

## **British Columbia Technical Working Group on Indian Residential Schools (BC TWG IRS)**

Ground-penetrating radar (GPR) is the most common geophysical search method for locating unmarked burials; it is the system with the longest history and strongest track record for this task. Until recently most GPR systems were single-channel arrays, but recently newer multichannel and multi-frequency units have become available.

### **What are the different forms of GPR?**

GPR uses EM (electromagnetic) waves of different frequencies to detect subsurface patterns based on their influence on the reflection of EM waves. As frequencies increase the depth of signal return decreases, but the resolution increases. GPR use for unmarked graves typically uses frequencies between 100 and 1000 MHz (megahertz). Higher frequencies do not travel as far into the ground but can detect smaller objects than lower frequencies.

Single channel GPR systems are devices that use one frequency at a time, usually from antennae on a cart. Multi-frequency systems put more than one frequency of GPR on the cart to run simultaneously, but independently. Multi-channel systems array multiple antennae of the same frequency on the cart, sometimes as many as 10 or more.

### **What Role Can These Options Play in Identifying Missing Children?**

Single channel systems are the oldest and most common form of GPR. They work well, but benefit from systematic data collection such as via a roaming process (where the GPR is moved across the ground and identifications are made in the field and marked on the land for later map recording) or in systematic grids (in which rectangular spaces are laid out on the ground and the GPR is moved a regular intervals – usually at 25 cm spaces in perpendicular lines).

Multi-frequency systems use a second antenna with a different frequency that allows for two data sets to be collected simultaneously. This can be of value since different frequencies can produce different results in the same area, especially if the subsurface patterns are complex.

Multi-channel systems allow for more lines of the same frequency to be collected at the same time, often at much closer intervals (less than 10cm rather than 25 cm used in grids). This saturation of the signal and the fixed relationships between the numerous transmitting and receiving antennae generally produce a clearer and more accurate result when compared to single channel or multi-frequency systems. Multi-channel systems also typically have more advanced mapping systems using a high precision GPS (GNSS RTK) base station connected to a rover unit on the GPR. These GPS systems accurately map the movement of the cart, often reducing the need for grids. Such devices can also be retrofitted to older single channel or multi-frequency systems.

### **What Are the Challenges of These Options in GPR?**

Many search teams have had success with and developed familiarity for single channel GPR. Multi-channel systems are more expensive and require additional training. Multi-frequency results can sometimes be useful if the subsurface patterns are complicated. It is likely that the multi-channel systems will become the new standard in GPR for GPR work in IRS contexts because they are faster at data collection and produce an improved result. Older systems continue to have considerable value.