		Mr.		Yang	7300 Warden Avenue	Suite 405	MARKHAM	L3R 9Z6		hnzydq123@yahoo.ca
Titan Homes		Mr.	Lawrence	Saltzman			ORILLIA			ljsaltzman@rogers.com
Landen Homes		Mr.	Dennis	Bottero			ORILLIA			bottero@rogers.com

From: Dorton, Peter (MTO)
To: Suzanne Troxler
Cc: sgendron@orillia.ca; Mulrenin, Colin (MTO); Grobel, Lukasz (MTO)
Subject: RE: Orillia Water Master Plan Update - Notice of Study Completion (120063)
Date: Tuesday, August 2, 2022 2:13:31 PM
Attachments: image001.jpg
image002.png
image003.png
image004.png
RE Orillia Water Master Plan Update - Notice of PIC (120063).msg
Orillia WMP Update - Notice of Completion.pdf

CAUTION: This email originated from outside of Tatham Engineering. Do not click on links or open attachments unless you know the sender and have verified the sender's email address and know the content is safe.

Hi Suzanne:

We note that the following point 8 on p. 81 of 433 of the Final Draft Report (my highlight) speaks to the only potential MTO impact, and as such, we have no further comments.

8. Add connecting watermain on Commerce Road from Kubota to Goldie Drive. Installation of approximately 750 m of 200 mm diameter watermain from the south end of Commerce Rd. near the Kubota facility to the secondary service of Kubota near Goldie Dr. This project will improve the water distribution system for the supply of water to the north end of PZ2. The watermain alignment will consider future MTO widening of Highway 11.

Thanks,
Peter Dorton
Senior Project Manager
Ministry of Transportation
Central Operations, Highway Corridor Management Section
159 Sir William Hearst Avenue, 7th Floor
Toronto, ON M3M 0B7
Cell: (437) 833 - 9396
E-Mail: peter.dorton@ontario.ca
Web: www.mto.gov.on.ca/english/engineering/management/corridor

---

From: Suzanne Troxler <stroxler@tathameng.com>
Sent: July 27, 2022 12:11 PM
To: Ingraldi, Aldo (MMAH) <Aldo.Ingraldi@ontario.ca>; Alison Gray <agray@townshipofsevern.com>; Keuken, Andrew <AKeuken@scdsb.on.ca>; Andrew Schell <aschell@orillia.ca>; Angela Taylor <angela.taylor@bell.ca>; Cooney, Ayn (IAO) <Ayn.Cooney@ontario.ca>; Allen, Brad (MECP) <Brad.Allen@ontario.ca>; Brenda Clark <service@simcoe.ca>; Brent Thomas <bthomas@orillia.ca>; Chantal Larochelle <chantal.larochelle@dfo-mpo.gc.ca>; Charles Gardner <Charles.Gardner@smdhu.org>; Hyde, Chris (MECP) <Chris.Hyde@ontario.ca>; Christine Hyde <chyde@smcdsb.on.ca>; Liu, Chunmei (MECP) <Chunmei.Liu@ontario.ca>; Thompson, Dan L. (NDMNRF) <Dan.L.Thompson@ontario.ca>; Dennis Bottero <bottero@rogers.com>; Derek Nadeau <derek.nadeau@canada.ca>; Donna Hewitt <dhewitt@oro-medonte.ca>; Staniscia, Donna (MECP) <Donna.Staniscia@ontario.ca>; Heather Coleman <heather.coleman@springwater.ca>; Henry Glavic <hglavic@charterconstruction.ca>; Ian Sugden <isugden@orillia.ca>; Jane Bonsteel <jmbonsteel@gmail.com>; jrand <jrand@smcdsb.on.ca>; John Pinsent <jpinsent@ramara.ca>; White, Justin (MTO) <Justin.White@ontario.ca>; Kim Benner <kim.benner@ontario.ca>; Lawrence Saltzman <ljsaltzman@rogers.com>; Gersht, Mary (MTO) <Mary.Gersht@ontario.ca>; Michelle Jakobi <mjakobi@oro-medonte.ca>; EA Notices to CRegion (MECP) <eanotification.cregion@ontario.ca>; Dorton, Peter (MTO) <Peter.Dorton@ontario.ca>; Rick Evans <grayapprentice@sympatico.ca>; Rob Baldwin <r.baldwin@lsrca.on.ca>; Robin Cadeau <rcadeau@orillia.ca>; Shawn Binns <sbinns@oro-medonte.ca>; @MOH-G-Environmental Health <EnvironmentalHealth@ontario.ca>; Harlow, Steve (MTCS) <Steve.Harlow@ontario.ca>; Rossi, Toni (IO) <Toni.Rossi@infrastructureontario.ca>; Wesley Cyr <wcyr@orillia.ca>; Yang <hnzydq123@yahoo.ca>
Cc: Stephen Gendron <SGendron@orillia.ca>; Robin Deduro <rdeduro@tathameng.com>
Subject: Orillia Water Master Plan Update - Notice of Study Completion (120063)

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All,

Please find attached the Notice of Completion of the Orillia Water Master Plan Update Class EA. This Notice was also mailed to you.

The Final Draft Report of the Water Master Plan Update is available on the City's website at orillia.ca/watermasterplan.

We look forward to your comments, which we would like to receive by September 1, 2022, so that we can review and incorporate them in the Final Report.

Please do not hesitate to contact us or Stephen Gendron at the City if you have any questions on the Final Draft Report.

Sincerely,

Suzanne Troxler P.Eng.
Manager - Water & Wastewater Engineering

stroxler@tathameng.com **T** 705-444-2565 x2089 **C** 705-888-0898
115 Sandford Fleming Drive, Suite 200, Collingwood, Ontario L9Y 5A6

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From: Stephen Gendron
To: Jane Bonsteel; jane@bonsteel.ca
Cc: Laura Smit; Suzanne Troxler
Subject: RE: New Response Completed for Water Master Plan (120063)
Date: Thursday, October 20, 2022 4:25:06 PM
Attachments: image001.png
image002.png
image003.png
image004.png
image006.jpg
image007.png
image008.png
image009.png
image010.jpg

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Hello, Jane Bonsteel,

Thank you for your comment. For your information, we have reviewed the flocculation tank calculation and included it below to show how the determination of 30 minutes of retention time was calculated. The 30 minute detention time is calculated with all three flocculation tanks in service at peak firm capacity for the Water Filtration Plant. I note that the firm capacity of the tanks (i.e., one out of service) would result in a 20 minute detention time as you have identified, however the flocculation tanks are rarely out of service.

As you are aware, residence time is a function of flowrate so the current residence time will be higher than 30 minutes, as the Water Filtration Plant currently operates well below the peak firm capacity under normal operating conditions. However, as you note, this treatment unit operation will be reviewed as a part of the optimization study.

Flocculation tank calcs

Peak Firm Capacity	27,280	m^3/d
Peak Firm Capacity	18.94	m^3/min

Each Flocculation Cell

Height	3.81	m
Width	3.81	m
Depth	6.55	m
Volume per Cell	**95.08**	**m^3**

Each flocculation tank

Cell 1	95.08	m^3
Cell 2	95.08	m^3
Volume per flocculation tank	**190.16**	**m^3**

Peak flow through	**Volume**		**Retention Time**	
1 floc tank	190.16	m^3	10.04	min
2 floc tanks	380.32	m^3	20.08	min
3 floc tanks	570.48	m^3	**30.11**	min

Stephen Gendron, *P. Eng.* (he/him) I **Manager of Environmental Engineering, Assets and Capital Projects**
Development Services and Engineering Department
Engineering Division
T: 705-325-2212
orillia.ca

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From: Jane Bonsteel <jmbonsteel@gmail.com>
Sent: Wednesday, October 19, 2022 11:59
To: Suzanne Troxler <stroxler@tathameng.com>; jane@bonsteel.ca
Cc: Stephen Gendron <SGendron@orillia.ca>; Laura Smit <LSmit@orillia.ca>
Subject: RE: New Response Completed for Water Master Plan (120063)

Thanks for the responses, Suzanne. I'm sorry to belabour the point, but the description of flocculation process points to 20min retention time, not 30 min. This is from the City's website: "The plant is equipped with three passes of two-stage hydraulic flocculation." My understanding of this that there are 3 trains of 2 cells each, meaning that a drop of water passes through two 10-min chambers. Given the raw water quality and the challenge the plant has in reducing the aluminum residual, the short flocculation time could be significant. But, I assume that this will be part of an optimization study.

Regards,
Jane

From: Suzanne Troxler
Sent: Wednesday, October 12, 2022 2:44 PM
To: jane@bonsteel.ca
Cc: Stephen Gendron; Laura Smit
Subject: RE: New Response Completed for Water Master Plan (120063)

Jane Bonsteel,

Thank you for taking the time to review the Final Draft of the Water Master Plan and providing detailed comments.

Our responses are as follows:

1. We have corrected the error on page 21 of the report. Thank you for picking that up.
2. The report states in section 5.1.2 that unaccounted for water includes leakage.
3. In our review of the City's 2014 Water Conservation and Efficiency Plan, we found the document contained some valid recommendations to enhance current efforts and to focus on ICI consumers and municipal activities. As such, and considering that the 2014 recommendations have not been fully implemented, the Water Master Plan recommends the 2014 Water Conservation and Efficiency Plan be updated, including the estimated costs and schedule, and implemented. The 2014 document is available on the City's website.
4. In the report in Appendix C, section 2.3.5, we have revised the statement regarding the flocculation tanks. For clarification, there are 3 floc tanks, each tank with 2 cells. Each floc tank has a retention time of 10 minutes, therefore for 3 tanks, the retention time is 30 minutes.
5. We agree that reducing the DOC content should be a goal of the recommended optimization study of the coagulation and flocculation processes, as well as for the entire treatment process. This was added to the Master Plan Report for clarity.
6. With regards to the potential for increased presence of cyanobacteria and toxic by-products at the intake of the WFP, the City monitors for microcystin, as required by its License, and is initiating a review of its algae bloom operating and monitoring response plan. The Report has been revised to include a specific recommendation in this regard.

We trust that the above addresses your comments.

Sincerely,

Suzanne

Suzanne Troxler P.Eng.
Manager - Water & Wastewater Engineering

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From: Stephen Gendron <SGendron@orillia.ca>
Sent: Monday, September 19, 2022 9:15 AM
To: Suzanne Troxler <stroxler@tathameng.com>
Cc: Laura Smit <LSmit@orillia.ca>
Subject: FW: New Response Completed for Water Master Plan
Importance: High

From: noreply@esolutionsgroup.ca <noreply@esolutionsgroup.ca>
Sent: Friday, August 26, 2022 16:31
To: Stephen Gendron <SGendron@orillia.ca>
Cc: stroxler@tathameng.com
Subject: New Response Completed for Water Master Plan

Hello,

Please note the following response to Water Master Plan has been submitted at Friday August 26th 2022 4:29 PM with reference number 2022-08-26-029.

1. **Please enter your comments here.**
   A few comments on the final draft:
   p.21, 5.1.1 - water supply is Lake Couchiching, not Lake Simcoe.
   5.1.2 - Unaccounted for water includes leakage.
   5.2.5 - What are the "enhanced water conservation measures"? As a resident of Orillia for the last 6 years, I have seen little, if any, information or materials promoting water conservation.
   Appendix C - W A T E R F I L T R A T I O N P L A N T A N D O T H E R T R E A T M E N T F A C I L I T I E S: p.5. If the floc tanks are 2-stage and each tank has a detention time of 10 minutes, the total detention time is 20 minutes (not 30 minutes). 20 minutes is short given the raw water quality, temperatures, direct filtration. Although the AO for DOC is 5 mg/L, the goal should be to reduce organics to as low as reasonably possible. (e.g.DOC of <1.8mg/L for biological stability). Treatment options and upgrades should be explored.
   As noted in the report, there are opportunities for improvement and optimization in the treatment process units at the WFP in terms of organics removal, T&O control, filtration performance, aluminum residual control.

   With respect to climate change, what is the ability of the current drinking water treatment process to deal with cyanobacteria and toxic by-products? There have been cyanobacteria events in Lake St John (Ramara) and in many lakes in Muskoka. I think it is highly likely that Lake Couchiching, which is shallow and highly impacted, could be affected by cyanobacteria sometime in the not-too-distant future. The report links cyanobacteria to taste and odour events, but there would also be health risks associated with cyanobacteria.

1. **Name**
   Jane Bonsteel

1. **Mailing Address**
   287 Bay St, Orillia, ON L3V 3X2

1. **Telephone**
   905-301-4472

1. **E-mail Address**
   jane@bonsteel.ca

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File 120063

January 17, 2023

Stephen Gendron, P. Eng.
Manager of Environmental Engineering, Assets and Capital Projects
Development Services and Engineering Department
City of Orillia
50 Andrew Street South, Suite 300
Orillia, Ontario L3V 7T5
sgendron@orillia.ca

Re: Orillia Water Master Plan Update
Final Report Errata

Dear Mr. Gendron:

We wish to bring to your attention the following necessary revisions to the Orillia Water Master Plan Update Final Report, and in the text of the Water Filtration Plant and Other Treatment Facilities report, which is included in Appendix C of the Final Report.

On page 33 of the Final Report, and on pages 14 and 15 and Table 8 of Appendix C, the text should state that the odour threshold concentration of geosmin is 4 ng/L, and that the odour threshold concentration of MIB is 9 ng/L. Revised pages are attached.

We trust this errata is clear. Please call if you have any questions.

Yours truly,
Tatham Engineering Limited

S. Troxler

Suzanne Troxler, B.Eng., M.Sc., P. Eng.
Manager, Water and Wastewater Engineering
ST:pt

copy: Laura Pye City of Orillia lpye@orillia.ca

I:\2020 Projects\120063 - Orillia Water Master Plan Update\Documents\Reports\L - WMP Errata - Gendron.docx

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