COMPREHENSIVE STUDY REPORT

CLIFFORD WATER WORKS UPGRADING PROJECT

Prepared for:

Industry Canada
151 Yonge Street, 3rd floor
Toronto ON
M5C 2W7

Prepared by:

The Corporation of the Town of Minto
5941 Highway No. 89
RR#1 Harriston, ON
N0G 1Z0

January 29, 2007

COMPREHENSIVE STUDY REPORT

<u>EXECUTIVE SUMMARY</u>

CLIFFORD WATER WORKS UPGRADING PROJECT

TABLE OF CONTENTS

Table of Contents (cont'd)

LIST OF TABLES

1.0 PROJECT DESCRIPTION

1.1 Purpose and Overview of Project

The Corporation of the Town of Minto, the project proponent, is upgrading the Clifford Water Works to address a series of identified operational deficiencies. The undertaking has included the development of a new well supply and a new water storage facility, the completion of improvements to an existing municipal well supply (Well 1), as well as the extension of servicing infrastructure to connect the new waterworks facilities to the existing water distribution system. The new well supply augments the Well 1 supply and permitted the decommissioning of an existing well supply (Well 2). Construction of the new storage facility also permitted the decommissioning of the existing water storage standpipe.

The improvements to the municipal water system constitute the *Community of Clifford Water Works Upgrading Project.*

1.2 General Description of the Community and the Municipal Water System

The community of Clifford, Ontario is a small urban settlement within the boundaries of the Town of Minto, a constituent municipality of the County of Wellington. Clifford is situated along the route of Provincial Highway No. 9, near the northwestern border of both the Town of Minto and Wellington County. The village, which has an estimated population of 800 persons, is predominantly a low-density residential centre that also contains a well-developed commercial sector (servicing local residents and the surrounding agricultural community).

Water is supplied to customers in Clifford via a municipal water system first commissioned in 1947. Prior to the commencement of the upgrading project, the system, referred to as the Clifford Water Works, was comprised of two drilled bedrock well supplies (Wells 1 & 2), two pumphouses, an elevated storage facility (standpipe), and a network of distribution watermain. The system provides service to approximately 340 residential, commercial and institutional customers.

In April 2002, the Town of Minto initiated a Municipal Class Environmental Assessment (Class EA) under the *Environmental Assessment Act* of Ontario to resolve a series of problems with Clifford Water Works including these key deficiencies:

- **Inadequate firm supply capacity.** The Clifford water system required 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 Clifford system was rated at 4.5 L/s, which is significantly less than the base year design maximum day demand (13.0 L/s).

- **Well 2 Deficiencies.** Engineering evaluations and reports carried out in response to the Ontario Drinking Water Protection Regulation (O. Reg. 459/00) resulted in the identification of a number of well upgrades required for Well 2 (e.g., install continuous reading chlorine residual and turbidity analysers). An associated hydrogeolgic study also concluded that Well 2 was hydraulically connected to Coon Creek.

- **Water storage deficiencies.** The limited height of the standpipe resulted in inadequate system pressures in the distribution system. The total effective storage volume of the standpipe (794 m^3) also did not meet the required design volume for the existing population (988 m^3).

The Class EA investigation was completed in January 2004. The proponent selected the Community of Clifford Water Works Upgrading Project as the preferred strategy for resolving the identified problems.

1.3 Project Components and Activities

1.3.1 Nelson Street Well Supply

The new well supply, referred to as the Nelson Street Well Supply, is located in a predominantly low-density residential area in the south end of the village. The site was an undeveloped, 1,575 m^2 parcel which is comprised primarily of manicured lawn (a row of deciduous and coniferous trees is also evident along the northern limits of the property).

Development of the Nelson Street Well Supply involved the following principal activities:

- Development of a municipal well supply capable of providing a total supply capacity of 15.2 Litres per second (L/s). This yield was accomplished by developing an overburden and a bedrock well supply (being Wells 3 & 4, respectively).
- Construction of a 1,275 m^3 elevated water storage tank.
- Construction of a pumphouse to house pumping and treatment equipment. The pumphouse is located within the base of the elevated storage tank.
- The extension of services (e.g., watermain, storm sewers, sanitary sewers) along the Nelson Street road allowance to the project site. There are no watercourse crossings associated with site servicing.

1.3.2 Well 1 Site

Improvements to the Well 1 Site involved the following principal activities:

- Upgrading of the main production well (Well 1) in accordance with the work prescribed in the Consolidated Certificate of Approval (CC of A) issued by the Ministry of the Environment (e.g., installation of a chlorine contact watermain).

- Completion of miscellaneous upgrades to the existing pumphouse, including the installation of a new well pump, a new stainless steel riser pipe and a new pump starter and control panel.

- Removal of the existing storage standpipe following the commissioning of the new elevated storage tank at the Nelson Street site.

1.3.3 Well 2 Site

- Decommissioning of the standby well (Well 2) in accordance with *Ontario Regulation 903/90* (Regulation 903).

1.4 Federal Regulatory Context

The Town of Minto initiated the Clifford Water Works Upgrading Project under the terms of the Canada-Ontario Infrastructure Program (COIP). Industry Canada, as the federal agency administering COIP, is designated as the Responsible Authority (RA) for this comprehensive study. The Canadian Environmental Assessment Agency (CEAA) is designated as the federal environmental assessment coordinator (FEAC) for this comprehensive study.

The expert FA's identified for this study are as follows:

- Department of Fisheries and Oceans
- Environment Canada
- Natural Resources Canada
- Health Canada

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

1.5 Scope of Assessment

1.5.1 Comprehensive Study Scoping Document

A *Comprehensive Study Scoping Document* was prepared for this project and submitted to the Federal Minister of the Environment, following initial public consultation. The Minister's decision to continue the assessment as a comprehensive study was released on December 22, 2004.

The scope of factors considered in this environmental assessment are as follows:

Physical and Natural Environments

- Ground water quantity and quality
- Surface water quantity and quality
- Fisheries and aquatic resources
- Terrestrial features (vegetation and wildlife)
- Species at risk
- Noise
- Air quality

Socio-Economic and Cultural Environments

- Local users of groundwater.
- Adjacent land uses (development patterns, downstream effects, potential contamination sources).
- Local neighbourhood and residents.
- First Nations communities.
- Worker health and safety.
- Public health and safety.
- Aesthetics.
- Heritage and historical cultural resources.
- Sewage treatment plant capacity.

Malfunctions and Accidents

- Accidental spills where applicable.
- Contingency plans and measures for responding to emergencies.

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

- Seismic activity.
- Climate change.
- Icing and winter operations.

Cumulative Environmental Effects

- Cumulative effects of the project with the planned replacement and/or installation of new watermains within the village.

Sustainability of the Resource

- Capacity of Renewable Resources

1.6 Spatial and Temporal Boundaries

1.6.1 Spatial Boundaries

The project is located entirely within the limits of the former Village of Clifford. The following are the 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: all three well sites, the unopened Nelson Street road allowance, 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 includes an area approximately 250 m beyond the right-of-way. The corridor also includes possible effects, including accidents and malfunctions within an area of approximately 500 m beyond the right-of-way.

- The regional boundary includes an area beyond Clifford's community boundary of approximately one kilometre that may be affected by the project.

1.6.2 Temporal Boundaries

The following are the temporal boundaries for the project:

- The short term temporal boundary of the project would last approximately one year and includes the construction and commissioning phases 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.

- The long term temporal boundary for the project would last up to the operational life expectancy of the project which is 50 years and includes activities such as possible accidents and malfunctions.

1.7 Assessment Methodology and Framework

1.7.1 General Methodology

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:

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

1.7.2 Identification of Valued Ecosystem Components (VECs)

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.

VEC's selected for this project are:

- Ground water quantity and quality.
- Surface water quantity and quality.
- Fisheries and aquatic resources.
- Terrestrial features (vegetation and wildlife).
- Species at risk.
- Noise.
- Air quality.
- Local users of groundwater.
- Adjacent land uses (development patterns, downstream effects, potential contamination sources).
- Local neighbourhood and residents.
- First Nations communities.
- Worker health and safety.
- Public health and safety.
- Aesthetics.
- Heritage and historical cultural resources.
- Sewage treatment plant capacity.
- Capacity of renewable resources.

The environmental effects of the project on the identified VEC's are assessed within the report and summarized in this document.

1.7.3 Impact Mitigation and Analysis of Effects

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 valued ecosystem components (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.

2.0 EVALUATION OF ALTERNATIVES

2.1 Water Supply and Water Storage Alternatives

The following represent possible alternatives considered during this study:

Water Supply

- Upgrade Existing Well Supplies
- Develop a Surface Water Intake
- Develop a new Well Supply

Water Storage

- No Identified Alternatives
  - existing facilities cannot be feasibly expanded or upgraded to resolve the identified storage deficiencies (i.e., additional tankage is required).
  - alternative sites for additional tankage were evaluated

2.2 Alternative Means for Performing the Project

Nelson Street Well Supply

i. Collector Wells

- Facilities and Equipment
  - No Alternative Means (designed in accordance with hydrogeological assessment)

- Location of Works
  - Utilize the Existing Test Wells (Test Wells TW1/02, TW1/02)
  - Construct New Wells at the Site

ii. Water Storage Facilities

- Facilities and Equipment
  - Elevated Tank
  - Ground Level Reservoir

- Location of Works
  - No Alternative Means (building location restricted by zoning provisions)

iii. Treatment and Disinfection Equipment

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

- Location of Works
    - Within a New Pumphouse
    - Within the Base of the Proposed Elevated Storage Tank

iv. Site Servicing

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

- Location of Works
    - Within Existing Road Allowances
    - Within New Easements

Well 1 Upgrading

i. Chlorine Contact Facilities

- Facilities and Equipment
    - Watermain
    - Clearwell

- Location of Works
    - No Alternative Means (designed in accordance with engineering specifications)

ii. Miscellaneous Upgrades

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

- Location of Works
    - No Alternative Means (existing works)

Well 2 Decommissioning

- Facilities and Equipment
    - No Alternative Means (conducted according to Regulation 903)

- Location of Works
    - No Alternative Means (existing works)

2.3 Summary of Environment Effects Analysis

The environmental effects of the various alternatives to the project and alternative means were evaluated based on factors such as technical complexity, cost, implications for current and future land use and potential impacts to the natural and social environments. Following completion of this review process, the project as defined in section 1.3 of this summary was selected as the preferred strategy for resolving the problems identified with the Clifford Water Works.

3.0 CONSTRUCTION PLAN AND TIMETABLE

3.1 General Construction Sequence

3.1.1 Elevated Storage Tank

The construction plan for the erection of the elevated tank incorporated the following tasks:

- Mobilization of the Contractor to the site.
- Completion of the layout and topsoil stripping (including delineation of the access road and laydown areas).
- 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 testing of the concrete pedestal.
- Completion of mechanical, electrical and miscellaneous metal work associated with the elevated tank controls and the Wells 3 and 4 pumphouse.
- Pre-hoist welding and inspection of the steel tank.
- Hoisting of the bowl.
- Installation of yard piping and completion of miscellaneous site work.
- Documentation and reporting on the project.

3.1.2 Utility Corridor and Site Servicing

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

- Mobilization of the Contractor to the site.
- Completion of the layout.
- Clearance of a 15 m (maximum) wide area of vegetation along the servicing route in order to facilitate trenching and construction equipment (the width of the cleared area varies in relation to the required services).
- Excavation of trenching for all inground service.
- Installation of services in accordance with engineering specifications.
- Installation of a new pole line and electrical service to the site.
- Backfilling of trenches in accordance with engineering specifications.
- Revegetation of disturbed areas with native grass seed and mulch.
- Documentation and reporting on the project.

3.1.3 Wells 3 and 4

The construction plan for the development of production Wells 3 and 4 incorporated the following general tasks:

- Supply and installation of pitless adaptors and vented well caps on Wells 3 and 4.
- Supply and installation of submersible well pumps, riser piping and associated equipment in Wells 3 and 4.
- Supply and installation of a flanged, gasketted cap on test well TW2/02.
- Completion of all necessary disinfection procedures.
- Completion of all required inspections and testing (e.g., radiographic weld testing).
- Documentation and reporting on the project.

3.1.4 Well 1

The construction plan for upgrading Well 1 incorporated the following tasks:

- Initiation of field work following the commissioning of Wells 3 and 4 (given that Well 1 is the only supply well).
- Removal of the existing well pump.
- Clean and inspect the well casing, installation of a liner, if required.
- Supply and installation of a new well pump, along with associated electrical upgrades.
- Supply and installation of a new discharge elbow, if required.
- Installation the chlorine contact watermain.
- Completion of all necessary chlorination procedures.
- Completion of all required inspections and testing (e.g., radiographic weld testing).
- Abandonment, removal, and disposal of the existing storage standpipe.
- Completion of site rehabilitation, as required.
- Documentation and reporting on the project.

3.1.5 Well 2

The decommissioning plan for Well 2 incorporated the following tasks:

- Decommissioning of the well in accordance with Regulation 903. This work would be completed following the upgrading of Well 1.
- Disconnection of the well from the water distribution system.
- Removal of all pumping and treatment equipment and all chemicals.
- Transfer of all chemicals to either the Well 1 or Nelson Street site as appropriate.
- Retention or disposal of all pumping and treatment equipment as appropriate.
- Demolition and disposal of the pumphouse building.
- Site rehabilitation, as required.
- Documentation and reporting on the project.

3.2 Project Timetable

The following summarizes the general timetable for the upgrading project:

- Completion of detailed design for all planned facilities (September 2004).
- Initiation of field work for the supply works and utilities (March 2005).
- Construction and commissioning of Nelson Street supply works (October 2005).
- Installation of utilities in the servicing corridor and site services (October 2005).
- Construction and commissioning of Nelson Street storage facility, and Well 2 decommissioning (October 2005).
- Completion of Well 1 upgrades (December 2005).
- Decommissioning of the existing standpipe (June 2006).

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

3.3 Related Construction and Operational Plans

The project was constructed, and will operate, in accordance with a series of plans designed to mitigate adverse impacts and to provide strategies for addressing potential problems. The following plans were implemented for this project:

- Health and Safety Management Plan.
- Traffic Management Plan.
- Emergency Response and Spills Contingency Plan.
- Hydrostatic Pressure Testing Plan.
- Operations Plan.
- Contingency Plan.

4.0 ENVIRONMENTAL EFFECTS ANALYSIS

Table 4.1 summarizes the potential adverse environmental effects, impact mitigation and residual effects of the project upon the identified VECs.

Table 4.1
Clifford Water Works Upgrading Project
Summary of Environmental Effects of the Project upon the Identified VECs.

ENVIRONMENTAL COMPONENT	EXISTING CONDITIONS (of the environmental factors included in scope)	POTENTIAL ADVERSE IMPACTS (of project on environmental factors included in scope)
Groundwater Quality and Quantity	• The Quaternary geology of the Clifford area consists of a variety of glacial deposits. • The overburden aquifer that supplies Well 3 is regionally extensive and obtains recharge from the underlying bedrock aquifer and the overlying aquitard. • The surficial deposits in the area of Coon Creek and Well 2 are glacial lacustrine shallow water deposits, underlain by Elma Till; a stoney and sandy silt till. Elma Till is indicated for the area west of Coon Creek, generally in the vicinity of the Nelson Street well site. • Ten private and municipal well supplies, test wells (TW) and monitoring wells (MI) were monitoring during the hydrogeologic assessment. • The maximum day water demand in Clifford is forecasted to increase from a 2005 estimated demand of 13.0 L/s to 14.8 L/s by 2025 and to 20.7 L/s by 2055.	• The overall quality of the groundwater pumped from Wells 3 and 4 is considered suitable for a municipal water system. • Well 3 was selected as the primary water source due largely to the low iron concentrations found in the water supply. However, water produced from Well 3 contains levels of iron that exceed the ODWQS upon commencement of pumping. • Well 3 can produce 7.6 L/s (100 Igpm) for potable use on a long-term basis. Well 4 can produce the required flow of 15.2 L/s to provide a back-up supply to Well 1. • The existing wells in the area, including domestic water supplies, should not be adversely affected by the operation of Wells 3 and 4. • Wells 3 and 4 are not considered to be under the influence of surface water.

ENVIRONMENTAL COMPONENT	EXISTING CONDITIONS (of the environmental factors included in scope)	POTENTIAL ADVERSE IMPACTS (of project on environmental factors included in scope)
Fisheries and other Aquatic Resources	• Drain No. 93 contains cyprinid species indicative of its function as a warm water fish habitat. The habitat should be retained or enhanced to support the fish community within the system. • Coon Creek contains brook trout and other coldwater species which confirm its function as a cold water fish habitat. • The headwaters of Coon Creek form part of the Clifford – Harriston Complex (being a Provincially significant wetland complex, made up of 30 individual wetlands). The regional boundary of the project area is not situated within the Clifford – Harriston Complex.	• There are no watercourses in the immediate vicinity of the Nelson Street site or the Well 1 site (Well 2 is situated adjacent to Coon Creek). Deleterious materials could be released to drainage systems during the construction phase.
Terrestrial Features		
i. Vegetation	• Habitats in the study area are a mixture of landscaped private property, parkland, old field and agricultural lands. These habitats are are not considered significant or sensitive to development and are commonly found in the local area.	• Construction-related activities resulted in the temporary removal of vegetation within the right-of-way and the permanent removal of a minimal amount vegetation at the Nelson Street site. • Most of the vegetation removed temporarily and permanently from the right-of-way will be grasses and shrubs

ENVIRONMENTAL COMPONENT	EXISTING CONDITIONS (of the environmental factors included in scope)	POTENTIAL ADVERSE IMPACTS (of project on environmental factors included in scope)
ii. Wildlife Resources	• No provincially significant species are known to inhabit the study area. • The affected habitats are influenced by existing residential and agricultural activities and are not considered significant for wildlife resources.	• Construction-related activities resulted in the temporary removal of wildlife habitat within the right-of-way and the permanent removal of a minimal amount of habitat at the Nelson Street site. • Most of the temporarily affected areas provided limited habitat to species that are not significant or sensitive to development and are commonly found in the local area.
Species at Risk	• Nine Species at Risk were identified are possibly having a range within the study area; namely the American Badger, Grey Fox, Spotted Turtle, the Monarch, Least Bittern, Yellow-breasted Chat, Northern Bobwhite, Butternut Tree and American Ginsing.	• The right-of-way and corridor are not considered traditional habitat for the identified species. • The study area does not provide suitable habitat for the Species at Risk and these species were not observed during a field assessment.

ENVIRONMENTAL COMPONENT	EXISTING CONDITIONS (of the environmental factors included in scope)	POTENTIAL ADVERSE IMPACTS (of project on environmental factors included in scope)
Air Quality	• The MOE compiles continuous ambient air quality data from more than 40 monitoring sites. Based on a review of the identified sites, Clifford is centrally located between the Tiverton (northwest) and Kitchener (southeast) monitoring stations. The data available from these monitoring stations provides a relatively accurate representation of the airshed conditions in the study area. • Based on the Air Quality Index provided for the 2003 reporting period, the air quality in the village of Clifford, 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 the localized climatic conditions.	• The works do not incorporate facilities which are designed to discharge air pollutants. • Water disinfection equipment represents the only project component which could contribute to local air pollution levels (specifically, a release of the disinfectant, sodium hypochlorite). • Construction-related activities associated with the project will generate minor increases in air pollution levels in the vicinity of the right-of-way and corridor.
Noise	• No specific noise assessments have been completed in the vicinity of the right-of-way, however existing noise levels will be considerably less than traditional urban environments due primarily to the limited amount of development in the area, the lack of heavy industrial activities in the community, the low traffic volumes evident in the area and the lack of a major highway in the immediate vicinity.	• The Nelson Street well 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. • The well pumps and the water disinfection metering pumps represent the only project components which could contribute to local noise

ENVIRONMENTAL COMPONENT	EXISTING CONDITIONS (of the environmental factors included in scope)	POTENTIAL ADVERSE IMPACTS (of project on environmental factors included in scope)
		pollution levels. Without attenuation, the operation of these pumps could generate a moderate level of noise pollution (i.e., 55 to 70 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.
Local Users of Groundwater	• Four existing domestic wells are situated within 1000 m of the subject property. The closest private well is situated over 700 m west of the project site.	• 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 supplies.
Adjacent Land Uses		
i. Development Patterns	• The southwestern district of Clifford has historically been utilized for farmland. Following the Second World War, most lands in the vicinity of the Nelson Street site have been gradually developed for low-density residential purposes.	• The Nelson Street Well Supply is situated in an area of Clifford which is currently residential in character and is planned for future residential growth. The new well supply and storage facility could therefore be incompatible or inconsistent with the existing and planned development pattern.

ENVIRONMENTAL COMPONENT	EXISTING CONDITIONS (of the environmental factors included in scope)	POTENTIAL ADVERSE IMPACTS (of project on environmental factors included in scope)
ii. Downstream Effects	• Coon Creek and Drain No. 93 floodways represent the only substantive watercourses in the project area. Details on these watercourses are presented in the Surface Water Quality and Quantity and Fisheries and other Aquatic Resources sections of this table.	• The operation of Wells 3 and 4 would have immeasurable impacts on the shallow groundwater flow system in the area and would be significantly less than the measurable impacts of operating Well 2. • The groundwater discharge conditions to Coon Creek will be maintained with the operation of Wells 3 and 4.
iii. Potential Sources of Contamination	• A groundwater contaminant inventory and risk assessment was prepared for Minto as part of the *Groundwater Management and Protection Study* (GMPS). • For the Clifford area, several point and non-point sources of contamination were inventoried and assessed for risk to groundwater resources, including gas stations, abandoned wells, nutrient application).	• A preliminary groundwater vulnerability assessment was completed as part of the GMPS. Based on the findings of the assessment, it was concluded that the entire Clifford urban area is rated as having a low vulnerability to contamination, due to the large overburden thickness with relatively fine grained material.
Local Neighbourhood and Residents	• Lands surrounding the Nelson Street site are relatively undeveloped, with the exception of residential units along John Street and an adjacent commercial/ industrial use	• Construction-related impacts resulting from the undertaking are anticipated to be similar to those experienced with normal road and building construction (e.g., elevated noise, odour and dust levels, minor traffic disruptions along the Nelson Street corridor)

ENVIRONMENTAL COMPONENT	EXISTING CONDITIONS (of the environmental factors included in scope)	POTENTIAL ADVERSE IMPACTS (of project on environmental factors included in scope)
		• The operation of facilities at the Nelson Street site will generate negligible levels of noise and air pollution. Traffic generated from operational activities will also be minimal.
Nearby First Nations Communities	• There are no substantive Aboriginal or non-Aboriginal communities evident within the regional boundary of this project (Saugeen First Nation No. 29, situated 60 km northwest of Clifford, is the closest First Nations community.	• The community of Clifford 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.
Health and Safety	• Details on the surrounding population are provided in the Local Neighbourhood and Residents and Aesthetics sections of this table.	• Construction activities will be carried out in accordance with industry standards for worker and public health and safety (as defined by the *Ontario Provincial Standard Specifications* and any special provisions deemed appropriate). • An *Operations Plan* has been prepared for the Clifford Water Works to provide operations personnel with a reference document for system operation and maintenance, as well as emergency measures.
Aesthetics	• Lands surrounding the Nelson Street site are relatively undeveloped, with the exception of residential units along John Street and an adjacent commercial/ industrial use	• The construction of an elevated storage tank can represent a visual and physical intrusion to neighbouring property owners and the larger community.

ENVIRONMENTAL COMPONENT	EXISTING CONDITIONS (of the environmental factors included in scope)	POTENTIAL ADVERSE IMPACTS (of project on environmental factors included in scope)
	• The John Street residential area is generally screened from the Nelson Street site by a series of large trees evident at the rear of the subject property	
Heritage and Historical Cultural Resources	• The project proposes development on lands which are previously undisturbed by construction (being the Nelson Street well site and the associated utility corridor).	• The Ministry of Culture advised that the project site and watermain route do not appear to have the potential to impact upon buried heritage resources.
Sewage Treatment Plant Capacity	• The waterworks upgrades are designed to increase the total supply capacity in order to meet long-term water demands. Accordingly, these improvements will increase the sewage flow volumes discharged to the municipal sanitary sewage system over the planning period.	• Based upon the findings of the STP review, there would appear to be sufficient hydraulic capacity within the plant to accommodate growth until, at least, 2015 (assuming that the flow rate per person equivalent will not exceed the MOE design guideline in the long-term).
Capacity of Renewable Resources	• Vegetation and wildlife habitats in the study area are a mixture of landscaped private property, parkland, old field and agricultural lands. These habitats are are not considered significant or sensitive to development and are commonly found in the local area. • Ground water resources associated with the deep bedrock aquifer have sustained Wells 1 and 2.	• Construction-related activities resulted in the temporary removal of wildlife habitat within the right-of-way and the permanent removal of a minimal amount of habitat at the Nelson Street site. Most of the temporarily affected areas provided limited habitat to species that are not significant or sensitive to development and are commonly found in the local area.

ENVIRONMENTAL COMPONENT	EXISTING CONDITIONS (of the environmental factors included in scope)	POTENTIAL ADVERSE IMPACTS (of project on environmental factors included in scope)
		• 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 supplies.

5.0 EFFECTS OF THE ENVIRONMENT ON THE PROJECT

Table 5.1 summarizes the potential adverse environmental effects, impact mitigation and residual effects of environmental components upon the project.

Table 5.1
Clifford Water Works Upgrading Project
Summary of Environmental Effects of the Environment upon the Project

ENVIRONMENTAL COMPONENT	EXISTING CONDITIONS (of the environmental factors included in scope)	POTENTIAL ADVERSE IMPACTS (of project on environmental factors included in scope)
Flooding and Erosion Hazards	• Coon Creek and Drain No. 93 are the only watercourses in the study area which has the potential to generate significant flood and erosion hazards. Coon Creek represents the only watercourse which could impact upon the defined right-of-way and corridor. • Well 1 is situated approximately 425 m northwest of Coon Creek at an elevation approximately 10 m above the floodplain. Well 2 is situated approximately 50 m east of Coon Creek at an elevation of approximately 3 m above the floodplain. The Nelson Street site is situated approximately 300 m northwest of Coon Creek at an elevation approximately 10 m above the floodplain.	• Hydrological study work identified that under extreme rainfall conditions, exceeding a 1 in 100 year event, flows of 50.0 m^3/s would be realized (being the Hurricane Hazel storm distribution). In this storm scenario, flood levels in Coon Creek could potentially overtop the 368 m elevation. However, the potential for groundwater contamination via the flooding of Well 2 have been minimized following well abandonment. • The defined right-of-way is not located in an area which is identified as being susceptible to erosion. In this regard, the Saugeen Valley Conservation Authority has not calculated specific erosion rates for these locations given the lack of identifiable and measurable erosion impacts. There is also no record of erosion problems within the right-of-way and no physical evidence of erosion impacts at these locations long-term basis.
Ice Encroachment and Scour Hazards	• Coon Creek and Drain No. 93 are the only watercourses in the study area which has	• Ice encroachment and scour hazards are not anticipated to impact upon the physical

ENVIRONMENTAL COMPONENT	EXISTING CONDITIONS (of the environmental factors included in scope)	POTENTIAL ADVERSE IMPACTS (of project on environmental factors included in scope)
	the potential to generate significant ice encroachment and scour hazards. Coon Creek represents the only watercourse which could impact upon the defined right-of-way and corridor.	works constructed at the Nelson Street project site, given the relative location of the Coon Creek floodway • There is no historical evidence that ice encroachment or scouring have impacted upon the physical works associated with Well Sites 1 and 2.
Wind Hazards	• Clifford is not considered to be a community highly susceptible to extreme wind conditions.	• High wind conditions in the study area could potentially impact upon the stability of the elevated storage tank.
Seismic Hazards	• Clifford is not situated in a region considered highly susceptible to seismic activity. • Under the terms of the Ontario Building Code, the community is situated in Earthquake Zone 1 (the susceptibility scale of the Code increases in magnitude from 0 to 4).	• Seismic activity in the study area could potentially impact upon the stability of the elevated storage tank.
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: – 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	• Climate change could impact upon the following operational aspects of this project: – Ground Water Recharge Rates. The hydrogeological study work completed for this project demonstrates that the Wells 1, 3 and 4 aquifers will sustain the municipal water system on a long-term basis given the projected water demands and current ground water recharge rates. Should groundwater

ENVIRONMENTAL COMPONENT	EXISTING CONDITIONS (of the environmental factors included in scope)	POTENTIAL ADVERSE IMPACTS (of project on environmental factors included in scope)
	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.	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. Should water demands increase appreciably during the time frame, additional water supply and storage facilities may be required.

6.0 ACCIDENTS, MALFUNCTIONS AND ADVERSE CONDITIONS

6.1 Construction Phase

A number of formal plans have been developed to minimize the potential effects of accidents, malfunctions and adverse conditions on the identified VEC's during the construction phase (listed below). Construction specifications required the Contractor to adhere to the identified plans to ensure that the construction phase of the project did not generate significant adverse environmental effects.

Mitigation Plans:

- Emergency Response and Spills Contingency Plan.
- Traffic Management Plan.
- Health and Safety Management Plan.
- Hydrostatic Pressure Testing Plan.

6.2 Operations Phase

A number of formal plans have been developed to address the potential environmental effects of accidents, malfunctions and adverse conditions on the identified VEC's during the operations phase of the project (listed below). The Town will adhere to these plans to ensure that the operations phase of the project does not generate significant adverse environmental effects.

Mitigation Plans:

- Operations Plan.
- Contingency Plan.

6.3 Decommissioning Phase

No formal decommissioning plan has been prepared to identify the potential effects of accidents, malfunctions and adverse conditions on the identified VEC's during the decommissioning phase. Decommissioning of the new waterworks 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 generate significant adverse environmental effects.

7.0 MITIGATION MEASURES

7.1 Construction Activities

7.1.1 Standard Mitigation

Table 7.6 of the report summarizes a series of standard mitigation measures which were incorporated into the contract specifications for the various components of the project. Mitigation for several construction-related activities are summarized within the table, including measures to minimize the environmental effects of the following:

- Refuelling and maintenance.
- Traffic control.
- Waste disposal.
- Pesticides.
- Drainage and water control.
- Sedimentation/ erosion control.
- Noise control.

Sections 7.2.4 and 10 of the report also identify a series of mitigation plans and protocols which were incorporated into the contract specifications for the various components of the project. Among the plans and measures summarized in the report are the following:

- Wellhead and aquifer protection measures.
- Groundwater level monitoring procedures.
- Well closure plan.
- Wildlife and terrestrial habitat protection measures.
- Emergency response and spill prevention protocols.

7.2 Environmental Construction Monitoring and Management Plan

The project is not considered to have the potential to adversely impact upon the environmental setting of the project area. Aside from the standard mitigation presented in Table 7.6 and the emergency response measures associated with the Contingency Plan, no additional plans were incorporated into the construction specifications to monitor environmental conditions in the project area.

7.3 Post-Construction Environmental Monitoring

Section 10 of the report identifies a series of mitigation plans and protocols which will be implemented as part of the operations plan for this project. Among the plans and measures summarized in the report are the following:

- Groundwater monitoring activities.
- Sedimentation and erosion control measures.
- Air quality and noise pollution monitoring.

- Emergency response and spill prevention protocols.
- Contingency planning procedures.

8.0 CUMULATIVE ENVIRONMENTAL 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 projects which may potentially produce cumulative effects were identified:

- Cumulative effects of the project with the proposed replacement of the water distribution system.
- Cumulative effects of the project with other developments planned in Clifford.

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, the nature of the watermain replacement program and the limited development activity anticipated in the community, it was concluded that the implementation of the Clifford 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.

9.0 CONSULTATION

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 04-03-950)

- A public notice was prepared detailing the public consultation period for the draft scoping document. The notice was circulated in two local community newspapers (first printed June, 2006) and posted to the COIP and CEAA websites. No written or oral comments were received.

- A second public notice was prepared detailing a second public consultation period and provided the public with the opportunity to submit comments or concerns related to the environmental implications of the proposed project. The notice was circulated in two local community newspapers (first printed April 5, 2006) and posted to the COIP and CEAA websites. No written or oral comments were received.

A third public consultation 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 CEAA for consideration.

10.0 SUMMARY OF ENVIRONMENTAL EFFECTS

Table 10.1 summarizes the potential adverse environmental effects, impact mitigation and residual effects associated with this project.

Table 10.1
Clifford Water Works 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*
Fisheries and aquatic resources	*x*			*x*				*x*
Terrestrial features	*x*				*x*			*x*
Species at Risk		*x*		*x*				*x*
Noise	*x*				*x*			*x*
Air quality	*x*				*x*			*x*
Capacity of renewable resources	*x*				*x*			*x*
Socio-Economic and Cultural Environments								
Local groundwater users	*x*				*x*			*x*
Adjacent land uses	*x*				*x*			*x*
Local neighbourhood and residents	*x*				*x*			*x*
First Nations communities		*x*		*x*				*x*
Worker health and safety	*x*				*x*			*x*
Public health and safety	*x*				*x*			*x*
Aesthetics	*x*				*x*			*x*
Heritage and historical		*x*		*x*				*x*

cultural resources									
Sewage treatment plant capacity	***x***				***x***			***x***	
Environmental Conditions									
Flooding and erosion	***x***				***x***			***x***	
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***	
Cumulative Effects									
Distribution system replacement	***x***				***x***			***x***	
Future development activities	***x***				***x***			***x***	

11.0 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, to confirm the impacts resulting from the pumping of Wells 3 and 4. Findings of this monitoring exercise will confirm the validity of the hydrogeologic study work with respect to groundwater quantity.

- Additional monitoring of stream piezometer SP2/02 to confirm that Wells 3 and 4 are not considered to be groundwater sources under the influence of surface water. Findings of this monitoring exercise will confirm the validity of the hydrogeologic study work with respect to groundwater quality.

In accordance with the recommendations of the hydrological investigation, monitoring activities associated with the Follow-up Program will be carried out monthly for a period of two years. If any problems are found, additional monitoring will occur for a longer period of time, as necessary. Industry Canada and the Canadian Environmental Assessment Agency will be provided with the data generated from the monitoring process (as summarized in an annual report). The availability of the findings from the Follow-up Program will be posted on the CEA Registry.

12.0 CONCLUSIONS

The environmental effects of the project were considered including the environmental effects of 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 Community of Clifford Water Works 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

<u>COMPREHENSIVE STUDY REPORT</u>

CLIFFORD WATER WORKS UPGRADING PROJECT

TABLE OF CONTENTS

Table of Contents (cont'd)

Table of Contents (cont'd)

Table of Contents (cont'd)

Table of Contents (cont'd)

Table of Contents (cont'd)

Table of Contents (cont'd)

Table of Contents (cont'd)

Table of Contents (cont'd)

LIST OF TABLES

List of Tables (cont'd)

LIST OF FIGURES

1.0 INTRODUCTION

1.1 Purpose and Overview of Project

The Corporation of the Town of Minto, the project proponent, is upgrading the Clifford Water Works to address a series of identified operational deficiencies. The undertaking has included the development of a new well supply and a new water storage facility, the completion of improvements to an existing municipal well supply (Well 1), as well as the extension of servicing infrastructure to connect the new waterworks facilities to the existing water distribution system. The new well supply augments the Well 1 supply and permitted the decommissioning of an existing well supply (Well 2). Construction of the new storage facility also permitted the decommissioning of the existing water storage standpipe.

The improvements to the municipal water system constitute the *Community of Clifford Water Works Upgrading Project.* Project contacts are as follows:

Municipal Contact:

Gordon Duff, Treasurer
Corporation of the Town of Minto
5941 Highway No. 89
RR1 Harriston, ON
N0G 1Z0
gordon@town.minto.on.ca

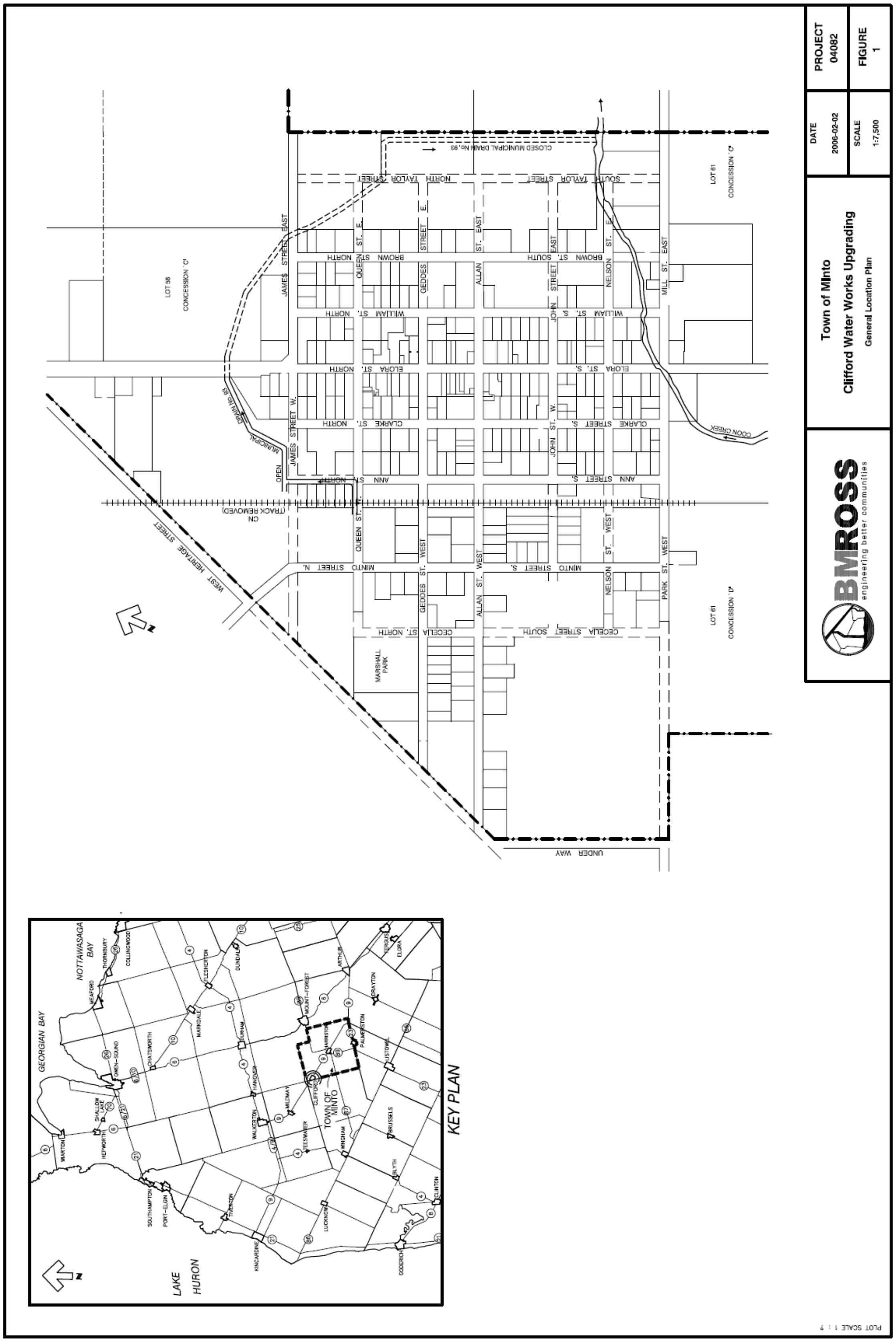
Consultant Contact:

Scott Allen, Planner
B.M. Ross and Associates
206 Industrial Drive
Mount Forest
N0G 2L0
sallen@bmross.net

1.2 General Description of the Community and the Municipal Water System

The community of Clifford, Ontario is a small urban settlement within the boundaries of the Town of Minto, a constituent municipality of the County of Wellington. Clifford is situated along the route of Provincial Highway No. 9, near the northwestern border of both the Town of Minto and Wellington County. The village, which has an estimated population of 800 persons, is predominantly a low-density residential centre that also contains a well-developed commercial sector (servicing local residents and the surrounding agricultural community). Figure No. 1 illustrates the general location of Clifford.

Water is supplied to customers in Clifford via a municipal water system first commissioned in 1947. Prior to the commencement of the upgrading project, the system, referred to as the Clifford Water Works, was comprised of two drilled bedrock well supplies (Wells 1 & 2), two pumphouses, an elevated storage facility (standpipe), and a network of distribution watermain. The system provides service to approximately 340 residential, commercial and institutional customers.


PROJECT
04082
FIGURE
1
DATE
2006-02-02
SCALE
1:7,500
Town of Minto
Clifford Water Works Upgrading
General Location Plan
BMROSS
engineering better communities
KEY PLAN
LAKE HURON
GEORGIAN BAY
NOTTAWASAGA BAY
TOWN OF MINTO
CLOSED MUNICIPAL DRAIN No. 93
COON CREEK
MARSHALL PARK
WEST HERITAGE STREET
UNDER WAY

In April 2002, the Town of Minto initiated a Municipal Class Environmental Assessment (Class EA) under the *Environmental Assessment Act* of Ontario to resolve a series of problems with Clifford Water Works including these key deficiencies:

- **Inadequate firm supply capacity.** The Clifford water system required 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 Clifford system was rated at 4.5 Litres per second (L/s), which is significantly less than the base year design maximum day demand (13.0 L/s). An additional 8.5 L/s of supply capacity was therefore needed to address this deficiency.

- **Well 2 Deficiencies.** Engineering evaluations and reports carried out in response to the *Ontario Drinking Water Protection Regulation* (Regulation 459) resulted in the identification of a number of well upgrades required for Well 2 (e.g., install continuous reading chlorine residual and turbidity analysers). The Town was also required to complete hydrogeologic investigative work to identify if Well 2 is "Ground water Under the Direct Influence (GUDI)" of surface water. The study concluded that Well 2 is hydraulically connected to Coon Creek. Additional treatment facilities (e.g., chemically-assisted filtration) were required if Well 2 was to remain in service.

- **Water storage deficiencies.** The limited height of the standpipe resulted in inadequate system pressures in the distribution system. Current design guidelines recommend that normal system pressures should be between 350 kilopascals (kPa) and 550 kPa. These guidelines also prescribe that normal pressures should remain above 275 kPa during peak rate demand periods. Normal pressures in some areas of the Clifford system approached the minimum recommended pressure under normal conditions (i.e., 140 kPa). This problem was further compounded when there are large demands in the system, such as hydrant flushing or during a fire flow event. The total effective storage volume of the standpipe (794 m^3) also did not meet the required design volume for the existing population (988 m^3). The adequacy of storage volume, as with system pressures, would have continued to decline as the local population increased.

The Class EA investigation was completed in January 2004. The proponent selected the Community of Clifford Water Works 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 supply and elevated storage facility, the upgrading of an existing well supply, the retirement of a municipal well and the decommissioning of a storage facility. A site for the new municipal well supply and storage facility was selected after consideration of technical investigations, environmental impacts, and potential benefits. The site is located along the route of Nelson Street, immediately west of the Ann Street intersection. Site services have been extended along the Nelson Street road allowance.

1.3.2 Nelson Street Well Supply

The new well supply, referred to as the Nelson Street Well Supply, is located in a predominantly low-density residential area of Clifford at a site fronting an unopened portion of the Nelson Street road allowance in the south end of the village. The site was an undeveloped, 1,575 m^2 parcel situated on lands described as Lot 339 and Part of Lot 338, Reference Plan 61R7542.

Development of the Nelson Street Well Supply involved the following principal activities:

- Development of a municipal well supply capable of providing a total supply capacity of 15.2 L/s. This yield was accomplished by developing an overburden and a bedrock well supply (being Wells 3 & 4, respectively). The wells were established within close proximity to existing test wells, in order to access the aquifers evaluated during the hydrogeological investigation.
- Construction of a 1,275 m^3 elevated water storage tank.
- Construction of a pumphouse to house pumping and treatment equipment. The pumphouse is located within the base of the elevated storage tank.
- The extension of services (e.g., watermain, storm sewers, sanitary sewers) along the Nelson Street road allowance to the project site. There are no watercourse crossings associated with site servicing.

1.3.3 Well 1 Site

Improvements to the Well 1 Site involved the following principal activities:

- Upgrading of the main production well (Well 1) in accordance with the work prescribed in the Consolidated Certificate of Approval (CC of A) issued by the Ontario Ministry of the Environment (MOE). The following represent the key improvements mandated by the CC of A:
    - Installation of a chlorine contact watermain on a site immediately adjacent to the existing well site.
    - Installation of a standby chlorination system, a secondary chemical containment tank and analytical equipment in the pumphouse.

- Completion of miscellaneous upgrades to the existing pumphouse, including the following:

  - Installation of a new well pump capable of delivering 15.2 L/s at 86 m total dynamic head (TDH). The pump capacity of 15.2 L/s matches the permitted capacity for the well as found in the CC of A and the Permit to Take Water (PTTW). It was necessary to increase the TDH capability of the well pump from the present 64 m due to the increase in top water level in the new elevated tank when compared to the existing standpipe.
  - Installation of a new well liner.

- Removal of the existing storage standpipe following the commissioning of the new elevated storage tank at the Nelson Street site.

1.3.4 Well 2 Site

- Decommissioning and abandonment of the standby well (Well 2) in accordance with *Ontario Regulation 903/90* (Regulation 903). This work was undertaken after the new well supply at the Nelson Street site was commissioned for production purposes.

1.4 Regulatory Context

1.4.1 Federal Environmental Assessment Process

The Town of Minto initiated the Clifford Water Works 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 Clifford Water Works Upgrading Project involves the construction of a new municipal well supply capable of providing approximately 480,000 m^3/a (representing a 96% 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 proposed works.

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 MOE 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 upgrades to the Clifford 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 Clifford Water Works Upgrading Project, certain project components were considered Schedule B activities under the terms of Appendix 1 (e.g., development of new ground water supplies and water storage facilities, decommissioning of existing municipal wells and storage facilities). 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 Town of Minto carried out the Class EA investigation between April 2002 and January 2004. B.M. Ross and Associates (BMROSS) was retained to coordinate the Class EA process on behalf of the Town. A Technical Steering Committee comprised of representatives from the Town, R.J. Burnside & Associates Limited (providing hydrogeological services), and BMROSS, was formed to provide direction to the project.

1.4.3 Local Jurisdiction

The community of Clifford was founded in 1854 and first incorporated as a Village of the County of Wellington in 1874. On January 1st, 1999, the Towns of Harriston and Palmerston, the Village of Clifford and the Township of Minto amalgamated to form the Town of Minto. The new Town has a population of more than 8,000 permanent residents and a land base of approximately 300 km^2. In general, Minto is comprised of a number of small urban centres dispersed throughout a predominantly rural community. Clifford represents one of the smaller urban settlements in the Town of Minto, having an estimated population of approximately 800 persons and a land base of 290 ha ±. The community is located along the route of Provincial Highway No. 9, near the northwestern border of both the Town of Minto and the County of Wellington.

Clifford is characterized as a low-density residential community, which incorporates a traditional downtown commercial core and a limited amount of highway commercial development (along the route of Highway No. 9). The community also contains a number of institutional facilities and benefits from the provision of municipal water and wastewater facilities. In general, the scale and nature of development evident in Clifford is consistent with smaller urban communities throughout Midwestern Ontario.

Jurisdictional authority for the delivery of municipal water in the County of Wellington has been defined through a service provision agreement between the County and its constituent municipalities. The Town of Minto functions as the owner and operator of municipal water supply facilities in Clifford, as well as three other public water systems within the municipality. Accordingly, the Town has the authority to implement the upgrades to the Clifford Water Works.

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 proposed 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:

- Department of Fisheries and Oceans
- 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 Clifford 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.

At the outset of the provincial Class EA investigation, preliminary details on the proposed project sites was circulated to the Ministry of Culture (Heritage & Libraries Branch, Southwest District) for comment. The Ministry evaluated the proposal taking into consideration its defined screening criteria and its database of known historical sites in the vicinity of the proposed works, including First Nations communities. In correspondence dated July 8, 2002, the Ministry advised that the proposed site does not appear to have the potential to impact upon buried cultural heritage resources.

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 A 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 22, 2004.

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 Clifford well system upgrades includes:

Well 1 Site:

- Installation of a chlorine contact watermain on a site immediately adjacent to the existing well site.
- Installation of a standby chlorination system, a secondary chemical containment tank and analytical equipment in the pumphouse.
- Miscellaneous upgrades to the pumphouse building.
- Decommissioning and dismantling of the water standpipe on the site.
- Construction equipment access, laydown areas.
- Site rehabilitation.

Well 2 Site:

- Decommissioning and abandonment of the well.
- Removal and disposal of equipment and chemicals.
- Possible demolition of the pumphouse building.
- Construction equipment access, laydown areas.
- Site rehabilitation.

Nelson Street Site:

- The construction of well components (two wells) capable of providing a supply of at least 15.2 L/s (1313 m^3/d, 479 347 m^3/a).
- The construction of a 1275 m^3 elevated storage tank.
- Construction of a pumphouse to house treatment and pumping equipment (in the base of the elevated storage tank).
- The extension of services (water main, sewer main and storm water drain) along the unopened Nelson Street road allowance to the project site.
- Construction equipment access, laydown areas.
- Site rehabilitation.

1.7.3 Scope of Assessment

(a) 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.

(b) 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. • Surface water quantity and quality. • Fisheries and aquatic resources. • Terrestrial features (vegetation and wildlife). • Species at risk. • Noise. • Air quality.
Socio-Economic and Cultural Environments	• Local users of ground water. • Adjacent land uses (development patterns, downstream effects, potential contamination sources). • Local neighbourhood and residents. • First Nations communities. • Worker health and safety. • Public health and safety. • Aesthetics. • Heritage and historical cultural resources. • Sewage treatment plant capacity.
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, icing and winter operations).
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: • Cumulative effects of the project with other developments that are planned within Clifford. • Cumulative effects of the project with the proposed replacement and/or installation of new water mains within the village.

Environmental Component	Scope of Factors Considered
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 Clifford. 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: all three well sites, the unopened Nelson Street road allowance, 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 includes an area approximately 250 m beyond the right-of-way. The corridor also includes possible effects, including accidents and malfunctions (for example, failure of the new elevated storage tank, 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 includes an area beyond Clifford's community boundary of approximately one kilometre that may be affected by the project. This includes the effects of construction activities (noise, dust, vehicle emissions, etc), and operational activities (possible negative effects of drawdown because of the system's ground water withdrawal).

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 one year and includes the construction and commissioning phases of the project. It includes activities such as: the construction and commissioning of new wells and an elevated storage tank; the installation of a transmission water and sewer main; and, the decommissioning of a well and existing standpipe. It also includes activities related to construction equipment access, lay down areas as well as any accidents or malfunctions associated with the construction phase 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., failure of the new elevated storage tank, 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 50 years and includes activities such as: possible accidents and malfunctions (for example, failure of the new elevated storage tank, 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 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.
- Fisheries and aquatic resources.
- Terrestrial features (vegetation and wildlife).
- Species at risk.
- Noise.
- Air quality.
- Local users of ground water.
- Adjacent land uses (development patterns, downstream effects, potential contamination sources).
- Local neighbourhood and residents.
- First Nations communities.
- Worker health and safety.
- Public health and safety.
- Aesthetics.
- Heritage and historical cultural resources.
- Sewage treatment plant capacity.
- Capacity of renewable resources.

The environmental effects of the project on these VEC's are assessed within 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.

2.2 Related Investigations

2.2.1 General

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

2.2.2 Hydrogeology

R.J. Burnside & Associates (Burnside Environmental) conducted hydrogeological testing at the Nelson Street well supply to confirm the sustainability of the overburden and bedrock aquifers over the planning period, the quality of water provided from each well and the impacts of well operation on the surrounding hydrogeologic environment (i.e., existing well supplies). Existing water well records and mapping compiled as part of the *Town of Minto Ground water Management and Protection Study* (GMPS) were reviewed to provide a hydrogeologic interpretation of the Clifford area. Ground water level monitoring of existing wells and stream piezometers was also conducted as part of the long-term testing procedure.

2.2.3 Fisheries and Aquatic Resources

Natural Resource Solutions Inc. (NRS) carried out an examination of the potential impacts of the project on fisheries and aquatic resources. Fisheries and aquatic resources within the regional boundary of the study were considered during this assessment. A specific emphasis was placed on assessing the Coon Creek and Drain No. 93 floodways (being the only substantive watercourses in the project area).

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

- Collection and review of background information on fisheries and aquatic resources, Earth and Life Science Areas of Natural and Scientific Interest (ANSI's), and wetlands (as provided by the Ministry of Natural Resources).
- Collection and review of background information on fish habitat, including Species at Risk (as provided by the Saugeen Valley Conservation Authority).
- Completion of a habitat and fisheries assessment exercise by an Aquatic Biologist. Field reconnaissance was carried out on December 16, 2004 and June 1, 2005 and incorporated the following activities:
    - Documentation of substrate types, channel form and available habitat
    - Sampling, identification and enumeration of the fish community (via electrofishing)

2.2.4 Vegetation Resources

NRS carried out an examination of the potential impacts of the 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, ANSI's and Species at Risk.
- Completion of a terrestrial vegetation assessment exercise by a Terrestrial Biologist. Field reconnaissance was carried out on June 20, 2005 and incorporated the mapping and inventorying of the surrounding vegetation communities.

2.2.5 Wildlife Resources

NRS carried out an examination of the potential impacts of the project on wildlife 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 wildlife, ANSI's and Species at Risk.
- Collection and review of breeding bird data from the Ontario Breeding Bird Atlas.
- Incidental observations of wildlife were conducted by the Terrestrial Biologist as part of the June 20, 2005 field reconnaissance.

2.2.6 Cultural Resources

A preliminary assessment of cultural resources was conducted to examine the potential impacts of the 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.

2.2.7 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.

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 proposed 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 proposed 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 and Water Storage Alternatives

The following represent possible alternatives to the project considered during this study:

Water Supply

- Upgrade Existing Well Supplies
- Develop a Surface Water Intake
- Development of a New Well Supply

Water Storage

- No identified alternatives
  - existing facilities cannot be feasibly expanded or upgraded to resolve the identified storage deficiencies (i.e., additional tankage is required).
  - alternative sites for additional tankage were evaluated

3.1.2 Analysis of Water Supply Alternatives

3.1.2.1 Upgrade Existing Well Supplies

(a) Existing Facilities

At the outset of the Class EA investigation, the Clifford Water Works was supplied by two supply wells, Wells 1 and 2. The two well supplies were equipped with submersible pumps that discharge directly into the distribution system. Well 1 is a large capacity, bedrock well supply that serves as the primary production well for the system. The well is controlled automatically based on standpipe liquid levels. Well 2 (known locally as the Dairy Well) is a small capacity, bedrock well supply that was originally constructed to service a nearby cheese factory. Well 2

served as a standby well supply and was used only when needed (i.e., high system demands or if Well 1 is out of service). Well 2 was manually controlled.
The wells had a permitted capacity of 15.2 L/s and 4.5 L/s respectively (refer to Table 3.1). Water from both wells was treated via the injection of sodium hypochlorite (chlorine). An iron sequestering agent is also used to treat the water from Well 1.

Table 3.1
Municipal Well Supplies (April 2002):
Clifford Water Works

Well No.	Type	Depth (m)	Diameter (mm)	Year Drilled	Rated Capacity (L/s)
1	Bedrock	55	250	1964	15.2
2*	Bedrock	50	125	1967	4.5
Firm supply capacity					4.5

* Emergency Supply Well

(b) Upgrading Requirements

Engineering evaluations and reports carried out in response to Regulation 459 resulted in the identification of a number of specific items of work that must be undertaken within the water system. These upgrades have been mandated by the provincial Ministry of Environment (MOE) as part of the issuance of a Consolidated Certificate of Approval (CC of A) for the Clifford Water Works and will be required if the existing wells are to remain in use. The Certificate, dated September 10, 2002, stipulated a series of upgrades required if the Town plans to keep the wells in use. The key upgrading requirements prescribed by the CC of A are as follows:

- Complete hydrogeologic investigative work to identify if Well 2 is under the direct influence of surface water.
- Seal Well 2 casing to a minimum of 450 mm above ground surface level using a manufactured pitless adapter. Ensure all casing penetrations, where necessary, are properly sealed.
- Provide a removable cap for the exterior termination of the well blow off line.
- Install automatic continuous reading chlorine residual and turbidity analysers complete with alarming.
- Consider providing backpressure valves on chemical feed line.
- Improve site grading to promote positive surface drainage away from the pumphouses.

The work items required to upgrade Well 1 were completed in accordance with MOE requirements during the period 2002-04. Following the completion of the Class EA investigation, it was anticipated that additional hydrogeologic study work would be required to increase the supply capacity of the well from 11.4 L/s to 15.2 L/s to meet long-tern demands. However, recent investigations have concluded that the well pump currently operates at 15.2 L/s (the pump had previously been throttled to 11.4 L/s).

With respect to Well 2, Burnside Environmental completed a hydrogeologic investigation in 2001 to determine if Well 2 is under the direct influence of surface water. The study identified a direct hydraulic connection between the bedrock aquifer at the Well 2 site and the sand and gravel deposits beneath a nearby watercourse (Coon Creek). It was therefore concluded that Well 2 drew from ground water under the direct influence (GUDI) of surface water. Additional treatment facilities (e.g., chemically-assisted filtration) would therefore be required if Well 2 was to remain in service. As well, further hydrogeologic investigations would be required to determine if the aquifer can provide a supply capable of achieving adequate firm supply for the 20-year design period. A new pumphouse would also need to be constructed to accommodate the additional treatment facilities and the other equipment mandated by the CC of A.

(c) Assessment Summary

Upgrading Well 1 was considered a practical strategy for providing one supply source over the planning period. Accordingly, this work is identified as part of the project.

With respect to Well 2, the deficiencies identified with water quality and the supply capacity of Well 2 could not be resolved without the completion of extensive hydrogeologic assessments, the provision of additional filtration equipment, the installation of additional treatment and pumping equipment and the construction of a new pumphouse on site. The capital costs for completing this work was estimated to exceed those required to develop a new well supply. There were also concerns that maintaining the well supply in operation would pose a significant contamination risk for the water system, given the identified hydraulic connection between the well supply and Coon Creek.

Given these considerations, upgrading of only the existing municipal well supplies was not considered a practical alternative for upgrading the Clifford Water Works.

3.1.2.2 Develop a Surface Water Intake

(a) Existing Surface Water Sources

Coon Creek represents the only permanent surface waterbody in close proximity to Clifford. Coon Creek flows northwards through the eastern portion of the village along a north-south axis. The stream, which forms part of the South Saugeen River watershed, originates approximately 4.5 km south of Clifford and discharges into Meux Creek, roughly 4.0 km northeast of the study area. In the vicinity of Clifford, Coon Creek has water depth ranging from 0.15 m to 0.35 m (in pools) under normal conditions.

The Saugeen Valley Conservation Authority classes the watercourse as a class “D” drain, which is a cool-water stream. Class D drains are considered permanent trout and/ or salmon streams. Portions of Coon Creek also flow through areas that are ecologically diverse and, as a result, are considered environmentally significant from a regional and provincial perspective.

(b) Project Requirements

In general, a new surface water-based system would involve installation of a suitable water supply intake designed to achieve the long-term water demands, as well as provision of low and high-lift pumping equipment, chemically assisted filtration and disinfection facilities and the construction of a new water treatment plant. The location of the new intake would be determined through modeling and analysis of the existing streambed.

(c) Assessment Summary

The shallow water depth associated with Coon Creek is not considered conducive for a surface water supply for the following reasons:

- Intakes situated in shallow water depths are highly susceptible to the impacts of freezing and damage from frazil ice.
- Capital and operational costs for a surface-based system are expected to be considerably higher than a ground water-based system, due to the increased requirements for filtration and disinfection.
- Shallow streams typically exhibit poorer water quality than deeper waterbodies, based upon consideration of water quality indicators (e.g., microbacteriological contaminant counts, turbidity levels, concentrations of suspended solids).
- Operation of a new intake facility may draw excessive amounts of water from the stream, which would adversely impact upon aquatic and terrestrial resources. Construction-related activities could also be disruptive to fish and fish habitat and would likely require the removal of riparian vegetation.

Lakelet Lake, situated 10 km southwest of Clifford represents the only other significant waterbody in the vicinity of the project area. The water depths of Lakelet Lake may be sufficient for use as a surface water source. Extraction of raw water from this waterbody is not considered a practical solution in this situation however, due to the capital costs required to extend a transmission watermain from the service area to the supply source, including booster pumping facilities, as well as the additional capital and operating costs associated with a surface water system (estimated additional capital costs: $4.0 million).

Given these considerations, development of a surface water intake was not considered a practical alternative for upgrading the Clifford Water Works.

3.1.2.3 Conclusions Regarding Water Supply Alternatives

Based upon the evaluation of the identified water supply alternatives, it was concluded that the development of a new well supply, either at an existing well site or at a new site, was the most practical and effective solution for upgrading the supply component of the Clifford Water Works. Additional evaluations were therefore conducted to assess options for development of a new well supply and to investigate various collector well configurations.

3.1.3 Evaluation of New Well Supply Alternatives

3.1.3.1 Develop a New Well at an Existing Well Field

The development of a large capacity well (or wells) at either the Well 1 or Well 2 sites, in conjunction with increasing the equipped capacity of the Well 1 supply, would enable the Town to address the identified system deficiencies. The development of a new well supply at the Well 1 site would allow the Town to forego the upgrading required for Well 2.

A preliminary technical analysis of this option was completed. The results of this evaluation suggested that there are several limitations with developing a new well supply at an existing site including the following:

- The water supplied from Well 1 exhibits elevated iron concentrations. Additional treatment facilities may be needed to address problems with poor aesthetic water quality if a new well is developed at that site.

- There is insufficient physical space at the Well 1 pumphouse to accommodate the pumping and treatment facilities required for a second large capacity well supply at that site. A new pumphouse would need to be constructed at that site.

- The development of a new well at the Well 2 site has the potential to be GUDI, given the proximity of the site to Coon Creek and study conclusions related to the Well 2 bedrock supply. Chemically-assisted filtration may be required as part of the development of any new well at that location.

- There was insufficient physical space at the Well 2 pumphouse to accommodate the pumping and treatment facilities required for a new, large capacity well supply at that site. In addition, the Well 2 property is very small, making it difficult to expand the size of the works at this site.

3.1.3.2 Develop a New Well Source

(a) Considerations

The development of a new well, or wells, at a new site would enable the Town to address the identified system deficiencies discussed previously. This option required the construction of a new well, a new pumphouse to house treatment and pumping equipment, as well as the installation of a transmission watermain from the new facility to a connection point on the system. The introduction of a second well supply would also permit the decommissioning of Well 2.

A hydrogeological investigation was undertaken by Burnside Environmental in order to evaluate the viability of a new well supply. The well exploration process built upon the findings of the GMPS. In particular, the study identified potential ground water sources in the central and western portions of Clifford. The identified area is comprised of glacially-derived overburden sediments (25 m to 30 m) overlying a permeable layer of bedrock in the Salina Formation.

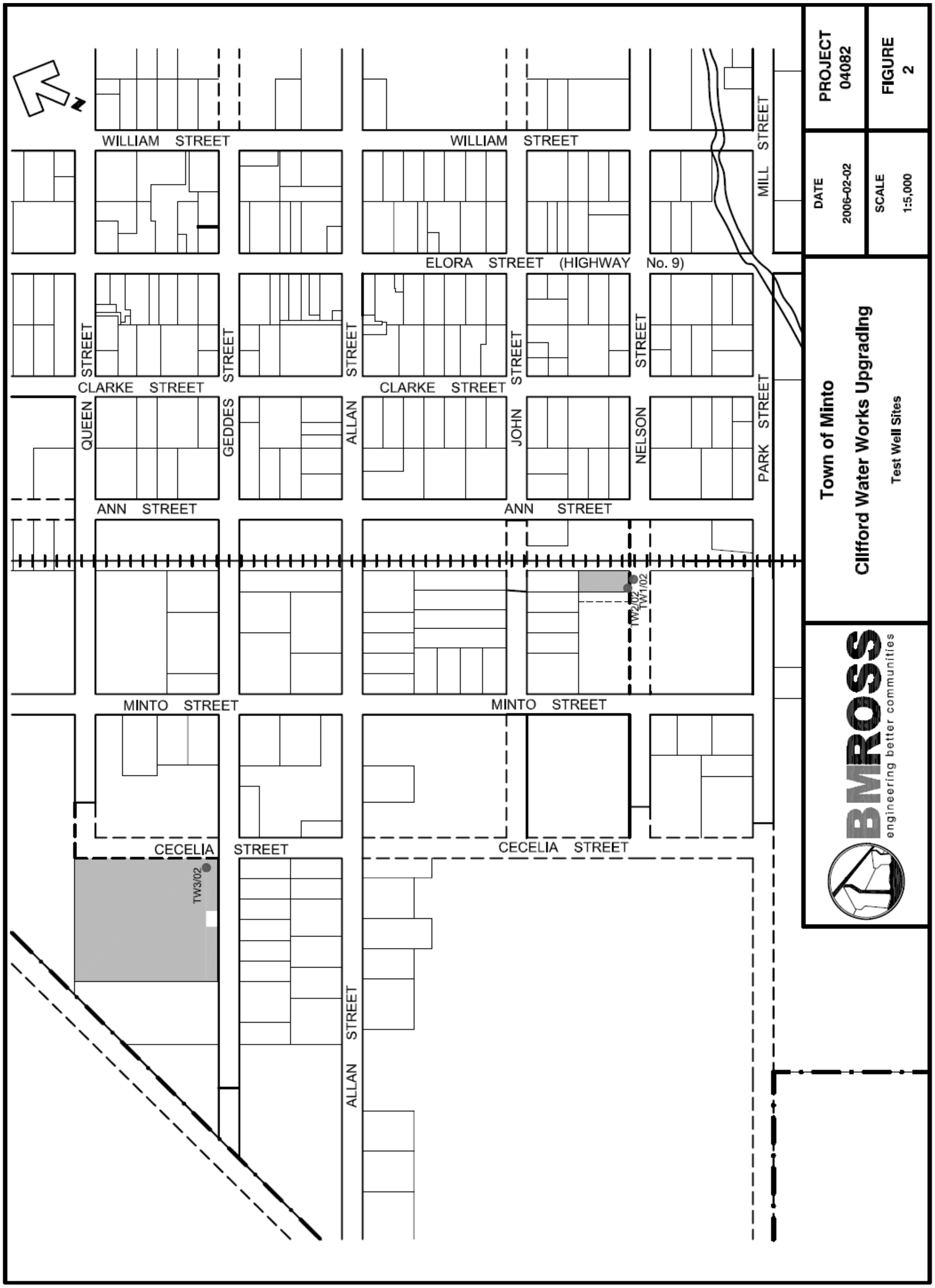
A preliminary engineering review was conducted to identify and evaluate suitable locations for the required facility in the area designated within the GMPS. The following represent the key locational considerations associated with this analysis:

- The project site should be large enough to accommodate the proposed well supply. A land base of approximately 1,000 m^2 is required for the facility.
- An adequate power supply must be available to facilitate pumphouse operation (typically three phase power).
- 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 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 largely compatible with surrounding land uses (existing and planned) and should be easily accessible for system operators.
- The project site should be located on public land or property which can be readily acquired by the Town.

(b) Test Well Locations and Analysis

Taking the above criteria into consideration, potential well sites were identified at Marshall Park on Geddes Street and at an industrial property fronting the unopened portion of the Nelson Street road allowance (refer to Figure No. 2). Exploratory drilling was initiated on these sites in January 2002. A total of three test wells were drilled as part of the hydrogeologic investigation using air rotary technology.

The first test well (Test Well 1/02) was drilled at the Nelson Street site into the bedrock at a depth of 43.3 m. A second (TW2/02) test well was drilled at this site into the deep granular overburden formation at a depth of 35.8 m. A third test well (TW3/02) was drilled into the deep granular overburden formation at Marshall Park to a depth of 35.6 m. A test well was not drilled into the bedrock at Marshall Park because, during the drilling process, a granular deposit was identified above the bedrock which was thought to be a better water source (i.e., lower concentrations of iron and manganese). Furthermore, a successful bedrock well (TW1/02) had been constructed at the Nelson Street site.


WILLIAM STREET
ELORA STREET (HIGHWAY No. 9)
CLARKE STREET
ANN STREET
MINTO STREET
CECELIA STREET
QUEEN STREET
GEDDES STREET
ALLAN STREET
JOHN STREET
NELSON STREET
PARK STREET
MILL STREET
TW1/02
TW2/02
TW3/02
PROJECT
04082
FIGURE
2
DATE
2006-02-02
SCALE
1:5,000
Town of Minto
Clifford Water Works Upgrading
Test Well Sites
BMROSS
engineering better communities

A preliminary report was prepared by Burnside Environmental to document the initial findings of the hydrogeologic study report and to provide a series of recommendations for further well development. The report was submitted to the MOE in support of an application to obtain a Permit to Take Water for TW2/02. In particular, the report details a series of key components associated with the field work and analysis (e.g., test well construction, testing and monitoring, well capacity, aquifer response and interference).

The following summarizes the key findings of the hydrogeological investigation:

- Water sampling was completed on the three well supplies following the completion of variable step pump testing. The results of the testing concluded that the water quality available from both Nelson Street test wells is suitable for municipal production wells. The well yields from TW1/02 and TW2/02 were also considered acceptable for a municipal well supply. Test well TW3/02 at Marshall Park was eliminated from further consideration due to the low capacity available from the granular overburden formation encountered at that location. Specifically, the test well did not maintain a pumping rate of 13.65 L/s during the variable rate testing procedure (TW1/02 maintained a pumping rate of 15.85 L/s)

- Iron concentrations in the granular overburden supplying TW2/02 appear to be considerably lower than concentrations in the bedrock formation supplying TW1/02 (0.2 mg/L versus 0.5 mg/L, respectively). However, the supply capacity available from the overburden is considerably less than the yield available from the bedrock supply.

- Long-term pump testing indicates that the development of an overburden and/or bedrock well(s) at the Nelson Street site will not impact upon the existing hydrogeological environment (i.e., minimal well interference). These ground water sources are also not considered to be GUDI, given that (1) water sampling does not show evidence of surface-related activities and (2) the site is approximately 280 m from the nearest known surface water body (Coon Creek). Artificial ponds and ditches are also located about 500 m. northwest of the site.

- Test data demonstrated that TW2/02 could efficiently produce water at a rate of approximately 7.6 L/s. Testing also indicated that the overburden could potentially provide a considerably higher yield (i.e., in excess of 15.0 L/s). However, higher pumping levels may draw water from the bedrock which could elevate iron and manganese concentrations.

- Test data demonstrated that TW1/02 could efficiently produce water at a rate of more than 22.7 L/s.

- The overall quality of the ground water pumped from TW1/02 and TW2/02 is considered suitable for a municipal water system. Iron and manganese treatment may be recommended for the bedrock supply pending the outcome of more detailed chemical analyses.

3.1.3.3 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 site was the most practical and effective solution for upgrading the supply component of the Clifford 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).

3.1.4 Collector Well Configurations

3.1.4.1 General

Nine alternative well supply configurations were evaluated during the Class EA process to determine the best possible method for incorporating a new well supply into the Clifford Water Works. The performance of each configuration was assessed with respect to total supply capacity, as well as the rated capacity (1) when the largest well is out of service (firm capacity) or (2) when a well supply is out of service that results in the lowest remaining supply capacity. The analysis specifically examined the ability of each configuration to address the base year maximum day demand and the design maximum day demand for the 20-year planning period.

It should be noted that Well 1 capacity was considered to be 11.4 L/s at the time of the investigation. Some of the options propose to maintain that capacity, others propose to increase the capacity to the approved 15.2 L/s.

3.1.4.2 Alternative Well Configurations

The nine well configurations examined during the Class EA process are as follows:

1. Well 1 and Well 3 (TW2/02 with an 8.0 L/s supply capacity).
2. Same as Option 1, plus 100% backup for Well 1.
3. Same as Option 1, plus 100% backup for Wells 1 and 3.
4. Well 1 and Well 4 (TW1/02 with a 15.9 L/s supply capacity).
5. Same as Option 4, plus 100% backup for Well 4.
6. Same as Option 4, plus 100% backup for Wells 1 and 4.
7. Same as Option 4, increase Well 1 capacity to 15.2 L/s.
8. Wells 1, 3, and 4.
9. Same as Option 8, plus 100% backup for Well 1.

In review, all supply options were capable of providing total supply capacity in excess of existing and design maximum day demands. Options 1 and 4 were the only supply alternatives that could not provide firm supply capacity to meet existing and design maximum day demands.

Options 3, 5, 6, 7, 8 and 9 can provide firm supply capacity to meet existing maximum day demand for any combination of one well supply being out of service for any reason.

3.1.4.3 Analysis of Preferred Configurations

(a) Identified Options

A detailed analysis was completed to determine which of the well supply options would be further evaluated in the study. The analysis centred on the ability of various well supplies to achieve a firm supply capacity which could meet the maximum day design demand for the 20-year planning period. It was determined that the two most practical and cost-effective options available to meet this need are as follows:

1. Operate Well 1 at a pump capacity of 15.2 L/s and provide 100% backup; abandon Well 2.
2. Develop Wells 3 and 4, maintain Well 1; abandon Well 2.

(b) Technical Considerations

A more comprehensive evaluation was undertaken to determine the relative merits of the two selected well supply options. The following issues were identified at the outset of this review:

- The total supply capacity available from Option 2 is 27.2 L/s, which could exceed 31.5 L/s if Well 1 is upgraded at a future date (Wells 3 and 4 would not operate simultaneously). The firm supply capacity of Option 2 is 15.2 L/s (which exceeds the 20-year design demand of 14.8 L/s).

- Option 2 provides a second point for supplying the distribution system, which could help improve chlorine residual levels in the system (depending on how the overall system was operated).

- Option 2 incorporates three supply points, which increases the overall security of the system by providing additional system redundancy. Option 2 would also be capable of providing a larger water supply capacity for higher demand periods.

- The aesthetic water quality available from Well 3 is expected to be better than the water available from the bedrock well supplies, due to the lower concentration of iron and manganese in the granular overburden formation. This may help reduce aesthetic water quality problems.

- The desirability of Option 1 would be contingent on the overall success of efforts to improve the distributed aesthetic water quality as currently supplied by Well 1, and the ongoing evaluation of system chlorine residual decay.

- If Well 3 were established to improve water quality, it would be important to upgrade water storage to permit pumping the lower capacity overburden supply on a continuous basis (i.e., to serve as the primary supply well) with minimal reliance on bedrock supplies. The storage facility could be sized to accommodate peak demand periods in excess of the Well 3 capacity.

- Option 2 represents a more expensive upgrading alternative, given the capital costs required to develop a new well supply site and the ongoing costs associated with operating and maintaining an additional well supply facility. The estimated capital costs for Options 1 and 2 are $498,000 and $627,000, respectively. These estimates include, where applicable, the costs to equip the well supplies, provide disinfection equipment, construct chlorine contact facilities, and provide for standby power, mechanical and electrical works, and other miscellaneous site works. The Option 2 cost is predicated on using the base of a new elevated tank as a pumphouse chamber. Option 2 excludes the cost of a new Well 1 pumphouse (if desired), the cost for standby power and the cost of extending municipal services to the new site (that cost is included in the new storage cost estimate). Both options exclude the costs related to mandatory Well 1 improvements required by Regulation 459.

(c) Identification of a Preferred Collector Well Configuration

Based upon the findings of the technical review, Option 2 was concluded to be the preferred well supply configuration.

This decision was primarily based on the following considerations:

- Option 2 configuration provides the most effective strategy for improving the distributed aesthetic water quality and ensuring the overall security of the water supply for Clifford.
- The cost differential between the options was not seen to be prohibitive, considering the overall improvements to water quality and system reliability.
- Neither option was anticipated to generate significant environmental impacts upon the hydrogeologic setting or the general environmental setting of the project site.

3.1.5 Storage Site Evaluation

3.1.5.1 Criteria

A site evaluation process was conducted to determine a suitable location for a new water storage facility. At the outset of this process, a number of locational considerations were identified for the storage facility. They are as follows:

- The proposed site should be large enough to accommodate the required system storage for the ultimate design population.

- The site should be located in close proximity to large diameter watermain in order to ensure that the tank can be filled efficiently on a nightly basis (i.e., for equalization storage) and to reduce material costs.
- The storage facility should not be situated in an area exhibiting significant natural or cultural features. The project site should also be capable of accommodating construction activities without impacting upon sensitive natural features.
- The project site should be largely compatible with surrounding land uses (existing and planned) and should be easily accessible for system operators.

3.1.5.2 Identified Sites

Based on the foregoing criteria, three alternate sites were originally selected for the new structure. The first site, the existing standpipe location, was eliminated from further consideration due to insufficient physical space to construct and accommodate the proposed facility. The Nelson Street well site and Marshall Park represented the other two sites evaluated during the study. Both sites were considered suitable from an engineering standpoint, given that these locations have ground elevations equal to, or slightly higher than the existing storage standpipe. The two sites also present advantages from an economic perspective if the proposed well supply and storage facility are situated at the same location. In this respect, efficiencies can be achieved as a result of the following:

- Locating the well supply pumphouse chamber in the pedestal of the proposed tank (which permits the sharing of mechanical and control equipment).
- Sharing the municipal services required for the new storage and supply facilities (e.g., watermain and sewer extensions).

3.1.5.3 Comparative Analysis

(a) General Criteria

A series of site selection criteria were developed during the Class EA process to evaluate the relative merits of each location. The criteria developed for this study were used to determine the most suitable option for the project. The evaluation was based on the following factors:

Visual and Physical Intrusion. The visual and physical impacts associated with elevated storage facilities can be substantial, given the overall mass and height of these facilities (e.g., shadowing effects, sightline intrusions). New storage facilities should not be located in prominent areas of the community, such as parks or the commercial core. The facilities should also not be located in areas that would adversely impact upon adjacent landowners.

Disruption of Natural Features. Development sites are anticipated to have some impact upon the natural environment, (i.e. the removal of trees, disturbance of habitat). Sites located outside of the sensitive areas are generally expected to be the least disruptive to natural features.

Inconvenience Posed by Construction. Given that the development of an elevated storage facility is a significant infrastructure project, the construction process may pose some inconvenience to area residents and may cause temporary disruptions to local traffic movement. Sites requiring construction near developed areas or roadways pose the greatest potential to inconvenience area residents.

Anticipated Impact on Affected Landowners. Each option requires the construction of an elevated storage facility at the project site. Sites generating significant public opposition would present the highest potential for impacts.

Potential Land Use Conflicts. This is largely a measure of compatibility between the proposed storage facility and adjacent land use activities. Land use impacts would generally be greatest for the alternative sites located near existing and planned residential development.

(b) Site Evaluation

An evaluation exercise was undertaken to compare the relative impacts of the alternative sites. The process involved assigning a value out of 10 for each of the stated criteria, which related to the potential impact of development (i.e., 10 representing significant impact, 5 representing a moderate impact, 0 representing no impact). Rankings for the two sites were tabulated from the assigned scores.

Table 3.2 summarizes the results of the site assessment exercise.

Table 3.2
Clifford Elevated Storage Facility:
Evaluation of Alternative Development Sites

Site Selection Criteria	Marshall Park	Nelson Street Well Site	Considerations
	Assessment of Effects		
Visual Intrusion	7	5	Marshall Park is situated in a prominent community facility. The Nelson Street site is located in an area with limited development.
Disruption to Natural Features	6	2	Development at Marshall Park will require significant tree removal

			which may impact upon habitat. The Nelson Street site is largely devoid of sensitive features and habitat.
Inconvenience Posed By Construction	5	4	Project sites are situated on local roads with minimal development
Site Selection Criteria	**Marshall Park**	**Nelson Street Well Site**	**Considerations**
	Assessment of Effects		
Anticipated Impact On Affected Landowners	7	4	Removal of trees from Marshall Park could adversely impact upon resident's quality of life. Development on the Nelson Street site should not significantly impact upon local residents,
Potential Land Use Conflicts	6	5	Development in Marshall Park is less consistent with existing land uses. Development at the Nelson Street site is largely compatibly with surrounding land uses.
Total Score	31	20	Minimal environmental impacts are expected from the implementation of either site option, however development of the Nelson Street site is anticipated to generate fewer environmental impacts.
Ranking	**2**	**1**	The Nelson Street site is considered the preferred alternative for a new well supply.

(c) Preferred Site

Based upon the preliminary assessment of alternative project sites carried out during the Class EA process, the Nelson Street well site was concluded to be the most suitable location for the new Clifford water storage facility. This decision was primarily based on the following considerations:

- The Nelson Street site has been determined to be a more suitable location for a new municipal water supply.
- Marshall Park is considered a more prominent location in the community, given its function as a passive recreational area and the adjacent residential development. An elevated tank at that site would have a more adverse impact upon both nearby residents and the larger community.
- The proposed well site at Marshall Park is currently forested. Development of the site would result in the loss of natural features and habitat. The Nelson Street site does not exhibit any significance from an ecological perspective.
- Part of Marshall Park is situated at a higher elevation than the preferred site; however, the additional costs associated with constructing a slightly higher elevated tank at the Nelson Street location would be significantly less than the additional costs required to extend the required municipal services to separate well supply and storage sites.

3.2 Alternative Means of Carrying out the Project

3.2.1 Identified Alternative Means

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.

Nelson Street Well Supply

i. Collector Wells

- Facilities and Equipment
  - No Alternative Means (designed in accordance with hydrogeological assessment)
- Location of Works
  - Utilize the Existing Test Wells (TW1/02, TW1/02)
  - Construct New Wells at the Site

ii. Water Storage Facilities

- Facilities and Equipment
  - Elevated Tank
  - Ground Level Reservoir

- Location of Works
  - No Alternative Means (building location restricted by zoning provisions)

iii. Treatment and Disinfection Equipment

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

- Location of Works
  - Within a New Pumphouse
  - Within the Base of the Proposed Elevated Storage Tank

iv. Site Servicing

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

- Location of Works
  - Within Existing Road Allowances
  - Within New Easements

Well 1 Upgrading

i. Chlorine Contact Facilities

- Facilities and Equipment
  - Watermain
  - Clearwell

- Location of Works
  - No Alternative Means (designed in accordance with engineering specifications)

ii. Miscellaneous Upgrades

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

- Location of Works

- No Alternative Means (existing works)

Well 2 Decommissioning

- Facilities and Equipment
  - No Alternative Means (conducted according to Regulation 903)

- Location of Works
  - No Alternative Means (existing works)

3.2.2 Analysis of Alternative Means (Nelson Street Well Supply)

3.2.2.1 Collector Well Locations

(a) Identified Alternatives

The following represent the practical alternatives considered for developing new collector wells on the Nelson Street well supply site:

- Utilize the Existing Test Wells (Test Wells TW1/02, TW1/02)
- Construct New Wells at the Site

(b) Considerations

The key considerations with respect to locating collector wells on the project site are as follows:

- Test wells TW1/02 and TW2/02 were drilled as 150 mm diameter wells into the overburden and bedrock aquifers evident at the site, respectively. Use of these wells for the purpose of production would require well reconstruction to 200 mm diameter wells to provide for additional capacity as well as increased efficiency.

- Construction of new wells at the site requires that 200 mm diameter wells be drilled into the aquifers tested during the hydrogeologic investigation, given that these aquifers provide a suitable quality and quantity of water for a municipal well supply.

- Construction of new 200 mm diameter wells would also 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 locations 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 3.3 summarizes the outcome of the environmental effects analysis carried out for the two collector well location alternatives.

Table 3.3
Alternative Collector Well Locations:
Environmental Effects Analysis

Valued Ecosystem Component	Existing Site	New Site	Considerations
	Level of Effect		
Ground water quantity and quality	Low	Low	Neither site option is expected to significantly impact upon ground water resources.
Surface water quantity and quality	Minimal/ Nil	Minimal/ Nil	No impacts are expected from well development at either site option.
Fisheries and aquatic resources	Minimal/ Nil	Minimal/ Nil	No impacts are expected from well development at either site option.
Terrestrial features (vegetation, wildlife)	Minimal/ Nil	Minimal/ Nil	Development of an existing well site will result in minimal additional disturbance to terrestrial features. Development of a new well site will result in some additional disturbance to terrestrial features at the Nelson Street site.
Species at risk	Minimal/ Nil	Minimal/ Nil	No impacts are expected from well development at either site option.
Noise	Low	Low	Both options will generate a minimal increase in ambient noise levels
Air quality	Minimal/ Nil	Minimal/ Nil	Neither site option is expected to impact upon air quality in the area.
Local users of ground water	Low	Low	Neither site option is expected to significantly impact upon ground water resources.

Valued Ecosystem Component	**Existing Site**	**New Site**	**Considerations**
	Level of Effect		
Local neighbourhood and residents	Low	Low	Neither option will be fully compatible or consistent with the residential character of the area, however well facilities will not significantly impact upon the existing development pattern.
First Nations communities	Minimal/ Nil	Minimal/ Nil	No impacts are expected from well development at either site option.
Worker health and safety	Low	Low	Minimal impacts are expected from well development at either site option.
Public health and safety	Low	Low	Minimal impacts are expected from well development at either site.
Aesthetics	Minimal/ Nil	Minimal/ Nil	Minimal impacts are expected from well development at either site.
Heritage and historical cultural resources	Minimal/ Nil	Minimal/ Nil	No impacts are expected from well development at either site.
Sewage treatment plant capacity	Minimal/ Nil	Minimal/ Nil	Both options will increase flow conveyed to the sewage treatment plant.
Capacity of Renewable Resources	Minimal/ Nil	Minimal/ Nil	No additional impacts are expected from well development at either site 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 (1) minimal environmental impacts are expected from the implementation of either site option and (2) both options are suitable for carrying out the project (i.e., no substantive differences exist between the alternatives). Taking these conclusions into consideration, the following plan for the development of the collector wells at the Nelson Street well site was formulated:

- A new overburden well (Well 3) would be established within close proximity (7.4 m north) of TW2/02 in order to access the overburden aquifer evaluated during the hydrogeological investigation.
- A new bedrock well supply (Well 4) would be developed into the bedrock through the reconstruction of TW1/02.

There are a limited number of factors associated with the identified collector well configuration plan which justified its selection as the preferred well development plan. The most significant of these are as follows:

- Provides the community with well supply facilities designed (1) to improve the existing quality of the raw water and (2) to augment the existing supply capacity to meet long-term demands.
- Presents minimal long-term impacts to air quality, noise levels and local aesthetics.
- Involves the drilling of only one additional well.

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 Water Storage Alternatives

(a) Identified Alternatives

i. Elevated Storage

An elevated storage tank, designed to meet system storage requirements and maintain adequate system pressures, would provide the Town with an alternative that addresses the key deficiencies related to the use of the existing standpipe. The construction of a modern storage facility would also permit the Town to decommission the existing storage standpipe.

Based on a preliminary engineering assessment, the new tank would require a storage capacity of approximately 1,000 m^3 to achieve the 20-year design volume and 1,275 m^3 to achieve the 50-year design volume. The required storage could be accommodated in a facility having a tank approximately 46 m in height. The tank would likely be comprised of a minimum 14 m diameter tank erected upon a 7.5 m diameter concrete pedestal.

ii Ground Level Reservoir

The construction of a ground level reservoir would provide the community with an alternative that can address existing storage deficiencies and achieve the 20-year and 50-year design volumes discussed in the previous section. Ground level facilities also do not present the same level of visual intrusion as will occur with an elevated storage tank.

Based on a preliminary engineering design, the design storage volumes could be accommodated within a two-cell reservoir. This design would be advantageous from an economic perspective, as only one cell would need to be constructed initially to address Clifford's immediate (20-year) design storage requirements. The construction of a second cell could be deferred until a future date, to satisfy future storage requirements, when necessary. However, for maintenance purposes, it is desirable to have two cells constructed immediately in order to allow for one cell to be taken out of service (e.g., for maintenance) while the second cell remains active.

As noted previously, system storage could be provided by means of either an elevated storage tank or in-ground storage tank. Elevated storage can be provided via standpipes or elevated storage tanks. Ground level storage typically incorporates a buried concrete reservoir and a secondary booster pumping facility.

(b) Considerations

The following represents the general considerations regarding the alternative storage types:

- In-ground facilities present relatively minimal aesthetic impacts to neighbouring properties. As a result, these facilities can often be located in developed areas without adversely affecting the surrounding land use activities. In contrast, the height of elevated facilities can present significant visual intrusions to adjacent land uses and the surrounding community. In-ground facilities require a larger land base for construction and typically incorporate above-grade construction.

- Elevated storage facilities have marginally higher capital costs than ground-level facilities, due to the additional material needed for the tank and more complex construction requirements.

- Long-term operating costs for elevated tanks tend to be substantially lower than in-ground facilities, due to the use of gravity to achieve system pressures rather than booster pumps.

- Ground level storage facilities require a series of standby pumps and control valves which are more complex than elevated storage.

(c) Environmental Effects Analysis

The potential interactions between the identified storage tank alternatives 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 environmental effects of each identified option on the various environmental components prior to mitigation (using the impact criteria described in Table 2.1). Table 3.4 summarizes the outcome of the environmental effects analysis carried out for these storage tank alternatives.

Table 3.4
Alternative Water Storage Configurations:
Environmental Effects Analysis

Valued Ecosystem Component	Elevated Tank	In-ground Reservoir	Considerations
	Assessment of Effects		
Ground water quantity and quality	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Surface water quantity and quality	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Fisheries and aquatic resources	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Terrestrial features (vegetation, wildlife)	Minimal/ Nil	Minimal/ Nil	Development of an in-ground reservoir will result in a larger development footprint on the project site.
Species at risk	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Noise	Minimal/ Nil	Minimal/ Nil	Development of an elevated storage tank will result in negligible impacts to ambient noise levels (after the construction phase). Pumping facilities associated with in-ground facilities could increase ambient noise levels marginally.

Valued Ecosystem Component	**Elevated Tank**	**In-ground Reservoir**	**Considerations**
	Assessment of Effects		
Air quality	Minimal/ Nil	Minimal/ Nil	Neither option is expected to impact upon air quality (after the construction phase).
Local users of ground water	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Local neighbourhood and residents	Low	Low	Neither option is consistent with the residential character of the area, however the mass and height of the elevated storage tank is less consistent with the established development pattern.
First Nations communities	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Worker health and safety	Minimal/ Nil	Minimal/ Nil	Operation of the in-ground reservoir requires additional ongoing maintenance activities which marginally increases the potential threat to worker health and safety.
Public health and safety	Minimal/ Nil	Minimal/ Nil	Development of either option will result in minimal impacts to public health and safety.
Aesthetics	Moderate	Low	Both options have the potential to impact upon aesthetics, however the magnitude of the impact is greater for the elevated tank due to the height of the structure.
Heritage and historical cultural resources	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.

Valued Ecosystem Component	**Elevated Tank**	**In-ground Reservoir**	**Considerations**
	Assessment of Effects		
Sewage treatment plant capacity	Minimal/ Nil	Minimal/ Nil	Both options will increase flow conveyed to the sewage treatment plant.
Capacity of Renewable Resources	Minimal/ Nil	Minimal/ Nil	No additional impacts are expected from the implementation of either option (i.e., ground water, wildlife, vegetation impacts have been considered).

(d) Preferred Water Storage Type

After consideration of the findings of the technical review and the environmental effects analysis, the elevated storage tank was identified as the preferred type of storage for the Nelson Street Well Supply. This decision was primarily based on the following considerations:

- Elevated storage fully resolves the existing limitations with system pressures and, in comparison to ground-level storage, would be less technically complex in terms of ongoing management and control requirements.

- Ground-level tankage has a greater economic impact than elevated tankage, due to substantially higher long-term operating and maintenance costs (i.e., higher life-cycle costs).

- The aesthetic impacts associated with the development of an elevated tank upon adjacent property owners and the larger community were not considered significant, given the following factors (as discussed in section 7.14):

  - Lands surrounding the Nelson Street site are relatively undeveloped, with the exception of residential units along John Street and an adjacent commercial/ industrial use.

  - The John Street residential area is generally screened from the site by a series of large trees evident at the rear of the subject property.

  - Residents in the vicinity of the project site did not express concern with the proposed location for the storage facility during the public consultation process.

In review, construction and operation of the proposed storage facility 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).

3.2.3.3 Location of Treatment and Disinfection Equipment

(a) Identified Alternatives

The following represent the practical alternatives considered for housing treatment, disinfection and control equipment on the Nelson Street well supply site:

- Within a New Pumphouse
- Within the Base of the Proposed Elevated Storage Tank

(b) Considerations

The key considerations with respect to the selection of a pumphouse facility are as follows:

- A new pumphouse consists of an insulated, above-grade building to accommodate all chemical and disinfection facilities, metering pumps, process piping and electrical equipment. The building footprint would be approximately 360 m^2.

- All required treatment and pumping equipment can be accommodated within the base of the elevated storage tank. Locating the well supply pumphouse chamber in the pedestal of the proposed tank permits the sharing of some mechanical and control equipment.

- The capital and maintenance costs associated with a new pumphouse will be higher than the pumphouse chamber, given the additional building requirements of this option.

- Construction of the pumphouse would result in the permanent removal of approximately 360 m^2 of vegetation.

(c) Environmental Effects Analysis

The potential interactions between the selected pumphouse alternatives 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 environmental effects of each identified option on the various environmental components prior to mitigation (using the impact criteria described in Table 2.1).

Table 3.5 summarizes the outcome of the environmental effects analysis carried out for these pumphouse alternatives.

Table 3.5
Alternative Pumphouse Locations:
Environmental Effects Analysis

Valued Ecosystem Component	New Building	Pumphouse Chamber	Considerations
	Assessment of Effects		
Ground water quantity and quality	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Surface water quantity and quality	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Fisheries and aquatic resources	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Terrestrial features (vegetation, wildlife)	Low	Minimal/ Nil	Development of a new building will increase the total development footprint on the project site, resulting in the permanent removal of approximately 360 m^2 of vegetation. Development within the elevated storage tank will not require increase the development footprint on the site.
Species at risk	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Noise	Low	Low	Pumphouse development at either location will result in negligible impacts to ambient noise levels (after the construction phase).
Air quality	Low	Low	Pumphouse development at either location will result in negligible impacts to air quality (after the construction phase).

Valued Ecosystem Component	New Building	Pumphouse Chamber	Considerations
	Assessment of Effects		
Local users of ground water	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Local neighbourhood and residents	Minimal/ Nil	Minimal/ Nil	Development of a new pumphouse would result in an additional waterworks building in this residential area, although the design of the structure would incorporate residential features.
First Nations communities	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Worker health and safety	Low	Low	Development of a new pumphouse requires additional building construction, which marginally increases the potential threat to worker health and safety.
Public health and safety	Minimal/ Nil	Minimal/ Nil	Pumphouse development at either location will result in minimal impacts to public health and safety.
Aesthetics	Low	Low	Development of a new pumphouse will result in an additional building on the project site, which presents a minor increase in the aesthetic impact of the site.
Heritage and historical cultural resources	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Sewage treatment plant capacity	Low	Low	Both options will increase flow conveyed to the sewage treatment plant.

Valued Ecosystem Component	New Building	Pumphouse Chamber	Considerations
	Assessment of Effects		
Capacity of Renewable Resources	Minimal/ Nil	Minimal/ Nil	No additional impacts are expected from the implementation of either option (i.e., ground water, wildlife, vegetation impacts have been considered).

(d) Preferred Pumphouse Type

After consideration of the findings of the technical review and the environmental effects analysis, it was concluded that the treatment and disinfection facilities required for the Nelson Street Well Supply should be housed in a pumphouse chamber in the base of the proposed elevated storage tank. There are a limited number of factors associated with the pumphouse chamber which justified its selection as the preferred well development plan. The most significant of these are as follows:

- Provides efficiencies with respect to capital and maintenance costs.
- Minimizes the amount of vegetation permanently removed on the site.
- Presents minimal long-term impacts to air quality, noise levels and local aesthetics.

In review, construction and operation of the pumphouse chamber 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).

3.2.3.4 Site Servicing

(a) Identified Alternatives

The following represent the practical alternatives considered for providing servicing infrastructure to the Nelson Street well supply site:

- Within Existing Road Allowances
- Within New Easements

(b) Considerations

The key considerations with respect to the selection of a servicing easement and access road are as follows:

- The servicing easement must connect the project site to existing water and sanitary sewer infrastructure located near the Nelson Street/Ann Street intersection
- Installation of services within the existing road allowance could have minor impacts on traffic during the construction phase of the project.
- Additional costs would likely be incurred with the acquisition of a private easement.
- Construction of services within private servicing easements has the potential to impact upon future development activities and would likely require the removal of several mature trees and shrubs (given the limited number of alternative servicing routes available).
- Access to private servicing easements can be problematic during periods of inclement weather.
- The access road should be constructed in an area which is consistent with the established development pattern and which results in minimal disturbance to the natural features of the project site.

(c) Environmental Effects Analysis

The potential interactions between the alternative site servicing corridors 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 environmental effects of each identified option on the various environmental components prior to mitigation (using the impact criteria described in Table 2.1). Table 3.6 summarizes the outcome of the environmental effects analysis carried out for the servicing corridor alternatives.

Table 3.6
Alternative Site Servicing Corridors:
Environmental Effects Analysis

Valued Ecosystem Component	Existing Road Allowances	New Servicing Easements	Considerations
	Assessment of Effects		
Ground water quantity and quality	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either corridor option.
Surface water quantity and quality	Minimal/ Nil	Minimal/ Nil	Sediment and erosion impacts may occur during construction. Impacts would be minimized with standard mitigation measures, although the impact

			potential is greater if servicing occurs via an undisturbed easement.
Valued Ecosystem Component	**Existing Road Allowances**	**New Servicing Easements**	**Considerations**
	Assessment of Effects		
Fisheries and aquatic resources	Minimal/ Nil	Minimal/ Nil	Sediment and erosion impacts may occur during construction. Impacts would be minimized with standard mitigation measures, although the impact potential is greater if servicing occurs via an undisturbed easement.
Terrestrial features (vegetation, wildlife)	Low	Moderate	Vegetation will be removed to facilitate site servicing via either option. Impacts would be minimized with standard mitigation measures, although the impact potential is greater if servicing occurs through a new servicing easement.
Species at risk	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either corridor option.
Noise	Minimal/ Nil	Minimal/ Nil	Service provision via either corridor option will result in negligible impacts to ambient noise levels (after the construction phase).
Air quality	Minimal/ Nil	Minimal/ Nil	Service provision via either corridor option will result in negligible impacts to air quality (after the construction phase).
Local users of ground water	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either corridor option.
Local neighbourhood and residents	Minimal/ Nil	Low	Service provision within the existing road allowance would be consistent with the local development pattern and would have a minimal impact upon the community, particularly after

			site restoration
Valued Ecosystem Component	**Existing Road Allowances**	**New Servicing Easements**	**Considerations**
	Assessment of Effects		
			Service provision via a new easement could conflict with future development patterns, given the limited routes available for site servicing via private lands.
First Nations communities	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Worker health and safety	Low	Low	Site servicing via either corridor option would result in minimal impacts to worker health and safety, although construction along the existing road right-of-way has a greater potential for traffic-related impacts.
Public health and safety	Low	Low	Site servicing via either corridor option would result in minimal impacts to public health and safety, although construction along the existing road right-of-way has a greater potential for traffic-related impacts.
Aesthetics	Minimal/ Nil	Low	Service provision within the existing road allowance would have minimal impact upon local aesthetics following site restoration. Service provision via a new easement could have a moderate impact upon the local community, given the likelihood for significant tree removal.
Heritage and historical cultural resources	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.

Sewage treatment plant capacity	Minimal/ Nil	Minimal/ Nil	Both options will increase flow conveyed to the sewage treatment plant.
Valued Ecosystem Component	**Existing Road Allowances**	**New Servicing Easements**	**Considerations**
	Assessment of Effects		
Capacity of Renewable Resources	Minimal/ Nil	Minimal/ Nil	No additional impacts are expected from the implementation of either corridor option (i.e., ground water, wildlife, vegetation impacts have been considered).

(d) Preferred Site Servicing Plan

After consideration of the findings of the technical review and the environmental effects analysis, the following plan for the extension of services and street access has been developed:

- Site servicing should be installed along the Nelson Street road allowance between the Ann Street intersection and the project site. Large diameter watermain, sanitary sewers, storm sewers and electrical conduit would be installed within the proposed corridor using an open trench construction technique. The 20 m road allowance is largely disturbed as a result of previous development activities associated with the former railway.

- An access road should be constructed from the Nelson Street road allowance to the elevated storage tank. The road should be wide enough to accommodate one vehicle and should incorporate a gravel surface. One parking space should also be provided for municipal staff. Vegetation disturbed and permanently removed by the road construction will be limited in scale (grasses) which is not considered sensitive in nature (see section 6.2.3 for a discussion of terrestrial and vegetative resources).

There are a number of factors associated with the proposed site servicing plan which justified its selection as the preferred well development plan. The most significant of these are as follows:

- Minimizes disruption to vegetation features and wildlife habitat in the vicinity of the project area.
- Presents minimal long-term impacts to air quality, noise levels and local aesthetics.
- Affected lands are entirely within municipal ownership (i.e., no land acquisition costs).
- Maintains established development pattern which should limit long-term impacts to future development activities
- Limits traffic disruption by largely avoiding construction activities near existing roadways.

In review, implementation of the defined site servicing plan is not anticipated to have significant adverse environmental effects upon the selected VEC's (see section 7.0 for a specific analysis of environmental effects).

3.2.4 Analysis of Alternative Means (Well 1 Site)

3.2.4.1 Chlorine Contact Facilities

(a) Identified Alternatives

The following represent the practical alternatives for the provision of chlorine contact facilities on the Well 1 site:

- Watermain
- Clearwell

(b) Considerations

The key considerations with respect to the selection of a pumphouse facility are as follows:

- Chlorine contact watermain is large diameter piping (600 mm diameter) 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). For Well 1, 15 minutes of chlorine contact time is required. Based upon the supply capacity of Well 1 (15.2 L/s), 52 m of piping would need to be installed around the perimeter of the pumphouse.

- The clearwell consists of an insulated, below-grade concrete tank designed with baffling to provide the required chlorine contact time. The tank would be constructed adjacent to the existing pumphouse. Based upon the supply capacity of Well 1, the footprint of the tank would be approximately 16 m^2.

- The capital costs associated with a clearwell are considerably higher than chlorine contact watermain. Probable costs for installing the two facilities would be approximately $55,000 and $31,000, respectively. Operating costs for the two facilities would be similar, although the operator would be required to enter the clearwell periodically for maintenance purposes (e.g., to drain and remove sediment).

- Construction activities associated with the two projects would temporarily disturb a similar amount of land on the Well 1 site.

(c) Environmental Effects Analysis

The potential interactions between the two chlorine contact options 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 environmental effects of each identified option on the various environmental components prior to mitigation (using the impact criteria described in Table 2.1).

Table 3.7 summarizes the outcome of the environmental effects analysis carried out for the chlorine contact alternatives.

Table 3.7
Alternative Chlorine Contact Facilities:
Environmental Effects Analysis

Valued Ecosystem Component	**Watermain**	**Clearwell**	**Considerations**
	Assessment of Effects		
Ground water quantity and quality	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Surface water quantity and quality	Minimal/ Nil	Minimal/ Nil	Sediment and erosion impacts may occur during construction. Impacts would be minimized with standard mitigation measures.
Fisheries and aquatic resources	Minimal/ Nil	Minimal/ Nil	Sediment and erosion impacts may occur during construction. Impacts would be minimized with standard mitigation measures.
Terrestrial features (vegetation, wildlife)	Minimal/ Nil	Minimal/ Nil	Vegetation will be removed to facilitate either option. Impacts would be minimized with standard mitigation measures (including site restoration).
Species at risk	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Noise	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option (after the construction phase).
Air quality	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option (after the construction phase).

Local users of ground water	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Valued Ecosystem Component	**Watermain**	**Clearwell**	**Considerations**
	Assessment of Effects		
Local neighbourhood and residents	Minimal/ Nil	Minimal/ Nil	Implementation of either option will result in negligible impacts to local development patterns or the community's quality of life (with the exception of minor construction-related impacts).
First Nations communities	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Worker health and safety	Low	Low	Construction and operational activities associated with these two options do not present a significant threat to worker health and safety, although use of a clearwell will require additional maintenance activities.
Public health and safety	Low	Low	Construction and operational activities associated with these two options do not present a significant threat to public health and safety.
Aesthetics	Minimal/ Nil	Minimal/ Nil	Implementation of either option will result in negligible aesthetic impacts, given that both facilities will be buried and the disturbed sites will be restored (minor aesthetic impacts will occur with both options during construction).

Valued Ecosystem Component	Watermain	Clearwell	Considerations
	Assessment of Effects		
Heritage and historical cultural resources	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Sewage treatment plant capacity	Minimal/ Nil	Minimal/ Nil	No impacts are expected from the implementation of either option.
Capacity of Renewable Resources	Minimal/ Nil	Minimal/ Nil	No additional impacts are expected from the implementation of either option (i.e., ground water, wildlife, vegetation impacts have been considered).

(d) Preferred Chlorine Contact Facility

After consideration of the findings of the technical review and the environmental effects analysis, it was concluded that the chlorine contact facilities required for the Well 1 site should be provided via a large diameter watermain installed around the perimeter of the existing pumphouse. There are a limited number of factors associated with which justified the selection of the watermain as the preferred chlorine contact facility. The most significant of these are as follows:

- Substantially lower capital costs;
- Requires less labour-intensive maintenance activities;
- Presents minimal long-term impacts to vegetation, air quality, noise levels and local aesthetics.

In review, installation and operation of the chlorine contact watermain 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 Existing Water Supply Facilities

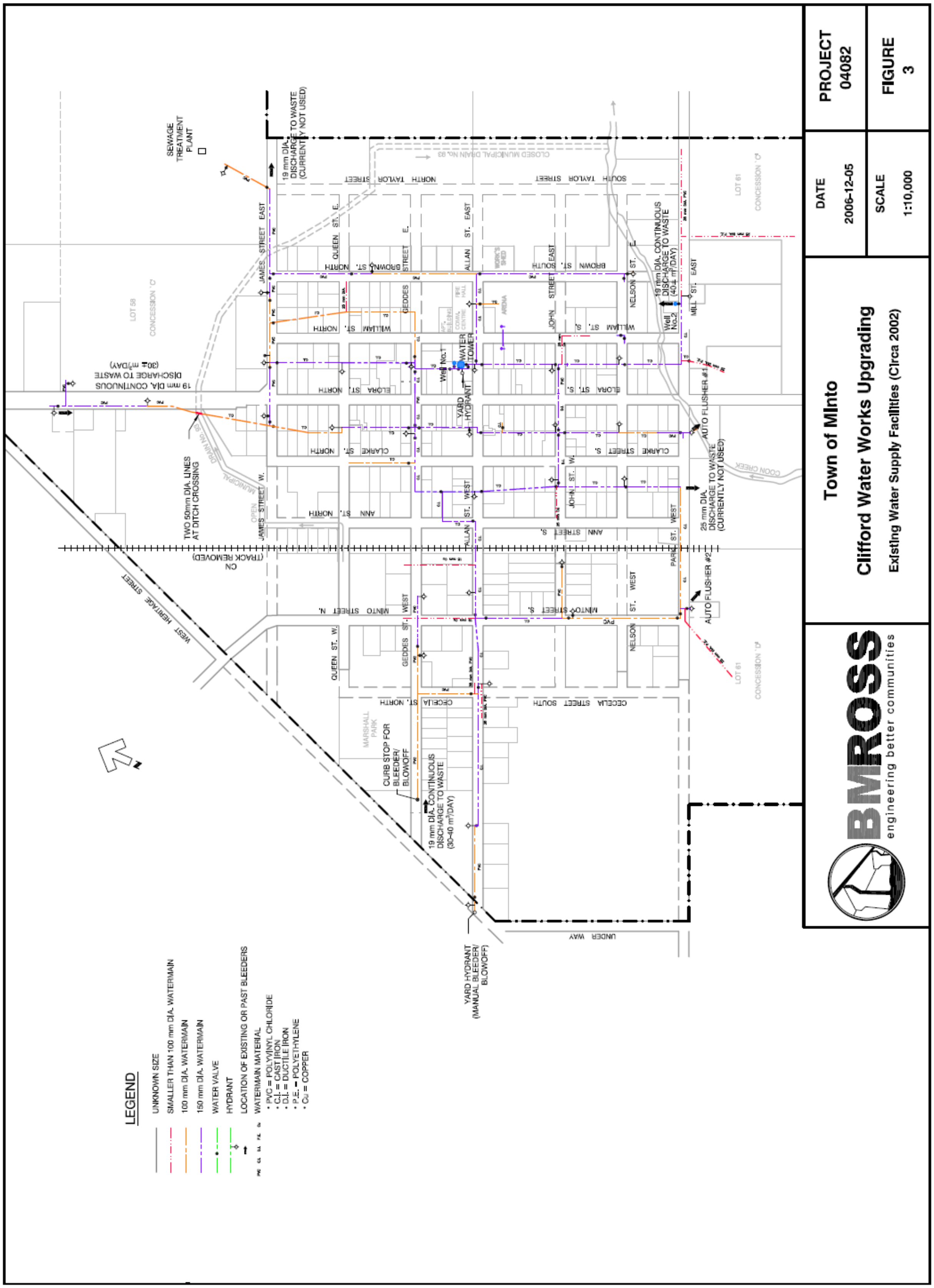
The community of Clifford is serviced by a municipal water system that was first commissioned in 1947. At the outset of the Class EA investigation, the system was comprised of two drilled bedrock well supplies (Wells 1 and 2), two pumphouses, an elevated storage facility (standpipe), and a network of distribution watermain. Approximately 310 residential households, 27 commercial activities and 6 institutional premises are supplied by the system. There are no major water users identified in the community. Figure No. 3 illustrates the location of major waterworks facilities in Clifford at the outset of the Class EA investigation.

Wells 1 and 2 were equipped with submersible pumps that discharged directly into the distribution system. Well 1 is a large capacity, bedrock well supply that serves as the primary production well for the system. The well is controlled automatically based on standpipe liquid levels. Well 2 (known locally as the Dairy Well) was a small capacity, bedrock well supply that was originally constructed to service a nearby cheese factory. Prior to decommissioning, Well 2 served as a standby well supply which was used only when needed (i.e., high system demands or if Well 1 is out of service). Well 1 has a permitted capacity of 15.2 L/s, Well 2 had a permitted capacity of 4.5 L/s (refer to Table 3.1).

Water from both wells was treated via the injection of sodium hypochlorite (chlorine). An iron sequestering agent is also used to treat the water from Well 1. During the course of the Class EA assessment, it was noted that Well 1 was equipped with a pump throttled to a rate of 11.4 L/s, but was capable of providing 15.2 L/s. Subsequent investigations have identified that the well is operated at 15.2 L/s.

The distribution system is comprised of an estimated 4,510 m of 100 mm diameter and 150 mm diameter cast iron watermain, 2,990 m of 100 mm and 150 mm diameter polyvinyl chloride (PVC) watermain, as well as a small amount of ductile iron watermain and small diameter copper and polyethylene watermain. The majority of the system (58%) is unlined cast iron pipe installed at or near the time the system was first commissioned. Most of the distribution system was installed within the rear yards of private residences.

The steel standpipe (constructed in 1947) had a total capacity of 794 m^3 and a height of 27 m prior to decommissioning.


PROJECT
04082
FIGURE
3
DATE
2006-12-05
SCALE
1:10,000
Town of Minto
Clifford Water Works Upgrading
Existing Water Supply Facilities (Circa 2002)
BMROSS
engineering better communities
LEGEND
UNKNOWN SIZE
SMALLER THAN 100 mm DIA. WATERMAIN
100 mm DIA. WATERMAIN
150 mm DIA. WATERMAIN
WATER VALVE
HYDRANT
LOCATION OF EXISTING OR PAST BLEEDERS
WATERMAIN MATERIAL
• PVC = POLYVINYL CHLORIDE
• C.I. = CAST IRON
• D.I. = DUCTILE IRON
• P.E. = POLYETHYLENE
• Cu = COPPER

4.2 Production Capacity and Demand

4.2.1 Current Water Demands

Table 4.1 illustrates the key water demand information for the Clifford Water Works, based on a review of 1997-2002 pumpage records.

Table 4.1
Annual Average and Maximum Day Pumpages (1997-2003): Clifford Water Works

Year	Average Day (m^3/day)	Maximum Day (m^3/day)
1997	378	1,189
1998	381	841
1999	388	787
2000	439	981
2001	665	1,096
2002	588	1,230
2003	512	874
Average (1997-2003)	489	1,000

The following observations were made following a review of the data presented in Table 4.1:

- Annual average day and maximum day pumping rates were relatively stable between the period 1997-1999. During that time frame, the annual average day demand increased marginally, from 378 m^3 to 388 m^3. The annual maximum day demand, in contrast, declined substantially over this period from a peak of 1,189 m^3 to 787 m^3.

- Annual average day and maximum day demands have generally increased between 1999 and 2002. Over this period, the average day flow rate increased from 388 m^3 to 588 m^3 with average day demand peaking in 2001 at 665 m^3. The maximum day flow also increased during this period from 787 m^3 to 1,230 m^3.
- Per capita water consumption was approximately 495 Litres per day (pre-October 2000). This level is marginally higher than MOE design guidelines, which anticipates a per capita consumption of between 270 Litres per day (L/d) and 450 L/d for non-major water users in Ontario communities. Recent (2001-03) water use has been approximately 50% higher than pre-October 2000 consumption levels.

- The recent increase in water consumption is attributed to the Town's use of bleeders, autoflushers, and bi-weekly hydrant flushing (initiated in October 2000). These measures were employed to maintain regulated levels of free chlorine residual throughout the distribution system and to address customer complaints of "dirty" and "odorous" water. It is expected that water consumption will decline significantly to pre-2000 levels when system upgrades are completed and these measures are discontinued (assuming the upgrades successfully address system aesthetic water quality problems).

- Recent annual maximum day demands of up to 1,200 m^3 are close to the total well supply capacity of Well 1 (1,313 m^3). The actual maximum day demand is expected to be higher than the identified value (i.e., storage was likely being depleted on those days).

4.2.2 Population Projection

Table 4.2 illustrates the total increase in population in Clifford for the period 1976-2001 and the average annual population growth over five year periods as reported by Statistics Canada. In review, the local population increased from 641 to 792 over the study period, which represents a net increase in population of 23.6% and an average annual growth rate of 0.85%.

Table 4.2
Population Data (1976-2001):
Community of Clifford

Year	Population
1976	641
1981	645
1986	661
1991	784
1996	775
2001	792
Percentage Change (1976-2001)	+ 23.6%
Annualized Average Change	0.85%

Table 4.3 demonstrates that the short-term growth levels in the community fluctuated considerably over the study period. Five-year average annual growth rates varied from a low value of - 0.24% for the period 1991-1996, to a high figure of 3.48% for the period 1986-1991. In general, the fluctuations evident in Clifford can be attributed to changes in local economic and demographic conditions.

Table 4.3
Short-Term Population Growth Rates (1976-2001):
Community of Clifford

Five-Year Interval	Annual Average Growth Rate
1976 – 1981	0.14 %
1981 – 1986	0.48 %
1986 – 1991	3.48 %
1991 – 1996	- 0.24 %
1996 – 2001	0.44%

Two key population projections have been prepared for the Clifford urban area in recent years. The most recent forecast was prepared by C.N. Watson and Associates Ltd. as background material to support the development of a new *County of Wellington Development Charges By-law*. This forecast projected that the community would achieve an annual average population increase of 1.46% during the period 2002-2022. The County of Wellington Planning & Development Department also produced a growth forecast based on 1996 census data as supporting material for the development of the *County of Wellington Official Plan*. This forecast projected that the community would achieve an annual average population increase of 1.125% during the period 1996-2016.

In review, the growth projection prepared by the County of Wellington (1) is relatively consistent with the 0.85% average annualized growth rate experienced in Clifford between 1976 and 2001 and (2) appears to be a realistic projection of future population growth in the community given the current development trends. The C.N. Watson projection, in contrast, appears to overemphasize peak periods of growth. This growth scenario therefore accelerates the future population to levels that may not be achieved in the long-term (given historical population growth and current development trends). A design population was therefore developed based upon a 1.125% annual average growth rate.

Table 4.4 summarizes the projected population of Clifford for the period 2005-55 using the defined future growth rate. The projection is based on the assumption that the population forecast developed for the Official Plan will be applicable to the study area during this time frame. A base year of 2005 was established for the forecast, given that system upgrades would probably not be fully implemented until that time. Growth projections were extrapolated for the long-term demands (i.e., the 20-year design period) and for the ultimate demands (i.e., the 50-year design period). The 20-year forecast was developed to determine the requirements for upgrading water supply facilities. The 50-year projection was established to determine the requirements for upgrading system storage facilities.

Table 4.4
Population Growth Forecast (2005-2055):
Community of Clifford

Year	Population
2005	828
2010	876
2015	926
2020	979
2025	1,036
2055	1,448

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. As discussed in section 4.2.1, per capita water consumption was approximately 495 L/d prior to the introduction of additional measures to help maintain free chlorine residual levels and improved aesthetic water quality throughout the distribution system (e.g., bleeders, bi-weekly flushing). Applying this consumption rate to the projected 2005 (base year) population translates into an average day demand for Clifford of approximately 410 m^3 (4.7 L/s). Applying a maximum day factor (2.75) to the average day value produces a maximum daily consumption of 1127 m^3 (13.0 L/s) for 2005, assuming the above-noted measures are no longer in use.

In order to estimate design flows for the 20-year and 50-year planning periods, 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).
- There will be no major water users established in the area during either planning period.
- Current measures to help maintain free chlorine residual levels and improve aesthetic water quality throughout the distribution system will be discontinued following system upgrading. Specifically, it is anticipated that the use of bleeders will be discontinued and hydrant flushing will be normalized (i.e., biannual flushing)
- The maximum day demand factor will be consistent with MOE design guidelines (i.e., a factor of "2.5" for a population of 1,001 to 2,000).

Based on these assumptions, the design average day demand and the design maximum day demand for the 20-year planning period are projected to be 513 m^3 (5.9 L/s) and 1,282 m^3 (14.8 L/s), respectively. The design average day demand and the design maximum day demand for the 50-year planning period are projected to be 717 m^3 (8.3 L/s) and 1,792 m^3 (20.7 L/s), respectively. Table 4.5 summarizes the existing system demand and extrapolates future demand for each planning period.

Table 4.5
Existing and Future Water Demands:
Community of Clifford

	Base Year (2005)	Projected (2025)	Projected (2055)
Population	828	1,036	1,448
Average Day Demand (L/s)	4.7	5.9	8.3
Maximum Day Demand (L/s)	13.0	14.8	20.7

4.2.4 Projected Storage Demands

Design storage volumes were developed by applying the population forecasts to MOE design criteria. MOE design guidelines prescribe that a proportion of storage be set aside for peak rate demands (equalization storage), fire protection, and emergency storage. Table 4.6 summarizes the existing storage requirements and extrapolates future storage needs for the 20-year and 50-year planning periods. The forecasted storage requirements are based on the key assumptions defined for future water demands.

Table 4.6
Existing and Future Storage Requirements:
Community of Clifford

	Base Year (2005)	Projected (2025)	Projected (2055)
Population	828	1,036	1,448
Total Storage Required (m^3)	663	988	1,258
Equalization Storage (m^3)	256	321	448
Fire Protection (m^3)	274	469	558
Emergency Storage (m^3)	133	198	252

4.3 Preliminary Engineering Concept

4.3.1 Sentinel Wells

4.3.1.1 Test Wells

The GMPS report included a section entitled "Potential for New Ground water Sources" which identified the area west of Clifford as a possible area for exploration. The bedrock and deep overburden in this area became the focus of well exploration which resulted in the construction of three test wells in 2002 (TW1/02, TW2/02, TW3/02) and the subsequent analysis of these wells.

The majority of the hydrogeologic investigation was carried out at the Nelson Street site, based on the following assumptions:

- The overburden and bedrock aquifers evident at this location would yield water quality and water quantity suitable for a municipal well supply.

- The overburden aquifer at this site would provide significantly better water quality than the existing bedrock well supplies.

Based upon the findings of well tests conducted for water quality, quantity and aquifer sustainability, it was concluded that the bedrock and overburden aquifers in the vicinity of the Nelson Street site would be suitable for municipal well supplies.

4.3.1.2 Collector Wells

The Town of Minto commissioned the construction of Clifford Wells 3 and 4 in 2004. Well 3 is a 200 mm diameter overburden well constructed in the same aquifer as TW2/02, situated approximately 7.5 m north of the test well (drilled to a depth of approximately 35.7 m). Clifford Well 4 was developed through the reconstruction of TW1/02 from a 150 mm diameter bedrock well supply to a 200 mm diameter bedrock well (drilled to a depth of approximately 40.8 m).

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

- Well 3; 0501721E, 4868048N
- Well 4; 0501723E, 4868041N

Hydrogeological testing of Wells 3 and 4 was conducted to confirm the sustainability of the overburden and bedrock aquifers, respectively, over the planning period, the quality of water provided from each well and 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 long-term testing procedure. Monitoring locations included existing production wells and test wells, four monitor wells (designated M1-MW4-00-S0, M1-MW4-00-D0, M1-MW5-00-D0, M1-MW6-00-D0), two stream piezometers (designated SP1/02 and SP2/02) and one unused domestic well.

Section 7.2 of this report highlights the procedures, results and conclusions of the hydrogeological assessment carried out for Wells 3 and 4, including a description of the potential environmental effects associated with the development and operation of the well supplies. Appendix B includes ground water level (potentiometric surface) mapping developed as part of the GMPS. To date, potentiometric surface mapping has not been prepared for the Clifford urban area.

4.3.2 Storage Considerations

Recent engineering evaluations concluded that the limited height of the standpipe resulted in pressures in the distribution system that are well below MOE guidelines. MOE design guidelines recommend that normal system pressures are to be between 350 kilopascals (kPa) and 550 kPa. These guidelines also prescribe that normal pressures should remain above 275 kPa during peak rate demand periods. Normal pressures in some areas of the Clifford system approach the minimum recommended pressure under normal conditions (i.e., 140 kPa). This problem is further compounded when there are large demands in the system, such as hydrant flushing or during a fire flow event.

Engineering evaluations also concluded that the total effective storage volume of the standpipe (794 m^3) was inadequate for the existing serviced population, based on available information and standard design criteria. Moreover, the available volume in the standpipe could not meet the required design volume (988 m^3) for the 20-year planning period or the design volume (1,258 m^3) when using a 50-year planning period for storage. The adequacy of storage volume, as with system pressures, could therefore be expected to continue to decline as the local population increases.

Section 3.2.3.2 of this report details the various matters considered during the preliminary review of the system storage, particularly with respect to facility types and possible project sites. As noted, the Nelson Street site was identified as the preferred site for the storage facility.

4.4 Works Undertaken

4.4.1 Nelson Street Well Supply

- Construction of well components (two wells) capable of providing a supply of at least 15.2 L/s (1313 m^3/d, 479 347 m^3/a).
- The construction of a 1275 m^3 elevated storage tank.
- Construction of a pumphouse to house treatment and pumping equipment (in the base of the elevated storage tank).
- The extension of services (water main, sewer main and storm water drain) along the unopened Nelson Street road allowance to the project site.
- Construction of a gravel access road.

4.4.2 Well 1 Site:

- Installation of a chlorine contact watermain on a site immediately adjacent to the existing well site.
- Installation of a standby chlorination system, a secondary chemical containment tank and analytical equipment in the pumphouse.
- Miscellaneous upgrades to the pumphouse building.
- Decommissioning and dismantling of the water standpipe on the site.

4.4.3 Well 2 Site:

- Decommissioning and abandonment of the well.

4.5 Construction Phase

4.5.1 Collector Wells

4.5.1.1 Wells 3 and 4

The following activities comprised the construction phase for the development of Wells 3 and 4 (section 5.0 of this report provides specific details on associated construction sequence):

- Well 3 was constructed within close proximity to TW2/02 in order to access the overburden aquifer evaluated during the hydrogeological investigation. The well has been developed to provide a well capacity of 7.6 L/s and is equipped with a variable speed pump to reduce iron concentrations in the well water during start/ stop operations. The well is also equipped with the following:

  - A pitless adaptor and vented cap.
  - A submersible turbine pump rated at 7.6 L/s @ 75 m total discharge head (TDH) and 100 mm diameter discharge watermain to treatment and monitoring facilities in the base of the adjacent elevated tank pedestal (discussed in the following section).

- Well 4 has been constructed into the bedrock through the reconstruction of TW1/02. This well would be developed to yield 15.2 L/s and serves as a backup well supply for Well 1 (Wells 3 and 4 do not operate simultaneously, Wells 1 and 4 only operate simultaneously in emergency situations). The well is equipped with the following:

  - A pitless adaptor and vented cap.
  - A submersible turbine pump rated at 15.2 L/s @ 84 m TDH and 100 mm diameter discharge watermain to treatment and monitoring facilities in the base of the adjacent elevated tank pedestal.

- Table 4.7 summarizes the well construction details for Wells 3 and 4.

Table 4.7
Clifford Municipal Well Construction Details

	Well 3	Well 4
Diameter (mm)	200	200
Existing Grade Elevation (m)	381.25	381.25
Top of Casing Elevation (m)	382.00	382.00
Static Water Level (m)	14.4	13.3
Depth to Bottom of Casing (m)	35.4	40.8
Well Depth (m)	35.4	43.3
Pump Intake Depth (m)	32.3	40.5
Permitted Pumping Rate (L/s)	7.6	15.2

Well depths and pump settings are measured from existing grade.
Water levels are measured from top of existing casings.

4.5.1.2 Well 1 Site

The following activities were incorporated into the construction phase for Well 1 upgrading:

- Upgrading of the main production well (Well 1) in accordance with the work prescribed in the CC of A issued by the MOE. The following defines the key improvements mandated by the CC of A:
  - Installation of a chlorine contact watermain on a site immediately adjacent to the existing well site.
  - Installation of a standby chlorination system, a secondary chemical containment tank and analytical equipment in the pumphouse.
- Completion of miscellaneous upgrades to the existing pumphouse. The key modifications are summarized below:
  - Installation of a new well pump capable of delivering 15.2 L/s at 86 m TDH (it is necessary to increase the TDH capability of the well pump from the present 64 m due to the increase in top water level in the new elevated tank when compared to the existing standpipe). The pump capacity of 15.2 L/s matches the present permitted capacity for the well as found in the CC of A and the PTTW.
  - Installation of a new stainless steel riser pipe (including a new well head fitting and discharge elbow).

  - Installation of a new pump starter and control panel including interconnection capabilities with other equipment as required.

  - Installation of a new well liner, subject to an inspection of the well casing.

- Removal of the storage standpipe following the commissioning of the new elevated storage tank at the Nelson Street site.

4.5.1.3 Well 2

Well 2 has been decommissioned in accordance with Regulation 903 as part of the Clifford Water Works Upgrading Project. Under Regulation 903, well abandonment required 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.

4.5.2 Utility Corridor and Site Access

The following activities were incorporated into the construction phase for provision of site servicing and street access to the Nelson Street well site:

- A 145 m utility corridor established within the Nelson Street West road allowance from the well site eastwards towards the Clarke Street intersection. The corridor incorporates the following components:

  - Extension of approximately 145 m of 300 mm diameter transmission watermain from the project site easterly to an existing 150 mm diameter watermain situated east of the Ann Street intersection.

  - Installation of approximately 69 m of 200 mm diameter sanitary sewer from the project site easterly to an existing maintenance hole associated with the 200 mm diameter sanitary sewer extending along Ann Street.

  - Extension of approximately 18 m of 300 mm storm sewer easterly to the outlet location. The outlet discharges into the former railway right-of-way and incorporates rip rap protection for erosion control purposes.
  - Installation of an overhead electrical service to the property boundary of the site. The electrical service within the site boundaries will be installed underground in suitably sized conduit.
  - Provision of telephone service to the tank base via suitably sized buried conduit.

- Watermain and sanitary sewer facilities include capped laterals extending westerly for a distance of approximately 7 m. Laterals are also extended north and south from the watermain along Ann Street for a distance of approximately 16 m.

- All pipeline facilities constructed a minimum of 1.5 m below grade for protection against freezing effects.

- An access road constructed from the Nelson Street road allowance to the elevated storage tank. The road is wide enough to accommodate one vehicle (3 m ±) and incorporates a gravel base and surface (total gravel depth: 0.6 m ±). One parking space is also provided for staff.

4.5.3 Elevated Storage Tank

The following activities were incorporated into the construction phase for the elevated storage tank at the Nelson Street well site:

- Completion of an elevated storage tank designed to meet the 50-year design requirement for system storage. The principal design parameters of the structure are summarized below:

- Design Population	1,449	persons
- Design Maximum Day Demand	1,793	m^3
- Total Storage Requirement	1,275	m^3
- Top Water Level for Storage	424.0	m
- Overflow Elevation	424.3	m
- Fire Storage Volume	570.0	m^3
- Emergency Storage Volume	255.0	m^3
- Low Water Level (Tank Empty)	416.4	m

The general dimensions of the structure are as follows:

- Total Height (excluding antennas)	44.8	m
- Diameter of Tank	16.2	m
- Diameter of Pedestal	7.5	m
- Floor Slab Elevation	381.5	m
- Footing Diameter	13.0	m
- Footing Volume	135	m^3
- Underside of Footing Elevation (Max.)	377.8	m

- Flows from Wells 1, 3, and 4 are conveyed via 150 mm and 300 mm inlet riser pipes (insulated and heat traced). The 300 mm diameter pipe also functions as a discharge pipe. A 300 mm diameter overflow pipe from the storage tank is also provided. The overflow pipe discharges to the 300 mm diameter storm sewer installed within the Nelson Street road allowance.

- The tank incorporates the Well 3 and 4 pumphouse within the base of the concrete pedestal. The pumphouse incorporates the following control, monitoring and treatment facilities:

  - Approximately 50 m of 600 mm diameter watermain at the elevated tank site for the purpose of providing chlorine contact time to the maximum pumphouse discharge of (15.2 L/s), complete with sample and service lines, valves, swab-launch assembly, and all associated appurtenances.

  - A sodium hypochlorite feed system consisting of two chemical metering pumps, one 100 L sodium hypochlorite solution storage tank, complete with all associated piping, valves, spill containment, controls and alarms.

  - An iron sequestering system consisting of two chemical metering pumps, one 200 L sequestering solution day tank and one 900 L sequestering solution storage tank, complete with all associated piping, valves, spill containment, controls and alarms.

  - Monitoring facilities for raw and treated water discharge, free chlorine residual, turbidity, and system pressure.

  - Associated yard piping and interconnections to Nelson Street services.

  - Associated mechanical and electrical work.

- A 10 m temporary easement was obtained along the western boundary of the subject property to facilitate the construction of the elevated storage tank.

- The pumphouse and the pedestal includes rigid foam insulation in the concrete walls to minimize weather effects and to provide sound attenuation of the ancillary works.

- The tank incorporates two antenna masts and an airways obstruction beacon to be installed on the top of the steel bowl.

4.6 Operation and Maintenance Phases

All waterworks facilities will be operated and maintained by the Town of Minto in accordance with the requirements and protocols set out in the *Clifford Water Works Operations Plan.* 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), and the CC of A (section 7.13.2.2 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 *Town of Minto 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 different types of corrective actions depending upon the nature of the occurring problem. In general, the Contingency Plan sets out standard response procedures to assess the scope of the situation and steps to mitigate the problem (section 9.2.4 of this report provides more specific details on the content of the plan).

4.7 Decommissioning Phase

All waterworks facilities constructed and operated in conjunction with this project will be decommissioned in accordance with applicable regulations. The following general activities will occur as part of the decommissioning work:

- Removal all equipment and debris on site.
- Disposal of all treatment and disinfection chemicals in accordance with industry protocols.
- Abandonment of all wells pursuant to Regulation 903 or successor legislation.
- Dismantling of all above-ground structures.
- Removal of below-ground structures, foundations and slabs.
- Abandonment of all underground servicing (remove services, as required)
- Revegetation of disturbed areas.

5.0 CONSTRUCTION PLAN AND TIMETABLE

5.1 General Construction Sequence

5.1.1 Elevated Storage Tank

The construction plan for the erection of the elevated tank incorporated the following tasks:

- Mobilization of the Contractor to the site.
- Completion of the layout and topsoil stripping (including delineation of the access road and laydown areas).
- 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 testing of the concrete pedestal.
- Completion of mechanical, electrical and miscellaneous metal work associated with the elevated tank controls and the Wells 3 and 4 pumphouse.
- Pre-hoist welding and inspection of the steel tank.
- Hoisting of the bowl.
- Installation of yard piping and completion of miscellaneous site work.
- Documentation and reporting on the project.

5.1.2 Utility Corridor and Site Servicing

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

- Mobilization of the Contractor to the site.
- Completion of the layout.
- Clearance of a 15 m (maximum) wide area of vegetation along the servicing route in order to facilitate trenching and construction equipment (the width of the cleared area varies in relation to the required services).
- Excavation of trenching for all inground service.
- Installation of services in accordance with engineering specifications.
- Installation of a new pole line and electrical service to the site.
- Backfilling of trenches in accordance with engineering specifications.
- Revegetation of disturbed areas with grass seed and mulch.
- Documentation and reporting on the project.

5.1.3 Wells 3 and 4

The construction plan for the development of production Wells 3 and 4 incorporated the following general tasks:

- Supply and installation of pitless adaptors and vented well caps on Wells 3 and 4
- Supply and installation of submersible well pumps, riser piping and associated equipment in Wells 3 and 4.
- Supply and installation of a flanged, gasketted cap on test well TW2/02
- Completion of all necessary disinfection procedures.
- Completion of all required inspections and testing (e.g., radiographic weld testing)
- Documentation and reporting on the project.

5.1.4 Well 1

The construction plan for upgrading Well 1 incorporated the following tasks:

- Initiation of field work following the commissioning of Wells 3 and 4 (given that Well 1 is the only supply well).
- Removal of the existing well pump
- Clean and inspect the well casing, installation of a liner, if required,
- Supply and installation of a new well pump, along with associated electrical upgrades.
- Supply and installation of a new discharge elbow, if required.
- Installation the chlorine contact watermain.
- Completion of all necessary chlorination procedures.
- Completion of all required inspections and testing (e.g., radiographic weld testing)
- Abandonment, removal, and disposal of the storage standpipe
- Completion of site rehabilitation, as required.
- Documentation and reporting on the project.

5.1.5 Well 2

The decommissioning plan for Well 2 incorporated the following tasks:

- Decommissioning of the well in accordance with Regulation 903. This work would be completed following the upgrading of Well 1.
- Disconnection of the well from the water distribution system.
- Removal of all pumping and treatment equipment and all chemicals.
- Transfer of all chemicals to either the Well 1 or Nelson Street site as appropriate.
- Retention or disposal of all pumping and treatment equipment as appropriate.
- Demolition and disposal of the pumphouse building
- Site rehabilitation, as required.
- Documentation and reporting on the project.

5.2 Project Timetable

The following summarizes the general timetable for the upgrading project:

- Completion of detailed design for all planned facilities (September 2004).
- Initiation of field work for the supply works and utilities (March 2005).
- Construction and commissioning of Nelson Street supply works (October 2005).
- Installation of utilities in the servicing corridor and site services (October 2005).
- Construction and commissioning of Nelson Street storage facility, and Well 2 decommissioning (October 2005).
- Completion of Well 1 upgrades (December 2005).
- Decommissioning of the storage standpipe (June 2006).

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

6.0 DESCRIPTION OF EXISTING ENVIRONMENT

6.1 Physical Characteristics and Conditions

6.1.1 Physiographic Characteristics

Clifford is situated within the Teeswater drumlin field geologic formation, which incorporates a land base of approximately 1,500 km^2 extending across the Counties of Bruce, Grey, Huron, Perth and Wellington. The characteristic drumlin is a low, broad oval hill with gentle slopes. The till in this formation is generally loamy in texture, moderately compact, highly calcareous and pale brown in colour (being derived from the soft, pale brown limestone of the area). The drumlin field was historically traversed by large meltwater rivers which cut broad valleys in the till (most prominently the Saugeen and Maitland River valleys). Most of the river valleys also exhibit broad terraces of sand and gravel, which fill much of the low ground between the drumlins (creating a “drumlin and gravel flat” landform pattern). The continuity of the drumlin field is broken in several locations by the presence of sand and gravel mounds (kames) and associated outwash. A large group of these sandhills is situated near Pike Lake, between Clifford and Mount Forest.

The overall slope of land in Clifford is eastward over an elevation change of approximately 13 m (highest recorded elevation: 381 m ±). The eastern limit of the community is bisected by the Coon Creek floodway (the landbase gradually slopes towards the floodway). Surface drainage over the Nelson Street site is generally north to south, over a gradual elevation change of approximately 1 m (from 381.2 m to 380.1 m). Drainage over the easement is generally eastward towards the Ann Street South intersection over an elevation change of approximately eight metres (from 380 m to 372.8 m). Natural drainage characteristics of the easement are bisected by the excavated rail bed.

Soils in the vicinity of Clifford are predominantly classified as Harriston loam. These till loams are typically silty in texture and are well drained. In general, Harriston loam is among the best agricultural soil in Southern Ontario. Soils found within the right-of-way and corridor are generally clay silt, underlain by an extensive glacial till deposit.

6.1.2 Hydrogeological Characteristics of Coon Creek and Adjacent Areas

Existing water well records and mapping compiled as part of the GMPS were reviewed to provide a hydrogeologic interpretation of the Clifford area. As a result of this 2001 investigation, it was determined that the regional hydrogeology of this area consists of approximately 25 m to 35 m of glacially derived overburden sediments overlying dolostone and shale bedrock in the Salina Formation.

The Quaternary geology of the Clifford area consists of a variety of glacial deposits. The surficial deposits in the area of Coon Creek and Well 2 are glacial lacustrine shallow water deposits. These are underlain by Elma Till; a stoney and sandy silt till. Elma Till is indicated for the area west of Coon Creek, generally in the vicinity of the Nelson Street well site. Glacial fluvial outwash deposits are indicated to the east of Coon Creek for several kilometres.

The shallow sand and gravel deposit in the Coon Creek floodplain is a relatively recent deposit underlain by Elma Till. The till is underlain by a highly permeable sand and gravel aquifer with varying gradation that overlies the Salina Formation bedrock aquifer.

6.1.3 Hydrological Characteristics of Coon Creek

6.1.3.1 General

A hydrological characterization of the drainage area upstream of Clifford was conducted by BMROSS in December 2005. The following summarizes the findings of the evaluation:

6.1.3.2 Description of Watershed

The total drainage basin upstream of the former Village of Clifford is approximately 14 km^2. The watershed over Coon Creek and this area falls under the jurisdiction of the Saugeen Valley Conservation Authority.

6.1.3.3 Watershed Parameters

The watershed consists of a large percentage of swamp area (approx. 18%) and is comprised mainly of medium textured soils and Muck under hydrologic groups B and D, respectively. The area primarily consists of Harriston Loam, Donnybrook Sandy Loam, and Muck. In developing the parameters for use in the hydrology calculations the physiographic features of the watershed were assessed from topographic and soils maps for the area.

6.1.3.4 Watershed Land Use

The land use of the basin is predominantly agricultural in nature and is composed of pastureland, croplands, woodland, and small areas of rural development. It is not expected that development or land use changes occurring over the next 20 to 30 years on the watershed will alter the runoff characteristics of the watershed.

6.1.3.5 Study Method

Given the relatively small size of the watershed, there are no detailed streamflow records for this watercourse; therefore design flows were calculated by theoretical methods as discussed below:

- HydroPak2 – Computer program developed by Jack W. MacPherson. Uses HYMO type calculations to estimate flows.

- Regional Flood Analysis (FLOODONT) – Computer program which uses Regional Regression Equations.

6.1.3.6 Theoretical Flow Values

Table 6.1 provides a summary of all flows developed for the watershed using the above-noted methods:

Table 6.1
Design Flood Flow Analysis Results

Frequency Event	**2**	**5**	**10**	**25**	**50**	**100**
Precipitation (mm) – Fergus (Shand Dam) SCS6hr	*38.4*	*55.7*	*67.2*	*81.7*	*92.5*	*103.2*
HydroPak2 (m^3/s)	1.1	3.6	5.9	9.4	12.2	15.2
Primary Equation (FLOODONT)	3.0	4.6	5.9	7.3	9.5	11.1
Secondary Equation (FLOODONT)	**4.8**	**5.8**	**7.3**	**8.8**	**15.8**	**18.3**
Flood Index Method (FLOODONT)	6.6	8.6	10.3	11.8	14.0	15.5

The values generated using the noted methods are all within a reasonable range of each other. (this provides confidence in the use of the values generated by these methods). The more conservative values generated using the Secondary Equation would be used for any future analysis purposes.

Flows generated using HyroPak2 under a Hurricane Hazel distribution produced flows equivalent to 50.0 m^3/s.

6.1.4 Active Wells and Water Licences

Several private and municipal well supplies, test wells (TW) and monitoring wells (MI) have been identified within relative proximity of the Nelson Street well site (following a review of MOE water well records and PTTW information). In total, four existing domestic wells are situated within 1000 m of the subject property. The closest private well is situated on the Under Way, over 700 m west of the project site.

Table 6.2 summarizes the well supplies monitored during the course of the hydrogeologic study work.

Table 6.2
Active Wells Monitored During Hydrogeologic Investigations

Monitor Location	Distance from the Project Site (m)[1]	Depth (m bgl)[2]
TW1/02	0	35.8
TW2/02	0	43.3
TW3/02	480	38.4
MI-MW4-00-DO	495	25.8
MI-MW4-00-SO	495	7.1
MI-MW5-00-DO	550	29
MI-MW6-00-DO	310	25.7
Well 1	500	54.6
Well 2	560	50
Domestic Well	1100	32.0

Notes: 1. Approximate distances from the Nelson Street site measured from 1:5,000 scale mapping.
2. Metres below ground level.

6.1.5 Climatic Conditions

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

Table 6.3 summarizes the climatic trends evident for the 30-year period:

Table 6.3
Selected Climatic Statistics (1971-2000): Hanover Monitoring Station

Selected Statistic	Climatic Normal
i) Temperature	
Average daily	6.5 °C
Average daily (maximum)	11.8 °C
Average daily (minimum)	1.2 °C
Days above 20 (maximum)	110.9
Days below 0 (maximum)	72.4
ii) Precipitation	
Total	1045.2 mm
Rainfall (total)	787.1 mm
Snowfall (total)	261.6 mm
Days with at least 0.2 mm rainfall	118.5
Days with at least 0.2 mm snowfall	52.7

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

6.1.6 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, Clifford is centrally located between the Tiverton (northwest) and Kitchener (southeast) monitoring stations. The data available from these monitoring stations provides a relatively accurate representation of the airshed conditions in the study area.

Table 6.4 summarizes the Air Quality Index (AQI) identified for the two sites during the 2003 monitoring period:

Table 6.4
Air Quality Index Summary:
Tiverton and Kitchener 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+)
Kitchener	21.0	56.1	11.2	1.1	0.0
Tiverton	31.6	67.6	10.4	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 Clifford, 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 the localized climatic conditions.

6.1.7 Noise

The Nelson Street well site is situated in a low-density residential section of Clifford; an area which currently includes a limited number of residential units and a considerable amount of vacant land. No specific noise assessments have been completed in the immediate area, however existing noise levels will be considerably less than traditional urban environments due to the following considerations:

- The limited amount of development in the area.
- The lack of heavy industrial activities in the community.
- The low traffic levels in the immediate area.
- The lack of a major highway in the immediate vicinity.

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 (the nearest institutional use is situated approximately 225 m from the eastern limit of the corridor and approximately 260 m from the eastern limit of the Nelson Street site).

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. Input from the Ministry of Natural Resources, the Saugeen Valley Conservation Authority and Natural Resource Solutions Inc. (biological consultants) were considered as part of this evaluation. Based on this review, the following conclusions were drawn:

- There are no sensitive natural areas or significant natural features within the boundaries of the defined right-of-way or corridor.

- Portions of Coon Creek flow through areas that are ecologically diverse and, as a result, are considered environmentally significant from a regional and provincial perspective. The Ministry of Natural Resources (MNR) has characterized these sensitive areas within its inventory of natural heritage sites. In review, the headwaters of Coon Creek form part of the Clifford – Harriston Complex (being a provincially significant wetland complex, made up of 30 individual wetlands). The Clifford – Harriston Complex is approximately 2,730 ha in area and is generally composed of 96% swamp, 2.5% marsh and 1.5% bog. According to the *County of Wellington Official Plan*, the regional boundary of the project area is not situated within the Clifford – Harriston Complex, although the Coon Creek floodway is designated for environmental protection.

- In correspondence dated, February 20, 2004, the Saugeen Valley Conservation Authority (SVCA) identified that in addition to the planned mitigation strategy, special attention is needed to minimize the potential impacts of construction upon the Redside Dace population and habitat. Redside Dace was classified as a threatened fish species by the Province of Ontario in 2000 and has been listed as a species of concern by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). The species is known to occur in Meux Creek. Given the hydraulic connection between Coon Creek and Meux Creek, there is potential that the species could reside in the project area.

- The floodway corridors of Coon Creek and Municipal Drain No. 93 are considered the only sensitive natural areas within the regional boundary having significance to this project. The Town engaged Natural Resource Solutions Inc. (biological consultants) to inventory the terrestrial and aquatic environments in the vicinity of the project site. The biological study work was completed during 2004-05.

6.2.2 Fisheries and other Aquatic Resources

6.2.2.1 Existing Habitat

The following represent the most relevant habitat features of Coon Creek and Drain No. 93:

- In August 2001, the SVCA sampled fish in Coon Creek as part of the drain classification program. A variety of species were identified; Brook Trout, Mottled Sculpin, Northern Redbelly Dace, Fathead Minnow, Creek Chub and White Chub.

- Electrofishing of Coon Creek was carried out by NRS on June 1, 2005. Among the fish species identified were Creek Chub, Brook Trout, White Sucker, Fathead Minnow and Brook Stickleback. None of these species are provincially or nationally rare.

- SVCA sampling of Drain No. 93 in August 2001 yielded a number of baitfish including the Northern Redbelly Dace, Fathead Minnow, Creek Chub and Brook Stickleback. NRS sampling in June 2003 yielded baitfish including Common Shiner, Central Mudminnow, Blacknose Dace and Fathead Minnow. None of these species are provincially or nationally rare.

6.2.2.2 Species at Risk

- A search of Environment Canada's *Species at Risk Act* (SARA) registry indicated there were no aquatic species at risk within the study area.

6.2.2.3 General Conclusions Regarding Existing Habitat

Based upon the findings of the biological investigation and comments from regulatory agencies, the following conclusions were drawn regarding fisheries and aquatic resources within Coon Creek and Drain No. 93:

- Drain No. 93 contains cyprinid species indicative of its function as a warm water fish habitat. The habitat should be retained or enhanced to support the fish community within the system.
- Coon Creek contains brook trout and other coldwater species which confirm its function as a cold water fish habitat. Brook Trout are an indicator species of clear, cool well-oxygenated streams and lakes.
- No Species at Risk (aquatic) are known to exist in the study area.

6.2.3 Vegetation and Terrestrial Resources

6.2.3.1 Existing Habitat

The following represent the most relevant habitat features of the right-of-way, corridor and the Coon Creek/ Drain No. 93 floodways:

- The Nelson Street well site is comprised primarily of manicured lawn. A row of deciduous and coniferous trees is also evident along the northern limits of the property. The tree cover is very limited in scale and does not include sensitive species.
- A variety of vegetation is evident within the boundaries of the former railbed, including deciduous trees, grasses and wildflowers. The vegetation is limited in scale and is not considered sensitive in nature.
- A total of 33 species of vascular plants were observed during the field assessment (summarized in Appendix II of the NRS report). None of the species encountered in the study area are considered provincially or nationally significant.
- Coon Creek west of Elora Street is situated within a municipal park comprised largely of mowed lawn within 1.5 m of the creek banks. The existing, non-mowed, vegetation is a mix of native and non-native herbaceous species (e.g., reed canary grass, march bedstraw). Cattail, Common Arrowhead, Blue Flag Iris and Watercress are found within the creek at this location.
- East of Elora Street, smaller trees and shrubs are evident within the riparian zone, along with a large Crack Willow and a number other trees (e.g., Silver Maple, Norway Maple, Balsam Poplar).

- There is little vegetation in the vicinity of Drain No. 93. West of Elora Street, the first 50 m of the drain is lined with White Elm, Crack Willow, Mountain Ash and Red Osier Dogwood. Beyond this, there is little overhead canopy. East of Elora Street the drain is buried and the lands are actively farmed. Where the drain briefly surfaces immediately east of Elora Street, the channel is densely vegetated by reed canary grass.

6.2.3.2 Species at Risk

- 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 study area does not provide suitable habitat for this tree and was not observed during the field assessment.

  - **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 project area does not provide a suitable habitat for this plant and was not observed during the field assessment.

6.2.3.3 General Conclusions Regarding Existing Habitat

Based upon the findings of the biological investigation and comments from regulatory agencies, the following conclusions were drawn regarding vegetation and terrestrial habitat within the vicinity of the project area:

- Habitats in the study area are a mixture of landscaped private property, parkland, old field and agricultural lands. These habitats are not significant or sensitive to development.

- Mature trees would be more sensitive to development than younger trees, shrubs or existing herbaceous vegetation. Efforts should be made to retain mature trees during construction activities.

- Post-construction enhancement opportunities should centre on native tree and shrub plantings.

- Although the Butternut and American Ginseng were identified as possibly having a range within the study area, the study area does not provide suitable habitat for these species. In addition, these species were not observed during a field assessment.

6.2.4 Wildlife Resources

6.2.4.1 Birds

(a) Existing Habitat

A total of 90 birds were identified in the study area following a review of available data. Of these, eight species were observed in the study area (including the European Starling, the American Robin, Common Grackle and American Goldfinch). No breeding bird surveys were conducted by NRS, but incidental observations were recorded during vegetative community mapping.

(b) Species at Risk

The NRS technical report also indicated that a total of 11 rare species have been recorded in Wellington County. Of these species, there is potential habitat available for the least bittern and yellow-breasted chat provided by shrubbery and emergent vegetation along the stream edges of Coon Creek and Drain No. 93. A search of the SARA registry indicated that these two species, as well as the Northern Bobwhite, have a possible range within the study area. 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 SARA Schedule I 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 1000 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. The NRS technical report indicates there is some potential habitat for this species provided by shrubbery and emergent vegetation along the stream edges of Coon Creek and Drain No. 93. The only project works that occurred near these watercourses was the decommissioning of the Well 2 site. None of the decommissioning activities at this site would affect 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 I species of special concern. It is noted 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. The NRS technical report indicates there is some potential habitat for this species provided by shrubbery and emergent vegetation along the stream edges of Coon Creek and Drain No. 93. The only project works that occurred near these watercourses was the decommissioning of the Well 2 site. None of the decommissioning activities at this site would affect potential habitat for the Yellow-breasted chat.

- **Northern Bobwhite**: The SARA registry indicates that the Northern Bobwhite, a SARA Schedule I endangered species, has a range that includes the study area. The Northern Bobwhite is widespread and common throughout much of its range in the eastern and central U.S., but is not widely distributed in southern Ontario, where it is at the northern and western limits of its range. The species resides permanently in Ontario, in the Carolinian Forest zone and southern Great Lakes forest region, mainly in Elgin, Middlesex and Lambton counties. The primary population occurs on Walpole Island in Lambton County. Although the SARA registry indicates that the study area is in the northern limits of its range, the NRS technical report does not report its presence within the study area and it has not identified as a rare species that has been seen in Wellington County. Habitat for the Northern Bobwhite generally requires grassland, cropland and bushy cover. It occurs mainly in cultivated areas with grain or corn, or on weedy abandoned farms near brushy patches or edges. It prefers areas where half the ground is exposed and the remainder contains upright growth of herbaceous and woody vegetation. There is not habitat of this type that would be affected by this project.

6.2.4.2 Mammals

(a) Existing Habitat

The NRS technical report stated a total of 15 species of mammals were identified following a review of available data, including the beaver, big brown bat, porcupine, European hare, white-tailed deer and the red fox. None of the identified species are considered significant. No mammals were observed during site visits.

(b) Species at Risk

A search of the SARA registry indicated that the American badger and the grey fox have a possible range within the study area. The following is a summary of habitat considerations for each Species at Risk, both generally and with respect to this project:

- **American Badger jacksoni subspecies**: The SARA registry indicates that the American Badger jacksoni subspecies is a SARA Schedule I endangered species. The site also indicates that the range of the American Badger includes the area around the Great Lakes on both sides of the Canada-US border. In Canada, the subspecies has a very restricted range and now occurs in extreme southwestern Ontario south of the Bruce and Niagara peninsulas, including the study area. The size of the population is estimated at 0 to 200 individuals, and trends are unknown. It is completely isolated from all other badger populations. The habitat requirements of the American Badger are not well understood, however friable soil suitable for badgers to burrow in and to support small burrowing mammals upon which badgers prey appears to be a key element. Open habitats, whether natural (grasslands) or man-made (agricultural fields, road right-of-ways, golf courses), are generally used. Little is known about badger habitat in southern Ontario, but it appears to be severely fragmented by human development, and individual badgers are at high risk of being killed on roads. The NRS technical report did not report this badger as having been recorded within the study area. The American Badger has also not been recorded as a significant species within Wellington County. No evidence of burrows, etc. for the badger were noted during a field assessment of the project area. Given the residential nature and urban setting of the project area, the American Badger is unlikely to inhabit the study area.

- **Grey Fox:** The SARA registry indicates that the Grey Fox is a SARA Schedule I 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. In spite of these habitat preferences, the species is considered a habitat generalist and is often found on the outskirts of cities. As noted above, the NRS technical report indicated that this fox is considered to be a species of significance in Wellington County, although none were observed during a field assessment. The project area is not considered to be habitat for this species given the residential and agricultural development and as a result, is unlikely to inhabit the study area.

6.2.4.3 Herpetofauna

(a) Existing Habitat

The NRS technical report stated a total of 14 species of amphibians and reptiles were identified in the vicinity of the study area following a review of available data. One species, a green tree frog, was observed in the study area during a site visit. The report also indicated that a total of five herpetofauna species are considered significant in Wellington County, including the Jefferson salamander, Butler's gartersnake and the Massasauga Rattle Snake. The project area is not considered habitat for these species given the residential and agriculture development in the area.

(b) Species at Risk

A search of the SARA registry indicated there is one herpetofauna which has a possible range within the study area, the spotted turtle, which is a SARA Schedule I endangered species. In Ontario, the Spotted Turtle occurs in the lower Great Lakes Region. Spotted Turtles are normally found in ponds, ditches, streams, swamps, bogs and marshes. They generally prefer soft (muddy) substrate and some aquatic vegetation. Spotted Turtles require quiet water; their presence in large, swift-flowing bodies of water usually indicates marshy areas along the shores. Given the nature of the habitat associated with this project, it is unlikely that the Spotted Turtle inhabits the study area or will be affected by the undertaking.

6.2.4.4 Lepidopterans

(a) Existing Habitat

The NRS technical report did not identify any lepidopterans in the vicinity of the study area following a review of available data. No lepidopterans were observed during site visits.

(b) Species at Risk

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 I 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. NRS completed a field assessment of plants in the project area and included a listing of identified plants in its report. None of the above mentioned plants were observed during the field assessment. 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 undertaking.

6.2.4.5 General Conclusions Regarding Existing Habitat

Based upon the findings of the biological investigation and comments from regulatory agencies, the following conclusions were drawn regarding wildlife habitat within the vicinity of the project area:

- No SARA Schedule I species are known to inhabit the study area.
- No provincially significant species are known to inhabit the study area.
- The affected habitats are influenced by existing residential and agricultural activities and are not considered significant for wildlife species.

6.3 Cultural Characteristics

6.3.1 Cultural Heritage

The community of Clifford 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 involves development on lands which are previously undisturbed by construction (being the Nelson Street well site and a small component of the associated utility corridor immediately east of the railbed). Development on these lands would therefore have the potential to impact upon buried cultural heritage resources. At the outset of the Class EA investigation, preliminary details on the proposed works were circulated to the Ministry of Culture (Heritage & Libraries Branch, Southwest District). The Ministry evaluated the proposal taking into consideration its defined screening criteria and its database of known historical sites in the vicinity of the proposed works.

In correspondence dated July 8, 2002, the Ministry advised that the proposed site and watermain route do not appear to have the potential to impact upon buried heritage resources. No further investigations were required to assess the impacts of the project on cultural heritage resources.

6.4 Economic and Social Characteristics and Conditions

6.4.1 Historical Land Use

The southwestern district of Clifford has historically been utilized for farmland. Since the Second World War, most lands in the vicinity of the Nelson Street site have gradually been developed for low-density residential purposes.

6.4.2 Land Use Planning and Site Activities

The County of Wellington Official Plan designates virtually all lands west of the former railway line for residential purposes. The only exceptions noted are Marshall Park (designated "Recreational") and lands fronting Nelson Street, east of Minto Street South (designated "Industrial"). The subject lands form the eastern portion of those lands designated for industrial activities.

Land uses adjacent to the project site are as follows:

North: Residential (single detached dwellings)
West: Industrial (telecommunications works yard)
South: Residential (single detached dwellings)
East: Open Space (former railway line)

7.0 ENVIRONMENTAL EFFECTS ANALYSIS

7.1 Approach

7.1.1 Defined Valued Ecosystem Components

The identification of VEC's for this study 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 proposed works.

VEC's selected for this project are:

- Ground water quantity and quality.
- Surface water quantity and quality.
- Fisheries and aquatic resources.
- Terrestrial features (vegetation and wildlife).
- Species at risk.
- Noise.
- Air quality.

- Local users of ground water.
- Adjacent land uses (development patterns, downstream effects, potential contamination sources).
- Local neighbourhood and residents.
- First Nations communities.
- Worker health and safety.
- Public health and safety.
- Aesthetics.
- Heritage and historical cultural resources.
- Sewage treatment plant capacity.
- 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 Quality and Quantity

7.2.1 Potential Environmental Effects on Ground Water Quantity

7.2.1.1 Well 3 Capacity Evaluation

(a) Objectives

Preliminary testing of Well 3 was completed following well construction and development in March 2004. The testing activity included variable rate step tests and long-term pumping tests to confirm the available supply and to measure drawdown effects.

The testing was designed to:

- Confirm that Well 3 was completed in the same deep aquifer as TW2/02.
- Confirm that the aquifer response of Well 3 is equivalent to TW2/02.
- Confirm that water quality of Well 3 is equivalent to TW2/02.
- Identify the water quality from Well 3 at different flow rates to test the concept of installing a variable speed pump for production purposes.

(b) Variable Rate Step Testing

Variable rate step testing was completed for Well 3 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 (see section 7.2.2 for a discussion on water quality results). Previous testing of TW2/02 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
Clifford Well 3:
Results of Variable Rate Step Test

	Step 1	Step 2	Step 3
Pumping Rate (L/s)	4.5	9.1	11.4
Total Drawdown after 30 minutes	4.86	11.59	15.28
Specific Capacity (L/s/m)	0.93	0.78	0.74

The variable rate testing indicates that Well 3 is capable of providing a capacity greater than 11.4 L/s without experiencing a significant reduction in specific capacity. However, since the physical water quality above 7.6 L/s contained sediment, it was determined that the well should be developed for that maximum capacity.

(c) Long-Term Testing

Based on the results of the variable testing and the water quality analysis, it was decided to complete long-term pump testing at flow rates of 3.8 and 7.6 L/s. Long-term testing of Well 3 was completed in March 2004 for the identified capacities. The purpose of the assessment was to ascertain the water quality and aquifer response following extensive pump operation.

Long-term testing of Well 3 consisted of pumping at 3.8 L/s for 68.8 hours continuously, followed by an increase in the pump rate to 7.6 L/s for an additional 71.7 hours. The static water level in Well 3 prior to testing was 14.40 metres below the top of casing (btoc) as measured under static conditions on March 19, 2002. After 68.8 hours of pumping at 3.8 L/s, the water level had declined 5.57 m (to a level of 19.97 m btoc). After an additional 71.7 hours of pumping Well 3 at 7.6 L/s, the water had declined a further 4.14 m to a level of 24.11 m btoc.
Table 7.2 is a summary of the wells monitored during the long-term pumping test and their response to pumping Well 3 at the identified capacities.

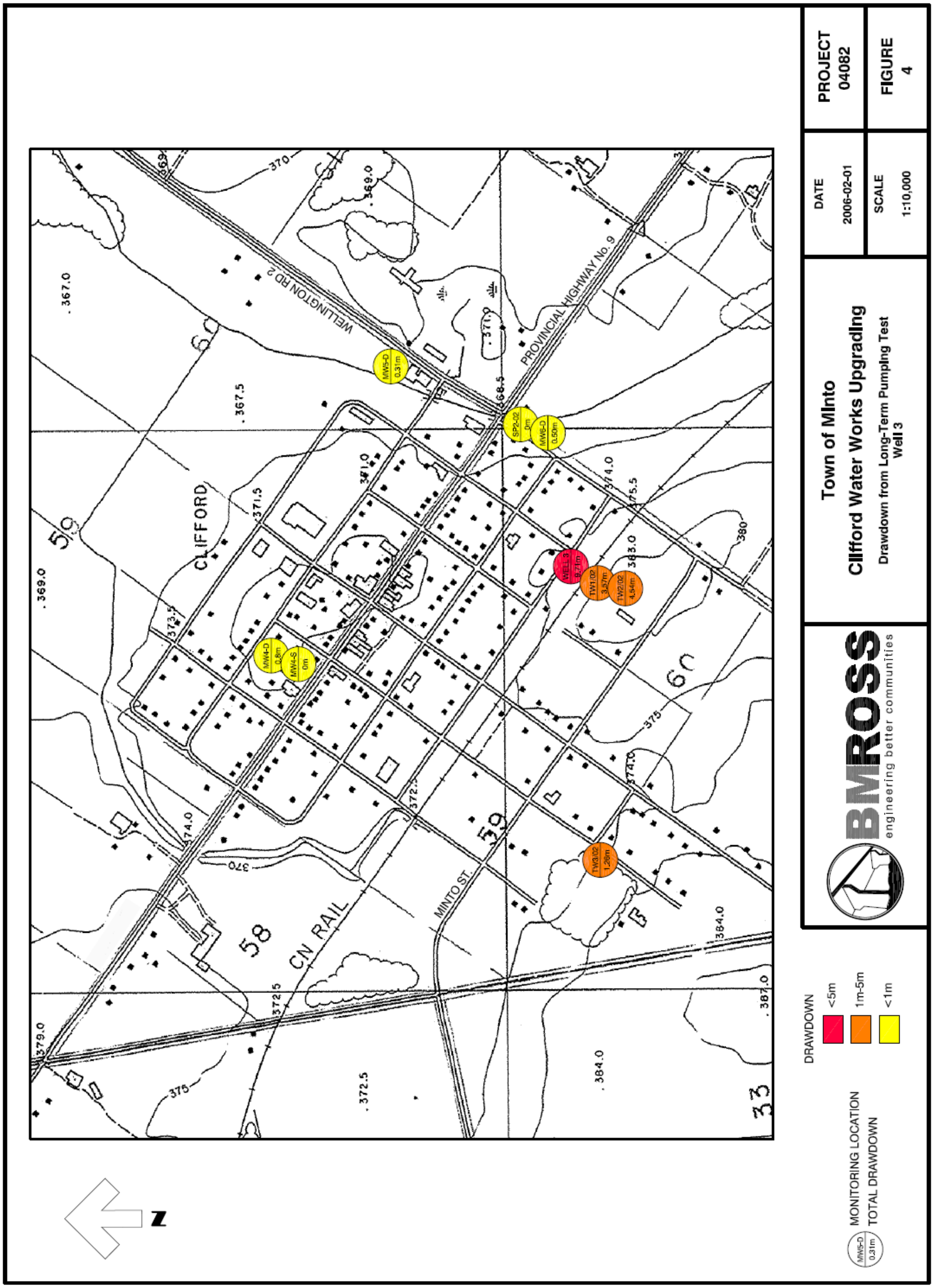
Table 7.2
Clifford Well 3:
Results of Long-term Pumping Test

Monitor Location	Distance from Well 3 (m)[1]	Drawdown, 3.8 L/s Portion of Test (m)	Drawdown, 7.6 L/s Portion of Test (m)	Total Drawdown (m)
Well 3	0	5.57	4.14	9.71
TW1/02	7.5	2.10	1.47	3.57
TW2/02	7.4	2.71	1.83	4.54
TW3/02	480	0.60	0.66	1.26
MI-MW4-00-DO	495	0.3	0.5	0.8
MI-MW4-00-SO	495	0	0	0
MI-MW5-00-DO	550	0.16	0.15	0.31
MI-MW6-00-DO	310	0.31	0.19	0.50
SP2/02	340	0	0	0

Note: 1 Distances outside of the Nelson Street site are measured from 1:5,000 scale mapping.

The long-term pumping test at Well 3 indicated a stable long-term pumping level of approximately 23.9 m below grade (bg) at a rate of 7.6 L/s. In review, the drawdown due to pumping Well 3 at a rate of 7.6 L/s will be limited to within a 900 metres radius of the facility. The total drawdown will be limited to less than 4.81 m in any of the existing wells surrounding Well 3.

The closest existing domestic well outside the Village is 550 m from the Well 3 site. Drawdown due to long-term pumping of Well 3 at this location is calculated to be less than 0.31 m based on the response of monitoring wells (refer to Figure No. 4). It is recommended that this domestic well should be investigated further to ensure that the reduction in water levels will not affect this supply and that the well is not a potential source of contamination for the aquifer. The three other domestic wells within 1000 m of the Well 3 site should also be investigated and possibly improved.


PROJECT
04082
FIGURE
4
DATE
2006-02-01
SCALE
1:10,000
Town of Minto
Clifford Water Works Upgrading
Drawdown from Long-Term Pumping Test
Well 3
BMROSS
engineering better communities
DRAWDOWN
<5m
1m-5m
<1m
MONITORING LOCATION
TOTAL DRAWDOWN
N
CLIFFORD
WELLINGTON RD 2
PROVINCIAL HIGHWAY No. 9
CN RAIL
MINTO ST.
MW5-D
0.31m
SP2-02
0m
MW6-D
0.50m
WELL 3
TW1/02
3.47m
TW2/02
4.54m
MW4-D
0.8m
MW4-S
0m
TW3/02
1.26m

(d) Ground Water Recharge

Issues pertaining to ground water recharge in the study area were evaluated as part of the GMPS and the Wells 3 and 4 investigation. The following represent the key findings of those reviews:

- In principle, all areas where infiltration can occur can be defined as potential recharge areas.
- Recharge areas are identified by significant downward vertical gradients.
- Topographically elevated areas with permeable formations generally form the principal recharge areas.
- Based on surficial geology, 50% of the Town of Minto is covered by relatively impermeable fine grained Elma Till. Recharge therefore occurs at a relatively slow rate but over a large area.
- Numerous granular deposits in the north also enhance infiltration and recharge.
- The water budget analysis carried out for the GMPS indicates that an average of 280 million cubic metres of water falls as precipitation on Minto annually. It is estimated that at least 56.4 million cubic metres (21%) of this water becomes ground water (with some discharge to surface water).
- It is estimated that 624,994 m^3 of ground water is used in Minto. The total amount of water used represents approximately one percent of the water that infiltrates each year. This suggests that there is sufficient water to meet future demand requirements.

(e) Supply Capacity Analysis

According to study findings, the theoretical drawdown resulting from 10 years of continuous pumping at a rate of 7.6 L/s would be approximately 12.6 metres. This would result in a pumping level of 27.0 metres bg. Given that the pump intake is located at a depth of 32.3 m bg, over 5.3 metres of available drawdown is provided in the well. However, testing confirmed that Well 3 responds as a leaky confined aquifer, as the drawdown from the well operation did not result in stable water levels (suggesting that the drawdown cone was continuing to expand and that leakage was not sustaining the water taking). Based on study findings, aquifer leakage will be extremely heterogeneous due to the variability of the overburden in this area. Only through long term pumping and monitoring will the exact response be determined.

The theoretical pumping level of 27.0 metres bg is conservative in nature, based on the assumption that water is pumped from Well 3 continuously for 10 years on a 24 hours per day basis. Under actual conditions, Well 3 will operate on a cyclic basis and the pumping level will be higher than 27.0 metres. Even if Well 3 produces all the required water for the Town, the drawdown in Well 3 would be less than the extreme condition predicted above. However, it is recommended that regular water level measurement should be completed to track any unforeseen water level declines.

7.2.1.2 Well 4

(a) Methodology

Preliminary testing of TW1/02 was completed in February 2002 in order to define the capacity of the well supply. The testing procedures conducted at that time provided an indication of the sustainability of the Well 4 bedrock aquifer and the potential impact that Well 4 could have upon the surrounding hydrogeologic environment.

(b) Variable Rate Step Test

Variable rate step testing for TW1/02 was conducted in the similar manner to the study work carried out for Well 3. Table 7.3 summarizes the results of the variable rate step test for Well 4.

Table 7.3
Clifford Well 4 (TW1/02):
Results of Variable Rate Step Test

	Step 1	**Step 2**	**Step 3**	**Step 4**
Pumping Rate (L/s)	4.6	9.1	13.7	15.9
Total Drawdown after 30 minutes	1.48	4.04	7.77	11.42
Specific Capacity (L/s/m)	3.07	2.25	1.76	1.39

The variable rate testing indicates that TW1/02 is capable of providing a capacity greater than 15.1 L/s. A constant reduction in specific capacity was identified as the rate is increased incrementally from 4.6 L/s to 15.9 L/s, however it is anticipated that the well will operate efficiently at higher flow rates.

(c) Long-term Testing

Long-term testing of TW1/02 was completed in June 2002. The testing consisted of pumping at 15.2 L/s for 72.5 hours continuously. The static water level in Well 4 prior to testing was 13.34 metres btoc as measured under static conditions. After the completion of long-term testing, the water level had declined 17.67 m to a level of 31.01 m btoc.

Table 7.4 summarizes the response rates of monitoring wells during the Well 4 long-term testing procedure.

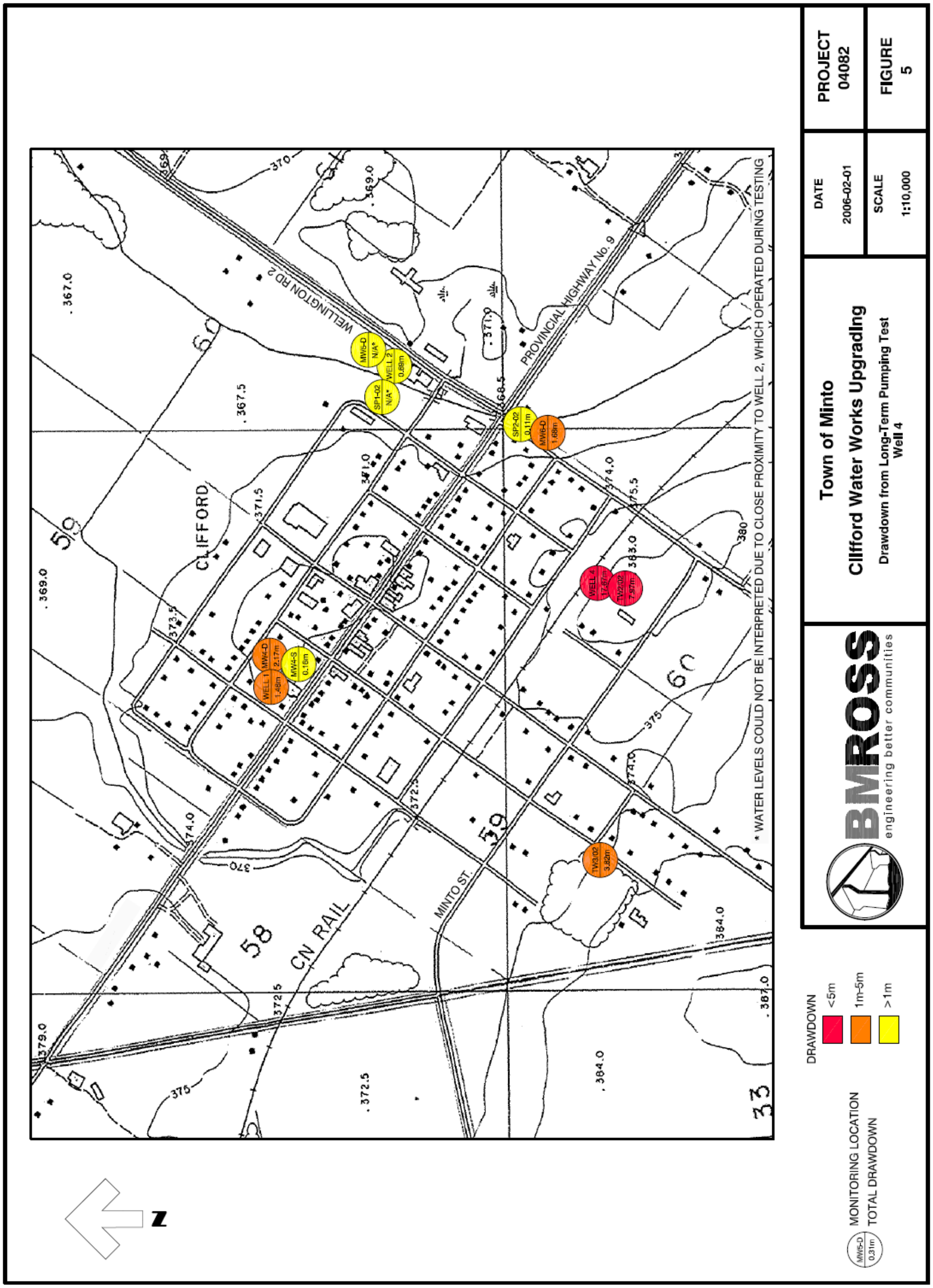
Table 7.4
Clifford Well 4:
Results of Long-term Pumping Test

Monitor Location	Distance from TW1/02 (m)[1]	Water Level Decline Observed after Pumping TW1/02 for 72.5 hours (m)
TW1/02 (Well 4)	0	17.67
TW2/02	3.44	7.97
TW3/02	400	3.82
MI-MW4-00-DO	410	2.17
MI-MW4-00-SO	410	0.16
MI-MW5-00-DO	570	N/A[2]
MI-MW6-00-DO	360	1.68
SP1/02	530	N/A[2]
SP2/02	370	0.11
Well 1	415	1.48
Well 2	570	0.69

Note: 1 Distances outside of the Nelson Street site measured from 1:5,000 scale mapping.
2 Water levels at M1-MW5-00-DO and SP1-02 could not be interpreted due to close proximity to Clifford Well 2, which operated during testing.

The testing procedure at TW1/02 indicated a stable long-term pumping level of approximately 31.0 bg at a rate of 15.2 L/s. The data reveals a significant water level response in the bedrock aquifer (3 m ±) within 500 m of TW1/02 and considerably less response for wells outside of this area (less than 1 m). Measurable drawdown due to the pumping of Well 4 appears to be limited to wells within 1000 m of the site. Figure No. 5 illustrates the results of the long-term pumping test.

Well 4 was specifically tested in April 2004 via a 50-minute test at a rate of 15.2 L/s in order to confirm its aquifer response and to obtain water samples. The static water level prior to testing Well 4 was 13.72 m btoc. After 50 minutes of pumping at a rate of 15.2 L/s, the water level lowered by 7.72 m to 21.44 m btoc. This is substantially less than the 50-minute drawdown of 12.41 m recorded during the 2002 long-term test. The reduced drawdown at the same pumping rate indicates a slight increase in well efficiency due to additional aquifer development during the overdrilling and redevelopment of TW1/02 to a larger diameter.


PROJECT
04082
FIGURE
5
DATE
2006-02-01
SCALE
1:10,000
Town of Minto
Clifford Water Works Upgrading
Drawdown from Long-Term Pumping Test
Well 4
BMROSS
engineering better communities
DRAWDOWN
<5m
1m-5m
>1m
MONITORING LOCATION
TOTAL DRAWDOWN
* WATER LEVELS COULD NOT BE INTERPRETED DUE TO CLOSE PROXIMITY TO WELL 2, WHICH OPERATED DURING TESTING
CLIFFORD
WELLINGTON RD 2
PROVINCIAL HIGHWAY No. 9
CN RAIL
MINTO ST.
MW5-D N/A*
SP1-02 N/A*
SP2-02 0.11m
MW6-D 1.68m
MW4-D 2.17m
WELL 1 1.48m
MW4-S 0.16m
TW3-02 3.82m
N

(d) Summary of Water Quantity Results

According to study findings, the theoretical drawdown resulting from 10 years of continuous pumping of Well 4 at a rate of 15.2 L/s would be approximately 19.6 m. This would result in a pumping level of 33.0 m bg. Given that the pump intake is situated at a depth of 41.0 m bg, over 6.4 m of available drawdown would be provided in the well.

The theoretical pumping level of 33.0 m bg is a conservative estimate, based on the assumption that water is pumped from Well 4 continuously for 10 years on a 24 hours per day basis. Under actual conditions, both Well 3 and Well 4 will operate on a cyclic basis and the pumping levels will be higher in both wells. Well 4 will also alternate with Well 1 and will therefore not operate continuously in the long-term.

Long-term testing demonstrated that there would be no adverse impact due to the operation of Well 4 (measurable drawdown due to pumping will be limited to 1000 m). Additional monitoring is required to evaluate the potential impacts to the domestic wells within this defined area and to determine the response of SP2/02 to Well 4 pumping. Water level data for SP2/02 showed conflicting responses to the 2002 and 2004 pumping tests. The 2002 data suggests a possible response, while the 2004 data exhibits no response. Further monitoring is required to confirm the lack of response observed in 2004.

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 TW1/02, TW2/02, Well 3 and 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 PTTW application requirements.

Table 7.5 summarizes the sampling results from the Nelson Street test wells and production wells. The parameters presented in the table are considered important indicators of water quality.

Table 7.5
Water Quality Analysis:
Nelson Street Well Supply

Parameter (mg/L)	TW1/02	Well 4	TW2/02	Well 3	ODWQS
Sodium (Na)	9.2	8.6	6.0	10.9	200
Iron (Fe)	0.53	0.53	0.20	0.05	0.30
Chloride ($C1^-$)	26.2	20.4	24.3	26.3	250
Manganese (Mn)	0.054	0.049	0.025	0.015	0.05
Nitrate ($NO3^-$)	0.2	0.2	0.2	0.4	10
Sulphate ($SO4^{-2}$)	32.3	31.8	34.0	30.0	500

In review, the water available from Wells 3 and 4 achieves the parameters set out by the ODWQS with the exception of the Iron and Manganese concentrations in Well 4 water. These deficiencies and related water quality issues are discussed below:

- Long-term pumping tests completed on Well 4 in the spring of 2004 revealed iron concentrations in the well water ranging from 0.49 to 0.53 mg/L. These findings are largely consistent with previous long-term testing of TW1/02 at 15.2 L/s conducted in the summer of 2002. Under this testing regime, the water initially contained iron at a concentration of approximately 1.73 mg/L which decreased to a stabilized concentration of approximately 0.50 mg/L by the conclusion of testing.

- The water quality from Well 3 is consistent with the water quality from TW2/02. This was anticipated, as Well 3 is drilled into the same aquifer and is located in close proximity to the test well. Iron and manganese concentrations for Well 3 are significantly less than those for Well 4. The water quality for Well 4 is consistent with the water quality from TW1/02, which is expected since Well 4 is constructed at the same location.

- Hydrogeologic data indicated that during long-term pumping of Well 3 at 3.8 L/s the water initially contained an iron concentration of approximately 0.92 mg/L. The iron concentration decreased to 0.54 mg/L after 20 minutes and to 0.04 mg/L by the end of the test. After the pumping rate was increased to 7.6 L/s the iron concentration increased immediately to 0.35 mg/L, but decreased to 0.11 mg/L within 15 minutes of the increase in pumping rate. The iron concentration in Well 3 ultimately stabilized at a level of approximately 0.16 mg/L during long-term pumping. This compares favourably to the iron testing completed on TW2/02 in the summer of 2002. During that test, the iron concentration stabilized at 0.2 mg/L at a pumping rate of 15.2 L/s.

- The increase in iron in the water is interpreted to be due to an increase in upward flow from the underlying bedrock aquifer (which contains higher iron concentrations). The level of iron in the water from the wells can therefore be minimized by pumping Well 3 at low flow rates for long periods, in contrast to the typical start/stop operation of municipal wells (where pumps operate at peak rate for shorter intervals).

- Data for Nitrilotriacetic acid (NTA) and benzo(a)pyrene were not available for Well 4.

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 (GUDI). MOE guidelines indicate that well supplies may potentially be GUDI if the facilities:

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

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 drain 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 Nelson Street Well Supply is approximately 280 m from Coon Creek. As result, Well 3 does not fall within the category of a potentially GUDI water source (given that it is an overburden 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). Well 4, in contrast, is a bedrock well that is within 500 m of surface water. If there is response with a surface water monitor, GUDI status becomes a concern. For this reason, stream piezometer SP2/02 was equipped with an automatic water level recorder to evaluate any possible ground water/surface water interaction. The 2004 data indicates that SP2/02 is not responding to pumping Wells 3 or 4. This should be confirmed with additional monitoring of SP2/02 once the two wells are equipped.

In summary, water quality data for Wells 3 and 4 show no impact of surface related activities as the concentrations of nitrate, chloride and sodium are all within natural background levels. The deep overburden and bedrock aquifers at the Nelson Street site are therefore not considered GUDI. This will be confirmed with additional water level monitoring in SP2/02 following the development and operation of the two well supplies.

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 Nelson Street Well Supply.

- The overall quality of the ground water pumped from Wells 3 and 4 is considered suitable for a municipal water system. Water from the wells meets the ODWQS, except for iron and manganese concentrations in Well 4 (being aesthetic parameters which are not health-related). Iron and manganese treatment may be recommended for the bedrock supply pending the outcome of more detailed chemistry analyses.

- Well 3 was selected as the primary water source due largely to the low iron concentrations found in the water supply. However, water produced from Well 3 contains levels of iron that exceed the ODWQS upon commencement of pumping but decline below the limit within three hours of start-up. Lower pumping rates can further reduce the concentration of iron in water from the deep overburden aquifer.

- The overburden aquifer that supplies Well 3 is regionally extensive and obtains recharge from the underlying bedrock aquifer and the overlying aquitard. This aquifer provides a higher quality of water than is evident with the existing bedrock supply wells (being more mineralized water sources). The regional nature of the aquifers and the leakage from above and below will sustain this water source on a long-term basis.

- The hydrogeology of the deep overburden aquifer is such that increased pumping rates result in increased leakage from the underlying bedrock aquifer. This is a problem as the iron concentration in the bedrock aquifer is typically in the range of 0.6 mg/L (compared to concentrations of less than 0.2 mg/L evident in the deep overburden aquifer).

- Well 3 can produce 7.6 L/s for potable use on a long-term basis. Well 4 can produce the required flow of 15.2 L/s to provide a back-up supply to Well 1 without adverse impacts in the surrounding area. The long-term pumping water level will be approximately 27 m bg in Well 3 and approximately 33 m bg in Well 4.

- The existing wells in the area, including domestic water supplies, should not be adversely affected by the operation of Wells 3 and 4. Additional monitoring should be conducted to confirm the impacts resulting from the pumping of the new well supplies.

- Wells 3 and 4 are not considered to be under the influence of surface water. This should be confirmed with additional monitoring of stream piezometer SP2/02 following well commissioning.

- TW2/02 should be maintained as a monitoring well.

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 Nelson Street Well Supply was governed by the following recommendations, in order to optimize the water quality and supply capacity available from Wells 3 and 4 and to minimize the adverse hydrogeological impacts associated with the operation of these wells.

- Well 3 should be equipped with a variable speed submersible pump in order to minimize the concentration of iron in the water. Ideally, this pump would provide the majority of the water source by running at flow rates of less than 3.8 L/s during the majority of the low water use seasons. When higher demand occurs, the flow rate of Well 3 can increase to its permitted rate of 7.6 L/s.

- Well 4 should be equipped to pump 15.2 L/s and connected to the distribution system once all approvals are received.

- Wells 3 and 4 should not be operated at the same time.

- Well 4 should alternate with Well 1 and should not be operated continuously on a long-term basis. Wells 1 and 4 could operate simultaneously during emergency conditions. Once Wells 3 and 4 are in service, testing of Well 1 should be completed to determine the maximum combined capacity at higher flow rates.

- Additional start/stop development of both Wells 3 and 4 should be completed prior to connection to the distribution system. This would ideally be completed once permanent 3-phase power is available at the site.

- Well 4 should be sampled for NTA and benzo(a)pyrene once the supply is equipped with a permanent pump.

- TW2/02 should be maintained as a monitor well with a secure well cap.

- The four nearby domestic wells should be investigated and monitored during the first two years of operation to ensure they are not impacted due to pumping. The wellheads may need to be upgraded to allow monitoring. If evidence of drawdown is observed in these monitoring wells following the development and operation of the Nelson Street site, the Town would be required to implement mitigation measures (e.g., reducing pumping rates, upgrade private well supplies, connect affected residents to the municipal system).

- Water levels in stream piezometer SP2/02 should be monitored to confirm that ground water/ surface water interactions do not occur as a result of the operation of Wells 3 and 4.

7.2.4.2 Standard Construction Mitigation

Table 7.6 summarizes a series of standard mitigation measures which are incorporated into the contract specifications of the project. Implementation of these measures will serve 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
Clifford Water Works Upgrading Construction Plan:
Standard Construction Mitigation

	Planned Mitigation
Refuelling and Maintenance	- Identify suitable locations for designated refuelling and maintenance areas (e.g., away from watercourses, storm inlets, and natural areas). - Refuelling or maintaining equipment will not occur within 30 m of a watercourse. Spillage and reporting plans are required. - Cleaning of equipment is not to occur in watercourses and in locations where debris can gain access to sewers or watercourses. - 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. - 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. - 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. - 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).

	Planned Mitigation
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. - Provide temporary drainage and pumping to keep excavation and site free from water. - Control disposal or runoff or water containing suspended materials or other harmful substances in accordance with approval agency requirements. - Provide settling ponds and sediment basins as required. - Do not direct water flow over pavements, except through approved pipes/ troughs. - 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. - 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. - 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. - Restrict tree removal to areas designated by the Contract Administrator. - Minimize stripping of topsoil and vegetation.
Sedimentation/ Erosion Control	- Erect sediment fencing to control excess sediment loss during construction period. - Minimize the removal of vegetation from sloped approaches to watercourses. - Protect watercourses, wetlands, catch basins and pipe ends from sediment intrusion. - Complete restoration works following construction. - 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. - 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.

7.2.4.3 Wellhead and Aquifer Protection Plan

Contract specifications for the development of Wells 1, 3 and 4 mandated 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 construction technique. As well, contract specifications mandated that the Contractor adhere to spill contingency protocols (refer to section 9.1.1 of this report).

7.2.4.5 Ground Water Level Monitoring

The construction plan for the development of Wells 3 and 4 required that ground water level monitoring be carried out to ascertain the potential impacts of well pumping. A network of monitoring wells, private wells and stream piezometers were monitored during the testing exercise using manual electronic water level meters and automatic water level recorders (AWLR). Manual measurements were collected at all locations before, during and after long-term testing. Data from AWLRs was collected at five minute intervals.

If evidence of drawdown is observed in the monitoring wells following the development of the Nelson Street site, the Town will be required to implement mitigation measures (e.g., reducing pumping rates, upgrade private well supplies, connect affected residents to the municipal system). Water levels in stream piezometer SP2/02 will also be monitored to confirm that ground water/ surface water interactions do not occur as a result of the development of the new well supplies.

7.2.4.6 Well Closure Plan

Well 2 has been decommissioned in accordance with Regulation 903. Contract specifications incorporated the standard mitigation measures summarized in Table 7.6 in order to protect ground water resources during the decommissioning phase.

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 aquifer drawdown.

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 within the study area. 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 surface water quality and quantity of Coon Creek were evaluated during the course of the hydrogeologic assessments of Wells 2, 3 and 4. The following conclusions were developed from the findings of the hydrogeologic study:

- Water quality data for Wells 3 and 4 show no impact from surface related activities.

- The deep overburden and bedrock aquifers at the Nelson Street site are not considered GUDI (additional monitoring is necessary to confirm the GUDI status of Well 4).

- The stream piezometers respond to pump testing of Well 2 at 4.5 L/s (the permitted rate). Decommissioning of this well would resolve this problem.

- The operation of Wells 3 and 4 would have immeasurable impacts on the shallow ground water flow system in the area and would be significantly less than the measurable impacts of operating Well 2.

- The ground water discharge conditions to Coon Creek will be maintained (unaffected) by the operation of Wells 3 and 4.

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 Fisheries and Aquatic Resources

7.4.1 Potential Effects on Fisheries and Aquatic Resources

The decommissioning activities at Well 2 site was the only undertaking carried out in an area adjacent to a watercourse (Coon Creek). The remainder of the project was carried out in areas which do not contain watercourses and are not adjacent to watercourses. There is the potential that deleterious materials could be released to Coon Creek and/or drainage systems during construction activities. This could have an impact upon fisheries and aquatic resources associated with Coon Creek.

7.4.2 Measures to Mitigate Effects on Fisheries and Aquatic Resources

Table 7.6 outlines several standard construction mitigation measures that were implemented during the construction phase of the project to limit the potential impacts of the project on fisheries and aquatic resources (e.g., sediment and erosion controls, restrictions for work in sensitive areas).

7.4.3 Residual Effects

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

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 on fisheries and aquatic resources. 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.

7.5 Terrestrial Features

7.5.1 Vegetation

7.5.1.1 Potential Effects on Vegetation

As discussed in section 6.2.3 of this report, terrestrial vegetation features within the study area are not considered significant or sensitive to development and are commonly found in the local area. Construction-related activities at the Nelson Street well site resulted in the temporary removal of vegetation within the road allowance and the permanent removal of approximately 240 m^2 of vegetation on the Nelson Street site (due to the construction of the elevated storage tank and the access road). Most of the vegetation removed temporarily and permanently from the defined right-of-way was manicured lawn. A limited number of small trees were removed in the vicinity of the former railroad right-of-way. None of the vegetation species affected by the work are considered sensitive or rare.

7.5.1.2 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) have been employed during the construction phase (Table 7.6 summarizes these measures).

The following provisions 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.

7.5.1.3 Residual Effects

Construction of this project required site clearing which will result in the permanent removal of approximately 240 m^2 of manicured lawn and a small number of shrubs and trees.

7.5.1.4 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.

7.5.2 Wildlife

7.5.2.1 Potential Effects on Wildlife

Construction-related activities resulted in the temporary removal of wildlife habitat within the Nelson Street road allowance and the permanent removal of approximately 240 m^2 of habitat on the Nelson Street site. Most of the temporarily affected areas provided limited habitat to species that are not significant or sensitive to development and are commonly found in the local area. The areas permanently affected by construction provided limited wildlife habitat value (e.g., refuge, foraging).

7.5.2.2 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).

7.5.2.3 Residual Effects

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

7.5.2.4 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.

7.6 Species at Risk

7.6.1 Potential Effects on Species at Risk

The *Species at Risk Act* was promulgated in June 2003. Schedule I to the SARA 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	American Badger	Grey Fox	-
Birds	Northern Bobwhite	Least Bittern	Yellow Breasted Chat virens subspecies
Reptiles & Amphibians	Spotted Turtle	-	-
Lepidoterans	-	-	Monarch
Plants, Lichens, Moss	American Ginseng 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. The biological assessment of Coon Creek conducted by NRS also concluded that the watercourse does not appear to be suitable habitat for Redside Dace and no evidence of this species was identified through the field survey (identified as a Species of Concern under Schedule III of the SARA registry).

7.6.2 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).

7.6.3 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.

7.6.4 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 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.

7.7 Air Quality

7.7.1 Potential Effects on Air Quality

The waterworks upgrades do not incorporate facilities which are designed to discharge air pollutants. In review, the water disinfection equipment represents the only project component which could contribute to local air pollution levels. Specifically, a release of the disinfectant, sodium hypochlorite, could have a harmful effect upon local environmental features (e.g., watercourses, air quality).

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.

7.7.2 Measures to Mitigate Effects on Air Quality

Multiple safety measures were incorporated into the design of the chlorine tank in order to minimize the potential impacts from a chemical release (e.g., provision of a secondary containment tank and adequate ventilation).

Contract specifications 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.

7.7.3 Residual Effects

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

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 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.

7.8 Noise

7.8.1 Potential Effects on Noise

The waterworks upgrades do not incorporate facilities which are designed to elevate ambient noise levels. In review, the well pumps and the water disinfection metering pumps represent the only project components which could contribute to local noise pollution levels. Specifically, the project involves the operation of submersible turbine pumps in Wells 3 and 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).

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 were 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 pumps for Wells 3 and 4 will be submersed in ground water 32.3 m and 40.5 m below grade, respectively, while the metering pumps will be housed within the insulated, concrete base of the elevated storage tank. Taking these factors into consideration, noise levels at the boundaries of the property are not anticipated to exceed 45 decibels 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 decibels (the point of reception in this instance is the nearest residential property).

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

Given the minimal noise levels anticipated from the constructed works, the project should not generate any residual effects on this VEC.

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 Socio-Economic and Cultural Environments

7.9.1 Local Users of Ground Water

7.9.1.1 Potential Effects on Local Users of Ground Water

Four domestic wells are situated within 1000 m of the Nelson Street Well Supply which could be affected by the development of a new municipal well supply.

7.9.1.2 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 supplies. In order to confirm this conclusion, the domestic wells will be investigated and monitored during the first two years of operation to ensure they are not impacted due to pumping. The wellheads may need to be upgraded to allow monitoring.

If evidence of drawdown is observed in these wells following the development of Wells 3 and 4, the Town 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.

7.9.1.3 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 aquifer drawdown.

7.9.1.4 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.

7.9.2 Adjacent Land Uses

7.9.2.1 Development Pattern

7.9.2.2 Potential Effects on the Development Pattern

The proposed Nelson Street Well Supply is situated in an area of Clifford which is currently residential in character and is planned for future residential growth. Concern exists that the introduction of a new well supply and storage facility would be incompatible or inconsistent with the existing and planned development pattern in the immediate area. In particular, the construction of an elevated storage tank has the potential to negatively impact upon surrounding land uses (given aesthetic impacts and shadowing effects). These land use conflicts could contribute to spatial crowding, particularly as the surrounding lands are developed for residential activities.

7.9.2.3 Measures to Mitigate Effects on the Development Pattern

The key policies guiding development in Clifford are the County of Wellington Official Plan and the *Town of Minto Zoning By-law*. As discussed previously, the subject lands are designated as Industrial in the Official Plan. Public services and utilities are permitted on lands in this designation. The subject lands are zoned “M1 Industrial Zone” by the local Zoning By-law. Section 6.34 of the By-law, entitled “Uses Permitted in all Zones”, prescribes that public works, such as water storage facilities and well supplies, are permitted in any zone. Accordingly, the works completed at the Nelson Street site are considered consistent and compatible with the existing framework of planning policies. The County of Wellington Planning and Development Department also reviewed the proposal and, in a letter dated May 17, 2002, indicated no concerns with the planned works. Furthermore, no planning-oriented objections were raised to the project during the course of the public consultation program. Taking these factors into consideration, no additional measures are proposed to mitigate potential land use conflicts.

7.9.2.4 Residual Effects

Given the foregoing, the project should not generate any residual effects on the local development pattern.

7.9.2.5 Significance of Residual Effects

Implementation of the project is not expected to have a significant adverse environmental effect upon the local development pattern. 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.

7.9.3 Downstream Effects

7.9.3.1 Potential Effects on Downstream Effects

Hydrogeologic investigations have concluded the following with respect to surface water flow in the vicinity of Coon Creek (the closest watercourse):

- The operation of Wells 3 and 4 would have no measurable impacts on the shallow ground water flow system in the area and would be significantly less than the measurable impacts of operating Well 2.

- The ground water discharge conditions to Coon Creek will be maintained with the operation of Wells 3 and 4.

7.9.3.2 Measures to Mitigate Effects on Downstream Effects

Table 7.6 outlines a series of standard construction mitigation measures that were implemented during the construction phase of the project (e.g., sediment and erosion controls, restrictions for work in sensitive areas). These measures limit the potential impacts of the project on the Coon Creek flow regime downstream of the study area.

7.9.3.3 Residual Effects

Given the foregoing, the project should not generate any residual downstream effects.

7.9.3.4 Significance of Residual Effects

Implementation of the project is not expected to have a significant adverse environmental effect downstream of the project site. 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.

7.9.4 Potential Sources of Contamination

7.9.4.1 Potential Effects Relating to Possible Sources of Contamination

(a) Contaminant Inventory

A ground water contaminant inventory and risk assessment was prepared for Minto as part of the GMPS. Information pertaining to potential sources of contamination were collected from several sources, including the MOE, the Technical Standards and Safety Authority (TSSA) and the Insurer's Advisory Organization (IAO).

The following data was provided by these agencies:

MOE
- PCB storage
- Waste disposal
- Organic Soil Conditioning
- Septage spreading
- Waste generators, receivers, haulers

TSSA
- Registered fuel tanks (gasoline, diesel, oil, propane)

IAO
- Historical fire insurance plans (urban areas)
- Fire inspection reports (commercial/ industrial properties)

Each site identified from the above-noted data sources was assigned a potential risk with respect to ground water contamination (e.g., high, low). Point and non-point sources of contamination were identified for Clifford (point sources of contamination have specific locations and can be plotted as discrete points on a plan).

Point Sources

For the Clifford area, the following point sources of contamination were inventoried and assessed for risk to ground water resources (refer to Appendix C):

- Gas stations (three former, one active).
- Smithing shops (two former).
- Factory (former).
- Mill (active).
- Tannery (former).
- Railway (former).
- Waste generator – liquid industrial waste (active).

Other considerations:

- The MOE Contaminated Sites database does not contain any reported spills (spill incidents are typically registered with the MOE).

- Septic systems tend to impact upon ground water in areas where large concentrations of these systems are evident (e.g., rural estate subdivisions, trailer parks). Septic systems in the vicinity of Clifford are not considered problematic in this regard, as there are no concentrations of septic systems in the vicinity of the community.

- The MOE database did not identify any abandoned wells in the Clifford area. Seven unused wells were identified in the area via resident surveys. It is anticipated that additional abandoned wells exist. The report recommends that further investigations into this matter be carried out during site specific hydrological investigations.

Based on information provided in the GMPS, all point contaminant sources were identified as having a “High” risk for contamination.

Non-Point Sources:

The following non-point sources of contamination were identified:

- Pesticide use (e.g., herbicides, insecticides, fungicides).
- Agricultural use (nutrient application).
- Lawn care.
- Organic soil conditioning/ septage sites (not applicable to the Clifford Area).
- Road salting.
- Agricultural drainage systems.

(b) Ground Water Modelling

Ground water modelling was carried out as part of the GMPS to delineate the well capture zones for the municipal supplies in existence at that time. Input parameters such as well radius, well discharge, transmissivity, aquifer thickness and hydraulic gradient were utilized to develop models for 100 day, 5 year, 10 year and 25 year capture zones.

A preliminary ground water vulnerability assessment was completed as part of the GMPS. The assessment involved assigning numerical scores related to the hydraulic conductivity and thickness of the material in each layer overlying the water table or aquifer. Based on the findings of the assessment, it was concluded that the entire Clifford urban area is rated as having a low vulnerability to contamination, due to the large overburden thickness with relatively fine grained material. In this regard, there will be a significant delay between the release of contaminants and potential impacts to the municipal well supply.

(c) General Conclusions Regarding Susceptibility to Contamination:

The findings of the GWPS assessments provided a basis for development of preliminary concepts regarding wellhead protection and land use planning. With respect to Clifford, the assessment was initially completed for Well 1. From that review, it was noted that the majority of potential contaminant sources are considered to be relatively low risk for ground water impacts. The exceptions noted are waste generators (including generators of petroleum hydrocarbon products) and a gas station. These uses could contaminate the ground water if inadequate containment is maintained. Periodic monitoring of water quality near the identified contaminant sites is recommended to ensure proper containment of any spills of waste oils and other contaminants on these sites.

7.9.4.2 Measures to Mitigate Potential Sources of Contamination

(a) Well Development

Well development activities associated with the Nelson Street Well Supply were 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 will minimize the risk for aquifer contamination during the well construction and decommissioning phases.

Contract specifications also mandated that the Contractor adhere to a series of emergency response and spill contingency protocols, including a requirement to notify the Wellington-Dufferin-Guelph Health Unit and the MOE Spills Action Centre if any spills occurred which caused damage to the environment. The response protocols are summarized in section 9.1.2.1 of this report.

(b) Future Source Protection Initiatives

The Saugeen Valley Conservation Authority, the Grey Sauble Conservation Authority and the Municipality of Northern Bruce Peninsula have been partnered for source water protection planning initiatives within their respective watersheds. The initiatives are 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 *Ontario Clean Water Act.* Municipalities, stakeholders and the general pubic would be involved in the decision-making process associated with these initiative.

With respect to Wells 1, 3 and 4, it is anticipated that the following activities will be undertaken during the course of the project:

- 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.

7.9.4.3 Residual Effects

Given the findings of the GWPS and the Burnside hydrogeologic investigation, as well as the identified mitigation measures, it is anticipated that Wells 3 and 4 can be developed as secure well supplies with a low susceptibility to contamination. In this regard, completion of the project should not generate any residual effects upon the security of existing well supplies or the municipal water system.

7.9.4.4 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 the security of existing well supplies or the municipal water system. 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.

7.10 Local Neighbourhood and Residents

7.10.1 Potential Effects on the Local Neighbourhood and Residents

The construction-related impacts resulting from the project were anticipated to be similar to those experienced with normal road and building construction. In this regard, the following impacts were anticipated as a result of this project:

- Elevated noise, odour and dust levels.
- Minor traffic disruptions along the Nelson Street corridor.
- Occasional disturbances to private property (e.g. materials laid across property boundaries).

In the long-term, the operation of an elevated storage tank with a pumphouse incorporated into the base of the facility will generate negligible levels of noise and air pollution. Traffic generated from operational activities will also be minimal (likely one to two vehicles per day). Decommissioning of the facilities will have impacts similar to the construction phase.

7.10.2 Measures to Mitigate Effects on the Local Neighbourhood and Residents

Table 7.6 outlines a series of standard construction mitigation measures that were implemented during the construction phase of the project (e.g., noise and traffic controls). These measures limited the potential impacts of the project on the local neighbourhood and residents.

7.10.3 Residual Effects

Given the foregoing, the project should not generate any residual effects on the local neighbourhood and residents.

7.10.4 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 the local neighbourhood and residents. 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.

7.11 Nearby First Nations Communities

7.11.1 Potential Effects on Nearby First Nations Communities

Saugeen First Nation No. 29 is the closest First Nations community to Clifford. The community is situated along the Lake Huron Shoreline approximately 60 km northwest of Clifford. The community of Clifford 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.

7.11.2 Measures to Mitigate Effects on Nearby First Nations Communities

No mitigation measures are proposed to limit the potential impacts of the project on First Nations communities.

7.11.3 Residual Effects

Given the foregoing, the project should not generate any residual effects on nearby First Nations communities.

7.11.4 Significance of Residual Effects

Implementation of the project is not expected to have a significant adverse environmental effect upon nearby First Nations communities. 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 Worker Health and Safety

7.12.1 Potential Effects on Worker Health and Safety

Activities associated with the implementation of the project (construction, operation and decommissioning phases) have the potential to adversely impact upon worker health and safety.

7.12.2 Measures to Mitigate Effects on Worker Health and Safety

Construction and operational activities associated with the project are being carried out in accordance with industry standards for worker health and safety.

In this regard, the Contractor must adhere to following health and safety protocols mandated within the Contract specifications. The key specifications in this respect are as follows:

- Provision of the necessary first aid items and equipment prescribed under the First Aid Regulations of the *Workplace Safety and Insurance Act* of Ontario.
- 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

7.12.3 Residual Effects

Given the foregoing and considering the scale and nature of the proposed works, the project should not generate any residual effects upon worker health and safety.

7.12.4 Significance of Residual Effects

Implementation of the project is not expected to have a significant adverse environmental effect upon worker health and safety. 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.

7.13 Public Health and Safety

7.13.1 Potential Effects on Public Health and Safety

Activities associated with the implementation of the project (construction, operation and decommissioning phases) have the potential to adversely impact upon public health and safety**.**

7.13.2 Measures to Mitigate Effects on Public Health and Safety

7.13.2.1 Construction Activities

Construction activities have been carried out in accordance with industry standards for public health and safety. Protective measures were set out in the contract documentation and include those defined by the *Ontario Provincial Standard Specifications* (OPSS) and any special provisions deemed appropriate given the proposed construction technique. In general, the provisions stipulate that the Contractor shall conduct operations in a manner which limits detrimental effects to the public. Table 7.6 outlines the general mitigation measures which were incorporated into the construction plan for the project.

7.13.2.2 Operational Activities

An Operations Plan has been prepared for the Clifford 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 Town of Minto has implemented the Operations Plan for Clifford Well 1 and will adapt the plan to reflect the equipment and procedural requirements associated with the operation of the Nelson Street Well Supply.

Table 7.8 provides a general summary of the procedural requirements stipulated within the Operations Plan. The purpose of these requirements is to operate the Clifford Water Works in accordance with established MOE standards, particularly with respect to defined requirements for water quality.

Table 7.8
Town of Minto Water Works Operations Plan:
Summary of Relevant Procedures (Clifford Water Works)

Water Treatment/ Monitoring	- The treatment system includes the use of sodium silicate for the sequestering of iron (Well 1 only) and sodium hypochlorite for disinfection of the raw water. The owner must ensure that the sodium hypochlorite meets American Water Works Association quality criteria and American National Standards Institute safety criteria. - The disinfection system in both pumphouses consists of a 100 L sodium hypochlorite storage tank, a chemical metering pump (chlorinator), piping and an injector. The storage tank is placed in a containment tank to retain any leakage and the chlorinator is installed above the storage tank. 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. - Treated water is constantly monitored in the pumphouse by a continuous on-line analyzer. The analyzer can measure free chlorine residual from 0 to 10 mg/L, and is complete with dual fully adjustable alarm set points. Continuous monitoring equipment for turbidity measurements samples the treated water for turbidity not less frequently than every fifteen minutes. The maximum alarm standard is 1.0 NTU. - Due to the high chlorine demand within the existing distribution system, the low alarm on the chlorine analyzer for Well 1 is set at 0.90 mg/L to ensure a chlorine residual of 0.20 mg/L at the extremities. This will remain at this setting until the distribution system is replaced. Corrective procedures, as defined in the Operations Plan and MOE Regulations, must be followed in the event that that chlorine residual decreases below 0.20 mg/L. - A Supervisory Computer and Data Acquisition (SCADA) system is scheduled to be installed and operational by mid-2005. The SCADA system will be used to control and monitor operation of the Town of Minto municipal water systems in the communities of Clifford, Palmerston and Harriston. The SCADA system will be configured such that each municipal system can function as an independent stand-alone control system. The Clifford Water Works component of the SCADA system will be located in the pumphouse at the base of the elevated storage tank. - The following features are common to all SCADA systems: ▪ Free chlorine residual and turbidity are monitored in the treated water being discharged from the downstream end of the chlorine contact watermain. ▪ At five-minute intervals, maximum, minimum and average values for the chlorine residual and turbidity will be calculated and recorded, based upon the 30 values sampled during the preceding five-minute period.

<table>
<tr><td></td><td>

Alarm signals generated by the analyzers (high and low chlorine residual, high turbidity and analyzer failure) input directly to the alarm dialer for forwarding to the operators. Alarms will be sounded at the pumphouse location and at the central SCADA node.
A high or low chlorine residual alarm or high turbidity alarm, will cause lockout of the well pumps. The pumps will not be allowed to restart without operator intervention.
Float switches in the chemical storage tanks will provide a low level alarm signal.
Discharge from the well pumps will be recorded on a daily basis.

</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.
- 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:
<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>
<tr><td>organic parameters</td><td>Every three years</td></tr>
<tr><td>sodium</td><td>Every five years</td></tr>
<tr><td>fluoride</td><td>Every five years</td></tr>
</table>
- If any sample result from the testing above exceeds 1/2 of the maximum acceptable concentration (MAC), sample frequency must be increased to quarterly.
- 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.
- The distribution system should be flushed on an annual basis and swabbed whenever microbial contamination becomes a recurring problem. Perimeter hydrants must be flushed at least biweekly. All other hydrants should be exercised twice per year and pumped out in the fall to avoid freezing.
- 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.
- Conduct an initial inspection and develop a summary for all production wells (including production, standby, test or monitoring wells) within the
</td></tr>
</table>

	immediate (50 day) capture zone of the production wells. This summary should document: ▪ Casing diameter and wall thickness ▪ Depth of well ▪ Type of well ▪ Material of casing ▪ Age of well ▪ Presence of annular seal ▪ Drainage around casing ▪ Extension of grade ▪ Well cap description - 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). - The operating authority should inspect all above grade well components on an annual basis. As part of the inspection work, the authority should: ▪ Record any deficiency that might affect the performance of the pumping equipment. ▪ Record any new potential sources of contamination within the 5 year capture zone. ▪ Record any deficiency that might potentially allow contaminants to enter the well. ▪ Review bacteriological and chemistry data to identify for changes or trends. ▪ Document the inspection and remedial action(s) taken, if applicable. - 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. - 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. - Daily inspections performed on the pumphouse should include the following maintenance and inspection procedures: ▪ Inspect for any security breach – e.g. door unlocked or ajar, window broken. ▪ Ensure heat is on in cold weather. ▪ Check all fittings and piping for leaks. - Other maintenance should include: ▪ Exercise and lubricate valves monthly. ▪ Calibrate flow meters annually.

	▪ Clean the turbidimeter chamber monthly. ▪ Calibrate the turbidimeter quarterly. - 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.

7.13.3 Residual Effects

Given the foregoing and considering the scale and nature of the proposed works, the project should not generate any residual effects upon public health and safety.

7.13.4 Significance of Residual Effects

Implementation of the project is not expected to have a significant adverse environmental effect upon public health and safety. 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.

7.14 Aesthetics

7.14.1 Potential Effects on Aesthetics

The construction of an elevated storage tank can represent a visual and physical intrusion to neighbouring property owners and the larger community. For this reason, a site selection process was conducted during the Class EA study to evaluate the relative merits of the identified storage sites (being the Nelson Street and Marshall Park locations). Matters such as land use compatibility, building setbacks, shadowing effects, lot size, sightlines, and cost were taken into consideration during the review.

7.14.2 Measures to Mitigate Effects on Aesthetics

The decision to select the Nelson Street site for a new storage site was predicated, in part, on the perception that the facility would not have a significant impact upon local aesthetics. This assessment was primarily based on the following considerations:

- Lands surrounding the Nelson Street site are relatively undeveloped, with the exception of residential units along John Street and an adjacent commercial/ industrial use.

- The John Street residential area is generally screened from the site by a series of large trees evident at the rear of the subject property.

- Residents in the vicinity of the project site did not express concern with the location for the storage facility during the public consultation process.

Based upon these considerations, no additional mitigation measures are proposed to mitigate the potential aesthetic impacts associated with the construction of a new elevated storage tank.

7.14.3 Residual Effects

Given the foregoing and considering the nature and design of the proposed works, the project should not generate any residual effects upon aesthetics.

7.14.4 Significance of Residual Effects

Implementation of the project is not expected to have a significant adverse environmental effect upon aesthetics. 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.

7.15 Heritage and Historical Cultural Resources

7.15.1 Potential Effects on Heritage and Historical Cultural Resources

Activities associated with the implementation of the project (construction, operation and decommissioning phases) have the potential to disturb heritage and historical cultural resources.

7.15.2 Measures to Mitigate Effects on Heritage and Historical Cultural Resources

The project proposes development on lands which are previously undisturbed by construction (being the Nelson Street well site and the associated utility corridor). Development on these lands would therefore have the potential to impact upon buried cultural heritage resources. At the outset of the Class EA investigation, preliminary details on the proposed works were circulated to the Ministry of Culture (Heritage & Libraries Branch, Southwest District). 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 July 8, 2002, the Ministry advised that the right-of-way and corridor do not appear to have the potential to impact upon buried heritage resources. No further investigations were required to assess the cultural heritage impacts of the proposed servicing plan. The Ministry did stipulate that the proponent must notify the Heritage & Libraries Branch if deeply buried archaeological resources are encountered during construction (including human remains).

7.15.3 Residual Effects

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

7.15.4 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.

7.16 Sewage Treatment Plant Capacity

7.16.1 Potential Effects on Sewage Treatment Plant Capacity

The waterworks upgrades have been designed to increase the total supply capacity in order to meet long-term water demands. Accordingly, these improvements will increase the sewage flow volumes discharged to the municipal sanitary sewage system over the planning period. The municipal sanitary sewer collection and treatment facilities were constructed in 1993-4 and were designed to service existing and future development activities in the community. The Clifford Sewage Treatment Plant (STP) is situated northeast of the James Street/ Brown Street intersection and has a rated hydraulic capacity of 500 m^3/day.

For the purposes of this investigation, a general review of the hydraulic capacity of the STP was carried out to assess the impact that increased sewage flows would have on plant operations. The following key issues were identified during this review:

- As of 2002, the average daily flow to the STP was 212 m^3 (equivalent flow rate: 265 L/cap•d). It is assumed that the significant variance between the average sewage flow rate and the average water demand (495 L/cap•d) can be attributed to high levels of unaccounted for water use within the water distribution system (it is unlikely that the sewage collection system experiences excessive exfiltration, given that the system is relatively modern). It is assumed that the excessive amount of unaccounted for water use in the water distribution system would be resolved following system upgrading.

- Applying the MOE guideline for per capita sewage flows, including extraneous flow, the plant has capacity to accommodate a population of approximately 925 persons (assuming an average flow volume of 540 L/cap•d). Under these flow conditions, the plant has the capacity to accommodate ten years of growth (given the population forecast summarized in Table 4.4).

- Under current operating conditions, it is estimated that an additional 130-140 L/cap·d is discharged to the STP via the bleeding procedures. Following the development of the Nelson Street Well Supply and the replacement of the existing water distribution system, it is anticipated that the use of bleeders will be discontinued.

Taking the above-noted issues into account, there would appear to be sufficient hydraulic capacity within the plant to accommodate growth until, at least, 2015 (assuming that the flow rate per person equivalent will not exceed the MOE design guideline in the long-term). Given that recent average per capita sewage flows are considerably less than MOE design guidelines, it is anticipated that the existing plant capacity will be capable of accommodating significantly higher growth levels. This will, in turn, likely extend the operational life of existing treatment facilities beyond 2015.

7.16.2 Measures to Mitigate Effects on Sewage Treatment Plant Capacity

It is recognized that minor modifications to treatment and disposal facilities at the plant may be needed to accommodate the increased sewage flows anticipated over the 20-year planning period (Sewage flow monitoring will provide the Town with data to forecast potential shortfalls in treatment capacity). However, the improvements to the water system are not anticipated to induce a significant increase in per capita flow rates or unanticipated levels of population growth.

7.16.3 Residual Effects

Given the foregoing, the project should not generate any residual effects upon the capacity of the Clifford STP.

7.16.4 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 sewage treatment plant capacity. 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.

7.17 Capacity of Renewable Resources

7.17.1 Potential Effects on the Capacity of Renewable Resources

The project involves development of a new well supply on lands which are previously undisturbed by construction, as well as the provision of site servicing via an undeveloped road allowance. Development on these lands therefore has the potential to impact upon the capacity of renewable resources, particularly the following matters:

- Ground water resources associated with the deep bedrock and overburden aquifers evident in the Clifford area.
- Vegetation and wildlife habitat within the servicing corridor.
- Vegetation and wildlife habitat evident at the well site.

7.17.2 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 respect:

- Ground Water Resources: The overburden aquifer that supplies Well 3 is regionally extensive and obtains recharge from the underlying bedrock aquifer and the overlying aquitard. The regional nature of the aquifers and the leakage from above and below will sustain this water source on a long-term basis. To minimize drawdown within the deep bedrock aquifer, Well 4 should alternate with Well 1 and should not be operated continuously on a long-term basis. Nearby domestic wells should be investigated and monitored during the first two years of operation to ensure they are not impacted due to pumping. If evidence of drawdown is observed in these monitoring wells following the development and operation of the Nelson Street site, the Town would be required to implement mitigation measures (e.g., reducing pumping rates).

- Utility Corridor Habitats: In the vicinity of the former railroad right-of-way, construction-related activities resulted in the temporary disruption of wildlife habitat and the removal of a limited number of trees, shrubs and grasses. Most of the temporarily affected areas provided limited habitat to species that are not significant or sensitive to development and are commonly found in the local area. The areas permanently affected by construction provided limited wildlife habitat value (e.g., refuge, foraging). Contract specifications incorporated a number of measures to protect vegetation in the vicinity of the project site (e.g., restrict tree removal is restricted to designated areas, restrict stripping of topsoil and vegetation to designated areas). None of the vegetation species affected by the work are considered sensitive or rare.

- Well Site Vegetation: Construction-related activities at the Nelson Street well site resulted in the temporary removal of vegetation to facilitate servicing and building activities and the permanent removal of approximately 240 m^2 of vegetation (being the footprint of the facilities and the access road). The affected areas provided limited wildlife habitat value and none of the vegetation species (grasses) impacted by the work are considered sensitive or rare.

7.17.3 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 aquifer drawdown.

7.17.4 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 Flooding and Erosion Hazards

8.1.1 Potential Effects of Flooding and Erosion Hazards

8.1.1.1 Flooding

Coon Creek represents the only watercourse in the study area which has the potential to flood the existing well sites and the defined right-of-way and corridor. The creek meanders through the southeastern section of the community within a defined channel and floodplain area having an approximate ground elevation of 365 m. Well 1 is situated approximately 425 m northwest of Coon Creek at an elevation approximately 10 m above the floodplain. Well 2 is situated approximately 50 m east of Coon Creek at an elevation of approximately 3 m above the floodplain. The Nelson Street site is situated approximately 300 m northwest of Coon Creek at an elevation approximately 10 m above the floodplain.

The preliminary hydrological study work identified that under extreme rainfall conditions, exceeding a 1 in 100 year event, flows of 50.0 m^3/s would be realized (being the Hurricane Hazel storm distribution). In this storm scenario, flood levels in Coon Creek could potentially overtop the 368 m elevation. However, the potential for ground water contamination via the flooding of Well 2 has been minimized following the abandonment of the well in accordance with Regulation 903.

8.1.1.2 Erosion

The defined right-of-way is not located in an area which is considered susceptible to erosion. In this regard, the Saugeen Valley Conservation Authority has not calculated specific erosion rates for these locations (given the lack of identifiable and measurable erosion impacts). There is also no record of erosion problems on any of these sites and no physical evidence of erosion impacts at these locations.

8.1.2 Measures to Mitigate Effects of Flooding and Erosion Hazards

Contract specifications for the development of Wells 1, 3 and 4 mandated 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 from flooding and erosion hazards. 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.

No additional mitigation measures were deemed necessary to mitigate flooding and erosion hazards.

8.1.3 Residual Effects

Given the foregoing, erosion, flooding and erosion 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, flooding and erosion hazards are not expected to have significant adverse environmental effects upon the project. 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 Ice Encroachment and Scouring Hazards

8.2.1 Potential Effects of Ice Encroachment and Scouring Hazards

Ice encroachment and scouring hazards are not anticipated to impact upon the physical works constructed at the Nelson Street well site, given the relative location of the Coon Creek floodway (discussed in section 8.1.1).

8.2.2 Measures to Mitigate Effects of Ice Encroachment and Scouring Hazards

Contract specifications incorporate the following measures to minimize freezing effects:

- The elevated storage tank will incorporate rigid foam insulation for the concrete pedestal and heated riser pipes.

- Underground servicing associated with the project will be buried at a depth below the established frostline (1.5 m.).

There is also no historical evidence that ice encroachment or scouring have impacted upon the physical works associated with Well Sites 1 and 2.

8.2.3 Residual Effects

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

8.2.4 Significance of Residual Effects

With the implementation of the identified mitigation measures, including monitoring, follow-up and any necessary adaptive management, ice encroachment and scouring hazards are not expected to have significant adverse environmental effects upon the project. 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.

8.3 Wind Hazards

8.3.1 Potential Effects of Wind Hazards

Wind conditions in the study area could potentially impact upon the stability of the new elevated storage tank.

8.3.2 Measures to Mitigate Effects of Wind Hazards

Contract specifications therefore require that the tank be designed to achieve the wind loading criteria defined within American Water Works Association (AWWA) Standard D100-96. In this regard, the design of the tank has accounted for the following:

- Wind Speed: 100 miles per hour (minimum);
- Cone Design Pressure: 15 pounds per square foot (psf);
- Cylinder Design Pressure: 18 psf.

8.3.3 Residual Effects

Given the foregoing, wind hazards 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, wind hazards are not expected to have significant adverse environmental effects upon the project. 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.

8.4 Seismic Hazards

8.4.1 Potential Effects of Seismic Hazards

The right-of-way and corridor are not located in areas identified as being highly susceptible to seismic activity.

8.4.2 Measures to Mitigate Effects of Seismic Hazards

Contract specifications required that the tank be designed to achieve the seismic loading standards prescribed by the Ontario Building Code. The project was therefore designed to the specifications of Earthquake Zone 1 (Zonal Velocity Ratio: 0.05). In this regard, the design of the tank has accounted for a lateral force of 199 kip (pounds force).

8.4.3 Residual Effects

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

8.4.4 Significance of Residual Effects

With the implementation of the identified mitigation measures, including monitoring, follow-up and any necessary adaptive management, seismic hazards are not expected to have significant adverse environmental effects upon the project. 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.

8.5 Climate Change

8.5.1 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.

8.5.2 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:

- **Ground Water Recharge Rates.** The hydrogeological study work completed for this project demonstrates that the Wells 1, 3 and 4 aquifers will sustain the municipal 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.

8.5.3 Residual Effects

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

8.5.4 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 have a significant adverse environmental effect upon the operation of the project. 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 from construction equipment and transported materials	- Adverse water quality in shallow/ deep aquifers
Surface water quantity and quality	- Contaminant spill - Siltation (due to high rainfall)	- Adverse water quality in nearby drains/watercourses
Fisheries and aquatic resources	- Contaminant spill - Equipment fire - Siltation	- Damage/ destruction to fish and fish habitat
Terrestrial features (vegetation, wildlife)	- Contaminant spill - Equipment fire - Siltation	- Damage/ destruction to native species and habitat
Species at risk	- Contaminant spill - Equipment fire - Siltation	- Damage/ destruction to identified species*
Noise	- Equipment malfunction (e.g., failed exhaust pipe)	- Elevated noise levels near the project site
Air quality	- Contaminant spill - Equipment fire - Equipment malfunction	- Deteriorated air quality near the project site
Local users of ground water	- Contaminant spill	- Adverse water quality in the ground water aquifers
Local neighbourhood and residents	- Contaminant spill - Equipment fire - Equipment malfunction - Displacement of building materials and excavated materials off-site	- Personal injury - Property damage

Valued Ecosystem Component	Incident	Environmental Effect
	(due to high winds/ rainfall)	
First Nations communities	- None anticipated	- Not applicable
Worker health and safety	- On-site accident (including chemical spill, equipment fire, vehicular collision)	- Personal injury
Public health and safety	- Traffic accident - Contaminant spill - Equipment fire - Equipment malfunction	- Personal injury
Aesthetics	- None anticipated	- Not applicable
Heritage and historical cultural resources	- None anticipated	- Not applicable
Sewage treatment plant capacity	- None anticipated	- Not applicable
Capacity of Renewable Resources	- Contaminant spill - Equipment fire - Siltation	- Adverse water quality in shallow/ deep aquifers - 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 have been 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 adhered 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 in this respect are 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 Wellington-Dufferin-Guelph 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 must develop a traffic management plan in accordance with the Ontario Traffic Manual Book 7 (Temporary Conditions) and subject to approval by the Town. The traffic plan developed for this project incorporates a limited number of measures, as the majority of construction activity is occurring outside of the travelled roadways.

The following measures were incorporated into the traffic management procedures and implemented when 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 in this respect are 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 are as 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 new 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 from on-site chemicals and operator vehicles - Low water levels	- Adverse water quality in shallow/ deep aquifers - Water shortages
Surface water quantity and quality	- Contaminant spill	- Adverse water quality in nearby drains/ watercourses
Fisheries and aquatic resources	- Contaminant spill	- Damage/ destruction to fish and fish habitat
Terrestrial features (vegetation, wildlife)	- Contaminant spill - Equipment fire	- Damage/ destruction to native species and habitat
Species at risk	- Contaminant spill - Equipment fire	- Damage/ destruction to identified species
Noise	- Equipment malfunction - Equipment fire	- Elevated noise levels near the project site
Air quality	- Contaminant spill - Equipment fire - Equipment malfunction	- Deteriorated air quality near the project site
Local users of ground water	- Contaminant spill - Equipment malfunction	- Adverse water quality in the distributed water - Personal injury - Water shortages
Local neighbourhood and residents	- Contaminant spill - Equipment fire - Equipment malfunction	- Personal injury - Property damage
First Nations communities	- None anticipated	- Not applicable
Worker health and safety	- On-site accident	- Personal injury
Public health and safety	- Contaminant spill - Equipment fire - Equipment malfunction	- Personal injury
Aesthetics	- None anticipated	- Not applicable
Heritage and historical cultural resources	- None anticipated	- Not applicable
Sewage treatment plant capacity	- None anticipated	- Not applicable
Capacity of Renewable	- Contaminant spill	- Damage/ destruction to native

Resources	- Equipment fire - Low water levels	species and habitat - Adverse water quality in shallow/ deep aquifers - 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.

9.2.3 Operations Plan

An Operations Plan has been prepared for the Clifford 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 Town of Minto has implemented the Operations Plan for Clifford Well 1 and will adapt the plan to reflect the equipment and procedural requirements associated with the operation of the Nelson Street Well Supply.

Table 7.8 provides a general summary of the procedural requirements stipulated within Operations Plan.

9.2.4 Contingency Plan

The Contingency Plan for the Clifford Water Works sets out appropriate actions plans to address problems and emergencies related to the operation of the project. The Town of Minto, as owner and operator, is required to adhere to the procedures defined in the document (a copy of which will be placed in the Well 3 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 Wellington-Dufferin-Guelph Health Unit and the MOE Spills Action Centre. Table 9.3 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 9.3
Potential Environmental Changes:
Clifford Water Works

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

Component	Environmental Change	Triggers
	Fire or explosion	- Observation - Phone call - 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 new waterworks, as well as an evaluation of the potential environmental effects resulting from the identified problems. Table 9.4 summarizes the findings of that assessment:

Table 9.4
Accidents, Malfunctions and Adverse Conditions (Decommissioning Phase): Environmental Effects Analysis

Valued Ecosystem Component	Incident	Environmental Effect
Ground water quantity and quality	- Contaminant spill from construction equipment and transported materials	- Adverse water quality in shallow/ deep aquifers
Surface water quantity and	- Contaminant spill	- Adverse water quality in

Valued Ecosystem Component	Incident	Environmental Effect
quality	- Siltation	nearby drains/ watercourses
Fisheries and aquatic resources	- Contaminant spill - Equipment fire - Siltation	- Damage/ destruction to fish and fish habitat
Terrestrial features (vegetation, wildlife)	- Contaminant spill - Equipment fire - Siltation	- Damage/ destruction to native species and habitat
Species at risk	- Contaminant spill - Equipment fire - Siltation	- Damage/ destruction to identified species
Noise	- Equipment fire - Equipment malfunction	- Elevated noise levels near the project site
Air quality	- Equipment fire - Equipment malfunction	- Deteriorated air quality near the project site
Local users of ground water	- Contaminant spill	- Adverse water quality in the collector wells
Local neighbourhood and residents	- Contaminant spill - Equipment fire - Equipment malfunction - Displacement of materials off-site	- Personal injury - Property damage
First Nations communities	- None anticipated	- Not applicable
Worker health and safety	- On-site accident	- Personal injury
Public health and safety	- Traffic accident - Contaminant spill - Equipment fire - Equipment malfunction	- Personal injury
Aesthetics	- None anticipated	- Not applicable
Heritage and historical cultural resources	- None anticipated	- Not applicable
Sewage treatment plant capacity	- None anticipated	- Not applicable
Capacity of Renewable Resources	- Contaminant spill - Equipment fire - Siltation	- Adverse water quality in shallow/ deep aquifers - 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 new waterworks 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 MITIGATION MEASURES

10.1 Construction Phase

10.1.1 Environmental Monitoring

The project is 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 9.1.1 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 is 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 Wells 3 and 4, in accordance with MOE Permit to Take Water No. 8554-6DDJ2H (issued June 23, 2005);

- Periodic water quality testing should be completed on all collector wells to ensure that petroleum products from the identified contaminant sites (and other sources) are not contaminating ground water resources

- Additional monitoring of existing wells in the area, including private wells, should be conducted to confirm the impacts resulting from the pumping of the new well supplies.

- Additional monitoring of stream piezometer SP2/02 should be completed to confirm that:

  - the ground water sources are not considered to be under the influence of surface water; and
  - the stream itself is not adversely affected by ground water withdrawal

- Maintain TW2/02 as a monitoring well.

- Sample Well 4 for NTA and benzo(a)pyrene.

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 Clifford 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 7.13.2.2 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 the Contingency Plan prepared for the Clifford 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 Construction Phase

11.1.1 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. With the use of the mitigation measures specified earlier in this

report, particularly those identified in Table 7.6, there should be no significant adverse residual environmental effects as a result of construction.
Therefore, based upon a review of the nature and scope of the project and the components of the construction plan, the construction phase of the project is not likely to produce significant adverse environmental effects.

11.2 Operations Phase

11.2.1 Significance of Residual Environmental Effects at the Operations Phase

Environmental effects that may result from this phase of the undertaking 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 undertaking and the components of the monitoring and contingency plans, the operations phase of the project is not likely to have significant adverse environmental effects.

11.3 Decommissioning Phase

11.3.1 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. With the use of the mitigation measures specified earlier in this report, particularly those identified in Table 7.6, there should be no significant adverse residual environmental effects as a result of project decommissioning.

Therefore, based upon a review of the nature and scope of the undertaking and the components of the general decommissioning strategy, this 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 undertaking 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 (i.e., environmental scoping).
- Identification of VEC's that may be affected by the proposed work.
- Review of proposed project and related works (including an evaluation of recommendations from related studies).
- Identification of possible cumulative environmental effects resulting from the construction and operation of the proposed works.
- Evaluation of other actions in the project area 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 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 Assessment Parameters

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

- The spatial boundary of the impact assessment was defined as the Clifford 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 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 undertaking 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 undertaking, the long-term temporal boundary of the project 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 Projects Known to Act in a Cumulative Manner

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 the proposed replacement of the water distribution system.
- Cumulative effects of the project with other developments planned in Clifford.

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

12.5 Potential Cumulative Effects

12.5.1 Watermain Replacement Program

Replacement of the existing water distribution system will be carried out following the commissioning of the new well supply, pumphouse and elevated storage facility. The watermain replacement work will be carried out within the existing road allowances using an open trench technique. The impacts associated with this work are similar to normal road construction activities (e.g., noise, odour, traffic restrictions). The project also requires the installation of watermain across Coon Creek and Drain No. 93 via a trenchless technology method of construction (e.g., directional drilling).

The planned watercourse crossings could have adverse impacts upon the watercourse and the surrounding natural environment. Such impacts could represent a further degradation of fish habitat, particularly Redside Dace habitat which may be evident in Coon Creek. Nibbling effects are therefore of particular concern, given the possibility that construction-related activities could disturb sensitive features in the vicinity of the water crossings.

The potential interactions between the watermain replacement program 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 environmental effects of the program on the various environmental components prior to mitigation (using the impact criteria described in Table 2.1).

Table 12.1 summarizes the outcome of the environmental effects analysis.

Table 12.1
Replacement of the Water Distribution System:
Environmental Effects Analysis

Valued Ecosystem Component	Level of Effect	Considerations
Ground water quantity and quality	Minimal/ Nil	No anticipated impacts
Surface water quantity and quality	Low	Impacts mitigated via directional drilling and standard erosion and sediment controls
Fisheries and aquatic resources	Low	Impacts mitigated via directional drilling and standard erosion and sediment controls
Terrestrial features (vegetation, wildlife)	Low	Limited impacts due to construction within road allowances and outside of riparian zones.
Species at risk	Minimal/ Nil	Limited impacts due to construction within road allowances and outside of

Valued Ecosystem Component	Level of Effect	Considerations
		riparian zones
Noise	Low	Normal construction-related impacts
Air quality	Minimal/ Nil	Normal construction-related activities
Local users of ground water	Minimal/ Nil	No anticipated impacts
Local neighbourhood and residents	Low	Normal construction-related impacts
First Nations communities	Minimal/ Nil	Not applicable
Worker health and safety	Low	Normal construction-related impacts
Public health and safety	Low	Normal construction-related impacts
Aesthetics	Minimal/ Nil	Limited to construction phase (buried works)
Heritage and historical cultural resources	Minimal/ Nil	No anticipated impacts
Sewage treatment plant capacity	Low	Increased water consumption due to improved flow distribution can be accommodated by existing plant capacity
Capacity of Renewable Resources	Minimal/ Nil	No anticipated impacts

12.5.2 Future Development Activities

The community of Clifford is characterized as a low-density residential community, which incorporates a limited amount of traditional downtown commercial development and a number of institutional activities. As evidenced in Table 4.2, population growth in Clifford has been relatively slow in the past 30 years due primarily to the relative location of the community with respect to growth centres in Ontario and the limited amount of economic growth experienced in Mid-Western Ontario over that time period. There is no evidence that the existing development pattern in Clifford has adversely impacted upon significant or sensitive natural features in the area or the integrity and capacity of ground water resources.

Currently, the community of Clifford is not being considered for any residential or non-residential development plans or any significant road construction projects. In accordance with municipal development policies, however, new developments within the Clifford urban area will be required to connect to the municipal water system. Long-term growth in the community will therefore be facilitated through the development of Nelson Street Well Supply, improvements to Well 1 and the development of any subsequent municipal wells needed to accommodate future water demands. There are a number of existing private well supplies within the defined regional boundary which could experience adverse impacts from the construction of 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.

The potential interactions between future development activities 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 environmental effects of new development on the various environmental components prior to mitigation (using the impact criteria described in Table 2.1).

Table 12.2 summarizes the outcome of the environmental effects analysis.

Table 12.2
Future Development Activities:
Environmental Effects Analysis

Valued Ecosystem Component	Environmental Effect Ranking	Considerations
Ground water quantity and quality	Low	Increased water consumption attributable to growth should be accommodated by the new waterworks
Surface water quantity and quality	Low	Development activities should not occur in close proximity to local drains/ watercourses
Fisheries and aquatic resources	Low	Development activities should not occur in close proximity to local drains/ watercourses
Terrestrial features (vegetation, wildlife)	Low	Development activities should not occur in areas exhibiting significant natural features.
Species at risk	Minimal/ Nil	Development activities should not occur in areas exhibiting significant natural features or in close proximity to local watercourses
Noise	Low	The anticipated growth levels will not significantly increase ambient noise levels in the community
Air quality	Minimal/ Nil	The anticipated growth levels will not significantly increase air pollution in the community
Local users of ground water	Low	Increased water consumption attributable to growth should be accommodated by the new waterworks

Valued Ecosystem Component	Environmental Effect Ranking	Considerations
Local neighbourhood and residents	Low	Planning policies direct growth to areas appropriate for development activities based on accepted planning principles
First Nations communities	Minimal/ Nil	Not applicable
Worker health and safety	Minimal/ Nil	Normal construction-related impacts
Public health and safety	Low	The anticipated growth levels should not have a significant adverse impact upon public heath and safety
Aesthetics	Low	Planning policies promote consistent and compatible development
Heritage and historical cultural resources	Minimal/ Nil	The anticipated growth levels should not have a significant adverse impact upon historical features in the community
Sewage treatment plant capacity	Low	Increased water consumption due to growth should be accommodated by existing plant capacity
Capacity of Renewable Resources	Minimal/ Nil	No anticipated impacts

12.6 Measures to Mitigate Effects

12.6.1 Watermain Replacement Program

Natural Resource Solutions was commissioned to evaluate the nature and scope of the construction activities and to define mitigation measures to limit disruption to the natural setting. Section 6.2 of this report summarizes the findings of that investigation and the recommendations with respect to construction mitigation. It is anticipated that the implementation of the proposed mitigation, in combination with any additional mitigation required by regulatory agencies, will minimize the nibbling impacts associated with the construction work.

With respect to the other identified forms of cumulative impact, the following conclusions were drawn from the study work:

- Growth-inducing effects could be promoted from the undertaking, given that the improvements to water service could stimulate new development in the vicinity of the affected watercourses. The effect of the development on the sensitive features of Coon Creek or Drain No. 93 will be minimal, however, given that established land use regulations largely restrict development activities near open watercourses.

- Existing land use policies will minimize the spatial crowding evident in the vicinity of the water crossings.

- Temporal crowding is not anticipated to be of concern at the crossing sites, given the relatively short duration of the construction period and the minimal disruption expected from the operational (buried) watermain.

12.6.2 Future Development Activities

Existing land use controls associated with the local Official Plan and Zoning By-law restrict the extent of development occurring in the community over the long-term. It is anticipated that the growth generated from an upgraded water supply, multiplier effects or unrelated activities, would be effectively accommodated by the existing and new well supplies. Given these considerations, the undertaking is not expected to represent an action which will intensify site development in an unsustainable manner.

With respect to other forms of cumulative impact, matters of physical-chemical transport, nibbling loss and temporal crowding are expected to be negligible as a result of this work. As noted previously, the development of the well supply, in combination with the other planned waterworks upgrades, could induce additional development in the community. The development potential of Clifford is not considered to be significant, however, given established land use planning policies, existing economic and demographic conditions and recent growth projections. Moreover, there are no other past, existing or imminent projects in the Clifford area which, in combination with this project, will adversely impact upon the community.

12.7 Residual Effects

Given the existing environmental setting, the findings of the biological investigation and the established land use development controls, the implementation of the Clifford Water Works Upgrading Project, in combination with the watermain replacement program and future development 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 the watermain replacement program is conducted with regard for the identified mitigation measures and that new development activities are carried out in accordance with established planning policies, implementation of the Clifford Water Works Upgrading Project 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 04-03-950)

- A public notice was prepared detailing the public consultation 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 weekly community newspapers; the Wellington Advertiser (June 25 and July 2, 2004 editions) and the Minto Express (June 29 and July 6, 2004 editions).
    - 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 Minto municipal office and the public library in Clifford. A 32-day review period was provided for comments. No written or oral comments were received.

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

    - The notice was circulated in two weekly community newspapers; the Wellington Advertiser (April 8, 2005 edition) and the Minto Express (April 5, 2005 edition).
    - 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 consultation 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 Class EA Investigation

During Phases 1 and 2 of the 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 Class EA public consultation program were as follows:

- An initial public notice was circulated summarizing the problems with the Clifford Water Works and defining the various alternative solutions being considered by the Town at that time. The notice was published in the April 31, 2002 and May 7, 2002 editions of the Minto Express (the local weekly newspaper). Individuals were given the opportunity to comment on the project until May 22, 2002. No comments were received as a result of this notice.

- A public meeting was held on September 30, 2003 at the Clifford Community Hall and notice of the meeting was published in the September 17, 2003 and September 24, 2003 editions of the local newspaper. The preferred solution was presented. Approximately 20 residents and stakeholders attended the meeting. No specific concerns were identified with the proposed works. The majority of comments received through the process pertained to low system pressures and the poor aesthetic water quality in the distribution system. The public was specifically interested in knowing what measures are being considered to mitigate these problems.

- A Notice of Completion was prepared to identify the selection of a preferred alternative and to summarize the proposed works. The notice was published in the December 17, 2003 and December 24, 2003 editions of the Minto Express. The project review period concluded January 16, 2004. No comments 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 Clifford 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 project, it was determined that consultation with First Nations was not necessary in order to complete the CSR.

13.3 Government

13.3.1 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 a general project summary containing a description of system deficiencies, a summary of potential solutions, and an outline of the Class EA process. The information was circulated to the various agencies on May 15, 2002 and these agencies were asked to comment on the project before June 12, 2002. Additional information was also circulated to agencies that requested specific details on the proposed well site (dated June 19, 2002).

Summary information on the preferred alternative was also circulated to government review agencies on December 15, 2003. Draft copies of the Screening Report were also distributed to a number of agencies for review. Agencies were asked to comment on the preferred alternative by January 16, 2004. The Saugeen Valley Conservation Authority provided comments for consideration.

Table 13.1 summarises the comments received from agencies during the Class EA process:

Table 13.1
Class EA Public Consultation Program:
Summary of Comments Received from Government Review Agencies

Review Agency	Summary of Comments
Ministry of Culture, Heritage & Libraries Branch (May 21, 2002/ July 8, 2002)	- The proposed site and watermain route does not appear to have the potential to impact upon cultural heritage resources.
County of Wellington Planning and Development Department (May 17, 2002)	- The Department has no comments with respect to the proposal.
Transport Canada – Ontario Region (May 23, 2002)	- Provided an application form to permit the construction of an elevated storage tank (if required).
Saugeen Valley Conservation Authority (July 10, 2002/ February 20, 2004	- The Province of Ontario classifies Redside Dace as a threatened fish species. The species is known to occur in Meux Creek. Coon Creek is a component of that stream system and, consequently, there is potential that the species could reside in parts of Coon Creek.

Review Agency	**Summary of Comments**
	- The installation of watermain under Coon Creek will require special attention to minimize the potential impacts to Redside Dace. - The Authority may be interested in incorporating one of the Clifford wells that will not be a part of the municipal system into its network of monitoring wells.

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

Table 13.2 summarizes the comments received from the expert FA's following circulation of project information and an initial draft of the Comprehensive Study Report.

Table 13.2
Comprehensive Study Public Consultation Program:
Summary of Comments Received from Expert Federal Authorities

Environment Canada – Ontario Region Environmental Assessment Section, Great Lakes & Corporate Affairs		
Date of Correspondence	Summary of Comments	Consideration/Action
November 14, 2005	- Based on the description of terrestrial habitats, the presence of a significant amount of breeding bird habitat does not exist. - The proponent should consider potential impacts to migratory birds and to restrict the large trees and significant sections of vegetation outside of the core breeding bird period. - Project construction activities, such as vegetation clearing, site access and staging could potentially result in the destruction of migratory birds or their nests if conducted in migratory bird habitat, particularly during the breeding season.	- Major excavation and construction work was completed outside of the identified breeding bird season.

	- Construction activities with the potential to destroy migratory birds should not take place during breeding bird season (May 1 to July 23) without completion of a nest survey by a qualified avian biologist.	
April 2006	- Additional details on the construction timing is required to confirm that the vegetation clearing avoids potential impacts to breeding birds.	- Section 5.2 of this report addresses construction timing.
Fisheries and Oceans Canada **Burlington District Office, Ontario Great Lakes Area**		
Date of Correspondence	Summary of Comments	Consideration/Action
November 18, 2005	- The project is not likely to cause significant adverse effects on fish and fish habitat after taking into account the implementation and mitigation measures. - Standard mitigation measures are provided for the directional drilling of watermain beneath Coon Creek and Drain No. 93. - Additional requirements are provided if open cutting of the watercourses is required for watermain installation.	- Construction plan for watermain crossings utilizes directional drilling.
April 2006	- Due to a change in the project scope, there is no directional drilling planned under existing watercourses. Accordingly, the decommissioning of Well 2 is the only project component adjacent to a watercourse. - Provided that standard sediment and erosion controls are implemented as discussed in the report, the Department has no additional concerns.	- Construction plan incorporated standard erosion and sediment control measures.

Health Canada **Environmental Health Assessment Services, Safe Environments Programme**		
Date of Correspondence	Summary of Comments	Consideration/Action
November 16, 2005	- Well monitoring activities proposed should be incorporated into the Follow-up Program for the project. - Additional investigations should be completed before the distribution system is replaced, including further assessments of water treatment options (particularly with respect to hydrogen sulfide). - Additional details should be provided on the background noise levels in the vicinity of the project area. Consideration of noise impacts during construction should be described in more detail. - Further details should be provided on the significance of cumulative impacts from other projects in the area (past, existing or imminent).	- Follow-up program includes two year monitoring of private well supplies. - Concerns regarding the water distribution system are outside the scope of this study, but will be taken into consideration. - Sections 6.17 and 7.8 of this report summarize issues pertaining to noise. - Section 12 of this report addresses cumulative impacts relating to development.
April 2006	- No further comments.	- None required.
Natural Resources Canada		
Date of Correspondence	Summary of Comments	Consideration/Action
November 8, 2005	- Detailed hydrogeological data and analysis were not provided for the Clifford Well 3 and Clifford Well 4 report. The supporting technical information is necessary to determine whether issues regarding well interference, aquifer response and security, and long-term resource sustainability have been addressed. - Further discussion is required regarding a potential contaminant sources in the	- Detailed hydrogeological data and analysis was provided to Natural Resources Canada. - Section 7.9.4 of this report discusses potential contaminant sources. - Section 4.3.1.2 of this report outlines the availability of ground water level mapping.

	community of Clifford. - A detailed potentiometric surface elevation map for Clifford would be helpful to document current conditions and to assess potential impacts.	
April 2006	- Presented several concerns regarding the previous hydrogeologic investigation and data requirements. The identified issues related primarily to problems associated with aquifer testing and interpretation, well interference estimates, recharge and leakage to the deep overburden and bedrock aquifers, mapping of ground water levels and adverse water quality results (i.e., Well 3 Total Coliforms result).	- Circulated a formal response and an information package for consideration. The formal response, included in Appendix I, discusses that data available from the operation of the two wells confirms the conclusions of the hydrogeological study work in regards to aquifer sustainability, water quality, domestic well interference and interference with Coon Creek (i.e., no significant adverse impacts have been identified with the development and operation of Wells 3 and 4).

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 undertaking and the lack of a First Nations interest in the project.

14.0 SUMMARY OF ENVIRONMENTAL EFFECTS

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

Table 14.1
Clifford Water Works 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
Fisheries and aquatic resources	x			x				x
Terrestrial features	x				x			x
Species at Risk		x		x				x
Noise	x				x			x
Air quality	x				x			x
Capacity of renewable resources	x				x			x
Socio-Economic and Cultural Environments								
Local groundwater users	x				x			x
Adjacent land uses	x				x			x
Local neighbourhood and residents	x				x			x
First Nations communities		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**
Worker health and safety	***x***				***x***			***x***
Public health and safety	***x***				***x***			***x***
Aesthetics	***x***				***x***			***x***
Heritage and historical cultural resources		***x***		***x***				***x***
Sewage treatment plant capacity	***x***				***x***			***x***
Environmental Conditions								
Flooding and erosion	***x***				***x***			***x***
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***
Cumulative Effects								
Distribution system replacement	***x***				***x***			***x***
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 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. Ground water resources were selected for further monitoring, as they represent the most likely environmental features to be adversely impacted by project implementation.

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, to further assess the impacts resulting from the pumping of Wells 3 and 4. This work will be carried out on a monthly basis. Findings of this monitoring 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 and additional monitoring and reporting will occur, as necessary.

- Additional monitoring of stream piezometer SP2/02 to confirm that Wells 3 and 4 are not considered to be ground water sources under the influence of surface water. This work will be carried out on a monthly basis. Findings of this monitoring exercise will confirm the validity of the hydrogeologic study work with respect to ground water quality. If GUDI concerns are encountered, remedial measures will be taken to address the identified problems and additional monitoring and reporting will occur, as necessary.

15.3 Timelines of Follow-up Program

Monitoring activities associated with the Follow-up Program will be carried out monthly for a period of two years. The results of the monitoring exercises will summarized in annual reports.

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 data generated from the monitoring process (as summarized in an annual report). The availability of the findings from the Follow-up Program will be posted on the CEA Registry.

16.0 CONCLUSIONS

In its analysis of the environmental effects of the Clifford well upgrade project, Industry Canada, as the Responsible Authority under the CEA Act, has taken into consideration the information provided by the Town of Minto in their application for funding under COIP. Industry Canada also considered advice provided by expert Federal Authorities, and results of feedback acquired through the public consultation process.

The environmental effects of the project were considered including the environmental effects of 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 Clifford well system upgrade project will not likely have 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.

References

American Water Works Association. AWWA Standard for Welded Steel Tanks for Water Storage (ANSI/ AWWA D100-96). March 1997.

B. M. Ross and Associates Limited. Clifford Water Works, “Dirty” Water & Chlorine Decay Investigation. December 2003.

B. M. Ross and Associates Limited. Clifford Water Distribution System: Watermain Replacement Plan (Preliminary). June 2004.

B. M. Ross and Associates Limited. Town of Minto (Clifford): Operations Manual. November 2004.

B. M. Ross and Associates Limited. Town of Minto, Clifford Area Hydrology: Coon Creek. December 2005.

B. M. Ross and Associates Limited. Town of Minto: Water Works Systems Contingency Plan. November 2004.

C.N Watson & Associates Ltd. Town of Minto Development Charge Background Study. April 2005.

Chapman, L.J. and Putnam, D.F. The Physiography of Southern Ontario. Third Edition. 1984.

Corporation of the Town of Minto. Zoning By-law No. 01-86. Consolidated: February 13, 2002.

County of Wellington Planning and Development Department. County of Wellington Official Plan, February 5, 2001 (Office Consolidation).

Cumulative Effects Assessment Working Group. Cumulative Effects Assessment Practitioners Guide. *Prepared for the* Canadian Environmental Assessment Agency. February 1999.

Environment Canada. Climate Change. Provincial and Territorial Impacts http://www.climatechange.gc.ca/english/affect/prov_territory/ontario.asp. February 9, 2006.

Environment Canada. Climate Data Online. http://www.climate.weatheroffice.ec.gc.ca/climateData/canada_e.html. July 29, 2005.

Environment Canada. Species at Risk. *Http://www.speciesatrisk.gc.ca/default_e.cfm.* November 18, 2006.

Hoffman, D.W., Richards, N.R. and Morwick, F.F. Soil Survey of Huron County. Report No. 13 of the Ontario Soil Survey. February 1952.

References (cont'd)

Industry Canada. Environmental Assessment Track Report: Town of Minto's Proposed Clifford Well Upgrade Project. September 9, 2004.

Landmark Ontario Ltd. Town of Minto, Ontario. Clifford Elevated Water Storage Tank. September 2004.

Ministry of Natural Resources (Ontario). Natural Heritage Information Centre. *Http://www.mnr.gov.on.ca/ MNR/ nhic/ areas/ areaslist.* July 30, 2005.

Ministry of the Environmental (Ontario). Sound Level Limits for Stationary Sources in Class 1 & 2 Areas. October 1995.

Ministry of the Environment (Ontario). Amended Permit to Take Water. No. 8554-6DDZH. June 23, 2005.

Municipal Engineers Association. Municipal Class Environmental Assessment, June 2000.

Municipal Engineers Association, Ministry of Transportation. Ontario Provincial Standard Specifications. April 2004.

Natural Resources Canada. Environmental Impact Statement Guidelines for Screenings of Inland Wind Farms under the *Canadian Environmental Assessment Act*. 2003.

Natural Resource Solutions Inc. Water System Improvements, Clifford Water Works: Natural Environment Existing Conditions Technical Report (Draft). July 19, 2005.

Ontario Ministry of the Environment. Air Quality in Ontario: 2003 Report. 2004.

Ontario Ministry of the Environment. Consolidated Certificate of Approval, (Clifford Water Works), September 10, 2002 (as amended).

Ontario Ministry of the Environment. Guidelines for the Design of Sanitary Sewage Works, Storm Sewer (Interim), Water Distribution Systems and Water Storage Facilities, Servicing of Areas Subject to Adverse Conditions, Water Supply for Small Residential Developments, Seasonally Operated Water Supplies and the associated Appendices. 1985, as amended.

Ontario Ministry of the Environment. Terms of Reference: Hydrogelogical Study to Examine Ground water Sources Under the Direct Influence of Surface Water. October 2001.

Ontario Ministry of Municipal Affairs and Housing. Ontario Building Code. 1997.

R.J. Burnside & Associates Limited. Hydrogeologic Study: Permit to Take Water Application, Proposed New Clifford Well 3 (TW2/02), Town of Minto. November, 2002.
References (cont'd)

R.J. Burnside & Associates Limited. Ground water Management and Protection Study, Town of Minto. November, 2001.

R.J. Burnside & Associates Limited. Permit to Take Water: Clifford Well 3 and Clifford Well 4. Town of Minto. August 2004.

Statistics Canada. Census of Population and Dwelling Counts, 1976-2001 reporting periods.

APPENDICES

TABLE OF CONTENTS

APPENDICES

Appendix A

Comprehensive Study Scoping Document

<u>Comprehensive Study Scoping Document</u>

Town of Minto: Upgrading of the Clifford 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 Clifford 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, Fisheries and Oceans Canada and Environment 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 Clifford 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 opportunity to participate. 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

Clifford, in the Town of Minto, is located in the northwest corner of Wellington County. The proposed project is located entirely within the limits of the former Village of Clifford (Figure 1). The individual well sites are shown in Figures 2.1, 2.2, and 2.3.

To comply with the Ontario Drinking Water Systems Regulation and to address capacity issues within the community for a fifty-year planning period, the Town of Minto, the project proponent, submitted a proposal to upgrade the Clifford well system.

The proposed project involves increasing production capacity (to the permitted capacity) at one well, decommissioning a second well, constructing a new well site with a production capacity equivalent to the capacity of the upgraded well, and constructing an elevated storage tank at the new well site. The extension of services to the Nelson Street site (includes the construction of a water main, a sewer main and a storm water drain), decommissioning of the existing stand pipe, improvements to the treatment system and other ancillary works will also be part of the project.

Background

The Clifford water system was first commissioned in 1947. It consists of two drilled bedrock wells at two well sites, two pumphouses, a 794 m^3 standpipe and a distribution system.

Raw water is presently disinfected, using sodium hypochlorite, prior to being pumped directly to distribution. The *Town of Minto Clifford Water Works Engineer's Report* indicates that the system does not meet provincial water treatment requirements because it does not provide

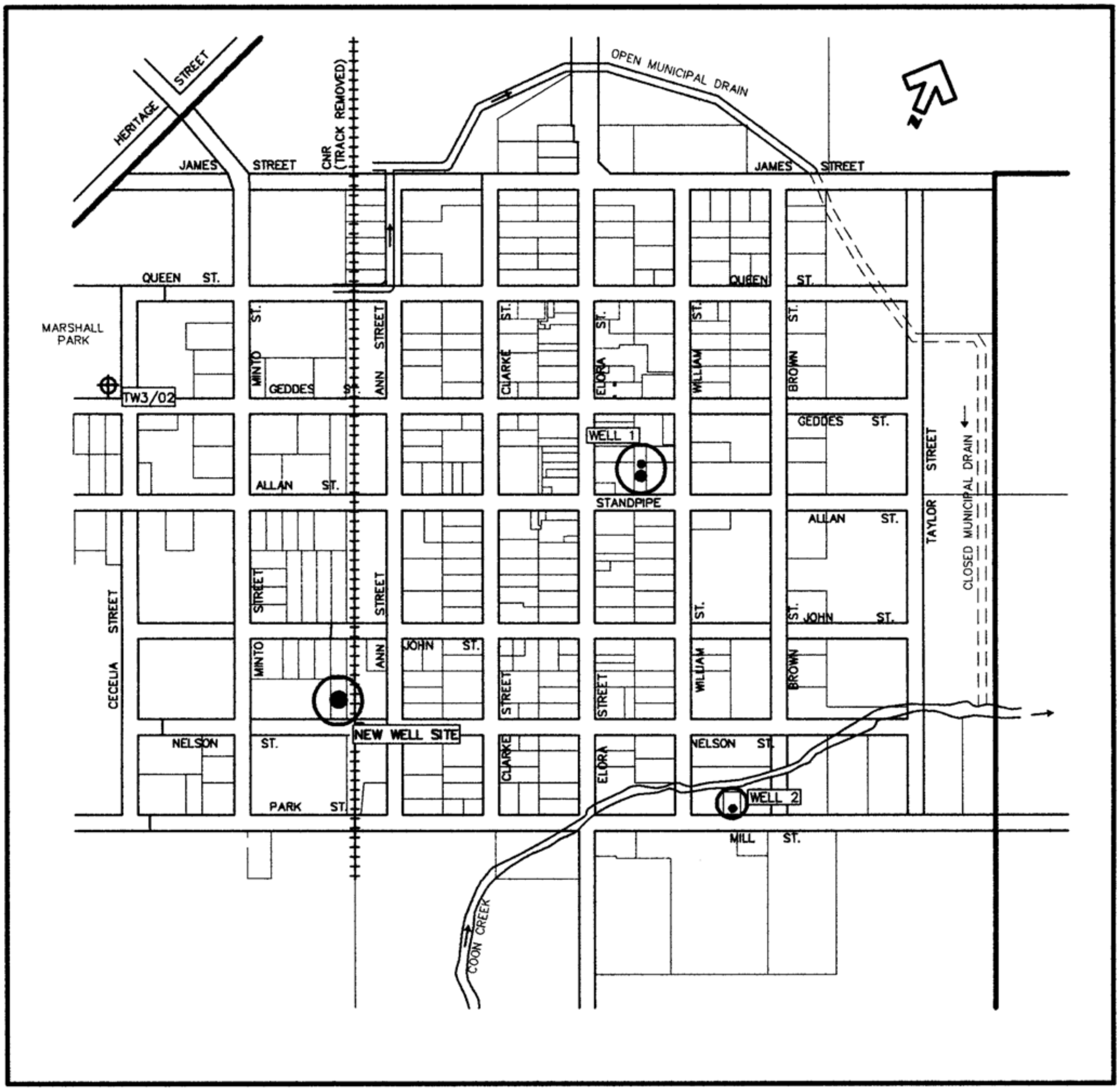


Figure 1 – Community of Clifford

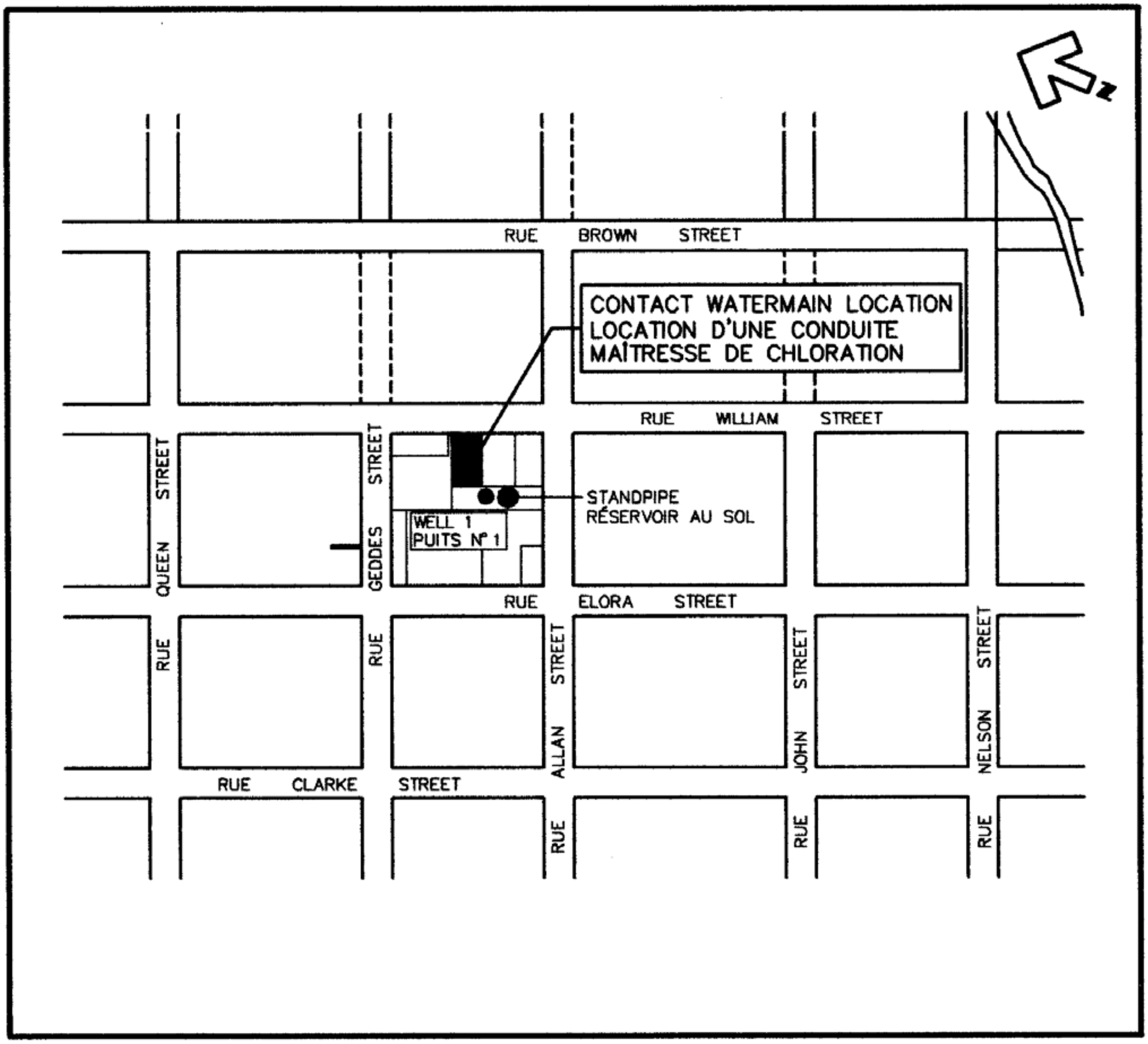


Figure 2.1 – Well Site #1

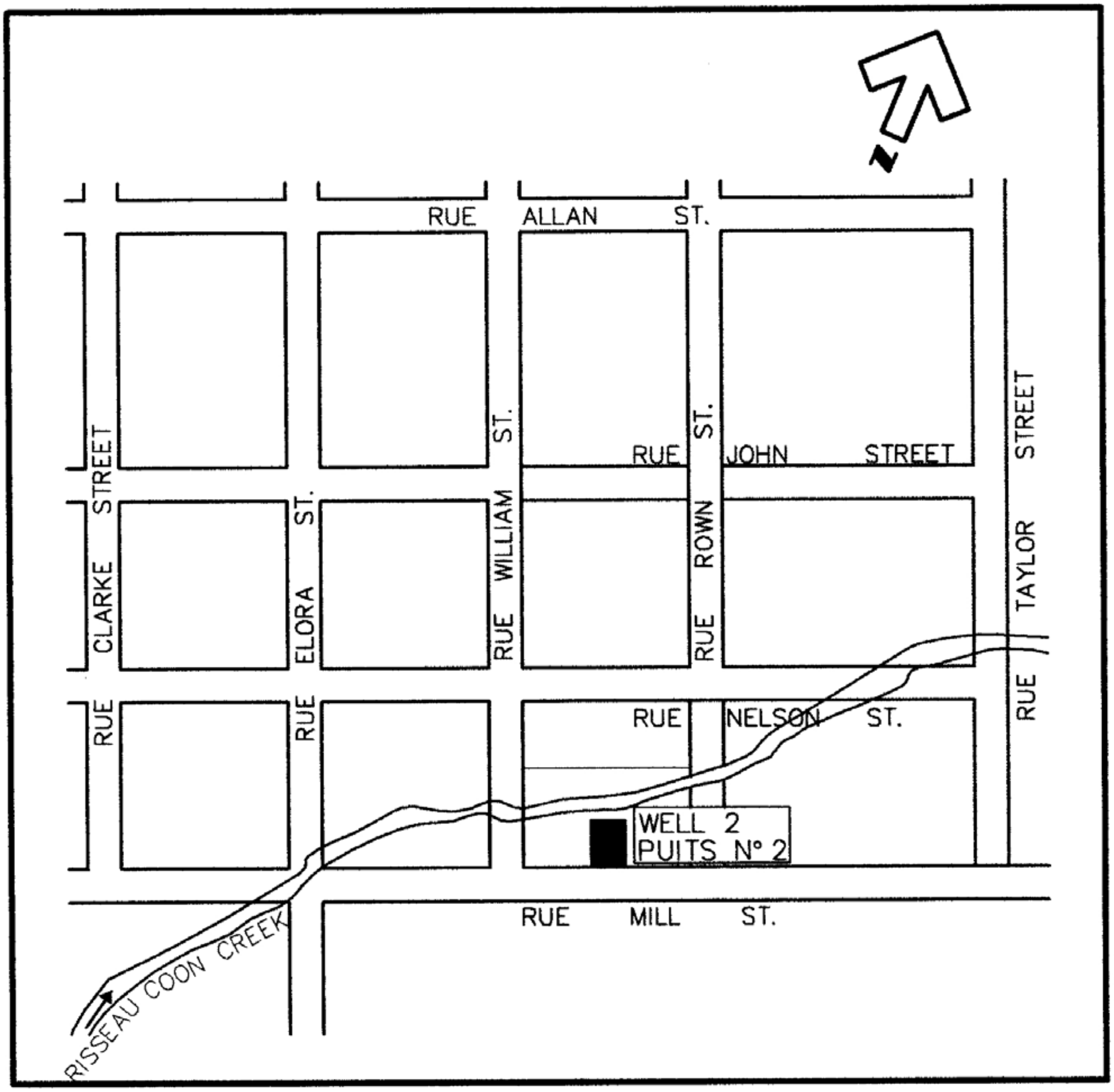


Figure 2.2 – Well Site #2

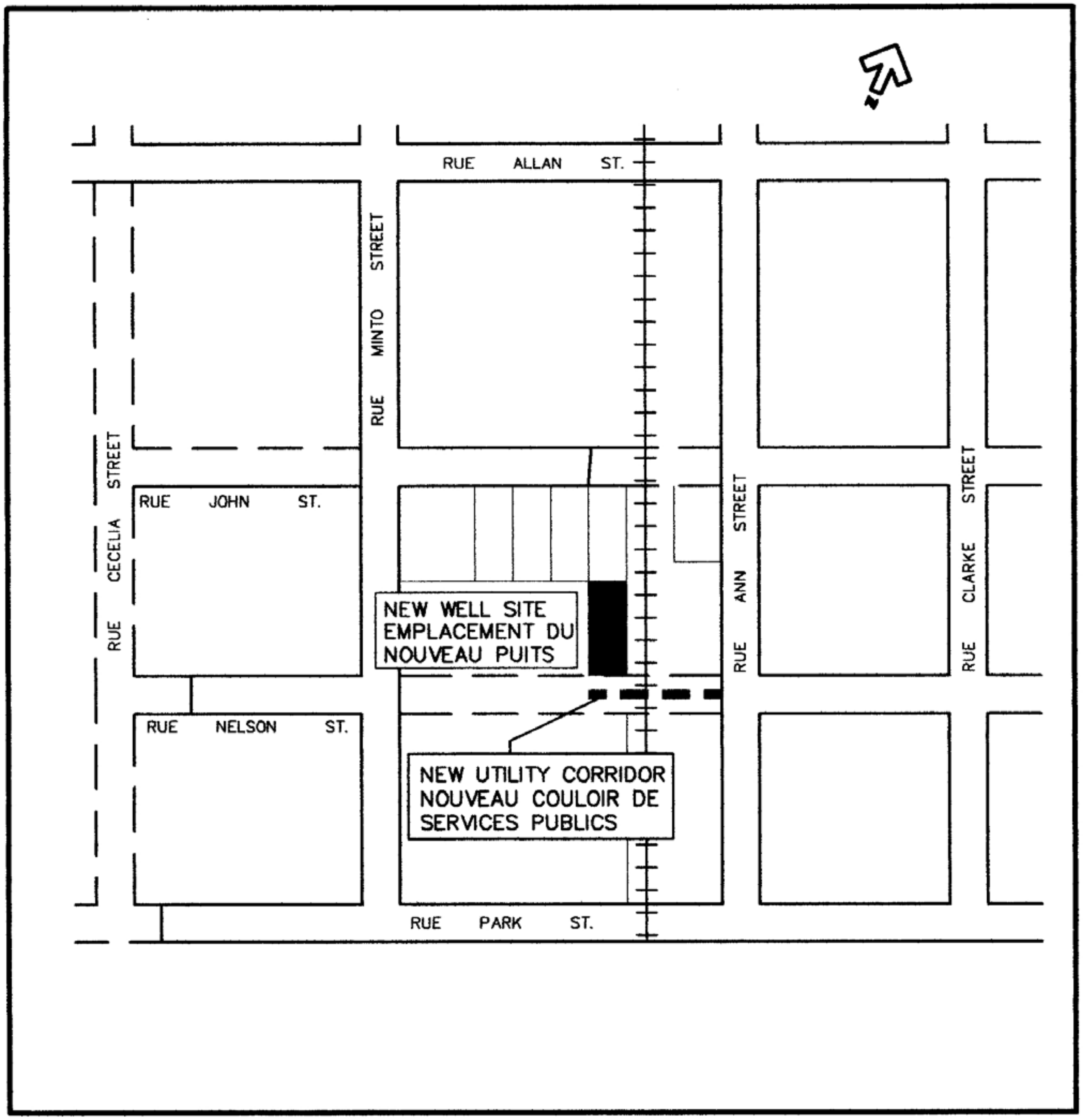


Figure 2.3 – Nelson Street Well Site

sufficient disinfection time prior to distribution.

The proposed project will require work at three sites and includes: the provision of adequate disinfection facilities and an increase in production capacity at Well #1; the decommissioning and abandonment of Well #2; the construction of a new well(s) at a new site with a production capacity equivalent to the capacity of the upgraded well; the construction of an elevated storage tank at the new well site; and decommissioning of the existing stand pipe. The extension of services to the new well site and other ancillary works will also be required.

Well #1 is Clifford's primary water supply. The well site is situated in a developed area of town. Surrounding land uses are residential, institutional and commercial in nature. All properties in the area of this site are serviced by municipal water and sewage systems. The well's raw water has naturally elevated levels of both hardness and iron and, as a result, this site also provides iron sequestration treatment. The well has a permitted capacity of 15.2 L/s (1309 m^3/d) but is currently only equipped with a pump for 11.4 L/s (985 m^3/d). The well site is located more than 400 m from the nearest watercourse.

Well #2, known locally as Dairy Well, is a small capacity bedrock well supply that was originally constructed to service a nearby cheese factory. It serves as a standby well that is used only when required, in times of high system demand or if Well #1 is out of service. It is located approximately 40 m from Coon Creek, which flows through Clifford. Hydro geological testing has determined that the well has a hydraulic connection with Coon Creek. Since the well is deemed to be groundwater under the direct influence of surface water (GUDI), any solution which incorporates this well as a water source would require the well water to be treated by a chemically assisted filtration or equivalent process.

Well #2 is also situated in a developed area of town. Land uses around the site are residential to the east, and commercial to the west and south. Coon Creek lies to the north. There are agricultural uses further to the south. All properties in the area of this site are serviced by municipal water and sewage systems. Raw water at this well also has naturally elevated levels of both hardness and iron. The well has a permitted capacity of 4.5 L/s (393 m^3/d).

The Clifford well system services 294 households and a limited number of industrial, commercial, institutional and agricultural operations. There are no major water users on the system. It has a rated capacity of 1374 m^3/d. It produced approximately 380 m^3/d of treated water (average 1997 - 1999) prior to the introduction of new provincial regulations. Based on population projections and other usage assumptions, average day demand is expected to increase from the 1997 - 1999 usage levels to 513 m^3/d over a twenty-year period and to 717 m^3/d at the fifty-year planning horizon. The maximum day demand is expected to increase from 787 m^3/d in 1999 to 1282 m^3/d at the twenty-year period and 1792 m^3/d at the fifty-year horizon.

Project Schedule

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

This schedule is largely dependent on the results of the geotechnical work at the new Nelson Street site, to verify that soils are suitable for a new elevated storage tank; the completion of the design for the Nelson Street well(s), storage and associated works; the completion of the Well #1 supply expansion hydrogeology study and expansion design work; 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 late July 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 draft comprehensive study report is expected to be available for a thirty-day public review of the report in early fall (September) 2004, following which the responsible authority will submit the comprehensive study report in November to the Agency. The Agency is required to have a public comment period on that version of the comprehensive study report. The final comprehensive study report is expected to be presented to the Minister of the Environment in early winter 2005 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, modifications to and/or decommissioning of Clifford's existing two well sites and proposed third site.

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

Well site #1:

- completion of the hydro geological work required to increase the rated capacity from 11.4 L/s to 15.2 L/s (a 33.33% increase);
- installation of a chlorine contact water main on a site immediately adjacent to the existing well site;
- installation of a standby chlorination system, a secondary chemical containment tank and analytical equipment in the pumphouse;
- miscellaneous upgrades to the pumphouse building which may include the construction of a new pumphouse building at this site;
- decommissioning and dismantling of the existing water standpipe on the site;
- construction equipment access, laydown areas; and
- site rehabilitation.

Well site #2:

- decommissioning and abandonment of the well;
- removal and disposal of equipment and chemicals;
- possible demolition of the pumphouse building;
- construction equipment access, laydown areas; and
- site rehabilitation.

Nelson Street site:

- the construction of well components (one or two wells) capable of providing a supply of at least 15.2 L/s (1313 m^3/d, 479 347 m^3/a);
- the construction of a 1273 m^3 elevated storage tank;
- construction of a pumphouse to house treatment and pumping equipment (likely in the base of the elevated storage tank);
- the extension of services (water main, sewer main and storm water drain) along the unopened Nelson Street road allowance to the project site;
- construction equipment access, laydown areas; and
- site rehabilitation.

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;
- ground water quality;
- surface water quantity;
- surface water quality;
- vegetation;
- species at risk;
- 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;
- icing and winter operations.

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 proposed replacement and/or installation of new water mains within the village;
- cumulative effects of the project with other developments that are planned within Clifford such as road and/or residential construction.

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 Village of Clifford. 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: all three well sites, the unopened Nelson Street road allowance, 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, failure of the new elevated storage tank, 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 would include an area beyond Clifford's community boundary of approximately one kilometre that may be 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 Clifford 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 one year and includes the construction and commissioning phases of the project. It can include activities such as: the construction and commissioning of new wells and an elevated storage tank; the installation of a transmission water and sewer main; and, the decommissioning of a well and existing standpipe. 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 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 elevated storage tank, 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 fifty years and includes activities such as: possible accidents and malfunctions (for example, failure of the new elevated storage tank, 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 Clifford well system and File Number 676 on your submission. Comments must be received by the close of business July 26, 2004. 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, the public will be provided with an opportunity to comment on the draft comprehensive study report by Industry Canada. 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, *Town of Minto Clifford Water Works Engineers Report*, 2001

B.M. Ross and Associates Limited, *Town of Minto Class Environmental Assessment for Water System Improvements Clifford Water Works - Screening Report*, 2003

Appendix B

Ground Water Management and Protection Study (Potentiometric Surface Map)

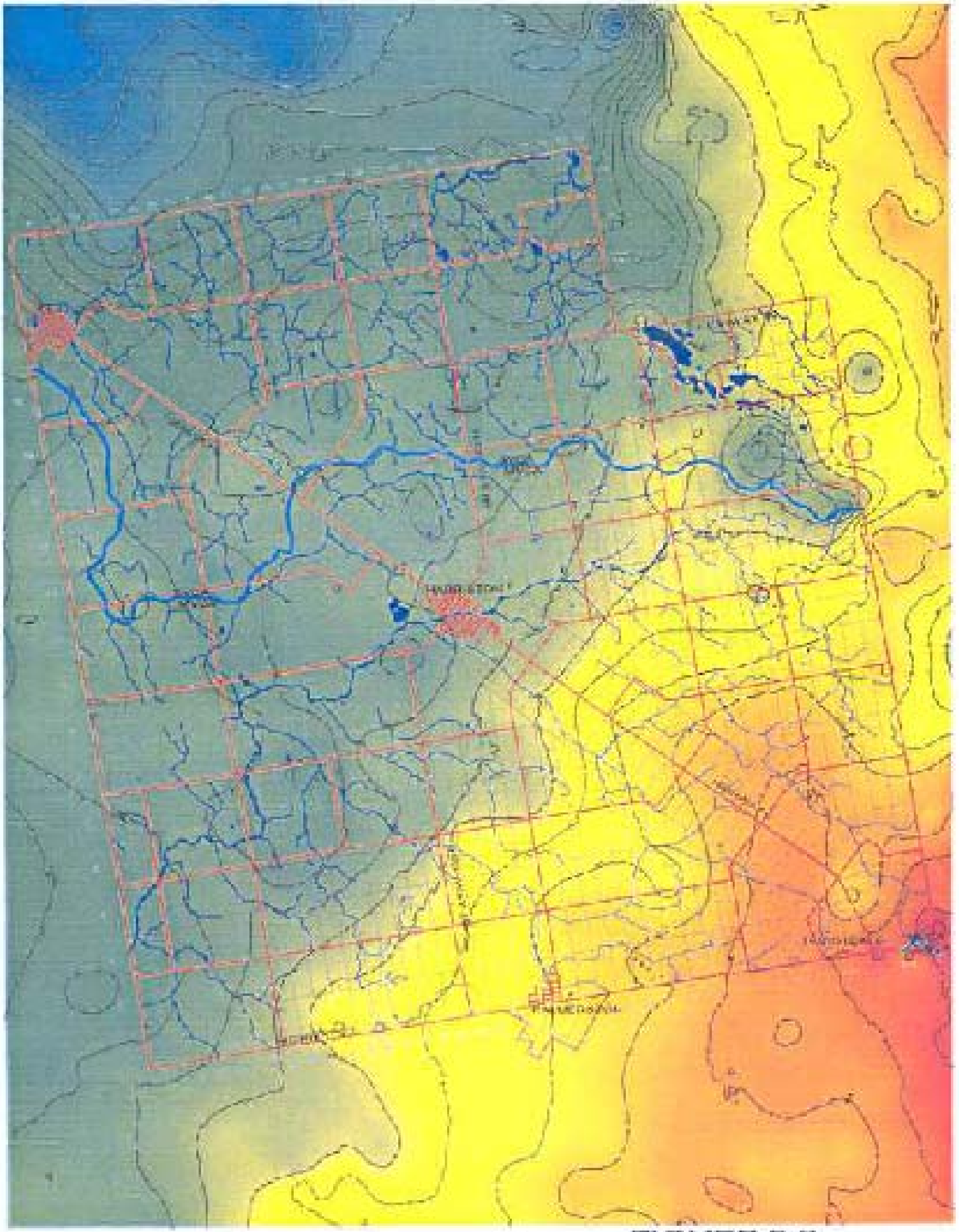


FIGURE 3.9
TOWN OF MINTO
GROUNDWATER MANAGEMENT
AND PROTECTION STUDY

POTENTIOMETRIC
SURFACE

WATERSHED BOUNDARIES
RIVERS AND STREAMS

NOTE:
WATER LEVELS MEASURED IN WELLS COMPLETED TO
DEPTHS GREATER THAN 15 METRES

Appendix C

Correspondence Regarding Natural Resources Canada Comments

R.J. Burnside & Associates Limited 292 Speedvale Avenue West Unit 7 Guelph ON N1H 1C4 Canada
telephone (519) 823-4995 fax (519) 836-5477 web www.rjburnside.com

BURNSIDE

[THE DIFFERENCE IS OUR PEOPLE]

January 4, 2007

Town of Minto
Public Works Superintendent
Box 160, 594 Highway 89
Harriston, ON N0G 1Z0

Attention: **Mr. Norm Fisk**
Director of Public Works

Re: **Clifford Water Works Upgrade Project**
Clifford Wells 3 and 4 Hydrogeologic Report
Natural Resources Canada Comments
File No: M 1316

Dear Mr. Fisk,

Further to discussions with BM Ross and receipt of Natural Resources Canada, (NRCan) comments concerning the Clifford Well 3 and 4 Hydrogeologic Reports, we are writing to provide additional information. We are copying this letter to BM Ross and Associates who we expect will forward this information to the suitable individuals at NRCan.

Background

The Town of Clifford is located in the northwest corner of Wellington County and the Town of Minto. R.J. Burnside & Associates Limited (Burnside) were retained in 2002 to complete exploration for additional groundwater sources for the Town, as there was only one (Clifford Well 1) existing dependable well source. Three test wells were drilled in 2002. Two of the wells, TW1/02 (bedrock well) and TW2/02 (overburden well) were identified as suitable sources for future municipal water supplies. Long term pumping tests were completed on both wells and Permit To Take Water (PTTW) 03-P-2041 was obtained from the Ministry of the Environment (MOE) for the site.

Funding and approvals were received for the construction of two new municipal wells called Clifford Well 3 (the overburden well next to TW2/02) and Clifford Well 4 (a bedrock well constructed through the reconstruction of TW1/02) in the winter and spring of 2004.

Long term testing of the new Clifford Wells 3 and 4 was completed following their construction. The long term testing was designed to confirm the water quality from each water source as opposed to identifying the sustainability of the aquifer, which had been established in the 2002 testing. We note that there was an existing PTTW for this site and pre-project consultation with the MOE confirmed that limited testing was required to confirm the water quality of the individual wells. The six day test of Clifford Well 3, focused on pumping the well at 3.8 L/s and 7.6 L/s to determine if water quality was affected by flow rate. Regional monitoring during this pumping test was completed to confirm the results from the 2002 test.

A report documenting the testing of the new Clifford Wells 3 and 4 was submitted to the MOE to obtain an amendment to the existing PTTW. The new PTTW 8554-6DDJZH was obtained and is currently in place regulating the operations of Clifford Wells 3 and 4. The new permit includes conditions to monitor selected domestic wells west of the site and water levels in and beneath Coon Creek.

The associated infrastructure including a water tower and connection to the existing Distribution System was completed in the fall of 2005. Clifford Wells 3 and 4 were brought online as new water sources for Clifford Distribution System in November 2005. We note that Clifford Well 2 (The Dairy Well) was abandoned as part of the upgrade of the Distribution System, and is no longer part of the system.

Natural Resources Canada Issues

Burnside has reviewed the comments provided by NRCan on the Hydrogeologic Reports submitted as part of a Federal Environmental Assessment for this project. Although there are a number of comments made with regards to specific issues within the Burnside Hydrologeologic Reports, the issues fall into the following categories:

1. The aquifer analysis provided does not allow proper estimation of the long-term impact of pumping;
2. The bacterial water quality of Clifford Well 3;
3. The sustainability of the water sources on a long-term basis;
4. Interference from the municipal wells on existing domestic wells in the area; and
5. Interference of Clifford Wells 3 and 4 on the upward gradients in the area of Coon Creek.

We agree with NRCan on many of their specific comments with regard to the suitability of data for analysis of the aquifers and the limitations determine the long term impacts based on the data provided. As a result, we have prepared a package of new data collected over the past two years that gives a complete picture of the system especially since the system has been up and running for almost a year and the monitoring data is available.

Attached is a CD copy of the Wellington Groundwater Management Study recently completed by Golder and Associates. This report was submitted to Burnside in October

2006. We refer NRCan staff to the three dimensional modeling of the Clifford Well 3 and 4 sites.

Section 3.4.1 of the report discusses the capture area that is delineated for the entire Clifford well field. We consider this information an excellent portrayal of the sustainability for the complete Well based Water Supply System. This report also provides a more complete regional perspective on the Clifford Water Supply System and interpretation with regard to soils interpolated between actual well sites.

We have also included hydrographs of monitor wells in the Clifford area. Some of the monitor wells are being monitored as part of the PTTW conditions, while others are being monitored as a matter of confirming interpretations in the Burnside Reports of 2002 and 2004

We note that since the wells have been in operation and providing the vast majority of the water for the Town of Clifford, there have been no reported adverse interference between the municipal wells and existing wells in the surrounding area.

Groundwater Conditions in the Coon Creek Area

Automatic water level recorders are in place in a deep (22 m below grade) overburden monitor well (MI-MW6/00) 15 m from Coon Creek and a shallow overburden streambed piezometer (MI-SP2). These AWLR are owned by the Town of Minto and were installed in order to confirm the predictions of the hydrogeologic report. The data is not compensated for barometric fluctuations.

Hydrographs for these monitors are presented from January 2005 to December 2006 in both full scale and a detailed section of the graph from August 10 to October 15, 2006 when the upward gradient between the deep overburden and shallow overburden between to the two monitors was reduced and reversed for a period of hours on selected days.

The hydrograph of MI-MW6/00 confirms the direct response of the deep overburden to pumping of Wells 3 and 4 observed during testing. Review of water use data for Clifford Wells 3, 4 and Clifford Well 1 indicates that the greatest response in the deep overburden occurs when Well 4 is operating. We have reviewed the operation of Well 4 with Minto staff and determined that the well was inadvertently left on for periods of up to 9 hours. This operation issue has been addressed.

The hydrograph of MI-SP2 shows no response to the operations of Clifford Wells 3 and 4. Review of precipitation events and atmospheric pressure data in September and October 2006 indicate significant rise in MI-SP2 water levels due to raised water levels in the creek and variable day to day pressures in the MI-SP2 AWLR due to atmospheric pressure variations.

We note that each time the site was visited the gradient between the shallow overburden 1.1 m beneath Coon Creek accessed by MI-SP2 and the creek water level indicated an upward gradient. This condition was present in October 2006 even when there was a downward gradient present between the shallow overburden and deep overburden.

We have discussed the operation of the Clifford Well 4 with Minto staff and have re-affirmed the concept that Well 4 is intended as an emergency back-up source and that it should only be run for less than 1 hour each day. This should minimize the occurrence of lowered water levels in deep overburden near Coon Creek.

The presence of an upward gradient between the shallow overburden and the creek indicates that discharge of groundwater to the creek is being maintained. However, a long-term condition where the regional gradient is reduced or reversed could eventually impact the shallow gradient. In order to ensure this does not occur use of Well 4 will be minimized as mentioned above and we have installed a AWLR in Coon Creek and a barometric logger to more closely track the upward gradient between the shallow overburden and the Coon Creek water level in 2007.

Response to NRCan Issues

The following are specific responses to the NRCan comments with reference to the additional data and interpretation provided.

1. **Aquifer Analysis** – As mentioned above the Clifford aquifer does not meet the majority of assumptions to complete a detailed analysis. If the purpose of the analysis is to predict long term response, it is better hydrogeologic practice to make use of new operational data that is now available. With the availability of actual operational data further theoretical analysis is not required.
2. **Bacterial Quality** – Clifford Well 3 is currently operational and tested on a weekly basis to confirm the bacteria free nature of the water.
3. **Aquifer Sustainability** – The three dimensional modeling indicates that there is enough formation present on a regional basis and enough groundwater flow within this formation to sustain the proposed water taking for the entire Clifford system of Wells 1, 3 and 4. In addition we have a year of data that shows at least preliminary data that the water taking is sustainable in the long term.
4. **Domestic Well Interference** – There have been no complaints of domestic well interference to date. The water level data indicates that the response to pumping has been less that predicted in the hydrogeologic reports. A decline of 2.5 and 4 m in 2006 is considered to be within typical seasonal variations observed at MI-MW6/00

in 2005 before Wells 3 and 4 were operational as the water levels rose again during the fall of 2006.

5. **Coon Creek Interference** – Monitoring data from Coon Creek indicates that upward gradients between the shallow overburden and the creek were maintained throughout the 2006 irrigation season. As mentioned previously, the use of Well 4 will be reduced, a AWLR will be installed in Coon Creek and a barologger will be used to adjust the data from all AWLR to ensure the upward gradient from the shallow overburden is maintained.

Discussion

The process of exploration, testing, reporting and permitting required to establish a Municipal Water Supply System, is based on the peak required demand from an individual well. The maximum day demand that occurs once a year (based on its definition) are the basis for establishing the required capacity from a well. The PTTW for a well must meet this maximum day flow rate in order to allow the operation of the well and equipping of the well, for that maximum day use.

The 72 hour pumping test of a new municipal well is designed to over estimate the impact of the maximum day demand from a well supply and to assess the impacts of the water taking, while staff are on site to monitor the wells in the area and the surface water features.

Analysis of the data collected during a long term test completed at the maximum day demand is commonly used to demonstrate the sustainability of the water supply and to demonstrate the level of impact on the surrounding hydrogeologic environment. Extrapolation of this maximum day demand significantly over estimates the impact of the true impact of pumping. This is because the average water taking from a well site is typically only 33 percent-40 percent of the maximum day demand.

Extensive experience with municipal wells and systems after their installation shows that the long term impact due to pumping that occurs in a cyclic manner usually for less than 12 hour per day, can be best predicted through the consideration of average day water taking. This is why the steering committee for the Wellington County groundwater management study decided, after significant discussion, to complete the three dimensional modeling of the municipal wells based on long term average pumping rates that were increased to meet demand in 20 years.

Although the determination of vertical leakage to a particular producing aquifer, the analysis of water level response from a variety of observation locations gives the hydrogeologist more information. It is not necessarily useful in the long term prediction of sustainability and interference. The numerous assumptions that aquifer analysis equations are based upon are not met at the Clifford site. The producing aquifer is of highly variable thickness, variable gradation, is underlain by fractured bedrock, and overlain by inconsistent thickness aquitards whose permeability is variable.

Burnside presented data that was considered useful in the MOE assessment of the site to demonstrate the long term suitability of the new wells, especially considering the existing presence of a 40 year old producing well. We have included the water use of Clifford Well 1 that shows the transition from Well 1 to Well 3 in November 2006. Although extensive analysis of numerous monitor wells would provide a more complete report, Burnside's focus was on providing the information that would be required to obtain a PTTW for this site. This task was completed and the long term response observed in the past year of monitoring confirms the conclusions from the Clifford report to be true.

We trust that the additional information provided in this letter demonstrates the sustainability and lack of interference for the new Clifford Municipal Well 3 and 4. If you have any additional questions, please do no hesitate to call.

Yours truly,

R.J. Burnside & Associates Limited

Jim Baxter, P.Eng.
Ground Water Resource Engineer
JB:js

Enc.
cc: Mr. Scott Allen, BM Ross, Godrich

070104 Fisk.doc
1/4/2007 2:03 PM