GROUND PENETRATING RADAR SURVEY
AT
LOT 1573 AND 1583 SCOTT CRESCENT,
BC
FOR
XXXX
(Project No. 1484)

Terraprobe Geoscience Corp.
112-17 Fawcett Rd.
Coquitlam, BC
Canada, V3K 6V2
Tel: 604 553 4778
Fax: 604 243 6993

e-mail: gpr@terraprobe.com
web: www.terraprobe.com

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Project No. **WO#1484**

XXX

Attention:

Subject: GPR SURVEY AT

1. Background

Terraprobe Geoscience Corp. (Terraprobe) was commissioned by XX to undertake a low frequency Ground Penetrating Radar (GPR) survey of XX

The GPR survey forms part of an environmental assessment exercise being conducted by Entech and the GPR survey was being conducted to verify presence of oil tanks, transformers, storage tanks/ vessels in specific areas of environmental concern.

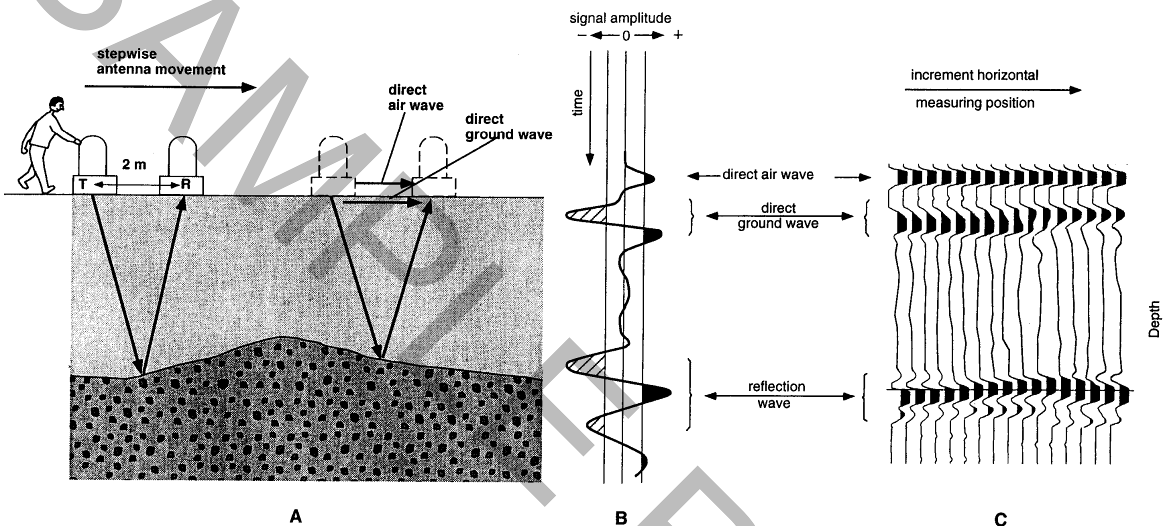
The areas surveyed are as follows:

- Area around the Metal Fabrication Building which is the Old Power Station (Lot 1573 Scott Cresent),
- Old Truck Wash Station; near Monitoring Well MW4 (Lot 1583 Scott Crescent)
- Old Truck Repair Shop (Lot 1583 Scott Crescent)
- Scott Crescent Rd. fronting Lot 1573 and 1583 (for mapping utilities)

Fig. 1 shows the areas where GPR survey was conducted.

2. GPR Theory and Principles

Ground penetrating radar is the general term applied to techniques that employ radio waves to profile structures and features in the subsurface. GPR method is based on emission, reflection and detection of electromagnetic waves. A short pulse of high frequency (10-1000 MHz) electromagnetic energy is produced and transmitted into the ground. The pulse spreads into the earth materials and is affected by the properties of the surrounding material. Some of the energy is reflected at the interface between materials of different (permittivity) properties. A receiver as signal strength versus delay time records the reflected energy at the surface. Processed radar data are plotted as surveyed horizontal distance (metres) versus two-way travel time in nanoseconds. The figure below illustrates the GPR principle.



GPR principle and reflection profiling. A: paths of the three main electromagnetic waves, B: corresponding single radar signal, C: resulting radar plot.

GPR can locate both metallic and non-metallic targets. Penetration depth and detect ability of targets depend on antenna frequency, target orientation and the dielectric properties of the host material. The interpreted radar profiles provide a two-dimensional cross section of the subsurface along the surveyed lines. The interpretation and presentation of GPR data can often be enhanced through the use of plan map displays of the data. Map view allows differentiation of targets.

3. Methodology

3.1. GPR instrumentation

GSSI 400 MHz GPR system was used for the survey. The low frequency antennae was used as this is appropriate for utilities mapping and for detecting deeper targets and anomalies with reasonable resolution.

3.2. Data Collection

For the most part the GPR survey was performed in grid scan mode. The spacing was established at 0.5m. The grid size varied depending on site conditions and access. In total there were **17 survey grids** that were surveyed within the site. Line scans was utilized for the survey of the utilities along Scott Crescent. Location and size of each respective survey grid is depicted in ***Fig. 2***.

3.3 GPR Data Interpretation

The primary response of radar to buried point like features is the hyperbolic arch, formed by the interaction between the shape of the radar beam, depth to the target and the velocity of the radar energy. Radar energy from the antenna is sent out in a cone. As the antenna approaches the target the distance decreases, forming the ascending part of the apparent hyperbola centered over the anomaly. The width of the arch is a function of the velocity and depth. The descending arch is formed as the antenna moves away.

Material inhomogeneities, different water saturation, salinity or void space can cause change in signal amplitude. Wire mesh and closely spaced rebars can cause an extreme high-energy response of the signal. This high-energy response or reflection can be interpreted as an anomaly since the low frequency signal cannot penetrate through the wire mesh or tighly spaced rebars..

Data processing was performed using GSSI Radan processing software. The following steps were carried out:

- gain recovery,
- temporal and spatial filtering,
- background removal
- migration

4. GPR Survey Results

Data Quality. The dual frequency antennas provided sufficient data quality to about **2m** depth. Beyond this depth the GPR signal improves gradually as you move away from the Mamquam Channel. It is possible that the deterioration of the GPR signal is due to the chloride content as the nearby channel is tidally influenced.

Anomalies. In geophysical terms anomalies are defined as areas where there is high GPR signal amplitude and high energy response or reflection. Metallic targets normally exhibit this type signal attribute. For this project site where previous land use would be taken into consideration the anomalies may represent steel structures, metal tanks or vessels that could have been used for storing chemicals etc. The areas where anomalies have been identified are shown in ***Fig. 3***.

Utilities Mapping. Utilities identified are water, sanitary, telecommunications and the main water line for the old hydropower. The location of the utilities including their respective depths are also shown in ***Fig.3***.

5. Recommendations

GPR provides good information of subsurface conditions however the technology alone will not provide 100% accuracy. Supplementary investigation like borehole drilling, sampling etc. is recommended to confirm the findings.

6. Limitations

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 or ± 0.5m to the boundaries. 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.***

Thank you for choosing Terraprobe, please do not hesitate to contact us if you have any further questions.

Ed Maglanque, ASct (Civil)
Subsurface Utility Engineering Specialist

Valesca Schaefer, Dipl. Geol.
Field Operations Supervisor

FIG. 1 KEY PLAN SHOWING AREAS SURVEYED

LEGEND

- GPR SURVEY USING GRIDS (yellow)
- GPR SURVEY USING LINE SCAN (FOR UTILITIES MAPPING) (orange)

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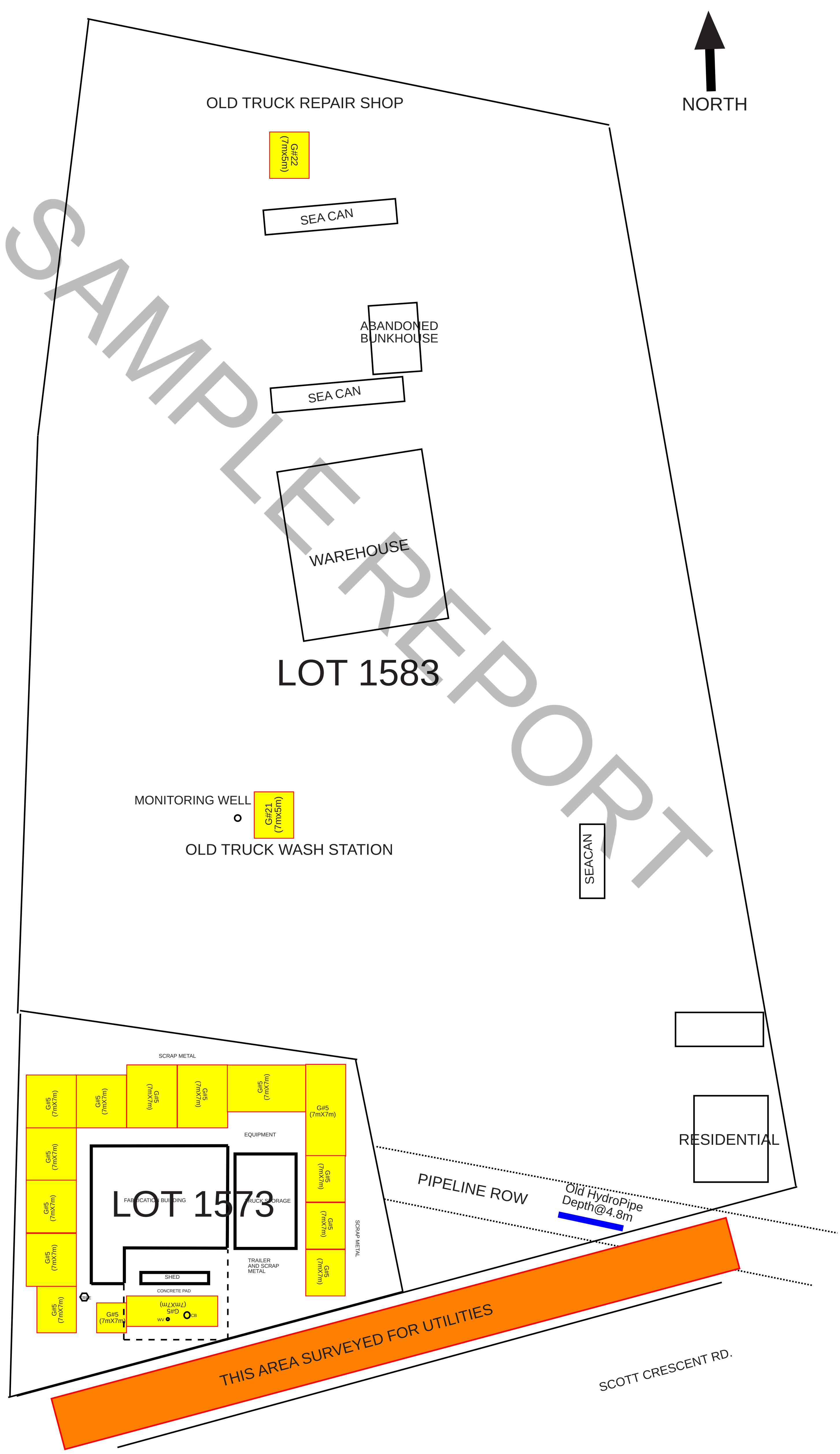

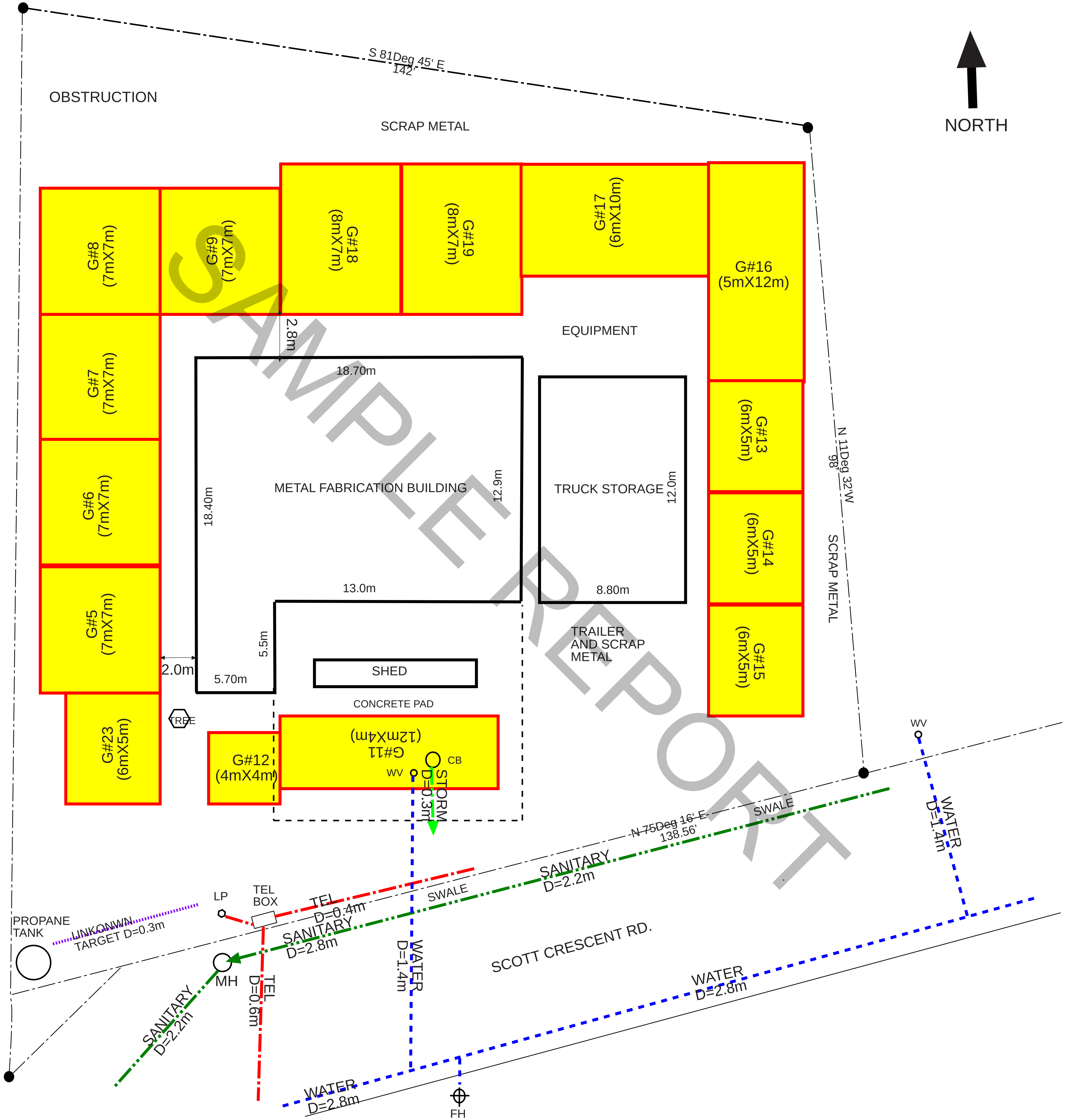

FIG. 2 BLOW UP PLAN OF AREAS SURVEYED AROUND METAL FABRICATION BLDG. (OLD POWER STATION): ALSO SHOWS UTILITIES IDENTIFIED ALONG SCOTT CRESCENT RD.

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GPR SURVEY USING GRIDS

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FIG. 3 LOCATION OF ANOMALIES

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