

# **HYDROGEOLOGICAL SCREENING REPORT**

**HIGHWAY 62 REALIGNMENT AND ROAD IMPROVEMENTS**  
**1.0 kilometre South of Quin Mo Lac Road to the South Limit of the Village of Madoc**

**GWP 4506-02-00**

PREPARED FOR:



**MINISTRY OF TRANSPORTATION – EASTERN REGION**

**AUGUST 2008**

PREPARED BY:



2655 North Sheridan Way, St. 280 Mississauga, ON L5K 2P8  
Ph: 905-823-4988 • Fx: 905-823-2669  
Email: [ecoplans@ecoplans.com](mailto:ecoplans@ecoplans.com)

---

**PROJECT NO. 550287**

## TABLE OF CONTENTS

<b>1.0</b>	<b>INTRODUCTION .....</b>	<b>1</b>
1.1	PURPOSE OF STUDY .....	1
1.2	SCOPE OF WORK .....	1
1.2.1	Background Information Review .....	1
1.2.2	Site Inspection .....	1
1.2.3	Documentation .....	2
1.3	PUBLIC CONSULTATION .....	2
<b>2.0</b>	<b>STUDY AREA DESCRIPTION .....</b>	<b>3</b>
<b>3.0</b>	<b>BACKGROUND INFORMATION REVIEW .....</b>	<b>5</b>
3.1	TOPOGRAPHY .....	5
3.2	DRAINAGE .....	5
3.3	GEOLOGY .....	5
3.3.1	Surficial Geology .....	5
3.3.2	Bedrock Geology .....	6
3.4	HYDROGEOLOGY .....	6
3.5	AERIAL PHOTOGRAPHS .....	7
3.6	WATER WELL RECORDS .....	8
3.7	BACKGROUND STUDIES .....	9
3.8	PERMITS TO TAKE WATER (PTTWs) .....	13
<b>4.0</b>	<b>SITE INSPECTION .....</b>	<b>14</b>
<b>5.0</b>	<b>WATER WELL SURVEY .....</b>	<b>16</b>
<b>6.0</b>	<b>EVALUATION OF GROUNDWATER RESOURCES .....</b>	<b>17</b>
6.1	SOUTH SECTION OF STUDY AREA .....	17
6.2	NORTH SECTION OF STUDY AREA .....	18
6.3	LONGER TERM CONSTRUCTION IMPACTS (NORTH AND SOUTH SECTIONS) .....	18
6.4	RELATIVE RISKS OF CONSTRUCTION IMPACTS TO PRIVATE WATER WELLS .....	19
<b>7.0</b>	<b>RECOMMENDATIONS .....</b>	<b>20</b>
<b>8.0</b>	<b>REFERENCES .....</b>	<b>22</b>

### LIST OF FIGURES

Figure 1	Study Area Location
Figure 2	MOE Water Well Records – Depths to Water
Figure 3	MOE Water Well Records – Well Depths
Figure 4	Surficial Geology of Site and Surrounding Area
Figure 5	Surveyed Water Wells and Site Features
Figure 6	Geological Cross-Section of Site A – A'
Figure 7	Geological Cross-Section of Site B - B'

### LIST OF TABLES

Table 1	Review of Aerial Photographs – Significant Site Features
Table 2	MOE Water Well Record Database Summary
Table 3	Surveyed Water Wells

### LIST OF APPENDICES

Appendix A	Site Photographs
------------	------------------

## **1.0 INTRODUCTION**

Ecoplans Limited (Ecoplans) was retained by the Ministry of Transportation – Eastern Region (MTO) to provide hydrogeological expertise in support of proposed road improvements to Highway 62 from one kilometre (km) south of Quin-Mo-Lac Road to the south limit of the Village of Madoc (Project) (Figure 1). The proposed highway improvements include horizontal and vertical realignments, road widening, site drainage improvements and relocation and reconstruction of three intersections. As part of the widening and realignment along Highway 62, within the section from Quin-Mo-Lac Road to Moira Lake, a bedrock cut (to a maximum depth of 25 meters) is proposed through this section. In support of these improvements, and as required by the Ministry of the Environment (MOE), MTO has retained Ecoplans to carry out a Hydrogeological Screening (Study) of the area in order to assess potential hydrogeological impacts resulting from the proposed project.

This report documents the findings and recommendations with respect to potential groundwater-related impacts in the study area.

### **1.1 Purpose of Study**

The purpose of the Study is to evaluate the geology and hydrogeology of the study area, and provide an assessment of potential groundwater impacts from the proposed highway construction.

### **1.2 Scope of Work**

The scope of the study consisted of a site history review (“background information review”) and site reconnaissance (“site inspection”). Each is briefly discussed below.

#### ***1.2.1 Background Information Review***

The background information review included reviewing and evaluating the following information sources:

- Topographic maps (Ontario Base Maps and National Topographic Survey Maps);
- Current and historical aerial photographs;
- Ministry of the Environment (MOE) water well records;
- Geological Maps (surficial and bedrock);
- Federal, provincial and municipal groundwater studies; and
- Background studies (geotechnical, environmental and drainage)

#### ***1.2.2 Site Inspection***

Site inspections were completed to document and evaluate existing conditions such as surface topography, surface and subsurface hydrology, water well locations, land use and structures, and municipal servicing. The site inspections included the following items:

- Describing the general topography and drainage characteristics of the study area;
- Describing any significant geological features on and directly adjacent to the study area including kettle holes and exposed bedrock;



- Verifying the location and nature of all permanent water courses and tributaries within one kilometer (km) of the study area;
- Describing the location and nature of all significant water courses and associated features including wetlands, tributaries, closed depressions, kettle holes, and drainage ditches on and directly adjacent to the study area;
- Verifying existing lands use and presence of structures within 500 metres of the study area;
- Verifying the presence of municipal piped water to the study area;
- Verifying the location and nature of any significant groundwater discharge/seepage areas; and
- Completing a private water well survey of all wells within 500 m of the proposed Highway 62 realignment.

### **1.2.3 Documentation**

The results of the background information review and site inspection are documented in this report and provide an assessment of both the local and regional groundwater system and its vulnerability to potential highway construction activities. The vulnerability assessment includes the following considerations:

- Location and significance of surface water courses at and around the study area;
- Current and future use of groundwater in the vicinity of the study area for water supply;
- Groundwater susceptibility to surface contamination;
- Presence of sensitive receptors (water wells and surface water courses) hydraulically downgradient of the study area; and
- Presence of potentially impacted groundwater users within the study area with respect to the proposed bedrock cut.

## **1.3 Public Consultation**

Given the public sensitivity to the proposed highway improvements and since various components of the Study require interaction and cooperation with potentially affected property owners, citizens groups, and regulatory agencies, a key element of the study is the preparation and implementation of a Public Consultation Program (PCP).

The PCP was developed to address the study-specific requirements and to provide a detailed outline of the methods for public and agency consultations that will be utilized and implemented throughout the duration of the study. The PCP has been developed to place an emphasis on consultation with the water well owners in the vicinity of the study area.

## 2.0 STUDY AREA DESCRIPTION

The study area includes a 500 m buffer zone along Highway 62, extending from approximately 1 km south of Quin-Lo-Mac Road northwards to the south limits of the Village of Madoc (approximately 5.8 km in length). Figure 2 presents the study area plan as well as the proposed Highway 62 realignment. The following is a summary of significant site features in the area based on background information review (Section 3.0) and Ecoplans' site inspection (Section 4.0).

- The central area is located on a large bedrock outcrop rising above the surrounding agricultural areas to the south and west part of the study area, and Moira Lake to the north and east. Exposed bedrock outcrops are visible at numerous locations;
- The limestone bedrock appears to be covered by a discontinuous thin veneer of overburden, and is predominantly vegetated with mixed deciduous and coniferous forest;
- Numerous fractures were observed within the limestone outcrops;
- Groundwater seepage was observed along the northern slope of the main bedrock outcrop, just south of Moira Lake;
- A former limestone quarry is located at the northeastern corner of highway 62 and Quin-Mo-Lac Road. The quarry is approximately 0.18 ha in size and has an approximate maximum depth of 5 m. The former quarry is located directly within the proposed new re-alignment of Highway 62;
- The north and east ends of the study area slope significantly downwards toward Moira Lake;
- Land located to the south (from the former quarry south to approximately 1 km past Quin-Mo-Lac Road) consists primarily of agricultural lands;
- Land located to the north of the Moira Lake bridge consists of flatter, low-lying marsh and forested lands. Bedrock exposure visibly decreases through this area;
- Surface water bodies located within a 2 km buffer of Highway 62 include two lakes (Snake Lake and Whire Lake) which are both located southeast of the Quin-Mo-Lac and Highway 62 intersection (the lake locations are presented in Figure 1);
- Moira Lake (as shown in Figure 1) divides the study area in half at the Moira Lake bridge; and
- Moira Creek runs along the western side of Highway 62 from Moira Lake northwards towards the Town of Madoc.

### Current Land Use

According to the Preliminary Design Report (TSH, 2005), existing land uses in the study area are agricultural, vacant scrub lands, and rural residential. Farming operations are generally animal operations with minor land use for cropping. Commercial development within the study area is limited.

Based on the site visit, the following types of land use were identified within the study area, the site falls within the following land designations:

- *Rural* – found on all sides of the study area extending from the east to the west limits of the Township of Madoc. Permitted land uses include: agricultural, forestry, low density residential, rural commercial, rural industrial, recreational and institutional.

- *Agricultural* – found south and west of Highway 62 from Quin-Mo-Lac Road northwards to Moira Lake. Permitted land uses include farm residences and structures relating to farming operations.

Ecoplans also completed a ground survey of the surrounding area to document current land use and any significant structures and water courses within 500 metres of the site. Figure 2 shows the approximate site limits and significant structures documented during the survey. The following relevant data from the ground survey is included below:

- The site is surrounded by mixed land uses ranging from open field/forest to agricultural to residential/cottage properties;
- There are numerous residents located along Highway 62. Based on the ground survey, the majority of properties located directly adjacent to Highway 62 appeared to be dwelt in year-round as opposed to seasonally;
- Significant water courses within 500 m of the site include Moira Lake as well as numerous wetlands along the northern portions of the site towards the Village of Madoc.

#### Current Municipal and Private Servicing

As part of the ground survey, Ecoplans attempted to confirm the presence and extent of private servicing of the site and the immediate surrounding area. At the time of inspection, Ecoplans identified municipal water service to the Town of Madoc. Ecoplans also confirmed that the surrounding area outside the Town of Madoc limits is serviced privately-owned water wells, with each farm/dwelling/business serviced by a septic system and associated weeping tile bed (See Section 5.0).

There are two municipal wells located within the site limits. Both wells provide potable water to the community of Madoc and are located within the town limits. Municipal sewage service is also supplied to the town via two sewage treatment lagoons as outlined on Figure 5A.

### **3.0 BACKGROUND INFORMATION REVIEW**

Ecoplans completed a background information review for the study area. The purpose of the review was to gain a general understanding of the regional and local geology and hydrogeology of the site. This was achieved by reviewing topographic and geological maps, water well records, current and historical aerial photographs, local and regional groundwater studies, and background geotechnical and environmental studies.

#### **3.1 Topography**

The site is located within the physiographic region known as the Dummer Moraines (Chapman and Putnam, 1984). The study area is characterized by rough, stony land bordering on the Canadian Shield. The general topography of the study area is variable. The study area itself is located on a large bedrock outcrop on its south end which drops quickly to approximately the same elevation as Moira Lake in the area of Watson Line and Highway 62 intersection. Moira Lake has an approximate elevation of 155 meters above sea level (masl) (JWL, 2001). The main rock outcrop extends through the study area for approximately 1.1 km in the north/south direction and 0.5 km in the east/west direction. The topography surrounding the bedrock outcrop is relatively flat in comparison and gently slopes upwards from Moira Lake towards the Hastings Highlands.

#### **3.2 Drainage**

Regional drainage is into Moira Lake, located in the approximate centre of the study area. Moira Lake is part of the Quinte watershed (which is the largest watershed in the area), which drains approximately 2,700 square kilometers (km<sup>2</sup>), and includes the entire Municipality of Centre Hastings and Township of Madoc (Dillon, 2004). From Moira Lake, surface water is directed downstream via the Moira River towards the adjacent Tweed and Stocco Lakes. Surface water then flows southwest and ultimately towards Belleville and Lake Ontario.

Numerous vertical fractures throughout the exposed bedrock section of study area indicate that site infiltration is relatively fast providing significant recharge to the bedrock aquifer. The site inspection was conducted during the spring melt and it was noted that low lying areas (i.e. land on the shoreline of Moira Lake) is subject to fluctuations of surface water elevations during high flow periods.

#### **3.3 Geology**

##### **3.3.1 Surficial Geology**

According to the Quinte Regional Groundwater Study completed by Dillon Consulting Limited (2004) for Quinte Conservation, the study area consists of both Precambrian and Paleozoic rock and is interspersed by surficial overburden units consisting of either sandy, silty or gravelly till units or organic (peat and muck) soil types. Till units located within the study area were deposited during the retreat of glaciers approximately 10,000 years ago and are made up of material scoured from the landscape during their advance. Organic soil found within the low lying areas of the study area is resultant from poorly drained areas and/or a shallow water table. The south section of the study area from Qui-Lo-Mac Road to the approximate location of the abandoned quarry consists of drumlinized silt/sandy till and is expected to be less than 10 m in thickness before bedrock is encountered (TSH, 2000). In general, the majority of the study area

consists of Paleozoic rock with less than 1 m of overburden (Dillon, 2004). Figure 4 depicts the overburden deposits located within the study area.

### 3.3.2 Bedrock Geology

The bedrock surrounding the study area is composed of Precambrian rock from intersection of Highway 62 and Moira Lake northwards towards the Town of Madoc and Paleozoic sedimentary bedrock from the intersection of Highway 62 and Moira Lake southwards towards Quin-Lo-Mac Road (OGS, 1991). The proposed bedrock cut will intersect the Paleozoic bedrock of the Shadow Lake and Gull River Formations which consist of limestone, dolostone and sandstone from the Middle Ordovician period (OGS, 1991). A North-South cross-section along Highway 62 section is provided as Figure 6, showing the subsurface geology interpreted from geological information provided in the MOE water well records. The subsurface geology confirms that limestone and predominantly to the south of Moira Lake Bridge and will be cut during the construction of the new alignment (Figure 6). Granite is the predominant formation north of the Moira Lake Bridge. A thin layer of overburden composed of clay, sand and gravel is also located in patches with an increasing thickness southwards starting at Quin-Mo-Lac Road. Another cross-section (E-W) along Preston Road/Quin-Mo-Lac Road along the southern limits of the study area is presented on Figure 7, showing a relatively thicker overburden deposits overlying limestone bedrock. It is also noted that overburden deposits increases in thickness west of highway 62 along Preston Road.

The bedrock throughout the study area is known to be vertically fractured with the number of fractures decreasing with depth (Dillon, 2004). Figure 4 shows the bedrock geology of the site and surrounding area.

## 3.4 Hydrogeology

### Preamble

Groundwater is found in water bearing zones below the ground. Less permeable or impermeable layers called aquitards may separate these water bearing zones or aquifers. The aquitards restrict groundwater movement typically between the shallow groundwater zone and the deeper groundwater zone. The shallow groundwater zone is usually perched, unconfined (i.e. not under hydrostatic pressure), limited in areal extent, and generally reflects the surface topography. On the other hand, the deeper groundwater zone is usually at depth, confined (i.e. under hydrostatic pressure/artesian conditions), regional in extent, and does not generally reflect the surface topography. The regional aquifer, or groundwater system, is usually the potable water supply source for human and agricultural consumption.

### Study Area

The hydrogeology of the study area is predominantly characterized by the bedrock (regional) aquifer system. A majority of the domestic water wells in the study area utilize the upper 10 to 20 m of the bedrock as their source of potable water. The average well depth throughout the Township of Madoc is reported to be 30 m with almost 99 percent of wells installed into the bedrock formation (Dillon, 2004).

The bedrock aquifer system throughout the study area is located in the Paleozoic bedrock deposits composed primarily of limestone, dolostone and sandstone. Groundwater flow is through secondary porosity from these fractures, while primary porosity only accounts for approximately 2% of all flow (Freeze and Cherry, 1979). Vertical fractures can also form which may result in unconfined aquifer conditions (as observed during the site visit) where the bedrock is exposed at ground surface without adequate overburden cover which has the potential of increasing

susceptibility to surface contamination. The Madoc Village – Municipality of Centre Hastings Well Head Protection Area Delineation Report (Dillon, 2004) indicates that the bedrock aquifer throughout the study area can be considered unconfined due to the heterogeneity and orientation (i.e. vertical) of bedrock fracturing and, based on these fracture characteristics, the actual flow patterns around wells are difficult to predict.

Based on previous reports reviewed as part of this study, the groundwater flow throughout the Moira watershed mimics surface water drainage patterns and flows south to southwest (Dillon, 2004). However, local groundwater flow at smaller scales may deviate from the deeper groundwater system due to the effects of local topography.

### 3.5 Aerial Photographs

Historical aerial photographs (for the years 1929, 1948, 1966, 1976, 1987 and 1995) for the site and surrounding area were reviewed by Ecoplans to identify any surface features that are of potential hydrogeological significance (surface water bodies, vegetation cover and human development impacts). A description of the notable features for each aerial photo is summarized in Table 1.

**Table 1 Review of Aerial Photographs – Significant Site Features**

Year	Significant Site Features
1929	<ul style="list-style-type: none"> <li>- Hwy 62 present</li> <li>- Surrounding lands are predominantly agricultural</li> <li>- Railway adjacent to Hwy 62 present</li> <li>- A pond south of the intersection of Hwy 62 and Watson Lane present</li> <li>- Minimal forest cover in the southern section of the site (south of Moira Lake)</li> </ul>
1948	<ul style="list-style-type: none"> <li>- Agricultural activities have increased in the surrounding lands</li> <li>- Possible mining activities identified to the west of the site (west of the railway) in the northern section (north of Moira Lake)</li> <li>- Small quarry identified to the northeast of the intersection of Hwy 62 and Quin-Mo-Lac Road</li> <li>- Growth of the Town of Madoc</li> <li>- No other significant changes since the 1929 aerial photo</li> </ul>
1966	<ul style="list-style-type: none"> <li>- Increased number of cottages and residential dwellings identified throughout study area</li> <li>- Continued growth of the Town of Madoc</li> <li>- No other significant changes since the 1948 aerial photo</li> </ul>
1976	<ul style="list-style-type: none"> <li>- Two sewage lagoons identified to the west of Hwy 62 in the northern section</li> </ul>

Year	Significant Site Features
	<p>of the study area</p> <ul style="list-style-type: none"> <li>- Continued growth of the Town of Madoc</li> <li>- No other significant changes since the 1976 aerial photo</li> </ul>
1987	<ul style="list-style-type: none"> <li>- Railway adjacent to Hwy 62 appears to be abandoned</li> <li>- Mining activities west of the railway in the northern section appears to be abandoned</li> <li>- Small quarry northeast of the intersection of Hwy 62 and Quin-Mo-Lac Road appears to be abandoned</li> <li>- Continued growth of the Town of Madoc</li> <li>- No other significant changes since 1976 aerial photo</li> </ul>
1995	<ul style="list-style-type: none"> <li>- Continued growth of the Town of Madoc</li> <li>- No significant changes since 1987 aerial photo</li> </ul>

The most significant observations noted on the aerial photos are:

- The possible mining activities first identified in the 1948 aerial photo to the west of the study area; and
- The quarry identified northeast of the intersection of Highway 62 and Quin-Mo-Lac Road.

### 3.6 Water Well Records

#### Preamble

The Ministry of the Environment's Water Well Database is a compilation of water wells drilled in the Province of Ontario for the purpose of human, agricultural and industrial consumption. Pursuant to the Ontario Water Resources Act, any well drilled for these purposes must be drilled by an MOE licensed well drilling contractor and documented on a Water Well Record. The record is then filed with the MOE. Examples of data recorded on a water well record include: location of well, date drilled, depth to water, static water level and subsurface stratigraphy. Since well records have been completed by many different drillers during the past 50 or so years, data accuracy and consistency is sometimes questionable. The most important data recorded on a record are the depth of the water supply aquifer and the subsurface stratigraphy. This information helps in determining whether the aquifer is hydraulically connected to the surface hydrology of an area through groundwater recharge and discharge. It is also important to realize that water wells are drilled into aquifers that can yield appreciable quantities of water for their intended purpose. The majority of these aquifers are normally found at depth in the deep groundwater zones. Therefore, shallow perched aquifers are rarely exploited as a resource due to high susceptibility to contamination, low yields, and potential impacts to surface water baseflow. Water well records seldom identify shallow perched aquifers.



However, given their limitations, water well records still provide a useful source of both local and regional geological and hydrogeological information.

### Study Area

Ecoplans completed a water well record search within a 500 m radius of Highway 62. The results of the search identified a total of 105 water wells. The results of the water wells records search for wells within the buffer area have been summarized in Table 2 and on Figures 2 and 3. However, it should be noted that the well locations are approximate and based on coordinate information provided within the water well records database, which are all subject to some margin of error. The following relevant data from the records is included below:

- The earliest water well records available were from 1948 and as recent as 2006;
- With the exception of 3 overburden wells, all water wells are drilled into the bedrock aquifer, 102 wells in total;
- Water wells drilled into the bedrock aquifer terminate between 7.6 metres (m) to 160 m below ground surface (the 160 m well is a municipal supply well for Madoc Village);
- The depth to water for water wells drilled into the bedrock aquifer range between 0.6 m to 32.3 m below ground surface;
- 103 wells encounter water at less than 15 m below ground surface (i.e. shallow wells), 2 wells encounter water between 15 m and 32 m below ground surface (i.e. intermediate wells);
- The groundwater elevations range from 143.3 m above sea level to 186.8 m above sea level;
- Six wells are commercial water wells, 92 wells are domestic water wells, two of which are installed in the overburden, two wells are use for stock, one of which is installed in the overburden, two wells are classified as municipal wells and another two wells are public supply water wells. One well had no recorded information; and
- The two municipal supply wells are recorded as being installed in Madoc Village in 1950 and 2006 and are located within the 500 m buffer at the northern end of the study area.

### 3.7 Background Studies

This section summarizes the background studies that were reviewed noting significant relevant information.

- i) *Quinte Regional Groundwater Study – Final Report. File No: 03-1813. Prepared by Dillon Consulting Limited. October, 2004.*

Significant relevant information from the above study included:

- The predominant aquifer in the study area is fractured bedrock;
- Precambrian rock is the main aquifer for the Town of Madoc within the study area and north of the Highway 62, Moira Lake intersection;
- Paleozoic limestone provides potable water to the residences located within the study area south of Moira Lake;
- Groundwater flow is through both vertical and horizontal fractures in the bedrock aquifer;
- The top 10 to 30 m of bedrock is very fractured and highly susceptible to contamination due to the lack of overburden;



- Infiltration into the bedrock aquifer is rapid due to the amount of vertical fracturing;
- The bedrock aquifer can be considered unconfined due to vertical fractures;
- The majority of residential wells throughout the area provide sufficient volumes for residential use (approximately 13 liters per minute);
- Natural water quality is generally good. Sulphur has been encountered in the limestone aquifer in areas with higher amounts of shale;
- All residents in the study area are on groundwater;
- There is no evidence of interference due to groundwater pumping; and
- Overburden aquifers are seldom used for water supply due to their variable thickness and limited extent.

ii) *Madoc Village, Municipality of Centre Hastings Wellhead Protection Area Delineation. File No: 03-1813. Prepared by Dillon Consulting Limited. October, 2004.*

Significant relevant information from the above study included:

- The Town of Madoc is supplied by two municipal supply wells (the wells are named the Rollins and Whytock Wells and are located at 95 Rollins Street and 4 Whytock Avenue in the Town of Madoc, respectively);
- The Rollins well was estimated to have been installed in 1955;
- The Whytock well was estimated to have been installed in 1978;
- 5-year average flows for the Rollins and Whytock wells are 325.5 and 222 cubic meters per day, respectively;
- Both wells were reported to contain elevated levels of Nitrate (up to 4.7 milligrams per liter (mg/L) at the Rollins well and 5.1 mg/L at the Whytock well);
- Both wells had detections for microbial parameters (e.g. *Escherichia coli* and total coliform bacteria);
- Both wells exceeded the Medical Officer of Health sodium criteria of 20 mg/L with concentrations of 36.4 mg/L and 27.2 mg/L at the Rollins and Whytock wells, respectively;
- A ravine located approximately 10 m from the Rollins well pump house was listed as a potential concern with respect to well head contamination;
- Contaminants within watercourses were named as a potential source for groundwater contamination due to the vertical fracturing throughout the area; and
- Approximately 20-25% of precipitation was estimated to contribute to bedrock aquifer recharge.

iii) *Municipality of Centre Hastings Groundwater Management Study. Project No: 52-27059. Prepared by Totten-Sims Hubicki Associates (TSH). September, 2000.*

Significant relevant information from the above study included:

- The Municipality of Centre Hastings (municipality) was formerly known as Huntington Township;
- Land use throughout the municipality is primarily agricultural/residential;

- The municipality is composed primarily of heterogeneously fractured rock from the Precambrian age in the north and Paleozoic sedimentary limestone rocks in the remainder of the municipality;
- The upper 15 to 30 m often provide wells with yields exceeding 10 L/min;
- Groundwater quality is reported to be mineralized and/or sulphurous when wells are installed into the deeper bedrock;
- Due to the this overburden layers, the bedrock aquifer is highly to moderately vulnerable to surface-derived contaminants;
- More than 90 percent of installed monitoring wells are completed in limestone at depths less than 30 m; and
- Wells samples as part of the above study had detections and exceedences for microbial parameters.

iv) *Hydrogeology and Bedrock Geology Technical Memorandum. MTO Work Plan: 86-99-00. Prepared by Jacques Whitford Limited. September, 2001.*

Significant relevant information from the above study included:

- Over the 1.9 km profile length of the proposed bedrock cut, the elevation varies from a high of 193.4 m to 156.8 m;
- The realignment of Highway 62 through the study area will involve a 25 m bedrock cut;
- Moira Lake has a water level elevation of approximately 155 masl;
- The interpolated water level is 5 m below the proposed bedrock cut bottom elevation based on review of three water well records in the study area;
- Well number 29-05079 (numbering system unknown) is approximately 120 m from the proposed realignment and was considered representative of the conditions adjacent to the 25 m bedrock cut at Station 20+850;
- Water is reported to have been found in well number 29-05079 at an elevation of 153.8 masl and has a reported static water elevation of 161.7 m. The proposed highway will extend to as deep as 163.6 masl at Station 20+850;
- Based on the above elevations, the static water level at well number 29-05079 is higher than the level of the proposed bedrock cut bottom elevation at Station 20+850 (by approximately 1.9 m); and
- The above report concluded that there is a possibility of water wells being affected by construction and recommended further study of wells in the vicinity of the proposed bedrock cut.

v) *GeoCres Report 3100-090. Proposed New Structure Over Deer Creek on Highway 62. Prepared by MTO. July, 1963*

- Foundation report involves the proposed construction of a new bridge over Deer Creek;
- The proposed structure is located approximately 60 m north of the Highway 62 and Highway 7 intersection along Russel Street in the village of Madoc;
- Overburden encountered during geo-technical drilling consisted of silty sand or sandy silt with gravel underlain by a Silty clay followed by a glacial till;
- Depths to bedrock ranged from 2.4 mbgs to 5.2 mbgs;
- Bedrock encountered consisted of crystalline limestone;

- The report recommends installation of bridge abutments into bedrock as well as a proper dewatering scheme be carried out;
  - Creek level elevation was found to be 553.0 (unitless); and
  - Spread footings were recommended and/or the use of sheet piling installed to bedrock.
- vi) *GeoCres Report 3100-091. Proposed Madoc Creek Culvert Extension at Highway 62 and Proposed New Culvert at Madoc Creek and Highway 7. Prepared by MTO. July, 1962*
- The foundation report involves the proposed culvert extension at Madoc Creek and Highway 62 as well as a new culvert at the crossing of Highway 7 and Madoc Creek;
  - The site is located on the north side of the Village of Madoc, east of Highway 62;
  - A total of 5 boreholes were advanced and encountered approximately 3 to 4.2 metres of overburden, which was underlain by limestone bedrock;
  - Overburden consisted mainly of Silty clay to Clay and Sand with organic matter;
  - Groundwater was found to be 0.6 to 0.9 mbgs at each borehole location;
  - Spread footings were recommended for each location and were recommended to be founded in sound bedrock; and
  - No dewatering problems were anticipated (it was proposed that any seepage be controlled by open pumping).
- vii) *GeoCres Report 3100-092. Proposed New Bridge at Madoc Creek and Highway 7 Line 'C'. 2 Miles West of Madoc. Prepared by MTO. August, 1962*
- The foundation report involves the proposed new bridge at the Highway 7 and Madoc Creek intersection;
  - The site is located 3.2 km west of the Town of Madoc, Concession V, Lot 3;
  - The overburden at the site consists of a layer of Sandy silt and Silty fine sand underlain by very stiff to firm silty clay;
  - A thin layer of gravel was encountered between the clay layer and bedrock;
  - Bedrock was found at an elevations between 524 and 532 (unitless) and consisted of a sound, dark grey schist;
  - Artesian conditions were encountered in the bedrock and granular directly above it. No piezometers were not installed, but a maximum head of 0.6 m above ground surface was measured;
  - Bridge abutments were recommended to be supported on small displacement piles driven into bedrock due to unfavorable groundwater conditions; and
  - Dewatering operations were recommended to be undertaken using sheet piling and scour protection.

### **3.8 Permits to Take Water (PTTWs)**

Ecoplans conducted a search of active permits to take water within the study area via an MOE Eastern Region database. No active permits were found within the study area; however, two (2) active permits were located within 500 m of the defined search boundary. The information provided by the MOE is presented below. A figure depicting the locations of the active PTTWs is presented in Figure 4.

#### **Permit to Take Water 1601-6WDLG5**

Three locations are covered under this permit; 95, 96 and 97 Rollins Street. The permit has been issued to The Corporation of the Municipality of Centre Hastings for the purposes of water supply. The permit allows for a taking from three separate wells (one on each property). Well number two has a dewatering rate of 568 litres per minute (L/min) and a total of 818280 litres per day (L/day) as an allowed taking. Wells number one and three both have an allowable dewatering rate of 1020 L/min (1,469,000 L/day). The permit was issued on February 5, 2007 and expires on December 31, 2016.

#### **Permit to Take Water 89-P-4059**

Two locations are permitted under the above permit. The permit was issued to Canada Talc Limited for lot 14 and concession 14 located in the township of Huntingdon. Purposes of the permits are for quarry dewatering operations (Henderson and Conley shafts are listed as the source locations). The permit was issued July 30, 1989 and expires August 30, 2009.

## 4.0 SITE INSPECTION

Site inspections were carried out on May 21 to 23 and again on June 4 and 5, 2008. The purpose of the site inspections were to observe and document any significant hydrogeological features of the study area such as surface water courses, seepage zones and springs (groundwater discharge), topography and surficial geology. The results of the inspections are summarized below:

### Significant Site Features

- Site topography ranges from relatively flat, rural farmland to significant elevation changes due to bedrock topography throughout the study area;
- Numerous bedrock outcrops were observed during the site inspection;
- There is a bridge located to the north of the proposed bedrock cut spanning Moira Lake (indicating that there is hydraulic separation via surface water occurring between areas to the north and south of the Moira Lake Bridge). The location of the bridge has been labeled on Figure 5B;
- There are wetlands located approximately 900m east along Quin-Lo-Mac Road and also along the east and west sides of Highway 62 north of the Moira Lake bridge. Wetlands along with surface water courses have been labeled on Figures 5A through 5D;
- A potential groundwater seepage zone was observed along the northern ridge of the proposed bedrock cut (immediately south of the Highway 62 and Watson Lane intersection). It is important to note that this groundwater seepage may be ephemeral due to the fact that the site inspection was carried out during a time of year in which the groundwater table is expected to be at its highest elevation. No groundwater seepage was observed during a confirmatory inspection undertaken during the June 4 and 5 visits;
- A former rail bed was observed running northwest from the Highway 62 and Watson Lane intersection northwest towards the village of Madoc (as labeled on Figures 5B and 5C);
- The section of Highway 62 almost immediately north of the proposed bedrock cut is flanked on either side by Moira Lake for approximately 600 m (Figure 5B);
- There is a medium sized pond (approximately 30 m across) located immediately south of the Highway 62 and Watson Lane intersection (Figure 5C);
- There are numerous seasonal cottages located throughout the study area along the shores of Moira Lake. Approximately seven of these cottages are located on an island within Moira Lake to the east of McDonald Crescent. The seven cottages on the Moira Lake island use a former mine shaft located in the centre of the island for sewage disposal. The age and depth of the mine shaft are unknown (no cottagers were available during the site visits);
- There is a large sewage treatment lagoon located to the west of Highway 62 (Figure 5A). The sewage lagoon is owned by the Ministry of Environment (MOE);
- Municipally supplied water was observed (i.e. fire hydrants) throughout the Town of Madoc. The approximate limit of supplied water is outlined in Figure 5A (i.e. last observed hydrant);
- An abandoned rock quarry is located on the northeast corner of the Quin-Lo-Mac Road and Highway 62 intersection (outlined in Figure 5C);
- During the time of the site inspections undertaken in May and June of 2008, the southeast corner of the former quarry contained ponded water. Both inspections occurred after rainfall events and discussions with local residents indicate that the former quarry does not contain

water year round, thus inferring that the source of the ponded water is through stormwater and snowmelt; and

- A potential mineshaft is reportedly associated with the abandoned quarry. The site inspections could not locate this mineshaft.

## 5.0 WATER WELL SURVEY

Ecoplans completed a door-to-door water well survey of all wells within 500 metres of the study area. The purpose of the door-to-door well survey was to confirm the presence, location and construction details, access permitting. The results of the survey identified 54 confirmed private water wells within 500 metres of the site. Letters were dropped off to all residences, providing project description and contact information to schedule an appointment at a later stage. Figures 5A through 5D show the confirmed water well locations. An arbitrary number (1 through 54) has been assigned to each residential well visited to protect well owners' privacy. A complete listing depicting assigned well numbers and owner addresses can be provided upon request. Well Survey results are summarized in Table 3. An outline of the results of the well survey is provided below:

### Domestic Water Wells

- A total of 105 water wells were identified within 500 m of Highway 62 in the MOE Water Well Records. A summary of MOE water well information is provided in Table 1. Locations of the MOE water wells is presented in Figures 2A through 2D;
- 103 properties were visited as part of the site inspection on May 21 to 23, 2008 to contact residents and confirm water wells locations;
- A second attempt to contact well owners that were previously unavailable/not home was made on June 4 and 5, 2008.
- Of the 103 properties visited during the two attempts, contact was made with 54 private well owners (approximately 53 % of total visited) and a water well survey was completed. Table 2 provides a summary of collected information from the water well owners contacted during the site inspection;
- Overall, owner response was well received (only one resident refused to speak to Ecoplans staff);
- Of the 54 private wells located, 49 were used for domestic/residential purposes and 5 were used for commercial purposes (wells number 31, 32 and 47 through 49 in Table 3);
- Well number 8 has logged complaints with the MOE regarding colour and odour; and
- Information letters were also posted at the Madoc Post Office, Centre Hastings Municipal Office (located in Madoc) and the Ivanhoe Community Center.



## 6.0 EVALUATION OF GROUNDWATER RESOURCES

The study area is dominated by either Precambrian bedrock (from the intersection of Highway 62 and Moira Lake northwards) or Paleozoic sedimentary rock from the intersection of Highway 62 and Moira Lake southwards (as outlined in Figure 4). Bedrock is known to be near surface or exposed at surface throughout much of the study area.

Moira Lake, the surface water body dividing these two geological features has the potential to act as a hydraulic barrier between the north and south end of the study area (as labeled in Figure 4). The action of this hydraulic barrier is based on the following:

- Groundwater can interact with surface water in three basic ways;
  - (i) Lakes can receive groundwater inflow;
  - (ii) Lakes can lose water as seepage to groundwater; or
  - (iii) A combination of both occurs at different locations throughout the lake (most commonly occurring in larger lakes).

The above indicates that groundwater within the study area is interacting with surface from Moira Lake via bedrock fractures within the Precambrian and/or Paleozoic geologic units. As such, during construction, it is expected that the above three interactions will continue to occur throughout the duration of the project indicating that Moira Lake will act as a barrier/buffer and inhibit any direct interaction between the two geologic units.

Due to the fact that Moira Lake can be considered to be acting as a hydraulic barrier, the sections containing the Precambrian and Paleozoic bedrock will be respectively referred to as the north and south portions of the study area and will be dealt with separately for the purposes of this discussion.

### 6.1 South Section of Study Area

Based on design details provided to Ecoplans, the proposed realignment of Highway 62 will involve a bedrock cut through the south section of the study area to a maximum depth of approximately 25 metres. The proposed bedrock cut will begin at approximately the location of the former quarry (along Quin-Lo-Mac Road) and progress northwards towards the Highway 62 and Watson Lane intersection. The bedrock throughout this area is known to be vertically fractured. As such, this area can be considered a significant groundwater recharge area for the local water table. It is expected that recharge is driven downward through vertical fractures in the bedrock and ultimately discharges to Moira Lake. It is expected that most private water wells in this area utilize this local groundwater table.

There are 10 confirmed domestic wells located between the proposed Highway 62 realignment and its existing alignment. The proposed bedrock cut has the potential to separate these wells hydraulically from Moira Lake (which may be supplying the bedrock aquifer via fractures).

Based on the final elevation of the bedrock cut and the installation depths of surrounding wells, there is also the possibility that hydraulic pressure may be relieved and groundwater may be drawn away from these wells towards the bedrock cut. Also, significant fracturing may occur during blasting due to the physical composition of the bedrock. This fracturing could potentially interfere with domestic well yield.

Any dewatering occurring during the construction phase of Highway 62 has the potential for contaminant migration to the point of dewatering and jeopardize aquifer water quality and/or



surface water quality at the point of discharge. Dewatering activities also have the potential for impacts with respect to well quantity and available yield for domestic well users.

The south section of the study area also includes residential and agricultural properties from the Highway 62 and Quin-Mo-Lac intersection southward towards Bell Road. There are 11 wells located in this area that may be affected by the re-alignment and road improvements. However, due to the information provided to Ecoplans at the time of this report, the potential for direct impacts to the wells during construction are considered to be minimal through this area. A summary outlining longer term construction impacts which may be of concern for the entire study area is presented in Section 6.3.

## **6.2 North Section of Study Area**

Based on the proposed design drawings provided to Ecoplans, the north section of the study area does not involve any bedrock cuts or excavations, which significantly minimizes the vulnerability of groundwater.

Due to the fact that there are no expected bedrock cuts and/or significant excavations, direct construction impacts and groundwater vulnerability in this area can be considered lower than the southern section.

Road construction may include culvert replacement, which may require de-watering during construction. If de-watering were to occur there is potential for contaminant migration to the point of de-watering and jeopardize groundwater quality and/or surface water quality at the point of discharge. There is also the potential that any work requiring dewatering could potentially affect the amount of water available for domestic use.

Any excavation, blasting work and movement of heavy equipment has the potential to affect fractures within the bedrock and could potentially interfere with private water well yields.

The well survey confirmed five commercial businesses within the northern portion of the study area. The observed business types included: appliance repair and sales, automotive service, wood products manufacture, automotive sales and a car wash. All confirmed businesses were located between Highway 62 and the sewage lagoons (Figure 5A). These businesses as well as the sewage treatment lagoons, have the potential for groundwater impacts through spills/releases to the subsurface.

## **6.3 Longer Term Construction Impacts (North and South Sections)**

Longer term construction impacts may include any of the following:

- Localized groundwater recharge interference due to surface/storm water management implementation resulting from culvert replacement and/or road re-grading;
- Direct physical impact through property acquisition by the MTO (i.e. wells may need to be re-located due to road alignments);
- Introduction of contaminants into the groundwater table from poor construction practices (i.e. improper sediment and erosion control plans, improper machinery refueling areas/spill control procedures);
- Introduction of contaminants due to proximity of domestic wells in relation to the new Highway 62 alignment (i.e. domestic water wells may be closer to the realigned highway resulting in higher susceptibility to contamination).

- Interference with domestic well yields due to bedrock fracture changes resulting from blasting, excavation, heavy machinery use and movement; and
- Potential for increased susceptibility of the groundwater table to surface contaminants (e.g. road salt) due to excavation depths and their associated increased proximity to the groundwater table i.e. the bedrock cut could place the road elevation of Highway 62 closer to the groundwater table resulting in a shorter migration pathway for contaminants.

## 6.4 Relative Risks of Construction Impacts to Private Water Wells

Based on the information collected and assessed during this study, there is the potential for construction impacts to the private water wells in the vicinity of the proposed bedrock cut. The relative risk groupings for the wells are summarized below.

### “High Risk” Wells

Wells considered to have a “high risk” status are wells that have the potential for direct, immediate construction impacts (i.e. deeper bedrock cuts are within close proximity and have the potential for significant groundwater use interference). Well numbers 15 through 20 and well number 40 (as outlined in Figure 5C) are considered to be at “high risk” when compared to wells throughout the study area. It is the intention of the focused well survey and pumping tests (see Section 7.0 – Recommendations) to better predict and potentially mitigate associated construction impacts in this area.

### “Medium Risk” Wells

Wells considered to have a “medium risk” status are located within the southern section of the study area and consist of the remaining 3 wells located between the current Highway 62 alignment and the proposed alignment (well numbers 12 through 14). Also, well number 38 has been designated as “medium risk” due to proximity to the cut and field observed elevations (i.e. these wells have the potential to be impacted based on well depth and proposed bedrock cut elevations).

### “Low Risk” Wells

Wells considered to be “low risk” are wells outside of the proposed bedrock cut area (southern section). Foreseeable construction impacts for “low risk” wells are outlined in Section 6.3 (Longer Term Construction Impacts). All remaining wells on-site are considered to be “low risk”.

## 7.0 RECOMMENDATIONS

Based on the analysis and observations collected during the site inspection, water well survey and background information review, there is a significant potential that wells along the south portion of the study area will be affected by the proposed bedrock cut (these wells have been highlighted in Figure 5C). As such, it is recommended that a detailed Hydrogeological Investigation be implemented prior to any construction activities. As a minimum, the Hydrogeological Investigation should include the following:

### Detailed Residential Well Survey

All wells identified as having the potential for direct construction impacts (in particular wells within the bedrock cut area) should have a detailed residential well survey performed, which will allow for the collection of more specific information regarding well construction and depth, static water level elevation, pump depth and chemical testing for specific compounds of concern. There are a total of eleven (11) wells which have been identified as having potential for direct construction impacts. These wells have been highlighted in Figure 5C.

Information gathered from the detailed well survey will allow for the mitigation of any construction impacts prior to construction (i.e. pump lowering and/or well deepening) as well as allow for the provision of baseline information with respect to water quantity and quality for potential claim resolution at a later stage.

### Focused Hydrogeological Investigation

A focused hydrogeological investigation should include the installation of a monitoring and pumping well network (1 pumping well and 5 monitoring wells) to allow for the collection of groundwater chemical and physical properties within the proposed bedrock cut. Collection of groundwater samples from each monitoring well will provide baseline data to provide a comparison to any potential impacts during and after construction.

The undertaking of hydraulic testing will provide an opportunity to predict any expected impact(s) in the local bedrock aquifer throughout the area of the proposed bedrock cut. Interactions within the aquifer both horizontally and vertically can be better understood and will ultimately allow for the prediction of construction impacts on surrounding private wells. As part of the hydraulic tests, selected residential wells will be monitored in order to aid in the prediction of construction impacts. The hydraulic testing will also provide input with regards to volumes that may potentially need to be dewatered during construction.

### Hydrogeological Design

Based on the results of the focused hydrogeological investigation, a hydrogeological design study should be completed to provide a discussion and present recommendations for planning, design and operational purposes. The study should include a discussion on the site's surface and subsurface hydrological regime including their interaction; any soil and groundwater exceedances (i.e. above the applicable environmental and drinking water standards; susceptibility of the local surface and subsurface hydrology to highway operation impacts; potential flow paths and contaminant attenuation capabilities of any contamination that may migrate off-site; drainage management and stormwater management to minimize the potential for environmental impacts.

Based on the above information, Ecoplans will provide discussions and recommendations on mitigation alternatives; detailed design of mitigative or contingency measures to ensure protection of surface water and groundwater resources; and design of a groundwater monitoring program including both on-site monitoring wells and off-site water supply wells (where appropriate).

Sincerely,

**Ecoplans Limited**

---

Mark Misko, B.Sc.  
Environmental Scientist

---

Martin Gedeon, M.Sc., P. Geo.  
Project Hydrogeologist

---

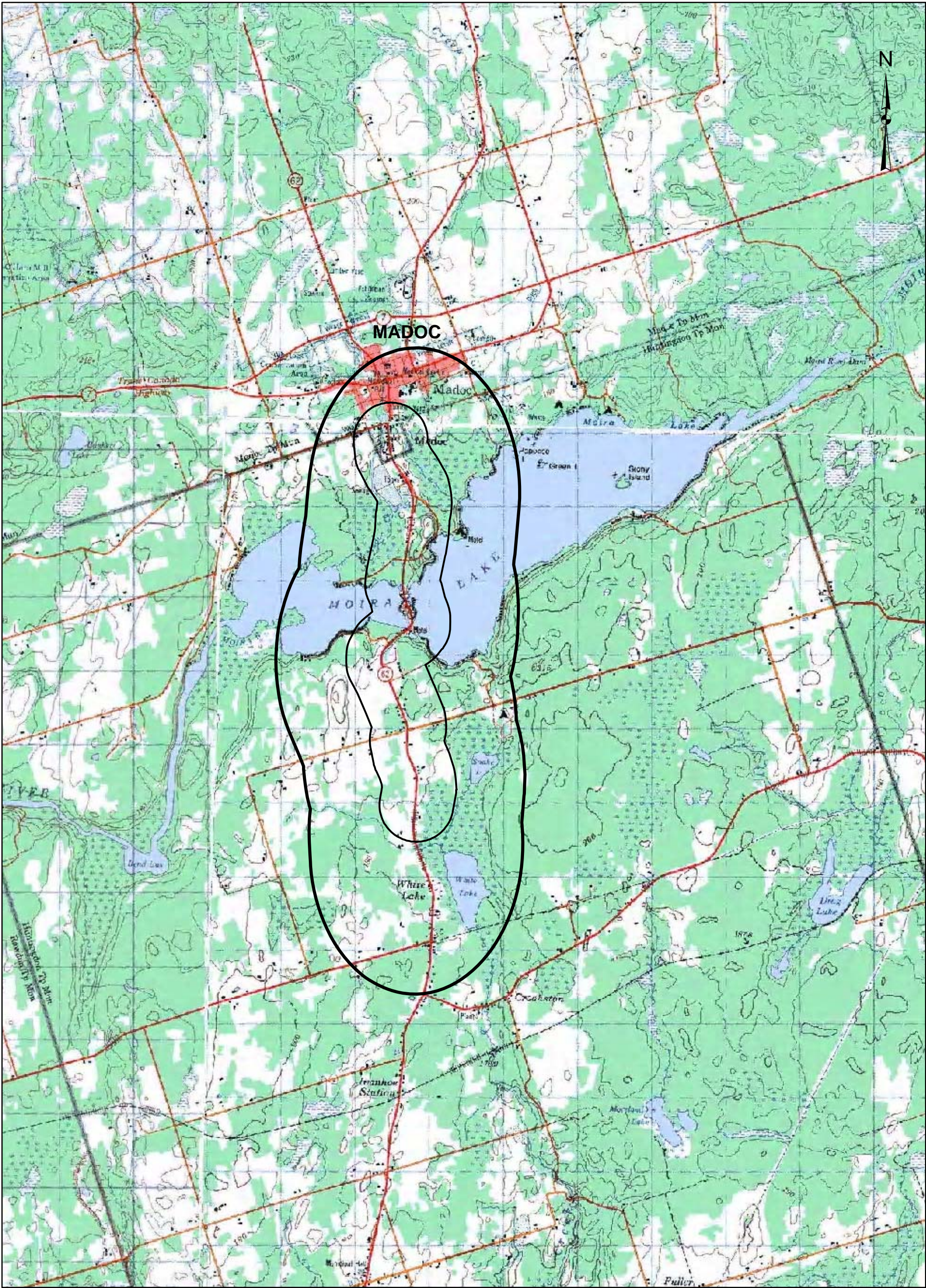
Derek Stewart, M.Sc., P. Geo.  
Project Manager

## 8.0 REFERENCES

- Barnett, P.J., Cowan, W.R. and Henry, A.P. 1991. *Quaternary Geology of Ontario, Southern Sheet*. Ontario Geological Survey, Map 2556, scale 1:1,000,000.
- Belanger, Robert. 2003. *Urban Geology of the National Capital Area*. Geological Survey of Canada, 2003
- Chapman, L.J. and Putnam, D.F. 1984. *The Physiography of southern Ontario, 3<sup>rd</sup> Edition*. Ontario Geological Survey, Map 2715, scale 1:600,000.
- Chapman, L.J. and Putnam, D.F. 1984. *The Physiography of southern Ontario*. Ontario Geological Survey, Special Volume 2, 270p.
- Fetter, C.W. 2001. *Applied Hydrogeology*. Prentice-Hall Inc., Upper Saddle River, New Jersey, USA.
- Freeze, R.A. and Cherry, J.A. 1979. *Groundwater*. Prentice-Hall Inc., Englewood Cliffs, New Jersey, USA.
- Ontario Geological Survey. 1991. *Bedrock Geology of Ontario, Southern Sheet*. Ontario Geological Survey, Map 2544, scale 1:250,000.
- S.N. Singer, C.K. Cheng and M.K. Scafe. 2003. *Hydrogeology of Southern Ontario, Second Edition*. Environmental Monitoring and Reporting Branch; Ministry of the Environment, Toronto, Ontario.
- Williams, D.A., Wolf, D.R. and Rae, A.M. 1982. *Paleozoic Geology of the Arnprior-Quyon Area, Southern Ontario*; Ontario Geological Survey, Map P.2726, Geological Series, scale 1:50,000.
- Dillon Consulting Limited. Quinte Regional Groundwater Study – Final Report. File No: 03-1813. October, 2004.
- Dillon Consulting Limited. Madoc Village, Municipality of Centre Hastings Wellhead Protection Area Delineation. File No: 03-1813. October, 2004.
- Totten-Sims Hubicki Associates (TSH). *Municipality of Center Hastings Groundwater Management Study*. Project No: 52-27059. September, 2000.
- Jacques Whitford Limited. Hydrogeology and Bedrock Geology Technical Memorandum. MTO Work Plan: 86-99-00. September, 2001.

## FIGURES

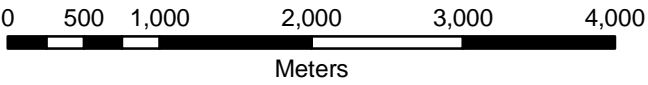




**Legend**

Study Area - 500 m Buffer

Study Area - 2 km Buffer



Source: Ontario Base Map 1:10,000

SCALE 1:50,000



HYDROGEOLOGICAL SCREENING REPORT  
HIGHWAY 62 FROM 1.0 KM SOUTH OF QUIN-MO-LAC ROAD TO THE SOUTH LIMITS OF MADOC  
ASSIGNMENT NO. 4007-E-0031

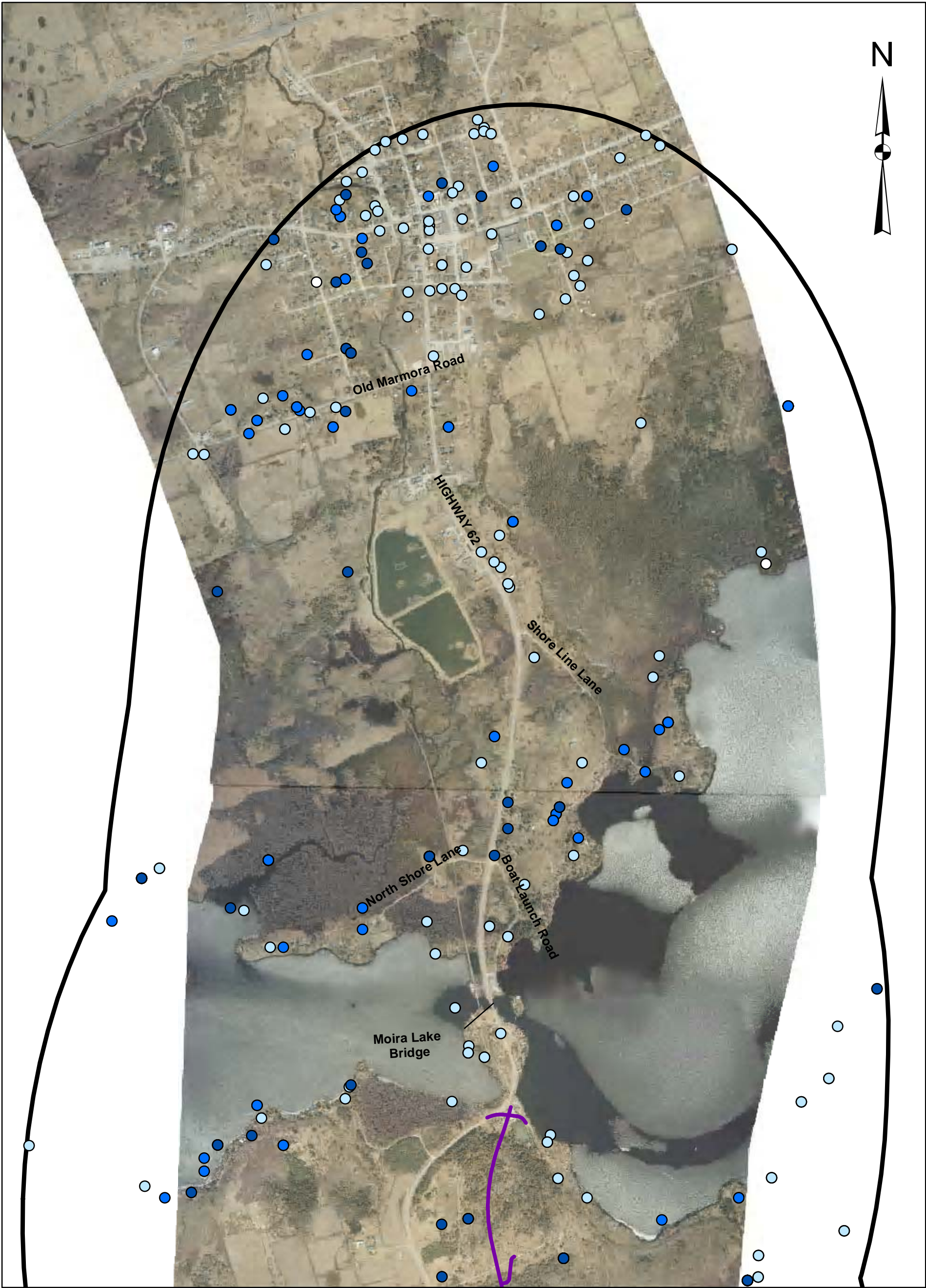
**STUDY AREA LOCATION**

DATE:  
AUGUST 2008

PROJECT:  
550287

FIGURE  
**1**





**Legend**

- Depth to Water > 25m
- Depth to Water >15m to <25m
- Depth to Water 0m to 15m
- Depth to Water - No Data
- Proposed Alignment
- ▭ Study Area - 2 km Buffer

0 255 510 1,020

Meters

Source: Aerial Photograph provided by the Ministry of Transportation

SCALE 1:14,000



HYDROGEOLOGICAL SCREENING REPORT  
HIGHWAY 62 FROM 1.0 KM SOUTH OF QUIN-MO-LAC ROAD TO THE SOUTH LIMITS OF MADOC  
ASSIGNMENT NO. 4007-E-0031

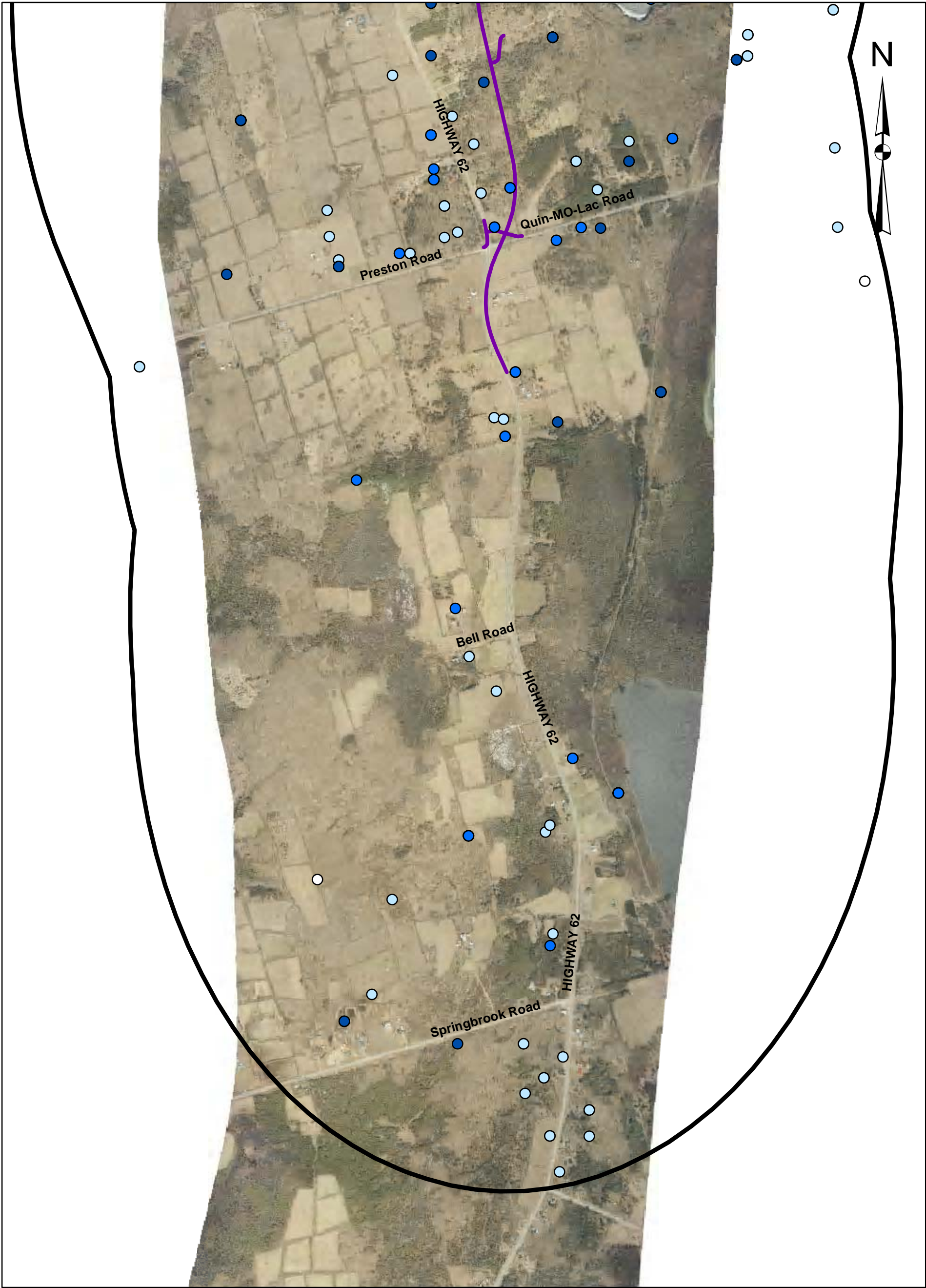
**MOE WATER WELL RECORDS - DEPTH TO WATER**

DATE:  
AUGUST 2008

PROJECT:  
550287

FIGURE  
**2A**





**Legend**

●

Depth to Water > 25m

○

Depth to Water - No Data

●

Depth to Water >15m to <25m

○

Depth to Water 0m to 15m

—

Proposed Alignment

▭

Study Area - 2 km Buffer

0

255

510

1,020

Meters

Source: Aerial Photograph provided by the Ministry of Transportation

SCALE 1:14,000



HYDROGEOLOGICAL SCREENING REPORT  
HIGHWAY 62 FROM 1.0 KM SOUTH OF QUIN-MO-LAC ROAD TO THE SOUTH LIMITS OF MADOC  
ASSIGNMENT NO. 4007-E-0031

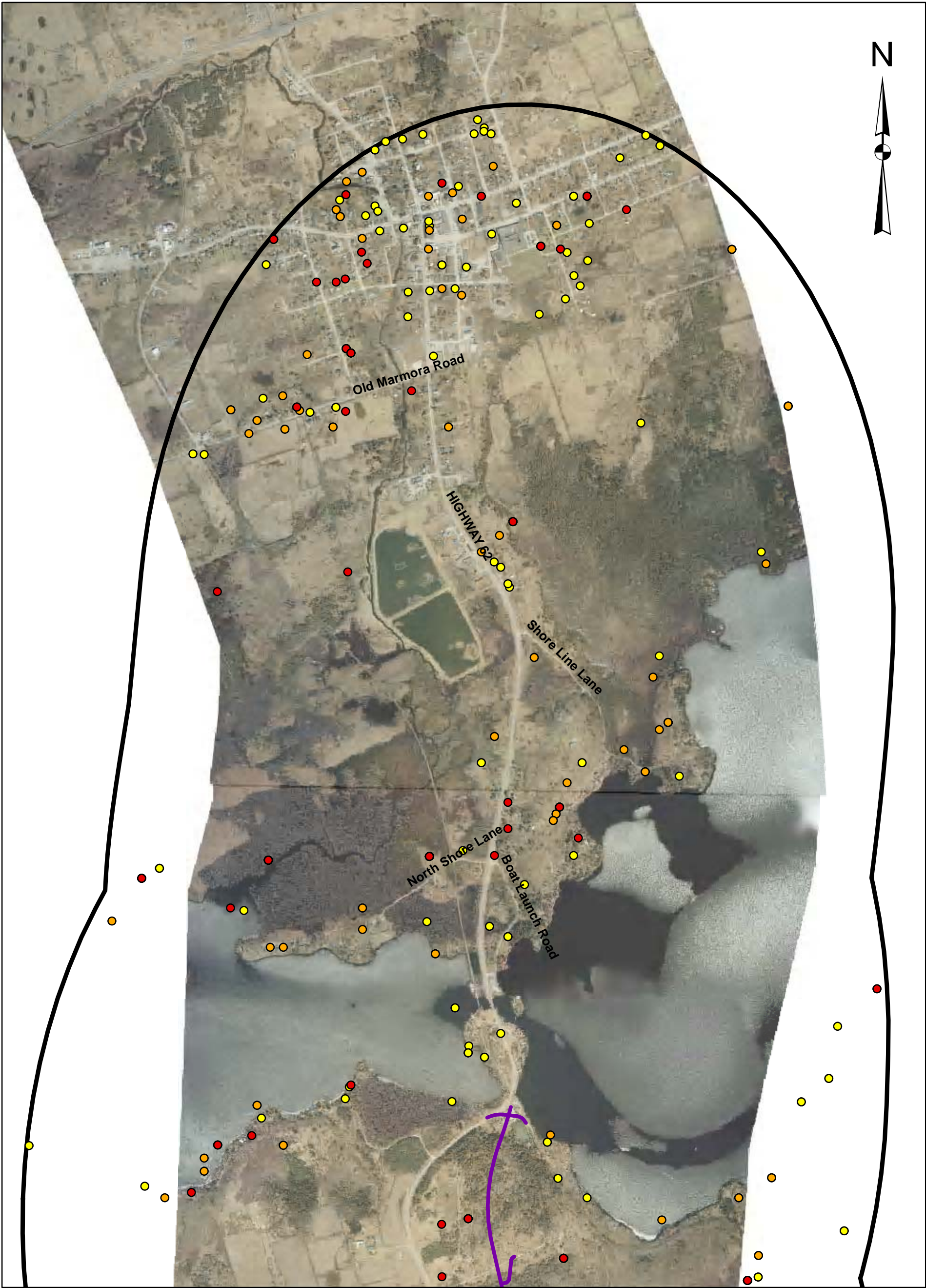
**MOE WATER WELL RECORDS - DEPTH TO WATER**

DATE:  
AUGUST 2008

PROJECT:  
550287

FIGURE  
**2B**





**Legend**

●

 Depth of Well > 25m

●

 Depth of Well - > 15m to 25m

●

 Depth of Well - 0m to 15m

—

 Proposed Alignment

Study Area - 2 km Buffer

02555101,020

Meters

Source: Aerial Photograph provided by the Ministry of Transportation

SCALE 1:14,000



HYDROGEOLOGICAL SCREENING REPORT  
HIGHWAY 62 FROM 1.0 KM SOUTH OF QUIN-MO-LAC ROAD TO THE SOUTH LIMITS OF MADOC  
ASSIGNMENT NO. 4007-E-0031

**MOE WATER WELL RECORDS - WELL DEPTH**

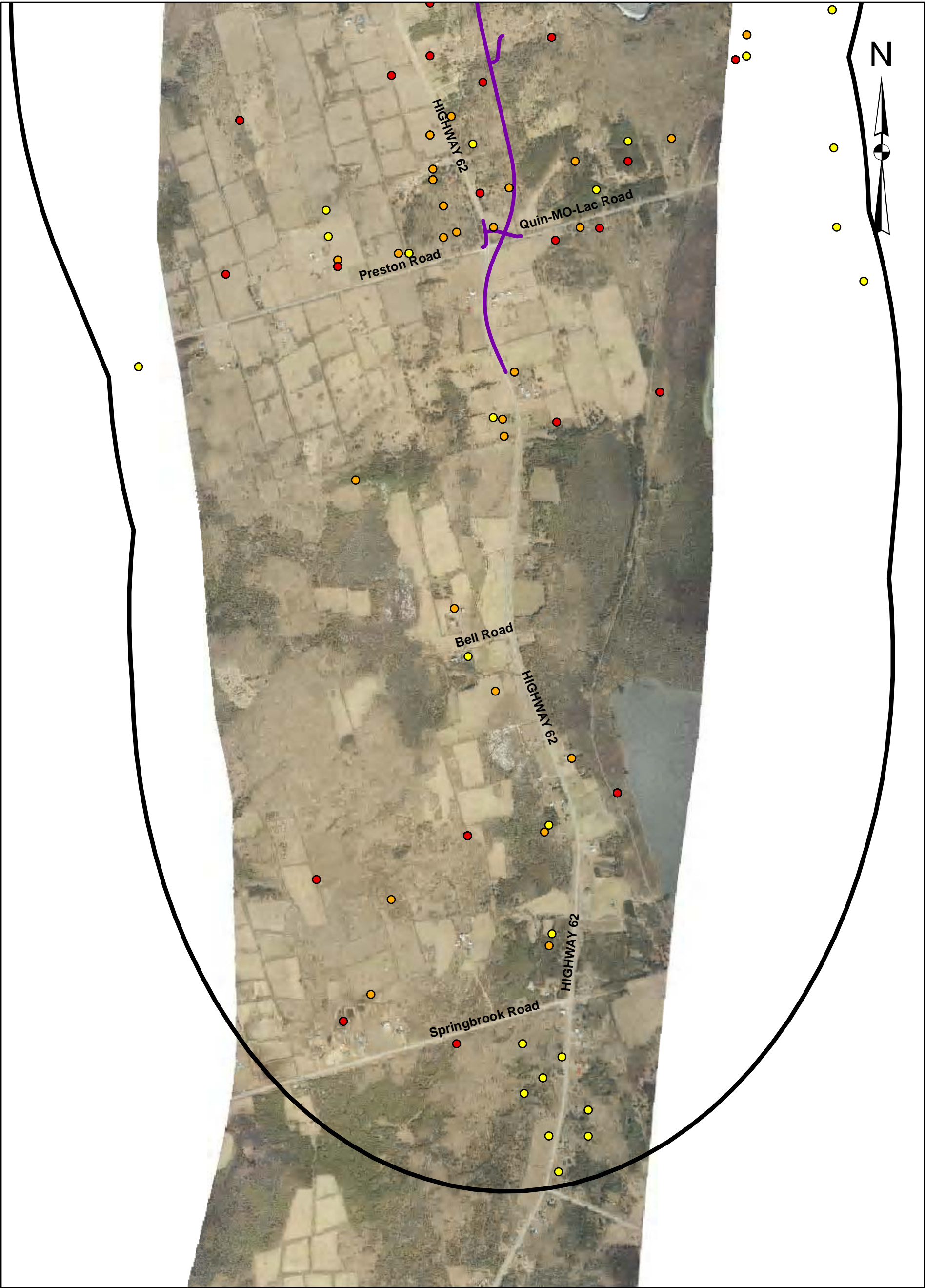
DATE:  
AUGUST 2008

PROJECT:  
550287

FIGURE

**3A**





**Legend**

●

Depth of Well > 25m

●

Depth of Well - > 15m to 25m

●

Depth of Well - 0m to 15m

Proposed Alignment

Study Area - 2 km Buffer

0

255

510

1,020

Meters

Source: Aerial Photograph provided by the Ministry of Transportation

SCALE 1:14,000



HYDROGEOLOGICAL SCREENING REPORT  
HIGHWAY 62 FROM 1.0 KM SOUTH OF QUIN-MO-LAC ROAD TO THE SOUTH LIMITS OF MADOC  
ASSIGNMENT NO. 4007-E-0031

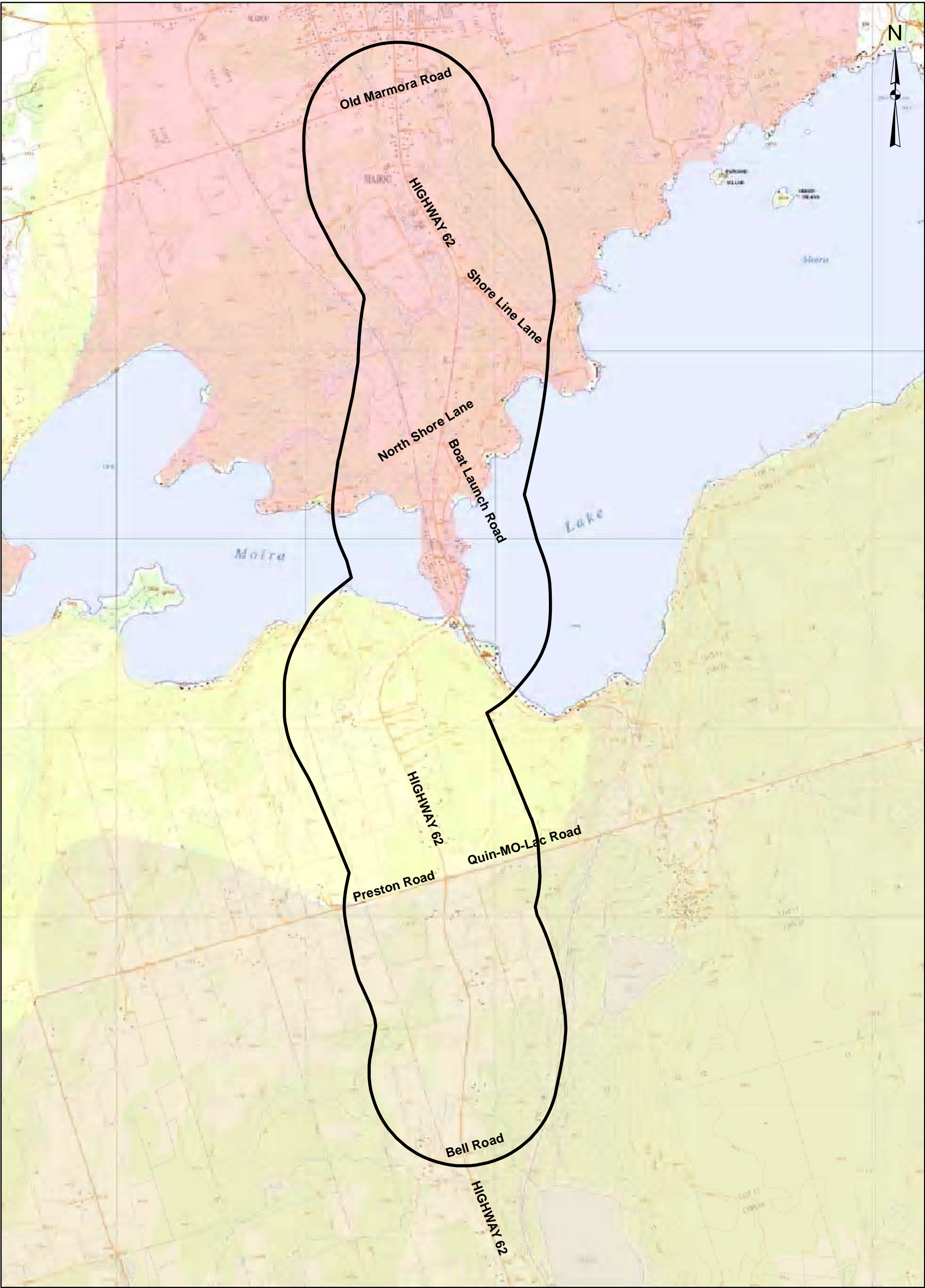
**MOE WATER WELL RECORDS - WELL DEPTH**

DATE:  
AUGUST 2008

PROJECT:  
550287

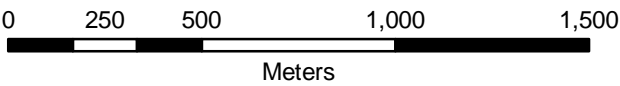
FIGURE  
**3B**





Legend

- Precambrian Granite Rocks
- Paleozoic Sedimentary Limestone
- Stony Till/Hummocky Moraine
- Study Area - 500 m Buffer



Source: Aerial Photograph provided by the Ministry of Transportation

SCALE 1:19,525



HYDROGEOLOGICAL SCREENING REPORT  
HIGHWAY 62 FROM 1.0 KM SOUTH OF QUIN-MO-LAC ROAD TO THE SOUTH LIMITS OF MADOC  
ASSIGNMENT NO. 4007-E-0031  
**SURFICIAL GEOLOGY MAP**

DATE:  
AUGUST 2008  
PROJECT:  
550287

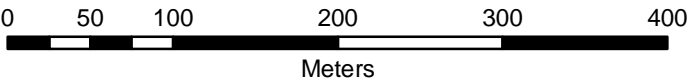
FIGURE  
4





**Legend**

- Field Verified Wells - Ecoplans May 2008
- Former Railway Line
- Well ID Potentially Affected Wells
- Groundwater Seepage Zone
- Proposed Alignment
- Study Area - 500 m Buffer
- Wetlands



Source: Aerial Photograph provided by the Ministry of Transportation

SCALE 1:4,600



HYDROGEOLOGICAL SCREENING REPORT  
HIGHWAY 62 FROM 1.0 KM SOUTH OF QUIN-MO-LAC ROAD TO THE SOUTH LIMITS OF MADOC  
ASSIGNMENT NO. 4007-E-0031  
**SURVEYED WATER WELLS AND SITE FEATURES**

DATE:  
AUGUST 2008  
PROJECT:  
550287

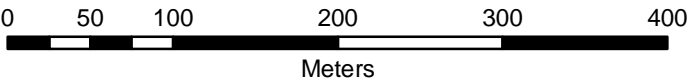
FIGURE  
**5A**





**Legend**

- Field Verified Wells - Ecoplans May 2008
- Former Railway Line
- Well ID Potentially Affected Wells
- Groundwater Seepage Zone
- Proposed Alignment
- Study Area - 500 m Buffer
- Wetlands



Source: Aerial Photograph provided by the Ministry of Transportation

SCALE 1:4,600



HYDROGEOLOGICAL SCREENING REPORT  
HIGHWAY 62 FROM 1.0 KM SOUTH OF QUIN-MO-LAC ROAD TO THE SOUTH LIMITS OF MADOC  
ASSIGNMENT NO. 4007-E-0031  
**SURVEYED WATER WELLS AND SITE FEATURES**

DATE:  
AUGUST 2008  
PROJECT:  
550287

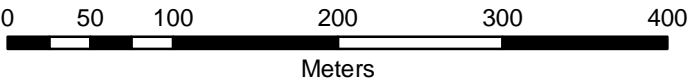
FIGURE  
**5B**





Legend

- Field Verified Wells - Ecoplans May 2008
- Former Railway Line
- Well ID Potentially Affected Wells
- Groundwater Seepage Zone
- Proposed Alignment
- Study Area - 500 m Buffer
- Potential Recharge Area
- Wetlands



Source: Aerial Photograph provided by the Ministry of Transportation

SCALE 1:4,600



HYDROGEOLOGICAL SCREENING REPORT  
HIGHWAY 62 FROM 1.0 KM SOUTH OF QUIN-MO-LAC ROAD TO THE SOUTH LIMITS OF MADOC  
ASSIGNMENT NO. 4007-E-0031

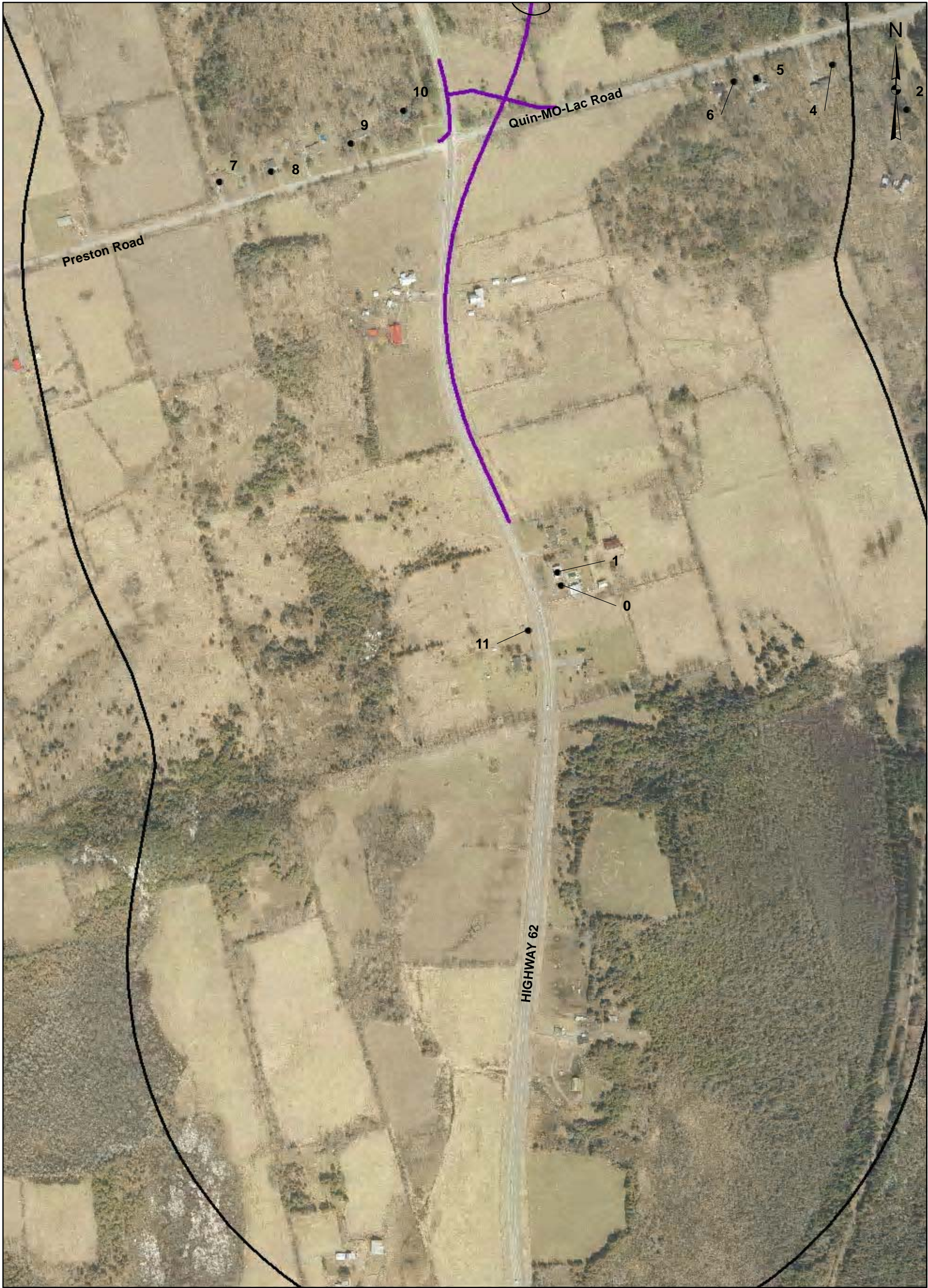
SURVEYED WATER WELLS AND SITE FEATURES

DATE:  
AUGUST 2008

PROJECT:  
550287

FIGURE  
5C





**Legend**

● Field Verified Wells - Ecoplans May 2008

— Former Railway Line

Well ID Potentially Affected Wells

Groundwater Seepage Zone

Proposed Alignment

Study Area - 500 m Buffer

Wetlands

050100200300400

Meters

Source: Aerial Photograph provided by the Ministry of Transportation

SCALE 1:4,600

HYDROGEOLOGICAL SCREENING REPORT  
HIGHWAY 62 FROM 1.0 KM SOUTH OF QUIN-MO-LAC ROAD TO THE SOUTH LIMITS OF MADOC  
ASSIGNMENT NO. 4007-E-0031

**SURVEYED WATER WELLS AND SITE FEATURES**

DATE:  
AUGUST 2008

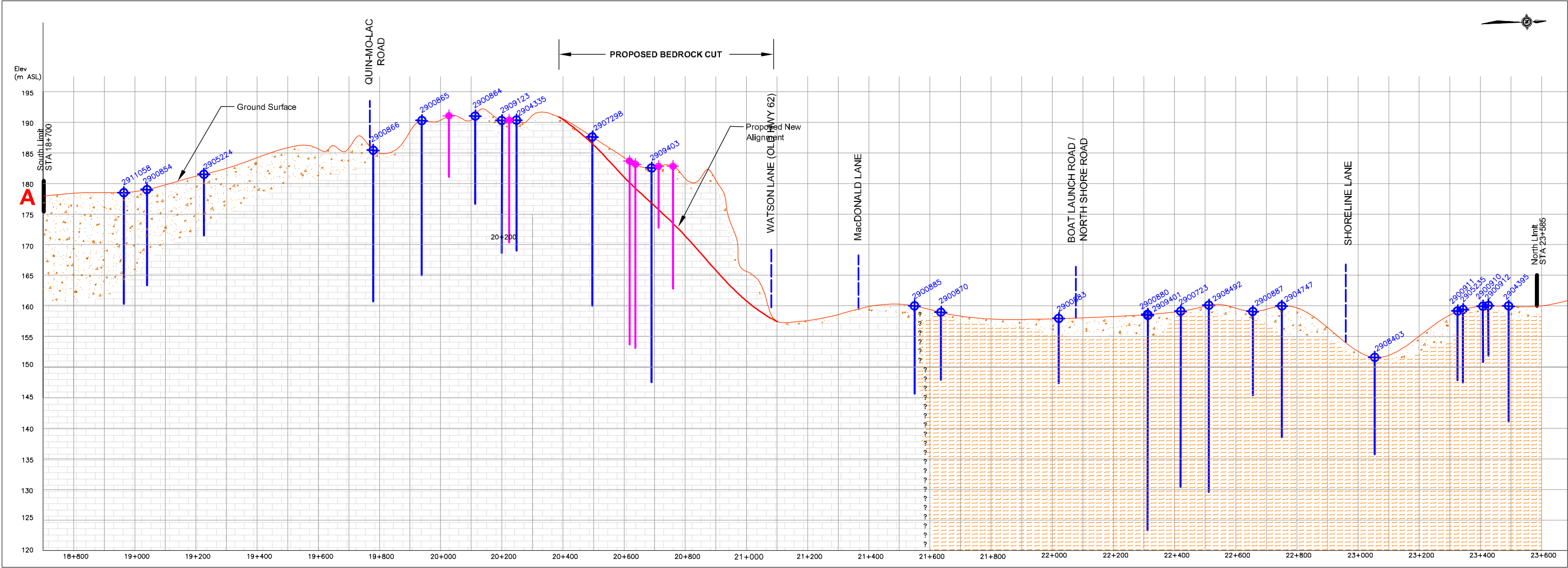
PROJECT:  
550287

FIGURE  
**5D**





Source: Aerial Photograph provided by the Ministry of Transportation



SCALE:

Horizontal: 0 50 100m

Vertical: 0 5 10m

**LEGEND:**

- Water Well Location
- Gravel and Clay
- Limestone
- Granite

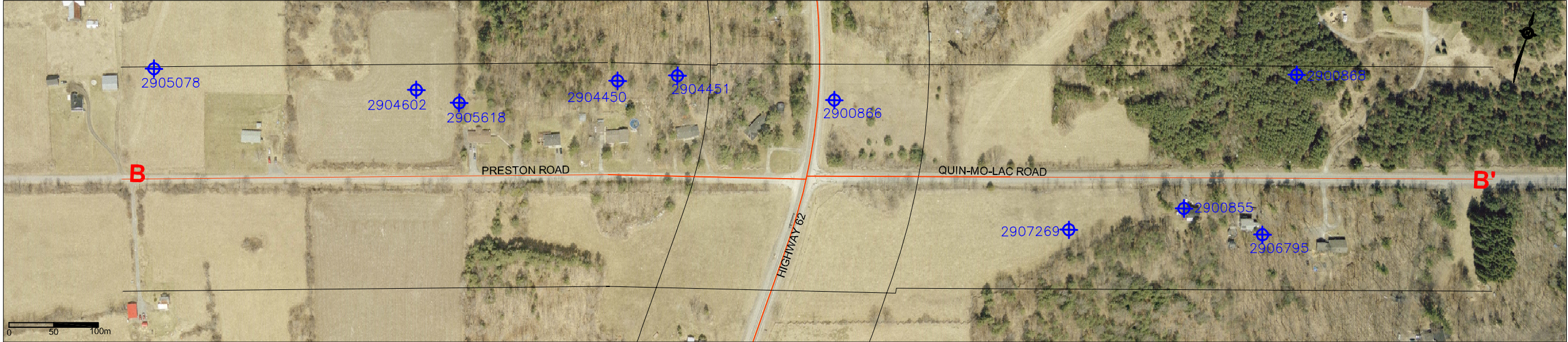


HYDROGEOLOGICAL SCREENING REPORT  
HIGHWAY 62 FROM 1.0 KM SOUTH OF QUIN-MO-LAC ROAD TO SOUTH LIMITS OF MADOC  
ASSIGNMENT NO. 4007-E-0031

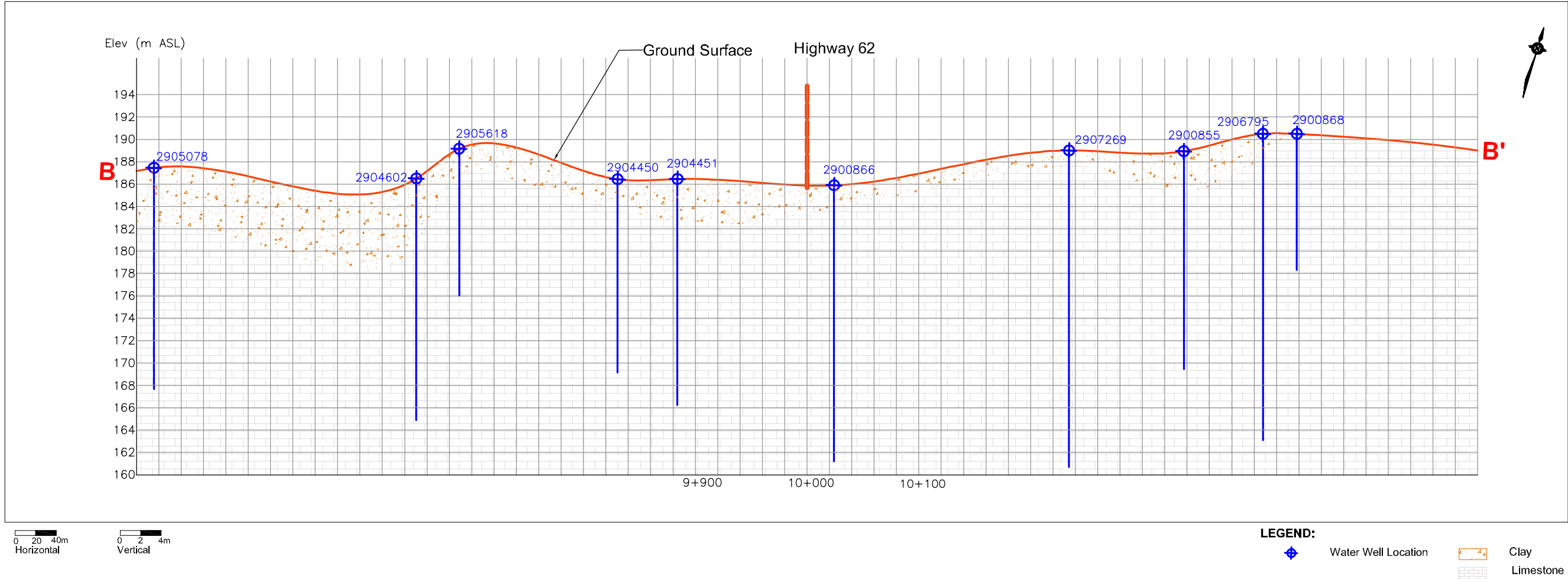
**GEOLOGICAL CROSS-SECTION A - A'**

DATE: August 2008	DRAWN BY: G. Yang	FIGURE NO.:  6
PROJECT NO.: 550287	CHECKED BY: M.Gedeon	





Source: Aerial Photograph provided by the Ministry of Transportation



## **TABLES**

**TABLE 2**  
**MOE Water Well Records Summary**  
**Hydrogeological Screening Report**  
**Highway 62 Realignment and Road Improvements - Assignment No. 4007-E-0031**

ID	County	Township	Concession	Lot	Northing	Easting	Elevation (masl)	Well Depth (m)	Well Depth (masl)	Depth to Bedrock (mbgs)	Depth to Bedrock (masl)	Static Water Elevation (mbgs)	Static Water Elevation (masl)	Date Installed	Water Use	Well Type
2900723	Hastings	Huntingdon Township	13	12	4928400	303750	158.5	29.3	129.2	0.6	157.9	15.2	143.3	9/2/1954	Domestic	Bedrock
2900852	Hastings	Huntingdon Township	11	9	4924602	303592	178.3	16.2	162.2	7.0	171.3	4.0	174.3	8/29/1959	Stock	Bedrock
2900853	Hastings	Huntingdon Township	11	10	4925326	303739	179.8	11.0	168.9	0.0	179.8	6.1	173.7	5/13/1961	Stock	Overburden
2900854	Hastings	Huntingdon Township	11	10	4925321	303774	179.8	15.5	164.3	11.6	168.2	8.5	171.3	11/30/1962	Domestic	Bedrock
2900855	Hastings	Huntingdon Township	11	11	4926048	304068	175.3	22.3	153.0	3.7	171.6	14.6	160.6	11/23/1967	Domestic	Bedrock
2900864	Hastings	Huntingdon Township	12	10	4926365	303662	190.5	14.3	176.2	0.0	190.5	6.7	183.8	8/21/1948	Domestic	Bedrock
2900865	Hastings	Huntingdon Township	12	10	4926179	303689	190.5	25.3	165.2	1.8	188.7	6.1	184.4	6/4/1962	Domestic	Bedrock
2900866	Hastings	Huntingdon Township	12	10	4926050	303740	187.5	24.7	162.8	1.8	185.6	9.1	178.3	12/6/1966	Domestic	Bedrock
2900867	Hastings	Huntingdon Township	12	11	4927073	303940	158.5	10.7	147.8	3.4	155.1	3.4	155.1	6/5/1951	Public Supply	Bedrock
2900868	Hastings	Huntingdon Township	12	11	4926192	304130	190.5	12.2	178.3	0.0	190.5	5.5	185.0	12/10/1959	Domestic	Bedrock
2900869	Hastings	Huntingdon Township	12	11	4927238	303912	155.4	15.2	140.2	4.6	150.9	4.9	150.6	8/5/1961	Domestic	Bedrock
2900870	Hastings	Huntingdon Township	12	11	4927623	303723	158.5	11.6	146.9	1.2	157.3	1.5	157.0	5/26/1967	Domestic	Bedrock
2900880	Hastings	Huntingdon Township	13	10	4928317	303580	157.0	9.1	147.8	3.0	153.9	2.4	154.5	6/3/1950	Commercial	Bedrock
2900881	Hastings	Huntingdon Township	13	10	4928018	303199	157.0	24.4	132.6	1.2	155.8	12.2	144.8	6/30/1950	Domestic	Bedrock
2900882	Hastings	Huntingdon Township	13	11	4927575	303602	157.0	12.2	144.8	1.2	155.8	3.4	153.6	7/16/1950	Domestic	Bedrock
2900883	Hastings	Huntingdon Township	13	11	4928029	303680	155.4	10.7	144.8	0.0	155.4	3.7	151.8	10/16/1954	Domestic	Overburden
2900884	Hastings	Huntingdon Township	13	11	4927365	303538	155.4	7.6	147.8	0.9	154.5	2.4	153.0	3/21/1955	Domestic	Bedrock
2900885	Hastings	Huntingdon Township	13	11	4927533	303662	160.0	14.3	145.7	2.4	157.6	1.2	158.8	6/28/1963	Domestic	Bedrock
2900886	Hastings	Huntingdon Township	13	11	4928188	303813	160.0	13.7	146.3	0.6	159.4	9.1	150.9	6/5/1967	Domestic	Bedrock
2900887	Hastings	Huntingdon Township	13	12	4928650	304031	158.5	13.7	144.8	1.2	157.3	3.7	154.8	10/8/1965	Domestic	Bedrock
2900888	Hastings	Huntingdon Township	13	12	4928700	304190	157.0	19.2	137.8	0.0	157.0	2.1	154.8	10/15/1966	Domestic	Bedrock
2900889	Hastings	Huntingdon Township	13	12	4928456	303933	157.0	21.3	135.6	0.0	157.0	5.2	151.8	7/26/1965	Domestic	Bedrock
2900890	Hastings	Huntingdon Township	13	12	4928431	303922	157.0	21.3	135.7	1.2	155.8	5.8	151.2	8/1/1966	Domestic	Bedrock
2900910	Hastings	Huntingdon Township	14	12	4929392	303723	160.0	9.1	150.9	2.1	157.9	3.0	157.0	5/4/1963	Domestic	Bedrock
2900911	Hastings	Huntingdon Township	14	12	4929317	303757	158.5	12.2	146.3	0.9	157.6	6.1	152.4	4/29/1964	Domestic	Bedrock
2900912	Hastings	Huntingdon Township	14	12	4929413	303698	160.0	8.5	151.5	0.3	159.7	4.3	155.8	2/24/1967	Domestic	Bedrock
2900986	Hastings	Madoc Village	0	0	4930222	303138	182.9	64.0	118.9	0.9	182.0	4.9	178.0	4/1/1950	Municipal	Bedrock
2901008	Hastings	Madoc Village	0	0	4930194	303469	167.6	12.2	155.4	6.1	161.5	3.0	164.6	7/17/1956	Commercial	Bedrock
2903947	Hastings	Huntingdon Township	13	10	4927420	303150	157.0	9.8	147.2	5.8	151.2	1.8	155.1	12/6/1968	Domestic	Bedrock
2903952	Hastings	Huntingdon Township	12	10	4926270	303510	190.5	21.6	168.9	1.5	189.0	9.1	181.4	5/6/1965	Domestic	Bedrock
2904266	Hastings	Huntingdon Township	12	10	4926230	303510	190.5	21.6	168.9	3.7	186.8	8.2	182.3	6/7/1969	Domestic	Bedrock
2904297	Hastings	Huntingdon Township	14	11	4929980	303000	167.6	10.7	157.0	2.1	165.5	6.4	161.2	8/1/1969	Domestic	Bedrock
2904334	Hastings	Huntingdon Township	12	10	4926130	303550	190.5	21.3	169.2	4.6	185.9	7.9	182.6	9/4/1969	Domestic	Bedrock
2904335	Hastings	Huntingdon Township	12	10	4926470	303580	190.5	21.3	169.2	1.8	188.7	7.3	183.2	9/12/1969	Domestic	Bedrock
2904395	Hastings	Huntingdon Township	14	12	4929450	303650	160.0	19.2	140.8	1.8	158.2	4.0	156.1	10/30/1969	Domestic	Bedrock
2904450	Hastings	Huntingdon Township	12	10	4926010	303550	186.2	17.4	168.9	2.7	183.5	6.1	180.1	1/30/1970	Domestic	Bedrock
2904451	Hastings	Huntingdon Township	12	10	4926030	303600	186.2	20.1	166.1	3.7	182.6	6.7	179.5	1/20/1970	Domestic	Bedrock
2904565	Hastings	Huntingdon Township	12	11	4927210	303900	152.4	9.4	143.0	3.7	148.7	4.3	148.1	6/8/1970	Domestic	Bedrock
2904601	Hastings	Huntingdon Township	12	10	4926920	303600	190.5	27.4	163.1	0.0	190.5	12.8	177.7	7/25/1970	Domestic	Bedrock
2904602	Hastings	Huntingdon Township	12	10	4925950	303380	186.2	21.6	164.6	0.0	186.2	10.7	175.6	7/30/1970	Domestic	Bedrock
2904603	Hastings	Huntingdon Township	13	11	4928650	303650	160.0	10.4	149.7	4.0	156.1	2.1	157.9	8/1/1970	Domestic	Bedrock
2904747	Hastings	Huntingdon Township	13	12	4928750	303700	160.0	21.3	138.7	4.9	155.1	3.0	157.0	12/8/1970	Domestic	Bedrock
2904748	Hastings	Huntingdon Township	13	11	4927720	303550	160.0	9.1	150.9	3.0	157.0	0.9	159.1	12/14/1970	Domestic	Bedrock
2905052	Hastings	Huntingdon Township	13	12	4928575	303975	152.4	19.8	132.6	2.7	149.7	6.1	146.3	10/27/1971	Domestic	Bedrock
2905204	Hastings	Madoc Village	0	0	4929925	303525	167.6	23.2	144.5	2.4	165.2	10.7	157.0	2/16/1972	Domestic	Bedrock
2905224	Hastings	Huntingdon Township	11	10	4925500	303820	182.9	18.3	164.6	10.1	172.8	6.7	176.2	4/22/1972	Domestic	Bedrock
2905229	Hastings	Huntingdon Township	13	11	4927990	303750	158.5	10.1	148.4	0.0	158.5	2.1	156.4	3/6/1972	Domestic	Bedrock
2905235	Hastings	Huntingdon Township	14	12	4929330	303750	160.0	12.8	147.2	0.9	159.1	6.1	153.9	4/6/1972	Domestic	Bedrock
2905618	Hastings	Huntingdon Township	12	10	4925950	303420	189.0	13.1	175.9	2.1	186.8	6.1	182.9	12/9/1972	Domestic	Bedrock
2905799	Hastings	Huntingdon Township	13	11	4928047	303444	158.5	9.1	149.4	0.0	158.5	2.1	156.4	4/9/1973	Domestic	Bedrock
2906371	Hastings	Madoc Village	0	0	4929925	303088	175.3	16.8	158.5	1.2	174.0	6.1	169.2	5/10/1974	Domestic	Bedrock
2906604	Hastings	Madoc Village	14	12	4930062	303386	175.3	28.7	146.6	0.6	174.7	10.7	164.6	11/5/1974	Domestic	Bedrock
2906623	Hastings	Madoc Village	14	11	4929984	303135	173.7	29.3	144.5	16.8	157.0	15.2	158.5	11/5/1974	Domestic	Bedrock
2906795	Hastings	Huntingdon Township	11	11	4926046	304142	190.5	27.4	163.1	1.8	188.7	5.5	185.0	9/4/1974	Domestic	Bedrock
2906974	Hastings	Huntingdon Township	12	11	4927550	303600	160.0	9.1	150.9	3.0	157.0	1.2	158.8	7/24/1975	Domestic	Bedrock
2907106	Hastings	Huntingdon Township	14	12	4929513	303718	167.6	16.2	151.5	3.0	164.6	6.1	161.5	9/3/1975	Domestic	Bedrock
2907261	Hastings	Huntingdon Township	13	11	4927925	303475	160.0	16.2	143.9	0.0	160.0	5.5	154.5	9/26/1975	Domestic	Bedrock

Notes:  
m meters  
masl meters above seal level  
mbgs meters below ground surface

**TABLE 2**  
**MOE Water Well Records Summary**  
**Hydrogeological Screening Report**  
**Highway 62 Realignment and Road Improvements - Assignment No. 4007-E-0031**

ID	County	Township	Concession	Lot	Northing	Easting	Elevation (m)	Well Depth (m)	Well Depth (masl)	Depth to Bedrock (mbgs) <sup>(1)</sup>	Depth to Bedrock (masl)	Static Water Elevation (mbgs)	Static Water Elevation (masl)	Date Installed	Water Use	Well Type
2907269	Hastings	Huntingdon Township	11	11	4926000	303975	189.0	28.3	160.6	0.9	188.1	10.7	178.3	7/3/1975	Domestic	Bedrock
2907298	Hastings	Huntingdon Township	12	10	4926700	303500	185.9	28.3	157.6	1.8	184.1	7.6	178.3	5/14/1975	Domestic	Bedrock
2907414	Hastings	Huntingdon Township	12	10	4926600	303700	192.0	27.4	164.6	0.3	191.7	7.6	184.4	8/30/1975	Domestic	Bedrock
2908345	Hastings	Huntingdon Township	12	11	4926300	304050	196.6	15.2	181.4	0.0	196.6	9.8	186.8	9/4/1977	Domestic	Bedrock
2908403	Hastings	Huntingdon Township	14	12	4929050	303850	152.4	16.2	136.2	0.0	152.4	3.7	148.7	4/29/1977	Domestic	Bedrock
2908492	Hastings	Huntingdon Township	13	11	4928500	303750	160.0	30.5	129.5	1.8	158.2	4.6	155.4	10/5/1977	Domestic	Bedrock
2908913	Hastings	Huntingdon Township	13	10	4928099	303199	160.0	22.9	137.2	0.9	159.1	10.7	149.4	8/7/1978	Domestic	Bedrock
2908958	Hastings	Huntingdon Township	12	11	4927000	304050	160.0	11.6	148.4	2.4	157.6	3.7	156.4	7/18/1978	Domestic	Bedrock
2909123	Hastings	Huntingdon Township	12	10	4926399	303499	190.5	21.6	168.9	3.0	187.5	6.1	184.4	5/31/1979	Domestic	Bedrock
2909401	Hastings	Huntingdon Township	13	11	4928299	303699	160.0	35.1	125.0	3.7	156.4	3.0	157.0	12/17/1979	Domestic	Bedrock
2909403	Hastings	Huntingdon Township	12	10	4926899	303499	182.9	35.1	147.8	0.6	182.3	7.6	175.3	5/30/1979	Domestic	Bedrock
2909818	Hastings	Huntingdon Township	12	10	4926199	303799	190.5	21.3	169.2	1.2	189.3	9.1	181.4	5/1/1981	Domestic	Bedrock
2909874	Hastings	Huntingdon Township	13	12	4928299	303999	160.0	7.6	152.4	0.3	159.7	3.0	157.0	8/11/1981	Domestic	Bedrock
2909974	Hastings	Huntingdon Township	14	11	4929999	303099	160.0	9.1	150.9	3.0	157.0	0.6	159.4	9/24/1981	Domestic	Bedrock
2910189	Hastings	Huntingdon Township	13	12	4928482	303946	nv	17.1	nv	0.6	nv	7.9	nv	10/20/1982	Domestic	Bedrock
2910207	Hastings	Huntingdon Township	13	11	4928295	303453	nv	7.6	nv	2.7	nv	1.2	nv	12/15/1982	Domestic	Bedrock
2910761	Hastings	Huntingdon Township	12	11	4926770	303961	nv	10.4	nv	2.4	nv	1.2	nv	12/20/1984	Public Supply	Bedrock
2910889	Hastings	Huntingdon Township	12	11	4926770	303961	nv	47.2	nv	0.6	nv	25.9	nv	6/17/1985	Domestic	Bedrock
2910933	Hastings	Huntingdon Township	14	12	4929566	303770	nv	16.5	nv	5.8	nv	3.7	nv	8/20/1985	Commercial	Bedrock
2911058	Hastings	Huntingdon Township	11	10	4925256	303780	nv	18.3	nv	15.2	nv	6.1	nv	8/26/1985	Domestic	Bedrock
2911269	Hastings	Huntingdon Township	12	10	4926626	303354	nv	53.9	nv	0.3	nv	11.6	nv	9/17/1986	Domestic	Bedrock
2911532	Hastings	Huntingdon Township	14	12	4929566	303770	nv	13.7	nv	4.6	nv	4.0	nv	5/7/1987	Commercial	Bedrock
2911744	Hastings	Huntingdon Township	13	11	4928295	303453	nv	45.7	nv	0.0	nv	12.2	nv	11/6/1987	Domestic	Bedrock
2912250	Hastings	Huntingdon Township	13	12	4928482	303946	nv	36.6	nv	1.8	nv	3.7	nv	7/12/1988	Domestic	Bedrock
2912381	Hastings	Huntingdon Township	12	11	4926770	303961	nv	9.8	nv	2.4	nv	2.4	nv	11/24/1988	Domestic	Bedrock
2912587	Hastings	Huntingdon Township	13	12	4928482	303946	nv	18.3	nv	3.7	nv	1.8	nv	3/15/1989	Domestic	Bedrock
2912664	Hastings	Huntingdon Township	14	12	4929566	303770	nv	31.1	nv	4.6	nv	6.7	nv	5/1/1989	Domestic	Bedrock
2912774	Hastings	Huntingdon Township	13	11	4928295	303453	nv	12.2	nv	0.6	nv	3.0	nv	5/4/1989	Commercial	Bedrock
2913029	Hastings	Huntingdon Township	13	11	4928295	303453	nv	43.3	nv	0.0	nv	4.3	nv	9/12/1989	Domestic	Bedrock
2913031	Hastings	Huntingdon Township	13	11	4928295	303453	nv	12.2	nv	0.9	nv	3.7	nv	9/13/1989	Domestic	Bedrock
2913707	Hastings	Huntingdon Township	13	11	4928295	303453	nv	41.1	nv	4.3	nv	1.2	nv	4/27/1990	Domestic	Bedrock
2913709	Hastings	Huntingdon Township	13	11	4928295	303453	nv	50.3	nv	0.0	nv	9.8	nv	4/27/1990	Domestic	Overburden
2913769	Hastings	Huntingdon Township	12	11	4926770	303961	nv	18.3	nv	4.0	nv	4.0	nv	6/26/1990	Domestic	Bedrock
2914079	Hastings	Huntingdon Township	11	10	4925256	303780	nv	23.8	nv	3.7	nv	11.6	nv	10/24/1990	Domestic	Bedrock
2914424	Hastings	Huntingdon Township	13	11	4928295	303453	nv	18.9	nv	0.9	nv	3.7	nv	5/8/1991	Domestic	Bedrock
2914460	Hastings	Huntingdon Township	12	11	4926770	303961	nv	18.0	nv	2.1	nv	2.4	nv	6/12/1991	Domestic	Bedrock
2914525	Hastings	Huntingdon Township	13	11	4928295	303453	nv	42.7	nv	0.3	nv	7.6	nv	5/27/1991	Domestic	Bedrock
2916315	Hastings	Huntingdon Township	13	12	4928482	303946	nv	30.8	nv	0.3	nv	4.9	nv	9/8/1994	Domestic	Bedrock
2916488	Hastings	Huntingdon Township	13	11	4928295	303453	nv	43.3	nv	0.0	nv	5.5	nv	11/22/1994	Domestic	Bedrock
2917333	Hastings	Huntingdon Township	14	11	4929375	303144	nv	29.0	nv	3.7	nv	6.1	nv	11/18/1996	Commercial	Bedrock
2917659	Hastings	Huntingdon Township	13	11	4928295	303453	nv	37.2	nv	0.0	nv	5.2	nv	9/8/1997	Domestic	Bedrock
2918652	Hastings	Huntingdon Township	12	11	4926770	303961	nv	25.0	nv	3.4	nv	1.2	nv	6/6/2000	Domestic	Bedrock
2919512	Hastings	Huntingdon Township	11	10	4925310	303980	nv	30.5	nv	25.6	nv	2.4	nv	6/21/2002	Domestic	Bedrock
2919570	Hastings	Madoc Township	13	11	4927375	303134	nv	12.2	nv	0.9	nv	2.7	nv	8/3/2002	Domestic	Bedrock
2921316	Hastings	Huntingdon Township	13	12	4928365	304017	nv	42.7	nv	0.6	nv	5.2	nv	6/24/2006	Domestic	Bedrock
2921338	Hastings	Huntingdon Township	13	10	4927428	303156	nv	45.1	nv	13.1	nv	4.6	nv	6/13/2006	Domestic	Bedrock
2921429	Hastings	Madoc Village	0	0	4930206	303155	nv	160.0	nv	4.9	nv	32.3	nv	6/13/2006	Municipal	Bedrock
2921430	Hastings	Madoc Village	0	0	4930206	303155	nv	0.0	nv	0.0	nv	0.0	nv	9/6/2006		

Notes:  
m meters  
masl meters above seal level  
mbgs meters below ground surface

**TABLE 3**  
**Surveyed Water Wells**  
**Hydrogeological Screening Report**  
**Highway 62 Realignment and Road Improvements - Assignment No. 4007-E-0031**

ID	Address	Northing	Easting	Well Type	Quantity/Quality	Notes
1	12766 Hwy 62	4925659	303874	buried (drilled?)	good	2 wells on ppty; only using 1 (2nd one listed). Location of wells approximate
		4925643	303879	buried (drilled?)		
2	118 Quin-Mo-Lac Rd	4926236	304308	drilled	good	installed 1974
3	95 Quin-Mo-Lac Rd	4926495	304226	drilled	unknown	Owner not home (well depth 80 ft - owner estimate)
4	96 Quin-Mo-Lac Rd	4926292	304216	drilled	good	installed approx 15 years ago
5	80 Quin-Mo-Lac Rd	4926276	304121	drilled	good	installed 1974
6	72 Quin-Mo-Lac Rd	4926271	304094	buried (drilled?)	good	installed 1967. Location of well approximate
7	58 Preston Rd	4926146	303454	drilled	unknown	resident didn't have time for survey
8	44 Preston Rd	4926159	303518	buried (drilled?)	poor quality (see notes)	Installed 1976. Location of well approximate. Colour and odor problems; MOE involved - resident believes it's attributed to horse farm south of house on Hwy 62 (12845 Hwy 62)
9	16 Preston Rd	4926194	303617	unknown (drilled?)	unknown	Owner not home, well by driveway, no form filled out
10	12887 Hwy 62	4926235	303682	buried (drilled?)	good	installed 1969-70
11	12751 Hwy 62	4925587	303838	unknown (drilled?)	good	
12	12934 Hwy 62	4926406	303728	drilled	good quantity, iron in water	35-40 ft bgs depth
13	12936 Hwy 62	4926455	303696	drilled	good	depth = 182' static = 32' gpm = 25
14	12954 Hwy 62	4926546	303668	drilled	unknown	Owner not home, well by driveway, no form filled out
15	13002 Hwy 62	4926778	303648	drilled	good	
16	13010 Hwy 62	4926861	303617	drilled	good quantity, iron in water	installed approx 26-28 years ago
17	13026A Hwy 62	4926951	303642	drilled	good	owner busy, left letter
18	13044 Hwy 62	4926994	303625	unknown	unknown	Owner not home, well by driveway, no form filled out
19	13068 Hwy 62	4927107	303593	buried (drilled?)	good	
20	13070 Hwy 62	4927289	303553	buried (drilled)	good	installed approx 40 years ago; resident signed PTE, very interested/willing in project
21	108 Blakely Lane	4927562	303103	buried (drilled)	good	installed approx 40 years ago
22	75 Watson Lane	4927355	303948	buried (drilled)	good	
23	12 McDonald Cres	4927818	303818	drilled	good quantity, hardness	installed approx 25 years ago
24	16 McDonald Cres	4927859	303778	drilled	good quantity, sulphur	2 resident rental unit; renter moving out in 2 weeks
25	66 Boat Launch Rd	4928360	303887	drilled - 2 wells on ppty	good	2 wells on ppty; rented cottages on 2nd well, 10 gpm
26	94 Boat Launch Rd	4928457	303766	drilled	good	installed approx 15 years ago; 12.5 gpm
27	100 Boat Launch Rd	4928542	303796	drilled	good	installed 1977-78; 100ft bgs, 50ft water
28	13606 Hwy 62	unknown location		buried	good	no gps, no picture
29	13618 Hwy 62	unknown location		buried (drilled)	good	no gps, no picture
30	13632 Hwy 62	4929667	303674	buried (drilled)	good	no picture (buried)
31	13623 Hwy 62	4929600	303676	drilled	good	installed 1985, approx 50ft deep; Commercial land use - appliance repair
32	13657 Hwy 62	4929751	303558	drilled	good quantity, sulphur	installed approx 10-12 years ago; non-potable, Commercial land use - auto repair
33	107 North Shore Rd	4928257	303258	drilled	good	164 ft deep, water level at approx 83ft
34	13273-H Hwy 62	4927778	303708	drilled	good	installed 1975 (Bill Taylor), 30ft deep, 50 gpm - well record (no MOE number on record)
35	13273-G Hwy 62	4927774	303692	drilled	good	installed 1970-75, 32ft deep
36	13273-F Hwy 62	4927835	303681	drilled	unknown	installed 1975-83
37	13273-E & D Hwy 62	4927888	303656	drilled	unknown	installed approx 1985, approx 87ft deep, shared well
38	13026B Hwy 62	4927074	304012	drilled	unknown	owner busy, left letter, no form
39	12941 Hwy 62	4926464	303596	buried (drilled)	good	
40	13056 Hwy 62	4927045	303625	buried (drilled)	good	
41	14 McDonald Cres	4927840	303781	buried (drilled)	good	
42	22 Boat Launch Rd	4928094	303756	buried (drilled)	good	
43	56 Boat Launch Rd	4928183	303913	buried (drilled)	good	
44	73 Watson Lane	4927342	304013	drilled	good	
45	93 Watson Lane	4927259	304035	drilled	good	
46	13608 Hwy 62	4929575	303784	buried (drilled)	good	
47	13649 Hwy 62	4929688	303585	drilled	good	not used for potable water - commercial property
48	13641 Hwy 62	4929671	303679	drilled	good	not used for potable water - commercial property
49	13639 Hwy 62	4929657	303646	buried (drilled)	good	not used for potable water - commercial property
50	13403 Hwy 62	4928917	303739	drilled in dug	good	previously tested - want water tested again
51	13453 Hwy 62	4928794	303741	drilled	good	
52	17 North Shore Rd	4928454	303660	drilled	good	
53	107 Watson Lane	unknown (phone in)		drilled	good	~60 feet deep
54	13335 Highway 62	unknown (phone in)		drilled	good	hand pump, ~30 feet deep, winter use only

**APPENDIX A**  
**SITE PHOTOGRAPHS**





A1 - Madoc municipal well



A2 - Looking northeast into Abandoned Quarry - Quin-Mo-Lac Road



**SITE PHOTOGRAPHS**  
 HYDROGEOLOGICAL SCREENING REPORT  
 HIGHWAY 62 FROM 1KM SOUTH OF QUIN-MO-LAC ROAD TO SOUTH LIMITS OF MADOC  
 ASSIGNMENT NO. 4007-E-0031

DATE:  
 AUGUST 2008  
 PROJECT NO.  
 550287





A3 - Looking northwest at former CN rail bridge



A4 - Looking northwest at northern sewage lagoon



**SITE PHOTOGRAPHS**  
HYDROGEOLOGICAL SCREENING REPORT  
HIGHWAY 62 FROM 1KM SOUTH OF QUIN-MO-LAC ROAD TO SOUTH LIMITS OF MADOC  
ASSIGNMENT NO. 4007-E-0031

DATE:  
AUGUST 2008  
PROJECT NO.  
550287



A5 - Looking southeast at pond from former rail yard towards Highway 62



A6 - Wetland located 900m east of Quin-Mo-Lac road and Highway 62



**SITE PHOTOGRAPHS**  
HYDROGEOLOGICAL SCREENING REPORT  
HIGHWAY 62 FROM 1KM SOUTH OF QUIN-MO-LAC ROAD TO SOUTH LIMITS OF MADOC  
ASSIGNMENT NO. 4007-E-0031

DATE:  
AUGUST 2008  
PROJECT NO.  
550287





A7 - Former mine shaft currently used for deep sewage disposal on cottage island



A8 - Looking northeast at former two loons restaurant



**SITE PHOTOGRAPHS**  
 HYDROGEOLOGICAL SCREENING REPORT  
 HIGHWAY 62 FROM 1KM SOUTH OF QUIN-MO-LAC ROAD TO SOUTH LIMITS OF MADOC  
 ASSIGNMENT NO. 4007-E-0031

DATE:  
 AUGUST 2008  
 PROJECT NO.  
 550287