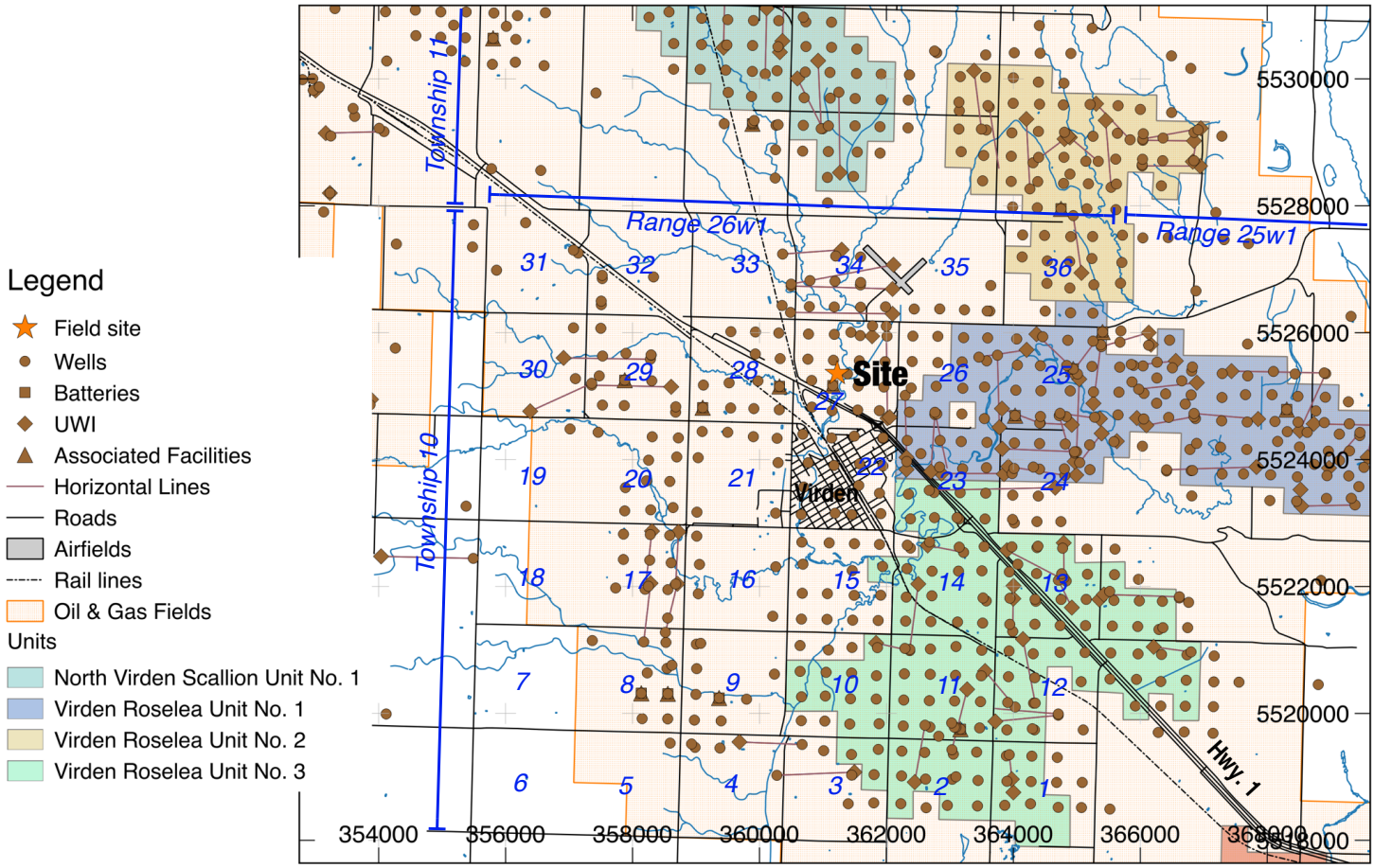
2015 Geophysics Field School

Virden Saline Contamination Project: May 5-7 (field work)

1) Goals

The area around Virden, Manitoba is the oil-producing region of Manitoba. The oil is produced from a saline aquifer; production methods dating back to the 1950s led to localized saline contamination at production sites, which is now in the process of being cleaned up. Your objectives for this survey are to locate and characterize saline contamination and production infrastructure at a formerly-producing site in the Virden area. For the purpose of this project, our hosts (and "client" – it may be helpful to think of the project as a simulated consulting job) will be Tundra Oil and Gas, our main contact person being Mr. Dean White.



Our site is at the location marked above – site 6-27-10-26. That is (reading from right to left), range 26, township 10, section 27, LSD 6 (see the Wikipedia article on the Dominion Land Survey for an explanation of this coordinate system). It lies in the Virden Oil Field.

Some more specific questions to be answered:

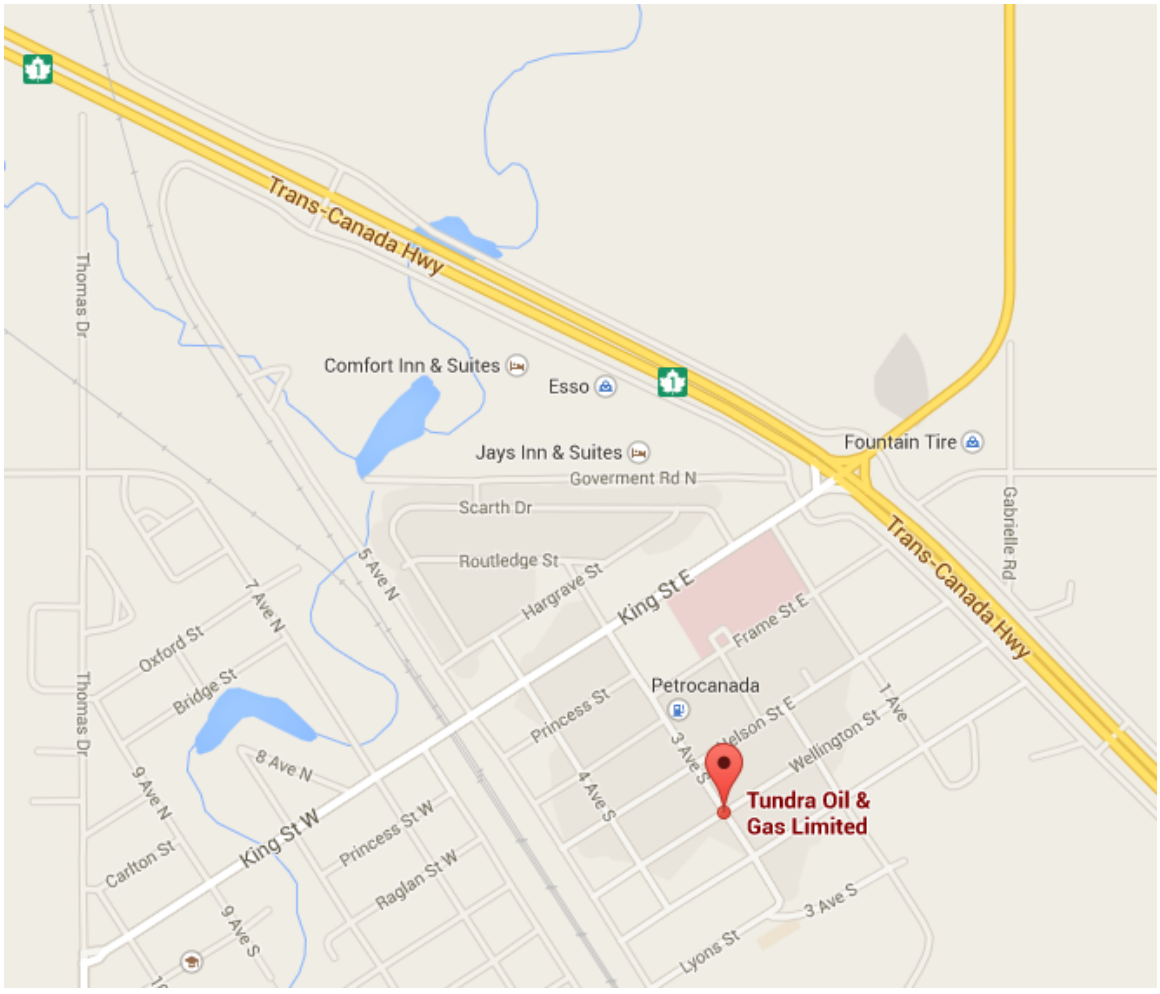
1. Is there an electrical response associated with a previous facility at the site?
2. What is the aerial and depth distribution of the high salinity?
3. What is the possible source of the salinity and controls on its horizontal and vertical distribution?
4. Does the high salinity correlate with an areas of areas of vegetation damage?
5. What are the optimal, and other possible, geophysical instruments for investigation of the salinity?

6. What is the appropriate compensation to the landowner for the damaged ground?

At the end of the project, you should be able to outline the location of the contamination in both area and depth, and map as much of the associated production infrastructure as possible. Good site maps and accurate surveying of locations (referenced to both fixed infrastructure and GPS) will be key to future clean-up efforts.

2) Logistics

On the nights of May 5 and 6, we'll be staying at the Comfort Inn and Suites, (204) 707-6020, marked on the map below. Please try to keep the volume of baggage reasonable, as we'll have limited van space; Virden does have the usual range of stores for town of its size. There will be an opportunity to purchase lunch for the day either in the morning or at noon, depending on scheduling. *Any noise complaints during our stay will result in a large deduction from the project mark.*



The red marker is the Tundra field office. My cellphone may be used as an *emergency* contact number: 204-997-9204.

3) Methods

Since we're looking for (conductive) saline contamination, the obvious methods to use will be electromagnetic. Our primary goal will be to obtain *EM31 and GSSI Profiler maps* of the study area; *EM34* will be used to constrain the depth extent of conductivity anomalies, as will *DC resistivity soundings*.

Magnetics and *VLF* will be helpful in locating metallic infrastructure (such as flow lines); *hammer seismic* will be helpful in assessing soil layering which may not be detectable by electrical means. We will also take advantage of the dipole-dipole mode of the *DC resistivity system* which will provide conductivity profiles across the study area. Since water flow is key to understanding near-surface contamination, an *elevation survey* of the entire site will need to be carried out.

4) Groups

Data collection will be a collective enterprise, and *everyone will have access to all data*. Work will be done in groups of four each group will have a different leader for each half day of data collection, and the group leaders will meet to determine which group will perform which survey.

Group 1	Group 2	Group 3
Neil Clark	Easton Sato	Shehryar Gill
Steve Kachappilly	Harsimran Mann	Kevin Ramlakhan
Tony Ulom	Gafaar Ibikunle	Amandeep Dhatt
Qaisar Naseem	Yana Tyomkin	Jason Cornick
	Sodiq Ishola	

Data entry will be collective (to spread the workload); some laptops will be available in Virden, and entering/downloading data while still in Virden is encouraged. Data analysis will be carried out in pairs, while reports will be individual.

5) Equipment

Everyone is responsible for assembling a set of equipment, as shown below. It is your responsibility to see that all necessary parts are present! *Remember to include manuals, spare batteries and relevant battery chargers*, as this is a multi-day project. We may be working by a road, so everyone should have a safety vest. We will also be bringing a box of hard hats (it's a Tundra safety requirement); also bring work boots or solid hiking boots, and safety glasses if you have them. Rubber boots would also be a good idea, as the site may be muddy.

Student	Instrument	Student	Instrument
Clark, Neil E.	EM31 & data logger	Mann, Harsimran S.	EM34 & data logger
Cornick, Jason P.	GSSI Profiler	Naseem, Qaisar	GPR
Dhatt, Amandeep K.	Hard hats & safety glasses	Ramlakhan, Kevin	Magnetometer with VLF
Gill, Shehryar	DC Resistivity	Sato, Easton A.	12V batteries and chargers, toolkit & multimeter
Ibikunle, Gafaar	Hammer Seismic	Tyomkin, Yana E.	Field laptop, manuals
Ishola, Sodiq	Surveying gear: level, tripod, stake	Ulom, Tony	3 GPSes, compass, tapes, pin flags (new ones), Sharpies, stakes, tarps
Kachappilly, Steve	Magnetometer with gradient + base station		

6) Schedule:

May 4: Before leaving the department, each person should assemble the equipment for which they are responsible. Instructors will check vehicles.

May 5, morning: Meet at department at **8:30 AM**; with vehicle packing and a preliminary meeting, we should be on the road by **9:30**. We'll meet in Brandon (around 11:30-12:00) for a gasoline/washroom stop, and aim to arrive in Virden by 1:00.

May 5, mid-day: Upon arrival in Virden, we'll proceed directly to the Tundra office for introductions, a presentation, and lunch (provided by Tundra). *Take detailed notes* on the Tundra presentation, as they'll be useful for your reports.

May 5, afternoon: We'll be escorted to the field site by Tundra personnel. Upon arrival, we'll have a brief planning meeting before getting to work; the first priority will be to lay out a grid, begin a site map, and do some exploratory EM31 measurements to find the range of reasonable values. This may also be a good time to check for interference between the instruments. If time allows, we'll begin the EM grids.

May 5, evening: We'll leave the site at 6 PM, checking into the hotel around 6:30. Doing some data entry at this stage will speed things up later; this is also a good time to start planning the main survey.

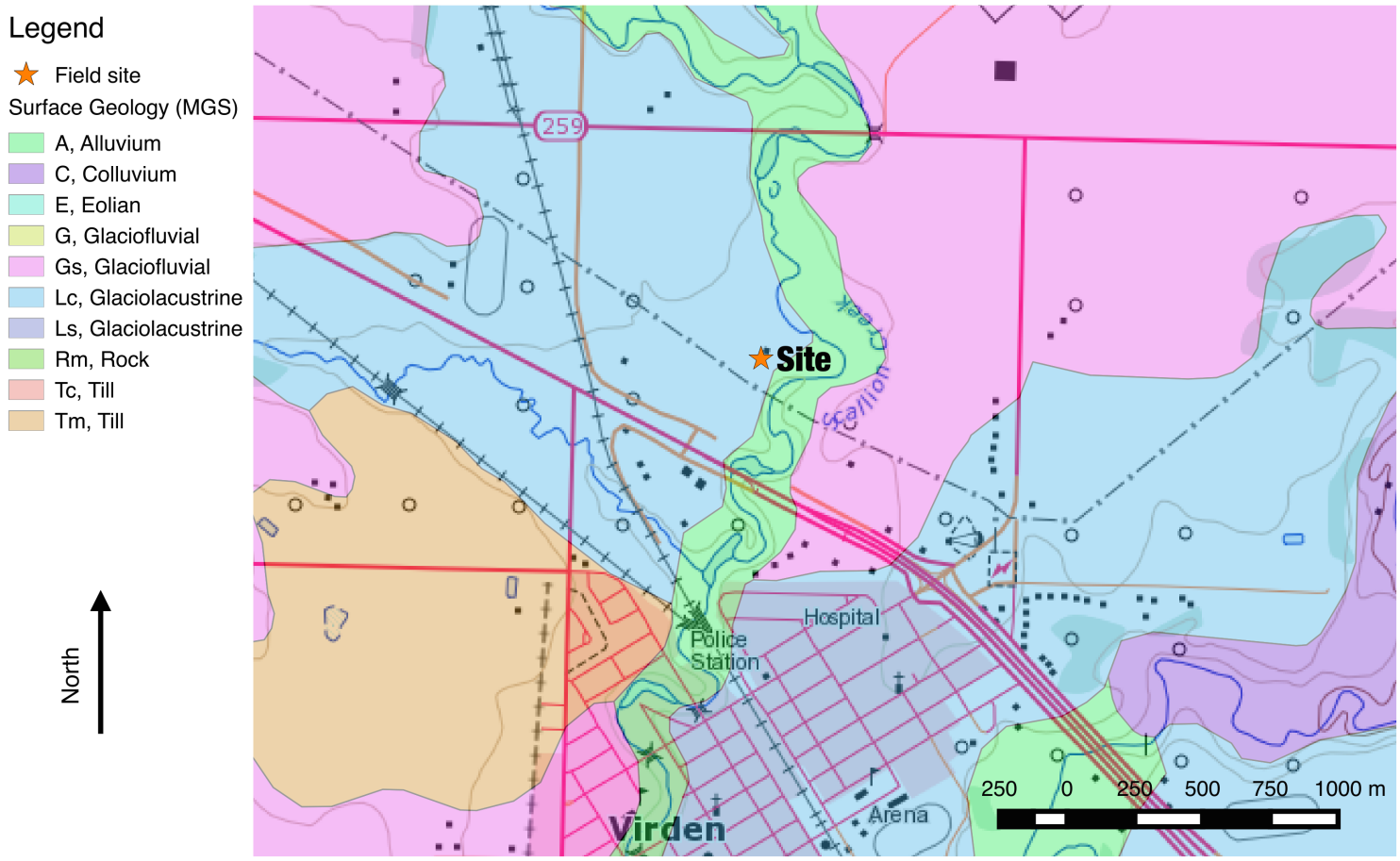
May 6, all day: Be ready to leave for the site at **8:30 AM**. Design of surveys for the second day is largely up to you, though EM31 grids should be completed; it may be helpful to make a rough map of the EM response as you go, in order to target other surveys. We'll break for lunch around noon, and leave the site around 5:30. Again, data entry in the evening would be helpful.

May 7, morning: Pack up and check out of the hotel by **8:30**. By this point you should have a good idea of the conductivity distribution over the site, as well as the location of magnetic features such as flow lines. Surveys on the third day should be mostly aimed at pinpointing or further characterizing already-located features. We'll leave the site by 1 PM, have lunch in Virden, and return to Winnipeg by 5:30-6:00 PM. Once the vehicles are unpacked, you're done for the day.

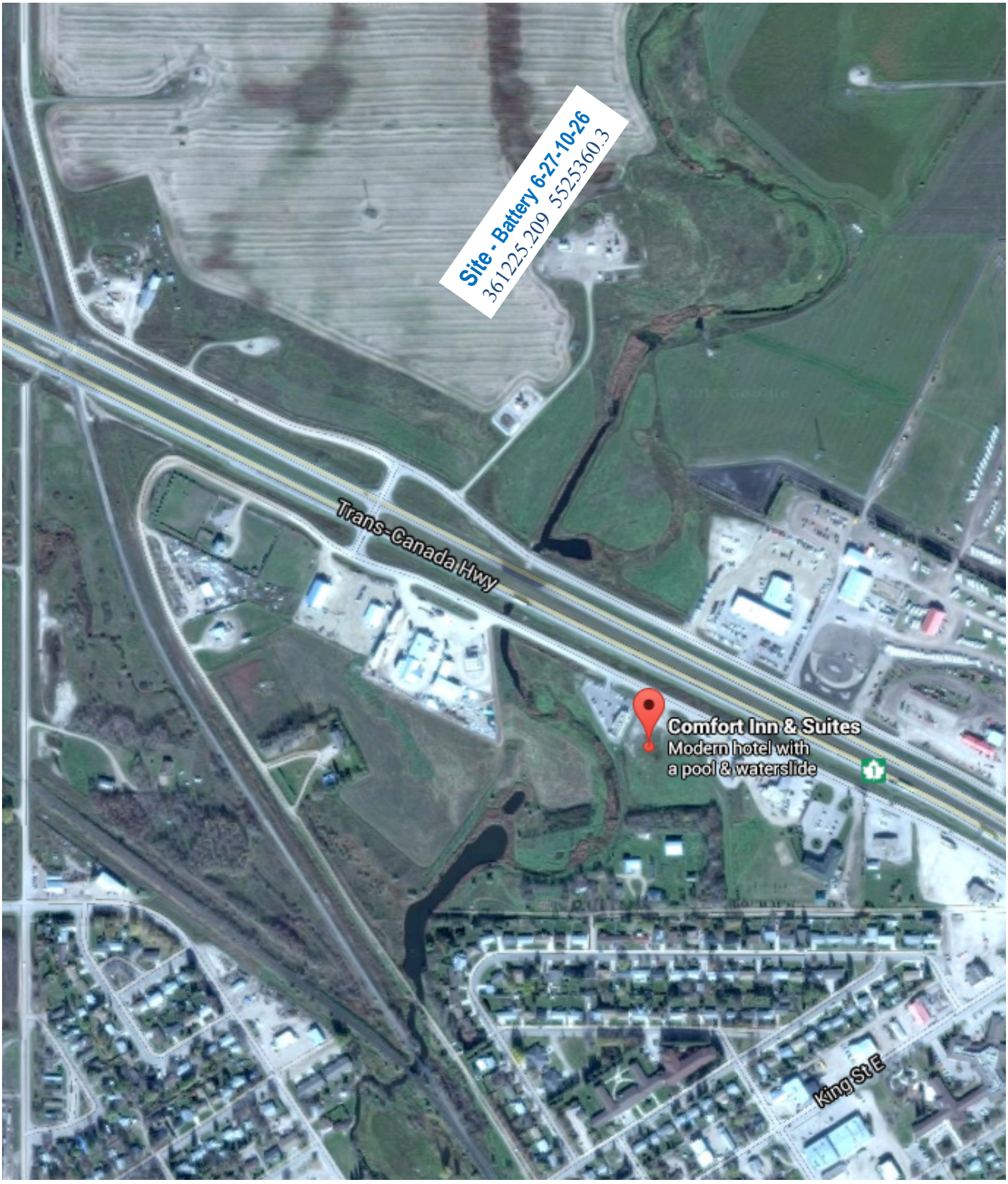
7) Data entry and analysis

Data entry, as noted above, is a collective enterprise, and all data will be shared. Everyone is expected to pitch in! Data reduction and analysis will take place in smaller groups (still to be determined); you should aim to produce contour maps of the EM data and elevation, magnetic and VLF profiles, layer thickness measurements from hammer seismic, etc. More details on the analysis will be distributed on your return.

Surface geology overlain on topographic map



Location of new site, Virden, Manitoba



Zoomed image of site