# COMPREHENSIVE STUDY REPORT

# MITCHELL WELL SUPPLY UPGRADING PROJECT

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# COMPREHENSIVE STUDY REPORT

## EXECUTIVE SUMMARY

# MITCHELL WELL SUPPLY
# UPGRADING PROJECT

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# EXECUTIVE SUMMARY

## 1.0 INTRODUCTION

### 1.1 Project Summary

The Corporation of the Municipality of West Perth, located northwest of Stratford along Highway 8, has upgraded the Mitchell Water Works to address a series of identified operational deficiencies. The upgrading plan included the development of a new well, the construction of a treatment building, the installation of a ground-level reservoir (to adequately disinfect treated water prior to distribution) and ancillary works. The new well supply augments the three existing well sources in order to increase the total supply capacity within the system.

A site for the new municipal well supply (referred to as the Arthur Street well supply) was selected after consideration of technical investigations, environmental impacts and potential benefits. The site is located on the same property as the West Perth Works Centre, which is situated along the route of Arthur Street immediately north of the Herbert Street intersection.

### 1.2 Federal Regulatory Context

The Mitchell Well Supply Upgrading Project was initiated under the terms of the Canada-Ontario Infrastructure Program (COIP), which is administered by Industry Canada. This program was initiated in 2000 as a partnership between the federal, provincial and municipal governments to improve urban and rural municipal infrastructure in Ontario. In accordance with the terms of the COIP partnership agreement, each party provides an equal financial contribution to approved projects.

The *Canadian Environmental Assessment Act* applies to federal authorities when they contemplate some action in relation to a project that would enable it to proceed in whole or in part. A federal environmental assessment may be required when a federal authority:

(a) is the proponent of a project;
(b) provides financial assistance to the proponent;
(c) makes federal lands available for the project; or
(d) issues certain permits or licences, or other approvals.

Therefore, a federal environmental assessment was required prior to a decision being made by Industry Canada to fund the project.

Part III, item 10 of the *Comprehensive Study List Regulation* requires that a comprehensive study be conducted for projects proposing an expansion of a facility for the extraction of 200,000 $m^3/a$ or more of ground water that would result in an increase in production capacity of more than 35%. The Mitchell Well Supply Upgrading Project involves the construction of a new municipal well supply capable of providing approximately 3,153,600 $m^3/a$ (representing an 82% increase in total system supply capacity). Accordingly, a comprehensive study was completed for the project.

No other federal land, funding, or approvals are required for the project.

### 1.3 Provincial Regulatory Context

The project was also subject to the Class Environmental Assessment developed for municipal infrastructure projects (i.e., roads, water and wastewater projects) and followed the procedures set out in the *Municipal Class Environmental Assessment* (Class EA) document. With respect to the Mitchell Well Supply Upgrading Project, certain project components were considered Schedule B activities (i.e., development of a new ground water supply). Schedule B projects generally include improvements and minor expansions to existing facilities with a potential for some adverse environmental impacts. Projects are approved following the completion of a formal environmental screening process.

The provincial Class Environmental Assessment for the project was carried out between May 2002 and November 2003. The proponent selected the Mitchell Well Supply Upgrading Project as the preferred strategy for resolving the identified problems. In accordance with the *Safe Drinking Water Act*, implementation of the project required a Permit to Take Water (for the new well supply) and a Certificate of Approval (for site servicing). Both permits have been obtained for the project.

## 2.0 SCOPE OF THE PROJECT

The scope of the project assessed included the construction, operation and decommissioning of a new municipal well supply, and included:

- the development of a municipal well supply capable of providing a total supply capacity of 100 L/s (8,640 $m^3$/d, 3,153,600 $m^3$/a);
- the construction of a pumphouse to house discharge pumps, treatment equipment, instrumentation, discharge monitoring and controls, and process piping;
- the installation of a ground-level reservoir adjacent to the planned pumphouse to provide chlorine contact time prior to discharging of treated water to the distribution system;
- the installation of standby power facilities adjacent to the pumphouse; and,
- the extension of site servicing (e.g., watermain, storm sewers, sanitary sewers) to the Arthur Street road allowance to interconnect with existing infrastructure; and,
- Construction of a gravel access road and concrete parking area.
- The Mitchell Well Supply Upgrades project has been implemented to address known deficiencies with the existing waterworks, including an inadequate firm supply demand and in adequate long-term supply capacity.

## 3.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

The new well supply, referred to as the Arthur Street well supply, is located in the southeast section of the community in an area that is predominantly industrial in character. The 1.4 ha parcel is situated on lands described as Part of Park Lot 40, Registered Plan 339, (former) Town of Mitchell.

The subject property is situated within the industrial sector of Mitchell; an area which includes a number of active manufacturing activities and an operational railroad. The nearest industrial building is situated approximately 50 m from the new pumphouse facility.

Soils in the vicinity of the project are classified as Perth clay loam; a series of the Grey-Brown Podzolic soil group. These till loams are typically comprised of 15 cm of dark grey clay or silt loam, mottled most intensely above the parent material. Natural drainage within the Perth clay loam series is poor to imperfect. Ground water from the project area flows towards the Thames River.

The Arthur Street well site is comprised almost entirely of landscaped lawn. Certain landscaping features have also been completed on the site; specifically a small planting area comprised of two spruce trees and a bush, a single deciduous tree recently planted and a row of coniferous (pine) trees planted along the eastern limit of the property (providing aesthetic screening). The tree cover is very limited in scale and does not include sensitive species. There is also little vegetation within the corridor for the ancillary works, given that industrial character of this developed area. Local vegetation is limited to manicured grasses and landscaping features (i.e., limited tree and shrub plantings).

The community of Mitchell does not exhibit any cultural heritage features which would be affected by the project. There are also no substantive Aboriginal communities evident within the regional boundary of this project (as defined in section 1.8.1 of the report).

Land uses adjacent to the project site are industrial and include: a public works yard and railroad line to the north; a farm equipment manufacturer to the west; a construction works yard to the south; and, a fencing manufacturer to the east.

## 4.0 ASSESSMENT OF LIKELY ENVIRONMENTAL EFFECTS AND MITIGATION

This comprehensive study report considered the potential adverse environmental effects of the project on the following environmental components:

- Ground water quantity and quality
- Surface water quantity and quality
- Vegetation
- Species at risk
- Migratory birds
- Wildlife
- Noise
- Air quality
- Heritage and historical cultural resources
- Capacity of renewable resources

Also assessed were likely effects of the environment on the project, the effects of accidents and malfunctions, and cumulative effects. Where effects were identified, mitigation measures were proposed to avoid, minimize, or compensate for these effects. Table 4.1 summarizes the general findings of environmental effects analysis.

**Table 4.1**
**Mitchell Well Supply Upgrading Project**
**Summary of Environmental Effects**

| Environmental Component | Environmental Effects Analysis | | | | | | Residual Effects | |
|---|---|---|---|---|---|---|---|---|
| | Potential Adverse Effects | | | Potential for Full Impact Mitigation | | | Are Effects Significant? | |
| | Yes | No | Uncertain | Yes | No | Uncertain | Yes | No |
| **Physical and Natural Environments** | | | | | | | | |
| Ground water quantity and quality | *x* | | | | *x* | | | *x* |
| Surface water quantity and quality | | *x* | | *x* | | | | *x* |
| Vegetation | *x* | | | | *x* | | | *x* |
| Species at Risk | *x* | | | *x* | | | | *x* |
| Migratory Birds | *x* | | | *x* | | | | *x* |
| Wildlife | *x* | | | | *x* | | | *x* |
| Noise | *x* | | | *x* | | | | *x* |
| Air quality | *x* | | | *x* | | | | *x* |
| Capacity of renewable resources | *x* | | | | *x* | | | *x* |
| **Cultural Environment** | | | | | | | | |
| Heritage and historical cultural resources | | *x* | | *x* | | | | *x* |
| **Environmental Conditions** | | | | | | | | |
| Erosion, ice encroachment and scour hazards | *x* | | | *x* | | | | *x* |
| Seismic activity | *x* | | | *x* | | | | *x* |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| Climate change | ***x*** | | | ***x*** | | | | ***x*** |
| **Accidents, Malfunctions and Adverse Conditions** | | | | | | | | |
| Construction phase | ***x*** | | | ***x*** | | | | ***x*** |
| Operations phase | ***x*** | | | ***x*** | | | | ***x*** |
| Decommissioning phase | ***x*** | | | ***x*** | | | | ***x*** |

Taking into consideration the implementation of mitigation measures, the review of the potential interactions between the project and these environmental components did not result in the identification of any likely significant adverse environmental effects.

## 5.0 ASSESSMENT OF CUMULATIVE EFFECTS

Cumulative effects represent the combined impacts of successive actions upon an environmental setting. Based upon an assessment of the undertaking and other projects being carried out or considered in the community, the following potential cumulative effects were identified:

- Cumulative effects of the project with other developments planned in Mitchell.

An assessment methodology was carried out to evaluate the nature and magnitude of these cumulative impacts within the context of the existing environment setting and future community development. Following consideration of the existing environmental conditions and nature and magnitude of development activity anticipated in the community, it was concluded that the implementation of the Mitchell Water Works Upgrading Project, in combination with past, existing or imminent projects is not expected to represent an action which will generate any significant adverse cumulative effects upon the defined regional boundary.

## 6.0 PUBLIC CONSULTATION

The public consultation program for this comprehensive study incorporated the following components:

- A public registry was established for the project and listed on the Canadian Environmental Assessment Registry (reference number 04-03-8000).

- A public notice detailing the public comment period (22 days) for the draft scoping document and notifying the public of the availability of participant funding for participation in the study was published in two local community newspapers on April 13, 2005 and was also posted on the Industry Canada and Canadian Environmental Assessment Agency Internet sites. No written or oral comments were received.

- A public notice detailing a second public comment period (24 days) and providing the public with the opportunity to submit comments or concerns related to the environmental implications of the proposed project was circulated in two local community newspapers on January 11, 2006 and was also posted on the Industry Canada and Canadian Environmental Assessment Agency Internet sites. No written or oral comments were received.

A third public comment period will be provided following the completion of the comprehensive study report, at which time, the public will be provided with a 30-day review period to provide written comments on the project to the Canadian Environmental Assessment Agency. Notices detailing the completion of the report and the review periods will be advertised in local community newspapers.

## 7.0 MONITORING AND FOLLOW-UP PROGRAM

A monitoring and follow-up program was designed to verify the accuracy of the EA predictions and to confirm that the mitigation measures identified were effective. The follow-up program was limited to the potential long-term impacts of the project on ground water quantity and quality, because standardized construction procedures with well-documented mitigation have been proposed and ground water resources represent the most likely environmental features to be adversely impacted by project implementation. The follow-up and monitoring program will include:

- Additional monitoring of existing wells in the area, including private wells, will be carried out during the initial 18-month period of well operation to confirm the impacts resulting from the pumping of Well 4. Data gathered during this period will provide information on the initial conditions of existing wells within the general cone-of-influence. This information will be used to monitor impacts associated with well pumping and to respond to any adverse impacts over the operational phase of the project (e.g., excessive drawdown of private wells).

- Additional monitoring of chemical and microbiological parameters will be carried out in accordance with Ontario Ministry of the Environment sampling requirements. If water quality problems are encountered over the operational phase of the project, remedial measures will be taken to address the identified problems and additional monitoring and reporting will occur.

- Further assessment of the vulnerability of the Well 4 capture zone will be conducted; building upon the findings of an ongoing source water protection and any related investigations. Remediation measures will also be defined for any potential contaminant risks identified though these investigations.

Monitoring and reporting activities associated with the Follow-up Program will be carried out for a period of three years from the time that Well 4 is commissioned. If interference problems are found, remedial measures will be taken to address the identified problems and additional monitoring and reporting will occur, as necessary.

Industry Canada and the Canadian Environmental Assessment Agency will be provided with the data generated from the monitoring process (as summarized the 18-month monitoring report and annual well reports) and findings will be posted on the CEA Registry. The availability of findings from the follow-up program will be posted on the CEA Registry.

## 8.0 CONCLUSIONS AND RECOMMENDATIONS

The environmental effects of the project were evaluated with respect to accidents and malfunctions, effects of the environment on the project, alternative means, the capacity of renewable resources and cumulative effects. Mitigation measures were identified to address any potential effects of the project. Taking into consideration the implementation of mitigation, Industry Canada has concluded that the construction, operation and decommissioning of the Mitchell Well Supply Upgrading Project is not likely to result in any significant adverse environmental effects. A monitoring and follow-up program has also been designed to ensure the accuracy of this conclusion.

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# MITCHELL WELL SUPPLY UPGRADING PROJECT

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# 1.0 INTRODUCTION

## 1.1 Purpose and Overview of Project

The Corporation of the Municipality of West Perth, the project proponent, has upgraded the Mitchell Water Works to address a series of identified operational deficiencies. The upgrading project included the development of a new well, the construction of a treatment building, the installation of a ground-level reservoir (to adequately disinfect treated water prior to distribution) and ancillary works. The new well supply augments the three existing well sources in order to increase the total supply capacity within the system.

The improvements to the existing municipal water system constitute the *Community of Mitchell Well Supply Upgrading Project.* Project contacts are as follows:

| **Municipal Contact:** | **Consultant Contact:** |
|---|---|
| Phil Graul, Water System Operator<br>West Perth Power Inc.<br>169 St. David Street<br>Mitchell, ON N0K 1N0<br>philgraul@westperth.com | Scott Allen, Planner<br>B.M. Ross and Associates Limited<br>62 North Street<br>Goderich, ON N7A 2T4<br>sallen@bmross.net |

## 1.2 General Description of the Community and the Municipal Water System

The community of Mitchell, Ontario is the most prominent urban centre in the Municipality of West Perth. The community, which is generally located at the intersection of Provincial Highway Nos. 8 and 23, has a population of approximately 4,000 persons. Mitchell is largely a residential and commercial centre, however the community does exhibit a relatively strong industrial sector. Figure No. 1 to Appendix A illustrates the general location of Mitchell.

Water is supplied to customers in Mitchell via a municipal water system first commissioned in the 1930's. Prior to the commencement of the upgrading project, the system, referred to as the Mitchell Water Works, was comprised of three drilled bedrock well supplies (Wells 1, 2 and 3) discharging to a common pumphouse and reservoir for treatment. The system also includes a 3,900 $m^3$ elevated water storage facility (standpipe) and a network of distribution watermain. Wells 1, 2 and 3 are bedrock well supplies having total rated supply capacities of 30.3 Litres per second (L/s), 37.5 L/s and 53.0 L/s, respectively. The total capacity of the three wells is 120.8 L/s.

The system provides service to approximately 1510 residential properties, three major industrial users and a number of smaller industrial, commercial and institutional customers. West Perth Power Inc. operates the water system on behalf of the Municipality of West Perth and in accordance with Ministry of the Environment Certificate of Approval No. 0334-6CBRU7. Under *Ontario Regulation 128/04*, the Mitchell Water Works is designated as a Class III municipal residential system. Figure No. 2 to Appendix A illustrates the general location of the major waterworks facilities associated with the Mitchell Water Works.

In May 2002, the Municipality of West Perth initiated a Municipal Class Environmental Assessment under the *Environmental Assessment Act* of Ontario to resolve several problems with Mitchell Water Works including these key deficiencies:

- **Inadequate firm supply capacity.** The Mitchell water system requires additional supply to achieve a firm capacity greater than the existing maximum day demand (firm supply capacity is defined as the rate at which water can be supplied to the distribution system with the largest supply being out of service for any reason). Firm water supply capacity for the Mitchell system is currently rated at 67.8 L/s, which is significantly less than the base year design maximum day demand (87.2 L/s). An additional 19.4 L/s of supply capacity is therefore needed to address this deficiency.

- **Inadequate long-term supply capacity.** The Mitchell water system requires additional supply to effectively accommodate the estimated maximum day design demand for the 22-year planning period (2004-26). Total system capacity for the Mitchell system is currently rated 120.8 L/s, which is significantly greater than the rated system capacity (90.9 L/s) and the estimated maximum day design demand (98.7 L/s) for the planning period. However, it is uncertain whether the total supply capacities of Wells 2 and 3 can be sustained in the long term. An additional supply source is therefore considered necessary to resolve this concern.

The Class EA investigation was completed in November 2003. The proponent selected the Community of Mitchell Well Supply Upgrading Project as the preferred strategy for resolving the identified problems.

## 1.3 Project Description

### 1.3.1 General

The project involved the development of a new well, the construction of a treatment building, the installation of a ground-level reservoir (to adequately disinfect treated water prior to distribution) and ancillary works. A site for the new municipal well supply was selected after consideration of technical investigations, environmental impacts and potential benefits. The site is located on the same property as the West Perth Works Centre, which is situated along the route of Arthur Street immediately north of the Herbert Street intersection.

### 1.3.2 Arthur Street Well Supply

The new well supply, referred to as the Arthur Street well supply, is located in the southeast section of the community in an area that is predominantly industrial in character. The 1.4 ha parcel is situated on lands described as Part of Park Lot 40, Registered Plan 339, (former) Town of Mitchell.

Development of the Arthur Street well supply involved the following principal activities:

- Development of a municipal well supply capable of providing a total supply capacity of 100 L/s. This yield was accomplished by developing a new bedrock well supply (Well 4). The new well was established through the redevelopment of an existing test well (TW2/03) in order to access the aquifer evaluated during the hydrogeological investigation.

- Construction of a pumphouse to house discharge pumps, treatment equipment, instrumentation, discharge monitoring and controls, and process piping.

- Installation of a ground-level reservoir adjacent to the new pumphouse to provide chlorine contact time prior to discharging of treated water to the distribution system.

- Installation of standby power facilities adjacent to the pumphouse.

- The extension of site servicing (e.g., watermain, storm sewers, sanitary sewers) to the Arthur Street road allowance to interconnect with existing infrastructure.

## 1.4 Regulatory Context

### 1.4.1 Federal Environmental Assessment Process

The Municipality of West Perth initiated the Mitchell Well Supply Upgrading Project under the terms of the Canada-Ontario Infrastructure Program (COIP). This program was initiated in 2000 as a partnership between the federal, provincial and municipal governments to improve urban and rural municipal infrastructure in Ontario. In accordance with the terms of the COIP partnership agreement, each party provides an equal financial contribution to approved projects.

Municipalities proposing infrastructure projects and related activities requiring financial assistance from the Government of Canada must adhere to the environmental assessment (EA) requirements prescribed by the *Canadian Environmental Assessment Act* (CEA Act). Pursuant to section 5 of the CEA Act, an environmental assessment must be conducted before a decision on the funding allocation can be made.

With respect to ground water extraction, Part III, item 10 of the *Comprehensive Study List Regulation* prescribes that comprehensive studies are required for projects proposing an expansion of a facility for the extraction of 200,000 $m^3$/a or more of ground water that would result in an increase in production capacity of more than 35%. The Mitchell Well Supply Upgrading Project incorporates the construction of a new municipal well supply capable of providing approximately 3,153,600 $m^3$/a (representing an 82% increase in total system supply capacity). Accordingly, completion of a comprehensive study process is required before a decision can be made by Industry Canada to provide federal government COIP funding for the project.

### 1.4.2 Provincial Environmental Assessment Process

Municipalities proposing infrastructure projects and related activities must adhere to the environmental assessment requirements prescribed by the *Environmental Assessment Act* of Ontario (EA Act). In general, the intent of the EA Act is to establish a project review process to promote the protection, conservation and effective management of the environment (the context of environment under the EA Act includes the natural, social, cultural, built and economic environments).

The EA Act prescribes two types of environmental assessment planning and approval processes:

- **Individual Environment Assessments (Part II).** Proponents of projects subject to Part II of the EA Act are required to prepare project-specific Terms of References and carry out individual environmental assessments (subject to Ontario Ministry of Environment review and approval).

- **Class Environmental Assessments (Part II.1).** Proponents of projects subject to Part II.1 of the EA Act are required to fulfil the procedural requirements of an approved class environmental assessment process for a specific class of activities. Providing the approved process is followed, the project is deemed to comply with the EA Act.

The improvements to the Mitchell Water Works were subject to the Class Environmental Assessment developed for municipal infrastructure projects (i.e., roads, water and wastewater projects). The study process followed the procedures set out in the *Municipal Class Environmental Assessment* (Class EA) document. Appendix 1 of the Class EA document, entitled “Project Schedules”, defines the specific project schedule applying to various roads, water and wastewater activities. With respect to the Mitchell Well Supply Upgrading Project, certain project components were considered Schedule B activities under the terms of Appendix 1 (i.e., development of a new ground water supply). Schedule B projects generally include improvements and minor expansions to existing facilities with a potential for some adverse environmental impacts. Projects are approved following the completion of a formal environmental screening process.

The Municipality of West Perth carried out the provincial Class EA investigation between May 2002 and November 2003. R.V. Anderson Associates Limited (RVA) was retained to coordinate the Class EA process on behalf of the Municipality. An advisory committee comprised of representatives from the Municipality, Lotowater Geoscience Consultants Ltd. (providing hydrogeologic services) and RVA was formed to provide direction to the project.

### 1.4.3 Local Jurisdiction

The community of Mitchell was founded in 1837 and first incorporated as a Village of the County of Perth in 1857. In January 1998, the Town of Mitchell and the Townships of Hibbert, Logan and Fullerton amalgamated to form the Municipality of West Perth. The new Municipality has a population of more than 9,100 permanent residents and a land base of approximately 580 $km^2$. In general, West Perth is comprised of one prominent urban centre (Mitchell) and a number of small urban settlements dispersed throughout a largely agricultural community. Mitchell has an estimated population of approximately 4,020 persons and a land base of 5.5 ha. The community is located at the intersection of Provincial Highway Nos. 8 and 23, near the geographical centre of the Municipality of West Perth and the near the western limit of the County of Perth.

Mitchell is characterized as a low-density residential community, which incorporates a traditional downtown commercial core and a limited amount of highway commercial development. The community also contains three large industrial operations, various smaller manufacturing and processing activities and a number of institutional facilities. In general, the scale and nature of development evident in Mitchell is consistent with smaller urban communities throughout Midwestern Ontario.

Jurisdictional authority for the delivery of municipal water in the County of Perth has been defined through a service provision agreement between the County and its constituent municipalities. The Municipality of West Perth is the owner and operator of municipal water supply facilities in Mitchell and has the authority to implement the upgrades.

## 1.5 Roles of Federal Agencies

### 1.5.1 Responsible Authority

Industry Canada, as the federal agency administering COIP, has been identified as the Responsible Authority (RA) for this comprehensive study. Industry Canada is subsequently responsible for: (1) coordinating the consultation and documentation components of the comprehensive study; and, (2) making a recommendation to the federal Minister of the Environment (the Minister) as to whether or not significant adverse environmental effects associated with the planned works are likely. The broad mandate of the RA, as defined in Section 11(1) of the CEA Act, is to, "*Ensure that the environmental assessment is conducted as early as is practicable in the planning stages of the project and before irrevocable decisions are made*".

### 1.5.2 Federal Environmental Assessment Coordinator

The Canadian Environmental Assessment Agency (the Agency) is designated as the federal environmental assessment coordinator (FEAC) for this comprehensive study.

The following represent the key roles of the FEAC:

- Coordinate the involvement of federal authorities in a comprehensive study.
- Ensure that a one-window approach is utilized to assemble and disseminate project information.
- Facilitate coordination and cooperation among federal authorities and other study participants.
- Coordinate the harmonization of the federal and provincial environmental assessment processes, as applicable.

### 1.5.3 Expert Federal Authorities

At the outset of the comprehensive study process, a number of potential expert Federal Authorities (FA's) were identified that could provide expert advice or specialized knowledge for consideration during the environmental assessment. The expert FA's identified for this study included:

- Environment Canada.
- Natural Resources Canada.
- Health Canada.

The expert FA's do not have an EA decision-making responsibility with respect to the project.

## 1.6 Roles of First Nations

The community of Mitchell and the surrounding rural area is not a traditional territory for First Nations and no First Nations interest has been identified or declared with respect to this project.

## 1.7 Scope and Timing of the Environmental Assessment

### 1.7.1 Comprehensive Study Scoping Document and Report to Minister

A *Comprehensive Study Scoping Document* was prepared for this project. Pursuant to section 21(2) of the CEA Act, a public consultation was completed with respect to the proposed scope of the project for the environmental assessment, the factors to be considered in the assessment, the proposed scope of those factors, and the ability of the comprehensive study to address issues related to the project. The scoping document is included as Appendix B to this report.

Pursuant to section 21(2), after this consultation was complete, the scoping document was incorporated into an *Environmental Assessment Track Report*, which was submitted to the Minister for a decision on whether to continue the environmental assessment as a comprehensive study, or to refer the project to a mediator or review panel in accordance with Section 29 of the CEA Act.

The Minister's decision to continue the assessment as a comprehensive study was released on December 8, 2005.

### 1.7.2 Scope of the Project

The scope of the project refers to the various components (i.e., construction, operation, modification, decommissioning) that were considered as part of the project for the purpose of the environmental assessment. The scope of the environmental assessment for the Mitchell Well Supply Upgrading Project includes:

- Construction of well components capable of providing a total supply capacity of 100 L/s (8,640 $m^3$/d, 3,153,600 $m^3$/a).
- Construction of a pumphouse to house treatment and pumping equipment.
- Installation of a single cell ground-level reservoir for chlorine contact purposes.
- Installation of standby power facilities adjacent to the pumphouse.
- The extension of site servicing (e.g., watermain, storm sewers, sanitary sewers) to the Arthur Street road allowance to interconnect with existing infrastructure.
- Construction equipment access, laydown areas.
- Operation and maintenance of the well, pumphouse, treatment processes, and the reservoir.
- Site rehabilitation.
- Decommissioning of the site at the end of the project's operational life.

### 1.7.3 Scope of Assessment

#### 1.7.3.1 Factors to be Considered

The CEA Act requires that the following factors be considered in the environmental assessment (sections 16(1) and 16(2)):

- The environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out.
- The significance of the effects referred to in the previous paragraph.
- Comments from the public that are received in accordance with this Act and its regulations.
- Measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project.
- The purpose of the project.
- Alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternative means.
- The need for, and the requirements of, any follow-up program in respect of the project.
- The capacity of renewable resources that are likely to be significantly affected by the project to meet the needs of the present and those of the future.

### 1.7.3.2 Scope of Factors to be Considered

Table 1.1 summarizes the scope of factors considered in this environmental assessment.

**Table 1.1**
**Scope of Environmental Assessment**

| Environmental Component | Scope of Factors Considered |
|---|---|
| Physical and Natural Environment | • Ground water quantity and quality.<br>• Surface water quantity and quality.<br>• Vegetation, including wildlife habitat and biodiversity.<br>• Species at risk.<br>• Migratory birds, particularly with respect to the potential for disturbance or destruction of migratory birds or their nests.<br>• Wildlife.<br>• Noise.<br>• Air quality - local and downwind airborne emissions (including odours and volatiles). |
| Cultural Environment | Indirect effects of the project on heritage and historical cultural resources. |
| Malfunctions and Accidents | The probability of possible malfunctions or accidents associated with the project during construction, operation, modification, decommissioning, abandonment or other undertaking in relation to the work, and the potential adverse environmental effects of these events. |
| Changes to the Project Caused by the Environment | Environmental hazards that may affect the project should be described and the predicted effects of these environmental hazards (e.g., seismic activity and climate change). |
| Cumulative Environmental Effects | The cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out, including:<br>• Cumulative effects of the project with other developments that are planned within Mitchell such as road and/or residential construction, or additional ground water takings. |
| Sustainability of the Resource | Consideration of the renewable resources that may be significantly affected by the project and the criteria used in determining whether their sustainable use will be affected (including the sustainability of the ground water system). |

## 1.8 Spatial and Temporal Boundaries

### 1.8.1 Spatial Boundaries

The project is located entirely within the limits of the former Village of Mitchell. The following are the spatial boundaries for the EA:

- The right-of-way includes any land area that is directly disturbed by the construction activities of the project. This includes: the Arthur Street well site, and any associated construction equipment access routes and lay down areas.

- The corridor includes any area beyond the right-of-way, which could be disturbed by project effects. This includes effects during construction (noise, dust, vehicle emissions, traffic, etc) and would include an area approximately 250 m beyond the right-of-ways. The corridor also includes possible effects, including accidents and malfunctions (e.g., chemical spills) as it relates to operation of the water system and would include an area of approximately 500 m beyond the right-of-way.

- The regional boundary would include an area beyond Mitchell's community boundary, this being the greater of one kilometre or the extent of the area affected by the project. This could include the effects of construction activities (noise, dust, vehicle emissions, etc), operational activities (possible negative effects of draw down because of the system's ground water withdrawal), and effects that the increased system capacity could have on the Mitchell sewage treatment system (possible negative effects from increased treatment volumes and decreased surface water quality).

### 1.8.2 Temporal Boundaries

The following are the temporal boundaries for the EA:

- The short term temporal boundary of the project would last approximately six months and includes the construction and commissioning phases of the project. It includes activities such as: the construction and commissioning of the new well; the construction and commissioning of the new pumphouse; and, the construction and commissioning of the chlorine contact water main and its connection to the distribution system. It also includes activities related to construction equipment access, lay down areas as well as any accidents or malfunctions associated with the construction phase of the project.

- The medium term temporal boundary of the project is expected to be in the two to three year range and includes activities such as: the effectiveness of site restoration; possible accidents and malfunctions (e.g., chemical spills) as it relates to operation of the water system; and, possible negative effects of draw down because of the system's ground water withdrawal.

- The long term temporal boundary for the project would last up to the operational life expectancy of the project which is 22 years and includes activities such as: possible accidents and malfunctions (for example, failure of the new on-site water mains, chemical spills, etc) as it relates to operation of the water system; and, possible negative effects of draw down because of the system's ground water withdrawal.

### 1.9 Study Framework

This report summarizes the study process conducted for the comprehensive study and defines the significance of the environmental effects anticipated with project implementation.

The principal components of the document are as follows:

- Environmental Assessment objectives, approach and study methodology.
- Identification of alternatives to the project and alternative means of carrying out the project.
- Description of project components and related activities.
- Identification of the construction plan and construction timetable.
- A summary of the environmental setting.
- An evaluation of the environmental effects of the project, any alternative means of carrying out the project and planned mitigation.
- Information on the public consultation program.
- Conclusions regarding the significance of residual environmental effects of the project.
- Details on the need for and requirements of a follow-up program.

## 2.0 ENVIRONMENTAL ASSESSMENT: GENERAL APPROACH AND METHODOLOGY

### 2.1 General Approach

A general assessment methodology was carried out to evaluate the effects of the project on existing environmental resources. The methodology incorporates the following stages of evaluation:

i. Identification of existing environmental conditions (baseline conditions, inventories)
ii. Identification and evaluation of potential effects (positive and negative impacts)
iii. Identification and evaluation of mitigation measures
iv. Prediction of environmental effects (residual effects following mitigation)
v. Determination of the significance and likelihood of adverse environmental effects

The identification of baseline conditions and evaluation of potential impacts followed the study process carried out during the provincial Class EA process. A variety of activities were incorporated into this analysis, including spatial analysis, field reconnaissance, consultation with affected stakeholders, municipal staff and regulatory agencies, and expert opinion from subconsultants.

Valued Ecosystem Components (VEC's) for this project were selected by considering all of the potential interactions between the project components (and their associated activities) and various aspects of the environment. If it was thought that a potential interaction could exist, that environmental factor was included as a VEC. The result was the following list of VEC's:

- Ground water quantity and quality.
- Surface water quantity and quality.
- Vegetation.
- Species at risk.
- Migratory birds.
- Wildlife.
- Noise.
- Air quality.
- Local users of ground water.
- Adjacent land uses.
- Heritage and historical cultural resources.
- Capacity of renewable resources.

The environmental effects of the project on these VEC's are discussed and evaluated in section 7.0 of this report.

The selection of mitigation measures incorporated an assessment of mitigation requirements and an evaluation of alternative forms of mitigation. This assessment was based on the consideration of three broad approaches to mitigation; avoidance, minimization of negative effects on VEC's and compensation.

The prediction of residual environmental effects involved an impact analysis of the planned works following the application of mitigation. The determination of significant adverse environmental effects involved evaluating any likely residual effects associated with the project with respect to factors such as magnitude, duration, reversibility, frequency and geographic extent.

Comments received through the public consultation process and through consultation with the expert FA's were taken into consideration during the evaluation exercise. Table 13.1 summarizes the comments received through consultation and summarizes how specific concerns were addressed within the EA.

## 2.2 Related Investigations

### 2.2.1 General

Several specialized evaluations were carried out to assess the environmental effects of the planned works on the defined VEC's. The scope of these evaluations is generally summarized below. The findings of these investigations are described in detail in subsequent sections of this report.

### 2.2.2 Hydrogeology

Lotowater Geoscience Consultants Ltd. (Lotowater) conducted hydrogeological testing for the planned Arthur Street Well Supply to confirm the sustainability of the bedrock aquifer over the planning period, the quality of water provided by the well supply and the impacts of well operation on the surrounding hydrogeologic environment (i.e., existing well supplies). Existing water well records and aquifer mapping compiled as part of the *Perth County Ground water Study* (PCGS) were reviewed to provide a hydrogeologic interpretation of the Mitchell area. Ground water level monitoring of existing wells was also conducted as part of the long-term testing procedure.

The PCGS, prepared by Waterloo Hydrogeologic, obtained data from the following sources:

- Ministry of the Natural Resources
  - Topographic Elevation
  - Cadastral (Lots/ Concessions)
  - Quaternary Geology
  - Base Mapping Reference Features

- Ministry of the Environment
  - Well Completion and Geologic Data
  - Permitted Water Takings
  - Landfills, Fuel Storage Tanks, Spills
  - Base Mapping Reference Features

- Geological Survey of Canada
  - Quaternary Geology
  - Bedrock Geology

- Water Survey Canada
  - Surface Water Stage Elevations and Flows
- County of Perth
  - Spatial Distribution of Land Uses

### 2.2.3 Vegetation Resources

RVA carried out an examination of the potential impacts of the planned project on terrestrial vegetation resources in the study area.

The following study methods were carried out as part of this assessment:

- Collection and review of background information on terrestrial vegetation, Earth and Life Science Areas of Natural and Scientific Interest (ANSI's), wetlands (as provided by the Ministry of Natural Resources), and Species at Risk (as provided by the Upper Thames River Conservation Authority) known to exist in the vicinity of the regional boundary.

### 2.2.4 Wildlife Resources

An examination of the potential impacts of the planned project on wildlife resources was carried out for the study area.

The following study methods were carried out as part of this assessment:

- Collection and review of background information on terrestrial wildlife, ANSI's, and Species at Risk known to exist in the vicinity of the regional boundary.
- Collection and review of breeding bird data from the *Ontario Breeding Bird Atlas*.

### 2.2.5 Cultural Resources

A preliminary assessment of cultural resources was conducted to examine the potential impacts of the planned project on cultural heritage resources. The assessment incorporated a review of known heritage sites, local knowledge and input from the Ontario Ministry of Culture. Heritage resources within the defined right-of-way and corridor of the study were considered during this assessment.

### 2.2.6 Health and Socio-Economic Impacts

An evaluation of potential impacts of the project was carried out with consideration for several indicators of health and socio-economic conditions, including noise pollution, public safety, aesthetics, odour and dust levels, vehicular traffic volumes, water quality and land use compatibility. The assessment included an analysis of information obtained from construction design specifications, applicable planning policies and regulations, input from review agencies, and comments from local residents and stakeholders. Health and socio-economic matters within the regional boundary of the study were considered during this assessment, but not considered in making a determination of significance under CEAA.

## 2.3 Determination of the Significance of Adverse Environmental Effects

Paragraph 16(1)(a) of the CEA Act prescribes that the significance of the environmental effects of a project, including the effects of malfunctions and accidents associated with the project and any cumulative effects likely to occur from the project and other projects that have or will be carried out, must be evaluated.

The nature and significance of residual environmental effects resulting from the project and alternatives to the project were determined through an assessment of the following impact predictors (i.e., impact characteristics).

- Direction (nil, positive, negative).
- Nature (direct, indirect, cumulative).
- Magnitude (level of effect, loss of function).
- Location/ Extent (where effect occurs, number/ volume affected).
- Scale (localized or regional effects).
- Timing (seasonality of effects, immediate or delayed impacts).
- Duration (period of impact).
- Frequency (intermittent or continuous).
- Reversibility (extent of recovery, recovery time).
- Ecological Context (characteristics of population affected, implications for future generations and other trophic levels).
- Socio-economic and cultural context (characteristics of affected community, implications for recovery).

For the purposes of this EA, impact determination criteria developed by Natural Resources Canada has been applied to predict the magnitude of residual effects resulting from the implementation of the project and alternatives to the project. Table 2.1 summarizes the impact criteria.

**Table 2.1**
**Residual Environmental Effects:**
**Criteria for Impact Determination**

| Level of Effect | General Criteria |
|---|---|
| High | Implementation of the project could threaten sustainability of resource (VEC) and should be considered a management concern. Additional remediation, monitoring and research may be required to reduce impact potential. |
| Moderate | Implementation of the project could result in a resource decline below baseline, but impact levels should stabilize following project completion and into the foreseeable future. Additional management actions may be required for mitigation purposes. |
| Low | Implementation of the project could have a limited impact upon the resource during the lifespan of the project. Research, monitoring and/or recovery initiatives may be required for mitigation purposes. |
| Minimal/ Nil | Implementation of the project could impact upon the resource during the construction phase of the project but would have a negligible impact on the resource during the operational phase. |

Given the criteria defined in Table 2.1, for this EA determination of the significance of residual effects is based on the following considerations:

- Residual impacts from this project assessed as having a Moderate or High level of effect on a given VEC would be considered significant adverse environmental effects.
- Residual impacts from this project assessed as having a Minimal/ Nil to Low level of effect on a given VEC would not be considered significant adverse environmental effects.

# 3.0 EVALUATION OF ALTERNATIVES

## 3.1 Identified Alternatives to the Project

### 3.1.1 Water Supply Alternatives

During the course of the provincial Class EA investigation, the merits of several alternatives to the project were reviewed to determine their effectiveness at addressing the identified water supply deficiencies. Each alternative was assessed with respect to relevant environmental, economic and technical considerations. The following represent possible alternatives to the project considered during this study:

- Limit Community Growth.
- Reduce Water Demands.
- Develop Private Wells.
- Development of a New Well Supply
- Treated Surface Water Supply.
- Pipeline from Another Municipal Water Supply.
- Supplemental Well Site in Mitchell

Following a preliminary evaluation of the identified water supply alternatives, it was concluded that the development of a new well supply to supplement the existing well system is the most practical solution for upgrading the supply component of the Mitchell Water Works. Additional evaluations were therefore conducted to assess options for development of a new well supply at either an existing well site or a new well site.

### 3.1.2 Evaluation of New Well Supply Alternatives

#### 3.1.2.1 Develop a New Well Source

#### (a) Site Selection

A preliminary hydrogeological investigation was conducted by Lotowater to identify and evaluate suitable locations for a new well site. The following represent the key locational considerations associated with this analysis:

- The well supply should be capable of yielding a minimum supply capacity of 50 L/s to 60 L/s.

- The new site should be located outside of the capture areas for Wells 1, 2 and 3 and should be located in an area which minimizes interference with other wells (as defined within the Perth County Ground Water Management Study). The exploration depth of the bedrock aquifer system was also considered as part of this analysis.

- The project site should be largely compatible with surrounding land uses (existing and planned) and should be easily accessible for system operators.

- Each site should be located in close proximity to the existing water supply and sanitary sewage infrastructure to minimize the amount of piping required to connect the well supply to existing works and to limit the land base impacted by construction activities.

- The site should be situated in an area which optimizes the water system. In this regard, preference is given to sites on the west side of the North Thames River in order to remediate pressure problems in addition to supplying the existing standpipe.

- The well supply should not be situated in an area exhibiting significant natural or cultural features. The site should also be located in an area that can accommodate construction activities without impacting upon sensitive natural features.

- The project site should be located on public land or property which can be readily acquired by the Municipality.

**(b) Test Well Locations and Analysis**

**i. TW1/02**

Taking the above criteria into consideration, a potential well site was identified on an open grassed area of Keterson Park, approximately 50 m from the Arthur Street road allowance (refer to Figure No. 2, Appendix A). The Keterson Park site is approximately 1.1 km northeast of the three existing municipal wells. Exploratory drilling was initiated at this site in October 2002. A 200 mm nominal diameter (dia.) test well (TW1/02) was drilled at the site into the upper bedrock to a depth of 25.6 m. Following geophysical logging, a 150 mm dia. steel well casing was set into the hole to a depth of 25.6 m. A 150 mm dia. hole was drilled and sampled using air rotary methods from the base of the well casing to a depth of 76.2 m.

Preliminary testing of TW1/02 was completed following well construction and development in November 2002. The testing activity incorporated a constant rate pumping test performed at a flow rate of 5.9 L/s. Depth discrete water samples were collected during the testing procedure from the main test pump discharge (25.6 m), as well as depths of 33.5 m, 53.3 m and 61 m. Water levels were recorded from a private well supply (situated approximately 2 km east of TW1/02) and the municipal monitoring well (MW2/02) located at the Well 1 and Well 2 site.

Initial testing results are as follows:

- The well characterization results indicated that there are four main producing zones in the bedrock aquifer sequence at TW1/02. The approximate depth of the producing zone and the approximate proportion of water produced at the test flow rate are as follows:

  - 26.9 m (80%)
  - 30 m (trace)
  - 34.8 m to 37.8 m (15%)
  - 45.7 m (trace)

  No measurable flow into the well was recorded below 47 m.

- The major water producing zone at TW1/02 is located in the shallow bedrock less than 3 m below the base of the well casing. This finding is consistent with the producing zones of Wells 1 and 2.

- Analysis of the drawdown trend identified during testing indicates that the maximum well yield for the well would be limited to 15 L/s or less (i.e., far below the target yield). This is attributed to study findings which indicate that (1) the shallow producing zone of TW1/02 is less productive than Wells 1 and 2 and (2) the lower producing zone which is present in Well 3 is absent at TW1/02.

- Water quality results were acceptable and similar to the water quality obtained from the three existing wells.

- The presence of 25 m of overburden sediments with a relatively low hydraulic conductivity and the absence of water features within 500 m of the site indicated that the ground water drawn from TW1/02 is not under the direct influence of surface water.

Given the low capacity available from TW1/02, the Municipality decided to continue the exploration program for a new well site.

**ii. TW2/03**

A series of additional well sites were evaluated in the second set of well exploration. The locational criteria discussed above were applied to determine a preferred site. Following this analysis, a suitable location for a new test well was identified. The site forms part of the West Perth Works Centre which fronts Arthur Street in the south end of the community. The Works Centre site is located approximately 0.9 km southeast of Well 3 and approximately 1.1 km southeast of Wells 1 and 2.

The following factors justified the selection of this site:

- Close proximity to large diameter watermains and the standpipe (the location may not address system pressure problems, but will minimize site development costs).

- Existing development on the site (municipal workshed) minimizes the disruption to the natural and social environments in the vicinity.

- The site is designated "Industrial" by the *Town of Mitchell Official Plan*. Municipal waterworks facilities are compatible and consistent with industrial activities.

A second test well (TW2/03) was drilled at the Works Centre site in April 2003 to assess the potential aquifer yield from the site. The 150 mm dia. test well was drilled into the upper bedrock to a depth of 29.9 m. Following geophysical logging, a 150 mm dia. steel well casing was set into the hole to a depth of 29.7 m. A 150 mm dia. hole was drilled and sampled using air rotary methods from the base of the well casing to a depth of 71.6 m.

Preliminary testing of TW2/03 was completed following well construction and development in May 2003. The testing activity incorporated a variable rate pumping test performed at flow rates of 7.6 L/s, 11.4 L/s and 15.1 L/s, followed by an aquifer test performed at a flow rate of 15.1 L/s over the period from May 26 to May 28 (total pumping time: 49 hours). Depth discrete water samples were collected during the testing procedure from the main test pump discharge (25.6 m), as well as depths of 36.6 m, 54.9 m and 67.1 m. Water levels were recorded from a group of observation wells which included a private commercial/ industrial well supply (situated approximately 300 m northeast of TW2/03), Wells 2 and 3, three multilevel monitoring wells in the vicinity of Wells 1 and 2 (referred to as MW1/02, MW2/02 and MW3/02) and the Keterson Park test well (TW1/02).

Initial testing results for TW2/03 are as follows:

- The well characterization results indicated that there are three main producing zones in the bedrock aquifer sequence at TW2/03, being 30 to 33 m, 59 to 61 m and 69 to 71m.

- Analysis of the drawdown trend identified during testing indicates that a production well with a casing set at 29 m would support a pumping rate of 15 L/s to 25 L/s over the long term. Setting the well casing at a depth of 55 m could increase the aquifer capacity to 40 L/s. These conclusions are based on the assumption that Well 3 would be operating simultaneously, while Wells 1 and 2 would not be in operation.

- Water quality results for most of the tested parameters are within the *Ontario Drinking Water Quality Standards* (ODWQS) with the exception of fluoride. Fluoride concentrations ranged from 1.6 mg/L to 1.8 mg/L, which are marginally higher than the 1.5 mg/L ODWQS standard. The fluoride concentrations are similar to the existing wells. Sodium levels are also elevated (in excess of 20 mg/L), which is consistent with the other municipal wells in Mitchell.

- The presence of 30 m of overburden sediments with a relatively low hydraulic conductivity and the absence of water features within 500 m of the site indicated that the ground water of this test well is not under the direct influence of surface water.

- Aquifer testing indicated that Well 3, MW2/02, TW1/02 and the private well were all affected by the pumping of TW2/03. In general, minor interference (drawdown) was observed in each well during the testing activities.

Given the results from TW2/03, the Municipality decided to proceed with the construction of a new production well at the Arthur Street site. It was noted that further analysis would be required to assess the extent of interference effects and further consultation would be needed with the Ontario Ministry of Environment (MOE) and the Ontario Ministry of Health to ensure that the water quality was acceptable for a municipal well supply.

#### 3.1.2.2 Conclusions Regarding Well Supply Alternatives

Based upon the evaluation of alternatives for a new well supply, it was concluded that the development of a new well at the West Perth Works Centre on Arthur Street is the most practical and effective solution for upgrading the supply component of the Mitchell Water Works. The potential environmental risk associated with this project was also considered reasonable, given the findings of hydrogeologic study work with respect to the available water quantity and water quality, the limited spatial impact of the project (i.e., minimal well interference effects) and the use of accepted technologies (i.e., limited complexity).

## 3.2 Alternative Means of Carrying out the Project

### 3.2.1 Identified Alternative Means (Arthur Street Well Supply)

The technically and economically feasible alternatives for carrying out the major components of the project are summarized below. Components identified as having no alternative means can be implemented with minor design modifications (e.g., alternate pump sizes, different pipe materials). However, modifications of this nature will not change the environmental effects of these project components in any appreciable manner.

### i. Collector Wells

- Facilities and Equipment
  - Install a Well Casing at the Test Well Depth (29 m ±)
  - Install a Deep Well Casing (55 m ±)

- Location of Works
  - No Alternative Means (well location largely restricted by existing development)

**ii. Pumphouse Facility**

- Facilities and Equipment
  - No Alternative Means (designed in accordance with engineering specifications)

- Location of Works
  - No Alternative Means (pumphouse location constrained by existing development and building restrictions)

**iii. Chlorine Contact Facilities**

- Facilities and Equipment
  - Utilize a Watermain
  - Utilize a Single Cell Reservoir
  - Utilize a Two Cell Reservoir

- Location of Works
  - No Alternative Means (location of facilities constrained by existing development)

**iv. Site Servicing**

- Facilities and Equipment
  - No Alternative Means (designed in accordance with engineering specifications)

- Location of Works
  - No Alternative Means (site servicing route restricted by existing development)

### 3.2.2 Analysis of Alternative Means (Arthur Street Well Supply)

#### 3.2.2.1 Collector Well Facilities and Equipment

**(a) Identified Alternatives**

The following represent the practical alternatives for developing a new collector well on the Arthur Street well supply site:

- Install a Well Casing at the Test Well Depth (29 m ±).
- Install a Deeper Well Casing (55 m ±).

### (b) Considerations

The key considerations for the development of the collector well were as follows:

- Option 1 involves installation of a casing to a depth of approximately 29 m with a maximum drawdown set at the base of the well. Aquifer testing of TW2/03 indicates that the aquifer and production well would support a pumping rate of 15 L/s to 25 L/s over the long-term.

- Option 2 involves installation of a casing to a depth of approximately 55 m to increase the available drawdown from the bedrock aquifer. In this configuration, the long-term yield of the production well could increase to 40 L/s.

- Well yield estimates were developed based on the assumption that Well 3 would be operating simultaneously, while Wells 1 and 2 would not be in operation.

- Water quality available from the two bedrock aquifers is expected to be similar. In both cases, the water quality is expected to be generally good and similar to the existing well supplies. Fluoride and sodium concentrations are expected to exceed the ODWQS.

- Implementation of either option requires that the 150 mm dia test well be reconstructed as a 200 mm dia. production well in order to obtain an adequate supply capacity.

- Implementation of either option would require additional disturbance on the project site. The amount of disturbance associated with drilling a new well is relatively minor when compared with the disturbance required to construct the other components of the project.

### (c) Environmental Effects Analysis

The potential interactions between the identified alternative collector well designs and the VEC's identified in section 2.1 of this report were evaluated. The purpose of this evaluation was to determine, in relative terms, the anticipated environmental effects of each identified option on the various environmental components prior to mitigation (using the impact criteria described in Table 2.1).

Table 3.1 summarizes the outcome of the environmental effects analysis carried out for the two collector well casing alternatives.

**Table 3.1**
**Alternative Collector Well Casing Depths:**
**Environmental Effects Analysis**

| Valued Ecosystem Component | Option 1 (29 m ±) | Option 1 (55 m ±) | Considerations |
|---|---|---|---|
| | Level of Effect | | |
| Ground water quantity and quality | Low | Low | Neither casing depth is expected to significantly impact upon ground water resources, although interference effects are anticipated in both instances. |
| Surface water quantity and quality | Minimal/ Nil | Minimal/ Nil | No impacts are expected from well development at either depth option. |
| Vegetation. | Minimal/ Nil | Minimal/ Nil | Well development at either depth will result in some disturbance and removal of terrestrial features at the Arthur Street site. |
| Species at risk | Minimal/ Nil | Minimal/ Nil | No impacts are expected from well development at either depth option. |
| Migratory Birds | Minimal/ Nil | Minimal/ Nil | No impacts are expected from well development at either depth option. |
| Noise | Minimal/ Nil | Minimal/ Nil | Both options will generate a minimal increase in ambient noise levels. |
| Air quality | Minimal/ Nil | Minimal/ Nil | Neither option is expected to impact upon air quality in the area. |
| Local users of ground water | Low | Low | Neither option is expected to significantly impact upon ground water resources, although interference effects are anticipated in both instances. |

| Valued Ecosystem Component | Option 1 (29 m ±) | Option 1 (55 m ±) | Considerations |
|---|---|---|---|
| | Level of Effect | | |
| Heritage and historical cultural resources | Minimal/ Nil | Minimal/ Nil | No impacts are expected from well development at either depth. |
| Capacity of renewable resources | Low | Low | No additional impacts are expected from well development at either depth option (i.e., ground water, wildlife, vegetation impacts have been considered). |

**(d) Preferred Location Plan**

After consideration of the findings of the technical review and the environmental effects analysis, it was concluded that the well casing depth for Well 4 should be established at approximately 55 m. Option 2 was selected primarily because of the higher long-term yield available from the deeper bedrock aquifer. In review, development of the defined collector well plan is not anticipated to have significant adverse environmental effects on the selected VEC's (see section 7.0 for a specific analysis of environmental effects).

### 3.2.3.2 Chlorine Contact Facilities

**(a) Identified Alternatives**

The following represent the practical alternatives for the provision of chlorine contact facilities on the Well 4 site:

- Utilize a Watermain.
- Utilize a Single Cell Reservoir.
- Utilize a Two Cell Reservoir.

**(b) Considerations**

The key considerations for the selection of a pumphouse facility were as follows:

- Well 4 is considered to be ground water, using the definition found in the *Procedure for Disinfection of Drinking Water in Ontario*. In accordance with the requirements of the Disinfection Procedure, the treated water from Well 4 must have a minimum of 15 minutes of chlorine contact time for proper disinfection.

- Chlorine contact watermain is large diameter piping (600 mm dia.) designed to lengthen the travel time of the treated water supply prior to discharging into the distribution system (in order to ensure effective chlorine disinfection). The watermain would be constructed around the outer perimeter of the site. Based upon the total supply capacity of Well 4 (100 L/s) and the required contact volume (90 $m^3$), 325 m of piping would need to be installed around the perimeter of the pumphouse.

- The single cell ground-level reservoir consists of a concrete tank (single cell) designed with a single inlet diffuser, baffle curtains and a single high-lift pump. Based upon the supply capacity of Well 4 and the required contact volume (180 $m^3$), the minimum footprint of the tank would be approximately 72 $m^2$. The structure would be constructed below the planned pumphouse to a depth of approximately 3.7 m below grade (chlorine contact depth: 2.5 m).

- The two cell ground-level reservoir consists of a concrete tank (two cell) designed with dual inlet diffusers, baffle curtains and two high-lift pumps (in individual pump wells). The tank would be constructed adjacent to the existing pumphouse. Based upon the supply capacity of Well 4 and the required contact volume (180 $m^3$), the minimum footprint of the tank would be approximately 72 $m^2$. The structure would be constructed below the planned pumphouse to a depth of approximately 3.7 m below grade (chlorine contact depth: 2.5 m).

- The probable capital costs associated with the three facilities are as follows:

  - Watermain: $ 232,000.
  - Single Cell Reservoir: $165,000.
  - Two Cell Reservoir: $227,500.

- Operating costs for the two facilities would be similar, although the operator would be required to enter the reservoir periodically for maintenance purposes (e.g., to drain and remove sediment). Maintenance and operating costs for the two cell facility will be marginally more expensive than the single cell facility due to the additional high-lift pumping.

- Construction of each option would disturb a small amount of land in the vicinity of the planned pumphouse. Lands disturbed by construction activities would be fully restored with native vegetation.

### (c) Environmental Effects Analysis

The potential interactions between the identified alternative chlorine contact facilities and the VEC's identified in section 2.2 of this report were evaluated. The purpose of this evaluation was to determine, in relative terms, the environmental effects of each identified option on the various environmental components prior to mitigation (using the impact criteria described in Table 2.1).

Table 3.2 summarizes the outcome of the environmental effects analysis carried out for these chlorine contact alternatives.

**Table 3.2**
**Alternative Chlorine Contact Facilities:**
**Environmental Effects Analysis**

| Valued Ecosystem Component | Watermain | Single Cell Reservoir | Two Cell Reservoir | Considerations |
|---|---|---|---|---|
| | Level of Effect | | | |
| Ground water quantity and quality | Minimal/ Nil | Minimal/ Nil | Minimal/ Nil | No impacts are expected from the implementation of these options. |
| Surface water quantity and quality | Minimal/ Nil | Minimal/ Nil | Minimal/ Nil | Sediment and erosion impacts may occur during construction. Impacts would be minimized with standard mitigation measures. |
| Vegetation | Minimal/ Nil | Minimal/ Nil | Minimal/ Nil | Vegetation will be removed to facilitate each option. Impacts would be minimized with standard mitigation measures (including site restoration). |
| Species at risk | Minimal/ Nil | Minimal/ Nil | Minimal/ Nil | No impacts are expected from the implementation of these options. |
| Migratory Birds | Minimal/ Nil | Minimal/ Nil | Minimal/ Nil | No impacts are expected from the implementation of these options. |
| Noise | Minimal/ Nil | Minimal/ Nil | Minimal/ Nil | No impacts are expected from the implementation of these options (following construction). |
| Air quality | Minimal/ Nil | Minimal/ Nil | Minimal/ Nil | No impacts are expected from the implementation of these options (following construction). |
| Local users of ground water | Low | Low | Low | No impacts are expected from the implementation of these options. |
| Heritage and historical cultural resources | Minimal/ Nil | Minimal/ Nil | Minimal/ Nil | No impacts are expected from the implementation of these options. |

| Valued Ecosystem Component | Watermain | Single Cell Reservoir | Two Cell Reservoir | Considerations |
|---|---|---|---|---|
| | Level of Effect | | | |
| Capacity of renewable resources | Low | Low | Low | No additional impacts are expected from the implementation of these options (i.e., ground water, wildlife, vegetation impacts have been considered). |

**(d) Preferred Chlorine Contact Facility**

Given the findings of the technical review and the environmental effects analysis, it was concluded that chlorine contact facilities required for the Well 4 site should be provided via a single cell ground-level reservoir constructed adjacent to the planned pumphouse. There are several factors which justified this selection, the most significant of which are as follows:

- Substantially lower capital costs than the other options.
- Lower operating and maintenance costs than the two cell reservoir.
- Less physical disruption than the contact watermain.
- Presents minimal long-term impacts to vegetation, air quality, noise levels and local aesthetics.

In review, installation and operation of the single cell ground-level reservoir is not anticipated to have significant adverse environmental effects on the selected VEC's (see section 7.0 for a specific analysis of environmental effects).

## 4.0 PROJECT COMPONENTS AND ACTIVITIES

### 4.1 Water Supply Facilities (2002)

#### 4.1.1 Wells 1, 2 and 3

At the outset of the Class EA investigation, the community of Mitchell was serviced by a municipal well system comprised of two supply wells (Wells 2 and 3) and a standby well (Well 1). Well 1 is a large capacity bedrock well equipped with a submersible pump that discharges raw water to Wellhouse 2 where it is combined with raw water from Well 2 and discharged to a central facility for treatment and disinfection. Well 1 is situated within Wellhouse 1, approximately 10 m east of the North Thames River, 60 m north of Ontario Road (Provincial Highway No. 8) and 95 m west of St. George Street (illustrated on Figure No. 2, Appendix A). Well 1 is currently used only when needed (i.e., high system demands or if Well 2 is out of service). Well 2 is situated within Wellhouse 2, approximately 35 m from the North Thames River, 100 m north of Ontario Road and 60 m west of St. George Street. Well 2 is equipped with a submersible pump which discharges the raw water to the treatment plant. Well 3 is a large capacity, bedrock well supply that serves as the primary production well for the system. The well is situated within Wellhouse 3, approximately 230 m south of Ontario Street and 15 m east of St. George Street. This well supply has historically supplied untreated water to one industrial customer (for food processing). Raw water from Well 3 is now pumped to the central facility for treatment and disinfection prior to being discharged to the municipal distribution system.

Wells 1, 2 and 3 have permitted capacities of 30.3 L/s, 37.5 L/s and 53 L/s respectively, as specified by MOE Certificate of Approval (C. of A.) No. 0334-6CBRU7 (refer to Table 4.1). The wells are in close proximity to one-another and appear to obtain water from the same bedrock aquifer system. The wells should be considered as a well field, or single water source, due to their proximity and similar water producing intervals. Hydrogeologic study work concluded that the three ground water supplies are not considered to be under the direct influence of surface water. The principal reason for this determination is that the bedrock aquifer and the well completion zones are separated from the near surface environment, including the North Thames River, by widespread deposits of silt/clay till and glaciolacustrine sediments. These sediments are characterized by a relatively low hydraulic conductivity, which restricts surface water infiltration to the bedrock aquifer within the inferred capture area of the three wells.

**Table 4.1**
**Municipal Well Supplies (2002):**
**Mitchell Water Works**

| Well No. | Type | Depth (m bg)[1] | Diameter (mm) | Year Drilled | Rated Capacity (L/s) |
|---|---|---|---|---|---|
| 1 | Bedrock | 24.4 | 200 | 1933 | 30.3 |
| 2 | Bedrock | 33.5 | 200 | 1949 | 37.5 |
| 3 | Bedrock | 54.9 | 200 | 1967 | 53 [2] |
| Firm supply capacity | | | | | 67.8 |

Notes: [1] Below ground level [2] Pumping rate restricted due to 45 L/s due to liner diameter limits

All three wells yield water which is considered to be of a very good quality with virtually no record of adverse bacteriological test results. There is also no indication of adverse results for chemical parameters which would be associated with surface influences (e.g., nitrates).

### 4.1.2 Treatment and Disinfection Facilities

Raw water from Wells 1, 2 and 3 is discharged to the Mitchell Treatment Plant, constructed in 1962 and located approximately 80 m north of Ontario Road and 30 m west of St. George Street. The raw water is combined in the basement of the facility after which chemicals are injected into the raw water for treatment purposes.

Primary treatment occurs via a mixed-oxidant (MIOX) disinfection system. With a MIOX treatment system, salt brine is passed through the MIOX generator where treated chemicals are produced electrolytically in the form of hypochlorous acid (primarily), chlorine dioxide, oxygen, ozone, hydrogen peroxide and chlorine. The MIOX solution is collected in a 760 L tank and injected into water at rates appropriate to meet treatment objectives. A liquid chlorine (sodium hypochlorite) disinfection system is also available for backup purposes (applied under pressure in the form of 12% sodium hypochlorite). The sodium hypochlorite is stored in a 200 L tank and is injected into the raw water by a chemical metering pump. An iron sequestering agent (sodium silicate) is also injected to the water for iron sequestering. The chemical is stored in a 200 L tank and injected by a metering pump.

The treated water flows into a chlorine contact reservoir (clearwell) located adjacent to the plant. The clearwell has two distinct compartments; a 138 $m^3$ baffled reservoir and a 238 $m^3$ unbaffled reservoir (the baffled section of the reservoir was constructed in 2003 to provide additional chlorine contact time). The plant is also equipped with chlorine and turbidity analyzers that provide continuous monitoring of treated water being discharged from the plant. The analyzers incorporate alarms which trigger in the event of an adverse condition for either chlorine residual or turbidity. A Supervisory Control and Data Acquisition (SCADA) system was installed in the Treatment Plant in 1998 to provide automatic system controls, select monitoring and data recording.

### 4.1.3 Water Distribution System

Treated water in the reservoir is pumped into the distribution system via a high lift pumping system comprised of three vertical turbine pumps. The distribution system is comprised of approximately 35 km of watermain generally ranging in diameter from 25 mm to 305 mm. Water storage in the distribution system is provided via a 3,900 $m^3$ standpipe, located on Arthur Street immediately south of Toronto Street, which forms an integral component of system operations for flow equalization, system pressure equalization and for control of the high lift pumps. A booster pumping station (BPS), located at the base of the standpipe, allows for the use of almost the entire storage standpipe for fire fighting and other emergency uses (effective storage volume: 3,520 $m^3$). The station is equipped with a centrifugal pump, with a rated capacity of 165 L/s at 21 m total discharge head (TDH). The standpipe and BPS were constructed in 1980.

The water distribution system services the entire community of Mitchell, as well as a small number of customers in the former Townships of Logan and Fullerton situated near the urban boundary.

## 4.2 Production Capacity and Demand

### 4.2.1 Current Water Demands

Table 4.2 illustrates the key water demand information for the Mitchell Water Works, based on a review of recent pumpage records. As noted, annual average day and maximum day pumping rates were relatively stable during the reporting period. These annual average flows are also considerably less than the firm supply capacity (5,900 $m^3$). Within the summer months, however, maximum day flows often approach or exceed the firm supply capacity. During peak flow periods, the actual maximum day demand is expected to be higher than the identified value (i.e., storage was likely being depleted on those days).

**Table 4.2**
**Annual Average and Maximum Day Pumpages: Mitchell Water Works**

| Year | Average Day ($m^3$/day) | Maximum Day ($m^3$/day) |
|---|---|---|
| 1995 | 2,674 | 4,405 |
| 1996 | 2,468 | 4,780 |
| 1997 | 2,478 | 5,347 |
| 1998 | 2,376 | 4,679 |
| 1999 | 2,546 | 3,861 |
| | | |
| 2003 | 3,282 | 5,640 |
| 2004 | 2,743 | 4,350 |
| 2005 | 2,732 | 4,100 |

### 4.2.2 Population Projection

Table 4.3 illustrates the total increase in population in Mitchell for the period 1961-2001 and the average annual population growth over five year periods as reported by Statistics Canada. In review, the local population increased from 2,247 to 4,022 over the study period, which represents a net increase in population of 44.1% and an average annual growth rate of 1.45%.

**Table 4.3**
**Population Data (1961-2001): Community of Mitchell**

| Year | Population |
|---|---|
| 1961 | 2,247 |
| 1971 | 2,545 |
| 1981 | 2,777 |
| 1991 | 3,382 |
| 2001 | 4,022 |
| Percentage Change (1976-2001) | + 44.1% |
| Annualized Average Change | 1.45% |

For planning purposes, the County of Perth Planning & Development Department applied the cohort survival method to produce a growth forecast for Mitchell. The projection was developed for the period 2001-26 and was based upon an assessment of historical growth projections and broad urban growth assumptions.

Table 4.4 summarizes the population forecast developed for Mitchell. The forecasted population for 2026 (5,666 persons) has been selected as the design population for the water demand analysis identified in the following section of the report.

**Table 4.4**
**Population Growth Forecast (2001-2026):**
**Community of Mitchell**

| Year | Projected Population |
|---|---|
| 2001 | 4,022 |
| 2006 | 4,307 |
| 2011 | 4,613 |
| 2016 | 4,940 |
| 2021 | 5,290 |
| 2026 | 5,666 |
| Percentage Increase (2001-2026) | + 40.9% |
| Annualized Average Change | 1.38% |

### 4.2.3 Water Demand Projections

Design water demands were developed by applying per capita demand rates to the base year population and to the design populations. With respect to water demand rates, historic per capita water consumption in Mitchell is approximately 275 L/d for all users excluding major industrial users.

In order to estimate design flows for the 22-year planning period, the following key assumptions have been made:

- Per capita average day water consumption will remain at current levels (i.e., future demands will be directly proportional to growth).

- Demands from the three existing major industrial water uses will remain at current levels (total average day demands: 2,950 $m^3$; maximum day demands: 5,100 $m^3$).

- The maximum day demand factor for non-industrial users will be consistent with MOE design guidelines (i.e., a factor of “2.0” for a population of 3,000 to 10,000 persons).

Based on these assumptions, the design average day demand and the design maximum day demand for the 22-year planning period are projected to be 4,508 $m^3$ (52.2 L/s) and 8,528 $m^3$ (98.7 L/s), respectively.

### 4.2.4 Sewage Plant Capacity

The Mitchell sewage treatment plant, constructed in the mid-1990's, is a lagoon-based system designed for a capacity of 5,740 person equivalents. Based on the population forecast for Mitchell, the surplus capacity of the facility should be capable of accommodating the growth projected over the planning period. Future expansion of the facility may be required if growth rates accelerate, if per capita flows increase or if sanitary servicing is extended to areas outside of the Mitchell area.

## 4.3 Preliminary Engineering Concept

### 4.3.1 Sentinel Wells

#### 4.3.1.1 Monitoring Wells

In April 2002, the Municipality of West Perth developed three multilevel monitoring wells in the bedrock the vicinity of Wells 1 and 2 (referred to as MW1/02, MW2/02 and MW3/02). Each monitoring location incorporated two 32 mm dia. wells; one constructed to access the overburden (S), the other developed to access the shallow bedrock producing zone (D).

Table 4.5 summarizes the key characteristics of the monitoring wells.

**Table 4.5**
**Monitoring Wells Characteristics:**
**Mitchell Water Works**

| Well | Monitor Location | Depth (m bg) |
|---|---|---|
| MW1 | S | 9.14 |
| | D | 16.76 |
| MW2 | S | 10.36 |
| | D | 18.59 |
| MW3 | S | 10.67 |
| | D | 19.51 |

#### 4.3.1.2 Test Wells

Lotowater initiated well exploration activities for a new municipal well supply in Mitchell based, in part, on information provided within the PCGS findings and other previous hydrogeologic investigations. The bedrock aquifer became the focus of well exploration, which resulted in the construction of two test wells in 2002 (TW1/02, TW2/03) and the subsequent analysis of these wells. The location of the test wells is illustrated on Figure No. 2, Appendix A. The majority of the hydrogeologic investigation was carried out on TW2/03 (the Arthur Street site), based on assumptions that the bedrock aquifer evident at this location would provide a higher maximum well yield (given that the lower bedrock producing zone evident at TW2/03 is absent at TW1/02).

Upon assessment of the well tests performed on TW2/03 for water quality, quantity and aquifer sustainability, it was concluded that the bedrock aquifer in the vicinity of the Arthur Street site would be suitable for a municipal well supply. TW1/02, situated in Keterson Park, was retained as a monitoring well.

#### 4.3.1.3 Collector Well

The Municipality of West Perth commissioned the construction of Mitchell Well 4 in 2003. Well 4 is a large capacity bedrock well developed through the reconstruction of TW2/03 (drilled to a depth of approximately 71.6 m). The reconstruction of TW2/03 involved the removal of the nominal 150 mm dia. test well casing, followed by the enlargement of the drill hole to a nominal diameter of 600 mm using mud rotary drilling methods. A nominal 400 mm dia. steel outer casing was set to a depth of 29 m and the annular space between the casing and the drill hole was cemented. Further well construction involved the air-rotary drill of a nominal 380 mm dia. drill hole from 29 m to 54.3 m. A nominal 300 mm dia. steel well casing was installed to the 53.4 m depth, followed by the cementing of the annular space. The final phase of well construction involved the drilling of a nominal 300 mm dia. open hole from 54.3 m to a depth of 71.6 m. Following this work, the well was developed by pumping with compressed air.

The UTM co-ordinates for Well 4 are as follows (based on NAD 83 datum, Zone 17):

- 0484266E, 4811842N.

Initial hydrogeological testing of Well 4 was conducted to confirm the yield of the new well. A variable rate test was performed at flow rates of 15 L/s, 30 L/s, 45 L/s and 60 L/s. The results of this analysis indicated that the well capacity was much higher than expected (i.e., up to 100 L/s). The analysis also indicated that additional well development would be required to operate the well at rates above 30 L/s. Consequently, an enhanced well development program was performed that included injection of hydrochloric acid followed by air-lift pumping over a three week period. Further variable rate testing was completed for flow rates of 35 L/s, 70 L/s and 105 L/s.

Following the enhanced well development program, an aquifer test was performed at a flow rate of 100 L/s between May 31 and June 2, 2004 (total pumping time: 49.5 hours). The testing was completed to provide data for (1) an assessment of aquifer yield and long-term sustainability of the bedrock aquifer over the planning period, (2) the quality of water provided from the well and (3) the impacts on well operation on the surrounding hydrogeologic environment (i.e., existing well supplies). Ground water level monitoring was conducted as part of the testing procedure. Monitoring locations included the observation wells that were monitored for the TW2/03 aquifer test, as well as two private domestic well supplies, one private domestic/ commercial well supply and a private communal water system supply.

Section 7.2 of this report highlights the procedures, results and conclusions of the hydrogeological assessment carried out for Well 4, including a description of the potential environmental effects associated with the development and operation of the new well supply.

## 4.4 Works Undertaken

- Construction of a new collector well capable of providing a total supply capacity of 100 L/s (8,640 $m^3$/d, 3,153,600 $m^3$/a).
- Construction of a pumphouse (approximate footprint: 100 $m^2$) to house pumping, treatment equipment, instrumentation and controls and process piping.
- Installation of a 180 $m^3$ ground-level reservoir adjacent to the new pumphouse to provide chlorine contact time prior to discharging of treated water to the distribution system.
- Installation of standby power facilities adjacent to the pumphouse.
- The extension of site servicing (e.g., watermain, storm sewers, sanitary sewers, electrical service) to the Arthur Street road allowance to interconnect with existing infrastructure.
- Construction of a gravel access road and concrete parking area.

## 4.5 Construction Phase

### 4.5.1 Collector Well

The following activities comprised the construction phase for the development of Well 4 (section 5.0 of this report provides specific details on associated construction sequence):

- The development of Well 4 involved the reconstruction of TW2/03 in order to access the bedrock aquifer evaluated during the hydrogeological investigation. The well was developed to provide a maximum well capacity of 100 L/s. As the permitted capacity of Well 4 exceeds normal system demands, the well has been equipped with a variable-frequency drive to permit it to operate at capacities more closely matching system demands. The well was also equipped with the following:

  - A pitless adaptor and vented cap.
  - A submersible turbine pump rated for 100 L/s at 42.7 m TDH and 250 mm dia. discharge watermain to treatment and monitoring facilities in the new pumphouse (discussed in the following section).

  - A well pump discharge equipped with a flow control valve to ensure that the design or permitted discharge rate is not exceeded.

- Table 4.6 summarizes the well construction details for Well 4.

**Table 4.6**
**Mitchell Well 4 Construction Details***

| | |
|---|---|
| Diameter (mm) | 200 |
| Existing Grade Elevation (m) | 345.9 |
| Existing Top of Casing Elevation (m) | 346.6 |
| Static Water Level (m) | 17.30 |
| Depth to Bottom of Casing (m) | 54.3 |
| Well Depth (m) | 71.6 |
| Pump Intake Depth (m) | 50 |
| Permitted Pumping Rate (L/s) | 100 |

* Well depths and pump settings are measured from existing grade.

### 4.5.2 Pumphouse

A pumphouse facility was constructed during this project phase to house pumping, treatment, disinfection and monitoring equipment. The following activities comprise the main components of the facility:

- The pumphouse incorporates a concrete slab floor, concrete block walls, timber roof trusses and an exterior finish incorporating decorative brick, vinyl siding and asphalt shingles. The pumphouse is fully insulated to minimize weather effects and to provide sound attenuation of the ancillary works.

  The general dimensions of the structure are as follows:

  - Total Height 5.5 m
  - Total Width 10.0 m
  - Total Length 10.0 m
  - Floor Slab Elevation 346.8 m
  - Footing Depth 2.1 m

- The following control, monitoring and treatment facilities were installed into the pumphouse:

  - A mixed-oxidant (MIOX) generator to serve as the primary source of disinfection (sized to provide a maximum chlorine dosage of 4 mg/L at a raw water flow of 100 L/s). The MIOX system generates a mixed-oxidant solution electrolytically from a sodium chloride (NaCl) brine. Electrolysis of chloride solutions generates chlorine ($Cl_2$) and hypochlorite (OCl). The mixed-oxidant solution consists of hypochlorous acid (HOCl) and other chlor-oxygen species. The solution is stored in a 2000 L oxidant tank and injected into the water stream via a chemical metering pump flow-paced in proportion to raw water flow. A second metering pump, complete with automatic switchover capabilities, provides standby service.

  - A sodium hypochlorite system to provide standby service for the MIOX system (sized to provide a maximum chlorine dosage of 3 mg/L at a raw water flow of 100 L/s). The system consists of a chemical metering pump, flow paced to well pump discharge, and a 200 L day tank. This system will be placed on-line manually if the MIOX system is to be taken out of service or in the event of a system failure. Automatic switchover of the sodium hypochlorite system is not required, since the presence of elevated storage and alternate well supplies in the system will provide operators with sufficient time to respond to problems.

  - An iron sequestering system consisting of one chemical metering pump, flow paced to well discharge, and a 200 L sequestering solution (sodium silicate) day tank.

  - High-lift pump facilities capable of achieving the pumping capacity of 100 L/s at 47 m TDH.

  - Monitoring and alarm facilities for raw and treated water discharge, free chlorine residual, turbidity and system pressure. The monitoring system is integrated with the existing Supervisory Control and Data Acquisition (SCADA) system for the Mitchell water system in order to permit continuous monitoring and data recording.

  - Associated mechanical, electrical and control systems.

  - Associated yard piping.

- A single-cell ground-level reservoir is constructed immediately adjacent to the pumphouse for the purpose of providing chlorine contact time to the maximum pumphouse discharge of 100 L/s (approximate footprint: 72 $m^2$). The reservoir is equipped with baffles to avoid short-circuiting of flows through the cell and an inlet diffuser to promote even distribution of the inflow across the flow path. The reservoir extends approximately 1.0 above grade, with approximately 0.5 m ± of cover provided (revegetated with native grass seed and mulch).

- A 230 kW exterior standby diesel generator has been installed immediately north of the pumphouse. The 2.7 m high generator set is housed in a free-standing enclosure (weather-proof, insulated and sound attenuated) and is set on a concrete pad having a footprint of approximately 10.1 $m^2$. Diesel fuel is stored in a double-walled tank below the generator (i.e., sub-base mounted). Chain link fencing has been installed around the perimeter of the generator site.

- Site grading and elevations for the new facilities have been designed in accordance with Section 3.2.5.9 of the American Water Works Association's *Recommended Standards for Water Works*. The most relevant requirements of the section are as follows:

  - The permanent casing for all ground water sources shall project at least 450 mm above final ground surface.

  - The pumphouse floor elevation shall be at least 600 mm above flood elevation and 150 mm above final ground elevation.

  - The top of the casing shall terminate at least 900 mm above the flood elevation.

### 4.5.3 Site Servicing

Site servicing was extended to the pumphouse facility during the construction phase. The general servicing plan incorporated the following activities:

- Extension of approximately 30.8 m of 300 mm dia. watermain from the pumphouse easterly to an existing 300 mm dia. transmission watermain situated on the east side of the Arthur Street road allowance.

- Installation of approximately 25.1 m of 125 mm dia. sanitary sewer from the pumphouse easterly to an existing 200 mm dia. sanitary sewer extending along Arthur Street.

- Extension of approximately 20.1 m of 300 mm dia. storm sewer easterly from the pumphouse to a new shallow grassed swale which will discharge into an existing ditch extending along the western side of the Arthur Street road allowance. The swale extends approximately 6.9 m and varies in width from approximately 1.0 m to 3.5 m (at the point of discharge). The depth of the swale is approximately 0.25 m. A catch basin was also provided immediately adjacent to the pumphouse.

- Extension of approximately 3.2 m of 300 mm dia. overflow pipe northerly from the reservoir to a concrete headwall structure for erosion control (approximate footprint: 6.0 $m^2$). A 33.5 m ± shallow grassed swale was extended easterly from the structure to discharge overflow into the existing roadside ditch along the western side Arthur Street. The swale varies in width from approximately 1.0 m to 3.0 m (at the point of discharge). The depth of the swale is approximately 0.5 m.

- Installation of a new 3-phase electrical service to the property boundary of the site. The electrical service within the site boundaries was installed underground in suitably sized conduit. A new pad-mounted transformer was also placed on the site adjacent to the road allowance (approximate footprint: 2.8 $m^2$).

- Construction of an access road from Arthur Street westerly to the new parking area for the pumphouse facility (approximate distance: 13.5 m). The 5.1 m ± wide lane has a gravel base and surface (total gravel depth: 0.6 m ±). The parking area is roughly 125 $m^2$ and incorporates a concrete surface. A new 400 mm dia. culvert has been provided to carry the road across the existing ditch (total culvert length: 12 m ±).

### 4.6 Operation and Maintenance Phases

All waterworks facilities will be operated and maintained by the Municipality of West Perth in accordance with the requirements and protocols set out in the *Mitchell Water Works Operations Manual*. The plan has been prepared to provide operations personnel with a reference document detailing the requirements for system operation and maintenance, as well as measures to address emergency situations (e.g., accidents, spills, equipment failures). The manual incorporates a general overview of system equipment and procedural activities, as well as additional requirements prescribed by the current provincial water system regulation, *Ontario Regulation 170/03* (Regulation 170) (section 9.2.2.1 of this report provides more specific details on the content of the plan).

Measures for dealing with problems and emergencies related to the operation of the project are described in the *Municipality of West Perth Water Systems Contingency Plan*. The plan establishes appropriate courses of action to mitigate the adverse effects for the following general situations:

- Supply and treatment problems (e.g. adverse water quality test results, failed chlorinator).
- Distribution system problems (e.g., critical watermain break, damaged hydrant).
- Storage facility problems (e.g., loss of storage, structural failure).
- Emergency conditions (e.g., breach of security, fire or explosion).

There are several types of corrective actions depending upon the nature and magnitude of the occurring problem. For this reason, the Contingency Plan sets out general response procedures to assess the scope of the situation and steps to mitigate the problem (section 9.2.2.2 of this report provides more specific details on the content of the plan).

### 4.7 Decommissioning Phase

The Arthur Street Well Supply will be decommissioned in accordance with *Ontario Regulation 903/90* (Regulation 903) or successor legislation, as well as any requirements of regulatory agencies. Under Regulation 903, well abandonment requires the following general activities:

- Removal of all equipment and debris in the well.
- Removal of the well casing to a minimum depth of two metres below surface.
- Removal of water within the well, placement of sand or pea gravel and bentonite chips from the bottom of the well to the deeper of the deepest formation supplying water or to the top of the intake zone of the well.
- Plugging of the well, including the annular space, via an abandonment barrier comprised of a slurry which typically includes clean water and a combination of other materials (e.g., bentonite, Portland cement, disinfected sand and gravel.
- Dismantling of all above-ground structures associated with the well (i.e. the pumphouse building and all pumping and treatment facilities).
- Removal of below-ground structures, foundations and slabs.
- Sealing of the well at ground surface via bentonite chips and soil cover.
- Revegetation of disturbed areas.

# 5.0 CONSTRUCTION PLAN AND TIMETABLE

## 5.1 General Construction Sequence

### 5.1.1 Well Development

The construction plan for the development of production Well 4 incorporated the following general tasks:

- Mobilization of the Contractor to the site.
- Supply and installation of a pitless adaptor and vented well cap.
- Supply and installation of the submersible well pump, discharge piping and associated equipment.
- Completion of all necessary disinfection procedures.
- Completion of all required inspections and testing (e.g., radiographic weld testing).
- Completion of all required documentation and reporting on the works.

### 5.1.2 Site Servicing and Access Road

The construction plan for the installation of site servicing incorporated the following tasks:

- Completion of the layout and topsoil stripping (including delineation of the access road and laydown areas).
- Clearance of a 6 m ± wide area of vegetation along the servicing route from Arthur Street in order to facilitate the access road, as well as trenching and construction equipment.
- Excavation of trenching for all inground services.
- Installation of services in accordance with engineering specifications.

- Installation of a 3-Phase primary cable on the existing pole line extending along the western side of Arthur Street and the extension of an underground electrical service to the site (including provision of a pad-mounted transformer).
- Backfilling of trenches in accordance with engineering specifications.
- Revegetation of disturbed areas with native grass seed and mulch.
- Completion of all required documentation and reporting on the works.

### 5.1.3 Pumphouse Facility

The construction plan for the erection of the pumphouse incorporated the following tasks:

- Excavation and confirmation of the soil bearing capacity of the foundation (geotechnical testing).
- Installation of the footings and pouring of the concrete slab.
- Construction and inspection of the ground-level reservoir and all associated facilities.
- Construction and inspection of the pumphouse structure and exterior finish.
- Completion of mechanical, electrical and miscellaneous metal work associated with the pumphouse controls.
- Completion of all necessary chlorination procedures.
- Installation of yard piping and completion of miscellaneous site work.
- Revegetation of disturbed areas with native grass seed and mulch.
- Completion of all required documentation and reporting on the works.

## 5.2 Project Timetable

The following summarizes the general steps for the completion of the upgrading project:

- Completion of detailed design for all planned facilities (May 2006).
- Initiation of field work for the supply works and utilities (July 2006).
- Construction and commissioning of Arthur Street supply works (December 2006).
- Completion of site restoration activities (December 2006).

Major waterworks facilities at the Arthur Street site were not constructed during time periods which would have adversely impact upon fisheries resources or bird nesting activities.

# 6.0 DESCRIPTION OF EXISTING ENVIRONMENT

## 6.1 Physical Characteristics and Conditions

### 6.1.1 Physiographic Characteristics

Mitchell is situated within the Stratford Till Plain geologic formation, which incorporates a land base of approximately 3,550 $km^2$ extending across the Counties of Middlesex, Huron, Perth and Wellington. The till plain is characterized as an area of ground moraine interrupted by several terminal moraines. The till in the Stratford Till Plain formation is predominately a brown calcareous silty clay (being derived from the Huron Ice Lobe).

Topographic relief in Perth County is relatively minimal with the exception of moraine ridges which extend across various parts of the region. Prominent topographic features in the County are largely the result of glacial deposition (moraines, eskers) and erosion (river valleys) during the Quartenary Period.

The Paleozoic bedrock subcropping below Perth County is the Salina Formation. The formation consists of 120 m to 200 m of interbedded shale, mudstone, dolostone, gypsum and salt. Paleozoic bedrock in the County of Perth is buried under some of the thickest Quartenary overburden in southern Ontario (sediments near the communities of Atwood and Milverton are approximately 100 m thick). Most of the County is covered by approximately 30 m of unconsolidated sediment, although the river valleys, including the Thames River valley, exhibit minimal deposition. The bedrock geology encountered at the Mitchell wells is the Lucas Formation of the Detroit River Group (a microcrystalline limestone). The Quaternary geology of the Mitchell area consists of a variety of glacial deposits.

The dominant landform feature in the Mitchell area is the Rannoch Till Deposit; a clayey silty till which forms the surface till over most of the western section of Perth County from the Mitchell Moraine southwards to the Town of St. Marys. The Mitchell Moraine is a single strand of heavy till which is relatively narrow but well defined by its moderate relief. The material within the till is generally characterized as pale brown calcareous clay till with a limited amount of pebbles and boulders included. The moraine is well defined within the Mitchell area where it extends along a north-south axis through the western section of the community. From Mitchell southward, a spillway, now followed by the North Thames River, extends along the eastern edge of the Moraine. In this respect, the river valley developed on glaciofluvial deposits.

Soils in the vicinity of the defined right-of-way and corridor are classified as Perth clay loam; a series of the Grey-Brown Podzolic soil group. These till loams are typically comprised of 15 cm of dark grey clay or silt loam, mottled most intensely above the parent material. Natural drainage within the Perth clay loam series is poor to imperfect.

The overall slope of land in the Mitchell area is westward over a gradual elevation change from approximately 348 m to 344 m (Geodetic Survey of Canada). Natural drainage characteristics in the community are bisected by the Mitchell Moraine and the North Thames River and Whirl Creek floodways (the landbase gradually slopes towards these floodways). Surface drainage over the Arthur Street site is generally towards a grassed swale which bisects the property on an east-west axis immediately south of the existing works building. The site exhibits a gradual elevation change of approximately 0.4 m (from 345.5 m to 345.9 m).

### 6.1.2 Hydrogeological Characteristics

Existing water well records and mapping compiled as part of the Perth County Ground water Study (PCGS) were reviewed to provide a hydrogeologic interpretation of the Mitchell area. The following summarizes the general findings of this assessment:

- Cross-sections completed for the PCGS indicate that bedrock is encountered at an elevation of 320 m east of Mitchell and 290 m west of the community.

- The bedrock aquifer within the Mitchell capture zones has been classified as having low susceptibility to contamination.

- Ground water flow in the bedrock is from northeast to southwest within the Mitchell area and throughout the Perth County region.

- Testing programs at the existing municipal wells and the test wells has identified that the Mitchell aquifer consists of discrete producing zones within the Detroit River Group sequence. The discrete producing zones appear to be solution enhanced bedding features and fractures.

- Overburden sediments in the Mitchell area consist of glacial till (a mixture of silt, sand, stones, clay) with some glaciolacustrine sediments (silt, clay). The overburden is between 30 m and 50 m in depth, with the thickest sections of the overburden situated beneath the Mitchell Moraine. Within the vicinity of the north Thames River valley, the thickness of the overburden is relatively minimal (between 10 m and 15 m).

- Ground water flow in the overburden is suspected to be towards the Thames River.

### 6.1.3 Hydrological Characteristics of the North Thames River

The Upper Thames Region Conservation Authority (UTRCA) monitors the stream flow of the North Thames River at a gauging station situated on Road 32 south of Mitchell. Data collected at this station for the period 1953-2003 was utilized to obtain stream flow measurements for the PCGS.

The following summarizes the key characteristics of the watercourse and the associated watershed:

- The total drainage basin upstream of Mitchell is approximately 320 $km^2$, which represents approximately 9% of the Upper Thames River watershed. Two subwatersheds are incorporated into this drainage basin; the North Mitchell watershed (total area: 176 $km^2$) and the Whirl Creek watershed (total area: 143 $km^2$). The North Mitchell watershed incorporate the headwaters of the North Thames River, which originate from the union of several small creeks which drain large flat areas of agricultural land.

- Average monthly flows over the recording period are as follows (by selected month):
  - January: 4.08 $m^3/s$
  - March: 13.40 $m^3/s$
  - May: 1.30 $m^3/s$
  - June: 0.86 $m^3/s$
  - July: 0.82 $m^3/s$
  - September: 1.68 $m^3/s$
  - November: 4.70 $m^3/s$

- Maximum daily flows achieved over the recording period are as follows:
  - January: 207.0 $m^3/s$
  - March: 360.0 $m^3/s$
  - June: 50.7 $m^3/s$
  - July: 45.0 $m^3/s$
  - September: 216.0 $m^3/s$
  - November: 146.0 $m^3/s$

- Minimum daily flows identified over the recording period are as follows:
  - January: 0.02 $m^3/s$
  - March: 0.06 $m^3/s$
  - June: 0.00 $m^3/s$
  - July: 0.00 $m^3/s$
  - September: 0.00 $m^3/s$
  - November: 0.00 $m^3/s$

- The mean annual stream flow at Mitchell is approximately 4.4 $m^3/s$. This flow contributes approximately 11.5% of the flow in the Thames River downstream of London.

- There are two small dams located on watercourses in the North Thames watershed, including the Mitchell Conservation Area dam situated immediately north of Provincial Highway No. 8.

### 6.1.4 Surface Water Quality Characteristics of the North Thames River

In 2001, the UTRCA reviewed the environmental conditions of the North Mitchell watershed and compared this information with the other 27 subwatersheds with the Upper Thames River watershed. The assessment included a review of long-term water quality monitoring obtained from the North Thames River gauging station (water quality monitoring at this location was initiated in the early 1970's).

The key findings of the comparative assessment are as follows:

- Total phosphorous concentrations have remained relatively consistent over the monitoring period. Average concentrations over a 10-year period (1990-2000) are approximately 0.08 mg/l, a value which exceeds the MOE objective (0.03 mg/l). The concentration of phosphorous evident at the North Mitchell monitoring station is equivalent to the average for the entire Upper Thames watershed.

- Fecal coliform concentrations have increased over the monitoring period, indicating increasing contamination from human/ animal sources. Average bacteria counts over a 10-year period (1990-2000) are approximately 407 per 100 ml, a value which exceeds the MOE objective (100 per 100 ml). The bacteria counts evident at the North Mitchell monitoring station also exceed the average counts for the entire Upper Thames watershed (304 per 100 ml).

- The Benthic Score (Family Biotic Index) for the North Thames watershed is 6.57 compared to an average of 5.66 for the entire Upper Thames watershed. Benthic organisms are the aquatic invertebrates that live in stream sediments and are a good indicator of water quality and stream health. The Family Biotic Index scores each species according to its pollution tolerance; with scores ranging from 0 (for organisms very intolerant to organic wastes) to 10 (for organisms very tolerant to organic waste).

- Riparian cover in the North Thames watershed is well below the average for the Upper Thames watershed.

- Virtually all headwaters of the major tributaries in the North Thames watershed are channelized and intermittent.

- A total of 16 spills were reported in the North Thames watershed between 1988-2001, which is relatively high compared with other subwatersheds in the Upper Thames watershed.

- Approximately 1% of the North Thames watershed is classified as highly erodible, resulting in lands contributing over 7 tonnes/ ha of soil to the watercourse annually. On average, 9% of the landbase in the Upper Thames River watershed is being classified as highly erodible.

### 6.1.5 Active Wells and Water Licences

According to the PCGS, a total of 72 active permits exist within the County of Perth and a 5 km radius surrounding the jurisdiction (as issued by the MOE). Of these, 60 (83%) of the permits are for ground water extraction, 9 (13%) are for surface water extraction and 4 (5%) are for both ground water and surface water taking. The majority of the permits (40) are issued for communal and municipal well supplies. It total, the maximum permitted extraction rate for these 72 activities is 184,880 $m^3$/day

Several private and municipal well supplies, test wells (TW) and monitoring wells (MI) have been identified within relative proximity of the Arthur Street well site. In total, two existing private wells are situated within 1,500 m of the subject property (being the Kelly Well and the Fischer Well). The Kelly Well is a commercial/industrial well situated approximately 300 m northeast of the project site. The Fischer Well is situated approximately 1,300 m west of the project site. This well was formerly used as the communal production well for a local residential subdivision. Residences within the subdivision were recently connected to the Mitchell Water Works and, consequently, the well is no longer used for production purposes.

Table 6.1 summarizes the well supplies monitored during the course of the hydrogeologic study work.

**Table 6.1**
**Active Wells Monitored During the Well 4 Hydrogeologic Investigation**

| Monitor Location | Distance from Well 4 (m) | Measuring Point (e.g., Top of Casing/ Flange) | Pre-Test Level Below Measuring Point (m) |
|---|---|---|---|
| Well 4 | 0 | 1.68 (above ground) | 18.89 |
| Kelly | 300 | 0.38 (above ground) | 16.37 |
| Well 3 | 800 | 1.41 (above pumphouse floor) | 18.14 |
| MW1/02-D | 1,100 | 0.96 (above ground) | 10.44 |
| Well 2 | 1,100 | 0.73 (above pumphouse floor) | 12.99 |
| MW3/02-D | 1,100 | 0.91 (above ground) | 9.40 |
| MW2/02-D | 1,150 | 0.97 (above ground) | 8.57 |
| TW1/02 | 1,200 | 0.45 (above ground) | 13.83 |
| Fischer * | 1,300 | 0.13 (above pumphouse floor) | 20.12 |
| Vanderhyden | 1,550 | 0.29 (above ground) | 20.43 |
| Haemmerli | 1,550 | 0.28 (above ground) | 18.59 |
| Vorstenbosch (farm) | 1,600 | 0.70 (above ground) | 14.72 |
| Vorstenbosch (domestic) | 1,700 | 0.18 (above ground) | 15.51 |

* Decommissioned and abandoned in accordance with Regulation 903.

### 6.1.6 Climatic Conditions

Environment Canada has recorded and compiled climatic data at the Stratford MOE monitoring station for the period 1971-2000. As the community of Stratford is approximately 20 km southeast of Mitchell, the normalized data available from the monitoring station provides a relatively accurate representation of the conditions evident within the study area.

Table 6.2 summarizes the climatic trends evident for the 30-year period:

**Table 6.2**
**Selected Climatic Statistics (1971-2000):**
**Stratford MOE Monitoring Station**

| Selected Statistic | Climatic Normal |
|---|---|
| **i) Temperature** | |
| Average daily | 7.0 °C |
| Average daily (maximum) | 11.5 °C |
| Average daily (minimum) | 2.4 °C |
| Days above 20 (maximum) | 113.7 |
| Days below 0 (maximum) | 74.0 |
| **ii) Precipitation** | |
| Total | 1064.2 mm |
| Rainfall (total) | 820.3 mm |
| Snowfall (total) | 243.9 mm |
| Days with at least 0.2 mm rainfall | 84.4 |
| Days with at least 0.2 mm snowfall | 23.3 |

In review, the climatic conditions evident in the vicinity of Mitchell are relatively consistent with the data available for other monitoring stations in Southwestern Ontario.

Generalized climate information for Perth County was also summarized in the PCGS. The following represent the most relevant data with respect to his project:

$ Warm summers, mild winters and fairly reliable precipitation characterize the Perth County climate. Climatic fluctuations on a yearly basis are expected due to the spatial variations caused by topography and the varying exposure to the prevailing winds in relation to the Great Lakes.

$ The 30-year climate norm data identifies that, on an annual average, the wettest months of the year are April, August, September and November (April normally has the lowest amount of precipitation). January and February represent the driest months (February normally has the lowest amount of precipitation).

$ The mean annual evaportranspiration in the watershed is about 450 mm. In the Mitchell area, the evaportranspiration could be higher due to significant amounts of water available in swamps, ponds, marshes or soil-water storage.

### 6.1.7 Air Quality

The MOE compiles continuous ambient air quality data from more than 40 monitoring sites. The monitoring program measures the levels of six contaminants, ozone ($O_3$), fine particulate matter ($PM_{2.5}$), nitrogen dioxide ($NO_2$), carbon monoxide (CO), sulphur dioxide ($SO_2$) and total reduced sulphur (TRS) compounds. Based on a review of the identified sites, Mitchell is centrally located between the Grand Bend (southwest), London (south) and Kitchener (east) monitoring stations. The data available from these monitoring stations provides a relatively accurate representation of the airshed conditions in the study area.

Table 6.3 summarizes the Air Quality Index (AQI) identified for the three sites during the 2003 monitoring period:

**Table 6.3**
**Air Quality Index Summary (2003):**
**Grand Bend, Kitchener and London Monitoring Stations**

| Monitoring Station | Percentage of Valid Hours AQI in Range* | | | | |
|---|---|---|---|---|---|
| | Very Good (0-15) | Good (16-31) | Moderate (32-49) | Poor (50-99) | Very Poor (100+) |
| Grand Bend | 28.1 | 62.8 | 8.3 | 0.8 | 0.0 |
| Kitchener | 21.0 | 56.1 | 11.2 | 1.1 | 0.0 |
| London | 34.1 | 53.2 | 11.7 | 1.0 | 0.0 |

* AQI values are based on concentration of the above-noted pollutants converted to a common scale or index.

Given these findings, the air quality in the village of Mitchell, on average, is assumed to be good to very good. This may be due, in part, to the rural setting of the community, the limited amount of industrial activity in the region and localized climatic conditions.

### 6.1.8 Noise

The subject property is situated within the industrial sector of Mitchell; an area which includes a number of active manufacturing activities and an operational railroad. No specific noise assessments have been completed in the immediate area, however existing noise levels will be comparable with traditional urban environments given the various industrial activities evident in the vicinity of the project site (e.g., construction yard, fencing manufacturer, food processing plant). Based on the land usage, actual observations, and a familiarity with traffic patterns, it is estimated that the existing ambient noise levels for the study area range from 65 to 70 decibels (periodic increases in noise levels are expected due to the urban setting).

The project site is not considered to be within a noise sensitive area, as sensitive receptors such as schools, daycares, senior homes and hospitals are not situated in close proximity to the right-of-way or corridor (there are no sensitive uses within 500 m of the defined right-of-way). The nearest industrial building is situated approximately 50 m from the new pumphouse facility.

## 6.2 Biological Characteristics and Conditions

### 6.2.1 Sensitive Natural Areas

A review of known sensitive areas was completed for the defined right-of-way, corridor and regional boundary of the study area. Information from the Ontario Ministry of Natural Resources (MNR), the Upper Thames River Conservation Authority and the RVA environmental assessment were considered as part of this evaluation. Based on this review, it was determined that there are no significant natural areas or wetlands within the boundaries of the defined right-of-way and corridor or within the immediate vicinity of Mitchell.

In review, the only sensitive areas identified in proximity to the project site are the North Thames Valley ANSI and the Whirl Creek wetland. The MNR has characterized these sensitive areas within its inventory of natural heritage sites. In review, the North Thames Valley ANSI extends over a 1,400 ha area incorporating a variety of physiologic features (e.g, Milverton Moraine, Wartburg Till, Elma Till, Mitchell Moraine, Rannoch Till, esker and terraces). This ANSI, which is situated approximately 6.8 km south of Mitchell, exhibits the truncation of the Milverton Moraine by the Mitchell Moraine. The Whirl Creek wetland is 34 ha wetland complex situated approximately 7.2 km southeast of the project site. The complex is composed of one wetland type (100% swamp) and incorporates a variety of vegetation including hemlock, American Beech, Yellow Birch; soft maple, ferns, soft maple and dogwood.

### 6.2.2 Fisheries and other Aquatic Resources

In the Mitchell area, there are three subwatersheds of the Thames River; the Glengowan, North Mitchell and Whirl Creek. The three water subwatersheds extend over a land base of approximately 325 $km^2$ and incorporate approximately 73% of West Perth. In total, 28 species of fish have been recorded in the Glengowan subwatershed, including Rock Bass, Smallmouth Bass and Largemouth Bass. Within the Whirl Creek watershed, 19 fish species have been recorded, including Rock Bass and Smallmouth Bass. Very little fish sampling has been conducted in the North Thames River watershed (the Bluntnose Minnow is the only recorded species).

A search of Environment Canada's *Species at Risk Act* (SARA) registry indicated the following Schedule 1, 2 and 3 species are known to exist within the three identified watersheds:

- Schedule 1: None identified.
- Schedule 2: Black Redhorse (Glengowan Subwatershed).
- Schedule 3: Greenside Darter (Glengowan and Whirl Creek Subwatersheds)
  Silver Shiner (Glengowan Subwatershed).

The project site is situated near the northern limit of the Glengowan subwatershed, approximately 650 m east of the North Thames River floodway corridor and 550 m southwest of the Whirl Creek floodway corridor. Accordingly, riparian zones associated with these watercourses are located outside of the defined right-of-way and corridor for this project.

### 6.2.3 Vegetation and Terrestrial Resources

The following represent the most relevant habitat features of the right-of-way and corridor:

- The Arthur Street well site is comprised almost entirely of manicured lawn. Certain landscaping features have also been completed on the site; specifically a small planting area comprised of two spruce trees and a bush, a single deciduous tree recently planted east of TW2/03 and a row of coniferous (pine) trees planted along the eastern limit of the property (providing aesthetic screening). Tree cover within the entire defined right-of-way is very limited in scale and there is no evidence of sensitive species (based upon observations made during site visits).

- There is little vegetation in the remainder of the right-of-way corridor, given that industrial character of this developed area. Local vegetation is limited to manicured grasses and landscaping features (i.e., limited tree and shrub plantings). Tree cover within the corridor is very limited in scale and there is no evidence of sensitive species (based upon observations made during site visits).

A search of the SARA registry indicated there were two plants which had a possible range within the study area:

- **Butternut:** The SARA registry indicates that the Butternut is mainly encountered as a minor component of deciduous stands, but large pure populations exist on certain flood plains. It grows best in rich, moist, and well-drained soils often found along streams. It may also be found on well-drained gravel sites, especially those made up of limestone. It is also found, though seldomly, on dry, rocky and sterile soils. In Ontario, the Butternut generally grows alone or in small groups in deciduous forests, commonly associated with trees such as Linden, Black Cherry, Beech, Black Walnut, Elm, Hemlock, Hickory, Oak, Red Maple, Sugar Maple, Yellow Poplar, White Ash and Yellow Birch. Although the Butternut can range through the study area, the presence of the Butternut in Ontario has generally been reported in the Point Pelee and St. Lawrence Islands National Parks. The Arthur Street well site does not provide suitable habitat for this tree and this species was not observed during various site inspections and surveys of the subject property.

- **American Ginseng:** The SARA registry indicates that in Canada, ginseng grows in rich, moist, undisturbed and relatively mature deciduous woods in areas of neutral soil (such as over limestone or marble bedrock). The forest canopy is usually dominated by Sugar Maple, White Ash, Bitternut Hickory, and Basswood. Colonies of ginseng are often found near the bottom of gentle south-facing slopes, where the microhabitat is warm and well-drained. In Canada, it occurs in southern Ontario and southwestern Quebec. It is considered to be rare or uncommon in most of its North American range. In Ontario, concentrations occur along the Niagara Escarpment and the eastern edge of the Precambrian Shield. The Arthur Street well site does not provide suitable habitat for this plant and this species was not observed during various site inspections and surveys of the subject property.

### 6.2.4 Wildlife Resources

#### 6.2.4.1 Birds

A total of 26 birds have been confirmed in the general study area following a review of the most recent Ontario Breeding Birding Atlas (2001-2005). An additional 64 species sitings were categorized as probable or possible. This study area, designated Square 17MJ81 of Region 6 (Huron-Perth), extends over 100 $km^2$ and includes a variety of wetland and swamp complexes, woodlots, sewage lagoons and riparian zones associated with the North Thames River and Whirl Creek watersheds. These areas form the key habitat for the identified species.

A search of the SARA registry indicated there were two rare bird species which had a possible range within the study area; the least bittern and yellow-breasted chat. The following is a summary of habitat considerations for each Species at Risk, both generally and with respect to this project:

- **Least Bittern:** The Least Bittern is a *Species at Risk Act* (SARA) Schedule 1 threatened species. The SARA registry indicates that the Least Bittern breeds from southern Canada south to South America, and winter from California, Texas and Florida to Panama and Colombia. In Ontario, the Least Bittern nests south of the Canadian Shield. The Canadian population of Least Bitterns is estimated at less than 1,000 pairs. The majority of Least Bitterns that breed in Canada are found in Ontario. The Canadian population is likely continuing to slowly decline, but reliable survey methods to estimate the population size and trend over time have not been developed. Least Bitterns nest in freshwater marshes, where dense tall aquatic vegetation is interspersed with clumps of woody vegetation and open water. They are most regular in marshes that exceed 5 ha in area. In the northern part of their range, they are most strongly associated with cattails, the most common tall emergent aquatic plant. None of the works at this site would affect any potential habitat for the Least Bittern. In addition, the least bittern is intolerant of loss of habitat and human disturbance and, consequently, is unlikely to habitat the study area.

- **Yellow-breasted Chat:** The SARA Registry indicates that the Yellow-breasted Chat, is a SARA Schedule 1 species of special concern. The SARA registry indicates that the Yellow-breasted Chat breeds from southern Canada south to central Mexico. The Yellow-breasted Chat breeds in dense thickets around wood edges, riparian areas, and in overgrown clearings. The Ontario population is very dependent on successional habitats of thick shrubbery. These habitats are the result of vegetative growth in forest openings created by storms, fire, or abandoned fields. The availability of habitat in Ontario has been generally stable over the last decade. None of the works at the project site would affect any potential habitat for the Yellow-breasted chat.

#### 6.2.4.2 Mammals

No mammals were observed during various site visits and none are known to habitat the defined right-of-way. Given the nature of the habitat associated with the project site and the industrial setting of the general study area, it is unlikely that any large populations of mammals inhabit the study area or will be affected by the new well supply.

A search of the SARA registry indicated that the grey fox may have a possible range within the study area. It is noted that the Grey Fox is a SARA Schedule 1 threatened species. The site also indicates that the range of the Grey Fox is generally from southern Canada to northern Colombia and Venezuela. In Canada, the populations of this species are very small. In Ontario, the Grey Fox is thought to be present from southwestern Ontario (Windsor) to the Quebec border. Grey Foxes inhabit deciduous forests and marshes. They make their dens in many different kinds of substrate (rock outcrops, hollow trees, underground burrows dug by other animals, or piles of brush), but the dens are usually located in an area of dense brush, fairly close to a water source. The project area is not considered to be habitat for this species given the surrounding urban development and the limited size of the affected site and as a result, is unlikely to inhabit the study area.

#### 6.2.4.3 Herpetofauna

No amphibians or reptiles were observed during various site visits and none are known to habitat the defined right-of-way. Given the nature of the habitat associated with the project site and the industrial setting of the general study area, it is unlikely that any significant populations of amphibians or reptiles inhabit the study area or will be affected by the new well supply.

A search of the SARA registry indicated there is no herpetofauna which has a possible range within the study area.

#### 6.2.4.4 Lepidopterans

No lepidopterans were observed during various site visits and none are known to habitat the defined right-of-way. Given the nature of the habitat associated with the project site and the industrial setting of the general study area, it is unlikely that any significant populations of lepidopterans inhabit the study area or will be affected by the new well supply.

A search of the SARA registry indicated there is one lepidopteran that has a possible range within the study area, the Monarch, a SARA Schedule 1 species of concern. The Monarch is widely distributed from Central America to southern Canada, and from coast to coast. Monarchs in Canada exist primarily wherever milkweed (Asclepius) and wildflowers (such as Goldenrod, asters, and Purple Loosestrife) exist. This includes abandoned farmland, along roadsides, and other open spaces where these plants grow. The population of the Monarch is limited by loss of habitat to logging, human disturbance, and predation, especially while wintering in Mexico. Widespread and increasing use of herbicides in North America is another significant threat, which kills both the milkweed needed by the caterpillars and the nectar-producing wildflowers needed by the adults. Given the nature of the habitat associated with this project, it is unlikely that the Monarch inhabits the study area or will be adversely affected by the new well supply.

#### 6.2.5 Level of Habitat Assessment

Based upon the findings of the preliminary biological review and comments from regulatory agencies, the following general conclusions were drawn regarding wildlife and breeding bird habitat within the vicinity of the project site:

- No SARA Schedule 1 species is known to inhabit the defined right-of-way or corridor.
- No provincially significant species are known to inhabit the defined right-of-way or corridor.
- Habitats in the study area are primarily landscaped private property. These habitats are not significant or sensitive to development.
- The affected habitats are influenced by existing industrial activities and are not considered significant for wildlife species or for breeding bird habitat.
- Implementation of the project is not anticipated to have any interaction upon the existing aquatic habitat of local watercourses.

Given the characteristics of wildlife and breeding bird habitat in the study area (i.e., common, non-sensitive species), no detailed or specialized biological assessments were conducted for this EA.

### 6.3 Cultural Characteristics

#### 6.3.1 Cultural Heritage

The community of Mitchell does not exhibit any cultural heritage features which would be affected by the project. There are also no substantive Aboriginal communities evident within the regional boundary of this project.

### 6.3.2 Archaeological Resources

The project involved development on lands that had not been heavily disturbed by previous construction activities. Construction of the project therefore had the potential to impact upon buried cultural heritage resources.

At the outset of the provincial Class EA investigation, preliminary details on the project were circulated to the Ministry of Culture (Heritage & Libraries Branch, Southwest District). In correspondence dated May 22, 2002, the Ministry advised that additional information on the project site to determine if the extent and type of land disturbance would exhibit the potential to impact upon heritage resources. Additional information on the Arthur Street well site was circulated to the Ministry in February 2006. In correspondence dated, March 2, 2006, the Ministry advised that the project site does not exhibit cultural heritage potential given that the small area affected by the project and the previous disturbance evident on the site.

No further investigations were required to assess the impacts of the project on cultural heritage resources.

# 7.0 ENVIRONMENTAL EFFECTS ANALYSIS

## 7.1 Approach

### 7.1.1 Defined Valued Ecosystem Components

The identification of VEC's for this EA followed an assessment of information gathered from various sources including background reports, specialized studies, public consultation and consultation with government review agencies. The VEC's selected represent those elements which are considered of significance for this project and which could be adversely affected by the construction of the new well supply.

VEC's selected for this project are:

- Ground water quantity and quality.
- Surface water quantity and quality.
- Vegetation.
- Species at risk.
- Migratory birds.
- Wildlife.
- Noise.
- Air quality.
- Local users of ground water.
- Heritage and historical cultural resources.
- Capacity of renewable resources.

### 7.1.2 Evaluation of Environmental Effects

The following section of the report provides a summary of the potential environmental impacts of the project on the selected VEC's. The evaluation of environmental effects follows the assessment methodology presented in section 2.3 of this report.

For each VEC, the analysis of effects is arranged in the following framework:

- Potential Environmental Effects
- Measures to Mitigate Effects
- Residual Effects
- Significance of Residual Effects

## 7.2 Ground Water Quantity and Quality

### 7.2.1 Potential Environmental Effects on Ground Water Quantity

#### 7.2.1.1 Well Capacity Evaluation

#### (a) Objectives

Preliminary testing of Well 4 was completed following well construction and development in Spring 2004. The aquifer testing activity included variable rate step tests and long-term pumping tests to confirm the available supply and to measure drawdown effects.

Testing was carried out under the following conditions:

- Well 1 pumping rate - 0 L/s.
- Well 2 pumping rate - 0 L/s.
- Well 3 pumping rate - 30 L/s.
- Well 4 pumping rate - 100 L/s.

#### (b) Variable Rate Step Testing

Variable rate step testing was completed for Well 4 in March 2004 to determine the available supply capacity. The testing procedure was carried out at selected pumping rates (steps) of 30 minutes separated by 30 minute periods of recovery. Previous testing of TW2/03 had demonstrated the regional impact of pumping 7.6 L/s from the overburden aquifer at the site. However, additional monitoring of the test wells and monitor wells was completed to confirm the response observed during the 2002 investigation.

The results of the variable rate step test are summarized in Table 7.1.

**Table 7.1**
**Mitchell Well 4:**
**Results of Variable Rate Step Test**

| | Step 1 | Step 2 | Step 3 |
|---|---|---|---|
| Pumping Rate (L/s) | 35 | 70 | 105 |
| Total Drawdown after 30 minutes (m) | 1.22 | 2.63 | 4.58 |
| Specific Capacity (L/s/m) | 29 | - | 23 |

Well characterization results from the variable rate testing indicate that major water producing zones are present in the production well at depth intervals of approximately 59 m below ground level (bg) to 61 m bg and 69 m bg to 71 m bg. The results of the variable rate testing indicate that there is significant improvement in well performance following the additional well development. Test results also indicated that the well could support a flow rate of 100 L/s for the aquifer test.

### (c) Long-Term Testing

#### i. General Methodology

Long-term testing of Well 4 consisted of pumping the new well at a flow rate of 100 L/s for a period extending for three days (total pumping time: 49.5 hours). The static water level in Well 4 prior to the aquifer test was approximately 17.3 m bg.

#### ii. Measured Drawdown

Table 7.2 is a summary of the wells monitored during the long-term pumping test and their response to pumping Well 4.

**Table 7.2**
**Mitchell Well 4:**
**Total Drawdown at the Conclusion of the Aquifer Test**

| Monitor Location | Distance from Well 4 (m) | Measuring Point (e.g., Top of Casing/ Flange) | Pre-Test Level Below Measuring Point (m) | Total Drawdown (m) |
|---|---|---|---|---|
| Well 4 | 0 | 1.68 (above ground) | 18.89 | 8.1 |
| Kelly | 300 | 0.38 (above ground) | 16.37 | 2.3 |
| Well 3 | 800 | 1.41 (above pumphouse floor) | 18.14 | 5.3 |
| MW1/02-D | 1,100 | 0.96 (above ground) | 10.44 | 1.7 |
| Well 2 | 1,100 | 0.73 (above pumphouse floor) | 12.99 | 1.8 |
| MW3/02-D | 1,100 | 0.91 (above ground) | 9.40 | 1.7 |
| MW2/02-D | 1,150 | 0.97 (above ground) | 8.57 | 1.7 |
| TW1/02 | 1,200 | 0.45 (above ground) | 13.83 | 0.8 |

| Monitor Location | Distance from Well 4 (m) | Measuring Point (e.g., Top of Casing/ Flange) | Pre-Test Level Below Measuring Point (m) | Total Drawdown (m) |
|---|---|---|---|---|
| Fischer | 1,300 | 0.13 (above pumphouse floor) | 20.12 | 2.6 |
| Vanderhyden | 1,550 | 0.29 (above ground) | 20.43 | 3.5 |
| Haemmerli | 1,550 | 0.28 (above ground) | 18.59 | 3.6 |
| Vorstenbosch (farm) | 1,600 | 0.70 (above ground) | 14.72 | 0.7 |
| Vorstenbosch (domestic) | 1,700 | 0.18 (above ground) | 15.51 | 0.3 |

The following summarizes the key findings of the long-term pumping test and the related analysis:

- A response to the aquifer test was evident at the bedrock monitoring wells (MW1/02, MW2/02, MW3/02) situated in close proximity to Wells 1 and 2.
- A significant response to the aquifer test was observed at the Haemmerli and Vanderhyden wells (total drawdown in excess of 3.0 m). The drawdown trends at both of these observations wells was similar to the late stage drawdown trend observed at Well 4.
- The Fischer and Vorstenbosch (farm) wells were affected by the aquifer test, however the water level data was difficult to interpret due to the operation of both wells during the testing.
- The Vorstenbosch (domestic) well and TW1/02 experience minimal impact from the testing (total drawdown less than 1.0 m).
- The preferential orientation of the drawdown cone-of-influence is roughly north-south with increasing drawdown to the south and less drawdown evident to the east and west.

### iii. Projected Drawdown

A drawdown projection was developed based on the extrapolation of the drawdown trend identified during the aquifer testing. The projection was developed for a hypothetical 19-year period under the test conditions. The results of the drawdown projections are as follows:

- The projected drawdown for Well 4 is approximately 19 m. This projection assumes that the drawdown trend does not change in relation to boundary conditions not evident during the study (e.g., vertical recharge from above reaching the aquifer, reduction in the transmissivity of the aquifer at greater distances from the well). The projected drawdown would result in a pumping level of 36 m bg. Given that the base of the well casing would permit a pump intake setting at a depth of approximately 50 m bg, 14 m of available drawdown would be remain in the well after the hypothetical 19-year time period**.** The aquifer test results therefore indicate that the aquifer at Well 4 can supply a yield of 100 L/s on a long-term basis.

- The projected drawdown cone-of-influence indicates that drawdowns of 15 m to 20 m may occur in the oval-shaped core area that includes Well 4 and two private wells. For distances of 2.5 km to 3.5 km from the core area, drawdowns of approximately 5 m may occur.

- For Well 3, the projected long-term drawdown is approximately 13 m. The drawdown effects may have been masked slightly by a recovery in water levels caused by reducing the pumping rate of Well 3 to 30 L/s during the test (Well 3 normally operates at 45 L/s). In this respect, the pre-test water level of Well 3 under a pumping rate of 30 L/s was approximately 16.7 m below the pumphouse floor (bpf). Adjusting for a maximum flow rate of 45 L/s, the pre-test water level would have likely been 22 m bpf to 24 m bpf. Factoring in the projected long-term drawdown, the pumping water level would be in the range of 35 m bpf to 37 m bpf. The Well 3 pump intake depth setting is approximately 36.6 m bpf.

- For Well 2, the projected long-term drawdown is approximately 8 m. Given that the pre-test water level was 13 m, the projected pumping level is approximately 21 m bpf. Well 1 is expected to have a similar pumping level. The pump intake settings for Wells 1 and 2 are 16.6 m bpf and 20.5 m bpf, respectively.

**iv. Interference**

Long-term testing demonstrated the pumping of Well 4 at the peak rate of 100 L/s would have a significant interference effect on all three municipal production wells (particularly Wells 1 and 2). For the pumping conditions in place during the aquifer test, the drawdown projections indicate that the production well water levels will reach the pump intakes at approximately the following hypothetical times:

- Well 1: 19 years.
- Well 2: 19 years.
- Well 3: 10 years.

No interference with the water supply occurred at the private supply wells monitored during the aquifer test. Two cases of possible interference were later reported to the Municipality by private well owners in rural areas south of Well 4. The problems apparently ceased following the conclusion of the aquifer test.

The magnitude of drawdown and well interference associated with the operation of Well 4 will depend upon the actual pumping rates and duration of pumping when the well is brought into production. The assessment of well interference carried out for Well 4 is considered the conservative case where the well operates continuously at the maximum rate over the long-term (based on a projection of the drawdown trends recorded during the aquifer test). It is anticipated that the well will cycle on/off and/or operate at a lower flow rate to meet system demands.

### (d) Ground Water Recharge

#### i. General

Issues pertaining to ground water recharge with the County of Perth were evaluated on a regional scale as part of the water budget analysis carried out for the PCGS. This section of the report summarizes the findings of the water budget analysis and the specific assessment regarding recharge rates.

#### ii. Water Taking

The vast majority of water in Perth County is non-consumptive on a watershed level, as the water is returned to its original watershed. Uses, such as irrigation, do result in greater losses to the atmosphere via evaporation and evapotranspiration.

Table 7.3 summarizes the estimates that were prepared in the PCGS regarding water taking in West Perth.

**Table 7.3**
**West Perth Water Taking by Activity**

| Water Use Activity | Water Taking ($m^3$/day) |
|---|---|
| Domestic: | |
| Rural | 758 |
| Mitchell Urban Area (Average Day) | 2,660 |
| Agricultural: | |
| Livestock | 2,826 |
| Field Crop/ Vegetable Farming* | 61.7 |
| Industrial/ Commercial/ Institutional/ Dewatering | 14.3 |
| **Total** | **6,320** |

* Includes Irrigation, spraying, equipment use, processing and other minor uses

On a watershed basis, ground water taking in the UTRCA jurisdiction exceeds 31,900 $m^3$/ day. This accounts for more than 60% of the ground water taken throughout the County of Perth (estimated at approximately 52,200 $m^3$/ day).

Table 7.4 summarizes the total daily and yearly ground water taking for the County of Perth:

**Table 7.4**
**County of Perth:**
**Estimated Water Taking**

| Activity | Water Taking ($m^3$) | |
|---|---|---|
| | Daily | Yearly |
| Permits to Take Water | 10,532 | 3.8 million |
| Rural Ground Water | 4,182 | 1.5 million |
| Municipal | 24,574 | 8.9 million |
| Agricultural | 12,924 | 4.7 million |
| Total | 52,212 | 19 million |

### iii. Water Budget

A water budget was developed during the PCGS which considered a series of factors influencing the natural water cycle, including precipitation, runoff, recharge and evapotranspiration. The water balance developed for the study was based on the following general formula:

GW (in) + SW (in) + Precipitation = GW (out) + SW (out) + ET + (Net Storage)

In this equation, GW and SW represent ground water and surface water respectively. ET represents evapotranspiration and Net Storage equates to the amount of infiltrated water that does not return to the receiving stream. Positive net storage is typically evident in the winter months with snow accumulation, while negative Net Storage typically occurs in the summer where water is pulled from soil-water storage. Over the long-term, inflows and outflows typically result in a Net Storage value approaching zero.

A series of information on precipitation and evapotranspiration was compiled and analyzed from the Stratford weather monitoring station. From this analysis, a simplified water budget was developed for Perth County. Annual water budget parameters developed for the County are as follows:

- Precipitation: 2,280 million $m^3$.
- Evapotranspiration: 1,360 million $m^3$.
- Recharge: 175 million $m^3$.
- Runoff: 745 million $m^3$.

Recharge was estimated to average 80 mm/a throughout the County. Runoff was calculated as being the difference between precipitation and the other components of the water budget.

### iv. Conclusions Regarding Ground Water Recharge Rates

Based upon a comparison of the annual estimates for ground water recharging (175 million $m^3$) and water taking (19 million $m^3$), there appears to be adequate ground water available to meet current and future demands on a regional scale. Within the PCGS, it was noted that the water budget developed for Perth County represents a regional estimate and further refinement is needed to assess water budgets at a more localized scale. In this respect, additional analysis at a watershed or sub-watershed scale would provide additional information about safe ground water yield and the potential impacts of future development. This work may be completed as part of the regional source protection initiative being carried out under the *Clean Water Act* of Ontario (discussed in section 7.2.4.5 of this report).

## 7.2.2 Potential Environmental Effects on Ground Water Quality

### 7.2.2.1 Water Quality Indicators

A complete analysis of ground water quality was conducted for Well 4 as part of the hydrogeologic study work. The evaluation compared a series of water quality parameters with standards prescribed by the *Ontario Drinking Water Quality Standards* (ODWQS), being a Regulation (O. Reg. 169/03) to the *Safe Drinking Water Act*, as well as previous water quality legislation. The findings of the analysis were presented to the MOE pursuant to the Permit to Take Water application requirements.

During the long-term testing procedure, water samples were collected for analysis at times of 24 hours and 48 hours. Results were submitted to a commercial laboratory for analysis of microbiological indicators (e.g., E. coli, Total Coliforms), chemical parameters (e.g, pesticides, PCB, Dioxin) and other non-health related parameters (e.g., Iron, Manganese).

The following summarizes the major findings of the water quality analysis:

- No E. coli or Total Coliforms were detected in the Well 4 samples.
- The water available from Wells 4 achieves the chemical parameters set out by the ODWQS with the exception of fluoride concentrations. Fluoride in the well has been measured at concentrations of 1.8 mg/L to 2.0 mg/L, which exceeds the 1.5 mg/L Standard. Fluoride concentrations also exceed the Standard in the other municipal production wells (the Medical Officer of Health was advised of this situation following testing of TW2/03).
- Table 7.5 summarizes the sampling results from Well 4 and TW2/03 for several key indicators of ground water quality (the parameters presented are among the most common water quality problems experienced with well supplies in the general vicinity of the project area).

**Table 7.5**
**Water Quality Analysis:**
**Arthur Street Well Supply**

| Parameter (mg/L) | TW2/03[1] | Well 4[2] | ODWQS |
|---|---|---|---|
| Sodium (Na) | 36 | 37 | 200 |
| Iron (Fe) | 0.31 | 0.22 | 0.30 |
| Chloride ($C1^-$) | 2.9 | 11 | 250 |
| Manganese (Mn) | 0.026 | - | 0.05 |
| Nitrate ($NO3^-$) | < 0.05 | < 0.05 | 10 |
| Sulphate ($SO4^{-2}$) | 92 | 99 | 500 |

Notes:
1 Sampling results obtained after 24 hours of pumping TW2/03 @ 15 L/s
2 Sampling results obtained after 48 hours of pumping Well 4 @ 100 L/s

- The low nitrate, chloride and volatile organic compound concentrations measured during the testing programs indicate that there has been little anthropogenic impact upon the ground water quality of the Well 4 aquifer.

#### 7.2.2.2 GUDI Status

In October 2001, the MOE prescribed a series of criteria to identify communal ground water supplies that are potentially under the influence of surface water. MOE guidelines indicate that well supplies may potentially be "Ground water Under the Direct Influence (GUDI)" of surface water if the facilities:

i. Regularly contain Total Coliforms and/ or periodically contain *E. coli.*

ii. Are located within approximately 50 days horizontal saturated travel time from surface water or are within 100 m (overburden wells) or 500 m (bedrock wells) of surface water (whichever is greater) and meet one or more of the following criteria:

  – Wells may be drawing water from an unconfined aquifer.
  – Wells may be draining water from formations within approximately 15 m of surface.
  – Wells are part of an enhanced recharge/ infiltration project.
  – When the well is pumped, water levels in surface water rapidly change or hydraulic gradients beside the surface water significantly increase in a downward direction.
  – Chemical water quality parameters (such as temperature, conductivity, turbidity, total dissolved solids, pH, colour, oxygen) are more consistent with nearby surface water than local ground water and/or if they fluctuate significantly and rapidly in response to climatological or surface water conditions.

In review, the Arthur Street Well Supply is approximately 560 m from Whirl Creek. As result, Well 4 does not fall within the category of a potentially GUDI water source (given that it is a bedrock well that is protected from surface contaminants, it exceeds 15 m in depth, and the associated water quality data shows no impact from surface sources).

#### 7.2.2.3 Potential Sources of Contamination

#### (a) Wellhead Protection Areas (Wells 1, 2 and 3)

A conceptual model for the Mitchell well field was developed as part of the PCGS for the purpose of delineating time-of-travel based capture zones for Wells 1, 2 and 3 (similar modelling has not yet been carried out for Well 4). The three-dimensional model was developed with consideration for the following factors:

- Finite difference grid spacing was established at 700 m regionally with refinement to 25 m in the vicinity of the wells.

- Hydraulic conductivities of four defined geologic layers (being the overburden, the bedrock/overburden contact layer and two layers of unweathered bedrock).

- Aquifer recharge was assumed to be constant through the model area. A recharge rate of 65 mm/a was applied, which is consistent with base flow estimates for the Thames River watershed.

- Constant head boundary conditions were defined along the east and west extents of the model in the bedrock layer and the overburden/ bedrock contact zone (to represent ground water flow conditions). No-flow boundaries were assigned to the north and south boundaries of the model, perpendicular to the inferred flow direction. River boundary conditions were applied to account for the Thames River influence on the local ground water flow system. The bottom of the model was established 100 m below the bedrock overburden contact zone (a no-flow condition was applied at this boundary given that flow is anticipated to be horizontal and beyond the area of influence of the well).

- Water level data from MOE well records formed the basis for the model calibration data. A total of 67 wells were used for calibration purposes. The pumping rates were determined by scaling the current pumping rates with the expected growth in the serviced population.

Capture zones (wellhead protection areas) for the Mitchell production wells were developed for the 50-day, 2-year, 10-year and 25-year times-of-travel. The following summarizes the key considerations with respect to the wellhead protection areas:

- Additional scenarios were completed to address parameter sensitivity (i.e., variations to hydraulic conductivities, recharge and porosity). The largest capture zone area variations result from variations in the porosity values.

- In the vicinity of the municipal well field, the time-of-travel from ground surface to the bedrock aquifer is estimated to require more than 120 years.

- The time-of-travel estimate does not consider the potential for water to move via a conduit (e.g., an improperly abandoned borehole).

**(b) Contaminant Inventory**

A ground water contaminant inventory and risk assessment was prepared for West Perth as part of the PCGS. Information pertaining to potential sources of contamination were collected from several sources, including the MOE, the Technical Standards and Safety Authority (TSSA) and the Ontario Ministry of Northern Development and Mines (MNDM).

The following data was provided by these agencies:

| | | |
|---|---|---|
| **MOE** | - | PCB storage |
| | - | Contaminant spill sites |
| | - | Waste disposal |
| | - | Organic Soil Conditioning |
| | - | Landfills |
| | - | Waste generators, receivers, haulers |
| | - | Abandoned wells |
| **TSSA** | - | Registered fuel tanks (gasoline, diesel, oil, propane) |
| **MNDM** | - | Oil and gas wells |

The most prominent contaminant sources in the identified capture zones are as follows:

**Well 1 Capture Zone**

- Dairy processing facility (within the 10-year capture zone).
- Automotive garage (within the 50-day capture zone).
- Car Wash (within the 10-year capture zone).
- Automotive garage (within the 10-year capture zone).

**Well 2 Capture Zone**

- Dairy processing facility (within the 10-year capture zone).
- Automotive garage (within the 10-year capture zone).
- Car Wash (within the 10-year capture zone).

**Well 3 Capture Zone:**

- Dairy processing facility (within the Well 50-day capture zone).

### (c) General Conclusion Regarding Susceptibility to Contamination:

Based on information provided in the PCGS, the bedrock aquifer associated with Wells 1, 2 and 3 has been classified as having a low susceptibility to contamination.

### 7.2.3 Conclusions Regarding Potential Effects on Ground Water Quality and Quantity

Based upon the findings of the hydrogeological study work, the following conclusions were drawn with respect to the quality and quantity of water available from the Arthur Street Well Supply and the potential effects of well development:

- The overall quality of the ground water pumped from Well 4 is considered suitable for a municipal water system and similar to the existing municipal production wells. Water from the well meets the ODWQS, except for fluoride concentrations.

- The Well 4 aquifer can produce 100 L/s for potable use on a long-term basis. The long-term pumping water level will be approximately 36 m bg.

- Long-term testing demonstrated the pumping of Well 4 at a peak rate of 100 L/s would have a significant interference effect on all three municipal production wells (particularly Wells 1 and 2), as well as private well supplies outside of the Mitchell service area (particularly private wells in the rural areas south of the community). This finding is based on a conservative projection, which anticipates that the well will operate continuously at the maximum rate in the long-term. It is expected that the well will cycle on/off and/ or operate at a lower flow rate to meet system demands.

- The drawdown and interference effects associated with Well 4 are expected to extend beyond the 22-year planning period, given that the well supply will likely remain in operation beyond this time frame.

- Well 4 is not considered to be under the influence of surface water.

- Given the annual estimates for ground water recharging versus water taking, there appears to be adequate ground water available in the County of Perth to meet current and future demands on a regional scale.

### 7.2.4 Measures to Mitigate Effects on Ground Water Quantity and Quality

#### 7.2.4.1 Specific Well Development Mitigation

The development of the Arthur Street Well Supply was governed by the following recommendations, in order to optimize the water quality and supply capacity available from Well 4 and to minimize the adverse hydrogeological impacts associated with the operation of this well:

- Well 4 should be equipped to pump 100 L/s and connected to the distribution system once all approvals are received.

- A pumping strategy should be developed to minimize mutual interference between the municipal wells and to reduce or eliminate the potential for adverse impacts to the private wells within the Well 4 cone-of-influence. The overall objective of the pumping strategy would be to determine optimal well operation under a variety of conditions (current and future), including average day, maximum day and fire-protection scenarios. The strategy would be implemented by the water operator to generally prevent well interference and, in turn, to avoid the need for additional mitigation (although low-level pump shut-off systems and operator alerts should be incorporated into the operating system).

- Ground water quality should be monitored throughout the operational phase of the project in accordance with MOE protocols (as summarized in Table 9.3). Remedial measures should be implemented to address any identified problems and additional monitoring and reporting will occur, as necessary and in accordance with MOE protocols.

#### 7.2.4.2 Standard Construction Mitigation

Table 7.6 summarizes a series of standard mitigation measures which were incorporated into the contract specifications of the project. Implementation of these measures severed to minimize the adverse effects of the project on ground water resources, as well as other identified VEC's (as discussed throughout this section of the report).

**Table 7.6**
**Arthur Street Well Supply Construction Plan:**
**Standard Construction Mitigation**

| Activity | Impact Mitigation |
|---|---|
| Refuelling and Maintenance | - Identify suitable locations for designated refuelling and maintenance areas (e.g., away from watercourses, storm inlets, and natural areas).<br>- Refuelling or maintaining equipment will not occur within 30 m of a watercourse. Spillage and reporting plans are required. |

| Activity | Impact Mitigation |
|---|---|
| | - Cleaning of equipment is not to occur in watercourses and in locations where debris can gain access to sewers or watercourses.<br>- Prepare to intercept, clean-up, and dispose of any spillage which may occur (whether on land or water). |
| Traffic Control | - The Contractor shall prepare and submit a traffic plan to the Project Engineer for review and acceptance.<br>- Traffic flow should be maintained at all times during construction for private access. If it is necessary to detour traffic, the Contractor will coordinate the routing and provide adequate signage and barricades.<br>- At the end of each working day, a minimum of one lane of traffic, controlled by barricades, delineators, etc. shall be maintained for emergency vehicles. |
| Disposal | - Dispose of all construction debris in approved locations.<br>- Implement all reasonable measures to prevent the emptying of fuel, lubricants or pesticides into sewers or watercourses (e.g., maintain a minimum 30 m separation from all watercourses and drainage systems, do not clean equipment in watercourses). |
| Pesticides | - Coordinate the use of pesticides and herbicides with affected landowners and the local pesticide control officer. |
| Drainage and Water Control | - All portions of the work should be properly and efficiently drained during construction.<br>- Provide temporary drainage and pumping to keep excavation and site free from water.<br>- Control disposal or runoff or water containing suspended materials or other harmful substances in accordance with approval agency requirements.<br>- Provide settling ponds and sediment basins as required.<br>- Do not direct water flow over pavements, except through approved pipes/ troughs.<br>- Provide splash pads where water is discharged to a watercourse. |
| Dust Control | - Cover or wet down dry materials and rubbish to prevent blowing dust and debris.<br>- Avoid the use of chemical dust control products adjacent to wetlands and watercourses. |
| Site Clearing | - Protective measures shall be taken to safeguard trees from construction operations.<br>- Equipment or vehicles shall not be parked, repaired, refuelled near the dripline area of any tree not designated for removal. Construction and earth materials shall also not be stockpiled within the defined dripline areas.<br>- Restrict tree removal to areas designated by the Contract Administrator.<br>- Minimize stripping of topsoil and vegetation. |

| Activity | Impact Mitigation |
|---|---|
| Sedimentation/ Erosion Control | - Erect sediment fencing to control excess sediment loss during construction period.<br>- Minimize the removal of vegetation from sloped approaches to watercourses.<br>- Protect watercourses, wetlands, catch basins and pipe ends from sediment intrusion.<br>- Complete restoration works following construction.<br>- Install straw bale check dams in ditchlines following rough grading of ditches. |
| Noise Control | - Site procedures should be established to minimize noise levels in accordance with local by-laws.<br>- Provide and use devices that will minimize noise levels in the construction area.<br>- Night time or Sunday work shall not be permitted, except in emergency situations. |

#### 7.2.4.3 Wellhead and Aquifer Protection

Contract specifications for the development of Well 4 mandate that the work be carried out in accordance with Regulation 903. The Regulation incorporates a series of measures to protect the wellhead and the associated aquifer. Specific policies are prescribed within the Regulation to address the following components of well development:

- Construction of the well casing (e.g., requirements for watertight casing, minimum height of casing above the ground surface, casing materials).
- Grouting of annular spaces.
- Disinfection.
- Pump installation.
- Venting.
- Testing of well yield (i.e., water level measurements following pump testing).

No additional mitigation measures were deemed necessary to mitigate construction-related impacts to the wellhead and associated aquifer.

#### 7.2.4.4 Ground Water Protection

In addition to the mitigation measures prescribed by Regulation 903, well development has been carried out in accordance with industry standards for ground water protection. Protective measures set out in the contract documentation included those defined by the OPSS and special provisions deemed appropriate given the planned construction technique. Contract specifications also mandated that the Contractor adhere to a series of emergency response and spill contingency protocols, including a requirement to notify the Perth District Health Unit and the MOE Spills Action Centre if any spills occur which cause damage to the environment. The response protocols are summarized in section 9.1.2.1 of this report.

#### 7.2.4.5 Future Source Protection Initiatives

The findings of the PCGS contaminant risk assessment provide a basis for development of preliminary concepts regarding wellhead protection and land use planning. The study also incorporated a series of recommendations to enhance source protection at a regional and local level, including the following initiatives:

- Development of an effective ground water data management system.
- Promotion of public education initiates to foster source protection.
- Inclusion of source protection planning in County and Municipal Official Plans.
- Additional ground water monitoring (i.e., development of a sentinel well program).
- Further investigation of potential contaminant sources.

The Upper Thames River, Lower Thames Valley and St. Clair Region Conservation Authorities have been partnered for a source water protection planning initiative within their respective watersheds. The initiative is being carried out to develop surface and ground water protection policies and programs for local municipalities, including wellhead protection strategies, in accordance with the objectives of the Clean Water Act. Municipalities, stakeholders and the general pubic would be involved in the decision-making process associated with this initiative.

With respect to the Mitchell well system, it is anticipated that the following activities will be undertaken in the near future:

- Additional capture zone modelling and aquifer vulnerability mapping.
- Detailed evaluation of potential contaminant sites.
- Development and implementation of regulatory strategies for source protection (e.g., land use restrictions to minimize contamination risks).
- Development and implementation of non-regulatory strategies for source protection (e.g., promotion of best management practices, public education programs, financial incentives).
- Further development of a ground water monitoring program.

Completion of this work will provide a direction for future source protection initiatives, including possible development of land use restrictions, additional requirements for ground water monitoring and remedial measures to resolve identified risks for contamination.

### 7.2.5 Residual Effects

Based upon the findings of the hydrogeologic investigation, the project has the potential to generate residual effects with existing ground water wells in the study area. Specifically, the project could interfere with the operation of neighbouring well supplies in the long-term by increasing drawdown in the bedrock aquifer.

### 7.2.6 Significance of Residual Effects

With the implementation of the identified mitigation measures, including monitoring, follow-up and any necessary adaptive management, implementation of the project is not expected to have a significant adverse environmental effect on ground water quantity and quality. In this regard, the anticipated residual effect of this project on ground water quantity would be considered Low in magnitude based upon the impact criteria presented in Table 2.1. The anticipated residual effect of this project on ground water quality would be considered Minimal/ Nil in magnitude based upon the impact criteria presented in Table 2.1

## 7.3 Surface Water Quality and Quantity

### 7.3.1 Potential Effects on Surface Water Quality and Quantity

The potential effects of the project on the surface water quality and quantity of local watercourses were considered as part of the Lotowater hydrogeologic assessment. The following conclusions were developed from the findings of the analysis:

- Water quality data for Well 4 shows no impact from surface related activities.
- The results of the aquifer testing, the water chemistry test results and the presence of approximately 30 m of overburden sediments with a relatively low hydraulic connectivity all indicate that Well 4 is unlikely to have a significant impact upon surface water features in the cone-of-influence.
- The deep bedrock aquifer at the Arthur Street site is not considered GUDI.
- The ground water discharge conditions to the North Thames River and Whirl Creek will be maintained (unaffected) by the operation of Well 4.
- Deleterious materials could be discharged into the adjacent Arthur Street drainage system during the construction phase of the project.

### 7.3.2 Measures to Mitigate Effects on Surface Water Quality and Quantity

In order to minimize the adverse environmental effects of the project on surface water quality and quantity, standard sediment and erosion controls were employed during the construction phase (Table 7.6 summarizes these measures).

### 7.3.3 Residual Effects

Given the minimal interaction between the project and surface water resources, the project is not anticipated to generate any residual effects on this VEC.

### 7.3.4 Significance of Residual Effects

With the implementation of the identified mitigation measures, including monitoring and any necessary adaptive management, implementation of the project is not expected to have a significant adverse environmental effect on surface water quality and quantity. In this regard, the anticipated residual effect of this project on surface water resources would be considered Minimal/ Nil in magnitude based upon the impact criteria presented in Table 2.1.

## 7.4 Vegetation

### 7.4.1 Potential Effects on Vegetation

As discussed in section 6.2.3 of this report, terrestrial vegetation features within the study area are not considered sensitive to development and are commonly found in the local area. Construction-related activities resulted in the temporary removal of approximately 1,250 $m^2$ of vegetation within the right-of-way and the permanent removal of approximately 550 $m^2$ of vegetation on the Arthur Street site (due to the construction of the pumphouse facilities and the access road). Most of the vegetation removed temporarily and permanently from the right-of-way was landscaped grass (lawn). A small number of young trees and shrubs in the vicinity of access road were also removed. None of the vegetation species affected by the work are considered sensitive or rare.

### 7.4.2 Measures to Mitigate Effects on Vegetation

In order to minimize the adverse environmental effects of the project on vegetation, standard mitigation measures (e.g., sediment and erosion controls, site clearing restrictions) were employed during the construction phase (Table 7.6 summarizes these measures).

The following mitigation measures were also incorporated into the contract specifications to protect vegetation in the vicinity of the project site:

- Tree removal is restricted to designated areas. No trees shall be removed unnecessarily.
- Stripping of topsoil and vegetation shall be restricted to designated areas.
- Operations shall not cause damage to the trunk or branches of trees, or flooding or sediment deposits on areas where trees are not designated for removal.
- Equipment and vehicles shall not be parked, repaired or refuelled within the dripline of any tree not designated for removal.
- Construction materials shall not be stored and earth materials shall not be stockpiled within the dripline of any tree not designated for removal.

- Branches 25 mm or greater in diameter that are broken shall be cut back cleanly at the break or within 10 mm of their base if a substantial portion of the branch is broken (within five calendar days of damage).

- Roots 25 mm or larger in diameter that are exposed by construction activities shall be cut back cleanly to the soil surface within five calendar days of exposure.

- Bark that is damaged by construction activities shall be neatly trimmed back to uninjured bark within five calendar days of damage.

- All damaged areas shall be restored with topsoil, native grass seed and mulch.

### 7.4.3 Residual Effects

Construction of this project requires site clearing which will result in the permanent removal of approximately 550 $m^2$ of manicured lawn and a small number of shrubs and trees.

### 7.4.4 Significance of Residual Effects

With the implementation of the identified mitigation measures, including monitoring and any necessary adaptive management, implementation of the project is not expected to have a significant adverse environmental effect upon vegetation within the study area. In this regard, given the limited scale of the project, as well as the characteristics of the affected vegetation (i.e., common, non-sensitive species), the anticipated residual effect of this project on vegetation would be considered Minimal/ Nil in magnitude based upon the impact criteria presented in Table 2.1.

## 7.5 Species at Risk

### 7.5.1 Potential Effects on Species at Risk

The *Species at Risk Act* was promulgated in June 2003. Schedule I to the SARA registry lists all species that considered to be endangered, threatened or of special concern. A search of the Environment Canada Species at Risk website identified the following Schedule I species that have a possible range in the study area.

**Table 7.7**
**Possible SARA Schedule I Species within the Study Area**

| Component | Endangered | Threatened | Special Concern |
|---|---|---|---|
| **Mammals** | - | Grey Fox | - |
| **Birds** | - | Least Bittern | Yellow Breasted Chat virens subspecies |
| **Reptiles & Amphibians** | - | - | - |
| **Lepidoterans** | - | - | Monarch |
| **Plants, Lichens, Moss** | American Ginseng<br><br>Butternut | - | - |

Section 6.2 of this report summarizes the habitat characteristics of each identified species. As noted in the discussion, the right-of-way and corridor are not considered traditional habitat for the identified species.

### 7.5.2 Measures to Mitigate Effects on Species at Risk

In order to minimize the adverse environmental effects of the project on all forms of vegetation and wildlife, including species at risk, standard mitigation measures (e.g., pesticide, drainage and noise controls) were employed during the construction phase (Table 7.6 summarizes these measures).

### 7.5.2 Residual Effects

Given the minimal interaction between the project and identified species at risk, the project is not anticipated to generate any residual effects on this VEC.

### 7.5.3 Significance of Residual Effects

With the implementation of the identified mitigation measures, including monitoring and any necessary adaptive management, implementation of the project is not expected to have a significant adverse environmental effect upon species at risk. In this regard, the anticipated residual effect of this project on this VEC would be considered Minimal/ Nil in magnitude based upon the impact criteria presented in Table 2.1.

## 7.6 Migratory Birds

### 7.6.1 Potential Effects on Migratory Birds

Section 6.2.4.1 of this report summarizes the various birds observed or confirmed in the general study area following a review of the 2001-05 Ontario Breeding Birding Atlas (Region 6, Square 17MJ81). As discussed, a total of 26 birds have been confirmed in the general study and an additional 64 species sitings were categorized as probable or possible. However, the right-of-way and corridor are not considered traditional habitat for the identified bird species due to the following considerations:

- The project site is located within an active industrial area with manufacturing activities (including heavy truck traffic) occurring in close proximity to the facilities on an ongoing basis.
- There are no significant woodlots, marshes or riparian zones in the vicinity of the right-of-way or corridor.
- The limited amount of vegetation found on site provides minimal habitat value and incorporates species that are not significant or sensitive and are commonly found throughout the community.
- The project requires a relatively small land base.

### 7.6.2 Measures to Mitigate Effects on Migratory Birds

In order to minimize the adverse environmental effects of the project on migratory birds, standard mitigation measures (e.g., site clearing restrictions and noise controls) were employed during the construction phase (Table 7.6 summarizes these measures).

### 7.6.3 Residual Effects

Given the minimal interaction between the project and the identified migratory birds, the project is not anticipated to generate any residual effects on this VEC.

### 7.6.4 Significance of Residual Effects

With the implementation of the identified mitigation measures, including monitoring and any necessary adaptive management, implementation of the project is not expected to have a significant adverse environmental effect upon migratory birds. In this regard, the anticipated residual effect of this project on this VEC would be considered Minimal/ Nil in magnitude based upon the impact criteria presented in Table 2.1.

## 7.7 Wildlife

### 7.7.1 Potential Effects on Wildlife

Construction-related activities will result in the temporary removal of approximately 1,250 $m^2$ of wildlife habitat within the right-of-way and the permanent removal of approximately 550 $m^2$ of habitat on the Arthur Street site.

The areas temporarily and permanently affected by construction provide limited habitat value to species that are not significant or sensitive to development and are commonly found in the local area.

### 7.7.2 Measures to Mitigate Effects on Wildlife

In order to minimize the adverse environmental effects of the project on wildlife habitat, standard mitigation measures (e.g., sediment and erosion controls, site clearing restrictions) were employed during the construction phase (Table 7.6 summarizes these measures).

### 7.7.3 Residual Effects

Given the minimal interaction between the project and wildlife, the project is not anticipated to generate any residual effects on this VEC.

### 7.7.4 Significance of Residual Effects

With the implementation of the identified mitigation measures, including monitoring and any necessary adaptive management, implementation of the project is not expected to have a significant adverse environmental effect upon wildlife. In this regard, given the limited scale of the project and the non-sensitive nature of the affected habitat, the anticipated residual effect of this project on wildlife resources would be considered Minimal/ Nil in magnitude based upon the impact criteria presented in Table 2.1.

## 7.8 Noise

### 7.8.1 Potential Effects on Noise

The project does not incorporate facilities that will substantially elevate ambient noise levels. In review, the well pump, water disinfection metering pumps and the standby generator represent the only project components which could contribute to local noise pollution levels. Specifically, the project involves the operation of a submersible turbine pump in Well 4, as well as the use of chemical metering pumps in the pumphouse. Without attenuation, the operation of these pumps could generate a moderate level of noise pollution (i.e., 55 to 70 decibels at the source). The standby generator, which only operates under emergency situations and during testing procedures, has the potential to generate elevated noise levels (i.e., in excess of 100 decibels at the source).

Construction-related activities associated with the project generated increased noise levels in the vicinity of the right-of-way and corridor. The noise levels experienced during the construction phase are typical of road and building construction.

### 7.8.2 Measures to Mitigate Effects on Noise

Operational noise levels will be mitigated significantly through the project design. In this regard, the well pump for Well 4 will be submersed in ground water 50 m below grade, while the metering pumps will be housed within the insulated pumphouse. Taking these factors into consideration, noise levels at the boundaries of the property are not anticipated to exceed 45 decibels (dBa) when the various pumps are in operation. The MOE does not apply formal noise restrictions to stationary sources in small urban areas (Class 2 Areas) if the sound level at the point of reception is less than 45 dBa (the point of reception in this instance is the nearest residential property). The generator set will be housed within a sound attenuated enclosure complete with a hospital grade silencer. With the implementation of these measures, noise levels associated with the operation of the standby generator will be approximately 73 dBa at a distance 7 m from the source (detailed noise assessments of this unit are not required by the MOE, given that there are no residential dwellings within 60 m of the source).

Contract specifications incorporated the following measures to mitigate noise levels during the construction phase of the project:

- Site procedures should be established to minimize noise levels in accordance with local by-laws.
- Provide and use devices that will minimize noise levels in the construction area.
- Night time or Sunday work shall not be permitted, except in emergency situations.

### 7.8.3 Residual Effects

#### 7.8.3.1 Construction Activities

Accurately predicting construction noise is difficult due to the variability of several factors including the amount and type of construction equipment, construction methods, and scheduling of work. Though precise information on these factors is not available, some general conclusions can be made based on the types of construction work anticipated and the similarities of the equipment.

Typically, the construction activities anticipated for this project can be classified into the following five phases:

**Site Preparation:** Involves the stripping / removal of topsoil and vegetative cover from the site. Typically a dozer, excavator, and dump truck would be used for this operation. This activity will take between one and two days.

**Earthwork and Excavation:** Involves the excavation of the subsurface soil to the required depth of the underside of the reservoir and building structure. This activity will take between two and three days.

**Building Erection:** Involves the actual construction of the reservoir and building and involves aspects of construction such as concrete forming, carpentry, and masonry work. Very little heavy equipment is required for this aspect of the work apart from the occasional delivery of materials such as concrete, wood trusses, concrete block, and mechanical piping and equipment. Upon erection of the building walls, they will be backfilled to grade using equipment such as an excavator, compaction hoepac, and a dump truck. The entire backfilling procedure will take between one and two days.

**Site Servicing:** Involves the installation of the underground services including, contact watermain, storm drainage piping, sanitary drainage piping, electrical conduits / ductwork, and communication conduits. This aspect of the project will usually occur concurrently with the building erection and the installation of the piping will likely occur intermittently over one to two weeks. Equipment will typically consist of an excavator, dump truck, and compaction equipment (vibratory roller or hoepac).

**Site Restoration:** Following completion of all the underground servicing and the erection of the building, the area will be graded and restored. Restoration will include the completion of a gravel access road and concrete parking area. Areas outside of the laneway and parking will be restored with topsoil and grass seed. The construction of these works will require the use of an excavator, dozer, vibratory roller, and concrete delivery truck.

Most construction equipment operates with a noise level between 75 and 90 dBA as measured at a distance of 15 metres. The noise levels generated by the types of construction equipment anticipated to be used in relation to this project are presented in the following table (as established by the United States Environmental Protection Agency):

**Table 7.8**
**Noise Generation Table:**
**On-Site Construction Equipment**

| Equipment | Noise Level (Decibels)* |
|---|---|
| Bulldozer | 80 |
| Excavator | 85 |
| Dump truck | 86 |
| Concrete truck | 85 |
| Concrete pump | 82 |
| Concrete vibrator | 76 |
| Vibratory Roller | 73-75 |
| Tamper | 74-77 |

* Noise level at a distance of 15 m.

Noise levels from a point source such as a piece of construction equipment will attenuate 6 dBA per doubling of distance over a hard surface such as a parking lot. Thus if a piece of construction equipment generates 86 dBA at 15 metres, the noise level at 60 metres would be 74 dBA. In this regard, there are relatively few receptors were impacted by construction noise at the site since most of the surrounding areas support industrial uses.

#### 7.8.3.2 Operational Activities

Testing and operational procedures associated with the standby generator will periodically increase ambient noise levels. The key considerations in this regard are as follows:

- The generator will be tested once a month for 60 minutes and once a year for a 180 minute load test in accordance with established safety standards (CAN/CSA C282).

- An average of five power outages have occurred annually over the last three years (maximum period of outage: two hours).

It is recognized that the long-term operation of the generator would increase ambient noise levels in the immediate study area. However this situation would likely only arise during a major power disruption (i.e., a power outage extended for at least three days). In a scenario of this nature, numerous emergency generator units would be in operation throughout the community in order to maintain a basic power supply to various institutional facilities, community centres, industries and private residences. Within this context, the increased noise levels from the Well 4 generator would not significantly elevate ambient noise levels throughout the community. Moreover, in a protracted power outage scenario, the operation of the Well 4 generator would be essential for the provision of large quantities of potable water (a public health priority in a municipal emergency). In this regard, the potential residual noise effects associated with the operation of the Well 4 generator in an emergency would be significantly outweighed by the need to maintain a secure and dependable water supply during such an event.

### 7.8.4 Significance of Residual Effects

With the implementation of the identified mitigation measures, including monitoring and any necessary adaptive management, implementation of the project is not expected to have a significant adverse environmental effect upon noise levels in the study area. In this regard, the anticipated residual effect of this project on noise levels would be considered Minimal/ Nil in magnitude based upon the impact criteria presented in Table 2.1.

## 7.9 Air Quality

### 7.9.1 Potential Effects on Air Quality

The project does not incorporate facilities which are designed to discharge air pollutants during normal operations. In review, a spill from the water disinfection equipment and the operation of the standby diesel generator represent the only project components that could contribute to local air pollution levels. With respect to water disinfection equipment, a release of the MIOX solution or sodium hypochlorite could have a harmful effect upon local environmental features (e.g., watercourses, air quality). The operation of the standby generator will result in the emission of several contaminants, including the following pollutants:

- Oxides of Nitrogen ($NO_X$) as Nitrogen Dioxide ($NO_2$) and Nitric Oxide (NO).
- Carbon Monoxide (CO).

Construction-related activities associated with the project generated minor increases in air pollution levels in the vicinity of the right-of-way and corridor. However, the air pollution levels experienced during the construction period were typical of road and building construction projects and were temporary in nature.

### 7.9.2 Measures to Mitigate Effects on Air Quality

Operational emission levels will be mitigated significantly through the project design. With respect to the disinfection system, multiple safety measures will be incorporated into the design of the MIOX and chlorine tankage in order to minimize the potential impacts from a chemical release (e.g., provision of a secondary containment tank and adequate ventilation). For the standby diesel generator, dispersion modelling was conducted to evaluate the operational impacts of the unit on adjacent industrial developments (designated as non-sensitive receptors). The assessment was carried out in accordance with MOE requirements under section 9 of the *Environmental Protection Act* of Ontario (EPA). In this regard, MOE criteria specify the maximum half-hour point of impingement (POI) concentrations for $NO_X$ and CO (the nearest receptor is situated 50 m from the generator site). Based on the operation of the generator at the rated speed of 1,800 rpm and a 100% load, the resultant $NO_X$ and CO emission rates for the unit are below MOE criteria and therefore adhere to EPA requirements (as noted on Table 7.9).

**Table 7.9**
**Well 4 Standby Generator:**
**Emission Summary Table**

| Contaminant | POI Concentration ($ug/m^3$) | MOE Criteria ($ug/m^3$) | Percentage of Criteria |
|---|---|---|---|
| $NO_X$ | 1,433 | 1,880 | 76.2 % |
| CO | 153 | 6,000 | 2.6 % |

Contract specifications also incorporated the following measures to mitigate air pollution levels during the construction phase of the project:

- Coordinate the use of pesticides and herbicides with affected landowners and the local pesticide control officer.
- Cover or wet down dry materials and rubbish to prevent blowing dust and debris.
- Avoid the use of chemical dust control products adjacent to wetlands and watercourses.

#### 7.9.3 Residual Effects

Given the low contaminant emission rates anticipated from the well supply facilities, the project should not generate any residual effects on air quality in the study area.

#### 7.9.4 Significance of Residual Effects

With the implementation of the identified mitigation measures, including monitoring and any necessary adaptive management, implementation of the project is not expected to have a significant adverse environmental effect upon air quality in the study area. In this regard, the anticipated residual effect of this project on air quality would be considered Minimal/ Nil in magnitude based upon the impact criteria presented in Table 2.1.

### 7.10 Local Users of Ground Water

#### 7.10.1 Potential Effects on Local Users of Ground Water

Two domestic wells are situated within 1,500 m of the Arthur Street Well Supply which could be affected by the development of a new municipal well supply. Two private well owners in rural areas south of Well 4 also reported interference problems during the well testing procedures.

#### 7.10.2 Measures to Mitigate Effects on Local Users of Ground Water

The hydrogeologic assessment concluded that the existing wells in the study area, including domestic well supplies, should not be adversely impacted by the operation of the new well supply. In order to confirm this conclusion, the domestic wells will be investigated and monitored during the initial operation of Well 4 to ensure they are not impacted due to pumping.

If evidence of drawdown is observed in these wells following the development of Well 4, the Municipality would be required to implement additional mitigation measures which could include any of the following:

- Reducing pumping rates.
- Upgrading private well supplies.
- Connecting affected residents to the municipal system.

Well construction was also carried out in accordance with the wellhead, aquifer and ground water protection measures specified in Regulation 903 (refer to section 7.2.4). These measures minimized the risk for aquifer contamination during the well construction phase.

#### 7.10.3 Residual Effects

Based upon the findings of the hydrogeologic investigation, the project has the potential to generate residual effects with existing ground water wells in the study area. Specifically, the project could interfere with the operation of neighbouring well supplies in the long-term by increasing drawdown in the bedrock aquifer.

#### 7.10.4 Significance of Residual Effects

With the implementation of the identified mitigation measures, including monitoring, follow-up and any necessary adaptive management, implementation of the project is not expected to have a significant adverse environmental effect on local users of ground water. In this regard, the anticipated residual effect of the project on this VEC would be considered Low in magnitude based upon the impact criteria presented in Table 2.1.

### 7.11 Heritage and Historical Cultural Resources

#### 7.11.1 Potential Effects on Heritage and Historical Cultural Resources

Activities associated with the construction and decommissioning phases of the project have the potential to directly disturb heritage and historical cultural resources. Indirect effects on these resources could also be realized during the operations phase of the project.

#### 7.11.2 Measures to Mitigate Effects on Heritage and Historical Cultural Resources

The project involved development of a well site on lands which have not been heavily disturbed by construction. Development on these lands therefore had the potential to impact upon buried cultural heritage resources. In order to evaluate this matter further, additional information on the Arthur Street well site was circulated to the Ministry of Culture (Heritage & Libraries Branch, Southwest District) for consideration. The Ministry evaluated the proposal taking into consideration its defined screening criteria and its database of known historical sites in the vicinity of the project site.

In correspondence dated March 2, 2006, the Ministry advised that development of the right-of-way does not appear to have the potential to impact upon buried heritage resources. No further investigations were required to assess the direct cultural heritage impacts of the project. However, the construction plan required that the proponent must notify the Ministry if deeply buried archaeological resources are encountered during construction (including human remains). No archaeological resources were encountered during the construction phase.

There are no known heritage or historical cultural resources in the vicinity of the project site which would be indirectly affected by the operational activities of the project.

#### 7.11.3 Residual Effects

Given the foregoing, the project should not generate any residual effects upon heritage and historical cultural resources.

#### 7.11.4 Significance of Residual Effects

Implementation of the project is not expected to have a significant adverse environmental effect upon heritage and historical cultural resources. In this regard, the anticipated residual effect of the project on this VEC would be considered Minimal/ Nil in magnitude based upon the impact criteria presented in Table 2.1.

### 7.12 Capacity of Renewable Resources

#### 7.12.1 Potential Effects on the Capacity of Renewable Resources

The project involved construction of a new well supply and the provision of site servicing on lands previously undisturbed by construction. The development of Well 4 therefore has the potential to impact upon the capacity of renewable resources, particularly with respect to the following environmental components:

- Ground water resources associated with the deep bedrock aquifer evident in the Mitchell area.
- Vegetation and wildlife habitat evident at the well site.

#### 7.12.2 Measures to Mitigate Effects on the Capacity of Renewable Resources

Mitigating factors and mitigation measures for the identified impacts are discussed previously in this section of the report. The following summarizes the key considerations in this regard:

- Ground Water Resources: The bedrock aquifer that supplies Well 4 can produce 100 L/s for potable use on a long-term. However, hydrogeologic testing demonstrated the pumping of Well 4 at the peak rate would have a significant interference effect on all three municipal production wells (particularly Wells 1 and 2), as well as private well supplies outside of the Mitchell service area (particularly private wells in the rural areas south of the community). To limit drawdown within the deep bedrock aquifer, a pumping strategy should be developed to minimize mutual interference between the municipal wells and to reduce or eliminate the potential for adverse impacts to the private wells within the Well 4 cone-of-influence. Additional monitoring of existing wells in the area, including private wells, will also be conducted to further assess the impacts resulting from the pumping of Well 4. This exercise will confirm the validity of the hydrogeologic study work with respect to ground water quantity. If interference problems are found, remedial measures will be taken to address the identified problems (e.g., reducing pumping rates) and additional monitoring and reporting will occur, as necessary.

- Vegetation and Wildlife Habitat: Construction-related activities at the Arthur Street well site resulted in the temporary removal of vegetation to facilitate servicing and building activities and the permanent removal of approximately 550 $m^2$ of vegetation for the development footprint and the access road. The affected areas provide limited wildlife habitat value and the vegetation species impacted by the work (grasses, shrubs, small trees) are not considered sensitive or rare.

### 7.12.3 Residual Effects

Based upon the findings of the hydrogeologic investigation, the project has the potential to generate residual effects upon the capacity of renewable resources. Specifically, the project could interfere with the operation of existing public and private well supplies in the long-term by increasing drawdown in the bedrock aquifer.

### 7.12.4 Significance of Residual Effects

With the implementation of the identified mitigation measures, including monitoring, follow-up and any necessary adaptive management, implementation of the project is not expected to have a significant adverse environmental effect upon the capacity of ground water resources or vegetation and wildlife habitat. In this regard, the anticipated residual effect of the project on this VEC would be considered Low in magnitude based upon the impact criteria presented in Table 2.1.

# 8.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

## 8.1 Erosion, Ice Encroachment and Scouring Hazards

### 8.1.1 Potential Effects of Erosion, Ice Encroachment and Scouring Hazards

The defined right-of-way and corridor are located in areas which are not identified as being susceptible to erosion. In this regard, the Upper Thames River Conservation Authority has not calculated specific erosion rates for this location (given the lack of identifiable and measurable erosion impacts). There is also no record of erosion problems on this site and no physical evidence of erosion impacts at this location.

There is no historical evidence that ice encroachment or scouring have impacted upon the Arthur Street site, given the relative location of the North Thames River and Whirl Creek floodways.

### 8.1.2 Measures to Mitigate Effects of Erosion, Ice Encroachment and Scouring Hazards

Contract specifications incorporated the following measures to minimize freezing effects:

- The pumphouse will incorporate rigid foam insulation within the walls and baton insulation within the ceiling. Radiant heating will be provided throughout the building.
- Underground servicing associated with the project will be buried at a depth below the established frostline (1.5 m.) or, where adequate cover is not available, insulated piping will be provided.

### 8.1.3 Residual Effects

Given the foregoing, erosion, ice encroachment and scouring hazards should not generate any residual effects upon the project.

### 8.1.4 Significance of Residual Effects

With the implementation of the identified mitigation measures, including monitoring, follow-up and any necessary adaptive management, erosion, ice encroachment and scouring hazards are not expected to impact on the project in a manner that could result in significant adverse environmental effects. In this regard, the anticipated residual effect of these hazards on the project would be considered Minimal/ Nil in magnitude based upon the impact criteria presented in Table 2.1.

## 8.2 Seismic Hazards

### 8.2.1 Potential Effects of Seismic Hazards

The right-of-way and corridor are not located in an area identified as being highly susceptible to seismic activity. In this regard, the Ontario Building Code designates Mitchell within Earthquake Zone 0 (Zonal Velocity Ratio: 0.00).

### 8.2.2 Measures to Mitigate Effects of Seismic Hazards

No mitigation measures were required for this project as, in accordance with the Ontario Building Code, the design of the pumphouse did not have to account for any additional seismic loading standards.

### 8.2.3 Residual Effects

Given the foregoing, seismic hazards should not generate any residual effects upon the project.

### 8.2.4 Significance of Residual Effects

Given the relative location and characteristics of the new well supply, seismic activity is not expected to impact on the project in a manner that could result in significant adverse environmental effects. In this regard, the anticipated residual effect of seismic hazards on the project would be considered Minimal/ Nil in magnitude based upon the impact criteria presented in Table 2.1.

## 8.3 Climate Change

### 8.3.1 Potential Effects of Climate Change

Environment Canada has compiled data produced from global climate change models to forecast the potential impacts of climate change in Ontario over the next 50 years. The key concerns with climate change in relation to this project are as follows:

- Heat waves in southern Ontario will increase in frequency, intensity and duration. The total number of days in excess of 30 degrees Celsius will likely increase from 10 to 30. The number of cold weather days will likely decrease.

- Extreme weather events, including severe thunderstorms, freezing rain and very hot days (i.e., greater than 35 degrees Celsius), will all increase.

- Lake levels will be lower than current conditions, potentially by more than one metre. Smaller and earlier spring runoff events will also be evident.

- The quantity of drinking water might decrease as water sources are threatened by drought. Less rainfall events could also increase the need for irrigation in southwestern Ontario.

### 8.3.2 Measures to Mitigate Effects of Climate Change

Given the above-noted considerations, it is predicted that climate change could impact upon two key operational aspects of this project; ground water recharge rates and water consumption rates. Each matter is discussed below and mitigation measures are presented:

- **Ground Water Recharge Rates.** The hydrogeological study work completed for this project demonstrates that the bedrock aquifers associated with the municipal well supplies will sustain the Mitchell water system on a long-term basis given the projected water demands and current ground water recharge rates. It is anticipated that the aquifer recharge characteristics will be not significantly impacted by climate change over the design period. Should ground water recharge rates decline to levels which cannot sustain municipal water demands, additional hydrogeologic investigations will be required to explore mitigation options (e.g., upgrading the existing well supplies, identifying new water sources, implementing stringent water conservation measures).

- **Water Demands**. Water supply and storage facilities are designed in a conservative manner to provide a measure of protection against long-term fluctuations in water demands. It is anticipated that the water supply and distribution system will be capable of accommodating the increase in household water consumption attributable to climate change over the design period. Should water demands increase appreciably during the time frame, additional water supply and storage facilities may be required.

### 8.3.3 Residual Effects

Given the foregoing, climate change should not generate any residual effects upon the project.

### 8.3.4 Significance of Residual Effects

With the implementation of the identified mitigation measures, including monitoring, follow-up and any necessary adaptive management, climate change is not expected to impact on the project in a manner that could result in significant adverse environmental effects. In this regard, the anticipated residual effect of climate change on the project would be considered Low in magnitude based upon the impact criteria presented in Table 2.1.

## 9.0 ACCIDENTS, MALFUNCTIONS AND ADVERSE CONDITIONS

### 9.1 Construction Phase

### 9.1.1 Potential Environmental Effects

An assessment was conducted to identify the potential effects of accidents, malfunctions and adverse conditions on the identified VEC's during the construction phase. The assessment involved a review of potential problems which could arise during the implementation of the construction plan, as well as an evaluation of the potential environmental effects resulting from the identified problems. Table 9.1 summarizes the findings of the assessment.

**Table 9.1**
**Accidents, Malfunctions and Adverse Conditions (Construction Phase): Environmental Effects Analysis**

| Valued Ecosystem Component | Incident | Environmental Effect |
|---|---|---|
| Ground water quantity and quality | - Contaminant spill/ accident involving construction equipment or transported materials | - Adverse water quality in shallow/deep aquifers |
| Surface water quantity and quality | - Contaminant spill/ accident<br>- Siltation (due to high rainfall) | - Adverse water quality in nearby drains/ watercourses |

| Valued Ecosystem Component | Incident | Environmental Effect |
|---|---|---|
| Vegetation | - Contaminant spill/ accident<br>- Equipment fire<br>- Siltation | - Damage/destruction to native species and habitat |
| Species at risk | - Contaminant spill/ accident<br>- Equipment fire<br>- Siltation | - Damage/destruction to identified species and habitat* |
| Migratory birds | - Contaminant spill/ accident<br>- Equipment fire | - Damage/destruction to native species and habitat |
| Wildlife | - Contaminant spill/ accident<br>- Equipment fire<br>- Siltation | - Damage/destruction to native species and habitat |
| Noise | - Equipment malfunction (e.g., failed exhaust pipe) | - Elevated noise levels near the project site |
| Air quality | - Contaminant spill/ accident<br>- Equipment fire<br>- Equipment malfunction | - Deteriorated air quality near the project site |
| Local users of ground water | - Contaminant spill/ accident | - Adverse water quality in the Well 4 aquifer |
| Heritage and historical cultural resources | - None anticipated | - Not applicable |
| Capacity of Renewable Resources | - Contaminant spill/ accident<br>- Equipment fire<br>- Siltation | - Adverse water quality in shallow/deep aquifers<br>- Damage/destruction to native species and habitat |

* In accordance with the Species at Risk Act, any effects to a Species at Risk occurring as a result of the construction, operation or decommissioning of this project must be reported as prescribed by the Act. In this regard, no person shall damage or destroy the residence of one or more individuals of a wildlife species that is listed as an endangered species or a threatened species, or that is listed as an extirpated species if a recovery strategy has recommended the reintroduction of the species into the wild of Canada. Moreover, no person shall kill, harm, harass, capture or take an individual of a wildlife species that is listed as an extirpated species, an endangered species or a threatened species.

### 9.1.2 Mitigation Plans

A number of formal plans were developed to address the potential environmental effects which could occur during the construction phase (the nature and content of these plans are summarized below). The Contractor was required to adhere to the identified plans to ensure that the construction phase of the project did not have significant adverse environmental effects on the identified VEC's.

#### 9.1.2.1 Emergency Response and Spills Contingency Plan

The Contractor was required to adhere to specific emergency response and spill contingency protocols mandated within the contract specifications. The key specifications were as follows:

- Submit procedures for interception, rapid clean-up and disposal of spillages that may occur to the Contract Administrator for review, prior to commencing work.

- Be prepared at all times to intercept, clean-up and dispose of any spillage that may occur.

- Keep all materials required for clean-up of spillages readily accessible on site.

- Report any spills causing damage to the environment immediately to the Perth District Health Unit and the MOE Spills Action Centre.

- Provision of the necessary first aid items and equipment prescribed under the First Aid Regulations of the Worker's Compensation Act.

#### 9.1.2.2 Traffic Management Plan

Contract specifications stipulated that the Contractor develop a traffic management plan in accordance with the *Ontario Traffic Manual Book 7 (Temporary Conditions)* and subject to approval by the Municipality. The traffic plan developed for this project incorporated a limited number of measures, as the majority of construction activity is occurring outside of the travelled roadways.

The following measures were incorporated into traffic management procedures, as required:

- Provision of standard signage identifying construction work and lane restrictions.
- Placement of barrels delineating the construction area and lane restrictions.
- Provision of flagpersons to direct traffic during construction.
- A requirement that affected roadways remain open at all times during construction and that private access is maintained.
- A requirement that the Contractor retain responsibility for grading, maintaining and restoring any streets used as haul roads.

#### 9.1.2.3 Health and Safety Management Plan

The Contractor was required to adhere to specific health and safety protocols mandated by existing legislation and identified within the contract specifications. The key specifications were as follows:

- Provision of the necessary first aid items and equipment prescribed under the First Aid Regulations of the Worker's Compensation Act.

- Adherence to the regulations issued by the Ontario Ministry of Labour under the Occupational Health and Safety Act.
- Receipt of a Clearance Certificate from the Workplace Safety and Insurance Board

#### 9.1.2.4 Hydrostatic Pressure Testing Plan

Contract specifications stipulated that the Contractor must carry out hydrostatic testing of all installed pipelines in accordance with the applicable OPSS. The key components of this testing exercise were follows:

- Hydrostatic testing shall be conducted under the supervision of the Contract Administrator upon completion of the service installation.
- A test section shall be either a section between valves or the completed pipeline. Test sections will be filled slowly with water and all air shall be removed from the pipeline. The water shall be supplied through a temporary connection which shall include an appropriate cross-connection control device. A 24-hour absorption period will be allowed before the start of the test.
- Swabbing is required prior to pressure testing of the main. A minimum of two new swabs will be passed through each section of the main to ensure there is no blockage or debris.
- Test pressures must be in accordance with the applicable OPSS. The test section shall be subjected to the specified continuous test pressure for two hours.
- The measured leakage shall be compared with the allowable leakage as calculated for the test section. If the measured leakage exceeds the allowable leakage, all leaks shall be located and repaired and the test section shall be retested until a satisfactory result is obtained.
- Once satisfactory pressure testing results are obtained and all other testing requirements have been met, the Contract Administrator must request approval from the municipality for the main to be connected to the existing system. The Contract Administrator must be present on site during the removal of the temporary connection and until the connection to the existing system is complete.
- The Contractor must prepare a method of dewatering in order to protect the final connection from contamination of the new or existing pipeline with foreign material or ground water.

## 9.2 Operations Phase

### 9.2.1 Potential Environmental Effects

An assessment was conducted to identify the potential effects of accidents, malfunctions and adverse conditions on the identified VEC's during the operations phase of the project. The assessment involved a review of potential problems which could arise during the operation of the planned waterworks, as well as an evaluation of the potential environmental effects resulting from the identified problems. Table 9.2 summarizes the findings of the assessment.

**Table 9.2**
**Accidents, Malfunctions and Adverse Conditions (Operations Phase): Environmental Effects Analysis**

| Valued Ecosystem Component | Incident | Environmental Effect |
|---|---|---|
| Ground water quantity and quality | - Contaminant spill/ accident involving on-site chemicals or operator vehicles<br>- Low water levels | - Adverse water quality in shallow/ deep aquifers<br>- Water shortages |
| Surface water quantity and quality | - Contaminant spill/ accident | - Adverse water quality in nearby drains/ watercourses |
| Vegetation | - Contaminant spill/ accident<br>- Equipment fire | - Damage/ destruction to native species and habitat |
| Species at risk | - Contaminant spill/ accident<br>- Equipment fire | - Damage/ destruction to identified species and habitat. |
| Migratory Birds | - Contaminant spill/ accident<br>- Equipment fire | - Damage/ destruction to native species and habitat |
| Wildlife | - Contaminant spill/ accident<br>- Equipment fire | - Damage/ destruction to native species and habitat |
| Noise | - Equipment malfunction<br>- Equipment fire | - Elevated noise levels near the project site |
| Air quality | - Contaminant spill/ accident<br>- Equipment fire<br>- Equipment malfunction | - Deteriorated air quality near the project site |
| Local users of ground water | - Contaminant spill<br>- Equipment malfunction | - Adverse water quality in the distributed water<br>- Personal injury<br>- Water shortages |
| Heritage and historical cultural resources | - None anticipated | - Not applicable |
| Capacity of Renewable Resources | - Contaminant spill/ accident<br>- Equipment fire<br>- Low water levels | - Damage/ destruction to native species and habitat<br>- Adverse water quality in shallow/ deep aquifers<br>- Water shortages |

### 9.2.2 Mitigation Plans

A number of formal plans have been developed to address the potential environmental effects which could occur during the operations phase. These plans are summarized below. The Town will adhere to these plans to ensure that the operations phase of the project does not have significant adverse environmental effects on the identified VEC's.

#### 9.2.2.1 Operations Plan

An Operations Plan has been prepared for the Mitchell Water Works to provide operations personnel with a reference document detailing the requirements for system operation and maintenance, as well as measures to address emergency situations (e.g., accidents, spills, equipment failures). The manual incorporates a general overview of system equipment and procedural activities, as well as additional requirements prescribed by Regulation 170, and the CC of A. The Municipality of West Perth has implemented the Operations Plan for Mitchell Wells 1, 2 and 3 and will adapt the plan to reflect the equipment and procedural requirements associated with the operation of the Arthur Street Well Supply.

Table 9.3 provides a general summary of the procedural requirements stipulated within the Operations Plan. The purpose of these requirements is to operate the Mitchell Water Works in accordance with established MOE standards, particularly with respect to defined requirements for water quality.

**Table 9.3**
**Mitchell Water Works Operations Plan:**
**Summary of Relevant Procedures**

| | |
|---|---|
| **Water Disinfection/ Treatment/ Monitoring** | - The MIOX solution is collected in a day tank and injected into water at rates appropriate to meet treatment objectives. The injection rate must both satisfy the oxidant demand of the water and meet the standard for disinfection residual.<br>- The liquid chlorine disinfection system is used only as a backup system to the MIOX disinfection system. As raw water flows through the header, 12% sodium hypochlorite is injected full strength under pressure. The sodium hypochlorite is stored in a 200 L drum and injected into the raw water by a chemical metering pump rated at 11.3 L/hr. The chlorinator is installed above the storage tank. The operator controls the chlorine dosage by manually setting the stroke of the chemical pump. The treated water chlorine residual is constantly monitored in the treatment by an on-line analyzer. The operation of the chlorinator is interlocked with the operation of the well pumps. Whenever a well pump operates, the chlorinator also starts. This interlock prevents unchlorinated water from being pumped into the distribution system.<br>- The treatment plant has an iron sequestering treatment system which utilizes sodium silicate (injected under pressure). The chemical is stored in a 200 L tank, and injected into the water by a chemical metering pump rated at 11.3 L/hr. The operator controls the sodium silicate dosage by manually setting the stroke of the chemical pump. |

<table>
<tr>
<td>Water Disinfection/ Treatment/ Monitoring (cont'd)</td>
<td>
- The owner must ensure that the both sodium hypochlorite and the sodium silicate meet American Water Works Association (AWWA) quality criteria and American National Standards Institute (ANSI) safety criteria. The owner is required to have documentation available to prove these requirements<br>
- The Mitchell treatment plant is equipped with both a chlorine analyzer and turbidity analyzer that provide continuous monitoring of chlorine residual and turbidity in the treated water leaving the treatment plant and entering the distribution system. Each analyzer is connected to an alarm system which is triggered an alarm in the event of an adverse condition for either of these two parameters. Both the MIOX solution and sodium hypochlorite (when applicable) usage and chlorine residuals must be reported in the daily operations log and must be available for the Annual Operating Report. Additional daily readings include: flow meter reading, turbidity and free chlorine residual.<br>
- In the case of a failure signal from the chlorination systems, an alarm will be generated, and the well pump associated with the failed chlorinator will be shut down and will not be allowed to restart until the alarm has been cleared by the operator. Alarms for the high and low chlorine residual levels in the treatment plant are set at 0.35 mg/L and 1.80 mg/L (alarms are sent to on-call pager through an autodialer). The optimal free chlorine residual leaving the treatment plant is 1.25 mg/L.<br>
- A spare chemical metering pump is available should the lead unit fail. If the chlorine residual analyzer detects too low a free residual to ensure 0.20 mg/L at extremities of the distribution system, the operator must visit the facility immediately to confirm the status of the chlorinator and the chlorine analyzer.<br>
- The treated water must always meet the MOE's Procedure for Disinfecting Drinking Water in Ontario by ensuring that the proper treatment equipment is supplied and the disinfection facilities are operated and maintained to specific standards
</td>
</tr>
<tr>
<td>Distributed Water</td>
<td>
- Records must be maintained of the daily maximum flow rate and the maximum daily volume of water conveyed into the system from each well source. Records must also be kept of any exceedance of these flows. The records must include the amount, date, time and duration of the exceedence.<br>
- Water quality in the distribution system must be monitored according to the MOE requirements. The following represent key sampling and testing parameters and testing periods defined by the regulations:<br>
<table>
<tr><th>Parameter</th><th>Minimum Sampling Requirements</th></tr>
<tr><td>Free chlorine residual</td><td>Daily</td></tr>
<tr><td>E. coli or fecal coliforms, total coliforms, general bacteria pop.</td><td>Weekly</td></tr>
<tr><td>Trihalomethanes</td><td>Every three months</td></tr>
<tr><td>Lead</td><td>Yearly</td></tr>
<tr><td>nitrites and nitrates</td><td>Every three months</td></tr>
<tr><td>inorganic parameters</td><td>Every three years</td></tr>
</table>
</td>
</tr>
</table>

<table>
<tr><td>Distributed Water (cont'd)</td><td>
organic parameters — Every three years<br>
Sodium — Every five years<br>
Fluoride — Every five years<br>
- If any sample result from the organic, inorganic, or lead testing exceeds 1/2 of the maximum acceptable concentration (MAC), testing frequency must be increased to quarterly.<br>
- A record must be made of all samples collected and tested. All records and information related to, or resulting from, the monitoring, sampling and analyzing activities must be retained for five years.<br>
- The distribution system should be flushed on an annual basis and swabbed whenever microbial contamination becomes a recurring problem. All other hydrants should be exercised twice per year and pumped out in the fall to avoid freezing.<br>
- All valves in the distribution system, including hydrant valves, should be exercised annually.
</td></tr>
<tr><td>Well Maintenance</td><td>
To ensure the production wells and all of their components are maintained in a suitable condition from the standpoint of water safety, the following inspection tasks must be completed and documented.<br>
- Conduct an initial inspection and develop a summary for all production wells (including production, standby, test or monitoring wells) within the immediate (50 day) capture zone of the production wells. This summary should document:<br>
▪ Casing diameter and wall thickness<br>
▪ Depth of well<br>
▪ Type of well<br>
▪ Material of casing<br>
▪ Age of well<br>
▪ Presence of annular seal<br>
▪ Drainage around casing<br>
▪ Extension of grade<br>
▪ Well cap description<br>
- Complete a below-grade visual inspection of all wells to establish a baseline condition. Determine the date of the previous well video for each well supply or arrange for a new inspection (if the video inspection is over 10 years old or was not completed).<br>
- The operating authority should inspect all above grade well components on an annual basis. As part of the inspection work, the authority should:<br>
▪ Record any deficiency that might affect the performance of the pumping equipment.<br>
▪ Record any new potential sources of contamination within the 5 year capture zone.<br>
▪ Record any deficiency that might potentially allow contaminants to enter the well.<br>
▪ Review bacteriological and chemistry data to identify for changes or trends.<br>
▪ Document the inspection and remedial action(s) taken, if applicable.
</td></tr>
</table>

| | |
|---|---|
| **Well Maintenance (cont'd)** | - A qualified professional should visually inspect the condition of the well casing below grade every ten years. If there are concerns identified during the well inspection, or if the frequency of occurrence of contaminated raw water samples increases, a qualified engineer or hydrogeologist should be consulted.<br>- Remedial action should be implemented when an inspection indicates non-compliance with respect to regulatory requirements and/or a risk to water quality. All remedial actions should be documented. |
| **Pumphouse Monitoring** | - A regular preventative maintenance plan will identify issues before problems become evident. A record of maintenance checks and equipment repairs is recommended for each well.<br>- Daily inspections performed on the pumphouse should include the following maintenance and inspection procedures:<br>▪ Inspect for any security breach – e.g. door unlocked or ajar, window broken.<br>▪ Ensure heat is on in cold weather.<br>▪ Check all fittings and piping for leaks.<br>- Other maintenance should include:<br>▪ Exercise and lubricate valves monthly.<br>▪ Calibrate flow meters annually.<br>▪ Clean the turbidimeter chamber monthly.<br>▪ Calibrate the turbidimeter quarterly.<br>- Whenever maintenance is performed on the piping and other equipment in direct contact with the drinking water in the pumphouse, MOE procedures must be followed. |

#### 9.2.2.2 Contingency Plan

The Contingency Plan for the Mitchell Water Works sets out appropriate actions plans to address problems and emergencies related to the operation of the project. West Perth Power, as the operator of the system, is required to adhere to the procedures defined in the document (a copy of which will be placed in the Well 4 pumphouse).

The Contingency Plan establishes appropriate courses of action to mitigate the adverse effects for the following general situations:

- Supply and treatment problems (e.g. adverse water quality test results, failed chlorinator).
- Distribution system problems (e.g., critical watermain break, damaged hydrant).
- Storage facility problems (e.g., loss of storage, structural failure).
- Emergency conditions (e.g., breach of security, fire or explosion).

There are different types of corrective actions depending upon the nature of the occurring problem. In general, the Contingency Plan sets out response procedures to assess the scope of the situation, define steps to mitigate or isolate the problem, determine necessary contacts and support agencies, notify the public (as needed), determine if the problem posses a health and safety risk, undertake appropriate remedial action and monitor the outcome. Where necessary, the response protocol includes adherence to an established notification procedure which requires an immediate report to the Perth-Dufferin-Guelph Health Unit and the MOE Spills Action Centre.

Table 9.4 summarizes the most predictable environmental problems to be encountered during the operational life of the water system, as set out in the Contingency Plan.

**Table 9.4**
**Potential Environmental Changes:**
**Mitchell Water Works**

| Component | Environmental Change | Triggers |
|---|---|---|
| Water Quantity | Low water levels | - Well level during pumping is below normal values<br>- Pumping rate is decreasing as observed on metering<br>- Observation<br>- Telephone call<br>- Storage decreasing<br>- Loss of pressure<br>- Alarms |
| | Excessive consumption | - System pressure is dropping to critical levels.<br>- Customer complaints.<br>- Elevated tank level is dropping to critical levels. |
| Water Quality | Bacteriological contamination | - Routine analysis<br>- Observation |
| | Foreign matter in well supply | - Routine analysis<br>- Observation |
| Climatic Conditions | Frozen watermain | - Customer complaint<br>- Loss of service to an area<br>- Lower than normal pressures |
| | Power failure | - Observation in pumphouse<br>- Power failure alarm<br>- Telephone call regarding loss of pressure<br>- Pump alarm |
| | Flooding | - Weather report<br>- Flood warning<br>- Telephone call |

| Component | Environmental Change | Triggers |
|---|---|---|
| Other Natural Problems (e.g., seismic activity) | Watermain breaks | - Observation<br>- Loss of pressure<br>- Public Input |
| | Structural failure | - Observation<br>- Telephone call |
| | Fire or explosion | - Observation<br>- Phone call<br>- Alarm |

The Contingency Plan provides remedial action plans to mitigate the potential impacts. In general, most of the described procedures are short-term measures designed to protect public health and to resolve the identified problem in an expeditious manner (e.g., contact required personnel, consult with the general public, procure all necessary materials and services, undertake necessary repairs). Additional action strategies are provided for those problems considered more long-term in nature, particularly reductions in both water quantity and quality. The Plan proposes additional measures in these circumstances, including the provision of additional monitoring and the procurement of alternate water sources.

The implementation of the corrective measures set out in the Contingency Plan will address environmental hazards occurring in the short-term (e.g., chemical spills, frozen watermains). These measures should minimize any negative impacts associated with immediate environmental problems. In the long-term, the monitoring procedures associated with the Operations Plan will identify trends of concern (e.g., gradual reductions in ground water levels, steadily increasing iron concentrations in the well water). The Contingency Plan can be subsequently implemented, as required, to mitigate any identified concerns. Remediation of potential long-term hazards will minimize any prolonged effects resulting from systemic problems with the water system (e.g., increased contaminant concentrations in the well water).

## 9.3 Decommissioning Phase

### 9.3.1 Potential Environmental Effects

An assessment was conducted to identify the potential effects of accidents, malfunctions and adverse conditions on the identified VEC's during the decommissioning phase. The assessment involved a review of potential problems which could arise during the abandonment of the planned waterworks, as well as an evaluation of the potential environmental effects resulting from the identified problems. Table 9.5 summarizes the findings of that assessment:

**Table 9.5**
**Accidents, Malfunctions and Adverse Conditions (Decommissioning Phase): Environmental Effects Analysis**

| Valued Ecosystem Component | Incident | Environmental Effect |
|---|---|---|
| Ground water quantity and quality | - Contaminant spill/ accident involving construction equipment or transported materials | - Adverse water quality in shallow/ deep aquifers |
| Surface water quantity and quality | - Contaminant spill/ accident<br>- Siltation (due to high rainfall) | - Adverse water quality in nearby drains/ watercourses |
| Vegetation | - Contaminant spill/ accident<br>- Equipment fire<br>- Siltation | - Damage/ destruction to native species and habitat |
| Species at risk | - Contaminant spill/ accident<br>- Equipment fire<br>- Siltation | - Damage/ destruction to identified species and habitat |
| Migratory birds | - Contaminant spill/ accident<br>- Equipment fire | - Damage/ destruction to native species and habitat |
| Wildlife | - Contaminant spill/ accident<br>- Equipment fire<br>- Siltation | - Damage/ destruction to native species and habitat |
| Noise | - Equipment malfunction (e.g., failed exhaust pipe) | - Elevated noise levels near the project site |
| Air quality | - Contaminant spill<br>- Equipment fire<br>- Equipment malfunction | - Deteriorated air quality near the project site |
| Local users of ground water | - Contaminant spill/ accident | - Adverse water quality in the Well 4 aquifer |
| Heritage and historical cultural resources | - None anticipated | - Not applicable |
| Capacity of Renewable Resources | - Contaminant spill/ accident<br>- Equipment fire<br>- Siltation | - Adverse water quality in shallow/ deep aquifers<br>- Damage/ destruction to native species and habitat |

### 9.3.2 Mitigation Plans

No formal decommissioning plan has been prepared for the waterworks and servicing infrastructure associated with this project. Decommissioning of the project will be carried out in accordance with applicable regulations and with regard for all municipal contingency plans in effect at that time (e.g., spills contingency plans, occupational health and safety procedures). Completion of abandonment activities in this manner should ensure that the decommissioning phase of the project does not have significant adverse environmental effects on the identified VEC's.

# 10.0 ENVIRONMENTAL MONITORING AND MANAGEMENT

## 10.1 Construction Phase

### 10.1.1 Environmental Monitoring

The project was not considered to have the potential to adversely impact upon the environmental setting of the project area. Aside from the standard mitigation and emergency response measures identified in Table 7.6 and section 9.1.2.1 of this report, respectively, no additional plans were incorporated into the construction plan to monitor environmental conditions in the project area.

### 10.1.2 Cultural Heritage Monitoring

The project was not considered to have the potential to adversely impact upon the cultural heritage of the project area. No additional monitoring plans were incorporated into the construction plan to monitor cultural heritage matters in the vicinity of the project area.

## 10.2 Post-Construction Environmental Monitoring

### 10.2.1 Ground Water Monitoring

The following ground water monitoring activities will be conducted following the commissioning of Well 4, in accordance with MOE Permit to Take Water No. 1407-64CJLJ (issued March 30, 2005);

- Daily recording of water takings.
- Weekly recording of static water levels.

- Within 18 months of Well 4 being placed in production, a report must be prepared containing an inventory of all existing private wells within the cone of influence of Well 4, identifying the wells at risk of being adversely affecting by the pumping and proposing remedial measures to address any interference at these locations (including a timeline for implementing these measures). The requirement is intended to result in the development of a pro-active remedial action plan for well interference (taking into account that interference effects may develop over the long term as pumping rates are gradually increased).

#### 10.2.2 Sediment and Erosion Control Plan

Sedimentation and erosion concerns will be monitored following the conclusion of construction activities. The assessment will be carried out by municipal staff during the warranty period as mandated by the contract specifications. Any identified concerns will be remediated by the Contractor following consultation with the municipal engineer and any applicable review agency. Monitoring and remediation activities will be carried out by municipal staff following the conclusion of the warranty period.

#### 10.2.3 Impacts to Air Quality and Noise Generation

Air quality and noise concerns relating to the project will be monitored by the water system operator during the course of routine system management. In accordance with the Contingency Plan, any concerns identified with emissions from treatment facilities or noise levels from pumphouse equipment will be investigated by municipal staff in consultation with the municipal engineer and any applicable review agency. Remediation measures will be carried out as needed.

### 10.3 Operational Activities

An Operations Plan has been prepared for the Mitchell Water Works to provide operations personnel with a reference document detailing the requirements for system operation and maintenance, as well as measures to mitigate operational problems and to address emergency situations (e.g., accidents, spills, equipment failures). Section 9.2.2.1 of this report provides additional information on the Operations Plan.

### 10.4 Contingency Planning

Measures for dealing with problems and emergencies related to the operation of the project are described in Contingency Plan prepared for the Mitchell Water Works. The plan establishes appropriate courses of action to mitigate the adverse effects for a range of potential problems. There are different types of corrective actions depending upon the nature of the situation. In general, the Contingency Plan sets out general response procedures to assess the scope of the situation and steps to mitigate the problem.

# 11.0 RESIDUAL ENVIRONMENTAL EFFECTS

## 11.1 Significance of Residual Environmental Effects at the Construction Phase

Environmental effects from this phase of the project were temporary in nature and limited to the construction-related activities. Based upon a review of the nature and scope of the planned works, the components of the construction plan, and with the implementation of the mitigation measures specified earlier in this report, particularly those identified in Table 7.6, the construction phase of the project was not expected to produce significant adverse environmental effects.

## 11.2 Significance of Residual Environmental Effects at the Operations Phase

Environmental effects that may result from this phase of the project can be either temporary in nature (related to problems such as frozen or broken watermains, power failures, and treated water quality), or long-term (raw water quantity and quality). Based upon a review of the nature and scope of the new well supply and the components of the monitoring and contingency plans, the operations phase of the project is not likely to produce significant adverse environmental effects.

## 11.3 Significance of Residual Environmental Effects at the Decommissioning Phase

Environmental effects from this phase of the project will be temporary in nature and limited to the decommissioning activities. Based upon a review of the nature and scope of the new well supply, the components of the general decommissioning strategy, and with the implementation of the mitigation measures specified earlier in this report, particularly those identified in Table 7.6, the decommissioning phase of the project is not likely to produce significant adverse environmental effects.

# 12.0 CUMULATIVE ENVIRONMENTAL EFFECTS

## 12.1 Considerations

Cumulative effects represent the combined impacts of successive actions upon an environmental setting. Within the context of the environmental assessment processes, cumulative impact analyses are conducted to ensure that the incremental effect of the planned work does not facilitate a significant environmental effect action given existing and planned activities in the affected area. In general, cumulative impacts occur between actions, between actions and the environmental setting and between environmental elements (VEC's). The magnitude of these impacts can equal the sum of the individual effects (i.e., additive effects) or can be an increased effect (i.e., synergistic effects).

The following represent the potential methods by which cumulative effects can occur:

- **Physical-chemical transport**. A physical or chemical constituent is transported away as a result of the proposed action (e.g., air emissions).

- **Nibbling loss.** Land and habitat is gradually disturbed and lost due to a series of combined actions (e.g., incremental forest clearing).

- **Spatial and temporal crowding**. Development activities gradually intensify the use of land beyond an accepted threshold. Spatial crowding occurs when impacts associated with these activities converge in a manner that can adversely impact upon VEC's (e.g., overlapping of noise pollution and chemical emissions). Temporal crowding occurs if effects from different activities overlap before a VEC can recover from an introduced action.

- **Growth-inducing potential.** New actions can induce "spin-off" effects which can augment existing cumulative effects (e.g., improved road access to sensitive natural areas).

## 12.2 Assessment Methodology

The following procedure was carried out to evaluate the nature and magnitude of these cumulative impacts within the context of the existing environment setting and future community development:

- Assessment of existing land use activities, infrastructure, natural features and socio-economic characteristics in the study area (i.e., environmental scoping).
- Review of proposed project and related works (including an evaluation of recommendations from related studies).
- Identification of VEC's that may be affected by the proposed work (i.e., identification of residual effects).
- Evaluation of other actions in the project area (past, present and future) that may impact upon the identified VEC's.
- Assessment of the incremental additive effects of the proposed works on the identified VEC's (i.e., analysis of cumulative effects).
- Consideration and selection of measures to mitigate adverse cumulative effects.
- Prediction of whether VEC's will be significantly impacted by the proposed works (assuming mitigation measures and monitoring programs are implemented, as planned).
- Evaluation of the significance of residual effects from the proposed work.

## 12.3 Parameters

For the purpose of this analysis, the following parameters and assumptions were established to define relationships between the project and existing and future actions:

- The spatial boundary of the impact assessment was defined as the Mitchell service area, with the exception of the adjacent private well supplies impacted by hydrogeologic study work. The scope of the analysis was largely centred in the vicinity of the new well supply and the linear watermain routes, although the assessment did examine impacts dispersed throughout the larger hydrogeologic setting.

- The temporal boundary of the assessment extended from the existing conditions (i.e., baseline conditions) through the construction period to the end of the operational life of the project. Impacts associated with construction and commissioning of the project were expected to have a short-term temporal boundary (i.e., approximately one year). Site restoration activities and initial operational problems were anticipated to have a medium-term temporary boundary (i.e., two to three years). Given the operational plan associated with the new well supply, the long-term temporal boundary was assumed to extend for a continual basis throughout the operational life of the facilities (with increased usage during high water demand periods).

- The sectoral impacts of the project are largely restricted to those related to resource extraction and municipal infrastructure (addressing both construction, operation and decommissioning activities).

- Future actions in the vicinity of the project site will be consistent with the land use patterns designated within the local Official Plan. The implementation of this development pattern is considered to be a reasonably foreseeable action.

## 12.4 Identification of Potential Cumulative Effects

Sections 7.0 and 8.0 of this report identified that the project has the potential to generate residual effects upon the following VEC's:

- Ground Water Quantity and Quality
- Vegetation
- Wildlife
- Local Users of Ground Water
- Capacity of Renewable Resources

Based upon a review of the planned works, in conjunction with an assessment of the local environmental setting and other projects being carried out or considered in the defined regional boundary, the following potential cumulative effects were identified for this project:

- Cumulative effects of the project with other developments planned in Mitchell.

The potential cumulative impacts of past, present and future development projects, in combination with the implementation of the Well 4 project, were evaluated in relation to the identified VEC's. The findings of this review are summarized below.

## 12.5 Evaluation of Potential Cumulative Effects

### 12.5.1 Existing Development Pattern

The community of Mitchell is characterized as a low-density residential community which incorporates a well developed downtown commercial core and a considerable amount of industrial development. Mitchell has a small population (4000 people) relative to most urban centres in southwestern Ontario, although the average annual growth rate (1.45%) experienced in the community exceeds most small urban settlements in the region over the past 30 years. This is primarily due to the proximity of the community to regional growth centres, particularly the City of Stratford.

There is no evidence that the existing development pattern in Mitchell has adversely impacted upon significant or sensitive natural features in the area or the integrity and capacity of ground water resources.

### 12.5.2 Future Development Activities

The development potential of Mitchell is not considered to be significant, given growth management policies incorporated into the Official Plan, as well as existing economic and demographic conditions and recent growth projections. Currently, the Mitchell urban area is being considered for several residential development plans which could create between 100 to 150 residential building lots in the next five years (subject to *Planning Act* approvals). A 25 unit residential subdivision (Thamesview Estates) situated near the community's northwest limit is the only active development plan which has received draft approval under section 51 of the Planning Act. There are currently no significant non-residential development plans or any significant road construction projects planned for Mitchell.

In accordance with municipal development policies, new developments within the Mitchell urban area are required to connect to the municipal water system. Long-term growth in the community will therefore be facilitated through the development of Well 4 and any subsequent municipal wells needed to accommodate future water demands. There are a number of existing municipal and private well supplies within the defined regional boundary which could experience adverse impacts from the construction of one, or more, additional large capacity municipal wells (e.g., increased drawdown, mutual interference effects). Most new development activities will also occur on undisturbed lands (i.e., greenfield sites), which will likely result in the permanent removal of vegetation and wildlife habitat.

Given existing land use controls in agricultural areas (e.g., restrictions on farm severances, requirements for full municipal servicing for multiple lot developments), there are no significant development plans proposed or anticipated in the rural component of the regional boundary. Future development activities in these rural areas are therefore not expected to adversely impact upon ground water resources or natural heritage features.

## 12.6 Measures to Mitigate Effects

### 12.6.1 Ground Water Resources

As discussed in section 7.2.3, it is anticipated that the supply capacity of Well 4, in combination with existing municipal well supplies will be capable of accommodating future water demands in the service area over the 22-year planning period   However, the adequacy of the supply capacity will be routinely monitored and evaluated as part of the water system operations plan. The Municipality will also carry out servicing reviews of new development proposals to ensure that the available well supply can accommodate the estimated water demands of these projects. If, through these monitoring and review processes, it is determined that additional supply capacity is needed to meet system demands, the Municipality will need to explore a range of alternatives to address the situation (e.g., limit community development, upgrade existing wells, augment existing supplies).  Any decision to increase the total supply capacity would require the completion of additional hydrogeologic investigations to confirm that existing well supplies would not be adversely impacted by the development of a new municipal well supply and/ or the upgrading of existing municipal wells.

Section 7.2.4.1 discusses the mitigation measures and monitoring programs being planned for Well 4 to minimize mutual interference between the municipal wells and to reduce or eliminate the potential for adverse impacts to private wells within the Well 4 cone-of-influence (particularly drawdown).   Similar programs would likely be needed to permit the development of any additional municipal wells and/ or to increase the supply capacity of existing municipal wells.

### 12.6.2 Vegetation and Wildlife Habitat

The potential impacts of new development proposals on the natural environment will be evaluated as part of the *Planning Act* approvals process.  Projects which are anticipated to have adverse effects on vegetation and wildlife resources typically do not proceed without substantial mitigation (including avoidance of sensitive features and areas).

### 12.7 Residual Effects

Given the existing environmental setting and the established land use development controls, the development of Well 4, in combination with past, present and imminent projects, is not expected to represent an action which will generate any residual cumulative effects upon the defined regional boundary.

### 12.8 Significance of Residual Effects

Provided that new development activities are carried out in accordance with established planning policies, the development of the Arthur Street Well Supply, in combination with past, existing or imminent projects in the Mitchell area, is not expected to have significant adverse cumulative environmental effects upon the identified VEC's. In this regard, the anticipated residual effect of this project, in combination with past, existing or imminent projects within the defined regional boundary, would be considered Minimal/ Nil in magnitude based upon the impact criteria presented in Table 2.1.

## 13.0 CONSULTATION

### 13.1 Public Information Distribution and Consultation Responses

#### 13.1.1 Comprehensive Study Process

To date, the public consultation program developed for the comprehensive study has incorporated the following components:

- A public registry was established for the project and listed on the Canadian Environmental Assessment Registry (reference number 04-03-8000)

- A public notice was prepared detailing the public comment period for the draft scoping document and notifying the public of the availability of project funding for participation in the study.

  - The notice was circulated in two local community newspapers; the Mitchell Advocate and the Stratford Beacon Herald (initial circulation date: April 13, 2005).
  - The notice was also posted to the COIP and the Canadian Environmental Assessment Agency websites.
  - Copies of the draft scoping document were made available electronically on the Industry Canada and the Canadian Environmental Assessment Agency websites, with hard copies made available at the West Perth municipal office and the public library in Mitchell. A 22-day review period was provided for comments. No written or oral comments were received.

- A public notice was prepared detailing a second public comment period and provided the public with the opportunity to submit comments or concerns related to the environmental implications of the project.

  - The notice was circulated in two weekly community newspapers; the Mitchell Advocate and the Stratford Beacon Herald (initial circulation date: January 11, 2006)
  - The notice was also posted to the COIP and the Canadian Environmental Assessment Agency websites.
  - A 24-day period was provided for comments. No written or oral comments were received.

A third public comment period will be provided following the completion of the Comprehensive Study Report. The public will be provided with a 30-day review period to provide written comments on the project to the Canadian Environmental Assessment Agency. Notices detailing the completion of the report and the review periods will be advertised in local community newspapers. All comments received from the public will be distributed to the expert federal authorities and the Agency for consideration.

#### 13.1.2 Provincial Class EA Investigation

During Phases 1 and 2 of the provincial Class EA process, consultation was undertaken to obtain input from the general public and review agencies that might have an interest in the project. In general, the consultation program involved the preparation of information describing the defined problem, the identified alternatives and the preferred alternative under consideration. Comments obtained through the various consultation methods described in this section of the report were incorporated into the evaluation of alternatives phase of the investigation.

The key components of the provincial Class EA public consultation program were as follows:

- An initial public notice was issued in May 2002 announcing the initiation of the Class EA investigation and outlining the initiation of the hygrogeological exploration program and the need to prepare a long-term water supply strategy. The notice also served to advertise a public open house held May 30, 2002 at the West Perth Municipal Office. The notice was published in the May 22, 2003 edition of the Mitchell Advocate. Ten people attended the open house. The public did not express any significant concerns at the meeting and no comment forms were submitted after the meeting (indicating that the public did not have serious objections to the project).

- A second public open public meeting was held on September 16, 2003 at the West Perth Municipal Office to present the preliminary preferred solution and to receive input. The meeting was advertised in the September 10, 2003 edition of the Mitchell Advocate. Two people attended the open house. The public did not express any significant concerns at the meeting and no comment forms were submitted after the meeting.

- A Notice of Completion was issued in November 2003 to identify the selection of a preferred alternative and to summarize the planned works. No objections to the project were received from the public as a result of the notice.

## 13.2 First Nations Consultation

As noted earlier in Section 1.6, the community of Mitchell and the surrounding rural area is not a traditional territory for First Nations. As a result of this and a provincial review which indicated there were no known historical sites, including First Nations, located in the vicinity of the planned works, it was determined that consultation with First Nations was not necessary in order to complete the CSR.

## 13.3 Government

### 13.3.1 Provincial Class EA Consultation

Input into the study process was solicited from government review agencies by way of direct mail correspondence. Agencies that might have an interest in the study were sent letters providing details about the project, study contacts, open houses and procedures to forward comments and obtain information. Letters were circulated to 14 federal, provincial, municipal and non-governmental agencies in May 2002 and September 2003.

General comments were received from four agencies during the provincial Class EA process, being the Ontario Ministry of Transportation, the Department of Fisheries and Oceans (Coast Guard, Central & Arctic Region), the Department of Fisheries and Oceans (Ontario Great Lakes Area) and the Ontario Ministry of Culture. The key issues identified related to the need to be apprised of future study information, the need to refer project information to other stakeholders and the need to assess the project site for buried archaeological features. No specific concerns or objections were received from the review agencies in relation to the planned works.

### 13.3.2 Correspondence Submitted to Industry Canada and the Canadian Environmental Assessment Agency

Table 13.1 summarizes the comments received from the expert FA's following circulation of project information and an initial draft of the Comprehensive Study Report.

**Table 13.1**
**Comprehensive Study Public Consultation Program:**
**Summary of Comments Received from Expert Federal Authorities**

| **Health Canada** | | |
|---|---|---|
| **Date of Correspondence** | **Summary of Comments** | **Consideration/Action** |
| June 14, 2006 | - Baseline noise level data should be provided for closest noise receptor to the site.<br>- Additional details should be provided on the magnitude of construction-related noise impacts<br>- Operation of the standby generator could cause an adverse environmental effect if operated for a prolonged period (i.e., operation of the unit for more than 1 hour per day for a period exceeding two months). | - Sections 6.1.8 and 7.8 of this report summarize issues pertaining to noise. |
| | - Appropriate mitigation measures should be identified and implemented to minimize the hydrogeologic effects of Well 4 on existing private and municipal well supplies. | - The hydrogeologic monitoring program will be implemented as noted in section 7.2.4. The results of this program will be summarized in a report submitted as part of Follow-up program. |
| | - The proposed wellhead protection strategy should be implemented. | - Source protection measures will be implemented, as defined through the wellhead protection exercise. |
| **Natural Resources Canada** | | |
| **Date of Correspondence** | **Summary of Comments** | **Consideration/Action** |
| June 14, 2006 | - Well 4 will likely remain in production beyond the 22-year planning period associated with this EA. The identified interference impacts associated with the pumping of Well 4 could therefore occur beyond the stated planning period. | - Sections 7.2.1.1 c) iv) and 7.2.3 of the report provide supplemental information on the magnitude of drawdown. Study recommendations are intended to mitigate the identified interference effects. |

| Health Canada | | |
|---|---|---|
| **Date of Correspondence** | **Summary of Comments** | **Consideration/Action** |
| | - Vertical downward ground water flow across the aquitard will be enhanced by drawdown in the bedrock aquifer. The possibility of rapid ground water flow through fractures is not discussed. | - Fractures in the bedrock may result in higher ground water velocities, compared with flow through the overburden sediments. An assessment of the presence of fractures and their effects on groundwater flow could be evaluated by field testing. |
| | - Given the industrial character of the study area, several potential contaminant sources are situated in the vicinity of Well 4. More consideration and assessment is warranted for determining potential or suspected contaminant sources and monitoring/ sampling for relevant contaminants. | - The ground water protection plan for West Perth includes the capture zones for Wells 1-3, but should be updated to include the Well 4. In this regard, a vulnerability assessment for the Well 4 capture zone is being carried out as part of the source protection program being implemented under the Ontario Clean Water Act (refer to section 7.2.4.5). Remediation measures for any potential contaminant risks will also be considered as part of this evaluation (e.g., land use restrictions). |
| | - Well 4 is situated in close proximity to the community's sewage treatment ponds. Additional information should be provided on the ponds (e.g, physical characteristics, operational procedures). | - Concerns regarding the potential treat to Well 4 posed by the sewage treatment ponds should be incorporated into the updated West Perth ground water protection plan. |

| Health Canada | | |
|---|---|---|
| **Date of Correspondence** | **Summary of Comments** | **Consideration/Action** |
| | - More detailed estimates should be provided for drawdown (using an analytical aquifer model employing aquifer parameters derived from the analysis of pump test results). | - The analysis of interference carried out for Well 4 is considered the preferred method of predicting interference effects, given that (1) it is based on actual data recorded during the test and (2) the assumptions inherent with the analytical solutions for transmissivity and storativity are violated at the site (i.e., typically homogeneous/ isotropic conditions and simplified boundary conditions). |
| | - The pumping of Well 4 at the proposed rate could eventually render Wells 1-3 inoperable. Observed interference at private wells could also be exacerbated via long term pumping.<br>- The proposed pumping strategy will be implemented to mitigate interference effects, however shifting pumping between municipal wells may not alleviate most mutual interference effects due to the overlap in the cones of influence. Additional mitigation should be explored in the Follow-up Program.<br>- An inventory of private wells within the Well 4 cone-of-influence should be prepared and, as part of this work, at risk wells should be identified and appropriate remedial measures should be prescribed. This exercise should be carried out and documented as part of the Follow-up Program. Moreover, potential impacts associated with Well 4 are likely longer in nature than the identified 18-month monitoring period prescribed by the Permit to Take Water. | - Concerns regarding mutual interference and interference with private well supplies will be evaluated and addressed as part of the proposed pumping strategy (discussed in section 7.2.4.1) and the 18-month monitoring program (as discussed in section 10.2.1). |

| Health Canada | | |
|---|---|---|
| **Date of Correspondence** | **Summary of Comments** | **Consideration/Action** |
| | - The Contingency Plan does not discuss the specific measures that will be taken to resolve a low water problem. | - Well 4 will be equipped with a pressure transducer/ datalogger for recording well water levels. Water level data will be reviewed on a regular basis as part of the pumping strategy. The water level recording device will be connected into the operating system and will incorporate a low level pump shut-off and alarm to alert the operator if low water levels are evident. |
| | - Short-term and long-term measures to resolve water quantity problems for private well supplies should be incorporated into the Contingency Plan. | - A contingency plan will be prepared for private wells detailing evaluation, response and reporting mechanism for interference effects. |
| | - Many of the identified comments and recommendations could be addressed through the Follow-up Program. | - Section 15.0 provides more details on the Follow-up Program. |
| January 3, 2007 | - Consider including parameters in the water quality monitoring program that indicate recharge through the till (e.g., chloride ions from road salt). | - Comments will be taken into consideration during the development of the monitoring program. |
| | - Consider using long-term pumping data to estimate leakage across the aquitard (to provide a better estimate of the hydraulic behaviour of the aquitard on a larger scale). | - Comments will be taken into consideration during the development of the monitoring program. |
| | - Recorded data could be incorporated into a leaky aquifer model to predict future drawdown and to estimate the upper limit of hydraulic connectivity (this approach may be more appropriate for the predictive analysis proposed in the follow-up program). | - Comments will be taken into consideration during the development of the monitoring program. |

| Health Canada | | |
|---|---|---|
| **Date of Correspondence** | **Summary of Comments** | **Consideration/Action** |
| | - The contingency plan for well interference proposed in the November 3, 2006 correspondence from Lotowater should be included in the follow-up program. One or more monitoring wells should be installed as part of this program. | - Comments will be taken into consideration during the development of the interference contingency plan.<br>- Provided additional details on the contingency plan (Section 15.2). |

### 13.3.3 Agency and First Nations Site Tour and Meeting

An agency and First Nations site tour and meeting was not scheduled for this project, given the limited scope of the new well supply and the lack of a First Nations interest in the project.

## 14.0 SUMMARY OF ENVIRONMENTAL EFFECTS

Table 14.1 summarizes the potential environmental effects, impact mitigation and residual effects associated with this project.

**Table 14.1**
**Mitchell Well Supply Upgrading Project**
**Summary of Environmental Effects**

| Environmental Component | Environmental Effects Analysis | | | | | | Residual Effects | |
|---|---|---|---|---|---|---|---|---|
| | Potential Adverse Effects | | | Potential for Full Impact Mitigation | | | Are Effects Significant? | |
| | Yes | No | Uncertain | Yes | No | Uncertain | Yes | No |
| **Physical and Natural Environments** | | | | | | | | |
| Ground water quantity and quality | x | | | | x | | | x |
| Surface water quantity and quality | | x | | x | | | | x |
| Vegetation | x | | | | x | | | x |
| Species at Risk | x | | | x | | | | x |
| Migratory Birds | x | | | x | | | | x |
| Wildlife | x | | | | x | | | x |
| Noise | x | | | x | | | | x |
| Air quality | x | | | x | | | | x |
| Capacity of renewable resources | x | | | | x | | | x |
| **Cultural Environment** | | | | | | | | |
| Heritage and historical cultural resources | | x | | x | | | | x |
| **Environmental Conditions** | | | | | | | | |
| Erosion, ice encroachment and scour hazards | x | | | x | | | | x |
| Seismic activity | x | | | x | | | | x |
| Climate change | x | | | x | | | | x |

| Environmental Component | Environmental Effects Analysis | | | | | | Residual Effects | |
|---|---|---|---|---|---|---|---|---|
| | Potential Adverse Effects | | | Potential for Full Impact Mitigation | | | Are Effects Significant? | |
| | Yes | No | Uncertain | Yes | No | Uncertain | Yes | No |
| **Accidents, Malfunctions and Adverse Conditions** | | | | | | | | |
| Construction phase | *x* | | | *x* | | | | *x* |
| Operations phase | *x* | | | *x* | | | | *x* |
| Decommissioning phase | *x* | | | *x* | | | | *x* |
| **Cumulative Effects** | | | | | | | | |
| Future development activities | *x* | | | *x* | | | | *x* |

# 15.0 FOLLOW-UP PROGRAM

## 15.1 Need for a Follow-up Program

A Follow-up Program is required to verify the accuracy of impact predictions and to determine the effectiveness of mitigation measures. Since all construction activities associated with the project are standardized construction procedures with well-documented mitigation techniques, Industry Canada has determined that the Follow-up Program will be limited to an assessment of the long-term impacts of the project on ground water quantity and quality.

## 15.2 Requirements of the Follow-up Program

The Follow-up Program for this project will consist of the following activities:

- Additional monitoring of existing wells in the area, including private wells, will be conducted to further assess the impacts resulting from the pumping of Well 4. This exercise will be carried out during the initial 18-month period of well operation to confirm the validity of the hydrogeologic study work with respect to ground water quantity. Data gathered during this period will provide information on the initial conditions of existing wells within the general cone-of-influence. This information will be used to monitor impacts associated with well pumping and, as necessary, to respond to adverse impacts over the operational phase of the project (e.g., excessive drawdown of private wells). If interference problems are found, remedial measures will be taken to address the identified problems and additional monitoring and reporting will occur, as necessary and as set out in an operational contingency plan. The contingency plan will incorporate a specific well interference, evaluation and reporting mechanism, as well as a strategy for corrective action.

- Additional monitoring of chemical and microbiological parameters will be carried out in accordance with MOE sampling requirements (summarized in Table 9.3). This monitoring program will confirm the validity of the hydrogeologic study work with respect to ground water quality. If water quality problems are encountered over the operational phase of the project, remedial measures will be taken to address the identified problems and additional monitoring and reporting will occur, as necessary and in accordance with MOE protocols.

- Further assessment of the vulnerability of the Well 4 capture zone will be conducted; building upon the findings of the ongoing Clean Water Act investigations summarized in section 7.2.4.5 and any related investigations. Remediation measures will also be defined for any potential contaminant risks identified though these investigations.

### 15.3 Timelines of Follow-up Program

Monitoring activities associated with the Follow-up Program will be carried out by a qualified professional for a period of three years. The results of the monitoring exercises will be summarized in annual reports. A report will also be prepared following the 18-month monitoring program.

### 15.4 Reporting to Industry Canada and the Canadian Environmental Assessment Agency on Follow-up

Industry Canada and the Canadian Environmental Assessment Agency will be provided with the 18-month monitoring report and the annual well reports for further evaluation. The availability of findings from the follow-up program will be posted on the CEA Registry.

## 16.0 CONCLUSIONS AND RECOMMENDATIONS

In its analysis of the environmental effects of the Mitchell Well Supply Upgrading Project, Industry Canada, as the Responsible Authority under the CEA Act, has taken into consideration the information provided by the Municipality of West Perth in their application for funding under COIP. Industry Canada also considered advice provided by the expert Federal Authorities (Environment Canada, Health Canada and Natural Resources Canada) and results of feedback acquired through the public consultation process.

The environmental effects of the project were evaluated with respect to accidents and malfunctions, effects of the environment on the project, alternative means, the capacity of renewable resources and cumulative effects. Mitigation measures and a follow-up program were also developed to address potential effects of the project. Industry Canada has concluded that, with the implementation of the mitigation measures specified in this CSR, and with the provincial requirements regarding the construction, operation and decommissioning of the water system, the project will not likely result in any significant adverse environmental effects. Notwithstanding the above conclusion, comments received during the public review of this CSR will be used to verify that stakeholder concerns are being addressed and that the environmental effects of this project are acceptable.

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# APPENDICES

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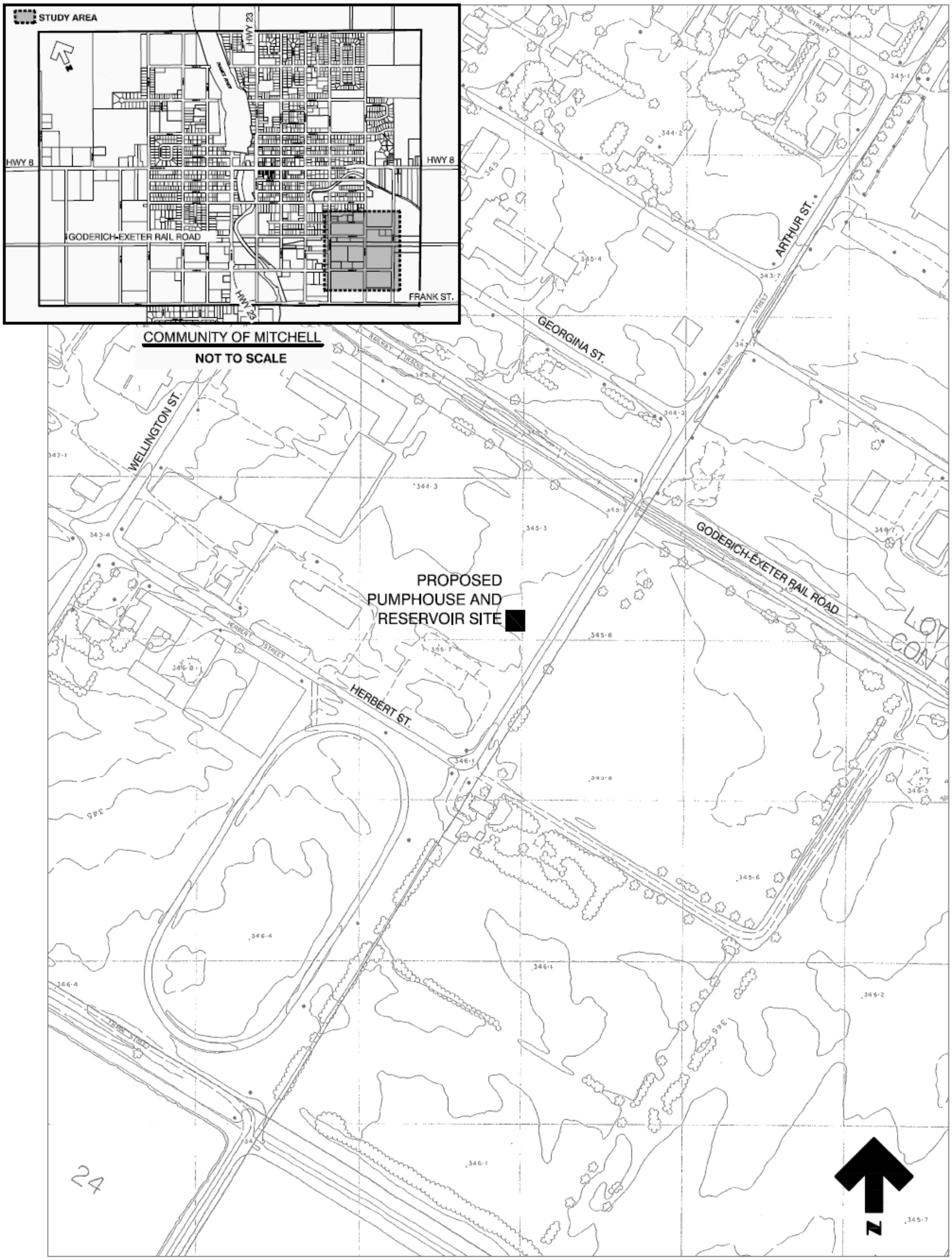
## APPENDICES

# APPENDIX A

# GENERAL LOCATION PLANS



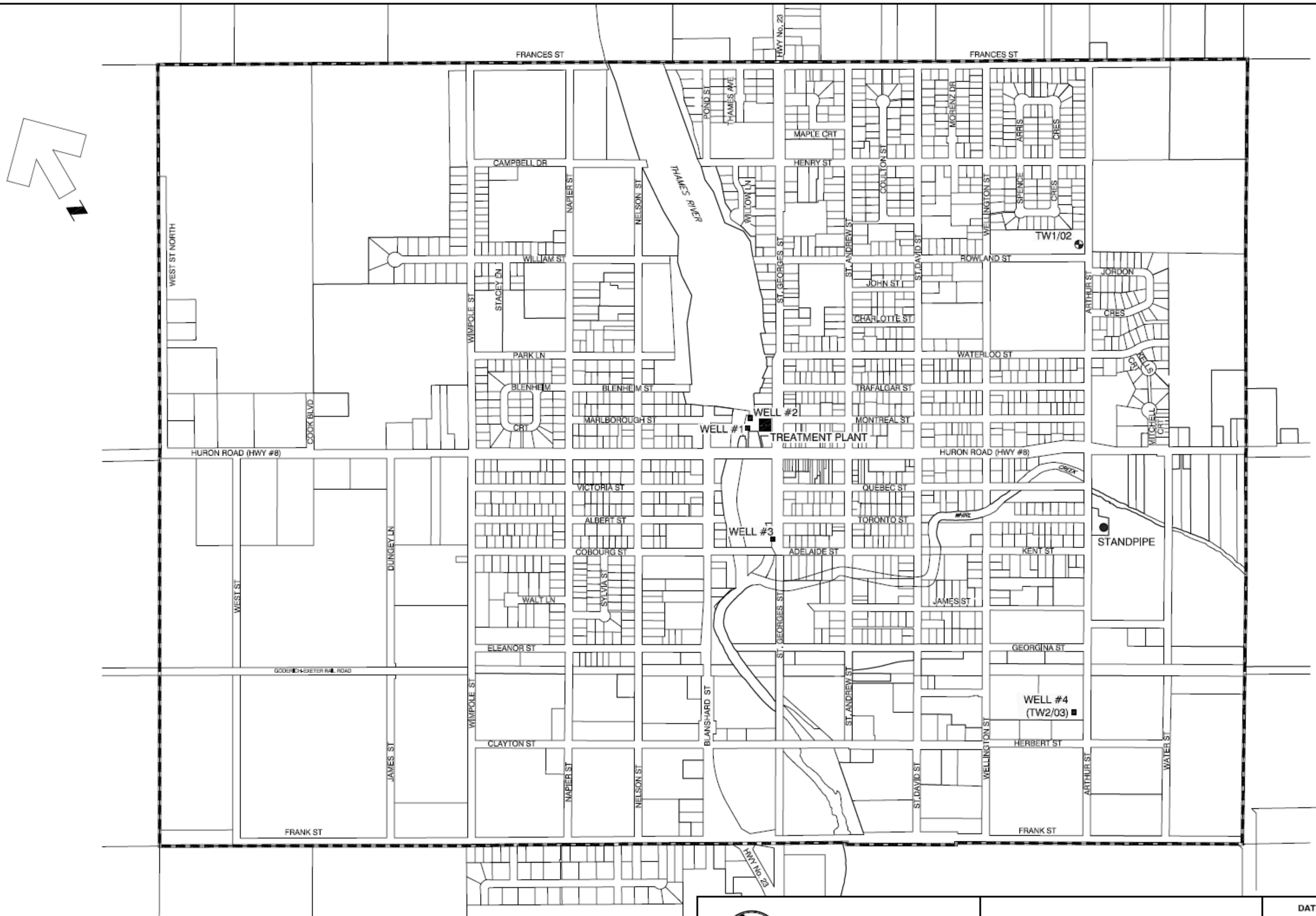

BMROSS
engineering better communities

**Municipality of West Perth (Mitchell)**

**Proposed Water Pumphouse and Reservoir**

General Location of the Well Site

| DATE | PROJECT No. |
|---|---|
| Feb, 28, 2006 | 04214 |
| SCALE | FIGURE No. |
| Not to Scale | 1 |




| | | | |
|---|---|---|---|
| BMROSS engineering better communities | Municipality of West Perth<br>Existing Water Supply Facilities | DATE<br>March 12, 2007 | PROJECT No.<br>04214 |
| | | SCALE<br>1:10,000 | FIGURE No.<br>2 |

# APPENDIX B

# COMPREHENSIVE STUDY SCOPING DOCUMENT

**COMPREHENSIVE STUDY SCOPING DOCUMENT**

**Municipality of West Perth: Upgrading of the Mitchell Well System**

# 1.0 INTRODUCTION

## 1.1 Purpose of the Scoping Document

Industry Canada is considering whether to provide funding to enable the proposed upgrading of the Mitchell well system (the Project). Pursuant to section 5 of the *Canadian Environmental Assessment Act*, an environmental assessment under that Act must be conducted before a funding decision can be made. As such, Industry Canada has determined that it is a responsible authority for the project, and therefore must ensure that the environmental assessment is conducted as early as is practicable in the planning stages of the project and before irrevocable decisions are made.

The Canadian Environmental Assessment Agency, as the federal environmental assessment coordinator, has determined that there is no other responsible authority that is required to conduct an environmental assessment for this project. However, Environment Canada, Natural Resources Canada, and Health Canada will provide expert advice in relation to the project.

This document describes the proposed scope of the project for the purposes of the environmental assessment, the factors proposed to be considered in the environmental assessment and the proposed scope of those factors. This document is intended to provide information to assist the public in commenting on this proposed approach to the environmental assessment as described in this document (see section 3.0 for further details).

## 1.2 Environmental Assessment Process

The upgrading of the Mitchell well system is subject to a comprehensive study under the *Canadian Environmental Assessment Act*, pursuant to paragraph 10 of the *Comprehensive Study List Regulations*.

Industry Canada has initiated the environmental assessment and, pursuant to section 21(2) of the Act, must provide a report to the Minister of the Environment, following public consultation, and recommend whether the environmental assessment should be continued by means of a comprehensive study, or the project should be referred to a mediator or review panel.

The report from the responsible authority to the Minister of Environment must include:

- the scope of the project, the factors to be considered in the assessment and the scope of those factors;
- public concerns in relation to the project;
- the project's potential to cause adverse environmental effects; and
- the ability of the comprehensive study to address issues relating to the project.

After considering the responsible authority's report and recommendation, the Minister of the Environment will decide whether to refer the project back to the responsible authority so that it may continue the comprehensive study process, or refer the project to a mediator or review panel.

If the Minister of Environment determines that the environmental assessment may continue as a comprehensive study, the responsible authority will provide the public with an additional opportunity to participate in the comprehensive study process. Further, on completion of the comprehensive study report, the Canadian Environmental Assessment Agency (the Agency) will seek public comments on the comprehensive study report. The Agency will also provide participant funding in order to assist the public in participating in the comprehensive study process.

If the Minister decides to refer the project to a mediator or a review panel, the project will no longer be subject to the comprehensive study process under the Act. The Minister, after consulting the responsible authority and other appropriate parties, will set the terms of reference for their review, and appoint the mediator or review panel members. The public will have an opportunity to participate in the mediation or the panel review, and participant funding will be provided.

## 1.3 Project Background

### Project Overview

Mitchell, in the Municipality of West Perth, is located on Highway 8 approximately 21 kilometres west of Stratford. The proposed project is located entirely within the limits of the former Town of Mitchell (see Appendix 1). The well site, which is the subject of this study, is shown in Appendix 2.

To address capacity issues within the community for a 22-year planning period, the Municipality of West Perth, the project proponent, submitted a proposal to upgrade the Mitchell well system.

The proposed project involves the construction of a new well, the construction of a treatment building, and the installation of an oversized watermain, which will allow treated water to be adequately disinfected prior to distribution. The oversized watermain will connect to the distribution system on Arthur Street immediately in front of the new well site.

### Background

The Mitchell water system was first commissioned, with one well, in the 1930's. Additional wells were added to the system in 1949 and 1967. The system now consists of three drilled bedrock wells at two locations, with each well located in its own well house, one treatment facility, a 3900 $m^3$ standpipe, and a distribution system.

Raw water is disinfected, using sodium hypochlorite, and stored in an on-site ground level reservoir prior to being pumped to distribution. The *Municipality of West Perth Mitchell Water System Engineer's Report*, prepared in 2001, indicated that the system did not meet provincial water treatment requirements because it did not provide sufficient disinfection time prior to distribution. This was rectified with upgrades to the system that were completed in 2003.

The existing treatment facility is located approximately 30 metres from the North Thames River. It consists of a treatment building and a ground level reservoir. The facility is co-located with Wells #1 and #2. The building provides the treatment for the three existing wells of the system. Disinfection of the raw water is achieved using sodium hypochlorite, which is generated on-site in a process using brine and a mixed oxidant. Raw water in the area has naturally elevated levels of iron and, as a result, the facility also provides iron sequestration treatment using sodium silicate.

As noted above, Wells #1 and #2 are located on the same site as its treatment facility. Well #1 is the water system's standby well and is situated approximately eight metres from the North Thames River. It is in an area susceptible to flooding during a 25-year storm event, although there is no knowledge of this site ever being flooded. Upgrades at this site that were completed in 2002 resolved any potential effects flooding might have had on the well. Well #2 serves as a duty well. It is situated approximately 35 m from the river and is above the regulatory flood level. The well site is situated in a developed area of town. Surrounding land uses are a mixture of residential, commercial, and open space. All properties in the area of this site are serviced by municipal water and sewage systems. The permitted capacity for Well #1 is 1818 L/min (2618 $m^3$/d) and for Well #2 2274 L/min (3275 $m^3$/d).

Well #3 is also a duty well. It is situated approximately 85 m from the North Thames River and is also in an area susceptible to flooding during a 25-year storm event, although there is no knowledge of this site ever being flooded. Upgrades at this site that were completed in 2002 resolved any potential effects flooding might have had on the well. This well site is also situated in a developed area of town. Surrounding land uses are mixture of residential, industrial (food processing), and open space. All properties in the area of this site are serviced by municipal water and sewage systems. The permitted capacity for Well #3 is 3180 L/min (4579 $m^3$/d).

Overall, the Mitchell well system services 1509 households, two major industrial users and other smaller industrial, commercial, and institutional operations. The existing system has a permitted treatment capacity of 7854 $m^3$/d and produces approximately 2475 $m^3$/d of treated water (average 1997 - 1999). Based on population projections and other usage assumptions, average day demand is expected to increase from the 1997 - 1999 usage levels to 6378 $m^3$/d at the 2026 planning horizon. The maximum day demand is expected to increase to 8528 $m^3$/d in the same time period.

The proposed project will require the construction of physical works at the new well site on Arthur Street and includes: the construction of a new well with a production capacity of approximately 100 L/s; the construction of a treatment building to house pumping, treatment, and monitoring and control equipment; and, the construction of an oversized watermain on the site to provide the required disinfection prior to entering the distribution system. Other ancillary works will also be required.

**Project Schedule**

It is anticipated that the project will take six months to bring into service following the start of construction.

This schedule is largely dependent on: the results of the geotechnical work at the new Arthur Street site; the completion of the design for the new Well #4, treatment facility and associated works; completion of the Well #4 supply hydrogeology study; and the approval of permits to take water.

**Environmental Assessment Schedule**

The responsible authority expects to submit its report and recommendation to the Minister of Environment in the spring of 2005 on whether the environmental assessment should continue by means of a comprehensive study or be referred to a mediator or review panel. If the comprehensive study process continues, the public will have an opportunity to provide additional input into the comprehensive study process. The responsible authority proposes to submit the comprehensive study report to the Agency in the fall of 2005. The Agency is required to have a public comment period on the comprehensive study report. The final comprehensive study report is expected to be presented to the Minister of the Environment early in 2006 for the environmental assessment decision statement.

## 2.0 SCOPE

### 2.1 Scope of the Project

The proposed scope of the project refers to the various components of the proposed undertaking that are considered as part of the project for the purpose of the environmental assessment. The scope of the project includes undertakings in relation to the physical works or physical activities related to the construction and operation of the proposed new well site.

Specifically, the scope of the project for the environmental assessment of the Mitchell well system upgrades is:

- construction of well components capable of providing a supply of approximately 100 L/s (8640 $m^3$/d, 3 153 600 $m^3$/a);
- construction of a pumphouse (approximately four metres by six metres in size) to house treatment and pumping equipment;
- installation of a chlorine contact water main (approximately 145 m in length and 600 mm in diameter on the site);
- construction equipment access, laydown areas;
- operation and maintenance of the well, pumphouse, treatment processes, and the

watermain;
- site rehabilitation; and
- decommissioning of the site at the end of the project's operational life.

## 2.2 Scope of assessment

### 2.2.1 Factors to be Considered

The CEA Act requires that the following factors be considered in the environmental assessment (sections 16(1) and 16(2):

- *the environmental effects of the project, including the environmental effects of malfunctions or accidents that may occur in connection with the project and any cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out;*
- *the significance of the effects referred to in the previous paragraph;*
- *comments from the public that are received in accordance with this Act and its regulations;*
- *measures that are technically and economically feasible and that would mitigate any significant adverse environmental effects of the project;*
- *the purpose of the project;*
- *alternative means of carrying out the project that are technically and economically feasible and the environmental effects of any such alternative means;*
- *the need for, and the requirements of, any follow-up program in respect of the project; and*
- *the capacity of renewable resources that are likely to be significantly affected by the project to meet the needs of the present and those of the future.*

### 2.2.2 Scope of Factors to be Considered

The following provides details on the proposed scope of the factors to be considered in the environmental assessment.

**Physical and Natural Environment**
- ground water quantity and quality;
- surface water quantity and quality;
- vegetation, including wildlife habitat and biodiversity;
- wetlands, if applicable, and their functions;
- species at risk;
- migratory birds, particularly with respect to the potential for disturbance or destruction of migratory birds or their nests;
- wildlife;
- noise;
- air quality - local and downwind airborne emissions (including odours and volatiles).

**Socio-Economic and Cultural Environments**

- adjacent land uses;
- local neighbourhood and residents;
- worker health and safety;
- public health and safety;
- aesthetics;
- heritage and historical cultural resources.

**Malfunctions and Accidents**

The probability of possible malfunctions or accidents associated with the project during construction, operation, modification, decommissioning, abandonment or other undertaking in relation to the work, and the potential adverse environmental effects of these events, should be identified and described. The description should include:

- accidental spills where possible;
- contingency plans and measures for responding to emergencies.

**Any change to the project that may be caused by the environment**

The environmental hazards that may affect the project should be described and the predicted effects of these environmental hazards should be documented. The following issues should be addressed in the environmental assessment and the design of the project:

- seismic activity;
- climate change.

**Cumulative Environmental Effects**

The cumulative environmental effects that are likely to result from the project in combination with other projects or activities that have been or will be carried out should be identified and assessed. The approach and methodologies used to identify and assess cumulative effects should be explained. The cumulative effects assessment should focus on, but not necessarily be limited to:

- cumulative effects of the proposed project with the possible replacement and/or installation of new water mains within Mitchell;
- cumulative effects of the project with other developments that are planned within Mitchell such as road and/or residential construction, or additional groundwater takings.

**Sustainability of the Resource**

The environmental assessment shall consider the renewable resources that may be significantly affected by the project and the criteria used in determining whether their sustainable use will be affected. The Comprehensive Study will emphasize in particular the sustainable use of the ground water system.

**Spatial and Temporal Boundaries**

The proposed project is located entirely within the limits of the former town of Mitchell. The following are proposed spatial boundaries for the project:

- The right-of-way includes any land area that is directly disturbed by the construction activities of the project. This includes: the Arthur Street well site, and any associated construction equipment access routes and lay down areas.

- The corridor includes any area beyond the right-of-way, which could be disturbed by project effects. This includes effects during construction (noise, dust, vehicle emissions, traffic, etc) and would include a proposed area approximately 250 m around beyond the right-of-ways. The corridor also includes possible effects, including accidents and malfunctions (for example, chemical spills, etc) as it relates to operation of the water system and would include an area of approximately 500 m beyond the right-of-way.
- The regional boundary will include an area beyond Mitchell's community boundary, this being the greater of one kilometre or the extent of the area affected by the project. This could include the effects of construction activities (noise, dust, vehicle emissions, etc), operational activities (possible negative effects of draw down because of the system's groundwater withdrawal), and effects that the increased system capacity could have on the Mitchell sewage treatment system (possible negative effects from increased treatment volumes and decreased surface water quality).

The following are proposed temporal boundaries for the project:

- The short term temporal boundary of the project would last approximately six months and includes the construction and commissioning phases of the project. It can include activities such as: the construction and commissioning of the new well; the construction and commissioning of the new pumphouse; and, the construction and commissioning of the chlorine contact water main and its connection to the distribution system. It can also include activities related to construction equipment access, lay down areas as well as any accidents and malfunctions that may be associated with the construction phase of the project.
- The medium term temporal boundary of the project is expected to be in the two to three year range and includes activities such as: the effectiveness of site restoration; possible accidents and malfunctions (for example, failure of the new on-site watermains, chemical spills, etc) as it relates to operation of the water system; and, possible negative effects of draw down because of the system's groundwater withdrawal.
- The long term temporal boundary for the project would last up to the operational life expectancy of the project which is 22 years and includes the operation and maintenance, and eventual decommissioning of the project, in addition to activities such as: possible accidents and malfunctions (for example, failure of the new on-site water mains, chemical spills, etc) as it relates to operation of the water system; and, possible negative effects of draw down because of the system's groundwater withdrawal.

**Proposed design of the Follow-up Program**

The purpose of a follow-up program is to verify the accuracy of impact predictions and determine the effectiveness of mitigation measures. Elements of the follow-up program will be identified in the Comprehensive Study.

## 3.0 PUBLIC PARTICIPATION

The public is invited to provide its views at this stage of the environmental assessment of the project on the following areas:

- the proposed scope of the project;
- the factors proposed to be considered in the assessment and the proposed scope of those factors; and
- the ability of the comprehensive study to address issues relating to the project.

Persons wishing to submit comments may do so in writing to Industry Canada. Please be as detailed as possible and clearly reference the Mitchell well system and File Number 650 on your submission. Comments must be received by the close of business April 29, 2005. Comments may be sent by electronic mail to COIP-PICO@ic.gc.ca, by facsimile to (416) 954-6654, or by mail to:

Industry Canada
Canada-Ontario Infrastructure Program
151 Yonge Street, 3rd Floor
Toronto, Ontario
M5C 2W7

Should a comprehensive study be conducted for the project, Industry Canada will provide the public with an additional opportunity for input into comprehensive study process. Once the comprehensive study report has been submitted to the Agency, the public will be provided an opportunity to review and provide comments during the Agency's public comment period, prior to final recommendation to the Minister of Environment.

The public will also have opportunities to participate in the review, should the project be referred to a mediator or a review panel.

Following the Minister's decision on the type of environmental assessment that is to be conducted (comprehensive study, mediation, or panel review), funding will be available from the Canadian Environmental Assessment Agency for members of the public to participate in the environmental assessment.

## References

B.M. Ross and Associates Limited, *Municipality of West Perth Mitchell Water System First Engineers Report*, 2001

R.V Anderson Associates Limited, *Municipality of West Perth Mitchell Water Supply Study*, 2003