VILLAGE OF LIMOGES
Potable Water and Wastewater Master Plan

Prepared for

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1.0 INTRODUCTION

Delcan Corporation has been retained by Golder Associates on behalf of the Nation Municipality to provide professional engineering services to complete a potable water and wastewater master plan for the Village of Limoges.

The Village of Limoges has approximately 3,200 residents with 80% of its population located in The Nation Municipality and the other 20% located in the Township of Russell. According to the United Counties of Prescott and Russell Official Plan, future growth is expected to increase the population to 10,900 by 2026.

In the summer of 2010, the Golder/Delcan team completed a capacity review of the potable water and wastewater systems for the Village of Limoges and prepared the report titled "VILLAGE OF LIMOGES POTABLE WATER AND WASTEWATER SYSTEMS CAPACITY REVIEW", dated September 2010. This report recommended the completion of a hydraulic review for both systems.

In May 2011, the report titled "VILLAGE OF LIMOGES POTABLE WATER AND WASTEWATER SYSTEMS HYDRAULIC REVIEW", described the existing hydraulic conditions of both systems with respect to the existing design documents. The study concluded that both the water supply and wastewater treatment systems are near capacity and inadequate to support future growth within designated areas.

To address the growth potential and the capacity constraints, The Nation Municipality has undertaken a master planning process to develop integrated long range infrastructure plans for existing and future land uses. Although the Village of Limoges is within the Nation Municipality and the Township of Russell it is The Nation Municipality that operates the potable water and wastewater systems through existing agreements.

1.1 Master Planning Process

This study is being completed in accordance with requirements of the Municipal Class Environmental Assessment, June 2007 (amended in 2011) which is an approved process under the *Environmental Assessment Act.* Master Plans are long range plans that integrate the various infrastructure requirements for the overall system within the Municipal Class Environmental Assessment (MCEA) Process. A Master Plan encompasses separate related projects that are dispersed over an area which are individually implemented over a period of time and will develop an overall strategy for implementing the project requirements. The individual projects that are recommended under a Master Plan can be classified as either Schedule A, Schedule B or Schedule C under the MCEA process. The Limoges Water and Wastewater Master Plan is comprised of Schedule B and Schedule C projects and will fulfill Phase 1 to Phase 4 of the MCEA process:

- Phase 1: Problem or Opportunity
- Phase 2: Existing Conditions and Alternative Solutions
- Phase 3: Alternative Design Concepts for the Preferred Solution
- Phase 4: Environmental Assessment Reporting
- Phase 5: Implementation

1.1.1 Objectives

The objectives of this study consist of the following items:

- To review available background information on the potable water and wastewater systems that service the Village of Limoges located in The Nation Municipality;
- To evaluate the remaining available capacity of both systems that is not currently allocated for existing and future development; and
- To determine additional required infrastructure to service future growth in the Village.

2.0 PROJECT NEED AND JUSTIFICATION

2.1 Population and Land Use

2.1.1 Existing Development Village of Limoges

A primary land use survey (Appendix A) was undertaken in January 2011 (Delcan, 2011a) which identified all existing development within the serviced areas and distinguished between occupied and under construction (UC) (not occupied) development. The purpose of the survey was to support the master planning process by assessing the amount and type of development that is connected to the water and wastewater systems and to identify future development capacity of the planned serviced areas within Limoges. The results of the land use survey are shown in Figure 2-1.

The land use survey shows residential development broken down into low density (1 and 2 unit) dwellings, medium density (townhouse) dwellings, and high density (apartment) dwellings. Industrial/commercial/institutional (ICI) development and open spaces are also indicated in the survey. The land use survey outlined the designated Urban Policy Area in purple, and the designated Trade and Industry Policy Area green (Figure 2-1).

Table 2-1 summarizes the required data for both the existing serviced development and the future serviced development at full “build-out” within the areas that are designated Urban Policy Area and Trade and Industry Policy Area. It also includes the corresponding data for the existing serviced development in the rural area. For residential development, Table 2-1 shows the number of dwelling units broken down into low, medium and high densities. For the existing industrial/commercial/institutional (ICI) development, the data is provided by land area.

Overall there are 719 low density and 56 high density residential units and 272,119 m^2 of ICI land serviced by both the municipal water and sewer services. There are an additional 400 low density residential units and an additional 27,675 m^2 of ICI land serviced by the municipal water supply service. There is no existing development serviced by sewers only. Most of the fully serviced development is located in The Nation Municipality portion of the Urban Policy Area designation.

2.1.2 Future Development Village of Limoges

For the purpose of undertaking the master plan, the area to be fully serviced constitutes the designated Urban Policy Area and the designated Trade and Industry Policy Area, as well as those existing uses within the rural area for which full urban services have been approved.

2.1.3 Urban Policy Area

The calculation of development capacity within the Urban Policy Area is based on residential development, with a “built-in” allowance for associated small-scale open space and institutional uses. In the case of the Russell Township portion, this was done to reflect the Official Plan land use designations and, in the case of The Nation Municipality portion, this was done to reflect the location of the Future Development lands on the periphery of the Village away from the core area and main roads where ICI development would normally be expected to occur. Further, it was concluded that any future ICI development in the Urban Policy Area will be small-scale infill and redevelopment projects that will have a negligible impact on the Water and Wastewater Master Plan.

Table 2-1: Dwelling Units and ICI Gross Land Area

Land Use	Sewer and Water					Water Only					Sewer Only					Total Residential Units	Total ICI Land Area (m^2)
Residential	Low Density (units)	Medium Density (units)	High Density (units)	Total Units	Land Area (m^2)	Low Density (units)	Medium Density (units)	High Density (units)	Total Units	Land Area (m^2)	Low Density units	Medium Density units	High Density units	Total Units	Land Area (m^2)		
NATION MUNICIPALITY																	
Urban Policy Area																	
Existing Residential	588	0	56	644	na	58	0	0	58	na	0	0	0	0	na		
Approved Residential[1]	136	18	39	193	na	3	0	0	3	na	0	0	0	0	na		
Proposed Residential[2]	422	153	284	859	na	0	0	0	0	na	0	0	0	0	na		
Vacant Residential Land[3]	198	49	106	353	na	0	0	0	0	na	0	0	0	0	na		
Residential Infill[4]	50	50	50	150	na	0	0	0	0	na	0	0	0	0	na		
Subtotal	1,394	270	535	2,199	na	61	0	0	61	na	0	0	0	0			
Existing ICI[5]	na	na	na	na	66,110	na	na	na	na	0	na	na	na	na	0		
Trade and Industry Policy Area																	
Existing Residential	0	0	0	0	na	3	0	0	3	na	0	0	0	0	na		
Existing ICI	na	na	na	na	36,259	na	na	na	na	27,675	na	na	na	na	0		
Future ICI	na	na	na	na	418,920	na	na	na	na	0	na	na	na	na	39,000		
Subtotal	0	0	0	0	455,179	3	0	0	3	27,675	0	0	0	0	39,000		
Rural Policy Area																	
Existing Residential	0	0	0	0	na	242	0	o	242	na	0	0	0	0	na		
Future Residential	0	0	0	0	na	0	0	0	0	na	181	0	0	181	na		
Existing Calypso[6]	na	na	na	na	222,023	na	na	na	na	na	na	na	na	na	na		
Future Calypso[7]	na	na	na	na	148,015	na	na	na	na	na	na	na	na	na	na		
Existing ICI	na	na	na	na	139,750[8]	na	na	na	na	0	na	na	na	na	0		
Future ICI	na	na	na	na	0	na	na	na	na	0	na	na	na	na	0		
RUSSELL TOWNSHIP																	
Urban Policy Area																	
Existing Residential	100	0	0	100	na	37	0	0	37	na	0	0	0	0	na		
Approved Residential[1]	8	unknown	unknown	8	na	0	0	0	0	na	0	0	0	0	na		
Proposed Residential[2]	unknown	unknown	unknown	unknown	na	0	0	0	0	na	0	0	0	0	na		
Vacant Land[3]	677	169	363	1209	na	0	0	0	0	na	0	0	0	0	na		
Infill[4]	unknown	unknown	unknown	unknown	na												
Subtotal	786	169	363	1318	na	37	0	0	37	na	0	0	0	0	na		

1 Includes vacant lots and under construction (UC)
2 Includes pre-consultation development proposals
3 Based on density and unit distribution in recently approved and proposed developments
4 Infill allowance of 150 dwelling units, evenly distributed between low, medium and high density units
5 Excludes cemetery and future ICI development requires redevelopment of existing uses
6 Client has advised that 60% of allocated capacity is currently used which has been assumed to represent 60% of total lot area = 222,012 m2
7 Client has advised that 40% of allocated capacity is available for future expansion which has been assumed to represent 40% of total lot area = 148,015 m2
8 2 schools and nursing home
9 Does not include Calypso

Land Use	Sewer and Water					Water Only					Sewer Only					Total Residential Units	Total ICI Land Area (m^2)
Residential	Low Density (units)	Medium Density (units)	High Density (units)	Total Units	Land Area (m^2)	Low Density (units)	Medium Density (units)	High Density (units)	Total Units	Land Area (m^2)	Low Density units	Medium Density units	High Density units	Total Units	Land Area (m^2)		
Existing ICI	na	na	na	na	30,000	na	na	na	na	0	na	na	na	na	0		
Proposed ICI	na	na	na	na	74,665	na	na	na	na	0	na	na	na	na	0		
Subtotal	na	na	na	na	104,665	na	na	na	na	0	na	na	na	na	0		
Trade and Industry Policy Area																	
Existing Residential	0	0	0	0	na	0	0	0	0	na	0	0	0	0	na		
Existing ICI	na	na	na	na	0	na	na	na	na	0	na	na	na	na	0		
Future ICI	na	na	na	na	344,903												
Subtotal																	
Rural policy Area																	
Existing Residential	31	0	0	31	na	60	0	0	60	na	0	0	0	0	na		
Future Residential						2			2	na	0	0	0	0	na		
Existing ICI	na	na	na	na	0	na	na	na	na	0	na	na	na	na	0		
Future ICI	na	na	na	na	0	na	na	na	na	0	na	na	na	na	0		

TOTAL SERVICING SYSTEMS

Land Use	Sewer and Water					Water Only					Sewer Only					Total Residential Units	Total ICI Land Area (m^2)
Residential	Low Density (units)	Medium Density (units)	High Density (units)	Total Units	Land Area (m^2)	Low Density (units)	Medium Density (units)	High Density (units)	Total Units	Land Area (m^2)	Low Density units	Medium Density units	High Density units	Total Units	Land Area (m^2)		
Water Existing Uses	719	0	56		272,119[9]	400	0	0		27,675						**1,175**	**299,794**
Sewer Existing Uses	719	0	56		272,119[9]						0	0	0		0	**775**	**272,119**
Water Full Build-out	2,211	439	898		1,110,607[9]	405	0	0		27,675						**3,953**	**1,138,282**
Sewer Full Build-out	2,211	439	898		1,110,607[9]						181	0	0		39,000	**3.729**	**1,149,607**

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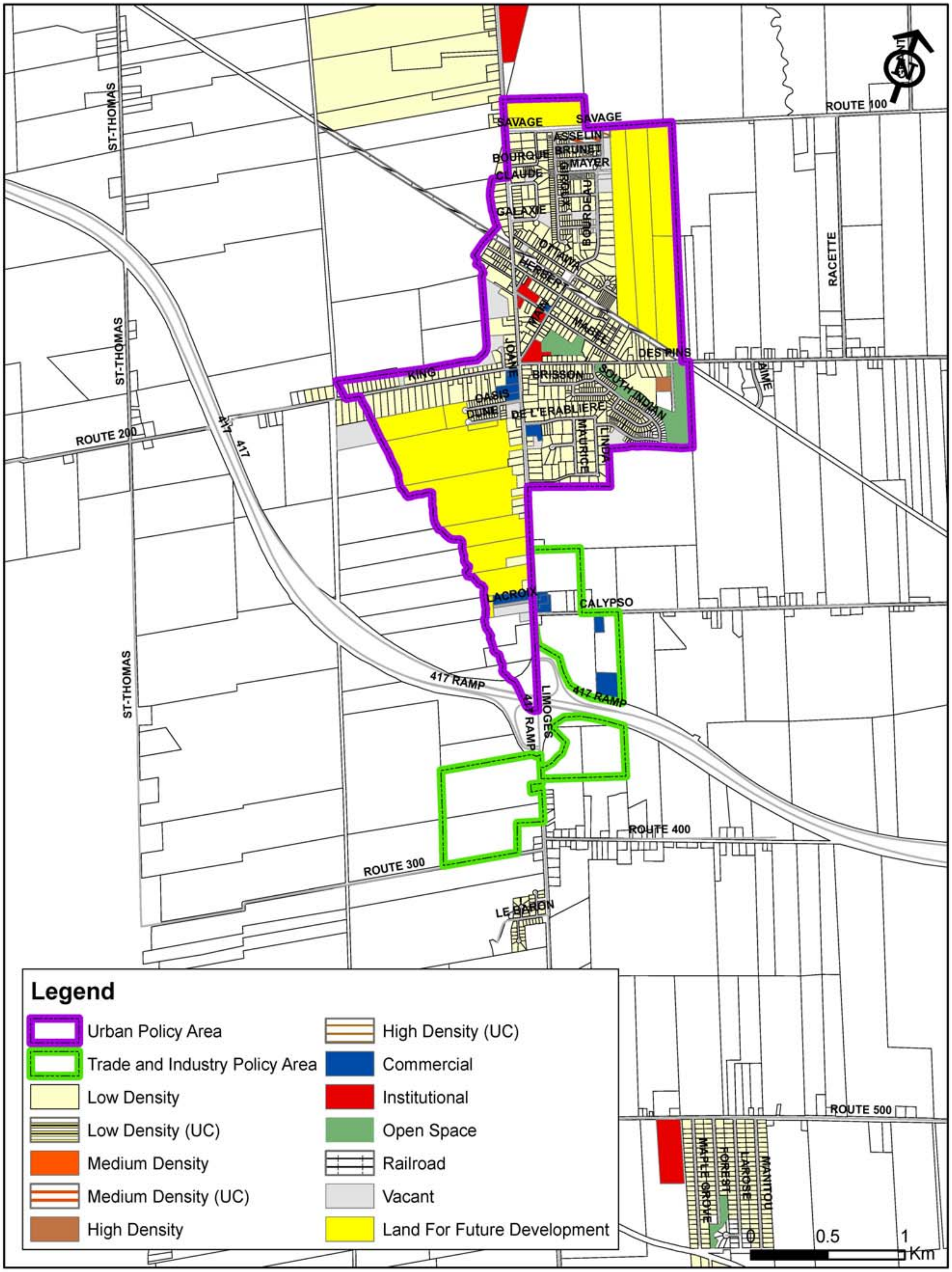
[1] *Includes vacant lots and under construction (UC)*
[2] *Includes pre-consultation development proposals*
[3] *Based on density and unit distribution in recently approved and proposed developments*
[4] *Infill allowance of 150 dwelling units, evenly distributed between low, medium and high density units*
[5] *Excludes cemetery and future ICI development requires redevelopment of existing uses*
[6] *Client has advised that 60% of allocated capacity is currently used which has been assumed to represent 60% of total lot area = 222,012 m^2*
[7] *Client has advised that 40% of allocated capacity is available for future expansion which has been assumed to represent 40% of total lot area = 148,015 m^2*
[8] *2 schools and nursing home*
[9] *Does not include Calypso*

Figure 2-1: Land Use Survey Results



It is projected (Table 2-2) that there will be 2,211 low density, 439 medium density and 898 high density dwelling units on full services (sewer and water), most of which is to be located in the Urban Policy Area. In total, it is estimated that there will be 3,953 dwelling units serviced by the municipal water supply system, and 3,729 dwelling units serviced by the municipal sewer system. The difference in the number of dwelling units connected to the two servicing systems is accounted for by residential development connected only to the water supply system or the sewer system, primarily in the rural area. No additional fully serviced or partially serviced residential development is proposed for the rural area.

Table 2-3 contains population projections based on the dwelling unit distribution contained in Table 2-2 and on the residential occupancy rate used in the Development Charges By-law of The Nation Municipality. Table 2-4 identifies the estimated population to be serviced by the municipal water supply system is 11,651 (3,953 dwelling units), and the estimated population to be serviced by the municipal sewer system is 10,889 (3,729 dwelling units).

In order to confirm that the dwelling unit distribution that was used in this analysis is appropriate, a second population projection was made using the Statistics Canada occupied dwelling unit rate. Table 2-4 contains population projections based solely on the total number of projected dwellings and the occupied dwelling rate, which results in projected populations of 11,266 to be serviced by the municipal water supply system, and 10,628 to be serviced by the municipal sewer system. While these projections are slightly lower than those contained in Table 2-2, they are similar and are considered to be reflective of a larger household size in new development, which tends to have a higher occupancy rate by younger families, in comparison with household sizes throughout the entire municipality. The projected populations for the purpose of master planning in the Urban Policy Area have been estimated to be 11,650 persons and 10,890 persons respectively for the municipal water and municipal sewer systems.

2.1.4 Trade and Industry Policy Area

The existing ICI development is located in the Urban Policy Area, the Trade and Industry Policy Area and the rural area. To date, very little ICI development has taken place in the Trade and Industry Policy Area. It is assumed that all future ICI development, with the exception of small-scale infill and redevelopment projects in the Urban Policy Area, will be located in the designated Trade and Industry Policy Area. There are 299,794 m^2 of developed ICI land serviced by the municipal water supply system and 272,119 m^2 of developed ICI land serviced by the municipal sewer system within Russell Township and the Nation Municipality. The total amounts of ICI land to be serviced by the municipal water supply and sewer systems at full “build-out” are 1,138,282 m^2 and 1,149,607 m^2, respectively (Table 2-1).

Table 2-2: Development Analysis Summary

Land Use	Sewer and Water					Water Only					Sewer Only					Total Residential Units	Total ICI Land Area (m^2)
Residential	Low Density (units)	Medium Density (units)	High Density (units)	Total Units	Land Area (m^2)	Low Density (units)	Medium Density (units)	High Density (units)	Total Units	Land Area (m^2)	Low Density (units)	Medium Density (units)	High Density (units)	Total Units	Land Area (m^2)		
TOTAL SERVICING SYSTEMS																	
Water Existing Uses	719	0	56	775	272,119	400	0	0		27,675						1,175	299,794
Sewer Existing Uses	719	0	56	775	272,119						0	0	0		0	775	272,119
Water Full Build-out	2,211	439	898	3,548	1,110,607	405	0	0		27,675						3,953	1,138,282
Sewer Full Build-out	2,211	439	898	3,548	1,110,607						181	0	0		39,000	3,729	1,149,607

Table 2-3: Estimated Population from Development Charges Dwelling Unity Occupancy Rates

Land Use	Sewer and Water				Water Only				Sewer Only				Total Residential Units	Total ICI Land Area (m^2)
Residential	Low Density (units)	Medium Density (units)	High Density (units)	ICI Land Area (m^2)	Low Density (units)	Medium Density (units)	High Density (units)	ICI Land Area (m^2)	Low Density (units)	Medium Density (units)	High Density (units)	ICI Land Area (m^2)		
Water Existing Uses	719	0	56	272,119	400	0	0	27,675					1,175	299,794
Sewer Existing Uses	719	0	56	272,119					0	0	0	0	775	272,119
Water Full Build-out	2,211	439	898	1,110,607	405	0	0	27,675					3,953	1,138,282
Sewer Full Build-out	2,211	439	898	1,110,607					181	0	0	39,000	3,729	1,149,607

Table 2-4: Estimated population from Statistics Canada Nation Municipality Occupied Dwelling

	Total Units	Total Population
Water: Existing Residential Uses	1,175	3,349
Sewer: Existing Residential Uses	775	2,209
Water: Full Residential Build-out	3,953	11,266
Sewer: Full Residential Build-out	3,729	10,628

[1]2.85 persons per unit

2.2 Potable Water and Wastewater Capacity Review

A review of the Potable Water and Wastewater Capacity in the Village of Limoges was undertaken (Delcan, 2010). The objectives of the report include:

- To review available background information on the potable water and wastewater systems that service the village of Limoges located in the Nation Municipality; and
- To establish the remaining available capacity of both systems that is not currently allocated for existing and future development.

2.2.1 Potable Water Capacity

Metered water usage records for 2009 and the first six months of 2010 were provided by The Nation Municipality. Population estimates and land use criteria were assigned to all residential users for the purposes of determining the average daily water consumption.

The average daily flow for residential users was calculated at 149 and 144 L/day/cap for 2009 and 2010, respectively. Historically, a value of 350 L/day/cap is used for the calculation of domestic flow.

Factors that may lead to lower flows include:

- authorized consumption (e.g., unmetered and unbilled consumption of water for fire-fighting and hydrant flushing);
- losses due to meter inaccuracies or unauthorized consumption; or
- losses due to leakage at water service lines, breaks or leakage on mains and hydrants/laterals or at storage facilities.

The running average Limoges Well Supply Flow for the years 2007, 2008, and 2009 was calculated based on MOE guidelines, to be 688 m^3/d. Based on a Maximum Day Factor equal to 1.75, the current Maximum Day Water Demand for Limoges is estimated to be 1204 m^3/d. Therefore, the Uncommitted Reserve Capacity (at maximum day demand) for the year ending 2009 is estimated to be 876 m^3/d or 42.1% of the Limoges Well Supply Rated Capacity.

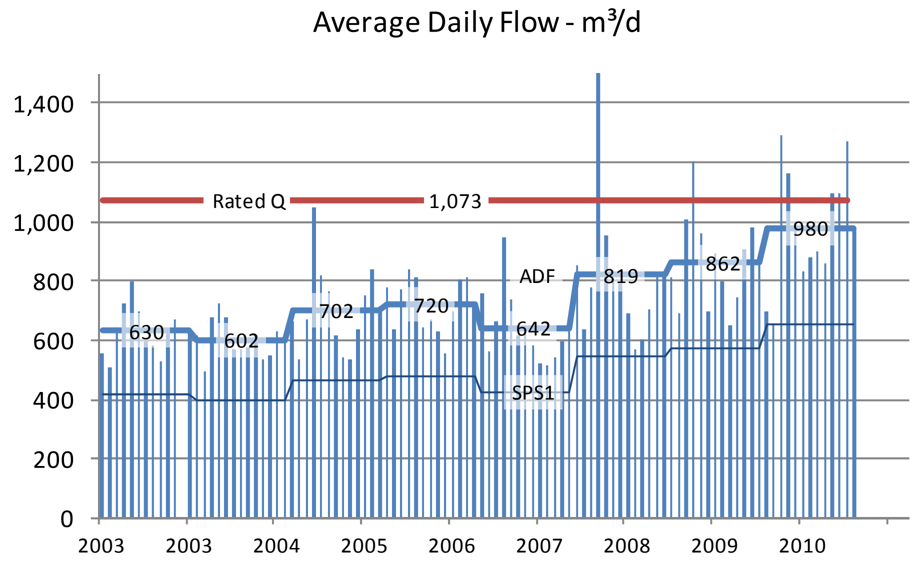
The Calypso Water Park was opened in 2010 and will have a major impact on the Limoges Well Supply System. Maximum Day Demand of 575 m^3/d for the Calypso Park development was provided by the proponent's Consulting Engineer – Genivar The Uncommitted Reserve Capacity would then decrease to 301 m^3/d or 14.5% of the Limoges Well Supply Rated Capacity.

The Limoges Well Supply System is approaching 85.5% use of the remaining capacity. Based on an average daily flow of 213 L/cap/d and assuming 3.5 persons/unit, further development would be restricted to 230 single family homes within the village.

2.2.2 Wastewater Capacity

Average daily flows have increased over the past decade at a rate of about 6.5% p.a. to about 1,000 m^3/d as shown in Figure 2-2.

Figure 2-2: Average Daily Wastewater Flow



This includes metered flows and deduced contributions from other pumping stations. The Limoges Sewage Treatment Lagoon Facility has a rated capacity of 1073 m^3/d which leaves less than 100 m^3/d of capacity for future development; equivalent to about 250 people or 100 houses. The Municipality currently has development applications for over 300 houses which will remain pending until such time as additional capacity is provided.

2.3 Summary

The future growth potential in the Village of Limoges is:

- 2,775 new dwelling units to be serviced on 135 hectares of residential land; and
- 115 hectares of serviced existing and future Institutional, Commercial and Industrial (ICI).

The existing water and wastewater systems are at or near capacity now and only limited growth can be accommodated. Additional infrastructure capacity is required to service future growth.

3.0 EXISTING ENVIRONMENTAL CONDITIONS

Existing conditions have been documented to determine sensitivities and provide a baseline against which to assess project effects and evaluate alternatives. The baseline data was collected and analyzed for key environmental parameters in order to:

- Provide an understanding of existing conditions;
- Allow for future predictions of how the proposed project may cause the environmental conditions to change;
- Allow for future predictions of how adverse effects can be mitigated; and
- Provide a basis for designing monitoring programs.

The aspects of the environment to be included are social, biological, physical and technical. An inventory of existing conditions within the study area has been conducted primarily using secondary sources of information augmented with field investigations where necessary. The area boundaries may vary depending on the environmental features to be investigated as described in the following sections.

Following the identification of alternative solutions, an initial desktop Assimilative Capacity Study was undertaken to confirm the general acceptability of the Castor River for sewage effluent. As the EA proceeded to the subsequent phases, additional information was collected to ascertain specific information regarding discharge criteria and constraints. This additional information has been provided in the Updated Existing Conditions section (Section 5) as it presents information relevant to the design parameters of the preferred solutions.

3.1 Study Area

The study area for the proposed water and wastewater systems master planning process for the Village of Limoges is very large but necessary at this stage of high level assessment. It extends from Hamilton and Macdonald Road to the west, Gendron Road to the east, Maglardy Road to the north and Route 700 and Marionville Road to the south.

Approximately 30% of the study area is within the City of Ottawa Boundary (Burton and Russland Road to the north and Canaan Road to the east). Located within the study area are the Villages of Bearbrook, Cheney, Vars, Russell, Brisson, Embrun, St. Onge, Forest Park, Gagnon, Felton, Longtinville and Forget (Figure 3-1). The study area as illustrated in Figure 3-1 was developed based on the extent of the studies that required completion for the master plan. The large area incorporates the various water supply options including the City of Ottawa to the northwest (Orleans), Clarence-Rockland to the northeast (Cheny), the Marionville well to the south, and the Castor River.

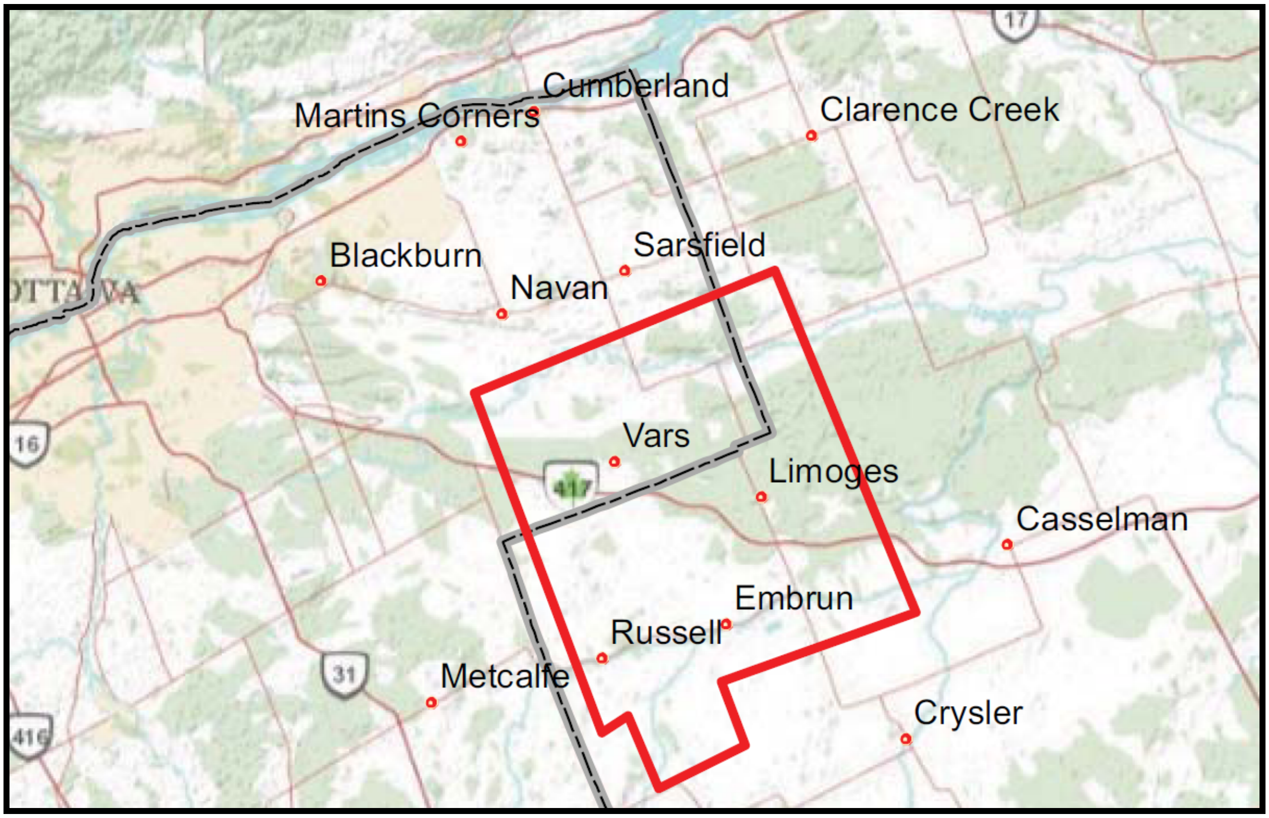
3.2 Social Environment

Components of the social environment that may be affected by the proposed project that have influenced the study include:

- Legislative and Policy Context
- Existing Land Use
- Archaeology
- Areas of Potential Environmental Concern

Legislation and policy play an integral part in managing planning activities as it is used to help guide the decision making process. The following section presents a general overview of pertinent relevant policies that could potentially influence the Limoges Water and Wastewater Master Plan. General policies are described based on the various levels of government including Federal, Provincial and Municipal levels.

Figure 3-1: Study Area



3.2.1 Legislative and Policy Context

3.2.1.1 Federal

Species at Risk Act, 2003

The Species at Risk Act was introduced in June 2003 to protect endangered species in Canada. The Act aims to prevent wildlife species from becoming extinct, and to secure the necessary actions for recovery. The Act recognizes that the protection of wildlife species is a joint responsibility and that all Canadians have a role to play in the protection of wildlife. It applies to all federal lands in Canada; all wildlife species listed as being at risk; and their critical habitat (Fisheries and Oceans Canada, 2011)

3.2.1.2 Provincial

The Provincial Policy Statement, 2005

Implemented under section 3 of the Planning Act, the purpose of the Provincial Policy Statement (PPS) is to provide direction related to land use planning and development within the province of Ontario. The PPS sets the policy foundation for regulating the development and use of land while protecting resources of provincial interest, public health and safety, and the quality of the natural environment. Planning authorities "shall be consistent with" this policy and provincial plans in their decision making process. Section 1.6.1 of the PPS deals with matters relating to infrastructure as it relates to growth; “Infrastructure and public service facilities shall be provided in a coordinated, efficient and cost-effective manner to accommodate projected needs” and “planning for infrastructure and public service facilities shall be integrated with planning for growth so that these are available to meet current and projected needs”. Section 1.6.4 directs the planning for sewage and water services to accommodate growth in a manner that promotes the efficient use of existing municipal sewage services and municipal water services; and 2 private communal sewage services and private communal water services, where municipal sewage services and municipal water services are not available.

With the update of the PPS in 2005 a greater emphasis has been placed on the protection of natural heritage features and water resources. Section 2.1.2 of the PPS States that “the diversity and connectivity of natural features in an area should be maintained, restored or, where possible, improved, recognizing linkages between and among natural heritage features” (Ministry of Municipal Affairs and Housing, 2005).

Clean Water Act, 2006

The purpose of the Clean Water Act is to protect existing and future sources of drinking water in the Province of Ontario. It ensures that communities are able to protect their municipal drinking water supplies through developing collaborative, locally driven science-based protection plans. Communities will identify potential risks to local water sources and take action to reduce these risks. A Source Protection Area, for the purpose of the Act, is established over an area in which the Conservation Authority has Jurisdiction under the Conservation Authorities Act. The source protection area is watershed based (Raisin and South Nation Conservation Authorities, 2011).

Ontario Water Resources Act

The purpose of this Act is to provide for the conservation, protection and management of Ontario’s waters and for their efficient and sustainable use, in order to promote Ontario’s long-term environmental, social and economic well-being. The Water Resources Act regulates sewage disposal and "sewage works" and prohibits the discharge of polluting materials that may impair water quality. The act was also designed in part to protect the province's water resources from industrial and commercial users who might draw more water out of provincial aquifers than they can reasonably sustain. Permits to take more than 50,000 litres of water per day from ground or surface water sources are regulated under the Water Resources Act. The Act also regulates well construction, well operation and abandonment, and the approval, construction and operation of all waterworks (Ontario Water Resources Act, 2010).

Endangered Species Act, 2007

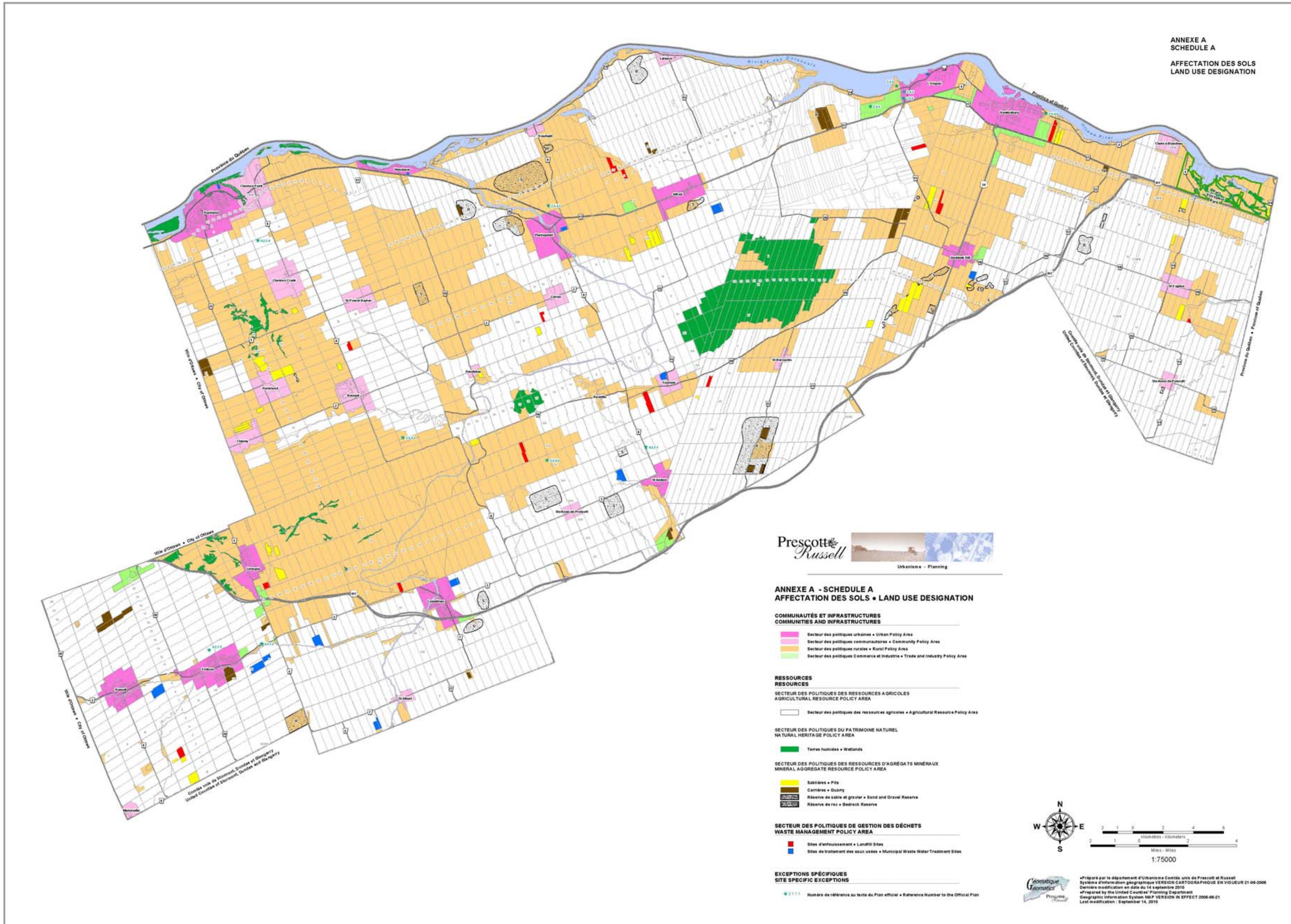
On June 30, 2008, the Endangered Species Act came into effect, replacing the previous 1971 Endangered Species Act. The purpose of the Act is to identify Species at Risk, to protect species and their habitats and to promote the recovery of these species. The Act places a strong emphasis on science based review and assessment of species. It also recognizes the importance of stewardship and includes the creation of a Species at Risk in Ontario Stewardship Program (Ministry of Natural Resources, 2010).

3.2.1.3 Municipal Policy

The United Counties of Prescott and Russell Official Plan (Consolidated, May 2006)

The United Counties of Prescott and Russell is the eastern most county in Ontario and covers approximately 2000 square kilometres. Prescott and Russell are comprised of eight local municipalities; they include the City of Clarence Rockland, the town of Hawkesbury, the Village of Casselman, the Township of Alfred and Plantagenet, the Township of Champlain, the Township of East Hawkesbury, the Nation Municipality, and the Township of Russell. The Village of Limoges is located within the Nation Municipality and Township of Russell. The objective of the Official Plan is to provide guidance and policy direction for growth and development within the county (Figure 3-2).

Figure 3-2: Schedule A of the United Counties of Prescott and Russell Official Plan



Urban Policy Area

The Limoges Village boundary is the general extent of the Urban Policy Area. The Urban Policy Area designation is intended to absorb a significant part of future growth in the United Counties. The policies outlined in the Urban Policy Section of the County Official Plan are intended to give council 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 infrastructure will not be required to resolve environmental problems in the future.

Trade and Industry Policy Area

The Trade and Industry Policy Area designation is located outside of the Village boundary located adjacent to the Urban Policy Area on either side Highway 417. The intent of the Trade and Industry Policy Area is to provide for economic development in areas located outside of the Urban Policy and the Community Policy Areas. The Trade and Industry Policy Area encourages and supports mixed use employment areas which can accommodate serviced or un-serviced commercial, industrial, or tourism related areas on a regional scale.

Rural Policy Area

The Rural Policy Area (Section 2.5.1 of the Official Plan) is comprised of lands which are located outside of the primary resource and development areas. The policies within the Official Plan (OP) are intended to provide for orderly development within the rural area which is consistent with the protection of natural resources and respects the objective of protecting rural and urban areas. The OP notes that in order to protect the Rural Policy Area it is important to avoid inefficient land use patterns such as strip and scattered development.

Agricultural Resource Policy Area

The intent of the Agricultural Resource Policy Area (Section 4.2.1 of the OP) is to limit incompatible land uses to reduce the conflicts between farming and non-farming uses resulting from unplanned expansion and rapid growth. The OP is designed to promote agricultural uses and to control non-agricultural uses through a series of policy statements which apply to all land uses. The vast majority of land west of Limoges is designated Agricultural Resource Policy Area.

Wetland Policy Area

Wetland Policy Areas (Section 5.5.1 of the OP) exist to the west of the Village of Limoges. The wetlands shown on the land use plan are designated Provincially Significant by the Ministry of Natural Resources. Wetland areas serve important functions such as controlling groundwater recharge and discharge, reducing flood damage, stabilizing shorelines, retaining and removing nutrients, supporting the food chain, providing fish and wildlife habitat and contributing to the social and economic quality of life in the county. Where possible, activities that create or maintain infrastructure within the requirements of the Environmental Assessment Process shall be located outside of designated wetlands.

Significant Woodlands

Surrounding the Urban Policy Area and the Trade and Industry Policy Area in the Village of Limoges the Significant Woodlands Designation (Section 5.5.6 of the OP) exists. Within the county context, the vast majority of this designation exists north of Highway 417. Woodlands include treed areas, woodlots and forested areas all of which vary in their level of significance. Significant woodlands in the United Counties have both natural and human values. Several policies are outlined in the County Official Plan as it relates to development (within or adjacent to Significant Woodlands) and the need for an Environmental Impact Statement.

Fish Habitat

The Fish Habitat designation (Section 5.5.7 of the OP) exists within the Village of Limoges and extensively throughout the County. The County OP relies on the PPS definition of fish habitat; "the spawning grounds and nursery, rearing, food supply, and migration areas on which species depend directly or indirectly in order to carry out their life process". The OP outlines several policies relating to development, drain maintenance, stormwater management, vegetative buffers and reasonable authorities as they relate to impacts on fish habitat within the county.

Floodplain

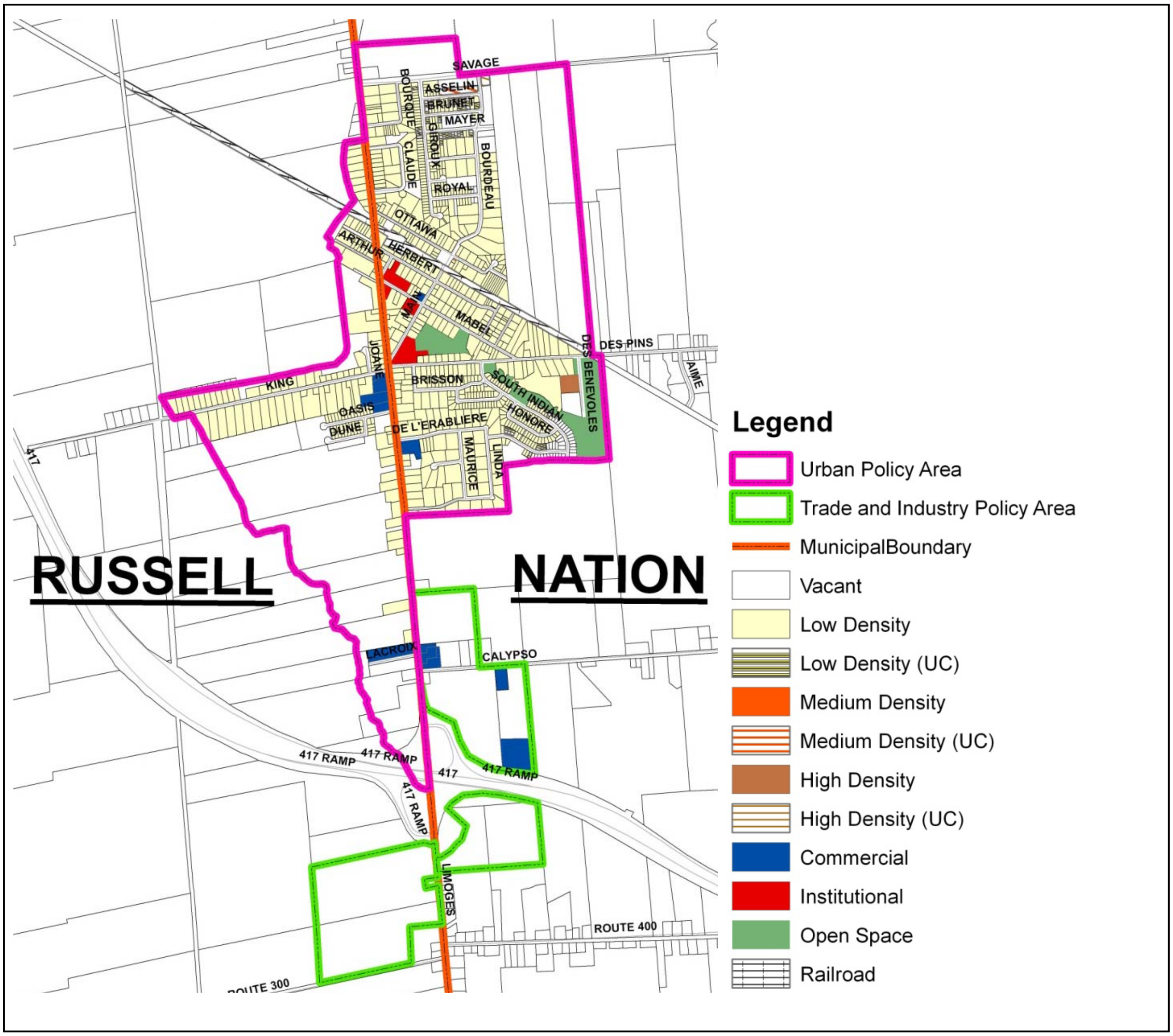
A 1 in 100 year floodplain has been identified by the Ministry of Natural resources and South Nation Conservation (SNC) within the Village of Limoges and designated in the OP (Section 6.5.1). In reviewing development applications, it is a requirement of the approval authority that the proponent must demonstrate that there are no flood or erosion hazards prior to the submission of the development application.

3.2.2 Existing Land Uses

The predominant land use found within the study area is agriculture and agriculture type uses typical of rural areas; the 2001 census found that 60% of the total area of Prescott and Russell is made up of farms. Within the study area this percentage is likely higher. Most of the existing agricultural land is located south and west of the Village of Limoges extending into the City of Ottawa. Forested and natural areas also make a large portion of the study area. The Larose Forest is located in the eastern part of the study area and is the single largest managed forest within the County. It exists between the Villages of Bourget, Casselman and Limoges. Within the City of Ottawa portion of the study area, large contiguous woodlands exist. Provincially significant wetlands exist immediately west of the Village of Limoges. A small portion of the Mer Bleue wetland is also within the City of Ottawa portion of the study area.

The majority of development is contained within the larger villages located within the study area including Limoges, Russell, Embrun and Vars (City of Ottawa). The major land use within the villages is residential. These residential areas are generally comprised of single family and semi-detached homes, as well as town homes and low-rise apartments. Each Village also contains various institutional uses such as churches, schools, and recreational facilities. Commercial uses are generally located within the village centers. Commercial uses may include small retail plazas, automotive shops, and restaurants. Several other small villages exist within the study area including Cheney, Bearbrook, Gagnon, Brisson, North Russell, Forget, St-Onge, Longtinville, and Felton. These small settlements are located primarily within the Agriculture designation and have a very small population base. Figure 3-3 illustrates the existing land use within the Village of Limoges.

Figure 3-3: Village of Limoges Existing Land Use



3.2.3 Archaeological Resources

A Preliminary Desktop Archaeological Assessment (Appendix B) was completed in March 2011 (Golder, 2011a), with the objective of identifying areas of archaeological potential and recognizing any concerns which could potentially result in complications during the construction of the Limoges Potable Water and Wastewater Expansion project. It is important to note that this is not a Stage 1 archaeological assessment which is required by the Ministry of Tourism, Culture and Sport prior to development.

The general desktop review included an examination of the environmental background of the study area, historical maps and studies pertaining to the history of the study area, previous archaeological investigations and archaeological work conducted in the region, and a review of the Ministry of Ministry of Tourism and Culture's Standards and Guidelines for Consulting Archaeologists. Previous archaeological research, registered archaeological sites and archaeological potential of the study area are discussed below.

3.2.3.1 Previous Archaeological Research

A limited amount of research has been conducted within the study area or within the immediate vicinity. All of the detailed archaeological investigations within the study area have been completed as part of Cultural Resource Management Studies, these include:

- Stage 1 and Stage 2 assessment (Embrun Lagoon expansion project);
- Stage 1 assessment (Russell Lagoon expansion project);
- Heritage and Archaeological study (Village of Vars); and
- Overview Archaeological Potential studies (Clarence and Russell Townships, now part of Prescott and Russell United Counties).

3.2.3.2 Registered Archaeological Sites

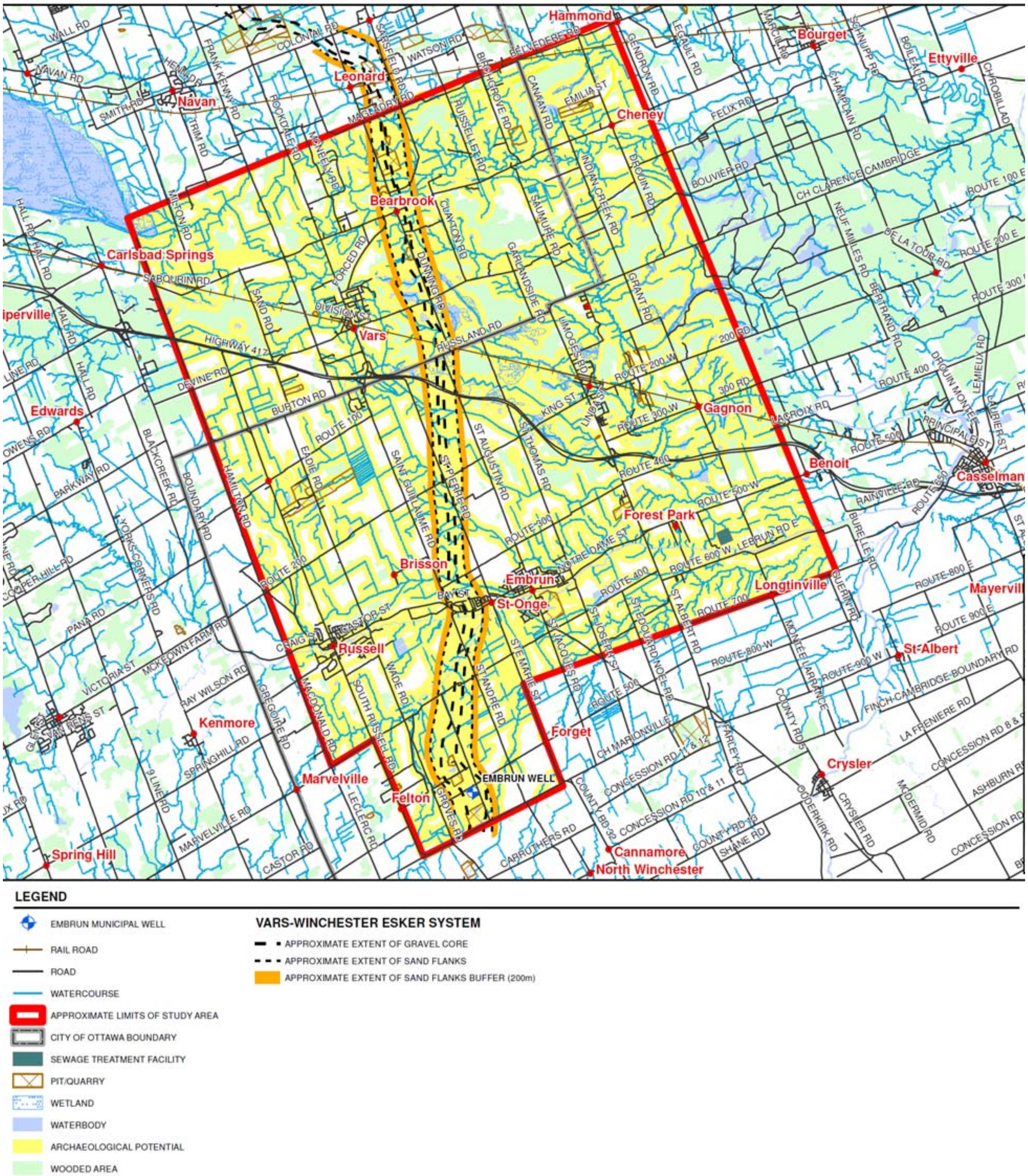
The Ontario Ministry of Tourism, Culture and Sport's archaeological site database was consulted as the primary source of information regarding known archaeological sites within the study area. The search found that there are no documented or registered archaeological sites within the study area. The only known archaeologically significant artefacts discovered within the study area date to the pre-contact era and have been identified as a ground stone adze and a quartz projectile point uncovered in the town of Russell in the latter half of the 19th century.

3.2.3.3 Archaeological Potential

Based on the Ministry of Tourism, Culture and Sport's guidelines for establishing archaeological potential an overlay has been created and is shown in Figure 3-4. When creating the archaeological potential overlay several factors must be considered including elevation, watershed area, distance from water, morphology of the watercourse, geomorphological features, topography, soils, drainage and biology. The overlay suggests that there is a good potential for discovering additional sites.

It should be noted that a built heritage assessment has yet to be completed and may be necessary to understand the full extent of the heritage building significance within the study area. Also, a detailed stage 1 archaeological assessment should be conducted for specific projects to help identify specific features of archaeological concern.

Figure 3-4: Archaeological Potential



Source: Golder, 2011a

3.2.4 Areas of Potential Environmental Concern:

A preliminary environmental site assessment desktop survey (Appendix C) was completed in March, 2011 (Golder, 2011b) to identify existing and former operation/activities that may have potential environmental impacts.

The desktop survey included a review of the, Ontario Ministry of the Environment (MOE) Waste Disposal Sites Inventory, June 1991; MOE Database on polychlorinated biphenyls (PCB) Storage Sites; and the Inventory of Coal Gasification Plant Waste Sites in Ontario, April 1987 (Figure 3-5).

3.2.4.1 <u>Waste Disposal Site Inventory</u>

A search of the 1991 MOE (Waste Disposal Site Inventory) indicated the following:

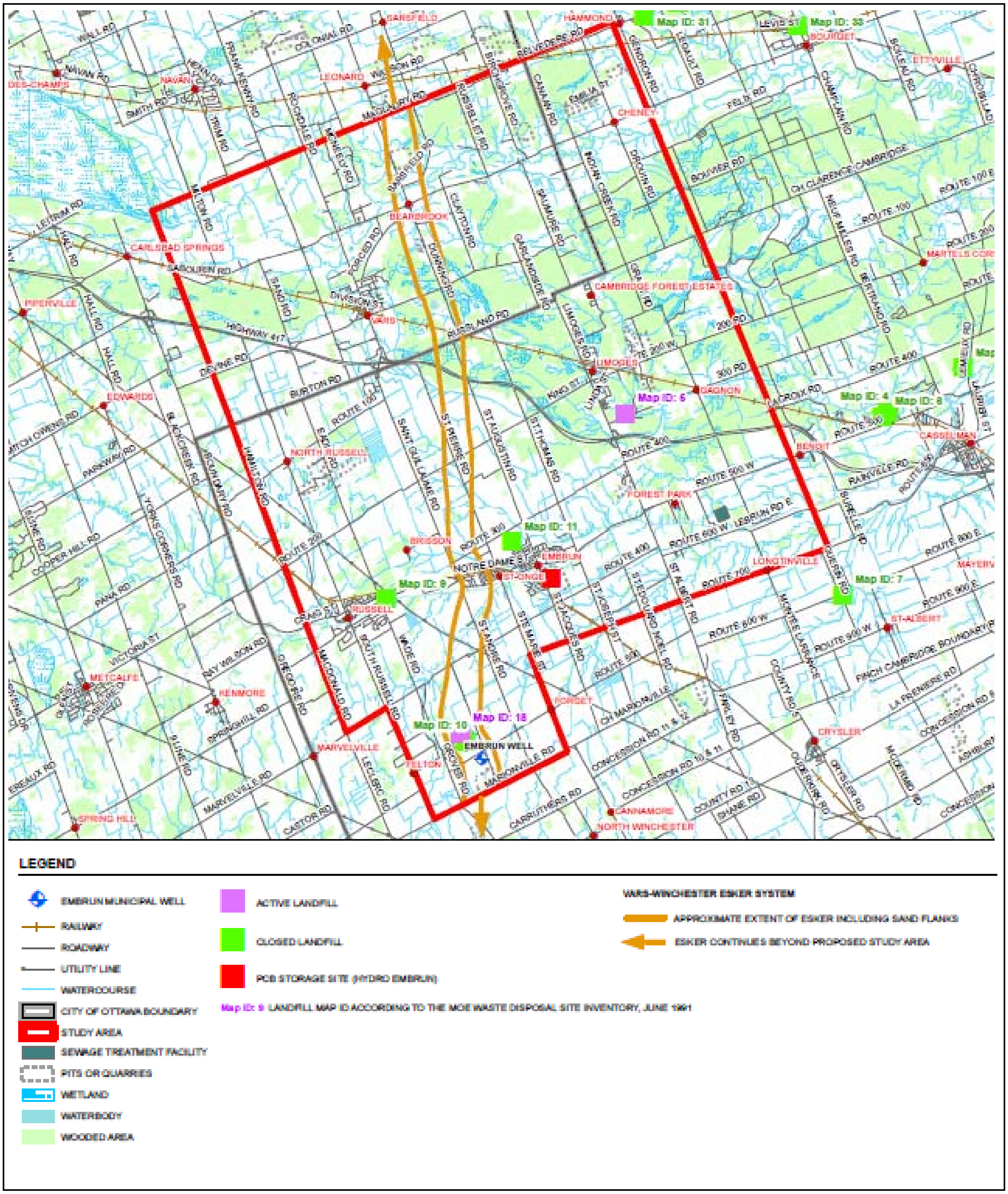
- A closed urban municipal/domestic wastes disposal site (Map ID 9). The closed site is located on adjacent lands south of Route 300 and Eadie Road. This site is classified Class “A” (hazardous to humans) and was closed in 1977;
- A closed urban municipal/domestic wastes disposal site (Map ID 11). The closed site is located on adjacent lands south of Route 300. This site is classified Class “A” (hazardous to humans) and was closed in 1971;
- A closed rural industrial liquid/hazardous wastes disposal site (Map ID 10). The closed site is located 1 km north of the Embrun Municipal Well in the south part of the study area. This site is classified Class “B” (hazardous to environment) and was closed in 1975;
- An active rural municipal/domestic wastes disposal site (Map ID 18). The active site is located 1km north of the Embrun Municipal Well in the south part of the study area This site is classified Class “A” (hazardous to humans); and
- An active rural municipal/domestic wastes disposal site (Map ID 5). The active site is located on adjacent lands east of Limoges. This site is classified Class ”B” (hazardous to environment).

Updated information to supplement the 1991 MOE inventory, as provided in correspondence from the MOE, indicates that the Embrun Hydro PCB storage site is located on St. Jacques Street, and the two waste sites west of Casselman that were listed as ‘active’ in the 1991 inventory, are now ‘inactive’/’closed’. Additionally, the waste site listed as ‘active’ at Map Is 7 near St. Albert is a closed waste site.

In addition to the above listed closed and active waste disposal sites located within the study area, six (6) closed or inactive urban/rural, municipal/domestic waste disposal sites are located within 1 to 6 km east and southeast of the study area. Figure 3-5 illustrates the areas of potential environmental concern.

A review of the *Inventory of Coal Gasification Plant Waste Sites in Ontario* was also completed for the study area. This classification includes tar distillation plants, creosoting plants, roofing felt and tarred paper products manufactures, by-product charcoal and coke oven plants of the iron and steel industry, industrial manufactured gas plants and wood distillation plants. The review concluded that no registered former coal gasification plants or industrial sites producing and /or using coal tar or related tars are within the study area.

Figure 3-5: Areas of Potential Environmental Concern



3.3 Biological Environment

Components of the biological environment that may be affected by the proposed project that have influenced the study include:

- Species at Risk
- Aquatic Habitat
- Terrestrial Habitat

A preliminary natural heritage features background and records review (Appendix D) was completed in March 2011 (Golder, 2011c). This review included documents from the Ministry of Natural Resources, South Nation Conservation Authority, Ontario Breeding Bird Atlas, Ontario Herpetofaunal Atlas, Municipal Official Plans and existing aerial photography. The results of the review are discussed below.

3.3.1 Species at Risk

Species at Risk (SAR) are defined as those species listed under the Ontario Endangered Species Act (ESA) or the Federal Species at Risk Act (SARA). A total of 24 SAR were identified as having the potential to exist within the study area (Table 3-1). Actual records of 11 species were identified. However, these records are generally incomplete and any of the species with range maps that overlap the study area have the potential to occur, dependent on the individual habitats found within the study area.

Table 3-1: Potential Species at Risk within the Study Area

Taxonomy	Common Name	Scientific Name	ESA Status	SARA Status	Likelihood of Occurrence in Sewage Lagoon Area*	Source
Amphibian	western chorus frog	*Pseudacris triseriata*	No Status	Threatened	Moderate	Herpetile Atlas Records
Bird	least bittern	*Ixobrychus exilis*	Threatened	Threatened	Low	Range Maps
	peregrine falcon	*Falco peregrinus*	Threatened	Threatened	Low	Range Maps
	black tern	*Chlidonias niger*	Special Concern	Not at Risk	Low	Range Maps
	bobolink	*Dolichonyx oryzivorus*	Threatened	No Status	Low	OBBA records
	Canada warbler	*Wilsonia canadensis*	Special Concern	Threatened	Low	OBBA records
	chimney swift	*Chaetura pelagica*	Threatened	Threatened	Low	OBBA records
	common nighthawk	*Chordeiles minor*	Special Concern	Threatened	Low	Range Maps
	Henslow's sparrow	*Ammodramus henslowii*	Endangered	Endangered	Low	Historical NHIC records
	red-headed woodpecker	*Melanerpes erythrocephalus*	Special Concern	Threatened	Low	Range Maps
	short-eared owl	*Asio flammeus*	Special Concern	Special Concern	Low	Range Maps
	whip-poor-will	*Caprimulgus vociferous*	Threatened	Threatened	Low	OBBA records

Taxonomy	Common Name	Scientific Name	ESA Status	SARA Status	Likelihood of Occurrence in Sewage Lagoon Area*	Source
Fish	American Eel	*Anguila rostrata*	Endangered	No Status	Low	Range Maps
	lake sturgeon	*Acipenser fulvescens*	Threatened	No Status	Low	Range Maps
Insect	monarch	*Danaus plexippus*	Special Concern	Special Concern	Moderate	Range Maps
	West Virginia white	*Artogeia virginiensis*	Special Concern	No Status	Low	Range Maps
Mammal	grey fox	*Urocyon cinereoargenteus*	Threatened	Threatened	Low	Range Maps
Plant	American ginseng	*Panax quinquefolius*	Endangered	Endangered	Low	Range Maps
	butternut	*Juglans cinerea*	Endangered	Endangered	Moderate	Range Maps
Reptile	Blanding's turtle	*Emydoidea blandingii*	Threatened	Threatened	Low	Herpetile Atlas Records
	eastern ribbon snake	*Thamnophis sauritus*	Special Concern	No Status	Moderate	Herpetile Atlas Records
	milksnake	*Lampropeltis triangulum*	Special Concern	Special Concern	Moderate	Herpetile Atlas Records
	snapping turtle	*Chelydra serpentina*	Special Concern	Special Concern	Moderate	Herpetile Atlas Records
	spotted turtle	*Clemmys guttata*	Endangered	Endangered	Low	Herpetile Atlas Records

**Note – this is based on a coarse level desktop Ecological land Classification, field studies should be done to confirm habitat and or presence of these species*

Source: Golder 2011c

Given the large size of the study area and the lack of specific project footprints, Ecological Land Classification (ELC) and SAR habitat assessments have not been completed for the entire study area, with the exception of the sewage lagoon area, where a coarse scale ELC has been completed (Figure 3-6). This ELC was used to assess general habitat for potential SAR in the sewage lagoon area. A likelihood of occurrence for SAR was made based upon this assessment (Table 3-1). Six species were ranked with a moderate likelihood of occurrence, however this could change based on field assessment, or when specific alternatives are considered. It is important to note at this stage that the current ELC is based on desktop analysis of available imagery, and cannot be considered 100% accurate without field inventories.

3.3.2 Aquatic Habitat

Within the study area there are 1,200 km of watercourses, and they range from large rivers to smaller tributaries, municipal drains to intermittent streams. Due to the vast size of the study area, specific information in individual watercourse and fish habitat is limited. However, it is likely that many of the watercourses within the study area would be considered fish habitat under the Fisheries Act. A more detailed assessment will be required once the specific project footprints are determined.

3.3.3 Provincially Significant Wetlands

Three Provincially Significant Wetlands exist within the study area, including the Limoges Wetland (evaluated in 1985; a wetland complex with areas of marsh and swamp), Mer Bleue Bog (evaluated in 1983; a wetland area with bog, swamp and open water), and the Wolf Creek Swamp (evaluated in 1984; a wetland complex with areas of marsh, swamp and open water). The Larose wetland is a candidate Area of Natural and Scientific Interest (ANSI) while the Mer Bleue bog is designated an ANSI by the Province.

3.3.4 Significant Woodlands, Valleylands, and Significant Wildlife Habitat

A significant amount of land within the study area is agricultural, particularly in the north and south western potion. Large wooded areas exist east of Limoges and are for the most part, a component of the Larose Forest.

According to the MNR, designated Significant Woodlands, Valleylands, and Significant Wildlife Habitat do not exist within the study area outside of the protected areas mentioned above. It is possible that significant terrestrial habitat exists within the study area but it has yet to be assessed by MNR. The Natural Heritage features of the study area are located on Figure 3-6.

3.4 Physical Environment

Components of the physical environment that may be affected by the proposed project that have influenced the study include:

- Surficial Geology
- Bedrock Geology
- Hydrogeology

More detailed information than presented below is attached in the Golder Associates *Existing Hydrogeological Conditions: Limoges Municipal Potable Water Environmental Assessment* report (Appendix E).

3.4.1 Surficial Geology

Published information (Geological Survey of Canada, 2001) indicates that the surficial geology within the study area to the south of Highway 417 consists primarily of offshore marine deposits including massive blue-grey clay, silty clay and silt (Figure 3-7). To the north of Highway 417, the mapped surficial sediments consist of sand and gravel deposits as well as clay silt and till. Surface sands underlay the Village of Limoges as well as a significant proportion of the adjacent land areas. Glacial till was observed at the surface in some areas but to a much more limited degree than the silt and clay sand deposits.

Within the study area, the sands overlay the clay and silt deposits which overlay till and bedrock. The overburden thickness is greatest along the eastern edge of the study area as well as in areas on the west side and the south central portion of the study area (between approximately 25m to 50m in depth). The central portion of the study area has an overburden thickness between approximately 2m and 5m. Figure 3-8 shows depth to bedrock within the study area (Golder, 2011d).

Figure 3-6: Natural Features

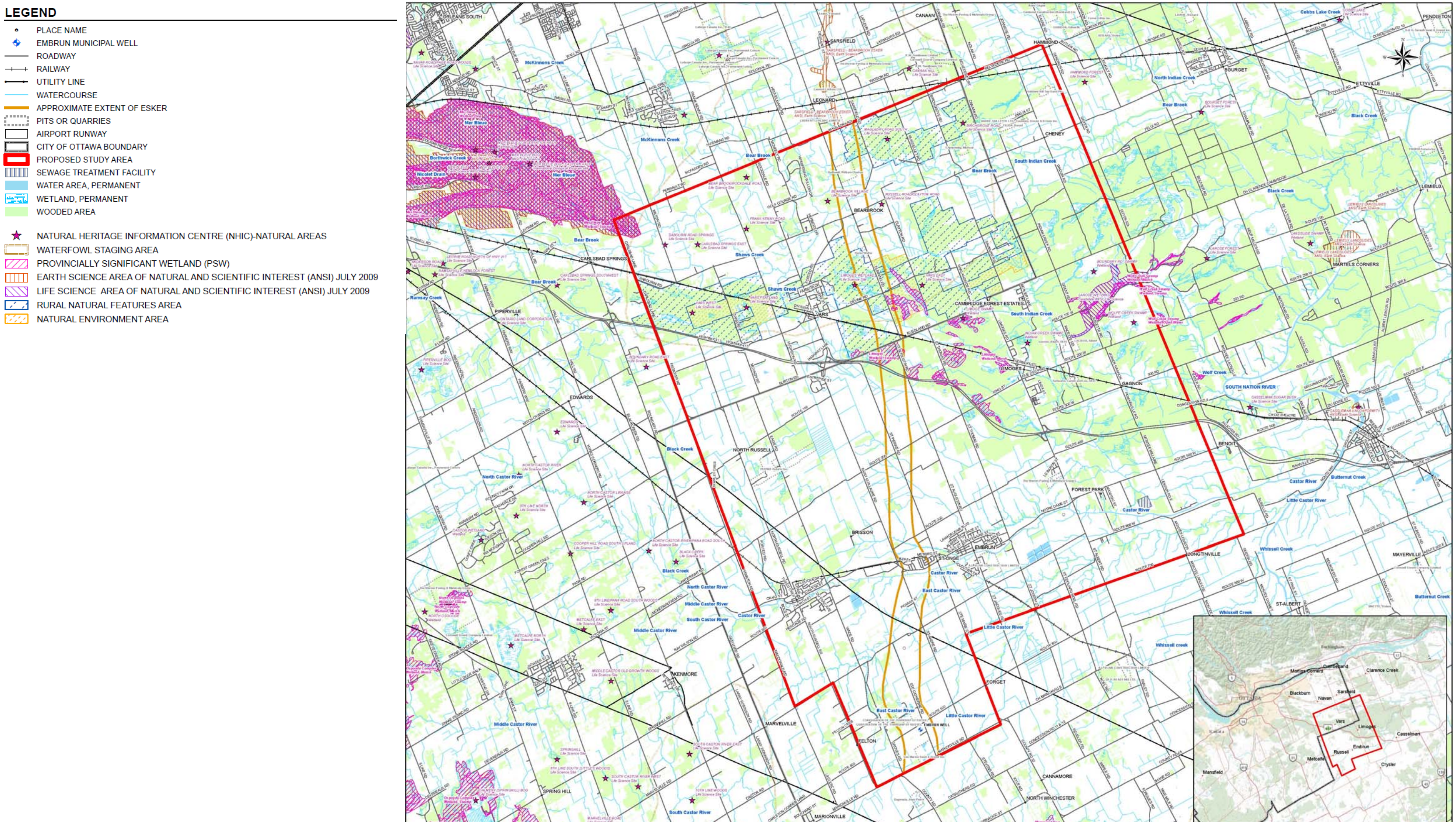


Figure 3-7: Surficial Geology

LEGEND

STUDY AREA

SURFICIAL GEOLOGY

1a	TILL, PLAIN WITH LOCAL RELIEF <5m
1b	TILL, DRUMLINIZED
1c	TILL, HUMMOCKY TO ROLLING WITH LOCAL RELIEF 5 TO 10 m
2	ICE CONTACT STRATIFIED DRIFT: GRAVEL & SAND
3	OFFSHORE MARINE DEPOSITS: CLAY, SILTY CLAY & SILT
3_g	OFFSHORE MARINE DEPOSITS: CLAY, SILTY CLAY & SILT (GULLIES & RAVINES)
3a	OFFSHORE MARINE DEPOSITS: CLAY & SILT UNDERLYING EROSIONAL TERRACES
3a_g	OFFSHORE MARINE DEPOSITS: CLAY & SILT UNDERLYING EROSIONAL TERRACES (GULLIES & RAVINES)
4	DELTAIC AND ESTUARY DEPOSITS: MEDIUM TO FINE GRAINED
4_g	DELTAIC AND ESTUARY DEPOSITS: MEDIUM TO FINE GRAINED (GULLIES & RAVINES)
5a	NEARSHORE SEDIMENTS: GRAVEL, SAND & BOULDERS
5b	NEARSHORE SEDIMENTS: FINE TO MEDIUM GRAINED SAND
6a	ALLUVIAL DEPOSITS: SILTY SAND, SILT, SAND & CLAY
6a_g	ALLUVIAL DEPOSITS: SILTY SAND, SILT, SAND & CLAY (GULLIES & RAVINES)
6b	ALLUVIAL DEPOSITS: MEDIUM GRAINED STRATIFIED SAND WIT SOME SILT
6b_g	ALLUVIAL DEPOSITS: MEDIUM GRAINED STRATIFIED SAND WIT SOME SILT (GULLIES & RAVINES)
7	ORGANIC DEPOSITS: MUCK & PEAT
d	DUNE
d_g	DUNE (GULLIES & RAVINES)
l	LANDSLIDE AREA
l_g	LANDSLIDE AREA (GULLIES & RAVINES)
r1	BEDROCK: INTRUSIVE & METAMORPHIC
r2	BEDROCK: LIMESTONE, DOLOMITE, SANDSTONE & LOCAL SHAI
r2_g	BEDROCK: LIMESTONE, DOLOMITE, SANDSTONE & LOCAL SHAI (GULLIES & RAVINES)
zz	WATER

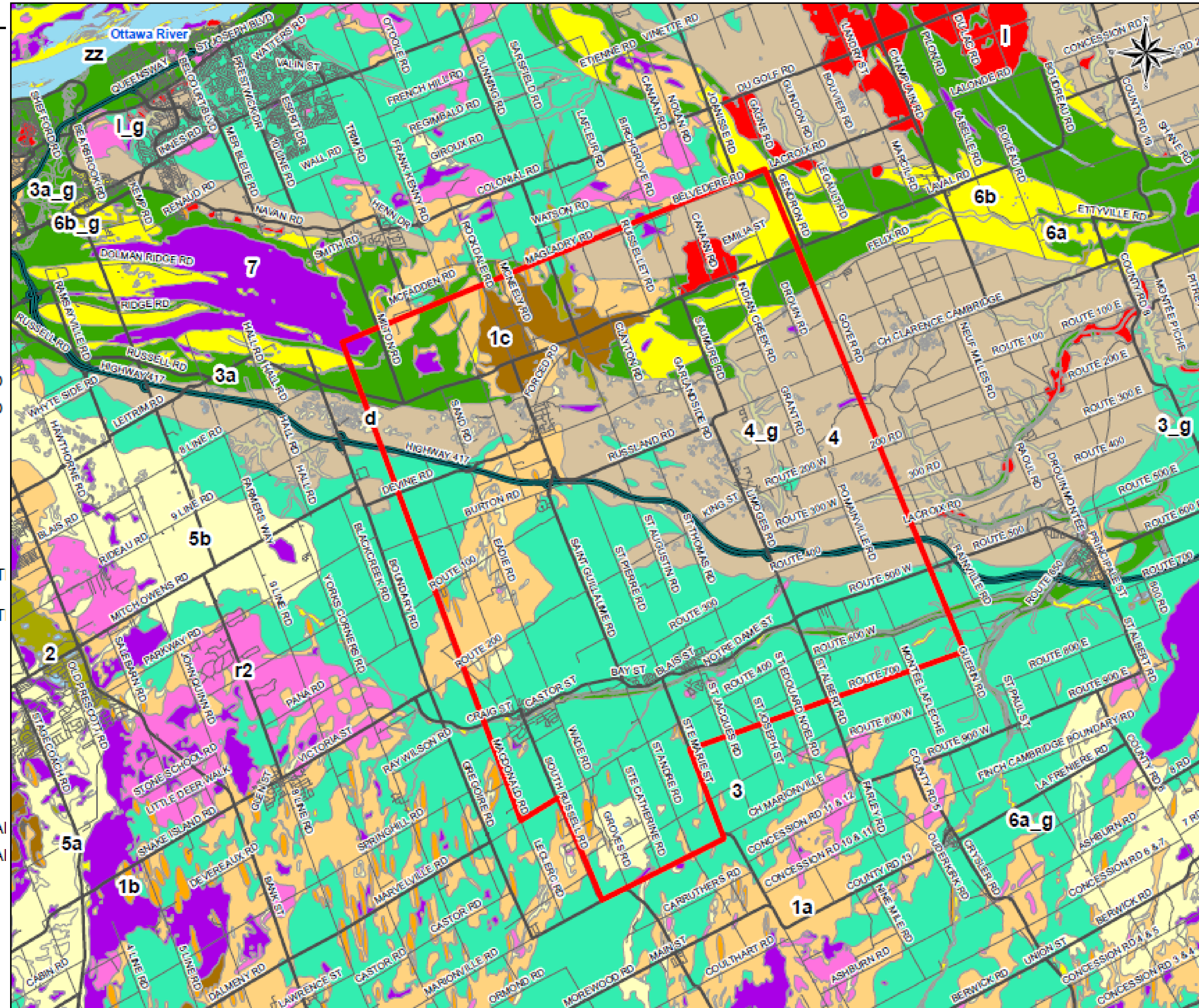


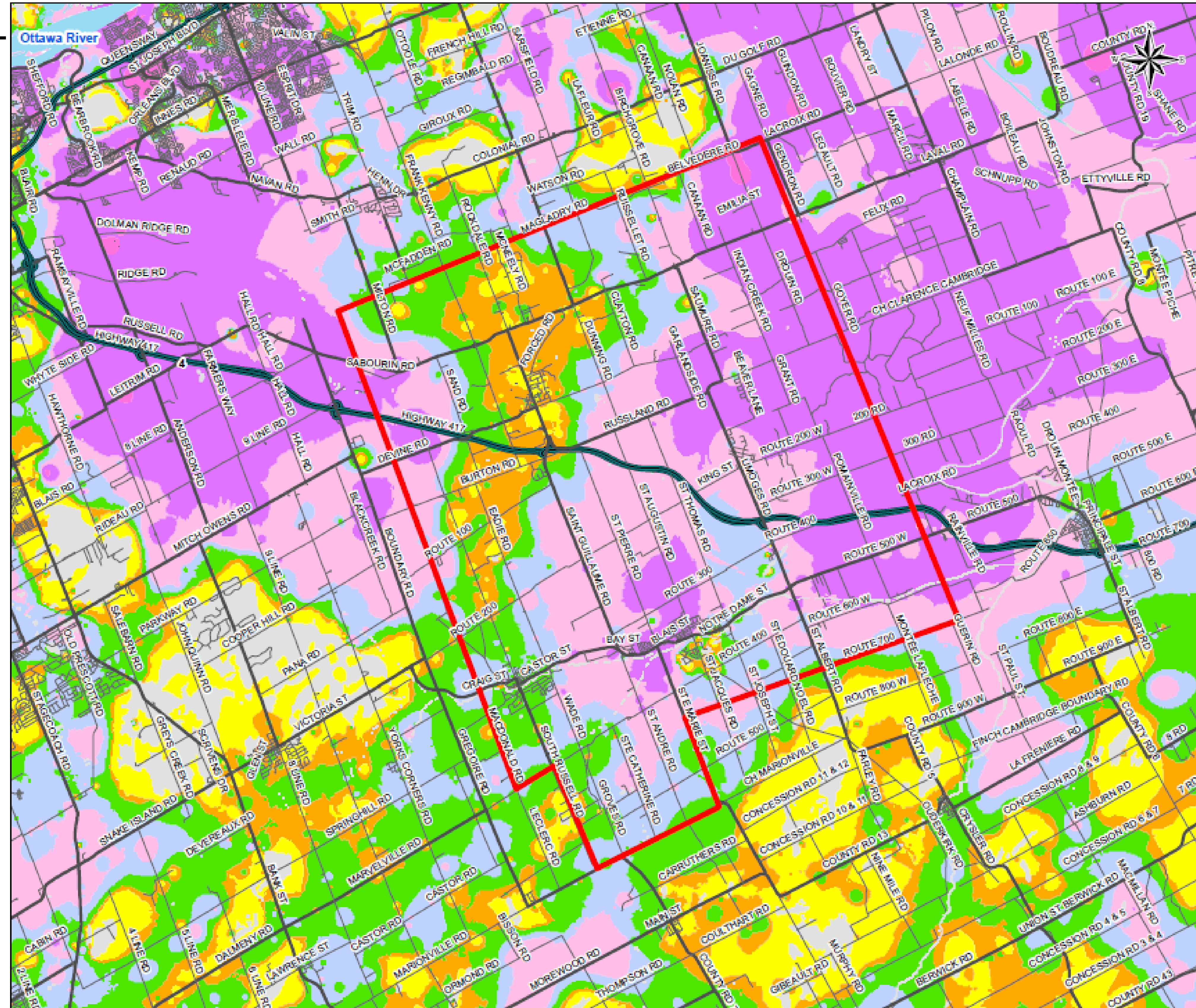
Figure 3-8: Depth to Bedrock

LEGEND

STUDY AREA

TREND IN DEPTH TO BEDROCK
METRES

- 0 to 2
- 2 to 3
- 3 to 5
- 5 to 10
- 10 to 15
- 15 to 25
- 25 to 50
- 50 to 150



3.4.2 Bedrock Geology

Bedrock geology within the study area primarily consists of siltstone, and shale of the Queenston, Carlsbad and Billings Formations. Bedrock from the Lindsay Formation is found in the north, and complex geology is located in the south part of the study area due to faulting (Figure 3-9). Available data suggests that bedrock is shallowest within the central-western part of the study area (2m-5m in depth) and slopes down (25 m – 50 m) toward the eastern and western limits of the study area. The Gloucester Fault is a significant geological feature within the study area and the fault zone is the approximate flow path of the Castor River (Golder, 2011d).

3.4.3 Hydrogeology

3.4.3.1 Overburden Aquifers

The Vars-Winchester esker exists within the study area running north/south for approximately four kilometers west of the Village of Limoges, and spans a length of 50km from the Ottawa River to the Village of Winchester. The Vars-Winchester esker is made up of a gravelly central ridge covered and flanked with sand deposits. The sand and gravel deposits are confined by 20 m of clay on the outer flanks and only 4 m near the Vars/Limoges communal wells. Groundwater recharge is thought to occur through infiltration in the northern portion of the study area. The esker is made up of very fine sand deposits, with an average overburden thickness of approximately 10m. This area is also considered to have a relativity high transmissivity.

It should be noted that lowering the groundwater levels in the sand and gravel esker may result in a lowering of pore pressures in the soft clay layer above and on the flanks of the esker. This may result in the consolidation of the soft clay layer causing the settlement of the ground surface in the area affected by the groundwater drawdown. Settlements in the sand and gravel would also be expected due to the lowering of groundwater levels but not at the same magnitude as the soft clay flanks. Settlements due to long term water table lowering could vary depending on the distance from the well site. The extent to which settlements are a problem depend upon the amount of settlement, uniformity of settlement, the type and history of the structure.

The potential for settlement has been based on a limited number of boreholes and published information. Due to the size of the area on and surrounding the Vars-Winchester esker, there could be large variation in surficial geology across the study area (Golder, 2011d).

A deltaic sand aquifer extends over most of the northern half of the study area (Golder, 2011d). There is limited information defining the hydrogeological properties of this aquifer. Although possible, within the aquifer, the development of a large multi-well municipal system is relatively impractical with many construction and operational short-comings.

3.4.3.2 Shallow Bedrock Aquifer

Water well records were reviewed to determine if a bedrock well could furnish adequate quantities of potable groundwater for the long term requirements of Limoges. The MOE water well records within the study area, demonstrate no real potential for a long term supply from the bedrock for Limoges in terms of quality and quantity. The only high capacity bedrock wells in the area are those for the Village of Russell approximately 12 km away. Limestone and dolostone in the south of the study area have some well-developed permeability zones which appear to be hydraulically connected to recent freshwater recharge from the surface.

3.4.3.3 Deep Bedrock Aquifer

Generally, deep bedrock formations have low potential for producing groundwater with potable quality within the study area and beyond. Limestone formations that have some groundwater potential are within the first 300m of the surface although the porewaters are likely to be brackish. The Nepean sandstone is often the best source of groundwater producing bedrock in the shallow subsurface but in the 700m-800m depths range there is virtually no possibility for a potable groundwater supply (Golder, 2011d).

3.4.3.4 Area Communal Well Systems

Limoges Water System

The existing Limoges water supply consists of two overburden wells located on the south side of Russland Road, in the Township of Russell, approximately 4km west of the Limoges water treatment plant. The combined permitted pumping rate for the wells is 2,080 m^3 per day. Published reports from 2004-2009 indicate that the groundwater quality is good with occasional occurrences of non-pathogenic bacteria as well as aesthetic exceedences in the raw water supply; the treatment process is sufficient to treat the raw water to the applicable standards.

Vars Water Supply System

The Vars water supply system consists of two overburden wells that were drilled in 1991 (Well No. 1) and 1994 (Well No. 2). They are located about 4.6 km west of the Limoges water treatment plant and are separated by approximately 32 m. The combined permitted pumping rate is 2,300 m^3 per day with the actual volume pumped for the system being 414 m^3 per day in 2009.

The aquifer was pump tested for 72 hours in 1990 and 1991 at a rate of 26.5 L/s and 30.3 L/s in 1994. The recovery monitoring demonstrated that water levels did not fully recover at the end of the 72 hours of pumping. Aquifer assessments indicate that the theoretical safe yield for a 20 year period was estimated to be 6009 m^3 per day and a safe yield of 3,506 m^3 per day. Water quality tested in 1990, 1991 and 1994 found that the water quality results were generally below the Ontario Drinking Water Quality Standards (ODWQS) with some aesthetic exceedences. After reasonable but extensive treatment process the groundwater meets all requirements of the ODWQS.

Embrun/Marionville System

The Embrun/Marionville water supply system is run by the Township of Russell but the wells were taken offline in 2010 once Embrun was connected to the water supply from the City of Ottawa. The source of the water came from two overburden wells located approximately 15.2 km southwest of the Limoges treatment plant. The combined permitted pumping rate for the wells is 5,633 m^3 per day. The actual average amount of water pumped for the system was 2,398 m^3 per day in 2009.

Elevated concentrations of total dissolved solids (TDS), iron, and manganese have consistently characterized the groundwater quality in the production well and surrounding area. Bacterial results collected in 2009 and 2010 indicated occasional detections of total coliform (TC) and heterotrophic bacteria in the raw water supply. Treatment has brought these elevated concentrations below the ODWQS

Figure 3-9: Bedrock Geology

LEGEND

STUDY AREA

13 QUEENSTON FORMATION: RED TO LIGHT GREENISH GRAY SILTSTON AND SHALE, WITH INTERBEDS OF SILTY BIOCLASTIC LIMESTONE IN LOWER PART

12 CARLSBAD FORMATION: INTERBEDDED DARK GRAY SHALE, FOSSILIFEROUS CALCAREOUS SILTSTONE, AND SILTY BIOCLASTIC LIMESTONE

11 BILLINGS FORMATION: DARK BROWN TO BLACK SHALE, WITH LAMINATIONS OF CALCAREOUS SILTSTONE

10 EASTVIEW FORMATION: INTERBEDDED SUBLITHOGRAPHIC TO FINE CRYSTALLINE LIMESTONE AND DARK BROWN TO DARK GREY SHALE

MIDDLE TO UPPER ORDOVICIAN

9 LINDSAY FORMATION: SUBLITHOGRAPHIC TO FINE CRYSTALLINE LIMESTONE, NODUALAR IN PART, WITH INTERBEDS OF CALCARENITE AND SHALE

8 VERULAM FORMATION: INTERBEDDED BIOCLASTIC LIMESTONE, SUBLITHOGRAPHIC TO FINE CRYSTALLINE LIMESTONE

7 BOBCAYGEON FORMATION: INTERBEDDED SILTY DOLOMITE, LITHOGRAPHIC TO FINE CRYSTALLINE LIMESTONE, OOLITIC LIMESTONE, SHALE, AND FINE-GRAINED CALCAREOUS QUARTZ SANDSTONE

6 GULL RIVER FORMATION: INTERBEDDED SILTY DOLOMITE, LITHOGRAPHIC TO FINE CRYSTALLINE LIMESTONE, OOLITIC LIMESTONE , SHALE, AND FINE-GRAINED CALCAREOUS QUARTZ SANDSTONE

5 ROCKCLIFFE FORMATION: INTERBEDDED FINE-GRAINED LIGHT GREENISH GREY QUARTZ SANDSTONE, SHALEY LIMESTONE AND SHALE, LOCALLY CONGLOMERATE AT BASE, INTERBEDS OF CALCARENITE (ST. MARTIN MEMBER, 5A) AND SILTY DOLOSTONE IN UPPER PART

LOWER ORDOVICIAN

4 OXFORD FORMATION: SUBLITHOGRAPHIC TO FINE CRYSTALLINE DOLOSTONE

4* ALTERED FROM PUBLISHED MAPPING

3 MARCH FORMATION: INTERBEDDED QUARTZ SANDSTONE, SANDY DOLOSTONE, AND DOLOSTONE

CAMBRIO ORDOVICIAN

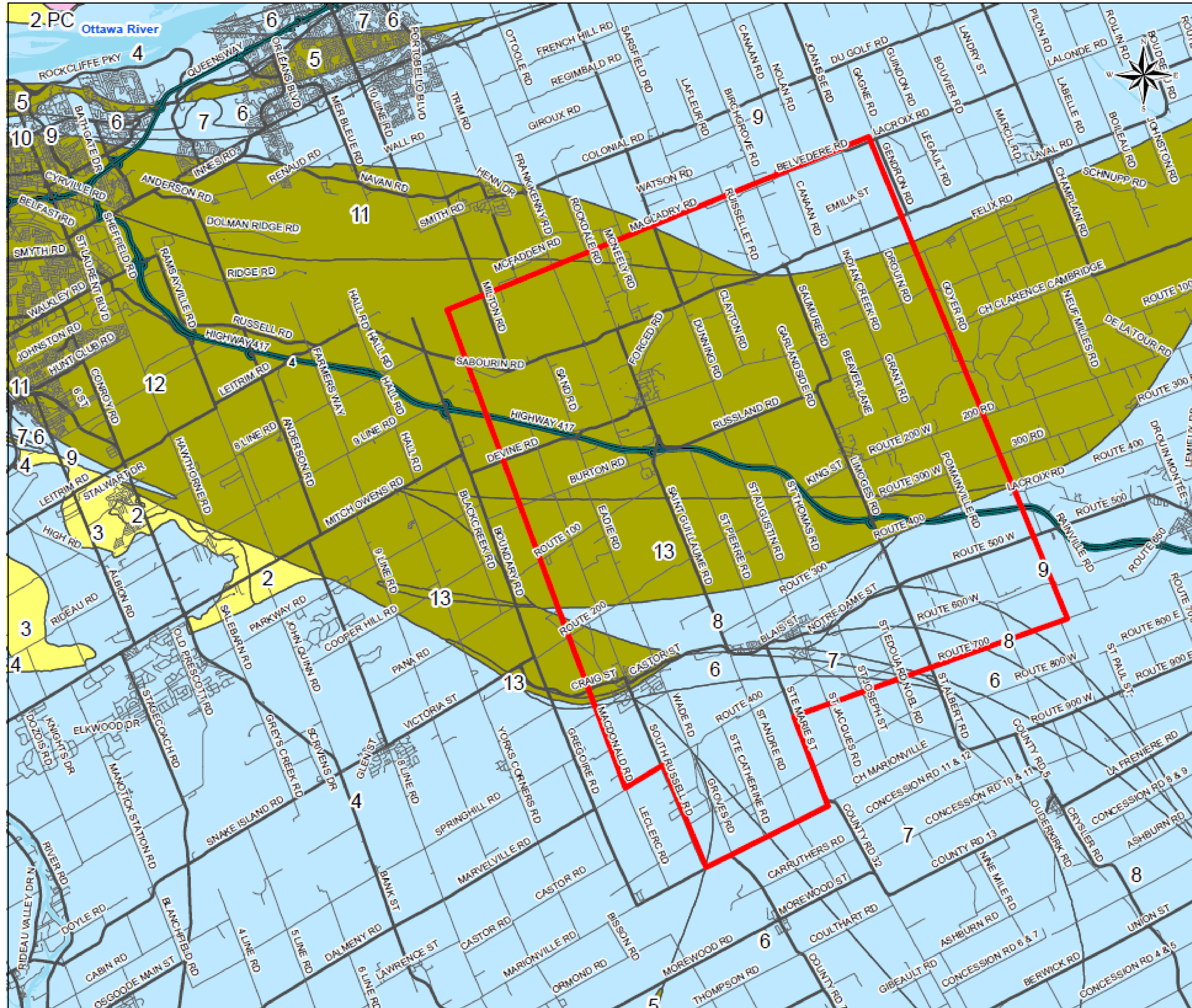
2 NEPEAN FORMATION: FINE TO COARSE GRAINED QUARTZ SANDSTONE, PARTIALLY CALCAREOUS IN UPPER PART

1 COVEY HILL FORMATION: NONCALCAREOUS FELDSPATHIC, FINE TO COARSE GRAINED QUARTZ SANDSTONE AND QUARTZ PEBBLE CONGLOMERATE

UNCONFORMITY

PRECAMBRIAN

PC UNDIFFERENTIATED METAMORPHIC AND IGNEOUS ROCKS



3.5 Technical

Components of the existing technical environment that may be affected by the proposed project that have influenced the study include:

- Limoges Potable Water System
- Limoges Wastewater System

As part of the technical review of the existing conditions a Potable Water and Wastewater Systems Hydraulic Review for the Village was undertaken (Appendix F).

3.5.1 Limoges Potable Water System

3.5.1.1 Water Supply

The existing water supply for the Limoges water system was brought into service in 2001. It consists of two, 250 mm diameter, overburden wells located approximately 4 km west of the village. Well No. 1 is 24.5 m deep and is located east of 2452 Russland Road and is housed within a building which also contains the standby generator. It is equipped with a vertical turbine pump having a design point of 24.1 L/s at 19.6 m Total Dynamic Head (TDH). Well No. 2 is 21.5 m deep and is located east of 2472 Russland Road and is housed within a concrete chamber. It is equipped with a submersible pump having a design point of 24.1 L/s at 19.6 m TDH. From the wells the raw water is pumped through a 5 km long 300 mm diameter watermain to the Limoges Water Treatment Plant.

MOE Permit to Take Water No.03-P-4045 indicates that the combined total water taking from both wells shall not exceed 2,080 m^3/day (24.1 L/s). Published reports from 2004-2009 indicate that the groundwater quality is good with occasional occurrences of non-pathogenic bacteria as well as aesthetic exceedences in the raw water.

3.5.1.2 Water Treatment

The Limoges water treatment facility is located at 269 Limoges Road in the north end of the Village. The water treatment plant has a rated capacity of 24.1 L/s (2,080 m^3/day). At the water treatment facility, the raw water passes through a tray aerator in order to remove methane and part of the hydrogen sulphide (H_2S) gases present in the raw water. The water then drops into an aeration basin in order to stabilize the remaining concentration of H_2S and continues the H_2S oxidation. The aerated water is then pumped into a detention tank where potassium permanganate is injected to complete the oxidation of the remaining H_2S, iron, manganese and organic matter. An alum-based coagulant poly-aluminum-silicate-sulphate (PASS-100 from Eaglebrook) and a polymer (CIBA Magnafloc LT25) are presently injected into the water upon leaving the detention tank in order to enhance the coagulation of the oxidized organic matter. Two (2) flocculation vessels with lamellas provide a 40 minute retention time for the flocs to settle. Afterwards, additional potassium permanganate is injected before the clarified water enters the four (4) dual media anthracite and greensand filters. After filtration, the water is chlorinated and sent to a 160 m^3 clearwell before being pumped into the above-ground reservoir.

3.5.1.3 Water Distribution & Storage

The Water Distribution system begins at the above-ground cylindrical water storage reservoir located adjacent to the water treatment plant. The reservoir has a firm capacity of 1,734 m^3 and consists of 3.6 m high vitrified steel plates covered by an aluminum roof.

Upon leaving the reservoir, water enters the adjacent pump station which houses three booster pumps, three fire pumps and one backwash pump. The design point of the booster pumps is 8.6 L/s at 39.0 m TDH while the fire pumps have a design point of 54.6 L/s at 24.4 m TDH. One booster pump is always running with the pressure in the distribution system regulated by a pressure reducing valve located in the pump station. As demand increases, and the flowrate through the flowmeter increases, additional booster pumps and fire pumps are started according to the specific flowrate set-points. Upon leaving the pump station, the water enters the distribution network.

The Limoges water distribution network provides water to the Village of Limoges, Calypso Water Park, Le Baron Estates, Forest Park and the Ben Tardif mobile home park. It has two pressure zones. The first pressure zone (Zone 1) encompasses all of the village core (including Calypso Park, Le Baron and the St. Viateur Nursing Home) and extends as far south as the check valve located in an easement just north of Route 500 (opposite the Cambridge Public School).

The second pressure zone (Zone 2) is regulated within the Forest Park pump station. The northern limit of Zone 2 is at the aforementioned check valve and includes the Cambridge Public School, Route 500, Forest Park and continues southward on Castor Street and Route 600 to the Ben Tardif mobile home park. During overnight hours (23:00 to 06:00) the Forest Park reservoir filling valve in Zone 2 may open in which case the Zone 2 booster pumps switch off. While the filling valve is open, the pressure in Zone 2 matches that provided from Zone 1.

As mentioned, Zone 2 is provided with a stand-alone underground storage reservoir and a pump station located at 214 Maple Grove Street in the Forest Park Community. The underground reservoir has a firm capacity of 717 m^3. The pump station is equipped with three electrically driven vertical turbine pumps and one diesel driven fire pump. Figure 3-10 illustrates the potable water system.

Figure 3-10: Limoges Potable Water System

3.5.2 Limoges Wastewater System

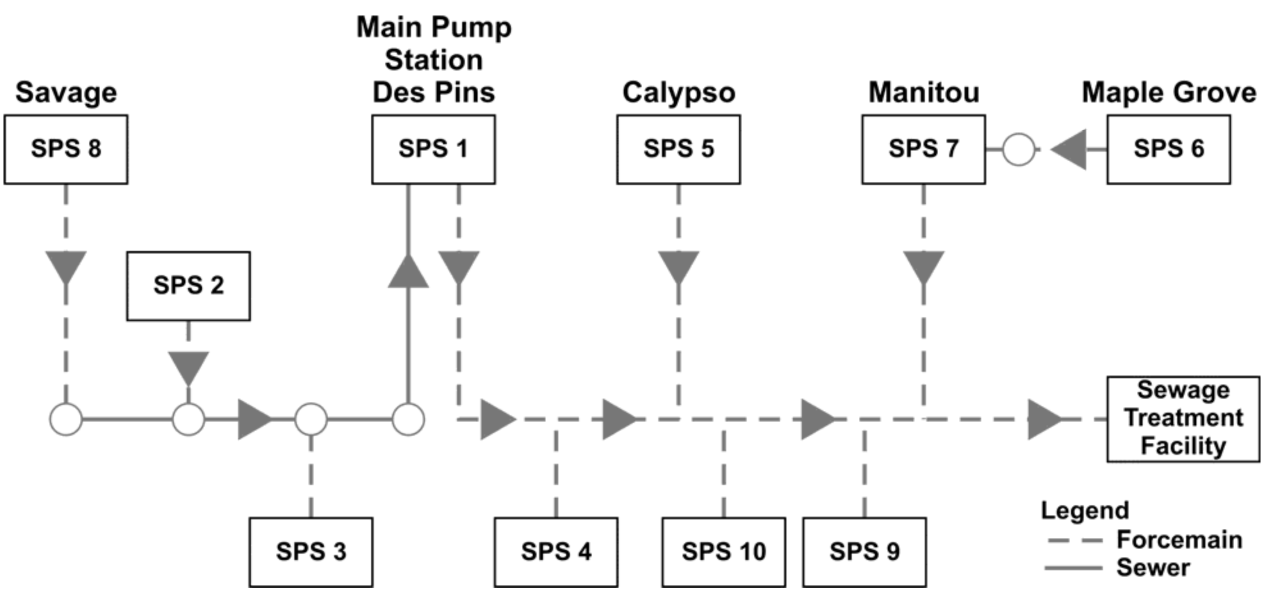
3.5.2.1 Wastewater Collection

The wastewater collection system for the Village of Limoges was brought into service in 2001. Several expansions to the system have occurred since that time to accommodate growth and requests for service. The system consists of gravity sewers which all drain to sewage pumping stations (SPSs) prior to being conveyed to the sewage treatment facility (Figure 3-12). The village core is serviced by three local sewage pump stations, SPS-2, SPS-3 and SPS-8 which are all tributary to SPS-1. SPS -2 is located at 32 Main Street, SPS-3 is located adjacent to 468 Limoges Road, SPS-8 is located at 2165 Savage Street, and SPS-1 is located at 2131 Des Pins Street. From SPS-1 a 9 km long 300 mm diameter 'main' forcemain conveys sewage to the wastewater treatment facility located at 1899 Route 500W.

Five additional sewage pumping stations discharge directly into the 'main' forcemain at various locations along its route. These are SPS-4, SPS-5, SPS-7, SPS-9 and SPS-10 (Figure 3-11):

- SPS-4 (Bytown) is located opposite 2146 Calypso Street;
- SPS-5 (Calypso) is located at 2090 Calypso Street;
- SPS-6 (Maple Grove) is located at 214 Maple Grove;
- SPS-7 (Manitou) is located next to 107 Manitou;
- SPS-9 (Cambridge Public School) is located at 2123 Route 500W; and
- SPS-10 (St. Viateur Nursing Home) is located at 1003 Limoges Road.

Figure 3-11: Forcemain and Pump Station Schematic



3.5.2.2 Wastewater Treatment

The wastewater treatment facility was brought into service in 2001. It consists of two retention lagoons which discharge to the Castor River in the spring and fall. It is equipped with an alum injection system for phosphorous removal, and an aeration system to prevent the formation of hydrogen sulphide for odour control. The facility has an approved rated daily average flow of 1,073 m^3/d and a total capacity of approximately 227,600 m^3.

Effluent Water Quality

Effluent samples and flow measurements were collected at the Limoges Treatment Lagoon during both spring and fall discharge events in 2010 (Golder, 2011g). Table 3-2 is a summary of the results from the 15 samples.

Table 3-2: Effluent Parameter Values-Limoges Facility

Parameters	Spring Minimum	Spring Maximum	Spring Average	Autumn Minimum	Autumn Maximum	Autumn Average
Unionized Ammonium(mg/L)	0.011	0.083	0.051	0.0003	0.004	0.002
BOD_5 (mg/L)	5	12	9.33	<3	3	<3
DO (mg/L)						
pH	6.79	7.54	7.31	7.21	8.65	8
Total Phosphorus (mg/L)	0.14	0.28	0.08	0.04	0.2	0.105
Effluent Flows (m^3/s)	.0474	.1495	.0812	.0134	.0491	.0224
TSS (mg/L)	<3	21	8.83	<3	16	8.17

Unionized ammonia concentrations generally exceeded the Provincial Water Quality Objectives (PWQO) limit of 0.02 mg/L. Throughout the autumn months, however, the concentrations remained within the PWQO limit. BOD_5 concentrations were primarily less than the minimum detection limit. PH was within the PWQO limit of 6.5 to 8.5 except on one occasion October 26, 2010 when it was 8.65. Total phosphorus exceeded the PWQO limit of 0.03 mg/L in all spring and fall samples.

Figure 3-12: Wastewater System

3.5.2.3 Assimilative Capacity Study of the Castor River

The Castor River received the effluent from the Limoges lagoons. A desktop assimilative capacity study (Appendix G) of the Castor River was undertaken in May 2011 (with an update completed in November 2011) to assess:

- existing water quality performance in the Castor River during non-discharge conditions;
- existing downstream water quality performance in the Castor River during batch discharge; and
- the maximum permissible increase in treatment capacity that can be achieved for the Limoges facility relative to Certificate of Approval No. 3-1820-97-986.

Castor River Water Quality

Water quality in the Castor River is measured at two upstream locations as part of the Provincial Water Quality Monitoring Network (PWQMN); one at the Wade Road Bridge, upstream of the Russell sewage lagoon discharge; and a second at St Andre Road, downstream of the Russell Sewage Treatment Lagoon. The St. Andre Road station was selected as the most appropriate for characterizing the water quality at the Limoges lagoon outlet since it would account for the effects of the Russell Sewage Lagoon. Four key parameters were reviewed for period between 2002 and 2006. The average results are presented in Figures 3-13 and 3-14.

According to a review of the Clean Water Program 2009 Annual Report (SNC, 2010), phosphorous management is a recognized imperative in the South Nation Conservation area. Based on the PWQMN results, the phosphorus levels in the Castor River are regularly higher than the 30 µg/L PWQO.

Figure 3-13: Castor River Water Quality: pH and Dissolved Oxygen

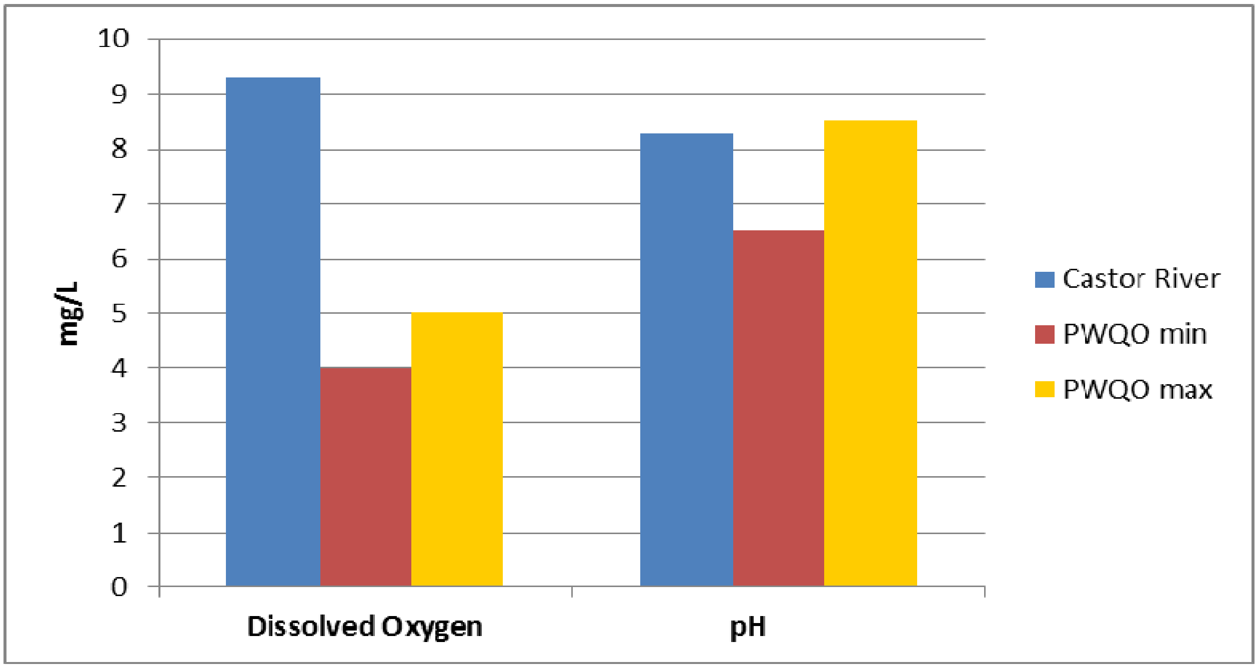
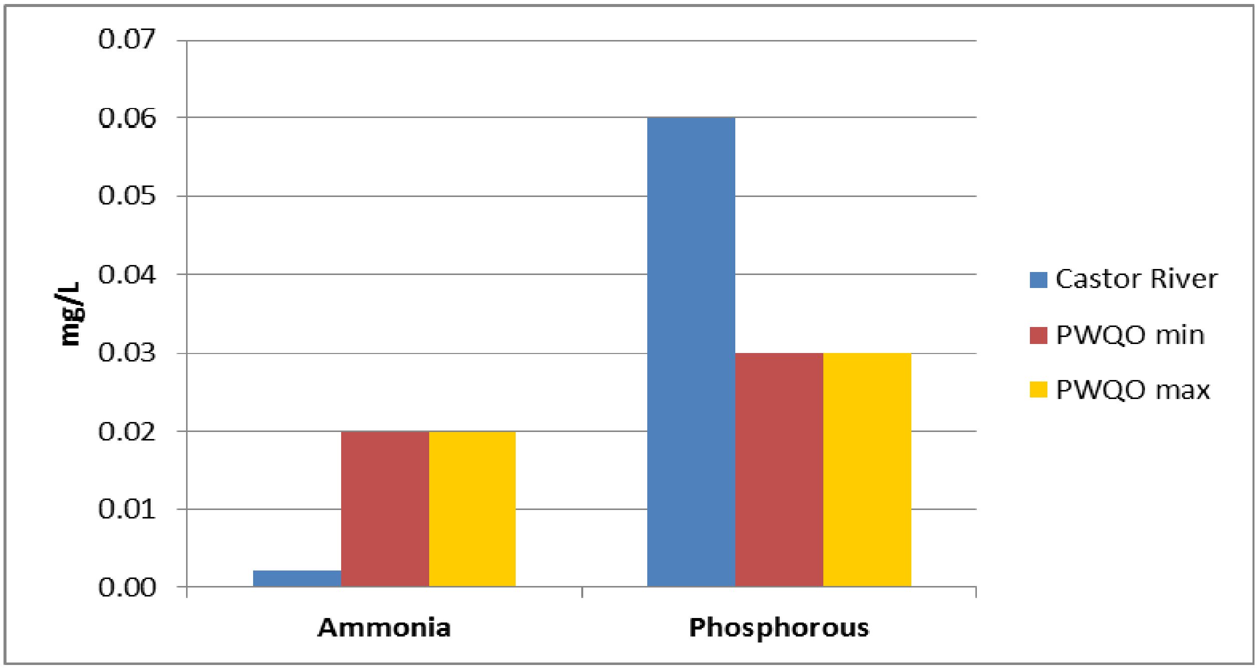


Figure 3-14: Castor River Water Quality: Ammonia and Phosphorus



Castor River Water Quantity

A representation of flows for the subject reach was developed through data provided by the Water Survey of Canada (WSC). Based on this record, daily flows averaged 5.4 m^3/s, with minimum and maximum average daily flows of 0.03 m^3/s (on August 7, 1968) and 156 m^3/s (on March 29, 1998), respectively. Average monthly flows over the period varied from a maximum of 22.4 m^3/s for April to a minimum of 1.0 m^3/s in August. Additional flow information was collected from the monitoring station at St Andre Road.

Overall, flow conditions were based on the larger set of available daily flow records (1968-2002, 2004, and 2005). The average flow conditions were assumed to correspond to the mean for each three month period, while the low flow condition was assumed to correspond to the minimum 7 day average low flow with a return period of 20 years ($7Q_{20}$).

Assimilative Capacity

Based on the comparison of existing water quality performance and applicable PWQO / ECA criteria the available assimilative capacity for examined parameters of interest is tabulated in Table 3-3 below (Golder, 2011g). Based on existing effluent quality and corresponding ECA and water quality (PWQO) criteria there is sufficient assimilative capacity in the Castor River to increase effluent flows by approximately 247% (Golder, 2011g).

Table 3-3: Available Assimilative Capacity Based on Key Parameter Compliance with Existing Certificate of Approval or Provincial Water Quality Objectives

Parameter	Regulating Criteria	Threshold	Allowable Increase	
			Kg	%
pH	PWQO[10]	6.5 – 8.5	No spare capacity without additional treatment due to occasional exceedences[10]	
Total Ammonium	C of A	15 mg/L Spring 3 mg/L Autumn	No limitations identified provided concentrations remain below C of A criteria	
Unionized Ammonia	PWQO	0.02 mg/L	No allowable increase based on PWQO since background concentrations are above PWQO. Concentrations above the PWQO are implicitly permitted by the terms of the C of A.	
Total Phosphorous	C of A	392 kg	344.6[11]	727[11]
	PWQO	0.03 mg/L	No allowable increase based on PWQO since background concentrations are above PWQO. Concentrations above the PWQO are implicitly permitted by the terms of the C of A.	
Dissolved Oxygen (Warm Water Biota)	PWQO	5 mg/L Spring	-	56[12]
		4 mg/L Autumn	-	93[12]
Biochemical Oxygen Demand	C of A	9,791 kg	6,966 kg	247[11]

[10] pH-induced inflow limitations could be addressed through chemical additives, ensuring that the PWQO range of 6.5 – 8.5 is maintained under all discharge conditions.
[11] Based on 2010 combined spring and autumn discharges compared to the design limits in the existing C of A.
[12] Based on the initial mixing of the effluent (assumed dissolved oxygen concentration of 1 mg/L) into the river. Dissolved oxygen induced limitations could potentially be addressed by appropriate aeration of the effluent before discharge

4.0 ALTERNATIVE SOLUTIONS

An understanding of growth objectives, existing conditions, and an analysis of technical considerations were utilized in developing alternative solutions. Water and wastewater servicing alternatives are described in the following sections.

4.1 Water Supply

4.1.1 Description of Alternatives

- Do Nothing
- Groundwater
- Existing surface water sources (piped services)
- New Surface water sources (piped services)

Alternative 1: Do Nothing

The "Do Nothing" alternative would involve leaving the existing water supply system in its current state and would not implement any additional measures to increase water capacity to accommodate additional growth. Since the current system is at capacity, further development is restricted.

Alternative 2: Groundwater Source

The "Groundwater Source" alternative would include various ways to expand the existing groundwater supply system and increase the production of existing municipal wells within or beyond existing regulated rates. This could take the form of expanding existing wells or the development of new municipal wells. Existing wells would remain in operation. Water treatment facilities would need to be expanded to accommodate the additional volumes and additional storage facilities would also be required to allow for additional growth and development within the Village limits or serviced area.

Alternative 3: Surface Water Source (piped services)

The "Surface Water Source" alternative would include the provision for piped surface water sources located within the municipality or from outside of the municipalities including the City of Ottawa, Township of Russell and the Municipality of Clarence-Rockland. In addition to the requirement for a water feedermain to transport the water, water storage facilities would also be required and could be in the form of above ground / at-grade storage tanks or cisterns, and the requirement for a new municipal treatment facility. All other current water sources and supporting infrastructure would be decommissioned to allow for additional growth and development within the Village limits or serviced area.

Alternative 4: Municipal Water Source (piped services)

The "Municipal Water Source" alternative would include the extension of a water forcemain to connect to existing City of Ottawa treated water system. Water storage facilities would also be required to store water. The existing Treatment Plant would be downsized to provide disinfection only. All other current water sources and supporting infrastructure would be decommissioned to allow for additional growth and development within the Village limits or serviced area.

4.1.2 Evaluation of Alternatives

The evaluation of alternative solutions involved an impact assessment of each alternative with respect to the criteria and indicators developed by the Study Team (Table 4-1).

Table 4-1: Evaluation of Water Supply Alternatives

Criteria	Alternatives			
	Do Nothing	New Groundwater Source	New Surface Water Source	Piped Water from Neighbouring Municipality
Environmental Criteria: • Natural Heritage Features • Surface Water • Groundwater	• No physical works result in no effect • No surface water effects • Potential settlement surrounding existing well requires continued monitoring	• Localized effect on area surrounding wells • No surface water effects • Suitable groundwater quality and quantity available	• Extensive feedermain construction effects • Reduction in surface water quantity from sources • Additional wastewater from treatment plant requires discharge to surface • No groundwater effects	• Extensive forcemain construction effects • No local surface water effects • Dewatering will be required during construction
Land Use Policy Criteria: • Growth in Settlement Areas	• Does not permit growth	• Permits growth in development areas	• Permits growth in development areas	• Permits growth in development areas
Cost Criteria: • Capital Cost • Operational Cost	• None • Lowest operational costs	• Moderate capital cost • Moderate operational costs	• High capital cost for new treatment plant • High operational costs	• High capital cost • Low operational costs
Technical Criteria: • Constructability • Reliability	• No physical works • Does not improve the reliability or provide contingencies	• Simple to construct • Expansion of existing system can be easily phased • Reliable technology • Reliable water quality	• Complex to construct • Difficult transition • Can be phased • Technology dependant on raw water quality	• Moderate construction complexities • Can be easily phased • Reliable water quality
Totals		**Carried Forward**		**Carried Forward**

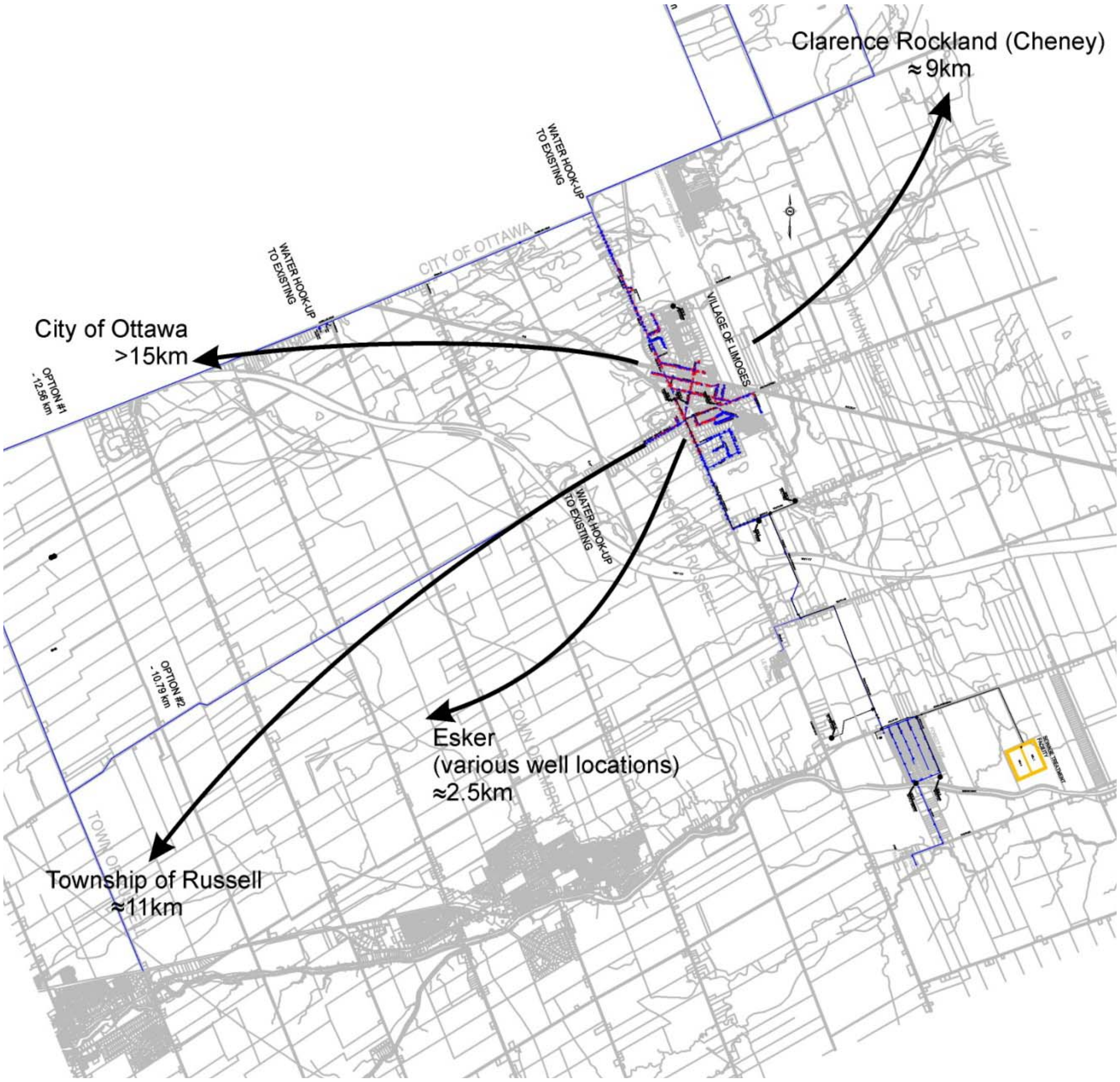
Preferred

Not acceptable

4.1.3 Preferred Water Supply Alternatives Carried Forward

The ‘new groundwater source’ and ‘piped water from a neighbouring municipality’ options were carried forward as the preliminary preferred water servicing solutions (Figure 4-1).

Figure 4-1: Preferred Water Supply Solutions



4.1.3.1 Groundwater Source Alternative

The groundwater source alternative would include various ways to expand the existing groundwater supply system and increase the production of existing municipal wells within or beyond existing regulated rates. This could take the form of expanding existing wells or the development of new municipal wells. Existing wells would remain in operation. Water treatment facilities would need to be expanded to accommodate the additional volumes. Additional storage facilities would also be required.

A new groundwater source was carried forward as a preliminary preferred alternative based on the following evaluation:

- No surface water effects
- Suitable groundwater quality and quantity available
- Permits growth in development areas
- Moderate capital and operation cost
- Simple to construct and expansion can be easily phased
- Reliable technology
- Reliable water quality requiring less treatment

4.1.3.2 Piped Water Alternative

The piped surface water alternative would include the provision for piped surface water sources located within the municipality or from outside municipalities including the City of Ottawa, Township of Russell and the Municipality of Clarence-Rockland. In addition to the requirement for a water feedermain to transport the water, water storage facilities would also be required and could be in the form of above ground or at-grade storage tanks or cisterns, and the requirement for a new municipal treatment facility. Piped water from a neighbouring municipality was carried forward as a preliminary preferred alternative based on the following evaluation:

- No local surface water effects
- Permits growth in development areas
- Low operational cost
- Moderate construction complexities and can be easily phased
- Reliable water quality

4.2 Wastewater System

4.2.1 Description of Alternative Solutions

- Do Nothing
- New Treatment Cell (Lagoon)
- Mechanical Treatment Plan
- Connect to Adjoining Municipalities

Alternative 1: Do Nothing

The “Do Nothing” alternative would leave the existing sewage collection and treatment capacity in its current state and would not implement additional measures to increase sewage capacity to accommodate additional growth. The wastewater treatment system for the Village of Limoges is at capacity, and planned development is not able to continue.

Alternative 2: New Treatment Cell (Lagoon)

The “New Treatment Cell” alternative would require the design and development of additional retention lagoon(s) located within the municipality. The existing sewage lagoons would remain operational to allow growth to continue at an existing rate or and allow for additional development.

Alternative 3: Mechanical Treatment Plant

The “Mechanical Treatment Plant” Alternative would include the construction of a stand-alone sewage treatment facility on or near the site of the existing sewage lagoons. The existing lagoons would provide short term storage capacity once the new treatment facility was on-line. Treated effluent would outlet to the Castor River. This alternative would permit growth to continue at an existing rate or allow for additional development.

Alternative 4: Connect to Adjoining Municipalities

The "Connect to Adjoining Municipalities" Alternative would require the construction of a sewer forcemain to connect to an existing neighbouring municipality sewage collection system. Sewage treatment would be accomplished by the receiving system. The existing sewage lagoons would be decommissioned. This alternative would permit growth to continue at an existing rate or allow for additional development.

4.2.2 Evaluation of Alternatives

The evaluation of alternative solutions involved the completion of an impact assessment for each alternative with respect to the criteria and indicators developed by the Study Team (Table 4-2).

Table 4-2: Evaluation of Alternatives Wastewater Servicing

Criteria	Alternatives			
	Do Nothing	New Retention Pond	New Mechanical Plant	Piped to Neighbouring Municipality
Environmental Criteria: • Natural Heritage Features • Surface Water	• No physical works result in no effect • Continued discharge to Castor River	• Localized effect on area surrounding lagoons • Continued discharge to Castor River	• Localized effect on area surrounding lagoons • Improved discharge quality to Castor River	• Extensive forcemain construction effects • Discharge diverted from Castor River elsewhere
Land Use Policy Criteria: • Growth in Settlement Areas	• Does not permit growth	• Permits growth in development areas	• Permits growth in development areas	• Permits growth in development areas
Cost Criteria: • Capital Cost • Operational Cost	• None • Lowest operational costs	• Moderate capital cost • Moderate operational costs	• High capital cost • High operational costs	• Highest capital cost • High operational costs
Technical Criteria: • Constructability • Reliability	• No physical works • Does not improve the reliability or provide contingencies	• Simple to construct • Can be easily phased • Established technology	• Simple to construct • Can be easily phased • Known and reliable technology	• Potential construction complexities • Cannot be easily phased • Conveyance risks
Totals		**Carried Forward**	**Carried Forward**	

Preferred

Not acceptable

4.2.3 Preferred Wastewater Alternatives Carried Forward

The ‘new retention pond’ and ‘mechanical treatment plant’ options were carried forward as the preliminary preferred wastewater servicing solutions. Figure 4-2 identifies the preferred location for the new sewage treatment facility, with the lagoons illustrated in yellow.

Figure 4-2: Preferred Wastewater Solutions

4.2.3.1 New Retention Ponds Alternative

The new treatment cell/retention pond alternative would require the design and development of additional retention lagoon(s) located within the municipality. The existing sewage lagoons would remain operational to allow growth to continue at an existing rate or allow for additional development. The new retention pond alternative was carried forward as a preliminary preferred alternative based on the following evaluation:

- Localized effects on the area surrounding lagoons
- Permits growth in development areas
- Simple to construct
- Easily phased
- Established technology

4.2.3.2 Mechanical Treatment Plant Alternative

The mechanical treatment plant alternative would include the construction of a stand-alone sewage treatment facility on or near the site of the existing sewage lagoons. The existing lagoons would provide short term capacity once the new treatment facility was on-line. Treated effluent would outlet to the Castor River permitting growth to continue at an existing rate or allowing for additional development. The mechanical treatment plant alternative was carried forward as a preliminary preferred alternative based on the following evaluation:

- Localized effects on the area surrounding lagoons
- Improved discharge quality to the Castor River
- Permits Growth in development areas
- Can be easily phased
- Known and reliable technology

5.0 UPDATED EXISTING CONDITIONS

5.1 Assimilative Capacity

An initial desktop Assimilative Capacity Study was undertaken to confirm the general acceptability of the Castor River for sewage effluent. As the EA proceeded to the subsequent phases, additional information was collected to ascertain specific information regarding discharge criteria and constraints (Golder 2011g). The field component consisted of:

- Bathymetric and velocity transects surveys;
- Water and sediment quality sampling;
- A dissolved oxygen survey (vertical profiles, longitudinal profiles, and 24 hour monitoring);
- An inspection of the existing Limoges outfall; and
- An inspection of the weir at Casselman.

The assessment of the results incorporated flow representation, dissolved oxygen modeling, nutrients, and sediment oxygen demand. The allowable effluent discharge rates to the Castor River used the model developed and calibrated with the information collected and assessed.

There are potential seasonal periods when the Castor River cannot accommodate the design flow. Using the existing lagoons to store the effluent during periods of reduced or no allowable discharge has been suggested as an option where continuous discharge from the mechanical treatment plant is not feasible.

Based on the analysis and assessment of the Assimilative Capacity of the Castor River, the following conclusions are provided:

- On the basis of maintaining downstream dissolved oxygen concentrations above the PWQO values, effluent discharge from a mechanical treatment plant is possible under most conditions. Temporary storage of the effluent or reduced effluent flow rates are required most years during low flow periods during the summer and winter ice covered period.
- Based on a 35-year simulation, the volume of the existing lagoons (340,000 m3) provides adequate storage capacity to hold the plant effluent during the winter and autumn periods.
- Allowable discharge loads of total ammonia can be established to maintain an acceptable un-ionized ammonia concentration downstream.
- The concentrations for total phosphorous in the Castor River exceed the PWQO values in most of the historical samples. This would suggest that there is no additional assimilative capacity in the Castor River to accommodate increased loads of phosphorous. However, during the approval process of the future facility, the effects of phosphorous on the water quality in the Castor River must be considered when establishing the effluent criteria and allowable discharge loads.

5.2 Hydrogeological Investigation

Groundwater may form a part of the Limoges water supply into the future. In order to supply the increased demands for potable water, due to development within Limoges, an additional well or wells will likely be required. A groundwater resource evaluation was undertaken to determine a suitable location for a new municipal well and to drill a test well at that location. A pumping test was conducted to determine the potential for groundwater of sufficient quantity and quality is available (Golder, 2011f). The site was chosen based on known hydrogeological information from the existing communal supply wells on the Vars-Winchester esker as well as geophysical work performed by the Geological Survey of Canada (GSC).

A test well was installed to a depth of approximately 32 m and pumped for a relatively short period of time to determine preliminary hydraulic characteristics of the aquifer. Adjacent groundwater monitoring wells were used to monitor aquifer response to pumping test. The pumping test was conducted for 24 hours at a rate of 80 - 120 L/min and recovery was monitored over the following 24 hours.

It has been shown at a number of locations that the esker is capable of producing groundwater at a quantity that is sufficient for an additional municipal well or wells for the Village of Limoges. The Embrun wells are permitted to be able to produce 65 L/s, the Vars wells can produce 27 L/s and the Limoges wells can produce 24 L/s. For the required water supply to service the anticipated growth in Limoges (145 L/s) it is anticipated that an additional two to six wells will be required, based on the maximum and minimum flow rates from existing wells on the aquifer. These wells will have to be spaced at some distance from each other along the aquifer. Water quantity should not be a constraint to using groundwater as a potential source to meet the requirements of the Village of Limoges. However, access to property to build new wells and the infrastructure required to connect the new wells to the existing system may add expense to the project.

A preliminary assessment has been carried out to determine if the proposed water taking from the sand and gravel deposits will result in drawdowns that could cause settlement of the overlaying soft clay soils. Based on the results of the modeling and the current understanding of the clay properties from one testing location (near the existing Limoges communal well site), the proposed pumping (and groundwater drawdown) has a low likelihood of causing significant settlement at the ground surface (Appendix E).

In order to minimize drawdown and ensure that the water table is not lowered for extended periods of time, multiple wells can be installed at various points along the esker in order to minimize the impacts of water taking at a single location. Multiple wells, operating at lower flows than would be required for a single well, will not induce the same potential area of influence (in size) around the wellhead. The wells would be located along the esker such that they would not interfere with each other or with other groundwater users. The Vars and Limoges communal wells are located approximately 1.5 kilometres apart and show no interference with each other.

The proposed well location is approximately four kilometres south of the Limoges wells (5.5 kilometres south of the Vars wells) and as such should not interfere with the existing wells. Well field design factors should be considered in order to improve groundwater production from the site, including:

- Well construction, including installation of an appropriate gravel pack and well screen that must be designed to prevent fine particles from blocking the screen which can restrict flow to the well;
- Larger diameter wells should be installed to allow for greater production rates by allowing for installation of larger pumps and increased groundwater flows; and,

- Multiple wells could be installed to meet the required supply for Limoges within the esker. These wells should be located to minimize interference.

The water quality results from the test well shows a potable supply of acceptable water quality that meet the ODWQS for the parameters analyzed in the esker aquifer. Nearby overburden groundwater not on the esker aquifer is of different water quality and appears more similar to the bedrock groundwater quality. The bedrock is not only deemed unsuitable for a communal well due to its physical characteristics, but also due to variable water quality characteristics. The results of this study and background information from the area show that bedrock is generally more mineralized than the overburden groundwater. Bedrock groundwater may also contain natural gas.

5.3 Source Water Protection

The *Clean Water Act, 2006* regulates the preparation and implementation of source water protection plans for drinking water supplies. The Raisin-South Nation Source Protection Committee developed a Source Protection Plan that contains a collection of policies to address activities that are, or would be, significant drinking water threats for all municipal drinking water systems in the area (Raisin-South Nation Source Protection Region, 2012).

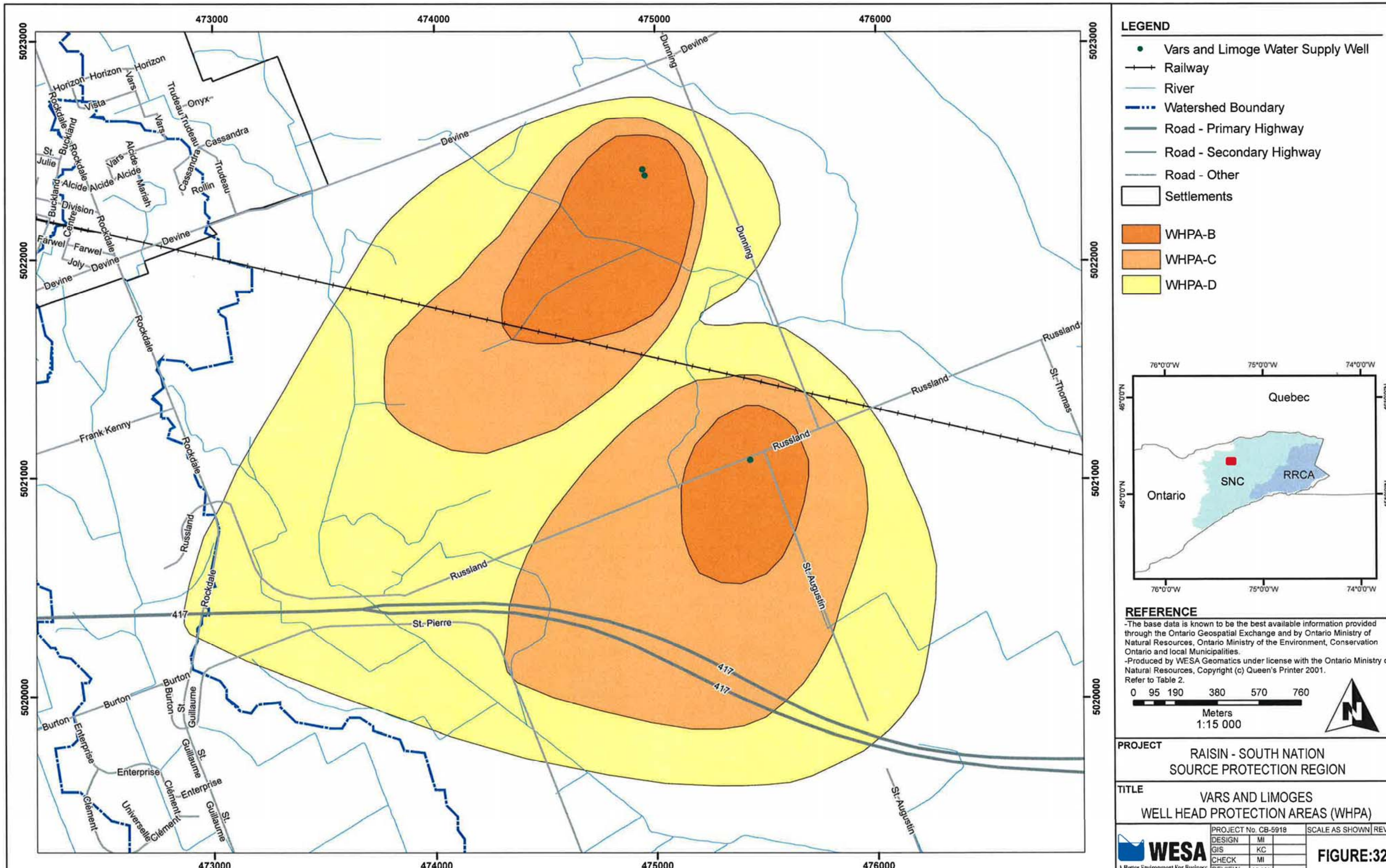
> *"The goal of Source Protection is to ensure that drinking water sources are clean and safe even before they are treated. Ultimately, this can save money related to water treatment, and will help to protect the source for long-term use. The Source Protection Plan is part of a science-based, multi-barrier approach to providing clean water from source to tap in the Raisin-South Nation Source Protection Region."*
>
> (Raisin-South Nation Source Protection Region, 2012).

5.3.1 Municipal Wells

As part of the source protection planning exercise undertaken by the Raisin Region Conservation Authority (RRCA) and South Nation Conservation (SNC 2010), completed a Well Head Protection Area (WHPA) Study and a vulnerability assessment for the Limoges and Vars municipal wells (Golder 2011d). The following four wellhead protection zones were defined (Figure 5-1):

- Zone A – 100 metre radius pathogen security/prohibition zone;
- Zone B – 2 year Time of Travel (ToT) pathogen management zone;
- Zone C – 5 year ToT Dense Non-Aqueous Phase Liquid (DNAPL)/contaminant protection zone; and,
- Zone D – 25 year ToT secondary protection zone.

Figure 5-1: Vars/Limoges Well Head Protection Area



These zones are used to assist in identifying various levels of potential risks faced by municipal supply wells from pathogens and chemical contaminants. As part of the source water protection process, an issues evaluation and threats inventory for the defined WHPA, as well as a tier 1 water quality risk assessment for identified threats within the WHPA was undertaken by Dillon Consulting Limited and reported by Golder Associates in the Existing Hydrogeological Conditions Study (Golder 2011d).

The threats assessment for the Limoges and Vars municipal wells WHPA D which is shared with both well fields (Dillon Consulting Limited, 2010) identified the following:

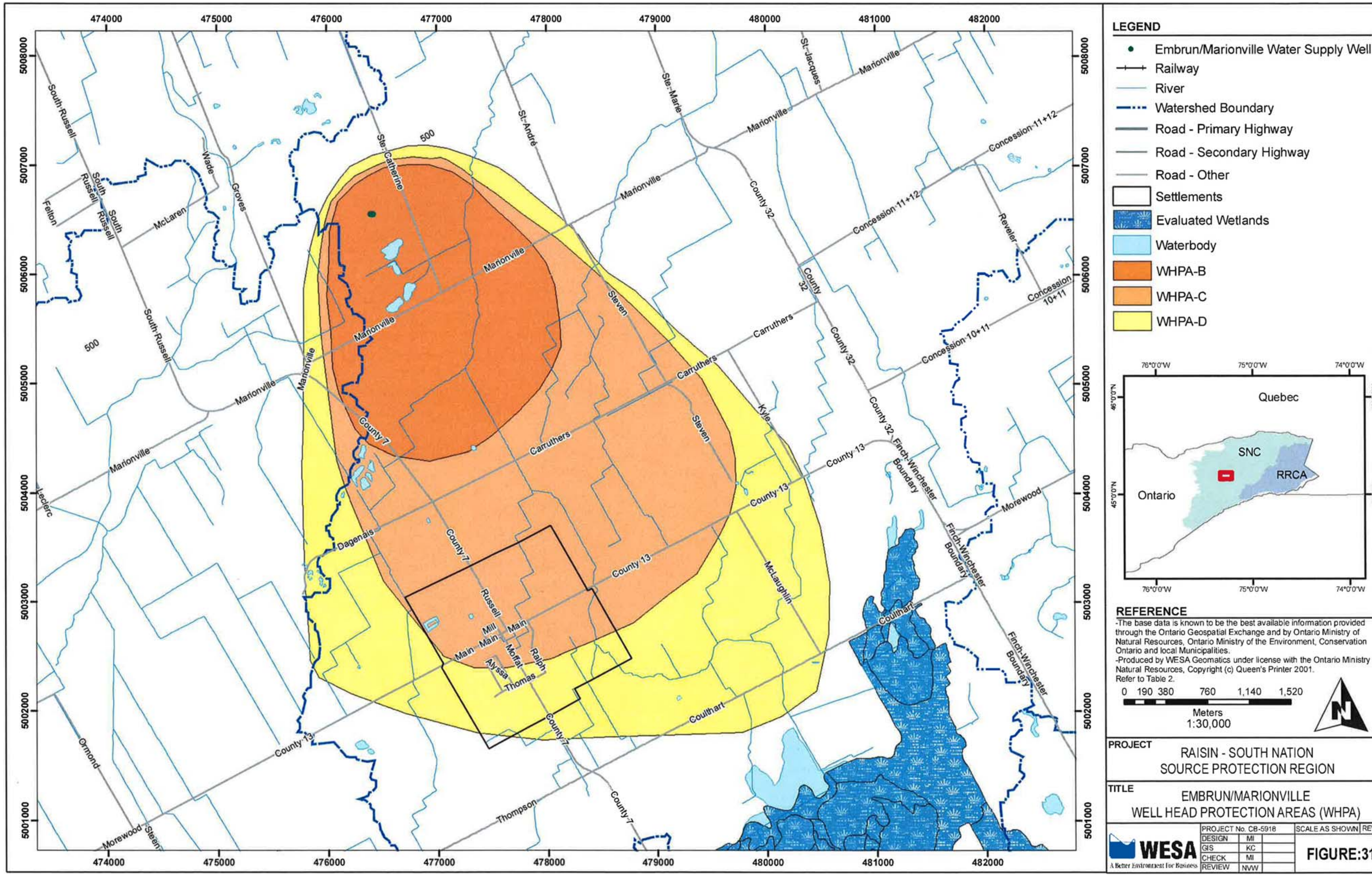
- No features were identified in the Vars/Limoges WHPA-D that support prescribed activities that could potentially pose significant threats;
- No possible occurrence of prescribed activities was identified that would potentially pose a significant threat to the Vars/Limoges WHPA-D; and
- One small non-PCB mineral oil spill has occurred in the WHPA-D. However it is not located within the vulnerability zone with a score of 10 and remedial activities may have occurred. It is unlikely that this spill will impact the source water in Vars or Limoges WHPAs.

The threats assessment for the Embrun/Marionville municipal wells (Figure 5-2) identified the following (Golder 2011):

- The majority of the threats for the Embrun/Marionville WHPA are associated with crop farming activities;
- The threats associated with crop farming activities are associated with the use of commercial fertilizers, agricultural source material, non-agricultural source material, fuel, pesticide and commercial fertilizer. The use may include handling, storage, or application;
- A total of four parcels had a significant threat associated with non-metallic mineral mining and quarrying due to the storage of Dense Non-Aqueous Phase Liquids (“DNAPL”) and/or the handling and storage of fuel;
- Six parcels had significant threats associated with cattle ranching and farming activities. The threats associated with this activity include the application of source material and the management or handling of agricultural source material and agricultural source material generation;
- Five parcels identified threats from on-site septic system holding tanks for recreational/residential use, all of which occurred in WHPA-B; and
- A total of three parcels had significant threats associated with the handling and storage of a DNAPL based on land use activities of Automotive Parts, Accessories and Tire Stores, Automotive Repair and Maintenance and Residential Building Construction.

Threats identified in the WHPAs for the Vars, Limoges and Embrun/Marionville Wells include mostly threats associated with agricultural use, residential septic systems and fuel storage and handling. In the three existing water supplies in the Vars-Winchester esker (Vars, Limoges and Embrun/Marionville) it has been found that with treatment, the water is considered to be potable. The Vars municipal wells have had exceedences of the Ontario Drinking Water Quality Standards (ODWQS) for colour, TOC, manganese and iron in the raw water. The Limoges municipal wells have had exceedences of colour, dissolved organic carbon, iron and manganese in the raw water supply. The Embrun/Marionville wells have also had exceedences of TDS, iron and manganese in the raw water.

Figure 5-2: Embrun / Marionville Well Head Protection Area



Treatment at all locations has brought the concentrations of these parameters to below the ODWQS. Overall, wells completed in the esker are expected to produce groundwater that is safe and aesthetically suitable for human consumption (Golder 2011d). The threats identified near the Embrun/Marionville wells can be considered a constraint to development at the site (Golder 2011d). Further study will be required to determine if contamination could be a potential problem at this location.

5.3.2 Surface Water

The Village of Casselman municipal drinking water intake is located within the South Nation River a short distance (approximately 2 km) downstream of the confluence with the Castor River. The Intake Protection Zone 2 (IPZ-2) for the Casselman intake, identified during Source Water Protection assessment work as required by the *Clean Water Act*, extends almost all the way to the Limoges lagoons. Effluent limits for sewage effluent will need to be developed for Total Phosphorus (TP), ammonia, Total Suspended Solids (TSS), and *E. coli*, in consideration of this.

6.0 ALTERNATIVE DESIGN CONCEPTS

6.1 Water Supply Alternative Concepts

Alternative 1: New Groundwater Source – New Wells

The current groundwater supply system could be expanded by adding more wells to meet the ultimate demand. A pilot well was drilled within the Vars/Winchester Esker at the intersection of Route 200 and St. Pierre Road in the Township of Russell. Results from the pilot well confirmed that a single well could have the potential of supplying a flow rate of 24 L/s. The flow rate of about 24 L/s from the existing wells No. 1 and 2 could be supplemented by additional wells within the esker to meet the ultimate demand within the current village boundary. The Limoges WTP would be expanded as required. It is assumed that the water quality from the new well(s) would be of similar quality to the existing ground water source and as such, the existing WTP process would be appropriate. A new watermain to the pilot well site would be 5.5 km long and would connect at the existing Limoges well site (Figure 6-1). The existing watermain from the Limoges wells to the Limoges WTP would have to be upsized or twinned once the capacity of the existing watermain is reached.

Alternative 2: New Groundwater Source – Embrun/Marionville WTP

The current groundwater supply system could be expanded by adding more wells to meet the ultimate demand. When Russell Township connected to the City of Ottawa water distribution system as part of their Source Water Replacement Project, the existing Embrun/Marionville Water Treatment Plant (WTP) was taken off-line and is currently for sale. Lower flow rates from the Embrun Wells in the range of 45 L/s would reduce raw water iron and manganese concentrations which would lower treatment costs. The existing Embrun/Marionville WTP could remain operational as a pre-treatment process to reduce upgrades/modifications at the Limoges treatment plant. There is also an opportunity to partner with the Township of Russell as part of their plans to service the business park located near the 417/Rockdale Road interchange. A 12 km long watermain would be required from the existing Limoges well No. 1 and No. 2 location to the Embrun Reservoir, where the pipe would be connected to the existing watermain from the Embrun/Marionville Treatment Plant (Figure 6-1). The constraint associated with this well is that these wells could have to be permanently shut down, if the aquifer becomes contaminated by the landfill site located nearby. In addition to the existing Embrun/Marionville well, there would be a need to add wells to meet the ultimate demand in Limoges.

Alternative 3: Piped Water from a Neighboring Municipality – Clarence Rockland

This option consists of connecting the Limoges water distribution system to the Clarence-Rockland water distribution system (Figure 6-1). The existing Clarence-Rockland WTP would have to be doubled in size to accommodate the Limoges demand. The existing transmission main from Rockland to Hammond would have to be twinned and the existing booster station in Rockland would have to be tripled in size. A new booster station would be needed on Bouvier Road. The Limoges WTP plant would be scaled back to provide disinfection only. This option was seen as cost prohibitive; therefore, no costing was developed for this option.

Alternative 4: Piped Water from a Neighboring Municipality – Russell Township

As part of this option, a new connection to the Russell Township feedermain would be made to supply water to Limoges. A booster station at the intersection of Eadie Road and Burton

Road, in the Township of Russell, would be required, along with a 6 km long watermain that would connect at the existing Limoges wells No. 1 and No. 2 site (Figure 6-1). The existing watermain from the Limoges wells to the Limoges WTP would have to be upsized or twinned once the capacity of the existing watermain is reached. The Limoges WTP plant would be scaled back to provide disinfection only and the Limoges wells would be abandoned.

Alternative 5: Piped Water from a Neighboring Municipality – Russell Township

This option is similar to alternative 4; however, the booster station would be located at the intersection of Eadie Road and Route 200, in the Township of Russell (Figure 6-1). A 11.5 km watermain would be required as this pipe would have to be connected directly at the Limoges WTP. The Limoges WTP plant would be scaled back to provide disinfection only and the Limoges wells would be abandoned, including the existing raw water feedermain.

Alternative 6: Piped Water from a Neighboring Municipality – City of Ottawa

Under this option, a connection to the City of Ottawa Distribution System would be made near the intersection of Innes Road and Trim Road in Orleans. A water booster station would be required, along with a 23 km long watermain that would be connected to the existing Limoges wells No. 1 and No. 2 site (Figure 6-1). The existing raw-water feedermain from the Limoges wells to the Limoges WTP would have to be upsized or twinned once its capacity was reached. Similar to Alternatives 4 & 5, the Limoges WTP would be scaled back to provide disinfection only and the Limoges wells would be abandoned.

6.1.1 Evaluation of Alternative Concepts

Five categories of evaluation criteria were developed with consideration of the existing environment conditions that may be impacted by the proposed alternatives. These criteria were used to analyse and evaluate the relative preference of each alternative. The criteria are explained in Table 6-1 along with the rationale for the selection of the criteria and the indicators used to assess the potential impacts.

Figure 6-1: Water Supply Alternatives

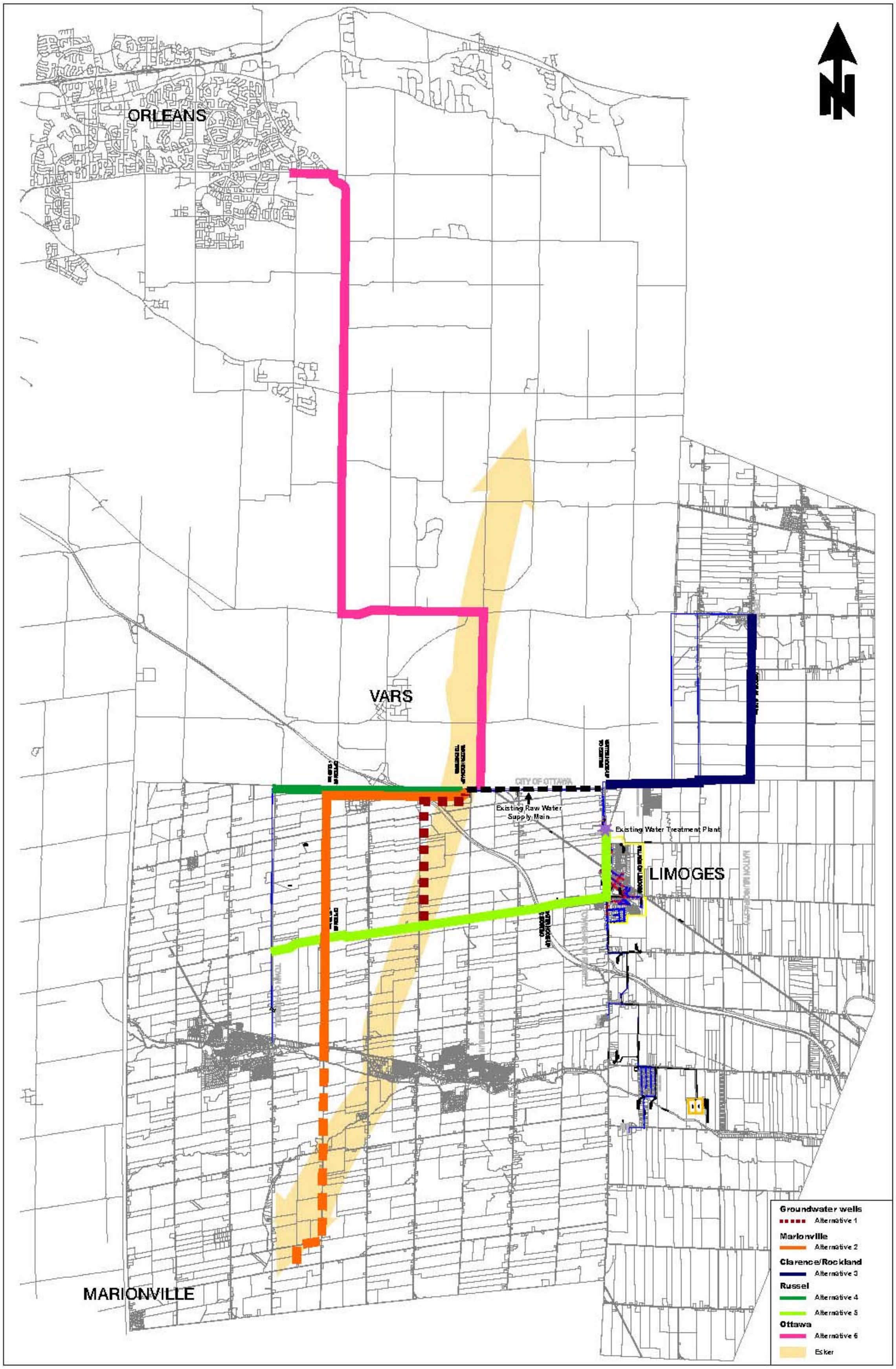


Table 6-1: Water Supply Source Evaluation Criteria

CRITERIA (Value)		RATIONALE	INDICATORS
Biological Environment	Natural Heritage	Minimize disruption to natural heritage features	Loss of natural heritage features (i.e., woodlots, ANSI) Effect on rare species
	Surface Water	Minimize impacts to surface water quality and quantity related to conveyance from source	Disruption of surface watercourses Loss of fish habitat Degradation of water quality
Physical Environment	Groundwater	Minimize impacts to groundwater quality and quantity	Assessment of predicted changes to water quality and quantity
	Geotechnical	Recognize geotechnical constraints to constructability and design requirements related to conveyance from source	Presence of bedrock Presence of clay
Social Environment	Agricultural	Protect high quality / active agricultural lands	Loss of agricultural land
	Archaeology	Minimize disruption of potential cultural resources	Disturbance in areas of archaeological potential
	Property Requirements	Minimize land requirements	Requirement for land, easements, agreements
Economic	Capital Cost	Ensure long term funding and economic sustainability	Class D capital cost estimates
	Operational and Maintenance Costs	Ensure long term funding and economic sustainability	Operation and Maintenance cost estimates
Technical	Constructability	Ease of construction and integration with the existing system	Length of construction period, complexity of the construction, ease of phasing
	Reliability	Implement a dependable and consistent system	Demand, malfunctions, system failures, constancy in technology and water quality
	Expansion potential	Implement a system which is capable of growth consistent with the development plans	Ability of the system to be expanded
	Permit and approvals	Minimize the cost and time of required approvals and permits needed for construction	Permit and approval requirements
	Source water protection	Protect drinking water sources	Source Water Protection Requirements
	Drinking Water Quality	Minimize treatment requirements	Treatment requirements of water supply source

The evaluation involves the ranking of each alternative solution relative to one another for each of the criteria (Table 6-2). The environmental impacts were predicted considering the interaction of all phases of the alternative solutions with the existing environment. The ranking considered the order of preference amongst the alternatives as well as the degree of impact based on professional judgment. This ranking was done by members on the consulting team responsible for the various aspects of the study.

Table 6-2: Water Supply Source Evaluation of Alternatives

	CRITERIA (Value)	Option 1 (New Groundwater Source – New wells)	Option 2 (New Groundwater Source – Embrun/Marionville WTP)	Option 3 (Piped water from a neighboring municipality – Clarence Rockland)	Option 4 (Piped water from a neighboring municipality – Russell Township)	Option 5 (Piped water from a neighboring municipality – Russell Township)	Option 6 (Piped water from a neighboring municipality – City of Ottawa)
Natural Environment	Natural Heritage	Low	Low-Slight	Slight	Low	Low-Slight	Low-Slight
	Surface Water	Low	Low	Low-Slight	Low	Low-Slight	Low-Slight
	Groundwater	Slight	Slight	Low	Low	Low	Low
	Geotechnical	Slight-Some	Slight	Low	Slight	Slight	Low
Social environment	Agricultural	Slight impact to agricultural land for the well location and feedermain	No impact to agricultural land	No impact to agricultural land	Slight impact to agricultural land near the intersection of Burton Road and Eadie Road	No impact to agricultural land	No impact to agricultural land
	Archaeology	Low	Low-Slight	Slight	Low	Low	Low
	Property Requirements	Slight-Some requirement for additional property to accommodate new pump houses, well(s), and piped connections. Easements likely required to tunnel under Hwy 417 New watermain to the pilot well site and upsizing or twinning of the existing watermain from the existing Limoges well site will be constructed within the existing ROW. No property will be required.	Slight-Some requirement for additional property to accommodate well(s) to meet ultimate future demand. Piped infrastructure will be located within the existing ROW. Easements likely required to tunnel under Hwy 417.		Slight property requirement at the intersection of Burton and Eadie Road to accommodate the required pumping station. The required upsizing or twinning of the watermain from the existing Limoges well site does not require additional property as the piped infrastructure would be constructed within the ROW.	Slight property requirement at the Eadie Road Route 200 intersection to accommodate the required booster station. All piped infrastructure will be located within existing ROW.	Slight property requirements for the required booster station. All piped infrastructure will be located within existing ROW. The upgrading of the existing piped infrastructure will not require additional property.
Economic	Capital Cost	$23.5M	$20.6M	>30.0M	$10.3M	$10.6M	$26.4M
	Operational and Maintenance Costs	Some O&M cost	Some O&M cost	Significant O&M cost. Must first pay supply rate established by Clarence-Rockland	Significant O&M cost. Must first pay supply rate established by City of Ottawa plus up to a 50% surcharge for local users	Significant O&M cost. Must first pay supply rate established by City of Ottawa plus up to a 50% surcharge for local users	Significant O&M cost. Must first pay supply rate established by City of Ottawa plus up to a 50% surcharge for local users.

CRITERIA (Value)		Option 1 (New Groundwater Source – New wells)	Option 2 (New Groundwater Source – Embrun / Marionville WTP)	Option 3 (Piped water from a neighboring municipality – Clarence Rockland)	Option 4 (Piped water from a neighboring municipality – Russell Township)	Option 5 (Piped water from a neighboring municipality – Russell Township)	Option 6 (Piped water from a neighboring municipality – City of Ottawa)
Technical	Constructability	Some construction period. Slight complexity (i.e. water treatment plant) Best phasing opportunity	Some construction period. Slight complexity (water treatment plant). Good phasing opportunity.	Some construction period, slight complexity, no phasing opportunity	Some construction period, low complexity. Limited phasing opportunity	Some construction period. Low complexity. No phasing opportunity	Significant construction period. Low complexity. No phasing opportunity
	Reliability	Good water quality Multiple supply lines provide improved redundancy Proven technology	Reasonable water quality Proven technology Condition assessment required for existing infrastructure	Best water quality Proven technology	Does not meet ultimate demand Proven technology demand capacity Best water quality	Does not meet ultimate demand Proven technology Best water quality	Proven technology Best water quality
	Expansion potential	Best expansion opportunity	Best expansion opportunity	Limited expansion potential due to infrastructure size/capacity Competing interest for increased capacity	Limited expansion opportunity due to infrastructure size / capacity Agreement renegotiation with Ottawa Competing interest for increased capacity	Limited expansion opportunity due to infrastructure size / capacity Agreement renegotiation with Ottawa Competing interest for increased capacity	Limited expansion opportunity due to infrastructure size / capacity Agreement renegotiation with Ottawa Competing interest for increased capacity
	Permit and approvals	Some approval requirement. Requires MOE approval for new wells and WTP expansion. Need agreement with Russell for new infrastructure within road allowance	Some approval requirement. Existing plant has approval. Requires MOE approval for additional wells and WTP expansion. Requires agreement with Russell for infrastructure within road allowance and purchase of existing infrastructure	Some approval requirement. Requires MOE approval for Clarence Rockland WTP expansion.	Significant Approval requirement. Requires MOE approval for pipes and booster station Requires agreement from Russell for infrastructure Russell currently prohibited from allowing a new connection	Significant Approval requirement. Requires MOE approval for pipes and booster station Requires agreement from Russell for infrastructure Russell currently prohibited from allowing a new connection	Significant approval requirement. Requires MOE approval for pipes and booster station Requires agreement from Ottawa for water supply and Feasibility analysis of Ottawa pressure zones required
	Source water protection	Source within Source Water Protection Area. The new well field would require a WHPA.	New source within Source Water Protection Area Potential influence of water quality from existing municipal landfill	No impact, surface water source	No impact, surface water source	No impact, surface water source	No impact, surface water source
	Water Quality	Slight treatment requirement	Some treatment requirement. Also potential contamination from existing municipal landfill	Low treatment requirement (disinfection)	Low treatment requirement (disinfection)	Low treatment requirement (disinfection)	Low treatment requirement (disinfection)

Preferred

Not acceptable

The ‘New Groundwater Source – New Wells’ alternative (Option 1) was selected as the preferred alternative based on the following key decision factors:

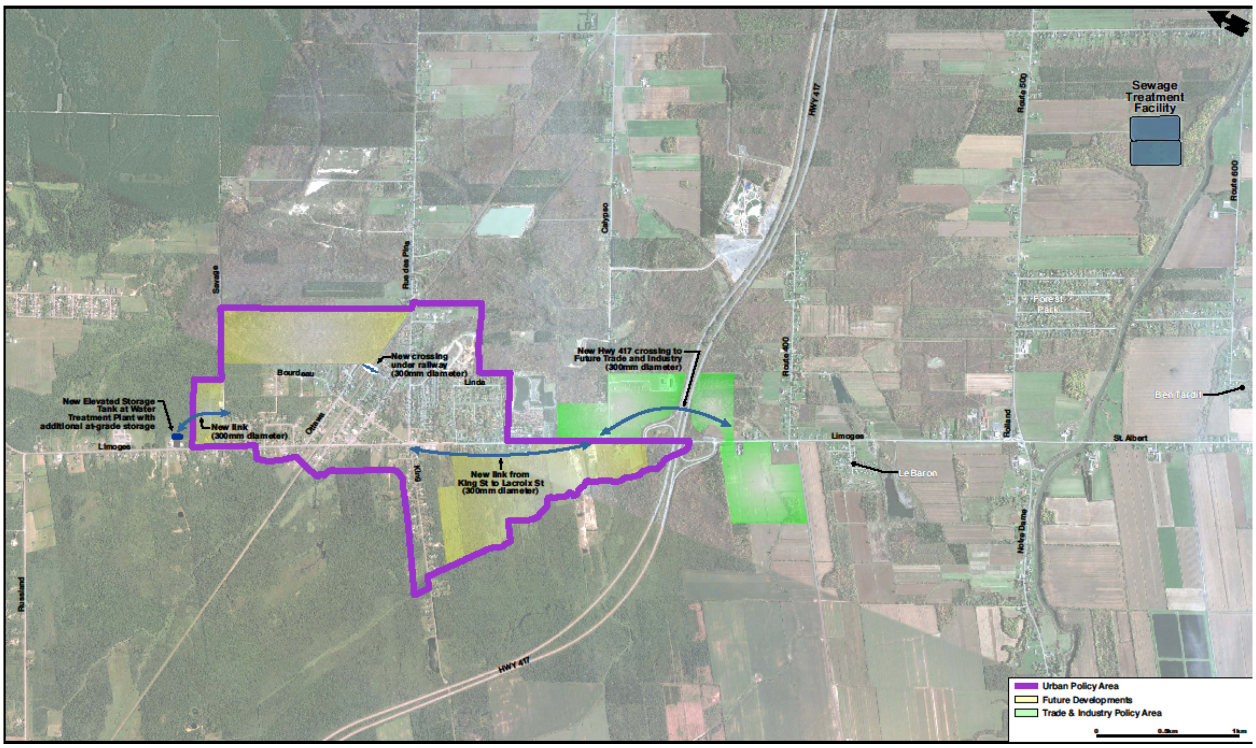
- Low impact to natural heritage features;
- Low impact to surface water quality and quantity;
- Low Operation and Maintenance costs;
- Best expansion opportunities; and
- Relatively simple permit and approval process.

6.2 Water Distribution and Storage Alternatives

Alternative 1: Additional Elevated and At-Grade Storage at Existing Water Treatment Plant

Additional storage could be added next to the existing surface reservoir at the Limoges water treatment plant. An elevated water tower would be sized to accommodate, at minimum, the equalization storage necessary to satisfy peak hour demand while storage for fires and emergencies could be provided at-grade. The existing booster pump station would need to be upgraded to accommodate the growth in demand. In this scenario the storage is located entirely at the water treatment plant at the north end of the village (Figure 6-2).

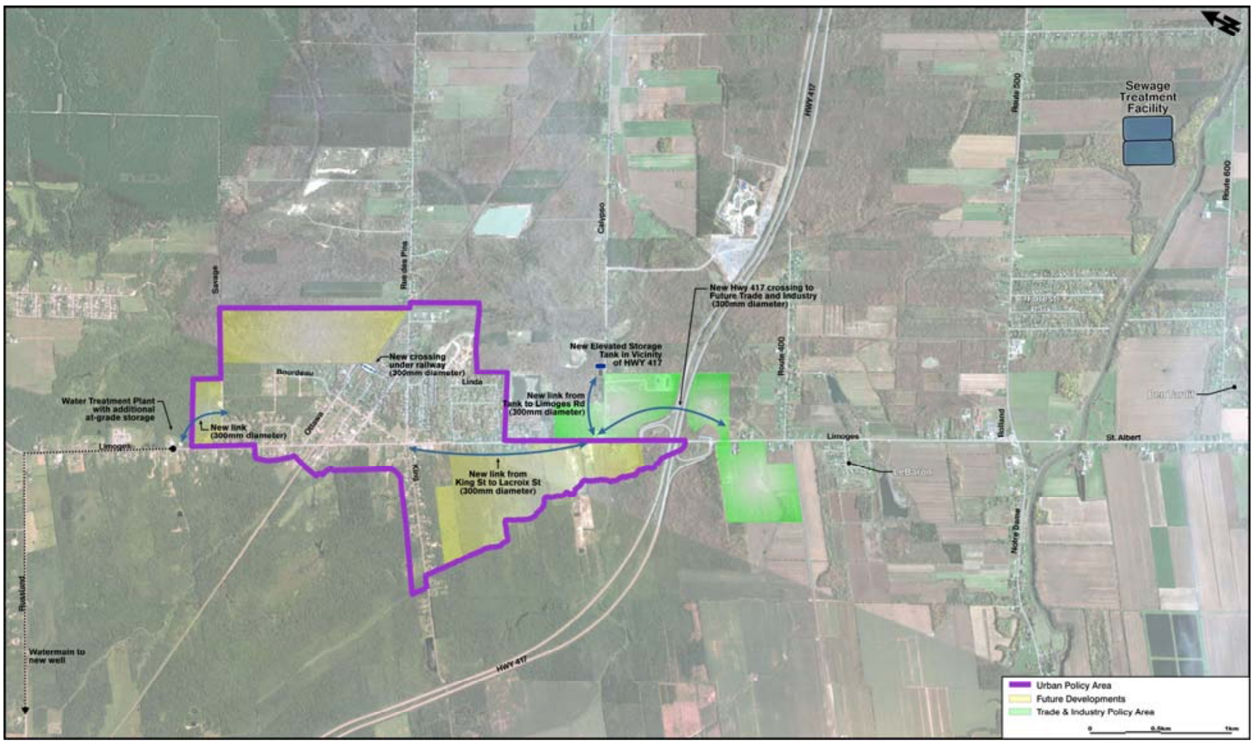
Figure 6-2: Alternative 1 Elevated and At-grade Storage at Existing WTP



<u>*Alternative 2: Additional Elevated Storage in the vicinity of Highway 417 and At-Grade Storage at Existing Water Treatment Plant*</u>

Additional elevated storage could be added in the vicinity of Highway 417 (vicinity of Calypso Street). Similar to Alternative 1, an elevated water tower would be sized to accommodate, at minimum, the equalization storage necessary to satisfy peak hour demand. Storage for fires and emergencies could be placed at-grade at the existing water treatment plant. The booster pump station would need to be upgraded to accommodate the growth in demand. In this scenario the storage is not provided solely at the water treatment plant but has been separated so that additional elevated storage is provided closer to anticipated growth nodes (Figure 6-3).

Figure 6-3: Alternative 2 Elevated at 417 and At-grade at Existing WTP



The following recommendations would be part of the implementation of either Alternative 1 or 2:

- It is recommended that an additional watermain link (300 mm dia.) be provided from the water treatment plant to Savage Drive, possibly at Giroux, as a means of increasing redundancy. Currently nearly the entire village would be without water if the watermain on Limoges Road, between the water plant and Savage Drive, were to break.
- It is recommended that an additional watermain link (300 mm dia.) be made between King Street and Lacroix Street. This could possibly be made within the future development lands in the Township of Russell (west side of Limoges Rd.) This is necessary to improve the hydraulic performance as demand increases. It will also provide redundancy as currently the Limoges Rd watermain is the sole north/south connection south of Linda Street and is therefore a source of vulnerability.

- An additional crossing (300mm dia.) of the Via Rail railroad at Andrew Street is recommended to improve redundancy as development in the northeast progresses. Consideration should also be given to providing a crossing near Des Benevoles Street when development approaches this location.
- In the short-term, the areas south of Highway 417 are vulnerable to low pressure during peak hour demand as it only has one connecting watermain. It is recommended that pressure in this area be monitored by operations personnel. Should pressure conditions become unacceptable, an in-line booster pump or an additional watermain (300 mm dia.) crossing of Highway 417 may be necessary. When the Trade & Industry Policy Areas south of Highway 417 are to be developed, the additional watermain (300 mm dia.) crossing of Highway 417 will be necessary to satisfy flow and pressure requirements.

6.2.1 Evaluation of Alternative Concepts

Five categories of evaluation criteria were developed with consideration of the existing environment conditions that may be impacted by the proposed alternatives. These criteria were used to analyse and evaluate the relative preference of each water distribution and storage alternative. The criteria are explained in Table 6-3 along with the rationale for the selection of the criteria and the indicator used to assess the potential impact.

Table 6-3: Water Distribution and Storage Evaluation Criteria

CRITERIA (Value)		RATIONALE	INDICATORS
Biological Environment	Natural Heritage	Minimize disruption to natural heritage features	Loss of natural heritage features (i.e., woodlots, ANSI) Effect on rare species
	Surface Water	Minimize impacts to surface water quality and quantity	Disruption of surface watercourses Loss of fish habitat Degradation of water quality
Physical Environment	Groundwater	Minimize impacts to groundwater quality and quantity	Assessment of predicted changes to water quality and quantity
	Geotechnical	Recognize geotechnical constraints to constructability and design requirements	Presence of bedrock Presence of clay
Social Environment	Agricultural	Protect high quality / active agricultural lands	Loss of agricultural land
	Visual	Minimize visual impacts Maximize visual opportunities	Visual effects and views
	Archaeology	Minimize disruption of potential cultural resources	Disturbance in areas of archaeological potential
	Property Requirements	Minimize land requirements	Requirement for land, easements, agreements

CRITERIA (Value)		RATIONALE	INDICATORS
Economic	Capital Cost	Ensure long term funding and economic sustainability	Class D capital cost estimates
	Operational and Maintenance Costs	Ensure long term funding and economic sustainability	Operation and maintenance cost estimates
Technical	Constructability	Ease of construction and integration with the existing system	Length of construction period, complexity of the construction, ease of phasing
	Reliability	Implement a dependable and consistent system	Malfunctions, system failures, constancy in technology and water quality

The evaluation involves the ranking of each alternative solution relative to one another for each of the criteria. The environmental impacts were predicted considering the interaction of all phases of the alternative solutions with the existing environment. The ranking considered the order of preference amongst the alternatives as well as the degree of impact based on professional judgment. This ranking was done by members on the consulting team responsible for the various aspects of the study (Table 6-4).

Table 6-4: Water Distribution and Storage Evaluation of Alternatives

CRITERIA (Value)		Alternative 1 (Additional Elevated and At-grade storage at Existing WPT)	Alternative 2 (Additional Elevated Storage at HWY 417 and At-grade Storage at Existing WTP)
Biological	Natural Heritage	Low	Low
	Surface Water	Low	Low
Physical	Groundwater	Low	Low
	Geotechnical	Low	Low
Social environment	Agricultural	No impact to agricultural Land	No impact on agricultural land
	Visual	Some negative visual effects possible to nearby residents as a result of the elevated tower. Negligible visual effect for at grade storage.	Reasonable Visual effect. If a tactful elevated tower is constructed the Village of Limoges could benefit from this display to 417 motorists. Slight negative visual effect to nearby residents. Negligible Visual impact from the at grade storage located at the treatment facility.
	Archaeology	Low	Low
	Property Requirements	Some additional property requirements to accommodate elevated and at grade storage.	Some additional property required to accommodate the elevated and at grade storage

CRITERIA (Value)		Alternative 1 (Additional Elevated and At-grade storage at Existing WPT)	Alternative 2 (Additional Elevated Storage at HWY 417 and At-grade Storage at Existing WTP)
Economic	Capital Cost	$8.2M	$8.6M
	Operational and Maintenance Costs	Some O&M cost	Some O&M cost
Technical	Constructability	Some length of construction, slight complexity, good phasing opportunity	Some length of construction, slight complexity, good phasing opportunity
	Reliability	Limited reliability for system failures as all storage is contained at extremity of network	Best reliability for system failures and fire protection as storage is distributed within network

Preferred

Not acceptable

The Alternatives are similar with respect to the biological and physical impacts. Alternative 2: Elevated Storage at 417 & At-grade Storage at Existing WTP is the preferred water distribution and storage alternative based on the following key decision factors:

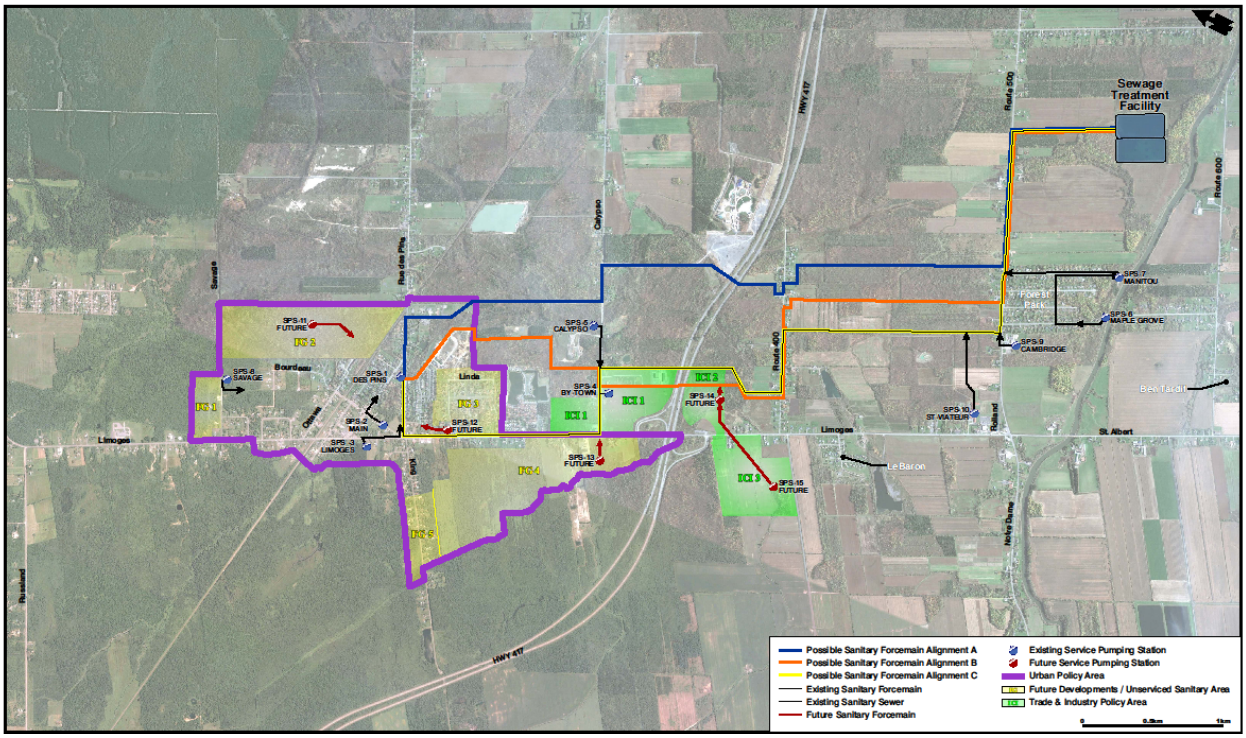
- Both alternatives were similar for natural and social impacts
- Offers more redundancy in the system
- Maximize visual opportunities
- Good pressure and distribution technically

6.3 Wastewater Collection Alternatives

Alternative 1: SPS 1 Upgrade and Twinning of Existing Forcemain

This option consists of upgrading SPS 1 and twinning the existing sewage forcemain to accommodate the future servicing needs of the Nation Municipality and Russell Township within the Village of Limoges urban policy area. The estimated future service population of SPS 1 is 7,025 persons and the upgraded station discharge of approximately 130 L/s will exceed the hydraulic design capacity of the present forcemain. A new forcemain is required and three potential forcemain alignments (alignments A, B and C) have been identified which would permit future growth and orderly development opportunities within the Limoges community (Figure 6-4).

Figure 6-4: Alternative 1: SPS 1 Upgrade and Twinning of Existing Forcemain



This option allows for the construction of:

- new SPS 11 to service future development area FG 2 within Nation Municipality;
- new SPS 12 to service un-serviced area FG 3 within Nation Municipality;
- new SPS 13 to service future development area FG 4 and un-serviced area FG 5 within Russell Twp.;
- new SPS 14 to service Trade & Industry Policy Area ICI-2 within Nation Municipality; and
- new SPS 15 to service Trade & Industry Policy Area ICI-3 within Russell Twp.

Wastewater from SPS 2, SPS 3 and SPS 8 discharges to the existing gravity sewer system and is collected at SPS 1. Future SPS 11 and future SPS 12 will also discharge to the gravity sewer system. Local sewer upgrades may be necessary and would need to be investigated at the time SPS 11 and SPS 12 are developed.

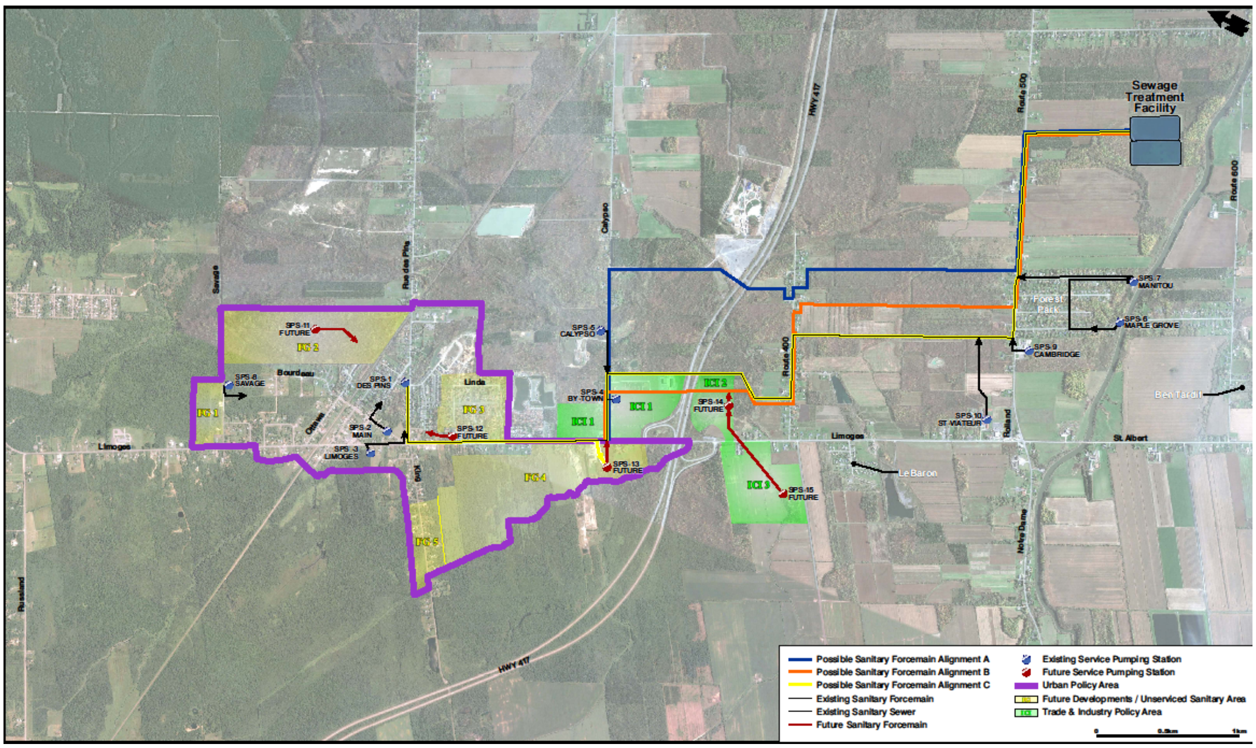
The service area of the current By-Town pumping station (SPS 4) essentially overlaps Trade & Industry Policy Area ICI-1 within Nation Municipality. Based on available information, the gravity sewer at SPS 5 (Calypso) could be extended westerly and intercept the By-Town gravity sewer system. SPS 4 could then be eliminated.

The forcemain alignment between SPS 1 and the Sewage Treatment Facility will entail additional land and multiple land ownership deals will be needed. The (chosen) forcemain alignment will have an impact on the future design and operating control of SPS 13, 14 and 15 as a common forcemain strategy among the stations will be unavoidable.

Alternative 2: SPS1 Upgrade and Re-Pumping at New SPS 13

This option considers the establishment of a new, but larger, SPS 13 which would combine the wastewater discharge from SPS 1 with the collected sewage waste from areas FG4 and FG5 within Russell Township. A second forcemain from SPS 1 parallel to the existing forcemain along des Pins Street and Limoges Road is assumed to be constructed to SPS 13. This would provide a factor of safety to the current forcemain which would otherwise be operating above safe operating conditions. SPS 13 would discharge a waste flow of approximately 182 L/s through a new dedicated forcemain with an outlet to the Sewage Treatment Facility (Figure 6-5).

Figure 6-5: Alternative 2: SPS1 Upgrade and Re-Pumping at New SPS 13



The off-loading of sewage discharge from SPS 1 through its current forcemain would permit the on-loading of a similar sewage discharge from SPS 14 and SPS 15 (Trade & Industry Policy Areas ICI-2 and ICI-3).

6.3.1 Evaluation of Wastewater Collection Alternative Concepts

Five categories of evaluation criteria were developed with consideration of the existing environment conditions that may be impacted by the proposed alternatives. These criteria were used to analyse and evaluate the relative preference of each wastewater collection alternative. The criteria are explained in Table 6-5 along with the rationale for the selection of the criteria and the indicator used to assess the potential impact.

Table 6-5: Wastewater Collection System Evaluation Criteria

CRITERIA (Value)		RATIONALE	INDICATORS
Biological Environment	Natural Heritage	Minimize disruption to natural heritage features	Loss of natural heritage features (i.e., woodlots, ANSI) Effect on rare species
	Surface Water	Minimize impacts to surface watercourses	Disruption of surface watercourses Loss of fish / aquatic habitat Degradation of water quality
	Linkages	Maintain natural linkages	Disruption of linkages
Physical Environment	Geotechnical	Recognize geotechnical constraints to constructability and design requirements	Presence of bedrock
	Hydrogeology	Minimize impacts to groundwater quality and quantity	Assessment of predicted changes to water quality and quantity Presence of elevated groundwater
	Contamination	Minimize the risk of contaminant migration	Disturbance of areas of know contamination
Social Environment	Archaeology	Minimize disruption	Disruption of areas of archaeological potential
	Property Requirements	Minimize land requirements	Requirement for land, easements, agreements
	Land uses	Minimize disruption	Disruption to private / public land uses
Economic	Capital Cost	Ensure long term funding and economic sustainability	Class D capital cost estimates
	Operational and Maintenance Costs	Ensure long term funding and economic sustainability	Operation and maintenance cost estimates
Technical	Constructability	Ease of construction and integration with the existing system	Length of construction period, complexity of the construction, ease of phasing
	Reliability	Implement a dependable and consistent system	Malfunctions, system failures, constancy in technology

The evaluation involves the ranking of each alternative solution relative to one another for each of the criteria (Table 6-6). The environmental impacts were predicted considering the interaction of all phases of the alternative solutions with the existing environment. The ranking considered the order of preference amongst the alternatives as well as the degree of impact based on professional judgment. This ranking was done by members on the consulting team responsible for the various aspects of the study.

Table 6-6: Wastewater Collection System Evaluation of Alternatives

CRITERIA (Value)		Option 1 (SPS 1 upgrade and twinning of existing forcemain)	Option 2 (SPS1 upgrade and re-pumping at new SPS 13)
Biological Environment	Natural Heritage	Option 1A – Slight Option 1B – Slight Option 1C – Low	Option 2A – Slight Option 2B – Slight Option 2C – Low
	Surface Water	Low-Slight	Low-Slight
	Linkages	Option 1A – Slight Option 1B – Slight Option 1C – Low	Option 2A – Slight Option 2B – Slight Option 2C – Low
Physical Environment	Geotechnical	Slight	Slight
	Hydrogeology	Low	Low
	Contamination	Option 1A – Low Option 1B – Some Option 1C – Low	Option 2A – Low-Slight Option 2B – Low Option 2C – Low
Social Environment	Archaeology	Low	Low
	Property Requirements	Option 1A – Slight Option 1B – Slight Option 1C – Low	Option 2A – Low-Slight Option 2B – Low Option 2C –Low
	Land uses	Option 2A – Low-Slight Option 2B – Low Option 2C –Low	Option 2A – Low-Slight Option 2B – Low Option 2C –Low
Economic	Capital Cost	$15.2	$13.1
	Operational and Maintenance Costs	Some O&M cost	Some O&M cost
Technical	Constructability	Some length of construction, Slight complexity with SPS 1 upgrades Good phasing opportunity	Some length of construction Low complexity Best phasing opportunity
	Reliability	Good reliability	Good reliability Increased flexibility due to re-pumping (SPS 1 – SPS 13)

Preferred

Not acceptable

Alternative 2: Sewage Pumping Station upgrade and re-pumping at a new Sewage Pumping Station (Limoges/Calypso) is the preferred wastewater collection system alternative based on the following key decision factors:

- Both alternatives were similar for natural and social impacts;
- Reduced need for major upgrades at SPS 1 (des Pins);
- Offers more redundancy in the system; and
- Allows for better phasing for future SPS 14 (SE ICI) and SPS15 (SW ICI).

6.4 Wastewater Treatment alternatives

Alternative 1: Expansion of Existing Limoges Lagoon System

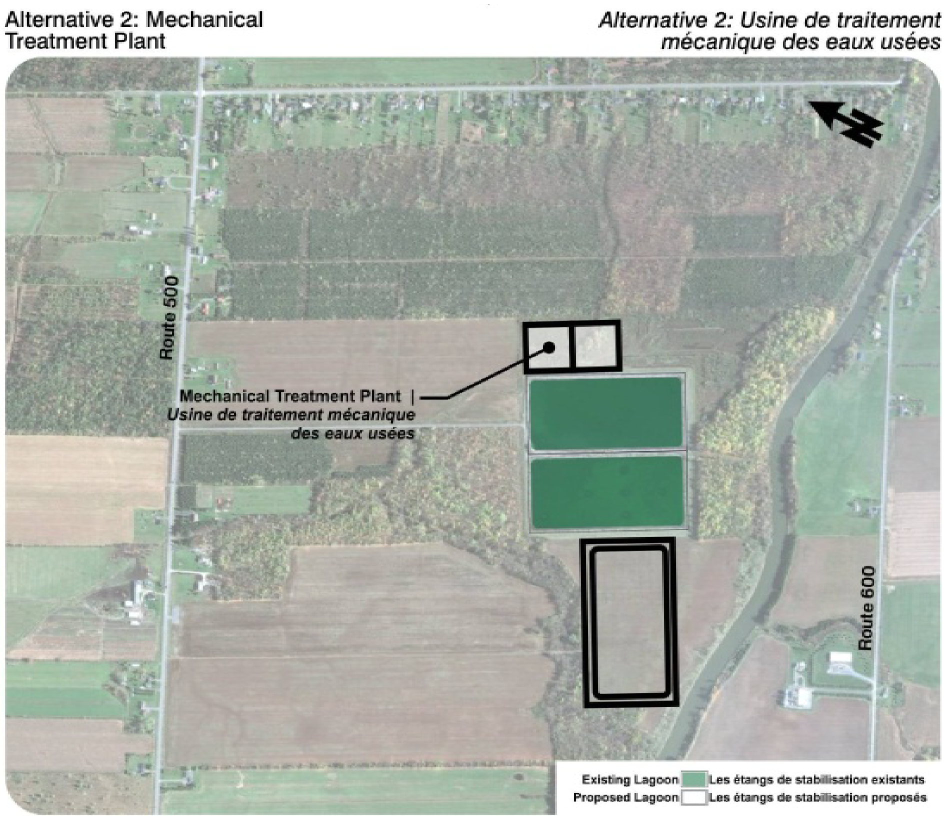
This option consists of the expansion of the existing two cell lagoon system. The existing lagoon cells have a combined capacity of approximately 230,000 m^3 and based on the growth potential within the existing urban boundary, there could be a potential need for 13 additional lagoon cells. There would be a significant need for additional land and multiple land ownership deals would be required (Figure 6-6)

Figure 6-6: Alternative 1: Expansion of Existing Limoges Lagoon System

Alternative 2: New Mechanical Wastewater Treatment Plant

This option includes the construction of a new mechanical wastewater treatment plant at the existing lagoon system site. Field investigations have confirmed that continuous discharge is not feasible. As such, storage ponds will be required to provide sufficient capacity during non-discharge periods. The re-use of the existing lagoon cells will be needed for storage with the construction of a new storage pond to accommodate the increase in future flows (Figure 6-7).

Figure 6-7: Alternative 2: New Mechanical Wastewater Treatment Plant



6.4.1 Evaluation of Alternative Concepts

Five categories of evaluation criteria were developed with consideration of the existing environment conditions that may be impacted by the proposed alternatives. These criteria were used to analyse and evaluate the relative preference of each wastewater treatment alternative. The criteria are explained in Table 6-7 along with the rationale for the selection of the criteria and the indicator used to assess the potential impact.

Table 6-7: Wastewater Treatment Evaluation Criteria

CRITERIA (Value)		RATIONALE	INDICATORS
Biological Environment	Natural Heritage	Minimize disruption to natural heritage features	Loss of natural heritage features (i.e., woodlots, ANSI) Effect on rare species
	Surface Water	Minimize impacts to surface watercourses	Disruption of surface watercourses Loss of fish / aquatic habitat Degradation of water quality
	Linkages	Maintain natural linkages	Disruption of Linkages

CRITERIA (Value)		RATIONALE	INDICATORS
Physical Environment	Geotechnical	Recognize geotechnical constraints to constructability and design requirements	Presence of bedrock Presence of clay
	Hydrogeology	Minimize impacts to groundwater quality and quantity	Qualitative assessment of predicted changes to water quality and quantity
Social Environment	Agricultural	Protect high quality / active agricultural lands	Loss of agricultural land
	Odour	Minimize impacts of odour	Odour production and management
	Visual	Minimize visual impacts	Visual effects and views
	Archaeology	Minimize disruption of potential cultural resources	Disturbance in areas of archaeological potential
	Property Requirements	Minimize land requirements	Requirement for land, easements, agreements
Economic	Capital Cost	Ensure long term funding and economic sustainability	Class D capital cost estimates
	Operational and Maintenance Costs	Ensure long term funding and economic sustainability	Operation and maintenance cost estimates
Technical	Constructability	Ease of construction and integration with the existing system	Length of construction period, complexity of the construction, ease of phasing
	Reliability	Implement a dependable and consistent system	Malfunctions, system failures, constancy in technology
	Expansion potential	Implement a system which is capable of growth consistent with the development plans	Ability of the system to be expanded
	Permit and approvals	Minimize the cost and time of required approvals and permits needed for construction	Permit and approval requirements
	Discharge quality (phosphorus, e.coli)	Ensure ability to meet discharge quality criteria	Comparison of discharge quality to existing guidelines
	Source water protection	Protect drinking water sources	Discharge control

The evaluation involves the ranking of each alternative solution relative to one another for each of the criteria. The environmental impacts were predicted considering the interaction of all phases of the alternative solutions with the existing environment. The ranking considered the order of preference amongst the alternatives as well as the degree of impact based on professional judgment. This ranking was done by members on the consulting team responsible for the various aspects of the study (Table 6-8).

Table 6-8: Wastewater Treatment Evaluation of Alternatives

CRITERIA (Value)		Option 1 (Expansion of existing Limoges lagoon system)	Option 2 (New mechanical wastewater treatment plant)
Biological Environment	Natural Heritage	Significant	Some
	Surface Water	Significant	Some
	Linkages	Some	Slight
Physical environment	Geotechnical	Some	Some
	Hydrogeology	Low	Low
Social environment	Agricultural	Greater loss of agricultural land for lagoons	Slight loss of agricultural land
	Odour	Odour control harder to manage	Odour control easier to manage
	Visual	Greater visual impact due to footprint	Lesser visual impact
	Archaeology	Low-Slight	Low-Slight
	Property Requirements	Significant property requirement	Some property required
Economic	Capital Cost	$38.9M	$22.3M
	Operational and Maintenance Costs	Slight O&M cost	Some O&M cost
Technical	Constructability	Low complexity, best phasing opportunity Can be expanded one lagoon at a time	Some complex construction, good phasing opportunity
	Reliability	Proven technology Large flows to Castor may be impossible due to assimilative capacity	Proven technology Summer flows to Castor may require additional lagoon storage
	Expansion potential	Limited expansion potential due to buffer area requirements and adjacent land uses.	Good expansion potential. Monitoring requirements to confirm ultimate capacity
	Permit and approvals	Environmental Compliance approval (ECA) from MOE Buffer assessment for constrained setbacks	ECA from MOE
	Discharge quality (phosphorus, e.coli)	Secondary treatment only	Ability to control broad range of discharge parameter
	Source water protection	High seasonal loading	Continuous discharge

Preferred

Not acceptable

The preferred wastewater treatment alternative is Alternative 2: New Mechanical Wastewater Treatment Plant based on the following key decision factors:

- Lower natural and social impacts;
- Lower agricultural and property impacts; and
- More expandable in the long term.

7.0 PREFERRED ALTERNATIVES

7.1 Potable Water

The preferred water supply solution is Alternative 1 (Figure 7-1). This involves adding additional wells into the Vars/Winchester esker near the intersection of Route 200 and St. Pierre Road. It is assumed that the water quality from the new wells will be similar to the existing wells with respect to treatment needs at the WTP. The process flow diagram for the existing WTP as provided in the First Engineers Report (2004) is shown in Figure 7-2. A new 400 mm diameter raw water feedermain from the new well site to the existing wells would be 5.5 km long. The existing raw water feedermain from the Limoges wells to the Limoges WTP would have to be upsized or twinned once the capacity of the existing watermain is reached. The Limoges WTP would be expanded as required (Figure 7-3).

It was estimated that the residential population to be served by the water system is 11,650 people (Section 1.4). The Trade and Industry Policy Area is 89.2 ha. Assuming an average day demand of 28 m^3/ha/d for ICI and 350 L/p/d for residential demand, then the Trade & Industry Policy Area is equivalent to 7,136 people (80 p/ha). The total equivalent population to be serviced by the water system is 18,786. The average day demand for the water system would be 6,575 m3 (76 L/s). Using a maximum day peaking factor of 1.9 (per Table 8-2 of the MOE Design Guidelines for Drinking Water Systems – 2008), the maximum day demand on the water system would be 12,493 (145 L/s).

Figure 7-1: Preferred Water Supply Alternative

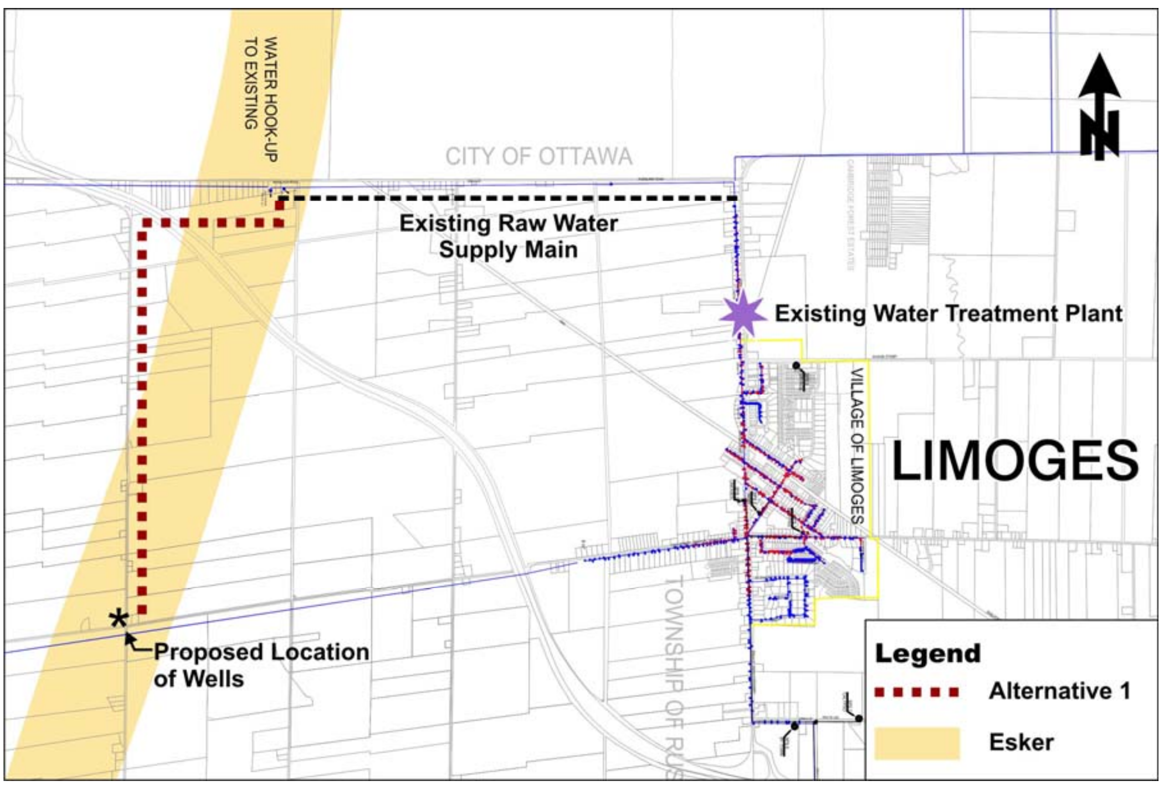


Figure 7-2: Existing Water Treatment Plant Process Flow Diagram

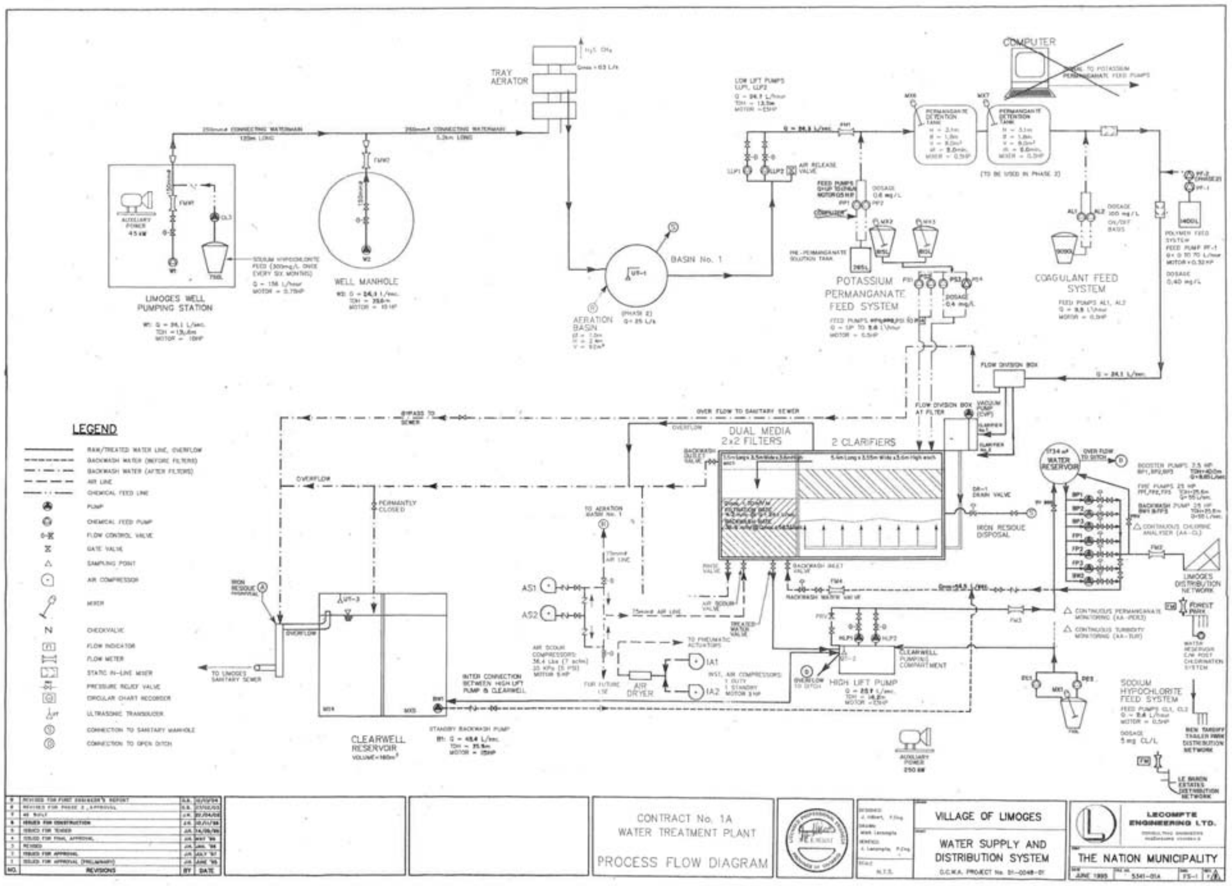
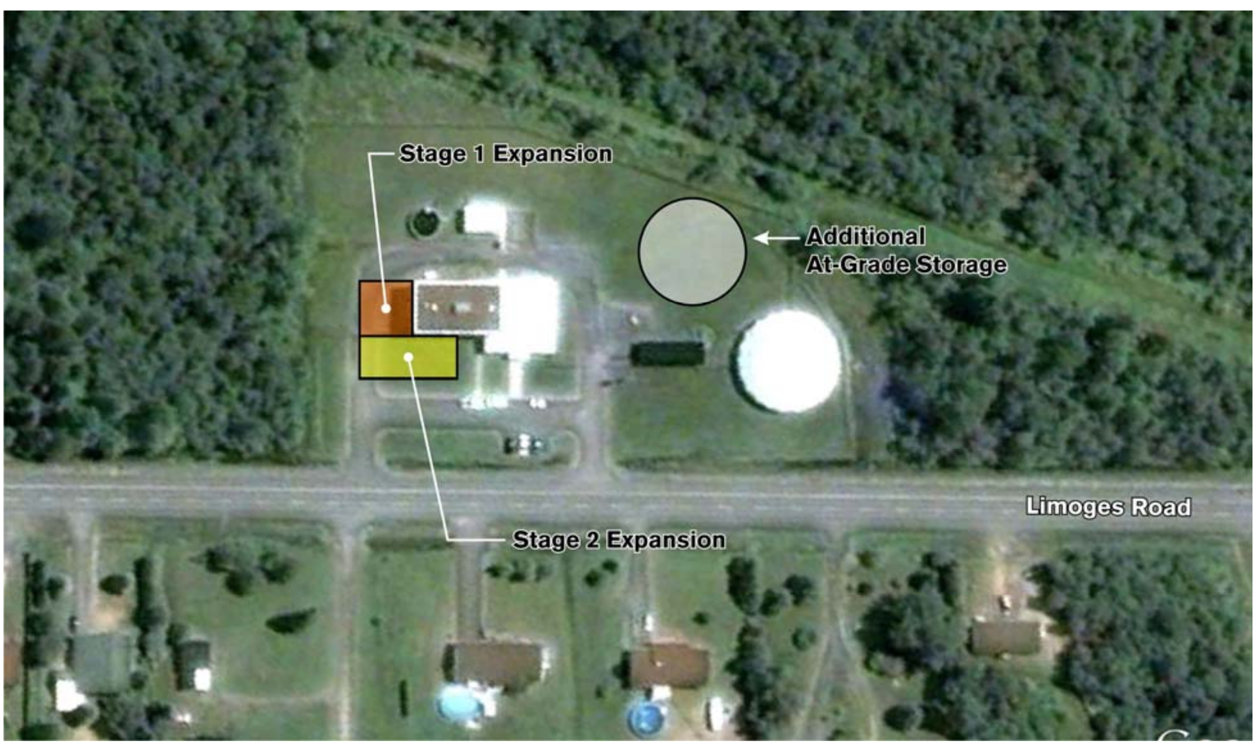


Figure 7-3: Water Treatment Plant Staging



The preferred water distribution & storage solution is Alternative 2. This involves adding elevated storage in the vicinity of Highway 417. At-grade storage would also be added at the water treatment plant. The storage requirements were determined per section 8.4.2 in the MOE Design Guidelines (MOE, 2008). The Fire Storage requirement was determined to be 3,600 m^3. The equalization storage was determined to be 3,178 m^3 while emergency storage was determined to be 1,695 m^3 for a total storage requirement of 8,473 m^3. The existing storage capacity is 1,734 m^3 at the water treatment plant and 717 m^3 at the Forest Park pump station. Therefore the total additional storage required is 6,022 m^3. This could be achieved with a 3,200 m^3 elevated tank and 2,800 m^3 of at-grade storage.

The following recommendations should also be considered as part of the preferred solution:

1. It is recommended that two new wells be provided to augment the amount of raw water supply to the WTP. Confirmation on the quantity and quality of the water from the new wells is required to make certain that the existing WTP can properly treat the water for potable water use.
2. It is recommended that the WTP process be evaluated to confirm that the treatment process is appropriate for the new raw water supply from the new wells.
3. It is recommended that an additional watermain link (300 mm dia.) be provided from the water treatment plant to Savage Drive, possibly at Giroux, as a means of increasing redundancy. Currently nearly the entire village would be without water if the watermain on Limoges Road, between the water plant and Savage Drive, were to break.
4. It is recommended that an additional watermain link (300 mm dia.) be made between King Street and Lacroix Street. This could possibly be made within the future development lands in the Township of Russell (west side of Limoges Rd.) This is necessary to improve the hydraulic performance as demand increases. It will also provide redundancy as currently the Limoges Rd watermain is the sole north/south connection south of Linda Street and is therefore a source of vulnerability.
5. It is recommended that the WTP be expanded in phases to meet the water supply needs as per the growth plans of the community.
6. An additional crossing (300 mm dia.) of the Via Rail railroad at Andrew Street is recommended to improve redundancy as development in the northeast progresses. Consideration should also be given to providing a crossing near Des Benevoles Street when development approaches this location.
7. In the short-term, the areas south of Highway 417 are vulnerable to low pressure during peak hour demand as it only has one connecting watermain. It is recommended that pressure in this area be monitored by operations personnel. Should pressure conditions become unacceptable, an in-line booster pump or an additional watermain (300 mm dia.) crossing of Highway 417 may be necessary. When the Trade & Industry Policy Areas south of Highway 417 are to be developed, the additional watermain (300 mm dia.) crossing of Highway 417 will be necessary to satisfy flow and pressure requirements.
8. An additional watermain link (300 mm) should be made on Calypso Street in order to improve the hydraulic performance and improve redundancy from the proposed elevated storage tank location.

It is anticipated that the first stage of water supply will involve an expansion of the existing capacity by 40 L/s to 64.1 L/s. This will provide for a growth in equivalent population of

4,800 people. This will involve the installation of wells at the identified source location (St. Pierre Road at Route 200) as well as the installation of a 5.5 km 400 mm diameter raw water feedermain from the new wells to the existing well site. The existing raw water feedermain will be twinned. The WTP and booster pump station would also be expanded to meet the growing needs of the municipality. The intent would be to expand the WTP in appropriate stages based on the treatment processes needed and their individual treatment capacities, with the plan to have an overall capacity of 64.1 L/s (5,540 m^3/d) for Stage 1. It is anticipated that the first stage of water distribution will involve the installation of the elevated storage tank, the link between the WTP and Savage Drive and the link on Calypso Road (Figure 7-4). The remaining work may be completed in subsequent stage(s) as necessary (Figure 7-5).

Figure 7-4: Stage 1 Potable Water Distribution System

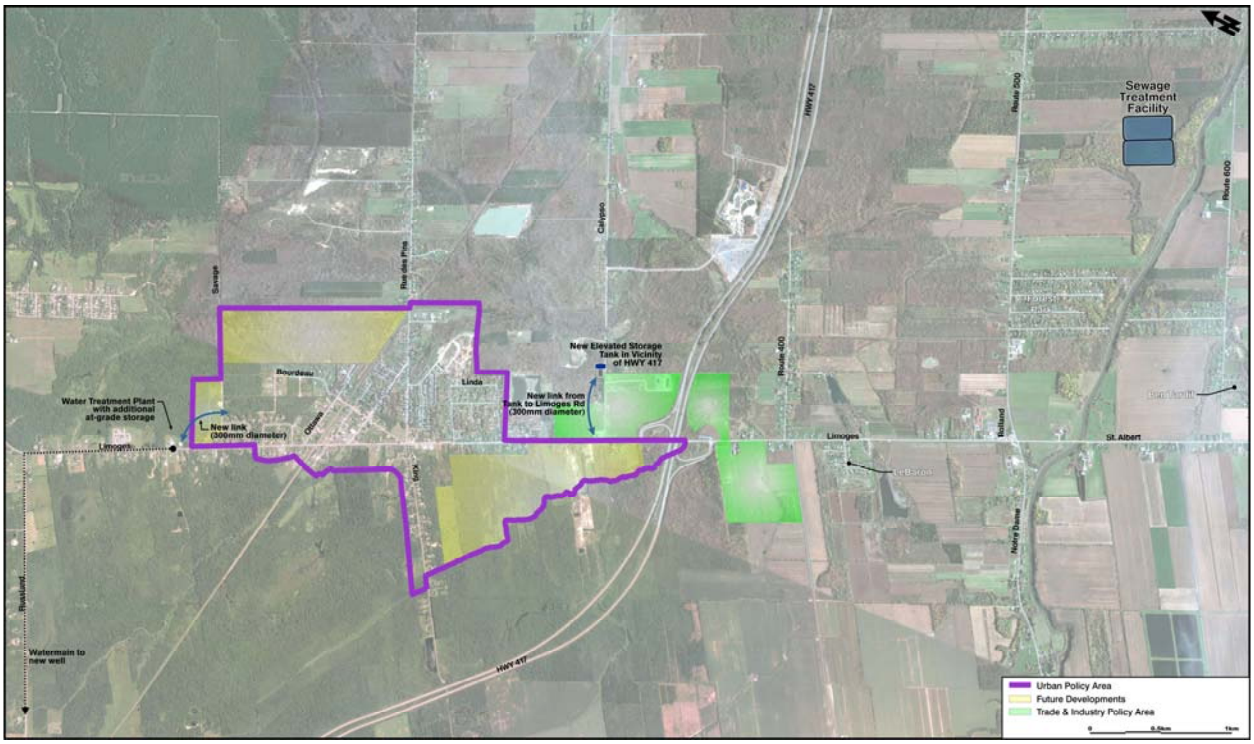
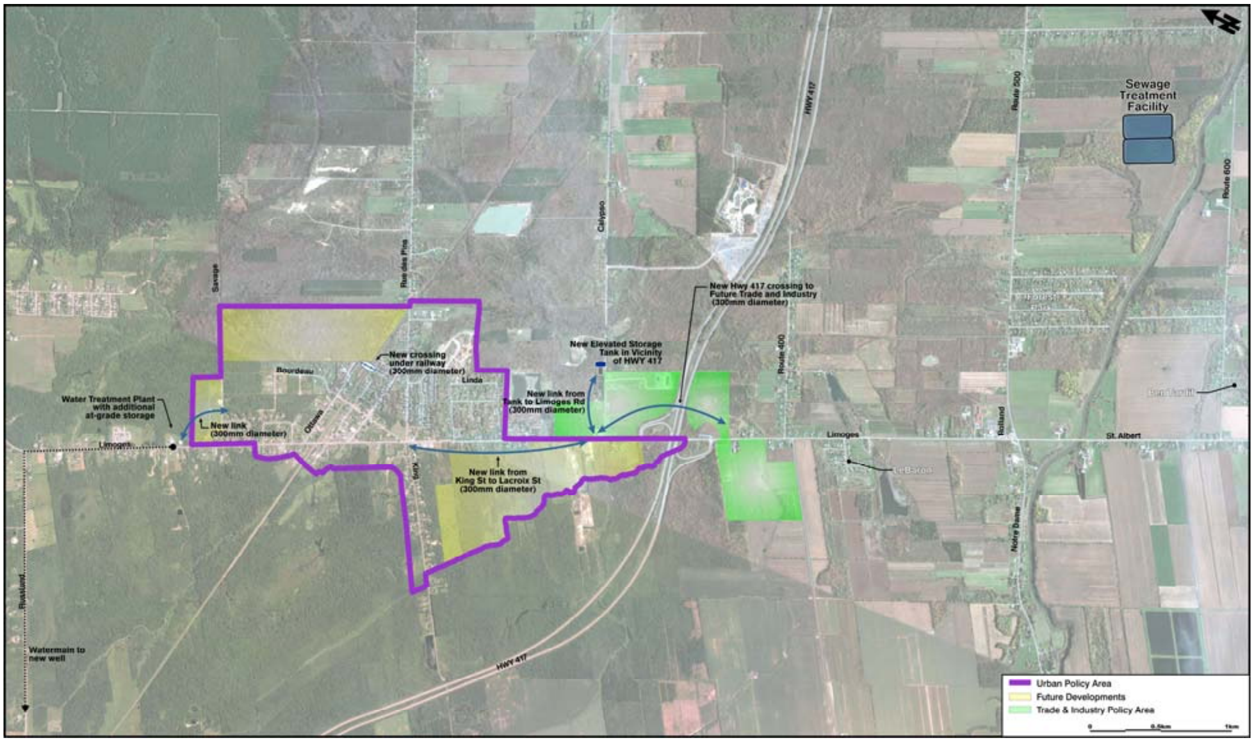


Figure 7-5: Stage 2 Potable Water Distribution System



7.1.1 Impacts and Mitigation – Water System

The values and conditions identified in the documentation of existing conditions were used as the basis for assessing the effects of the preferred alternative on the transportation, social, physical and biological environments. The impact analysis involved applying the following steps:

- Identify and analyse instances where the project may interact with existing environmental conditions.
- Acknowledge predetermined project activities that act as *built-in mitigation* measures.
- Identify opportunities for further *mitigation of residual* effects, if possible/practical.
- Determine the *significance of the residual* environmental effects, after further mitigation.

In order to understand the project interactions with the environment it is necessary to consider all phases of the project: pre-construction/design (P); construction (C); and operation (O).

7.1.1.1 Best Management Practices (BMPs)

In this assessment, "built-in mitigation" is defined as actions and design features incorporated in the pre-construction, construction, and operational phases that have the specific objective of lessening the significance or severity of environmental effects which may be caused by the project.

The expanded Limoges Water System will be designed and implemented with the benefit of contemporary planning, engineering, and environmental management practices. Regard shall be had for the legislation, policies, regulations, guidelines, and best practices of the day. Where possible, mitigation measures will be prescribed in the construction contracts and specifications. Examples of practices that should be employed, based on current standards, are described below. These measures can be considered "built into" the preferred design. They will be updated and refined during the pre-construction, construction, and operation phases of the project.

Erosion and Sediment Control Plan

The purpose of the Erosion and Sediment Control Plan is to determine the degree of erosion and sedimentation that would occur under normally anticipated weather conditions during the life of the project, and to develop and implement mitigative strategies to control any foreseen areas determined to have a pre-disposition to the problem. This may include: the identification of planting and slope rounding specifications within the contract tender; identifying and specifying seeding and sodding locations; identifying areas requiring slope benching or retaining structures in the detailed design process; and post construction monitoring and mitigative practises.

Construction and Traffic Management Plan

A Construction and Traffic Management Plan will be developed to manage the road's transportation function for all travel modes including equipment and material deliverables at various times during the construction period. The objective of the plan will be to maintain safe and clear pedestrian routes, maintain existing traffic as close as possible to its current conditions, and outline the road signage program.

Unexpected Discovery of Archaeological Resources

If during the course of construction archaeological resources are discovered, the site should be protected from further disturbance until a licensed archaeologist has completed an assessment and any necessary mitigation has been completed.

If unexpected archaeological resources are encountered, construction must cease and a licensed consultant archaeologist engaged to carry out field work, in compliance with Section 48 (1) of the Ontario Heritage Act. Should deeply buried deposits be found during any construction activities, the Ministry of Tourism, Culture and Sport (416) 314-7148, shall be notified immediately. In the event that human remains are encountered during construction activities, local law enforcement authorities and/or the coroner will be notified immediately, followed by the Ministry of Tourism, Culture and Sport, and the Registrar of Cemeteries at the Ministry of Consumer Services (416) 326-8393.

Emergency Response Plan

The preparation of an Emergency Response Plan, to be used by the contractor, will be included to allow full access to emergency services during the construction period, so that at any given time there is a method to access all adjacent land uses. Additionally, the Emergency Response Plan should include provisions for providing temporary services to end users in the event of a construction related service outage or other service disruption. A spills response and reporting plan will be prepared and adhered to by the contractor. Spills or discharges of pollutants or contaminants will be reported immediately. Clean up shall be initiated quickly to ensure protection of the environment.

Environmental Protection

It will be the responsibility of the contractor to ensure that no contamination, waste or other substances, which may be detrimental to aquatic life or water quality, will enter a watercourse as either a direct or indirect result of construction. In this regard, any floating debris resulting from construction which accumulates on watercourse beds and watercourse banks is to be immediately cleaned up and disposed of. Any spills or contamination, waste or other substances which may be detrimental to aquatic life or water quality will also be immediately cleaned up.

Any work which will cause or be the cause of discharge to watercourses is to be prohibited. At all times, construction activities are to be controlled in a manner that will prevent entry of deleterious materials to watercourses. In particular, construction material, excess material, construction debris and empty containers are to be stored away from watercourses and the banks of watercourses.

Management of Contaminated Materials

The MOE and the Construction Manager are to be notified immediately upon discovery of any contaminated material encountered within the construction area. If contaminated materials or contaminated groundwater are encountered within the construction limits, these are to be removed and disposed of in accordance with all applicable Acts and Regulations. Treatment and discharge of contaminated groundwater are also to be in accordance with applicable legislation and regulations.

Geotechnical Investigations

Geotechnical investigations will be required to confirm groundwater and subsurface conditions and potential impacts that will need to be considered in the detailed design phase of the project. Geotechnical investigations will also be required to undertake the pavement design. Foundation investigation will be required for structural design of new structures.

Public Communications Plan

The purpose of the Public Communications Plan is to keep the public informed about the work in progress and the end result of the construction activities. Residents and other stakeholders should be kept aware of scheduled road disruptions, interruption to other services and other construction related details ahead of time so that their activities can be planned with minimum disruption. The plans should detail how to communicate the information to the public, what information should be disseminated, and at which project stages the communications should take place.

7.1.1.2 Site Specific Mitigation Measures

Once potential effects were predicted, mitigation measures were identified. Often these mitigation measures were sufficient to reduce potential negative effects to an insignificant or negligible status. Mitigation included environment rehabilitation and replacement.

Fisheries Compensation

The SNC have an agreement with DFO and are responsible for the evaluation of any proposed works regarding their impact on fish habitat. Fisheries assessments should be undertaken in the area of water crossings to determine the presence of fish/fish habitat. If required, mitigation or compensation plans will need to be prepared for SNC approval.

Bird Survey and Management Plans

Any works/ activities (including vegetation removal) with the potential to disturb or destroy migratory birds or their nests shall occur outside of the breeding bird season (May 1st to July 31st) or whatever season within which birds are frequenting the project area and may be impacted. If work is proposed to occur within the breeding bird season, a bird nest survey shall be conducted to avoid the disruption of migratory birds or their nests.

Stage 1/2 Archaeological Assessments

Stage 1/2 Archaeological Assessments should be conducted in construction areas identified with archaeological potential in accordance with Ministry of Tourism, Culture and Sport guidelines.

Property Impact

Costs associated with acquiring property and property rights on which to build or provide construction easements for the construction of the well fields and watermains includes, in addition to actual property value; right-of-way preparation, legal and appraisal services and land survey.

Land use

Areas adjacent to the proposed water system are in various stages of developement and redevelopment. The planned land use of these future development areas will need to be considered and integrated during staging of the water system. Land use in the area of the well field will be subject to the Source Water Protection Act.

7.1.2 Impact Assessment – Water System

As described in the methodology, an environmental effect requires consideration of the interaction of the project (i.e. project activities) with the environment. Pre-construction, construction and operational activities have been assessed.

Professional judgement and experience formed the basis for identifying environmental effects and mitigation measures. The analysis was based primarily on comparing the existing environment with the anticipated future environment, during and after construction. Consideration was given to:

- the magnitude, spatial extent, and duration of effects;
- the proportion of a species population or the number of people affected;
- direct or indirect effects;
- the degree to which the effect responds to mitigation; and
- the level of uncertainty about the possible effect.

In this assessment, “residual” environmental effects are defined as changes to the environment caused by the project, and vice versa, when compared to existing conditions and taking into account all mitigation measures. Potential residual environmental effects are assessed with regards to their significance, including spatial and temporal considerations, and are categorized according to the following definitions:

“Negligible” *means an effect that may exhibit one or more of the following characteristics:*

- nearly-zero or hardly discernible effect; or

- affecting a population or a specific group of individuals at a localized area and/or over a short period.

"Insignificant" *means an effect that may exhibit one or more of the following characteristics:*

- not widespread;
- temporary or short-term duration (i.e., only during construction phase);
- recurring effect lasting for short periods of time during or after project implementation;
- affecting a specific group of individuals in a population or community at a localized area or over a short period; or
- not permanent, so that after the stimulus (i.e., project activity) is removed, the integrity of the environmental component would be resumed.

"Significant" *means an effect that may exhibit one or more of the following characteristics:*

- widespread;
- permanent transcendence or contravention of legislation, standards, or environmental guidelines or objectives;
- permanent reduction in species diversity or population of a species;
- permanent alteration to groundwater flow direction or available groundwater quantity and quality;
- permanent loss of critical/productive habitat;
- permanent loss of important community archaeological/heritage resources; or
- permanent alteration to community characteristics or services, established land use patterns, which is severe and undesirable to the community as a whole.

"Positive" means an effect which results in an improvement to the existing or future conditions.

The above definitions of significance were adopted for use in this assessment because many of the impacts cannot be quantified in absolute terms, although changes and trends can be predicted. The definitions provide guidance and are intended to minimize personal bias.

Monitoring is important to verify the accuracy of effects predictions. Monitoring measures were recommended to determine which effects actually occurred with project implementation, and may result in the modification of mitigation measures to improve their effectiveness. Identified monitoring measures included inspection and surveillance, and compliance monitoring.

Table 7-1 describes the potential effects, mitigation, residual effects and their significance, and monitoring recommendations for the preferred alternative.

Table 7-1: Water System Impacts and Mitigation

Environmental Value		Project Activity / Environmental Interaction	Phase[13] P	C	O	Specific Location	Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Level of Significance	Monitoring Recommendation
Social Environment	Regulatory Planning and Policy	The project has been incorporated into planned development to provide the ability for the community to develop according to the Official Plan and Provincial Planning Policy	•				• Construct in accordance with demand from developing communities	Water supply to developing communities	Positive	Monitor development applications to determine timing of construction
Social Environment	Land Use	Lands required for the easements will be assessed with consideration for land use and landowner interests	•			Well field and watermain / feedermain routes	• Fair market value for lands that are required to construct the water supply and distribution system	Transfer of required lands to municipality	Insignificant	None required
Social Environment	Land Use	Some land uses in the vicinity of the new municipal wells may be prescribed as drinking water threats through the *Clean Water Act*, *2006* regulations			•	Well field	• Land use management in accordance with the Nutrient Management Act, 2002 (as amended), Clean Water Act, 2006 and other regulations a prescribed by the Raisin-South Nation Source Protection Region	Applications for development in the vulnerable areas will be flagged for review by the Risk Management Official	Insignificant	As per the Raisin-South Nation Source Protection Region *Proposed Source Protection Plan*
Social Environment	Noise	Noise levels produced by stationary and moving construction equipment (dozers, trucks, loaders, scrapers) will occasionally be disruptive		•		Construction areas	• Contractor to ensure that the municipal by-laws are not contravened, equipment is well tuned, lubrication of moving parts, restrict unnecessary idling	Effects from construction activities will be heard	Insignificant	Monitor complaints during construction
Social Environment	Vibration	Construction activities will generate noticeable vibrations		•		Construction areas	• Contractor to ensure that accepted vibration limits are maintained	Minimal vibrations	Insignificant	Monitor complaints during construction
Social Environment	Air Quality	Dust and equipment exhausts will increase pollution locally during the construction period		•		Throughout Corridor	• Termination of operations during periods of high winds • Use of temporary enclosures, and use of water/dust suppressants as necessary	Dust may be an irritant to adjacent residents and pedestrians	Insignificant	Monitor complaints during construction
Social Environment	Archaeological Resources	Potential for disruption/ disturbance of archaeological resources during construction		•		Areas of archaeological potential	• Undertake Archaeological Assessment in areas of identified archaeological potential • Unexpected discoveries will require the contacting of appropriate authorities	None expected	Negligible	As per Archaeological Assessment recommendations
Social Environment	Registered Archaeological Sites	No documented or registered archaeological sites within the study area		•		Construction areas	• Unexpected discoveries will require the contacting of appropriate authorities	None expected	Negligible	As per Heritage Assessment recommendations
Social Environment	Areas of Potential Environmental Concern	Active and closed waste disposal sites have the potential to cause impacts to soil and groundwater quality	•	•	•	New well field	• Wells have been located in the esker with a source water protection area and should not be affected by the active or closed landfills	None expected	Negligible	As per the Raisin-South Nation Source Protection Region, *Proposed Source Protection Plan*
Social Environment	Views	Elevated water tower will introduce a new element into the viewscape		•	•	Highway 417	• Design tower to be visually aesthetic and to promote the Village	Change in the viewscape with an opportunity to identify the Village to roadway users	Positive	None required

13 **P** -Pre-construction/Design
C - Construction
O - Operation

	Environmental Value	Project Activity / Environmental Interaction	Phase[13]			Specific Location	Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Level of Significance	Monitoring Recommendation
			P	C	O					
Biological Environment	Species at Risk (SAR)	Potential for disruption/ disturbance of SAR and/or their habitat		•	•		• Undertake SAR inventory prior to construction in areas of potential SAR habitat and identify mitigation measures if required	Potential short term minor disruptions to localized populations following mitigation	Insignificant	As per *Ontario Endangered Species Act* mitigation plan if required
Biological Environment	Aquatic Habitat / Surface Water	Decrease in water quality due to accidental spills during construction refueling and accidents during operation, resulting in pollutants entering the watercourses		•	•	Entire Corridor	• No refueling within 30 m of a watercourse • *Emergency Response Plan*	Some contaminants within stormwater system	Insignificant	As per Emergency Response Plan
Biological Environment		Decrease in water quality from sedimentation due to construction activities in the vicinity of water crossings		•		Water crossings	• Construction fencing at work areas near watercourses to limit the area of disturbance • *Erosion and Sedimentation Control Plan*	Minor short-term localized degradation of water quality	Insignificant	Monitoring of baseline water quality may be required during detail design
Biological Environment		Potential loss of fish habitat as a result of new water crossings for infrastructure		•		Water crossings	• Design cross-sections to avoid modifications at crossings • Avoid in-water work to the extent possible • Minimize the area of in-water alteration to the extent possible • Follow in-water construction timing restriction • If in-water work is anticipated, develop mitigation plan to manage potential loss of fish habitat	Potential for short-term localized disruption of fish habitat	Insignificant	As per mitigation plan, if required
Biological Environment	Provincially significant Wetlands (PSW)	No PSW in the immediate vicinity of the proposed system					• None required	None anticipated	Negligible	None required
Biological Environment	Significant Habitat	No significant habitat has been identified, however, existing urban wildlife may be displaced or disturbed during the construction of the project		•		At water edges	• Design a *Landscaping Plan* which will replace some of the habitat lost • Protection of identified features and individual specimens with exclusion fencing • Replacements –native varieties	Replacement of existing landscape features	Insignificant	Monitor health of new plantings
Physical Environment	Surficial Geology	The potential for soft ground conditions or excess groundwater pressures that may impact the stability of excavations.	•				• No unusual problems are anticipated in trenching in the overburden materials using large conventional hydraulic excavating equipment. • Side slopes should be stabilized in the short term at 1 horizontal to 1 vertical to depths of approximately 4 metres if the water table is not encountered. • If excavations extend below the water table in sandy soils then side slopes of 3 horizontal to 1 vertical may be required. • Undertake detailed geotechnical investigation during detailed design	Some of the excavations would need to be carried out within shoring/sheeting generally consisting of trench boxes if trench stability is an issue	Insignificant	None required
Physical Environment	Bedrock Geology	Bedrock excavation is not expected for excavations in the vicinity of the Village	•				• Undertake detailed geotechnical investigation during detailed design	None anticipated	Negligible	None required

Environmental Value		Project Activity / Environmental Interaction	Phase[13] P	Phase[13] C	Phase[13] O	Specific Location	Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Level of Significance	Monitoring Recommendation
	Hydrogeology	Groundwater inflow is expected for essentially all excavations within the study area and temporary excavations may require dewatering		•		Areas of new infrastructure / replacement	• Hydrogeology assessment of anticipated inflow and need for MOE Permit-to-Take-Water (PTTW) • Removal of groundwater by well filtered sumps in the excavations • Contractor to develop and implement an *Erosion and Sediment Control Plan*	Potential for increased sedimentation down stream	Negligible	Monitor effectiveness of Erosion and Sediment Control Plan Monitor PTTW requirements carried out by contractor for conformance to application
Technical Conditions	Well Development	Introduction of new wells could result in groundwater level lowering	•	•	•	Well field	• Locate communal wells within the esker based on water balance to avoid interference with other wells • Site-specific hydrogeological assessment to confirm the available groundwater quantity and quality for a municipal well	Pumping rate modifications / reductions if settlement occurs	Insignificant	Monitoring wells exist around the proposed well location and are currently being monitored quarterly to assess the natural fluctuations of the aquifer prior to the installation of a communal well.
Technical Conditions	Road Traffic Volumes and Capacities	Detours will be required during construction, particularly where the watermains will cross existing roads. This will potentially slow traffic and affect existing bus routes, being a possible irritant to drivers and pedestrians		•		Roadway /intersections	• Construction phasing to minimize effects to traffic • A *Construction and Traffic Management Plan* will be prepared and adhered to by the contractor. Standard traffic control measures will be used to manage traffic flow • A *Public Communications Plan* will be implemented by the contractor. Detours will provide a minimum of two traffic lanes for their duration	Possible traffic delays during construction	Insignificant	Ongoing monitoring of Construction and Traffic Management Plan
Technical Conditions	Structures and Utilities	Pumping from permeable layers could cause groundwater level lowering for a significant zone of influence around excavations		•			• Undertake detailed geotechnical investigation during detailed design	None expected	Insignificant	None required
Technical Conditions		Ground movements may affect utilities and buildings in the immediate vicinity of excavations		•			• Undertake detailed geotechnical investigation during detailed design	Localized temporary settlement where excavations would extend within the 1H:1V (horizontal: vertical) zone of influence of building foundations	Insignificant	Settlement monitoring

7.2 Preferred Wastewater System

7.2.1 Wastewater Collection System

The preferred wastewater collection solution is Alternative 2 with forcemain alignment C. This involves upgrading SPS-1 and re-pumping at proposed SPS-13. Based on the results of the development analysis as detailed in Section 1.4, estimates of the population were prepared to determine the approximate capacity of the various pump stations and are included below:

- SPS-1 will be upgraded to a peak design flow of 130 L/s from its current rated capacity of 51.9 L/s and will service approximately 7,000 people.
- SPS-11 will be designed to service approximately 1,900 people with a peak design flow of 30 L/s.
- SPS-12 will be designed to service approximately 200 people and will have a peak discharge rate of 7.5 L/s, to ensure self-cleaning of a 100mm diameter forcemain.
- SPS-13 will be designed to service the population from areas FG-4 and FG-5, (population of 3,500 and a peak design flow of 52 L/s) in addition to the flow from SPS -1 (130 L/s) for a total peak flow of 182 L/s.
- SPS-15 will be designed to service 36 ha for a peak design flow of 23 L/s.
- SPS-14 will be designed to service ICI-2 (16.7 ha with a peak design flow of 11 L/s) in addition to the peak design flow from SPS-15 (23 L/s) for a total peak flow of 34 L/s.

The wastewater flow rates were determined using the following criteria:

- For residential flows the average day rate of 310 L/p/d was applied with peaking factor per the Harmon formula. The peak extraneous flow allowance was taken as 227 L/p/d.
- For Trade & Industry Policy areas an average day rate of 28 m^3/ha/d was applied with a peaking factor of 1.5. The extraneous flow allowance was taken as 0.15 L/s/ha

It is anticipated that the first stage of the wastewater collection solution will involve an upgrade to SPS-1 (des Pins), the installation of SPS-11 & SPS-13 and the installation of a 7 Km, 400 mm diameter, forcemain from SPS-13 to the sewage treatment facility (Figure 7-6). The remaining work may be completed in subsequent stage(s) as necessary based on area development (Figure 7-7).

Figure 7-6: Stage 1 Wastewater Collection System

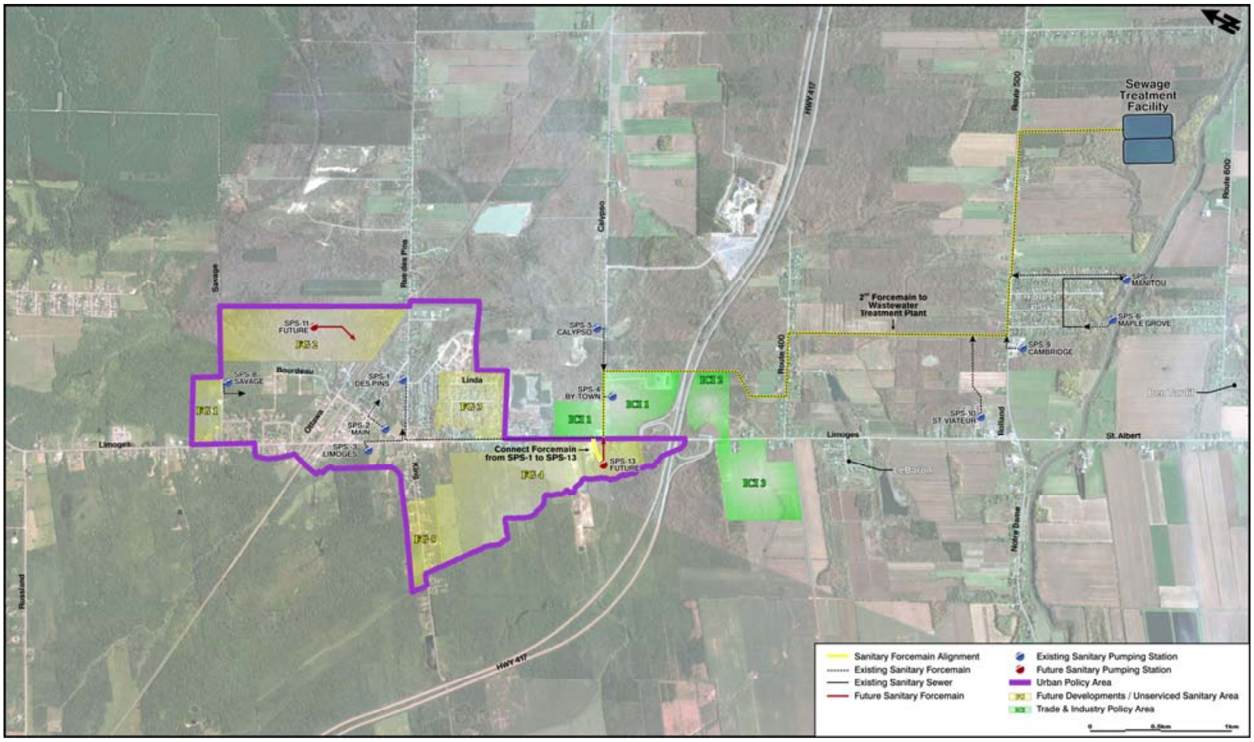
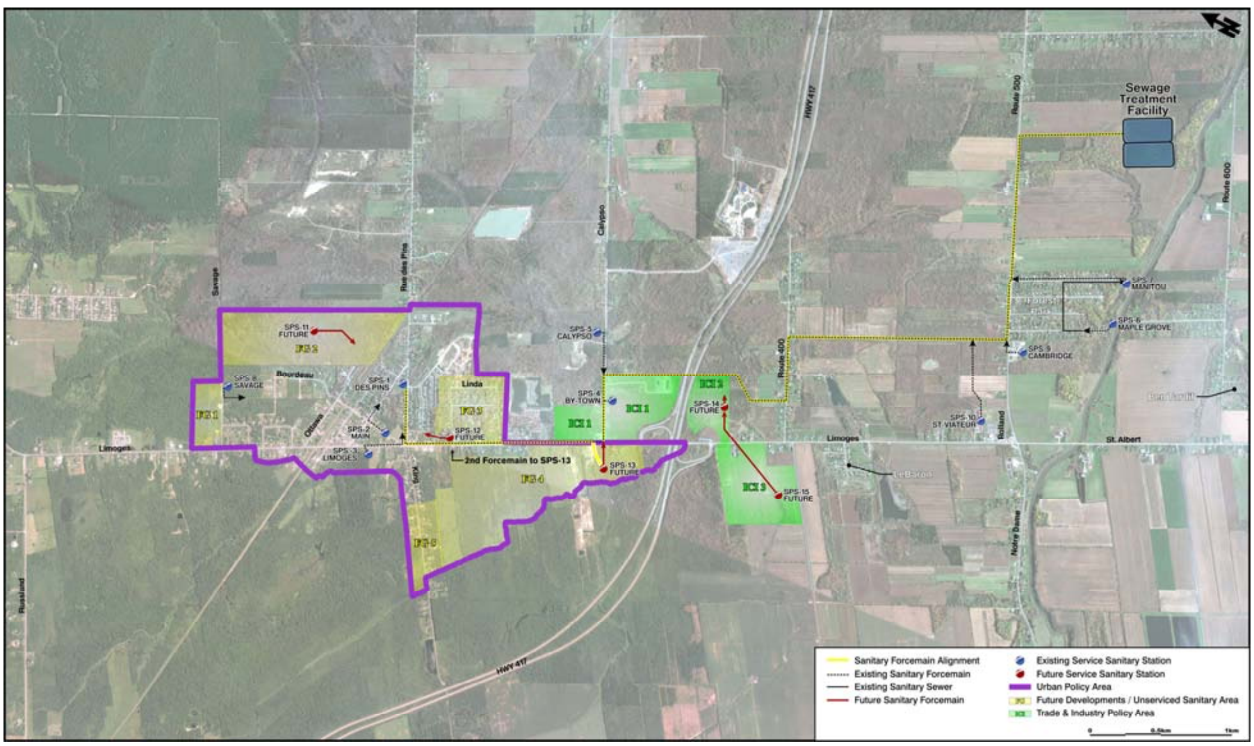


Figure 7-7: Stage 2 Wastewater Collection System



7.2.2 Wastewater Treatment System

The preferred wastewater treatment alternative is Alternative 2. This involves the construction of a new mechanical wastewater treatment plant. The limited assimilative capacity of the Castor River (further details provided in Section 7.2.3) places significant constraints on design options. The chosen technology will need to satisfy the following:

- 'Tertiary' treatment effluent quality will be required to permit continuous discharge to the Castor River implying high removals of BOD, suspended solids and phosphorus, and year-round nitrification and disinfection.
- Due to high background phosphorus concentrations the PWQO will not be met at the plant outfall but, 'tertiary' treatment processes will be capable of maintaining the annual loading at, or slightly below, the current limit for the lagoons. Nation Municipality may negotiate an arrangement with the South Nation Conservation Authority for expansion.
- Even with this level of treatment, effluent storage will be required during periods of low river flow – the existing lagoons with a gross capacity in the order of 340,000 appear to be ideally sized for this purpose and might also support a Stage 2 plant rating of 6,900 m3/d.
- The assimilative capacity study demonstrated that Stage 1 (3,500 m3/d) effluent criteria could be applied to Stage 2 (6,900 m3/d) but it was based on limited water quality data and numerous assumptions. Effluent monitoring will be undertaken prior to Stage 2 implementation to confirm effluent discharge and future criteria requirements.
- Considering the long-term planning horizon for future expansion of the plant, updated assimilative studies will almost certainly be required based on monitoring data accumulated in the intervening period taken upstream and downstream of the outfall. There is no immediate need for initiating the monitoring programme but it should include all relevant parameters (TP, BOD, CBOD, TSS, E. coli, TAN, pH, DO).

'Tertiary' treatment typically implies nitrification and the addition of effluent filtration to a conventional secondary biological treatment train for enhanced solids. MOE Design Guidelines list many, but not all of the proven biological processes in common use in North America as follows:

Table 7-2: Biological Processes in Common Use in North America

Suspended Growth	Fixed Film	Hybrid
Conventional Activated Sludge (CAS) process Plug Flow Complete Mix Contact Stabilization Extended Aeration (EA) Step-Feed ASP High-Rate ASP Membrane Bioreactor (MBR) Sequencing Batch Reactor (SBR) Oxidation Ditch (added to list) Lagoon (Facultative and/or Aerated)	Rotating Biological Contactor (RBC) Trickling Filter (TF)	Integrated Fixed-film Activated Sludge (IFAS) Trickling Filter/Solids Contact (TF/SC) Rotating Biological Contactor/Solids Contactor (RBC/SC) Biological Aerated Filter (BAF)

The defining characteristics in selecting the preferred process option for Limoges can be summarized as follows:

- The plant is relatively small at 3,500 m^3/d;
- It must be capable of tightly-controlled year-round nitrification; and
- The site is not tightly constrained.

In Ontario, the most common process for a plant characterized in this way would be Extended Aeration and there is no need to conduct an extensive analysis of all possible options to justify its selection in this case. The features of an Extended Aeration plant are:

- Aeration tank sized with long hydraulic retention times;
- Long sludge age for achieving nitrification;
- No primary sedimentation;
- Secondary clarifier for solids separation and sludge return to aeration; and
- Aerobic digesters for biosolids stabilization.

In many respects, Extended Aeration may be considered a generic process categorized by long sludge age – and Membrane Bioreactors (MBR) and Sequencing Batch Reactors (SBR) may be considered as Extended Aeration plants configured to eliminate the need for secondary clarifiers. Membrane plants then go further to eliminate the need for tertiary filters. The Oxidation Ditch is another Extended Aeration configuration and added to the MOE list although there are few examples of its use in Ontario.

MBRs and SBRs are more compact than conventional Extended Aeration plants which reduce their overall footprint. MBRs are a relatively recent development but now an accepted technology – although as of 2011 there were less than 15 MBR municipal plants in Canada and most were smaller than that proposed for Limoges. The membranes deteriorate over time and as such must be considered a “consumable”. The replacement schedule will vary from plant to plant but is unlikely to exceed 8-10 years and the replacement cost remains relatively high.

SBRs are also a relatively new technology although the concept is as old as the activated sludge process itself. Their resurgence over the past couple of decades can be attributed in part, to the reliability of programmable logic controllers. SBRs are typically marketed as proprietary systems although apart from the equipment to decant at the end of each settling cycle, the only other proprietary product is the PLC control logic and possibly the process design. In all other respects, SBRs utilize equipment found in conventional Extended Aeration plants.

There is no single Extended Aeration configuration best-suited for Limoges as all could be incorporated into a process train capable of meeting the effluent quality compliance limits. It is reasonable to suggest however, that an SBR would represent the lowest capital cost based on design-build pricing over the past decade where selection of plant configuration was the responsibility of the contractor.

The following is a list of qualitative comparisons between the various configurations. The list could be developed into an evaluation matrix and weighted but the analysis would remain qualitative. For the purposes of this Master Plan it is proposed that the SBR configuration be adopted for further development. In general, its advantages over conventional Extended

Aeration are significant and while the MBR has advantages over the SBR, they are perhaps not sufficient to warrant acceptance of the disadvantages of the MBR. This position should remain open however, until the preliminary design stage at which time more detailed costing and evaluation could add further support to the recommendation or point towards a different Extended Aeration configuration.

Table 7-3: Comparison of Various Plant Configurations

Conventional Extended Aeration	Sequencing Batch Reactor	Membrane Bioreactor
Advantages		
Simple operation Many plants in operation throughout the province Good final secondary effluent quality	Relatively small footprint Increasing number of plants in operation throughout the province Inherent flow equalization capability Eliminates need for final clarifiers Enhanced control over filamentous biomass growth "Perfect" static settling for solids separation during clarification cycle Effluent discharge rate is a constant under all flow conditions, simplifying downstream unit sizing De-nitrification for alkalinity recovery readily accommodated Biological phosphorus removal capability reduces the use of coagulant Final effluent quality approaching tertiary standards	Smallest footprint Increasing number of plants in operation throughout the province Eliminates the need for final clarifiers Eliminates the need for tertiary filtration Reduces chemical or power consumption for effluent disinfection De-nitrification for alkalinity recovery readily accommodated Biological phosphorus removal capability reduces the use of coagulant Highest quality effluent exceeding typical tertiary standards
Disadvantages		
Relatively large footprint Final clarifiers can be capacity-limiting RAS control more complex Solids inventory management more difficult under peak wet weather flows Effluent filtration required to achieve tertiary effluent quality	Continuous cyclic operation increases reliance on proper automated operation of mechanical equipment: valves, pumps, blowers Equipment and cycle reliability has been a concern during development of the technology Proprietary process controls can limit Owner access for modification Effluent filtration required to ensure tertiary quality effluent	Fine screening of raw sewage influent critical to good operation Reactors must be sized for peak wet weather flows or equalization required More complex operation requiring proper automated operation of mechanical equipment and controls Equipment and cycle reliability has been a concern during development of the technology Membranes require regular cleaning Lower efficiency coarse bubble aeration required to control membrane fouling Uncertain membrane life and relatively high replacement costs

The process train for an SBR plant is shown on Figure 7-8 and described in Table 7-4:

Figure 7-8: Process Flow Diagram for SBR

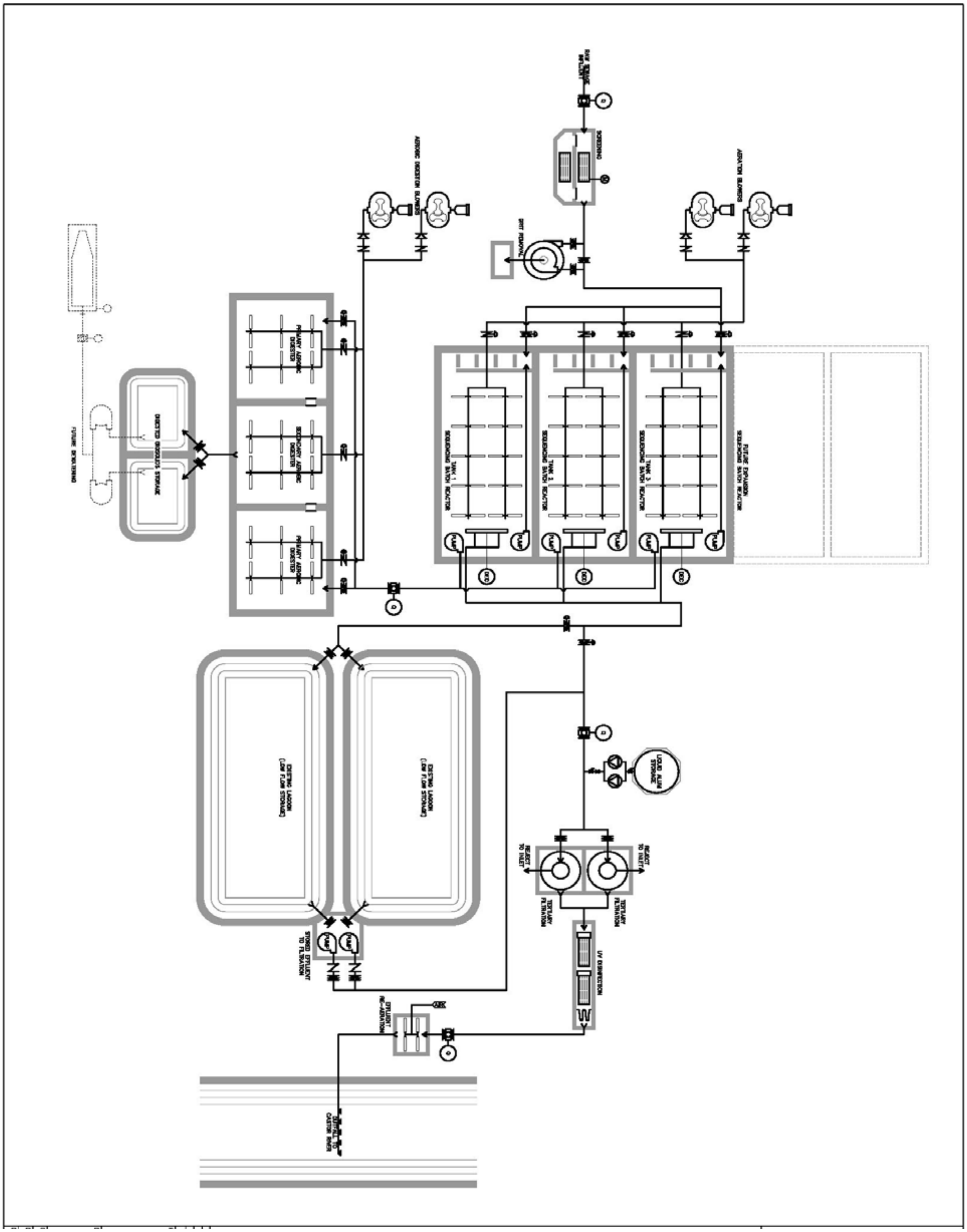


Table 7-4: Process Train for a Sequencing Batch Reactor Plant

SBR Process Component	Comments
Screening	Mechanical screen (fine screen 6± mm – possibly grinder-screen combination with auto wash and bagging system) and manual coarse screen bypass
Grit Removal	For protection of downstream mechanical equipment – possibly auto wash and dewatering system – no standby necessary
SBR Tanks	Three tank configuration per MOE Guidelines – fine pore aeration
Seasonal Retention Lagoons	Existing lagoons – remove sludge accumulation from east cell
Chemical Feed	Liquid alum for phosphorus removal – possible reuse of existing system
Sand Filtration	Cyclic operation or continuous wash filters
Disinfection	Ultra-violet auto-clean system – preferred over chlorine as it eliminates a contact tank and de-chlorination chemical feed
Effluent Re-aeration	Post disinfection aeration tank to increase dissolved oxygen concentration prior to discharge
Biosolids Digestion	Aerobic digesters – typically used for Extended Aeration plants where WAS oxygen concentrations are elevated and sludge age is long – this may require reconsideration depending on ultimate disposal methods
Biosolids Storage	Lagoon storage of liquid biosolids – sized for seasonal land-spreading disposal – this may require reconsideration depending on ultimate disposal methods
Biosolids Dewatering (future)	As required for ultimate landfill disposal or composting

Due to the limited reserve capacity available in the lagoons it was deemed imperative to develop an interim solution that would provide sufficient time to commission the long term solution (mechanical treatment plant). In developing recommendations for future treatment options, it became apparent that an opportunity did exist for simply re-rating the existing lagoons. Historical effluent quality data suggests the lagoons are performing as well as a conventional activated sludge plant. As such, there is limited risk in setting compliance limits lower to permit an increase in its volumetric rating. This is addressed in the following (Appendix I):

- Report – 'Nation Municipality, Village of Limoges, Wastewater Treatment Plant Re-Rating Study', April 2012, Delcan Corporation in association with Golder Associates; and
- Memorandum – 'Wastewater Treatment Plant Re-Rating Study, Village of Limoges, The Nation Municipality', May 31, 2012, Ministry of the Environment, Kingston.

The net results of this work are two sets of effluent criteria agreed to by MOE – one for a mechanical plant and one for the re-rated lagoon facility as listed in Table 7-5.

Table 7-5: Wastewater Effluent Criteria

Effluent Criteria	Mechanical Plant			Re-rated Lagoons	
Rated Capacity	$3,500\ m^3/d$ (1)			$1,500\ m^3/d$ (2)	
Parameter	Design (mg/L)	Limit (mg/L)	Loading (kg/d)	Design (mg/L)	Limit (mg/L)
$CBOD_5$	3	5	17.3	25	30
Total Suspended Solids	3	5	17.3	30	40
Total Phosphorus	0.2	0.3	1.0	0.7	0.7
Total Ammonia-N					
Summer (May 1 – Oct 31)	0.7	1	3.5	2	3
Winter (Nov 1 – Apr 30)	3	5	17.3	12	14
E. coli (counts/100 mL)	100	200	n/a		
Total Residual Chlorine	Non-detect	0.02	0.07		
Hydrogen Sulphide				Non-detect	0.01

(1) The assimilative studies were based on Stage 1 and 2 design flows of 40 L/s and 80 L/s which equate to 3,456 m³/d and 6,912 m³/d.

(2) The waste stabilization/storage lagoons are currently rated at 1,073 m³/d. The new rating represents a 40% increase.

The following are some key findings and conclusions arising from these studies:

1. The existing lagoons achieve effluent qualities similar to those from a conventional mechanical activated sludge plant with phosphorus removal.
2. Despite excellent performance, 1,500 m³/d represents the effective limit for lagoon treatment because at 7Q20 river flows (lowest average 7-day flow with a return period of 20 years):
   a. Any further increase in BOD loading would depress dissolved oxygen concentrations in the river below the Provincial Water Quality Objective (PWQO) of 4 mg/L; and
   b. Any further increase in total ammonia nitrogen would raise the un-ionized ammonia fraction in the river above the PWQO of 20 µg/L.
3. Seasonal-release retention lagoons were carried forward as a preferred alternative for further consideration but eliminated in favour of a mechanical plant due to, in part, uncertainty over the assimilative capacity of the river. The recent studies make this definitive:
   a. While biochemical oxygen demand (BOD) removals might be improved by continuous aeration of the lagoons, no improvement in performance could be expected beyond conventional 'secondary' treatment without improved solids removals – and 'tertiary' treatment will be required for continued discharge to the Castor River; and
   b. Although the existing lagoons nitrify in the summer, year-round nitrification will be a requirement for future expansion and this cannot be assured, regardless of whether they are continuously aerated or not.
4. Background phosphorus concentrations in the South Nation watershed already exceed the PWQO of 30 µg/L. The annual mass loading limit for the Limoges lagoons is 392 kg/yr and despite the fact the actual release is only about 15% of that total, conventional technology will not eliminate the nutrient. For continued discharge to the Castor River therefore, the Municipality will be required to negotiate an agreement with the South Nation Conservation Authority to fund phosphorus offset activities through the Total Phosphorus Management program.

Therefore, it is anticipated that the interim stage of the wastewater treatment solution will involve re-rating the existing facility from the current 1,073 m^3/d to 1,500m^3/d. This will permit an equivalent population growth of approximately 1,100 persons assuming an average day rate of 400 L/p/d (including average extraneous flow of 90 L/p/d). Because the re-rating does not involve any construction the associated cost is minimal. It is anticipated that the first stage will involve the installation of a mechanical treatment plant adjacent to the existing lagoons with a rated capacity of 3,500 m^3/d. This will permit an equivalent population growth beyond the first phase of 5,000 people. The second stage will involve an expansion of the plant to a rated capacity of 6,900 m^3/d (Figure 7-6).

Discharges from ICI development represent approximately 40% of the rated flow. Due to the inherent variability and uncertainty surrounding water use in areas designated for ICI development, flow predictions should be reviewed regularly to re-establish the balance between residential and ICI when considering development applications. ICI flows at build-out are based on a contribution of 28 m^3/d/ha per MOE Guidelines. The ICI contribution today is estimated to be a small fraction of that at about 4 m^3/d/ha and as such, a mid-range value of 18 m^3/d/ha has been used for the Stage 1 plant rating. This provides a reasonable allowance for ICI and should the type of development not generate flows of this magnitude, the Stage 1 plant rating might support a population closer to build-out. If a large water user expressed interest in establishing a facility in Limoges, the ICI capacity allocation would have to be evaluated specifically for that user and a decision made in the best interests of the community. Depending on the magnitude of the flows generated, the developer might be required to provide on-site treatment and independently resolve the issue of assimilative capacity. The proposed Stage 2 plant rating of 6,900 m^3/d is simply a 100% expansion, the size of which would be re-evaluated at the time.

Figure 7-9: Wastewater Treatment System Staging

7.2.3 Mechanical Treatment Plant Feasibility Study

In addition to the assimilative capacity study of the Castor River for wastewater treatment lagoons servicing the Village of Limoges, a Mechanical Treatment Plant Feasibility Study (MTPFS) (Golder 2012a) was also completed. The purpose of this study was to report the methodology, assumptions and results of the screening level assimilative capacity study carried out on a reach of the Castor River downstream of the existing lagoon treatment plant. The results of the screening level assessment may be used to assess the feasibility of a mechanical treatment plant in terms of allowable discharges to the Castor River to maintain specific water quality objectives.

Bathymetric and streamflow transects, water quality and sediment quality sampling, a dissolved oxygen survey, Limoges Outfall Inspection, and Casselman Weir Inspection were completed as a part of the MTPFS. Data collected confirmed that the water levels in the Castor River and the South Nation River are controlled by a weir located on the South Nation River immediately downstream of Casselman (Golder 2012a). The data was used as input to the Streeter Phelps model to estimate effluent travel time and re-aeration coefficients for the purposes of establishing BOD and DO results (Golder 2012a).

The model was used to estimate the required river flow for effluent discharge under several scenarios. The assessment considered a variety of flows, temperatures, both ice-covered and ice-free conditions, and various water and effluent parameters.

The MTPFS and the update memo (Golder 2012b) indicate that:

- On the basis of maintaining downstream dissolved oxygen, effluent discharge from a mechanical treatment plant is possible under most conditions. Temporary storage of the effluent or reduced effluent flow rates are required most years during low flow period during the summer and winter ice covered period.
- Based on a 35-year simulation, the volume of the existing lagoons (340,000m^3) provides adequate storage capacity to hold the plant effluent during the winter and autumn periods.
- Allowable discharge loads of total ammonia can be established to maintain an acceptable un-ionized ammonia concentration downstream. The maximum total ammonia concentration should be less than 5.0 mg/L during the winter (November to April) and less than 1.0 mg/L during the summer (May to October) when the discharge flow is 40 L/s. The effluent criteria for ammonia should be re-evaluated prior to any future expansion of the plant and should consider both the assimilative capacity of the river as well as the recorded performance of the plant.
- The concentrations for total phosphorus in the Castor River exceed the PWQO values in most of the historical samples. This would suggest that there is not additional assimilative capacity in the Castor River to accommodate increased loads of phosphorus. Since it is not likely that the mechanical treatment plant can achieve effluent phosphorus concentrations that are below the PWQO, the effluent criteria for total phosphorus will likely be based on an offset of non-point source reductions elsewhere in the watershed.
- The mixing zone assessment indicates that the MOE's requirements regarding fish passage and exposure to un-ionized ammonia concentrations above the acute toxicity levels have been met.
- Additional inflows into the Castor River between Russell and the confluence with the South Nation River may provide additional assimilative capacity and reduce the amount of effluent storage required.

7.2.4 Impacts and Mitigation – Wastewater System

The values and conditions identified in the documentation of existing conditions were used as the basis for assessing the effects of the preferred alternative on the transportation, social, physical and biological environments. The impact analysis involved applying the following steps:

- Identify and analyse instances where the project, as described in Section 5.0, may interact with existing environmental conditions, as described in Section 4.0.
- Acknowledge predetermined project activities that act as *built-in mitigation* measures.
- Identify opportunities for further *mitigation of residual* effects, if possible/practical.
- Determine the *significance of the residual* environmental effects, after further mitigation.

In order to understand the project interactions with the environment it is necessary to consider all phases of the project: pre-construction/design (P); construction (C); and operation (O).

7.2.4.1 Best Management Practices (BMPs)

In this assessment, "built-in mitigation" is defined as actions and design features incorporated into the pre-construction, construction, and operational phases, which have the specific objective of lessening the significance or severity of environmental effects that may be caused by the project.

The expanded Limoges Wastewater System will be designed and implemented with the benefit of contemporary planning, engineering, and environmental management practices. Regard shall be had for the legislation, policies, regulations, guidelines, and best practices of the day. Where possible, mitigation measures will be prescribed in the construction contracts and specifications. Examples of practices that should be employed, based on current standards, are described below. These measures can be considered "built into" the preferred design. They will be updated and refined during the pre-construction, construction, and operation phases of the project.

Erosion and Sediment Control Plan

The purpose of the Erosion and Sediment Control Plan is to determine the degree of erosion and sedimentation that would occur under normally anticipated weather conditions during the life of the project, and to develop and implement mitigative strategies to control any foreseen areas determined to be pre-disposed to the problem. This may include: the identification of planting and slope rounding specifications within the contract tender; identifying and specifying seeding and sodding locations; identifying areas requiring slope benching or retaining structures in the detailed design process; and post construction monitoring and mitigative practises.

Construction and Traffic Management Plan

A Construction and Traffic Management Plan will be developed to manage the road's transportation function for all travel modes including equipment and material deliverables at various times during the construction period. The objective of the plan will be to maintain safe and clear pedestrian routes, maintain existing traffic as close as possible to its current conditions, and outline the road signage program.

Unexpected Discovery of Archaeological Resources

If during the course of construction archaeological resources are discovered, the site should be protected from further disturbance until a licensed archaeologist has completed the assessment and any necessary mitigation has been completed.

If unexpected archaeological resources are encountered, construction must cease and a licensed consultant archaeologist shall be engaged to carry out field work, in compliance with Section 48 (1) of the Ontario Heritage Act. Should deeply buried deposits be found during any construction activities, the Ministry of Tourism, Culture and Sport (416) 314-7148, will be notified immediately. In the event that human remains are encountered during construction activities, local law enforcement authorities and/or the coroner will be notified immediately, followed by the Ministry of Tourism, Culture and Sport, and the Registrar of Cemeteries at the Ministry of Consumer Services (416) 326-8393.

Emergency Response Plan

The preparation of an Emergency Response Plan to be used by the contractor will be included to allow full access to emergency services during the construction period, so that at any given time there is a method to access all adjacent land uses. Additionally, the Emergency Response Plan should include provisions for providing temporary services to end users in the event of a construction related service outage or other service disruption. A spills response and reporting plan will be prepared and adhered to by the contractor. Spills or discharges of pollutants or contaminants will be reported immediately. Clean up shall be initiated quickly to ensure protection of the environment.

Environmental Protection

It will be the responsibility of the contractor to ensure that no contamination, waste or other substances, which may be detrimental to aquatic life or water quality, will enter a watercourse as either a direct or indirect result of construction. In this regard, any floating debris resulting from construction which accumulates on watercourse beds and watercourse banks is to be immediately cleaned up and disposed of. Any spills or contamination, waste or other substances which may be detrimental to aquatic life or water quality will also be immediately cleaned up.

Any work which will cause or be the cause of discharge to watercourses is to be prohibited. At all times, construction activities are to be controlled in a manner that will prevent entry of deleterious materials to watercourses. In particular, construction material, excess material, construction debris and empty containers are to be stored away from watercourses and the banks of watercourses.

Management of Contaminated Materials

The MOE and construction manager are to be notified immediately upon discovery of any contaminated material encountered within the construction area. If contaminated materials or contaminated groundwater are encountered within the construction limits, these are to be removed and disposed of in accordance with all applicable Acts and Regulations. Treatment and discharge of contaminated groundwater are also to be in accordance with applicable legislation and regulations.

Geotechnical Investigations

Geotechnical investigations will be required to confirm groundwater and subsurface conditions and potential impacts that will need to be considered in the detailed design phase of the project. Geotechnical investigations will also be required to undertake the pavement design. Foundation investigation will be required for structural design of new structures.

7.2.4.2 Site Specific Mitigation Measures

Once project specific potential effects were predicted, mitigation measures and Best Management Practices (BMPs) were identified for the wastewater treatment facility. Often these mitigation measures were sufficient to reduce potential negative effects to an insignificant or negligible status. Mitigation includes environment rehabilitation and replacement.

Treatment Plant Design

As presented in the 18 May 2012, Limoges WWMP Memo (Golder 2012b), the following recommendations are provided: Based on the contents of this report and the preceding conclusions, the following recommendations are provided:

- Additional verification exercises should be undertaken to confirm that multiple simultaneous discharges from other facilities on the Castor River that may affect the available assimilative capacity during the Limoges discharge, have been readily accounted for in water quality parameter values employed in this assessment;
- Since the screening level assessment was completed based on an assumed conceptual plant design, the results presented in this report may not be applicable to the final design. At various points during the plant design, the effluent parameters assumed in this study should be verified. In the case of large discrepancies between the assumed values and the actual plant values, the assessment in this report should be reevaluated.
- The mixing zone assessment should be re-evaluated after a conceptual design of the plant and the outfall is available. The mixing zone assessment can be used to assess variations in water quality across the river, to determine if specific water quality objectives are not med near the shoreline, and to assess potential obstacles to fish passage.
- To further evaluate the storage requirements, it is recommended that the allowable discharge rates for the mechanical plant be evaluated using constraints that are representative of the operational limitations of a mechanical treatment plan.
- While the Mechanical Treatment Plant Feasibility Study was intended as a feasibility study for a mechanical treatment plant with some input from the MOE, it may not meet all of the requirements of the permitting process. It is recommended that the permitting requirements be discussed in detail with the regulatory agencies (e.g. MOE) should the decision be made to proceed with the mechanical treatment plan option
- Prior to the detailed design and permitting process of the mechanical treatment plant, additional analysis should be completed to evaluate the additional flows into the Castor River and re-evaluate the required storage volume.

Monitoring Program

Toxicity testing for rainbow trout and daphnia magna is to be conducted on a quarterly basis, to be reduced annually following two straight years of no acute lethality.

Prior to finalizing the effluent limits for Phase 3, a monitoring program should be conducted on the Castor River during the interim period of time prior to reaching the ultimate design flow rate. The monitoring should include key parameters upstream and downstream of the Limoges discharge. Monitored parameters should include total phosphorus (TP), BOD_5, $CBOD_5$, TSS, *E. coli*, TAN, DO, pH, temperature, and calculated un-ionized ammonia. Temperature, pH, and DO measurements of the effluent should also be included, along with regular effluent monitoring. Parameter monitoring should be conducted on a seasonal basis, with emphasis on the periods of time that both facilities are discharging to the river (spring and fall), as well as during the critical summer/early fall low flow period (once a year-round discharge is established at Limoges).

Fisheries Compensation

The SNC have an agreement with DFO and are responsible for the evaluation of any proposed works with regards to their impact on fish habitat in the drainage area. A fisheries assessment should be undertaken in the area of water crossings to determine the presence of fish/fish habitat.

Bird Survey and Management Plans

Any works/ activities (including vegetation removal) with the potential to disturb or destroy migratory birds or their nests shall occur outside of the breeding bird season (May 1st to July 31st) or whatever season within which birds are frequenting the project area and may be impacted.

Stage Two Archaeological Assessments

Stage 2 Archaeological Assessments should be conducted in construction areas identified to have archaeological potential in accordance with Ministry of Tourism, Culture and Sport guidelines.

Public Communications Plan

The purpose of the Public Communications Plan is to keep the public informed about the work in progress and the end result of the construction activities. Residents and other stakeholders must be kept aware of scheduled road disruptions, interruption to other services and other construction related details ahead of time so that their activities can be planned with minimum disruption. The plans should detail how to communicate the information to the public, what information should be disseminated, and what project stages the communications should take place.

Property Impact

Costs associated with acquiring property and property rights on which to build or provide construction easements for the construction of the treatment plant, storage lagoons and sewers includes, in addition to actual property value, right-of-way preparation, legal and appraisal services and land survey.

Land use

Areas adjacent to the proposed wastewater system are in various stages of developement and redevelopment. The planned land use of these future development areas will need to be considered and integrated during the staging of the project in order to reduce conflicts and maximize land use and development opportunities.

7.3 Impact Assessment – Wastewater System

As described in the methodology, an environmental effect requires consideration of the interaction of the project (i.e. project activities) with the environment. Pre-construction, construction and operational activities were all assessed.

Professional judgement and experience formed the basis for identifying environmental effects and mitigation measures. The analysis was based primarily on comparing the existing environment with the anticipated future environment, during and after construction. Consideration was given to:

- the magnitude, spatial extent, and duration of effects;
- the proportion of a species population or the number of people affected;
- direct or indirect effects;
- the degree to which the effect responds to mitigation; and
- the level of uncertainty about the possible effect.

In this assessment, "residual" environmental effects are defined as changes to the environment caused by the project, and vice versa, when compared to existing conditions and taking into account all mitigation measures. Potential residual environmental effects are assessed as to their significance, including spatial and temporal considerations, and are categorized according to the following definitions:

"Negligible" *means an effect that may exhibit one or more of the following characteristics:*

- nearly-zero or hardly discernible effect; or
- affecting a population or a specific group of individuals at a localized area and/or over a short period.

"Insignificant" *means an effect that may exhibit one or more of the following characteristics:*

- not widespread;
- temporary or short-term duration (i.e., only during construction phase);
- recurring effect lasting for short periods of time during or after project implementation;
- affecting a specific group of individuals in a population or community at a localized area or over a short period; or
- not permanent, so that after the stimulus (i.e., project activity) is removed, the integrity of the environmental component would be resumed.

"Significant" *means an effect that may exhibit one or more of the following characteristics:*

- widespread;
- permanent transcendence or contravention of legislation, standards, or environmental guidelines or objectives;
- permanent reduction in species diversity or population of a species;
- permanent alteration to groundwater flow direction or available groundwater quality and quality;
- permanent loss of critical/productive habitat;
- permanent loss of important community archaeological/heritage resources; or

- permanent alteration to community characteristics or services, established land use patterns, which is severe and undesirable to the community as a whole.

The above definitions of significance were adopted for use in this assessment because many of the impacts cannot be quantified in absolute terms, although changes and trends can be predicted. The definitions provide guidance and are intended to minimize personal bias.

Monitoring is important to verify the accuracy of effects predictions. Monitoring measures were recommended to determine what effects actually occurred with project implementation, and may result in the modification of mitigation measures to improve their effectiveness. Identified monitoring measures included inspection and surveillance, and compliance monitoring.

Table 7-6 describe the potential effects, mitigation, residual effects and their significance, and monitoring recommendations for the preferred alternative.

Table 7-6: Wastewater System Impacts and Mitigation

Environmental Value		Project Activity / Environmental Interaction	Phase[14] P	C	O	Specific Location	Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Level of Significance	Monitoring Recommendation
Social Environment	Regulatory Planning and Policy	The project has been incorporated into planned development to provide the ability for the community to develop according to the Official Plan and Provincial Planning Policy	•				• Construct in accordance with demand from developing communities	Wastewater services to developing communities	Positive	Monitor development applications to determine timing of construction
Social Environment	Land Use	Lands required for the easements will be assessed with consideration for land use and landowner interests	•			Treatment Plant and sewer routes	• Fair market value for lands required to construct the treatment plant and sewer routes	Transfer of required lands to municipality	Insignificant	None required
Social Environment	Noise	Noise levels produced by stationary and moving construction equipment (dozers, trucks, loaders, scrapers) will occasionally be disruptive		•		Construction areas	• Contractor to ensure that the municipal by-laws are not contravened, equipment is well tuned, lubrication of moving parts, restrict unnecessary idling	Effects from construction activities will be heard	Insignificant	Monitor complaints during construction
Social Environment	Vibration	Construction activities will generate noticeable vibrations		•		Construction areas	• Contractor to ensure that accepted vibration limits are maintained	Minimal vibrations	Insignificant	Monitor complaints during construction
Social Environment	Air Quality	Dust and equipment exhausts will increase pollution locally during the construction period		•		Throughout	• Termination of operations during periods of high winds • Use of temporary enclosures, and use of water/dust suppressants as necessary	Dust may be an irritant to adjacent residents and pedestrians	Insignificant	Monitor complaints during construction
Social Environment	Archaeological Resources	Potential for disruption/ disturbance of archaeological resources during construction	•	•		Areas of archaeological potential	• Undertake Archaeological Assessment in areas of identified archaeological potential • Unexpected discoveries will require the contacting of appropriate authorities	None expected	Negligible	As per Archaeological Assessment recommendations
Social Environment	Registered archaeological Sites	No documented or registered archaeological sites within the study area	•			Construction areas	• Unexpected discoveries will require the contacting of appropriate authorities	None expected	Negligible	As per Heritage Assessment recommendations
Social Environment	Areas of Potential Environmental Concern	Active and closed waste disposal sites have the potential to cause impacts to soil and groundwater quality within the vicinity of these sites	•	•	•	Sewage Lagoon location	• Once the design of the project has been further developed, a more detailed review of available information and potential risks should will be carried out	None expected	Negligible	As per the Raisin-South Nation Source Protection Region, *Proposed Source Protection Plan*
Biological Environment	Species at Risk (SAR)	Potential for disruption/ disturbance of SAR and/or their habitat		•	•		• Undertake SAR inventory prior to construction in areas of potential SAR habitat and identify mitigation measures if required	Potential short term minor disruption to localized populations following mitigation	Insignificant	As per *Ontario Endangered Species Act* mitigation plan if required
Biological Environment	Aquatic Habitat / Surface Water	Decrease in water quality due to accidental spills during construction refueling and accidents during operation, entering the watercourses		•	•	Entire Corridor	• No re-fuelling within 30 m of a watercourse • *Emergency Response Plan* • Toxicity testing for rainbow trout and daphnia magna as identified in the Monitoring Program	Some contaminants within stormwater system	Insignificant	As per Emergency Response Plan

14 **P** -Pre-construction/Design
C - Construction
O - Operation

	Environmental Value	Project Activity / Environmental Interaction	Phase[14] P	C	O	Specific Location	Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Level of Significance	Monitoring Recommendation
		Decrease in water quality from to sedimentation due to construction activities in the vicinity of water crossings		•		Water crossings	• Construction fencing at work areas near watercourses limiting area of disturbance • *Erosion and Sediment Control Plan*	Minor short-term localized degradation of water quality	Insignificant	Monitoring of baseline water quality may be required during detail design
		Potential loss of fish habitat as a result of new water crossings for infrastructure		•		Water crossings	• Design cross-sections to avoid modifications at crossings • Avoid in-water work to the extent possible • Minimize the area of in-water alteration to the extent possible • Follow in-water construction timing restriction • If in-water works are anticipated, develop mitigation plan to manage potential loss of fish habitat	Potential for short-term localized disruption of fish habitat	Insignificant	As per mitigation plan, if required
	Provincially significant Wetlands (PSW)	No PSW in the immediate vicinity of the proposed system					• None required	None anticipated	Negligible	None required
	Significant Habitat	No significant habitat has been identified, however, existing urban wildlife may be displaced or disturbed during the construction of the project		•		At water edges	• Design a *Landscaping Plan* which will replace some of the habitat lost • Protection of identified features and individual specimens with exclusion fencing • Replacements –native varieties	Replacement of existing landscape features	Insignificant	Monitor health of new plantings
Physical Environment	Surficial Geology	The potential for soft ground conditions or excess groundwater pressures that could impact the stability of excavations.	•				• No unusual problems are anticipated in trenching in the overburden materials using large conventional hydraulic excavating equipment. • Side slopes should be stable in the short term at 1 horizontal to 1 vertical to depths of approximately 4 metres if the water table is not encountered. • If excavations extend below the water table in sandy soils then side slopes of 3 horizontal to 1 vertical may be required. • Undertake detailed geotechnical investigation during detailed design	Some of the excavations will need to be carried out within shoring/sheeting generally consisting of trench boxes if trench stability is an issue	Insignificant	None required
Physical Environment	Bedrock Geology	Bedrock excavation is expected for excavations in the vicinity of the Village	•				• Undertake detailed geotechnical investigation during detailed design	None anticipated	Negligible	None required
Physical Environment	Hydrogeology	Groundwater inflow is expected for essentially all excavations within the study area and temporary excavations may require dewatering		•		Areas of new infrastructure / replacement	• Hydrogeology assessment of anticipated inflow and need for MOE PTTW • Removal of groundwater by well filtered sumps in the excavations • Contractor to develop and implement an *Erosion and Sediment Control Plan*	Potential for increased sedimentation down stream	Negligible	Monitor effectiveness of Erosion and Sediment Control Plan Monitor PTTW requirements carried out by contractor for conformance to application

	Environmental Value	Project Activity / Environmental Interaction	Phase[14] P	C	O	Specific Location	Mitigation Measures *Built-in Mitigation Measures*	Potential Residual Effect	Level of Significance	Monitoring Recommendation
Technical Conditions	Effluent Discharge	Increase in downstream dissolved oxygen concentrations above the PWQO values during periods of low flow	•	•	•	Castor River	• Establish and maintain allowable discharge loads • Confirm if multiple simultaneous discharges from other facilities on the Castor River, that may affect the available assimilative capacity during the Limoges discharge, have been readily accounted • Verify plant effluent parameters during detailed design • Additional analysis to evaluate the additional flows into the Castor River and to re-evaluate the required effluent storage volume	Temporary storage of the effluent or reduced effluent flow rates during low flow periods during the summer and winter ice covered period	Insignificant	Monitor effluent discharge following Stage 1 implementation to verify ultimate discharge capacity Monitor effluent as per MOE ECA
		Loads of total ammonia can increase un-ionized ammonia concentrations downstream			•	Castor River	• Establish and maintain allowable discharge loads • Confirm if multiple simultaneous discharges from other facilities on the Castor River, that may affect the available assimilative capacity during the Limoges discharge, have been readily accounted	None anticipated	Insignificant	Monitor effluent discharge following Stage 1 implementation to verify ultimate discharge capacity Monitor effluent as per MOE ECA
		Increased concentrations for total phosphorous in the Castor River exceed the PWQO values			•	Castor River	• Establish and maintain allowable discharge loads • Confirm if multiple simultaneous discharges from other facilities on the Castor River, that may affect the available assimilative capacity during the Limoges discharge, have been readily accounted • Contribute to SNC Total Phosphorus Management Program, if required	Localized increase in phosphorus	Insignificant	Monitor effluent discharge following Stage 1 implementation to verify ultimate discharge capacity Monitor effluent as per MOE ECA
	Road Traffic Volumes and Capacities	Detours will be required during construction, particularly where the sewers will cross existing roads. This will potentially slow traffic and affect existing bus routes, being a possible irritant to drivers and pedestrians		•		Roadway /intersections	• Construction phasing will minimize effects to traffic • A *Construction and Traffic Management Plan* will be prepared and adhered to by the contractor. Standard traffic control measures will be used to manage traffic flow • A *Public Communications Plan* will be implemented by the City. Detours will provide a minimum of two traffic lanes for their duration	Possible traffic delays during construction	Insignificant	Ongoing monitoring of the Construction and Traffic Management Plan
	Structures and Utilities	Pumping from permeable layers could cause groundwater level lowering for a significant zone of influence around the excavations		•			• Undertake detailed geotechnical investigation during detailed design	None expected	Insignificant	None required
		Ground movements may affect utilities and buildings in the immediate vicinity of excavations		•			• Undertake detailed geotechnical investigation during detailed design	Localized temporary settlement where excavations would extend within the 1H:1V (horizontal: vertical) zone of influence of building foundations	Insignificant	Settlement monitoring

8.0 CONSULTATION

Consultation is an integral part of the Class Environmental Assessment process. Consultation and the exchange of information was undertaken using a variety of methods including meeting with the general public, and meetings with the Study Team and approval agencies. Scheduling of consultation opportunities corresponded to key project milestones throughout the process. Details of the consultation are contained in Appendix H and are summarized below.

8.1 Notice of Commencement

A study commencement was published on the municipal web site and in the Prescott Russell *Vision* on March 3, 2011.

8.2 Public Meeting #1

A public meeting was held on May 17, 2011- 7 p.m. at the Limoges Recreation Centre 205 Limoges Road, Limoges, Ontario. Forty-six people signed in from Village of Limoges.

The meeting consisted of an initial Open House session with display boards and the Study Team available to answer questions. A subsequent presentation was followed by a question and answer period.

At the meeting, the following information was presented.

- The preliminary preferred water servicing solutions carried forward included:
  - A new groundwater source
  - Piped water from a neighbouring municipality
- The preliminary preferred wastewater servicing solutions carried forward included:
  - New stabilization ponds/lagoons
  - New mechanical treatment plant with storage lagoons

Key issues identified by the public and the responses to the comments are as follows.

- Costs / cost allocation for new infrastructure
- Who will pay the costs of these expansions?
- The developers and any new residents not presently connected will be paying for the new system- not those presently connected to the system
- Water quantity and quality
- Sufficient water quality and quantity must be available for expansion
- The Study Team will be considering both of these factors during the subsequent stages of the study and additional investigations will be conducted as required
- Servicing for existing developments
- Provisions should be made for existing residents/developments to connect to the municipal system
- There will be an opportunity for existing residents to connect, however this is not the focus of this assessment and it will need to be discussed with municipal staff.

8.3 Public Meeting #2

A second public meeting was scheduled following consultation with the agencies including the Ministry of the Environment and the Conservation Authority. At this time the preferred options were presented.
The second public meeting was held on July 26, 2012 at 7 p.m. at the Limoges Recreation Centre 205 Limoges Road, Limoges, Ontario. Sixty-six people signed in primarily from Village of Limoges.

The meeting consisted of an initial Open House session with display boards and the Study Team available to answer questions. A subsequent presentation was followed by a question and answer period.

At the meeting, the following information was presented.

- The preliminary preferred water servicing alternative:
  - New groundwater source
  - Elevated storage at 417 & at-grade storage at the existing Water Treatment Plant
- The preliminary preferred wastewater servicing solutions:
  - New mechanical treatment plant with storage lagoons
  - Sewage Pumping Station upgrade and re-pumping at new Sewage Pumping Station (Limoges/Calypso)

Key issues identified by the public and the responses to the comments are as follows:

- *Servicing from Russell*

  Nation Municipality and Russell Township should consider an option to service the area south of Highway 417 with the water from the Township of Russell.
  Russell currently has a large amount of excess capacity, as they built the ultimate solution in one project that would satisfy the demands for the next 20 years. The maximum daily water supply each day is very close to the Limoges' ultimate demand of 150L/s, therefore, in 5 years when Russell has grown available capacity may not be available. It introduces very complex scenarios for both municipalities competing for the available capacities as growth occurs.

  In addition the current agreement with Russell and the City of Ottawa does NOT allow connections and distribution to other users. The City of Ottawa is unlikely to allow this to happen as it would reduce/eliminate their opportunities to service their own communities (i.e. Greely, Metcalfe, etc.). It is also very important to note that existing and future Limoges water users would have to pay higher rates for their water. Russell residents currently pay more than 50% more than Limoges residents for water. This has been considered in the evaluation and this option was not selected as the preferred alternative.

- *Feasibility of Utilizing the Marionville Water Treatment Plant*

  The Marionville Water Treatment Plant Option should be reconsidered. Russell Township is considering selling the existing Marionville WTP. The recommendations in Russell's original Master Plan prepared by Stantec states that the municipal landfill site could affect the esker and that remedial works would be required at the landfill site. For this reason, the Russell Master Plan recommended to discontinue use of the system and pipe water from the City of Ottawa.

Russell Township would need to provide documentation that can confirm that evaluations/studies/designs/works have been completed to satisfy the above noted requirement. There would have to be a full assessment of the WTP, pumps, feedermains and appurtenances to confirm the operational status of these components and their capabilities to deliver water all the way to Limoges. It is likely that upgrades (i.e. pumps) to the system would be required to overcome to additional losses in the new feedermain to Limoges. In addition the Marionville well does not meet the ultimate capacity requirements for growth in the Village and additional new wells would still be required. This has been considered in the evaluation and this option was not selected as the preferred alternative.

- *Water Quality*

  Water in Limoges is currently good in general but is hard. Greater consideration should be given to the softer water provided by the City of Ottawa.

  Water hardness in the existing and proposed wells is within acceptable provincial objectives for hardness. Water supply from the City of Ottawa was considered as an alternative and was not selected based primarily on the following key considerations: Significant Operation and Maintenance cost; supply rate established by City of Ottawa; up to a 50% surcharge for local users; No phasing opportunity; limited expansion opportunity due to infrastructure size / capacity; and competing interest for increased capacity.

8.4 Stakeholder Consultation

Nation Municipality consulted with various municipal and provincial agencies as part of the Environmental Assessment process. Consultation with the agencies and stakeholders was established with the issuance of the Notice of Commencement (February 2011). The following agencies have been contacted at key project milestones including the Notice of Commencement and public meetings:

- The United Counties of Prescott and Russell;
- The Township of Russell;
- City of Ottawa;
- Ontario Ministry of Environment; and
- South Nation Conservation.

Nation municipality met with stakeholders as identified in Table 8-1. Nation Municipality/ Stakeholder correspondence has been provided in Appendix H.

Table 8-1: Stakeholder Consultation

Date	Consultation
March 31, 2011	Met with MOE and SNC
April 19, 2011	Met with representatives from the Township of Russell
May 16, 2011	Met with MOE and SNC
July 14, 2011	Met with Kingston MOE
December 19, 2011	Met with representatives from the Township of Russell

9.0 FUTURE COMMITMENTS

This Master Plan has been undertaken in accordance with the Municipal Class Environmental Assessment Process. During the planning phase, the Study Team worked closely with the Technical Agencies to address any environmental concerns and issues. The potential impacts, mitigation measures and the associated net impacts have been identified, evaluated and assessed as documented. The ensuing implementation and design process will need to be implemented in accordance with the conditions as noted in this Master Plan. In addition, there is further work that will need to be undertaken during both preliminary design and detailed design.

The acceptance of this Master Plan under the Ontario *Environmental Assessment Act* does not constitute approval under other legislation required to construct the projects, and specific approvals will be required for many components. The following is a list of approvals and permits that may be required during the design and construction.

Permit-to-take-Water

Water takings in Ontario are governed by the *Ontario Water Resources Act* (OWRA) and the Water Taking Regulation (O. Reg. 387/04) a regulation under the Act. Section 34 of the OWRA requires anyone taking more than a total of 50,000 litres of water in a day apply to the Ontario Ministry of Environment for a Permit-To-Take-Water (PTTW). This includes the taking of water for any use; whether agricultural, commercial, construction, dewatering, industrial, institutional, recreational, remediation, water supply or other purposes.

Ontario Water Resources Act

The *Ontario Water Resources Act* (OWRA) is designed to conserve, protect and manage Ontario's water resources for efficient and sustainable use. The Act regulates sewage disposal and "sewage works" and prohibits the discharge of polluting materials that may impair water quality. The Act requires that Ministry of Environment approval be obtained prior to establishing, altering, extending or replacing any sewage works, including works used for the collection, transmission, treatment or disposal of stormwater. MOE approval would be required for the sewage and stormwater infrastructure associated with this project. Prior to initiating the detail design for the final upgrade (phase 3) of the sewage works, The Nation Municipality will undertake MOE recommended effluent monitoring.

Ontario Endangered Species Act

The *Endangered Species Act* (ESA), 2007 addresses the protection and recovery of species at risk in Ontario. If a species is listed on the Species at Risk in Ontario List as an extirpated, endangered or threatened species, the Act protects the species and their habitat. The ESA 2007 includes flexible tools that encourage good stewardship and benefit to species at risk. The Act also includes a permit process for authorization to engage in an activity that may not otherwise be permitted under the legislation. Permits may be granted under the following circumstances:

- The activity is necessary for human health and safety.
- The purpose of the activity is to help protect or recover the species at risk.
- The activity will result in an overall benefit to the species.
- Permits may also be granted for activities that result in significant social or economic benefit to Ontario. Even in these cases, the activity must not jeopardize the survival or recovery of a species at risk.

A permit under the ESA may be required if there are endangered species identified within or near the construction areas; if the proposed activities occur in or near protected habitat; or if the proposed activities harm/harass the species or damage/destroy the protected habitat. The permit application will need to include justification for any required removals as well as a mitigation/recovery plan.

Ministry of Transportation

Construction of the water storage tower adjacent to Highway 417 may be within the Ministry of Transportation's (MTO) permit control area, as specified in the *Public Transportation and Highway Improvement Act*, R.S.O. 1990, c.P.50 (PTHIA), and will generally be the responsibility of the proponents.

Ontario Heritage Act

The *Ontario Heritage Act* gives municipalities and the provincial government powers to preserve the heritage of Ontario. Plans for the renovation of a building designated under Part IV of the Heritage Act must comply with the requirements set out therein. Part VI of the Act deals with the conservation of resources of archaeological value. The Ministry of Tourism, Culture and Sport reviews archaeological reports and investigations to ensure compliance with their requirements.

Public Lands Act

The Ministry of Natural Resources is responsible for managing Ontario's Crown land resources as outlined in the *Public Lands Act* (PLA). If in-water works, disturbance of the river bed, and/or disturbance of the Castor River shoreline is required, a work permit from MNR may be required. During detailed design, plans will be sent to the MNR for review and if required, a work permit applied for under the PLA.

Clean Water Act

The intent of the *Clean Water Act* is to protect existing and future sources of drinking water, as part of the provincial government's overall commitment to protecting and enhancing human health and the environment. This act requires communities to look at their municipal drinking water sources, identify potential sources of contamination, and create and carry out a plan to protect both the quality and quantity of municipal drinking sources.

The Nation Municipality will work together with the South Nation conservation Authority and Source Protection Committee to develop a wellhead protection area for the proposed wells and incorporate them into the Source Protection Plan for the Source Protection Region, at the appropriate time during the expansion of the potable water supply.

9.1 Modifying the Recommended Plan

The Master Plan is based on a functional design level of detail. The functional design level does not provide the same level of detail that will be available during later stages of preliminary and detailed design. Nonetheless, the functional design does provide a sufficient level of detail to assess the environmental effects of the Recommended Plan.

Some aspects of the projects may be subject to change as the detailed plans are developed. Changes may arise in terms of study area conditions, the development of new technology or mitigation measures, or the identification of previously unknown information. The proponent will be responsible for assessing the significance of the proposed change(s) based on further technical assessments and consideration of applicable policy as well as public and agency input as required.

A major design change would require completion of an amendment to the Master Plan, while a minor change would not. For either kind of change, it is the responsibility of the proponent, to ensure that all possible concerns of the public and affected agencies are addressed.

Minor changes may be defined as those which do not appreciably change the expected net impacts associated with the project. For example, a design change in pumping station location and modifications to underground infrastructure would be considered minor. Such changes could likely be dealt with during the design phase and would remain the responsibility of the Municipality to ensure that all relevant issues are taken into account.

Due to unforeseen circumstances, it may not be feasible to implement the project as described herein. Accordingly, any major modification to the project or major change in the environmental setting for the project which occurs after filing of this Master Plan shall be reviewed by The Nation Municipality and an addendum to the environmental assessment shall be prepared, as required. An example of a major change would result from a proposed shift in the preferred design components which would warrant changes in mitigation or an alternative water supply. An addendum to the Master Plan/EA would be required to document the change and allow related concerns to be addressed and reviewed by the appropriate stakeholders.

10.0 SUMMARY AND CONCLUSION

Master Plans are defined in the Municipal Class EA as long-range plans that integrate infrastructure requirements for existing and future land use with environmental assessment planning principles. The Master Plan provides a broad framework for the need and justification of various projects and identifies specific projects required to meet the identified needs. A Master Plan does not require approval under the EA Act; however, specific projects within a Master Plan must fulfill the appropriate Class EA requirements. Part II orders can only be requested for projects identified in the Master Plan, which are subject to the Class EA, and not the Master Plan itself. The Village of Limoges Water and Wastewater Master Plan followed Approach 3, which fulfills Phases 1 through 4 of the EA process for Schedule B and C projects. The following is the list of projects the Master Plan has identified:

Water Supply Project

Expand the existing water supply system consisting of the following components:

- Establish a well at a new municipal well site
- New water storage facility
- Extend and enlarge the water distribution system
- Increase pumping station capacity
- Increase water treatment plant capacity.

All components of the recommended alternative are required to meet the need and are considered as a single project in accordance with the Class EA. Increasing water treatment plant capacity beyond the existing rated capacity is a Schedule C activity.

Wastewater Project

Expand existing wastewater collection and treatment system consisting of the following components:

- Construct new sewage treatment plant and storage lagoons
- Forcemain and sewer connections
- New and upgraded pumping stations (Schedule C)

All components of the recommended alternative are required to meet the identified needs and are thus considered a single project in accordance with the Class EA process. Although the components are considered Schedule C projects the overall project (Master Plan) should be considered a Schedule C project in accordance with the EA process.

Table 10-1 indicates the project taks, associated costs and projected timeline.

Table 10-1: Water & Wastewater Projects

STAGE 1 WATER PROJECT DESCRIPTION	COST
New well(s) and accessories	$1.3M
Feedermain from new well(s) to existing wells	$4.5M
Twin existing feedermain from existing wells to water treatment plant	$4.0M
Expansion of water treatment plant (by 40 L/s)	$4.4M
New elevated storage facility	$3.2M

STAGE 1 WATER PROJECT DESCRIPTION	COST
Watermain link to Giroux St.	$0.5M
Calypso Road watermain twinning	$0.4M
TOTAL	**$18.3M**

STAGE 2 WATER PROJECT DESCRIPTION	COST
Additional wells and accessories	$0.5M
Expansion of water treatment plant (by 85 L/s)	$9.5M
Additional at-grade storage facility	$1.9M
Limoges Road watermain twinning	$1.1M
Crossing of VIA Railway at Andrew Street	$0.2M
Additional Link across Highway 417	$1.2M
TOTAL	**$14.4M**

STAGE 1 WASTEWATER PROJECT DESCRIPTION	COST
Re-rate existing lagoons (to 1,500 m3/d) (interim)	N/A
Upgrade Sanitary Pump Station (SPS) -1	$0.2M
Install SPS-13	$1.4M
New forcemain from SPS-13 to WWTF	$6.4M
Install SPS-11 & forcemain	$1.0M
New wastewater treatment plant (3,500 m^3/d)	$8.4M
TOTAL	**$17.4M**

STAGE 2 WASTEWATER PROJECT DESCRIPTION	COST
SPS-12 including collection system and forcemain	$2.0M
Upgrade SPS-1	$0.7M
Sanitary forcemain from SPS-1 to SPS-13	$1.9M
Sewage collection system on King Street	$0.6M
SPS-14 and forcemain	$0.5M
SPS-15 and forcemain	$0.9M
Expand wastewater treatment plant (to 6,900 m^3/d)	$8.4M
New lagoon cell	$3.2M
TOTAL	**$18.2M**

1) *Stage 1 is anticipated to occur between the year 2012 and 2017*
2) *Stage 2 is anticipated to occur between the year 2018 and 2032*

Projects such as the proposed water and sewer system expansions have the potential to affect the surrounding environments. The purpose of this environmental assessment is to predict these changes and suggest measures which may be taken to minimize the negative effects and enhance or broaden the positive environmental effects.

In this study, the Purpose and Need for the projects were presented, Existing Conditions were described, alternative solutions and alternative designs were identified and evaluated, and impacts assessed. Throughout the process, the project benefited from public and stakeholder participation including, public open houses of which stakeholders were informed, stakeholder meetings, and consultation with adjacent municipalities. In part, feedback from these meetings, enabled the Study Team to identify and mitigate, where possible, localized impacts for both facility users and residents/landowners immediately adjacent to the proposed project. This involvement also maximized, to the extent possible, public and agency confidence in the selection of a Preferred Design, as well as the process which led to relevant decisions.

During the construction phase, each individual area will be an active construction site. Traffic disruptions, noise, dust and visual interruptions will be inevitable. Ongoing communications by The Nation Municipality with the affected public will go a long way in alleviating potential concerns and ensuring that timely information about the project is disseminated. Following the construction phase, there will be many positive effects related to servicing ongoing area development.

While the Water and Wastewater servicing projects have the potential for negative effects on the human and biophysical environments in its vicinity, these effects can be sufficiently mitigated with prescribed design features and sound environmental management practices, where possible and practical. Additional approvals that may be required as a part of the subsequent detailed design process have been identified. By incorporating the mitigation measures identified, no “significant” adverse environmental effects are expected to prevail after mitigation.

REFERENCE LIST

Delcan Corporation. (2011a). *Village of Limoges Development Analysis.* Ottawa

Delcan Corporation. (2011b). *Village of Limoges Potable Water and Wastewater Systems Hydraulic Review. Ottawa*

Delcan Corporation. (2010). *Village of Limoges – Potable Water and Wastewater Systems Capacity Review*

Fisheries and Oceans Canada (DFO). (2011). *A Strategic Plan for Aboriginal Involvement in the Species at Risk Program*. Ottawa: Queens Printer.

Geological Survey of Canada. (2001).

Golder Associates. (2011a). *Preliminary Desktop Archaeological Assessment: Potable Water and Wastewater Systems Expansion for the Village of Limoges, Ontario.* Ottawa

Golder Associates. (2011b). *Preliminary Desktop Environmental Site Assessment: Potable Water and Wastewater Systems Expansion for the Village of Limoges, Ontario.* Ottawa

Golder Associates. (2011c). *Preliminary Natural Heritage Features Background and Records Review Summary.* Ottawa.

Golder Associates. (2011d). *Existing Hydrogeological Conditions: Limoges Municipal Potable Water Environmental Assessment Limoges, Ontario.* Ottawa.

Golder Associates. (2011e). *Amended Memorandum*: *Limoges Assimilative Capacity Desktop Study*. Ottawa

Golder Associates (2011f). *Hydrogeological Investigation in Support of a New Groundwater Supply for the Village of Limoges the Nation Municipality, Ontario*

Golder Associates (2011g). *Limoges Assimilative Capacity Study – Updated Memo*. November 25, 2011.

Golder Associates. (2012a). Castor River Assimilative Capacity Study: *Mechanical Treatment Plan Feasibility Study for the Village of Limoges*

Golder Associates (2012b). MEMORANDUM *Limoges Treatment Plant: Updated Response to MOE Comments and Proposed Effluent Limits for Mechanical Treatment Plan*

Lecompte, 2009 Application for C of A for forest park sewage system dated July 2009 *Includes calculation of uncommitted reserve capacity (32% available, including calypso)*

Ministry of Municipal Affairs and Housing (MMAH). (2005). *Provincial Policy Statement.* Toronto: Queens Printer for Ontario.

Ministry of Natural Resources (MNR). (2010). *The Endangered Species Act 2007*. Retrieved from http://www.mnr.gov.on.ca/en/Business/Species/2ColumnSubPage/STEL01_131232.html

Ministry of the Environment. (2011). *Ontario Water Resources Act*. Retrieved from http://www.ene.gov.on.ca/environment/en/legislation/ontario_water_resources_act/index.htm

Ministry of the Environment (2008). *Design Guidelines for Drinking-Water Systems.* PIBS 6881e

Ontario Water Resources Act (OWRA). (2010). Ontario Water Resources Act, R.S.O. 1990, c.O.40. Queen's Printer for Ontario

Raisin -South Nation Source Protection Region (RRCA/SNC). (2012). *Proposed Source Protection Plan.* Retrieved from http://www.yourdrinkingwater.ca/view.php?id=11

South Nation Conservation (SNC). 2010. Clean Water Program. 2009 Annual Report. Retrieved from: http://www.nation.on.ca/pdf/2009%20Annual%20CWP%20Report.Final.July%202010.pdf

United Counties of Prescott and Russell. (2006). *Prescott Russell Official Plan*. Retrieved from http://gis.prescott-russell.on.ca/frame_eng.asp?url=plan_officiel_en.asp