TreeRadar® Investigations
Peter Barton Associates

TreeRadar^{R} GPR
Tree Root Investigations

13 Lambolle Road
London NW3

Tree Root Mapping Report

October 2024

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CONTENTS **Page**

Complete data set including Plans and Visuals as used in this report are given in associated zip file: - LLP403 - Addendum A7 - Trench View Radargrams & Associated Data.

1. Introduction

1.1 On instructions received from Paul Allen of Enviroarb Solutions Ltd, Peter Barton Associates carried out a TreeRadar^{R} GPR root investigation at 13 Lambolle Road, London NW3.

2. The Site

2.1 The property at 13 Lambolle Road is *a* residential Victorian house in Belsize Park.

2.2 The GPR root survey focused on the area at the rear of the garden north of the southern boundary adjacent to a row of cypress trees as shown in the schematics as shown at Appendix A1.

3. The Survey

3.1 The survey was carried out on the Monday 7th October by the TreeRadar^{R} GPR team of Peter Barton Associates. The weather conditions on the day of the survey were cloudy with sun.

3.2 Ten scan-lines were set out at 1m centres extending into the site 10m from the Southern boundary. Details are shown on the scan-line layout schematics at Appendix A1.

3.3 Scanning was carried out using the TreeRadar^{R} GPR field unit fitted with the 400MHz antennae. Scanning was to 2m depth. Roots of 20 mm diameter and over were targeted.

3.4 A total of 10 scan-lines were surveyed. Details are shown on the scan-line layout schematics at Appendix A1.

4. GPR Data Processing

4.1 The data outputs from the TreeRadar^{R} root-scanning were processed by bespoke software (TreeWin TBA). This software provides a high degree of accuracy as to plotting the location and presence of tree roots.

4.2 The current analysis process provides accuracy of more than 85%. Majority of inaccuracies are in plotting root clusters as one root, as outlined below.

- Root clusters plotted as part of the GPR survey are gatherings of live roots with root diameters of less than 10mm which have a spatial separation of less than 5mm. Such groupings can be recorded as a single root plot location. Therefore, clusters of roots from significant garden plants can also be recorded as a single root plot.
- Dead roots having different reflective qualities are not plotted; dead roots are defined as non-active decedent roots of more than 12 months.

5. Data out-puts

5.1 The data outputs as processed by the software (TreeWin TBA) provides a high degree of accuracy as to plotting the location and presence of tree roots. Outputs are as follows:

Cut Face Trench Radargrams

- As part of the root analysis, scaled, cut face spatial view radargrams were generated for each line scanned. These provide visual scaled 2D view of root locations including linear position and depth.
- Detailed information is shown on the example spatial view trench visuals given in Appendix A5. Information includes a brief overview of findings including average root density counts (roots per metre) and noted non-root reflectors (services, rocks/rubble etc.).

Multi-trench View Visuals

- As part of the root analysis, multi-trench view visuals are generated for groups of scan-lines where practical. These provide an across site visual of root locations and depth. Multi-trench visuals are given at Appendix A4.

Top-Down View Root Maps

- The top-down view (TDV) Root position and density and plots are generated by the TBA software. These have been annotated to the site plan provided and shown at Appendix A2, A3 and A4.

Root Position Maps

- Root positioning TDVs give an indication of roots along the scanlines. These provide a visual indication in plan-view of root position, root-free zones related to existing trees and site features. Root positioning TDVs are key to providing a holistic assessment of the site.

  Root Position TDVs: identified root positions are shown along the scan-lines as small triangles. These are colour coded according to depth of the roots within the profile:

Red:	60cm depth
Green:	60cm to 120cm depth
Blue:	Below 120cm depth

Root Morphology Maps

- Root morphology maps provide a visual overview of tree root layout and have been developed by our technicians from Root Position maps. Being predictive, root morphology maps should not be scaled. Root morphology maps provide a holistic overview of root distribution and patterns. Unusual characteristics such as atypical root patterns are visually obvious. The root morphology map is given at Appendix A3.

5.2 Interpretation of radargrams, root densities and root position maps require due consideration to be given to adjacent sapling trees and coarse vegetation that may be growing on site. These are not necessarily shown in detail on the topographical survey drawings. Saplings, shrubs, and non-target trees will impact on the root density counts.

5.3 A complete data set including Plans and Visuals as used in this report are given in associated zip file: - LLP403- Addendum A7 - Trench View Radargrams & Associated Data.

6. Overview of findings

6.1 Ten scan-lines were set out at 1m centres extending into the site 10m from the Southern boundary.

6.2 Following data processing the following was evident:

- Root densities [average roots per metre] range from low root density [1.72 roots per metre scan-lines 10] to medium/high [3.04 roots per metre scan-line 3].
- Majority of root reflectors are in the top 60cm depth band with higher densities near to the southern boundary.
- Some roots are evident around/below 1 metre depth band - these are presumed to be roots from mature broadleaf/ornamental trees adjacent.
- Cultivated soil depths are variable down to around 1 metre depth overlying a cluttered sub-strata profile.

6.3 Conclusions

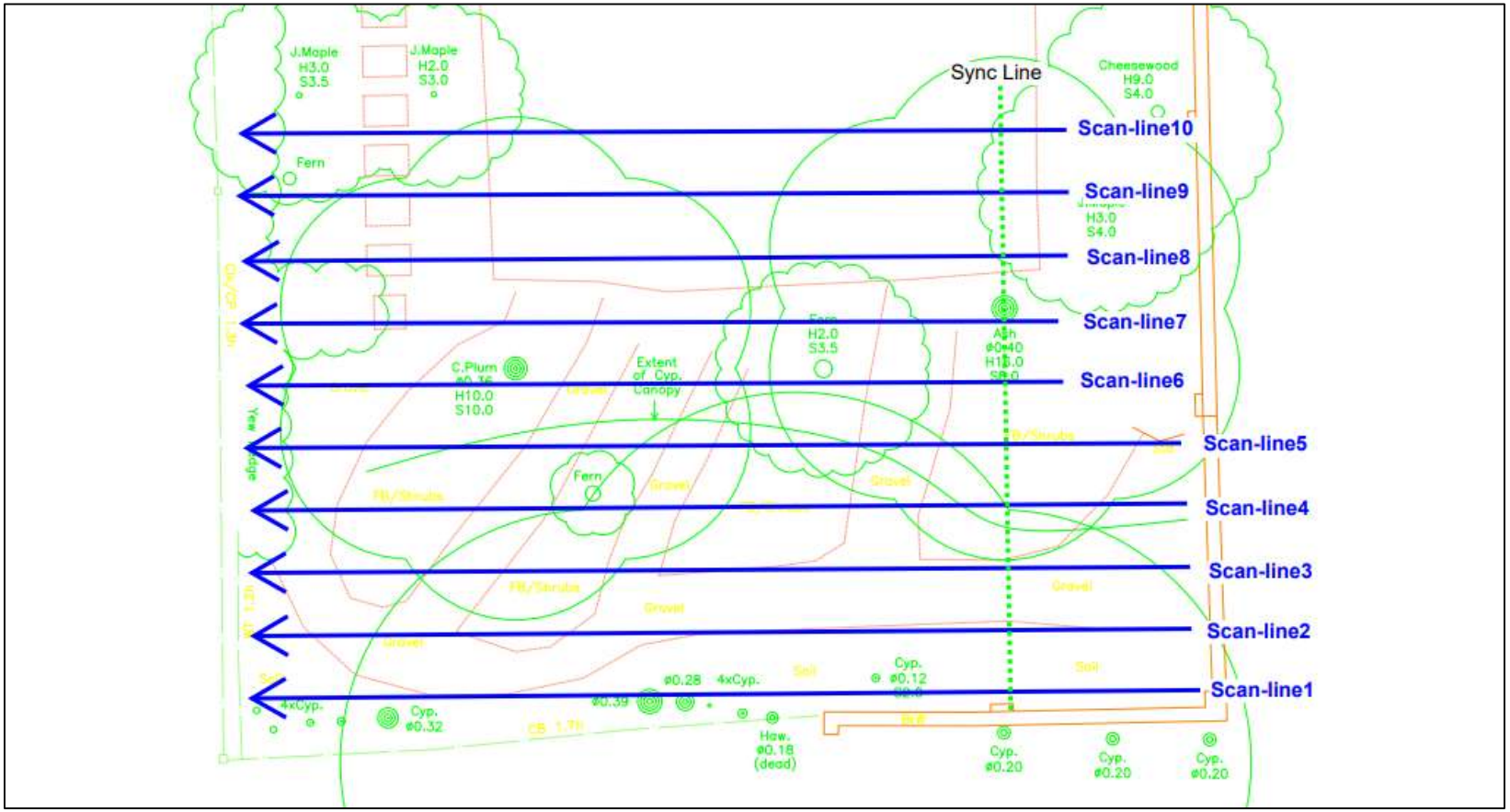
There was a significant drop off in root densities from around scan-line 5 to scan-line 10. The higher root densities are typical of cypress trees as is apparent along the southern boundary.

There are roots evident at around the 1 metre depth band. These are assumed to be roots from mature ornamental trees adjacent.

The low root count per metre across the site should provide facility for the installation of screw piles or similar whilst avoiding damage to the roots of retained trees.

Appendix A1: Scan Line Layout Schematics

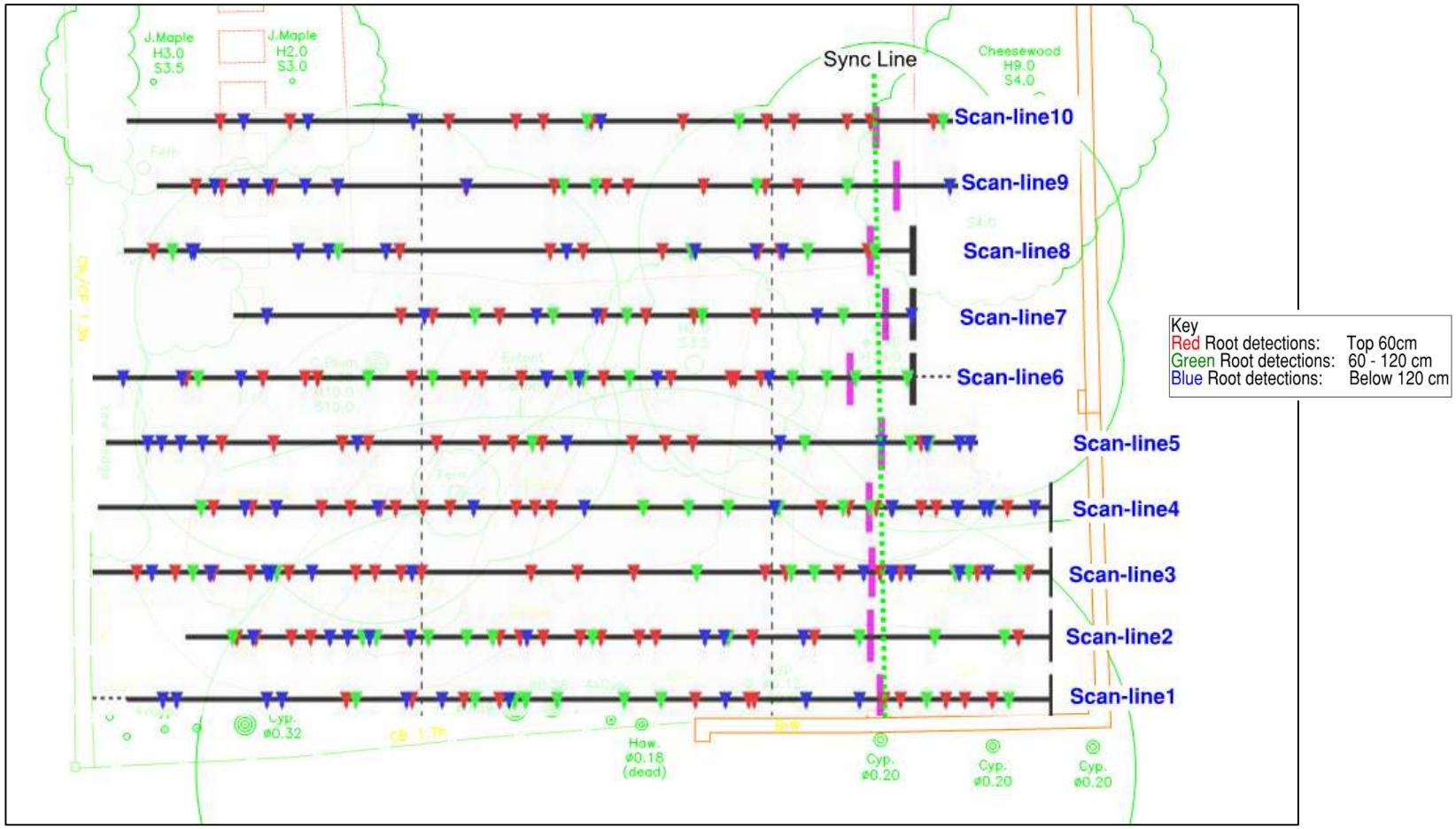
Scan-Line Layout Schematics



Scan-lines plotted to plan

Appendix A2: Top-Down View Root Locations

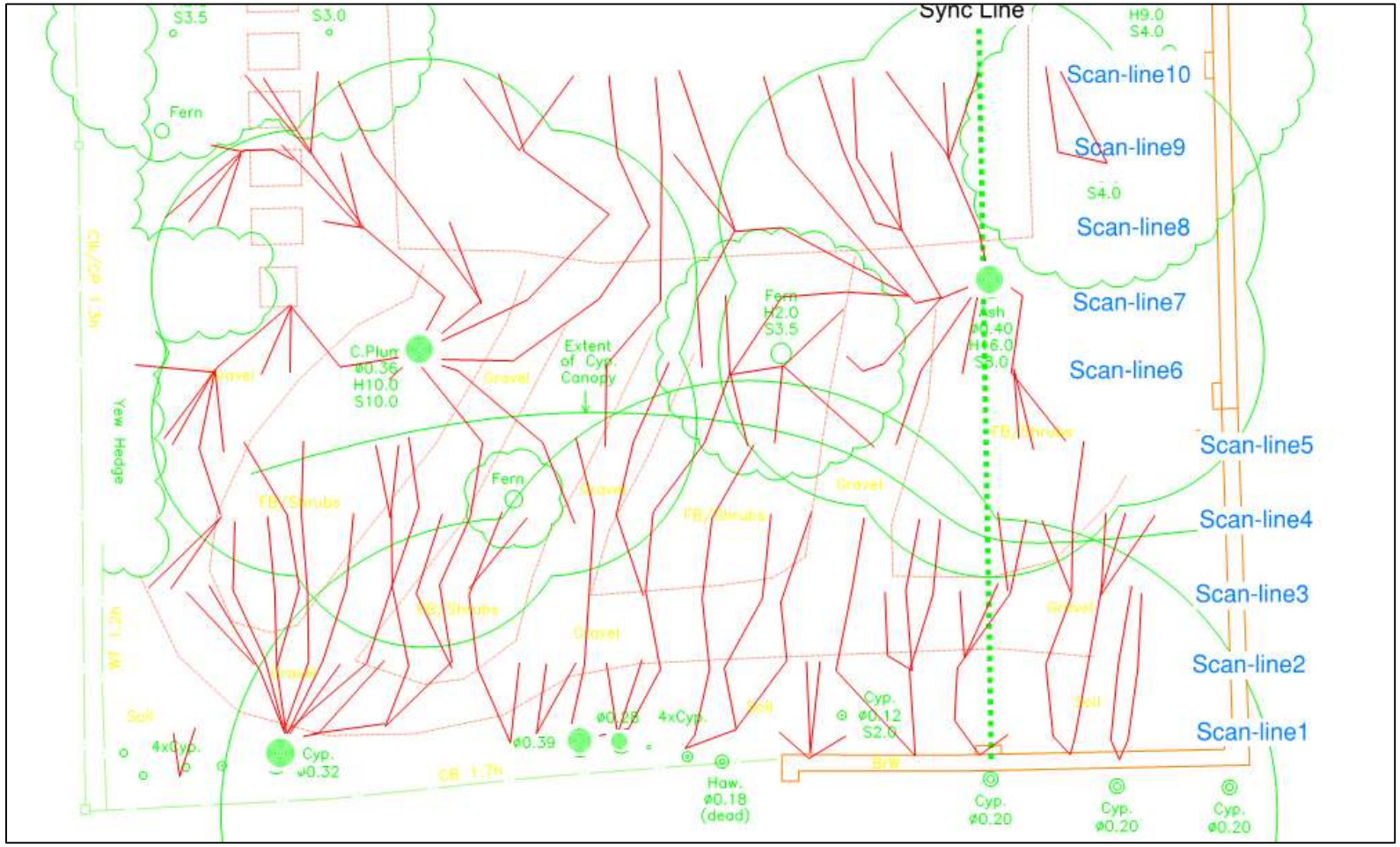
Top-Down View Root Locations



Root positions plotted to scan-lines/plan

Appendix A3: Top-Down View Root Morphology Map

Top-Down View Root Morphology Map



Root Morphology to Scan-lines

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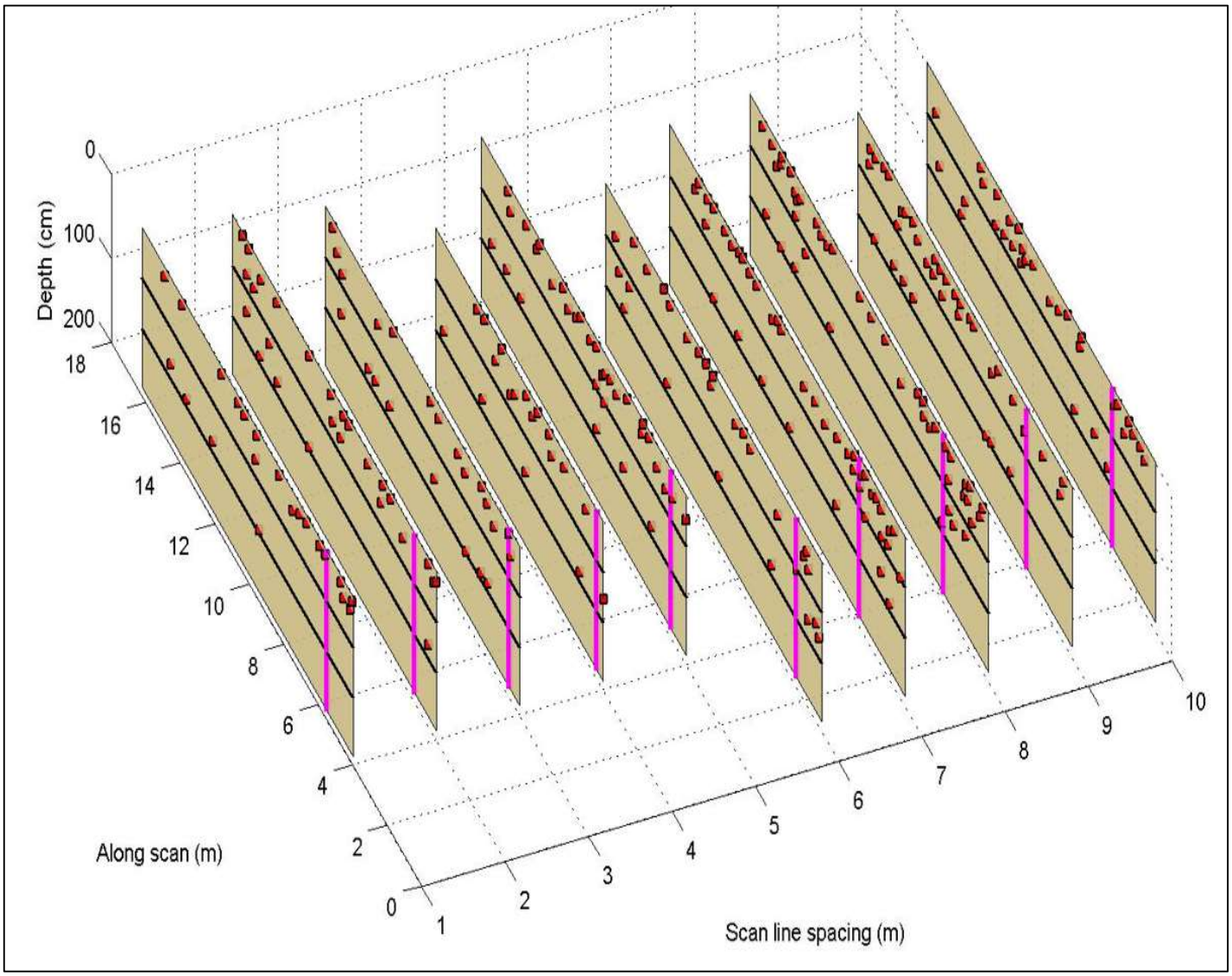
Appendix A4: Roots to Multi-trench (3D)

Multi-trench view visuals show roots in a 3D virtual trench-face view arrangement. These provide an overview of root positions, density, and depth. The horizontal line markers are set at 60cm and 120cm depth. Vertical markers align to the tree.

Multi trench view visuals provide for a quick review of findings - for a more precise and detail analysis of root positions please refer to the trench view radargrams in Appendix A5 and Addendum A7.

Roots to Virtual Trench



Scan-lines 1-5
Multi-trench view visuals show roots in a 3D virtual trench-face view arrangement

Appendix A5: Example Radargrams - 2D Virtual Trenches

The following visuals show the GPR data outputs following analysis; these are “trench face” radargrams. These provide a detailed, below the scan line scaled spatial view showing the depth and distance of roots in a virtual trench face.

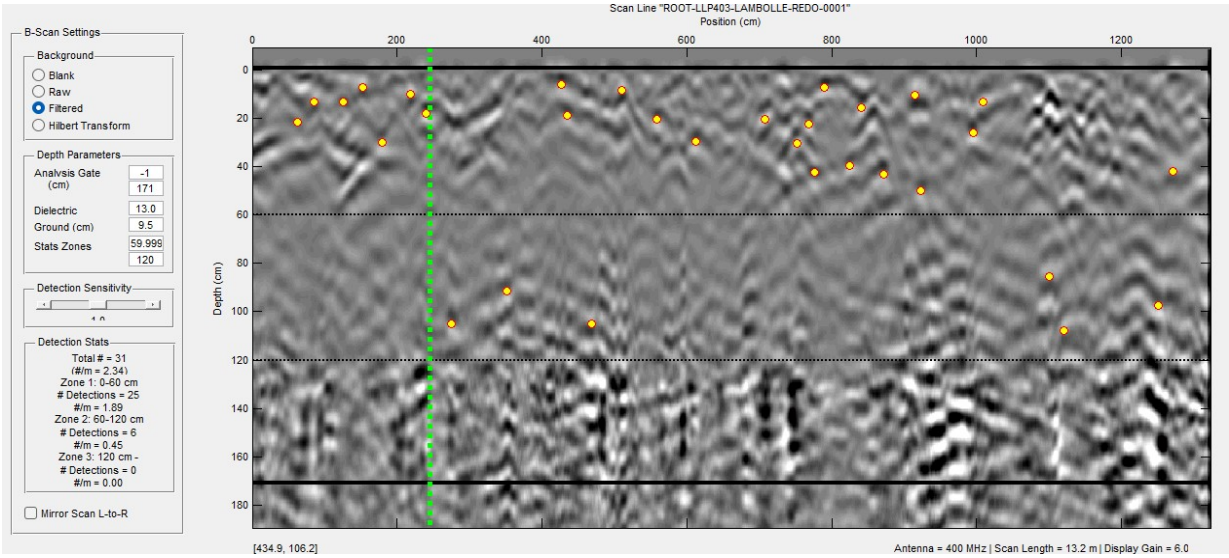
There is a distance scale along the top, and depth scale down the left axis. The horizontal broken lines indicate depths of 60cm and 120cm. The green broken lines are synchronisation markers to tree as indicated in the visuals at Appendix A2.

Root densities are shown left of the radargram.

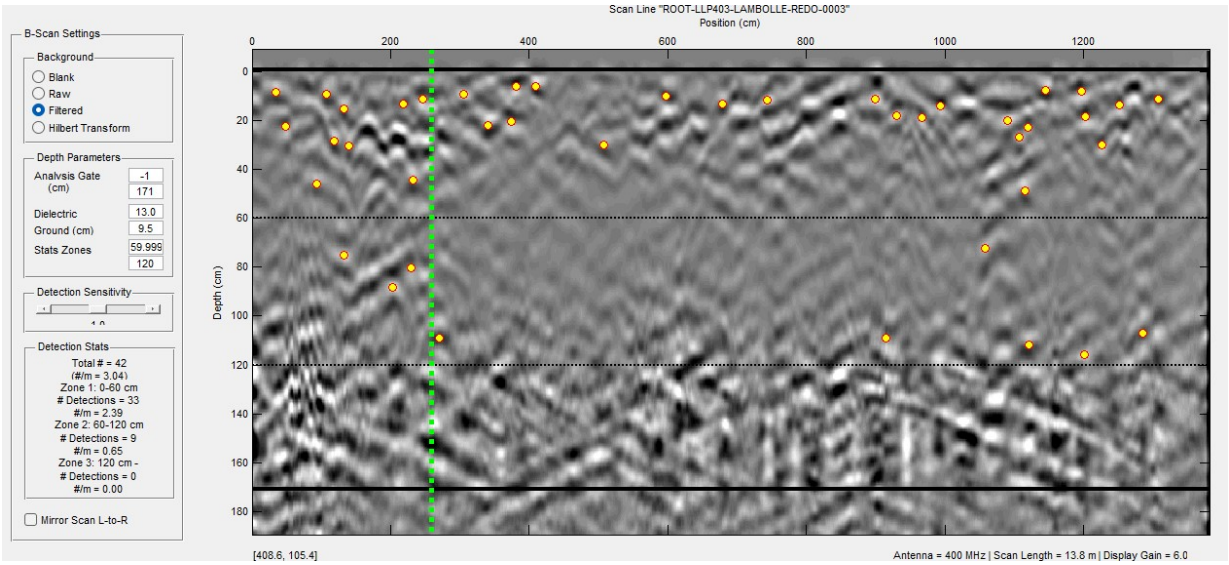
Radargrams provide the most accurate distance/depth to scale in relation to roots below ground.

Complete data set including Plans and Visuals as used in this report are given in associated zip file: - LLP403 - Addendum A7 - Trench View Radargrams & Associated Data

Radargrams

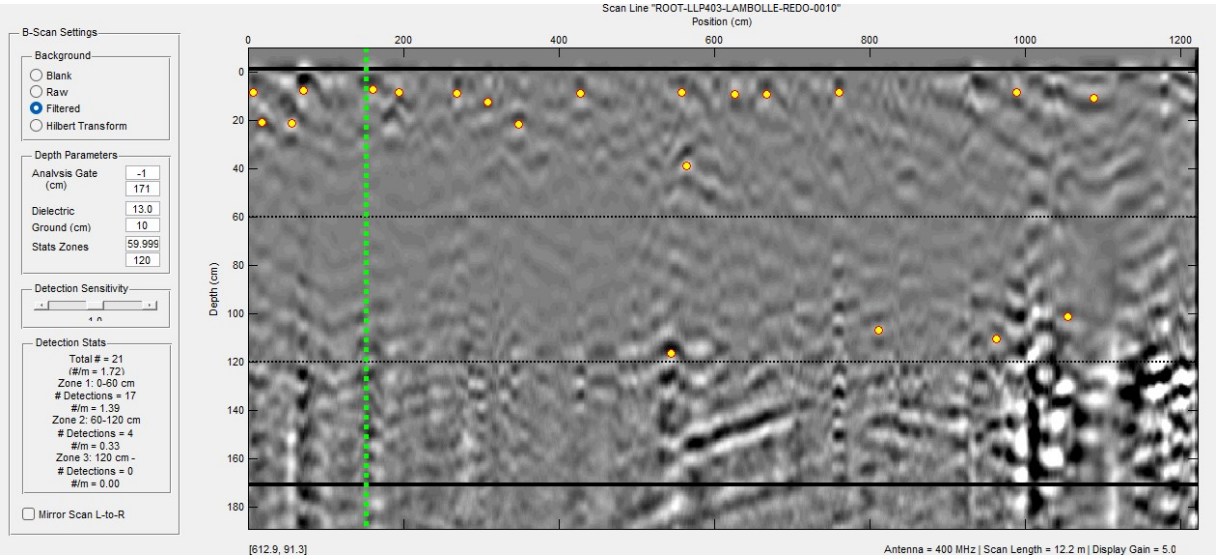


Scan-line 1:
Radargram showing root reflectors and non-root reflectors (mainly below 100cm). The vertical broken green at around 250cm is a scan-line synchronisation marker.
Average root densities shown – near surface roots are more associated with adjacent cypress trees, root reflectors (at around 1m depth) associated with the adjacent broadleaf trees.



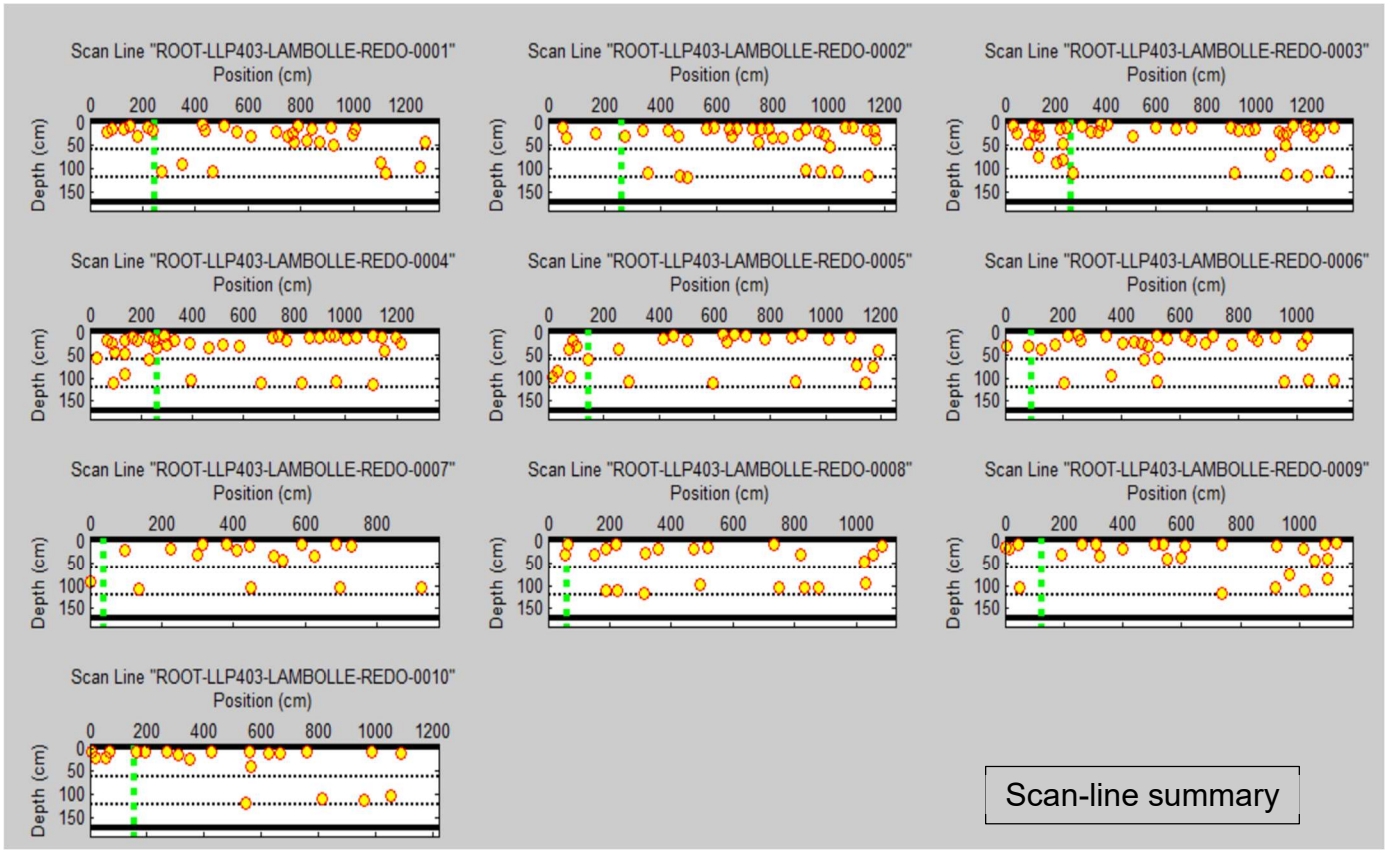
Scan-line 3:
Radargram showing root reflectors and non-root reflectors (mainly below 100cm) – possible service run at 200cm distance.
The vertical broken green at around 250cm is a scan-line synchronisation marker.
High average root densities shown – near surface roots are more associated with adjacent cypress trees, root reflectors (at around 1m depth) associated with the adjacent broadleaf trees.

Radargrams



Scan-line 10:
Radargram showing root reflectors and non-root reflectors - mainly below 100cm. The vertical broken green at around 150cm is a scan-line synchronisation marker.
Average root densities shown.

Scan-line summary given below



Appendix A6: Glossary of Common Terms Used

GLOSSARY OF COMMON TERMS USED:

Group/Tree No: Reference number given for individuals and small groups. Letter given for woodlands, shelterbelt, large young group planting and large linear groups.
Species: Common and scientific names given.
Approximate Height: In metres from ground level.
Crown Spread: In metres.
D.B.H: Diameter at breast Height. Diameter of tree at 1.5m from ground level.
Group of: More than one tree in proximity, including woodlands, shelterbelts and larger linear plantings.
Group effect: Canopies of trees in proximity or touching. These trees often have uneven crowns and are more effective as part of a tree group than they would be as a single specimen.
No Visual Defect: No visible outward signs of stress, disease, decay, and no characteristics felt to be unusual of the species.
Increase in Soil Level: Raised ground above original level around the base of the tree.
Trenching/Excavations: Subterranean works potentially causing root severance.
Pruning Wounds: Scars left from previous tree surgery work.
Weak Fork: Stem and branch unions exhibiting potential structural weakness such as a tight V shaped fork and/or included bark.
Multi-Stemmed: More than one main stem.
Apical Die Back: Necrosis of branch tips.
Minor Dead Wood: Small dead twigs and branches within the crown.
Major Dead Wood: Large dead branches and stubs within the crown.
Low Hanging Branches: Branches, which obstruct passage underneath them.
Overall Condition: Condition of the tree assessed from ground level, inspecting for outward signs of stress, disease, and decay on the day of surveying. Physical condition and outward symptoms may change rapidly with climate and season. All trees should be inspected regularly and expect advice sought if damage and/or decline is detected.

Good: Showing excellent health and vigour for its species, age, and site conditions.
Fair: Showing normal vigour and health for its species, age, and site conditions.
Poor: Of low vigour and health but not yet considered dangerous.
Dangerous: Structurally unsound or dead, dying and decayed. Dangerous trees must be felled.
Varied: Varied condition is used for groups of trees where the individuals within the group may have different outward signs of stress, disease and decay but do not warrant individual surveying

Recommendations:

Remove: Take out a tree by felling or dismantling and remove bulk of root system.

Reduce Crown: Reduction of height and/or spread by judicious pruning, cutting back to appropriate live side shoots, retaining shape where possible.

Lift Crown: Raising of lower crowns and creating greater ground clearance either by the removal of whole lower branches, or by the removal of parts of lower branches. A clearance height may be given, as necessary. This operation should be carried out so as not to leave large wounds on tree trunk.

Prune back: Reduce length of branches to clear targets, buildings, lamp columns etc. Branches should be reduced to appropriate growing points.

Clear Services: Reduce length of branches to provide a safe clearance from overhead power cables etc. Back to an appropriate growing point (observing all current safety regulations).

Monitor: Trees identified as needing regular observation to ensure condition or consider other actions (time period specified).

GPR Surveys

Antenna: Device used to propagate and receive electromagnetic waves (Radar pulses).

Cross section: Image that results from side-by-side display of several traces which are from adjacent spatial measurement positions.

GPR: Ground Penetrating Radar - a method which uses radar pulses to investigate and image the subsurface.

Hyperbola: Characteristic inverted “U” GPR response from a given target.

Noise: unwanted signals from non-root reflectors.

Non-root reflectors: Observed radar patterns not produced by roots.

Profile disturbance: Changes to the soil properties caused by activities such as excavations, construction, and instillation of services.

Radargram: Where reflected radar signals are processed and converted into an 2D image showing the subsurface profile.

Aggregate: Any hard, inert, mineral material used for mixing in graduated fragments. It includes sand, gravel, crushed stone, or slag. Materials often used in the creation of concrete or asphalt.

Root densities: Measured in roots per meter and described by categories ranging from very low to very high.

Root reflectors: Observed radar patterns produced by roots.

Sapling trees: Young trees often newly planted or self-seeded.

Scan lines: The collection of lines scanned using GPR. Scan lines can be either parallel lines or circular or semi-circular lines at varying distances from tree trunks.

Service runs: Underground utilities such as: water, gas, electrical power, sewage, and telecommunications.
Spatial view: Relationship of entities within a given space.
Subsurface clutter: Reflected signals from non-root reflectors.
Subsurface: Material which is not exposed at the surface of the ground.
Synchronisation markers: Fixed locational points plotted to provide facility for mapping root locations to scaled plans.
Voids: Subsurface features such as basements, tunnels and pipes which create a significant hyperbolic reflection (see Hyperbola).