WSSA REGISTRATION - 340 Chemin Riviere Du Portage, Baie Sainte Anne, NB
DEL Residence Inc. – OPEN WELL GEOTHERMAL SYSTEM – Return Well Construction
PID 40225575

1) *Name of proponent*.

DEL Residence Inc. (owner Jacqueline Doucet) **(Figures 1 and 2 attached)**

2) *Location of drill targets (including property PID) and purpose of the proposed water supply.*

The PID is 40225575. The drill target (Lat. 2614 949.5, Lon. 7560 423.3) is located at the east side of the property, as per the attached **Figure 3**. The building has a high capacity well drilled in April 1991, located near on the north side of the building. **(See Photograph 1- attached)** The driller estimated the well yield at 60 usgpm. At the time the well was drilled, it led to two heat exchangers located in the middle of the building. A third heat exchanger was added later.

Following the installation of the well and heat exchangers, the discharge water was led to a tile drain type pipe in a deep trench. This led to a wet well pit and exit pipe, which was located at the rear of the property between the building and the Portage River, at the top of the riverbank. When the geothermal system was installed, it did not meet the Open Well Geothermal Systems policy which required the discharge of the heat exchangers to be returned to the aquifer.

The source well has been operating since 1991 (30yrs) with no known problems of yield or interference with adjacent wells. The water is of good quality (Per. Comm. Owner) and is used not only for the heat exchangers but also to provide the water supply to the building residents. No treatment system was observed on the water system other than a UV treatment system.

The geothermal system requires a return well to be constructed and tested to ensure the well(s) can receive the return water. It is proposed that the Return Well be drilled to the east of the building adjacent to the existing wet well. **(Figure 3)** The narrow strip

of land to the rear of the property and between the property and the river water is Crown Reserve land.

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

The present well provides an estimated flow rate to the building heat exchangers and residents of 0.23m^3/min. This is based upon the minimum system flow for the three heat exchangers as per the manufacturers recommendations of 0.125m^3/min. In addition, there are 10 seniors' units in the building, a hair dressing salon, and two apartments. The estimated requirements for the water supply for these units is 0.75m^3/day. The well flow rate to the building is likely higher than this. Consequently, using a total flow rate of 0. 2 m^3/min is reasonable. The return well will have to be able to receive this total flow.

The actual flow rate or yield of the source well will be assessed using a flow meter on the discharge under normal usage conditions. We will be able to assess this when the Return Well is tested as the discharge of the source well will be accessed and used for the discharge flow into the Return well. Without seeing the actual configuration of the piping used for discharge (it is buried and we have no drawings) it is difficult to give a method of assessing the flow rate. A flowmeter, known volume container, weir flow structure are available to be used. The method would be chosen when we unearth the piping. The ability of the source well to provide the required flow will be assess through the monitoring of the source well itself. (See Section 6)

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

The water sources within the immediate area are all private wells. The nearest well is located to the north at a distance of 30 metres. To the south, the nearest houses are at 60 metres and 70 metres. To the west, across the road, lie more houses. (**Figure 2** shows the houses nearby). The present well has operated for the past 30 years with no apparent impact on nearby wells. There are no high-capacity municipal wells in the area.

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

Site Geology

The well log for the existing well (source well) is attached. The log provides the geology beneath the site. It consists of a thin layer of surficial material underlain by shale and sandstone units. Beneath the surficial units lies a brown sandstone followed by a red-grey shale unit which overlies a second sandstone unit in which the water was encountered. (**Driller's log**) The well was constructed with 85 feet of casing and the estimated flow rate was 60 usgpm (air lift estimate).

Regional Geology

Weathering in upper bedrock units such is common throughout the Pennsylvanian deposits which underlie the entire area. The underlying horizontally to near horizontally bedded sandstones and shales pass outwards towards the sea and beneath the adjacent Portage River.

The groundwater recharge occurs over higher ground to the west and would contribute to regional flows. Shallower flow systems are recharged through direct recharge both locally and to the immediate west. Discharge of shallower groundwater flow likely occurs to the Portage River and the nearby Bay.

6) Outline the proposed hydrogeological testing and work schedule.

Return Well

The new return well will be drilled at the east side of the property at the top of the riverbank. It is expected to be completed into the grey sandstone unit at 118feet or lower, similar to the depth of the present well. After cleaning and development, the well will be tested to assess the ability to receive the discharge water. It is intended to excavate the end of the pipe that discharges into the wet well and transfer the water directly into the return well using a sump pit and pump to assess the receiving rate. Depending on the ease of accomplishing this, alternatively we may be able to access the discharge at the building and pipe the water across the ground surface into the return well to assess the ability of the well to receive the flow.

Conducting a pump test on the Return Well will not provide information on its ability to receive the discharge water as a pump test is conducted under stress conditions (i.e. pumping below water level and inducing flow by creating an artificial head surrounding the well) while the return well will receive water under non-stress conditions (i.e.

gravity flow). Observation wells are not required as there positive head developed by gravity feed is transmitted to the deep aquifer itself.

The flow from the discharge of the system will fed into the top of the casing of the Return Well and the ability of the well to receive the discharge quantity will be evaluated over a two hour period. If the well overflows at any time then the discharge test will be halted and a decision made to construct a second return well. If the Return well receives the discharge adequately (i.e. does not overflow) then the water level will be measured in the casing over a period of several hours. This would start 3 hours before high tide and end 3 hours after high tide. This would allow the discharge into the return well to be assess against the highest head acting against the recharge volume.

Source Well

While the source well cannot be tested directly with a pump test, a monitor tube will be inserted into the Source Well to allow water level to be monitored over a period of 5 days, which will include one weekend. The actual water usage (pumping rate of the source well) will be assessed using a flowmeter inserted into the piping system itself and/or assess by direct measurement at the end of the discharge pipe prior to entering the Return Well. This will allow the discharge into the Return Well also to be established. Before testing commences a water quality sample will be obtained from the well.

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.

The nearest potential contaminant source are two heating oil tanks one located to the north and one to the south of the building well. The locations of these are shown on **Figure 2.** No other oil tanks were observed in the area of the source well. A small garage type building located to the south is used as a welding shop. Given the assumed direction of groundwater flow, which is from west to east to discharge to the Portage River, the possible contaminant sources noted above would not impact the source well or the return well.

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

The source well has operated with no known water quality or quantity problems for the past 30 years. No other problems are known to the building owner.

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

The Portage River lies a short distance of 21 metres behind the building to the east. **(Figure 4 - attached)** Wetlands lie 150 metres to the north of the building, at the Bay shore and 80 metres across the Portage River. No impacts are anticipated to these wetlands. As the return well will be located at the top of the River bank a Watercourse Alteration Permit has been applied for.

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

Ramsey Well Drilling Ltd will be the driller for the return well, and V. Nowicki of ARC Geobac Group Inc., the site professional. Geothermal system design engineers are Tweedie and Associates of Moncton.

11) *Attach a 1:10000 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.

See Figures 1, 2, 3 and 4

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

No zoning map available. This is an LSD without a rural plan.

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

Return Well cannot accept the design flow
A second return well would be drilled.

Salt water in source well from nearby Portage River and/or Bay
Several courses of action are possible:
1) The heat pumps would designed accordingly for the saltwater;
2) A new source could be drilled further inland; and/or,
3) cased to seal off the saltwater if it occurs in a distinct unit.
These actions are not likely as the well has operated for 30 years with no known water quality problems.

Flowing well
Unlikely, as existing source well has never flowed due to artesian pressure. Recharge areas inland are not elevated to any great degree.

Caving formations or swelling clays/shales
Sealed off with casing. Well construction will be designed accordingly. Liner casing could also be employed to secure the walls of the well. Source well log noted no caving or swelling formations. Casing set to 85 feet.

Rising sea levels
Site is protected by a 7.5metre high bank adjacent to the Portage River. Both the source well and return well are at the similar elevations.

14) *Background and Operations*

Information obtained from a Phase I completed in 2007 for the property by ADI consultants stated that the land use was originally agricultural and residential. The original use of the property was for the construction of a school (Manual School) in the mid 1950's. The school was demolished in the 1980's and the existing building was built. The former use of the building was as a bowling alley and pharmacy prior to conversion to a residential and commercial use.

Currently, the building contains two apartments at the front of the building, a hair salon in the middle of the building, with the remainder of the building being occupied

by units for seniors. The building is heated using three heat exchanger units of size 25, 50 and 55 ton. There are electric baseboard heaters as back-up in many of the rooms.

Victor Nowicki M.Sc. P.Geo.
ARC Geobac Group Inc.

Attached Figures
EIA DEL Residence Inc.

Figure 1 - Aerial of Site

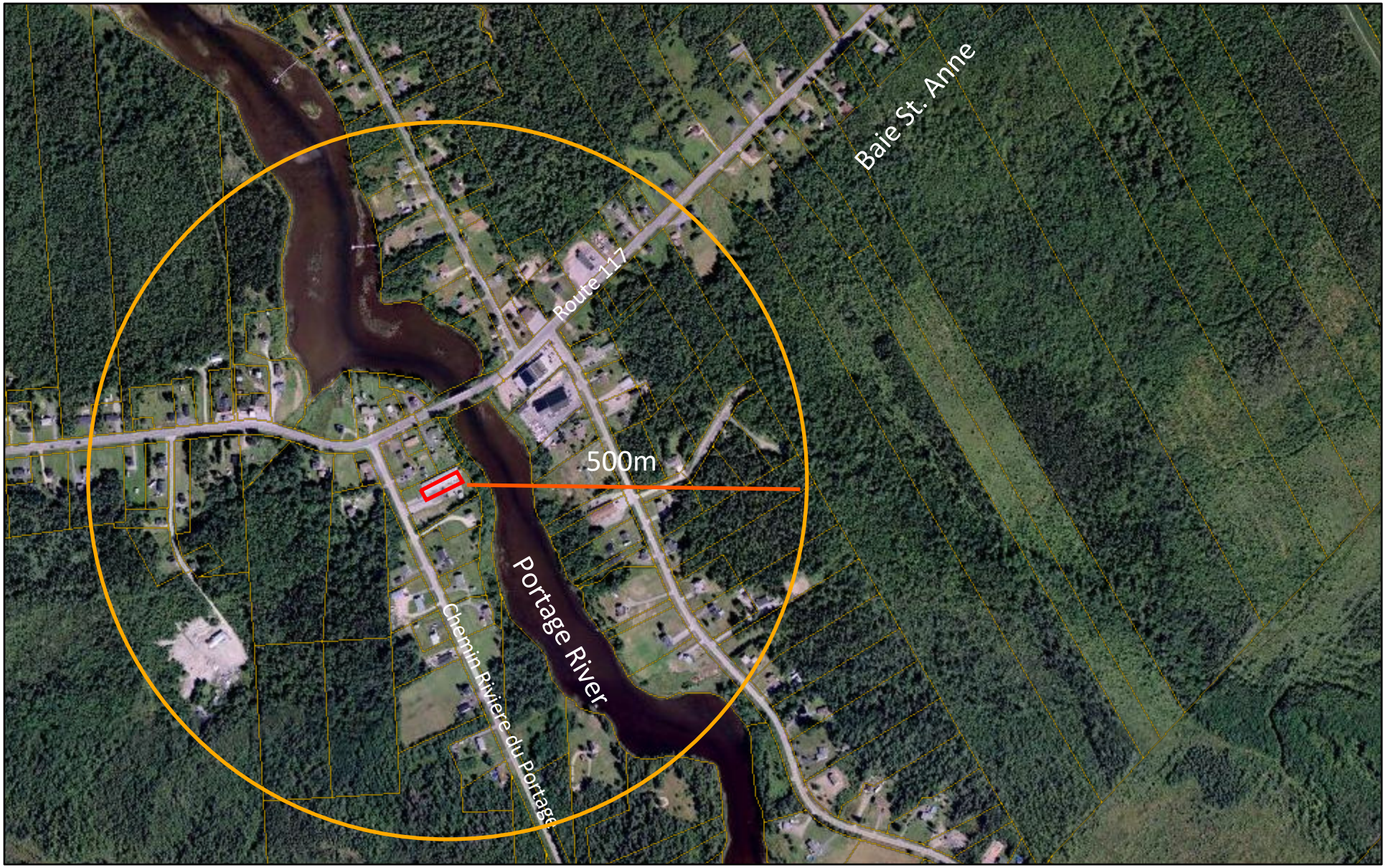

Figure 2 Contaminant sources and Property Identification

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Property Assessment

Large Scale / Grande échelle

Oil Tanks

1:2,000

0 0.01 0.03 0.06 mi

0 0.03 0.06 0.11 km

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Figure 3 - Site layout with Source and Return Wells

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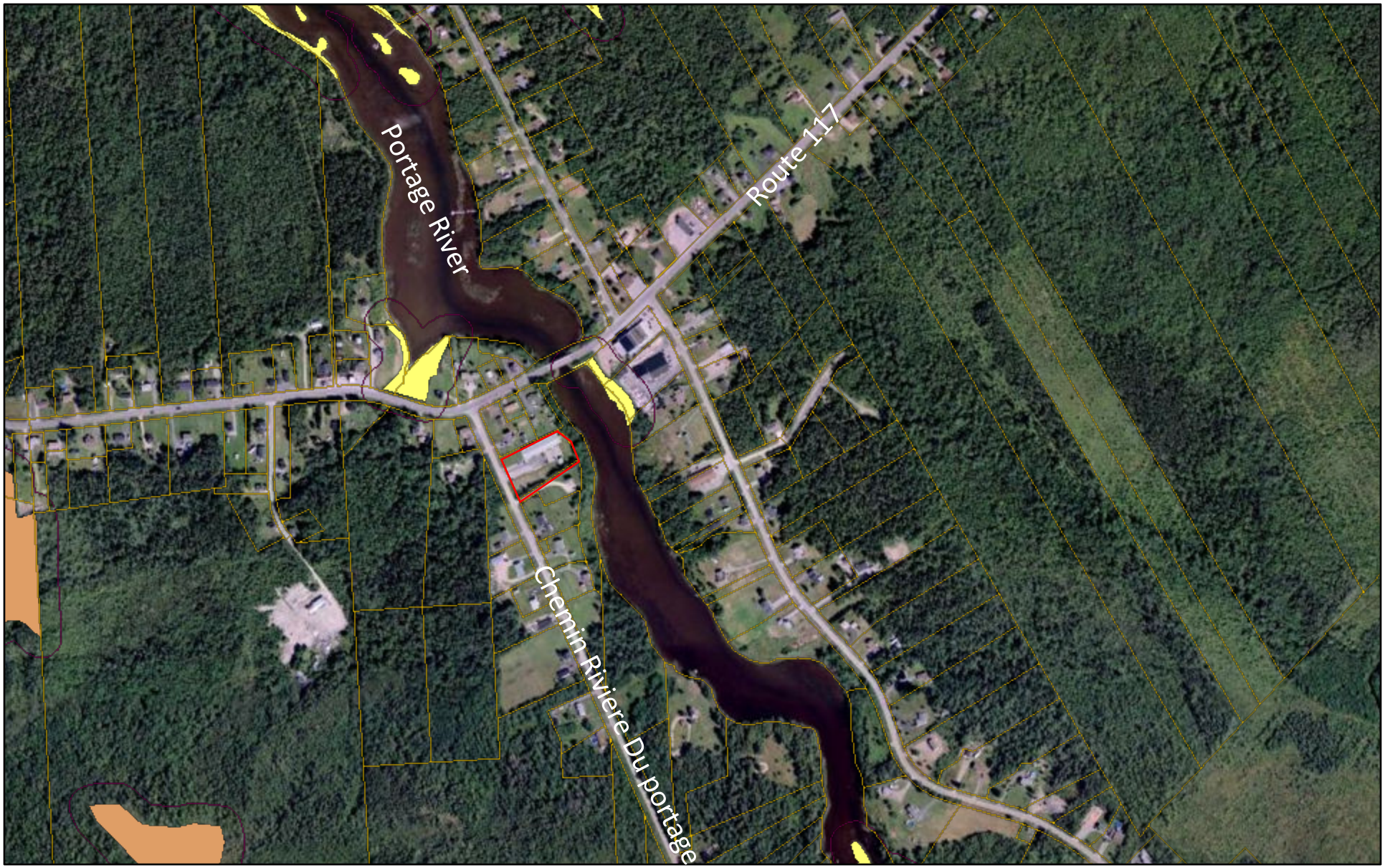
Figure 4 Wetlands and Surface Waters



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Subject property

2

1

Buffer 30m

Large Scale / Grande échelle

1:8,000

0 0.05 0.1 0.2 mi

0 0.1 0.2 0.4 km

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GeoNB

This map is a graphical representation which approximates the size, configuration and location of features. This map is not intended to be used for legal descriptions or to calculate exact dimensions or area.

Environmental Impact Assessment - Open Well Geothermal System Return Well Construction DEL Residence Inc.

Baie Sainte Anne, NB
PID 40225575

Prepared for

Jacqueline Doucet
DEL Residence Inc.
340 Chemin Riviere du Portage
Baie Sainte Anne, NB
E9A 1G8

Prepared by

ARC Geobac Group Inc.
P.O. Box 30021, Prospect Plaza
Fredericton, NB, E3B 0H8

ARC Geobac Group Ref: A-1148

EIA REGISTRATION – DEL Residence Inc. – 340 Chemin Riviere Du Portage, OPEN WELL GEOTHERMAL SYSTEM - RETURN WELL CONSTRUCTION

1. PROPONENT

***a) Name of proponent*.**

DEL Residence Inc. (Figure 1)

b) Address

340 Chemin Riviere du Portage, Baie Sainte Anne, NB, E9A 1G8

c) Principal contact

Jacqueline Doucet, Owner 1-506-228-4541

d) Contact for EIA

Victor Nowicki M.Sc. P.Geo. ARC Geobac Group inc. 506-476-7069

e) Property Ownership

DEL Residence Inc. Contact - Jacqueline Doucet

2.0 PROJECT DESCRIPTION

a) Project name

Return Well Construction for Existing Open Well Geothermal System at 340 Chemin Riviere Du Portage

b) Project Overview

The project is to construct a Return Well at the rear of the building to receive the discharge from the existing Source Well for the Open Well Geothermal System.

c) Purpose and Rationale

The open well geothermal system was constructed approximately 30 yrs ago. It was constructed with a source well located on the north side of the building. The water from this well, which pumped 55usgpm into three heat exchangers, was discharged to a pipe, buried approximately 6ft below ground surface. This pipe was led to a wet well located at the rear of the property adjacent to the Portage River bank, which then discharged directly to the Portage River. This discharge construction is in contravention of existing guidelines for open well systems which state that discharge water should be returned to the aquifer units from which the water is drawn. Consequently, this project is to construct the return well for this system. The system has run without problems for the past 30 yrs except for the unacceptable discharge portion of the system.

d) Project Location

The PID of the site is 40225575. This is an existing building, built in early 1980's and has the address 340 Chemin Riviere du Portage in Baie Sainte Anne, NB. **(Figure 1)** **Figures 1 and 2** show the site location and location of existing source and proposed return wells. The equipment is located inside the building in two utility rooms centrally located. **Figure 3** shows the site layout and infrastructure. The Return Well will be located at Lat. 2614 949.5, Lon. 7560 423.3. This location is at the rear of the property and downgradient of the source well and is 21m from the Portage River. Application for a Watercourse Alteration Permit to allow placementof the Return Well has been forwarded to DELG.

e) Siting Considerations

The geothermal source well is located adjacent to the northern edge of the building and will be approximately 150 ft from the proposed Return Well**. (Figure**

3). The Return Well will be 0.2m in diameter and drilled into the deepest unit encountered during construction of the source well which was a grey sandstone unit at 118ft. As formations change in elevation over distances, the depth of the grey sandstone unit may vary somewhat in the Return well. There are wetlands located nearby some distance from the building. **(Figure 4)** The new well does not lie inside the 30m zone around the wetlands, which lies some distance to the north and north-west and across the Portage River. No impacts to the wetlands are considered as the well will be receiving water from a source well on site. Other locations on site could not be considered as they are: 1) up gradient of the source well thus leaving the possibility of plume capture by the source well; and /or adjacent to the septic system tank and/or field.

f) Physical Components

Site plan and layout are attached.

g) Construction Details

The new Return Well will be located in the north west corner of the property, as per the attached **Figure 3**. The facility already has a high capacity source well drilled in 1991. The driller rated the well at 60 usgal/min. This well presently discharges into a pipe which leads to a wet well at the riverbank. It is proposed that this pipe be excavated and/or replaced and pipe led to the new Return Well, also to be constructed on the riverbank.

The new well will be drilled as a conventional rotary drilled well with steel casing of similar depth (+/- 25m) as the source well. Total depth of the well will be + 36 m at a

drilled diameter of 0.2m. A new PVC discharge water line will be laid from the heat exchangers to the return well, if the existing line cannot be used.

h) Operation and Maintenance

Water is pumped from the source well and delivered to the heat exchangers depending on heat demand from November to May. The same system also acts to cool the building at other times of the year. The source well also provides drinking water to the various residents and users of the building thoughout the year. Routine maintenance of the heat exchangers takes place on a regular and scheduled basis.

i) Documents related to Undertaking

No documents related to the site and/or project are included, except the drill log of the source well.

3.0 EXISTING ENVIRONMENT

a) Physical and Natural Features

The site has a flat to gentle slope towards the Portage River at the rear of the property. The top of the riverbank and lies approximately 6 to 7 m above the water level. The riverbank is steep but showed no evidence of collapse or erosion. Surface drainage for the site and the immediate area is towards the River. There are no water courses on site. Wetlands which lie to the north west are shown on **Figure 4**.

b) Site Geology

The existing well log provides the geology beneath the site. It consists of a thin layer of surficial material underlain by shale and sandstone units. Beneath the surficial unit lies a brown shale to a depth of 18m. This in turn was underlain by a sandstone unit followed by a red-grey shale unit, which overlaid a second grey sandstone unit at 36 m in which the water was encountered.

c) Groundwater

The existing well is rated at approximately 55 usgpm. This based upon the required flow for the 3 heat pumps, which is 33 usgpm. This combined with the water usage for the apartments and residents at 1200 us gal (assuming worst case scenario of peak flow over 1 hour period @ 20 usgpm), the peak flow would be 53 usgpm. It we assumed a 3-5 usgpm requirement for the salon, the well likely provides 60 usgpm to the building. As the well has delivered water successfully over the last 30 yrs it can safely be assumed that the well can deliver the required flow. The actual well yield to service the system will be evaluated during the construction phase and is detailed in the accompanying WSSA.

d) Environmental Issues.

No environmental issues are identified that could adversely affect the proposed works. The existing system has been in operation for 30 yrs. with no issues raised by the facility itself and/or the adjacent houses.

e) Private and Municipal wells

The nearest private wells lies some 30m, 60m and 70m from the source well. None of these wells have been affected by the existing geothermal system . No municipal wells lie within 1km of the site.

f) Air Quality

No air quality issued are identified associated with the site. The use of a drilling rig at the rear of the property will be for only one day and the noise will be shielded by the building itself. Some noise for a short time period will be realized, if the piping has to be replaced alongside the building.

g) Species at Risk

No known species at risk are associated with the site. As the site is fully utilized little area is available for potential habitat for species at risk. The area around the property has been developed and occupied by residential housing for +50yrs.

h) Critical and Sensitive habitat.

The site is small and fully developed with full time operation, no known habitats of this type are known.

i) Cultural Features

Recreation and Tourism sites do not lie within 500m of the property. Traditional uses by First Nations are not known to have been documented at the site. Heritage, historic sites and/or buildings are not known to have been present on site or nearby.

j) Historic and Existing Land Uses

All land adjacent to the site is privately owned except for the public road. The site was developed in 1954 as a school site. This later became a Bowlerama in 1982 until in 1991 the present facility came into being. No contamination is present on site and the land previously was not known to becontaminated.

4.0 IDENTIFICATION OF ENVIRONMENTAL IMPACTS

a) Adverse Impacts

No adverse impacts to the existing environment on site or adjacent to the site are identified.

b) Positive Impacts

The reduction continued reduction in the use of electrical power for heating is considered a positive impact for the project. Also, the construction of the return well will bring the site into conformance with existing policy and regulation.

5.0 SUMMARY OF PROPOSED MITIGATION

Impact Avoidance and regulatory conformity will result.

No adverse impacts are considered for this project therefore no mitigation is considered.

6.0 PUBLIC CONSULTATION

First Nations

No First Nations Reserve land lies within 75km of the site. The First Nations would be informed of the undertaking as DELG forwards the EIA to the Environmental co-ordinators for each First Nation.

Local Residents

No public consultation is proposed as the system has been in place and operating for 30 yrs with no issues locally. The construction of the return well will result in no impact to adjacent properties or residents.

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Attached Figures
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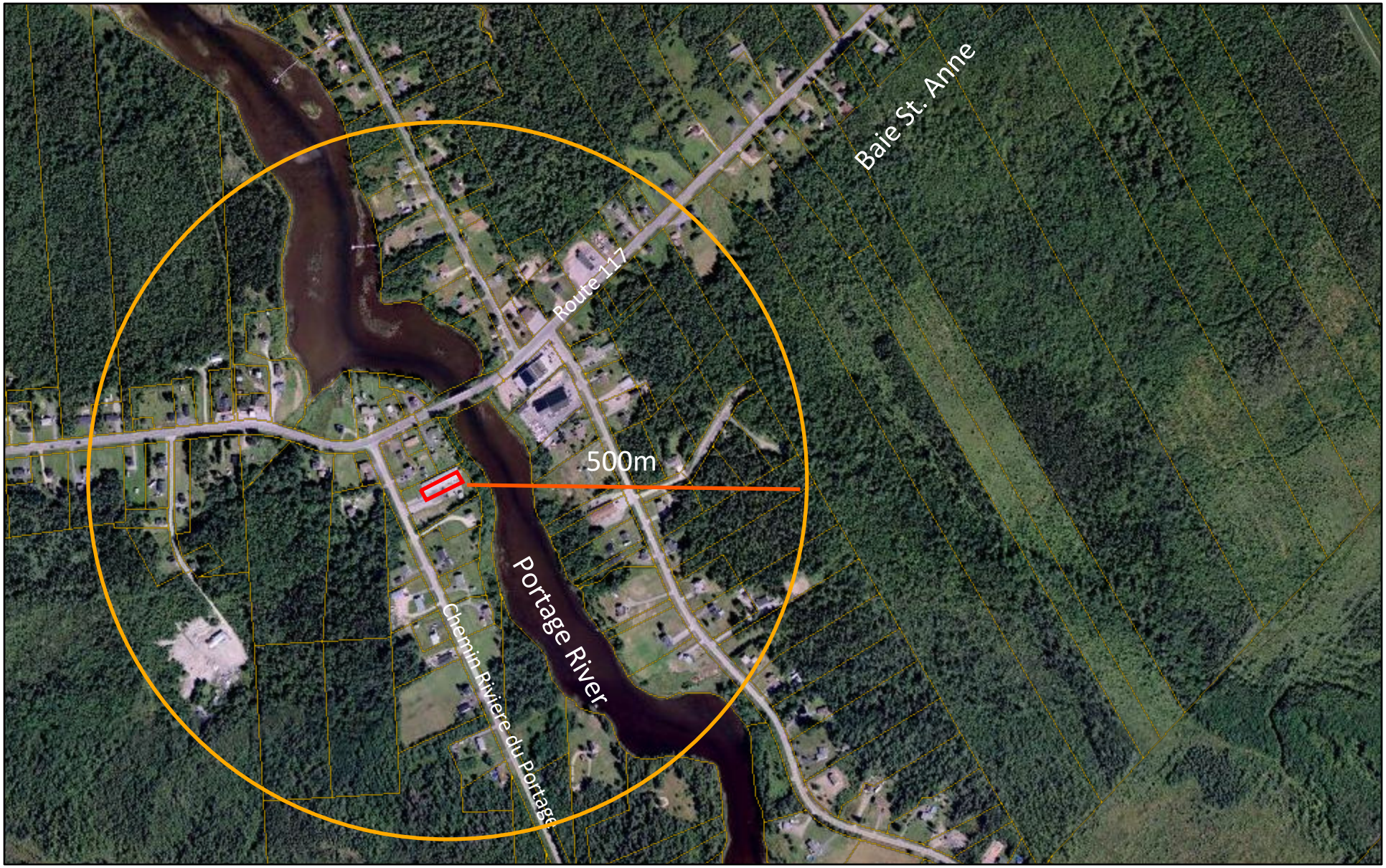

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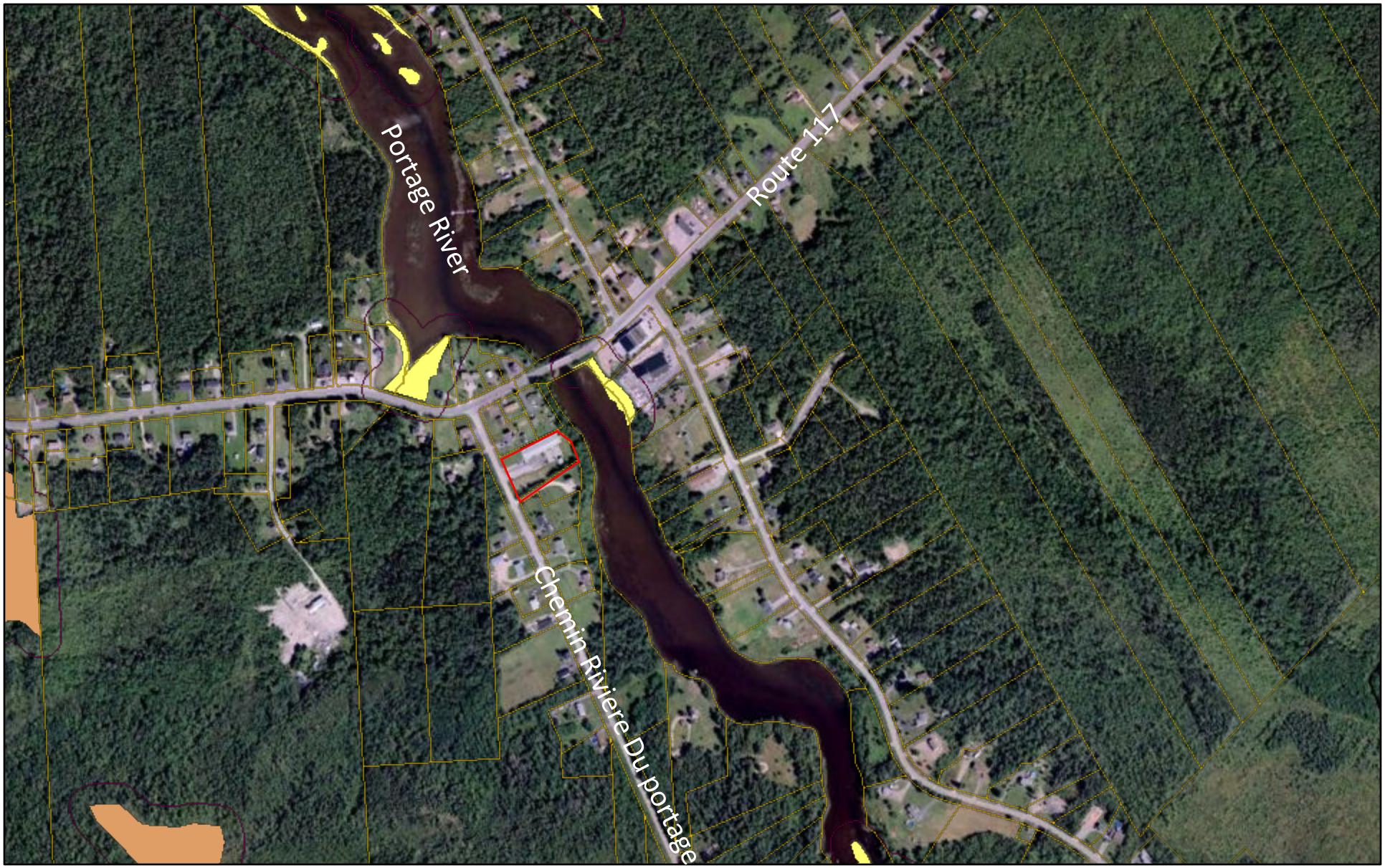

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