141-18986-00

TOWNSHIP OF RUSSELL WATER AND WASTEWATER MASTER PLAN UPDATE

April 2016



TOWNSHIP OF RUSSELL WATER AND WASTEWATER MASTER PLAN UPDATE

Township of Russell

Project No: 141-18986-00 Date: April 2016

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April 5, 2016

Craig Cullen Executive Director Public Works and Infrastructure Services Township of Russell 717 Notre-Dame St. Embrun (ON) K0A 1W1

Subject : Township of Russell Water and Wastewater Master Plan Update

Dear Mr. Cullen,

We are pleased to provide our final report for the Township's Water and Wastewater Master Plan. The mandatory 30-day review period for the Master Plan has concluded and no comments were received.

We trust that this submission meets your expectations.

Yours truly,

Gustavo Arvizu, P. Eng., M. Eng. Project Manager

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REVISION HISTORY

VERSION	DATE	DESCRIPTION
1	February 4, 2016	Issued for 30 day Review Period
2	April 5, 2016	Final Report Issued

EXECUTIVE SUMMARY

The Township of Russell is a lower tier municipality within the United Counties of Prescott Russell (UCPR) in eastern Ontario. In 2014, the Township retained WSP Canada Inc. (WSP) to complete an update to the 2004 Water and Wastewater Master Plan.

The Master Plan study area includes the geographical boundaries of the Township of Russell as defined in 2014, corresponding to an area of approximately 200 square kilometres with four urban communities: Embrun, Russell, Marionville and Limoges. The scope of the Master Plan also includes the Highway 417 Industrial Park.

The Master Plan was developed in accordance with Municipal Class Environmental Assessment (EA) document (October 2000, amended in 2007 and 2011). The Class EA process includes five phases:

- → Phase 1 Problem or Opportunity
- → Phase 2 Alternative Solutions
- → Phase 3 Alternative Design Concepts for Preferred Solution
- → Phase 4 Environmental Study Report (ESR)
- → Phase 5 Implementation

This Master Plan addresses Phases 1 and 2 of Municipal Class EA process.

The Master Plan outlines a framework for future works and infrastructure requirements over the study's planning horizon of 2016 to 2031. It also provides the context for the implementation of projects which are identified as required for future servicing. More detailed investigation is required at the project-specific level for projects identified as Schedule 'B' and Schedule 'C'.

This Master Plan update builds upon the conclusions of the 2004 Master Plan and it is based on the following objectives:

- → Provide reliable water and wastewater services to accommodate the projected residential, commercial, institutional and industrial development in the communities of Russell, Embrun and Marionville
- → Provide water and wastewater servicing to the Highway 417 Industrial Park
- → Define the Township's water and wastewater systems infrastructure requirements for the Study Area to the year 2031

The Master Plan involves an evaluation of the technical, environmental, social and cultural impacts of alternatives to address the system constraints and provide capacity for growth.

PLANNING

The population projections developed as part of the Township's Official Plan and 2013 Development Charges Study were taken as the basis for this Master Plan Update. These are based on the following assumptions:

1. 2013 population of 16,180.

- **2.** 2013-2023 population growth of 3,620.
- 3. Buildout (beyond 2031) population of 22,720.

Furthermore, information provided by the Township's planning department was compiled which includes a list of all the vacant development lands and the various development proposals received by the Township. Based on that list a total of 2723 residential units are estimated during the planning horizon.

It is important to recognize that not all areas of the Township are connected to the municipal water and wastewater system (some are serviced by private wells and septic tanks). Furthermore, the number of units currently connected to the water system is greater than the number of units serviced by the municipal wastewater system. This is an important distinction when planning for the infrastructure requirements.

This Master Plan assumes that all future development within the municipal boundaries would be (unless noted otherwise) connected to the municipal water and wastewater systems.

WATER SUPPLY, TREATMENT AND DISTRIBUTION

The City of Ottawa supplies drinking water to the Township from the Leitrim Road Pumping Station through a 9 km feedermain (Russell Feedermain) connecting to the Eadie Road Metering Station and extending to the Embrun Reservoir. Given the long distance and residence time in the watermain from Ottawa, the water has to be rechloraminated to achieve the required residual for secondary disinfection before distribution to Russell, Embrun and Marionville. The Embrun Reservoir is the hub from which treated water is distributed to the rest of the system. The Reservoir is equipped with two sets of booster pumps which discharge to Embrun and Russell, respectively. The Embrun booster pumps are controlled by the level in the Embrun Water Tower, and the Russell booster pumps are controlled by the level in the Russell Water Tower. The Marionville Booster Station (formerly known as the Russell Water Treatment Plant) draws water from the Russell distribution system to feed Marionville and to fill the Marionville Water Tower. This is illustrated in Figure ES 1 below.

The 417 Industrial Park is currently not connected to the municipal water distribution system. Existing development in the Park is serviced by private well systems.

Prior to 2010, the Embrun/Marionville Water Treatment Plant and the Russell Water Treatment Plant supplied the distribution system. However, since the construction of the Russell Feedermain from Ottawa, these facilities have been decommissioned.

The Township has entered into a water supply agreement with the City of Ottawa that commits up to 11,860 m³ over a 20-hour period to supply the Township.

Per capita water usage has declined considerably since 2010 (year when water metering was implemented in the Township). This has led to a re-evaluation of the remaining servicing capacity of the water supply system. Based on the projected 2031 serviced population, it is expected that the current agreed upon maximum supply capacity from Ottawa would be sufficient to service the forecasted growth. This is shown in Figure ES 2 below.



Figure ES 1 System Water Supply and Distribution System Overview



ES-4

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Figure ES 2 Water Demand Projections 2016-2031

The design of the distribution system is dependent on whether sufficient storage is available to account for variations in demand and to allow for emergencies and firefighting. The availability of floating storage (i.e. water towers) reduces the requirements for redundancy and extra capacity at the various booster pumping stations. The water storage requirements for the system were determined based on MOE Guidelines, and are a function of the maximum day demand of the system and the fire flow requirements. Fire flow requirements were determined based on the Fire Underwriter Survey (FUS) *Water Supply for Public Fire Protection* document. The FUS document establishes minimum fire flow requirements for various types of construction.

An analysis of the available storage and pumping capacity in Embrun, Russell and Marionville was conducted. Based on this analysis, it was determined that the storage and pumping capacity available in the different parts of the system is sufficient to accommodate growth to 2031. The only exception is Marionville, where the limited demands pose water quality constraints requiring the Marionville Water Tower to be only partially filled. This results in a reduced firefighting capacity. To address this issue, additional pumping capacity would be required at the Marionville Booster Pumping Station.

Construction of a secondary watermain loop in Embrun is recommended to improve security of supply.

No other capital projects are required to service the growth forecasted in the planning horizon.

One of the key objectives of this Master Plan is to determine the preferred approach to providing water and wastewater servicing to the Highway 417 Industrial Park. Concurrently with the development of the Master Plan, WSP completed a review of alternatives to service the Industrial Park. The preferred alternative identified involves constructing a watermain from the Eadie Road Metering Station feeding a new inground reservoir and booster pumping station in the vicinity of the Industrial Park, and constructing a watermain connection from the new booster station/reservoir to the Embrun Reservoir.

Several alternatives were evaluated to provide overall water servicing to the Township. The alternatives were evaluated with respect to their impact on the Natural Environment, the Social Environment and the Economic/Technical Environment. The preferred water servicing strategy for Russell Township includes the following:

- → A new watermain from Eadie Road Metering Station to the 417 Industrial Park
- → A new inground reservoir/booster station near the 417 Industrial Park
- → A new watermain from the industrial park booster station/reservoir to the Embrun Reservoir
- → Upgrades to Embrun Reservoir to accommodate the connection from the watermain servicing the Industrial Park
- → New fire pump at the Russell Booster Station to provide fire protection for Marionville
- → A new watermain along Industrial Avenue to loop the Embrun distribution system

A separate Class Environmental Assessment studies would be required for the servicing of the Industrial Park.



Figure ES 3 Preferred Water Servicing Strategy

SEWAGE COLLECTION, TREATMENT AND DISPOSAL

The communities of Embrun and Russell are serviced by independent wastewater systems consisting of a network of gravity sewers, and sewage pumping stations discharging to a Lagoon Treatment Facility.

Russell and 417 Industrial Park

The Russell wastewater system consists of a gravity sewer network with three distinct drainage areas, each leading to a sewage pumping station. Sewage Pumping Station (SPS) 2 services the northwest part of Russell and it discharges upstream of SPS 1's drainage area. SPS 1's drainage area includes most areas

north of the Castor River. SPS 1 discharges directly to the Russell Lagoon Facility. SPS 3 services the northwest area of Russell and it also discharges directly to the Russell Lagoon Facility.

The 417 Industrial Park is currently not connected to the municipal wastewater system. Existing development in the Park is serviced by private septic systems.

The sanitary sewage collection system and pumping station capacities for Russell were evaluated relative to the flows associated with the projected population growth. Historical data for the period 2010-2014 was analyzed and used to establish per capita wastewater design criteria which were used to estimate average daily flow projections. These were then compared to the capacity of the Russell Lagoon Facility to determine the need for expansion. Peak wastewater flows were estimated for each pumping station catchment area to assess limitations in pumping capacity.

The Russell Lagoon has sufficient capacity to service projected growth in Russell. New development within Russell would connect to the existing sanitary system. Therefore, the Do Nothing approach was deemed sufficient to service growth within Russell.

Several alternatives were considered to provide wastewater servicing of the Industrial Park. The preferred alternative involves conveying wastewater flows from the Industrial Park directly to the Russell Lagoon Facility. The alternatives have been evaluated with respect to their impact on the Natural Environment, the Social Environment and the Economic/Technical Environment.

The figure below shows the projected wastewater flows to the Russell wastewater system (including those generated in the Industrial Park). It is expected that the Russell Lagoon Facility would need to be upgraded to accommodate all of the forecasted growth. Furthermore, SPS 1 would also need to be upgraded.



Figure ES 4 Wastewater Flow Projections 2016-2031 – Russell and 417 Industrial Park

The preferred wastewater servicing strategy for Russell is illustrated below. The recommended projects include:

- → Constructing a new sewage pumping station and forcemain to the Russell Lagoons to service the 417 Industrial Park
- → Capacity Upgrades at Sewage Pumping Station 1
- → Expansion of Russell Lagoon Facility

Separate Class Environmental Assessment studies would be required for the servicing of the Industrial Park, the upgrades at SPS 1, and the expansion of the Russell Lagoon Facility.

Embrun

The Embrun wastewater system consists of a gravity sewer network with eight distinct drainage areas, each leading to a sewage pumping station. SPS 2, 4 and 5, all discharge upstream of SPS 1's drainage area. SPS 3 and SPS 7 discharge upstream of SPS 8. SPS 1, SPS 6 and SPS 8 discharge directly to the Embrun Lagoon Facility.

The figure below shows the projected wastewater flows to the Embrun wastewater system. The capacity of the Lagoons is considered sufficient to accommodate the forecasted growth to 2031. However, based on the location of the development areas within Embrun, upgrades would be required at SPS 1, 2, 3 and 7.



Figure ES 5 Wastewater Flow Projections 2016-2031 – Embrun

The preferred wastewater servicing strategy for Embrun is illustrated below. The recommended projects include:

→ Capacity Upgrades at Sewage Pumping Station 1

- → Capacity Upgrades at Sewage Pumping Station 2
- → Capacity Upgrades at Sewage Pumping Station 3
- → Capacity Upgrades at Sewage Pumping Station 7

Separate Class Environmental Assessment studies would be required for upgrades at the pumping stations.

The preferred wastewater servicing alternative for the Township of Russell is shown in the figure below.



Figure ES 6 Preferred Wastewater Servicing Strategy – Embrun

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1 INTRODUCTION

WSP was retained in 2014 by Russell Township to complete a Water and Wastewater Master Plan. The objective of the Master Plan is to review the capacity of the Township's water and wastewater systems, to determine infrastructure needs, and to establish a strategy to provide water and wastewater services to accommodate growth during the 2016 to 2031 planning horizon. The Master Plan builds upon the findings of the Township's 2004 Master Plan and other studies that have been completed since.

The conclusions and recommendations provided in this Master Plan report will help the Township to prepare a Capital Plan and to identify additional investigation and planning requirements. It should be noted that the scope of the project did not include an assessment of repair, rehabilitation or replacement needs related to infrastructure assets reaching the end of their expected service lives.

1.1 STUDY AREA

The study area for the Master Plan includes within the geographical boundaries of the Township of Russell as defined in 2015 and shown in Figure 2-1. The study area encompasses an area of approximately 200 square kilometres and is approximately 13 km wide (E-W) by 16 km long (N-S).

The Township of Russell is bounded by the City of Ottawa to the west, the Nation Municipality to the east, the Township of North Dundas to the south, and the City of Clarence-Rockland to the North. There are four urban communities (Embrun, Russell, Marionville, Limoges) within the study area that represent the majority of the existing population in the municipality. Because the communities of Marionville and Limoges extend into other municipalities, the infrastructure planning (servicing area) for these two communities could extend beyond the study area. The boundaries for each of the four communities correspond to the boundaries shown in the United Counties of Prescott-Russell Official Plan ((Russell Township, 2010).

Limoges is currently serviced by the Nation Municipality and therefore is not considered as part of the scope of this Master Plan.

1.2 SCOPE OF THE MASTER PLAN

Master Plans are long range plans, which integrate infrastructure requirements for existing and future land use with environmental assessment planning principles. These plans examine an infrastructure system(s) or group of related projects in order to outline a framework for planning for subsequent projects and/or developments (Municipal Engineers Association, 2011).

The following are distinguishing features of Master Plans (Municipal Engineers Association, 2011):

- a. The scope of Master Plans is broad and usually includes an analysis of the system in order to outline a framework for future works and developments. Master Plans are not typically undertaken to address a site-specific problem.
- b. Master Plans typically recommend a set of works which are distributed geographically throughout the study area and which are to be implemented over an extended period of time. Master Plans provide the context for the implementation of the specific projects, which make up the plan and satisfy, as a minimum, Phases 1 and 2 of the Class EA process. Notwithstanding that these works may be implemented as separate projects, collectively these works are part of a larger management system. Master Plan studies in essence conclude with a set of preferred

alternatives and, therefore, by their nature, Master Plans will limit the scope of alternatives, which can be considered at the implementation stage.

This Water and Wastewater Master Plan documents existing conditions, forecasts infrastructure needs to service growth, and evaluate alternative servicing strategies to define the preferred solution. The Master Plan evaluates infrastructure needs in 5-year increments starting in 2016 and ending in 2031.

The 20 year planning period corresponds to the planning horizon and population projections set in the Township's Official Plan and is consistent with provincial planning principles.

2 ENVIRONMENTAL ASSESSMENT PROCESS

2.1 ENVIRONMENTAL ASSESSMENT ACT

The Ontario Environmental Assessment Act (EAA) and the associated Codes of Practice require proponents to examine and document the environmental effects that might result from major projects or activities.

The Act defines the environment broadly as:

- 1. Air, land or water
- 2. Plant and animal life, including man
- 3. The social, economic and cultural conditions that influence the life of man or a community
- 4. Any building, structure, machine or other device or thing made by man
- 5. Any solid, liquid, gas, odour, heat, sound, vibration or radiation resulting directly or indirect from activities of man
- 6. Any part or combination of the foregoing and the interrelationships between any two or more of them.

The purpose of the Act is the betterment of the people of the whole or any part of Ontario by providing for the protection, conservation and wise management of the environment in the Province (RSO1990, c. 18, s.2).

2.2 PRINCIPLES OF ENVIRONMENTAL PLANNING

The Act sets a framework for a systematic, rational and replicable environmental planning process that is based on five key principles, as follows:

- → Consultation with affected parties Consultation with the public and government review agencies is an integral part of the planning process. Consultation allows the proponent to identify and address concerns cooperatively before final decisions are made. Consultation should begin as early as possible in the planning process.
- Consideration of a reasonable range of alternatives Alternatives to include functionally different solutions to the proposed undertaking as well as alternative methods of implementing the preferred solution. The "do nothing" alternative must also be considered.



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- → Identification and consideration of the effects of each alternative on all aspects of the environment This includes the natural, social, cultural, technical, and economic environments.
- Systematic evaluation of alternatives in terms of their advantages and disadvantages, to determine their net environmental effects - The evaluation shall increase in the level of detail as the study moves from the evaluation of alternatives to the proposed undertaking to the evaluation of alternative methods.
- → Provision of clean and complete documentation of the planning process followed This will allow traceability of decision-making with respect to the project. The planning process must be documented in such a way that it may be repeated with similar results.

2.3 MUNICIPAL CLASS ENVIRONMENTAL ASSESSMENT

To meet the requirements of the EAA, this project is being conducted in accordance with the Class Environmental Assessment (EA) process. The requirements for undertaking a Class EA are described in the document Municipal Class Environmental Assessment, (October 2000, as amended in 2007 & 2011), Municipal Engineers Association (MEA).

The Class EA planning process requires the integration of sound engineering judgement, prudent longterm planning and protection of all aspects of the environment (natural, social, economic and cultural). This includes consultation with the public and affected agencies, to obtain comments and input, to ensure regulatory compliance and ultimately achieve acceptance for the preferred alternative.

The overall result of the Class EA process is the identification of a preferred solution which results in minimal impact on the environment.

Class Environmental Assessments were approved by the Minister of the Environment in 1987 for municipal projects having predictable and preventable impacts. The Class EA streamlines the planning and approvals process for municipal infrastructure projects (including water and wastewater projects) which display the following important characteristics in common:

- → Recurring
- → Similar in nature
- → Usually limited in scale
- → Predictable range of environmental effects
- → Responsive to mitigation measures

The Class EA document applies to a group of projects which are approved under the Environmental Assessment Act, provided they are planned for according to the requirements of the Class EA. The specific requirements of the Class EA document depend on the type of project, its complexity and the significance of potential environmental impacts.

The Municipal Class Environmental Assessment (MCEA) document, prepared by the Municipal Engineers Association (October 2000, as amended in 2007 & 2011), outlines the procedures to be followed to satisfy EA requirements for water, wastewater and road projects. The process includes five phases:

- → Phase 1: Problem Definition
- → Phase 2: Identification and Evaluation of Alternative Solutions to Determine a Preferred Solution

- → Phase 3: Examination of Alternative Methods of Implementation of the Preferred Solution
- → Phase 4: Documentation of the Planning, Design and Consultation Process
- → Phase 5: Implementation and Monitoring

Public and agency consultation are integral to the Class EA planning process. Projects subject to the Class EA process are classified into four possible "Schedules" depending on the degree of expected impacts. It is important to note that the Schedule assigned to a particular project is proponent-driven. For example, if a project has been designated as Schedule A, the proponent can decide to comply with the requirements of a Schedule B or C of the MEA process based on the magnitude of anticipated impacts or the special public and agency consultation requirements specific to that particular project.

Agreements made or commitments given by the proponent to affected agencies or the public during the course of the screening process must be followed through and implemented, otherwise the EA approval will be not be granted. If an affected agency or the public has a concern that cannot be resolved by discussion and negotiation with the proponent, then they can request a proponent to comply with Part II of the EA Act. Through issuance of a Part II Order, Schedule "B" and Schedule "C" projects may be elevated to an individual EA, requiring the proponent to comply with Part II of the EA Act. Schedule "B" projects could also be elevated to a Schedule "C".

The Class EA process flowchart is provided in Figure 2-2 below.

SCHEDULE A PROJECTS

Schedule A projects are minor, operational and maintenance activities and are pre-approved without the need for further assessment. Projects with this designation are typically limited in scale and have minimal adverse environmental impacts. Examples of Schedule A projects include expansion of waterworks to connect to an existing system. This type of project is pre-approved and the proponent may proceed without following the procedures set out in any other part of the Class EA process.

SCHEDULE A+ PROJECTS

Schedule A+ projects were introduced by MEA in 2007. Similar to Schedule A, these projects are also pre-approved. However the main difference is that for Schedule A+ projects, the public must be advised prior to the project implementation. Examples of Schedule A+ projects include upgrades to a water treatment plant up to its existing rated capacity where no land acquisition is required; and the establishment, extension or enlargement of a sewage collection system and all necessary works to connect the system to an existing sewage or natural drainage outlet, provided all such facilities are in either an existing road allowance or an existing utility corridor, including the use of trenchless technology for water crossings.

SCHEDULE B PROJECTS

Schedule B projects generally include improvements and minor expansions to existing facilities where there is potential for some adverse environmental impacts. These projects require screening of alternatives for their environmental impacts and completion of Phases 1 and 2 of the Class EA planning process. If outstanding issues remain after the public review period, any party may request that the Minister of the Environment consider a Part II Order (also known as elevating the project to a Schedule C or an Individual EA).



NOTE: This flow chart is to be read in conjunction with Part A of the Municipal Class EA



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Provided no significant impacts are identified and no requests for a Part II order to a Schedule C or Individual Environmental Assessment are received, Schedule B projects are approved and may proceed directly to implementation. Examples include construction of new water storage facilities and water/wastewater conveyance facilities (pumping stations), among others.

SCHEDULE C PROJECTS

Schedule C projects generally include the construction of new facilities and major expansions to existing facilities. These projects are typically more complex and have the potential for significant environmental effects. As a result they proceed under full planning and documentation procedures and satisfy all five phases of the Class EA planning process. Phase 3 involves the assessment of alternative methods of carrying out the project, as well as public consultation on the preferred conceptual design. Phase 4 normally includes the preparation of an Environmental Study Report which is filed for public review. Provided no significant impacts are identified and no requests for Part II Order or elevating to an Individual Environmental Assessment are received, Schedule C projects are construction of a new water system including water supply and distribution system and expansion of a wastewater treatment facility.

2.4 MASTER PLANNING

While the planning and design process described above is a process by which municipalities may plan municipal works on a project by project basis, the MCEA process allows for cases when it is beneficial to begin the planning process by considering a group of related projects, or an overall system, e.g. water, wastewater and/or roads network, or a number of integrated systems, e.g. infrastructure master plan, prior to dealing with project specific issues. By planning in this way, the need and justification for individual projects and the associated broader context are better defined.

Master Plans are long range plans which examine infrastructure systems or groups of related projects to outline a framework for planning of subsequent projects and/or developments.

The following are distinguishing features of Master Plans:

- a. Their scope is broad and usually includes a system-level analysis to outline a framework for future works. Master Plans are typically not focused on a site-specific problem.
- b. Master Plans typically recommend a set of works which are distributed geographically throughout the study area and which are to be implemented over an extended period of time.
- c. Master Plans provide the context for the implementation of specific projects which make up the plan and satisfy, as a minimum, Phases 1 and 2 of the Class EA process. Notwithstanding that these works may be implemented as separate projects, collectively these works are part of a larger management system. Master Plan studies in essence conclude with a set of preferred alternatives and, therefore, by their nature, Master Plans limit the scope of alternatives which can be considered at the implementation stage.

The MCEA document (Appendix 4) outlines several approaches to conducting Master Plans.

Approach # 1 was adopted for the completion of this Master Plan. This process involves the preparation of a Master Plan document at the end of Phases 1 and 2 of the MCEA process, and is done at a level of detail which would require more investigation at the project-specific level to fulfill the requirements for the specific Schedule B and C projects identified within the Master Plan. The Master Plan document is made available for public comment prior to being approved by the municipality.

The Master Plan will become the basis for future investigations for specific Schedule B and C projects identified within it. Schedule B projects would require the filing of a Project File for review while Schedule C projects would have to fulfill Phases 3 and 4 prior to filing an Environmental Study Report for public review.

3 POLICY DOCUMENTS AND PLANNING STUDIES

3.1 THE PLANNING ACT, 1990

The Planning Act establishes the mechanisms and rules for land use planning in Ontario, outlining how land uses may be controlled, and who may control them. The Act sets the basis for the preparation of official plans and planning policies for future development, and it provides municipalities with local autonomy to make decisions and streamline the planning process. The Act empowers local citizens to provide their input to their municipal council and, where permitted, to appeal decisions to the Ontario Municipal Board.

3.2 PROVINCIAL POLICY STATEMENT, 2014

The Provincial Policy Statement (PPS) is a key component of Ontario's planning system as it sets policy direction on matters of provincial interest related to land use planning, growth management, environmental protection, and public health and safety; and aims to provide a stronger policy framework that guides communities in Ontario toward a higher quality of life and a better long-term future.

The PPS establishes the various municipalities' roles in planning for growth, intensification and redevelopment. New settlement area policies will only permit expansions where it is demonstrated that opportunities for growth are not available through intensification, redevelopment or in designated areas. The PPS also requires municipalities to co-ordinate and provide direction on policies with cross municipal boundaries, such as natural heritage systems and resource management. The PPS provides the basis or context for all Provincial Plans and Municipal Official Plans. The Province issued a new PPS on February 24, 2014, which came into effect on April 30, 2014.

3.3 OFFICIAL PLAN FOR THE UNITED COUNTIES OF PRESCOTT AND RUSSELL PLANNING AREA

The United Counties of Prescott and Russell Official Plan (Stantec, 2006) was adopted by the Council of the Corporation of the United Counties of Prescott and Russell on May 23, 2006.

Of relevance to this Master Plan is Schedule 'A', Land Use Designations, which designates the Villages of Embrun, Russell and Limoges as Urban Policy Areas, while the Village of Marionville is designated as a Community Policy Area. All the lands north of Highway 417, other than Limoges, as well as a limited number of properties south of the said highway, are designated Rural Policy Areas. The rest of the lands within the boundaries of the Township of Russell are, with the exception of several Mineral Aggregate Extraction Areas (licensed pits and quarries and Reserve Areas) and the 417 Industrial Park (designated as Trade and Industry Policy Area) are all designated Agricultural Resource Policy Area.

The County's Official Plan establishes policies for growth and settlements which primarily apply to Urban Policy Area and Community Policy Area designations. Some sections, particularly those considered as the most relevant to the Township of Russell Master Plan project are listed below.

3.3.1 GROWTH AND SETTLEMENT POLICIES

"The Urban Policy Area is intended to absorb a significant part of future growth in the United Counties.

The Urban Area policies are intended to create a planning framework which will encourage and support diversified, mixed use communities. The policies are intended to ensure that local Councils will have the ability and authority to shape their communities in accordance with local needs and local characteristics. The policies are also intended to permit continued development while also ensuring that costly unplanned engineered water and sewer infrastructures will not be required to resolve environmental problems in the future" [s.2.2.1].

3.3.2 LOCAL INFRASTRUCTURE PLANNING

"Council recognizes that the responsibility for the planning, construction and maintenance of some infrastructures is the responsibility of local municipalities. Council is aware of on-going efforts to resolve local infrastructure problems. Continued efforts to find solutions to local infrastructure problems by local municipalities are considered to be appropriate and in conformity with the policies of the United Counties Official Plan." [s.3.2.1].

3.3.3 GENERAL WATER AND WASTEWATER POLICIES

"The following general policies shall apply:

- 1. Development will not be encouraged where such development would result in unplanned expansions to existing water and wastewater infrastructures.
- 2. Development shall generally be directed to communities which can reasonably provide or extend full water and wastewater services.
- 3. On lands located along water transmission main routes, existing or new development on partial servicing (water service only) is permitted in accordance with the municipality's connection policies. New lot creation with a direct connection to the municipal water service shall be in accordance with section 7.4.2. Plans of subdivisions with a direct connection to the municipal water service shall not be approved.
- 4. The allocation of infrastructure capacity for infill and economic development purposes is encouraged.
- 5. Although it is recognized that the United Counties do not provide water and wastewater services, Council may assist local municipalities with the operation and/or expansion of water and wastewater systems when requested to do so. The upper tier involvement will be limited to technical assistance provided by the Public Works Department and the support of local efforts to secure financial assistance from senior levels of government. Such support will generally be provided when proposed improvements are consistent with the policies of the Official Plan or required to resolve health or environmental problems" [s.3.4.1] (parts only).

3.3.4 WATER AND WASTEWATER POLICIES IN THE URBAN POLICY AREA

Development shall be permitted only where it is confirmed by the local municipality that there is sufficient reserve capacity in the municipal water and sewer services in accordance with Ministry of the Environment guidelines and regulations.

Some Urban Policy Areas include lands where development has proceeded on the basis of municipal water only, or on private services. The Plan recognizes such areas as exceptions in the Urban Policy Area. Development on municipal water or on private water and septic services will only be permitted where the following conditions are met:

- 1. A local Official Plan specifically identifies the lands in question, either through a textual description or on mapping which forms part of the plan, and further describes the related level of water and sewer services
- 2. A local Official Plan includes appropriate policies which address the need to ensure long term water and waste water servicing needs
- 3. The municipality is satisfied that there will be no additional pressure for costly unplanned extension of full municipal services to the subject lands
- 4. Local zoning by-laws include provisions for larger frontages and lot areas

Partial services shall only be permitted where they are necessary to address failed individual on-site water and/or sewage services and within an Urban Policy Area to allow for infilling and rounding out of existing development on partial services. There must be reserve sewage or water system capacity and site conditions must be suitable for the long-term provision of services" [s.2.2.6]

3.3.5 WATER AND WASTEWATER POLICIES IN THE COMMUNITY POLICY AREA

"Some communities in the Community Policy Area designation were developed on the basis of communal sewage treatment services or municipal water services. The principal reason for the development of partial servicing in these communities was the need to resolve groundwater contamination problems. Continued development may take place in these communities on the basis of partial services provided that there is sufficient capacity in the existing infrastructure and provided that there is no negative impact on groundwater resources. Council may require evidence, in the form of a hydrogeology study or an Impact Assessment Study which confirms that the proposed development is feasible from a health and environment standpoint.

Development on private services in partially serviced communities shall not be permitted without an amendment to this Official Plan.

Development of five residential units or lots or more on communal water or communal waste water services may be permitted, subject to the provisions of section 7.4.1, where municipal water and/or waste water services cannot be provided and where site conditions are suitable over the long term. Communal systems are subject to the requirements of the Safe Drinking Water Act. Subsurface sewage disposal systems with a design capacity greater than 10,000 litres per day require approval under the Ontario Water Resources Act.

The expansion of the service capacity of the existing municipal or communal system in these communities for the purpose of increasing the development capacity of the community in question may
be permitted without an amendment to this Official Plan provided that the limits of the designation are not altered. Where an expansion to the limits of the Community Policy Area is proposed, the policies of Section 2.3.3 shall apply.

The expansion of communal or municipal water or sewer services is permitted within the limits of the policy area where the expansion is required for health or environmental purposes." [s2.3.6]

3.4 TOWNSHIP OF RUSSELL OFFICIAL PLAN

The Official Plan of the Township of Russell was adopted by the Council of the Corporation of the Township of Russell on August 23, 2010.

Schedule A1 through A5 of the Official Plan identifies the Land Use Designations for Embrun, Russell, Limoges, Marionville and the Highway 417 Industrial Park. The predominant land use designation within the village boundaries is Residential. In the Villages of Embrun and Russell, there are large areas designated Open Space, several areas designated Commercial and Industrial, some areas designated as Business Park, and some areas designated Multi-Unit Residential.

Along the shores of the Castor River, the Plan identifies a series of Sensitive Lands, which include both Unstable Slopes and/or Flood Risk Areas.

Similar to the Schedule A of the Counties Official Plan, the Schedule A of the Township of Russell Official Plan, with the exception of the Villages described above, designates most of the lands south of Highway 417 as "Agriculture". The intersection of Highway 417 and St. Guillaume Road (417 Industrial Park) is designated Industrial Park.

North of Highway 417, with the exception of the Village of Limoges, the designation of the lands is General Rural.

Schedule B identifies the roads within the Township limits both by jurisdiction and by their function. All County Roads are designated Village Major Collectors, while the rest of the roads are identified as Local Roads. An exception to this is a portion of Burton Road north of the 416 Industrial Park, which is shown on the plan as a Village Minor Collector.

The following are some of the most relevant policies of the Township Official Plan dealing with development issues in the Municipality:

"On this basis, the role of the Township of Russell Official Plan is to guide and direct the use of land within the Township's four Villages (Embrun, Russell, Limoges, and Marionville) and the industrial park adjacent to Highway 417. The boundaries of these areas are illustrated on Schedules A1-A5 and correspond to the boundaries of their respective policy designations as per the County Official Plan (Urban Policy Area, Community Policy Area, or Trade and Industry Policy Area). This Official Plan provides a vision for the future growth within these areas and a policy framework to guide their physical development for a period of 20 years, i.e. until the year 2031. These areas remain subject to the County Official Plan policies, which must be read in conjunction with this document. With the exception of the Highway 417 Industrial Park, the scope of the Township of Russell Official Plan does not include the areas located outside the Village boundaries, which are entirely subject to the policies of the County Official Plan." [s1.1] (parts only).

3.4.1 WATER AND WASTEWATER – GENERAL POLICIES

"All new development will generally occur on the basis of full municipal services, with the exception of Marionville where development on partial municipal services may be allowed (water only) and the Highway 417 Industrial Park where development on private services may be allowed.

Development will not be encouraged where such development would result in, or could lead to, unplanned expansions to existing water and wastewater infrastructures.

Development shall generally be directed to areas where water and wastewater services, if available, can reasonably be extended. Development applications on lands that are not serviced or partially serviced may be refused on the basis that full services will be extended to these lands in the future.

Development shall be permitted only where it is confirmed by the Township that there is sufficient reserve capacity in the municipal water and sewer services in accordance with Ministry of the Environment guidelines and regulations.

Council may consider the need to expand the public piped systems within the Villages, and may proceed to do so without an amendment to this Official Plan.

There are no plans to extend public piped systems into the rural areas, beyond the Village designations. Notwithstanding the foregoing, public piped systems may be extended beyond the Villages for specific projects approved by the Council of the Township of Russell, including the Highway 417 Industrial Park development, subject to an amendment to the County Official Plan. Council will explore means to bring public piped systems to the Highway 417 Industrial Park.

The developer shall be responsible for all costs related to the introduction or extension of any service required by virtue of these policies and an agreement to this effect shall be signed by the developer prior to final approval of the development." [s5.1.1] (parts only).

3.4.2 WATER AND WASTEWATER – EMBRUN AND RUSSELL

"Future development in the Villages of Embrun and Russell will generally occur on the basis of full municipal services.

For the purposes of servicing and development, the Villages of Embrun and Russell are divided into 'Full Municipal Serviced Areas' and 'Non-Serviced Development'. 'Non-Serviced Development' is identified on Schedules A1 and A2, while the remaining areas are considered 'Full Municipal Serviced Areas'. 'Full Municipal Serviced Areas' may also include partially serviced areas.

Council shall consider development applications within the 'Full Municipal Serviced Areas', excluding partially serviced areas, provided there is reserve capacity in both municipal systems to service the proposed development.

Within the 'Non-Serviced Development' and partially serviced areas, Council may consider development applications which would have the effect of increasing the number of dwelling units (i.e. infilling and/or intensification) without the need for an Official Plan Amendment, subject to the other policies of this Plan. In particular, the site conditions must be suitable for the long-term provision of private individual services." [s5.1.1.1] (parts only).

3.4.3 WATER AND WASTEWATER – LIMOGES

"Future development in the Village of Limoges will generally occur on the basis of full municipal services, subject to available capacity in The Nation Municipality." [s5.1.1.2] (parts only).

3.4.4 WATER AND WASTEWATER – MARIONVILLE

"Marionville is serviced by municipal water and private wastewater disposal systems in the form of septic systems. It is not expected that municipal wastewater services will be provided to Marionville within the planning period (up to 2031)." [s5.1.1.3] (parts only).

3.4.5 WATER AND WASTEWATER – HIGHWAY 417 INDUSTRIAL PARK

"The Highway 417 Industrial Park does not currently have access to municipal water and wastewater services and is serviced by private wells and septic systems. Future development in the Highway 417 Industrial Park will occur on the basis of private services.

Notwithstanding the foregoing, public piped systems may be extended to the Highway 417 Industrial Park development, subject to an amendment to the County Official Plan." [s5.1.1.3] (parts only).

3.5 ZONING BY-LAW

In addition to the above-listed documents, the Township of Russell has a comprehensive Zoning By-law, updated on July 2011. The Zoning By-law implements the policies of the Township Official Plan and is deemed to conform also to the Official Plan of the Counties of Prescott and Russell.

4 EXISTING CONDITIONS

The majority of the land within the villages of Embrun and Russell is serviced by municipal water and wastewater. However, not all of the areas connected to the water system are connected to the wastewater system.

Water and wastewater servicing in Limoges is provided by the Nation Municipality.

Marionville is connected to the municipal water system. However, no municipal wastewater system is available.

The 417 Industrial Park is currently not connected to the municipal systems. Existing development in the Park is serviced by private well and septic systems.

4.1 WATER SYSTEM

4.1.1 SYSTEM OVERVIEW

The City of Ottawa supplies drinking water to the Township from the Leitrim Road Pumping Station through a 9 km feedermain (Russell Feedermain) connecting to the Eadie Road Metering Station and extending to the Embrun Reservoir. Given the long distance and residence time in the watermain from Ottawa, the water has to be rechloraminated at the Embrun Reservoir to achieve the required residual for secondary disinfection before distribution to Russell, Embrun and Marionville.

The Reservoir is equipped with two sets of booster pumps which discharge to Russell and Embrun, respectively. The Russell booster pumps are controlled by the level in the Russell Water Tower, and the Embrun booster pumps are controlled by the level in the Embrun Water Tower. The Marionville Booster Station (formerly known as the Russell Water Treatment Plant) draws water from the Russell distribution system to feed Marionville and to fill the Marionville Water Tower. This is illustrated in Figure 4-1 below.

Prior to 2010, the Embrun/Marionville Water Treatment Plant and the Russell Water Treatment Plant supplied the distribution system. However, since the construction of the Russell Feedermain from Ottawa. these facilities have been decommissioned.



The Township has entered into a water supply agreement with the City of Ottawa that commits up to 11,860 m³ over a 20-hour period to supply the Township.

The Township owns and operates the water facilities in the municipality.

MOE issued on August 25, 2011 Drinking Water Works Permit 184-201 that describes the system and which together with Municipal Drinking Water License 184-101 sets the requirements for the operation and maintenance of the drinking water system. The following table summarizes the capacities of the various facilities in the Township's water system.

Table 4-1 Water Storage Facilities in Water System

FACILITY		CAPACITY
Embrun Reser	voir	1,410 m ³
Russell Water T	ower	2,300 m ³
Embrun Water 1	Tower	2,300 m ³
Marionville Water	Tower	1,135 m ³
Table 4-2 Pumping Facilities in	Water System	
FACILITY	FIRM CAPACITY	DESCRIPTION
Russell Booster Station (Embrun Reservoir)	31.4 L/s @ 52.8 m	Two pumps (one duty, one standby) each having a design flow rate of 31.4 L/s at a total dynamic head of 52.8 m
		Standby power
Embrun Booster Station (Embrun Reservoir)	57.5 L/s @ 52.34 m	Three pumps (two duty, one standby), each having a design flow rate of 28.75 L/s at a total dynamic head of 52.34 m Standby power
Marionville Booster Station (Russell Water Treatment Plant)	7.18 L/s @ 38 m	Two pumps (one duty, one standby), each having a design flow rate of 7.18 L/s at a total

dynamic head of 38 m Standby power



Figure 4-1 System Water Supply and Distribution System Overview



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The Limoges Water Treatment Plant located in The Nation Municipality feeds the water distribution systems serving the portion of the community of Limoges within the Township of Russell and the community of Le Baron Estate Development. Since the water system is under the responsibility of The Nation Municipality, the present Master Plan will not provide further details on this system.

There are approximately 27 km of feedermain and rough 62 km of distribution watermain in Township's distribution system. The overall water distribution system is shown in Figure 4-2 below.

provides a map of the water distribution network for the community of Russell. The development in the Community of Russell north of the Castor River, is serviced by a distribution network except for one neighborhood at the east end of the Community. The distribution network also services the immediate neighborhoods located south of the Castor River and east of South Russell Road. The remaining developed lands inside the Community boundaries located south of the Castor River and west of South Russell Road are serviced by private water systems. Two watermains cross the Castor River, providing adequate looping for fire protection and for emergencies.

Much of the development on municipal water in Embrun is located north of the Castor River. Only a portion of St Jacques Street, south of the Castor River is serviced by the distribution system. The elevated water storage tank is located on the south side of river. The remaining developed lands inside the Community boundaries and located south of the Castor River are serviced by private water systems.

All streets within the community of Marionville are mostly serviced with 150 mm diameter pipes. The only exception is the 250 mm diameter main on Gregoire Street and the portion Marionville Road up to the School.



4.1.2 SERVICED POPULATION

The 2014 estimated population serviced by the municipal water works systems for the urban communities of Embrun, Russell and Marionville was 6,717, 5,102 and 362 respectively. It must also be noted that there are some dwellings in Russell and Embrun which are on private wells and which are not serviced by the municipal water system.

The equivalent total estimated population within the three communities serviced by the municipal water system was 12,181 people in 2014.

4.1.3 WATER DEMANDS

The average and maximum day demand at the three communities between 2010 and 2014 are 2,531 m³/d and 4,640 m³/d. It should be noted however that the maximum day occurred in 2010 (the year when metering was started to be implemented). Maximum day demands have decreased significantly since 2011 and have remained relatively the same since. A spreadsheet showing historical water demands over the period 1999 to 2014 is included in **Appendix A**.

The five-year maximum day demand corresponds to 39.1% of the allowable maximum supply from Ottawa of $11,860 \text{ m}^3/\text{day}$.

4.1.4 WATER QUALITY IN DISTRIBUTION NETWORK

According to the 2014 Water and Sewer Annual Operations Compliance Report, the quality of the water distributed to the three communities met all the Ontario Drinking Water Standards outlined in the Safe Drinking Water Act, 2002.

4.1.5 FIRE PROTECTION

The water distribution systems can adequately provide fire flow within all three communities.

4.2 WASTEWATER SYSTEM - RUSSELL

The Township of Russell services the communities of Russell and Embrun with two separate municipal sanitary systems. A portion of each community currently operates on private sewage disposal systems.

The collection infrastructure is primarily composed of gravity sewer systems, pumping stations and forcemains. Together these components transport wastewater from the serviced buildings to the respective municipal treatment facilities near Embrun and Russell. In each community, the wastewater treatment is performed in stabilization lagoons. Final discharge of the treated wastewater is into the Castor River for both locations.

The community of Marionville does not currently have any sanitary works. There are no plans for providing this community with sanitary works in the next 20 years.

The 417 Industrial Park is currently not connected to the municipal wastewater system. Existing development in the Park is serviced by private septic systems.

A portion of the community of Limoges is within the Township of Russell, and is serviced by a gravity sewer, a pumping station and a waste stabilization lagoon system owned and operated by the Nation Municipality. This sanitary system is not considered in the scope of this Master Plan.

4.2.1 SYSTEM OVERVIEW

COLLECTION

The Russell wastewater system consists of a gravity sewer network with three distinct drainage areas, each leading to a sewage pumping station. Sewage Pumping Station (SPS) 2 services the northwest part of Russell and it discharges upstream of SPS 1's drainage area. SPS 1's drainage area includes most areas north of the Castor River. SPS 1 discharges directly to the Russell Lagoon Facility. SPS 3 services the northwest area of Russell and it also discharges directly to the Russell Lagoon Facility. The Russell Lagoon Facility is located to the east of the community on the south side of the river.

An overview of the collection system can be seen in Figure 4-3 below. The majority of development north of the Castor River in the community of Russell is serviced by a sanitary wastewater gravity system except for two residential/commercial subdivisions. The neighborhoods immediately abutting the bridge on Russell South Road, south of the Castor River, are also serviced by a gravity sanitary system. The remaining developed lands inside the community boundaries are serviced by private sewage systems.

Most of the piping within the collection system is 200 mm or 250 mm diameter, except for the 300 mm diameter collector pipe along Mill Street and across the Castor River to SPS 1.

FACILITY	FIRM CAPACITY	DESCRIPTION
SPS 1	80 L/s @ 44 m TDH	Two pumps (one duty, one standby) each having a design flow rate of 80 L/s at a total dynamic head of 44 m
		300 mm diameter forcemain
		Standby power diesel generator
SPS 2	23.5 L/s @ 12.2 m TDH	Two pumps (one duty, one standby) each having a design flow rate of 23.47 L/s at a total dynamic head of 12.2 m
		150 mm diameter forcemain
		Standby power diesel generator
SPS 3	110 L/s @ 19 m TDH	Two pumps (one duty, one standby) each having a design flow rate of 110 L/s at a total dynamic head of 19 m
		400 mm diameter forcemain
		Standby power diesel generator
		Standby power diesel generator

 Table 4-3
 Russell Collection System Pumping Stations

The station servicing Mother Teresa Catholic Elementary School, at the North end of the community is privately owned and operated and is not included in the scope of this report.



Legend

- Sanitary Sewer Pumping Station
 - Sanitary Sewer Manhole
- Sanitary Sewer
- Sanitary Forcemain
- Watercourse
- Village Boundary
- Sanitary Sewer Drainage Areas

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Pumping Station 1 Drainage Area Pumping Station 2 Drainage Area Pumping Station 3 Drainage Area



Figure 4-3

Sanitary Collection System Russell This page intentionally left blank.

TREATMENT

The Russell Lagoon Facility is a facultative waste stabilization pond system with seasonal discharge to Castor River. The Russell Lagoon was recently upgraded to a rated design capacity of 2,675 m³/d. The upgrades included modification of the inlet works: the addition of two waste stabilization cells and a storage cell (all of the new cells equipped with an aeration system); and an automatic control system to control the rate of effluent discharge to the Castor River. The system includes alum addition for phosphorus removal.

An overview of the Russell sewage treatment process and its connection to the rest of the pumping facilities in the collection system can be seen in Figure 4-4.



Pump Station No. 3

Figure 4-4 Russell Lagoon Facility Process Schematic

The operation and maintenance conditions for the facility are established in Environmental Compliance Approval (ECA) 3202-9XMPMQ issued August 25, 2015.

Despite the facility being rated for 2,675 m³/d, the ECA sets the facility's Maximum Operating Capacity at 2,000 m³/d until a Total Phosphorus Management (TPM) Agreement with the South Nation Conservation Authority has been established stating otherwise. Furthermore, the ECA requires that the proposal detailing the TPM Agreement be submitted to the Ministry for review upon the average daily flow of the facility reaching 1,700 m³/d (Ministry of the Environment and Climate Change, 2015).

Effluent discharge from the Lagoon Facility is done seasonally, on a controlled basis. The ECA establishes two discharge seasons:

- → Spring: starting when the liquid surface in the lagoon is substantially free of ice cover and ending April 30. The rate of discharge is such that a dilution ratio (river flow rate to effluent discharge rate) is 67.1:1 at a minimum.
- → Fall: starting October 1 and ending December 15. The rate of discharge is such that a dilution ratio is 13:1 at a minimum.

4.2.2 SERVICED POPULATION

The 2014 estimated population serviced by the Russell sewage system was 4,127. The estimated equivalent number of dwellings was 1,394. It should be noted that this population does not match that serviced by the municipal water system (there are more units connected to the municipal water system than units serviced by the sewage system).

4.2.3 WASTEWATER FLOWS

The capacity of the Russell Lagoon is expressed in terms of the average day influent raw sewage flow.

Based on the historical data for the past five years, the average day influent flow was 870 m³/day, which corresponds to 43.5% of the allowable maximum capacity of 2,000 m³/day and 32.5% of the rated capacity of 2,675 m³/day.

A spreadsheet showing historical wastewater flows over the period 1999 to 2014 is included in **Appendix B**.

4.2.4 TREATED EFFLUENT QUALITY

The ECA for Russell Lagoon specifies effluent objectives and effluent limits for BOD, TSS, TAN, TP, hydrogen sulphide and pH. The ECA also requires testing of the effluent for acute lethality to Rainbow Trout and *Daphnia Magna*.

The effluent objectives and limits are compared to average effluent quality data for the period 2011-2013 for the Russell Lagoon in Table 4-4 below.

Table 4-4: Russell Lagoon Effluent Objectives, Limits and 2011-2013 Effluent Quality

EFFLUENT PARAMETER	AVERAGE CONCENTRATION OBJECTIVE	AVERAGE CONCENTRATION LIMIT	AVERAGE EFFLUENT QUALITY (2011-2013)
CBOD ₅	20.0 mg/L	30.0 mg/L	3.5 mg/L
Total Suspended Solids	20.0 mg/L	30.0 mg/L	5.2 mg/L
Total Phosphorus	< 0.5 mg/L	0.5 mg/L 1.0 kg/d or 365 kg/year (average loading)	0.08 mg/L

EFFLUENT PARAMETER	AVERAGE CONCENTRATION OBJECTIVE	AVERAGE CONCENTRATION LIMIT	AVERAGE EFFLUENT QUALITY (2011-2013)
Total Ammonia Nitrogen	1.0 mg/L (Fall) 5.0 mg/L (Spring)	2.0 mg/L (Fall) 10.0 mg/L (Spring)	0.08 mg/L (Fall) 0.73 mg/L (Spring)
Hydrogen Sulphide	N/A	Non-detectable	0
pН	6.5 – 8.5	6.0 – 9.5	7.1-9.4

As noted above, the Lagoon's performance is excellent with effluent concentrations well below the requirements set by the ECA.

4.2.1 ASSIMILATIVE CAPACITY OF THE CASTOR RIVER

The Castor River receives treated effluent from Embrun and Russell, as well as the nearby community of Limoges (Nation Municipality), before it joins the South Nation River. Stantec completed an assimilative capacity review of the Castor River in 2005. According to the study (Stantec, 2005), the limiting criterion for discharge was ammonia in the fall.

The Castor River can assimilate 1,590,000 m³ of effluent with an average discharge concentration of 2.0 mg/L Total Ammonia Nitrogen (TAN) during the fall discharge window of October 1 – December 15 (Total Ammonia Nitrogen for the spring discharge would be acceptable at 10 mg/L). This corresponds to an average flow of 21,487 m³/d during the fall. This volume of effluent indicates that approximately 17% of the assimilative capacity of the river has been utilized, when considering flows from Embrun, Russell and Limoges (based on the 1073 m³/d rated capacity of the Limoges St. Isidore Lagoons per their existing C of A).

It should be noted however that historical effluent discharges of TAN from the Russell Lagoons have been less than 2 mg/L, which indicates that the assimilative capacity of the Castor River would be even greater.

4.3 WASTEWATER SYSTEM – EMBRUN

4.3.1 SYSTEM OVERVIEW

COLLECTION

Much of the development in the community of Embrun is located north of the Castor River. The majority of the community is serviced by a sanitary wastewater gravity system, except for about three residential neighborhoods and two commercial subdivisions. Additionally, a portion of St. Jacques Street south of the Castor River, is serviced by the gravity sanitary system. The remaining developed lands inside the community boundaries and located south of the Castor River are serviced by private sewage systems.

Most of the sanitary sewers consist of 250 and 300 mm diameter gravity sewers. A 400 mm diameter trunk sewer runs on Notre-Dame Street between St-Augustin Street and SPS 1. The community is currently divided into eight drainage areas each leading to a sewage pumping station. SPS 2, 4 and 5, all discharge upstream of SPS 1's drainage area. SPS 3 and SPS 7 discharge upstream of SPS 8. SPS 1, SPS 6 and SPS 8 discharge directly to the Embrun Lagoon Facility.

An overview of the drainage areas and sewers is presented in the figure below. The extent of the drainage areas is described below.

Table 4-5 Embr	un Collection System Drainage Areas	
DRAINAGE AREA	CONTRIBUTING AREAS	DISCHARGES TO
1	This area, located on the north shore of the river, includes the portion of the community east of St-Augustin Street, from the river to Patenaude Subdivision. This drainage area receives sewage from SPS 2, 4 and 5.	Flows by gravity to SPS 1.
2	It covers the central portion of the community north of the river, from St- Augustin to Ste-Marie Street, and from the river to the northern limit of the community. St-Jacques Nursing Home and Riviere Castor School are the large flow contributors within this area. SPS 3 discharges into this drainage area.	Flows by gravity to SPS 2.
3	This area services the portion of the community west of Ste-Marie Street. The Municipal Building complex (serviced by SPS 7) discharges into this drainage area. Place d'Embrun Shopping Center is the only large flow contributor in this area.	Drains to SPS 3.
4	This drainage area includes the residential development area located south of the river and west of St. Jacques Road. Embrun High School is largest flow contributor in this area.	Drains to SPS 4.
5	This area is servicing the northeastern portion of the community, north of Drainage area no.1, and east of St- Augustin Street.	Drains to SPS 5.
6	This area corresponds to the Clouthier Subdivision.	Drains to SPS 3.
7	This drainage area services commercial development in the west portion of the village receiving flow from the new Embrun West collector.	Drains to SPS 7.
8	This station services the Melanie East Subdivision and other development south of the river off St. Marie Road.	Drains to SPS 8.

Eight sewage pumping stations service the community of Embrun. All except SPS 4 and SPS 8 are located on the north side of the Castor River. The locations of these stations are presented in Figure 4-5. A description of the pumping stations follows:

- → SPS 1, located south of Notre-Dame Street and east of St. Augustine Street. The pumping station is equipped with two pumps (one duty, one standby) each rated at 113 L/s with a Total Dynamic Head (TDH) of 14.7 m and a standby diesel generator. The 300 mm diameter forcemain was twinned in the year 2000 with a second 300 mm diameter forcemain discharging to the inlet of the Embrun lagoon Facility.
- → SPS 2 is situated beside a creek on Notre-Dame Street near the center of the community. The station is capable of 56 L/s at 13.3 m TDH (two pumps: one duty, one standby). The station is equipped with a standby diesel generator. The sewage is pumped through a 250 mm diameter forcemain up to the gravity sewer at the corner of Notre-Dame and St-Augustin Streets, near St-Jacques Bridge.
- → SPS 3 is located south of Notre-Dame Street, east of Ste-Marie Street, has a firm capacity of 30.0 L/s at 13.5 m TDH (two pumps: one duty, one standby). It is equipped with a standby diesel generator. The 150 mm diameter forcemain runs north on Ste-Marie Street to the intersection with Notre-Dame Street.
- → SPS 4 located south of Notre-Dame Street and east of St. Jacques Street. The 100 mm diameter forcemain from this station is attached to the bridge crossing the nearby Castor River, and discharges into the Notre-Dame Street gravity sewer near St-Jacques Street. The station is rated at 10.3 L/s with 8.6 m TDH (two pumps: one duty, one standby), and is equipped with a standby diesel generator.
- → SPS 5 is located in the northeast portion of the community, in a public park. It is the only station equipped with self-priming pumps; all others have submersible pumps. The rated capacity is 34.0 L/s at 16.5 m TDH. The 125 mm diameter forcemain extends to the gravity sewer on Lapointe Boulevard.
- → SPS 6 is located in the Clouthier Subdivision. The rated capacity is 128.2 L/s at 38.3 m TDH. The 300 mm diameter forcemain that discharges to the Embrun Lagoon.
- → SPS 7 is servicing three municipal buildings in the west part of the community and the flows conveyed by the new Embrun West Sewer. The pump station capacity is 8.5 L/s at a TDH of 9.2 m. The 100 mm diameter forcemain extends to the gravity sewer on Notre-Dame Street.
- → SPS 8 is located at the west end of Embrun, south of Castor River and it services the Melanie East Subdivision. The pump station capacity is 132 L/s at a TDH of 59.6 m. The 300 mm diameter forcemain extends from Route 400 to the distribution box at the inlet of the Embrun Lagoon.

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TREATMENT

The Embrun Lagoon Facility consists of eight lagoons. Four of the lagoons are equipped with an aeration system. The facility is also equipped with an alum injection system to improve phosphorus removal, and a hydrograph controlled release system that controls the effluent discharge in proportion to the flows in the Castor River. The Lagoon Facility's rated capacity as set in the ECA is 3,865 m³/d (Ministry of the Environment, 2014).

The operation of the Embrun Lagoons is subject to the Amended Environmental Compliance Approval 3996-9H4PX7 dated March 19, 2014. An overview of the Embrun sewage treatment facility and its connection to the rest of the pumping facilities in the collection system can be seen in Figure 4-6 below.



Figure 4-6 Embrun Lagoon Facility Process Schematic

Effluent discharge from the Lagoon Facility is done seasonally, on a controlled basis. The ECA establishes two discharge seasons:

- → Spring: starting on March 15 (or when the liquid surface in the lagoon is partially free of ice cover) and ending April 30. The rate of discharge is such that a dilution ratio (river flow rate to effluent discharge rate) is between 17.3:1 and 115:1.
- → Fall: starting October 1 and ending December 15. The rate of discharge is such that a dilution ratio (river flow rate to effluent discharge rate) is between 7.9:1 and 12:1.

The existing 900 mm diameter outfall pipe has been determined to be capable of a maximum full flow of 848 L/s based upon the minimum slope of 0.22%.

4.3.2 SERVICED POPULATION

The 2014 estimated population serviced by the Embrun sewage system was 6,260. The estimated equivalent number of dwellings was 1,928. It should be noted that this population does not match that serviced by the municipal water system (there are more units connected to the municipal water system than units serviced by the sewage system).

4.3.3 WASTEWATER FLOWS

The capacity of the Embrun Lagoon Facility is expressed in terms of the average day influent raw sewage flow.

Based on the historical data for the past five years, the average day influent flow was 1,484 m³/day, which corresponds to 38.4% of the facility's rated capacity of 3,865 m³/day.

A spreadsheet showing historical wastewater flows over the period 1999 to 2014 is included in **Appendix B**.

4.3.4 TREATED EFFLUENT QUALITY

The ECA for Embrun Lagoon specifies effluent objectives and effluent limits for BOD, TSS, TAN, TP, hydrogen sulphide and pH. The ECA also requires testing of the effluent for acute lethality to Rainbow Trout and *Daphnia Magna*.

The effluent objectives and limits are compared to average effluent quality data for the period 2011-2014 for the Embrun Lagoon in Table 4-4 below.

EFFLUENT PARAMETER	AVERAGE CONCENTRATION OBJECTIVE	AVERAGE CONCENTRATION LIMIT	AVERAGE EFFLUENT QUALITY (2011-2014)
CBOD ₅	20.0 mg/L	30.0 mg/L	2.8 mg/L
Total Suspended Solids	20.0 mg/L	30.0 mg/L	6.8 mg/L
Total Phosphorus	< 0.5 mg/L	0.56 mg/L 357 kg (fall season loading) 433 kg (spring season loading)	0.12 mg/L
Total Ammonia Nitrogen	1.0 mg/L (Fall) 5.0 mg/L (Spring)	2.0 mg/L (Fall) 10.0 mg/L (Spring)	0.7 mg/L (Fall) 4.8 mg/L (Spring)
Hydrogen Sulphide	N/A	Non-detectable	0
pН	6.5 – 8.5	6.0 – 9.5	7.1-8.5

Table 4-6 Embrun Lagoon Effluent Objectives, Limits and 2011-2014 Effluent Quality

As noted above, the Lagoon's performance is excellent with effluent concentrations well below the requirements set by the ECA.

4.3.5 ASSIMILATIVE CAPACITY OF THE CASTOR RIVER

The Castor River receives treated effluent from Embrun and Russell, as well as the nearby community of Limoges (Nation Municipality), before it joins the South Nation River. Stantec completed an assimilative capacity review of the Castor River in 2005. According to the study (Stantec, 2005), the limiting criterion for discharge was ammonia in the fall.

The Castor River can assimilate 1,590,000 m³ of effluent with an average discharge concentration of 2.0 mg/L Total Ammonia Nitrogen during the fall discharge window of October 1 – December 15 (Total Ammonia Nitrogen for the spring discharge would be acceptable at 10 mg/L). This corresponds to an average flow of 21,487 m³/d during the fall. This volume of effluent indicates that approximately 17% of the assimilative capacity of the river has been utilized, when considering flows from Embrun, Russell and Limoges (based on the 1073 m³/d rated capacity of the Limoges St. Isidore Lagoons per their existing C of A).

It should be noted however that historical effluent discharges of TAN from the Russell Lagoons have been less than 2 mg/L, which indicates that the assimilative capacity of the Castor River would be even greater.

5 FUTURE REQUIREMENTS

5.1 **GROWTH PROJECTIONS**

The Township's and the Counties' Official Plan included population forecasts to the year 2031. Given these projections and information provided by the Township's Planning Department, the service populations for the water and wastewater systems were estimated in five year intervals to the 2031 planning horizon. These population forecasts also correspond to those used for the financial plan developed to project the Township's water and wastewater rates (WSP, 2015).

The projections for the population serviced by the municipal water and wastewater systems are summarized in Table 5-1 and Table 5-2, respectively.

YEAR	2011-2016	2016-2021	2021-2026	2026-2031
Russell	6,006	6,909	7,332	7,539
Embrun	7,972	9,807	11,915	14,408
Marionville	370	428	428	428

Table 5-1 Serviced Population Projections – Water System

Table 5-2 Serviced Population Projections – Wastewater System

YEAR	2011-2016	2016-2021	2021-2026	2026-2031
Russell	5,050	5,953	6,376	6,583
Embrun	6,477	8,312	10,420	12,913



Drainage Area	Plan ID	Development Name	Area (ha)	Total Units	
Embrun Lagoons	51	Lapointe - St-Joseph	28.0	174	
SPS 1	33	Pierre Fritz	0.1	5	
SPS 1	36	Marc Latorest	0.1	1	
	40	Gilles et Denise Gratton 1106 Notre Dame	0.4	10	
SPS 1	44 50	Lapointe Dev. Ltd Versaille	3.2	47	
SPS 2	17	Lapointe Dev. Etd - versame	0.2	6	
SPS 2	20	Alain Dagenais - 931 Notre-Dame	0.2	1	
SPS 2	23	Michel Bourdeau - 987 Notre-Dame	0.1	3	
SPS 2	24	Franick - 7 Gauthier / Bourassa	0.2	2	
SPS 2	25	Franick - 1013 Notre Dame	0.1	1	
SPS 2	30	Renald Patenaude - 967-969-971 &973 N-D	0.1	18	
SPS 2	39	945 Notre Dame	0.2	13	
SPS 2	41	Frank Berube 1011 Notre Dame	0.1	3	
SPS 2	47	Maurice Lemieux - Blais	2.8	175	
SPS 3	19	Guy Drouin - 9 Lapaime	0.3	2	
SPS 3 SPS 3	21	Francis Boulanger 10 Chantal	0.2		
SPS 3	22		0.1	1	
SPS 3	20	Michel Cayer - 10 Dignard	0.1	2	
SPS 3	37	Maurice Lemieux - 860 Notre Dame	0.1	21	
SPS 3	42	Oligo properties - 848 Notre-Dame	1.6	127	
SPS 3	46	Place D'Embrun	1.6	150	
SPS 3	48	Lapointe Dev. Ltd - Menard West	10.7	117	
SPS 3	61	Lapalme Property	9.0	64	
SPS 4	16	Lapalme (St-Jacques)	2.9	27	
SPS 4	18	Daniel Legault - 1261 St Jacques	0.7	1	ROUTE
SPS 4	31	Castor Foundation - 90 Bourdeau	0.2	3	
SPS 4	59	Ivirchel Bourdeau Subdivision	12.3	/0	
SPS 6	52 10 11 8 56	Normand Rochon - St-Augustin	37.0	95	
SPS 7	10, 11, & 30	Embrun Realty - Séquin St	0.7	430	32 TPRONU
SPS 7	43	Brunet Gervais - 735 Notre-Dame	0.4	20	THE ST THE AVE
SPS 7	62E	Embrun Ford / Business Park Embrun	1.4	100	ST DATE ST DATE ST DATESON DR T RENOIR DR REMINIUM
SPS 8	13	Melanie Construction Faubourg Ste Marie	19.5	123	PELLE NE AND STLEAD 2 FELOIS RADIO 2 NO. NST
SPS 8	53	Melanie Construction - Ste-Marie East	4.2	56	CALL SU PERSON PERSON PERSON STATUS (50)
SPS 8	54	Melanie Construction - Ste Marie East	6.9	118	when a show a sh
SPS 8	57	Melanie Construction - Ste-Marie West	33.0	65	TENAN ES IN ELANS
SPS 8	60	M. Bruyere Land	20.5	64	
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	2	Lemieux (Radisson)	212.2	1	CE ST A THE CR POINT FLEDRE
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For the purposes of this Master Plan, the 417 (Vars) Industrial Park has been subdivided into three areas of potential development within the 2016-2031 planning horizon, corresponding to 220 ha (543 acres) as shown in Figure 5-4.

These areas are described briefly below:

- → Area 1: Existing business development west of St. Guillaume Road approximately 118.6 acres.
- → Area 2: Vacant lands owned by the Township west of St. Guillaume Road and west of Area 1 approximately 220.4 acres.
- → Area 3: Vacant, privately-owned lands located east of St. Guillaume Road approximately 87.5 acres.

Additional details on the 417 Industrial Park study area are provided in a report prepared to evaluate servicing alternatives for the Park (WSP, 2015).

5.2 PHASING OF FUTURE GROWTH

The Township's Planning Department provided a list of development areas, the estimated equivalent number of residential units and their expected timing. A number of these development areas have been draft approved or at the proposal stage. Therefore, these properties were assumed to be developed ahead of other areas for which no proposals have been registered.

The total number of development units identified in Russell, Embrun and Marionville, and the corresponding population growth closely corresponds to the population projections indicated in the Official Plan for the 2031 planning year. It is assumed that all future growth would be serviced by the municipal water system (all three communities) and the wastewater system (Russell and Embrun only).

The assumed development phasing for each community is summarized in Table 5-3. The development areas (colour coded based on when they are assumed to be developed) are shown in Figure 5-1, Figure 5-2 and Figure 5-3.

YEAR	2011-2016	2016-2021	2021-2026	2026-2031	Total Growth 2016-2031
Russell	289	301	141	69	511
Embrun	231	612	703	831	2,145
Marionville	-	-	32	35	67
Total Number of Units	520	913	876	935	2,723

 Table 5-3
 Development Phasing – Russell, Embrun and Marionville

The areas within the 417 Industrial Park projected to be developed in the 417 Industrial Park over the various planning periods are shown in Table 5-4.

PHASE	NUMBER OF HECTARES DEVELOPED	AREAS DEVELOPED
2011-2016	-	
2016-2021	42	Area 1, Area 2
2021-2026	84	Area 1, Area 2
2026-2031	126	Area 1, Area 3

Table 5-4 Development Phasing – 417 Industrial Park

5.3 DESIGN CRITERIA

The following design criteria were used to forecast future requirements for the water and wastewater systems. The design criteria are based on historical water demands and wastewater flows, where applicable or on MOE Guidelines.

One residential unit was assumed to have an equivalent population of 3 people.

5.3.1 WATER DESIGN CRITERIA

5.3.1.1 UNIT WATER DEMAND CRITERIA

The water demand criteria shown in Table 5-5 below are based on historical values of water consumption in the system over the period 2010 to 2014. The corresponding average day demand is 2,531 m³/d. This represents a per capita average day consumption is 230 L/cap/d. This value is within the range indicated in the *Design Guidelines for Drinking-Water Systems* (Ministry of the Environment , 2008).

The maximum day demand during the 2010-2014 period was 4,640 m³/d, and it was recorded in 2010 when the metering program was first implemented. 2011 was the first full year of water metering. The demand data shows that average day and maximum day demands dropped with the implementation of metering, and maximum day demands have been relatively constant since. For this reason, the maximum day demand for 2010 was not considered to determine the maximum day peaking factor design value. Instead, a value of 1.53 was adopted, which corresponds to the 2011 maximum day demand. A spreadsheet showing historical water demands over the period 1999 to 2014 is included in **Appendix A**.

An average day demand value of 10 m³/ha/d was adopted for development in the Industrial Park.

The design criteria adopted for this Master Plan are summarized in Table 5-5 below.

CRITERIA	VALUE	REFERENCE
Average Day Demand – Residential	230 L/cap/day	Derived from Historical Data (2010- 2014).
Average Day Demand – 417 Industrial Park	10.0 m ³ /ha/d	Vars Industrial Park Water and Wastewater Servicing Option Evaluation – Update (WSP, 2015)
Maximum Day Factor - Residential	1.53	Derived from Historical Data (2011- 2014).
Density Factor (Industrial Park)	75%	Applied to gross area to determine the actual building area.
Maximum Day Factor – 417 Industrial Park	2.00	Vars Industrial Park Water and Wastewater Servicing Option Evaluation – Update (WSP, 2015)
Peak Hour Factor	2.85	Value recommended in MOE Guidelines for populations between 10,001 and 25,000.

Table 5-5 Water System Design Criteria

Maximum day and peak hour demands are obtained by multiplying the average day demand by the corresponding peaking factors.

For the purposes of this Master Plan a fire flow requirement of 8,000 L/min (133 L/s) was adopted corresponding to the value recommended in the *FUS Water Supply for Public Fire Protection* document (Fire Underwriters Survey, 1999) for contiguous buildings. The corresponding fire duration is 2 hours.

5.3.1.2 WATER TREATMENT CAPACITY

The Township does not operate a water treatment facility.

As noted above, the Township has entered into a water supply agreement with the City of Ottawa that commits up to 11,860 m³ over a 20-hour period to supply the Township.

For the purposes of this Master Plan, it is therefore assumed that 11,860 m³/d is the maximum supply capacity available to the Township.

5.3.1.3 BOOSTER PUMPING STATION CAPACITY

Pumping stations are rated based on their firm capacity. If sufficient floating storage is available in a particular pressure district, the MOE defines firm capacity as the capacity of the station with the largest pump out of service. If there is insufficient or no floating storage, firm capacity is defined as the capacity with the two largest pumps out of service (Ministry of the Environment, 2008).

For each pressure district, the pumping stations have to be designed to provide peak hour or maximum day plus fire demands (whichever are greater), if no floating storage is available. If

sufficient floating storage is available, then the pumping station only needs to be designed to provide maximum day demands.

The Township's system consists of three pressure districts: Russell, Embrun and Marionville. The booster pumps in the Embrun Reservoir need to satisfy the above requirements for the Russell and Embrun pressure districts, while the Marionville Booster Station needs to be sized for the Marionville system demands.

5.3.1.4 TREATED WATER STORAGE CAPACITY

Storage requirements are based on the requirement to meet water demands that exceed the capacity of the supply source (in this case, allocated maximum supply from the City of Ottawa) and to satisfy fire flow demands. When the available supply is sufficient to satisfy the maximum day demands of the distribution system, storage requirements are determined using the following formula from the MOE Guidelines (Ministry of the Environment, 2008):

$$Storage = A + B + C$$

Where: A = Fire Storage, B = Equalization Storage = 25% of maximum day demand, and C = emergency storage = 25% of (A+B). Fire storage is the product of the fire flow and fire duration based on FUS requirements.

When the system can supply more than just the maximum day demand (but less than the peak demand), the fire storage requirements can be determined using the following formula:

$$A = (Peak Demand - Pumping Station Firm Capacity) \times Fire Duration$$

Where: peak demand is the greater of the peak hour demand and the maximum day plus fire demand.

Per MOE Guidelines, elevated storage should be designed such that the elevation of the equalization volume (B) is such that a minimum pressure of 275 kPa (40 psi) can be maintained in the system under peak hour flow conditions. The fire (A) and emergency (C) volumes should be at elevations that produce 275 kPa (40 psi) during peak hour demand conditions, and 140 kPa (20 psi) under the maximum day plus fire flow condition (Ministry of the Enviroment , 2008).

5.3.1.5 DISTRIBUTION CAPACITY

Watermains have to be sized to carry the greater of the maximum day plus fire flow or peak hour demand. The range of acceptable pressures under normal conditions (average to peak hour flows) is 275 kPa (40 psi) to 690 kPa (100 psi), while during fire flow conditions pressures may drop to 140 kPa (20 psi) (Ministry of the Enviroment , 2008). The maximum allowable water velocity in the distribution system is 3 m/s (Ministry of the Enviroment , 2008).

5.3.2 WASTEWATER DESIGN CRITERIA

5.3.2.1 UNIT WASTEWATER DESIGN CRITERIA

The unit flow criteria for growth adopted for this assessment are shown in Table 5-6 below. These values were derived from historical flow data over the period 2010 to 2014. Since Russell and Embrun are serviced by two independent wastewater systems, different design criteria were defined for these two communities.

Based on the five-year historical data, the average day influent flow to the Russell Lagoon Facility was 870 m³/day. The average day flow to the Embrun Lagoon Facility was 1,484 m³/day. The corresponding per capita average day flow is 238 L/cap/d and 231 L/cap/d for Russell and Embrun, respectively.

An average day flow value of 10 m³/ha/d was adopted for development in the Industrial Park.

CRITERIA	VALUE	REFERENCE	
Average Day Flow – Residential Russell	238 L/cap/day	Historical data 2010 - 2014	
Average Day Flow – Residential Embrun	231 L/cap/day	Historical data 2010 - 2014	
Average Day Flow – 417 Industrial Park	10.0 m³/ha/d	Vars Industrial Park Water and Wastewater Servicing Option Evaluation – Update (WSP, 2015)	
Density Factor (Industrial Park)	75%	Applied to gross area to determine the actual building area.	
Peak Extraneous Flow Allowance	32.8 m³/ha/d	Standard Value applied by Township	
Peak Flow Factor – 417 Industrial Park	2.5	Vars Industrial Park Water and Wastewater Servicing Option Evaluation – Update (WSP, 2015)	

Table 5-6: Wastewater System Design Criteria

Average day flows are obtained by adding the residential and industrial flow contributions.

The peak flow is the sum of residential, industrial and I&I (extraneous) peak flow contributions. Peak residential flows are obtained by multiplying the average day flows by the Harmon Peaking Factor, a commonly used factor for determining peak wastewater flows in municipal wastewater systems. The formula for calculating the Harmon Peaking Factor is as follows (Ministry of the Environment, 2008):

Harmon Peaking Factor =
$$1 + \frac{14}{(4 + P^{\frac{1}{2}})}$$

where P= the design contributing population in thousands.

Peak ICI flows are obtained by multiplying the institutional, commercial and industrial average day flows by the ICI peaking factor.

5.3.2.2 WASTEWATER TREATMENT

Wastewater treatment facilities are rated for average day flows. Plant effluent limits and objectives are established in the Environmental Compliance Approval (ECA) for the facility.

5.3.2.3 SEWAGE PUMPING CAPACITY

The firm capacity of the pumping station (with the largest pump out of service) must allow pumping of peak wet weather flows for the catchment (Ministry of the Environment, 2008).

5.3.2.4 SEWERS

The sewer system is sized to convey peak instantaneous flows. Sewage flows are made up of wastewater discharges from residential, commercial, institutional and industrial establishments, plus extraneous flow components from such sources as groundwater and surface runoff.

In addition to being able to convey peak flows, sufficient flow velocity should be maintained to transport the sewage solids to avoid deposition and the development of nuisance conditions under lower flow conditions. The minimum acceptable flow velocity in sewers is 0.6 m/s (Ministry of the Environment, 2008).

5.4 FUTURE WATER SYSTEM REQUIREMENTS

5.4.1 WATER DEMANDS AND SUPPLY CAPACITY REQUIREMENTS

The unit flow criteria indicated in Section 5.3.1.1 were used to estimate the future water demands in the Township. The demands corresponding to the population growth forecasts to the year 2031 are listed in Table 5-7 below. The demand projections shown below also include the demands associated with the 417 Industrial Park.

YEAR	POPULATION	AVERAGE DAY DEMAND (M ³ /D)	MAXIMUM DAY DEMAND (M ³ /D)	PEAK HOUR DEMAND (M ³ /D)
2016	14,348	3,300	5,054	9,405
2021	17,144	4,363	6,879	12,435
2026	19,675	5,365	8,611	15,291
2031	22,375	6,406	10,402	18,258

Table 5-7 Water Demand Projections

A desktop analysis of the demand projections is included in Appendix C.

As noted above, the available maximum day supply capacity from the City of Ottawa is 11,860 m³/d.

Thus, the available capacity is sufficient to meet the forecasted demands of the system to 2031. The projected average day and maximum day demands are plotted versus the available supply capacity in Figure 5-5 below.





5.4.2 WATER DISTRIBUTION SYSTEM ANALYSIS

The system in general is vulnerable in case of a loss of supply from Ottawa. However, the existing available storage capacity would be sufficient to provide adequate servicing if the emergency conditions for an extended period of time (i.e. over 30 hours).

5.4.2.1 RUSSELL

Hydraulic modeling of the distribution system indicates that the existing watermain distribution system can satisfy the required demand including fire protection for the community. Additional water distribution capacity is required to service future development in the North segment of the community, specifically along Concession Street.

5.4.2.2 EMBRUN

The distribution system is vulnerable to breaks along Notre-Dame Street. System development shall consider fire flow requirements within new subdivisions and a second major watermain.

5.4.2.3 MARIONVILLE

Hydraulic modeling of the distribution system indicates that the existing watermain distribution system can satisfy the required demand including fire protection for the community. Since little development is foreseen in the 5-year horizon, the present water distribution network will not require upgrades or modifications.

5.4.3 PUMPING STATIONS AND STORAGE

Given the projected demands and fire flow requirements an assessment was carried out of the available pumping capacity and storage available within the distribution system overall and within each pressure district.

As detailed in Sections 5.3.1.3 and 5.3.1.4, a combination of pumping and storage is necessary to adequately supply the system even during peak flow conditions.

To assess the suitability of the existing distribution system a two-step approach was taken:

- → Step 1: Compare the firm capacity of a pumping station servicing a pressure district to the estimated peak flows (i.e. maximum day demand plus fire flow) during the planning horizon.
- → **Step 2:** Determine the storage requirements for the pressure district.

The system is considered to be adequate, if the firm capacity of a pumping station is greater than the maximum day demand and the available storage is greater than or equal to the required storage (calculated per MOE Guidelines).

The results of the first step indicate that the Russell Booster Station has sufficient capacity to meet maximum day demands during the entire planning horizon. Embrun Booster Station has sufficient capacity up to 2026. However, it will need to be upgraded to meet maximum day demands projected for 2031. Lastly, the Marionville Booster Station (formerly known as the Russell Water Treatment Plant) has sufficient capacity to meet maximum day demands throughout the planning horizon. However, in all three cases, the maximum day plus day demands exceed the pumping capacity of the stations.

The results of the storage assessment indicate that Russell and Marionville have sufficient floating storage to provide equalization, fire and emergency storage. Embrun's elevated tank provides sufficient floating storage up until 2021. However, the combination of floating storage and pumping capacity are sufficient to meet the demand requirements up to the 2031 planning horizon.

It should be noted that although the Marionville Water Tower has a capacity of 1,135 m³, the low demands in the system have led Township staff to only use a portion of the available storage to avoid water quality issues. This practice is expected to continue given that very little growth is expected to occur in Marionville. Thus, for the purposes of this evaluation it was assumed that only 50% of the tower capacity would be available. This results in the need for addition pumping capacity to provide sufficient fire protection to Marionville.

The above analysis is included in Appendix C.

5.5 FUTURE WASTEWATER SYSTEM REQUIREMENTS – RUSSELL

5.5.1 WASTEWATER FLOWS AND TREATMENT CAPACITY REQUIREMENTS – RUSSELL AND 417 INDUSTRIAL PARK

The unit flow criteria indicated in Section 5.3.2 were used to estimate the future wastewater flows in Russell and in Embrun. The flows corresponding to the population growth forecasts to the year 2031 are presented in below. A desktop analysis of historical wastewater flows and future flow projections is included in **Appendix D**.

Table 5-8	Flow Projections – Russell		
	YEAR	POPULATION	AVERAGE DAY FLOW (M3/D)
	2016	5,050	1,200
	2021	5,953	1,415
	2026	6,376	1,516
	2031	6,583	1,565

The flow projections associated with the servicing of the 417 Industrial Park are shown below.

Table 5-9 Flow Projections – Industrial Park

YEAR	DEVELOPED AREA (HA)	AVERAGE DAY FLOW (M3/D)
2016	0	0
2021	42	420
2026	84	840
2031	126	1,260

Given its location, wastewater from the 417 Industrial Park is expected to be conveyed to the Russell Lagoon Facility. For this reason, the total flows to the Russell Lagoons would be the sum of the wastewater generated in the community of Russell and those generated in the Industrial Park.

Table 5-10 Flow Projections – Russell and Industrial Park

YEAR	AVERAGE DAY FLOW (M3/D)
2016	1,200
2021	1,835
2026	2,356
2031	2,825

The rated capacity of the Russell Lagoon Facility is 2,675 m³/d. However, the current ECA for the facility sets the Maximum Operating Capacity at 2,000 m³/d until a Total Phosphorus Management (TPM) Agreement with the South Nation Conservation Authority has been established. The ECA also states that a proposal detailing the TPM Agreement has to be submitted to the Ministry for review upon the average daily flow of the facility reaching 1,700 m³/d (Ministry of the Environment and Climate Change, 2015).

Figure 5-6 below shows the projected wastewater flows to be discharged to the Russell Lagoons versus the capacity of the facility. The plot also shows the capacity limits set on the facility's ECA as described above. The Russell Lagoon Facility would have sufficient capacity to service the projected growth both in the village of Russell and in the 417 Industrial Park until 2026. Therefore, a capacity expansion would be required before 2031.




5.5.2 WASTEWATER FLOWS AND TREATMENT CAPACITY REQUIREMENTS – EMBRUN

Table 5-11	Flow Projections – Embrun		
	YEAR	POPULATION	AVERAGE DAY FLOW (M3/D)
	2016	6,477	1,540
	2021	8,312	1,976
	2026	10,420	2,477
	2031	12,913	3,070

The rated capacity of the Embrun Lagoon Facility is 3,865 m³/d. Figure 5-7 shows the projected wastewater flows to be discharged to the Embrun Lagoons versus the capacity of the facility. The capacity has sufficient capacity to service the forecasted growth to the year 2031.



Figure 5-7 Wastewater Flow Projections vs. Available Supply Capacity – Embrun Lagoons

5.5.3 SEWER MODELLING FINDINGS – RUSSELL

A sanitary sewer spreadsheet was received from the Township. The Sanitary Sewer Calculation Sheet was originally developed by Stantec as part of the 2004 Master Plan.

The spreadsheet was updated to include new development areas and reviewed by the Township to confirm the accuracy of the information (particularly with regards to the material, dimensions and inverts of the sewers).

The ultimate flows projected for each drainage area were estimated by adding the estimated flow contribution from existing development to the flows estimated for future development areas as shown in Figure 5-1. The sanitary sewer spreadsheet is included in **Appendix E**.

For each of the scenarios modeled, the system was checked for surcharging of sewers and capacity exceedance at the pumping stations. The peak flows into each of the pumping stations determined through modeling of the various planning scenarios are shown in Table 5-12.

SEWAGE PUMPING	EXISTING STATION	2016 PEAK FLOW	2031 PEAK FLOW	
STATION	CAPACITY (L/S)	(L/3)	(Ľ/3)	
SPS 1	86.0	89.8	101.6	
SPS 2	23.5	15.5	16.5	
SPS 3	110.0	-	7.6	

Table 5-12	Sewage Pumping	Station Peak In	fluent Flow Rates	- Russell
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The sewer capacity review revealed some gravity sewers that will have a limited or no residual capacity after 2031. These pipes are listed in Table 5-13 and shown in Figure 5-8.

It should be noted that the Sanitary Sewer Calculation Sheet is based on many assumptions regarding the flow contribution from existing and future development to different sewers and the amount of infiltration to estimate the peak wet weather flow. Without a true knowledge of the real flow in the sewers (i.e. flow monitoring, it is difficult to determine which of these pipes needs upgrading. It is therefore recommended that a more accurate and calibrated hydraulic model of the sanitary sewer systems be developed prior to making decisions on replacement/upgrade of trunk sewers.

LOCATION	FROM MH	то мн
Craig Street	130	129
Craig Street	128	124
Mill Street	124	118
Mill Street	118	117
Mill Street	117	108
Mill Street	108	105
Mill Street	105	102
Castor Street	8	9
Parking lot south of Mill Street (north of river crossing)	96	97

Table 5-13 Sewers Approaching their Hydraulic Capacity - Russell

5.5.4 SEWER MODELLING FINDINGS – EMBRUN

A sanitary sewer spreadsheet was received from the Township. The Sanitary Sewer Calculation Sheet was originally developed by Stantec as part of the 2004 Master Plan.

The spreadsheet was updated to include new development areas and reviewed by the Township to confirm the accuracy of the information (particularly with regards to the material, dimensions and inverts of the sewers).

The ultimate flows projected for each drainage area were estimated by adding the estimated flow contribution from existing development to the flows estimated for future development areas as shown in Figure 5-2. The sanitary sewer spreadsheet is included in **Appendix E**.

For each of the scenarios modeled, the system was checked for surcharging of sewers and capacity exceedance at the pumping stations. The peak flows into each of the pumping stations determined through modeling of the various planning scenarios are shown in Table 5-14.



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SEWAGE PUMPING STATION	EXISTING STATION CAPACITY (L/S)	2016 PEAK FLOW (L/S)	2031 PEAK FLOW (L/S)
SPS 1	113.0	98.0	164.3
SPS 2	56.0	45.4	78.4
SPS 3	30.0	34.8	99.2
SPS 4	10.3	4.6	8.5
SPS 5	34.0	28.4	28.9
SPS 6	128.2	0.0	16.0
SPS 7	8.5	6.5	27.5
SPS 8	132.0	34.5	136.2

Table 5-14 Sewage Pumping Station Peak Influent Flow Rates - Embrun

The sewer capacity review revealed some gravity sewers that will have a limited or no residual capacity after 2031. These pipes are listed in Table 5-15 and shown in Figure 5-9.

It should be noted that the Sanitary Sewer Calculation Sheet is based on many assumptions regarding the flow contribution from existing and future development to different sewers and the amount of infiltration to estimate the peak wet weather flow. Without a true knowledge of the real flow in the sewers (i.e. flow monitoring, it is difficult to determine which of these pipes needs upgrading. It is therefore recommended that a more accurate and calibrated hydraulic model of the sanitary sewer systems be developed prior to making decisions on replacement/upgrade of trunk sewers.

LOCATION FROM MH TO MH Sewer directly upstream of 310 SPS 8 SPS8 County Road # 3 112 SPS 3 Notre-Dame Street 10 9 7 Notre-Dame Street 5 Notre-Dame Street 4 3 Notre-Dame Street 2 SPS 1

Table 5-15 Sewers Approaching their Hydraulic Capacity - Embrun

Embrun Lagoons 51 SPS 1 33 SPS 1 36 SPS 1 40 SPS 1 50 SPS 2 17 SPS 2 20 SPS 2 23 SPS 2 20 SPS 2 23 SPS 2 20 SPS 2 23 SPS 2 24 SPS 2 30 SPS 2 30 SPS 2 30 SPS 2 41 SPS 3 21 SPS 3 41 SPS 4 59	1 Lapointe - St-Joseph 33 Pierre Fritz 36 Marc Laforest 36 Gilles et Denise Gratton 1106 Notre Dame 36 Lapointe Dev. Ltd - Versaille 37 Lapointe Dev. Ltd - Versaille 38 Michel Bourdeau - 987 Notre-Dame 39 Michel Bourdeau - 987 Notre-Dame 30 Renald Patenaude - 967-969-971 & 973 N-I 39 945 Notre Dame 30 Renald Patenaude - 967-969-971 & 973 N-I 39 945 Notre Dame 30 Renald Patenaude - 967-969-971 & 973 N-I 39 945 Notre Dame 30 Renald Patenaude - 967-969-971 & 973 N-I 39 945 Notre Dame 30 Renald Patenaude - 967-969-971 & 973 N-I 39 945 Notre Dame 41 Franck Berube 1011 Notre Dame 30 Burice Lemieux - 809 Notre-Dame 31 Francis Boulanger - 10 Chantal 32 Francis Boulanger - 10 Dignard 33 Maurice Lemieux - 860 Notre Dame 34 Maline Dev. Ltd - Menard West 31 Lapalme Property 36 <td< th=""><th>28.0 0.1 0.1 0.1 0.1 0.1 0.1 0.3 3.2 0.2 0.1 0.2 0.1 0.2 0.1 0.2 0.1 0.2 0.1 0.2 0.1 0.2 0.1 0.2 0.1 0.2 0.2 0.2 0.2 12.3 12.3</th><th>174 5 1 10 47 6 1 3 2 1 18 13 3 175 2 1 1 2 1 1 2 1 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 3 70 95 450 6 20 100 123 56 118 65</th><th>report and a grant and b gran</th></td<>	28.0 0.1 0.1 0.1 0.1 0.1 0.1 0.3 3.2 0.2 0.1 0.2 0.1 0.2 0.1 0.2 0.1 0.2 0.1 0.2 0.1 0.2 0.1 0.2 0.1 0.2 0.2 0.2 0.2 12.3 12.3	174 5 1 10 47 6 1 3 2 1 18 13 3 175 2 1 1 2 1 1 2 1 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 2 1 3 70 95 450 6 20 100 123 56 118 65	report and a grant and b gran
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6 PROBLEM DEFINITION

As indicated in Section 2.3, Phase 1 of the Municipal Class EA process involves establishing the objectives of the Study and defining the "Problem."

Some of the existing water and wastewater infrastructure is insufficient to meet the needs for the projected population growth (residential and employment) in the Study Area.

Therefore, the Problem/Opportunity for the Township of Russell Water and Wastewater Master Plan has been defined as follows:

How to provide municipal water and wastewater infrastructure to service the growth forecasted to the year 2031, while minimizing impacts on the natural, cultural, social, and agricultural features in the study area.

7 ALTERNATIVE SOLUTIONS

As indicated in Section 2.3, Phase 2 of the Municipal Class EA process involves identifying and evaluating alternative solutions to the problem or opportunity described in Phase 1.

The alternatives to provide water and wastewater servicing to the Study Area as described below.

7.1 WATER SYSTEM

In Section 5.4, the following issues/constraints were identified:

- The existing water supply capacity from Ottawa is sufficient to meet the demands forecasted for the Township. However, the system is vulnerable in case of a break to the Russell Feedermain from Ottawa.
- → The distribution system in Embrun is vulnerable to breaks (particularly along Notre-Dame Street).
- → Additional pumping capacity would be required to provide adequate fire protection to Marionville.
- → The 417 Industrial Park is currently not connected to the municipal water system.

Given these limitations/issues, four alternative solutions were identified for the Township's Water System:

7.1.1 W1 - DO NOTHING

No infrastructure upgrades would be carried out to the distribution system.

This alternative would allow servicing some of the growth in Russell and Embrun. However, the The issues in the Embrun and Marionville distribution systems would not be addressed and the system would continue to be vulnerable to a loss of supply from Ottawa. No municipal water servicing would be available to the 417 Industrial Park.

7.1.2 W2 - WATERMAIN FROM EADIE RD. METERING CHAMBER TO BOOSTER PUMPING STATION AND RESERVOIR IN THE 417 INDUSTRIAL PARK

The Booster Pumping Station/Reservoir would include a rechloramination system and would provide sufficient storage for fire protection and emergency reserve to the Industrial Park. This option would allow servicing of the Industrial Park by connecting directly to the Russell Feedermain from Ottawa.

A new watermain along Industrial Avenue would be constructed to provide redundancy in Embrun. The Marionville Booster Pumping Station would be upgraded to provide additional capacity for fire protection.

This option would provide servicing to the Industrial Park and resolve other issues in the Embrun and Marionville distribution systems. However, it would not address the issue of lack of redundancy in the source of supply. Alternative W2 is shown schematically in the figure below.



Figure 7-1 Alternative W2 - New watermain connection to Eadie Rd. Metering Chamber and New Booster Pumping Station and Reservoir in 417 Industrial Park

7.1.3 W3 - WATERMAIN FROM EADIE RD. METERING CHAMBER TO NEW BOOSTER PUMPING STATION AND RESERVOIR AND NEW FEEDERMAIN FROM EMBRUN RESERVOIR

This option is a variation of Alternative W2 that includes a new watermain extending from the Embrun Reservoir to a new Booster Station/Reservoir in Industrial Park.

As part of this alternative, the Marionville Booster Pumping Station would also be upgraded to provide additional capacity for fire protection, and a new watermain along Industrial Avenue would be constructed to provide redundancy in Embrun.

This option would provide servicing to the Industrial Park and resolve other issues in the Embrun and Marionville distribution systems. This option would also provide additional flexibility and storage capacity to the Township in case of loss of supply from Ottawa. The reservoir and booster station in the Industrial Park would act as a second hub in the distribution system providing back-up supply to Russell, Embrun and Marionville (via Russell) in case of a failure at the Embrun Reservoir. Alternative W3 is shown schematically in the figure below.



Figure 7-2 Alternative W3 - Watermain connection to Eadie Rd. Metering Chamber, Industrial Park Booster Station/Reservoir and Feedermain from Embrun Reservoir to Industrial Park

7.1.4 W4 – RECOMMISSIONING OF EMBRUN/MARIONVILLE WTP AND WATERMAIN FROM THE EMBRUN RESERVOIR TO 417 INDUSTRIAL PARK

The Embrun/Marionville Water Treatment Plant (WTP) is currently out of commission. The majority of the equipment is still in good condition. However, some upgrades would be required to bring back the facility to working order.

There is an existing 300 mm diameter watermain connection from the WTP to the Embrun Reservoir which would allow the water produced at the WTP to be distributed to Russell or Embrun. There is also a 250 mm watermain from the WTP to Marionville.

The WTP's rated capacity of 5,616 m³/d would be sufficient to satisfy the demand requirements of the Industrial Park (WSP, 2015).

This option would involve the construction of a new watermain from the Embrun Reservoir to the Industrial Park. An elevated tank would be constructed at the Industrial Park to provide balancing, fire and emergency storage to the Industrial Park.

The Embrun/Marionville WTP would be dedicated to supply the Industrial Park while Russell, Embrun and Marionville, would continue to be serviced by the Ottawa supply.

In case of a loss of supply from Ottawa, however, the water produced at the WTP could be used to feed the rest of the system albeit requiring the operation of valves at the Embrun Reservoir and the issuance of a drinking water advisory.

As part of this alternative, the Marionville Booster Pumping Station would also be upgraded to provide additional capacity for fire protection, and a new watermain along Industrial Avenue would be constructed to provide redundancy in Embrun.

Alternative W4 would provide servicing to the Industrial Park and resolve other issues in the Embrun and Marionville distribution systems. This option would also provide additional flexibility and storage capacity to the Township in case of loss of supply from Ottawa. The Embrun/Marionville WTP would act as a second source of supply to the in the distribution system.

Alternative W4 is shown schematically in Figure 7-3 below.



Figure 7-3 Alternative W4 – Recomissioning of Embrun/Marionville WTP and Watermain from Embrun Reservoir to 417 Industrial Park

7.2 WASTEWATER SYSTEM

In Section 5.5, the following issues/constraints were identified:

- → The capacity of the Russell Lagoon Facility will be exceeded after 2026. A capacity expansion would be required before 2031.
- → The capacity of SPS 1 in Russell would be exceeded sometime after 2026. A capacity expansion would be required before 2031.

- → The capacity of SPS 1 and SPS 2 in Embrun would be exceeded sometime after 2026. A capacity expansion would be required before 2031.
- → The capacity of SPS 3 and SPS 7 in Embrun are approaching their rated capacity. A capacity expansion would be required within the next five to 10 years.
- → There are some sewers in the Russell collection system, particularly along Craig Street and Mill Street, that are reaching their hydraulic capacity (a hydraulic model and flow monitoring is required to confirm).
- There are some sewers in the Embrun collection system, particularly along Notre-Dame Street, that are reaching their hydraulic capacity (a hydraulic model and flow monitoring is required to confirm).
- → The 417 Industrial Park is currently not connected to the municipal wastewater system.

Given these limitations/issues, three alternative strategies were identified for wastewater servicing.

Several alternatives specific to the servicing of the 417 Industrial Park were reviewed as part of a separate study (WSP, 2015). The preferred alternative amongst those considered was adopted for this evaluation.

7.2.1 WW1 – DO NOTHING

No infrastructure upgrades would be carried out to the wastewater systems. Both the Russell and Embrun Lagoon Facilities have the ability to service growth forecasted in the two communities. However, the capacity of some of the sewage pumping stations in Russell and some in Embrun would be a constraint to future development.

No municipal wastewater servicing would be available to the 417 Industrial Park as it would only allow only partial servicing within Embrun and Russell, and would not allow development of the Industrial Park.

This alternative does not address the Problem defined as part of this Master Plan.

7.2.2 WW2 – UPGRADES TO RUSSELL AND EMBRUN SYSTEMS ONLY

This alternative involves addressing capacity constraints within the Russell and Embrun collection systems, specifically by increasing the capacity of SPS 1, in Russell and SPS 1, SPS 2, SPS 3 and SPS 7 in Embrun. However, this alternative does not include the provision of infrastructure to service the Industrial Park.

This alternative does not address the Problem defined as part of this Master Plan as it would only allow servicing within Embrun and Russell, but would not allow development of the Industrial Park. Alternative WW2 is shown in Figure 7-4 below.



Figure 7-4 Alternative WW2 - Upgrades to Russell and Embrun Systems Only

7.2.3 WW3 – UPGRADES TO RUSSELL AND EMBRUN SYSTEMS AND PUMPING STATION AND FORCEMAIN FROM INDUSTRIAL PARK TO RUSSELL LAGOON FACILITY

This alternative involves constructing a new sewage pumping station near the 417 Industrial Park and a forcemain(s) discharging directly to the Russell Lagoons. The capacity constraints within the Russell and Embrun collection systems would be addressed, specifically by increasing the capacity of SPS 1, in Russell and SPS 1, SPS 2, SPS 3 and SPS 7 in Embrun.



This alternative would fully address the Problem defined as part of this Master Plan. Alternative WW3 is shown in Figure 7-5 below.

Figure 7-5 Alternative WW2 - Upgrades to Russell and Embrun Systems and Pumping Station and Forcemain from Industrial Park to Russell Lagoon Facility

8 EVALUATION OF ALTERNATIVES

8.1 EVALUATION APPROACH AND EVALUATION CRITERIA

The approach used to determine the preferred alternatives for Water and Wastewater Servicing of growth in the Township of Russell is explained below. A matrix was created to document the advantages and disadvantages of each alternatives, and to ultimately determine the preferred solution.

- Define Evaluation Criteria Criteria were defined for the evaluation of the alternatives. The evaluation criteria for this project included (1) impact on the natural environment, (2) impact on the social and cultural heritage, (3) economic viability, and (4) technical and operational merit. The four evaluation criteria were considered to have equal importance in this evaluation.
- Document Advantages, Disadvantages and Potential Impacts The impacts associated with each alternative were determined and documented. These impacts were categorized under one of the four evaluation criteria.
- Compare Alternatives Each alternative's performance with respect to the evaluation criteria was compared to that of the other alternatives. Three ratings were used to describe an alternative's relative performance on a specific criterion: "most preferred", "less preferred" and "least preferred." This was represented visually by assigning colors, green for "most preferred", yellow for "less preferred" and orange for "least preferred."
- → Determine the Preferred Alternative The servicing alternative with the least overall impact was considered to be preferred and recommended for implementation.

The evaluation assessed the relative advantages and disadvantages of the alternative solutions in consideration of their net environmental effects. These are the residual effects to the environment once reasonable mitigation measures have been implemented. Net effects include the impacts associated of construction, operation, maintenance and decommissioning activities for each of the options as well as the social aspects of the environment (i.e. debt, changes in operation).

As explained above, the evaluation methodology involves the assessment of the impacts associated with the water and sewer servicing alternatives on four main evaluation criteria categories. Evaluation criteria for this project included impact on the natural environment, impact on the social and cultural environments, economic impact, and technical and operational merit. A more detailed breakdown of the impacts in their respective criterion category is provided in Table 3.1-1.

NATURAL ENVIRONMENT

- → Surface water and groundwater impacts
- → Watercourse crossings and fisheries
- → Impact on natural heritage features / vegetation

SOCIAL AND CULTURAL HERITAGE

- → Impact to built-up areas
- → Impacts to private properties
- → Compatibility with proposed land uses

TECHNICAL SUITABILITY

- → Ease of construction and site access
- → Soil/Ground conditions
- → Impact on operations during construction
- → Ease of integration with existing infrastructure
- Location and impacts to other utilities
- → Road / Railway crossings
- Ease of operation
- → Effect on ability to expand system
- Impact on vulnerability to future climate changes (I&I, pipe depth, flood-proofing facilities, etc.)

ECONOMIC VIABILITY

- Capital Costs
- → Operation and Maintenance (including energy) Costs

8.2 WATER SYSTEM ALTERNATIVE EVALUATION

The evaluation of each of the four alternatives is presented in Table 8-1.

All water options were considered to be equivalent in terms of their impact to the environment given that there are no water crossings and no natural features in the proximity of the infrastructure associated with each alternative.

The Do Nothing alternative was considered to have a negative social impact given that it would not address the Problem identified as part of the Master Plan. Namely, it would not allow for servicing of the 417 Industrial Park. Furthermore, the lack of redundancy in the source of supply could have a negative impact in case of a break to the Russell Feedermain. Infrastructure related to the other alternatives would be constructed outside areas having archeological, heritage or cultural interest.

Table 8-1 Evaluation of Alternatives – Water System

	ALTERNATIVE W1	ALTERNATIVE W2	ALTERNATIVE W3	ALTERNATIVE W4
	Do Nothing	Watermain from Eadie Road to Booster Station/Reservoir in 417 Industrial Park	Watermain from Eadie Rd. Metering Chamber to Booster Station/Reservoir and Feedermain from Embrun Reservoir	Recommissioning of Embrun/Marionville WTP and watermain from the Embrun Reservoir to 417 Industrial Park
NATURAL ENVIRONMENT				
Surface water and groundwater impacts	No construction involved. Therefore, no	Construction limited to unopened road	Construction limited to unopened road	Construction limited to unopened road
Watercourse crossings and impact on fisheries	Impacts on surface water/groundwater.	be decommissioned.	be decommissioned.	be decommissioned.
Impact on natural heritage features/vegetation	No watercourse crossings.	No watercourse crossings.	No watercourse crossings.	No watercourse crossings.
	no impact on natural nentage reatures.	No impact on natural heritage features.	No impact on natural heritage features.	No impact on natural heritage features.
SOCIAL AND CULTURAL HERITAGE				
Impact to built-up areas	No impact.	No impact.	No impact.	No impact.
Impacts to private properties	Industrial Park development would be limited	Municipal water supply would encourage	Municipal water supply would encourage	Municipal water supply would encourage
Compatibility with proposed land uses	Limited redundancy and security of supply.	Some redundancy and socurity of supply	New booster station/reservoir to be designed	Good redundancy and security of supply
	Limited redundancy and security of supply.	Some redundancy and security of suppry.	to blend in with surrounding development.	Good redundancy and security of supply.
			Good redundancy and security of supply.	
TECHNICAL SUITABILITY				
Ease of construction and site access	Not applicable given that no infrastructure	Construction to occur on undeveloped lands	Construction to occur on undeveloped lands	Construction to occur on undeveloped lands
Soil/ground conditions	would be constructed.	along unopened road allowances.	along unopened road allowances.	along unopened road allowances.
Impact on operations during construction	Status quo is sufficient to service growth within Russell, Embrun and Marionville, However, no	New infrastructure to service Industrial Park	New intrastructure to service Industrial Park	New infrastructure to service Industrial Park
Ease of integration with existing infrastructure	ability to service Industrial Park.	operation of the existing system.	operation of the existing system.	operation of the existing system.
Location and impacts to other utilities	Does not address the Problem identified in the	The supply to the Industrial Park would be	Connection from Industrial Park supply would	A new Permit to Take Water would be
Road / Railway crossings	Master Plan.	independent of the supply to the rest of the	provide flexibility in case of a temporary loss of	required for the Embrun/Marionville WTP.
Ease of operation	System vulnerable to a loss of supply from	system.	supply from the City of Ottawa.	Connection from Industrial Park supply would
Effect on ability to expand infrastructure	Ottawa.			supply from the City of Ottawa
Reduce vulnerabilities to future climate changes				
ECONOMIC VIABILITY				
Capital costs	\$0	\$2.5M-\$5M	\$5M-\$7.5M	\$7.5M - \$10M
Relative operation and maintenance costs (incl. energy)	No additional O&M costs	Medium O&M Costs – Additional requirements to operate and maintain new Industrial Park facilities.	Medium O&M Costs – Additional requirements to operate and maintain new Industrial Park facilities.	High O&M Costs – Additional requirements to operate and maintain new Industrial Park facilities and the Embrun/Marionville WTP.
SUMMARY	Least preferred: does not address the Problem defined by the Master Plan.	Less Preferred	Most Preferred	Less Preferred

8.1 WASTEWATER SYSTEM ALTERNATIVE EVALUATION

 Table 8-2
 Evaluation of Alternatives – Wastewater System

	ALTERNATIVE WW1	ALTERNATIVE WW2	
	Do Nothing	Upgrades to Russell and Embrun Systems Only	Upgra Station a
NATURAL ENVIRONMENT			
Surface water and groundwater impacts	There is potential for contamination of the groundwater	There is potential for contamination of the groundwater from the	Upgrades
Watercourse crossings and impact on fisheries	from the existing septic tanks in the industrial Park.	existing septic tanks in the industrial Park.	limited to I
Impact on natural heritage features/vegetation	No watercourse crossings.	Upgrades to sewage pumping stations would generally be limited to replacement of pumps with larger capacity pumps	allowance
	No impact on natural heritage features.	Upgrades to forcemains would be constructed along road	Constructi
		allowances. Therefore, limited impact to natural environment.	septic tanl
		No watercourse crossings.	No watero
		No impact on natural heritage features.	No impact
SOCIAL AND CULTURAL HERITAGE			-
Impact to built-up areas	No impact.	Some impacts on traffic during construction due to transport of materials and equipment.	Some imp
Compatibility with proposed lend upon	lack of municipal wastewater servicing.	Industrial Park development would be limited due to lack of	Municipal
compatibility with proposed land uses		municipal wastewater servicing.	in 417 Ind
			Sewage p
			blend in w
			Implemen
Ease of construction and site access	Not applicable given that no infrastructure would be	A bypass plan to be developed for upgrades to pumping	A bypass
Soil/ground conditions	constructed.	stations to be carried out without affecting operation.	stations to
Impact on operations during construction	Status quo is sufficient to service some growth within	There is sufficient capacity to facilitate expansion of Russell	There is s
Ease of integration with existing infrastructure	Russell and Embrun. However, no ability to service	Lagoons while maintaining the existing facility in operation.	Lagoons v
Location and impacts to other utilities	Does not address the Problem identified in the Master	plans to be implemented.	plans to b
Road / Railway crossings	Plan.	The system would continue to operate as it does now.	The syste
Ease of operation		This alternative does fully address the Problem identified in the	Design of
Effect on ability to expand infrastructure		Master Plan.	modular to
Reduce vulnerabilities to future climate changes			
ECONOMIC VIABILITY			
Capital costs	\$0	\$5M-\$7.5M (However, capital costs to be recovered through	\$15M-\$17
Relative operation and maintenance costs (incl.	No additional O&M costs	development charges)	developm
energy)		and maintain larger capacity facilities.	maintain r
SUMMARY	Least preferred: does not address the Problem defined by the Master Plan.	Less Preferred	

ALTERNATIVE WW3

Ides to Russell and Embrun Systems and Pumping nd Forcemain from Industrial Park to Russell Lagoons

to sewage pumping stations would generally be replacement of pumps with larger capacity pumps. to forcemains would be constructed along road es. Therefore, limited impact to natural environment.

ion limited to unopened road allowances. Private ks and wells in Industrial Park to be decommissioned.

course crossings.

on natural heritage features.

pacts on traffic during construction due to transport of and equipment.

wastewater servicing would encourage development ustrial Park.

oumping station in Industrial Park to be designed to vith future development. Odour control would be ted.

plan to be developed for upgrades to pumping be carried out without affecting operation.

ufficient capacity to facilitate expansion of Russell while maintaining the existing facility in operation.

e construction may impact roadways. Traffic control

m would continue to operate as it does now.

new sewage pumping station in Industrial Park to be allow for phased development in the Park.

.5M (However, capital costs to be recovered through ent charges)

0&M Costs – Additional requirements to operate and new Industrial Park facilities.

Most Preferred

WSP No 141-18986-00 April 2016

The Notice of Study Commencement was developed to target the ministries, organizations, agencies and other stakeholders that may be affected and/or interested in the Master Plan. The Notice of Study Commencement was published on the Township's website on August 25, 2014. The notice briefly outlined the purpose and justification for the Study and also indicated that a Public Information Centre

9

9.1

9.1.1

would be held.

The Notice of Study Commencement can be found in Appendix F.

NOTICE OF STUDY COMMENCEMENT

PUBLIC AND AGENCY

CONSULTATION

POINTS OF CONTACT

were established throughout the course of the Study.

9.1.2 NOTICE OF PUBLIC INFORMATION CENTRE

A Notice of Public Information Centre (PIC) was developed and published on the Township's website on October 1, 2015 with the objective of informing the general public and other stakeholders of the Study. The notice briefly outlined the purpose and justification for the Study. It also indicated that a PIC would be held on October 13, 2015 to present the alternative water and wastewater servicing solutions, the evaluation of the alternatives and the preferred recommended solution.

Consultation with the public (which includes stakeholders and interested parties) and government review agencies is a necessary and important component of the Municipal Class EA process. To meet the Class EA consultation requirements for this Master Plan, the Township issued notices on the local newspaper and on the Township's website to advise the public of the Study and provide the opportunity to provide input on the assessment and evaluation process for the alternatives identified in the Master Plan. The following sub sections provide a summary of the key points of contact that

9.1.3 PUBLIC INFORMATION CENTRE (PIC)

The Township of Russell Water and Wastewater Master Plan PIC was held on October 13, 2015 at the Municipal Town Hall, to present an overview of the Study, the water and wastewater servicing alternatives considered, the evaluation criteria and methodology that were used, and the preferred alternatives. The purpose of this Public Information Centre was to communicate the process used to carry out the Study and provide an opportunity to receive comments on both the approach followed and on the preferred recommended solution. A copy of the material presented at the PIC is included in **Appendix G**.

9.1.4 NOTICE OF STUDY COMPLETION

A Notice of Study Completion will be published on the Township's website and sent to key stakeholders upon filing of this Master Plan Report. This Notice is relevant for two reasons: it provides the public and relevant agencies with a final 30 day period to review the final conclusions of the Study, and it informs the general public of the outcome of the Study and the nature of the resulting projects.

The Notice was sent to the MOECC Environmental Approvals Branch and to the Ministry's Cornwall office. The Notice was also forwarded to the Counties of Prescott-Russell, the Nation Municipality, the Township of North Stormont, the Township of North Dundas, the City of Ottawa, and the South Nation Conservation Authority. No comments were received.

10 PREFERRED SOLUTION

As a result of the evaluation performed in the Section 8, preferred solutions have been identified to provide water and wastewater servicing to satisfy growth in the Study Area to the year 2031.

The preferred water servicing solution is Alternative W3, which consists of constructing a new watermain from the Eadie Road Metering Station to the 417 Industrial Park. A new reservoir/booster station would be constructed in the Industrial Park. The water received from Ottawa would be rechloraminated and pumped to service the Park. A watermain would be constructed from the reservoir/booster station to the Embrun Reservoir. This would provide an alternate feed to supply the Embrun and Russell systems. The preferred alternative is shown in Figure 10-1.

The preferred wastewater servicing solution is Alternative WW3, which involves upgrading the capacity of pumping stations in Russell and Embrun, the expansion of the Russell Lagoon Facility, and the construction of a new sewage pumping station in the 417 Industrial Park discharging directly to the Russell Lagoons. The preferred alternative is shown in Figure 10-2.



Figure 10-1 Preferred Water Servicing Alternative



Figure 10-2 Preferred Wastewater Servicing Alternative

As explained above, this Master Plan report fulfills the requirements for Phase 1 and 2 of the Municipal Class EA process. However, additional planning and consultation is required for projects deemed to be Schedule B or Schedule C projects. Other projects (falling under the scope of Schedule A or A+ activity per the Municipal Class EA process) can proceed directly to implementation.

10.1 CAPITAL INVESTMENT PROGRAM

Planning level estimates were developed for the infrastructure upgrades identified as part of the preferred servicing alternatives.

These values are only to be used to provide an order of magnitude estimate to facilitate the initial decision making. These cost estimates will need to be further refined as the scope of specific works is further defined and the conceptual design of the required upgrades is carried forward. Furthermore, some of the projects will require additional study to satisfy the requirements of the Municipal Class EA process (Municipal Engineers Association, 2011).

Unit cost databases were used to estimate the total project costs. These databases have been developed based on recent experience with similar projects in Ontario. However, where applicable, the cost estimates have been refined based on unique aspects of the implementation or construction of a specific project. Allowances for planning, design, program management, contract administration, environmental monitoring during construction and contingencies were included as percentages of the capital cost where appropriate. The cost estimates were developed in 2015 dollars.

10.1.1 WATER SYSTEM

Table 10-1 below includes a description of each project recommended as part of the preferred servicing strategy including the year when the project needs to be completed and whether a Municipal Class EA (Schedule B or C) is required. This list can be used to develop a capital investment program for the Township's Water System. The project list below includes major infrastructure projects required to address existing system deficiencies or which provide additional capacity to service both existing and new development. Local distribution watermains specifically required to service new growth areas are not included in the list below as it is expected they will be included in the Agreements of Subdivision for the various developments.

These projects are aimed to ensuring adequate fire flows and system pressures and providing security of supply for the system overall, while some are specifically aimed to servicing new development areas.

As noted above, the timing of these projects is dependent on the order in which the various areas are developed. If the order of magnitude or the number of units developed varies from the phasing described in Section 5.2, the servicing requirements will need to be reviewed and updated. Table 10-1 should be read in conjunction with Figure 10-1.

It is recommended that the Township develop a community growth strategy that targets priority areas to be developed. After this has been defined, the collection system upgrades can be implemented in a logical order.

	PROJECT NO.	YEAR REQUIRED	PROJECT	DESCRIPTION	ESTIMATED COSTS (2015\$)	CLASS EA SCHEDULE	TRIGGER
	W-01	2016-2021	Secondary Watermain Loop	New watermain along Industrial Avenue	\$230,000	Schedule A	Watermain required to provide security of supply and redundancy in the Embrun distribution system
_	W-02	2021-2031	Industrial Park Servicing	Booster station and reservoir in the Industrial Park and watermain to Embrun Reservoir	\$4,855,500	Schedule B	To service the Industrial Park and to provide redundancy

Table 10-1 Water System Projects (2016-2021)

10.1.2 WASTEWATER SYSTEM

Table 10-2 below includes a description of each project recommended as part of the preferred servicing strategy including the year when the project needs to be completed and whether a Municipal Class EA is required. This list can be used to develop a capital investment program for the Township's Wastewater Systems.

These projects are aimed to ensuring there is adequate conveyance capacity at the sewage pumping stations and the sewer system, and adequate treatment capacity at the lagoon facilities. Given that some of the upgrades required will involve additional investigation and the completion of a Municipal Class EA, capital cost estimates cannot be accurately determined as there are several alternative solutions to address the capacity deficit. The project list below only includes major infrastructure projects required to address existing system deficiencies or which provide additional capacity to service both existing and new development. Local sewers specifically required to service new growth areas are not included in the list below as it is expected they will be included in the Agreements of Subdivision for the various developments.

The timing of these projects is dependent on the order in which the various areas are developed. If the order of magnitude or the number of units developed varies from the phasing described in Section 5.2, the servicing requirements will need to be reviewed and updated.

It is recommended that the Township develop a community growth strategy that targets priority areas to be developed. After this has been defined, the collection system upgrades can be implemented in a logical order.

Table 10-2 should be read in conjunction with Figure 10-2.

PROJECT NO.	YEAR REQUIRED	PROJECT	DESCRIPTION	ESTIMATED COSTS (2015\$)	CLASS EA SCHEDULE	TRIGGER
WW-01	2016-2021	Russell SPS 1 Upgrade	Capacity expansion	\$270,000	Schedule B	To accommodate future growth from 2021 to 2031.
WW-02	2016-2021	Embrun SPS 3 Upgrade	Capacity expansion	\$270,000	Schedule B	To accommodate future growth from 2021 to 2031.
WW-03	2021-2026	Embrun SPS 1 Upgrade	Capacity expansion	\$670,000	Schedule B	To accommodate future growth from 2026 to 2031.
WW-04	2021-2026	Embrun SPS 2 Upgrade	Capacity expansion	\$270,000	Schedule B	To accommodate future growth from 2026 to 2031.
WW-05	2021-2026	Embrun SPS 7 Upgrade	Capacity expansion	\$270,000	Schedule B	To accommodate future growth from 2026 to 2031.
WW-06	2021-2026	Russell Lagoon Facility Expansion	Additional Aerated Cells and are for sludge remova	\$3,750,000	Schedule C	To accommodate future growth from 2026 to 2031.
WW-07	2021-2031	Industrial Park Servicing	Sewage pumping station and forcemain discharging at the Russell Lagoon Facility	\$8,444,135	Schedule B	To service the Industrial Park

 Table 10-2
 Wastewater System Projects (2016-2021)

10.2 POTENTIAL EFFECTS AND MITIGATING MEASURES

When constructing any type of infrastructure, there is a potential for environmental impacts to occur as a result of the construction activities. In such situations, measures must be taken to either minimize or offset the negative effects. Actions taken to reduce the effects of a certain project on the environment are called "mitigating measures".

The Class EA process requires development of mitigating measures after identification of the magnitude of the net negative impacts of the preferred alternative solution. These measures are defined in such a way to allow the project to be undertaken at a reasonable cost, while at the same time protecting the environment against net negative impacts.

The infrastructure projects identified as part of the preferred water and wastewater servicing solution will have the potential for environmental impacts, and where these can be anticipated in the design stage, special provisions should be written into the construction specifications and/or incorporated in the design. The provisions will dictate the construction methods that are permitted and more importantly the construction methods that are not allowed during specific operations. Unforeseen problems that arise during construction will be addressed on site, and the proponent's best judgment should be used to ensure that any resulting changes to the contract do not cause negative environmental impacts.

Staff responsible for inspecting the contractor's work must be made aware of such provisions in order to ensure compliance during construction. It will be the responsibility of the proponent to ensure that inspectors enforce compliance with the environmental provisions, as well as the standard engineering provisions of the design.

10.2.1 NATURAL ENVIRONMENTAL IMPACTS

10.2.1.1 VEGETATION

Impacts to vegetation will, for the most part, be limited to some trees located within the working areas. Where possible and if required, mature trees will be protected with temporary construction fence to ensure that they are not damaged during construction.

10.2.1.2 WILDLIFE AND WILDLIFE HABITATS

Although rare wildlife species were not identified in the areas where the proposed infrastructure is envisioned, there may be some impact to wildlife inhabiting the working areas that may be displaced for the duration of construction. A detailed review of wildlife and wildlife habitats would be required for those projects requiring a Schedule B or Schedule C Class EA. However, since some of the facilities to be upgraded are surrounded by developed areas, the chances of at risk species existing in the vicinity are minimal. Once construction and subsequent restoration is complete, wildlife may introduce itself into the disturbed areas. A construction fence should be used to prevent wildlife from entering the working areas during the construction period.

10.2.2 SOCIAL, CULTURAL AND ECONOMIC IMPACTS

10.2.2.1 TRAFFIC

Impacts to traffic should be considered when defining the alignment of new forcemains/watermains. The watermain and forcemain(s) envisioned as part of the Industrial Park servicing are expected to

be constructed along an unopened road allowance. This will minimize the need for road closures. It is expected that there will be an increase in construction traffic for delivery of material and equipment during construction of the infrastructure. Construction signage will be posted on the impacted roads to make motorists aware of the construction entrances.

10.2.2.2 ARCHAEOLOGY AND HERITAGE FEATURES

An Archaeological Investigation was not carried out as part of this Master Plan. It is recommended that the Schedule B and Schedule C projects identified carry out a Stage 1 Archaeological Assessment on the proposed site(s), and if necessary a Stage 2 Assessment. This is recommended to avoid delays/extra costs given that in the event of a potential archaeological or heritage find during construction, all works would need to be suspended and the authorities contacted to investigate the site.

10.2.2.3 NOISE, DUST AND VIBRATION

Noise, dust and vibration during construction projects is unavoidable. Potential sources of noise, dust, and vibration are truck traffic and regular construction activities. These impacts can generally be mitigated following the guidelines below:

- → All truck traffic, excavation equipment and other activity that potentially generates significant noise levels should be restricted to normal work hours pursuant to local municipal noise bylaws.
- → Excavated materials should be used on-site wherever possible in order to minimize truck haulage to off-site disposal areas.
- \rightarrow Dust control agents should be applied as necessary.
- → Dry exposed soil should be kept wet to make it less susceptible to wind erosion, and should be covered if left for extended periods of time.
- → Pre-construction and post-construction building surveys should be completed to ensure that any impacts associated with construction can be clearly identified.

10.2.2.4 ODOUR AND CORROSION

The preferred solution involves the construction of a new sewage pumping station to service the 417 Industrial Park. Consideration should be given during Class EA process to ensuring the formation of malodorous gases is minimized or reduced through adequate odour control technologies.

10.2.2.5 PUBLIC NOTIFICATION

Public notification during construction is to be facilitated through newspaper ads, notices on the Township's website, construction signage and flyers to local residents and businesses. All emergency services (Police, Fire, and EMS) should be notified of the project, specifically where construction is to impact access to public roads.

11 CONCLUSIONS AND RECOMMENDATIONS

The following items summarize the key findings, conclusions and recommendations of the Water and Wastewater Master Plan:

- → The available supply from the City of Ottawa (per the existing agreement to provide 11,860 m³ over a 20 hour period) would be sufficient to service the projected growth in Russell, Embrun, Marionville and the 417 Industrial Park to the year 2031.
- \rightarrow The Township should however, negotiate with the City to get a 24-hour continuous supply.
- → The Township would need to consult with the City of Ottawa to potentially increase the allocated capacity to accommodate growth beyond 2031.
- → The available pumping and storage capacity within the water system overall is generally sufficient to meet MOE Guidelines and Fire Underwriters fire flow requirements. The exception is Marionville, which has a relatively large amount of emergency storage, but due to limited water usage in the community, is faced with issues of water quality. This in turn has led Township's operators to maintain the Marionville Water Tower half full, which leads to some vulnerability in case of a fire. Therefore, the need for additional fire pumping capacity for Marionville has been identified.
- → The preferred water servicing alternative to accommodate growth to the year 2031 involves the construction of a new watermain from the Eadie Road Metering Station (which connects to the Russell Feedermain from Ottawa) to a new reservoir/booster station located in the vicinity of the 417 Industrial Park. A new watermain from this new reservoir/booster station to the Embrun Reservoir would also need to be constructed. This, along with some upgrades at the Embrun Reservoir, would allow for water from the Industrial Park facilities to be used to feed the Russell and Embrun systems and vice versa.
- → The Russell Wastewater Collection System was deemed to generally have capacity to accommodate the forecasted growth. However, SPS 1 would need to be upgraded after 2026 to service the flows forecasted for 2031. Capacity limitations were identified in the Embrun Wastewater Collection System. SPS 1, SPS 2, SPS 3 and SPS 7 would need to be upgraded to service the flows forecasted for 2031.
- → The preferred wastewater servicing alternative was to construct a new sewage pumping station at the or near the 417 Industrial Park which would discharge directly to the Russell Lagoon Facility.
- → To accommodate flows from both growth in Russell and the 417 Industrial Park, the Russell Lagoons would need to be upgraded.
- → A list of studies and capital projects associated with the preferred water and wastewater servicing solutions was provided. This can be used as the basis for an update to the Township's Development Charges By-law and to update the Township's Water and Wastewater Financial Plan.
- → It is recommended that the Township develop a community growth strategy that targets priority areas to be developed. After this has been defined, the water system and collection system upgrades can be implemented in a logical order.
- → It is recommended that the design criteria used for this Master Plan be reviewed annually to ensure they reflect the actual conditions of the water and wastewater systems. It is also recommended that the Master Plan be updated every five years after the completion of the Official Plan Amendment for the Township.

→ It is recommended that a sewer flow monitoring be implemented in the sewers identified to be approaching their capacity to determine whether the hydraulic model assumptions are correct and to more accurately assess upgrade requirements.

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Appendix A

HISTORICAL DATA WATER DEMANDS

APPENDIX A - HISTORICAL DATA WATER DEMANDS

	YEAR															
	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
POPULATION																
Russell	3,099	3,177	3,450	3,537	3,561	3,579	3,621	3,636	3,642	3,718	3,910	3,898	4,242	4,501	4,776	5,102
Embrun	3,920	4,040	4,085	4,262	4,611	5,145	5,497	5,861	6,155	6,423	6,589	6,490	6,548	6,590	6,629	6,717
Marionville	383	346	349	349	349	349	349	349	352	341	341	341	343	360	363	362
Total	7,402	7,563	7,884	8,148	8,521	9,073	9,467	9,846	10,149	10,482	10,840	10,729	11,133	11,451	11,768	12,181

TOTAL ANNUAL WATER FLOW (m3)

Russell	345,580	337,332	361,530	389,161	377,666	381,076	403,583	384,006	392,273	387,876	370,257	332,343	310,489	319,579	306,600	300,313
Embrun	479,888	448,390	487,185	486,891	543,615	589,062	607,248	611,150	650,921	653,995	639,407	589,818	576,853	574,605	555,548	590,648
Marionville	32,846	50,317	27,098	26,515	26,785	28,662	33,011	34,084	37,221	40,520	35,455	54,031	29,992	27,167	27,505	26,488
Total	858,314	836,039	875,813	902,567	948,066	998,800	1,043,842	1,029,240	1,080,415	1,082,391	1,045,119	976,192	917,334	921,351	889,653	917,449

AVERAGE DAILY FLOW (m3/d)

Russell	943	921	989	1,065	1,035	1,041	1,105	1,051	1,074	1,060	1,015	910	849	873	840	823
Embrun	1,314	1,225	1,333	1,333	1,488	1,610	1,663	1,673	1,782	1,787	1,753	1,615	1,587	1,570	1,522	1,618
Marionville	90	74	77	73	73	78	90	94	102	111	97	147	81	74	75	73
Total	2,347	2,220	2,399	2,471	2,596	2,729	2,858	2,818	2,958	2,958	2,865	2,672	2,517	2,517	2,437	2,514

AVERAGE DAILY FLOW PER CAPITA (m3/d/c)

Embrun	0.335	0.303	0.326	0.313	0.323	0.313	0.303	0.285	0.290	0.278	0.266	0.249	0.242	0.238	0.230	0.241
Russell	0.304	0.290	0.287	0.301	0.291	0.291	0.305	0.289	0.295	0.285	0.260	0.233	0.200	0.194	0.176	0.161
Marionville	0.235	0.214	0.221	0.209	0.209	0.223	0.258	0.269	0.290	0.326	0.284	0.431	0.236	0.206	0.207	0.202
Total	0.291	0.269	0.278	0.274	0.274	0.276	0.289	0.281	0.291	0.296	0.270	0.304	0.226	0.213	0.204	0.201

MAXIMUM DAY FLOW (m3/d)

Combined Max Day Factor

4,640	3,855	3,748	3,610	3,826
1.74	1.53	1.49	1.48	1.52

Design ADF per Capita

	0.225
Marionville	0.212
Embrun	0.238
Russell	0.183

Max Day Factor 1.53



Appendix B

HISTORICAL DATA WASTEWATER FLOWS
APPENDIX B - HISTORICAL DATA WASTEWATER FLOWS

0.3839586

RUSSELL

	YEAR 1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
POPULATION	2,265	2,422	2,531	2,618	2,638	2,657	2,698	2,711	2,714	2,792	2,984	2,993	3,137	3,592	3,867	4,127
TOTAL ANNUAL FLOW (m3)	261,374	264,913	245,801	270,784	299,451	311,549	345,380	349,564	324,784	375,908	333,982	320,809	323,301	281,839	331,131	330,212
AVERAGE MONTHLY FLOW (m3/month) AVERAGE DAILY FLOW (m3/d)	21,781 714	22,076 724	20,483 674	22,565 742	24,954 818	25,962 851	28,782 946	29,130 958	27,065 889	31,326 1,027	27,832 915	26,734 879	26,842 886	23,487 770	27,594 908	27,518 905
AVERAGE DAILY FLOW PER CAPITA (m3/cap/d) HOUSING UNITS	0.315	0.299	0.266	0.283	0.310	0.320	0.351	0.353	0.328	0.368	0.307	0.294	0.282	0.214	0.235	0.219
EMBRUN																
	YEAR 1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014
POPULATION	3,638	3,717	3,672	3,829	4,178	4,712	5,064	5,428	5,722	5,965	6,131	6,131	6,129	6,195	6,203	6,260
TOTAL ANNUAL FLOW (m3)	470,801	482,857	459,182	489,647	542,835	608,532	623,678	660,741	651,671	738,338	667,471	615,075	533,413	494,058	542,911	523,371
AVERAGE MONTHLY FLOW (m3/month)	39,233	40,238	38,265	40,804	45,236	50,711	51,973	55,062	54,306	61,528	55,623	51,256	44,451	41,171	45,243	43,614
AVERAGE DAILY FLOW (m3/d) AVERAGE DAILY FLOW PER CAPITA (m3/cap/d)	1,287	1,320	1,259	1,342	1,483	1,666	1,708	1,809	1,809	2,018	1,828	1,685	1,460	1,350	1,489	1,435

HOUSING UNITS

Design ADF	per Capita
-------------------	------------

	0.235
Marionville	0
Embrun	0.231
Russell	0.238



Appendix C

WATER SYSTEM ANALYSIS AND PROJECTIONS



	YEAR 2011	2012	2013	2014	2016	2021	2026	2031	Build Out	
POPULATION										
Russell	4,242	4,501	4,776	5,102	6,006	6,909	7,332	7,539	14,105	Service population for water is not the s
Embrun	6,548	6,590	6,629	6,717	7,972	9,807	11,915	14,408	22,009	
Marionville	343	360	363	362	370	428	428	428	428	
Total	11,133	11,451	11,768	12,181	14,348	17,144	19,675	22,375	36,542	All water servicing provided by the City
HOUSING UNITS										
Russell	1,414	1,500	1,592	1,713	2,002	2,303	2,444	2,513	4,702	
Embrun	2,183	2,197	2,210	2,426	2,657	3,269	3,972	4,803	7,336	
Marionville	114	120	121	127	127	127	159	194	194	
Total	3,711	3,817	3,923	4,266	4,786	5,699	6,574	7,509	12,232	
INDUSTRIAL DEVELOPMENT										
427 Industrial Park - Area 1 (ha)						36.0	36.0	36.0	36.0	
427 Industrial Park - Area 2 (ba)						6.0	48.0	66.9	66.9	
427 Industrial Park - Area 3 (ba)						0.0	40.0	23.1	26.6	
427 Industrial Park - Area 4 (ha)								20.1	37.0	
Total					0.0	42.0	84.0	126.0	166.5	Values include only developed area (a 7
Average Day Residential Demand										
(m3/d) - Russell	849	873	840	823	1,381	1,589	1,686	1,734	3,244	
Average Day Residential Demand					1 83/	2 256	2 740	3 31/	5 062	
(m3/d) - Embrun	1,587	1,570	1,522	1,618	1,034	2,250	2,740	5,514	3,002	
Average Day Residential Demand					85	98	98	98	98	
(m3/d) - Marionville	81	74	75	73	00	50	50	50	00	
Average Day Residential Demand	2 5 1 7	2 517	2 427	2 514	3,300	3,943	4,525	5,146	8,405	
(mord)	2,317	2,317	2,437	2,514						
Average Day Industrial Demand					0	420	840	1,260	1.665	
(m3/d)	0.547		o 40 -				5.005	.,	.,	
Average Day Demand (m3/d)	2,517	2,517	2,437	2,514	3,300	4,363	5,365	6,406	10,070	
Max Day Residential Demand					2 116	2 424	2 5 9 2	2 656	4 060	
(m ³ /d) - Russell					2,110	2,434	2,583	2,656	4,969	
Max Day Residential Demand					0.000	0.455	4 4 0 7	F 075	7 750	
(m ³ /d) - Embrun					2,808	3,455	4,197	5,075	7,753	
Max Day Residential Demand					120	454	454	454	151	
(m ³ /d) - Marionville					130	151	151	151	151	
Max Day Residential Demand	2 955	2 740	2 610	2 926	5 054	6 020	6 021	7 000	10 070	
(m ³ /d)	3,000	3,740	3,010	3,020	5,054	0,039	0,931	7,002	12,072	
Max Day Industrial Demand										
(m ³ /d)					0	840	1,680	2,520	3,330	
Maximum Day Demand (m ³ /d)	3.855	3.748	3.610	3.826	5.054	6.879	8.611	10.402	16.202	
	-,	-,	-,	-,	-,	-,	-,	,	,	
Peak Hour Residential Demand					3 937	4 529	4 806	4 942	9 246	
(m3/d) - Russell					0,001	1,020	1,000	.,	0,2.0	
Peak Hour Residential Demand					5,226	6,429	7,810	9,444	14,427	
(M3/d) - Embrun										
marianyilla					243	281	281	281	281	
(III3/0) - Manonvine Rock Hour Posidential Domand										
(m3/d)					9,405	11,238	12,897	14,667	23,953	
Peak Hour Industrial Demand					0	1,197	2,394	3,591	4.745	
(m3/d)						40.405	45 004	40.050	00.000	
Peak Hour Demand (m3/d)					9,405	12,435	15,291	18,258	28,699	



Comments

same as that for sewer system.

of Ottawa.

75% development density is assumed).



DESIGN CRITERIA		
Per Capita Average Day Demand		
(m3/cap/d)	0.230	
Average Day Demand per ha		

10
1.53
2
2.85
2.85
3
133
100
2
100

STORAGE AVAILABLE

Total Storage (m ³)	5,168	
Marionville Elevated Tank (m ³)	568	1,135
Embrun Elevated Tank (m ³)	2,300	
Russell Elevated Tank (m ³)	2,300	
Embrun Reservoir (m ³)	1,400	

PUMPING AVAILABLE

Maximum Supply from Ottawa (m ³ /d)	11,860
Maximum Supply from Ottawa (L/s)	137
Embrun Reservoir - Russell Booster Pumping Station (L/s)	43
Embrun Reservoir - Embrun Booster Pumping Station (L/s)	50
Marionville Booster Pumping Station (L/s)	7.45

PUMPING CAPACITY CHECK

OVERALL	2014	2016	2021	2026	2031	2048
(m ³ /d)	11,860	11,860	11,860	11,860	11,860	11,860
Average Day Demand (m ³ /d)	2,514	3,300	4,363	5,365	6,406	10,070
Maximum Day Demand (m ³ /d)	3,826	5,054	6,879	8,611	10,402	16,202
	2014	2016	2024	2026	2024	20.49
RUSSELL Embrun Reservoir - Russell	2014	2016	2021	2026	2031	2048
	3 715	2 715	0 74 5	0 745	~ - / -	
Booster Pumping Station (m ³ /d)	0,710	3,715	3,715	3,715	3,715	3,715
Booster Pumping Station (m ³ /d) Average Day Demand (m ³ /d)	823	1,381	3,715 1,589	3,715 1,686	3,715 1,734	3,715 3,244
Booster Pumping Station (m³/d) Average Day Demand (m³/d) Maximum Day Demand (m³/d)	823 1,260	1,381 2,116	3,715 1,589 2,434	3,715 1,686 2,583	3,715 1,734 2,656	3,715 3,244 4,969



Historical average over 2011-2014 period. 2010 not considered given it includes usage prior to implementation of metering (period of higher water usage).

Vars Business Park Servicing Study – Functional Overview (Stantec, 2012)

Historical maximum over 2010-2014 period.

Vars Business Park Servicing Study – Functional Overview (Stantec, 2012) MOE Guidelines recommend a value of 2.85 for populations between 10,001 and 25,000.

Vars Business Park Servicing Study – Functional Overview (Stantec, 2012) recommended a value of 2.7. For consistency with the criterion for residential uses, a value of 2.85 was adopted.

Based on FUS requirements for contiguous buildings (8000 L/min).

Vars Industrial Park Servicing Memo (2015)

Based on FUS requirements.

2004 Master Plan (Stantec) 2004 Master Plan (Stantec)

2004 Master Plan (Stantec)

118 USGPM @ 121 ft TDH.

Maximum amount available over a 20 hour period. Black out period from 6-10 PM.

Current setting at Embrun Reservoir fill valve is 110 L/s.

From Water Reserve Capacity Assessment (Stantec, 2011).

Based on shop drawing provided by Township (September 2009). Two pumps (1 duty, 1 standby)

required to supply the system beyond 2031.



Fire Flow (m ³ /d) 11,491 11,491 11,491 11,491 11,491 11,491	
Maximum Day + Fire Demand (m ³ /d) 12,752 13,607 13,925 14,074 14,147 16,460	A combination of st
EMBRUN 2014 2016 2021 2026 2031 2048	
Embrun Reservoir - Embrun Booster Pumping Station (m ³ /d) 4,320 4,320 4,320 4,320 4,320 4,320	
Average Day Demand (m ³ /d) 1,618 1,834 2,256 2,740 3,314 5,062	
Maximum Day Demand (m ³ /d) 2,478 2,808 3,455 4,197 5,075 7,753	
Peak Hour Demand (m ³ /d) 4,611 5,226 6,429 7,810 9,444 14,427	
Fire Flow (m ³ /d) 11,491 11,491 11,491 11,491 11,491 11,491 11,491 Maximum Day + Fire Demand	
(m ³ /d) 13,969 14,299 14,946 15,688 16,567 19,244	A combination of st
MARIONVILLE 2014 2016 2021 2026 2031 2048	
Marionville Booster Pumping Station (m ³ /d) 644 644 644 644 644 644	
Average Day Demand (m ³ /d) 73 85 98 98 98 98	
Maximum Day Demand (m ³ /d) 112 130 151 151 151 151	
Peak Hour Demand (m ³ /d) 208 243 281 281 281 281	
Fire Flow (m ³ /d) 11,491 11,491 11,491 11,491 11,491 11,491 11,491 Maximum Day + Fire Demand	
(m ³ /d) 11,603 11,622 11,642 11,642 11,642 11,642	A combination of s
427 INDUSTRIAL PARK 2014 2016 2021 2026 2031 2048	
Available Capacity from Ottawa (m ³ /d) 11,860 11,860 11,860 11,860 11,860 11,860 11,860	
Average Day Demand (m ³ /d) 0 0 420 840 1,260 1,665	
Maximum Day Demand (m ³ /d) 0 0 840 1,680 2,520 3,330	
Peak Hour Demand (m ³ /d) 0 0 1,197 2,394 3,591 4,745	
Fire Flow (m³/d) 8,640 8,640 8,640 8,640 8,640	
Maximum Day + Fire Demand	

OVERALL STORAGE REQUIREN	IENTS							
	Max Day Demand (m ³ /d)	Required Fire Flow (m³/d)	Max Day + Fire (m³/d)	Peak Hour (m³/d)	A - Fire Storage (m ³)	B - Equalization Storage (m ³)	C - Emergency Storage (m ³)	
2014	3,826	11,491	15,317	7,165	958	957	479	
2016	3,300	11,491	14,791	9,405	958	825	446	
2021	6 970	11 /01	19 270	12 /25	058	1 720	660	

	(m³/d)	(m³/d)		(,)	eter	Storage (m [°])	Storage (m [°])	(m ³)	(m³)	
2014	3,826	11,491	15,317	7,165	958	957	479	2,393	5,168	Peak hour flow estimated based on histo
2016	3,300	11,491	14,791	9,405	958	825	446	2,228	5,168	
2021	6,879	11,491	18,370	12,435	958	1,720	669	3,347	5,168	
2026	8,611	11,491	20,102	15,291	958	2,153	778	3,888	5,168	
2031	10,402	11,491	21,893	18,258	958	2,600	890	4,448	5,168	
2048	16,202	11,491	27,694	28,699	958	4,051	1,252	6,260	5,168	
Based on Capacity from Ottawa	11,860	11,491	23,351	22,069	958	2,965	981	4,903	5,168	

A + B + C =

Storage

Required

Storage

Available

(m³)

Upgrade

Required?

STORAGE REQUIREMENTS - RUSSELL

Max Day Demand (m ³ /d)	Required Fire Flow (m ³ /d)	Max Day + Fire (m ³ /d)	Peak Hour (m³/d)	A - Fire Storage (m ³)	B - Equalization Storage (m ³)	C - Emergency Storage (m ³)	A + B + C = Storage Required (m ³)	Floating Storage Available (m ³)	Additional Pumping Capacity Required?
--	--	---------------------------------------	---------------------	---------------------------------------	--	---	---	---	--



required to supply the system.

Peak hour flow estimated based on historical average day demands and MOE peaking factor.



2014	1 260	11 101	10 750	2 246	059	215	210	1 501	2 200	No	Max day and peak hour demands estim
2014	1,200	11,491	12,752	2,340	956	315	310	1,591	2,300	INU	peaking factor.
2016	2,116	11,491	13,607	0	958	529	372	1,858	2,300	No	Minimum reserve of 700 m ³ to be maint
2021	2,434	11,491	13,925	0	958	608	392	1,958	2,300	No	Storage capacity sufficient for fire fightir
2026	2,583	11,491	14,074	0	958	646	401	2,004	2,300	No	Storage capacity sufficient for fire fightir
2031	2,656	11,491	14,147	0	958	664	405	2,027	2,300	No	Storage capacity sufficient for fire fightir
2048	4,969	11,491	16,460	0	958	1,242	550	2,750	2,300	No	Storage capacity sufficient for fire fighting

STORAGE REQUIREMENTS - EMBRUN

	Max Day Demand (m ³ /d)	Required Fire Flow (m³/d)	Max Day + Fire (m ³ /d)	Peak Hour (m³/d)	A - Fire Storage (m ³)	B - Equalization Storage (m ³)	C - Emergency Storage (m ³)	A + B + C = Storage Required (m ³)	Floating Storage Available (m ³)	Additional Pumping Capacity Required?	
2014	2,478	11,491	13,969	4,611	958	620	394	1,971	2,300	No	Max day and peak hour demands estin peaking factor.
2016	2,808	11,491	14,299	5,226	958	702	415	2,075	2,300	No	Storage capacity sufficient for fire fighti
2021	3,455	11,491	14,946	6,429	958	864	455	2,277	2,300	No	Storage and pumping capacity sufficier
2026	4,197	11,491	15,688	7,810	958	1,049	502	2,509	2,300	No	Storage and pumping capacity sufficier
2031	5,075	11,491	16,567	9,444	958	1,269	557	2,783	2,300	No	Storage and pumping capacity sufficier
2048	7,753	11,491	19,244	14,427	958	1,938	724	3,620	2,300	Yes	Storage and pumping capacity sufficier

STORAGE REQUIREMENTS - MARIONVILLE

	Max Day Demand (m³/d)	Required Fire Flow (m ³ /d)	Max Day + Fire (m³/d)	Peak Hour (m ³ /d)	A - Fire Storage (m ³)	B - Equalization Storage (m ³)	C - Emergency Storage (m ³)	A + B + C = Storage Required (m ³)	Floating Storage Available (m ³)	Additional Pumping Capacity Required?	Max day and peak hour demands estima peaking factor.
2014	112	11,491	11,603	208	958	28	246	1,232	568	Yes	Storage and pumping capacity sufficient
2016	130	11,491	11,622	243	958	33	248	1,238	568	Yes	Storage and pumping capacity sufficient
2021	151	11,491	11,642	281	958	38	249	1,244	568	Yes	Storage and pumping capacity sufficient
2026	151	11,491	11,642	281	958	38	249	1,244	568	Yes	Storage and pumping capacity sufficient
2031	151	11,491	11,642	281	958	38	249	1,244	568	Yes	Storage and pumping capacity sufficient
2048	151	11,491	11,642	281	958	38	249	1,244	568	Yes	Storage and pumping capacity sufficient

STORAGE REQUIREMENTS - 427 Industrial Park

	Max Day Demand (m ³ /d)	Required Fire Flow (m ³ /d)	Max Day + Fire (m ³ /d)	Peak Hour (m ³ /d)	A - Fire Storage (m ³)	B - Equalization Storage (m ³)	C - Emergency Storage (m ³)	A + B + C = Storage Required (m ³)
2014	0	8,640	8,640	0	720	0	180	900
2016	0	8,640	8,640	0	720	0	180	900
2021	840	8,640	9,480	1,197	720	210	233	1,163
2026	1,680	8,640	10,320	2,394	720	420	285	1,425
2031	2,520	8,640	11,160	3,591	720	630	338	1,688
2048	3,330	8,640	11,970	4,745	720	833	388	1,941

A 1,940 m³ storage tank/reservoir is required at the Industrial Park.



nated based on historical average day demands and design

tained in case of emergency during black out period.

ing and system supply.

ing and system supply.

ing and system supply.

ing and system supply.

mated based on historical average day demands and design

ting and system supply. ent for fire fighting and system supply.

ated based on historical average day demands and design

t for fire fighting and system supply. t for fire fighting and system supply.

Appendix D

WASTEWATER SYSTEM ANALYSIS AND PROJECTIONS

	YEAR								
	2011	2012	2013	2014	2016	2021	2026	2031	Build O
POPULATION	0.407	0.500	0.007	4.407	5 050	5 050	0.070	0 500	40.44
Russell	3,137	3,592	3,867	4,127	5,050	5,953	6,376	6,583	13,149
Emprun Mariapyilla	6,129	6,195	6,203	6,260	6,477	8,312	10,420	12,913	20,514
	9 266	9 787	10 070	10 387	11 527	14 265	16 796	19 496	33 663
Iotai	3,200	5,707	10,070	10,507	11,027	14,200	10,750	13,430	55,000
HOUSING UNITS									
Russell	1,046	1,197	1,289	1,394	1,683	1,984	2,125	2,194	4,383
Embrun	2,043	2,065	2,068	1,928	2,159	2,771	3,473	4,304	6,838
Marionville	0	0	0	0	0	0	0	0	0
Total	3,089	3,262	3,357	3,322	3,842	4,755	5,599	6,499	11,221
127 Industrial Bark Area 1 (ba)						26.0	26.0	26.0	26.0
427 Industrial Park - Area 2 (ha)						50.0 6.0	30.0 48.0	50.0 66 9	50.0 66 0
427 Industrial Park - Area 2 (ha)						0.0	40.0	23.1	26.6
427 Industrial Park - Area 4 (ha)								20.1	20.0
Total					0.0	42.0	84.0	126.0	166.5
Average Day Residential Flow									
(m3/d) - Russell	886	770	908	905	1,200	1,415	1,516	1,565	3,126
Average Day Industrial Flow									
(m3/d)					0	420	840	1,260	1,665
Average Day Flow (m3/d) -									
Russell Lagoons	886	770	908	905	1,200	1,835	2,356	2,825	4,791
-									
Average Day Residential Flow	1 460	1 350	1 489	1 435	1 540	1 976	2 477	3 070	4 877
(m3/d) - Embrun	1,400	1,550	1,409	1,433	1,540	1,970	2,477	3,070	4,077
Average Day Flow (m3/d) -									
Embrun Lagoons	1,460	1,350	1,489	1,435	1,540	1,976	2,477	3,070	4,877
Average Day Residential Flow									
(m3/d) - Marionville	0	0	0	0	0	0	0	0	0
Average Day Flow (m3/d) -									
Marionville	0	0	0	0	0	0	0	0	0
Max Day Residential Flow (m ³ /d) -					1.839	2.167	2.321	2.397	4.787
Russell					.,	_,	_,	_,	.,
Max Day Industrial Flow (m ³ /d)					0	840	1,680	2,520	3,330
Max Day Flow (m3/d) - Russell					4 000	o o o -			o 44 -
Lagoons	U	U	U	U	1,839	3,007	4,001	4,917	8,117
Max Dav Residential Demand									
(m^{3}/d) - Embrun					2,358	3,026	3,794	4,701	7,469
Max Day Flow (m3/d) - Embrun									
Lagoons	0	0	0	0	2.358	3.026	3.794	4.701	7.469
	-	-	-	-	_,	-,	-,	-,	.,
Max Day Residential Demand					0	0	0	0	0
(m ³ /d) - Marionville					0	0	0	0	0
Max Day Flow (m3/d) -									
Marionville	0	0	0	0	0	0	0	0	0
DESIGN CRITERIA									
Per Capita Average Day Flow									
(m3/cap/d) - Russell	0.238								
Per Capita Average Day Flow									
(m3/cap/d) - Embrun	0.231								
Average Day Demand per ha -									
Industrial (m3/ha/d)	10								
Maximum Day Peak Factor -									
Residential	1.53								
Maximum Day Peak Factor -									
Industrial	2								
TREATMENT CAPACITY AVAILAB	LE								
Russell Lagoons (m ³ /d)	2,675								
Embrun Lagoons (m³/d)	3,865								



Out	Comments
49 14	Service population for water is not the same as that for sewer system.
63	
33 38	
21	
0 9 6 0 . 5	Values include only developed area (a 75% development density is assumed).
26	
65	
91	
77	
77	
37	
30	
17	
69	
69	

Historical average over 2011-2014 period. 2010 not considered given it includes usage prior to implementation of metering (period of higher water usage). Historical average over 2011-2014 period. 2010 not considered given it includes usage prior to implementation of metering (period of higher water usage).

Vars Business Park Servicing Study – Functional Overview (Stantec, 2012) Historical maximum water peaking factor over 2010-2014 period. Assumed to be the same for wastewater.

Vars Business Park Servicing Study – Functional Overview (Stantec, 2012)

ECA 3636-8WXJF7 (Issued October 16, 2012). Per ECA a TPM Agreement is required when flows reach 1,700 m3/d. The maximum operating capacity until such agreement is established is 2000 m3/d.

ECA 3996-9H4PX7 (Issued March 19, 2014).

TREATMENT CAPACITY CHECK

RUSSELL	2014	2016	2021	2026	2031	2048
Russell Lagoons - Ultimate Capacity	2,675	2,675	2,675	2,675	2,675	2,675
Russell Lagoons - Max Capacity until TPM is Established	2,000	2,000	2,000	2,000	2,000	2,000
Russell Lagoons - Capacity when TPM is Required	1,700	1,700	1,700	1,700	1,700	1,700
Average Day Flow - Russell	905	1,200	1,415	1,516	1,565	3,126
Average Day Flow - Industrial Park			420	840	1,260	1,665
Average Day Flow - Total	905	1,200	1,835	2,356	2,825	4,791
Assimilative Capacity Castor River (m3/d)	61,068	61,068	61,068	61,068	61,068	61,068

*Based on Stantec's Letter to Victor Castro dated October 12th, 2004 - 11,145,000 m3/year per community

EMBRUN	2014	2016	2021	2026	2031	2048
Embrun Lagoons Capacity	3,865	3,865	3,865	3,865	3,865	3,865
Average Day Flow	1,435	1,540	1,976	2,477	3,070	4,877



4,500 4,000 3,500 3,000 2,500 1,500 1,000 500 0 2010 2010 2010

PUMPING CAPACITY CHECK

RUSSELL	Rated Capacity (L/s)	2014	2016	2021	2026	2031
SPS 1 - Projected Flows (L/s)	80.0		89.8			101.6
SPS 2 - Projected Flows (L/s)	23.5		15.5			16.5
SPS 3 - Projected Flows (L/s)	110.0	0.0				7.6
	Rated					
EMBRUN	Capacity (L/s)	2014	2016	2021	2026	2031
SPS 1 - Projected Flows (L/s)	113.0		98.0			164.3
SPS 2 - Projected Flows (L/s)	56.0		45.4			78.4
SPS 3 - Projected Flows (L/s)	30.0		34.8			99.2
SPS 4 - Projected Flows (L/s)	10.3		4.6			8.5
SPS 5 - Projected Flows (L/s)	34.0		28.4			28.9
SPS 6 - Projected Flows (L/s)	128.2		0.0			16.0
SPS 7 - Projected Flows (L/s)	8.5		6.5			27.5
SPS 8 - Projected Flows (L/s)	132.0	34.5				136.2







257 new units of growth projected in this drainage area + 12 new units from SPS 2 drainage area. Expansion required.

12 new units of growth projected in this drainage area. 233 new units of growth projected in this drainage area.

Expansion required. 64 units plus 148 units in drainage areas 2 and 4. Expansion required. Forcemain designed for 66 L/s. Expansion required to accommodate 660 units plus 126 units in drainage area 7.

Expansion required.

Appendix E

SANITARY SEWER CALCULATION SHEETS

LOCA	TION							RESIDE	NTIAL ARE	A AND POPU	ILATION							INDUSTRIAL	COMMERC	CIAL II	NSTITUTION	IAL I+0	;+1		INFILTRATIO	N							PIPE		
STREET	FROM	то	EXISTING	FUTURE	EXISTING	FUTURE			CUML	JLATIVE	1		PEAK	EXISTING	FUTURE	EXISTING + FUTURE	AREA	ACCU. PEAK	AREA AC	CU.	AREA AC	CU. PE	AK EXISTING	ACCU. EXISTING	EXISTING INFILT.	FUTURE	ACCU. F FUTURE	future Infilt.	TOTAL EXISTING	TOTAL FUTURE	LENGTH	DIA.	SLOPE	CAP. VEL	L. REM
	M.H.	М.Н.	AREA	AREA	POP.	POP.	EXISTING	FUTURE	EXISTING + FUTURE	EXISTING	FUTURE	EXISTING + FUTURE	FACT.	PEAK FLOW	PEAK FLOW	PEAK FLOW		AREA FACTOR	AR	REA	AR	EA FLO	W AREA	AREA	FLOW	AREA	AREA	FLOW	FLOW	FLOW				(FULL) (FUL	LL) C
			(ha)	(ha)			AREA (ha)	AREA (ha)	AREA (ha)	POP.	POP.	POP.		(l/s)	(l/s)	(l/s)	(ha)	(ha) (per MOE)	(ha) (h	ha)	(ha) (h	a) (l/	s) (ha)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(I/s)	(I/s)	(m)	(mm)	(%)	(l/s) (m/s	s) (
							_										_			_	_	_													
PS 3 Drainage Ar	ea	2000	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00		00		0 0.00	0.00	0.00	0.00	0.00			44.50	200	0.04	25.0	
Boxcar	267	265	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00		.00 0	0.00	0 0.00	0.00	0.00	0.00	0.00	0.0	0.0	11.50	200	0.61	25.6 0	J.8
Boxcar	200	199	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00					0.00	0.00	0.00	0.00	0.0	0.0	40.30 34 50	200	0.40	21.6 (0.7
York Crossing	199	200	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00		.00 (0.00 0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	89.50	200	0.38	20.2 (0.6
York Crossing	200	201	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00		0.00	0.00 0.	00 0.00	0.00	0.00	0.00	0.00	0.0	0.0	91.50	250.00	0.32	33.5 (0.7
York Crossing	201	202	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00		0.00	0.00 0.	00 0.00	0.00	0.00	0.00	0.00	0.0	0.0	43.00	250.00	0.21	27.2 (0.6
Boxcar	267	268	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00		0.00	0.00 0.0	00.00	0.00	0.00	0.00	0.00	0.0	0.0	109.00	200	0.39	20.4 (0.6
Boxcar	268	269	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00		0.00	0.00 0.0	00.00	0.00	0.00	0.00	0.00	0.0	0.0	117.00	250	0.29	32.1 (0.7
Boxcar	269	270	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00		0.00	0.00 0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	10.50	250	0.29	31.8 (0.6
Boxcar	270	271	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00	0	.00	0.00 0.0	00.00	0.00	0.00	0.00	0.00	0.0	0.0	40.00	250	0.27	31.2 (0.6
Boxcar	271	202	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00	0	.00 (0.00 0.0	00.00	0.00	0.00	0.00	0.00	0.0	0.0	49.00	250	0.29	31.8 C	ე.6
York Crossing	202	272	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00	0	.00 (0.00 0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	86.00	250	0.24	29.4 0	J.6
York Crossing	272	273	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00	0	.00 (0.00 0.0	00.00	0.00	0.00	0.00	0.00	0.0	0.0	64.00	250	0.23	28.8 0	J.6
Duncanville	319	318	0.00	0.10	0		0 0.00	0.10	0.10	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00	(00.00	0.00 0.0		0.00	0.10	0.10	0.04	0.0	0.0	120.00	250	0.28	31.7 0	J.6
Duncanville	318	317	0.00	0.00	0		0 0.00	0.10	0.10	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00		.00 0			0.00	0.00	0.10	0.04	0.0	0.0	20.50	250	0.29	32.2 0	J.7
York Crossing	273	273	0.00	0.00	0		0 0.00	0.10	0.10	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00		00 0			0.00	0.00	0.10	0.04	0.0	0.0	46.00	375	0.29	68.4 (0.6
York Crossing	274	275	0.00	0.00	0		0 0.00	0.10	0.10	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00		00 0			0.00	0.00	0.10	0.04	0.0	0.0	35.00	375	0.13	66.3 (0.6
York Crossing	275	277	0.00	0.00	0		0 0.00	0.10	0.10	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00	0	.00 (0.00 0.0	0.00	0.00	0.00	0.10	0.04	0.0	0.0	49.00	375	0.16	70.8	0.6
Central Park	276	277	0.00	0.00	0		0 0.00	0.10	0.10	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00		.00 (0.00 0.0	0.00	0.00	0.00	0.10	0.04	0.0	0.0	42.50	450	0.12	97.8 (0.6
Central Park	277	278	0.00	0.00	0		0 0.00	0.10	0.10	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00	(.00 (0.00 0.0	00.00	0.00	0.00	0.10	0.04	0.0	0.0	41.00	450	0.12	99.6 (0.6
Central Park	278	281	0.00	0.00	0		0 0.00	0.10	0.10	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00	C	.00 (0.00	00.00	0.00	0.00	0.10	0.04	0.0	0.0	42.00	450	0.12	98.4 (0.6
Junction	279	280	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00	(.00 (0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	56.50	200	0.65	26.5 (0.8
Central Park	280	281	0.00	0.00	0	69	99 0.00	0.00	0.00	0	699	699	3.89	0.00	7.50	7.50		0.00		0.00	0	.00	0.00	00.00	0.00	0.00	0.00	0.00	0.0	7.5	75.50	200	0.89	30.9 1	1.0
Central Park	281	282	0.00	0.00	0		0 0.00	0.10	0.10	0	699	699	3.89	0.00	7.50	7.50		0.00		0.00	0	.00 (0.00	00.00	0.00	0.00	0.10	0.04	0.0	7.5	34.00	450	0.12	97.8 (0.6
Central Park	282	283	0.00	0.00	0		0 0.00	0.10	0.10	0	699	699	3.89	0.00	7.50	7.50		0.00		0.00	C	.00 (0.00 0.0	00.00	0.00	0.00	0.10	0.04	0.0	7.5	66.50	450	0.12	98.9 (0.6
Central Park	283	284	0.00	0.00	0		0 0.00	0.10	0.10	0	699	699	3.89	0.00	7.50	7.50		0.00		0.00	0	.00 (0.00 0.0	0.00	0.00	0.00	0.10	0.04	0.0	7.5	120.00	450	0.12	97.4 0	J.6
Central Park	284	285	0.00	0.00	0		0 0.00	0.10	0.10	0	699	699	3.89	0.00	7.50	7.50		0.00		0.00	(.00 (0.00 0.0	0 0.00	0.00	0.00	0.10	0.04	0.0	7.5	110.00	450	0.12	98.0 0	J.6
Central Park	285	286	0.00	0.00	0		0 0.00	0.10	0.10	0	699	699	3.89	0.00	7.50	7.50		0.00		0.00	(.00 0	0.00 0.0		0.00	0.00	0.10	0.04	0.0	7.5	63.50	450	0.13	101.2 0	J.6
Central Park	200	207	0.00	0.00	0		0 0.00	0.10	0.10	0	699	600	3.09	0.00	7.50	7.50		0.00		0.00		00 0			0.00	0.00	0.10	0.04	0.0	7.5	88.00	450	0.12	1/5.8 (0.9
Station Trail	207	200	0.00	0.00	0		0 0.00	0.10	0.10	0	099	099	3.89 4.00	0.00	0.00	0.00		0.00		0.00					0.00	0.00	0.10	0.04	0.0	1.5	76 50	200	0.20	26.5 (0.8
Station Trail	292	293	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00		.00 (0.00 0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	10.00	200	0.40	20.7 (0.7
Station Trail	293	294	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00	0	.00 (0.00 0.0	00.00	0.00	0.00	0.00	0.00	0.0	0.0	80.00	200	0.40	20.7 (0.7
Station Trail	294	295	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00	0	.00 (0.00 0.0	00.00	0.00	0.00	0.00	0.00	0.0	0.0	71.50	250	0.28	31.5 (0.6
Station Trail	295	296	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00	C	.00 (0.00 0.0	00.00	0.00	0.00	0.00	0.00	0.0	0.0	105.00	250	0.28	31.3 (0.6
Station Trail	296	297	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00	0	.00 (0.00	00.00	0.00	0.00	0.00	0.00	0.0	0.0	43.00	250	0.28	31.4 (0.6
Station Trail	297	298	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00	C	.00 (0.00	00.00	0.00	0.00	0.00	0.00	0.0	0.0	43.50	250	0.28	31.2 (0.6
Station Trail	298	288	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00	C	.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	118.00	250	0.28	31.4 (0.6
Central Park	288	289	0.00	0.00	0		0 0.00	0.10	0.10	0	699	699	3.89	0.00	7.50	7.50		0.00		0.00	C	.00 (0.00 0.0	00.00	0.00	0.00	0.10	0.04	0.0	7.5	88.00	450	0.20	128.9 0	0.8
Pioneer	299	300	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00	0	.00 (0.00 0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	68.50	200	0.66	26.6 0	0.8
Pioneer	300	301	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00	+	0.00	0	.00 (0.00 0.0	0.00	0.00	0.00	0.00	0.00	0.0	0.0	120.00	200	0.40	20.7 0	J.7
Pioneer	301	302	0.00	0.00	0		0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00	+	0.00		.00 (0.00 0.0		0.00	0.00	0.00	0.00	0.0	0.0	67.00	250	0.28	31./ 0	J.6
Pioneer	302	303	0.00	0.00	0		0 0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00					0.00	0.00	0.00	0.00	0.0	0.0	47.00	250	0.28	31.3 0	0.C
Pioneer	303	280	0.00	0.00	0		0 0.00		0.00	0	0	0	4.00	0.00	0.00	0.00		0.00		0.00					0.00	0.00	0.00	0.00	0.0	0.0	43.50	250 250	0.20 0.28	31.2 0	0.6
Central Park	289	290	0.00	0.19	0		0 0.00) 0.00	0.00	0	699	699	3.89	0.00	7.50	7.50		0.00		0.00		.00 (0.00	0.00	0.00	0.19	0.29	0.11	0.0	7.6	29.00	450	0.17	118.4	0.7
Central Park	290	Sta. 3	0.00	0.00	0		0 0.00	0.29	0.29	0	699	699	3.89	0.00	7.50	7.50		0.00		0.00		.00 (0.00 0.0	0.00	0.00	0.00	0.29	0.11	0.0	7.6	10.00	450	25.20	1431.2	9.0
PS 2 Drainage Ar	ea																													-		-	-		
Olde Towne Ave	213	214	0.60	0.00	18		0 0.60	0.00	0.60	18	0	18	4.00	0.20	0.00	0.20				0.00	0	.00 (0.00 0.6	0.60	0.23	0.00	0.00	0.00	0.4	0.4	56.70	200	0.49	23.0 (0.7





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LOCA	TION							RESIDE	NTIAL ARE	A AND POPU	LATION						INDUST	RIAL	COM	MERCIAL	INSTITUTIO	ONAL	I+C+I		I	INFILTRATIO	N							PIPE		Г
STREET	FROM	то	EXISTING	FUTURE	EXISTING	FUTURE			CUML	JLATIVE		PEAK	EXISTING	FUTURE	EXISTING + FUTURE	AREA	ACCU.	PEAK	AREA	ACCU.	AREA A	CCU.	PEAK	EXISTING	ACCU. EXISTING	EXISTING INFILT.	FUTURE	ACCU. FUTURE	FUTURE INFILT.	TOTAL EXISTING	TOTAL FUTURE	LENGTH	DIA.	SLOPE CA	P. VEL	REMAI
	M.H.	M.H.	AREA	AREA	POP.	POP.	EXISTING	FUTURE	EXISTING + FUTURE	EXISTING	FUTURE FUTURE	FACT.	PEAK FLOW	PEAK FLOW	PEAK FLOW	(ba)	AREA	FACTOR	(ha)	AREA	(ba)	AREA	FLOW	AREA	AREA	FLOW	AREA	AREA	FLOW	FLOW	FLOW	(m)	(mm)	(FUL	L) (FUL	L) CA
		045	(11d)	(114)						POP.			(#3)	(#3)	(#3)	(na)	(114)		(114)	(114)	(114)		(1/3)	(10)	(114)	(//3)	(114)	(114)	(#3)	(//3)	(#3)	(11)	(1111)	(70) (70) (11/3) (#3
Olde Towne Ave	214	215	0.70	0.00	21		0 1.30	0.00	1.30	39	0 39	4.00	0.43	0.00	0.43					0.00		0.00	0.00	0.70	1.30	0.49	0.00	0.00	0.00	0.9	0.9	62.30	200	0.50 2	$\frac{3.1}{0}$./
	215	210	0.90	0.00	21		0 2.20	0.00	2.20	87	0 87	4.00	0.73	s 0.00	0.73					0.00		0.00	0.00	0.90	2.20	1 10	0.00	0.00	0.00	1.0	2.1	59.00	200	0.49 2	$\frac{3.1}{23.0}$ (.7
	210	217	0.70	0.00	18		0 2.50	0.00	3 50	105	0 105	4.00	1 16	0.00 0.00	1 16					0.00		0.00	0.00	0.60	3 50	1.10	0.00	0.00	0.00	2.1	2.1	63.90	200	0.49 2	$\frac{3.0}{23.2}$ (.7
	221	220	0.00	0.00	6		0 0.00	0.00	0.20	6	0 6	4 00	0.07	7 0.00	0.07					0.00		0.00	0.00	0.00	0.20	0.08	0.00	0.00	0.00	0.1	0.1	11 40	200	4.39 6	3.2 0 38.7 (.7
Olde Towne Ave	220	219	0.90	0.00	27		0 1.10	0.00	1.10	33	0 33	4.00	0.36	0.00	0.36					0.00		0.00	0.00	0.90	1.10	0.42	0.00	0.00	0.00	0.8	0.8	82.30	200	0.50 2	23.1 ().7
Olde Towne Ave	219	218	1.20	0.00	36		0 2.30	0.00	2.30	69	0 69	4.00	0.76	0.00	0.76					0.00		0.00	0.00	1.20	2.30	0.87	0.00	0.00	0.00	1.6	1.6	109.10	200	0.71 2	27.6 ().9
Easement Olde																																				
	218	230	0.60	0.00	18		0 6.40	0.00	6.40	192	0 192	4.00	2.12	0.00	2.12					0.00		0.00	0.00	0.60	6.40	2.43	0.00	0.00	0.00	4.5	4.5	88.20	250	0.50 4	2.0 0	.9
	224	225	0.60	0.00	18	(0 0.60	0.00	0.60	18	0 18	4.00	0.20	0.00	0.20					0.00		0.00	0.00	0.60	0.60	0.23	0.00	0.00	0.00	0.4	0.4	84.20	200	0.40 2	0.8 0	.7
	226	225	0.60	0.00	18		0 0.60	0.00	0.60	30	0 30	4.00	0.40	0.00	0.40					0.00		0.00	0.00	0.60	0.60	0.23	0.00	0.00	0.00	0.6	0.6	45.20	200	1.24 3	0.5 1	.2
Brickvard	220	227	0.60	0.00	10		0 1.00	0.00	2.30	97	0 72	4.00	0.79	0.00	0.79					0.00		0.00	0.00	0.60	2.30	0.00	0.00	0.00	0.00	1.3	1.5	72.00	200	0.00 2	$\frac{3.3}{20}$ (.7
Brickvard	227	220	0.50	0.00	15		0 2.30	0.00	2.30	102	0 10	4.00	1 12		1 12					0.00		0.00	0.00	0.50	2.30	1.06	0.00	0.00	0.00	1.0	2.2	68.70	200	0.49 2	$\frac{3.0}{23.4}$ (.7
Olde Towne Ave	220	223	0.50	0.00	15		0 2.00	0.00	0.50	15	0 15	4.00	0.17	7 0.00	0.17					0.00		0.00	0.00	0.50	0.50	0.19	0.00	0.00	0.00	0.4	0.4	13.00	200	1.00 .3	32.4 0	.,
Olde Towne Ave	223	222	0.50	0.00	15		0 1.00	0.00	1.00	30	0 30	4.00	0.33	3 0.00	0.33					0.00		0.00	0.00	0.50	1.00	0.38	0.00	0.00	0.00	0.7	0.7	105.40	200	0.50 2	23.3 ().7
Olde Towne Ave	221	222	0.50	0.00	15		0 0.50	0.00	0.50	15	0 15	4.00	0.17	7 0.00	0.17					0.00		0.00	0.00	0.50	0.50	0.19	0.00	0.00	0.00	0.4	0.4	79.00	200	0.44 2	21.8 ().7
Cobblestone	222	229	0.50	0.00	15	(0 2.00	0.00	2.00	60	0 60	4.00	0.66	6 0.00	0.66					0.00		0.00	0.00	0.50	2.00	0.76	0.00	0.00	0.00	1.4	1.4	86.80	200	0.50 2	23.1 ().7
Cobblestone	229	230	0.50	0.00	15	(0 2.50	0.00	2.50	75	0 75	5 4.00	0.83	3 0.00	0.83					0.00		0.00	0.00	0.50	2.50	0.95	0.00	0.00	0.00	1.8	1.8	109.50	200	0.50 2	/3.2 ().7
Cobblestone	230	231	2.14	0.71	0	30	6 13.85	0.71	14.56	369	36 405	6 4.00	4.07	0.40	4.46					0.00		0.00	0.00	2.14	13.85	5.26	0.71	0.71	0.27	9.3	10.0	85.90	200	0.40 2	20.6 ().7
Gaslight	234	235	0.20	0.00	6		0 0.20	0.00	0.20	6	0 6	6 4.00	0.07	0.00	0.07					0.00		0.00	0.00	0.20	0.20	0.08	0.00	0.00	0.00	0.1	0.1	25.50	200	0.98 3	52.5 1	.0
Gaslight	236	235	0.80	0.00	24	. (0 0.80	0.00	0.80	24	0 24	4.00	0.26	6 0.00	0.26					0.00		0.00	0.00	0.80	0.80	0.30	0.00	0.00	0.00	0.6	0.6	87.00	200	0.76 2	<u>.</u> 8.6 ().9
Cobblestone	235	233	0.40	0.00	12		0 1.40	0.00	1.40	42	0 42	4.00	0.46	6 0.00	0.46					0.00		0.00	0.00	0.40	1.40	0.53	0.00	0.00	0.00	1.0	1.0	67.10	200	0.52 2	3.7 ().8
Cobblestone	233	232	0.80	0.00	24	. (0 2.20	0.00	2.20	66	0 66	6 4.00	0.73	3 0.00	0.73					0.00		0.00	0.00	0.80	2.20	0.84	0.00	0.00	0.00	1.6	1.6	75.70	200	0.50 2	.3.2 ().7
Cobblestone	232	231	0.50	0.00	15		0 2.70	0.00	2.70	81	0 81	4.00	0.89	0.00	0.89					0.00		0.00	0.00	0.50	2.70	1.03	0.00	0.00	0.00	1.9	1.9	42.80	200	0.49 2	.3.0 C).7
Woolenmill	231	239	0.40	0.00	12		0 16.95	0.71	17.66	462	36 498	3.98	5.06	6 0.39	5.45					0.00		0.00	0.00	0.40	16.95	6.44	0.00	0.71	0.27	11.5	12.2	67.10	200	0.40 2	.0.8 C	.7
Pebbelmill	236	238	0.50	0.00	15	(0 0.50	0.00	0.50	15	0 15	6 4.00	0.17	7 0.00	0.17					0.00		0.00	0.00	0.50	0.50	0.19	0.00	0.00	0.00	0.4	0.4	54.50	200	0.77 2	.8.8 C	1.9
Pebbelmill	238	239	0.60	0.00	18	(0 1.10	0.00	1.10	33	0 33	4.00	0.36	6 0.00	0.36					0.00		0.00	0.00	0.60	1.10	0.42	0.00	0.00	0.00	0.8	0.8	99.10	200	0.50 2	.3.3 0).7
Woolenmill	239	240	0.60	0.00	18	(0 18.65	0.71	19.36	513	36 549	3.95	5.59	0.39	5.98					0.00		0.00	0.00	0.60	18.65	7.09	0.00	0.71	0.27	12.7	13.3	78.40	200	0.40 2	0.6 0	.7
Gaslight	236	237	0.20	0.00	6	(0 0.20	0.00	0.20	6	0 6	6 4.00	0.07	7 0.00	0.07					0.00		0.00	0.00	0.20	0.20	0.08	0.00	0.00	0.00	0.1	0.1	85.50	200	0.40 2	.0.7 0	». 7
Broadway Ave	256	243	0.00	0.00	0		0 0.00	0.00	0.00	0	0 (4.00	0.00	0.00	0.00					0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	54.90	250	0.26 3	0.0 0	.6
Broadway Ave	243	244	0.30	0.00	9		0 0.30	0.00	0.30	9	0 9	4.00	0.10	0.00	0.10					0.00		0.00	0.00	0.30	0.30	0.11	0.00	0.00	0.00	0.2	0.2	43.80	250	0.23 2	8.4 0	.6
Abbey Cres	250	249	0.30	0.00	9		0 0.30	0.00	0.30	9	0 9	4.00	0.10	0.00	0.10					0.00		0.00	0.00	0.30	0.30	0.11	0.00	0.00	0.00	0.2	0.2	59.90	200	0.40 2	0.8 0	./
Abbey Cres	249	248	0.20	0.00	6		0 0.50	0.00	0.50	15	0 1	4.00	0.17	0.00	0.17					0.00		0.00	0.00	0.20	0.50	0.19	0.00	0.00	0.00	0.4	0.4	93.60	250	0.24 2	8.8 0	.0
Abbey Cres	240	247	0.20	0.00	6		0 0.70	0.00	0.70	21	0 2	4.00	0.23	0.00	0.23					0.00		0.00	0.00	0.20	0.70	0.27	0.00	0.00	0.00	0.5	0.5	77.90	250	0.24 2	9.2 0	.0
Abbey Cres	247	240	0.20	0.00	6		0 0.90	0.00	1 10	33	0 27	4.00	0.30	0.00	0.30					0.00		0.00	0.00	0.20	1 10	0.34	0.00	0.00	0.00	0.0	0.0	7.00	250	0.24 2	9.4 0 25 (.0
Abbey Cres	245	243	0.20	0.00	6		0 1.10	0.00	1.10	39	0 39	4.00	0.30	3 0.00	0.30					0.00		0.00	0.00	0.20	1.10	0.42	0.00	0.00	0.00	0.9	0.9	91.00	250	0.24 2	2.0 0) 6
Abbey Cres	250	251	0.20	0.00	6		0 0.20	0.00	0.20	6	0 6	4.00 4.00	0.07	7 0.00	0.07					0.00		0.00	0.00	0.20	0.20	0.08	0.00	0.00	0.00	0.1	0.1	57.00	200	0.40 2	20.8 (.0
Abbey Cres	251	252	0.20	0.00	6		0 0.40	0.00	0.40	12	0 12	4.00	0.13	3 0.00	0.13					0.00		0.00	0.00	0.20	0.40	0.15	0.00	0.00	0.00	0.3	0.3	18.80	250	0.21 2	27.4 ().6
Abbey Cres	252	253	0.20	0.00	6		0 0.60	0.00	0.60	18	0 18	3 4.00	0.20	0.00	0.20					0.00		0.00	0.00	0.20	0.60	0.23	0.00	0.00	0.00	0.4	0.4	73.50	250	0.24 2	29.4 ().6
Abbey Cres	253	254	0.20	0.00	6	. (0 0.80	0.00	0.80	24	0 24	4.00	0.26	3 0.00	0.26					0.00		0.00	0.00	0.20	0.80	0.30	0.00	0.00	0.00	0.6	0.6	59.10	250	0.24 2	28.9 ().6
Abbey Cres	254	255	0.20	0.00	6		0 1.00	0.00	1.00	30	0 30	4.00	0.33	3 0.00	0.33					0.00		0.00	0.00	0.20	1.00	0.38	0.00	0.00	0.00	0.7	0.7	120.00	250	0.24 2	<u>,</u> 9.2 ().6
Abbey Cres	255	244	0.20	0.00	6		0 1.20	0.00	1.20	36	0 36	6 4.00	0.40	0.00	0.40					0.00		0.00	0.00	0.20	1.20	0.46	0.00	0.00	0.00	0.9	0.9	43.20	250	0.23 2	8.6 ().6
Gaslight	244	59	0.20	0.00	6		0 3.00	0.00	3.00	90	0 90	4.00	0.99	0.00	0.99					0.00		0.00	0.00	0.20	3.00	1.14	0.00	0.00	0.00	2.1	2.1	55.70	250	0.16 2	3.9 ().5
Gaslight	59	237	0.20	0.00	6		0 3.20	0.00	3.20	96	0 96	6 4.00	1.06	0.00	1.06					0.00		0.00	0.00	0.20	3.20	1.22	0.00	0.00	0.00	2.3	2.3	38.28	200	0.50 2	3.1 ().7
Woolenmill	237	242	0.20	0.00	6		0 3.60	0.00	3.60	108	0 108	4.00	1.19	0.00	1.19					0.00		0.00	0.00	0.20	3.60	1.37	0.00	0.00	0.00	2.6	2.6	62.30	200	0.40 2	.0.8 ().7
Woolenmill	242	241	0.20	0.00	6	(0 3.80	0.00	3.80	114	0 114	4.00	1.26	6 0.00	1.26					0.00		0.00	0.00	0.20	3.80	1.44	0.00	0.00	0.00	2.7	2.7	69.20	200	0.40 2	.0.9 ().7
Woolenmill	241	240	0.16	0.15	0	2	7 3.96	0.15	4.11	114	27 141	4.00	1.26	6 0.30	1.55					0.00		0.00	0.00	0.16	3.96	1.51	0.15	0.15	0.06	2.8	3.1	16.90	200	1.01 3	,2.9 1	.0
Woolenmill	240	STA 2	0.20	0.00	6		0 22.61	0.86	23.47	633	63 696	3.90	6.79	0.68	7.47					0.00		0.00	0.00	0.20	22.81	8.67	0.00	0.86	0.33	15.5	16.5	31.50	200	0.19 1	4.3 0	.5
PS 1 Drainage Are	a																																			
Concession	154	155	0.73	0.00	15	(0 0.73	0.00	0.73	15	0 15	4.00	0.17	0.00	0.17	\vdash				0.00		0.00	0.00	0.73	0.73	0.28	0.00	0.00	0.00	0.4	0.4	78.00	250	0.28 3	<u>1.4</u> 0	.6
Concession	155	156	0.44	0.00	9	(0 1.17	0.00	1.17	24	0 24	4.00	0.26	6 0.00	0.26					0.00		0.00	0.00	0.44	1.17	0.44	0.00	0.00	0.00	0.7	0.7	80.00	250	0.28 3	,1.5 C	6





MAINING
CAP. (I/s)
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LOCA	ΓΙΟΝ							RESIDE	NTIAL ARE	A AND POPUL	ATION						INDUST	RIAL	COMME	ERCIAL	INSTITUT	IONAL	+C+I		II	NFILTRATIO	N							PIPE			
STREET	FROM	то	EXISTING	FUTURE	EXISTING	FUTURE			CUML	ULATIVE			PEAK EXISTING	FUTURE	EXISTING + FUTURE	AREA	ACCU.	PEAK	AREA	ACCU.	AREA	ACCU. P	EAK	EXISTING	ACCU. EXISTING	EXISTING INFILT.	FUTURE	ACCU. FUTURE	FUTURE INFILT.	TOTAL EXISTING	TOTAL FUTURE	LENGTH	DIA.	SLOPE	CAP.	VEL.	REM
	M.H.	M.H.	AREA	AREA	POP.	POP.	EXISTING	FUTURE	EXISTING + FUTURE	EXISTING	FUTURE	EXISTING + FUTURE	PEAK FACT. FLOW	PEAK FLOW	PEAK FLOW		AREA	FACTOR		AREA		AREA FI	LOW	AREA	AREA	FLOW	AREA	AREA	FLOW	FLOW	FLOW				(FULL) (I	FULL)	C
			(ha)	(ha)			AREA (ha)	AREA (ha)	AREA (ha)	POP.	POP.	POP.	(l/s)	(l/s)	(l/s)	(ha)	(ha)	(per MOE)	(ha)	(ha)	(ha)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(l/s)	(I/s)	(m)	(mm)	(%)	(l/s) ((m/s)	(
Concession	156	157	0.59	0.00	66	C	0 1.76	0.00	1.76	90	0	90	4.00 0.99	0.00	0.99					0.00		0.00	0.00	0.59	1.76	0.67	0.00	0.00	0.00	1.7	1.7	80.00	250	0.29	31.8	0.6	
Concession	157	158	0.00	0.00	0	C	0 1.76	0.00	1.76	90	0	90	4.00 0.99	0.00	0.99					0.00		0.00	0.00	0.00	1.76	0.67	0.00	0.00	0.00	1.7	1.7	72.50	250	0.27	31.1	0.6	
Concession	158	159	0.00	0.00	0	C	0 1.76	0.00	1.76	90	0	90	4.00 0.99	0.00	0.99					0.00		0.00	0.00	0.00	1.76	0.67	0.00	0.00	0.00	1.7	1.7	90.00	250	0.28	31.5	0.6	
Concession	159	160	0.15	0.00	3	0	0 1.90	0.00	1.90	93	0	93	4.00 1.02	0.00	0 1.02	2				0.00		0.00	0.00	0.15	1.90	0.72	0.00	0.00	0.00	1.7	1.7	15.00	250	0.28	31.5	0.6	
Concession	160	161	0.44	0.00	9	(0 2.34	0.00	2.34	102	0	102	4.00 1.12	0.00	0 1.12	2				0.00		0.00	0.00	0.44	2.34	0.89	0.00	0.00	0.00	2.0	2.0	98.27	200	0.40	20.8	0.7	
Concession	161	162	0.59	0.00	12	0	2.93	0.00	2.93	114	0	114	4.00 1.26	0.00	0 1.26	i				0.00		0.00	0.00	0.59	2.93	1.11	0.00	0.00	0.00	2.4	2.4	78.55	200	0.40	20.8	0.7	
Concession	162	163	1.02	0.00	21	(0 3.95	0.00	3.95	135	0	135	4.00 1.49	0.00	0 1.49					0.00		0.00	0.00	1.02	3.95	1.50	0.00	0.00	0.00	3.0	3.0	75.38	200	0.40	20.8	0.7	
Campbell Court	194	195	1.02	0.00	21	0	0 1.02	0.00	1.02	21	0	21	4.00 0.23	0.00	0.23	6				0.00		0.00	0.00	1.02	1.02	0.39	0.00	0.00	0.00	0.6	0.6	61.00	250	0.28	31.4	0.6	
Campbell Court	195	196	2.63	0.00	54	(3.66	0.00	3.66	75	0	75	4.00 0.83	0.00	0.83					0.00		0.00	0.00	2.63	3.66	1.39	0.00	0.00	0.00	2.2	2.2	121.00	250	0.36	35.9	0.7	
Campbell Court Easement	198	196	1.17	0.00	24	(0 1.17	0.00	1.17	24	0	24	4.00 0.26	0.00	0.26					0.00		0.00	0.00	1.17	1.17	0.44	0.00	0.00	0.00	0.7	0.7	54.00	250	0.28	31.3	0.6	
Campbell Court	196	197	0.00	0.00	0	0	0 4.83	0.00	4.83	99	0	99	4.00 1.09	0.00	0 1.09)				0.00		0.00	0.00	0.00	4.83	1.83	0.00	0.00	0.00	2.9	2.9	86.50	250	0.28	31.3	0.6	
Legion	197	142	0.29	0.00	6	(5.12	0.00	5.12	105	0	105	4.00 1.16	0.00	1.16	;				0.00		0.00	0.00	0.29	5.12	1.95	0.00	0.00	0.00	3.1	3.1	43.50	250	0.02	9.0	0.2	
Tweed	151	152	1.90	0.00	39	(0 1.90	0.00	1.90	39	0	39	4.00 0.43	0.00	0.43	3				0.00		0.00	0.00	1.90	1.90	0.72	0.00	0.00	0.00	1.2	1.2	122.30	250	0.56	44.7	0.9	
Tweed	152	142	0.29	0.00	6	(0 2.19	0.00	2.19	45	0	45	4.00 0.50	0.00	0.50					0.00		0.00	0.00	0.29	2.19	0.83	0.00	0.00	0.00	1.3	1.3	51.50	250	0.21	27.5	0.6	
Tweed	142	141	0.00	0.00	0	(0 7.32	0.00	7.32	150	0	150	4.00 1.65	0.00	0 1.65	5				0.00		0.00	0.00	0.00	7.32	2.78	0.00	0.00	0.00	4.4	4.4	9.00	250	0.33	34.3	0.7	
Tweed	151	150	1.32	0.00	27	0	0 1.32	0.00	1.32	27	0	27	4.00 0.30	0.00	0.30					0.00		0.00	0.00	1.32	1.32	0.50	0.00	0.00	0.00	0.8	0.8	109.60	200	0.40	20.8	0.7	
Tweed	149	150	1.46	0.00	30	C	0 1.46	0.00	1.46	30	0	30	4.00 0.33	0.00	0.33					0.00		0.00	0.00	1.46	1.46	0.56	0.00	0.00	0.00	0.9	0.9	27.70	200	0.29	17.6	0.6	
Easement Tweed	150	146	0.00	0.00	0	(2.78	0.00	2.78	57	0	57	4.00 0.63	0.00	0 0.63	6				0.00		0.00	0.00	0.00	2.78	1.06	0.00	0.00	0.00	1.7	1.7	48.20	200	0.27	17.0	0.5	
Easement Tweed	146	145	0.29	0.00	6	(0 3.07	0.00	3.07	63	0	63	4.00 0.69	0.00	0.69					0.00		0.00	0.00	0.29	3.07	1.17	0.00	0.00	0.00	1.9	1.9	41.70	200	0.46	22.1	0.7	
MacDougall	144	145	1.02	0.00	21		0 1.02	0.00	1.02	21	0	21	4.00 0.23	0.00	0.23					0.00		0.00	0.00	1.02	1.02	0.39	0.00	0.00	0.00	0.6	0.6	124.30	200	0.36	19.7	0.6	—
MacDougall	140	147	0.59	0.00	12		1 4.00 1 22	0.00	4.00	122	0	122	4.00 1.00	0.00	1.00					0.00		0.00	0.00	1.32	4.00	0.50	0.00	0.00	0.00	2.0	2.0	10.40	200	0.43	21.0	0.7	
Fasement Tweed	140	137	0.15	0.00	3		0 615	0.00	6.15	222	0	222	4.00 2.45	0.00	2 45	:				0.00		0.00	0.00	0.15	6.15	2 34	0.00	0.00	0.00	4.8	4.8	88.90	200	0.43	21.4	0.0	
MacDougall	144	143	1.46	0.00	30	(0 1.46	0.00	1.46	252	0	252	4.00 2.78	0.00	2.78					0.00		0.00	0.00	1.46	1.46	0.56	0.00	0.00	0.00	3.3	3.3	60.60	200	0.43	21.5	0.7	
MacDougall	143	141	0.73	0.00	15	(0 2.19	0.00	2.19	267	0	267	4.00 2.94	0.00	2.94					0.00		0.00	0.00	0.73	2.19	0.83	0.00	0.00	0.00	3.8	3.8	64.00	200	0.33	18.8	0.6	
Tweed	141	140	1.02	0.00	21	C	0 10.54	0.00	10.54	438	0	438	4.00 4.83	0.00	4.83	3				0.00		0.00	0.00	1.02	10.54	4.00	0.00	0.00	0.00	8.8	8.8	80.00	250	0.30	32.6	0.7	
Tweed	140	139	0.44	0.00	9	(0 10.97	0.00	10.97	447	0	447	4.00 4.92	0.00	0 4.92	2				0.00		0.00	0.00	0.44	10.97	4.17	0.00	0.00	0.00	9.1	9.1	40.00	250	0.67	48.9	1.0	
Tweed	139	138	1.32	0.00	27	(0 12.29	0.00	12.29	474	0	474	3.99 5.20	0.00	5.20					0.00		0.00	0.00	1.32	12.29	4.67	0.00	0.00	0.00	9.9	9.9	121.00	250	0.25	29.6	0.6	
Parkland	138	134	1.02	0.00	21	0	0 13.32	0.00	13.32	495	0	495	3.98 5.42	0.00	5.42					0.00		0.00	0.00	1.02	13.32	5.06	0.00	0.00	0.00	10.5	10.5	98.30	250	0.25	30.0	0.6	
Parkland	134	133	0.73	0.00	15	0	0 14.05	0.00	14.05	510	0	510	3.97 5.58	0.00	5.58	3				0.00		0.00	0.00	0.73	14.05	5.34	0.00	0.00	0.00	10.9	10.9	80.00	250	0.23	28.2	0.6	
Parkland	133	132	1.02	0.00	21	(0 15.07	0.00	15.07	531	0	531	3.96 5.79	0.00	5.79					0.00		0.00	0.00	1.02	15.07	5.73	0.00	0.00	0.00	11.5	11.5	61.20	250	0.28	31.3	0.6	
Parkland	132	131	0.73	0.00	15	C	0 15.80	0.00	15.80	546	0	546	3.95 5.95	0.00	5.95	5				0.00		0.00	0.00	0.73	15.80	6.00	0.00	0.00	0.00	12.0	12.0	62.80	250	0.30	32.7	0.7	
Tweed	138	137	1.17	0.00	24	(0 1.17	0.00	1.17	24	0	24	4.00 0.26	0.00	0.26	5				0.00		0.00	0.00	1.17	1.17	0.44	0.00	0.00	0.00	0.7	0.7	94.50	200	0.34	19.1	0.6	
Tweed	137	136	1.32	0.00	27	0	8.63	0.00	8.63	273	0	273	4.00 3.01	0.00	3.01					0.00		0.00	0.00	1.32	8.63	3.28	0.00	0.00	0.00	6.3	6.3	91.50	200	0.37	20.0	0.6	
Tweed	136	135	0.88	0.00	18	(9.51	0.00	9.51	291	0	291	4.00 3.21	0.00	3.21					0.00		0.00	0.00	0.88	9.51	3.61	0.00	0.00	0.00	6.8	6.8	58.60	200	0.34	19.2	0.6	
Iweed	135	131	0.73	0.00	15	(10.24	0.00	10.24	306	0	306	4.00 3.37	0.00	3.37					0.00		0.00	0.00	0.73	10.24	3.89	0.00	0.00	0.00	7.3	7.3	85.00	200	0.69	27.3	0.9	
Parkland	131	127	0.59	0.00	12		26.63	0.00	26.63	864	0	864	3.84 9.14	0.00	9.14	,				0.00		0.00	0.00	0.59	26.63	10.12	0.00	0.00	0.00	19.3	19.3	103.60	250	0.30	32.5	0.7	—
Craig	130	120	0.00	0.00	0	507	7 22.01	0.00	23.47	637	570	1207	3.90 0.78	5.8	2 12 45					0.00		0.00	0.00	0.00	22.01	8.78	0.00	0.00	0.33	15.5	21.6	85.00	200	0.02	40.7	0.6	
Craig	129	123	0.20	0.00	6	307	0 23.20	0.86	24.06	643	570	1213	3.74 6.63	5.8	12.40					0.00		0.00	0.00	0.29	23.10	8.89	0.00	0.86	0.33	15.5	21.0	120.00	200	1.59	41.3	1.3	
Craig	128	127	0.59	0.00	12	(23.78	0.86	24.64	655	570	1225	3.74 6.75	5.8	7 12.63					0.00		0.00	0.00	0.59	23.98	9.11	0.00	0.86	0.33	15.9	22.1	76.35	200	0.34	19.2	0.6	
Craig	127	126	0.15	0.00	3	(0 50.56	0.86	51.42	1522	570	2092	3.57 14.97	5.6	1 20.58	3				0.00		0.00	0.00	0.15	50.76	19.29	0.00	0.86	0.33	34.3	40.2	29.20	250	0.27	31.1	0.6	
Craig	126	125	0.29	0.00	6	(0 50.85	0.86	51.71	1528	570	2098	3.57 15.02	5.60	20.63	5				0.00		0.00	0.00	0.29	51.05	19.40	0.00	0.86	0.33	34.4	40.4	82.75	200	0.39	20.6	0.7	
Craig	125	124	0.29	0.00	6	(0 51.14	0.86	52.00	1534	570	2104	3.57 15.08	5.60	20.68					0.00		0.00	0.00	0.29	51.34	19.51	0.00	0.86	0.33	34.6	40.5	80.68	200	0.36	19.5	0.6	
Craig	121	122	1.17	0.00	24	(0 1.17	0.00	1.17	24	0	24	4.00 0.26	0.00	0.26	;				0.00		0.00	0.00	1.17	1.17	0.44	0.00	0.00	0.00	0.7	0.7	111.01	200	0.39	20.6	0.7	
Craig	122	123	0.59	0.00	12	(0 1.76	0.00	1.76	36	0	36	4.00 0.40	0.00	0.40					0.00		0.00	0.00	0.59	1.76	0.67	0.00	0.00	0.00	1.1	1.1	103.57	200	0.39	20.6	0.7	
Craig	123	124	0.00	0.28	0	15	5 1.76	0.28	2.03	36	15	51	4.00 0.40	0.17	0.56	5				0.00		0.00	0.00	0.00	1.76	0.67	0.28	0.28	0.10	1.1	1.3	37.49	200	1.58	41.2	1.3	
Mill	124	118	0.29	0.00	60	(53.19	1.14	54.33	1630	585	2215	3.55 15.94	5.72	2 21.67	1				0.00		0.00	0.00	0.29	53.39	20.29	0.00	1.14	0.43	36.2	42.4	61.51	250	0.28	31.3	0.6	
Mill	118	117	0.00	0.00	0	0	53.19	1.14	54.33	1630	585	2215	3.55 15.94	5.72	2 21.67					0.00		0.00	0.00	0.00	53.39	20.29	0.00	1.14	0.43	36.2	42.4	31.91	250	0.29	31.8	0.6	
Mill	117	108	0.44	0.00	9	(53.63	1.14	54.77	1639	585	2224	3.55 16.03	5.72	2 21.75					0.00		0.00	0.00	0.44	53.83	20.46	0.00	1.14	0.43	36.5	42.6	102.87	250	0.28	31.4	0.6	
Castor	110	109	0.88	0.00	18	(0 0.88	0.00	0.88	18	0	18	4.00 0.20	0.00	0.20					0.00		0.00	0.00	0.88	0.88	0.33	0.00	0.00	0.00	0.5	0.5	67.51	200	0.56	24.4	0.8	
Castor	109	108	0.29	0.00	6	(1.17 וו	0.00	1.17	24	0	24	4.00 0.26	0.00	0.26					0.00		0.00	0.00	0.29	1.17	0.44	0.00	0.00	0.00	0.7	0.7	98.69	200	0.61	25.6	0.8	





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LOCA	TION							RESIDEN	ITIAL AREA	AND POPUL	LATION						INDUST	RIAL	COMMERCIA	L IN	STITUTIONAL	I+C+I			INFILTRATIO	N							PIPE		
STREET	FROM	то	EXISTING	FUTURE	EXISTING	FUTURE			CUMUL	ATIVE		1	PEAK E	XISTING	FUTURE	EXISTING + FUTURE ARE	A ACCU.	PEAK	AREA ACCL	J. A	REA ACCU.	. PEAK	EXISTING	ACCU. EXISTING	EXISTING INFILT.	FUTURE	ACCU. FUTURE	FUTURE INFILT.	TOTAL EXISTING	TOTAL FUTURE	LENGTH	DIA.	SLOPE	CAP. VEI	L. REMAIN
	M.H.	M.H.	AREA (ha)	AREA (ha)	POP.	POP.	EXISTING AREA (ha)	FUTURE AREA (ha)	EXISTING + FUTURE AREA (ha)		FUTURE	EXISTING + FUTURE	FACT.	PEAK FLOW (l/s)	PEAK FLOW (I/s)	PEAK FLOW (I/s) (ha	AREA	FACTOR (per MOE)	AREA (ha) (ha)		(ha) (ha)	FLOW (I/s)	AREA (ha)	AREA (ha)	FLOW (l/s)	AREA (ha)	AREA (ha)	FLOW (I/s)	FLOW (I/s)	FLOW (I/s)	(m)	(mm)	(%)	(FULL) (FUL (I/s) (m/	LL) CAP
Mill	108	107	0.44	0.00	7	0	55.24	1.14	56.38	1670	585	2255	3.54	16.31	5.71	22.02			0	0.00	0.00	0.00	0.44	55.44	21.07	0.00	1.14	0.43	37.4	43.5	60.26	250	0.30	32.8	0.7
Mill	107	106	0.29	0.00	6	0	55.53	1.14	56.67	1676	585	2261	3.54	16.36	5.71	22.07			0	0.00	0.00	0.00	0.29	55.73	21.18	0.00	1.14	0.43	37.5	43.7	55.99	250	0.28	31.6	0.6
Mill	106	105	0.44	0.00	9	0	55.97	1.14	57.11	1685	585	2270	3.54	16.44	5.71	22.15			C	0.00	0.00	0.00	0.44	56.17	21.35	0.00	1.14	0.43	37.8	43.9	68.00	250	0.25	29.8	0.6
Mill	105	102	0.29	0.00	6	0	56.26	1.14	57.40	1691	585	2276	3.54	16.50	5.71	22.20			C	0.00	0.00	0.00	0.29	56.46	21.46	0.00	1.14	0.43	38.0	44.1	67.67	250	0.28	31.4	0.6
Main	116	115	0.59	0.00	6	0	0.59	0.00	0.59	6	0	6	4.00	0.07	0.00	0.07			C	0.00	0.00	0.00	0.59	0.59	0.22	0.00	0.00	0.00	0.3	0.3	57.91	200	0.37	20.0	0.6
Main	115	114	0.59	0.00	12	0	1.17	0.00	1.17	18	0	18	4.00	0.20	0.00	0.20			c	0.00	0.00	0.00	0.59	1.17	0.44	0.00	0.00	0.00	0.6	0.6	74.43	200	0.41	21.1 (0.7
Parallel	114	111	0.44	0.00	7	0	1.61	0.00	1.61	25	0	25	4.00	0.28	0.00	0.28			C	0.00	0.00	0.00	0.44	1.61	0.61	0.00	0.00	0.00	0.9	0.9	62.18	200	0.40	20.7 (0.7
Castor	113	112	0.73	0.00	15	0	0.73	0.00	0.73	15	0	15	4.00	0.17	0.00	0.17			C	0.00	0.00	0.00	0.73	0.73	0.28	0.00	0.00	0.00	0.4	0.4	51.51	200	0.40	20.8 (0.7
Castor	112	111	0.73	0.00	15	0	1.46	0.00	1.46	30	0	30	4.00	0.33	0.00	0.33			C	0.00	0.00	0.00	0.73	1.46	0.56	0.00	0.00	0.00	0.9	0.9	80.47	200	0.74	28.3 (0.9
Parallel	111	102	0.44	0.00	9	0	3.51	0.00	3.51	64	0	64	4.00	0.71	0.00	0.71			C	0.00	0.00	0.00	0.44	3.51	1.33	0.00	0.00	0.00	2.0	2.0	71.11	200	0.41	20.9	0.7
Mill	104	103	0.29	0.00	4	0	0.29	0.00	0.29	4	0	4	4.00	0.04	0.00	0.04				0.00	0.00	0.00	0.29	0.29	0.11	0.00	0.00	0.00	0.2	0.2	68.88	300	0.35	57.5 (0.8
Milli River Essement	103	102	0.15	0.00	3	0	60.22	0.00	61.35	1762	585	/ 2247	4.00	17.14	0.00	22.92				0.00	0.00	0.00	0.15	60.42	22.06	0.00	0.00	0.00	0.2 40.1	46.2	81.75 16.03	200	0.81	29.5	1.2
River Easement	102	100	0.00	0.00	6	0	60.51	1.14	61.64	1768	585	2353	3.53	17.14	5.69	22.03	-			0.00	0.00	0.00	0.00	60.71	22.30	0.00	1.14	0.43	40.1	46.4	64 25	300	0.74	95.4	1.2
River Easement	100	99	0.73	0.00	11	0	61.24	1.14	62.38	1779	585	2364	3.53	17.29	5.69	22.98				0.00	0.00	0.00	0.73	61.44	23.35	0.00	1.14	0.43	40.6	46.8	95.92	300	0.26	49.4	0.7
River Easement	99	97	0.00	0.00	0	0	61.24	1.14	62.38	1779	585	2364	3.53	17.29	5.69	22.98			0	0.00	0.00	0.00	0.00	61.44	23.35	0.00	1.14	0.43	40.6	46.8	36.58	300	0.22	45.0	0.6
Craig	120	119	0.88	0.00	18	0	0.88	0.00	0.88	18	0	18	4.00	0.20	0.00	0.20			C	0.00	0.00	0.00	0.88	0.88	0.33	0.00	0.00	0.00	0.5	0.5	62.51	200	0.39	20.5	0.7
Craig	119	163	0.59	0.00	12	0	1.46	0.00	1.46	30	0	30	4.00	0.33	0.00	0.33			C	0.00	0.00	0.00	0.59	1.46	0.56	0.00	0.00	0.00	0.9	0.9	77.14	200	0.42	21.2	0.7
Concession	163	164	0.15	0.00	3	0	5.56	0.00	5.56	168	0	168	4.00	1.85	0.00	1.85			C	0.00	0.00	0.00	0.15	5.56	2.11	0.00	0.00	0.00	4.0	4.0	21.98	200	0.39	20.4	0.7
Concession	165	164	1.02	0.00	21	0	1.02	0.00	1.02	21	0	21	4.00	0.23	0.00	0.23			C	0.00	0.00	0.00	1.02	1.02	0.39	0.00	0.00	0.00	0.6	0.6	85.68	200	0.40	20.8	0.7
Legion	164	20	0.29	0.00	6	0	6.88	0.00	6.88	195	0	195	4.00	2.15	0.00	2.15			C	0.00	0.00	0.00	0.29	6.88	2.61	0.00	0.00	0.00	4.8	4.8	80.01	200	0.79	29.1	0.9
First Ave	25	24	1.17	0.00	22	0) 1.17	0.00	1.17	22	0	22	4.00	0.24	0.00	0.24	_		C	0.00	0.00	0.00	1.17	1.17	0.44	0.00	0.00	0.00	0.7	0.7	83.36	200	0.40	20.7 (0.7
First Ave	24	22	0.88	0.00	18	0	2.05	0.00	2.05	40	0	40	4.00	0.44	0.00	0.44	_		C	0.00	0.00	0.00	0.88	2.05	0.78	0.00	0.00	0.00	1.2	1.2	88.39	200	0.11	10.7 (0.3
Maple	23	22	0.15	0.00	3	0	0.15	0.00	0.15	3	0	3	4.00	0.03	0.00	0.03			C	0.00	0.00	0.00	0.15	0.15	0.06	0.00	0.00	0.00	0.1	0.1	27.74	200	0.36	19.8 (0.6
First Ave	22	21	1.02	0.00	21	0	3.22	0.00	3.22	64	0	64	4.00	0.71	0.00	0.71			0	0.00	0.00	0.00	1.02	3.22	1.22	0.00	0.00	0.00	1.9	1.9	92.05	200	0.39	20.6 (0.7
First Ave	21	20	1.02	0.00	19	0	4.24	0.00	4.24	83	0	83	4.00	0.91	0.00	0.91				0.00	0.00	0.00	1.02	4.24	1.61	0.00	0.00	0.00	2.5	2.5	90.33	200	0.40	20.7 (0.7
First Ave	20	18	0.88	0.00	18	0	0.15	0.00	0.15	296	0	290	4.00	3.20	0.00	3.20				0.00	0.00	0.00	0.88	12.00	4.56	0.00	0.00	0.00	7.8	7.8	104.55	200	0.40	20.7	0.6
First St	18	14	0.13	0.00	12	0	12 73	0.00	12 73	311	0	311	4.00	3 43	0.00	3.43				00	0.00		0.13	12 73	4 84	0.00	0.00	0.00	83	8.3	63.64	200	0.30	20.4	0.7
Second	15	14	1.32	0.00	12	0	1.32	0.00	1.32	17	0	17	4.00	0.19	0.00	0.19				0.00	0.00	0.00	1.32	1.32	0.50	0.00	0.00	0.00	0.7	0.7	90.80	200	0.40	20.8	0.7
Second	14	13	0.29	0.00	6	0) 14.34	0.00	14.34	334	0	334	4.00	3.68	0.00	3.68			C	0.00	0.00	0.00	0.29	14.34	5.45	0.00	0.00	0.00	9.1	9.1	59.50	200	0.41	21.0	0.7
Second	13	11	0.73	0.00	15	0) 15.07	0.00	15.07	349	0	349	4.00	3.85	0.00	3.85			0	0.00	0.00	0.00	0.73	15.07	5.73	0.00	0.00	0.00	9.6	9.6	64.40	200	0.39	20.6	0.7
Concession	166	167	0.59	0.00	4	0	0.59	0.00	0.59	4	0	4	4.00	0.04	0.00	0.04			C	0.00	0.00	0.00	0.59	0.59	0.22	0.00	0.00	0.00	0.3	0.3	51.39	200	0.40	20.8	0.7
Concession	167	168	0.44	0.00	3	0	1.02	0.00	1.02	7	0	7	4.00	0.08	0.00	0.08			C	0.00	0.00	0.00	0.44	1.02	0.39	0.00	0.00	0.00	0.5	0.5	68.34	200	0.39	20.5	0.7
Concession	169	168	0.59	0.00	4	0	0.59	0.00	0.59	4	0	4	4.00	0.04	0.00	0.04			C	0.00	0.00	0.00	0.59	0.59	0.22	0.00	0.00	0.00	0.3	0.3	45.57	200	0.40	20.8	0.7
Castor	168	12	0.29	0.00	2	0	1.90	0.00	1.90	13	0	13	4.00	0.14	0.00	0.14			C	0.00	0.00	0.00	0.29	1.90	0.72	0.00	0.00	0.00	0.9	0.9	77.42	200	0.40	20.7	0.7
First Ave	17	12	0.73	0.00	15	0	0.73	0.00	0.73	15	0	15	4.00	0.17	0.00	0.17			C	0.00	0.00	0.00	0.73	0.73	0.28	0.00	0.00	0.00	0.4	0.4	97.99	200	0.37	19.9 (0.6
Castor	12	11	0.29	0.00	4	0	2.93	0.00	2.93	32	0	32	4.00	0.35	0.00	0.35	_		C	0.00	0.00	0.00	0.29	2.93	1.11	0.00	0.00	0.00	1.5	1.5	63.79	200	0.48	22.7 (0.7
Castor	11	10	0.59	0.00	12	0	18.58	0.00	18.58	393	0	393	4.00	4.33	0.00	4.33			C	0.00	0.00	0.00	0.59	18.58	7.06	0.00	0.00	0.00	11.4	11.4	96.01	250	0.27	31.1 (0.6
Castor	10	9	1.02	0.00	21	0	19.61	0.00	19.61	414	0	414	4.00	4.56	0.00	4.56			0	0.00	0.00	0.00	1.02	19.61	7.45	0.00	0.00	0.00	12.0	12.0	18.59	250	1.56	74.2	1.5
Settlement Lane	203	204	0.44	0.00	9	0	0.44	0.00	0.44	9	0	9	4.00	0.10	0.00	0.10				0.00	0.00	0.00	0.44	0.44	0.17	0.00	0.00	0.00	0.3	0.3	59.00	200	0.41	20.9 (J.7 1
Settlement Lane	204	205	0.29	0.00	6	0	0.73	0.00	1.02	21	0	15	4.00	0.17	0.00	0.17	-			0.00	0.00	0.00	0.29	0.73	0.28	0.00	0.00	0.00	0.4	0.4	10.00	250	0.62	47.0	0.8
Settlement Lane	203	200	0.29	0.00	6	0	0.29	0.00	0.29	6	0	6	4.00	0.23	0.00	0.23				00	0.00		0.29	1.02	0.39	0.00	0.00	0.00	0.0	0.0	131 50	250	0.40	49.7	1.0
Settlement Lane	262	206	0.29	0.00	6	0	0.59	0.00	0.59	12	0	12	4.00	0.13	0.00	0.13				0.00	0.00	0.00	0.29	1.61	0.61	0.00	0.00	0.00	0.7	0.7	110.00	250	0.38	36.7	0.7
Easement Station							0.00	0.00			0			5.1.5	0.00						0.00	5.00	0.20									_,,,			
	206	207	0.29	0.00	6	0	1.90	0.00	1.90	39	0	39	4.00	0.43	0.00	0.43			C	0.00	0.00	0.00	0.29	2.93	1.11	0.00	0.00	0.00	1.5	1.5	87.00	250	0.25	29.9	0.6
Station Trail	211	210	0.44	0.00	9	0	0.44	0.00	0.44	9	0	9	4.00	0.10	0.00	0.10			0	0.00	0.00	0.00	0.44	0.44	0.17	0.00	0.00	0.00	0.3	0.3	58.50	200	0.38	20.1 (0.6
Station Trail	210	209	0.44	0.00	9	0	0.88	0.00	0.88	18	0	18	4.00	0.20	0.00	0.20				00.00	0.00	0.00	0.44	0.88	0.33	0.00	0.00	0.00	0.5	0.5	/4.00	200	0.32	18./ (J.D
Station Trail	209 209	208 207	0.44	0.00	9	0	1.32	0.00	1.32	27	0	2/	4.00	0.30	0.00	0.30	-			0.00	0.00	0.00	0.44	1.32	0.50	0.00	0.00	0.00	U.8 4 4	U.8	01.00	250 250	1.05	20.9	0.6
Station Trail	200	260	0.44	0.00	9	0) 0.44	0.00	0.44	30 Q	0	30 Q	4.00	0.40	0.00	0.40				0.00	0.00) 0.00	0.44	0.44	0.07	0.00	0.00	0.00	1.1 0 3	ייו 12	86 50	250 250	0.25	29.9	0.6
Station Trail	260	259	0.44	0.00	9	0	0.44	0.00	0.88	18	0	18	4.00	0.10	0.00	0.20				0.00	0.00) 0.00	0.44	0.44	0.33	0.00	0.00	0.00	0.5	0.5	101 00	250	0.24	29.0	0.6
			Ş	5.50	J J	l v	5.00	0.00	0.00		0			0.20	0.00			I			0.00	1 0.00	0.11	0.00	0.00	5.50	5.50	5.50	010	510				`	<u> </u>





MAINING
CAP. (I/s)
-10.8
-12.0
-14.1
-12.7
19.8
20.4
19.8
20.4
27.4
18.9
57.4
29.3
37.1
49.0
2.0
20.0
20.0
16.5
20.2
24.4
20.0
9.5
19.7
18.7
18.2
12.9
19.7
12.2
20.1
11.9
11.0
20.6
20.1
20.5
19.8
19.4
21.2
19.7
62.2
20.7
40.0 27 0
37.U 10 2
36.0
50.0
28.4
19.8
18.1
60.1
28.8
29.0
28.5

LOCAT	TION							RESIDE	NTIAL AREA	A AND POPU	LATION							INDUSTR	RIAL	COM	MERCIAL	INSTITU	TIONAL	I+C+I		II	NFILTRATIO	N							PIPE			
STREET	FROM	то	EXISTING	FUTURE	EXISTING	FUTURE			CUMU	JLATIVE			PEAK	EXISTING	FUTURE	EXISTING + FUTURE	AREA	ACCU.	PEAK	AREA	ACCU.	AREA	ACCU.	PEAK	EXISTING	ACCU. EXISTING	EXISTING INFILT.	FUTURE	ACCU. FUTURE	FUTURE INFILT.	TOTAL EXISTING	TOTAL FUTURE	LENGTH	DIA.	SLOPE	CAP. \	VEL.	REM
	M.H.	M.H.	AREA (ha)	AREA (ha)	POP.	POP.	EXISTING AREA (ha)	FUTURE AREA (ha)	EXISTING + FUTURE AREA (ha)		FUTURE	EXISTING + FUTURE POP	FACT.	PEAK FLOW (l/s)	PEAK FLOW (I/s)	PEAK FLOW (l/s)	(ha)	AREA (ha)	FACTOR (per MOE)	(ha)	AREA (ha)	(ha)	AREA (ha)	FLOW (I/s)	AREA (ha)	AREA (ha)	FLOW (I/s)	AREA (ha)	AREA (ha)	FLOW (I/s)	FLOW (I/s)	FLOW (I/s)	(m)	(mm)	(%)	(FULL) (F (l/s) (⁻ULL) (m/s)	C (
Station Trail	259	258	0.44	0.00	9	0	1.32	0.00	1.32	27	0	27	4 00	0.30	0.00	0.30					0.00		0.00	0.00	0 44	1 32	0.50	0.00	0.00	0.00	0.8	0.8	77.50	250	0.25	29.4	0.6	
Station Trail	258	207	0.44	0.00	9	0	1.76	0.00	1.76	36	0	36	4.00	0.40	0.00	0.40					0.00		0.00	0.00	0.44	1.76	0.67	0.00	0.00	0.00	1.1	1.1	103.50	250	0.26	30.4	0.6	
Easement Dunlop	207	257	0.00	0.00	18	147	5.41	0.00	5.41	129	147	276	4.00	1.42	1.62	3.04					0.00		0.00	0.00	0.00	3.51	1.33	0.00	0.00	0.00	2.8	4.4	43.50	250	0.11	20.2	0.4	
Easement Dunlop	257	38	0.44	0.00	9	0	5.85	0.00	5.85	138	147	285	4.00	1.52	1.62	3.14					0.00		0.00	0.00	0.44	3.95	1.50	0.00	0.00	0.00	3.0	4.6	90.00	250	0.30	32.6	0.7	
Dunlop	43	41	0.88	0.00	18	0	0.88	0.00	0.88	18	0	18	4.00	0.20	0.00	0.20					0.00		0.00	0.00	0.88	0.88	0.33	0.00	0.00	0.00	0.5	0.5	73.76	250	0.52	42.9	0.9	
Dunlop	41	38	0.73	0.00	15	0	1.61	0.00	1.61	33	0	33	4.00	0.36	0.00	0.36					0.00		0.00	0.00	0.73	1.61	0.61	0.00	0.00	0.00	1.0	1.0	51.82	250	0.39	37.1	0.8	
Dunlop	36	37	1.32	0.00	27	0	1.32	0.00	1.32	27	0	27	4.00	0.30	0.00	0.30					0.00		0.00	0.00	1.32	1.32	0.50	0.00	0.00	0.00	0.8	0.8	96.32	250	0.46	40.1	0.8	
Dunlop	37	38	1.02	0.00	21	0	2.34	0.00	2.34	48	0	48	4.00	0.53	0.00	0.53					0.00		0.00	0.00	1.02	2.34	0.89	0.00	0.00	0.00	1.4	1.4	92.35	250	0.40	37.6	0.8	
Oak	38	40	0.29	0.00	6	0	10.10	0.00	10.10	225	147	372	4.00	2.48	1.62	4.10					0.00		0.00	0.00	0.29	4.24	1.61	0.00	0.00	0.00	4.1	5.7	77.11	250	0.29	31.9	0.7	
Oak	40	29	0.29	0.00	6	0	10.39	0.00	10.39	231	147	378	4.00	2.55	1.62	4.17					0.00		0.00	0.00	0.29	4.54	1.72	0.00	0.00	0.00	4.3	5.9	42.67	250	0.51	42.3	0.9	
Maple	34	33	0.59	0.00	12	0	0.59	0.00	0.59	12	0	12	4.00	0.13	0.00	0.13					0.00		0.00	0.00	0.59	0.59	0.22	0.00	0.00	0.00	0.4	0.4	43.59	200	0.70	27.4	0.9	
Maple	33	32	0.73	0.00	15	0	1.32	0.00	1.32	27	0	27	4.00	0.30	0.00	0.30					0.00		0.00	0.00	0.73	1.32	0.50	0.00	0.00	0.00	0.8	0.8	70.10	250	0.33	34.0	0.7	
Maple	32	31	0.88	0.00	18	0	2.19	0.00	2.19	45	0	45	4.00	0.50	0.00	0.50					0.00		0.00	0.00	0.88	2.19	0.83	0.00	0.00	0.00	1.3	1.3	64.62	250	0.50	41.9	0.9	
Maple	31	30	1.02	0.00	21	0	3.22	0.00	3.22	66	0	66	4.00	0.73	0.00	0.73					0.00		0.00	0.00	1.02	3.22	1.22	0.00	0.00	0.00	2.0	2.0	103.94	250	0.44	39.3	0.8	
Maple	30	29	1.17	0.00	24	0	4.39	0.00	4.39	90	147	90	4.00	0.99	0.00	0.99					0.00		0.00	0.00	1.17	4.39	1.67	0.00	0.00	0.00	2.7	2.7	106.68	250	0.37	36.0	0.7	
Nuplop	29 44	20 45	1 17	0.00	24	0	1 17	0.00	1 17	24	147	24	3.99 4.00	0.26	0.00	0.20		-			0.00		0.00	0.00	1 17	9.22	0.44	0.00	0.00	0.00	0.7	0.7	68 58	250	0.32	39.0	0.7	
Dunlop	45	26	0.88	0.00	18	0	2.05	0.00	2.05	42	0	42	4.00	0.20	0.00	0.20					0.00		0.00	0.00	0.88	2.05	0.44	0.00	0.00	0.00	1.2	1.2	70.41	250	0.45	35.4	0.0	
Maple	26	27	0.44	0.00	9	0	2.49	0.00	2.49	51	0	51	4.00	0.56	0.00	0.56					0.00		0.00	0.00	0.44	2.49	0.95	0.00	0.00	0.00	1.5	1.5	89.31	250	0.38	36.4	0.7	
Grace	42	27	0.88	0.00	18	0	0.88	0.00	0.88	18	0	18	4.00	0.20	0.00	0.20					0.00		0.00	0.00	0.88	0.88	0.33	0.00	0.00	0.00	0.5	0.5	86.26	200	0.55	24.4	0.8	
Maple	27	28	0.44	0.00	9	0	3.80	0.00	3.80	78	0	78	4.00	0.86	0.00	0.86					0.00		0.00	0.00	0.44	3.80	1.45	0.00	0.00	0.00	2.3	2.3	33.38	250	0.47	40.6	0.8	
Easement Gold/Maple	20	БЛ	0.15	0.00	2	0	10.02	0.00	10.02	409	147	555	2.05	4.44	1.60	6.04					0.00		0.00	0.00	0.15	12 17	F 00	0.00	0.00	0.00	0.4	11.0	41 45	250	0.51	40.7	0.0	
Easement Gold/Maple	54	55	0.44	0.00	9	0	19.46	0.00	19.02	400	147	564	3.95	4.44	1.60	6.13					0.00		0.00	0.00	0.13	13.61	5.17	0.00	0.00	0.00	9.7	11.3	30.18	250	0.70	42.7	1.0	
Gold	55	53	0.73	0.00	15	0	20.19	0.00	20.19	432	147	579	3.94	4.69	1.60	6.28					0.00		0.00	0.00	0.73	14.34	5.45	0.00	0.00	0.00	10.1	11.7	71.02	250	0.18	24.9	0.5	
Gold	53	52	0.88	0.00	18	0	21.07	0.00	21.07	450	147	597	3.93	4.88	1.59	6.47					0.00		0.00	0.00	0.88	15.22	5.78	0.00	0.00	0.00	10.7	12.3	109.73	250	0.39	37.0	0.8	
Elm	46	47	0.88	0.00	18	0	0.88	0.00	0.88	18	0	18	4.00	0.20	0.00	0.20					0.00		0.00	0.00	0.88	0.88	0.33	0.00	0.00	0.00	0.5	0.5	40.23	200	0.52	23.5	0.7	
Gold	56	47	0.44	0.00	9	0	0.44	0.00	0.44	9	0	9	4.00	0.10	0.00	0.10					0.00		0.00	0.00	0.44	0.44	0.17	0.00	0.00	0.00	0.3	0.3	32.61	200	0.65	26.5	0.8	
Elm	47	48	1.02	0.00	21	0	2.34	0.00	2.34	48	0	48	4.00	0.53	0.00	0.53					0.00		0.00	0.00	1.02	2.34	0.89	0.00	0.00	0.00	1.4	1.4	70.10	200	0.52	23.6	0.8	
Elm	48	49	0.59	0.00	12	0	2.93	0.00	2.93	60	0	60	4.00	0.66	0.00	0.66					0.00		0.00	0.00	0.59	2.93	1.11	0.00	0.00	0.00	1.8	1.8	80.16	250	0.24	29.1	0.6	
Georges	49	50	0.44	0.00	9	0	3.37	0.00	3.37	69	0	69	4.00	0.76	0.00	0.76					0.00		0.00	0.00	0.44	3.37	1.28	0.00	0.00	0.00	2.0	2.0	59.44	250	0.40	37.6	0.8	
Birch	51	50	0.88	0.00	18	0	0.88	0.00	0.88	18	0	18	4.00	0.20	0.00	0.20					0.00		0.00	0.00	0.88	0.88	0.33	0.00	0.00	0.00	0.5	0.5	47.55	200	0.65	26.5	0.8	
Georges	50	52	0.15	0.00	3	0	4.39	0.00	4.39	90	0	90	4.00	0.99	0.00	0.99					0.00		0.00	0.00	0.15	4.39	1.67	0.00	0.00	0.00	2.7	2.7	47.24	250	0.97	58.7	1.2	
Georges	57	58	0.44	0.00	9	0	25.90	0.00	25.90	549	147	696	3.90	5.89	1.50	7.47					0.00		0.00	0.00	0.44	20.05	7.62	0.00	0.00	0.00	13.5	15.1	43.20	250	0.40	37.8	0.8	
Kinnaird	76	77	1.32	0.00	27	0	1.32	0.00	1.32	27	0	27	4 00	0.30	0.00	0.30					0.00		0.00	0.00	1.32	1.32	0.50	0.00	0.00	0.00	0.8	0.8	79.25	200	0.40	17.4	0.6	
Kinnaird	77	78	0.59	0.00	12	0	1.90	0.00	1.90	39	0	39	4.00	0.43	0.00	0.43					0.00		0.00	0.00	0.59	1.90	0.72	0.00	0.00	0.00	1.2	1.2	75.59	200	0.34	19.2	0.6	
Loucks	79	78	1.02	0.00	21	0	1.02	0.00	1.02	21	0	21	4.00	0.23	0.00	0.23					0.00		0.00	0.00	1.02	1.02	0.39	0.00	0.00	0.00	0.6	0.6	71.02	200	0.32	18.5	0.6	
Loucks	78	80	0.59	0.00	12	0	3.51	0.00	3.51	72	0	72	4.00	0.79	0.00	0.79					0.00		0.00	0.00	0.59	3.51	1.33	0.00	0.00	0.00	2.1	2.1	108.51	250	0.39	37.2	0.8	
Loucks	80	81	0.73	0.00	15	0	4.24	0.00	4.24	87	0	87	4.00	0.96	0.00	0.96					0.00		0.00	0.00	0.73	4.24	1.61	0.00	0.00	0.00	2.6	2.6	51.82	250	0.44	39.5	0.8	
Maple	35	81	0.88	0.00	18	0	0.88	0.00	0.88	18	0	18	4.00	0.20	0.00	0.20					0.00		0.00	0.00	0.88	0.88	0.33	0.00	0.00	0.00	0.5	0.5	75.50	200	1.42	39.0	1.2	
Loucks	81	82	0.44	0.00	9	0	5.56	0.00	5.56	114	0	114	4.00	1.26	0.00	1.26					0.00		0.00	0.00	0.44	5.56	2.11	0.00	0.00	0.00	3.4	3.4	42.67	250	0.29	32.2	0.7	
Loucks	82	83	0.88	0.00	18	0	6.44	0.00	6.44	132	0	132	4.00	1.45	0.00	1.45					0.00		0.00	0.00	0.88	6.44	2.45	0.00	0.00	0.00	3.9	3.9	75.59	250	0.36	35.6	0.7	
Phair	90	89	1.17	0.00	24	0	1.17	0.00	1.17	24	0	24	4.00	0.26	0.00	0.26					0.00		0.00	0.00	1.17	1.17	0.44	0.00	0.00	0.00	0.7	0.7	78.64	200	0.48	22.6	0.7	
Phair	87	88	0.59	0.00	12	0	0.59	0.00	0.59	12	0	12	4.00	0.13	0.00	0.13					0.00		0.00	0.00	0.59	0.59	0.22	0.00	0.00	0.00	0.4	0.4	17.37	200	0.74	28.2	0.9	
Phair	88	89	1.02	0.00	21	0	1.61	0.00	1.61	33	0	33	4.00	0.36	0.00	0.36					0.00		0.00	0.00	1.02	1.61	0.61	0.00	0.00	0.00	1.0	1.0	102.41	200	0.49	22.8	0.7	
Easement Phair	89	84	0.29	0.00	6	0	3.07	0.00	3.07	63	0	63	4.00	0.69	0.00	0.69					0.00		0.00	0.00	0.29	3.07	1.17	0.00	0.00	0.00	1.9	1.9	81.38	200	0.45	22.0	0.7	
Loucks	86	85	0.88	0.00	18	0	0.88	0.00	0.88	18	0	18	4.00	0.20	0.00	0.20	┝──-┣			└──┤	0.00		0.00	0.00	0.88	0.88	0.33	0.00	0.00	0.00	0.5	0.5	73.15	200	0.60	25.4	0.8	
LOUCKS	85	84	0.88	0.00	18	0	1.76	0.00	1.76	36	0	36	4.00	0.40	0.00	0.40					0.00		0.00	0.00	0.88	1.76	0.67	0.00	0.00	0.00	1.1	1.1	56.39	200	0.60	25.4	0.8	
⊏IIII Hav	04 83	83 63	0.73	0.00	15	0	12.44	0.00	2.56	255	0	255	4.00	2.91	0.00	1.26					0.00		0.00	0.00	0.73	5.56	2.11	0.00	0.00	0.00	3.4 7 5	3.4	02.06	250	0.40	37.0	0.8	
Kinnaird	75	74	0.44	0.00	9 18	0	0.89	0.00	0.82	200	0	200	4.00	2.01	0.00	0.20					0.00		0.00	0.00	0.44	0.88	4.73	0.00	0.00	0.00	1.5	1.5	92.90 62.18	200	0.30	27.5	0.7	_
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LOCA	ΓΙΟΝ							RESIDE	NTIAL AREA	AND POPU	LATION							INDUST	RIAL	COMMERCIAL	INSTITUTIONAL	I+C+I		I	NFILTRATIO	N							PIPE		
STREET	FROM	то	EXISTING	FUTURE	EXISTING	FUTURE		1	CUMU	ILATIVE			PEAK	EXISTING	FUTURE	EXISTING + FUTURE	AREA	ACCU.	PEAK	AREA ACCU.	AREA ACCU.	PEAK	EXISTING	ACCU. EXISTING	EXISTING INFILT.	FUTURE	ACCU. FUTURE	FUTURE INFILT.	TOTAL EXISTING	TOTAL FUTURE	LENGTH	DIA.	SLOPE	CAP. VEL	REM
	M.H.	M.H.	AREA	AREA	POP.	POP.	EXISTING	FUTURE	EXISTING + FUTURE	EXISTING	FUTURE	EXISTING + FUTURE	FACT.	PEAK FLOW	PEAK FLOW	PEAK FLOW		AREA	FACTOR	AREA	AREA	FLOW	AREA	AREA	FLOW	AREA	AREA	FLOW	FLOW	FLOW				(FULL) (FULI	.L) C
			(ha)	(ha)			AREA (ha)	AREA (ha)	AREA (ha)	POP.	POP.	POP.		(l/s)	(l/s)	(l/s)	(ha)	(ha)	(per MOE)	(ha) (ha)	(ha) (ha)	(l/s)	(ha)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(I/s)	(I/s)	(m)	(mm)	(%)	(l/s) (m/s)	,) (
Kinnaird	74	72	1.02	0.00	21	(0 1.90	0.00	1.90	39	0	39	4.00	0.43	0.00	0.43				0.00	0.00	0.00	1.02	1.90	0.72	0.00	0.00	0.00	1.2	1.2	96.62	200	0.33	19.0 0.	1.6
Georges	73	72	0.59	0.00	12	(0 0.59	0.00	0.59	12	0	12	4.00	0.13	0.00	0.13				0.00	0.00	0.00	0.59	0.59	0.22	0.00	0.00	0.00	0.4	0.4	24.99	200	0.76	28.5 0.	1.9
Georges	72	/1	0.88	0.00	18	(0 3.37	0.00	3.37	69	0	69	4.00	0.76	0.00	0.76				0.00	0.00	0.00	0.88	3.37	1.28	0.00	0.00	0.00	2.0	2.0	79.55	250	0.38	36.4 0.	1.7
Georges	71	69	0.59	0.00	12		0 3.95	0.00	3.95	01	0	27	4.00	0.89	0.00	0.05				0.00	0.00	0.00	0.59	3.95	0.50	0.00	0.00	0.00	2.4	2.4	40.40	200	0.22	27.9 0.	
Georges	69	68	0.44	0.00	21		0 5.71	0.00	5.71	117	0	117	4.00	1 29	0.00	1 20				0.00	0.00	0.00	0.44	5.71	2.17	0.00	0.00	0.00	0.0	3.5	57.61	200	0.39	37.5 0	
Georges	68	67	0.44	0.00	9	(0 6.15	0.00	6.15	126	0	126	4.00	1.39	0.00	1.39				0.00	0.00	0.00	0.44	6.15	2.34	0.00	0.00	0.00	3.7	3.7	46.94	250	0.52	42.9 0	
Georges	67	64	0.88	0.00	18	(0 7.02	0.00	7.02	144	0	144	4.00	1.59	0.00	1.59				0.00	0.00	0.00	0.88	7.02	2.67	0.00	0.00	0.00	4.3	4.3	96.93	250	0.31	33.2 0).7
Eldon	66	64	1.02	0.00	21	(0 1.02	0.00	1.02	21	0	21	4.00	0.23	0.00	0.23				0.00	0.00	0.00	1.02	1.02	0.39	0.00	0.00	0.00	0.6	0.6	59.00	200	0.41	20.9 0).7
Georges	64	63	0.59	0.00	12	(0 8.63	0.00	8.63	177	0	177	4.00	1.95	0.00	1.95				0.00	0.00	0.00	0.59	8.63	3.28	0.00	0.00	0.00	5.2	5.2	41.76	250	0.26	30.5 0).6
Georges	63	62	0.29	0.00	6	(0 21.36	0.00	21.36	438	0	438	4.00	4.83	0.00	4.83				0.00	0.00	0.00	0.29	21.36	8.12	0.00	0.00	0.00	12.9	12.9	44.20	250	0.48	41.3 0).8
Georges	62	61	0.44	0.00	9	(0 21.80	0.00	21.80	447	0	447	4.00	4.92	0.00	4.92				0.00	0.00	0.00	0.44	21.80	8.28	0.00	0.00	0.00	13.2	13.2	71.93	250	0.32	33.7 0).7
Georges	61	60	0.88	0.00	18	(0 22.68	0.00	22.68	465	0	465	3.99	5.11	0.00	5.11				0.00	0.00	0.00	0.88	22.68	8.62	0.00	0.00	0.00	13.7	13.7	47.70	250	0.35	34.9 0).7
Georges	60	58	0.73	0.00	15	(0 23.41	0.00	23.41	480	0	480	3.98	5.27	0.00	5.27				0.00	0.00	0.00	0.73	23.41	8.90	0.00	0.00	0.00	14.2	14.2	107.59	250	0.29	32.0 0).7
Warner	58	6	0.44	0.00	9	(0 49.75	0.00	49.75	1038	147	1185	3.75	10.73	1.52	2 12.24				0.00	0.00	0.00	0.44	43.90	16.68	0.00	0.00	0.00	27.4	28.9	103.78	250	0.37	36.0 0).7
Castor	1	2	1.02	0.00	21	(0 1.02	0.00	1.02	21	0	21	4.00	0.23	0.00	0.23				0.00	0.00	0.00	1.02	1.02	0.39	0.00	0.00	0.00	0.6	0.6	55.00	200	0.38	20.1 0.).6
Castor	2	3	0.29	0.00	6	(0 1.32	0.00	1.32	27	0	27	4.00	0.30	0.00	0.30				0.00	0.00	0.00	0.29	1.32	0.50	0.00	0.00	0.00	0.8	0.8	73.00	200	0.36	19.6 0.	1.6
Castor	3	4	0.44	0.00	9	(0 1.76	0.00	1.76	36	0	36	4.00	0.40	0.00	0.40				0.00	0.00	0.00	0.44	1.76	0.67	0.00	0.00	0.00	1.1	1.1	96.38	200	0.39	20.5 0.)./
Castor	4	5	0.15	0.00	3		0 1.90	0.00	1.90	39	0	39	4.00	0.43	0.00	0.43				0.00	0.00	0.00	0.15	1.90	0.72	0.00	0.00	0.00	1.2	1.2	22.00	200	0.41	21.1 0.)./).7
Castor	6	7	0.00	0.00	3		0 1.90	0.00	51.80	1080	147	1227	4.00	11 13	1.51	12.64				0.00	0.00	0.00	0.00	45 94	17.46	0.00	0.00	0.00	28.6	30.1	80.47	200	0.43	32.3 0	.7
Castor	7	8	0.29	0.00	6		0 52.09	0.00	52.09	1086	147	1233	3.74	11.19	1.51	1 12.70				0.00	0.00	0.00	0.13	46.24	17.57	0.00	0.00	0.00	28.8	30.3	19.96	250	0.24	29.4 0	.,).6
Castor	8	9	0.44	0.00	9	(0 52.53	0.00	52.53	1095	147	1242	3.74	11.27	1.51	1 12.79				0.00	0.00	0.00	0.44	46.68	17.74	0.00	0.00	0.00	29.0	30.5	59.28	250	0.23	28.6 0	J.6
Mill	9	91	0.59	0.00	12	(0 72.72	0.00	72.72	1521	147	1668	3.65	15.27	1.48	3 16.75				0.00	0.00	0.00	0.59	66.87	25.41	0.00	0.00	0.00	40.7	42.2	50.14	300	0.24	47.1 0).7
Mill	91	92	0.29	0.00	6	(0 73.01	0.00	73.01	1527	147	1674	3.64	15.33	1.48	3 16.81				0.00	0.00	0.00	0.29	67.16	25.52	0.00	0.00	0.00	40.9	42.3	25.69	300	0.24	47.1 0).7
Mill	92	93	0.15	0.00	3	(0 73.16	0.00	73.16	1530	147	1677	3.64	15.36	1.48	3 16.83				0.00	0.00	0.00	0.15	67.31	25.58	0.00	0.00	0.00	40.9	42.4	70.56	300	0.19	42.6 0).6
Mill	93	94	0.44	0.00	7	(0 73.60	0.00	73.60	1537	147	1684	3.64	15.42	1.48	3 16.90				0.00	0.00	0.00	0.44	67.75	25.74	0.00	0.00	0.00	41.2	42.6	70.74	300	0.21	44.4 0).6
Mill	98	94	0.29	0.00	2	(0 0.29	0.00	0.29	2	0	2	4.00	0.02	0.00	0.02				0.00	0.00	0.00	0.29	0.29	0.11	0.00	0.00	0.00	0.1	0.1	55.99	200	1.48	39.8 1	.3
Parking Lot	94	95	0.15	0.00	1	(0 74.04	0.00	74.04	1540	147	1687	3.64	15.45	1.47	7 16.92				0.00	0.00	0.00	0.15	68.19	25.91	0.00	0.00	0.00	41.4	42.8	28.53	300	0.35	57.4 0).8
Parking Lot	95	96	0.00	0.00	0	(0 74.04	0.00	74.04	1540	147	1687	3.64	15.45	1.47	7 16.92				0.00	0.00	0.00	0.00	68.19	25.91	0.00	0.00	0.00	41.4	42.8	42.67	300	0.27	50.4 0.	1.7
Parking Lot	96	97	0.15	0.00	1	(0 74.18	0.00	/4.18	1541	147	1688	3.64	15.46	1.47	16.93				0.00	0.00	0.00	0.15	68.33	25.97	0.00	0.00	0.00	41.4	42.9	43.89	300	0.08	27.9 0.).4 1 5
Concession	97 170	170	0.00	0.00	0		0 135.42	1.14	130.30	3320	732	4052	3.33	30.44	6.71	37.15				0.00	0.00	0.00	0.00	129.77	49.31	0.00	1.14	0.43	79.0	00.9 87.0	8 30	450	0.48	107.0 1	.ə 1.2
Concession	170	172	0.15	0.00	3		0 135.72	1.14	136.85	3326	732	4058	3.33	30.40	6.71	37.17				0.00	0.00	0.00	0.15	130.06	49.37	0.00	1.14	0.43	79.9	87.1	11 70	450	0.40	204.2 1	. <u>.</u> 1.3
Bank	178	177	0.44	9.17	9	(0 0.44	9.17	9.61	9	0	9	4.00	0.10	0.00	0.10				0.00	0.00	0.00	0.44	0.44	0.17	9.17	9.17	3.49	0.3	3.8	10.42	200	1.92	45.4 1	1.4
Bank	177	176	0.88	0.00	18	(0 1.32	9.17	10.49	27	0	27	4.00	0.30	0.00	0.30				0.00	0.00	0.00	0.88	1.32	0.50	0.00	9.17	3.49	0.8	4.3	20.24	200	3.51	61.4 2	2.0
Bank	176	175	0.59	0.00	12	(0 1.90	9.17	11.07	39	0	39	4.00	0.43	0.00	0.43				0.00	0.00	0.00	0.59	1.90	0.72	0.00	9.17	3.49	1.2	4.6	34.26	200	4.31	68.1 2	2.2
Bank	175	174	0.29	0.00	6	(0 2.19	9.17	11.37	45	0	45	4.00	0.50	0.00	0.50				0.00	0.00	0.00	0.29	2.19	0.83	0.00	9.17	3.49	1.3	4.8	36.18	200	0.38	20.2 0).6
Bank	174	172	0.15	0.00	1	(0 2.34	9.17	11.51	46	0	46	4.00	0.51	0.00	0.51				0.00	0.00	0.00	0.15	2.34	0.89	0.00	9.17	3.49	1.4	4.9	39.80	200	0.70	27.4 0).9
Concession	172	173	0.00	0.00	0	(0 138.06	10.31	148.37	3372	732	4104	3.32	30.87	6.70	37.57				0.00	0.00	0.00	0.00	132.41	50.31	0.00	10.31	3.92	81.2	91.8	12.70	450	0.47	196.0 1	.2
South Russell Rd	186	185	0.59	0.00	12	(0 0.59	0.00	0.59	12	0	12	4.00	0.13	0.00	0.13				0.00	0.00	0.00	0.59	0.59	0.22	0.00	0.00	0.00	0.4	0.4	95.00	200	0.51	23.3 0).7
South Russell Rd	185	184	0.29	0.00	6	(0 0.88	0.00	0.88	18	0	18	4.00	0.20	0.00	0.20				0.00	0.00	0.00	0.29	0.88	0.33	0.00	0.00	0.00	0.5	0.5	95.00	200	0.51	23.3 0.).7
South Russell Rd	184	183	0.44	0.00	9	(0 1.32	0.00	1.32	27	0	27	4.00	0.30	0.00	0.30				0.00	0.00	0.00	0.44	1.32	0.50	0.00	0.00	0.00	0.8	0.8	95.00	200	0.51	23.3 0.).7
South Russell Rd	183	182	0.59	0.00	12	(0 1.90	0.00	1.90	39	0	39	4.00	0.43	0.00	0.43				0.00	0.00	0.00	0.59	1.90	0.72	0.00	0.00	0.00	1.2	1.2	95.70	200	0.50	23.2 0.	1.7
South Russell Rd	182	305	0.88	0.00	18		0 2.78	0.00	2.78	57	0	57	4.00	0.63	0.00	0.63	$\left \right $			0.00	0.00	0.00	0.88	2.78	1.06	0.00	0.00	0.00	1.7	1.7	64.50	200	0.50	23.1 0.	1.2
Des Pins	305	304	0.73	0.00	15		0 3.51	0.00	3.51	12	0	12	4.00	0.79	0.00					0.00	0.00	0.00	0.73	0.00	0.00	0.00	0.00	0.00	2.1	2.1	04.74 33.60	200 200	0 08	32.5 1	.3 1.0
Des Pins	317	311	1.32	0.00	27		0 1.32	0.00	1.32	27	0	27	4.00	0.30	0.00) 0.30				0.00	0.00	0.00	1.32	1.32	0.50	0.00	0.00	0.00	0.8	0.8	72.20	200	0.40	20.8 0).7
Des Pins	311	312	1.32	0.00	27	(0 2.63	0.00	2.63	54	0	54	4.00	0.60	0.00	0.60				0.00	0.00	0.00	1.32	2.63	1.00	0.00	0.00	0.00	1.6	1.6	54.90	200	0.40	20.8 0).7
Stiver	312	314	0.00	0.00	0	(0 2.63	0.00	2.63	54	0	54	4.00	0.60	0.00	0.60				0.00	0.00	0.00	0.00	2.63	1.00	0.00	0.00	0.00	1.6	1.6	14.60	200	0.41	21.0 0).7
Stiver	314	315	0.00	0.00	0	(0 2.63	0.00	2.63	54	0	54	4.00	0.60	0.00	0.60				0.00	0.00	0.00	0.00	2.63	1.00	0.00	0.00	0.00	1.6	1.6	48.20	200	0.41	21.1 0).7
Stiver	315	193	0.15	0.00	3	(0 2.78	0.00	2.78	57	0	57	4.00	0.63	0.00	0.63				0.00	0.00	0.00	0.15	2.78	1.06	0.00	0.00	0.00	1.7	1.7	75.20	200	0.40	20.7 0).7





MAINING
CAP.
(l/s)
17.8
28.2
34.4
25.5
24.4
24.0
34.0
39.1
28.9
20.3
25.3
28.4
20.5
21.2
17.8
7.1
19.5
18.8
19.5
19.9
20.3
20.3
2.2
-0.9
-1.9
4.9
4.8
0.2
1.8
39.7
14.6
7.5
-15.0
19.2
110.9
117.1
41.7
57.1
63.5
15.4
22.5
104.2
23.0
22.8
22.5
22.1
21.4
39.1
33.1
JZ.J 20.0
20.0
19.2
19.4
19.5
19.0

LOCA	TION							RESIDE	NTIAL AREA	A AND POPU	ILATION							INDUST	RIAL	COM	IMERCIAL	INSTITU	TIONAL I+	+C+I			NFILTRATIO	N							PIPE		
STREET	FROM	то	EXISTING	FUTURE	EXISTING	FUTURE		1	CUML	ILATIVE	1	1	PEAK	EXISTING	FUTURE	EXISTING + FUTURE	AREA	ACCU.	PEAK	AREA	ACCU.	AREA	ACCU. PI	EAK	EXISTING	ACCU. EXISTING	EXISTING INFILT.	FUTURE	ACCU. FUTURE	FUTURE INFILT.	TOTAL EXISTING	TOTAL FUTURE	LENGTH	DIA.	SLOPE	CAP. VE	EL. REM
	М.Н.	M.H.	AREA (ha)	AREA (ha)	POP.	POP.	EXISTING AREA (ha)	FUTURE AREA (ha)	EXISTING + FUTURE AREA (ha)	EXISTING POP.	FUTURE POP.	EXISTING + FUTURE POP.	FACT.	PEAK FLOW (l/s)	PEAK FLOW (I/s)	PEAK FLOW (l/s)	(ha)	AREA (ha)	FACTOR (per MOE)	(ha)	AREA (ha)	(ha)	AREA FL (ha) (LOW (I/s)	AREA (ha)	AREA (ha)	FLOW (I/s)	AREA (ha)	AREA (ha)	FLOW (I/s)	FLOW (I/s)	FLOW (I/s)	(m)	(mm)	(%)	(FULL) (FU (l/s) (m	ILL) C
Stiver	193	192	1.02	0.00) 21	0	3.80	0.00	3.80	78	0	78	4.00	0.86	0.00	0.86	6				0.00		0.00	0.00	1.02	3.80	1.45	0.00	0.00	0.00	2.3	2.3	71.00	200	0.44	21.7	0.7
Stiver	192	191	1.76	0.00) 36	0	5.56	0.00	5.56	114	0	114	4.00	1.26	0.00	1.26	6				0.00		0.00	0.00	1.76	5.56	2.11	0.00	0.00	0.00	3.4	3.4	61.50	200	0.39	20.5	0.7
Des Pins	317	309	1.17	0.00) 24	0	1.17	0.00	1.17	24	0	24	4.00	0.26	0.00	0.26	6				0.00		0.00	0.00	1.17	1.17	0.44	0.00	0.00	0.00	0.7	0.7	46.10	200	1.21	36.1	1.2
Des Pins	307	308	0.00	0.00) 0	0	0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00)				0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.0	0.0	15.60	200	0.38	20.3	0.6
Des Pins	308	309	1.17	0.00) 24	0	1.17	0.00	1.17	24	0	24	4.00	0.26	0.00	0.26	6				0.00		0.00	0.00	1.17	1.17	0.44	0.00	0.00	0.00	0.7	0.7	68.60	200	0.39	20.6	0.7
Meadowlark	309	310	0.00	0.00) 0	0	2.34	0.00	2.34	48	0	48	4.00	0.53	0.00	0.53	3				0.00		0.00	0.00	0.00	2.34	0.89	0.00	0.00	0.00	1.4	1.4	70.60	200	0.41	21.0	0.7
Meadowlark	310	190	0.29	0.00) 6	0	2.63	0.00	2.63	54	0	54	4.00	0.60	0.00	0.60)				0.00		0.00	0.00	0.29	2.63	1.00	0.00	0.00	0.00	1.6	1.6	92.70	200	0.43	21.5	0.7
Stiver	307	187	0.29	0.00) 6	0	0.29	0.00	0.29	6	0	6	4.00	0.07	0.00	0.07	7				0.00		0.00	0.00	0.29	0.29	0.11	0.00	0.00	0.00	0.2	0.2	57.70	200	0.24	16.2	0.5
Stiver	187	188	0.88	0.00) 18	0	1.17	0.00	1.17	24	0	24	4.00	0.26	0.00	0.26	6				0.00		0.00	0.00	0.88	1.17	0.44	0.00	0.00	0.00	0.7	0.7	98.00	200	0.38	20.2	0.6
Stiver	188	189	0.29	0.00) 6	0	1.46	0.00	1.46	30	0	30	4.00	0.33	0.00	0.33	3				0.00		0.00	0.00	0.29	1.46	0.56	0.00	0.00	0.00	0.9	0.9	11.00	200	0.45	22.1	0.7
Stiver	189	190	1.02	0.00) 21	0	2.49	0.00	2.49	51	0	51	4.00	0.56	0.00	0.56	6				0.00		0.00	0.00	1.02	2.49	0.95	0.00	0.00	0.00	1.5	1.5	74.00	200	1.22	36.2	1.2
Stiver	190	191	0.29	0.00) 6	0	5.41	0.00	5.41	111	0	111	4.00	1.22	0.00) 1.22	2				0.00		0.00	0.00	0.29	5.41	2.06	0.00	0.00	0.00	3.3	3.3	32.50	200	0.65	26.4	0.8
Easement Stiver	191	316	0.45	0.29) 3	36	11.43	0.29	11.71	228	36	264	4.00	2.51	0.40	2.90)				0.00		0.00	0.00	0.45	11.43	4.34	0.29	0.29	0.11	6.8	7.4	46.00	200	0.39	20.5	0.7
Easement Stiver	316	181	0.15	0.00) 3	0	11.57	0.29	11.86	231	36	267	4.00	2.54	0.40	2.94	1				0.00		0.00	0.00	0.15	11.57	4.40	0.00	0.29	0.11	6.9	7.4	76.50	200	0.41	20.9	0.7
Church	180	181	0.00	0.51	0	66	0.00	0.51	0.51	0	66	66	4.00	0.00	0.73	0.73	3				0.00		0.00	0.00	0.00	0.00	0.00	0.51	0.51	0.19	0.0	0.9	58.90	200	0.28	17.3	0.6
Church	181	179	0.44	0.00) 9	0	11.57	12.37	23.94	240	102	342	4.00	2.64	1.12	3.76	6				0.00		0.00	0.00	0.44	12.01	4.56	0.00	0.79	0.30	7.2	8.6	57.20	200	0.45	22.1	0.7
Church	179	304	0.44	0.00	9	0	12.01	12.37	24.38	249	102	351	4.00	2.74	1.12	3.86	6				0.00		0.00	0.00	0.44	12.45	4.73	0.00	0.79	0.30	7.5	8.9	106.38	200	0.41	20.9	0.7
South Russell Rd	304	173	0.00	0.00	0 0	0	15.52	12.37	27.89	321	102	423	4.00	3.53	1.12	4.66	6				0.00		0.00	0.00	0.00	15.96	6.07	0.00	0.79	0.30	9.6	11.0	47.80	300	0.41	61.7	0.9
Concession	173	STA 1	0.00	0.00	0 0	0	153.58	22.67	176.25	3693	834	4527	3.28	33.41	7.55	6 40.96	6				0.00		0.00	0.00	0.00	148.37	56.38	0.00	11.10	4.22	89.8	101.6	8.30	450	0.48	197.9	1.2
									DE	SIGN PARA	METERS											Designe	ed by:		PROJECT:		Russell Wa	ater & Wa	astewater	Master I	Plan						
																						EO															
Existing Average	Daily Flow	=	238	L/cap/da	у	Harmon "K"	1																														
Future Average Da	aily Flow=		238	L/cap/da	iy				PS2 Area/h	ouse=	0.100060773	ha										Checke	d by:		LOCATION:		Russell Sa	nitary Sev	wage Syst	tem							
									PS1 Area/h	ouse=	0.146320374	ha	Existing E	Extraneous F	low =			0.38	L/s/ha			GAC															
Industrial Peak Fa	ctor =		2										Future Ex	ktraneous Flo	= W			0.38	L/s/ha				_								1						
													Minimum	Velocity =				0.60	m/s			Dwg. R	eference:		Project No:						Ι,	Date:	Jul-15			She	et No.
													Manning'	s n =				0.013							141-18986-00											1 of	1





INING	
۹P.	
/s)	
19.4	
17.1	
35.4	
20.3	
19.9	
19.6	
19.9	
16.0	
19.4	
21.2	
34.7	
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50.7	
96.4	

	TWP Id	lent						RESIDE										INDUCT		CON	MEDCIAL	INCLIN		1.0.1				NI			_			DIDE			7
LOCATI	UN							RESIDE		AND POPU	JLATION									CON		INSTITU		1+0+1	ļ									PIPE		'	───
STREET	From	То	EXISTING	FUTURE	EXISTING	FUTURE			CUMU	ILATIVE			PEAK	EXISTING	FUTURE	EXISTING + FUTURE	AREA	ACCU.	PEAK	AREA	ACCU.	AREA	ACCU.	PEAK	EXISTING	ACCU. EXISTING	EXISTING INFILT.	FUTURE	ACCU. FUT FUTURE INF	ILT. G	FUTURE	LENGTH	DIA.	SLOPE	CAP.	VEL.	REMAININ
	мн	мн	AREA	AREA	POP.	POP.	EXISTING	FUTURE	EXISTING + FUTURE	EXISTING	FUTURE	EXISTING + FUTURE	FACT.	PEAK FLOW	PEAK FLOW	PEAK FLOW		AREA	FACTOR		AREA		AREA	FLOW	AREA	AREA	FLOW	AREA	AREA FL	W FLOW	W FLOW				(FULL)	(FULL)	CAP.
	<u> </u>		(ha)	(ha)			AREA (ha)	AREA (ha)	AREA (ha)	POP.	POP.	POP.		(l/s)	(l/s)	(l/s)	(ha)	(ha)	(per MOE)	(ha)	(ha)	(ha)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(ha)	(ha) (l	s) (l/s)) (l/s)	(m)	(mm)	(%)	(l/s)	(m/s)	(l/s)
PS3 Drainage Area																																4	4			4	
County Rd #3	129	128	0.00	0.00	0	0	14.69	41.23	55.92	84	505	589	3.94	0.88	5.32	6.20		0.00	4.30		0.00	1.70	1.70	0.00	1.70	16.39	6.23	0.00	41.23 1	5.67 7.	11 28.1 0	50.00	250	0.66	48.31	0.98	20.2
County Rd #3	128	127	1.30	0.00	15	525	15.99	41.23	57.22	99	1030	1129	3.77	1.00	10.37	11.37		0.00	4.30	5.80	5.80		1.70	0.00	7.10	23.49	8.93	0.00	41.23 1	5.67 9.	92 35.9 6	86.00	250	0.34	34.53	0.70	-1.4
County Rd #3	127	115	0.80	0.00	9	6	16.79	41.23	58.02	108	1036	1144	3.76	1.09	10.42	11.51		0.00	4.30		5.80		1.70	0.00	0.80	24.29	9.23	0.00	41.23 1	5.67 10.	32 36.4 0	40.00	250	0.45	39.89	0.81	3.4
County Rd #3	115	114	9.10	0.00	243	192	25.89	41.23	67.12	351	1228	1579	3.66	3.44	12.03	15.47		0.00	4.30		5.80		1.70	0.00	9.10	33.39	12.69	0.00	41.23 1	5.67 16.	13 43.8 2	. 103.00	250	0.27	31.17	0.64	-12.6
County Rd #3	114	113	0.90	32.98	18	450	26.79	74.22	101.01	369	1678	2047	3.58	3.53	16.05	19.58		0.00	4.30		5.80		1.70	0.00	0.90	34.29	13.03	32.98	74.22	28.20 16.	56 60.8	1 62.50) 250.00	0.31	32.87	/ 0.67	-27.
County Rd #3	113	112	1.08	0.19	12	3	27.87	74.41	102.28	381	1681	2062	3.58	3.64	16.07	19.71		0.00	4.30	1.20	7.00		1.70	0.00	2.28	36.57	13.90	0.19	74.41	28.27 17.	54 61.8	8 80.20) 250.00	0.31	33.07	0.67	-28.
County Rd #3	112	111	0.00	12.11	0	381	27.87	86.51	114.38	381	2062	2443	3.52	3.58	19.39	22.97		0.00	4.30	3.15	10.15		1.70	0.00	3.15	39.72	15.09	12.11	86.51	32.88 18.	68 70.9 4	90.20	250	0.28	31.56	0.64	-39.3
County Rd #3	111	110	14.58	0.00	477	3	42.45	86.51	128.96	858	2065	2923	3.45	7.92	19.06	26.98		0.00	4.30	1.20	11.35		1.70	0.00) 15.78	55.50	21.09	0.00	86.51	32.88 29.	01 80.9 4	93.80	250	0.33	33.91	0.69	-47.0
County Rd #3	110	109	1.10	0.00	18	3	43.55	86.51	130.06	876	2068	2944	3.45	8.08	19.07	27.15		0.00	4.30	1.10	12.45		1.70	0.00	2.20	57.70	21.93	0.00	86.51	32.88 30.	00 81.9 5	88.20	250	0.26	30.56	0.62	-51.3
	109	108	0.80	0.00	12	0	44.35	86.51	130.86	888	2068	2956	3.45	8.19	19.06	27.25		0.00	4.30	0.80	13.25		1.70	0.00	1.60	59.30	22.53	0.00	86.51	32.88 30.	72 82.65	87.20	250	0.36	35.91	0.73	-46.7
County Rd #3	108	107	2.18	2.78	12	62	46.53	89.30	135.83	900	2129	3029	3.44	8.27	19.57	27.85		0.00	4.30	2.30	15.55		1.70	0.00	4.48	63.78	24.24	2.78	89.30	33.93 32.	51 86.0 2	85.30	250	0.25	29.72	0.61	-56.3
Ste. Marie	107	106	1.30	20.90	42	251	47.83	110.20	158.03	942	2130	3078	3.43	8.65	19.60	28.25		0.00	4.30		15.55		1.70	0.00	1.30	67.08	24.73	20.90	110.20	1.88 33.	38 94.80	60.00	250	0.27	30.97	0.63	-63.8
Ste. Marie	105	PS3	2.00	0.00	18	0	49.03	110.20	161.03	909	2407	3430	3.39	0.70 8 94	22.54	31.32		0.00	4.30		15.55		1.70	0.00	2.00	68.08	25.49	0.00	110.20 4	1.88 34.	27 90.03 81 99.21	1 71 10	250	0.27	42 32	0.63	-67.8
PS8 Drainage Area	100	1 00	1.00	0.00	10	Ū	00.00	110.20	101.00	301	2401	0474	0.00	0.04	22.02	01.40		0.00	4.00		10.00		1.70	0.00	1.00	00.00	20.07	0.00	110.20	1.00 04.	33.2	71:10	200	0.01	42.02	0.00	
St. Therese	322	321	0.00	62,70	0	192	0.00	62,70	62,70	0	192	192	4.00	0.00	2.05	2.05		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	62,70	62.70 2	3.83 0.0	00 25.88	3 91.00	200	0.32	18.52	0.59	-7.3
St. Therese	321	320	0.00	0.00	0	168	0.00	62.70	62.70	0	360	360	4.00	0.00	3.85	3.85		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	62.70 2	3.83 0.	00 27.6 8	3 91.50	200	0.28	17.48	0.56	-10.1
	320	319	0.00	0.00	0	354	0.00	62.70	62.70	0	714	714	3.89	0.00	7.43	7.43		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	62.70 2	3.83 0.0	00 31.25	i 119.50	250	0.26	30.29	0.62	-0.9
	319	318	0.00	0.00	0	0	0.00	62.70	62.70	0	714	714	3.89	0.00	7.43	7.43		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	62.70 2	3.83 0.0	00 31.2	5 118.00	250	0.24	28.97	0.59	-2.1
	318	317	0.00	0.00	0	0	0.00	62.70	62.70	0	714	714	3.89	0.00	7.43	7.43		0.00	5.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	62.70 2	3.83 0.	00 31.25	5 17.50	250	0.23	28.43	0.58	-2.8
	317	316	0.00	0.00	0	0	0.00	62.70	62.70	0	714	714	3.89	0.00	7.43	7.43		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	62.70 2	3.83 0.	00 31.25	5 77.0	0 250.00	0.23	28.75	5 0.59	∂ -2.
	323	324	0.00	0.00	0	0	0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 0.	00 0.0	0 115.0	0 200.00	0.32	18.60	0.59) 18.
	324	325	0.00	0.00	0	0	0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 0.	00 0.0	0 115.0	0 200.00	0.32	18.60	J 0.59) 18.
	325	316	0.00	0.00	0	0	0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 0.	00 0.0 0) 19.00	, 200	0.32	18.43	0.59	18.4
	316	315	0.00	0.00	0	0	0.00	62.70	62.70	0	714	714	3.89	0.00	7.43	7.43		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	62.70	23.83 0.	00 31.2 5	i 99.50	, 300	0.19	42.26	0.60	11.0
	315	314	0.00	0.00	0	0	0.00	62.70	62.70	0	714	714	3.89	0.00	7.43	7.43		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	62.70	23.83 0.	00 31.2	i 121.00	300	0.19	42.16	0.60	10.9
	314	313	0.00	0.00	0	0	0.00	62.70	62.70	0	714	714	3.89	0.00	7.43	7.43		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	62.70 2	3.83 0.	00 31.2 5	i 121.00	300	0.19	42.16	0.60	10.9
	331	330	0.00	0.00	0	0	0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 0.	00 0.0 0	89.00	200	0.31	18.40	0.59	18.4
	330	332	0.00	0.00	0	0	0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 0.	00 0.0	48.50	200	0.33	18.84	0.60	18.8
	332	333	0.00	0.00	0	0	0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 0.	00 0.0	0 11.5(J 200.00	0.35	19.34	4 0.62	: 19.
	333	334	0.00	0.00	0	0	0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 0.	00 0.0	0 65.50	J 200.00	0.32	18.57	/ 0.59	, 18.
	335	336	0.00	0.00	0	0	0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00	5.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 0.	00 0.0 0	76.00	200	0.37	19.91	0.63	19.9
	336	337	0.00	0.00	0	0	0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 0.	00 0.0 0	13.50	200	0.30	17.85	0.57	17.8
	337	338	0.00	0.00	0	0	0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 0.	00 0.00	67.00	200	0.31	18.36	0.58	18.3
	338	339	0.00	0.00	0	0	0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 0.	00 0.0 0	72.50	200	0.32	18.47	0.59	18.4
	339	340	0.00	0.00	0	0	0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 0.	00 0.0 0	14.50	200	0.34	19.26	0.61	19.2
	340	341	0.00	0.00	0	0	0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 0.	00 0.00	78.00	200	0.32	18.57	0.59	18.5
	313	312	0.00	0.00	0	0	0.00	62 70	62 70	0	714	714	3.89	0.00	7.43	7.43		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	62 70	0.00 0.	00 31.24	48.50	200	0.23	55 54	0.39	20.7
	311	312	0.00	8 14	0	195	0.00	8 14	8 14	0	195	195	4 00	0.00	2.09	2.09		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	8 14	8 14	3.09 0	00 512	40.00 8 85.90	300	0.35	48.94	0.79	43 7
	312	310	0.00	0.14	0	369	0.00	70.91	70.91	0	1278	1278	3.73	0.00	12.03	12 74		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.14	70.91	0.03 0.1 06 94 0.1	00 39.6 0	125.80	450	0.20	88.06	0.03	48.1
	310	PS8	0.00	0.00	0	0	50.83	181.11	231.94	987	3765	4752	3.27	8.62	32.87	41.49		0.00	4.30		15.55		1.70	0.00	0.00	68.08	25.87	0.00	181.11 6	8.82 34.	49 136.1 8	3 91.70	450	0.10	89.32	0.56	-46.8
PS 7 Drainage Area																																					
Notre Dame St.	389	390	0.00	41.11	0	300	0.00	41.11	41.11	0	300	300	4.00	0.00	3.21	3.21		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	41.11	41.11 1	5.62 0.	00 18.83	3 87.33	3 250	0.27	31.17	0.64	12.3
Notre Dame St.	390	391	0.00	0.00	0	0	0.00	41.11	41.11	0	300	300	4.00	0.00	3.21	3.21		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	41.11 1	5.62 0.	00 18.83	3 107.69	250	0.28	31.39	0.64	12.5
Notre Dame St.	391	392	0.00	0.00	0	0	0.00	41.11	41.11	0	300	300	4.00	0.00	3.21	3.21		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	41.11 1	5.62 0.	00 18.83	36.07	250	0.28	31.31	0.64	12.4
Notre Dame St.	392	393	0.00	0.00	0	0	0.00	41.11	41.11	0	300	300	4.00	0.00	3.21	3.21		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	41.11 1	5.62 0.	00 18.8 3	3 74.54	250	0.28	31.56	0.64	12.7
Notre Dame St.	393	394	0.00	0.00	0	0	0.00	41.11	41.11	0	300	300	4.00	0.00	3.21	3.21		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	41.11	5.62 0.	00 18.8	3 7.1	7 250.00	0.28	31.41	1 0.64	↓ 12 .
Notre Dame St.	394	395	0.00	0.00	0	0	0.00	41.11	41.11	0	300	300	4.00	0.00	3.21	3.21		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	41.11	5.62 0.	00 18.8	3 30.7	5 250.00	0.29	32.17	7 0.66	ن 13.
Notre Dame St.	395	396	0.00	0.00	0	0	0.00	41.11	41.11	0	300	300	4.00	0.00	3.21	3.21		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	41.11	5.62 0.	00 18.83	121.83	, 250	0.28	31.42	0.64	12.5
Notre Dame St.	396	397	0.00	0.00	0	0	0.00	41.11	41.11	0	300	300	4.00	0.00	3.21	3.21		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	41.11 1	5.62 0.	00 18.83	48.10	250	0.29	32.08	0.65	13.2
Notre Dame St.	397	387	0.00	0.00	0	0	0.00	41.11	41.11	0	300	300	4.00	0.00	3.21	3.21		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	41.11 1	5.62 0.	00 18.83	71.17	250	0.27	30.73	0.63	11.8
St. Andre Road	385	386	0.00	0.00	0	0	0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 0.	00 0.0 0	54.35	200	0.50	23.12	0.74	23.1
St. Andre Road	386	387	0.00	0.00	0	0	0.00	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00 0.0	00 0.0 0	92.43	, 200	0.50	23.14	0.74	23.1
Notre Dame St.	387	388	0.00	0.00	0	0	0.00	41.11	41.11	0	300	300	4.00	0.00	3.21	3.21		0.00	4.30		0.00	<u> </u>	0.00	0.00	0.00	0.00	0.00	0.00	41.11	5.62 0.	00 18.8	<u>3</u> 65.94	4 250.00	0.29	31.92	2 0.65	<u>,</u> 13.
Notre Dame St.	388	384	0.00	0.00	0	0	0.00	41.11	41.11	0	300	300	4.00	0.00	3.21	3.21		0.00	4.30		0.00		0.00	0.00	0.00	0.00	0.00	0.00	41.11	5.62 0.	00 18.8	3 64.6	7 250.00	0.28	31.37	0.64	, 12.



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LOCAT	ION		1 1			RESIDE	INTIAL ARE	A AND POPU	JLATION						INDUS		CON	MMERCIAL	INSTITUTION	AL I+C+I		1					TOTAL				PIPE		_
STREET	From To	EXISTIN	G FUTURE	EXISTING	FUTURE		CUMI	JLATIVE		1	PEAK	EXISTING	FUTURE	EXISTING + FUTURE AR	EA ACCU.	PEAK	AREA	ACCU.	AREA ACC	U. PEAK	EXISTING	ACCU. EXISTING	EXISTING INFILT.	FUTURE	ACCU. FUTURE	FUTURE INFILT.	EXISTIN G	TOTAL FUTURE	LENGTH	DIA.	SLOPE CA	VP. VEL	REMAIN
ļ	МН МН	AREA	AREA	POP.	POP. EXISTIN	G FUTURE	EXISTING + FUTURE	EXISTING	FUTURE	EXISTING + FUTURE	FACT.	PEAK FLOW	PEAK FLOW	PEAK FLOW	AREA	FACTOR	(ba)	AREA	(ba) (ba	A FLOW	AREA	AREA	FLOW	AREA	AREA	FLOW	FLOW	FLOW	(m)	(mm)	(FU	ILL) (FUL	_L) CAP.
Soquin St	275 294		(11a)	0	18	0.12	0.12	POP.	POP. 10	POP.	4.00	(1/5)	(1/5)	(1/5) (11	ia) (Tia)		(na)	(11d)	(IIa) (IIa		(11d)	(112)	(1/5)	(11d) 0.12	(11a) 0.12	(1/5)	(1/5)	(1/5)	(11)	(1111)	(76) (1/3	S) (III/8	s) (1/5)
Seguin St.	375 384	0.0	7 0.00	0	10 0.	0.12	2 0.12	0	10	10	4.00	0.00	0.19	0.19	0.00	4.30		0.00	0.0		0.00	0.00	0.00	0.12	0.12	0.05	0.00	2.05	18.82	200	0.80 28	9.28 0.3	93 29
Notre Dame St	130 372	, <u> </u>	1 0.00	29	60 3	0.00	3.98	33	127	220	4.00	0.31	2.00	2.35	0.00	4.30		0.00	0.0		0.61	3.98	1.20	0.00	0.00	0.00	1.39	3.86	77 70	200	0.27 1	7.05 0	59 13
Notre Dame St.	372 373	0.6	1 0.00	6	0 4.	59 0.00	4.59	39	187	226	4.00	0.42	2.00	2.42	0.00	4.30		0.00	0.0	0.00	0.61	4.59	1.74	0.00	0.00	0.00	2.16	4.16	34.80	200	0.46 2	2.24 0	.71 18
Notre Dame St.	373 374	0.3	1 0.00	3	0 4.	0.00	0 4.90	42	187	229	4.00	0.45	2.00	2.45	0.00	4.30		0.00	0.0	0.00	0.31	4.90	1.86	0.00	0.00	0.00	2.31	4.31	49.40	200	0.30 1	8.07 0	.58 13
Notre Dame St.	374 376	6 0.0	0.00	0	0 4.	0.00	4.90	42	187	229	4.00	0.45	2.00	2.45	0.00	4.30		0.00	0.0	0.00	0.00	0 4.90	1.86	6 0.00	0.00	0.00	2.31	4.31	37.00	200.00	1.00 3	32.80 1	1.04 2
Seguin St.	384 376	6 0.0	0.00	10	0 0.	00 41.23	41.23	10	318	328	4.00	0.11	3.40	3.51	0.00	4.30		0.00	0.0	0.00	0.00	0.00	0.00	0.00	41.23	15.67	0.11	19.18	18.50	250.00	0.65 4	47.89 0).98 2
Notre Dame St.	376 377	2.4	5 0.00	8	0 7.	35 41.23	48.58	60	505	565	3.95	0.63	5.33	5.96	0.00	4.30		0.00	0.0	0.00	2.45	7.35	2.79	0.00	41.23	15.67	3.42	24.42	12.92	300	0.31 53	3.81 0.	.76 29
Industrial St.	380 379	9 5.5	1 0.00	18	0 5.	51 0.00	5.51	18	0	18	4.00	0.19	0.00	0.19	0.00	4.30		0.00	0.0	00.00	5.51	5.51	2.09	0.00	0.00	0.00	2.29	2.29	62.20	200	0.40 20	0.79 0.4	.66 18
Industrial St.	379 378	8 0.0	0.00	0	0 5.	51 0.00	5.51	18	0	18	4.00	0.19	0.00	0.19	0.00	4.30		0.00	0.0	00 0.00	0.00	5.51	2.09	0.00	0.00	0.00	2.29	2.29	47.50	200	0.40 20	0.74 0.4	66 18
Industrial St.	378 377 377 PS7	7 0.0 7 1.8	4 0.00	0	0 5.	0.00 0 0.00	5.51	18 84	505	18 589	4.00	0.19	0.00	0.19	0.00	4.30		0.00	0.0		0.00	5.51 14.69	2.09	0.00	0.00 41.23	15.67	2.29	2.29	5.00 3.75	200	1.60 41	1.49 1.3 70.62 1	32 39
PS6 Drainage Area	011 101	/ 1:0	+ 0.00	0			00.02	04		000	0.04	0.00	0.02	0.20	0.00	4.00		0.00	0.0	0.00	1.04	14.00	0.00	0.00	41.20	10.07	0.47	21.40	0.70	000	0.00 10	5.02	
Belfort St.	363 362	2 0.0	1 0.19	0	1350 0.	0.19	0.21	0	1350	1350	3.71	0.00	13.40	13.40	0.00	4.30		0.00	0.0	0.00	0.01	0.01	0.01	0.19	0.19	0.07	0.01	13.48	14.50	200	0.34 1	9.26 0	.61 5
Belfort St.	362 361	0.0	0.00	0	0 0.	0.19	0.21	0	1350	1350	3.71	0.00	13.40	13.40	0.00	4.30		0.00	0.0	0.00	0.00	0.01	0.01	0.00	0.19	0.07	0.01	13.48	112.50	200	0.32 1	8.55 0	.59 5
Belfort St.	361 360	0.0	0.00	0	0 0.	0.19	0.21	0	1350	1350	3.71	0.00	13.40	13.40	0.00	4.30		0.00	0.0	0.00	0.00	0.01	0.01	0.00	0.19	0.07	0.01	13.48	73.50	200	0.31 1/	8.35 0.	.58 4
Belfort St.	360 359	0.0	0.00	0	0 0.	0.19	0.21	0	1350	1350	3.71	0.00	13.40	13.40	0.00	4.30		0.00	0.0	0.00	0.00	0.01	0.01	0.00	0.19	0.07	0.01	13.48	61.00	200	0.31 1/	8.30 0.	.58 4
Belfort St.	359 358	3 0.0	0.00	0	0 0.	0.19	0.21	0	1350	1350	3.71	0.00	13.40	13.40	0.00	5.30		0.00	0.0	0.00	0.00	0.01	0.01	0.00	0.19	0.07	0.01	13.48	12.00	200	0.33 1/	8.94 0.	.60 5
Belfort St.	358 357	0.0	0.00	0	0 0.	0.19	0.21	0	1350	1350	3.71	0.00	13.40	13.40	0.00	4.30		0.00	0.0	0.00	0.00	0.01	0.01	0.00	0.19	0.07	0.01	13.48	72.00	200.00	0.32 1	18.54 0).59
Belfort St.	364 357	0.0	0.00	0	0 0.	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00	0.00	4.30		0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	71.50	200.00	0.60 2	25.44 0).81 2
Lyon St.	357 356	<u> </u>	0.00	0	0 0.	0.19	0.21	0	1350	1350	3.71	0.00	13.40	13.40	0.00	4.30		0.00	0.0	0.00	0.00	0.01	0.01	0.00	0.19	0.07	0.01	13.48	54.50	200.00	0.31 1	18.32 0	.58
Lucerne Dr.	355 354		0.00	0	0 0.	0.19	0.21	0	1350	1350	3.71	0.00	13.40	13.40	0.00	4.30		0.00	0.0		0.00	0.01	0.01	0.00	0.19	0.07	0.01	13.48	32 50	200	0.44 21	1.80 0.0	69 8 69 8
Colmar St.	351 352	2 0.0	0.00	0	0 0.	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00	0.00	4.30		0.00	0.0		0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.50	200	0.51 2	3.35 0	74 23
Colmar St.	352 353	3 0.0	0.00	0	0 0.	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00	0.00	4.30		0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	80.00	200	0.50 2	3.19 0	.74 23
Colmar St.	353 354	0.0	0.00	0	0 0.	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00	0.00	4.30		0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	120.00	200	0.50 2	.3.19 0.	.74 23
Lucerne Dr.	354 346	6 0.0	0.00	0	0 0.	0.19	0.21	0	1350	1350	3.71	0.00	13.40	13.40	0.00	4.30		0.00	0.0	0.00	0.00	0.01	0.01	0.00	0.19	0.07	0.01	13.48	85.00	250	0.24 2	.8.85 0.	.59 15
Bruges St.	351 350	0.0	0.00	0	0 0.	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00	0.00	3.30		0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	73.50	200	0.60 2!	.5.38 0.	.81 25
Bruges St.	350 349	0.0	0.00	0	0 0.	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00	0.00	4.30		0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.50	200	0.56 24	4.54 0.	.78 24
Bruges St.	349 348	3 0.0	0.00	0	0 0.	00.00	0.00	0	0	0	4.00	0.00	0.00	0.00	0.00	4.30		0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	112.00	200	0.60 25	5.37 0.	.81 25
Bruges St.	348 347	0.0	0.00	0	0 0.	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00	0.00	4.30		0.00	0.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	69.00	200	0.59 25	5.28 0./	80 25
Bruges St.	347 340	0.0	0.00	0	0 0.	0.00	0.00	0	1250	1250	4.00	0.00	12.40	12.40	0.00	4.30		0.00	0.0		0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.49	70.00	200	0.60 2:	5.41 0.7	81 2 3
Lucerne Dr.	345 344	4 0.0	0.00	0	0 0.	0.19	0.21	0	1350	1350	3.71	0.00	13.40	13.40	0.00	4.30		0.00	0.0	0.00	0.00	0.01	0.01	0.00	0.19	0.07	0.01	13.48	63.50	300.00	0.19 4	42.04 (0.59 2
Bruxelles	370 369	0.0	0.00	0	0 0.	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00	0.00	4.30		0.00	0.0	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01	65.50	200	0.60 2	5.31 0	.81 25
Bruxelles	369 368	3 0.0	0.00	0	0 0.	00.00	0.00	0	0	0	4.00	0.00	0.00	0.00	0.00	4.30		0.00	0.0	00.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01	38.50	200	0.60 2	.5.35 0	.81 25
Bruxelles	368 367	0.0	0.00	0	0 0.	0.00	0.00	0	0	0	4.00	0.00	0.00	0.00	0.00	5.30		0.00	0.0	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	0.01	101.00	200	0.32 1	8.46 0	.59 18
Bruxelles	367 366	6 0.0	0.00	0	285 0.	0.00	0.00	0	285	285	4.00	0.00	3.05	3.05	0.00	4.30		0.00	0.0	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	3.05	101.00	200	0.60 2!	5.49 0.	.81 22
Bruxelles	366 365	5 0.0	0.00	0	0 0.	0.00	0.00	0	285	285	4.00	0.00	3.05	3.05	0.00	4.30		0.00	0.0	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	3.05	101.00	200	0.60 2	5.49 0.	.81 22
Lucerne Dr.	365 344	0.0	0.00	0	0 0.	0.00	0.00	0	285	285	4.00	0.00	3.05	3.05	0.00	4.30		0.00	0.0	0.00	0.00	0.01	0.01	0.00	0.00	0.00	0.01	3.05	81.00	525	0.14 158	8.48 0.	73 155
Lucerne Dr.	344 343	<u> </u>	0.00	0	0 0.	0.19	0.21	0	1635	1635	3.65	0.00	15.96	15.96	0.00	4.30		0.00	0.0	0.00	0.00	0.03	0.01	0.00	0.19	0.07	0.01	16.05	25.00	525 525	0.24 210	0.69 0.4	.97 194
BS4 Drainage Area	343 F30	6 0.0	0.00	0	0 0.	0.19	0.21	0	1035	1033	3.05	0.00	15.90	15.90	0.00	4.30		0.00	0.0	0.00	0.00	0.03	0.01	0.00	0.19	0.07	0.01	10.05	14.50	525	0.34 232	2.54 1.	17 230
St Jacques Rd	126 125	5 1.5	9 1.62	18	9 1	59 1.62	2 3.21	18	9	27	4.00	0.19	0.10	0.29	0.00	4.30		0.00	0.0	0 0 00	1.59	1.59	0.61	1.62	1.62	0.62	0.80	1.51	59.00	250	0.27 3	0.68 0	62 25
St Jacques Rd.	125 124	1.3	3 0.00	15	0 2.	92 1.62	2 4.54	33	9	42	4.00	0.35	0.10	0.45	0.00	4.30		0.00	0.0	00.00	1.33	3 2.92	1.11	0.00	1.62	0.62	1.46	2.18	65.00	250.00	0.32	33.40 (02 20 0.68 3
St Jacques Rd.	124 123	3 2.6	6 0.00	30	0 5.	58 1.62	2 7.20	63	9	72	4.00	0.67	0.10	0.77	0.00	4.30		0.00	0.0	00.00	2.66	6 5.58	2.12	0.00	1.62	0.62	2.79	3.51	92.50	250.00	0.29 3	31.89 ().65 2
St Jacques Rd.	123 122	2 2.1	3 0.00	24	81 7.	71 1.62	9.33	87	90	177	4.00	0.93	0.96	1.89	0.00	4.30		0.00	0.0	0.00	2.13	7.71	2.93	0.00	1.62	0.62	3.86	5.44	79.50	250	0.49 4	1.60 0.	.85 36
St Jacques Rd.	122 121	1.5	9 0.00	16	210 9.	30 1.62	2 10.92	103	300	403	4.00	1.10	3.21	4.31	0.00	4.30		0.00	0.0	0.00	1.59	9.30	3.53	0.00	1.62	0.62	4.64	8.46	75.00	250	1.62 7	5.75 1.	.54 67
St Jacques Rd.	121 120	0.0	0.08	0	3 9.	30 1.70	11.00	103	303	406	4.00	1.10	3.24	4.34	0.00	4.30	 	0.00	0.0	00.00	0.00	9.30	3.53	0.08	1.70	0.65	4.64	8.52	118.00	250	0.27 3'	1.06 0.	.63 22
St Jacques Rd.	120 PS4	4 0.0	0.00	0	0 9.	30 1.70) 11.00	103	303	406	4.00	1.10	3.24	4.34	0.00	4.30		0.00	0.0	0.00	0.00	9.30	3.53	0.00	1.70	0.65	4.64	8.52	15.00	250	0.60 46	ô.06 0.'	94 37
PS5 Drainage Area	202 202			-		25 0.00	0.05		-		4.00	0.40	0.00	0.40	0.00	1.00		0.00		0.000	0.05	0.05	0.40	0.00	0.00	0.00	0.40	0.40	20.00	200	0.40	0.82	
Rembrant Dr	293 292	0.2		9	0 0.	0.00	0.25	9	0	9	4.00	0.10	0.00	0.10	0.00	4.30		0.00	0.0		0.25	0.25	0.10	0.00	0.00	0.00	0.19	0.19	22.32	200	0.20 20	0.03 0.0	00 20
Rembrant Dr	295 294	0.4	2 0.00 5 0.00	15 9	0 0.	+∠ 0.00 38 0.00	0.42	15 24	0	15 24	4.00	0.16	0.00	0.16	0.00	4.30		0.00	0.0		0.42	0.42	0.16	0.00	0.00	0.00	0.32	0.32	23.70 56.79	200	0.60 2	<u>5.38</u> 0.	.81 2 4
Normandie Ave	292 201	0.2	6 0.00	27	0 1	39 0.00) 1.60	60	0	60	4 00	0.20	0.00	0.64	0.00	4.00 ⊿ 30	†	0.00	0.0		0.23	1 60	0.20	0.00	0.00	0.00	1 20	1 20	70.62	200	0.40 2	20.65	66 10
Normandie Ave.	291 290) 0.9	3 0.00	33	0 2	63 0.00	2.63	93	0	93	4.00	0.99	0.00	0.99	0.00	4.30	1	0.00	0.0	0.00	0.93	2.63	1.00	0.00	0.00	0.00	1.99	1.29	79.19	200	0.40 2	20.85 0	.66 18
Normandie Ave.	290 289	0.5	1 0.00	18	0 3.	0.00	3.13	111	0	111	4.00	1.19	0.00	1.19	0.00	4.30		0.00	0.0	0.00	0.51	3.13	1.19	0.00	0.00	0.00	2.38	2.38	54.47	200.00	0.40 2	20.84 ().66 1
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	TWP Ide	ent					DEOIDENT											0000055														DIDE			
LOCAT	ION				-		RESIDENT	TAL AREA	AND POPU	JLATION				1		INDUS		COMMER	RCIAL	INSTITUT	TIONAL I+C+	1				, I		TOTAL							
STREET	From	То	EXISTING FUTUR	E EXISTING	FUTURE			CUMU	LATIVE		<u> </u>	PEAK	EXISTING	FUTURE	EXISTING + FUTURE ARI	A ACCU.	PEAK	AREA A	ACCU.	AREA	ACCU. PEA	K EXISTING	ACCU. EXISTING	EXISTING INFILT.	FUTURE	ACCU. FUTURE	FUTURE INFILT.	EXISTIN G	TOTAL FUTURE	LENGTH	DIA.	SLOPE C/	AP. V	/el. Re	EMAIN
	МН	мн	AREA AREA	POP.	POP.	EXISTING	FUTURE +	EXISTING	EXISTING	FUTURE	EXISTING FUTURE	+ FACT.	PEAK FLOW	PEAK FLOW	PEAK FLOW	AREA	FACTOR	A	AREA		AREA FLOW	V AREA	AREA	FLOW	AREA	AREA	FLOW	FLOW	FLOW			(Fl	ULL) (F	-ULL)	CAP.
			(ha) (ha)			AREA (ha)	AREA (ha) A	AREA (ha)	POP.	POP.	POP.		(l/s)	(l/s)	(l/s) (ha	a) (ha)	(per MOE)	(ha)	(ha)	(ha)	(ha) (l/s)) (ha)	(ha)	(l/s)	(ha)	(ha)	(l/s)	(l/s)	(I/s)	(m)	(mm)	(%) (l	/s) (n	n/s)	(l/s)
Normandie Ave.	289	288	0.42 0.00	0 15	5	0 3.56	6 0.00	3.56	126	0	12	4.00	1.35	5 0.0	0 1.35	0.00	4.30		0.00		0.00 0.0	00 0.42	2 3.56	1.3	5 0.00	0.00	0.00	2.70	2.70	55.48	200.00	0.40	20.65	0.66	1
Rembrant Dr	295	296	0.00 0.00	0 0)	0 0.00	0.00	0.00	0	0		0 4.00	0.00	0.0	0.00	0.00	4.30		0.00		0.00 0.	00 0.00	0.00	0.0	0 0.00	0.00	0.00	0.00	0.00	27.00	200	0.74 2	28.23	0.90	28
Rembrant Dr	296	297	1.02 0.00	0 36	3	0 1.02	2 0.00	1.02	36	0	3	36 4.00	0.39	0.0	0 0.39	0.00	4.30		0.00		0.00 0.	00 1.02	2 1.02	0.3	9 0.00	0.00	0.00	0.77	0.77	79.20	200	0.39 2	20.52	0.65	19
Rembrant Dr	297	298	0.85 0.00	0 30		0 1.86	0.00	1.86	66 97	0	6	06 4.00	0.71	0.0	0 0.71	0.00	4.30		0.00		0.00 0.	00 0.85	2.46	0.7	1 0.00	0.00	0.00	1.41	1.41	70.20	200	0.37 1	24.74	0.64	18
Rembrant Dr	298	299	0.42 0.00	0 21	5	0 2.40	3 0.00 3 0.00	2.40	102	0	10)2 4.00	0.93	0.0	0 1.09	0.00	4.30		0.00		0.00 0.	00 0.42	2 2.88	1.0	9 0.00	0.00	0.00	2.19	2.19	70.30	200	0.54 2	24.15	0.79	21
Normandie Ave.	288	287	0.34 0.00	0 12	2	0 6.78	3 0.00	6.78	240	0	24	4.00	2.57	0.0	0 2.57	0.00	4.30		0.00		0.00 0.0	00 0.34	4 6.78	2.5	8 0.00	0.00	0.00	5.14	5.14	41.93	200	0.41 2	20.88	0.66	15
Normandie Ave.	287	277	0.34 0.00	0 12	2	0 7.12	2 0.00	7.12	252	0	25	52 4.00	2.70	0.0	0 2.70	0.00	4.30		0.00		0.00 0.0	0.34	4 7.12	2.7	0.00	0.00	0.00	5.40	5.40	61.63	200	0.34 1	19.15	0.61	13
Centenaire St.	277	276	0.25 0.00	0 9	9	0 7.37	0.00	7.37	261	0	26	61 4.00	2.79	0.0	0 2.79	0.00	4.30		0.00		0.00 0.0	00 0.25	5 7.37	2.8	0 0.00	0.00	0.00	5.59	5.59	65.30	200	0.34 1	19.04	0.61	13
La Prairie St.	258	259	0.76 0.00	0 27	7	0 0.76	6 0.00	0.76	27	0	2	4.00	0.29	0.0	0 0.29	0.00	4.30		0.00		0.00 0.0	00 0.76	6 0.76	0.2	9 0.00	0.00	0.00	0.58	0.58	64.50	200	0.51 2	23.46	0.75	22
La Prairie St.	259	260	0.59 0.00	0 21	1	0 1.36	6 0.00	1.36	48	0	4	4.00	0.51	0.00	0.51	0.00	4.30		0.00		0.00 0.0	00 0.59	9 1.36	0.5	2 0.00	0.00	0.00	1.03	1.03	62.40	200	0.50 2	23.12	0.74	22
La Prairie St.	260	276	0.25 0.00	0 9	9	0 1.61	0.00	1.61	57	0	5	4.00	0.61	0.00	0.61	0.00	4.30		0.00		0.00 0.0	00 0.25	5 1.61	0.6	0.00	0.00	0.00	1.22	1.22	47.50	200	0.51 2	23.31	0.74	22
Renoir Dr	283	282	0.76 0.00	0 27	7	0 0.76	<u>6 0.00</u>	0.76	27	0	2	4.00	0.29	0.00	0 0.29	0.00	4.30		0.00		0.00 0.0	00 0.76	6 0.76	0.2	9 0.00	0.00	0.00	0.58	0.58	83.00	200	0.51 2	23.33	0.74	22
Centenaire St	202	275	0.00 0.00			0 10.30	0.00	10.34	366	0	36		3 01	0.0	0 3.91	0.00	4.30		0.00		0.00 0.	00 0.0	0 10.34	0.5	0.00	0.00	0.00	7.84	7.84	52 20	200.00	0.53	17 58	0.76	
Centenaire St.	275	273	0.34 0.00	0 12	2	0 10.67	7 0.00	10.54	378	0	30	78 4.00	4.04	0.0	0 4.04	0.00	4.30		0.00		0.00 0.	00 0.34	10.67	4.0	6 0.00	0.00	0.00	8.10	8.10	70.00	200.00	0.23	17.09	0.54	
Centenaire St.	274	227	0.59 0.00	0 21	- 	0 11.27	0.00	11.27	399	0	39	9 4.00	4.27	0.0	0 4.27	0.00	4.30		0.00		0.00 0.	00 0.59	11.27	4.2	8 0.00	0.00	0.00	8.55	8.55	36.70	200	0.30 1	17.96	0.57	9
La Prairie St.	258	257	0.00 0.00	0 0)	0 0.00	0.00	0.00	0	0		0 4.00	0.00	0.0	0.00	0.00	4.30		0.00		0.00 0.0	0.00	0.00	0.0	0 0.00	0.00	0.00	0.00	0.00	39.70	200	0.50 2	23.28	0.74	23
La Prairie St.	257	227	0.85 0.00	0 30)	0 0.85	0.00	0.85	30	0	3	4.00	0.32	2 0.0	0 0.32	0.00	4.30		0.00		0.00 0.0	0.85	5 0.85	0.3	2 0.00	0.00	0.00	0.64	0.64	87.60	200	0.50 2	23.24	0.74	22
Centenaire St.	227	226	0.51 0.00	0 18	3	0 12.62	2 0.00	12.62	447	0	44	4.00	4.78	8 0.0	0 4.78	0.00	4.30		0.00		0.00 0.0	00 0.51	12.62	4.8	0.00	0.00	0.00	9.58	9.58	87.00	200	0.26 1	16.86	0.54	7
Renoir Dr	283	284	0.51 0.00	0 18	3	0 0.51	0.00	0.51	18	0	1	8 4.00	0.19	0.0	0 0.19	0.00	4.30		0.00		0.00 0.0	00 0.51	0.51	0.1	9 0.00	0.00	0.00	0.39	0.39	59.80	200	0.50 2	23.23	0.74	22
Renoir Dr	284	285	0.93 0.00	0 33	3	0 1.44	0.00	1.44	51	0	5	51 4.00	0.55	0.0	0 0.55	0.00	4.30		0.00		0.00 0.0	0.93	3 1.44	0.5	5 0.00	0.00	0.00	1.09	1.09	79.80	200	0.50 2	23.22	0.74	22
Renoir Dr Ropoir Dr	285	286	0.76 0.00	0 27	7	0 2.20	0.00	2.20	78	0	7	⁷⁸ 4.00	0.83	0.00	0 0.83	0.00	4.30		0.00		0.00 0.0	00 0.76	<u> 2.20</u>	0.84	4 0.00	0.00	0.00	1.67	1.67	62.80	200	0.51 2	23.41	0.75	21
Frontenac Blvd	200	220	0.42 0.00	0 15	5	0 0.43	0.00	0.42	15	0	1	4.00	0.33	0.00	0.39	0.00	4.30		0.00		0.00 0.0	0.42	2.03	0.1	6 0.00	0.00	0.00	0.32	0.32	70.70	200	0.54 2	23.40	0.74	- 22
Frontenac Blvd.	230	229	0.59 0.00	0 13	, ,	0 1.02	2 0.00	1.02	36	0	3	36 4.00	0.39	0.00	0.39	0.00	4.30		0.00		0.00 0.0	0 0.59	9 1.02	0.3	9 0.00	0.00	0.00	0.32	0.32	67.60	200	0.49 2	22.92	0.73	22
Frontenac Blvd.	229	228	0.34 0.00	0 12	2	0 1.36	6.00	1.36	48	0	4	4.00	0.51	0.0	0 0.51	0.00	4.30		0.00		0.00 0.0	00 0.34	1.36	0.5	2 0.00	0.00	0.00	1.03	1.03	43.70	200	0.50 2	23.27	0.74	2
Frontenac Blvd.	228	226	0.85 0.00	0 30)	0 2.20	0.00	2.20	78	0	7	78 4.00	0.83	0.0	0 0.83	0.00	4.30		0.00		0.00 0.0	0.85	5 2.20	0.84	4 0.00	0.00	0.00	1.67	1.67	103.70	200.00	0.50	23.23	0.74	2
Centenaire St.	226	225	0.17 0.00	0 6	6	0 17.62	0.00	17.62	624	0	62	3.92	6.54	0.0	0 6.54	0.00	4.30		0.00		0.00 0.	00 0.17	7 17.62	6.7	0.00	0.00	0.00	13.24	13.24	43.70	200	0.19 1	14.36	0.46	1
Daze St.	245	243	0.42 0.00	0 15	5	0 0.42	2 0.00	0.42	15	0	1	5 4.00	0.16	0.0	0 0.16	0.00	4.30		0.00		0.00 0.	00 0.42	2 0.42	0.1	6 0.00	0.00	0.00	0.32	0.32	69.00	200	0.51 2	23.36	0.74	23
Daze St.	244	243	0.42 0.00	0 15	5	0 0.42	2 0.00	0.42	15	0	1	5 4.00	0.16	6 0.0	0 0.16	0.00	4.30		0.00		0.00 0.	00 0.42	2 0.42	0.1	6 0.00	0.00	0.00	0.32	0.32	53.20	200	0.51 2	23.37	0.74	23
Merlin St.	243	242	0.42 0.00	0 15	5	0 1.27	0.00	1.27	45	0	4	4.00	0.48	0.0	0 0.48	0.00	4.30		0.00		0.00 0.0	00 0.42	2 1.27	0.4	8 0.00	0.00	0.00	0.96	0.96	70.10	200	0.50 2	23.18	0.74	22
Merlin St. Merlin St	242	241	0.59 0.00	0 21	5	0 1.86	0.00	1.86	81	0	8	31 4.00	0.71	0.0 7 0.0	0 0.71	0.00	4.30		0.00		0.00 0.0	0 0.55	2.29	0.7	7 0.00	0.00	0.00	1.41	1.41	70.10 66.50	200	0.50 2	23.18	0.74	21
Lachaine St.	235	236	0.59 0.00	0 21	1	0 0.59	0.00	0.59	21	0	2	21 4.00	0.22	2 0.0	0 0.22	0.00	4.30		0.00		0.00 0.0	00 0.59	0.59	0.2	3 0.00	0.00	0.00	0.45	0.45	75.90	200	0.43 2	21.63	0.69	21
Lachaine St.	236	237	0.93 0.00	0 33	3	0 3.81	0.00	3.81	135	0	13	4.00) 1.44	0.0	0 1.44	0.00	4.30		0.00		0.00 0.0	0.93	3 3.81	1.4	5 0.00	0.00	0.00	2.89	2.89	113.00	200	0.50 2	23.29	0.74	20
Lachaine St.	237	238	0.93 0.00	0 33	3	0 4.74	0.00	4.74	168	0	16	68 4.00	1.80	0.00	1.80	0.00	4.30		0.00		0.00 0.0	0.93	3 4.74	1.8	0.00	0.00	0.00	3.60	3.60	108.40	200	0.51 2	23.36	0.74	19
Daze St.	265	266	1.10 0.00	0 39	9	0 1.10	0.00	1.10	39	0	3	4.00	0.42	0.00	0.42	0.00	4.30		0.00		0.00 0.0	00 1.10	1.10	0.4	2 0.00	0.00	0.00	0.84	0.84	86.50	200	0.40 2	20.86	0.66	20
Radisson Dr.	270	269	0.59 0.00	0 21		0 0.59	0.00	0.59	21	0	2	4.00	0.22	0.00	0.22	0.00	4.30		0.00		0.00 0.0	0.59	0.59	0.23	3 0.00	0.00	0.00	0.45	0.45	64.80	200	0.49 2	23.05	0.73	22
Radisson Dr.	269	268	0.76 0.00	0 27	7	0 1.36	6 0.00	1.36	48	0	4	4.00	0.51	0.0	0 0.51	0.00	4.30		0.00		0.00 0.	00 0.7	6 1.36	0.5	52 0.00	0.00	0.00	1.03	1.03	69.30	200.00	0.40	20.85	0.66	1
Radisson Dr.	268	266	0.51 0.00	0 18	3	0 1.86	6 0.00	1.86	66	0	6	6 4.00	0.71	0.0	0 0.71	0.00	4.30		0.00		0.00 0.	00 0.5	1 1.86	0.7	71 0.00	0.00	0.00	1.41	1.41	80.30	200.00	0.40	20.70	0.66	
Lachaine St.	266	267	0.34 0.00	0 12	2	0 3.30	0.00	3.30	117	0	11	4.00	1.25	0.0	0 1.25	0.00	4.30		0.00		0.00 0.	00 0.34	4 3.30	1.2	6 0.00 8 0.00	0.00	0.00	2.51	2.51	61.60 78.01	250	0.26 3	30.31	0.62	27
Lancelot St.	240	239	1.36 0.00	0 30 0 48	3	0 4.10	0.00 0.00	1.36	48	0	4	4.00	0.51	0.0	0 0.51	0.00	4.30		0.00		0.00 0.	00 1.36	5 4.13 5 1.36	0.5	2 0.00	0.00	0.00	1.03	1.03	78.01	200	0.51 2	23.39	0.74	23
Lachaine St.	239	238	0.51 0.00	0 18	3	0 6.02	2 0.00	6.02	213	0	21	3 4.00	2.28	0.0	0 2.28	0.00	4.30		0.00		0.00 0.0	00 0.51	6.02	2.2	9 0.00	0.00	0.00	4.56	4.56	81.80	250	0.28 3	31.53	0.64	26
Lachaine St.	238	222	0.08 0.00	0 3	3	0 10.84	0.00	10.84	384	0	38	4 4.00) 4.11	0.0	0 4.11	0.00	4.30		0.00		0.00 0.0	0.00	3 10.84	4.1	2 0.00	0.00	0.00	8.23	8.23	41.00	250	0.24 2	29.37	0.60	21
Lachaine St.	222	221	0.17 0.00	0 6	6	0 11.01	0.00	11.01	390	0	39	4.00) 4.17	0.0	0 4.17	0.00	4.30		0.00		0.00 0.0	00 0.17	7 11.01	4.1	9 0.00	0.00	0.00	8.36	8.36	42.10	250	0.26 3	30.40	0.62	22
Centenaire St.	217	218	0.34 0.00	0 12	2	0 0.34	0.00	0.34	12	0	1	2 4.00	0.13	0.0	0 0.13	0.00	4.30		0.00		0.00 0.0	0.34	4 0.34	0.1	3 0.00	0.00	0.00	0.26	0.26	35.60	200	0.51 2	23.32	0.74	23
La Croisee St.	215	216	0.00 0.00	0 0)	0 0.00	0.00	0.00	0	0		0 4.00	0.00	0.0	0 0.00	0.00	4.30		0.00		0.00 0.0	0.00	0.00	0.0	0 0.00	0.00	0.00	0.00	0.00	13.30	200	0.53 2	23.79	0.76	23
La Croisee St.	216	218	0.59 0.00	0 21		0 0.59	0.00	0.59	21	0	2	4.00	0.22	0.0	0 0.22	0.00	4.30	┣──┤──	0.00		0.00 0.0	0 0.59	0.59	0.2	3 0.00	0.00	0.00	0.45	0.45	71.50	200	0.50 2	23.27	0.74	22
Centenaire St.	218	219	0.76 0.00	0 27	7	0 1.69	0.00	1.69	60	0	6	60 4.00	0.64	0.00	0.64	0.00	4.30	┠──┼──	0.00		0.00 0.0	0 0.76	<u>6 1.69</u>	0.6	4 0.00	0.00	0.00	1.29	1.29	88.30	200	0.50 2	23.15	0.74	21
La Croisee St	219	214	1.44 0.00	0 54		0 2.20		2.20	/8 E4	0	-	4.00	0.83	0.00	0.83	0.00	4.30	┠──┼──	0.00		0.00 0.0	0.51	1 2.20	0.8	4 U.UU	0.00	0.00	1.67	1.67	δ8.20 105.60	200	0.50 2	23.24	0.74	21
La Croisee St	215	213	0.59 0.00	0 51	<u> </u>	0 2.03		1.44 2.03	51	0	5	72 4.00	0.55	v	0.00	0.00	4.30		0.00		0.00 0.0	00 0.5	+ 1.44 9 2.03	0.5	77 0.00	0.00	0.00	1.09	1.09	65 70	200	0.50 2	23 24	0.74	22
Louis Riel St.	213	220	0.25 0.00	0 9		0 2.29	0.00	2.00	81	0	8	<u>-</u> 4.00	0.87	0.0	0 0.87	0.00	4.30		0.00		0.00 0.	00 0.2	5 2.29	0.7	B7 0.00	0.00	0.00	1.74	1.74	76.10	200.00	0.50	23.18	0.74	2
Centenaire St.	220	221	0.17 0.00	0 6	6	0 4.66	6 0.00	4.66	165	0	16	65 4.00	1.76	0.0	0 1.76	0.00	4.30		0.00		0.00 0.	00 0.17	4.66	1.7	7 0.00	0.00	0.00	3.54	3.54	36.80	200	0.52 2	23.57	0.75	20
Centenaire St.	221	223	0.25 1.38	8 9	9	0 15.93	3 1.38	17.31	564	0	56	3.95	5.95	0.0	0 5.95	0.00	4.30		0.00		0.00 0.	00 0.25	5 15.93	6.0	5 1.38	1.38	0.53	12.00	12.53	54.60	300	0.18 4	41.38	0.59	28



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	TWP Ide	nt					RESIDEN	ITIAI ARFA								RIAI	COM		INSTITU		1+0+1				N							PIPE		-
LOCAT							RESIDEN		AND FOFO	LATION				EVICENC			001		INSTITU	TIONAL	ITOTI					40011		TOTAL	TOTAL	·				
STREET	From	To EXISTI	ING FUTURE	EXISTING	FUTURE			CUMUL	ATIVE		P	EAK EXISTIN	IG FUTURE	+ FUTURE ARE	A ACCU.	PEAK	AREA	ACCU.	AREA	ACCU.	PEAK	EXISTING	ACCU. EXISTING	EXISTING INFILT.	FUTURE	ACCU. FUTURE	FUTURE INFILT.	G	FUTURE	LENGTH	DIA.	SLOPE CAP	P. VEL.	REMAIN
	мн г	MH ARE	A AREA	POP.	POP.	EXISTING AREA (ha)	FUTURE AREA (ha)	EXISTING + FUTURE AREA (ha)	EXISTING		EXISTING + FUTURE F/	ACT. FLOW	PEAK FLO	PEAK FLOW	AREA	FACTOR	(ha)	AREA (ba)	(ha)	AREA F	FLOW	AREA (ba)	AREA (ba)	FLOW	AREA	AREA (ba)	FLOW (I/s)	FLOW	FLOW (I/s)	(m)	(mm)	(FUL	L) (FULL	.) CAP.
La Citadelle St	233 2	234 0		33		0.03	0.00	0.93	23	POP. 0	33	4.00 0	35 0	00 0 35		(por mol)	(na)	0.00	(na)	0.00	0.00	0.03	0.03	0.35	(110)	0.00	0.00	0.71	0.71	86.10	200	0.50 23	18 0.7	/ ("C/
La Citadelle St.	233 2	223 0	0.00	15	(0.33	0.00	1.36	48	0	48	4.00 0	51 0.	00 0.51	0.00	4.30		0.00		0.00	0.00	0.93	1.36	0.52	0.00	0.00	0.00	1.03	1.03	94.50	200	0.50 23	.13 0.7	4 22 74 22
Centenaire St.	223 2	224 1	.10 0.00	39	0	18.38	1.38	19.77	651	0	651	3.91 6	81 0.	00 6.81	0.00	4.30		0.00		0.00	0.00	1.10	18.38	6.99	0.00	1.38	0.53	13.80	14.32	134.00	300	0.20 43	.41 0.6	31 29
Radisson Dr.	270 2	271 0	0.76 0.00	27	C	0.76	0.00	0.76	27	0	27	4.00 0	29 0.	00 0.29	0.00	4.30		0.00		0.00	0.00	0.76	0.76	0.29	0.00	0.00	0.00	0.58	0.58	75.70	200	0.50 23	.24 0.7	/4 22
Radisson Dr.	271 2	272 0	0.34 0.00	12	C	0 1.10	0.00	1.10	39	0	39	4.00 0	42 0.	00 0.42	0.00	4.30		0.00		0.00	0.00	0.34	1.10	0.42	0.00	0.00	0.00	0.84	0.84	25.30	200	0.51 23	.51 0.7	′5 22
Radisson Dr.	272 2	273 1	.10 0.00	39	C	2.20	0.00	2.20	78	0	78	4.00 0	83 0.	00 0.83	0.00	4.30		0.00		0.00	0.00	1.10	2.20	0.84	0.00	0.00	0.00	1.67	1.67	116.52	200	0.51 23	.54 0.7	'5 21
Radisson Dr.	273 2	224 0	0.42 0.00	15	C	2.63	0.00	2.63	93	0	93	4.00 0.	99 0.0	0 0.99	0.00	4.30		0.00		0.00	0.00	0.42	2.63	1.00	0.00	0.00	0.00	1.99	1.99	84.90	300	0.51 68	.82 0.9	<i>i</i> 7 66
Centenaire St.	224 2	25 0	0.08 0.00	3	C	21.10	1.38	22.48	747	0	747	3.88 7.	75 0.0	0 7.75	0.00	4.30		0.00		0.00	0.00	0.08	21.10	8.02	0.00	1.38	0.53	15.76	16.29	24.50	300	0.20 43	.68 0.6	j2 27
Centenaire St.	225 F	PS5 0	0.17 0.00	6	C	38.89	1.38	40.27	1377	0	1377	3.71 13.	64 0.0	0 13.64	0.00	4.30		0.00		0.00	0.00	0.17	38.89	14.78	0.00	1.38	0.53	28.42	28.95	25.00	300	0.20 43	.25 0.6	,1 14
PS2 Drainage Area																																		
Notre Dame	101 1	00 1	.75 0.17	27	C	0 1.75	0.17	1.92	27	0	27	4.00 0	29 0.	00 0.29	0.00	4.30		15.55		1.70	0.00	1.75		0.00	0.17	0.17	0.06	0.29	0.35	104.50	250	0.36 35	.53 0.7	′2 35
Notre Dame	100	99 3	3.20	159	C	4.95	0.17	5.12	186	0	186	4.00 1	99 0.	00 1.99	0.00	4.30		15.55		1.70	0.00	3.20	3.20	1.22	0.00	0.17	0.06	3.21	3.27	99.00	250	0.19 25	.85 0.5	J3 22
Notre Dame	99	98 1	.30	21	C	6.25	0.17	6.42	207	0	207	4.00 2	21 0.	00 2.21	0.00	4.30	<u> </u>	15.55		1.70	0.00	1.30	4.50	1.71	0.00	0.17	0.06	3.92	3.99	111.50	250	0.20 26	.42 0.5	,4 22
Notre Dame	98	96		0	C	6.25	0.17	6.42	207	0	207	4.00 2	21 0.	00 2.21	0.00	4.30	1.85	17.40		1.70	0.00	1.85	6.35	2.41	0.00	0.17	0.06	4.63	4.69	61.30	250	0.29 31	.86 0.6	,5 27
Notre Dame	96	95 1	.85 12.30	12	C	8.10	12.47	20.57	219	0	219	4.00 2	34 0.	2.34	0.00	4.30		17.40		1.70	0.00	1.85	8.20	3.12	12.30	12.47	4.74	5.46	10.20	63.20	250	0.34 34	.52 0.7	0 24
Notre Dame	95	94 0	0.31 18.97	27	18	8.41	31.44	39.85	246	18	264	4.00 2	63 0.	19 2.82	0.00	4.30	2.00	17.40		1.70	0.00	0.31	8.51	3.23	18.97	31.44	11.95	5.86	18.00	30.70	300	0.33 55	.19 0.7	8 37
Notre Dame	94	93	10.04	0	30	0 8.41	31.58	50.03	240	60	207	4.00 2	63 U.	22 2.80 64 3.27	0.00	4.30	3.00	20.40		1.70	0.00	3.00	14.51	4.37	10.04	31.58	12.00	7.00	19.23	73.10	300	0.28 51	.37 0.7	<u> </u>
Notre Dame	92	91	10.04	0) 8.41	41.62	50.03	240	60	306	4.00 2	63 0.	64 3.27	0.00	4.30	1.60	25.40		1.70	0.00	1.60	16.11	6.12	0.00	41.62	15.82	8.75	25.21	75.20	300	0.28 50	.86 0.7	0 20 72 25
Notre Dame	91	29 0).32	12	0	8.73	41.62	50.35	258	60	318	4.00 2	76 0.	64 3.40	0.00	4.30		25.00		1.70	0.00	0.32	16.43	6.24	0.00	41.62	15.82	9.00	25.46	71.40	300	0.30 53	.19 0.7	 75 27
Notre Dame	29	28		0	C	8.73	41.62	50.35	258	60	318	4.00 2	76 0.	64 3.40	0.00	4.30		25.00		1.70	0.00	0.00	16.43	6.24	0.00	41.62	15.82	9.00	25.46	16.50	300	0.42 62	.98 0.8	9 37
Marcel	81	80 9	9.65	239	C	9.65	0.00	9.65	239	0	239	4.00 2	56 0.	00 2.56	0.00	4.30		0.00		0.00	0.00	9.65	9.65	3.67	0.00	0.00	0.00	6.22	6.22	96.00	250	0.45 39	.89 0.8	31 33
Marcel	80	79 2	2.60	69	C	12.25	0.00	12.25	308	0	308	4.00 3	29 0.	00 3.29	0.00	4.30		0.00		0.00	0.00	2.60	12.25	4.66	0.00	0.00	0.00	7.95	7.95	109.00	250	0.28 31	.46 0.6	j4 23
Marcel	79	76 4	1.22	93	C	16.47	0.00	16.47	401	0	401	4.00 4	29 0.	00 4.29	0.00	4.30		0.00		0.00	0.00	4.22	16.47	6.26	0.00	0.00	0.00	10.55	10.55	104.00	250	0.28 31	.46 0.6	<i>i</i> 4 20
Blais	77	76 2	2.05 9.02	45	0	2.05	9.02	11.07	45	0	45	4.00 0	48 0.	00 0.48	0.00	4.30		0.00		0.00	0.00	2.05	2.05	0.78	9.02	9.02	3.43	1.26	4.69	100.50	250	0.31 32	.97 0.6	,7 28
Blais Blais and Jeanne D'Arc	76	75 2 46 0	2.10	27	(20.62	9.02	29.64	473	0	473	3.99 5	04 0. 19 0	00 5.04	0.00	4.30		0.00		0.00	0.00	2.10	20.62	7.84	0.00	9.02	3.43	12.88	16.30	85.50	250	0.30 32	.60 0.6	<u>6 16</u>
Castlebeau	67	40 0 66 2	2 85	66		21.10	0.00	2 85	400	0	400	4 00 0	71 0	00 0.71	0.00	4.30		0.00		0.00	0.00	2.85	21.10	1.08	0.00	9.02	0.00	1 79	10.04	91.00	250	0.30 32	57 0.0	6 30
Castlebeau	66	56		0		2.85	0.00	2.85	66	0	66	4.00 0	71 0.	00 0.71	0.00	4.30		0.00		0.00	0.00	0.00	2.85	1.08	0.00	0.00	0.00	1.79	1.79	110.00	250	0.30 32	.57 0.6	36 30
Castlebeau @ St. Jean E	3a 56	55		0	0	2.85	0.00	2.85	66	0	66	4.00 0	71 0.	00 0.71	0.00	4.30		0.00		0.00	0.00	0.00	2.85	1.08	0.00	0.00	0.00	1.79	1.79	112.00	250	0.30 32	.52 0.6	36 30
St. Jean Baptiste	55	54 6	6.40	264	C	9.25	0.00	9.25	330	0	330	4.00 3	53 0.	00 3.53	0.00	4.30		0.00		0.00	0.00	6.40	9.25	3.52	0.00	0.00	0.00	7.04	7.04	92.50	250	0.28 31	.47 0.6	34 24
St. Jean Baptiste	54	53 2	2.50	42	C) 11.75	0.00	11.75	372	0	372	4.00 3	98 0.	00 3.98	0.00	4.30		0.00		0.00	0.00	2.50	11.75	4.47	0.00	0.00	0.00	8.44	8.44	84.00	250	0.28 31	.65 0.6	54 23
St. Jean Baptiste	53	51 0).78	15	C	12.53	0.00	12.53	387	0	387	4.00 4	.14 0.	00 4.14	0.00	4.30		0.00		0.00	0.00	0.78	12.53	4.76	0.00	0.00	0.00	8.90	8.90	66.00	250	0.28 31	.48 0.6	j4 22
St. Jean Baptiste @ Blai	s 51 :	50 0).00	0	C	12.53	0.00	12.53	387	0	387	4.00 4	.14 0.	00 4.14	0.00	4.30		0.00		0.00	0.00	0.00	12.53	4.76	0.00	0.00	0.00	8.90	8.90	122.00	250	0.30 32	.57 0.6	<i>.</i> 6 23
St. Augustine	74	73 1	.05	26	0	0 1.05	0.00	1.05	26	0	26	4.00 0	28 0.	00 0.28	0.00	4.30		0.00		0.00	0.00	1.05	1.05	0.40	0.00	0.00	0.00	0.68	0.68	95.00	250	0.30 32	.57 0.6	<u>6 31</u>
St. Augustine	73	72		0		1.05	0.00	1.05	26	0	26	4.00 0	28 0.	00 0.28	0.00	4.30		0.00		0.00	0.00	0.00	1.05	0.40	0.00	0.00	0.00	0.68	0.68	95.00	250	0.30 32	.57 0.6	6 31 36 31
St. Augustine @ Dollard	71	70		0		0 1.05	0.00	1.05	20	0	20	4.00 0	28 0.	00 0.28	0.00	4.30		0.00		0.00	0.00	0.00	1.05	0.40	0.00	0.00	0.00	0.68	0.68	90.00	250	0.30 32	.57 0.6	36 31
Dollard	70	69 2	2.25	75	0	3.30	0.00	3.30	101	0	101	4.00 1	08 0.	00 1.08	0.00	4.30		0.00		0.00	0.00	2.25	3.30	1.25	0.00	0.00	0.00	2.33	2.33	101.50	250	0.34 34	.67 0.7	71 32
Dollard	69	68		0	C	3.30	0.00	3.30	101	0	101	4.00 1	08 0.	00 1.08	0.00	4.30		0.00		0.00	0.00	0.00	3.30	1.25	0.00	0.00	0.00	2.33	2.33	100.00	250	0.28 31	.47 0.6	54 2 9
Dollard @ St. Jean Bapt	ist 68	50 3	3.22	66	C	6.52	0.00	6.52	167	0	167	4.00 1	79 0.	00 1.79	0.00	4.30		0.00		0.00	0.00	3.22	6.52	2.48	0.00	0.00	0.00	4.26	4.26	98.00	250	0.28 31	.50 0.6	54 27
	50 4	48		0	C	0 19.05	0.00	19.05	554	0	554	3.95 5	85 0.	00 5.85	0.00	4.30		0.00		0.00	0.00	0.00	19.05	7.24	0.00	0.00	0.00	13.09	13.09	41.00	250	0.34 34	.87 0.7	'1 21
	48	47 3	3.72	72	0	22.77	0.00	22.77	626	0	626	3.92 6	56 0.	00 6.56	0.00	4.30		0.00		0.00	0.00	3.72	22.77	8.65	0.00	0.00	0.00	15.22	15.22	74.00	250	0.28 31	.53 0.6	4 16
	47 4	46		0	0	22.77	0.00	22.77	626	0	626	3.92 6	56 0.	00 6.56	0.00	4.30		0.00		0.00	0.00	0.00	22.77	8.65	0.00	0.00	0.00	15.22	15.22	80.00	250	0.28 31	.47 0.6	4 16
	40 45	45 44 1	91 0.10	69	E E E E E E E E E E E E E E E E E E E	3 45.78	9.02	52.69	1114	6	1114	3.77 11	23 0. 86 0	00 11.23	0.00	4.30		0.00		0.00	0.00	1 91	43.07	17.40	0.00	9.02	3.43	27.90	31.32	78.50	300	0.24 40	.99 0.0	<u> </u>
	44	32 2	2.01	78	8	3 47.79	9.12	56.91	1261	14	1275	3.73 12	57 0.	14 12.71	0.00	4.30		0.00		0.00	0.00	2.01	47.79	18.16	0.00	9.12	3.47	30.73	34.34	109.50	300	1.20 105	.89 1.5	50 71
	32	31 4	1.78 32.66	183		3 52.57	41.79	94.36	1444	16	1460	3.69 14	24 0.	16 14.40	0.00	4.30	4.60	4.60		0.00	0.00	9.38	57.17	21.72	32.66	41.79	15.88	35.96	52.00	102.70	300	0.25 48	.56 0.6	39 -7
	31	30 1	.51 0.11	45	55	5 54.08	41.90	95.98	1489	71	1560	3.67 14	60 0.	70 15.30	0.00	4.30		4.60		0.00	0.00	1.51	58.68	22.30	0.11	41.90	15.92	36.90	53.52	24.50	300	0.91 92	.26 1.3	31 38
	30	28		0	C	54.08	41.90	95.98	1489	71	1560	3.67 14	60 0.	70 15.30	0.00	4.30		4.60		0.00	0.00	0.00	58.68	22.30	0.00	41.90	15.92	36.90	53.52	23.30	300	1.76 128	.12 1.8	31 7 4
	28 F	PS2		0	C	62.81	83.52	146.33	1747	131	1878	3.61 16	85 1.	27 18.11	0.00	4.30		29.60		1.70	0.00	0.00	75.11	28.54	0.00	83.52	31.74	45.39	78.39	6.00	300	1.00 96	.70 1.3	57 18
PS1 Drainage Area																																		
From PS2 Notre Dame	10	9		0	C	62.81	83.52	146.33	1747	131	1878	3.61 16	.85 1.	27 18.11	0.00	4.30	1.00	30.60		1.70	0.00	1.00	76.11	28.92	0.00	83.52	31.74	45.77	78.77	64.40	400	0.10 64	.62 0.5	,1 -14
Notre Dame	9	8 15	5.00	214	0	87.11	85.21	172.33	2064	434	2498	3.51 19	36 4.	07 23.43	0.00	4.30	1.00	31.60		1.70	0.00	16.00	101.41	38.54	0.00	85.21	32.38	57.90	94.35	112.70	400	0.19 90	.32 0.7	2 -4
Notre Dame	8	<u>/ 1</u>	.20	30		88.31	85.21	1/3.53	2094	434	2528	3.50 19	02 4. 98 4	07 23.69	0.00	4.30		31.60		1.70	0.00	1.20	102.61	38.99	0.00	83.52	31.74	58.61	94.41	11.00	400	0.16 84	.24 0.6	<u>/ -10</u>
Notre Dame	6	5 1	.11 0.52	30	16	5 93.74 5 94.85	93.74	189.11	2203	437	2090	3.48 21	22 A	20 25 42	0.00	4.30		31.60		1.70	0.00	0.43	109.04	41.00	0.00	84 04	31.93	62.03	98.83	111 50	400	0.14 78	.84 0.6	30 -21
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	TWP	Ident																																				_
LOCATI	ON							RESIDE	ENTIAL ARE	EA AND POP	ULATION							INDUST	RIAL	CO	MMERCIAL	INSTITUT	TIONAL	I+C+I		I	INFILTRATIO	ON			τοται		í		PIPE			
STREET	From	То	EXISTIN	G FUTUR	E EXISTING	FUTURE		1	CUM	IULATIVE	T	T	PEAK	EXISTING	FUTURE	EXISTING + FUTURE	AREA	ACCU.	PEAK	AREA	ACCU.	AREA	ACCU.	PEAK	EXISTING	ACCU. EXISTING	EXISTING INFILT.	FUTURE	ACCU. FUTURE	FUTURE INFILT.	EXISTIN	TOTAL FUTURE	LENGTH	DIA.	SLOPE	CAP.	VEL.	REMAIN
	МН	МН	AREA (ha)	AREA (ha)	POP.	POP.	EXISTING AREA (ha	G FUTURE a) AREA (ha)	EXISTINO + FUTUR AREA (ha		FUTURE	EXISTING + FUTURE	FACT.	PEAK FLOW (I/s)	PEAK FLOW	PEAK FLOW (I/s)	(ha)	AREA (ha)	FACTOR	(ha)	AREA (ha)	(ha)	AREA (ha)	FLOW (I/s)	AREA (ha)	AREA (ha)	FLOW (I/s)	AREA (ha)	AREA (ha)	FLOW (I/s)	FLOW (I/s)	FLOW (I/s)	(m)	(mm)	(%)	(FULL)	(FULL) (m/s)	CAP. (I/s)
Notre Dame	5	4	()	20	24		0 96.0	94.26	190.31	2307	452	2759	3 47	(C) 7 21 42	2 4 20	25.62	(0.00	4.30	()	31.60	(1 70	0.00	1.20	110.35	41 93	0.00	93 74	35.62	63.36	103.18	112.00	400	0.24	101 11	0.80	-7
Notre Dame	4	3	1.6	35	12		0 97.7	70 94.26	5 191.96	2319	452	2771	3.47	21.52	4.20	25.72		0.00	4.30		31.60		1.70	0.00	1.65	112.00	42.56	0.00	84.04	31.93	64.08	100.10	120.00	400	0.11	68.81	0.55	-31
Notre Dame	3	2	1.9	91 3.1	7 12		3 99.6	61 97.43	3 197.04	1 2331	455	2786	3.47	21.62	4.22	25.84		0.00	4.30		31.60		1.70	0.00	1.91	113.91	43.29	3.17	96.91	36.82	64.91	105.95	85.00	400	0.19	90.35	0.72	-15
Notre Dame	2	1	3.7	75	36		0 103.3	97.43	3 200.79	2367	455	2822	3.46	6 21.93	4.21	26.14		0.00	4.30		31.60		1.70	0.00	3.75	117.66	44.71	0.00	84.04	31.93	66.64	102.79	148.00	400	0.17	86.95	0.69	-15
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Couth and North Foot of							_		_																						0.00		ļ!					ı ——
PS1	206	PS1	3.4	1 33.5	2 132	14	1 3.4	33.52	36.93	3 132	141	273	4.00	1.41	1.51	2.92		0.00	4.30		0.00		0.00	0.00	3.41	3.41	1.30	33.52	33.52	12.74	2.71	16.95	56.00	400	0.26	106.70	0.85	89
At PS1							145.6	6 172.18	3 317.83	3 4272	596	4868	3	37	5	42		0	5		32		2	0	0	160	61	0	159	60	98	164.32	0	400	0	104	1	-60
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									DESI	GN PARAME	TERS											Designe	ed by:		PROJECT:		Russell W	ater & W	Vastewate	r Master	Plan							
									PS8 Area	/h 0.1354074	1 ha											GAC																
Existing Average Daily F	low =		231	L/cap/d	ау	Harmon "K"	1		PS7 Area	/⊢ 0.3060456	6 ha																											
Future Average Daily Flo)W=		231	L/cap/d	ау				PS6 Area	/h 0.0745835	5 ha		Existing	Extraneous F	low =			0.38	L/s/ha			Checked	d by:		LOCATION:		Embrun S	anitary S	Sewage Sy	/stem								
									PS4 Area	/h 0.2657714	1 ha		Future E	xtraneous Flo	= WC			0.38	L/s/ha																			
Industrial Peak Factor =			2						PS5 Area	/h 0.084719) ha		Minimum	velocity =				0.76	m/s			Dura Da	4		Drain at Na							Deter	Aug 15					
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Appendix F

PUBLIC NOTICES

Notice of Study Commencement

Municipal Class Environmental Assessment Study Master Plan Update for Sewage and Water, Recreation, and Transportation

The Study:

The Township of Russell has initiated an Environmental Assessment Study to update certain components of its 2005 Master Plan, more particularly sewage and water, recreation, and transportation. The study area is the geographical boundaries of the Township of Russell.

The intent of this undertaking is to update the findings of the 2005 Master Plan to account for development in the urban sectors since then and to identify new infrastructure or improvements to existing infrastructure to accommodate future development over a 20 year planning period.

The Process:

The Study will be conducted in accordance with the planning and design process for 'Schedule B' projects as outlined in the Municipal Engineers Association "Municipal Class Environmental Assessment," (October 2000, as amended 2007 & 2011), which is approved under the Ontario Environmental Assessment (EA) Act. The Class EA process includes public/external agency consultation, an evaluation of alternative solutions, an assessment of potential impacts associated with the proposed improvements and development of measures to mitigate identified impacts.

Comments:

Public participation will form an integral part of the Class EA study to ensure that the ongoing concerns of the public and affected groups within the study area are identified, documented and assessed. A minimum of one public information center will be held for each component and advertised in advance to enable the public to meet the project team and to provide feedback. For more information, or if you would like to be placed on the study's mailing list, please contact:

For the transportation and sewage / water section: Jonathan Bourgon, Manager Infrastructure Services 857 Route 400 Russell ON K4R 1E5 Tel: 613- 443-5078 (222) E-mail: jonathanbourgon@russell.ca For the Recreation section: Mrs. Celine Guitard, Director Parks and Recreation 717 Notre-Dame Embrun ON K0A 1W1 Tel: 613-443-3066 (2327) E-mail: celineguitard@russell.ca

Appendix G

PUBLIC INFORMATION CENTRE PRESENTATION BOARDS



WELCOME TO THE PUBLIC INFORMATION CENTRE

Township of Russell Water and Wastewater Master Plan Update October 13, 2015







Township of Russell – Water and Wastewater Master Plan Update **PROJECT OVERVIEW**



STUDY AREA

- \rightarrow Limoges and the Highway 417 Industrial Park.
- \rightarrow
 - and Marionville
 - Industrial Park
 - _ 2031
- \rightarrow

The Study Area encompasses the entire Township of Russell, including the communities of Russell, Embrun, Marionville,

This project is an update to the Water and Wastewater Master Plan completed in 2003 and is based on the following objectives:

Provide reliable water and wastewater services to accommodate the projected residential, commercial and industrial development in the communities of Russell, Embrun

Provide water and wastewater servicing to the Highway 417

Establish the Township's water and wastewater systems infrastructure requirements for the Study Area to the year

The Master Plan involves an evaluation of the technical, environmental, social and cultural impacts of alternatives to address the system constraints and provide capacity for growth.







Township of Russell – Water and Wastewater Master Plan Update CLASS ENVIRONMENTAL ASSESSMENT PROCESS

The planning of major municipal projects or activities is subject to the Ontario Environmental Assessment (EA) Act, R.S.O. 1990, and requires the Proponent to complete an EA, including an inventory and description of the existing environment in the area affected by the proposed activity.

The Class EA process was developed by the Municipal Engineers Association (MEA), in consultation with the Ministry of the Environment (MOE), as an alternative method to Individual Environmental Assessments for recurring Municipal projects that were similar in nature, usually limited in scale, with a predictable range of environmental effects, and which were responsive to mitigating measures. The Municipal Class EA process applies to municipal infrastructure projects including roads, water and wastewater projects, etc.

The Class EA planning process as documented in the MEA Municipal Class EA document (October 2000, amended in 2007 & 2011) includes the following five phases:

Municipal Class EA Process

Phase 1 Problem or Opportunity

Phase 2 Alternative Solutions

Phase 3 Alternative Design Concepts for **Preferred Solution**

This Master Plan addresses Phases 1 and 2 of Municipal Class EA process. The Master Plan outlines a framework for future works and infrastructure requirements over the planning horizon (to 2031). It provides the context for the implementation of projects which are identified as part of the Master Plan.

This Master Plan follows Approach #1 as defined in the MEA Municipal Class EA document.It provides a broad level of assessment requiring more detailed investigation be completed at the project-specific level for the projects identified as Schedule 'B' and Schedule 'C'.

Phase 4 Environmental Study Report

Phase 5 Implementation

Public Information Centre Objectives

- \rightarrow
- \rightarrow Process)
- Receive feedback on the alternatives considered, including the evaluation process \rightarrow completed to identify the recommended alternative \rightarrow
- Satisfy the public consultation requirements of the Class EA Process

Schedule "B" Class EA Process



Provide background information and define the study need (Phase 1 of Class EA Process) Present the evaluation approach and evaluation of alternatives (Phase 2 of Class EA







Township of Russell – Water and Wastewater Master Plan Update **GROWTH PROJECTION AND GROWTH AREAS**



Marionville

WHERE ARE THE GROWTH AREAS

- The main growth areas are: \rightarrow
 - The communities of Russell, Embrun _ and Marionville
 - The Industrial Park ----
- \rightarrow The village of Limoges is serviced by Nation Municipality and therefore not included in the Master Plan Update.

NITY	2014	2016	2021	2026	2031
	5,102	5,847	6,930	7,287	7,494
	6,717	7,807	9,645	11,752	14,245
lle	362	370	428	428	428
	12,181	14,024	17,003	19,467	22,167







Township of Russell – Water and Wastewater Master Plan Update WATER SYSTEM SERVICING - EXISTING

- The Russell water system consists of 65 km of watermains, three water towers, an in-ground reservoir and three booster pumping stations.
- → The villages of Russell, Embrun and Marionville system are all interconnected and supplied water from the City of Ottawa through the Eadie Rd. Metering Station.
- → The current agreement with the City of Ottawa allows for the supply of a maximum of 164.7 L/s (11,860 m³/d).
- → In 2010, the Embrun/Marionville WTP was decommissioned. However, both the linear infrastructure and process infrastructure still remains.
- → In 2014 the Township's maximum day water demand was 3,826 m³/d.
- → The 417 Industrial Park is currently not connected to the Township's water system.



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Township of Russell – Water and Wastewater Master Plan Update WATER DEMAND PROJECTIONS

WATER SYSTEM DESIGN CRITERIA

Design Criteria	Residential Values	Industrial Value
Average Day Demand	221 L/cap/d	10 m ³ /h
Maximum Day Peaking Factor	1.53	2.0
Peak Hour Factor	1.9	2.7



2031. Additional capacity required to achieve build-out.

Water supply capacity is sufficient beyond






Township of Russell – Water and Wastewater Master Plan Update WATER SYSTEM SERVICING ALTERNATIVES





CONTROL OF

Township

W2 – New watermain connection to the Eadie Rd. Metering Chamber, New Booster Pumping Station and Reservoir in the Industrial Park



Township of Russell – Water and Wastewater Master Plan Update WATER SYSTEM SERVICING ALTERNATIVES

W3 – New watermain connection to the Embrun Reservoir.





W4 – Recommission the Embrun/Marionville WTP and new watermain from the Embrun Reservoir/PS to the Industrial Park.





Township



Township of Russell – Water and Wastewater Master Plan Update WASTEWATER SYSTEM SERVICING - EXISTING

- \rightarrow The Villages of Russell and Embrun are serviced by separate wastewater systems.
- → The Russell Wastewater System consists of a network of gravity sewers, three sewage pumping stations and the Russell Lagoon Facility.
- → The Embrun Wastewater System consists of a network of gravity sewers, eight sewage pumping stations and the Embrun Lagoon Facility.
- → The 417 Industrial Park, Limoges and Marionville do not have municipal wastewater systems. As part of the Master Plan, it is intended to provide wastewater servicing to the Industrial Park.
- → In 2014 the Russell Wastewater System average day flows were 905 m³/d, and the Embrun Wastewater System average day flows were 1,435 m³/d.



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Township of Russell – Water and Wastewater Master Plan Update WASTEWATER FLOW PROJECTIONS – RUSSELL

WASTEWATER SYSTEM DESIGN CRITERIA - RUSSELL		
Design Criteria	Residential Values	Industrial Par Values
Average Day Flow	238 L/cap/d	10 m ³ /ha/d
Peak Dry Weather Flow Peak Flow Factor	Harmon Peaking Factor	2.5
Peak Extraneous Flow Allowance	32.8 m ³ /ha/d	



Lagoon expansion required prior to 2031.







Township of Russell – Water and Wastewater Master Plan Update WASTEWATER FLOW PROJECTIONS – EMBRUN

WASTEWATER SYSTEM DESIGN CRITERIA - EMBRUN

Design Criteria	Residential Values
Average Day Flow	231 L/cap/d
Peak Dry Weather Flow Peak Flow Factor	1.53
Peak Extraneous Flow Allowance	32.8 m ³ /ha/d

Lagoon capacity is sufficient beyond 2031. Additional capacity required to achieve build-out.







Township of Russell – Water and Wastewater Master Plan Update WASTEWATER SYSTEM SERVICING ALTERNATIVES

WW1 – Do Nothing



WW2 – Growth within Russell and Embrun Only. No wastewater servicing to Industrial Park



Township of Russell – Water and Wastewater Master Plan Update WASTEWATER SYSTEM SERVICING ALTERNATIVES









Township of Russell – Water and Wastewater Master Plan Update **EVALUATION OF ALTERNATIVES Evaluation Methodology & Criteria**

Evaluation Approach

For each evaluation criterion and each alternative, the potential effects on the environment will be identified and evaluated relative to the other alternatives on a three-point scale:

- \rightarrow Least preferred
- \rightarrow Less preferred
- \rightarrow Most preferred



- Surface water and groundwater impacts
- Watercourse crossings and fisheries
- Impact on natural heritage features / vegetation

ECONOMIC VIABILITY

- Capital Costs
- Operation and Maintenance (including energy) Costs





TECHNICAL CONSIDERATIONS

- Ease of construction and site access Soil/Ground conditions
- Impact on operations during construction
- Ease of integration with existing wastewater infrastructure (i.e. size and compatibility)
- Location and impacts to other utilities
- Road / Railway crossings
- Ease of operation
- Does not affect ability to expand facility
- Reduce vulnerabilities to future climate changes

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Township





Township of Russell – Water and Wastewater Master Plan Update **EVALUATION OF ALTERNATIVES – WATER SYSTEM**



• New watermain to be constructed to feed Industrial Park.

 New reservoir and pumping station to be constructed within the Industrial Park.

• No other upgrades required to service growth within Russell, Embrun and Marionville.

Provide servoir Park and ection to Embrun R Industrial Conne S

W3

- New watermain to constructed to feed Industrial Park.
- New reservoir and pumping station to be constructed within the Industrial Park.
- New watermain connection from Industrial Park to the Embrun Reservoir to provide security of supply.
- No other upgrades required to service growth within Russell, Embrun and Marionville.

Less Preferred

Preferred

be

service al Park. to stri WTP Indus Embrun/Marionville the sion

- Recommission the Embrun/Marionville WTP.
- Additional investigation required assess suitability of to groundwater from WTP.
- New watermain from Embrun Reservoir to Industrial Park.
- Elevated tank required at Industrial Park to provide storage and fire protection.
- No other upgrades required to service growth within Russell, Embrun and Marionville.

Least Preferred







Township of Russell – Water and Wastewater Master Plan Update **EVALUATION OF ALTERNATIVES – WASTEWATER SYSTEM**

WW1 – Do Nothing	 Do Nothing No upgrades or expansion to existing system. Does not permit the development of the Industrial Park. Limits growth within Russell and Embrun.

Embrun **Russell and** to Limited ing Servici WW2

 Upgrades to sanitary pumping stations within Russell and Embrun.

- Does not permit the development of the Industrial Park.
- Limits growth to Russell and Embrun.

Less Preferred

Park and Embrun – Servicing of Industrial P.
 Areas within Russell and F. th 3 Growt



 Upgrades sanitary to pumping stations within Russell and Embrun.

 New sewage pumping station in Industrial Park discharging to Russell Lagoon Facility.

Expansion of Russell Lagoon Facility

Most Preferred







Township of Russell – Water and Wastewater Master Plan Update WASTEWATER SYSTEM SERVICING ALTERNATIVES Village of Russell



New forcemain from 417 Industrial Park

Upgrades to Russell Lagoons







Township of Russell – Water and Wastewater Master Plan Update WASTEWATER SYSTEM SERVICING ALTERNATIVES Village of Embrun



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Township of Russell – Water and Wastewater Master Plan Update PREFERRED SERVICING APPROACH

WATER

Project Name Industrial Park Servicing Secondary Watermain Loop - Embrun

Industrial Park Servicing Russell Lagoon Expansion Russell SPS 1 Upgrade WASTEWATER Embrun SPS 1 Upgrade Embrun SPS 2 Upgrade Embrun SPS 3 Upgrade Embrun SPS 7 Upgrade

The projects identified by the Master Plan are limited to those related to servicing growth. Projects related to the renewal/replacement of aging infrastructure are considered as part of the Township's Asset Management Strategy.

The timing of the projects is dependent on the timing of development proposals.

Additional planning (Class Environmental Assessment) studies are required for the abovementioned projects. Class Environmental Assessments require public consultation before proceeding to implementation.

Project Name









Township of Russell – Water and Wastewater Master Plan Update NEXT STEPS

Input received at this PIC will be used to refine the preferred water and wastewater servicing strategy.

Consultation with stakeholders and the MOECC will also take place.

Based on feedback obtained during Public Consultation, the preferred servicing strategy will be defined and the Master Plan Report will be completed and issued for 30 day public review.

A Notice of Study Completion will be published in the local newspaper.

The Master Plan will be the basis for the Township's Growth Management Strategy.



Contact for questions or comments:

Mr. Craig Cullen Executive Director, Infrastructure Services Township of Russell craigcullen@russell.ca

Please return your completed comment sheets to any member of the project team by November 13, 2015.





