

**WATER SUPPLY SOURCE ASSESSMENT
NEW PRODUCTION WELL
EIA REGISTRATION DOCUMENT**

Prepared for:



Village of Hillsborough
2849 Main Street
Hillsborough, NB
E4H 2X7

Prepared by:



Crandall Engineering Ltd.
1077 St. George Blvd., Suite 400
Moncton, N.B.
E1E 4C9

May 2, 2017
Project No. 14228-01



Crandall File: 14228-1
May 2, 2017

N.B. Department of Environment and Local Government
P. O. Box 6000
Fredericton, NB
E3B 5H1

ATTENTION: Mr. David Maguire - Manager, Environmental Assessment Section

Dear Sir:


**EIA Registration Document and WSSA Initial Application
New Production Well
Hillsborough, New Brunswick**

In regard to the above, Crandall Engineering Ltd. is pleased to provide the Department with six (6) copies of the EIA Registration Document for your review and comments, on behalf of our Client, the Village of Hillsborough.

Please do not hesitate to contact us should you require any additional information.

Yours very truly,

CRANDALL ENGINEERING LTD.



Laura Leger, P. Eng.
Project Engineer

- C. Ms. Shari Kaster, Clerk/Administrator - Village of Hillsborough
Mr. Pierre Plourde, P. Eng., Partner - Crandall Engineering Ltd.

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Crandall Engineering Ltd.
1077 boul. St. George Blvd.
Suite 400
Moncton, NB Canada E1E 4C9
Tel: (506) 857-2777
Fax: (506) 857-2753

133 Prince William St.
Suite 703
Saint John, NB E2L 2B5
Tel: (506) 693-5893
Fax: (506) 693-3250

564 Prospect St.
Suite 101
Fredericton, NB E3B 9M3
Tel: (506) 451-4400
Fax: (506) 857-2753

CRANDALLENGINEERING.CA

Village of Hillsborough

EIA Registration Document

Submitted to:

PROVINCE OF NEW BRUNSWICK
DEPARTMENT OF ENVIRONMENT AND LOCAL GOVERNMENT
P.O. Box 6000
Fredericton, N.B.
E3B 5H1

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**Appendix B: 1:50,000 Scale Map & Location Plan
(Crandall Engineering Ltd. Drawing 14228-1P-C102)**

REGISTRATION FORM

**PURSUANT TO SECTION 5 (2) OF
THE ENVIRONMENTAL IMPACT ASSESSMENT REGULATION 87-83
CLEAN ENVIRONMENT ACT**

1.0 THE PROPONENT

(i) Name of Proponent: Village of Hillsborough

(ii) Address: 2849 Main Street
Hillsborough, NB
E4H 2X7

(iii) Chief Executive Office:

Name: Ms. Shari Kaster
Official Title: Clerk/Administrator
Telephone: 506-734-3733
Fax: 506-734-3711
Email: hillsboroughnb@rogers.com

(iv) Principal Contact Person for purposes of Environmental Impact Assessment:

Name: Laura Leger, P. Eng.
Official Title: Project Engineer - Crandall Engineering Ltd.
Telephone: 506-857-2777
Fax: 506-857-2773
E-mail: lel@crandallengineering.ca

(v) Property Ownership:

As noted in the Water Supply Source Assessment Initial Application prepared by Crandall Engineering Ltd. and included in Appendix A, the proposed drilling targets may be located on subject properties PID 00613810 and PID 05009675. A third property, below the proposed drilling targets, is also a possibility due to the nature of the long and narrow property lines, thus PID 05003710 has also been identified. These sites were evaluated during the preliminary non-intrusive site investigations and reconnaissance surveys done by Crandall's Hydrology sub-consultant (Mr. John Hart of BGC Engineering Inc.) in the fall of 2014. Based on the water quality analysis conducted on the nearby Beaumont Spring, it was recommended to proceed with the detailed geophysics analysis of the area to confirm the final location of the test wells.

The Village does not presently own these properties. However, the Village has been in communication with the landowners. Following the geophysics field survey, a formal agreement will be created if required, pending the receipt of favorable results. The Village does however own the properties PID 00612499 and PID 00612507 which will primarily consist of the temporary access road to the existing Well No. 3, observation wells and pumphouse.

A total of two (2) drilling sites have been identified on the properties:

PID 00613810, 05003710, or 05009675: (final location and PID to be confirmed following geophysics)

- Test Hole 17-01
- Test Hole 17-02

Depending on the outcome of the test holes, permanent ownership of the land and/or easements may transpire, or if the test holes are unsuccessful, the holes will be abandoned as per NBDELG requirements.

2.0 THE UNDERTAKING

(i) Name of the Undertaking:

Water Supply Source Assessment - New Production Well, Village of Hillsborough.

(ii) Project Overview:

The Village of Hillsborough's municipal water supply consists of two (2) municipal wells, Well No.1, and Well No.3 (which replaced Well No.2 in 2009, due to high turbidity in Well No.2).

Although Well No. 3 had yielded acceptable results throughout its development in terms of both water quality and quantity, and it continues to have satisfactory results in these respects, the Village has experienced difficulties with combining the water from Well No. 3 and Well No. 1. Separately, each well is capable of producing water that meets the requirements outlined in the Water Quality Guidelines, when utilized alone. Precipitation in the piping network and discoloration of the water have been noted in the instances where both water sources are combined.

Significant efforts have been made in attempt to mitigate the problem, including cleaning of the well and its components with highly chlorinated water and the removal of chlorine addition at Well No.3 so that the transmission line to Well No.1 consists of raw water to minimize the potential for precipitation in the piping. Chlorine addition and UV disinfection is presently done at the Well No.1 Pumphouse, on the final water prior to distribution.

After further investigation, it was concluded that the cause of the current water quality issues is due to the difference in the water chemistry of the two (2) waters, and an incompatibility when the water from the two (2) wells is mixed. Therefore, the Village currently relies primarily on Well No. 1 to supply water to the residents of Hillsborough and avoid issues related to the mixing of the different waters. However, Well No. 1 is believed to be under the influence of surface water and its use is not recommended during high recharge

conditions (such as during heavy rainfall) and must occasionally be removed from service during such conditions.

Depending on the chemistry of the new well, the proposed new water supply is to be used in conjunction with one (1) of the existing wells as the primary water sources for the Village. It is anticipated that the other existing well will remain and act as a back-up well.

Therefore, in order to ensure a safe and reliable municipal water system for the Village of Hillsborough, a secondary back-up well is required to provide a secure water supply to the Village. The project will therefore include the following:

- Construction of an access road to the drilling site, including clearing and grubbing operations and access road construction (use of imported sandstone).
- Drilling of two (2) tests holes to determine the yield and water quality of the proposed site.
- If the test holes are found to be acceptable, the following work will be required:
 - Development of one (1) of the test holes and related works as required under the WSSA Guidelines, including use of the second test hole and nearby existing wells for observation.
 - Final well construction in accordance with WSSA guidelines.
 - Construction of permanent access road, connection to existing pumphouse and water transmission main to the existing system.

The previously drilled well (Well No. 3) or the observation wells used for its commissioning, are anticipated to be used as the third observation well for the duration of the 72-hour pumping test.

(iii) Purpose / Rationale / Need for the Undertaking:

The results of the work proposed herein are required to evaluate a potential for a new water source in the Village of Hillsborough, this will ensure a safe and reliable municipal water system. If this well is deemed sufficient, the well will act as a back-up well to the primary well in the Village (Well No.1).

A “do-nothing” approach is not acceptable in this case since the existing water system does not provide for a secure water supply. After significant mitigation efforts, Well No. 3 and Well No. 1 continue to experience issues with precipitation and discolored water when mixed. Furthermore, the existing Well No. 1 is under the influence of surface water and has been known to experience high turbidity due to rainfall events. The Village currently relies primarily on Well No. 1, however when this well cannot be used, the system lacks the capacity to meet demands.

(iv) Project Location:

As identified in Section 1 (v), the proposed site is located on PID 00613810, and PID 00612499, PID 00612507, PID 05009675 and PID 05003710 may also be affected by the new well, depending on its final location. The proposed location is shown on Drawing 14228-1P-C101 of the Water Supply Source Assessment Initial Application prepared by Crandall Engineering Ltd., (Appendix A of this document). The drawing is showing the preliminary location of the

proposed test holes over an existing aerial photograph. It is to be noted that the exact location of the test holes will be determined during the actual on-site work following approval to proceed from the NBDELG (WSSA Initial Application).

The Village of Hillsborough is located in south-east New Brunswick, approximately 20 km outside of Moncton and roughly 170 km south-east of Fredericton. It is located in the county of Albert and is part of the parish of Hillsborough.

The latitude and longitude of the proposed project site are as follows (approximately):

PID 00613810:

- Test Holes 17-01 and 17-02 - Latitude: 45.88413377, Longitude: -64.63323021 (to be confirmed by Geophysics)

Results from the geophysics study in the vicinity may result in a revision of the proposed test hole PID(s) due to the long and narrow nature of the property boundaries. The adjacent PIDs 05003710 and 05009675 are also possibilities for the final test hole locations.

A 1:50,000 scale map showing the proposed site in reference to the existing features is also included (Appendix B).

(v) Siting Considerations:

GENERAL SITING CONSIDERATIONS

As noted in Item 7) of the WSSA Initial Application (Appendix A), the preliminary non-intrusive site investigations and reconnaissance geophysical surveys were completed by Crandall's Hydrogeology sub-consultant, BGC Engineering Inc. (Mr. John Hart in conjunction with Mr. Geoff Dickinson, M. Eng., P. Eng.) in the fall of 2014. During the work, no signs of pollution or contamination hazards were noted.

Depending on the finalized location of the drilling target, the nearby residential well indicated on the drawing in Appendix A may fall outside the 500 m radius; however, this will be confirmed following geophysics. In addition, the proposed test well location is within the wellfield protection area of Well No.3.

As shown on the attached drawings, the proposed drilling target is not within 30 m of any Wetland and Watercourse according to GeoNB's delineation, and no indication of wetlands were found during the reconnaissance geophysical surveys.

For additional information on the geology and hydrogeology, please refer to the WSSA Initial Application in Appendix A of this document which was used to determine the preliminary location of the test holes.

It shall be noted that the exact route for the future piping to the existing system will be determined once the final well location has been established. However, it is expected that it will connect directly to the existing Pumphouse No. 3 located off Beaumont Road.

OTHER LOCATION CONSIDERED:

The location for the test holes was derived from the results of the preliminary non-intrusive site investigations and reconnaissance geophysical surveys performed by Crandall's Hydrogeology sub-consultant, BGC Engineering Inc.

ZONING

The proposed test holes are outside the Village's limits and no zoning exists in that area. However, the site is in the vicinity of the existing Well No.3 and therefore the land use would be similar.

WETLANDS

As shown on the attached drawing in Appendix A, the proposed drilling target is not within 30 m of any Wetland and Watercourse according to GeoNB's delineation.

(vi) Physical Components and Dimensions of the Project:

LAND REQUIREMENTS

A map showing the location of the proposed test holes relative to the environmental features of the region and a colour aerial photograph is attached as part of the WSSA Initial Application Submittal (Appendix A).

It shall be noted that the total area required on each property will only be known once the final test hole locations have been established. If the test hole does not provide sufficient yield, it will be capped in accordance with the NBDELG guidelines.

If acceptable yield is found, it is anticipated that the following infrastructures will be required:

- New water transmission line from the well to the existing Pumphouse No.3.

To perform the drilling investigations, the following work will be undertaken:

- Construction of access roads (clearing and grubbing and installation of Sandstone sub-base material);
- Drilling of the test holes and environmental protection during drilling and pump testing, in accordance with the NBDELG guidelines.

The total area of each subject property on which this work will take place is as follows:

PID 00612499: Access road - 13.3 hectares

PID 00612507: Access road - 6.37 hectares

PID 05009675: Access Road - 9.62 hectares

PID 00613810: Access Road and Test Holes - 11.64 hectares

PID 05003710: 13.78 hectares (possible test hole location pending results of geophysics)

However, only a portion of the total area of the successful site is to be developed. The total area on each property will be determined following the results of the geophysics and pump testing.

PHYSICAL COMPONENTS AND INFRASTRUCTURE

If successful yield is found, the construction of the well will be completed in accordance with the NBDELG guidelines. In addition to the well, the following components and infrastructure will be required:

- a. **Connection to Existing Pumphouse at Well No. 3:** Modifications will be required at the existing Well No.3 Pumphouse in order to integrate the new well controls.
- b. **Water transmission main and access road:** The installation of a new water transmission main and access road will be required from the existing water pump house building to the newly drilled well. This will be done by conventional open trench excavation.

(vii) Construction Details:

As soon as the EIA Registration Document and WSSA Initial Application are approved, the drilling of the test holes will be immediately undertaken.

It is estimated that, from the start of the tender period to full commissioning of the upgraded facility, it will require roughly 34 working weeks and EIA approval. In order to achieve this, the following schedule is proposed (assuming that the full EIA study-report-public input process is not required):

COMPONENT	APPROX. DURATION	START	END
1. EIA Registration, WSSA Initial Application, and Geophysics	4 weeks	May 1, 2017	May 26, 2017
2. Land Acquisition / Preliminary Agreements	2 weeks	May 8, 2017	May 19, 2017
3. Construction of Access Road	2 weeks	May 22, 2017	June 2, 2017
4. Preliminary Drilling and Step Testing	2 weeks	June 5, 2017	June 16, 2017
5. Preliminary Well Construction and 72 hr Constant Rate Pump Testing	2 weeks	June 19, 2017	June 30, 2017
6. WSSA Hydrogeological Study (Step 2) and Reviewing Process	5 weeks	July 3, 2017	August 4, 2017
7. Engineering Design to Tender Period	6 weeks	August 7, 2017	September 15, 2017

COMPONENT	APPROX. DURATION	START	END
8. Design Reviews and Approvals	2 weeks	September 18, 2017	September 29, 2017
9. Final Well Construction	2 weeks	October 2, 2017	October 13, 2017
10. Tender Award (Access Road, Piping, and Water Pumping Station Modifications)	3 weeks	October 16, 2017	November 3, 2017
11. Construction of Access Road and Piping	6 weeks	November 6, 2017	December 15, 2017
12. Water Pumping Station Modifications	6 weeks	November 6, 2017	December 15, 2017
13. Commissioning of New Well	1 weeks	December 18, 2017	December 22, 2017

The estimated hours of construction will be from Monday to Friday from 7:00 am to 7:00 PM except during the constant rate pumping where the work is 24 hrs / day.

The following equipment is anticipated to be used for the construction procedures:

- Earthwork: Excavators and dozers.
- Drilling: Well Drilling Equipment and pumps.

Potential sources of pollutants during the construction period are anticipated to include:

- Exhaust and other emissions from construction equipment.
- Noise from construction equipment.
- Water for drilling. The run-off water from the drilling operation will be controlled by the installation of erosion control structures. Typical installation for a drilling site include, the excavation of a drilling ditch, installation of erosion control structure (silt fencing and hay bales) and utilization of the existing wooded land where possible to minimize the effect of nearby stream.
- Silt from disturbed surface areas. This will be minimized by requiring the contractor to install silt fences and other erosion protection devices around work area and to reinstate disturbed areas as soon as is practical.

All waste generated during construction will be stored in containers and removed off-site by the Contractor.

The following sequence and procedures are recommended during the construction process:

1. Mobilization and installation of environmental protection devices.
2. Clearing and grubbing.
3. Construction of access road (imported sandstone).
4. Mobilization of drilling equipment and installation of environmental protection devices for the drilling work.
5. Drilling of test holes and step pumping test.

6. If unsuccessful:
 - Abandonment of test holes and removal of casing.
 - Clean-up, property restoration and demobilization.
7. If successful:
 - Enlargement of one (1) test hole (second well to be used a one [1] of two [2] observation wells).
 - Constant pumping rate testing including installation of environmental protection devices as required for selected pumping rate.
 - Clean-up, property restoration and demobilization.

As noted above, clearing and grubbing activities will be required on this land for the construction of the access road. The grubbing material will be disposed of off-site by the Contractor. The topsoil and organic material will be re-used for the restoration following the completion of the work. Trees will be returned to the Owners or will be used by the municipality.

As shown on the drawing in Appendix A, the work will be kept at least 30 m from streams and NBDELG wetlands.

(viii) Operation and Maintenance Details:

The water pumped from this new well (s) will be directed to the existing Pumphouse and subsequently transported to the water main on Beaumont Road. The stop and start signal will be controlled by the water level in the existing Municipal Reservoir. The daily water production of this new well, motor size and other components are unknown at this time and will be determined following the completion of the Hydrogeological Study (Step Two) and detailed design.

Normal operation and maintenance will include:

- Overall water pump house maintenance.
- Chlorine equipment maintenance (at existing Pumphouse No.1).
- Mechanical and electrical maintenance.
- Water sampling in accordance with the NBDELG and NBDOH.

It is to be noted that, generally, water pump house do not require extensive operation and maintenance. Furthermore, this project would involve the re-use of an existing pumphouse.

The power will be brought on site by the existing hydro transmission lines. Power costs for the Water Pump House are estimated to be approximately \$5,000.00 per year based on the initial use and present NB Power rates.

The water pump house will be operated and maintained by the Village maintenance personnel (water system operator).

(ix) Future Modification, Extensions, or Abandonment:

Not applicable.

(x) Project-Related Documents

The following project related documents are appended:

- The Water Supply Source Assessment Initial Application prepared by Crandall Engineering Ltd. (Appendix A).

In addition, the general area was subject to an EIA registration in 2009 for the development of Well No.3, under EIA Registration No.4561-3-1194.

3.0 DESCRIPTION OF THE EXISTING ENVIRONMENT

(i) Physical and Natural Features:

As noted in the previous sections, the proposed drilling target is not within 30 m of any Wetland and Watercourse according to GeoNB's delineation.

The complete geology and hydrogeology is available in the WSSA Initial Application in Appendix A of this document.

Additional soils information will be obtained following the preliminary investigations during the drilling of the proposed test holes.

Site Topography, General Surface Drainage Regime and Watercourses:

The approximate elevations at the proposed test location will be determined following geophysics. Therefore, the average gradient may be adjusted at that time. From the aerial photographs and topographical mapping, the site drains towards Canadian Brook.

As previously mentioned, private wells located within 500-m of the test holes depend on the finalized location of the drilling target, one (1) residential well may fall inside the 500-m radius. However, the proposed well location is within the wellfield protection area of Well No.3. This is depicted on the drawings in Appendix A.

There are no watercourses or wetlands within 30 m of the preliminary test hole site, based on GeoNB mapping.

(ii) Cultural Features:

There are no known major recreational activities close to any of the proposed drilling sites. The site is located in a relatively remote area.

(iii) Existing and Historic Land Uses:

The site is located in a remote wooded area with no immediately adjacent developed land. To the best of our knowledge, there are no pesticides or fertilizers being used on the land, nor is there any livestock grazing or livestock housing found within this area.

The drawing in Appendix A shows the subject properties with a 500 meters radius from the proposed test holes. From the aerial photograph, it can be observed that the adjacent properties are not heavily developed.

As noted in the WSSA Initial Application (see Appendix A), from the preliminary reconnaissance geophysical surveys conducted in the field by Crandall's Hydrogeology consultant, we do not anticipate any water quality concerns due to the surrounding land use but this will be confirmed during the preliminary drilling investigations.

There is no indication that there were previous developments on this site that may have been of cultural or historic interest.

4.0 SUMMARY OF ENVIRONMENTAL IMPACTS

As noted in previous sections of this document, at this time, the construction work will be limited to clearing and grubbing activities to access the identified drilling target, the construction of access roads using imported sandstone, drilling of test holes, enlargement of successful test holes and property restoration.

There is presently no flood mapping in this area, based on GeoNB mapping. However, the proposed area is in a highly-wooded area, distanced from the river and in an area where the Village has historically had their municipal wells. Thus, is anticipated floods and flood levels will not be a concern.

It is anticipated that the proposed work will have little effect on the surrounding environmental features. As noted in the previous section, the proposed drilling target is not within 30 m of any Wetland and Watercourse according to GeoNB's delineation. The main disturbance to existing environmental features will be during the construction of access roads and during drilling operations which will be protected with environmental protection structures as noted in Section 2 (vii) of this document.

However, it is noted that work will be required within the wellfield protected area of Well No.3, including:

- Clearing and grubbing for the new access road and well site, +/- 15 m wide;
(Zones A [0.3Ha], B [0.4Ha], and C [0.1Ha])
- Construction of new access road and water transmission main within clearing limits;
(Zones A, B, and C)
- Drilling of test holes, pump testing, and final well construction;
(Zone C)
- Modifications to existing Well No.3 pumphouse
(Zone A).

An application will be made for exemption under the Wellfield Protected Area Designation Order, and any requirements stipulated will be adhered to.

It is noted that the above values are approximate, pending confirmation of the final drilling targets following geophysics.

5.0 SUMMARY OF PROPOSED MITIGATION

Different mitigation measures will be used throughout the project to minimize environmental impacts as follows:

- Disturbed areas will be reinstated as soon as is practical, silt fences and other erosion protection devices around excavations and stockpiles will also be used until the fully grown.
- Clearing and grubbing activities and access road construction will be limited to the requirements of the drilling equipment.
- A set-back of 30 meters from major streams, rivers and wetlands will be respected.
- The construction will be inspected by the Village's engineering consultant.
- The Contractor will be responsible to have on site the proper leak and spill prevention equipments prior to commencement of any work. In the event of a spill, the contaminated soils will be removed from the site and disposed of at an approved decontamination site.

6.0 PUBLIC INVOLVEMENT

As noted in Section 1 (v), the Village will proceed with formal easements and / or land acquisition as appropriate, depending on the results of the geophysics and preliminary drilling.

Following the preliminary drilling investigations and constant rate pump testing, any landowners affected outside the identified properties will be contacted. At that time, the Village will prepare an overall public notice to inform the general public and any stakeholders of the details of the project.

7.0 APPROVAL OF THE UNDERTAKING

The following technical approvals are anticipated as being required for this project:

- Approval under the EIA Legislation from the NBDELG.
- Approval of the Initial Application and Hydrogeological Study under the NBDELG Water Supply Source Assessment.
- For the construction of the well, the contractor will be required to obtain the drilling permit from the NBDELG before undertaking the drilling operations.
- Certificate of Approval to Construct from the NBDELG for the work involved with the new well and modifications to the Pumphouse No.3.
- For any necessary modifications to the existing water pumphouse, the contractor will be required to obtain all building permits, electrical permits, etc. necessary for the work to be constructed.
- Approval to Operate as provided by the NBDELG once the facility has been completed and is being operated by the Village.

8.0 FUNDING

The preliminary phase of this well exploration project is fully funded by the Village of Hillsborough; however, upon favorable results of the 72-hour pumping test, Gas Tax Funding has been allocated to the 2014-2018 Period. This funding will include the construction of the well and its related infrastructure, as well as the connection to the existing Pumphouse.

9.0 SIGNATURE

May 2, 2017
Date

Shari Kaster
Ms. Shari Kaster
Clerk/Administrator
Village of Hillsborough

APPENDIX A:

**Water Supply Source Assessment Initial Application, incl.
Crandall Engineering Ltd. Drawing 14228-1P-C101**

Water Supply Source Assessment Initial Application

Please provide the following information:

- 1) **Name of proponent:** Village of Hillsborough.
- 2) **Location of drill targets (including property PID) and purpose of the proposed water supply:**

Based on preliminary (non-intrusive) work completed to date, a preliminary drill target is located on PID 00613810 in Hillsborough, New Brunswick. However, because a field survey (geophysics) is required in order to confirm the drill targets, it is considered that the final drill targets could be located on one of three (3) PIDs, due to the long, narrow nature of these properties. Therefore, the current application is for the following PIDs:

PID 05003710
PID 00613810
PID 05009675

The Village of Hillsborough's municipal water supply is currently fed by two (2) municipal wells, Well No.1, and Well No.3 (which replaced Well No.2 in 2009, due to high turbidity in Well No.2).

However, although Well No.3 had acceptable results during the WSSA process in terms of both water quality and quantity, and continues to exhibit good results, the Village has experienced difficulties with combining the water from Well No.3 and Well No.1. Either well is capable of producing water meeting the current Water Quality Guidelines, when utilized alone; however, when the waters are combined, the Village experiences issues with precipitation in the piping and discoloured water.

After further investigations and several efforts to mitigate the problem, it was concluded that the cause of the current water quality issues is due to the difference in chemistry of the two Wells, leading to an incompatibility when the water from the two (2) wells is mixed. Therefore, the Village currently relies primarily on Well No.1 to supply water to the residents of Hillsborough.

Depending on the chemistry of the new well, the proposed new water supply is to be used in conjunction with one (1) of the existing wells as the primary water sources for the Village of Hillsborough. It is anticipated that the other existing well will remain and act as a back-up well.

- 3) **Required water quantity (in m³/day) and/or required pumping rate.**

The required water quantity of the new well(s) is 851 m³/day (130 l/gpm). If this quantity is found, it will provide the appropriate back-up and redundancy in the water supply system during high precipitation events, when the use of Well No.1 may not be possible.

4) **List alternate water supply sources in area (including municipal systems).**

With the minimal use of Well No.3 at this time due to the water quality concerns noted above, the Village of Hillsborough has one (1) primary production well (Well No.1). Additionally, as per previous discussion with the Department during the development of Well No.3, Well No. 1 is believed to be impacted by surface water and its use should be limited during fast recharge conditions.

5) **Discuss area hydrogeology as it relates to the project requirements.**

The existing Well No. 3 and the two (2) nearby test wells are located in a clearing some 4.2 kilometres south-southeast of the centre of the Village (refer to Drawing 14228-1P-C101). The well site is located at the downstream limit of a 3.4 square kilometre subwatershed which is drained by Canadian Brook. The western edge of that subwatershed, some 2.4 km to the west, is at the northwestern extension of Livingstones Hill.

The project area is underlain by late Carboniferous Boss Point Formation sedimentary strata. This bedrock unit comprises grey to olive green, fine to medium-grained pebble conglomerate, sandstone and siltstone and some red-brown mudstone.

Bedrock is exposed in many of the brooks which show the strata to be flat lying or dipping at 10 to 15 degrees to the east-southeast. There are exceptions to this as two kilometres southwest of the recently completed wells there are bedrock units that dip southwest and northeast which suggests the presence of possible structure. The Boss Point Formation is underlain by sedimentary rocks from the Hopewell Cape Formation of the Mabou Group. Hopewell Cape rock outcrops along the Albert Mines Road some 300 m west of Well No. 3. This unit had also been intersected along Demoiselle Creek 3.5 kilometres west of the project area during a mineral exploration program. It dips southeast under the Boss Point Formation. The Hopewell Cape Formation comprises red to maroon mudstone, siltstone and fine grained sandstone and minor coarse-grained pebble sandstone.

A number of prior hydrogeological projects in southeastern New Brunswick have targeted the Boss Point Formation in the development of municipal and industrial water supplies because of its history of yielding above-average quantities of good quality water. Wells No. 2 and 3 intersected approximately 12 m of Boss Point formation rock above Hopewell Cape Formation rock - the upper part of which was a reddish-brown shale. Since the Boss Point Formation extends several kilometres up-slope of the well site and is known to be approximately 150 metres thick about 700 metres to the west, it was reasoned that the aquifer recharge potential could be substantial.

A local well driller reported that the rural residence located immediately adjacent to the new pump house has a high yielding well. In addition, a spring that in November 2008 yielded more than 0.16 litres/second (120 usgpm) is located about 150 metres to the southwest of the site. A reconnaissance geophysical survey (EM-16) was completed in the immediate area and a possible bedrock structure was found in the area of the spring. The strike of this feature (190 degrees) suggested that the bedrock structure extended towards the above-noted residence.

Supplementary geophysical work is proposed to identify the most promising location for new test wells.

6) **Outline the proposed hydrogeological testing and work schedule.**

It is the intent of the Village of Hillsborough to start drilling as soon as possible at the proposed test site to determine the preliminary yield and quality (see attached drawing for the preliminary proposed location). It is anticipated that one (1) test well and one (1) observation well will be drilled, and that the existing Well No.3 or its existing observation well will be used as the second observation well.

It is understood that the exploratory drilling may not be started until after approval of the EIA Registration Document and Initial Application has been received from the NBDELG.

The Village has received verbal permission from the affected landowners to conduct non-intrusive field surveys on the proposed properties. The Village will proceed with formal agreements if the field survey yields favorable results.

The complete schedule of the work is presented in the EIA Registration Document in Section 2 (vii). The following is the proposed schedule for the preliminary drilling investigation to establish the ground water profile (in accordance with the Water Supply Source Assessment Guidelines (March 2014)):

- Submittal of EIA Registration Document and WSSA Initial Application (including submittal and review process by NBDELG);
- Field Survey (Geophysics);
- Landowner agreements/land acquisition;
- Construction of Access Road;
- Preliminary drilling investigations and water sampling;
- Preliminary Well Construction, Step Pumping Test and 72-hour Constant Rate Pumping Test;
- WSSA Hydrogeological Assessment (Step 2) Report (including submittal and review process by NBDELG);
- Final Well Construction (based on results and approval of Step 2 EIA).

Based on the existing well construction and available hydrogeology, the proposed target depth below ground surface for the test wells is 90 m (150 and/or 200 mm diameter) to determine preliminary yield and quality.

If the newly constructed test well is found to be successful, step drawdown testing and a constant rate pumping test will be undertaken, in accordance with the Water Supply Source Assessment Guidelines (March 2014), including required sampling. This is proposed to be completed by the end of June, 2017.

The results of the 72-hour constant rate pumping test will be used to establish the safe yield of the test well in order to determine the construction method of the future production well. During the constant rate test, water level fluctuations will be monitored

in the new observation well, the existing Well No. 3 and the existing observation wells. Upon completion of the hydraulic testing, a report will be prepared in accordance with the Water Supply Source Assessment Guidelines (March 2014), outlining the methods used, field data, final design drawings of the well, and relevant information used to provide conclusions and recommendations. The report will also include a discussion of long-term sustainable yields of the well and impacts on surrounding water supplies, if any.

- 7) **Identify any existing pollution or contamination hazards within a minimum radius of 500 m from the proposed drill targets. Historical land use that might pose a contamination hazard (i.e. tannery, industrial, waste disposal, etc.) should also be discussed.**

To the best of our knowledge, supported by preliminary reconnaissance, there are no indications of any existing pollution or contamination hazards within a 500 m radius of the proposed drill targets. Depending on the final location of the well, one residential well may be within the 500 m radius.

However, it shall be noted that the exact location of the test holes will be determined following the field survey and geophysics. At that time, the 500 m minimum radius will be re-evaluated for existing pollution or contamination hazards. If any are found, Crandall will notify the NBDELG.

The attached drawing indicates the area encompassed by the 500 m radius.

- 8) **Identify any groundwater use problems (quantity or quality) that have occurred in the area.**

In 2008, the Village initiated the process of securing a replacement for its Well No. 2 due to high turbidity concerns. This resulted in the construction of Well No.3, located in the near vicinity of Well No.2. However, Well No.3 (replacement for Well No.2) also faced operating concerns when combined with the existing Well No.1, due to iron and manganese precipitation in the piping. To minimize the effects of precipitation, the addition of chlorine at Well No.3 was ceased, and the water from Well No.3 is now raw water until it reaches the Well No.1 pumphouse, where there is a single point of contact for chlorine prior to the distribution system.

It was concluded that the cause of this precipitation was due to the mixing of the two waters of differing chemistry. In addition, it is noted that the concentration of these substances in the raw water was not considered to be unusual for municipal wells in the area.

However, preliminary indications of the geology and hydrogeology in the proposed test well area, suggest the potential of a successful water supply in this area.

- 9) **Identify any watercourse(s) (stream, brook, river, wetland, etc.) within 60 m of the proposed drill targets.**

All streams, brooks and wetlands in the vicinity of the proposed drilling target are father than 60 m away from the site.

- 10) Identify site supervisory personnel involved in the source development (municipal officials, consultants and drillers).

Village of Hillsborough:
Clerk / Administrator - Shari Kaster
Operator - Gary Jonah

Crandall Engineering Ltd:
Project Engineer - Laura Leger, P. Eng.
Senior Hydrogeologist - John Hart, BGC Engineering Inc.

Well Drillers:
Eastern Well Drillers Ltd.

- 11) Attach a 1:10 000 map and/or recent air photo clearly identifying the following:
- proposed location of drill targets and property PID
 - domestic or production wells within a 500 m radius from the drill target(s)
 - any potential hazards identified in question 7.

The attached drawing 14228-1P-C101 includes a recent air photo overlain with available property information. The proposed drill target is clearly identified on PID 00613810; however, since the final target is to be confirmed by the field survey, PIDs 05003710 and 05009675 are also being considered. The 500 m buffer zone around the drill target, adjacent brooks and existing wells within a 500 m radius of the drill targets (location of domestic wells are approximate) are shown on the drawing.

- 12) Attach a land use/zoning map of the area (if any). Superimpose drill targets on this map.

The proposed drilling target is outside the Village of Hillsborough's limits. Thus, zoning constraints are not a concern for this project.

- 13) Contingency plan for open loop earth energy systems (see Section 2.3).

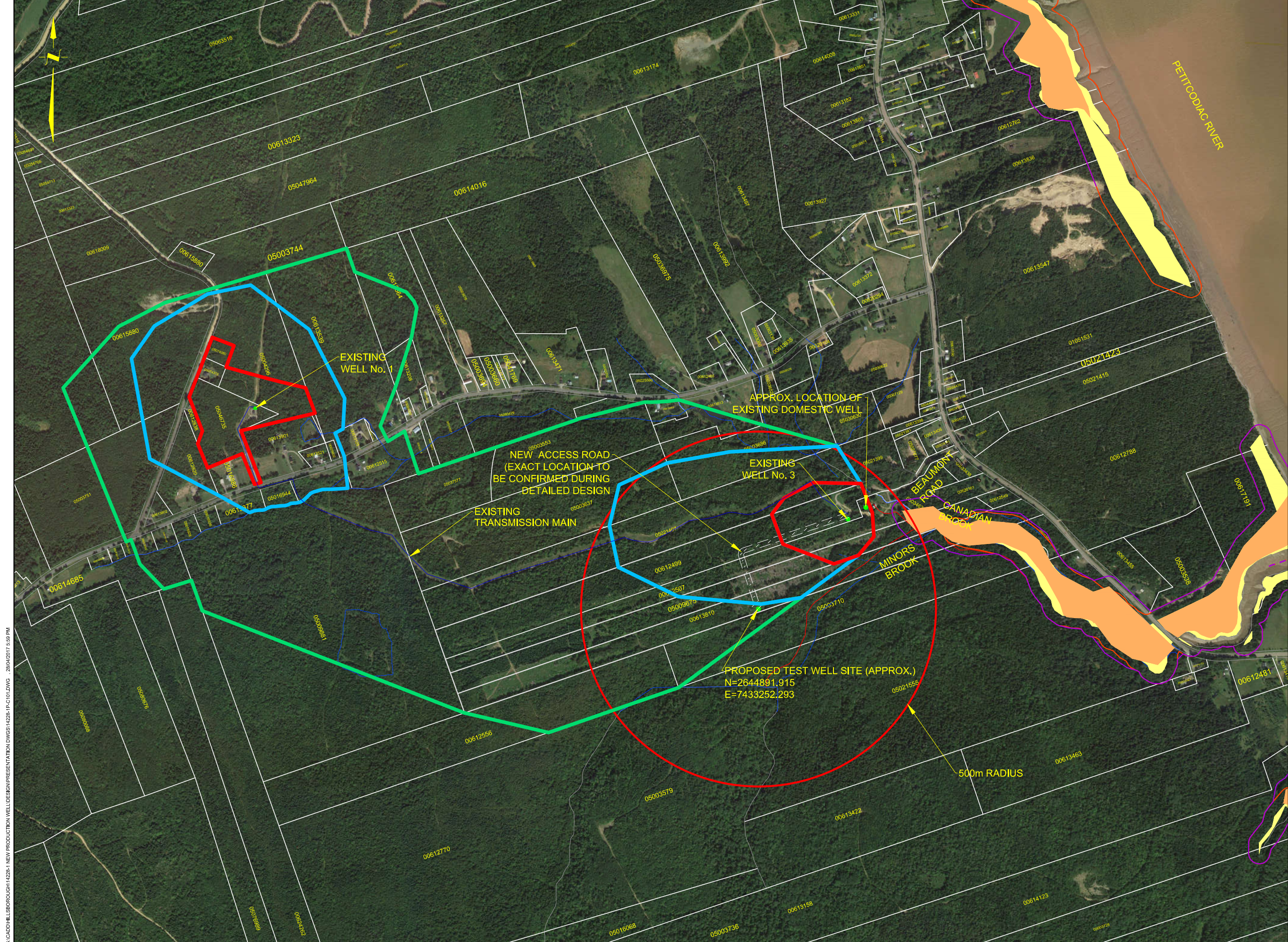
N/A.

Submit WSSA Initial Application:
c/o Manager
Department of Environment and Local Government
Environmental Assessment Section
Tel: (506) 444-5382
Fax: (506) 453-2627

Mailing Address:

P.O. Box 6000
Fredericton, New Brunswick
E3B 5H1

Physical Address:
20 McGloin Street, Marysville Place
Fredericton, New Brunswick
E3A 5T8



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NOTES

LEGEND	
■	ZONE "A" (11.30 HA)
■	ZONE "B" (43.20 HA)
■	ZONE "C" (116.90 HA)

- PROV. SIGNIFICANT WETLAND
- PSW 30m BUFFER
- REGULATED WETLAND
- RWM 30m BUFFER

00	APR 4/17	ISSUED FOR EIA REGISTRATION	TWA	LEL
NO.	DATE	REVISIONS	BY	APPR.



PRELIMINARY ONLY
DO NOT USE FOR CONSTRUCTION

PROJECT TITLE
VILLAGE OF HILLSBOROUGH WATER SYSTEM

HILLSBOROUGH N.B.
 DRAWING TITLE
PROPOSED TEST WELL SITE

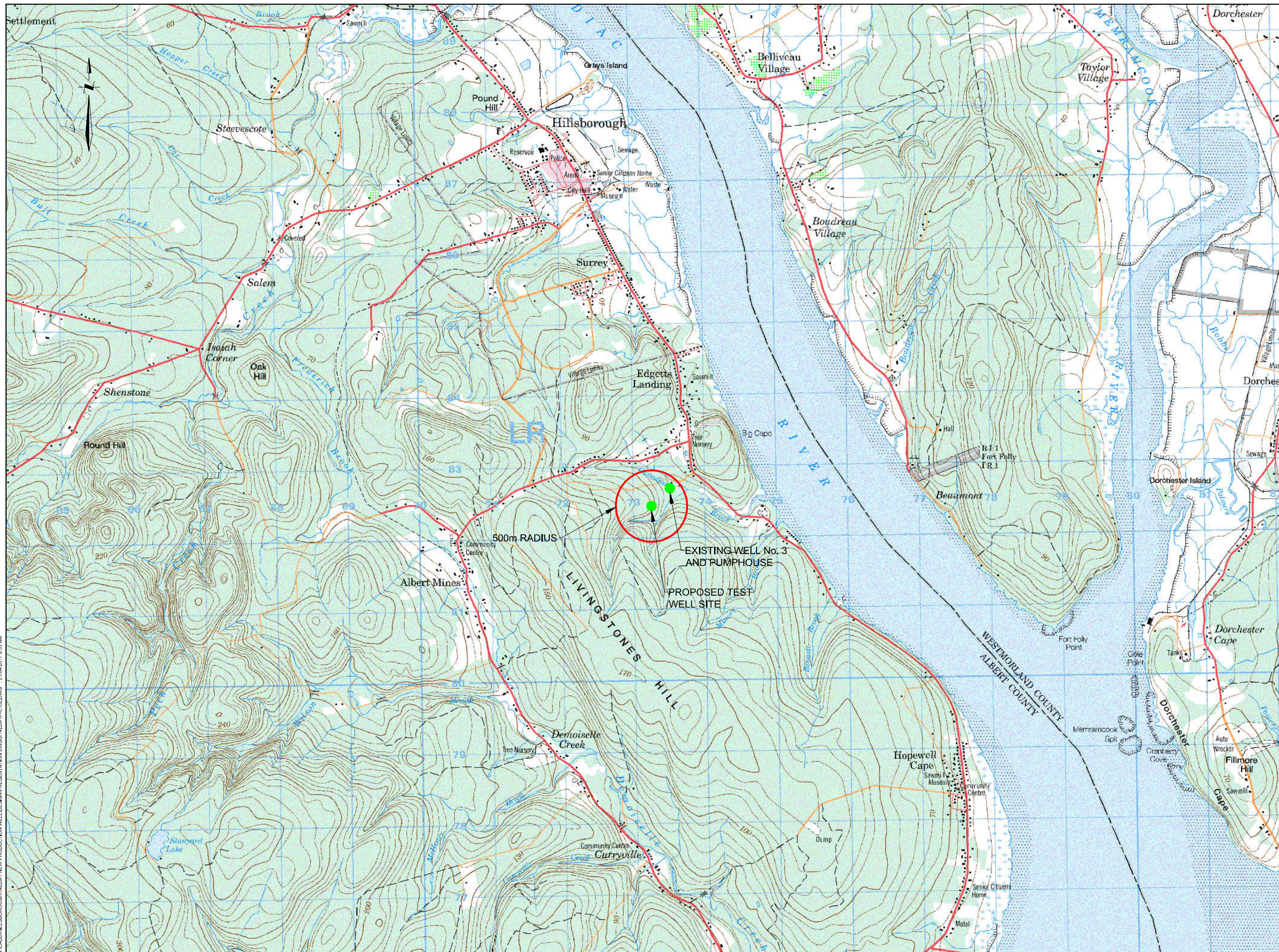
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	LEL	TWA
Sheet		1 of 1

File Name
 14228-1P-C101.DWG

Drawing No.
14228-1P-C101

APPENDIX B:

**1:50,000 Scale Map & Location Plan
(Crandall Engineering Ltd. Drawing 14228-1P-C102)**



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NOTES

NO.	DATE	ISSUED FOR EIA REGISTRATION	TWA	LEL
00	APR 4/17			
NO.	DATE	REVISIONS	BY	APPR.



PRELIMINARY ONLY
DATE PLOTTED: APR 21 2017
DO NOT BE USED FOR CONSTRUCTION

PROJECT TITLE	VILLAGE OF HILLSBOROUGH WATER SYSTEM		
HILLSBOROUGH DRAWING TITLE	OVERALL LOCATION PLAN		
Scale	Drawn By	Design By	
250m 0 500m SCALE 1:50,000	TWA	LEL	
	Checked By	Cadd Check	
	LEL	TWA	
File Name	14228-1P-C102.DWG		
Drawing No.	14228-1P-C102		
Sheet	1 of 1		