MAXVILLE WATER SUPPLY

Environmental Assessment
Phase 1 & 2 Report

February 2002

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EXECUTIVE SUMMARY

The Village of Maxville in the Township of North Glengarry has a history of poor water quality and supply problems documented from 1977. Groundwater for many individual wells failed to meet the MOE guidelines for health and aesthetic parameters in tests conducted in 1999 and 2001. Groundwater quality varies by property with 65% of properties surveyed having unsafe water based on bacteria counts. Other ODWS exceedences include turbidity, nitrate, iron, chloride, sodium, hardness and organic nitrogen. Groundwater quantity also varies by location with 20% of properties reporting periodic water shortages. A chronology of the events leading to this report follows:

1977 Eastern Ontario Health Unit undertook a sampling survey of some properties to determine the extent of nitrate pollution.

1979 MOE undertook a Water Pollution Survey of the Village of Maxville, as a result of the findings of the Health Unit Survey and complaints from members of the community.

1981 Kostuch Engineering Ltd. was retained to prepare an Environmental Study Report that surveyed the Village of Maxville with respect to sewage disposal and made recommendations for improvements. The primary recommendation was the construction of a communal sewage system.

1983 A.J. Graham Engineering Ltd. was retained to evaluate the alternatives of sewage system upgrading in the Village of Maxville.

1985 A.J. Graham Engineering Ltd. was retained to investigate the feasibility of Artificial Wetland Treatment for the effluent from the proposed communal lagoons.

1989 A communal sewage system was constructed.

1999 M.S. Thompson and Associates Ltd. was retained to perform a comprehensive survey and sampling of the local wells.

2001 The Thompson Rosemount Group was retained to conduct a Class Environmental Assessment for the Water Supply for the Village of Maxville.

The key problems associated with the water supply have been with:

- biological contamination;
- taste and odour problems with groundwater;
- turbidity of the groundwater; and
- periodic shortages of water at some locations.

The primary objective of the Environmental Assessment (EA) process was to identify a preferred solution that would provide the Village of Maxville with a safe sustainable potable water supply. In the process activities were carried out to identify possible sources of contamination contributing to the groundwater problem. The following is a list of investigations that were conducted in Phase 2.

- Well Water Testing Round 3
- Review of Septic System Decommissioning Reports
- Sewage Collection System Investigation, including
  - Closed Circuit Television (CCTV) Inspection of Main Sewer Lines
  - Lateral Inspections using CCTV and/or Dye Tests
- Surface Water Drainage Investigation, including
  - CCTV Inspection of Storm Sewer
  - Surface Water Sampling
- Hydrogeological Assessment, including
  - Review of Regional Geology/Hydrogeology
  - Private Well Records
  - Regional Groundwater Contamination
  - Modeling for a Communal Groundwater System
  - Test Well Development

As part of the hydrogeological assessment over 600 Ministry of the Environment Well Records were reviewed and compiled to illustrate specific capacity, vulnerability, and geological cross-sections. This information along with background information extracted from previous hydrogeological investigations and the Eastern Ontario Water Resources Management Study (2001) formed the basis for site selection for potential well locations.

During the test well development activity a combination of 21 boreholes and test wells were installed in an effort to find a suitable groundwater supply for the village. It is evident that from this program that a sufficient cost-effective groundwater supply is not available to meet the needs of the entire community. Hence other alternatives were evaluated.

Six alternatives were evaluated with respect to a preliminary inventory of the natural, social and economic environments. The alternatives were:

Alternative A:	Do Nothing
Alternative B:	Individual Well Correction and Treatment System Program
Alternative C:	Maxville Groundwater Communal Supply System
Alternative D:	Maxville and Area Communal Water System
Alternative E:	North Glengarry Regional Water System
Alternative F:	Connection to Adjacent Municipal Water Supply

At the conclusion of Phase 2 of an Environmental Assessment, typically the evaluation process has produced a preferred alternative solution that meets all of the screening criteria. In this case, none of the alternatives that were evaluated met all of the criteria. Affordability is the principal criterion that is not met. Without provincial assistance the large capital cost alternatives are not affordable.

The Public Liaison Committee (PLC) is resolved to finding a solution to the continuous problems associated with the water supply in the Village of Maxville. The PLC makes the following recommendations:

- For the short-term the recommended solution is Alternative A - "Do Nothing". The PLC recognizes that this alternative does not provide a solution to the residents of Maxville and therefore, recommends further evaluation of Alternative E for implementation in the long-term.

- For the long-term the recommended solution is Alternative E - "North Glengarry Regional System". This alternative will provide a continuous, sufficient supply of raw water that is readily treatable at the Alexandria Water Treatment Plant for distribution to communities in North Glengarry. It warrants further evaluation. A Regional Water Supply System also presents the opportunity to examine and perhaps more cost-effectively implement water treatment technologies and water recycling/reuse technologies that can be shared on a regional basis.

Hence this alternative presents a solution to water supply problems (present and future) for communities in North Glengarry.

While this study focused on a water supply for the Village of Maxville, other communities were included in the analysis of some of the alternatives.

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Glossary of Terms

ADF	Average Daily Flow
AO	Aesthetic Objective
Appurtenances	Machinery, appliances, or auxiliary structures attached to a main structure enabling it to function, but not considered an integral part of it.
Aquifer	A saturated permeable geological unit (sand, gravel, porous rock) that can transmit usable quantities of water under ambient hydraulic gradients.
Aquitard	Is a geological unit that is less permeable than an aquifer and inhibits water flow. An aquitard is insufficient to be used for production wells.
Aquitard Leakance	Aquitard leakance is the vertical flow of groundwater to a lower aquifer from a confining layer above.
Backwashing	Regular reversal of water flow through filters that resuspends the filter media to release accumulated material.
Bacteria	A group of diverse and ubiquitous procaryotic single-celled organisms.
BOD	*Biochemical Oxygen Demand* - A measure of the quantity of oxygen consumed by bacteria during the biochemical oxidation of organic matter in a specific period of time, at a specific temperature, and under specific conditions.
Chlorine Contact Time	Time during which water being treated is in contact with chlorine during the disinfection process. The required contact time for a selected germicidal action is a function of residual chlorine concentration, pH, temperature, presence of colloidal material, and the organism of concern.
Chlorine Residual	Unreacted chlorine present in treated water.
C of A	Certificate of Approval
Collection System	In wastewater, a system of underground pipes that receive and convey sanitary wastewater or storm water.
Contact Zone Aquifer	The contact aquifer is an aquifer that lies directly on top of the bedrock and below a confining geological formation. A fractured bedrock and gravel formation present at the geological contact between overburden and bedrock that is desirable as an aquifer in Eastern Ontario. This aquifer is usually confined meaning that it is isolated, by overlying aquitards, from surface contaminants. In a confined aquifer the change in an aquifer pressure in response to pumping from a well results in a lowering of the water level in the well.

CCTV	Closed Circuit Television used for the inspection of sewer pipes to determine its condition.
Drawdown	A lowering of the water table due to the extraction of groundwater.
DWPR	Drinking Water Protection Regulation
E.Coli	*E.coli (Escherichie coli)* is a type of coliform bacteria that is stipulated under the DWPR as being an indicator of possible pathogens in the water supply. the Regulations to provide an indication of the level of bacteriological contamination present in a water sample. *E. coli* is present in the intestine of all warm-blooded mammals and thus exists in sewage.
EOWRMS	*Eastern Ontario Water Resources Management Study* - a comprehensive study completed in March 2001 investigating regional water supply issues.
EPA	Environmental Protection Act
Equivalent Population	A method by which the water demand of industrial, commercial and institutional (ICI) users is rated according to an equal number of residential water consumers.
ESA	Environmental Site Assessment
Fire Flow	Water required for fire fighting purposes.
Fire Storage	Storage in the system to allow for short duration high flow demands in the event of a fire.
GUDI	*Groundwater Under the Direct Influence of Surface Water* – refers to groundwater supplies that are not sufficiently isolated from surface water.
Hardness	Characteristic of water in which minerals, particularly magnesium and calcium, are present at significant concentrations. Hardness can also react with soap causing scale on pipes and plumbing appliances.
Heterotropic Plate Count	The heterotropic plate count (HPC) is a method of measuring the bacteriological content of a water sample. HPC bacteria are not necessarily indicators of sewage contamination but rather a compromised water supply.
High Lift	Pump in system that provides high pressure throughout the water distribution network.
ICI	Industrial, commercial and institutional
IMAC	Interim Maximum Acceptable Concentration
Intrinsic Vulnerability	Intrinsic vulnerability refers to the geological protection that an aquifer has to potential contaminant sources.

Lagoon	Any large holding or detention pond, usually with earthen dikes, used to contain and treat wastewater through sedimentation and biochemical oxidation.
Lag Pump	In a duplex pumping system, the backup pump.
Lead Pump	In a duplex pumping system, the main pump
Lithology	The lithology is the physical makeup, including the mineral composition, grain size, and grain packing, of the sediments or rocks that make up the geological system.
Low Lift Pump	Pumping system that is used to raise water under low pressure. A low lift pump is typically used from the supply source to the treatment facility.
Lpcd	*Litres per capita per day* – a measure of the water demand per person per day.
MAC	Maximum Acceptable Concentration
MNR	Ontario Ministry of Natural Resources
MOE	Ontario Ministry of the Environment
MOF	Ontario Ministry of Finance
NTU	*Nephelometer Turbidity Unit* - A standard measure of the clarity of a water sample as measured using a nephelometer. A nephelometer is an instrument for comparing turbidities of water by passing light through a transparent tube and measuring the ratio of the intensity of the shattered light to that of the incident light.
ODWO	*Ontario Drinking Water Objectives* - The ODWO provided guidelines for acceptable parameters concentrations in drinking water. The ODWO was replaced by the Ontario Drinking Water Standards in 2000, which has stricter requirements.
ODWS	*Ontario Drinking Water Standards* - The current requirements on potable water in Ontario.
OG	Operational Guidelines
Ont. Reg. 459/00	Ontario Drinking Water Protection Regulation 459/00
OSTAR	Ontario Small Town and Rural Development Infrastructure Program
Peaking Factor	A multiplier used to calculate higher demand conditions from average daily flow.

PTTW	*Permit to Take Water* - All water supplies that use more than 50,000 L/d must get approval from the MOE to take the water from the source. Required for groundwater and surface water extraction.
Potable Water	Water fit for human consumption.
Raw Water	Surface or ground water that is available as a source of drinking water but has not received any treatment.
Reverse Osmosis	An advanced method used in water treatment that relies on a semipermeable membrane to separate the water from its impurities.
Total Coliform	The coliform group of bacteria has been the most commonly used indicator of water quality. The coliform group consists of all aerobic and facultatively anaerobic, gram-negative, oxidize-negative, non-spore forming, rod-shaped bacteria that ferment lactose in a broth medium.
Total Dynamic Head (TDH)	Combination of elevation head, friction head and velocity head. It is used to size pumps
TP	Total Phosphorus
Transmissivity	Transmissivity is a measurement of an aquifer's ability to transmit water without having a large impact on the amount of water in the ground. A transmissivity of greater than 10 m^2/day represents a good aquifer for water well exploitation.
Trihalomethanes (THM)	Suspected carcinogen formed as a byproduct of the reaction of chlorine and organic substances present in water.
TSS	Total Suspended Solids
Turbidity	Characteristic of water containing a high concentration of total dissolved solids (TDS) typically caused by the presence of clays and other light-scattering particles in the water.
Ultra-violet Irradiation	Ultra-violet irradiation (UV), which is present on sunlight, can kill bacteria, cysts, viruses if applied appropriately. UV lamps concentrate UV rays onto a stream of water and the UV kills microbes.
USEPA	United States Environmental Protection Agency
Vulnerability	Vulnerability is a relative term used to describe the potential for an aquifer to become contaminated.
Well Head Protection Zone (WHPA)	Area of land restrictively zoned to prevent land uses that may impact or contaminate the municipal production wells.
WHI	Waterloo Hydrogeologic Inc.

1 Introduction

1.1 Background

The Village of Maxville is part of the Township of North Glengarry. It is located northeast of the City of Cornwall. Poor water quality has been an issue in the village since the early 1970s[1].

The installation of a municipal sewage system in 1989 was intended to reduce the amount of groundwater contamination resulting from ineffective septic systems and holding tanks. However, further well water sampling conducted in 1999, indicated that approximately 65% of the wells sampled had bacteriological exceedences of the Ontario Drinking Water Standards. Additionally, about 19% of the homeowners reported that water supply shortages occur.

1.2 Study Objective

The Council of the Township of North Glengarry initiated this study in response to concerns expressed by residents regarding water quality and availability. The Study objectives are:

- determine and evaluate water supply alternative solutions;
- recommend a preferred solution that is technically achievable and will comply with Ontario Regulation 459/00 , regarding water quality;
- recommend a preferred solution that is economically achievable;
- complete the process including the public consultation component consistent with the provisions of the Class Environmental Assessment for Municipal Water and Wastewater Projects (2001); and
- produce the Environmental Study Report (ESR), which may also be used to support an application for funding assistance.

1.3 Description of the Study Area

1.3.1 Geographic Location

While the Study focuses on the Village of Maxville water supply problem, other communities in North Glengarry were examined in the context of an area solution, hence the Study Area in the broadest sense includes much of North Glengarry. A map showing the geographic location of the communities in North Glengarry is provided in Figure 1.3.

[1] Report on Private Services, The Village of Maxville, Sewage Works Project No. 4-0043, MOE.

The Township of North Glengarry is located in the northeastern section of the United Counties of Stormont, Dundas, & Glengarry. The largest community in the Township is Alexandria which is located approximately 45 km northeast of the City of Cornwall and 90 km southeast of the City of Ottawa.

The Village of Maxville is located at the western boundary of the Township of North Glengarry, approximately 24 km northwest of Alexandria. The centre of the community is the intersection of County Road 22 and County Road 20 (Highland Road).

The Village of Apple Hill is located at the south west corner of the Township of North Glengarry, approximately 17 km west of Alexandria. The centre of the community is the intersection of County Road 20 and County Road 17.

The community of Dominionville is located on County Road 20, between Maxville and Apple Hill, approximately 3 km south of Maxville.

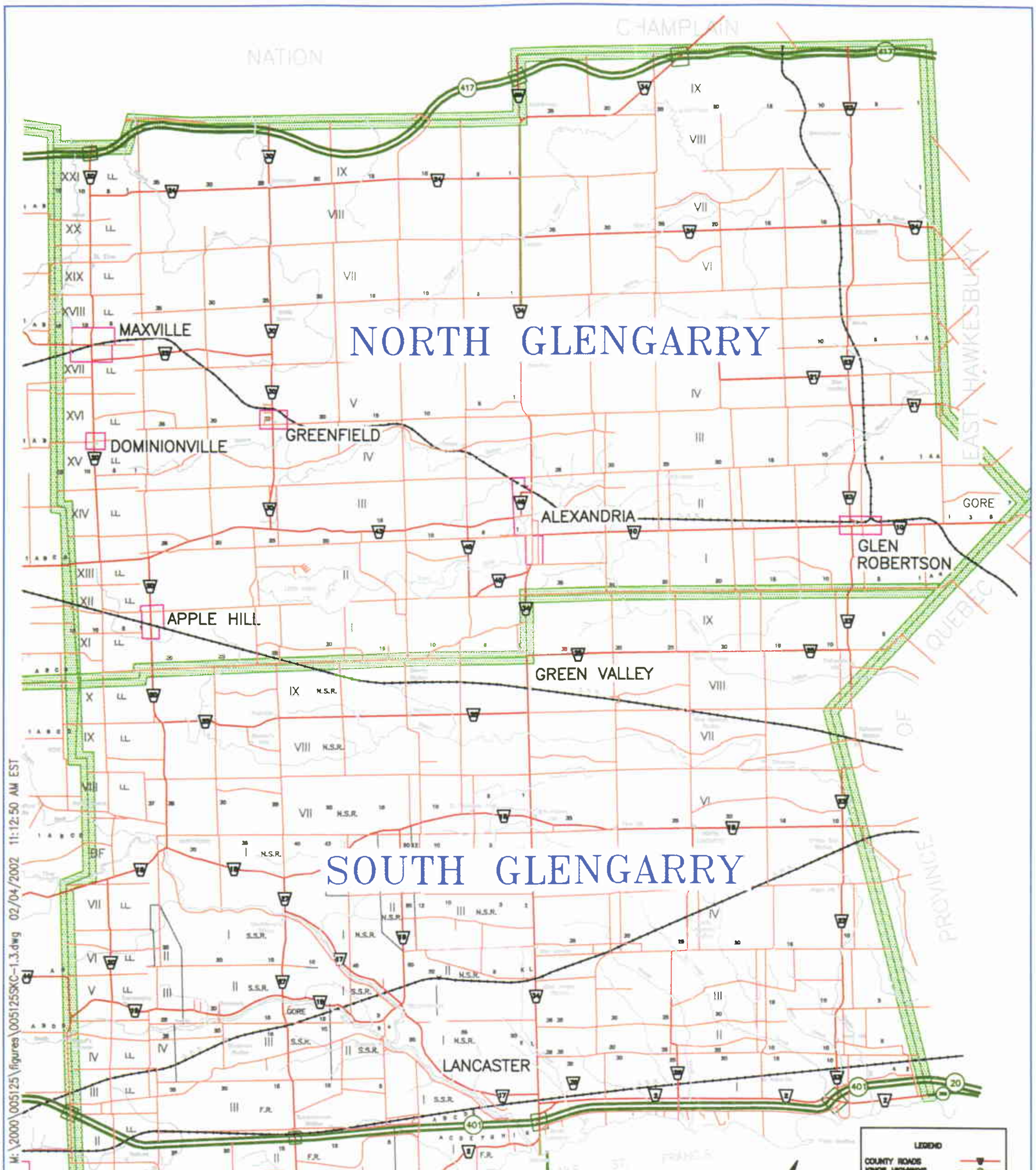
1.3.2 Land Use

Figure 5.5 illustrates in more detail the Study Area and in particular illustrates the village boundary for Maxville based on the Township of North Glengarry Official Plan, July 2000.

Land use designations in Maxville include:
- Residential;
- Community Core;
- Commercial;
- Industrial; and
- Major Open Space.

Land use designations adjacent to Maxville include:
- Agriculture (Restricted Agriculture and Rural per Zoning Bylaw); and
- Wetlands.

Land use designations in the surrounding areas include:
- Agricultural (Restricted Agriculture, Rural, General Agriculture per Zoning Bylaw);
- Wetlands;
- Waste Disposal; and
- Mineral Aggregate – Pit.



THOMPSON ROSEMOUNT GROUP INC
consulting engineers
CORNWALL FERGUS KINGSTON

MAXVILLE WATER SUPPLY
ENVIRONMENTAL ASSESMENT
PHASE 2 REPORT

GEOGRAPHIC AREA

scale	1: 20,000
date	SEPT 2001
drawn	K.W.
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1.3.3 Historical Background for Maxville

Maxville is a small community that originated along a main trade road between the St. Lawrence River and the Ottawa River in 1891. The village is named for the setters who were of Scottish decent. In 1948, Maxville celebrated its Scottish heritage by hosting the Highland Games. The tradition of the Highland games continues and is scheduled for the first weekend in August of every year. The Highland Games is one of the largest events of its kind in the world, hosting competitions for pipe bands, Highland Dance and heavyweight activities including caber toss, and hammer throw.

1.3.4 Population

The population of the Township of North Glengarry and some of its communities is shown in Table 1.3.

Table 1.3 – Population Data for North Glengarry

Community	Population	Households	Commercial Units	Industrial Units	Institutional Units
North Glengarry	10,550	4,514			
Maxville	**880**	**280**	**18**	**3**	**4**
Alexandria	3,392	1,324	180	15	7
Apple Hill	225	80	8	0	2
Dominionville	84	30	1	0	
Other Communities	5,969	2,800			

1.4 Funding Sources

The Township has initiated this project with the expectation of obtaining funding through the Ontario Small Town and Rural (OSTAR) Infrastructure Program. In the 2000 Budget, the Ontario Government has allocated $600 million over the next five years for infrastructure and economic development. In August 2000, the Government announced that $240 million of the total $600 million had been earmarked for Round 1 "Health and Safety" infrastructure projects primarily directed towards existing waterworks facilities. OSTAR Round 2, which has yet to be announced, is expected to provide funding for other health and safety infrastructure including new waterworks.

The ratepayers of Maxville (i.e. the benefiting property owners) will be assessed the majority of the costs of any future Maxville project. Provincial [redacted] assistance is essential to assist in developing an economically achievable solution. The cost may be shared by others in a broader service area is an area water supply alternative is selected.

Ultimately the Council of the Township of North Glengarry will determine the preferred alternative solution and whether or not an application for funding assistance is submitted to the Provincial Government.

1.5 Municipal Class Environmental Assessment Process

The Municipal Class Environmental Assessment (EA) process is designed to provide a simplified yet comprehensive methodology to address the environmental assessment of similar projects (e.g. water supply projects) across the Province. The reasoning for the simplification is to allow municipalities to complete projects that may have environmental impacts without always having the large expense of individually investigating each possible impact. Rather, all potentially impacted persons or agencies are notified and their input is solicited with the goal of narrowing the scope of any review process. Figure 1.5 shows the Municipal Class Environmental Assessment Planning and Design flow chart. This report and the associated public consultation process are intended to satisfy the requirements of Phase 2 of the Municipal Class Environmental Assessment Process.

1.6 Environmental Inventory

Completing an environmental inventory associated with each of the alternatives is essential in the assessment of the suitability of each alternative for provision of a sustainable water supply for the Village of Maxville. Figure 5.1 summarizes the environmental effects and relative impacts for each of the alternatives that have been evaluated for this project. The figure should be read in conjunction with the information presented in Chapter 5.

1.6.1 Natural Environment

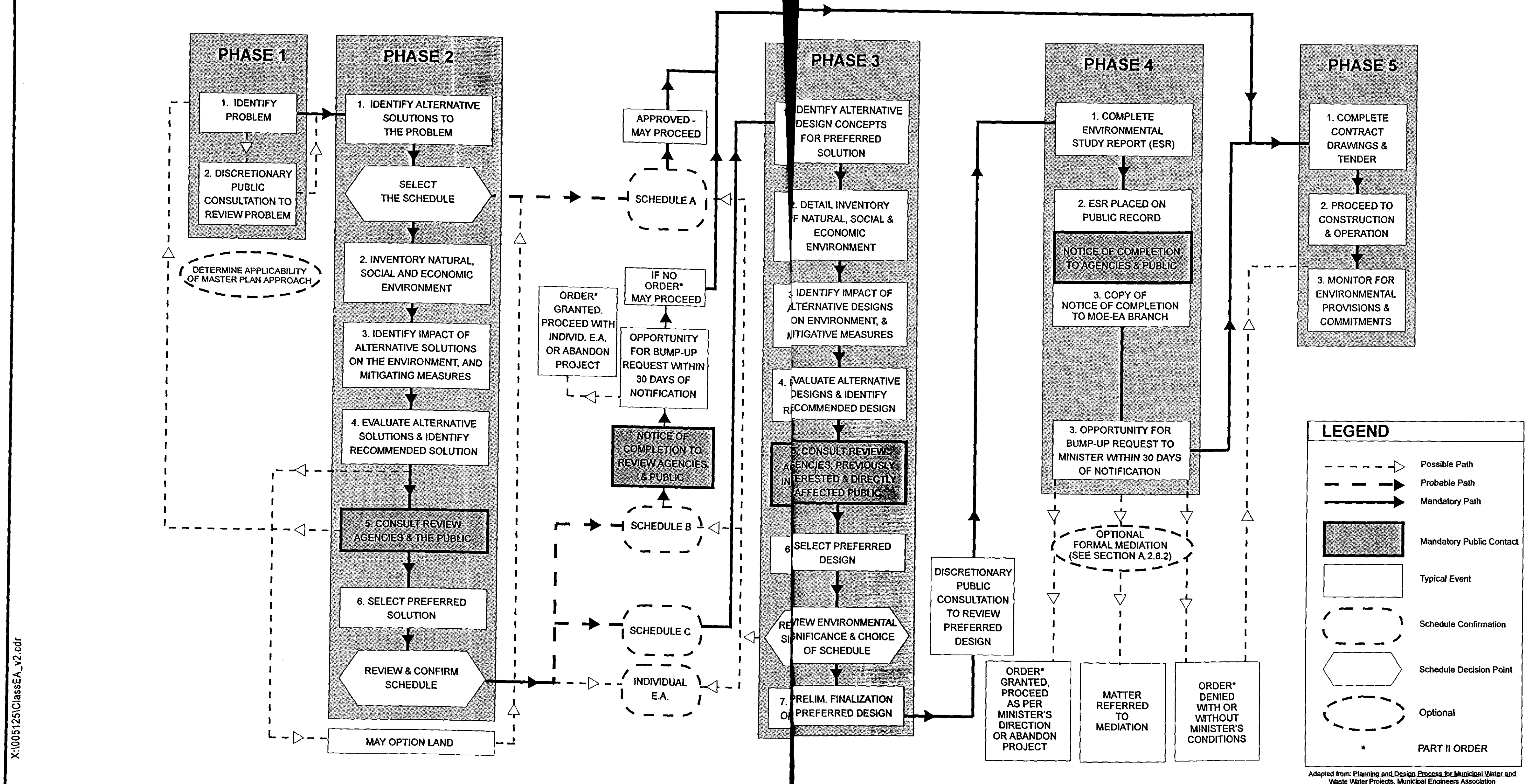
The Natural Environment consists of the air, soil, and water, including all living matter regardless of its interaction or impact on humans. This may include changes in climate, habitat, geology and hydrogeology among a vast variety of other issues. Agencies that are consulted in order to assess the inventory of the natural environment include:

- Ontario Ministry of the Environment;
- Ontario Ministry of Natural Resources;
- The Raisin Region Conservation Authority;
- The South Nation Conservation Authority; and
- Environmental Canada – Department of Fisheries and Oceans.

The impacts on the Natural Environment of water supply alternatives are in part dependent on the following conditions:

- Size and location of water treatment facility(s) and distribution networks;
- Construction methodology for any capital works;
- By-products of the treatment system (backwash water, solid waste, air and noise pollution); and
- Sensitivity of native species and geology.

These conditions are examined for each alternative to determine if there will be any significant and lasting impact(s) on the Natural Environment resulting from the implementation of any of the alternatives.



THOMPSON ROSEMOUNT GROUP INC. Consulting engineers CORNWALL FERGUS KINGSTON	MAXVILLE COMMUNAL WATER PROJECT ENVIRONMENTAL STUDY REPORT	scale NTS
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		job no. 005125
	PLANNING AND DESIGN PROCESS FOR MUNICIPAL WATER AND WASTEWATER PROJECTS	drawing no. FIGURE 1.5

1.6.2 Social Environment

The Social Environment is affected by the construction and operation of the alternatives and includes the effects on the human population living around or visiting the area. Examples of these effects include:

- Noise;
- Dust;
- Aesthetics;
- Loss of use;
- Quality of life/user experience; and
- Inconveniences.

The assessment of the impact is somewhat subjective, however, it is reasonable to assume that if there is potential for an impact then it should be considered in the evaluation of each alternative.

1.6.3 Economic Environment

The Economic Environment is defined in the context of this report as the benefit and costs of the proposed alternatives relative to the economic impact on the human population. Examples of possible impacts include:

- Employment creation or loss;
- Cost of alternatives (capital and operating);
- Loss of economic use (agricultural land); and
- Opportunity for economic gain (development).

Economic Environment may be directly related to the alternatives or may be indirectly related in that the alternative may open up areas for development or industrial growth. Therefore, its analysis forms an important component of the evaluation process.

The economic impact on the residents of Maxville (and the residents of North Glengarry) will be a significant factor in the determination of the preferred alternative. It is expected that there will be limited funding assistance from the Provincial Government towards the initial capital cost. The net capital cost and ongoing cost will be borne by the benefiting property owners in Maxville and the Township depending on the alternative that is implemented. The authority for implementing an assessment of costs for waterworks and other infrastructure is provided in the Municipal Act. While it is beyond the scope of this document to detail the methodology for cost recovery, an estimated capital cost and annual operating cost per typical household is provided for comparison (Table 6.1).

1.7 Public Consultation

Public consultation is a very important component as it provides the public and agencies with an opportunity for input into the EA process. As well, it provides the Township and their consultant with information related to the history of the project and the issues that are important to the residents so they can be addressed in the project documentation. This project requires two levels of public consultation, one to direct the project scope through the Public Liaison Committee (PLC), and another for public input, through public information centres and other media.

The public consultation process has been enhanced through the use of newsletters, newspaper articles, and advertising.

1.7.1 Public Liaison Committee

A Public Liaison Committee (PLC) was formed at the start of the project to assist in soliciting input from the public. The PLC includes:

1. Bill Franklin, Mayor, North Glengarry (NG)
2. George Currier, Councilor - Maxville Ward, NG
3. Maryanne Kampouris, Representative, NG
4. Francine Richer, Representative, NG
5. Garry Smith, Representative, NG
6. Morris McCormick, P.Eng., Manager, Water and Wastewater Facilities, NG
7. Bill Knight, P.Eng., Project Director, The Thompson Rosemount Group (TRG)
8. John St. Marseille, M.Sc., P.Eng., Senior Environmental Engineer/Hydrogeologist, TRG
9. Marco Vincelli, P.Eng., Environmental Engineer, TRG

The PLC met together nine times during Phase 2. The meeting records of the PLC meetings are presented in Volume 2, Appendix A.

1.7.2 Public Information Centre

A newsletter was sent out to all post office boxes in Maxville (See Volume 2, Appendix B) notifying the public of the Initial Public Information Centre (PIC) held on May 31st, 2001 at the Maxville Community Centre. Two sessions were held: one in the afternoon and one in the evening.

The PIC format, as developed by the PLC, consisted of a presentation followed by an open house with a panel presentation detailing the work completed to date. The Consultant and members of the PLC were available to answer questions. A sign-in sheet and comment sheet were provided to document public input into the process.

A total of 49 people signed in to afternoon and evening sessions of the Public Information Centre. It is estimated that the total number of people who attended was approximately 64. Of the people that came to the meeting, 11 filled out a comment sheet. The meeting record, sign-in sheet, comment sheet, and written responses are provided in Volume 2, Appendix C.

1.7.3 Mandatory Agency Contacts

As part of the EA consultation process, there is a requirement beyond general public consultation to solicit input from some government agencies, non-government organizations (NGO) and large water users in the municipality. This is done in accordance with the EA requirements by notification and provision of project documentation for review. Agencies are provided with the opportunity to comment at the start of the project and will only be removed from the circulation list if they so request. Table 1.7 lists the mandatory contacts that were sent preliminary Notices of Project Commencement. All of these agencies will receive a copy of the Phase 2 report unless they specifically request otherwise.

Table 1.7: Mandatory Agency

Local Agency/Industry	Provincial Agency	Federal Agency
Township of North Glengarry Eastern Ontario Health Unit Raisin Region Conservation Authority South Nation Conservation	Ministry of the Environment Ministry of Agriculture, Food and Rural Affairs Ministry of Citizenship, Culture & Recreation Ministry of Municipal Affairs and Housing Ministry of Natural Resources	Department of Fisheries and Oceans

2 Background Information

The following studies and reports have been reviewed as part of this project. This section details the history of water and wastewater in the Village of Maxville.

2.1 *Health Unit Survey, 1977.*

A copy of this study was not available, however the Water Pollution Survey, MOE, in 1979 often referred to it. The main purpose was to determine the extent of nitrate pollution. The survey took 69 samples scattered throughout the Village. It found bacterial activity was almost non-existent. The report did state that 9% of the wells sampled contained nitrate concentrations in the range of 10 to 20 mg/L which is indicative of a sewage.

2.2 *Water Pollution Survey – Village of Maxville, MOE, 1979.*

The MOE undertook a survey to collect information on groundwater quality and sewage disposal methods in the village. Private wells (204), storm sewer outfalls, various ditches and creeks were sampled. The findings are summarized below.

2.2.1 Water Supply

At the time of the survey, residents of the Village of Maxville obtained their water from drilled wells (68%) and dug wells (32%). Owners reported water shortages at approximately 4% of the wells surveyed. Water containing sulphur odour was reported in 23% of the wells.

23% of the wells sampled contained sulphide concentrations greater than 5 mg/L (ODWO objective). Approximately 6% of the wells surveyed had total coliform counts greater than 2 (ODWO objective) and none had fecal coliform counts greater than 2 (ODWO objective).

2.2.2 Wastewater Disposal

Of the 299 establishments surveyed, 2% were satisfactory, 33 % were sub-standard, 60% were seriously sub-standard, and 5% were creating a health or pollution hazard.

2.3 Report on Private Services – Village of Maxville, Kostuch Engineering Limited, 1981.

The objective of this study was to survey the community with respect to private sewage disposal systems and make recommendations on the most practical and cost effective method of improving, replacing or correcting any deficiencies found.

The principal recommendation was the construction of a communal sewage system to alleviate sewage disposal problems particularly in the core of the village.

2.4 Alternatives for Sewage System Upgrading in the Village of Maxville, A.J. Graham Engineering Limited, 1983.

This study evaluated alternatives for the collection and treatment of sewage for the Village of Maxville. It was recommended that a full-scale lagoon treatment facility and gravity sewage collection system be constructed for the Village.

2.5 Artificial Wetland Treatment – Village of Maxville, A.J. Graham Engineering Limited, 1985.

This study investigated the feasibility of discharging the effluent from an aerated lagoon into an artificial marsh. The report concluded that the total phosphorus (TP) criteria would be difficult to meet, the costs would be 3 times greater than a traditional fill-and-draw lagoon, and the amount of land required for a buffer around the marsh would be approximately 13 ha.

2.6 Construction of Sewage Disposal System, 1989.

In 1989, a sewage disposal system consisting of a two cell facultative lagoon, a gravity sewage collection system and two sewage pumping stations with forcemains was constructed. The total cost of the system was $2,500,000 with the net cost of $375,000 after provincial funding assistance under the Direct Grant Program (85%), being levied against the property owners in Maxville.

The facultative lagoon is discharged only in the spring into the east branch of the Scotch River, a tributary of the South Nation River. Effluent quality criteria as set out in the Certificate of Approval are 25 mg/L BOD, 25 mg/L TSS, and 1.0 mg/L TP.

It was expected that the construction of the sewage collection system would eliminate the primary source of groundwater contamination and hence well water quality would improve. Ten years later, groundwater contamination and individual well contamination continues to be pervasive.

3 Problem Definition

3.1 History of the Issues

The Village of Maxville has had a long history of issues associated with water supply that can be traced back three decades. The key problems associated with the water supply have been:

- sewage contamination of private wells (chemical and bacteriological indicators);
- taste and odour problems with groundwater;
- turbidity of the groundwater; and
- periodic shortages of water in some wells.

The water problems persist even after the implementation of the sewage disposal system in 1989. Consequently, in 1999 the Council of the Township of North Glengarry engaged M.S. Thompson & Associates Ltd. (The Thompson Rosemount Group Inc.) to undertake a comprehensive well survey to define the nature and extent of the problem. Previous studies investigated only 30-40% of the wells. This study covered more than 90% of the well supplies in the Village.

3.2 Water Sampling and Survey Report – M.S. Thompson & Associates, 1999

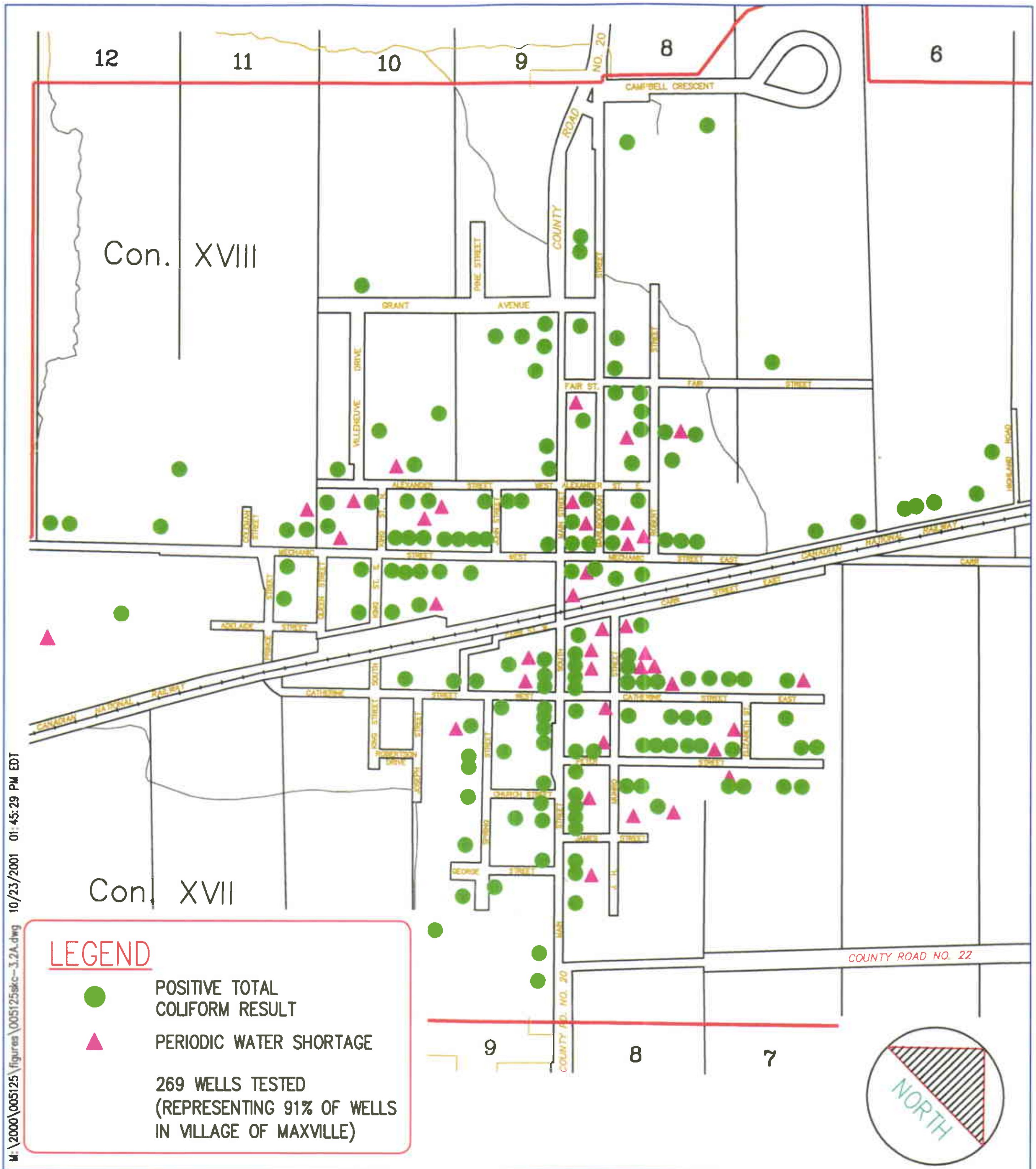
The program consisted of an extensive sampling and analysis of water from existing wells and a survey of individual residents. A total of 269 residences (of 297 residences, industrial, commercial, and institutional invited) responded to the survey.

The survey provided the following information:

- well water (treated and untreated) is consumed at 196 residences; the others rely on bottled water or other sources of supply;
- sulphur (or other odours) were reported at 100 residences;
- poor tasting water was reported at 53 residences;
- low water yield was reported at 52 residences;
- high water hardness was reported at 47 residences;
- high iron was reported at 25 residences; and
- turbidity or discoloured water was reported at 23 residences.

A total of 269 samples were obtained for the first round of analysis. Of these 177 were from drilled wells, 59 from dug wells, 6 from sand points and 27 were unknown. The health related exceedences are summarized below with the distribution by well type:

- 31 *E.coli* exceedences occurred (greater than 0 counts/100 mL), of which 15 corresponded to drilled wells;
- 167 Total Coliform exceedences occurred (greater than 0 counts/100 mL), of which 97 corresponded to the drilled wells; and
- 110 Background exceedences occurred (greater than 200 counts /mL), of which 69 corresponded to the drilled wells.



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LEGEND

- ● POSITIVE TOTAL COLIFORM RESULT
- ▲ PERIODIC WATER SHORTAGE

269 WELLS TESTED (REPRESENTING 91% OF WELLS IN VILLAGE OF MAXVILLE)

THOMPSON ROSEMOUNT GROUP INC
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The THOMPSON ROSEMOUNT Group

MAXVILLE WATER SUPPLY
ENVIRONMENTAL ASSESSMENT
PHASE 2 REPORT

ROUND 1 WELL SAMPLING

scale	1 : 7500
date	OCT 2001
drawn	K.W.
job no.	005125
drawing no.	FIG 3.2

Of the samples that were taken that showed bacteriological contamination, an attempt was made to resample those wells. A second round of analysis was conducted on all wells that reported bacteriological exceedences in the first round. A total of 170 samples were obtained for analysis. The health related exceedences are summarized below:

- 66 E.coli exceedences occurred (greater than 0 counts / 100 mL), of which 38 corresponded to the drilled wells;
- 129 Total Coliform exceedences occurred (greater than 0 counts/ 100 mL), of which 77 corresponded to the drilled wells; and
- 91 Background exceedences occurred (greater than 200 counts/ 100 mL), of which 56 correspond to the drilled wells.

The survey suggests that, due to the amount of contamination occurring in the drilled wells
(a) groundwater contamination is widespread in the community and
(b) short circuiting paths exist for contaminants to infiltrate these deeper supply aquifers.

The resulting document, which meets the requirements of Phase 1 of the Class EA Process, recommends the following:

- A detailed hydrogeological investigation be conducted to identify supply aquifers, groundwater flow direction, recharge zones, and the extent and possible source(s) of contamination.
- That the Municipality should apply to the MOE for funding assistance to complete an Environmental Study Report for a water supply in the Village of Maxville. The completion of an ESR is a prerequisite step to applying for capital funding assistance.
- A newsletter should be issued to the residents advising of the action to be taken and warning of possible well water contamination.

This Phase 1 document is provided in Volume 2, Appendix D.

3.3 Water Demand

In order to determine and effectively evaluate alternative solutions, water demand must be determined. For water supply projects of this nature, a 20-year planning period is typically used.

The maximum daily flow (Maximum Day) is the minimum standard for water treatment plant infrastructure design. Since many maximum days may occur in succession, it is essential that the water treatment plant and associated storage be able to provide sufficient treated water under this condition. Other design conditions are peak hour demand and fire flow demand. These conditions may be provided from a combination of storage and larger treatment plant infrastructure.

The design water demand (and hence the water supply capacity), must be determined based on the forecast water needs in the service area during the planning period. Since there are a variety of service areas that are being considered, there will be different demand scenarios depending on the alternative. We have identified several factors that impact the determination of the design flow rates for the different scenarios as follows:

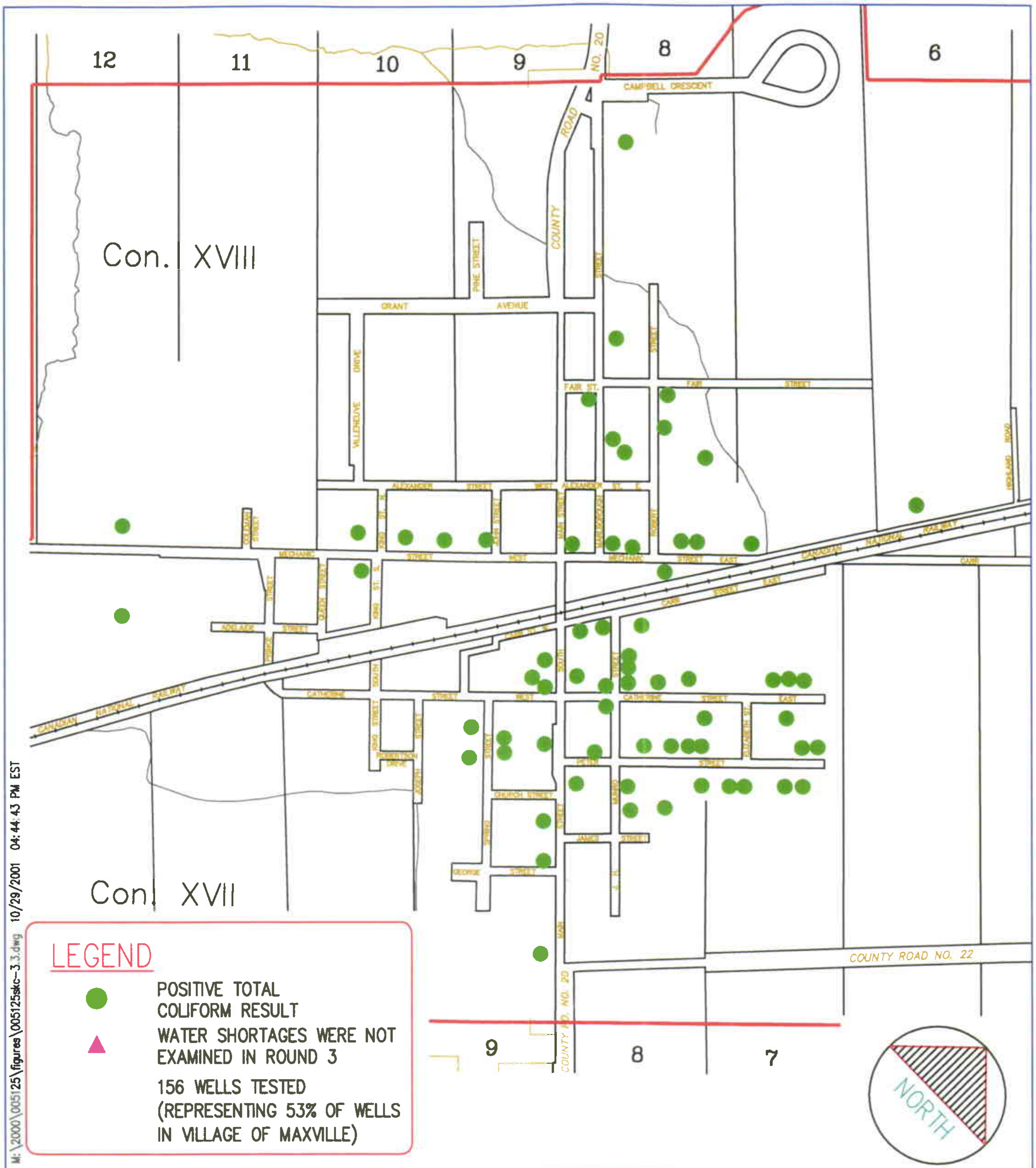
1) Population growth in the municipality;
2) Equivalent Population of Industrial, Commercial and Institutional users (ICI);
3) Peak hourly and maximum day flows;
4) Additional storage;
5) Fire protection requirements; and
6) Water conservation Strategy.

Ultimately water demand is a function of the population (residential and equivalent ICI population) and fire flow. For non-residential water users in the in the ICI category such as schools, restaurants, retail stores, and offices, an equivalent population is determined from which a water demand is estimated.

Fire flow places an additional demand on the water supply system particularly with respect to storage and pumping. Maxville is currently serviced by a fire department that can draw water from two reservoirs:

- The Spring Street Reservoir adjacent to the Fire Hall has a theoretical capacity of approximately 95 m^3 (20,900 IG), however, it has an open bottom and is spring fed thus the water level fluctuates according to the position of the water table. Periodically water is hauled to this reservoir to maintain a water supply;
- The Mechanic Street Reservoir (near the Maxville Manor) has a capacity of approximately 75 m^3 (16,500 IG) and is a spring fed pond. The pond is periodically dry; and
- The Fire Department is proposing to add a 45 m^3 (10,000 IG) reservoir near the existing Mechanic Street Reservoir.

Members of the PLC indicated that the infrastructure in place for fire protection is sufficient to deal with emergency situations in the Maxville area and hence fire flow may not be necessary if a communal water supply was recommended. Hence Alternative C, a Communal Groundwater Supply for Maxville, is examined with and without fire flow capability.



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MAXVILLE WATER SUPPLY
ENVIRONMENTAL ASSESSMENT
PHASE 2 REPORT

ROUND 3 WELL SAMPLING

scale	1 : 7500
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Table 3.2 illustrates the projected equivalent population for the various communities in the immediate area. Table 3.3 illustrates the projected water demand for the various communities with and with out fire flow.

Table 3.2: Projected 20-Year Design Population

Service Area	Maxville[1]	Apple Hill[2]	Dominionville[3]	Greenfield[3]	Alexandria[4]
Resident Population	880	225	84	140	3,392
Equivalent Population					
Industrial	218	0	0	0	3,056
Commercial	254	30	6	20	923
Institutional	385	0	0	0	674
Current Eq. Population	1737	255	90	160	8,045
20-year Growth Factor	1.22	1.14	1.14	1.14	1.22
Design Population	2,119	290	103	182	9,815

1 Maxville population information was obtained from the Township. The growth rate was set at 1.0% per annum. The ICI equivalent population was estimated from available data.

2 Apple Hill information was taken from the Apple Hill Communal Water Project Class Environmental Assessment Environmental Study Report. The population growth rate was set at 0.65% per annum.

3 Dominionville and Greenfield populations were obtained from the Township. The growth rate was set at 0.65% per annum.

4 Alexandria information was taken from the Alexandria Water Supply Study, Class EA Phase 1 & 2 Report (Draft). The growth rate was set at 1.0% per annum.

Table 3.3: Projected 20-Year Water Demand (with Fire Flows)

Service Area	Maxville	Apple Hill	Dominionville	Greenfield	Alexandria[2]
Design Population	2,119	290	103	182	9,815
Water Consumption (L/capita per day)	450	450	450	450	450
Average Day (m^3/day)	954	131	46	82	4,417
Maximum Day Factor	2.25	2.25	2.25	2.25	1.54
Maximum Day (m^3/day)	2,145	295	104	185	6,802
Peak Hour Factor	3.38	2.75	2.75	2.75	2.85
Peak Hour (m^3/day)	3,223	360	127	226	12,588
Fire Flow (L/s)[1]	110	38	38	38	220

1 In accordance with MOE deign criteria, fire flow must be sustained in Alexandria for a three hour period and in the other communities for a two hour period.

2 The rated capacity (C of A) of the Alexandria Water Treatment Plant is 8,200 m^3/day, although the Permit to Take Water (PTTW) limits the system to 5,616 m^3/day.

The information in Table 3.3 will be used to determine the design capacity of the alternative systems being examined.

3.4 Summary of the Issues

The Village of Maxville in the Township of North Glengarry has a history of poor water quality and supply problems documented from 1977. Groundwater for many individual wells failed to meet the MOE guidelines for health and aesthetic parameters in tests conducted in 1999 and 2001. Groundwater quality varies by property with 65% of properties surveyed having unsafe water based on bacteriological testing. Other ODWS exceedences include turbidity, nitrate, iron, chloride, sodium, hardness and organic nitrogen. Groundwater quantity also varies by location with 20% reporting periodic water shortages.

4 Phase 2 Investigations

While the nature and extent of the groundwater contamination is sufficiently defined in the Phase 1 document, it was deemed appropriate by the PLC to investigate the possible source(s) of contamination to ascertain if corrective measures would address the problem.

4.1 Well Water Testing (Round 3)

Concern was expressed by some residents that the results of the 1999 Water Well Testing Program (Round 1 and 2) may not have been an accurate representation of groundwater conditions. To substantiate the results of the first two rounds of well water sampling conducted in 1999, the PLC recommended that the Township initiated a third round, under the direction of the Manager of Water and Wastewater, Mr. Morris McCormick. The results of Round 3 are summarized and compared to the first two rounds in Table 4.1.

Table 4.1 Bacteriological Analysis of Well Water Testing (Summary Rounds 1-3)

Parameter	ODWS	No. of Exceedences			% of Exceedences		
Round		1	2[1]	3	1	2[1]	3
# of Samples		**269**	**170**	**156**			
Total Coliform	0 cts/100 mL	167	129	67	62%	76%	43%
E.coli	0 cts/100 mL	31	66	12	12%	39%	8%

Note [1] Round 2 testing was conducted, in accordance with MOE protocol, which requires retesting of only those wells that had failed in Round 1.

While some variation exists with respect to individual wells, it is concluded that there is close correlation between the Round 1 and 2 (1999) and the Round 3 (2001) results which show that groundwater supply continues to be contaminated. The sampling verified the previous results. Figure 3.2 and 3.3 illustrate the coliform test results for Round 1 and 3. It was indicated to Mr. McCormick during the Round 3 testing that [redacted]

4.2 Septic System Decommissioning

A possible source of groundwater contamination could be improperly decommissioned septic systems. Concern was expressed that during the construction of the sewage collection system in 1989, that not all buildings were connected and/or not all septic systems were properly decommissioned.

The Village of Maxville compiled records of the lateral connection and septic system decommissioning for each property in Maxville. These records were documented by the Building Inspector for Maxville during the construction of the sewage collection system in 1989.

A full review of these records was conducted. The following information is contained in the reports:

- Application for Sewer Service Connection and Agreement;
- Roll No., Street, and Lot Number;
- Site Plan showing location of plumbing exiting unit and entering sewage system;
- Date or proposed work;
- Name of contractor;
- Date septic tank was cleaned and filled;
- Date inspected; and
- Inspector's signature.

An example of a record is presented in Appendix G. The review showed that buildings had been connected to the sanitary sewers and that septic tanks were emptied of septage and filled with sand or other material, with the exception of one residential building on Mechanic Street West which has not been inhabited for a number of years.

Even if sewage had remained in the septic tanks, it is very unlikely that coliform bacteria would survive much more than 99 days outside of a host without the addition of nutrients (raw sewage). According to a paper, "The Survival Characteristics of a Non-Pathogenic Strain of Escherichia Coli 0157:H7", *E.coli* survival rate, under external ambient conditions, showed a 5.0 +/- 0.5 log cfu/g decrease in the bacteria over a 99 day period. Therefore, provided that all septic systems were disconnected from the building plumbing, buried septic tanks or holding tanks, whether properly or improperly decommission, could not be contributing to the groundwater contamination.

4.3 Sewage Collection System Inspection

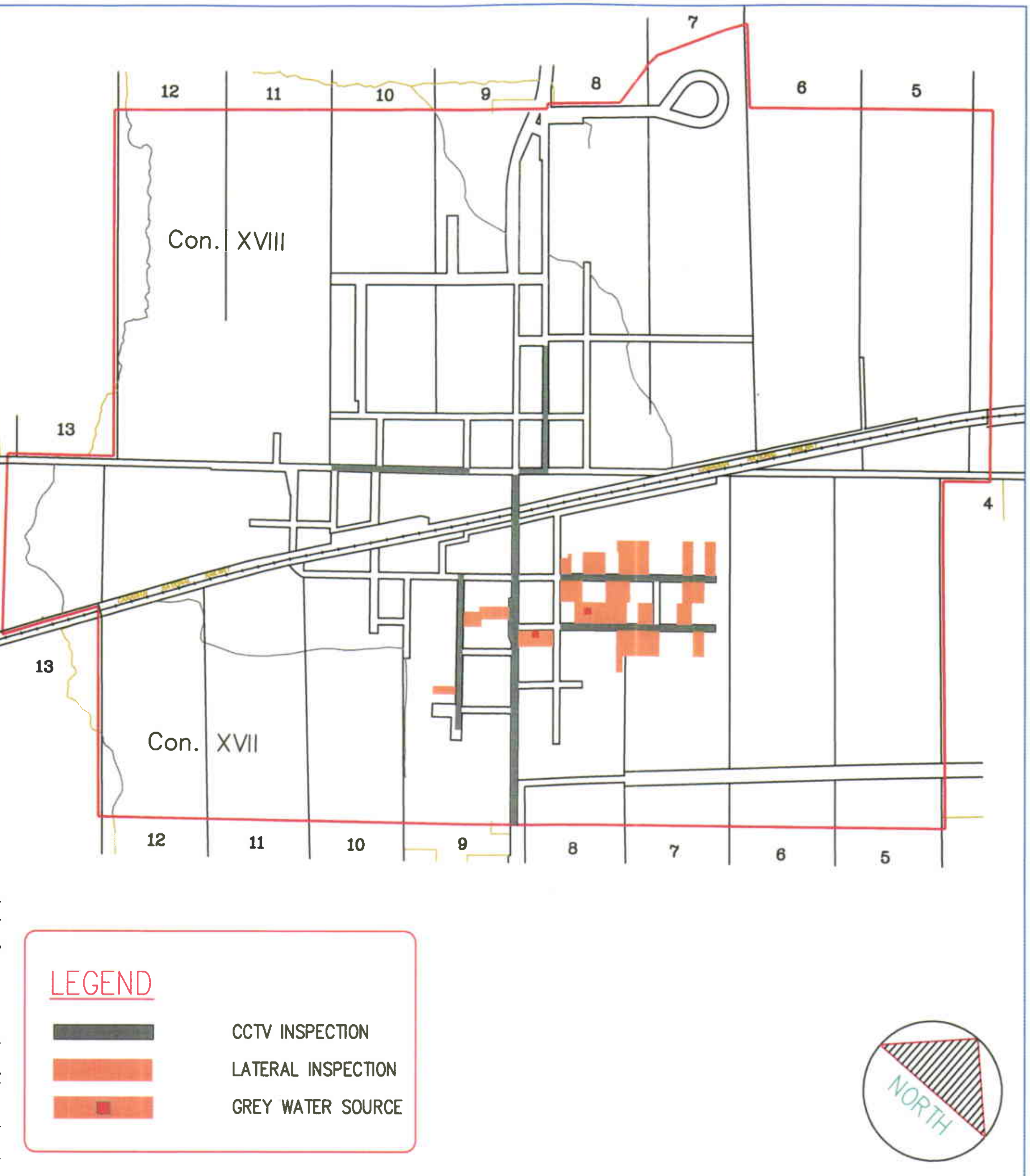
Another possible source of groundwater contamination could be an improperly constructed sewage collection system. To confirm the condition of the sewage collection system, a sanitary sewer investigation was initiated during the week of May 14, 2001. Two types of inspections were carried out:

- Closed Circuit Television (CCTV) Inspection of a portion of the collection system; and
- Lateral Inspections at selected properties.

The results are summarized:

4.3.1 CCTV Inspection Summary

Approximately 1.7 km of sanitary sewer was inspected predominantly in the southern portion of the Village, representing approximately 25% of the sewage collection system in Maxville. The sewers that were inspected are concentrated in areas where the well survey of 1999 indicated high levels of groundwater contamination, primarily along Peter Street, Catherine Street East, Main Street South, and Mechanic Street. The sanitary sewer along Spring Street was also inspected due to the presence of a high water table. Figure 4.3 shows the location of the sewers inspected.



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MAXVILLE WATER SUPPLY
ENVIRONMENTAL ASSESSMENT
PHASE 2 REPORT

SANITARY SEWER AND
LATERAL INSPECTION

scale	1 : 10, 000
date	AUG 2001
drawn	K.W.
job no.	005125
drawing no.	FIG 4.3

CCTV inspection is an effective tool for determining the condition of sewer pipes as well as lateral connections and manholes. Conditions such as active infiltration at joints, sumps, fractures, root intrusion, collapses, and improper lateral connections would be evident during an inspection.

The Maxville sanitary sewer system is constructed of PVC pipe with prefabricated Tees for lateral connections. Aside from the following conditions there was no evidence that the sewer mains were contributing to the groundwater contamination problem in Maxville:

- light to moderate grease buildup in the sewage pipes;
- occasional areas with moderate debris;
- one area where the sewer was out of round (pipe deflecting downwards);
- one area with moderate ponding due to sumps; and
- one area where the pipe was completely filled with water due to a sump.

After completing a CCTV inspection of approximately 25% of the sewage collection system without finding any significant deficiencies, it was concluded that further investigation was not warranted. The evidence suggests that the sewage collection system was properly constructed and that major deficiencies do not exist. While there may be isolated deficiencies in other portions of the sewage collection system it is unlikely that they would contribute significantly to the widespread groundwater contamination.

4.3.2 Lateral Inspections

Lateral inspections were conducted at 31 properties, 24 using CCTV and 7 using dye testing. The inspection focused on sections of the sewage system adjacent to wells showing contamination, primarily along Peter Street, Catherine Street East, and Main Street South. Aside from two grey water sources connected to a storm sewer (shower and wash basin), laterals were connected to the sanitary sewer. Those that were inspected using CCTV were generally in good condition, with three laterals showing an exposed gasket. Figure 4.3 shows the location of the laterals that were inspected.

The 31 laterals that were inspected represent approximately 10% of the connections to the sewage collection system in Maxville. While there may be isolated deficiencies in other portions of the sewage collection system relative to building connections, the contribution that these would have on the groundwater contamination cannot be quantified.

4.4 Surface Water Drainage Systems

Another possible contaminant source that was examined was the storm drainage system that comprises of open ditches and storm sewers. Generally surface water moves from south to north over land, through ditches, and storm sewers.

4.4.1 Storm Sewer Inspection

A CCTV inspection was conducted on approximately 50% of the Maxville storm sewer system (see figure 4.4). The inspection focused on areas of the system that are adjacent to wells showing contamination, primarily Catherine East, Catherine West, Main Street South, Mechanic Street East, Mechanic Street West, Peter Street, and Robert Street. More than half of the remaining storm sewer system was inaccessible for CCTV inspection due to a lack of suitable entry points. No obvious signs of sanitary sewage (toilet paper, etc.) were detected in the storm sewers or at the outfalls. The storm sewer outfall on Catherine Street West did have a detergent odour and soap bubbles, but no source could be identified because of the limited access to the storm sewer. A grey water source is suspected.

No direct connections of building plumbing systems to the storm drainage system were detected. While not all of the system was inspected it is unlikely there would be significant contributions to the widespread groundwater contamination from the storm water collection system. The contribution that these would have on the groundwater contamination cannot be quantified.

4.4.2 Surface Water Sampling

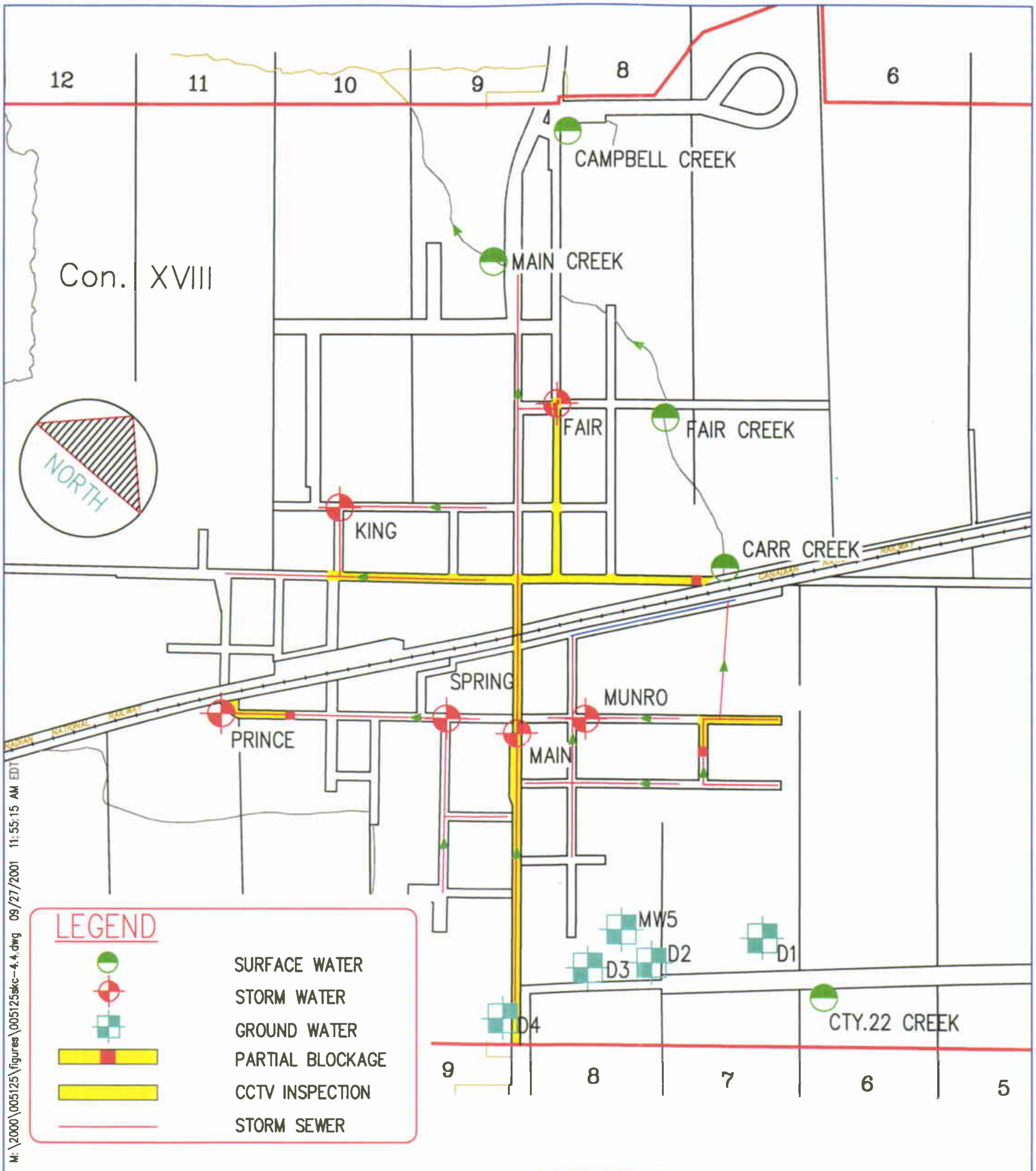
During the week of May 21, 2001, water samples were taken from open ditches and storm sewers at various locations to determine levels of contamination. Bacteriological contamination is expected in storm sewers and open ditches due to the presence of bird droppings and the feces of animals (dogs, cats, raccoons, squirrels, groundhogs, etc.).

The count level in the samples taken from the Main Street South and Munro Street locations shows unusually high concentrations of bacteriological contamination. CCTV inspection of the storm sewer on Main Street South did not identify any connections that would contribute to the high concentration. Limited access to the storm sewer on Munro Street prevented a detailed investigation into the sources of the high bacteriological contamination level.

Sampling locations and CCTV inspection locations are illustrated in Figure 4.4 (note that bacteriological counts are shown in 1000 per mL).

Bacteriological and indicator results are presented in Table 4.4.

The bacteriological results show a strong correlation to indicators including nitrate, ammonia, and organic nitrogen. The bacteriological values that exceed the OWDS are shaded.



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MAXVILLE WATER SUPPLY
ENVIRONMENTAL ASSESSMENT
PHASE 2 REPORT

STORM SEWER INSPECTION AND SAMPLING LOCATIONS

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date	AUG 2001
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Table 4.4 – Surface Water Results

Drainage Area	Sample Location	Type	Total Coliform	*E. Coli*	Hardness	Chlorides	Nitrate (N)	Ammonia (N)	Organic N
			Cts 10^3/ 100 mL		mg/L				
Main Street Drainage Area	Main*	S.S.	170	26	85	54	0.7	0.1	2.9
	Fair	S.S.	18	1.6	60	3.8	0.6	0.1	2.3
	Main Creek	O.D.	>50	>10	294	241	ND	0.1	7.5
	Campbell Creek	O.D.	9.8	4	271	38	1	ND	0.9
East Drainage Area	County Rd 22	O.D.	4.8	0.1	263	5.3	1.1	.02	0.9
	Munro*	S.S.	880	160	105	21	0.1	0.8	9.6
	Carr Creek	O.D.	4.5	1.4	220	60	1	ND	0.5
	Fair Creek*	O.D.	12	3.9	258	68	1	ND	0.5
Catherine West Drainage Area	Prince*	S.S.	58	4.3	748	55	33	2.7	1.1
	Spring*	S.S.	83	3.4	416	344	2.2	0.1	0.4
Alexander West Drainage Area	King	S.S.	20	7.5	90	78	0.6	0.9	1.9

TYPE: S.S. – Storm Sewer, O.D. – Open Ditch
ND – Non-Detect
* Samples reanalyzed at greater dilutions to confirm analysis.

Approximately 50% of the storm sewer system was inspected using CCTV. Surface water samples were taken at various locations in the storm sewers and open ditches. Several grey water connections were noted and should be corrected. The surface water contamination is extensive both in area and magnitude. No comparative results were available to verify whether this is indicative of an urban setting. Undoubtedly surface water contamination, because of the sensitive hydrogeological setting in Maxville, can reach the water supply aquifer(s).

4.5 Regional Groundwater Contamination

Interpretation of the groundwater head (pressure) shows that the groundwater divide extends in a southwest-northeast direction toward the southern end of Maxville proximate to County Road 22. Interpretation of topographic mapping shows that the surface water divide extends in a similar direction proximate to the intersection of County Roads 20 and 22.

The presence of coarse-grained deposits at the south end of the Maxville coupled with relatively high hydraulic head constitute high groundwater recharge potential (EOWRMS 2001).

As noted in the quality evaluation of local wells, bacteriological contamination is widespread and persistent in the village. A local, continuous supply of contaminants is inferred from the analysis. Contamination is compounded by low well yield.

The issue of the identifying the source(s) of the contamination has been contentious. Maxville has had a communal sewage system for more than 10 years and it was expected that well contamination would diminish over time. Typical survival rates for intestinal indicator bacteria could be up to 3 months outside a host, therefore, presumably other contaminant sources continue to affect the water supply.

It was postulated that regionally recharged groundwater was contaminated. To investigate this concern, a test well (TW-10) was drilled at the south end of the village (Figure 5.5), and it, along with other private wells at the south end of the village were analyzed. The results presented in Table 4.4 (see Appendix F for a full scan of chemical parameters) confirm that bacteriological contamination does not exist south of the village (i.e. upgradient) and hence the source(s) of the contamination are likely within the village.

Table 4.5 – Bacteriological and Chemical Analysis of Southern Wells

Sample Location	Type	Total Coliform	*E. Coli*	Background	Hardness	Chlorides	Nitrate (N)	Ammonia (N)	Organic N
		Cts / 100 mL			mg/L				
D1	D.W.	0	0	0	151	2.1	ND	0.08	0.10
D2	D.W.	0	0	30	308	32.5	ND	0.21	0.21
D3	D.W.	35	0	>1000	222	35.9	6.1	ND	0.53
D4	D.W.	0	0	>1000	142	1.7	ND	0.82	0.25
TW-10	D.W.	10	0	20	307	42.0	ND	0.12	0.67
Cty Rd 22	O.D.	4800	100	>1000	263	5.3	1.1	0.02	0.90

Type: D.W. – Drilled Well, O.D. – Open Ditch
ND – Non-Detect

4.6 Surface Water Infiltration

The surficial sand aquifer in Maxville is within 1 to 2 m of the surface. The Hydrogeological Report, prepared in 1981 by Water and Earth Science Associates Ltd., indicated that the surficial sand aquifer is "very sensitive to a variety of contamination problems (road salt, hydrocarbon spills, sewage effluent or leachate effluent migration, etc.)". Foundations, ditches, and wells all provide a pathway for surface contamination to short-circuit into the surficial sand aquifer. Improperly constructed well casings can allow surface contamination to travel further down into the lower sand aquifer and even the bedrock aquifer. It is not possible to eliminate the recharge of surface water and the contaminants that it carries to the aquifer(s), thus this is probably the primary source of well contamination in Maxville.

4.7 Conclusion of Investigations

Prior to the construction of the sewage collection system in 1989, the Village of Maxville had a history of groundwater contamination that was (generally) attributed to inadequate individual sewage systems. Following the construction of the sewage collection system and the connection of individual properties to the system, groundwater contamination persists as evidenced by the sampling surveys conducted in 1999 and 2001.

In order to assess possible source(s) of contamination, several investigations were undertaken to verify the integrity of the sewage collection system (Section 4.3) and to characterize the surface water in the storm sewer network in the village. The data showed that surface water contamination is systemic in the village (*E.coli.* and total coliform bacteria and other water chemistry indicators) as discussed in Section 4.4.

The implication is that private wells in the village will continue to be contaminated and that individual treatment systems or a communal water system will be required. The village's proximity to the groundwater recharge zone (i.e. short travel time and sensitivity to ambient fluctuations) and the likelihood of construction of additional private wells will result in continued groundwater depletion and lower well yield, in other words, groundwater shortages will likely become more profound.

5 Hydrogeological Assessment

5.1 Background

To evaluate the potential of using a groundwater-derived communal water supply for the Village of Maxville, a hydrogeological investigation was completed. The investigation was structured based on *Terms of Reference* provided by the Ministry of Environment (Appendix J).

The initial part of the investigation included a compilation and review of existing geological and hydrogeological information. The most comprehensive information sources included:

- Hydrogeological Investigation conducted by Water and Earth Science Associates Ltd. (WESA), as part of the Report on Private Services – The Village of Maxville, 1981
- Ministry of Environment (MOE) Well Records
- Eastern Ontario Water Resources Management Study (EOWRMS), 2001
- Aerial photography
  - A23964-66 (1975)
  - A10910 (1947)
  - A28048-123 (1994)
- Geological mapping
  - Quaternary Geology (0-1.6 million years ago) – Alexandria Area, Map P. 906, ODM 1973
  - Palaeozoic Geology (245-570 million years ago) – Maxville Area, Map 661A, 1941.

As a first step in selecting drilling sites, TRG retained Waterloo Hydrogeologic Incorporated (WHI) to compile and interpret the MOE well records. A database was developed that included some 600 well records that covered an area contained within a 9 km radius of Maxville.

The MOE well records contain the following data:

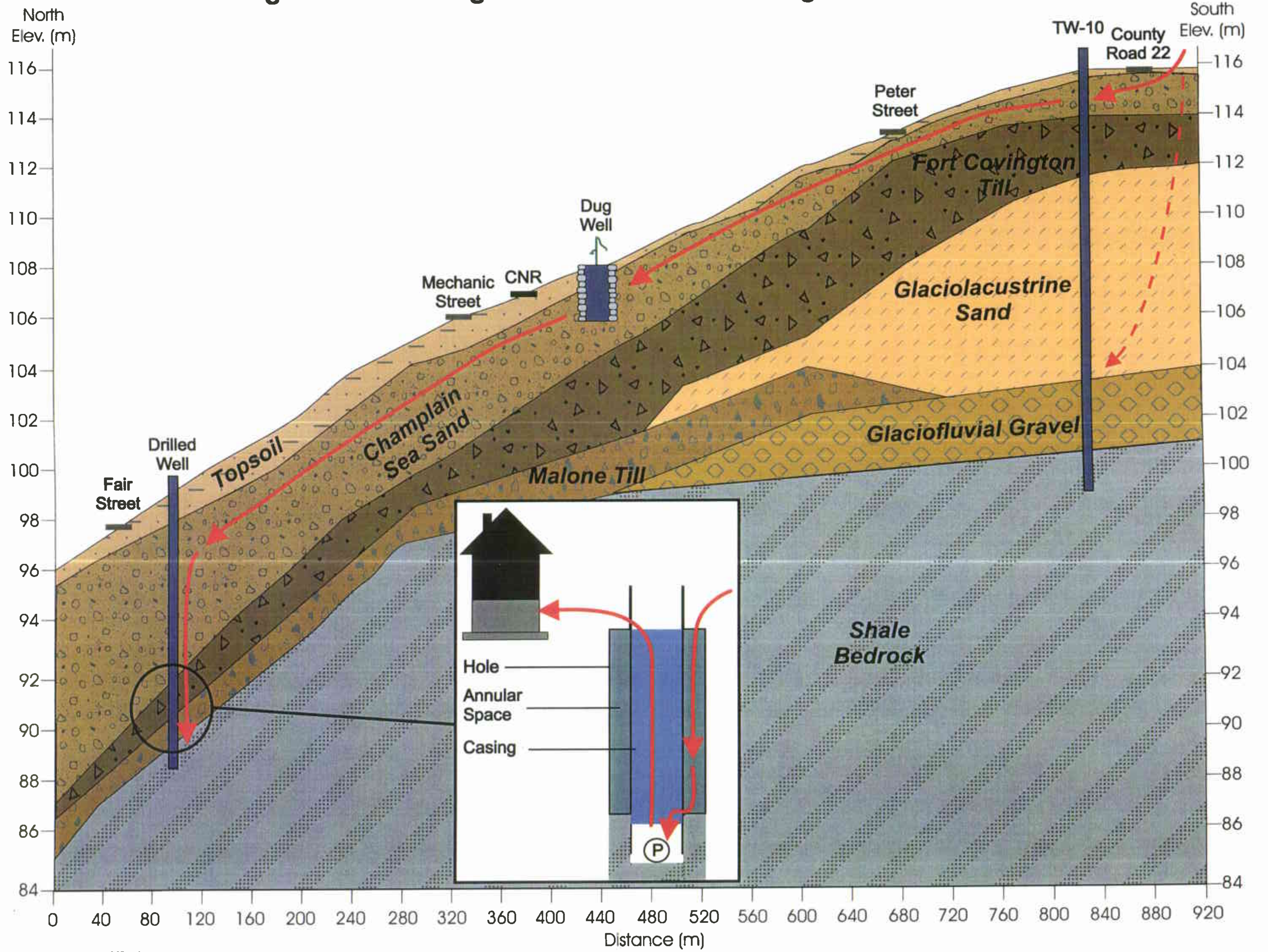
- geologic and hydrogeologic information;
- location and elevation of all registered water wells (drilled but not dug);
- static water levels used to interpret groundwater head (pressure);
- well construction details (depth to water, casing, and sealing); and
- recommended pumping rate.

The WHI report is contained in Appendix E.

5.2 Regional Geology and Hydrogeology

Maxville lies at a topographic maximum within Eastern Ontario. Its location also corresponds to the surface water divide between the St. Lawrence River to the south and the Ottawa River to the north. Extensive near-shore and offshore marine deposits are characteristic of the surficial geology in this area. These deposits range in size from cobble-boulder gravel to fine silt and clay. An extensive northeast-southwest trending marine beach bar is flanked to the north and south

Figure 5.1: Geological Cross Section Along Main Street



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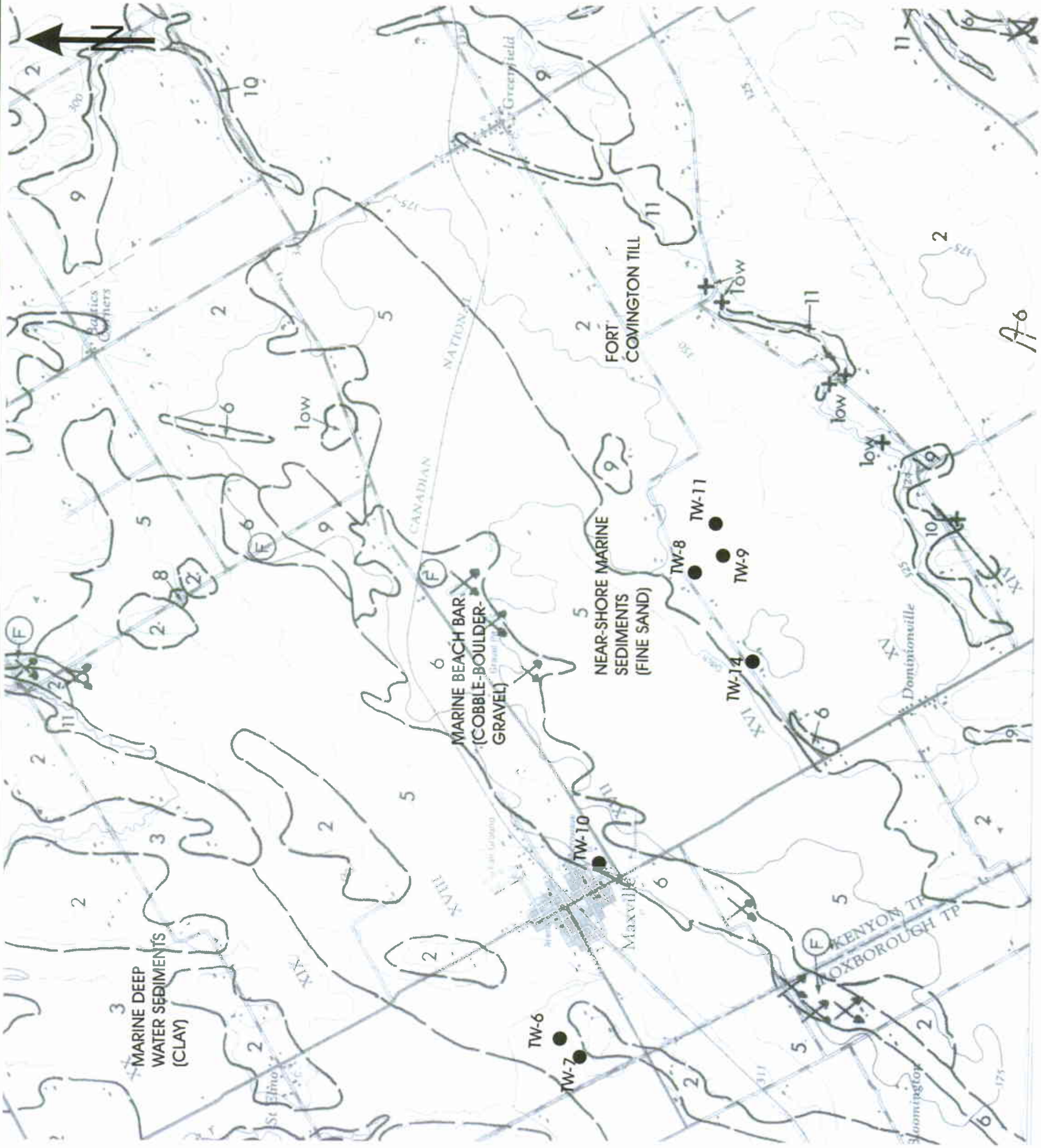

THOMPSON ROSEMOUNT GROUP INC. consulting engineers CORNWALL FERGUS KINGSTON	FIGURE TITLE QUATERNARY GEOLOGY (ADAPTED FROM MNR MAP 906: ALEXANDRIA AREA)	DATE	OCTOBER 2001
The THOMPSON ROSEMOUNT Group	JOB VILLAGE OF MAXVILLE WATER STUDY	SCALE	1:50,000
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			FIGURE 5.2

by marine shallow water sediments of fine sand. The Quaternary Geology mapping information is shown on Figure 5.2.

These near-shore and offshore marine deposits overlay *Fort Covington* till that consists of cobbly and bouldery sandy silt. In contrast to the high permeability of the near-shore and offshore marine deposits, the till is relatively impermeable. The till in turn overlies the bedrock of the Ottawa formation. This consists of thinly bedded limestone with shale partings and in areas discontinuous thick black shale partings.*(Quaternary Geology – Alexandria Area, Map P. 906, ODM 1973)*

From a hydrogeological perspective, the combination of high permeability surface deposits coupled with high hydraulic head results in a high recharge flux. It is recognized that the Maxville area comprises a high groundwater recharge potential zone (EOWRMS, 2001) and that high yielding aquifers exist but their extent may be limited as the formations pinch out.

Cross-sections were developed in preparation for selecting candidate sites for test drilling. A geological cross-section through Maxville developed from borehole information is shown on Figure 5.1. The other detailed cross-sections developed by WHI are shown in Appendix E.

5.3 Screening Criteria

Prior to conducting the test drilling, it was necessary to screen the well record information. The candidate sites for consideration for well drilling were screened using the following criteria:

- Vulnerability (Intrinsic and Specific);
- Proximity to Maxville;
- Co-operative Landowner; and
- Aquifer Capacity.

Vulnerability

Vulnerability is a term used to describe the relative potential for an aquifer to become contaminated. Vulnerability is classified as *intrinsic* or *specific* (explained below).

Intrinsic vulnerability

Intrinsic vulnerability refers to the geologic protection that an aquifer has from potential contaminant sources. This information is derived from geological data. A "low" intrinsic vulnerability is desirable.

Aquifer recharge time is used to classify intrinsic vulnerability as follows:

Table 5.3 – Intrinsic Vulnerability

Vulnerability Class	Aquifer Recharge	Implication
High	< 5 years	very quick (e.g. sand and gravel)
Medium High	5 to 10 years	moderately quick (e.g. fine sand)
Medium	10 to 100 years	slow (silt, till)
Medium Low	100^+ years	very slow (e.g. fine silt, clay)
Low	discharge zone	not vulnerable (water flow is upward)

In Eastern Ontario, and Maxville specifically, the *contact zone* aquifer is the preferred aquifer to develop for water resource exploitation. As the name implies, this is the aquifer that lies at the geologic contact between the overburden and the bedrock. This contact zone typically consists of glacially re-worked gravel deposits and fractured bedrock. The combination of relatively high hydraulic conductivity and separation from the surface makes them desirable aquifers. The depth to this aquifer is sufficiently large to ensure protection from surface contaminants yet not so deep (i.e. into bedrock) that highly reducing conditions produce undesirable aesthetic qualities including high iron, hardness, and sulfur.

It should be noted that poor well construction (the existence of a dug well or an improperly sealed well) can increase intrinsic vulnerability.

Specific Vulnerability

Specific vulnerability is the actual risk that a contaminant is present and can enter the aquifer. This is determined by land use mapping to identify potential contaminants in the area. A low specific vulnerability is desirable.

As this phase of the investigation, candidates drilling sites were selected by considering upgradient or remote (1 km or more) locations from obvious contaminant sources (gas stations, cemeteries, sewage systems, manure storage areas, intensive agricultural operations, etc.).

Proximity to Maxville

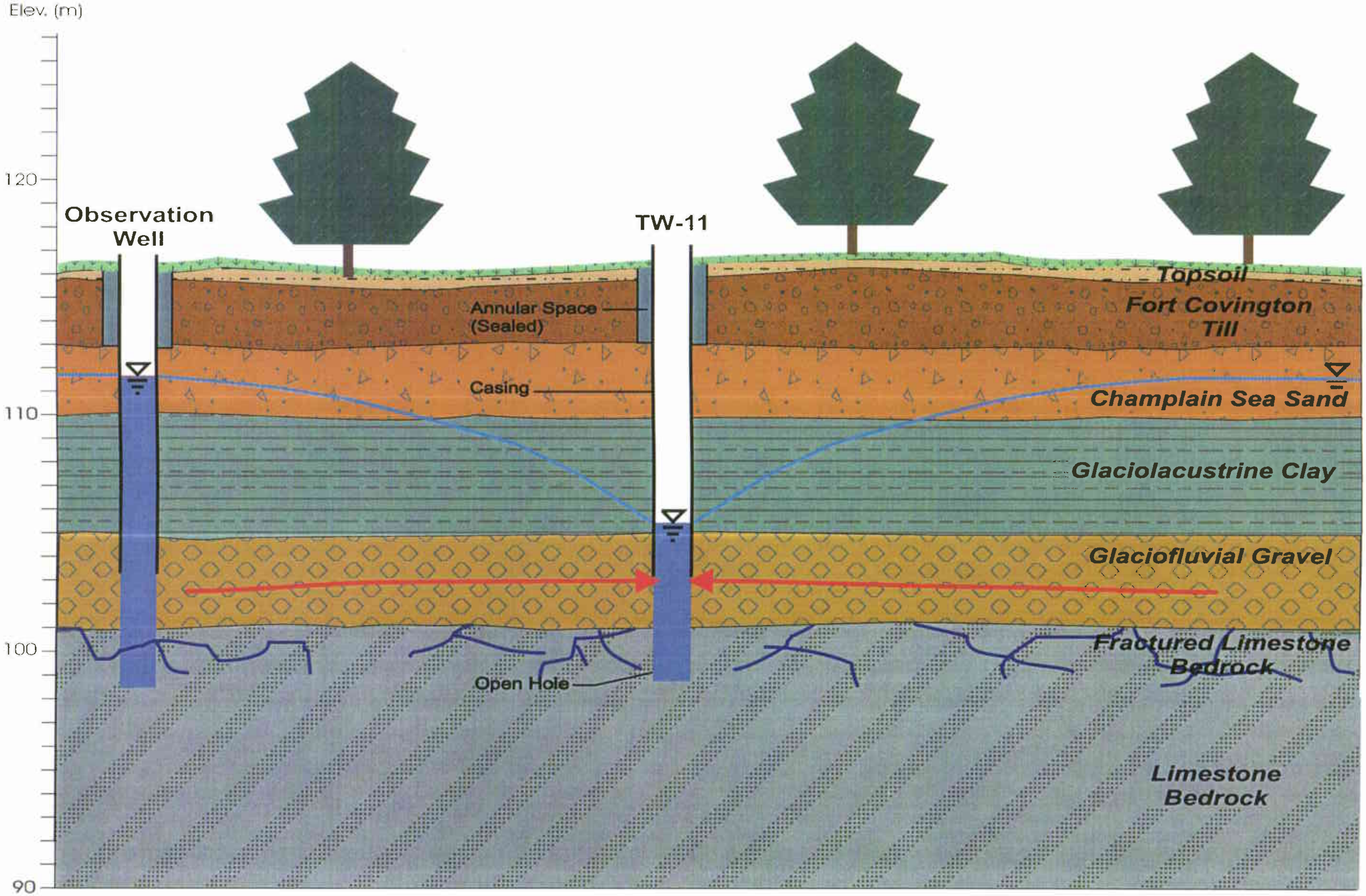
For economic reasons, to minimize the length of a potential water supply main, locations closer to Maxville, were first considered.

Commensurate with the MOE Terms of Reference, it was desirable to consider candidate sites within 1 km radius of Maxville and within the Township of North Glengarry. This radius was subsequently increased to 5 km during the later stages of the investigation.

Co-operative landowner

Since target areas for the drilling investigation were on private lands, written permission first had to be obtained from the landowner.

Figure 5.3: Geological Cross Section of a Production Well



X:\2000\005125\Production Well.cdr

Aquifer Capacity

The ability of an aquifer to supply water is determined by its specific capacity. This is calculated from the well records by dividing the recommended well pump rate (stipulated on the well record by the well driller) by the measured drawdown (stipulated on the well record by the well driller). Specific capacity provides a flow rate per unit metre of drawdown. A high value is interpreted as a potentially high yielding aquifer.

Based on a review of the well records, several areas were identified as being potential sites. The next step involved contacting landowners to introduce the study and ascertain whether they may consider providing drill rig access to the property. If permission was verbally granted, the landowner was met at the site with the driller to verify access, identify any underground services, determine desirable drilling location, compile any additional anecdotal information, and to sign a property access form.

5.4 Borehole and Test Well Investigation

Roy's Drilling was contracted to complete the air rotary drilling under the supervision of TRG staff. Details of the hydrogeological investigation are provided in Appendix E. The interpretation is provided herein.

The borehole investigation was initiated on April 23, 2001 at the south end of the village along County Road 22. Other sites investigated were toward the northwest, just east of Boundary Road, south and east toward Dominionville, and then farther south and east along Township Road 5. These are described in the following section. Figure 6.4. (pocket) illustrates locations of the boreholes and test wells.

A total of 15 boreholes were drilled, of which 12 were cased as test wells. The boreholes and test wells are described by location. It should be noted that the boreholes are identified by the prefix "BH" and the test well as "TW". When a borehole was instrumented as a well, the number remained the same the, prefix merely changed from "BH" to "TW".

Kenyon Concession 17 (IL) Lot 7

On April 23, drilling was initiated at this location. BH-1 was drilled about 100m south of County Road 22 to confirm whether there was adequate protection of the underlying aquifer to warrant well development. Coarse and medium gravel with some sand was encountered throughout the borehole depth of 11m which is consistent with the regional geology mapping that showed coarse grained marine beach deposits in this area (Figure 5.2). This borehole was subsequently abandoned and locations northwest of Maxville were next investigated.

Kenyon Concession 18 (IL) Lot 14

On April 23, 2001, BH-2, BH-3, BH-4 were drilled proximate to the Cumming Drain about 500m north of County Road 22. The lithology consisted of compact brown till overlying grey clay till at a contact depth of 3 m. The grey clay till became more stoney below 5 m and then sub-rounded gravel down to the 8.9 m bedrock contact depth. These holes were developed as TW-2, -3, and -4. The contact zone aquifer was not extensive but each was pumped with the drill air but yield was estimated to be less than 20 L/min.

On April 24, 2001, BH-5 was drilled about 100m north of County Road 22. Sandy silt with some gravel was encountered to a depth of overlying clay till at a depth of 11m. This hole was abandoned with a clay seal.

Kenyon Concession 18 (IL) Lot 16

Interpretation of the regional geology and closer examination of the well records, suggested that the area nearer to the Boundary Road may be suitable test location. Information indicated that overlying clay was sufficiently extensive and thick to provide protection to the aquifer.

On April 24, 2001, the drill rig was mobilized to this lot. BH-6 was drilled at the northwest corner of the bush about 300 m north of County Road 22. The lithology was interpreted as consisting of stiff blue marine clay to a 3.7m depth overlying fine sand and medium gravel. The gravel became coarse below 10m. This borehole was developed as a well. TW-6 consisted of a 13.1m deep well that was cased to a 10m depth using a 150mm casing. This well was constructed as an observation well.

BH-7 was drilled 150m southwest of BH-6 adjacent to the bush about 100m east of Boundary Road. A similar geological sequence was encountered at BH-7 except that the clay was encountered down to a 5.5m depth. TW-7 consisted of a 150mm diameter casing extending to a 9.8m depth through which a 0.9 m long, #20 stainless steel screen was installed using a telescope method. The natural filter pack screened interval was 9.8 to 10.7m (i.e. across the coarse sand and gravel formation).

Each well was developed with air for 3 hours using a jetting tool prior to completing a preliminary pumping test to establish yield. The well cleared during the jetting but when TW-7 was pumped, fine sand re-entered the well and it produced no more than 15 L/min (3.3 IG/min). It was likely that there was insufficient bridging through the natural filter pack around the screen (i.e. native gravel) to inhibit the movement of fines. While additional jetting and development may have increased the well yield, the yield was still well below the target requirement thus this location was temporarily abandoned while other possibly more favourable drilling locations were considered.

Kenyon Concession V, Lot E ½ 36

South and east of Maxville, MOE well records indicated relatively high specific yield wells. A willing landowner on this lot facilitated the construction of 3 boreholes (BH-8, BH-9, and BH-11) beginning on May 9, 2001. BH-8 was drilled at the west end of the east-half of Lot 36. The lithology at BH-8 was described as compact brown silty-sand bouldery till (Fort Covington till) to a depth of 2.7m overlying grey clay silt till with gravel (Malone Till) to a depth of 5.5m. Below 5.5m, fine grey sand was encountered to a depth of 11.3m where firm grey marine clay was encountered. Coarse gravel was encountered beneath the clay from a depth of 15m to 16.1m where fractured bedrock was encountered. This contact zone aquifer was estimated to yield copious amounts of water hence it was instrumented as a test well (TW-8).

TW-8 was installed using a 150mm diameter casing installed to a 13m depth. The casing was driven through the clay to form a natural formation seal. Benseal was added to a 3 m depth to provide a near surface annulus seal. Once the casing was installed, the well was drilled to an 18.3 m depth (i.e. about 2.2 m into bedrock) and then developed using a stop-start air technique and surging across a 10-13m depth for about 2 hours. The well was pumped using air and the capacity was estimated to be 40 L/min.

BH-9 was drilled 80 m south of TW-8. It was anticipated that TW-9 would be the pumping well and in an effort to increase the yield, this borehole was drilled to a 250mm diameter and cased. Upon testing this well did not yield additional water compared to TW-8.

The last well drilled at this location was TW-11 which was completed on May 23. It should be noted that TW-10 was drilled on May 18, 2001 nearer to Maxville (as explained below) prior to TW-11 since there was a desire to evaluate the regional water quality upgradent of the Village.

TW-8 and TW-9 were used as observation wells that are located 240 and 189 m respectively to the north of TW-11. TW-11 located at Concession V, Lot 36 is a 150 mm diameter, 18 m deep well with a casing that extends to 12.8 m. An extensive gravel formation (up to 5 m thick) was encountered on top of the bedrock. This contact zone aquifer was protected by more than 5 m of thick, stiff marine clay and almost 3 m of grey clay till. The highly confined aquifer had a static water level of less than 1m from the surface. These conditions are ideal in terms of low intrinsic vulnerability. A cross-section through the formation is shown on Figure 5.3.

A pump test was conducted on TW-11 (refer to section 5.5 for details). The yield of the well was approximately 57 m^3/day (8.7 IG/min), significantly less than that whish is required to support a communal system (communal system would require 10 or more wells to meet the projected average daily flow requirement of 1,000 m^3/day).

Kenyon Concession 17(IL), Lot 8

TW-10 was instrumented as a test well for the purpose evaluating possible regional groundwater contamination. The well was drilled on May 18, 2001. This location is upgradient from the village and located about 90m north of County Road 22. The lithology consisted of fine to medium sand and rounded gravel to a depth of 1.8m overlying brown till to a depth of 3m where brown fine sand was encountered. The sand was encountered from the 3m contact down to 15m where coarse sand and gravel was encountered. Shale bedrock was encountered at 15.9m below grade. A 150mm diameter casing was installed to a 15.9m depth. The well was subsequently terminated in shale bedrock at a 17m depth. The well was developed using stop-start air. It was tested to yield less than 20L/min, which was sufficient for quality sampling purposes.

Kenyon Concession 15(IL), Lot 6

Following the unsuccessful attempts to develop a water supply near TW-11, BH-12 was instrumented as a test well (TW-12) to evaluate aquifer yield. The hole was drilled on August 14, 2001.

The lithology at this location consisted of 2.4m of compact brown till, overlying grey clay till. The grey till was encountered to the bedrock contact depth, which was 12.8m. Only a thin vineer of gravel (<0.3m) was fractured at this contact. A 150 mm diameter steel casing was installed to a 14m depth into bedrock and sealed. An open hole was drilled into the limestone bedrock to a 24m depth. A large fracture formation was noted between 15-16m below grade. The well was surged for more than an hour and subsequent pumping showed yield at about 30-50L/min, which was insufficient for the projected water demand.

The next attempt at drilling was proximate to the Delisle River about 700m north of TW-12 beginning August 28, 2001.

BH-13 was drilled first about 300m north of the Delisle River. The lithology consisted of brown sandy till to a depth of 1.5m overlying grey till to a depth at 3m. At this depth, wet grey sand with silt was encountered and below 4.5m this formation had extensive soft grey clay. A thin layer of rounded coarse gravel was encountered just above the bedrock depth of 13.1m. The hole was extended to 14.5m into limestone bedrock and subsequently abandoned with hole plug since less than 10L/min of water was observed.

The second hole at this location (BH-14) was drilled 300m south of BH-13 next to the Delisle River. The lithology was similar to that encountered at BH-13 except bedrock was encountered at 9.5m below grade. This hole was abandoned with hole plug.

Kenyon Concession III, Lot 36

This location was chosen because of its proximity to sand and gravel deposits and high specific yields reported in the area from the MOE Well Record interpretation. Drilling of BH-15 was initiated on August 28, 2001. Limestone bedrock was encountered at 2.9m below grade. The overburden consisted of brown sandy till with cobbles. Numerous drops were encountered in the bedrock, and the expectation was that bedrock yield could possibly be high. The borehole was developed as a well (TW-15) and extended to a depth of 43 m. The well was developed by surging but upon testing, yield was less than 50L/min.

Since the most likely well yield potential existed proximate to TW-11, adjacent landowners were contacted and permission was granted to drill on Lot 37, Concession IV.

Kenyon Concession IV, Lot 37 (East ½)

Drilling was initiated on August 29, 2001 at the southerly most accessible area about 600m south of the Concession Road.

BH-16 was drilled within 50m of the marsh area that constitutes the apparent groundwater discharge zone that recharges the headwater of the Delisle River. At this location, compact brown silty till was encountered to the grey till contact depth of 2.9m. Boulders were encountered at 6m where the grey till contacted fine grey sand. Firm grey clay was encountered at 9m. This formation overlaid a thin gravel lense (0.6m) over bedrock. The bedrock contact depth was 12.5m. A temporary casing was placed in the hole to check the approximate yield, which was estimated to be 50L/min. This borehole was subsequently abandoned with hole plug.

The next borehole location was selected further west and south to avoid the marsh. BH-17 was drilled about 70m west and 200m south of BH-16. The lithology at this location was similar to that at BH-16 except no gravel was present at the bedrock contact, which was at 8.8m. The hole was extended to a depth of 11m in limestone bedrock and subsequently abandoned.

BH-18 was drilled about 200m north of BH-17. The lithology was similar to BH-16 with bedrock encountered at 11m. A thin gravel layer (about 0.3m) was encountered at the bedrock contact. The borehole was extended to 12m into bedrock. Yield was tested to be about 30L/min. The hole was subsequently abandoned with hole plug.

The last hole at this location, BH-19, was developed as a test well (TW-19). This well is located about 60m south of the Concession Road. The lithology of this location was similar to TW-11, with a thick layer (5m) of stiff grey marine clay overlying 2m of gravel and fractured bedrock. The bedrock was more competent at a depth of 14.6m.

A 150mm diameter casing was installed at the gravel contact depth of 13m. The well was surged for 30 minutes and subsequently air tested. The yield was estimated to be 60L/min. This well is located within the potential well field area identified on Figure 6.4. No pumping test was completed on this well since the sustainable yield was estimated to be similar to TW-11 (about 75m^3/day). Multiple supply wells would be required within this potential well field to meet the water demand for Maxville.

Kenyon Concession 18 (IL), Lot 6

Following discussions with the Steering Committee, a location at the north end of the Maxville Fairground was next selected for investigation. Information pertaining to a private well drilled close to the Fairground in October 2001 indicated that an unexpected high yield (200L/min) had been reported in the bedrock formation.

Beginning on November 28, 2001, BH-20 was drilled at the extreme north end of the Fairground property proximate to the airstrip. The lithology consisted of brown sand till overlying the limestone bedrock to a depth of 13m. The borehole was cased and extended to a depth of 30m into bedrock. The primary water bearing formation was identified between 20.5 to 21.5m below grade. The yield was estimated to be 80L/min.

A second test well (TW-21) was drilled about 200m to the east at the northeast corner of the Fairground property. The lithology was similar to TW-20 except no significant water bearing zone was encountered in bedrock. The hole was also extended to a 30m depth. The yield was estimated to be less than 10L/min.

Prior to completing a pumping test, each well was hydrofractured to open the formation(s) and maximize yield. Giffin Well Drilling was contracted to complete the hydrofracturing. The work was initiated and completed on December 14, 2001. An inflatable packer was inserted at a depth of 15m (i.e. about 3m into bedrock) and inflated. About 4,500 L of trucked water was pumped into the well at high pressure (700kPa). The pressure quickly dropped to zero soon after the injection was initiated which suggested that the formation opened. The well was purged using a 0.37kW pump for a period of 1 hour. The water was very turbid and brown. The water level was steady at 5.5m after pumping at 35 L/min for one hour. The static water level was 1.5m below the top of casing.

The east well was hydrofractured in a similar manner. The packer was set at 13.7m below the top of casing. The back pressure was much higher than the west well (about 2,000 kPa) and it took about 2 minutes to drop to zero. This process was repeated several times and the back pressure dropped to zero quickly. The packer was removed and the well was pumped for 1 hour at 45 L/min. The water level dropped to 25m and was cascading at 21m. The water bearing zone was at the same depth as the west well although the dynamic water level (and thus the yield) was much less.

A short duration pumping test was completed on the west well following the hydrofracturing. A 0.37kW submersible pump was installed on December 16, 2001 at a 24 m depth. The well was pumped at 47 L/min (the maximum rate of the pump) for 286 minutes (4 ¾ hours). The water level stabilized at a 11.2m depth but remained very turbid (about 150 NTU). No change in the water level was noted at TW-21 or the private domestic well located about 400m south of TW-20. The measured drawdown (11m) represents about 37% of the water column in the well. Assuming that 70% available drawdown is viable and a linear well loss function, the yield of this well is estimated to be 90 L/min (120m^3/day). This yield is about 10% of the average water demand of Maxville.

Well recovery was measured for 100 minutes where the well recovered to about 85%. The transmissivity was estimated from Theis and Jacob Method to be 1.6m^2/day (Appendix E). This compared closely to the Cooper and Jacob time drawdown estimate of 2.6m^2/day (Appendix E). These transmissivity's are about an order of magnitude less than target values thus multiple supply wells would be necessary to meet projected demand.

No water quality samples were obtained since the wells remained highly turbid.

5.5 Pumping Test

An application was made and granted for a Temporary *Permit To Take Water* (01-P-4906) to conduct a pumping test at TW-11. The well was pumped at a rate of 40 L/min (8.8 IG/min) on June 26 and 27. Induced drawdown was measured at 3 private wells and 2 test wells (TW-8 and TW-9) located within 300 m of the pumping well.

Water quality samples were taken 4 times during the pumping test. The first 3 samples were analyzed for a suite of general water chemistry indicators and bacteria. The last samples, taken 15 minutes before the pumping test was terminated, included a full Table 1,2,3 suite of ODWS parameters. The results are provided in Appendix F.

Generally, the water chemistry data shows very desirable results including:

- low hardness (80-90 mg/L as $CaCO_3$);
- low iron (0.1 – 0.17 mg/L); and
- non-detectable sulfur.

No *E.coli.* was detected but total coliform bacteria were present in 3 of the 4 samples.

Interpretation of the pumping test data was completed using *Aquifer Test* software. A time drawdown plot and the recovering analysis were used to determine the aquifer characteristics – namely transmissivity (Appendix E).

Interpretation of the pumping test data showed that pumping at TW-11 induced a steady-state drawdown of about a 200 m radius. The transmissivity (T) of the aquifer was interpreted from drawdown and recovery data. It was calculated to be 2 $m^3/m{\cdot}day$ which is relatively low for a gravel aquifer. Based on the available drawdown, the yield of this well was estimated to be 57 m^3/day (8.7 IG/min).

5.6 Well Head Protection Area (WHPA) and Groundwater Modeling

As discussed in the screening criteria section, apart from the ability of the aquifer to meet demand, the delineation of the wellhead protection area (WHPA) is important. The WHPA refers to the area immediately around an individual well or wellfield. The WHPA is established taking into account several factors including:

- aquifer drawdown;
- aquifer travel time;
- flow boundaries; and
- intrinsic vulnerability.

There are six generally accepted methods that are employed to delineate the WHPA. The methods, listed in order of increasing technical sophistication include (EC 1990):

- arbitrary fixed radii;
- calculated fixed radii;
- simplified variable shapes;
- analytical models;
- hydrogeological mapping; and
- numerical flow and transport models.

The method that was employed for this application involved analytical modeling. WHI was retained to analyze the well capture zones and the well head protection area (WHPA). A total of 10 simulations were performed using the USEPA analytical model WHPA. A variety of cases were tested involving different input parameters, pumping rates, and well configurations. In the different scenarios drawdown was predicted to be between 11 and 23 m depending on the input parameters and pumping data used in the model.

Although the analytical model was a simplified representation of the pumping in the contact zone aquifer, the results provide useful information about the expected drawdown at the test site. The program WHPA also generates traces depicting flowlines to the pumping wells. Graphically this provides an impression of the contributing area for the wells in each simulation, however WHI recommended that the traces not be used to define final capture zones for the respective wells since the model is unable to represent heterogeneity in the various aquifer properties and additional data would be required as part of the final wellfield design.

WHI evaluated future pumping scenarios using pumping test data and the analytical WHPA model published by the USEPA. Given the level of simplification involved, WHI recommended that the following analysis be used as a screening level tool to evaluate drawdown and the range of uncertainty for alternative pumping configurations.

A total of ten simulations are described. These assess the uncertainties in the model parameters, in particular:

- aquifer transmissivity (ability of the aquifer to convey water);
- aquitard leakance (vertical flow to the aquifer leaking from the confining clay layer above); and
- hydraulic gradient (slope of the potentiometric profile).

The primary control variables for each case were the location and pumping rate of pumping wells. The output variables are contour lines of simulated hydraulic head in the aquifer and particle tracks to show predicted flow lines to the wells. The particle tracks provide a graphic impression of the area contributing to each well. For this simulation, the proposed supply wells were placed on the Concession V, east ½ Lot 36 (i.e. the same parcel that the test wells were located within).

The hydraulic head distributions were compared to the ambient case (Scenario 1, no new pumping wells) to evaluate the impact of additional pumping on the surrounding water levels in the contact zone aquifer. Each of the existing 3 private well was estimated to extract 1 m^3/day so that ambient extraction condition was 3 m^3/day. This was done to ensure that the proposed water taking did not impact on the existing water supplies. The target yield was 1,000 m^3/day.

The model was calibrated to conform to the drawdown observed during the pumping test, the ambient water level data, and the lithological information provided to WHI. The scenarios and results are summarised in Table 5.4 below, and the results are plotted graphically in Figures 1 to 9 (Appendix E).

Table 5.4 Simulation Parameters and Results

No.	Scenario	Number of Wells	Pumping Rates	Aquifer Transmissivity	Confining Kz'	Hydraulic Gradient	Maximum Drawdown
1	Ambient Conditions	3	3 @ 1 m^3/d	2 m^2/d	0.005 m/d	0.003 m/m	–
2	Pumping Test	4	3 @ 1 m^3/d 1 @ 58 m^3/d	2 m^2/d	0.005 m/d	0.003 m/m	13 m
3	Higher Estimate of Transmissivity	8	3 @ 1 m^3/d 5 @ 200 m^3/d	10 m^2/d	0.005 m/d	0.003 m/m	13 m
4	High Leakance (high T)	8	3 @ 1 m^3/d 5 @ 200 m^3/d	10 m^2/d	0.010 m/d	0.003 m/m	12 m
5	Low Leakance (high T)	8	3 @ 1 m^3/d 5 @ 200 m^3/d	10 m^2/d	0.001 m/d	0.003 m/m	23 m
6	High Hydraulic Gradient (high T)	8	3 @ 1 m^3/d 5 @ 200 m^3/d	10 m^2/d	0.005 m/d	0.010 m/m	12 m
7	Low Hydraulic Gradient (high T)	8	3 @ 1 m^3/d 5 @ 200 m^3/d	10 m^2/d	0.005 m/d	0.001 m/m	12 m
8	Estimate of Sustainable Yield	8	3 @ 1 m^3/d 5 @ 60 m^3/d	2 m^2/d	0.005 m/d	0.003 m/m	14 m
9	Alternative Well Field Configuration	12	3 @ 1 m^3/d 6 @ 50 m^3/d 4 @ 30 m^3/d	2 m^2/d	0.005 m/d	0.003 m/m	14 m
10	Alternative Configuration and High Transmissivity	12	3 @ 1 m^3/d 5 @ 120 m^3/d 4 @ 100 m^3/d	20 m^2/d	0.005 m/d	0.003 m/m	11 m

As expected, the transmissivity (T) is a key parameter in this assessment. At TW-11, transmissivity (T) was interpreted from pumping test data to be 2 m^2/day, which is very low for this type of aquifer. The well records that were reviewed suggested that the transmissivity would likely be an order of magnitude higher than measured. Accordingly, since multiple wells would be required for a full production well field, it was anticipated that some of the wells could have a transmissivity of up to 20 m^2/day.

The results demonstrate that up to 12 wells may be required to meet the production demand (1,000 m^3/day) as shown in Scenario 10. These wells would have to be sufficiently spaced (200m or more) so that mutual induced drawdown did not lower the water level in each well to less than the available drawdown. It is desirable to target about two-thirds of available drawdown when all wells are pumped. In other words, the water level in the well does not drop more than two-thirds of the difference between the pump intake depth and the static water level.

5.7 Communal Groundwater Supply

The results of the modeling presented in Section 5.4 demonstrated that multiple production wells (10 or more) would be required to meet Maxville's proposed average day demand (1,000 m^3/day). The maximum day demand (2,937 m^3/day or 646,000 imp. gpd) would require many more wells or be supplied from storage. These wells would have to be spaced at 200 m or more apart. Multiple property acquisition would be required to establish the well heads. The approximate location is shown on Figure 6.4.

It should be noted that other property owners contacted TRG and the Township of North Glengarry expressing an interest in having their property evaluated as a possible test well location (i.e. groundwater supply). Extensive sand and gravel deposits, the presence of springs, and potentially high well yields were noted. Some of these areas in question (south and west of Maxville (Lot 15, 16, Concession 17 IL) and west of Maxville (Lot 1, Concession 4, Township of North Stormont) were considered during the initial location assessment in April but were subsequently eliminated during the screening process for various reasons including:

- High intrinsic vulnerability;
- High specific vulnerability; and
- Property outside of the Township of North Glengarry.

Despite these disadvantages that make the sites less desirable from an exploitation perspective, these groundwater supplies could still potentially be utilized for Maxville. The implication is that the groundwater is under the direct influence of surface water (GUDI) that would likely require:

- significantly higher level of water treatment (coagulation, sedimentation, and filtration);
- more extensive well head protection zone (e.g. control of land use around the well head and within the recharge zone);
- an additional monitoring network proximate to the supply wells to provide early warning of possible contaminants; and
- higher capital and operating costs associated with treatment.

5.8 Private Well Development

As concluded in various hydrogeological investigations for the Village of Maxville and confirmed in the work by TRG, an adequate supply of safe and aesthetically desirable groundwater within the village for *all* Maxville homeowners is not possible.

Although treatment systems, when properly configured and maintained, can consistently provided safe and palatable water, these still require sufficient water to meet day-to-day demands. From a water supply perspective, Maxville's unique position within a groundwater recharge zone and its proximity to a regional groundwater divide, limits the quantity of water that is theoretically available for extraction.

The geology of Maxville is generally described as consisting of coarse and medium grained deposits overlying bedrock (Figure 5.1). Interbeds of more fine-grained Fort Covington and Malone Till also exist. The maximum depth to bedrock varies from about 15 m at the south end of the village to about 8 m toward the north end. From a hydrogeological perspective, the presence of Champlain Sea sand as well as post-glacial deposits (Glaciolacustrine sand and gravel) dominate the groundwater flow (and contaminant) pattern. Recharge to the local aquifer(s) is via these deposits.

Previous studies indicated a vertical hydraulic gradient of about 0.01 m/m (WESA 1981). Using a mean vertical hydraulic conductivity (K_v) of 10^{-4} m/s and a porosity of 0.1 m^3/m^3, the mean vertical velocity would be about 1 m/day. However, pressure changes proximate to a pumping private well would induce a vertical hydraulic gradient that in turn could increase the velocity by an order of magnitude (i.e. 10 m/day). This induced velocity at each well in the village would expedite the movement of subsurface contaminants. As discussed in Section 4.5 surface contamination is pervasive and the migration of contaminants is compounded by the pumping of the existing wells.

5.9 Hydrogeological Investigation Conclusion

The geological formations that exist within the boundaries of the Village of Maxville are not favourable to support an adequate supply of high quality groundwater to meet the needs of residents in the Village. The quality of water is affected by the high vulnerability of the sand and gravel aquifers. The quality of the water can be improved by the installation of individual treatment systems. The quantity of water however is restricted as discussed in Section 5.8. Therefore, the reconstruction of wells within the Village will not provide all properties with an adequate supply of groundwater.

The development of a communal groundwater supply technically can be achieved. Remote locations with an extensive well field, a low vulnerability, and confined aquifer are possible but perhaps not economically or operationally practical. There are higher yielding groundwater supplies within closer proximity to Maxville but these aquifers are more vulnerable and in turn require more extensive WHPA management. Again, this may be cost and operationally impractical. The advantages and disadvantages along with its natural, social and economic implications are evaluated in Section 6.4.

6 Evaluation of Alternative Solutions

This section of the report describes the alternatives that may provide a solution for the problems associated with groundwater contamination and periodic shortages in Maxville and identifies which alternative(s) warrant a detailed evaluation (i.e. in Phase 3).

6.1 Alternative Solutions

A safe and reliable source of potable water is essential to the health, safety and economic development of a community, and to the quality of life of its residents.

6.1.1 Inventory of Alternative Solutions

In order to determine the preferred alternative solution(s) to the problem, a full range of possible alternatives must be evaluated based on a reasonable group of criteria and constraints. A range of alternative solutions has been developed based on the solutions available within the geographic and environmental confines of Maxville and area. The alternatives also draw on background information contained in the Apple Hill Water Supply ESR (1999) and the ongoing Alexandria Water Supply Study. The alternative solutions that are available to Maxville are identified as:

Alternative A	Do Nothing
Alternative B	Individual Well Correction and Treatment Systems
Alternative C	Maxville Communal Groundwater System
Alternative D	Maxville and Area Communal Groundwater System
Alternative E	North Glengarry Regional Water Supply System
Alternative F	Connection to a Neighboring Community Water Supply

The potential environmental effects for each alternative are illustrated in Figure 6.1.

6.1.2 Preliminary Screening Criteria

To narrow the scope of the project to the most reasonable set of solutions for analysis, TRG completed an initial screening. The criteria were established based on the project objectives and our experience in similar projects.

Figure 6.1: Environmental Effects of Alternatives

	Alternatives					
	A - Do Nothing	B - Well Correction & Treatment Systems	C -Maxville Communal Groundwater System	D - Maxville & Area Communal Groundwater System	E - North Glengarry Regional Communal System	F - Connecting to Adjacent Municipal Communal System
AESTHETICS						
removal of vegetation or landscape features		Yellow	Yellow	Yellow	Yellow	Yellow
change of compatibility with landscape					Yellow	Yellow
residents, non-residents, tourists exposed to new view					Yellow	
AGRICULTURE						
removal of productive farmland			Red	Red	Yellow	Yellow
disruption of field access from public roads		Yellow	Yellow	Yellow	Yellow	Yellow
disruption of tile and surface drains		Yellow			Yellow	Yellow
change in water quality		Green	Green	Green	Green	Green
change in water quantity		Red	Green	Green	Green	Green
change in crop yield			Green	Green		
reduced viability due to land loss			Red	Red		
effects of chemical, bacteria, noise,dust on crops, livestock and people						
CLIMATIC EFFECTS						
vegetation removal or snow accumulation, windscreening and shade on adjacent buildings and activities						
change in air quality						
ECONOMIC AND SOCIAL EFFECTS						
change to tax base		Red	Green	Green	Green	Green
change in employment opportunities			Green	Green	Green	Green
change in quality of life		Yellow	Green	Green	Green	Green
change in tax rate or cost of service		Red	Red	Red	Red	Red
FISH, AQUATIC WILDLIFE AND VEGETATION						
change or removal of existing habitat including food and shelter			Green	Green	Yellow	Yellow
change in water quality		Yellow				
change in water temperature						
effects of timing of construction activities on spawning and breeding periods					Yellow	
lowering of water table		Yellow	Red	Red	Yellow	Yellow
production of new habitat						
collecton of fish and organisms on intake screens					Yellow	
GROUNDWATER						
change in quality			Red	Red		
change in quantity		Yellow	Red	Red		
interference with flows or levels		Red	Red	Red	Yellow	Yellow
HERITAGE RESOURCES						
disruption and/or destruction of sites and structures having significant archaelogical, historical, architectural or economic values						
PUBLIC HEALTH						
effects on water quality		Yellow	Green	Green	Green	Green
effects on air pollutants						
effects on existing subsurface sewage disposal systems		Yellow	Yellow	Yellow	Yellow	Yellow
effects on 'quality of life' e.g. reduced water restrictions			Green	Green	Green	Green
NOISE AND VIBRATION						
changes in existing noise and vibration levels			Yellow	Yellow	Yellow	Yellow
RECREATION						
effects of accessibility changes						
disruption during construction					Yellow	Yellow
effects on layout or operations					Yellow	Yellow
effects on quality of user experience due to environmental changes					Yellow	Yellow

Improvement (Green)
less severe impact (Yellow)
more severe impact (Red)

Figure 6.1: Environmental Effects of Alternatives

	Alternatives					
	A - Do Nothing	B - Well Correction & Treatment Systems	C -Maxville Communal Groundwater System	D - Maxville & Area Communal Groundwater System	E - North Glengarry Regional Communal System	F - Connecting to Adjacent Municipal Communal System
	no forseeable impact					
RESIDENTIAL, COMMERCIAL, INDUSTRIAL, INSTITUTIONAL						
temporary disruption during construction		less severe impact	less severe impact	less severe impact	less severe impact	less severe impact
safety & movement patterns of pedestrian traffic			less severe impact	less severe impact	less severe impact	less severe impact
financial and social effects of relocation or removal of homes, businesses and institutions						
change in use or layout due to property loss			more severe impact	more severe impact	less severe impact	less severe impact
change in property value		less severe impact	Improvement	Improvement	Improvement	Improvement
improved sewage collection and water treatment		Improvement	Improvement	Improvement	Improvement	Improvement
reduction in water quantity and quality due to drawdown in private wells		more severe impact	more severe impact	more severe impact	less severe impact	less severe impact
effects on insurance rates via fire protection						
SOIL AND GEOLOGY						
erosion or compaction during construction		less severe impact	less severe impact	less severe impact	less severe impact	less severe impact
deposition of sediment on adjacent properties				less severe impact	less severe impact	less severe impact
contamination of soils						
mixing of topsoil with subsoil						
scarring of unique landforms						
SURFACE DRAINAGE						
diversion and/or channelization of watercourses		less severe impact				
effects on floodplain		less severe impact				
contamination of surface watercourse						
sedimentation and turbidity of adjacent water bodies due to construction activities						
"ponding" effects on adjacent properties due to natural drainage disruption				less severe impact	less severe impact	less severe impact
increased surface runoff						
decreased surface water quality						
decreased surface drainage						
TERRESTRIAL VEGETATION AND WILDLIFE						
mortality/stress of vegetation due to sediment deposition, construction equipment movement or changes in soil moisture		less severe impact	less severe impact	less severe impact	less severe impact	less severe impact
conditions resulting in reduction and/or deterioration of wildlife habitat				less severe impact	less severe impact	less severe impact
changes in vegetative composition as a result of environmental changes						
removal or disturbance of significant trees and/or ground flora						
new or increased exposure of trees leading to increased loss of habitat for wildlife						
effect on wildlife habitat						
effect of contaminants on vegetation and wildlife						
UTILITIES						
effects on other utilities, e.g., relocations		less severe impact	less severe impact	less severe impact	less severe impact	less severe impact

Improvement
less severe impact
more severe impact
no forseeable impact

The preliminary design screening criteria are as follows:

- the supply must meet the Ontario Drinking Water Standards;
- a comprehensive community-wide solution to the water supply problem it describes;
- the solution must meet MOE design guidelines;
- the solution must be proven in similar operating conditions;
- the natural, social and economic environment must not be significantly impaired by the solution;
- the solution must meet all applicable Provincial and Federal regulatory requirements;
- the solution must be affordable; and
- the solution should be eligible for funding assistance.

Alternative solutions are to be evaluated against the screening criteria to determine acceptability for further evaluation. It is conceivable that there is no alternative solution that satisfies all the screening criteria.

6.2 Alternative A: Do Nothing

6.2.1 Description

The "Do Nothing" approach implies that the municipality will take no corrective action. Maintaining current conditions would fail to alleviate any of the problems associated with the water supply, and may increase health risks resulting from water contaminants, particularly microbiological contaminants, for the users without treatment systems. Individual property owners may undertake corrective action by drilling new wells, installing treatment systems and/or purchasing bottled water.

Those with periodic water shortages may have to (continue to) haul water.

For those water users who wish to take steps to protect their potable water supply, there are many technologies available to address potable water needs. Different configurations are also available which can provide for a potable water point source or treat the water used throughout the entire house. Reverse osmosis, carbon filters, distillers, UV lights, iron exchangers, and softeners are all technologies available for individual treatment systems.

Table 6.2 describes the disinfection technologies available and Table 6.3 describes other treatment technologies.

Table 6.2 – Disinfection Technologies for Treatment of Bacterial Contamination

Technology	Description	Advantages	Disadvantages
Chlorination	The use of sodium hypochlorite or chlorine gas is widely used for the disinfection of potable water supplies.	Proven Technology Inexpensive	Additional Treatment for Byproduct Removal Chemical Treatment Requires maintenance Offensive Odour
Ultraviolet Light (UV)	Ultraviolet radiation has widely been used as a germicidal treatment for water. The adsorption of UV light by the DNA and proteins in the microbial cell results in the inactivation of the microorganism.	Effective disinfection Oxidation of organic compounds	Organisms can sometimes repair/ reverse the destruction effects of UV Low dosage may not effectively inactivate some viruses, spores, and cysts. No residual disinfection ability Requires maintenance
Distillation	Water is first heated to boiling. The water vapor rises to a condenser where cooling water lowers the temperature so the vapor is condensed, collected and stored. Most contaminants remain behind in the liquid phase vessel. However, organics with boiling points lower than 100 °C cannot be removed efficiently and can actually become concentrated in the product water. Another disadvantage is cost. Distillation requires large amounts of energy and water.	Removes a broad range of contaminants Reusable	Some contaminants can be carried into the condensate Requires careful maintenance to ensure purity Consumes large amounts of energy Requires Maintenance Very low throughput

Table 6.3 – Other Treatment Technologies

Technology	Description	Target Compounds
Aerator	An aeration unit can be used for iron removal. Air is bubbled through the water and oxidizes and precipitates the dissolved iron so that it can be filtered out.	Iron Sulphur
Carbon Adsorption	The activated carbon adsorption process creates a highly porous surface on the carbon particles. Organic contaminants are adsorbed by attraction to these pores.	Organic Compounds Taste & Odour Colour
Oxidizer	An oxidizer can be used for iron removal. This system uses a media called manganese greensand, that combined with a regenerate of potassium permanganate oxidizes the iron to a form that can be precipitated so that it can be filtered out.	Iron Sulphur
Reverse Osmosis (RO)	Reverse osmosis involves the high pressure transmission of liquid across a semi-permeable membrane.	Dissolved ions including Chloride, Sodium, & Nitrate
Water Softener	Water softeners use an operating methodology where one cation is preferentially exchanged for another (i.e. calcium and magnesium removal from solution by sodium exchange). The process is called ion exchange.	Calcium Magnesium

Table 6.4 shows examples of the typical cost ranges for different configurations of individual treatment systems. Cost will vary according to water consumption, raw water quality, maintenance, etc.

Table 6.4: Capital and Operating Costs for Individual Treatment Systems

Technology	Description	Purchase Cost	Annual Operating Cost[1]
Reverse Osmosis (90 L per day)	Comprises of a 5 micron sediment pre-filter, a 10 micron solid block carbon filter, a 90 L per day filter membrane, and 15 liter storage tank.	\$400 - \$600	\$20-\$50
UV Light (3.8 L per min)	Used to destroy bacteria, viruses, parasites and microorganisms.	\$250 - \$500	\$50 - \$75
5 Stage RO unit (136 L per day)	Comprises of a 5 micron sediment filter, a 10 micron solid block carbon filter, a filter membrane, ultraviolet light, a carbon post filter, and a 15 L storage tank.	\$700 - \$1,000	\$100 - \$200
5 Stage RO unit (380 L per day)	Comprises of a 5 micron sediment filter, a 10 micron solid block carbon filter, a filter membrane, ultraviolet light, a carbon post filter, a 53 L storage tank, and a booster pump.	\$1,200 - \$1,800	\$250 - \$350
Distiller (30 L per day)	Consists of a distiller to boil water, has an optional pumping package for \$400.	\$1,500 - \$2,000	\$350 - \$500

1 Operating cost does not included pump operation and maintenance, replacement, electricity, pressure tank and switch maintenance.

6.2.2 Summary

The advantages of this alternative are:

- There is no project cost associated with maintaining the status quo.
- The natural, social and economic environment would not be impacted by a major construction project.
- No approvals are required.
- The municipality assumes no liability for providing a solution or for maintaining the resulting system.

The disadvantages of this alternative are:

- It does not provide a single comprehensive solution.
- It does not address future municipal growth.
- Water quality continues to be impaired.
- Health risks due to biological contamination continue to exist.
- The MOE guidelines and the Ontario Drinking Water Standards are not met.
- Water shortages will continue.

The "Do Nothing" alternative avoids the capital and operating costs associated with a communal water supply. The capital and operating cost avoidance may be offset by:

- increased health risks,
- the cost of bottled water,
- the cost of individual treatment systems,
- the loss of quality of life, and
- the loss of property value.

The failure to correct water quality problems may lead to a decline in population and property values, and may deter future investment in the community.

This alternative does not meet all of the requirements of the screening criteria (i.e. not a comprehensive solution).

6.3 Alternative B: Individual Well Correction and Treatment System Program

This alternative implies that the municipality would develop a comprehensive program involving the construction of new wells and/or the installation of individual treatment units. The program could also include the installation of storage tanks for properties where water shortages are prevalent. An Individual Well Correction Program is a voluntary program since the municipality has no legislative authority to compel property owners to correct problems associated with individual wells or to install individual treatment units.

6.3.1 Service Area

The service area would include all residential, commercial and institutional properties that are currently serviced by the municipal sewage system.

6.3.2 Description

Typically, an Individual Well Correction Program would involve a detailed lot by lot survey, the examination of individual wells, the construction of new wells, and the installation of individual treatment systems.

The lot by lot survey would include:

- A detailed inspection of building plumbing systems;
- A detailed examination of all existing wells (depth, type, location, construction, etc.);
- Intensive sampling program directed at surface water and groundwater at each lot; and
- Topographic survey of each lot to confirm surface drainage patterns.

The construction of new wells would include:

- The replacement of dug wells with properly grouted drilled wells;
- The remedial grouting or replacement of existing drilled wells; and
- The proper decommissioning of unsuitable wells.

The installation of individual treatment systems would include:

- An assessment of each individual well to determine the treatment requirements; and
- The purchase and installation of the appropriate equipment.

6.3.3 Cost

The Individual Well Correction and Treatment System Program alternative alleviates the operating costs associated with a communal water supply. However, the cost of well correction and individual treatment systems is relatively high. The capital and operating costs of individual treatment systems are generally higher than a communal system on a per user basis. It is incumbent on the homeowner to ensure that the efficient operation of the system, including regular water testing, is conducted.

Most systems are add-ons to existing wells, and the capital costs include the configuration of individual systems, and the appropriate plumbing connections, and power supply. Operating costs include chemicals, cleaners, backwash water, power, and replacement components. See Section 6.1 for more details on the costs of an individual treatment system.

6.3.4 Summary

The advantages of this alternative are:
- Systems can be designed to meet individual well treatment requirements.
- Water can be treated to meet MOE guidelines and the Ontario Drinking Water Standards.
- The municipality assumes no liability for the operation and maintenance of a water supply.

The disadvantages of this alternative are:
- The onus is on each property owner to install and maintain individual treatment systems.
- This alternative is not eligible for Provincial Funding.
- Increased water usage (backwash requirements).
- Increased loadings to the municipal sewage disposal system (backwash).
- Does not provide a solution for all residents and water shortages will persist.
- This alternative may need to be extended to the entire Township.
- The capital and operating costs associated with individual systems is significant and can be greater than that of a communal system.

This alternative cannot provide a comprehensive community-wide solution that addresses the water quality and quantity needs of all of the residents of Maxville and hence it fails to meet all of the screening criteria.

6.4 Alternative C1: Maxville Communal Groundwater System with Fire Flow

This alternative solution involves the development of a communal groundwater system that would provide water to all properties in the service area in Maxville.

6.4.1 Service Area and Design Capacity

The proposed service area includes all residential, industrial, commercial and institutional (ICI) properties that are currently serviced by the municipal sewage system (see Figure 6.4 – pocket).

The service area includes all existing developed properties and limited new development for the anticipated 20-year planning period. The allowance for new growth includes 1% per annum for population and industrial, commercial and institutional land uses.

The study area includes a much broader area around Maxville associated with the hydrogeological investigation and the search for a suitable and sufficient source of water. The communal groundwater system will have the design capacity equal to the maximum day demand plus fire flow for Maxville (see Table 3.3), in accordance with MOE guidelines. The design capacity is 2,937 m^3/day (646,000 IG/day) with an average daily flow of 954 m^3/day (210,000 IG/day).

6.4.2 Description

For many Ontario communities, the development of a communal groundwater system is a viable alternative for a water supply. Examples of communal groundwater systems in Eastern Ontario include Glen Robertson, Newington, Redwood Estates, Moose Creek and Creg Quay. For Maxville, new wells would be developed within the immediate area to provide a supply of water for a communal system.

A communal groundwater system for Maxville would consist of:

- A system of groundwater wells and low lift pumps;
- A treatment plant, consisting of disinfection, which will provide potable water which meets the level of treatment required by Ontario Regulation 459/00 (if not under the influence of surface water);
- High lift pumps and a transmission pipeline to move the water from the point of treatment to the water distribution system;
- A distribution system to disburse potable water to the residents of Maxville; and
- A storage reservoir for peak demand, fire protection and emergency storage.

Figure 6.4 illustrates the approximate location of a possible well field and water treatment plant in the Dominionville area. The detailed hydrogeological investigation (Section 5 and Appendix E) concluded that, while a communal groundwater supply could be developed for Maxville, there are inherent difficulties may have significant cost and management implications.

Test well yields were relatively poor, implying production rates of less than 70 L/min (15 IG/min). Consequently, multiple wells configured over an expansive well field would be required to meet the demand projected for Maxville.

Wells located closer to Maxville had higher potential yields but failed to meet the screening criteria with respect to vulnerability.

6.4.3 Natural Environment

There will be impacts from both the construction and the operation of a groundwater supply system.

The distribution system will be constructed on existing municipal road allowances and easements hence the impacts will be limited to the construction period and include noise, dust, and disruptions to private property access, business and traffic. Construction impacts may be minimized through suitable construction methods.

The construction of the well(s) would have limited surface impacts outside of a 10m diameter radius around the well(s), but the construction of the site storage, building and appurtenances would require significant excavation and site disturbance. This can be mitigated by measures to reduce the impact of construction offsite such as a sediment management plan. A detailed biological assessment will be required to identify natural environmental issues and assist in determining how to mitigate or eliminate the impact due to construction.

The construction of the pipeline(s) from the well field to the distribution system will follow existing road allowances where possible to minimize the impact. Again, construction will require a sediment management plan to mitigate impacts outside of the area of construction. Scheduling of the construction to avoid conflicting with seasonal environmental issues (e.g. fish spawning, breeding) may be required if it is determined that a sensitive species may be adversely impacted by construction.

An extensive well head protection area will be required. The groundwater aquifer will require protection from the intrusion of contaminants that might result from land uses in the immediate area.

There is an advantage to the natural environment of groundwater extraction, which is the protection of land against development. The well head protection area will be protected either by purchase or zoning to preclude detrimental development within the well(s) cone of influence. This may result in protected natural areas that would not be disturbed for the life of the well(s).

6.4.4 Social Environment

The social environmental impacts of a groundwater system will be localized to the areas around the well field. Residents of this area may be impacted both socially and economically by the well head protection area restrictions that may be placed on their land. This may involve land purchase or changes to zoning to preclude any development that could have an adverse impact on the groundwater supply. Conversely, there may be social advantages as the land purchased for well head protection may become a natural park or site for other non-invasive public usage, which could benefit the community.

Groundwater supplies have in recent years gained a poor reputation due to contamination of local private wells by septic systems and the Walkerton crisis. Groundwater, if well protected, can be an excellent source of adequate water, but these aforementioned unfortunate situations have impacted public perception with regards to the use of wells for water supply and, as such, there may be concerns with a groundwater supply. Regardless of the concerns, the treatment of the water from the groundwater supply must meet the requirements of Ont. Reg. 459/00 and provide adequate drinking water quality.

The tax base can be affected by a suitable water supply. Property values typically increase, economic development opportunities are enhanced and fire insurance rates are decreased as a result of an adequate communal water supply.

6.4.5 Economic Environment

This alternative will result in impacts associated with the capital and operating costs of the system. These costs will vary depending on the number of wells that are found to be necessary to provide adequate capacity for the Village.

The economic impact that will have the most significant effect relative to other alternatives will be the land requirements for wellhead protection. As a result of the hydrogeological investigations, an area around the well(s) will be delineated as a wellhead protection area. This zone will have restrictions regarding land use to protect the groundwater recharge area from contamination and/or reduction in recharge rates. This may result in agricultural and/or other uses being taken out of the inventory. There will be economic effects associated with loss of production capacity, tax revenue, employment and development revenue. These are difficult to assess until nature and extent of the wellhead protection area is determined. Consideration would have to be made during the next phase based on the cost/benefit analysis of different well locations with regards to the economic effects.

The effects of large-scale groundwater extraction on adjacent wells may have an economic impact on residential and agricultural properties in the area. These impacts may necessitate the drilling of new private wells to replace existing wells or they may require lands outside of the current service area to be connected to the water distribution system. These issues may result in an economic impact on the residents that were affected.

6.4.6 Costs

The estimated initial capital cost of Alternative C1 is $8,712,700 (see Table 6.1 for a summary of the preliminary estimate cost for all alternatives) and the annual operating cost is estimated at $271,500. The initial capita cost includes an allowance for the well head protection zone but does not include the cost of individual connections on private properties.

Funding assistance under the Ontario Small Town and Rural (OSTAR) Infrastructure Program has not been included. Alternatives are compared based on their total capital and operating costs.

6.4.7 Summary

The advantages of a communal well system include:

- Provides water that meets the Ontario Drinking Water Standards.
- Eliminates the water shortage problem within the community.
- Isolation from contaminants and improved quality control.
- Potential to increase property values.
- Economic development opportunities enhanced.

APPENDIX I: PRELIMINARY ESTIMATED COSTS FOR MAXVILLE (Class D)

	Alternative A	Alternative B		Alternative C1	Alternative C2	Alternative D	Alternative E	Alternative F
	Do Nothing	Individual Well Corrections	Apple Hill Communal Water Supply System	Maxville Communal Water Supply System with Fire Flow	Maxville Communal Water Supply System without Fire Flow	Maxville - Apple Hill Area Communal Water Supply System with Fire Flow	Alexandria - Maxville - Apple Hill Area Communal Water Supply System with Fire Flow	Maxville Purchase Water from Hawkesbury
Service Area	na	Maxville	Apple Hill	Maxville	Maxville	Maxville, Apple Hill, Dominionville	North Glengarry	Maxville
Supply Source	na	Individual Wells	Groundwater System	Groundwater System	Groundwater System	Groundwater System	Alexandria WTP with St. Lawrence River Pipeline	Vankleek Hill
			Apple Hill (3)	Maxville	Maxville	Maxville	Maxville (5)	Maxville (6)
Capital Costs								
Initial Capital Cost		up to $5,000 ea	$1,914,500	$8,712,700	$8,198,500	$9,139,900	$11,845,172	$14,996,400
Municipal Share After Subsidy (1)	100%		$1,914,500	$8,712,700	$8,198,500	$9,139,900	$11,845,172	$14,996,400
Annualized 20 Year Capital Cost (2)			$166,900	$759,600	$714,700	$911,138	$1,032,700	$1,307,400
Operating Costs								
1st Year Incremental Operating Cost (4)		up to $750 ea	$79,800	$271,500	$255,500	$262,276	$208,900	$261,100
Total Annualized Cost (20-Year Projection)			$246,700	$1,031,100	$970,200	$1,173,415	$1,241,600	$1,568,500

Cost per Equivalent Household for Maxville (7)						
Number of Equivalent Households	115	500	500	500	500	500
Capital Cost pre Equivalent Household	$16,648	$17,425	$16,397	$20,902	$23,690	$29,993
Annualized Capital Cost pre Equivalent Household (20 Years)	$1,451	$1,519	$1,430	$1,822	$2,065	$2,615
1st Year Operating Cost per Equivalent Household	$694	$543	$511	$525	$418	$522
Annual Capital and Operating Cost pre Equivalent Household	$2,145	$2,062	$1,941	$2,347	$2,483	$3,137
Monthly Capital and Operating Cost per Equivalent Household	$179	$172	$162	$196	$207	$261

Notes:

(1) Provincial OSTAR Infrastructure Funding Assistance not included

(2) Annual Capital Cost Payment is based on 20-year repayment at 6% per annum.

(3) Apple Hill Treatment Cost has been increased from the Apple Hill ESR to account for the new DWPR 459/00 and inflation.

(4) Alexandria WTP existing operating cost levy not included.

Estimates include Net GST (3.0002%)

(5) Includes Water purchased from Alexandria at $0.30/m^3$; no allowance for Capital buy-in.

(6) Includes Water purchased from Hawkesbury and Vankleek Hill at $0.40/m^3$; no allowance for Capital buy-in.

(7) This represents an approximate apportionment of estimated project costs and is not intended to be a final assessment.

(8) PV Annual Operating Cost is based on 20-year with 5% annual increase.

The disadvantages of communal groundwater system are:
- The impact on the natural environment.
- The communal groundwater system will create an increased demand on groundwater resources.
- The well head protection area may restrict the use of agricultural lands in terms of chemical and liquid waste application.

A groundwater based communal system would normally be the preferred alternative for this setting, i.e. a rural community with a moderate water demand. However, given the results of the hydrogeological investigation and the requirement for an extensive well head protection area, this alternative becomes significantly more costly and hence less viable. This alternative is a Schedule C activity in accordance with the Municipal Class Environmental Assessment document.

The initial capital cost for this alternative is significant and without assistance this alternative is not viable.

Alternative C1 does not meet all of the preliminary screening criteria as set out in Section 6.2.

6.5 Alternative C2 – Maxville Communal Groundwater System without Fire Flow

This alternative is similar to Alternative C1, however, the design capacity of the proposed system does not include an allowance for fire flow in accordance with the MOE guidelines. The design capacity of the system is therefore reduced to 2,145 m^3/day (472,000 IG/day) with an average daily flow of 954 m^3/day (210,000 IG/day).

From a design perspective, the water distribution system would not have fire hydrants nor would the system components such as high lift pumps, storage, treatment equipment, and well configuration be sized to meet the maximum day flow plus fire flow. The system components could be upgraded at a later date to provide for fire flows. The distribution system (piping) would accommodate future fire flows. The distribution system could provide water to the Fire Hall reservoir to augment the existing fire fighting capabilities.

The hydrogeological investigation concluded that extracting sufficient quantities of water to supply the design capacity for Maxville would require multiple wells, therefore, increasing the cost of the system. The number of wells and the size of some systems components (and hence the initial capital cost and operating cost) can be reduced by eliminating the fire flow component.

The physical differences between Alternative C1 and C2 are:

- a reduced maximum day design capacity to 2,145 m^3/d from 2937 m^3/day;
- a reduced number of wells for groundwater supply; and
- Reduced storage requirements.

The estimated initial capital cost of Alternative C2 is $8,198,500 (000 (see Table 6.1 for a summary of the preliminary estimate cost for all alternatives) and the annual operating cost is estimated at $255,500. The initial capita cost includes an allowance for the well head protection area.

Funding assistance under the Ontario Small Town and Rural (OSTAR) Infrastructure Program has not been included. Alternatives are compared based on their total capital and operating costs.

The environmental impacts associated with Alternative C2 are similar to Alternative C1, as are the advantages and disadvantages.

Alternative C2 is not a viable solution because it does not meet all of the requirements of the screening criteria. The criterion that this alternative fails to meet is affordability.

6.6 Alternative D – Area Communal Groundwater System

6.6.1 Service Area and Design Capacity

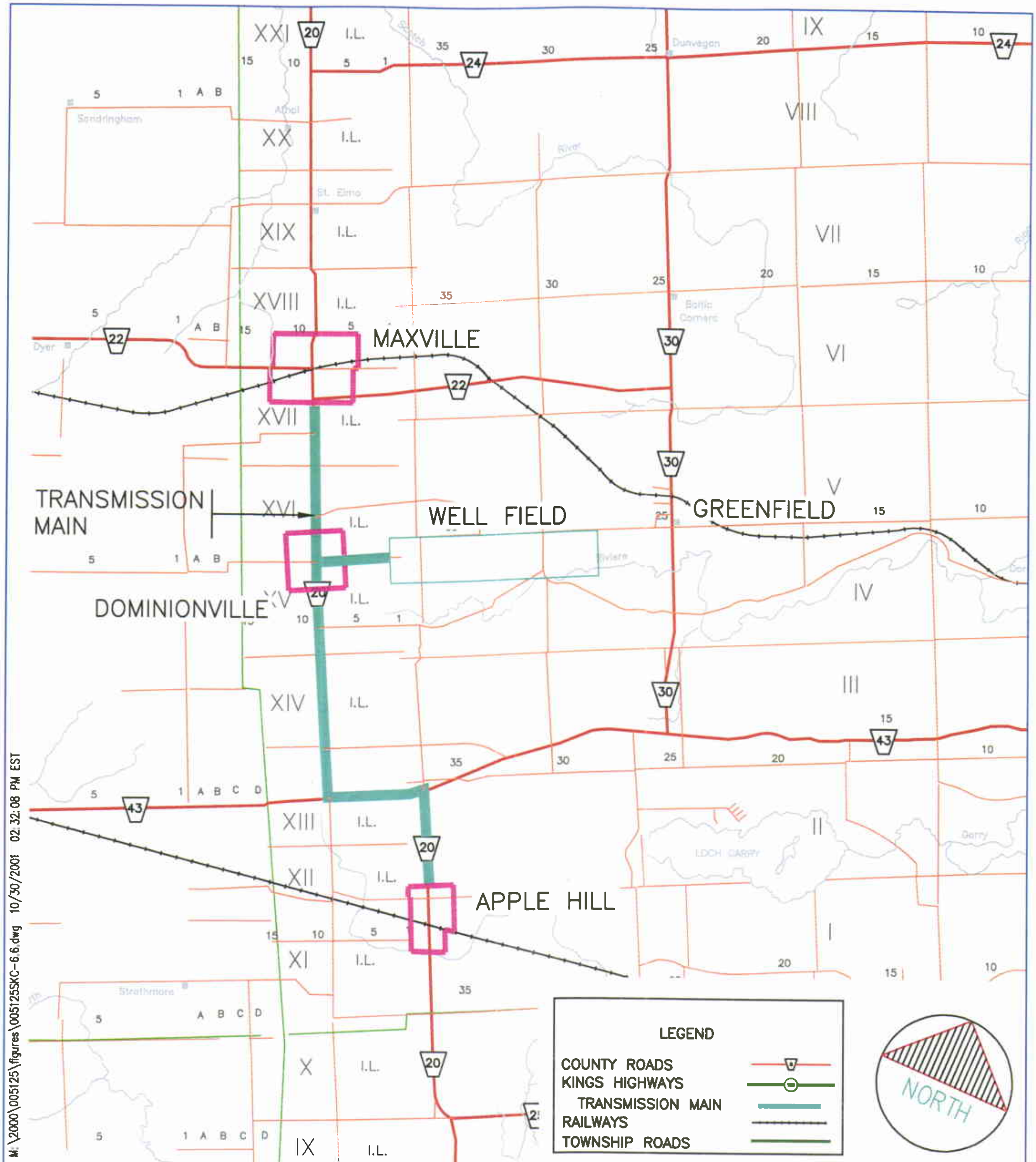
The proposed service area includes all existing developed properties and limited development for the anticipated 20-year planning period in the communities of Maxville, Apple Hill and Dominionville. The allowance for limited growth includes 1% per annum for population and industrial, commercial and institutional land uses.

The service area for this alternative is illustrated on Figure 6.6. The communal groundwater system will have the design capacity equal to the maximum day demand plus fire flow for Maxville, Apple Hill and Dominionville (see Table 3.3) which is 3,324 m^3/day (731,192 IG/day). Without fire flow this alternative would have a design capacity of 2,540 m^3/day (558,513 IG/day).

6.6.2 Description

Alternative D is an expansion of Alternative C. As noted in Section 6.6.1 the proposed service area includes the communities of Maxville (Alternative C), Dominionville and Apple Hill.

An Environmental Study Report (ESR) was completed in 1999 to identify a water supply source for Apple Hill. The ESR recommended a communal groundwater system without fire flow capability for Apple Hill. This alternative examines an area communal groundwater system that would meet the needs of Maxville and Apple Hill as well as provide the opportunity to service intermediate development such as Dominionville.



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MAXVILLE WATER SUPPLY
ENVIRONMENTAL ASSESSMENT
PHASE 2 REPORT

SERVICE AREA – ALTERNATIVE D:
AREA COMMUNAL GROUNDWATER SYSTEM

scale	1: 100,000
date	SEPT 2001
drawn	K.W.
job no.	005125
drawing no.	FIG 6.6

A communal groundwater system for Alternative D will consist of:

- A system of groundwater wells and low lift pumps;
- A treatment plant, consisting of filtration and disinfection, which will provide potable water which meets the level of treatment required by Ontario Regulation 459/00;
- High lift pumps and a transmission pipeline to move the water from the point of treatment to the water distribution systems in Maxville, Dominionville, and Apple Hill;
- Distribution systems in Maxville, Dominionville, and Apple Hill, including a booster station and re-chlorination facility in Apple Hill; and
- Storage reservoirs, located in Maxville and Apple Hill, for peak demand conditions, fire protection and emergency storage.

Figure 6.6 illustrates the approximate location of the well field and transmission main. The detailed hydrogeological investigation (Appendix E) has determined the nearest location for an adequate well field is east of Dominionville, approximately 3.5 km south of Maxville.

6.6.3 Natural, Social, and Economic Impacts

The natural, social, and economic impacts would be similar to Alternative C.

6.6.4 Costs

The estimated initial capital cost of Alternative D is $12,854,700 (see Table 6.1 for a summary of the preliminary estimate cost for all alternatives) and the annual operating cost is estimated at $322,600. The initial capita cost includes an allowance for the well head protection zone.

Funding assistance under the Ontario Small Town and Rural (OSTAR) Infrastructure Program has not been included. Alternatives are compared based on their total capital and operating costs.

6.6.5 Summary

The advantages and disadvantages are similar to Alternative C.

The advantages of a communal groundwater system include
- Provides water that meets the Ontario Drinking Water Standards.
- Eliminates the water shortage problem within the communities.
- Isolation from contaminants and improved quality control.
- Potential to increase property values.
- Economic development opportunities enhanced.

The disadvantages of communal groundwater system are

- The impact on the natural environment.
- The communal groundwater system will create an increased demand on groundwater resources.
- The well head protection area may significantly restrict the use of agricultural lands in terms of chemical and liquid waste application.
- There may be a drawdown of the water table that would affect other wells in the area.

A groundwater based communal system to serve two larger villages and the intermediate are would normally be the preferred alternative over individual systems servicing the two communities. However, in this circumstance, the cost of constructing a transmission main between the two communities increases the cost significantly enough to eliminate this option from further evaluation. This alternative is a schedule C activity in accordance with the Municipal Class Environmental Assessment document.

The initial capital cost for this alternative is significant and without assistance this alternative is not viable.

6.7 Alternative E – North Glengarry Regional System

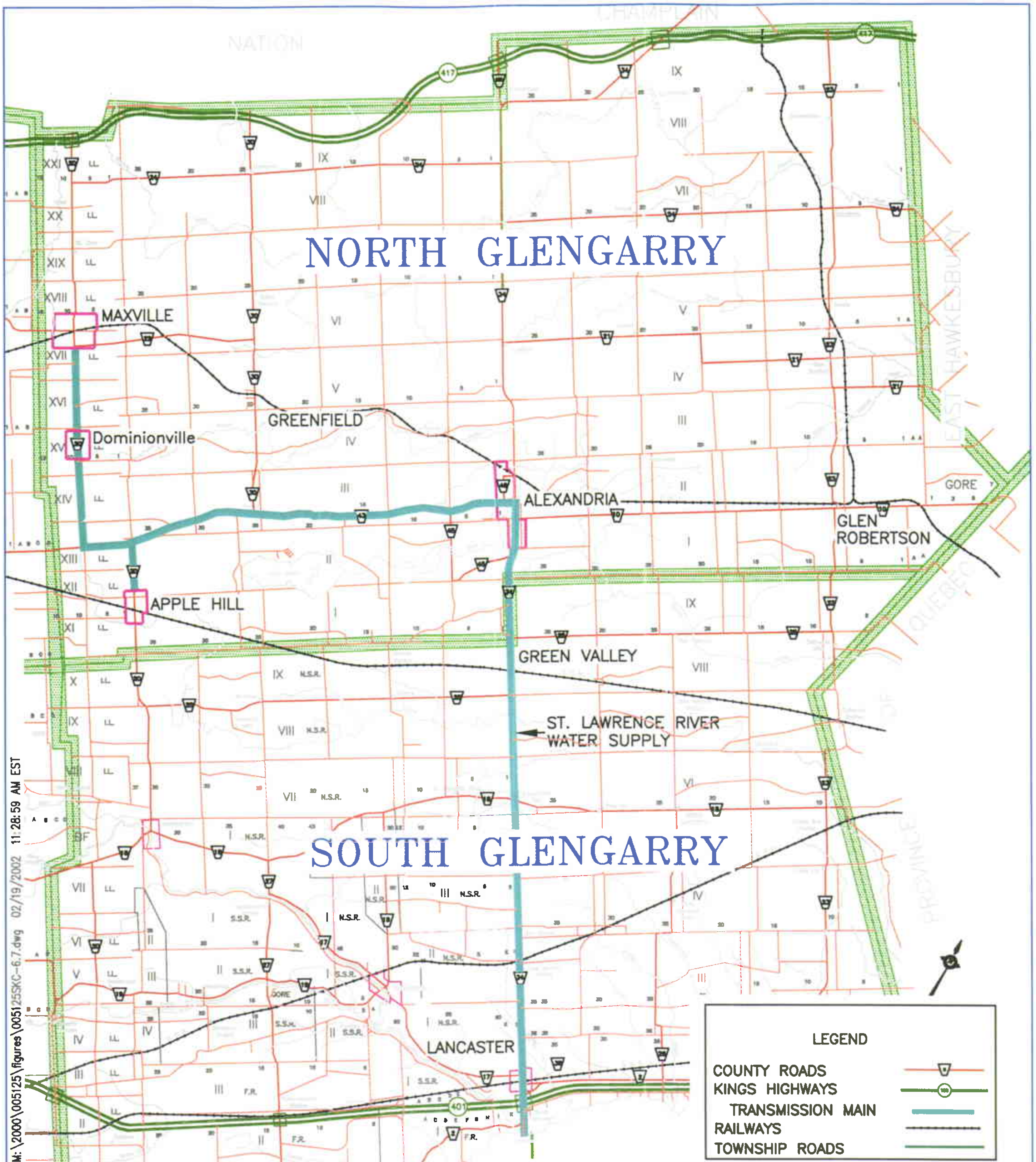
Alternative E is a long-term solution that involves a Regional Water Supply initially for Maxville, Alexandria, Dominionville, and Apple Hill and ultimately for other communities in North Glengarry.

Alexandria, which is 25 km from Maxville, has sufficient treatment capacity at the Water Treatment Plant, however, the water source is inadequate even for Alexandria. The Alexandria Water Supply issue needs to be addressed with a long-term solution.

Conceptually this alternative includes a raw water supply from the St. Lawrence River with treatment at the Alexandria Water Treatment Plant prior to distribution to Alexandria, Maxville, Apple Hill and Dominionville. Other communities such as Glen Robertson, Green Valley and Greenfield could connect in the future. Technologies such as recycling the wastewater from Alexandria could be employed to augment the Garry River supply or the St. Lawrence River Supply.

6.7.1 Service Area and Design Capacity

The proposed service area includes all residential, industrial, commercial and institutional properties within the communities of Alexandria, Maxville, Apple Hill, and Dominionville, as shown in Figure 6.7. An allowance for limited growth includes 1% per annum for population and industrial, commercial and institutional related growth over the 20-year planning period. The resulting design population is 9,815 as presented in Table 3.3. The Regional Water Supply concept makes provisions for the inclusion of other communities in North Glengarry in the future.



THE THOMPSON ROSEMOUNT GROUP INC
consulting engineers
CORNWALL FERGUS KINGSTON

MAXVILLE WATER SUPPLY
ENVIRONMENTAL ASSESSMENT
PHASE 2 REPORT

SERVICE AREA – ALTERNATIVE E:
NORTH GLENGARRY REGIONAL SYSTEM

scale	1: 200,000
date	SEPT 2001
drawn	K.W.
job no.	005125
drawing no.	FIG 6.7

The communal system will have a design capacity equal to the maximum day flow plus fire flow for Alexandria, Maxville, Apple Hill, and Dominionville (see Table 3.3) which is 9,178 m^3/day (2.02 MIGD). The average daily flow is 4,417 m^3 (0.97 MIGD). The current treatment capacity of the Alexandria WTP is 8,200 m^3/day (1.80 MIGD). As the capacity of the Alexandria WTP cannot meet the design capacity, additional storage will be required for fire and emergency conditions.

6.7.2 Description

The alternative would include:

- The construction of a pumping station at the St. Lawrence River and a transmission main from the St. Lawrence River to the Alexandria Water Treatment Plant,
- Upgrades to the Alexandria Water Treatment Plant,
- A transmission main would carry water to Maxville, Apple Hill, and Dominionville,
- A booster station and re-chlorination facility located near the intersection of County Road 20 and County Road 43 to maintain pressure and chlorine residuals in the system, and
- Storage reservoirs to provide fire protection and emergency storage in Maxville and Apple Hill.

The provision of a sustainable potable water supply (meeting Ontario Regulation 459/00; Ontario Drinking Water Standards) for many of the communities in the Township of North Glengarry is a significant challenge for the Council. The existing and potential future needs associated with water supply for area communities are summarized below.

<u>Alexandria</u>

Since 1954, the Town of Alexandria has obtained its water supply from the Garry River System subject to the provisions of a Permit to Take Water (PTTW). Notwithstanding the PTTW, there is a finite limit to this supply, which is highly influenced by seasonal meteorological conditions (i.e. precipitation). There have been periods in the recent past when the Town was in immediate danger of depleting its water supply. An on-going Water Supply Study is examining short term and long term alternative solutions. While final recommendations are not yet available, options being evaluated include the St. Lawrence River and wastewater recycling.

<u>Apple Hill</u>

The Environmental Study Report (ESR) completed in 1999, recommends a communal groundwater supply system for Apple Hill. Groundwater conditions in the Apple Hill area are suitable to support a medium flow water supply system without provision for fire flows.

<u>Maxville</u>

The Well Sampling Survey Report completed as phase 1 of the Environmental Assessment identified vast contamination of the wells in Maxville (65% of the wells sampled were contaminated). Aside from the groundwater contamination issue, the report also identified that approximately 19% reported low water yield.

Dominionville

A comprehensive survey of the existing wells in Dominionville has not been conducted. Dominionville is located between Maxville and Apple Hill and is therefore a logical candidate to connect to a regional system.

Other Communities That Could Potentially Benefit From a North Glengarry Regional System

Greenfield

Greenfield is located between Maxville and Alexandria and may therefore a logical candidate to connect to a regional system. A comprehensive survey of existing wells in Greenfield has not been conducted. However, based on water sampling at the former Kenyon Township Municipal building, there is evidence of (periodic) contamination. Eventually a municipal water supply project may be required.

Glen Robertson

The Glen Robertson community is serviced by a communal groundwater system. The distribution system was installed in 1982 and the groundwater supply and treatment system was commissioned in 1985. The only treatment provided at the water treatment plant (WTP) is disinfection by sodium hypochlorite. The extension of a transmission pipeline from Alexandria to this community would allow for the decommissioning of the existing water treatment plant.

Green Valley

If a pipeline is extended from the St. Lawrence River to provide the raw water source for the Township of North Glengarry, communities along the pipeline route, such as Green Valley, may choose to purchase water from North Glengarry or participate on a partnership basis.

A Regional Water Supply alternative presents the opportunity to examine and perhaps more cost-effectively implement water treatment technologies and water recycling/reuse technologies that can be shared on a regional basis. Partnerships with other municipalities may also be viable.

6.7.3 Natural Environment

After construction there would be very little impact to the natural environment as the majority of the installation would be underground and would not affect existing local ecosystems.

This alternative would include the following components that may result in impacts to the natural environment during construction:

- Raw water intake into the river;
- Low-lift pumping station;
- Raw water transmission main, and
- Distribution mains to communities.

The raw water intake may have the most significant impact on the natural environment by disturbing the river bottom and fish habitat. However, technologies such as directional boring may assist in mitigating these issues by reducing the disturbance to the river bottom. Regardless of the type of construction methodology utilized, an erosion control and sediment management plan consisting of silt curtains will be required. Additionally, construction timing should be coordinated to avoid conflicts with spawning periods in the target intake location of the river.

The low lift pumping stations will likely be located near the river shoreline and the excavation for the wet-well and building may impact on shoreline habitat, slope stability and sedimentation in the river. Incorporating a site selection process that includes consultation with MNR biologists to determine the constraints of site construction can mitigate any issues for the pumping station site. Furthermore, an erosion control and sediment management plan will be required for the construction.

For this alternative, the length of raw water feeder main is quite extensive. Therefore, there will be a variety of impacts that may have an effect on the natural environment:

- Stream and marsh crossings – effects on habitat, vegetation
- Surplus excavation material – site geology and interception of groundwater flow
- Removal of trees from feeder main alignment – destruction of vegetation
- Noise, dust – effects on habitat, vegetation, water and air quality

Some of these impacts will be minor and can be mitigated using prudent and efficient construction practices, however there will be some impacts that cannot be mitigated completely due to the nature of open cut pipe installation. A comprehensive pollution and sediment management plan implemented by the contractor will keep any impacts to a minimum.

The transmission line would be designed to follow existing road allowances where feasible to avoid having to acquire additional land or easements and to reduce the impact on the natural environment.

6.7.4 Social Environment

The principal long-term social impact would be loss of shoreline property use for residential and recreational uses. Furthermore, noise associated with the pumping of the raw water to Alexandria would impact properties adjacent to the low-lift pumping station.

During construction, there would be impacts associated with noise, dust, and traffic. Again, these can be mitigated somewhat by an appropriate construction management plan and good public relations.

The tax base can be affected by a suitable water supply. Property values typically increase, economic development opportunities are enhanced and fire insurance rates are decreased as a result of an adequate communal water supply.

6.7.5 Economic Environment

The capital and operating costs that would be associated with this alternative are significant.

A benefit associated with this alternative would be to provide small communities along the proposed transmission main alignment with raw water that could be treated and used as a municipal water supply. The raw water could be sold to the intermediate communities (Green Valley for example) to assist in reducing the economic impact on the Township of North Glengarry.

6.7.6 Cost

The estimated initial capital cost of Alternative E is $23,802,300 (see Table 6.1 for a summary of the preliminary estimate cost for all alternatives) and the annual operating cost is estimated at $372,800. The capital cost appointment to Alexandria would be approximately $8,975,600 and the capital cost appointment to Maxville, Apple Hill, and Dominionville would be approximately $14,826,700. The incremental annual operating cost is estimated at $112,800 for Alexandria and $260,000 for Maxville, Dominionville and Apple Hill.

Funding assistance under the Ontario Small Town and Rural (OSTAR) Infrastructure Program has not been included. Alternatives are compared based on their total capital and operating costs.

6.7.7 Summary

The advantages of this alternative include
- Provides for a continuous, sufficient supply of raw water.
- Ability to meet the Ontario Drinking Water Standards.
- More fully utilizes the infrastructure that exists (Alexandria WTP).
- Provides a solution for the Alexandria water supply problem.
- Resolves water quality and quantity problems for a number of communities in North Glengarry.
- Provides small communities along the proposed transmission main alignment with raw water that could be treated and used as a municipal water supply.
- Water treatment is consolidated in a single facility.
- Potential to increase property values.
- Economic development opportunities enhanced.

The disadvantages of this alternative are
- The impact on the natural environment during construction and following construction due to the raw water intake in the river, low-lift pumping station, and the transmission line.
- Affordability
- Agreements with neighboring municipality
- Approval for water taking

As a long term strategy, the North Glengarry Regional Water Supply System has merit. However, without substantial financial assistance from the Province of Ontario (or other source), this alternative is not affordable, hence it does not meet all of the screening criteria.

The initial capital cost for this alternative is significant and without assistance this alternative is not viable.

This alternative would be a schedule C activity according to the MEA Municipal Class Environmental Assessment documentation.

6.8 Alternative F – Connection to Adjacent Community Water Supply

This alternative considers a pipeline from the Vankleek Hill water supply to Maxville.

6.8.1 Service Area and Design Capacity

The proposed service area includes all residential, industrial, commercial and institutional properties that are currently serviced by the municipal sewage system in Maxville. The allowance for limited growth includes 1% per annum for population and industrial, commercial and institutional land users.

The communal water supply system will have the design capacity equal to the maximum day demand plus fire flow for Maxville (see Table 3.3). The design capacity is 2,937 m^3/day.

6.8.2 Description

Purchasing water from an adjacent municipality is a common approach to managing a water supply problem. In the immediate area, South Stormont Township purchases water from the City of Cornwall for St. Andrews West, Champlain Township purchases water from Hawkesbury for Vankleek Hill, and Elizabethtown Township purchases water from Brockville for Long Beach and Sherwood Springs. Consultants representing Nation Township were contacted to inquire about the activities of water infrastructure developments. The consultants indicated that the Nation Township had submitted an application to the Ontario Small Town and Rural (OSTAR) Infrastructure Program, under Round 1 Option 2 program, for funding of a water supply for the Village of Fournier. Fournier is located approximately 20 km northwest of Maxville. The groundwater supply for Fournier is not planned to accommodate other communities.

A discussion with the Ontario Ministry of the Environment, Planning and Approvals Branch confirms that there has been a proposal to develop a regional water supply in the Rockland-Clarence area. However, this proposal is preliminary and would require a pipeline from the Ottawa River.

The transmission main from Hawkesbury to Vankleek Hill has sufficient capacity to supply Maxville and it is assumed that the Hawkesbury Water Treatment Plant has sufficient reserve capacity to supply Maxville. Some of the Hawkesbury WTP reserve capacity has been committed to Champlain Township for L'Orignal through a draft water supply agreement.

This alternative would require:

- A water supply agreement with the Nation Township and the Town of Hawkesbury to supply potable water to the Maxville;
- A pipeline between Vankleek Hill and Maxville (35 km);
- A booster station and re-chlorination facility to maintain pressure and chlorine residuals in the system,
- A distribution system in Maxville; and
- A storage reservoir with booster pumping station, located in Maxville for peak demand conditions, fire protection and emergency storage.

6.8.3 Natural, Social and Economic Impacts

The natural, social, and economic impacts would be similar to those related to the construction of the transmission main contained in Alternative E.

6.8.4 Cost

The estimated initial capital cost of Alternative E is $14,996,400 (see Table 6.1 for a summary of the preliminary estimate cost for all alternatives) and the annual operating cost is estimated at $226,300. The annual operating cost includes an allowance of $0.30/m^3 to purchase water from Champlain Township. This is the same rate that Champlain Township pays to Hawkesbury.

The initial capital cost for this alternative is significant and without assistance this alternative is not viable.

This alternative does not meet all of the screening criteria.

7 Preferred Alternative

7.1 *Discussion*

At the conclusion of Phase 2 of an Environmental Assessment, typically the evaluation process has produced a preferred alternative solution that meets all of the screening criteria. In this case, none of the alternatives that were evaluated met all of the criteria. Affordability is the principle criterion that is not met.

Alternative A – Do Nothing (EA terminology), as the name implies proposes no further action. This alternative clearly does not provide a solution to the Maxville water supply problem, however, **this will be the recommended short-term alternative until such time as an affordable long-term alternative can be implemented.**

Individual property owners are encouraged to sample and test their water frequently. If they have concerns with respect to the water quality, they should consider installing treatment systems. Even with treatment systems installed, water tests should be conducted frequently and the treatment systems should be rigorously maintained in accordance with the manufacturers' requirements.

Alternative B – Individual Well Correction and Treatment System Program, is not a viable alternative. As discussed in the Report, hydrogeological conditions are such that a safe and sufficient individual well supply cannot be found for each property in Maxville. Groundwater contamination and intermittent water shortages are likely to continue to persist because of the aquifer's vulnerability.

Alternative - C1 and C2 (Maxville Groundwater Communal System) and Alternative D (Maxville and Apple Hill Groundwater Communal System) are not practical because of the difficulties relating to extracting relatively large volumes of water from the Maxville area aquifers. The detailed hydrogeological investigation confirms that there are no low vulnerability high yielding aquifers in the immediate area, and the complexities associated with managing an expansive well head protection area for multiple wells add substantially to the capital and operating costs.

Alternative E – North Glengarry Regional System, **is the recommended long-term alternative** solution. This alternative presents an opportunity to address existing water supply problems for several communities within North Glengarry including Maxville, Apple Hill, and Alexandria. It will provide a strategy for addressing future water supply needs in North Glengarry. Alternative E is a comprehensive long-term solution. However, **without funding assistance this alternative is not viable.**

Alternative F – Connecting to Adjacent Municipal Water Supply in Vankleek Hill is not recommended due to the high initial capital cost and the on-going cost of purchasing water from the Municipality of Champlain and Hawkesbury.

7.2 Recommended Solution

7.2.1 Short-term Strategy

For the short-term the recommended solution is Alternative A - "Do Nothing". The Public Liaison Committee recognizes that this alternative does not provide a solution to the residents of Maxville and therefore, recommend further evaluation of Alternative E for implementation in the long-term.

7.2.2 Long-term Strategy

For the long-term the recommended solution is Alternative E - "North Glengarry Regional System". This alternative provides a continuous, sufficient supply of raw water that is readily treatable at the Alexandria Water Treatment Plant and presents a solution to water supply problems for a number of communities in North Glengarry. It warrants further evaluation. A Regional Water Supply System presents the opportunity to examine and perhaps more cost-effectively implement water treatment technologies and water recycling/reuse technologies that can be shared on a regional basis.

7.3 The Next Step

This document is prepared for public and review agency consultation in accordance with the Planning and Design Process for Municipal Water and Wastewater Projects, MEA 2000.

Based on input from the review agencies and the public during the consultation period, the Public Liaison Committee will select the preferred solution and recommend that the Council of the Township of North Glengarry endorse the recommendation, prior to proceeding to Phase 3.

Phase 3 of the EA process involved a more detailed examination and cost estimate along with preliminary engineering for the preferred solution. Public and review agency consultation precedes the publication of the final Environmental Study Report (ESR) document and application for funding assistance.

7.4 Class EA Process – Part II Order

If members of the public, interest groups and government agencies feel that a project warrants the special evaluation of an individual environmental assessment, they may request this in writing to the Minister of the Environment. The Minister determines whether a "Part II Order" is warranted. If the Order is granted, the project cannot proceed until the individual environmental assessment has been completed. However, if the Order is denied, the Minister's decision is final.

The public and government agencies will be provided with the opportunity to voice their concerns and questions regarding this project and its results. The proponent and their consultant will make every reasonable attempt to address any concerns brought forward.

The Ministry of the Environment
135 St. Claire Avenue West
Toronto, Ontario M4V 1P5

Respectfully Submitted,

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Environmental Engineer

8 References

A.J. Graham Engineering Consultants Ltd. Alternatives for Sewage Systems Upgrading in the Village of Maxville. 1983.

A.J. Graham Engineering Consultants Ltd. Report on Artificial Wetland Treatment of Municipal Wastewater. 1985.

Bolton, D.J., C.M. Byrnea, J.J. Sheridana, D.A. McDowell, I.S. Blairb, and T. Hegartyc. The survival characteristics of a non-pathogenic strain of *Escherichia coli* O157:H7. Interenet: http://www.research.teagasc.ie/vteceurope/S+Gprog/boltonsg.html

CH2M Hill. Eastern Ontario Water Resources Management Study, March 2001.

Environment Canada. Fraser River Action Plan. Groundwater Quality Protection Practices. 1990.

Freeze, R.A. and J.A. Cherry. Groundwater. Prentice-Hall Inc., 1979.

Kostuch Engineering Ltd. Report on Private Sewage Services in the Village of Maxville. 1981.

Ministry of the Environment. Water Pollution Survey, Village of Maxville, County of Glengarry, 1979.

M.S. Thompson and Associates Ltd. Alexandria Water Supply – Phase 1 and 2 Report. 2000.

M.S. Thompson and Associates Ltd. Village of Maxville – Water Sampling and Survey Report. 1999.

Trow Ltd. Geotechnical Investigation – Proposed Sanitary Sewer System, Village of Maxville, Ontario. 1985.

Trow Ltd. Supplementary Report: Geotechnical Investigation – Proposed Sanitary Sewer System, Village of Maxville, Ontario. 1985.

U.S. Environmental Protection Agency. Wellhead Protection: A Guide for Small Communities. EPA/625/R-93/002. Office of Research and Development. Office of Water. Washington D.C. 20460. February 1993.

Water and Earth Science Associates Ltd. Hydrogeological Report on the Village of Maxville. 1981.

Waterloo Hydrogeologic Inc. WHPA Analytical Model Simulation of Drawdown Predictions in Maxville. 2001.

Aerial photography
- A23964-66 (1975)
- A10910 (1947)
- A28048-123 (1994)

Geological mapping
- Quaternary Geology – Alexandria Area, Map P. 906, ODM 1973
- Palaeozoic Geology – Maxville Area, Map 661A, 1941.