



## Remote Sensing and Grave Detection

### **What is remote sensing?**

Remote sensing is the science of obtaining information about objects or areas from a distance and includes airborne (e.g., drone or satellite) and ground-based (e.g., ground-penetrating radar) approaches. The most common techniques used in grave detection are ground-based, in a discipline known as geophysics.

### **How do geophysical surveys work?**

Geophysical survey techniques provide a way to locate underground features, including unmarked graves, without the need to disturb the ground. They detect the distribution and strength of various physical properties of the Earth including magnetic, electrical, and electromagnetic fields. Buried objects and features will have different physical properties from the surrounding soil and it is these differences that are detected and mapped.

### **Do geophysical survey techniques disturb the burial?**

No. In much the same way as navigational radar locates objects at a distance, archaeologists use geophysical survey techniques to see what is below the ground without needing to excavate, so there is no disturbance to the grave or surrounding area. For the most part, geophysical survey techniques do not identify the body in the grave. Rather, they measure the physical properties of the soil in the grave shaft. The presence of a coffin, if one exists, can also play an important role in grave detection.

### **Do I need to do a geophysical survey?**

No. As the Truth and Reconciliation Commission reported in 2015, and as all survivors and their families know, there are many missing children located across the country at former Indian Residential Schools and in other school contexts. There are also missing loved ones who were sent away for medical treatment and never returned. Geophysical survey is only necessary should Indigenous communities wish to better identify the locations and distribution of unmarked graves to either protect and memorialize these areas or to conduct further investigations. This decision is entirely up to the individual communities to make without external pressure or interference.

### **How do you conduct a geophysical survey?**

This will depend on the approach that is used. With most techniques, a grid is set up over the ground using tapes and ropes to guide the operator and to ensure the entire area is covered. Ground-based instruments are carried, pushed, or dragged back and

forth across the area in much the same way as you mow a lawn. Airborne instruments are flown on an Unmanned Aerial Vehicles (UAV), also known as drones. The areas need to be relatively clear of obstacles, including vegetation, for most approaches to work effectively or be completed in a timely manner.

### **What technique should be used?**

This will depend on the conditions at the site. Ground-penetrating radar (GPR), the technique used at the Kamloops Indian Residential School, is the most widely used and has the most successful track record for identifying unmarked graves in cemeteries. It has decades of use by archaeologists across the globe. However, there are some conditions where this approach does not work well. Fortunately, there are many other techniques including electrical resistivity/conductivity, magnetometry, and others that have also had success in identifying unmarked graves. While one approach may be enough, the best results are often achieved when multiple techniques are used together. Establishing which approach is best should be done by a trained professional with knowledge of the specific site being surveyed in partnership with the local community.

### **Who should do the survey?**

There are many options available for communities looking to have geophysical survey work done, particularly with GPR. Most remote sensing companies work in industry, identifying utilities or surveying buildings and highways. However, the application of GPR to cemeteries is uncommon and **requires specific training**. It is usually conducted by archaeologists or forensic scientists. The identification of graves requires specific data collection methods and interpretive knowledge. Unfortunately, we are also seeing some companies and individuals taking advantage of the tragic circumstances revealed at Kamloops Indian Residential School who do not have the appropriate experience. **Extreme caution is needed**. Communities who already have established and trusted relationships with archaeologists and/or forensic scientists should seek their advice before proceeding. The CAA advocates that Indigenous communities should be supported in developing their own remote sensing capacity to do the work of locating unmarked graves.

### **What are the chances of success in locating unmarked graves?**

The utility of remote sensing techniques in locating unmarked graves in cemeteries is well-established. Techniques for identifying clandestine burials are less well-known and the chances of success will be different depending on local geological conditions, land use, and vegetation. It is not possible to identify grave locations or the absence of graves with 100% certainty using remote sensing, though in some cases identifications can be made with great confidence. More likely, an archaeologist will assign different levels of confidence to their results in much the same way as a weather forecaster predicts the likelihood of rain. One way to increase confidence is to use different geophysical techniques at the same location, as complementary results from different approaches can improve confidence in grave identification. The greatest degree of certainty is achieved when a survey is followed up by excavation. Note that full excavation of a potential grave location is not necessary. Excavation of the uppermost ground surface to expose the top of the grave shaft confirms the presence of a burial. However, this type of “ground truthing” does disturb the upper grave shaft, which some

communities may prefer not to do. It is important to remember that failure to identify graves with remote sensing does not mean that graves are not present. It can equally mean that the conditions were not suitable for grave detection.

### **How long will it take and cost?**

Cost is difficult to estimate, as much will depend on who does the work, the conditions at each site, the equipment used, and the intent of the survey. Communities may only wish to establish a cemetery's general location (known as prospection) rather than map the number and distribution of graves in it (known as mapping). The former requires a less intensive survey methodology and takes less time but provides less detail. Oftentimes, it is most efficient to start with broad prospection, followed by intensive mapping. Other considerations, such as clearing vegetation to enable access for survey, need to be considered. Analyzing the data and reporting take time as well.

### **What are the risks?**

There are no physical risks to the graves or the individuals conducting the survey. Indeed, geophysical equipment used in archaeology is less powerful than your cell phone. The main risk is the potential for triggering and re-traumatizing community members, so it is extremely important that appropriate mental health supports are in place prior to work commencing. There is also the potential for disappointment and confusion should the results be inconclusive.

### **Do I need a permit or permission to conduct geophysical work?**

Ultimately, this question depends on where the survey site is located. Permit requirements for archaeological/geophysical surveys vary greatly between provinces and are different for federal land and Indian Reserves. It is essential to check with your provincial archaeology body and the relevant Indigenous government(s) to see if you will require a permit for the work. Often, there will be similar reporting requirements to a provincial or territorial archaeological body. Work on privately owned lands will also need the permission of the landowner.

### **Data agreements**

It is essential that communities control if, when, and how any investigation is carried out and how any messaging regarding that work is released to the public or media. We highly recommend that robust data agreements, that uphold the principles laid out in OCAP ([The First Nations Principles of Ownership, Control, Access and Possession](#)), are put in place between communities and the individuals or companies hired to do this work. The CAA will soon have draft data agreements for communities available on our website to guide them in this process.