Ground Penetrating Radar Survey
Landfill, Public Area:

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Project No. 4788
February14, 2020

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Feb. 14, 2020

Regional District
Attn:

Ground Penetrating Radar Survey Landfill

BACKGROUND

On February 07 and 09, 2020 Terraprobe Geoscience Corp. (Terraprobe) was commissioned by X to perform a high-resolution Ground Penetrating Radar (GPR) survey at the Landfill, XZ Road, X, BC. The purpose of this survey was to determine the extent of void space below the publicly accessible area (north-west corner of the plot.

GPR TECHNIQUE

Ground penetrating radar is the general term applied to techniques that employ radio waves to profile structures and features in the subsurface. Although typically used for ground (soil) applications, GPR can be used to identify features beneath other surfaces. GPR method is based on emission, reflection and detection of electromagnetic waves. A short pulse of high frequency (10-2600 MHz) electromagnetic energy is produced and transmitted into the ground or other medium (i.e. concrete, asphalt). The pulse spreads into the subsurface materials and is affected by the properties of the surrounding material. Some of the energy is reflected at the interface between materials of different electrical properties (dielectric constant). A receiver records the reflected energy at the surface. Processed radar data are plotted as surveyed horizontal distance (metres) versus two-way travel time in nanoseconds (2D mode). When GPR data are collected in a grid, 3D data processing and interpretation can be applied.

GPR can locate both metallic and non-metallic targets. Penetration depth and detectability of targets depend on antenna frequency, target orientation and the difference in electrical properties between the host material and the target.

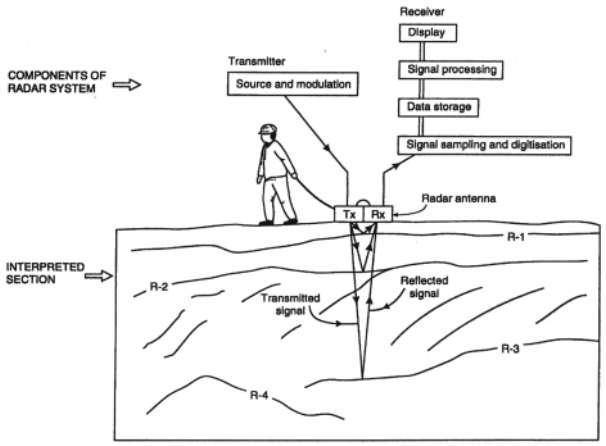

Figure 1: Schematic figure of GPR survey (Reynolds, 1997)

GPR FIELD SURVEY

During the initial site survey on February 07, a 400MHz antenna was used in walk-behind mode and areas of concern were mapped out in real time. Results were marked on the ground using spray paint.

Due to the extensive area size the decision was made to use a different approach and map as much of the area as possible:

The 600MHz 30-antenna dual polarization array Stream-C system manufactured by IDS GeoRadar was used for the data collection on February 09. In this array 23 antennas are mounted at regular polarization, resulting in a 4.4cm line spacing. Due to the dual polarization target can be detected regardless of their orientation. The Stream-C system was pulled behind a vehicle at a speed of approx. 4-5 km/h. Some smaller areas were filled in pushing the array.

A total of 7 project files were collected covering the area as shown below (see figures 2 through 8). Please note that location of data collected is displayed as before adjustments have been carried out.

The locations of all analyzed lines have been recorded using Leica GPS&PPS only as local mobile RTK was not available.

Data processing and interpretation took place at Terraprobe office.

Figure 2: Project 1

Figure 3: Project 2

Figure 4: Project 3

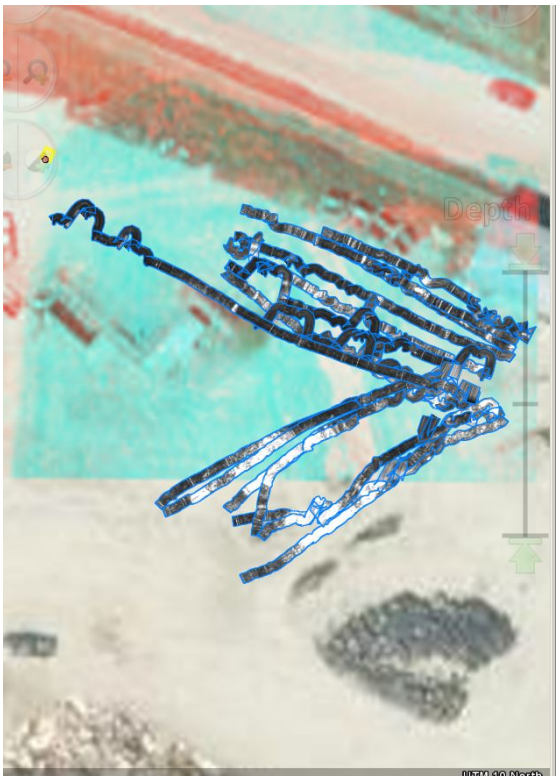

Figure 6: Project 5

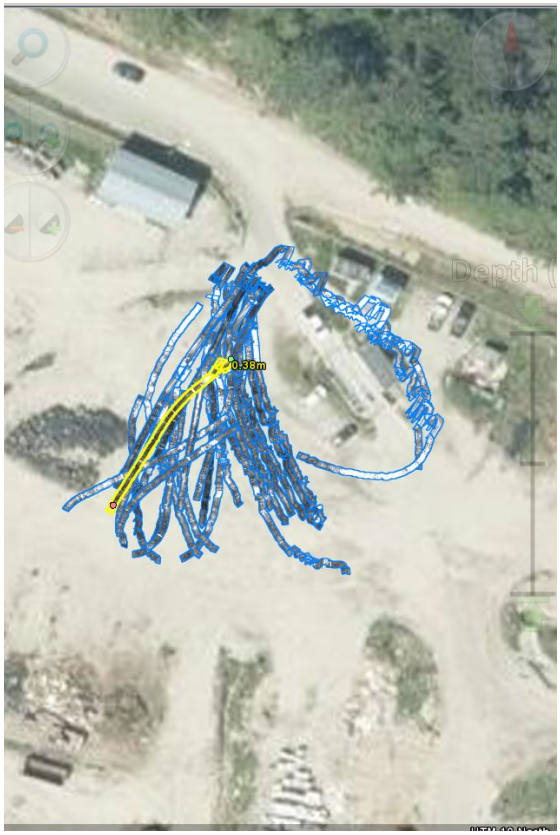

Figure 5: Project 4

Figure 7: Project 6

Figure 8: Project 7

GPR DATA PROCESSING

Data processing was done using IDS GREDHD processing and analysis software package. Several processing steps were carried out:

- Adjustment and interpolation of GPS position
- Temporal and 2D spatial filters
- Gain recovery
- Time-Depth conversion

GPR DATA INTERPRETATION

Data interpretation was performed within IDS GREDHD processing and analysis software package. Depth slices and radar profiles were carefully analyzed, and all anomalies marked.
Changes in the subsurface have been classified as follows:

- Red: anomalies more than 1ft thick
- Orange: anomalies between 0.5ft and 1 ft thick
- Yellow: anomalies less than 0.5ft.

GPR RESULTS

The processed GPR profile lines have been carefully analyzed manually. Sections of the profiles that show indication of void space below have been highlighted on the overview map below. You will see overlapping since some areas were covered by more than one project swath.

The anomalies outlined show areas with different subsurface properties which can be caused by buried materials. GPR is unable to determine the exact composition of the underground, hence this report should be used in conjunction with other methods of exploration (see recommendations below)

Figure 9: GPR survey results of anomalies (potential void or future void)
Red: anomalies more than 1ft thick; Orange: anomalies between 0.5ft and 1 ft thick; Yellow: anomalies less than 0.5ft thick.

RECOMMENDATIONS

We recommended to verify our findings by exposing the material below the gravel through drilling or digging.

LIMITATIONS

Please note that the depth to subsurface features derived from ground penetrating radar surveys are generally accepted as accurate to within ten to twenty percent of the true depths to the boundaries unless otherwise noted. Since the depth scale was calculated using average velocities and the material is not homogeneous, it could only be used as a guideline and not as exact measurement. The results are interpretive in nature and are considered to be a reasonable accurate presentation of existing conditions within the limitations of the radar profiling method. Since GPR provides indirect evidence, drilling and/or excavation are recommended to verify the interpretation.

Thank you for choosing Terraprobe, and if you have further questions please feel free to contact us.

Kind regards,

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