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STRATHFIELD COUNCIL
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ADDITIONAL INFORMATION

DA2020/080
7 September 2020

Report

Tree Root Mapping at 2 Eastbourne Road, Homebush, NSW.

Date: 10 August 2020
Job Number: GBGA2373
Author: Tuan Nguyen
Reviewed: Benjamin Wilkins

Contents

DISTRIBUTION

Revision	Electronic	Paper	Issued to
Draft	1	0	Richard Nicholas Verzi, rverzi@bc-a.com.au

1 INTRODUCTION

GBG Australia (GBG) carried out Non-Destructive Testing using Ground Penetrating Radar (GPR) on 30th and 31st August 2020 at 2 Eastbourne Road, Homebush, NSW. We are pleased to present the findings of the investigation in the following report.

The objective of the investigation is to locate roots emanating from several target trees which may affect proposed developments. GBG's results will be included the Development Application (DA) for the property.

2 GEOPHYSICAL INVESTIGATION SITE

The total area surveyed was approximately in red boxes(see Figure 1 below). The survey site was split into four areas for ease of data collection and reporting.

Figure 1: Aerial image of the survey site. The approximate GPR survey extents are sectioned off into four and are outlined in red. Image taken from Google Earth.

The investigation site was predominantly concrete slabs with some areas of natural ground with some grass. The site conditions included mulch, wet areas from recent rain events, branches, and other obstructions such as parked cars and outdoor furniture (see Figures 2 to 4 for examples). Visible roots at the base of several trees were observed onsite and recorded in the field notes. Any drains, services etc. were recorded on site were noted in the field notes.

Figure 2: Mulch, especially if damp, may absorb the radar signal and reduce the overall depth of penetration.

Figure 3: Damp or wet ground will absorb the radar signal and greatly reduces the depth of penetration.

Figure 4: Branches created uneven ground (GPR not suitable)

Figure 5: Outdoor furniture created some obstruction to the surveying of some areas and were therefore not surveyed if it could not be easily moved.

Area 1 also had concrete squares in parking slots which created uneven ground and may have affected the GPR results, see Figure 5 overleaf.

Figure 6: Concrete squares in parking slots that created uneven ground and affected the ground coupling to the GPR antenna and affected the quality of the GPR data in this area. (surface roots visible tree 29)

3 DATA ACQUISITION

3.1 GROUND PENETRATING RADAR

Data collection involved moving the GPR system slowly and steadily along a series of parallel lines at a minimum of 0.25 m and a maximum of 0.5 m intervals within the surveyable area, in both transverse and longitudinal profiles. A total of 179 files were collected for the investigation.

The GPR data profiles were collected with a 900 MHz antenna at 100 scans per metre along the profile lines with 512 samples collected for each scan at 16-bit amplitude. The GPR system was set to record a two-way travel time of 40 ns. Chainages along the profiles were logged by using a calibrated optical odometer connected to a survey wheel.

The GPR data for this investigation was acquired using a GSSI SIR3000 GPR data collection system. Antennas of high frequency provide high-resolution data but only penetrate to shallow depths, whilst low-frequency antennas provide deeper penetration with decreased resolution. The depth of penetration achievable with an antenna of a particular frequency is also dependent on the local subsurface conditions. The 900 MHz antenna was found to provide the best combination of depth of penetration and resolution possible with a useful depth of penetration of approximately 1.2 m.

On site quality control of the data was achieved in real-time by viewing profiles during acquisition. The profiles were recorded digitally for processing, analysis and interpretation at our Sydney office. Data processing included:

- Static Correction, to correct the signal to the surface;
- Background Removal 2D filtering, to remove noise and enhance the return the signal;

4 RESULTS AND INTERPRETATION

The results of the geophysical investigation for 2 Eastbourne Road, Homebush, NSW have been provided in the following drawing attached to Appendix A of this report as DWG GBGA2373-01 to -05. An ACAD file of the plans with the GPR results are overlaid and is also attached to Appendix A.

The quality of the data collected was of moderate to good quality and the effective depth of penetration post-processing was approximately 0.9 m from current ground surface. Interpreted tree roots are labelled as probable in brown. Any interpreted services are outlined in red.

The GPR investigation has mapped extensive tree root systems for all four areas, with interpreted roots averaging (below current ground surface):

- Area 1 – 50-300 mm
- Area 2 – 200-250 mm
- Area 3 – 150-200 mm
- Area 4 – 200-250 mm

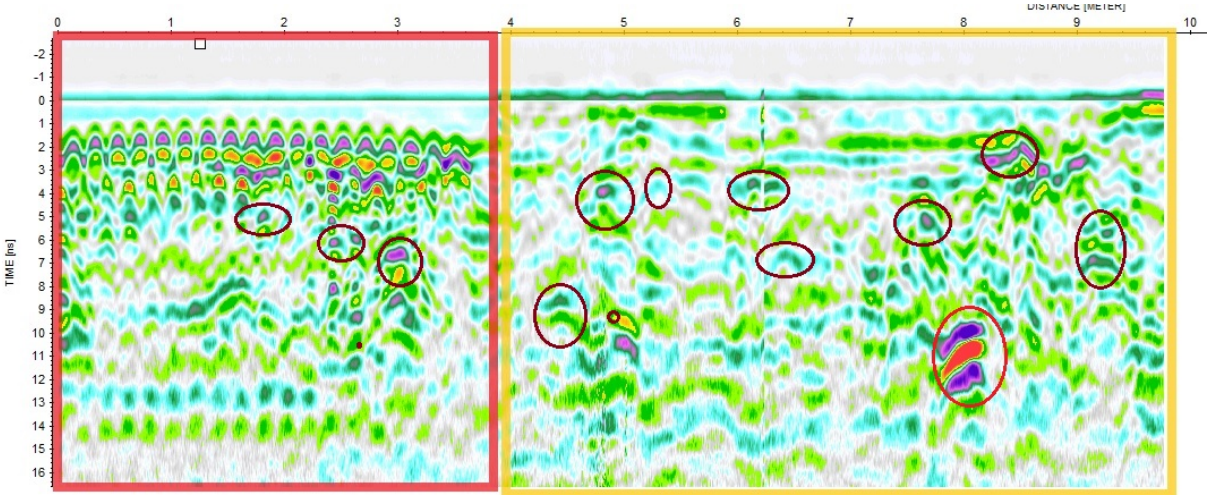


Figure 5: A sample profile showing limited roots under reinforeced slab in the red box

(roots in brown and red service).

Majority of interpreted roots have not been mapped to the specific tree due to many trees near by. They may emanate from other trees (from the neighbouring properties) or possible by remnant roots from previously removed trees. Despite the analyst's best efforts in determining which roots belongs to which tree. It must be noted that due to the nature of tree roots, it is not always possible to do so. Roots which are less than 50 mm in diameter are usually too small to be observed in the GPR data and hence only interpreted larger roots have been plotted. The diameter of the tree roots cannot be determined from the GPR data.

Average depths to the identified tree roots are in millimetres rounded to the nearest 50 mm and are shown alongside the plotted root. The depths quoted in this investigation have been calculated using an uncorrelated radar-wave velocity. The typical radar wave speed through the subsurface can vary considerably depending on the soil type, moisture content, and

various surface materials. As such without correlation, we would expect an accuracy of ± 20% of quoted depths.

5 CONCLUSIONS

GBG was commissioned to complete a tree root survey in the properties of 2 Eastbourne Road, Homebush, NSW. The results are presented in the plan-view drawings attached to this report with an ACAD file.

We hope that this report satisfies the requirements of this investigation. Should you have any questions about the investigation and its results, please do not hesitate to contact me.

For and on behalf of

GBG Australia

Tuan Nguyen
NDT Engineering

APPENDIX A. DWG GBGA2373-01 to 05 Tree Root Mapping Results with ACAD file

APPENDIX B. Ground Penetrating Radar Theory

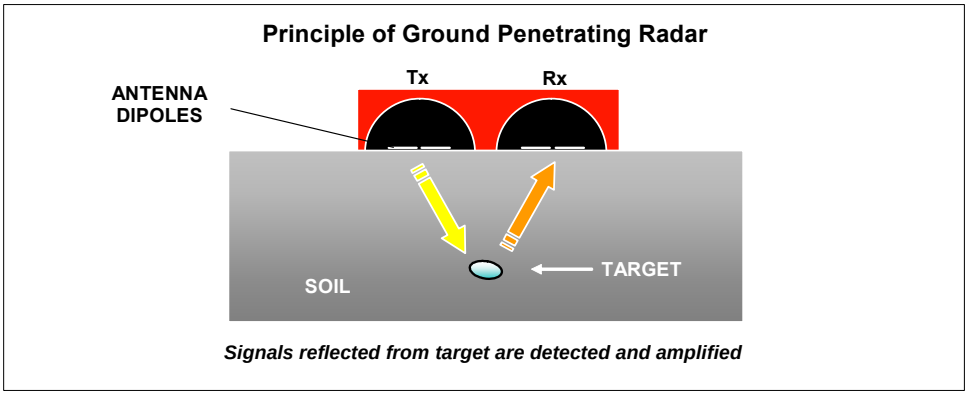
APPLICATIONS

- ✓ Stratigraphic mapping including depth to bedrock
- ✓ Locating karst features, sinkholes, voids or cave systems
- ✓ Depth to water table
- ✓ Archaeology (location of graves and artifacts)
- ✓ Location of underground infrastructure, including UST's and utilities
- ✓ Assessment of internal condition and defects of engineered structures
- ✓ Assessment of road and rail infrastructure, including asphalt and ballast condition
- ✓ Slab thickness, reinforcement placement and void detection

METHOD

Ground Penetrating Radar (GPR) is a non-destructive and non-invasive geophysical technique for rapidly imaging the shallow subsurface and producing high-resolution colour sections in real time. The method works by transmitting electromagnetic energy into the material being tested (most usually the ground). Typically 100,000 impulses per second are transmitted which are of very short duration and contain a wide spectrum of frequencies.

The transmitted electromagnetic energy propagates through the subsurface as a function of the subsurface material's electrical properties, which are in turn dependent on its physical and chemical properties. Reflection of radar energy occurs at boundaries between differing stratigraphic layers or inclusions which have contrasting electrical properties. Conversely, no reflections occur from a homogenous material where there are no internal reflectors. The reflections are detected by the receiving antenna placed adjacent to the transmitter. The depth to the target is proportional to the time (in nanoseconds) taken for the signal to travel from the transmitting antenna at the surface to the target and back to the receiver.

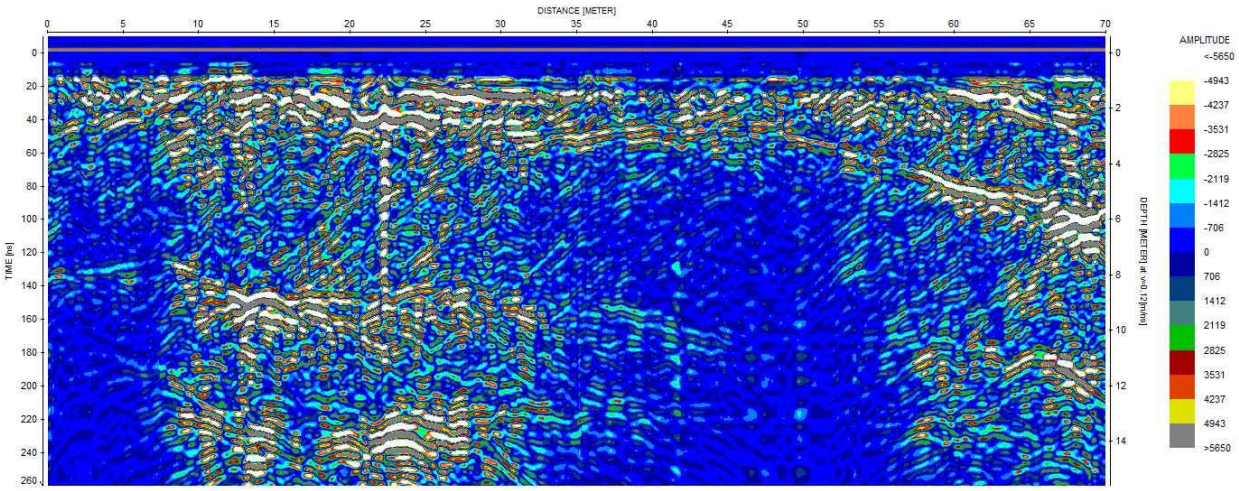


Schematic illustration of the principle behind ground penetrating radar

DATA ANALYSIS & PRESENTATION

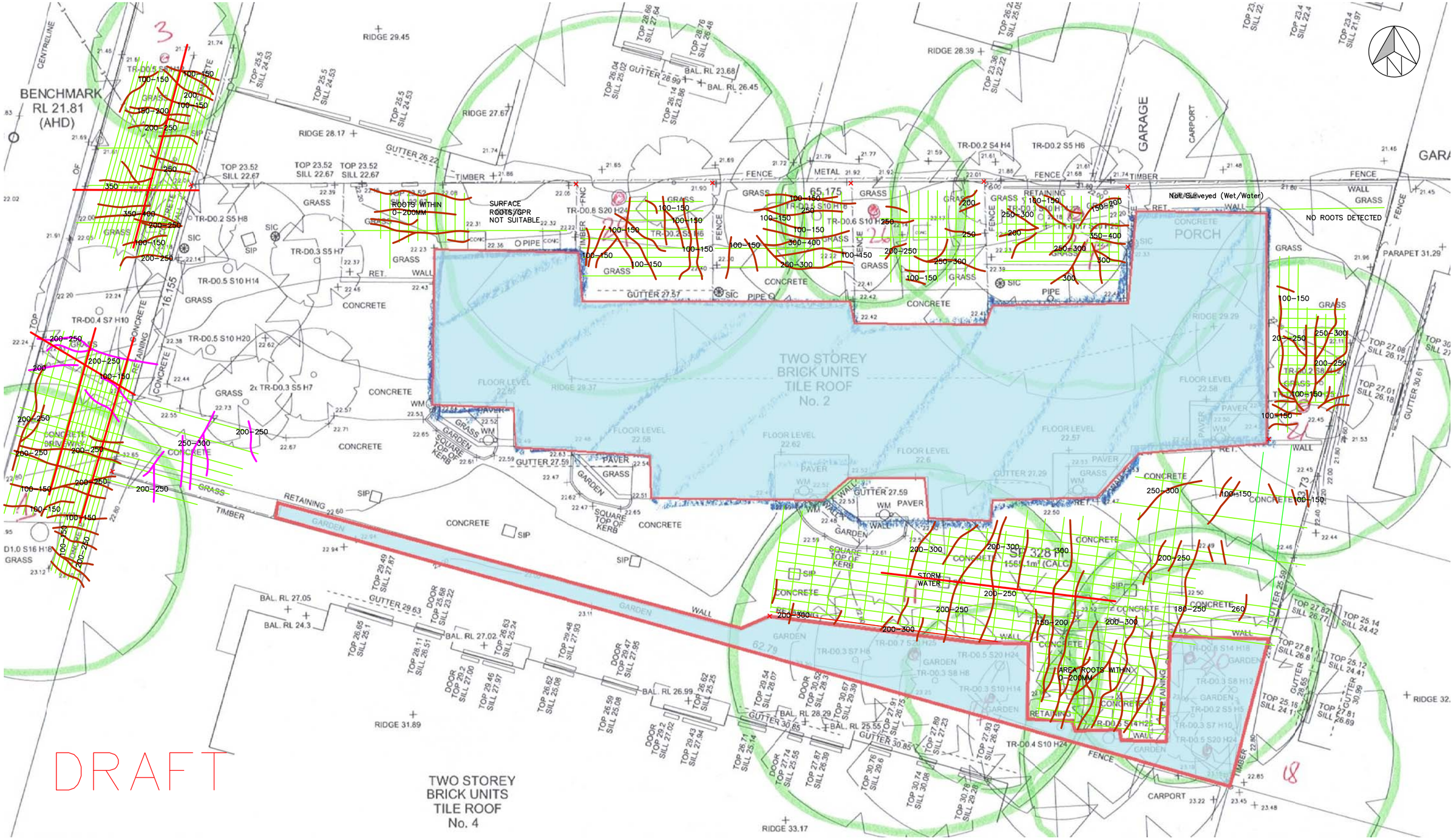
A radar-gram profile is built up of continuous scans along a selected line path, see below. These are 2D cross-sections of the subsurface showing variations in reflection amplitude as a colour scale. The recorded reflections can be analysed in terms of shape, phase, travel time and signal amplitude to provide information about a target's size, depth and orientation in relation to the material around it.

The depth of investigation achievable with the GPR method is largely a function of the antenna frequency used. Lower frequencies in the order of 100 MHz are typically used for geological mapping to a maximum depth of approximately 20 m, whilst high frequencies in the order of 1 GHz are used for high resolution investigations of structures including building, bridges and tunnels.



Processed GPR cross-section imaging a karst formation illustrated by the variations in the radar-wave reflection amplitudes. This enables the detailed analysis of voids or caves within limestone bedrock.

GROUND PENETRATING RADAR SURVEY



Legend

- GPR PROFILES
- SERVICES
- ROOTS >50mm
- ROOTS (NON TARGET TREE)
- 350 DEPTH TO ROOTS (mm)

Disclaimer:

THIS DRAWING HAS BEEN PREPARED USING EXISTING DRAWINGS OR PRINTS AS SUPPLIED BY THE CLIENT AND SUPPLEMENTED BY MEASUREMENTS TAKEN ON SITE. PRIOR TO COMMENCING ANY WORK, MEASUREMENTS MUST BE CHECKED.

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CLIENT:	BECHARA CHAN & ASSOCIATES PTY LTD	
TITLE:	TREE ROOTS MAPPING AT NO2 EASTBOURNE ROAD, hOMEBUSH, NSW	
DRAWN: T.N	PROJECT MANAGER: T.N	CADFILE: GBGA2373
SCALE: 1: 200	DATE: 10 AUGUST 2020	DRG No: GBGA2376-01
0 10m		REV: A3

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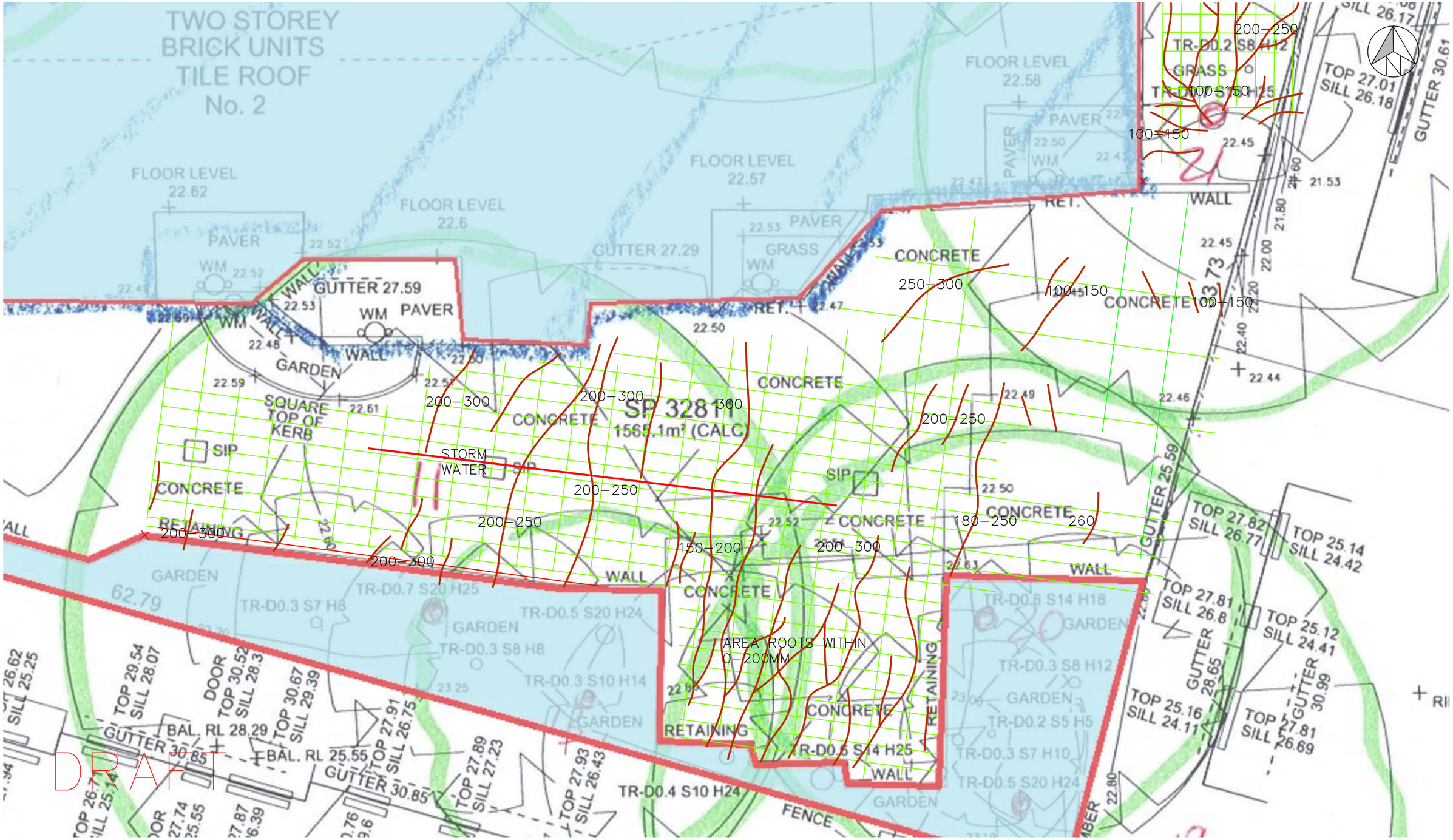
GROUND PENETRATING RADAR SURVEY



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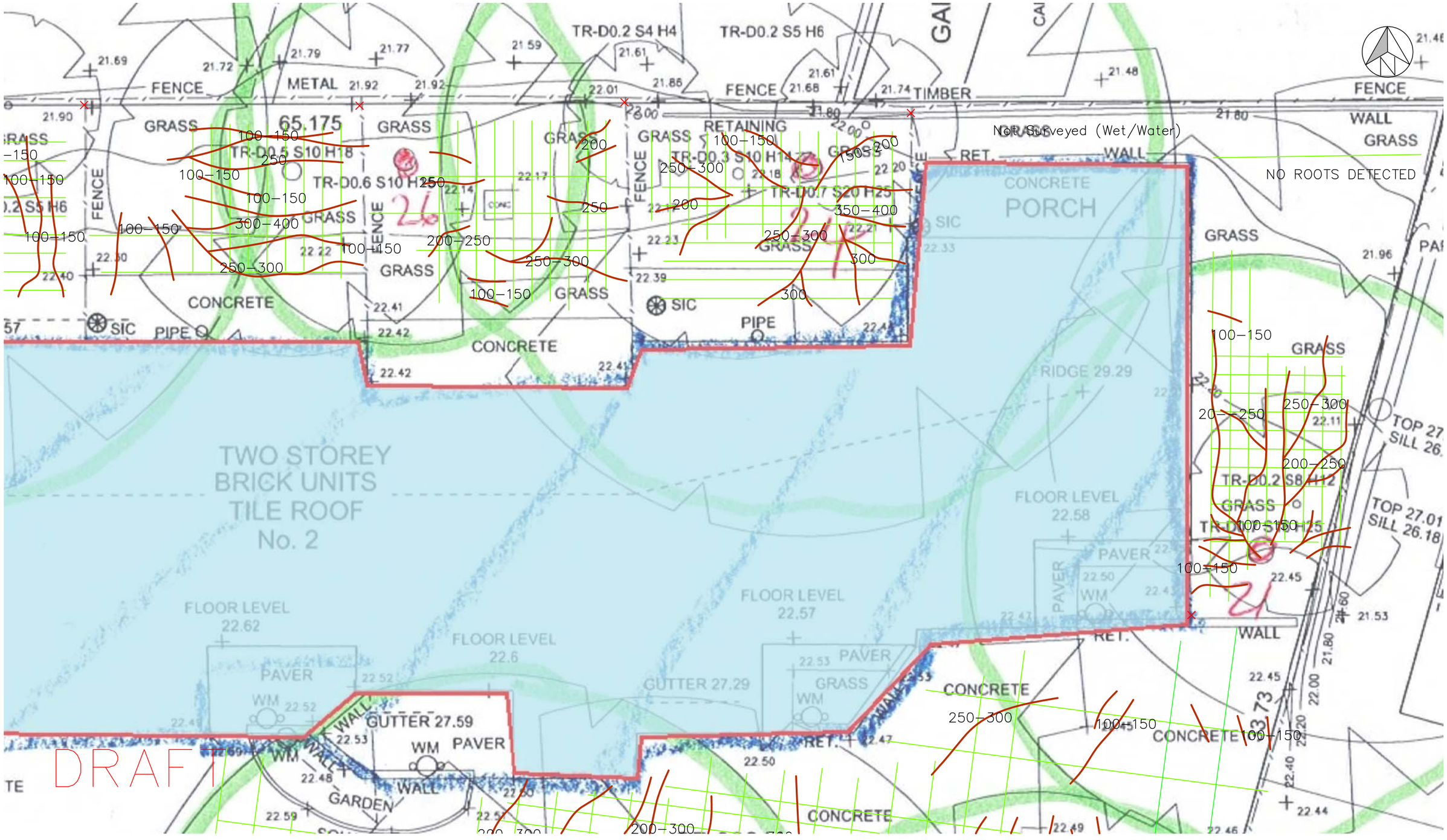

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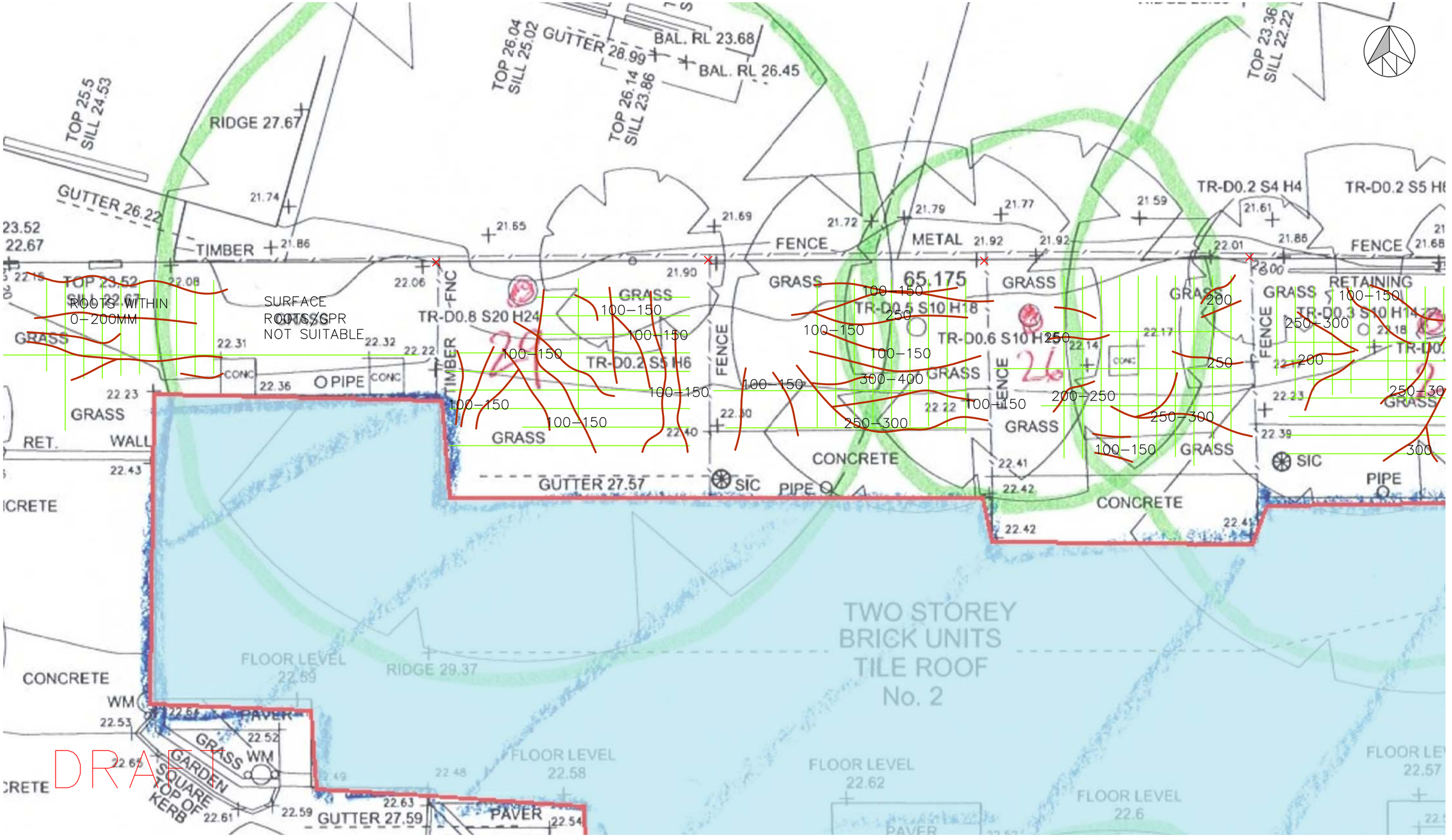
GROUND PENETRATING RADAR SURVEY



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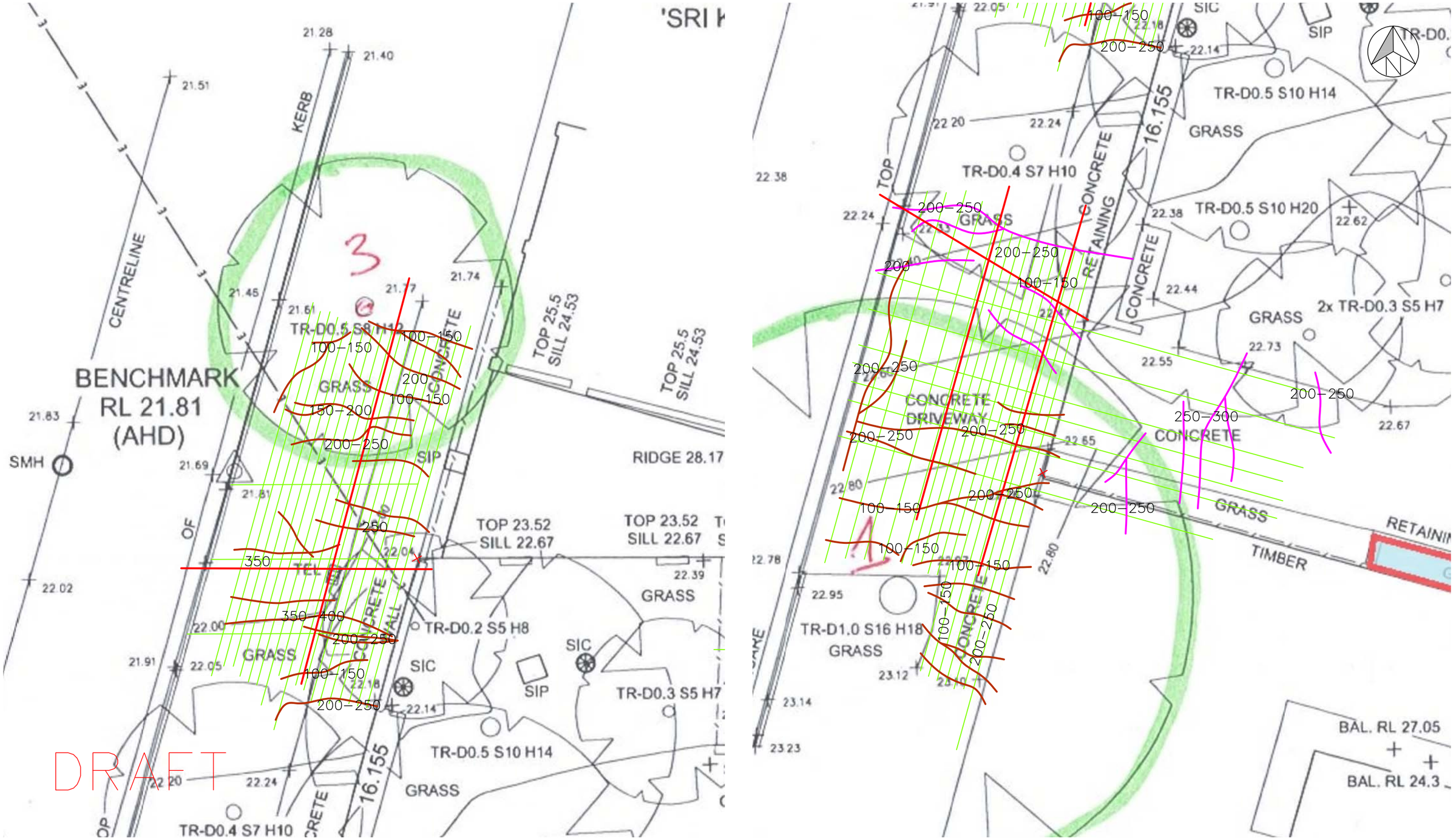
GROUND PENETRATING RADAR SURVEY



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