TREE RADAR ROOT SCAN REPORT

at

“The Water House”, Millfield Lane, London, N6 6HQ

Mr and Mrs A Beare
“Dormers”, 49 Fitzroy Park, London, N6 6HT

31 July 2018

Our Ref: 55928

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Contents

Contacts

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1.0 Introduction

1.1 Landscape Planning have been appointed by Mr and Mrs Beare, Dormers, 49 Fitzroy Park, N6 6HT to provide detailed tree root survey advice in relation to Beech T1, and to report in conjunction with Peter Barton Associates, who are commissioned specifically to carry out Tree Radar sub-surface scanning, at The Water House, Millfield, London, N6 6HT.

1.2 Please find at **Appendix 1** the Beech tree constraints plan, produced as a result of an earlier site survey of Beech T1/T18 in May 2018. This highlights the asymmetrical growth of the Beech tree's canopy to the south/south west.

1.3 The root protection area or "RPA" of the Beech is shown both as a nominal circle and as non-circular, observing the asymmetrical growth of the canopy.

1.4 We note at 4.6.2 of the BS that *"the rpa for each tree should initially be plotted as a circle centred on the base of the stem. Where pre existing site conditions or other factors indicate that rooting has occurred asymmetrically, a polygon of equivalent area should be produced. Modifications to the shape of the RPA should reflect a soundly based arboricultural assessment of likely root distribution*".

1.5 The Practitioner is also reminded in the introduction to BS5837:2012 Trees in relation to design, demolition and construction Recommendations on Page 1 that *"During their lifetime, trees will be vulnerable to disturbance, injury, environmental changes, pests and diseases. Construction work often exerts pressures on existing trees, as do changes in their immediate environment following the construction. A tree that has taken many decades to reach maturity can be damaged irreparably in a few minutes by actions that might be unwitting, negligent or wilful. The early provision of physical protection from damage is therefore critical"*.

1.6 Following discussions with the client team, the 'TreeRadar (Root) Survey' was undertaken on 18 June 2018 in order to gain a better understanding of the rooting habit of Beech Tree T1/T18 within the adjacent garden of the Water House, and to ascertain the degree, depth and density of roots growing beneath the asymmetric Beech canopy within the adjacent garden.

2.0 Executive Summary

2.1 The Beech tree, the subject of this report, has had its root locations and densities plotted to a depth of 2m in the defined area adjacent to the shared rear garden boundary, as described in this report. The central finding of this sub soil investigation is that Beech tree T1/T18 (which exhibits high amenity value with an A2 BS5837:2012 categorisation) is rooting across the shared garden boundary in the rear garden of the Water House.

2.2 The TreeRadar survey results identified that the highest density of tree roots found by the 400 MHz antenna was in association with Scan Lines 2 and 4. The collective precise location of these root densities can be seen within the Root Density Plan at **Appendix 2**. If the proposed excavations are as extensive in width and depth as initially proposed, we advise here that such actions will not ensure the continuing good health of the Beech tree.

2.3 The TreeRadar survey results identified that the highest density of tree roots found by the 900 MHz antenna was in association with Scan Line 5. The collective precise location of these root densities can be seen within the Root Density Plan (**Appendix 2).** Again, if the proposed excavations are as extensive as proposed, then we are of the opinion that such actions will not ensure the continuing good health of the Beech tree.

2.4 A number of plans are in circulation which show various root protection areas for Beech T1/T18; all of these plans and their various scales must be checked for accuracy in relation to the actual dimensioned location of Beech T1/T18 (see **Appendix 3**).

2.5 We note in the British Standard under tree survey parameters at 4.4.2.5 e) *"branch spread, taken as a minimum at the four cardinal points, to derive an accurate representation of the crown (to be plotted on the tree survey plan)".*

2.6 As such, we believe it is wrong, as it is technically misleading, to continue at this time on the premise that there are no sub surface Beech tree roots in the rear garden of The Water House. To disregard the asymmetric Beech canopy and rootplate growth to the south/southwest of the shared rear garden boundary will be to cause damage that will threaten the long-term viability of the Beech tree.

Margaret MacQueen BSc CBiol MRSB MICFor CEnv MAE MEWI

Principal Consultant Arboriculturist

Dated 31 July 2018

3.0 The Brief

3.1 To report on the use of "TreeRadar" Ground Penetration Radar (GPR), to investigate the presence and location of tree roots (located to the south beyond the shared rear garden boundary) associated with the mature Beech tree located in the adjacent property to the north (as shown on the site plan provided).

4.0 Site Plans Provided

4.1 A Site Plan was supplied, from which the appropriate location of scan lines have been plotted onto the ground and the drawing annotated. This is given at **Appendix 1.**

5.0 The GPR Survey

5.1 The survey was carried out by PBA Consulting on 18 June 2018; weather conditions were dry, bright, and sunny.

5.2 “TreeRadar” GPR equipment was used, which provides trench-less investigation facilities with minimal disturbance to the area and/or damage to the Beech tree or tree parts (roots).

5.3 Five scan lines were plotted in a grid pattern, adjacent the shared rear garden boundary, as given on the drawing in **Appendix 2**.

5.4 Both the 400MHz and 900MHz antennae were used. For the 400MHz antennae the scan depth was set at 2000mm; roots over 20mm were targeted. For the 900MHz antennae the scan depth was set at 1000mm and roots over 10mm diameter were targeted.

5.5 The results of the TreeRadar GPR scan were processed by bespoke software (TreeWin), which provides a high degree of accuracy as to the location and presence of tree roots and services. “TreeRadar” GPR and “TreeWin” are not diagnostic tools; the results given in this report have been interpreted by a competent arboricultural-GPR professional following current best practice.

5.6 It should be noted that “TreeRadar” locates roots over 20mm diameter and also clusters of tree roots with individual diameters of less than 10mm; where these have a spatial separation of less than 5mm, such groupings are normally recorded as a single root location.

6.0 The Scan Line Findings

6.1 All Scanning was conducted over grass. Heras fencing around the Beech canopy to the east had to be moved to ensure there was limited variance in line length west/east; however, Heras fencing to the South was bolted and as such was not able to be moved to permit further scan lines 6 and 7.

6.2 Consequently only 5 scan lines are shown on the drawing at **Appendix 2**. The findings are detailed in the PBA overview report found at **Appendix 2.**

6.3 The scan line data has been presented as virtual trench/excavation face format, in which a planar 2D view is generated that shows the predicted root location and depth along the virtual trench face. Roots are colour coded according to depth. These are shown in **Appendix 2.**

7.0 Conclusions

7.1 The GPR investigation has confirmed that there are tree roots within the rear garden subsoil of the Water House. This is in contrast to the arboricultural opinions, which directly advise on the safety in implementing the proximity and depth of excavation currently proposed.

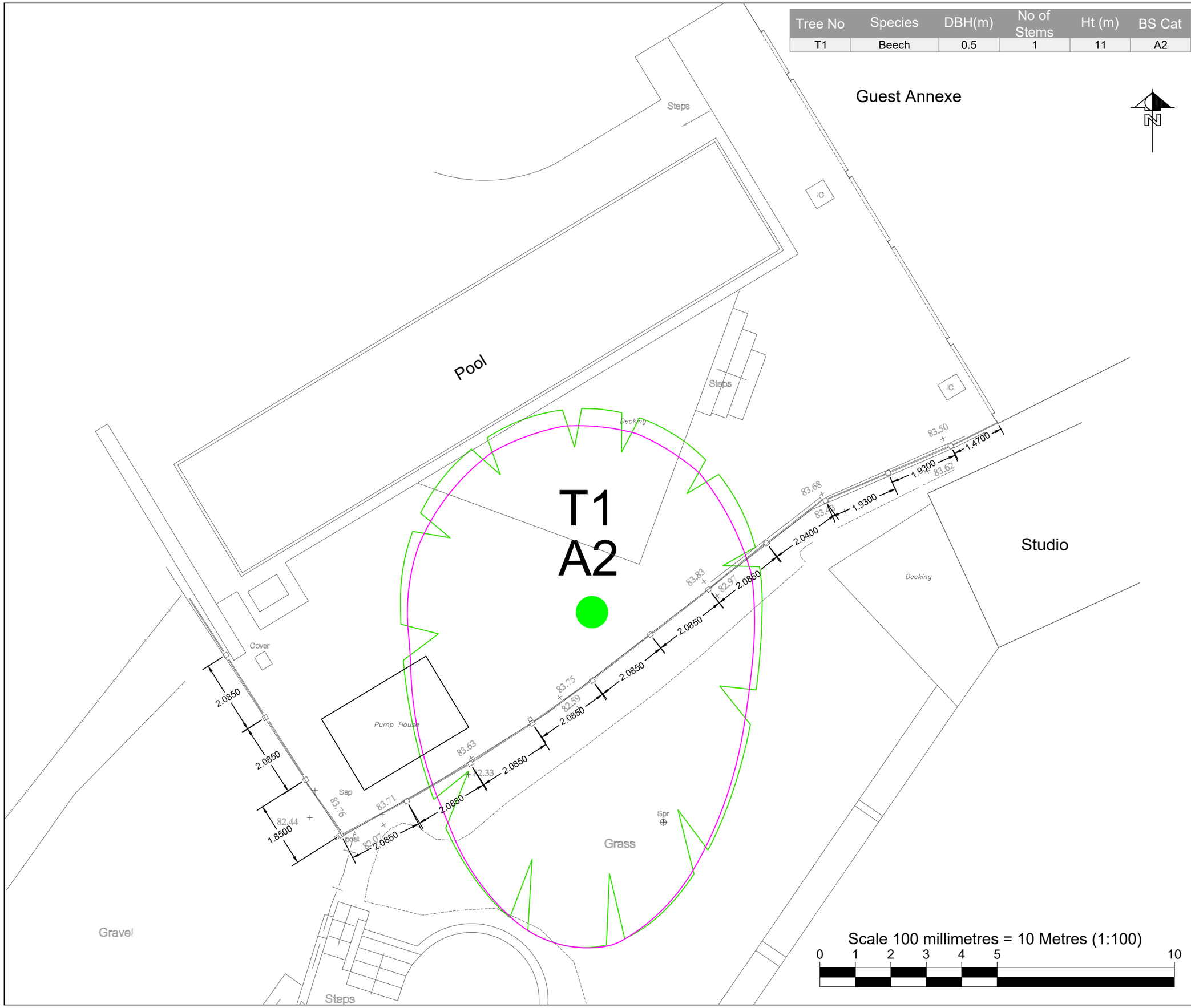
7.2 These impacts associated with the proposed works (needed to discharge Condition 5 of the approved permission) have not been considered by the Local Planning Authority and should be considered, since all available arboricultural reports to date suggest there will be no impacts because no tree roots were said to be found in investigations to date.

7.3 Appointed Engineers for the Applicant need to update, and subsequently provide accurate repositioning, of the root protection area for Beech T1/T18 on all working drawings/construction plans.

7.4 This will allow for the correct assessment of actual permissible arboricultural impacts which will be caused in the pursuit of discharging Condition 5.

Appendix 1 – Tree Constraints Plan

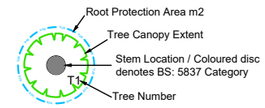
Tree No	Species	DBH(m)	No of Stems	Ht (m)	BS Cat
T1	Beech	0.5	1	11	A2



Scale 100 millimetres = 10 Metres (1:100)

0 1 2 3 4 5 10

Tree Survey Drawing Key



See Landscape Planning Tree Survey for Individual Tree Details

KEY

Please refer to Landscape Planning arboricultural report for details

- Category A - high quality and value
- Category B - moderate quality and value
- Category C - low quality and value
- Category U - removal

RPA - root protection area as defined by Table 2 BS 5837:2012 (Non-Circular)

Category U - removal

REVISIONS

No	Description	By	Date	Chkd

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Landscape Planning LIMITED

ISSUE:
-

CLIENT:
Karen Beare

LOCATION:
The Water House, Millfield Lane, London, N6 6HQ

DRAWING TITLE:
Tree Constraints Plan (TCP)

SCALE: 1:100 @ A3
DATE: 31st July 2018
DRAWN BY: L Button
CHKD BY: A Clarke
DRAWING No: 55928-01
REV: -

Appendix 2 – PBA Report

TreeRadar Investigations
Peter Barton Associates

TreeRadar GPR Tree Root Investigations

The Water House: N6 6HQ

July 2018

Section 1:
TreeRadar GPR Root Scanning: Operational Overview

Section 2:
TreeRadar GPR Root Scanning:
Water House: Overview of Findings

Section 3:
TreeRadar GPR Root Scanning:
Water House: Spatial View Radargrams

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Section 1: TreeRadar GPR Root Scanning: Operational Overview

Ground-Penetrating Radar (GPR) is an established subsurface investigation technique that has been used worldwide for over 30 years. It can locate objects underground including engineering and environmental targets. GPR can also detect variations in the subsurface profile.

Ground-Penetrating Radar operates by emitting an electromagnetic wave from a small surface antenna. When the signal encounters a boundary between objects with different electromagnetic properties it will reflect, refract, and/or diffract from the boundary in a predictable manner.

"Tree*Radar*" GPR operates similarly and detects the electromagnetic contrast and reflection properties between live tree roots and the surrounding soil matrix. Dead roots have a lower moisture content and do not have sufficient electromagnetic differences to the soil matrix, to be detected.

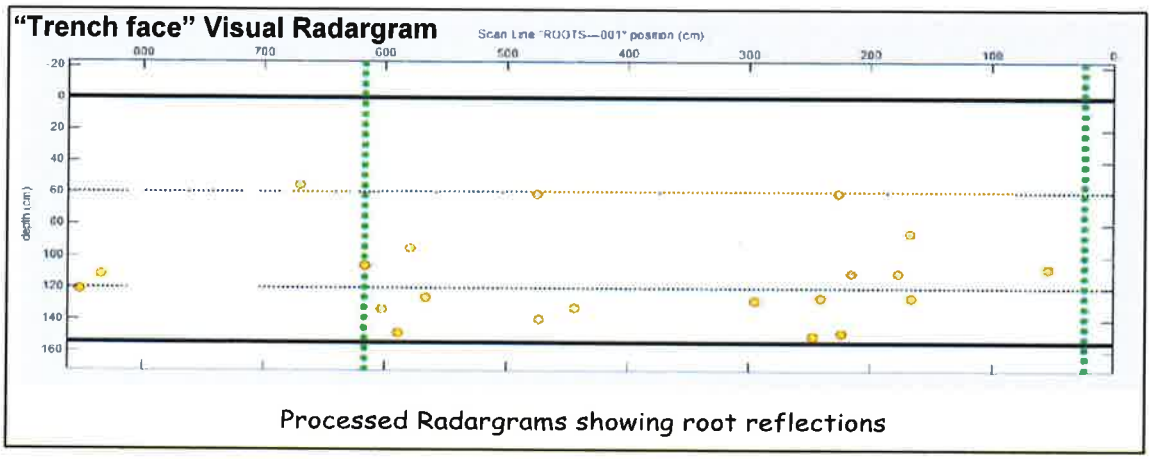
For tree root plotting a 400 MHz antenna is normally used, scanning to 2 metre depth. The 400 MHz antennae targets tree roots over 20mm diameter and above. A 900 MHz antenna can be used, scanning to 1 metre depth targeting roots 10mm diameter and above.

During the scanning process, the software couples the antennae to ground-measuring mechanism. This enables the distance and depth of the roots to be plotted automatically. Fixed locational points (synchronisation lines) are also collected. These are shown in the processed data outputs giving linked positional root locations. The data is collected on site to a field computer and downloaded to an Office PC for processing. The bespoke analysis software produces root radargram visuals including plan view root location and density plots, and for radial scans, root morphology maps.

Data Outputs
The data outputs following analysis include:

- Scaled "trench face" visual radargrams.
- Top Down View or plan view root position charts
- Root morphology maps

Scaled "trench face" visual radargrams provide a below the scan line scaled spatial view and display 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 green broken line shown below is a fixed site marker point - corner of buildings, tree, fence post etc.

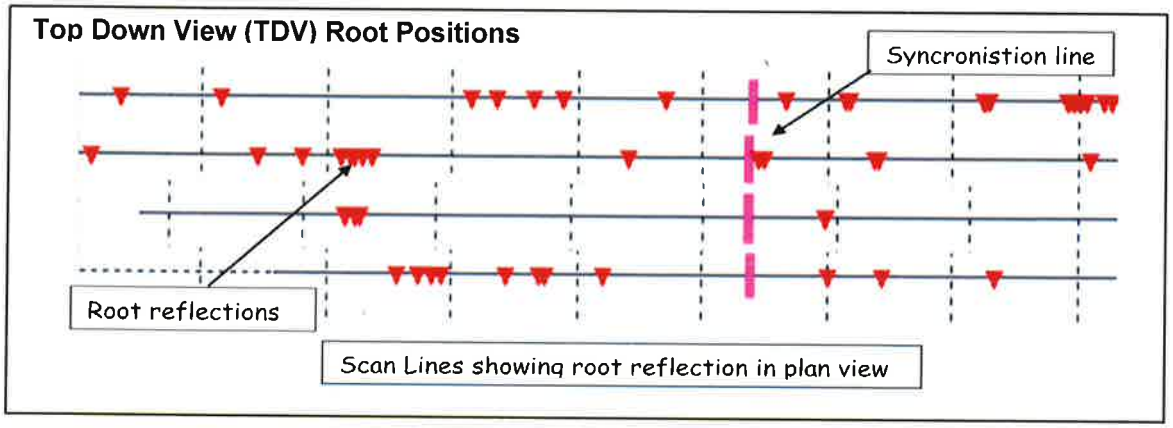


Processed Radargrams showing root reflections

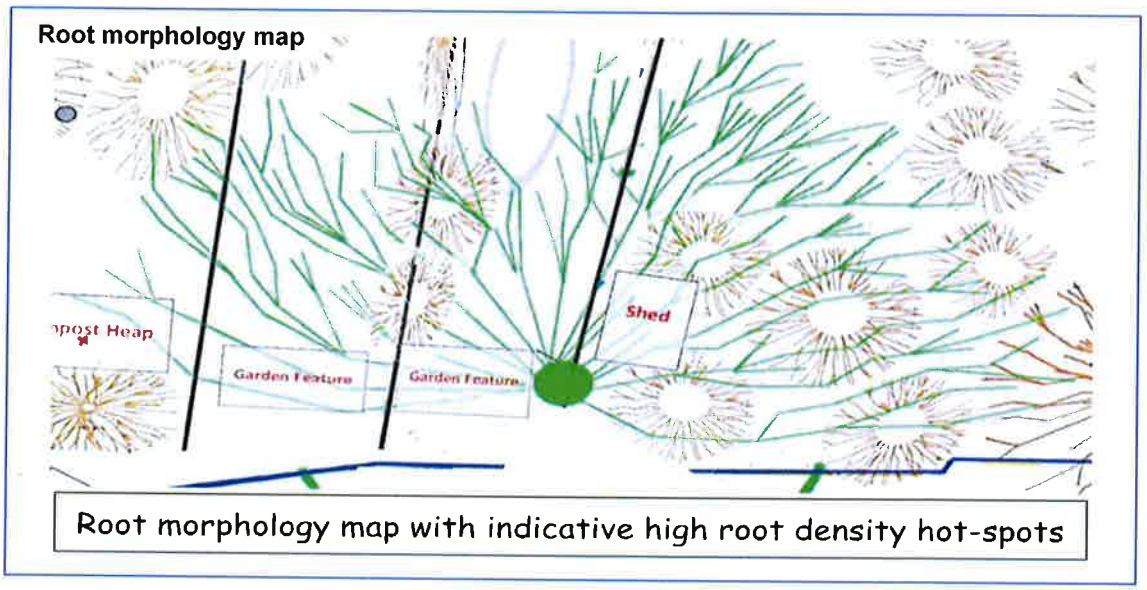
Operational Overview cont.....

Operational Overview cont.....

Top Down View (TDV) or plan view root position charts are generated by the software. These TDVs give an indication of root positioning along the scan lines. TDVs provide a visual indication of high/low root densities/root free zones in plan-view. The individual TDV lines for root position/density plots are normally mapped to site plans to show root positioning and densities in relation to site features.



Root morphology maps can also be provided. These are generated automatically by the bespoke software for circular/radial scan line surveys. For linear surveys, the root morphology is plotted to the root spread and pattern of the roots as given in the Top Down View (TDV) maps above. Root morphology maps give a detailed view of the spread and density of roots. For linear scanlines, it is possible to plot high root density hot-spots associated with other woody plants as shown below.



Tree Root Development

Under average field conditions, tree root development follows some predictable patterns. Root densities are normally lower near the main bole of trees. These are mainly large buttress roots etc. Roots then proliferate with radial distance from the tree with an associated increase in root numbers and density. Tree species and ground conditions impact on patterns and density.

In the below ground spatial depth profile, roots normally exploit a 70cm to 90cm band width depending on ground conditions. Very few roots over 20mm diameter are normally found in the top 40cm – 60cm soil depth. Variations are associated with soil type and tree species.

Section 2: TreeRadar GPR Root Scanning: Water House - Overview of Findings

Methodology

Five scan-lines were set out parallel to the fence with the bole of treeT1 off centre to the east as indicated by the double row broken green synchronisation lines shown in the visuals.

Scan-line one was positioned half-metre from the fence, all remaining scan-lines were set out from scan-line 1 at one metre apart. Scan-lines 1 and 2 were either side of a short row of live coppiced dog wood to the west of tree T1; the remainder of the scan lines were over the adjacent grass area.

Each scan-line was scanned with both the 400 MHz antenna and the 900 MHz antenna.

- The data from the 400 MHz antenna was analysed/processed to provide spatial view root radargrams and TDV (plan view) root densities and positions visuals.

- Spatial view radargrams for 900 MHz antenna are also provided and shown in Section 3. These give a comparison of smaller roots 10mm< in the top metre depth profile.

Findings: 400 MHz antenna
Reflections were analysed for roots over 20 mm diameter:

- Overall the average root densities per metre (ARDM) ranged from medium to low. The highest ARDM was along scan-line 2 at 3.42 roots per metre; the lowest ARDM was along line 3 at 1.67 roots per metre.

- There were no root reflections identified in the top 70 cm soil depth along scan-lines 1 - 3; along scan-lines 4 and 5 no root reflections were found in the top 60cm soil depth.

- In the trench face spatial view, along scan-lines 1 – 3 majority of roots were in a 60cm bandwidth below 70 cm topsoil depth. Along scan-lines 3 and 4 the spatial view band width was 50/40cm below 60 cm topsoil depth.

- There was evidence of metal reflectors possibly services in line 1 and evidence of excavations and none root reflectors along most scan-lines.

Conclusions.

- The high root density visualisation to the centre of scan-lines 1,2 and 4 are more associated with the roots of the Beech and adjacent Hornbeam coalescing.

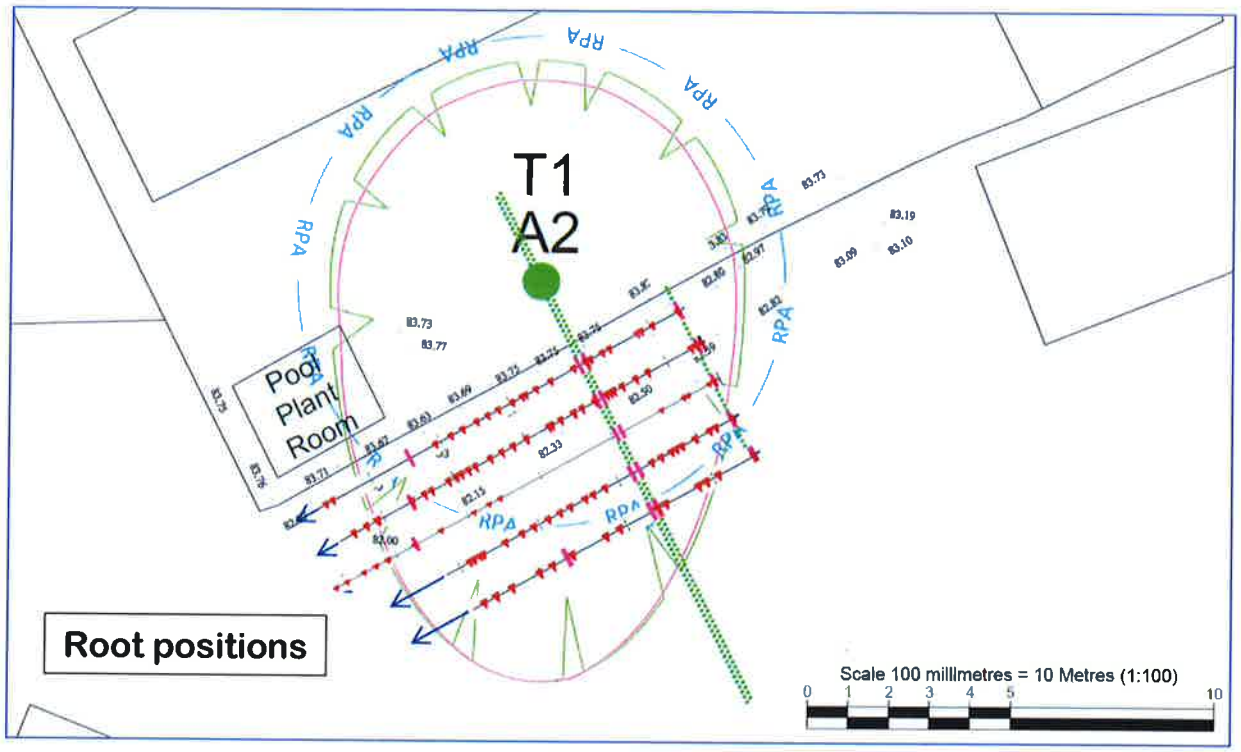
- The low root density visualisation to the centre of scan-line 3 is attributed to past soil excavations etc.

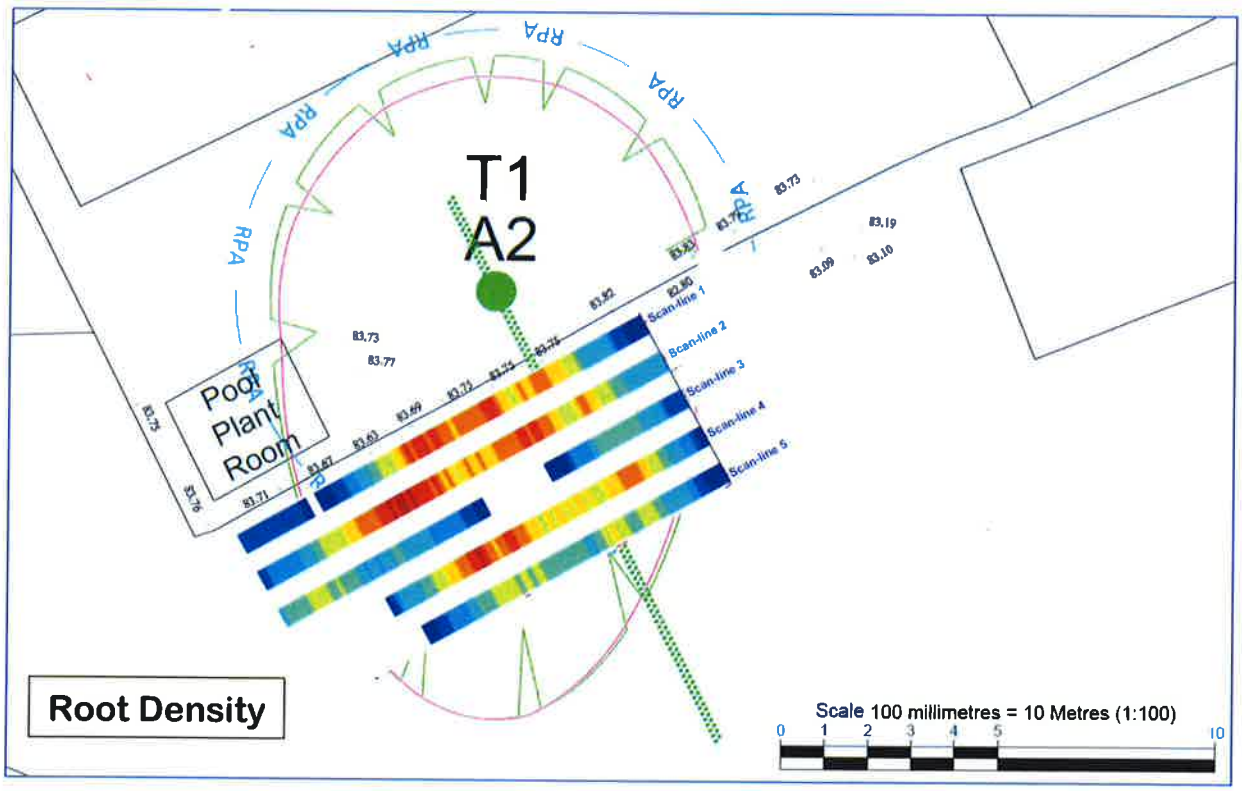
Findings: 900 MHz antenna
Reflections were analysed for roots over 10 mm diameter:

- Overall the average root densities per metre (ARDM) ranged from high to low. The highest ARDM was along scan-line 5 (10) at 5.64 roots per metre; the lowest ARDM was along line 1 (6) at 1.70 roots per metre.

- Except for scan-line 1, root distribution was well spread across the radargram profile.

Plan view Root positions and density.





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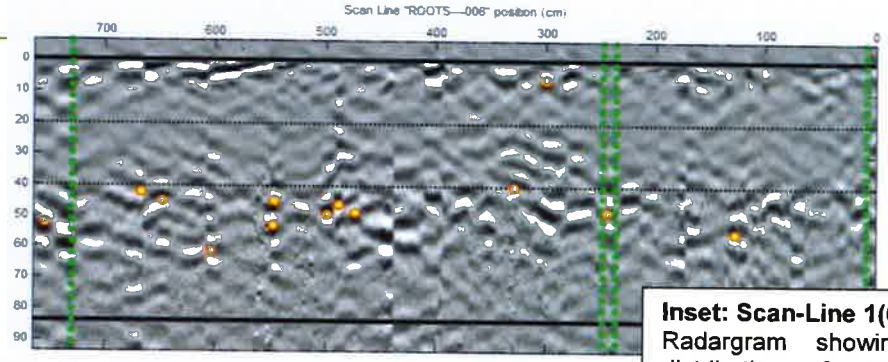
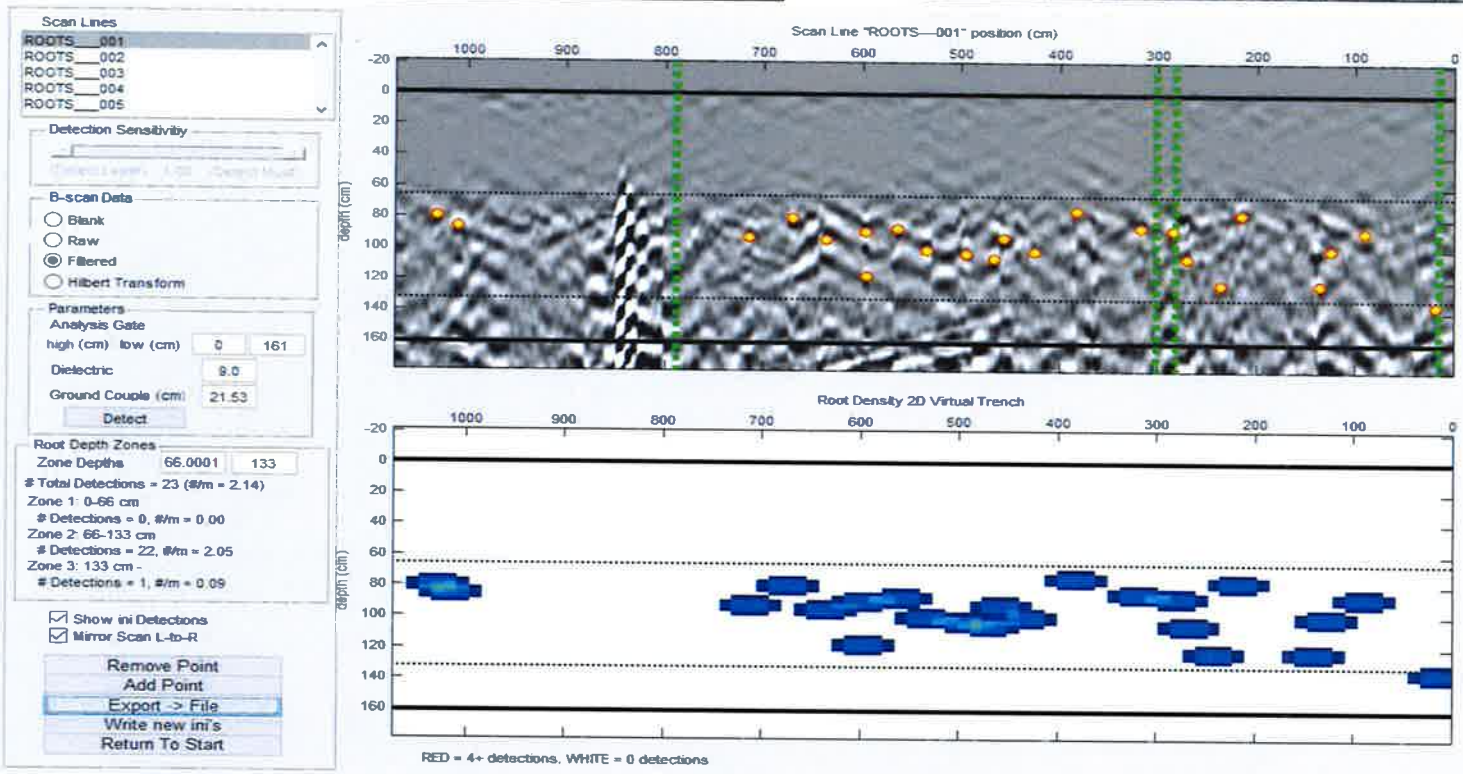
Section 3: TreeRadar GPR Root Scanning: Water House: Spatial View Radargrams

Below: Scan-Line 1
Radargram showing below ground spatial depth (2m) profile. Roots have exploit a 60cm band width. There are no indicators for roots over 20mm diameter in the top 70cm soil depth. There are indicators of excavations/metallic reflections. Root density: 2.14 ARDM.



Inset: Scan-Line 1(6)
Radargram showing distribution of roots about 10mm diameter in the top 100cm soil depth.



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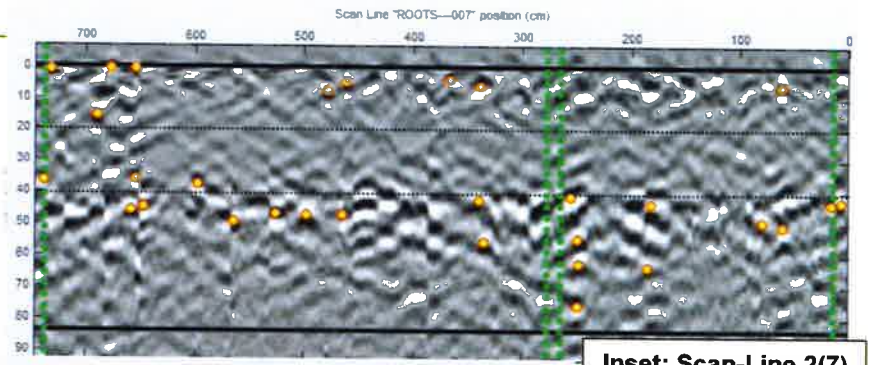
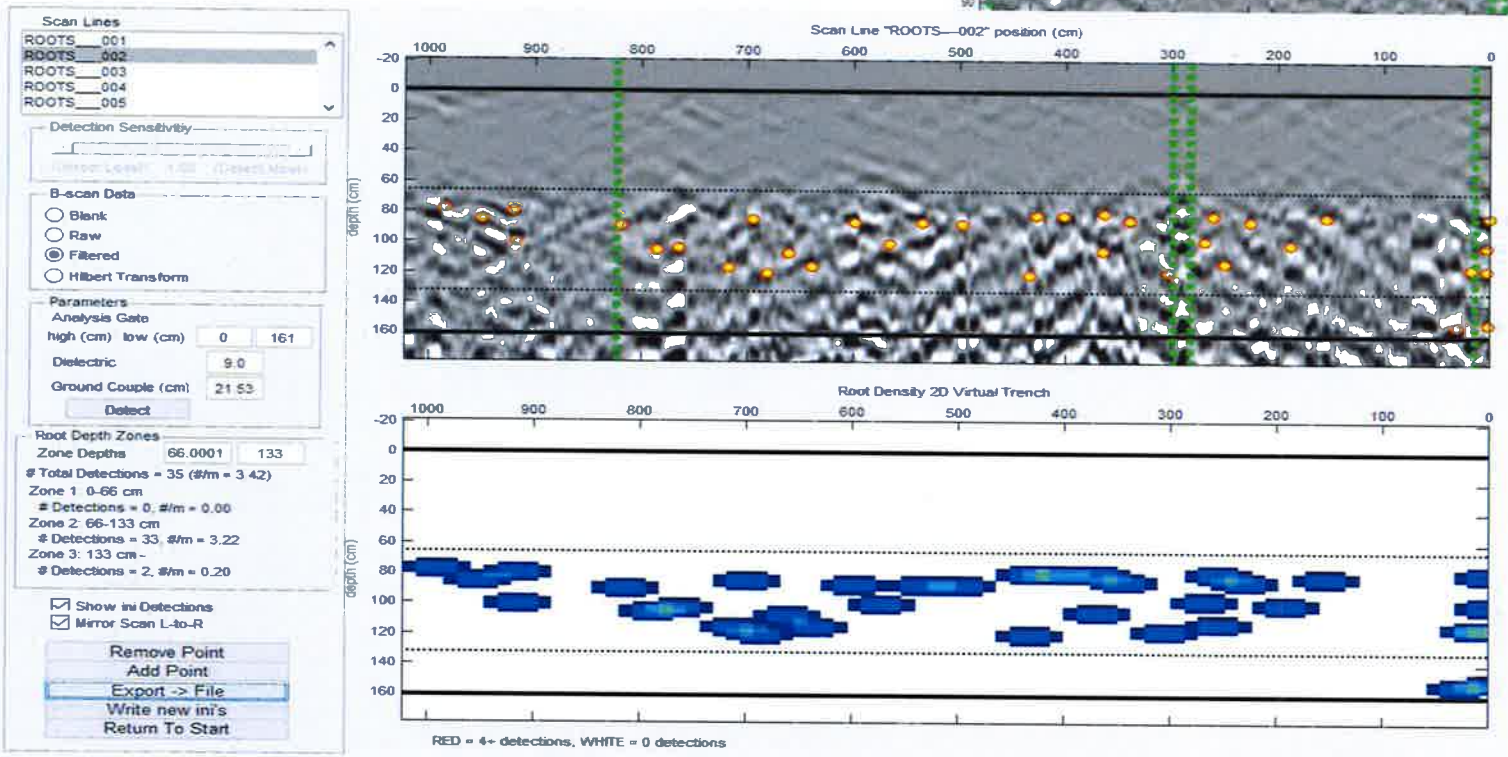
Below: Scan-Line 2
Radargram showing below ground spatial depth (2m) profile. Majority roots have exploit a 60cm band width. There are no indicators for roots over 20mm diameter in the top 70cm soil depth. There are indicators of excavations. Root density: 3.42 ARDM.



Inset: Scan-Line 2(7)
Radargram showing distribution of roots about 10mm diameter in the top 100cm soil depth.



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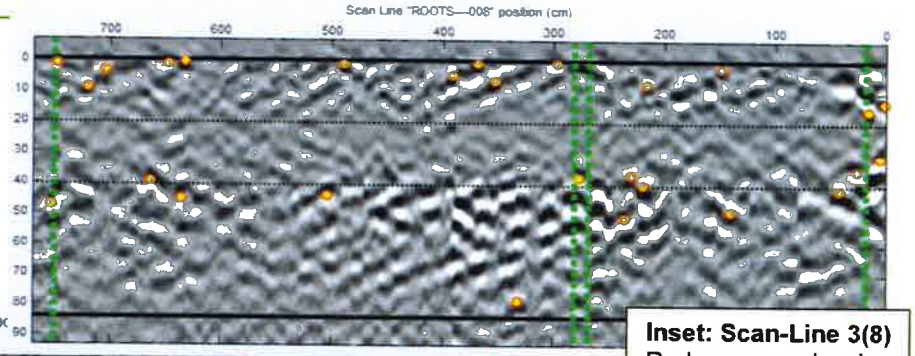
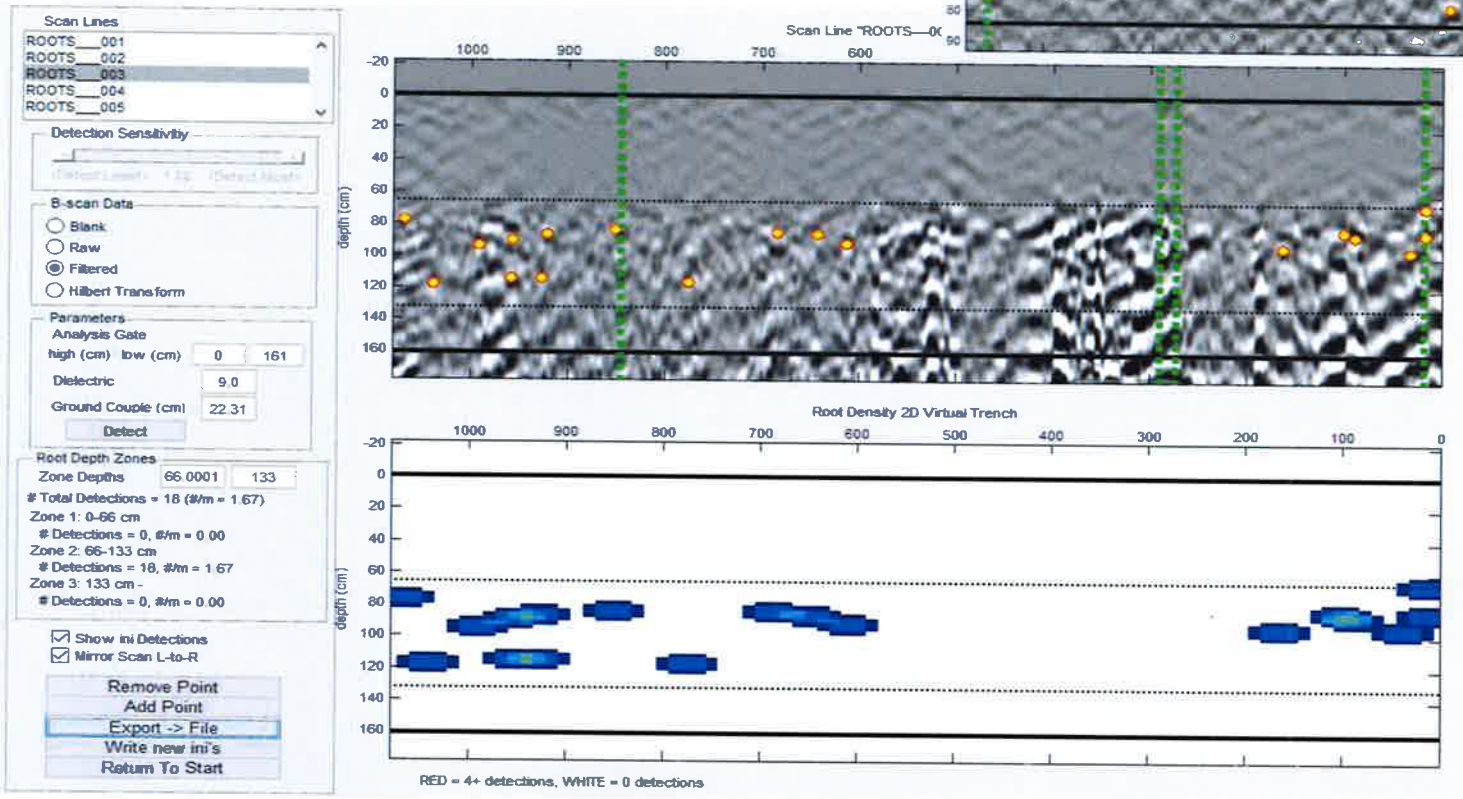
Below: Scan-Line 3
Radargram showing below ground spatial depth (2m) profile. Roots have exploit a 60cm band width. There are no indicators for roots over 20mm diameter in the top 70cm soil depth. There are indicators of excavations. Root density: 1.67 ARDM.



Inset: Scan-Line 3(8)
Radargram showing distribution of roots about 10mm diameter in the top 100cm soil depth.



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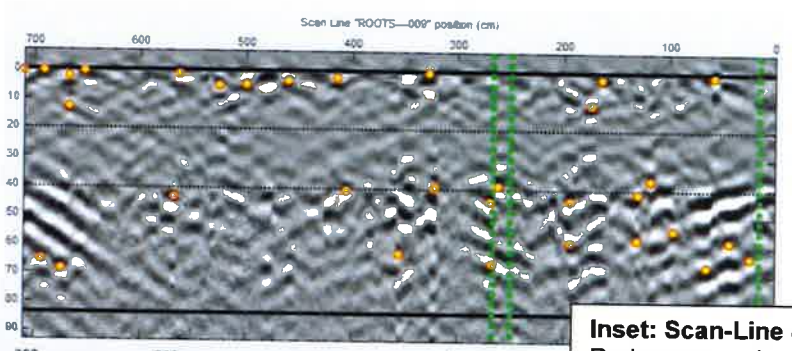
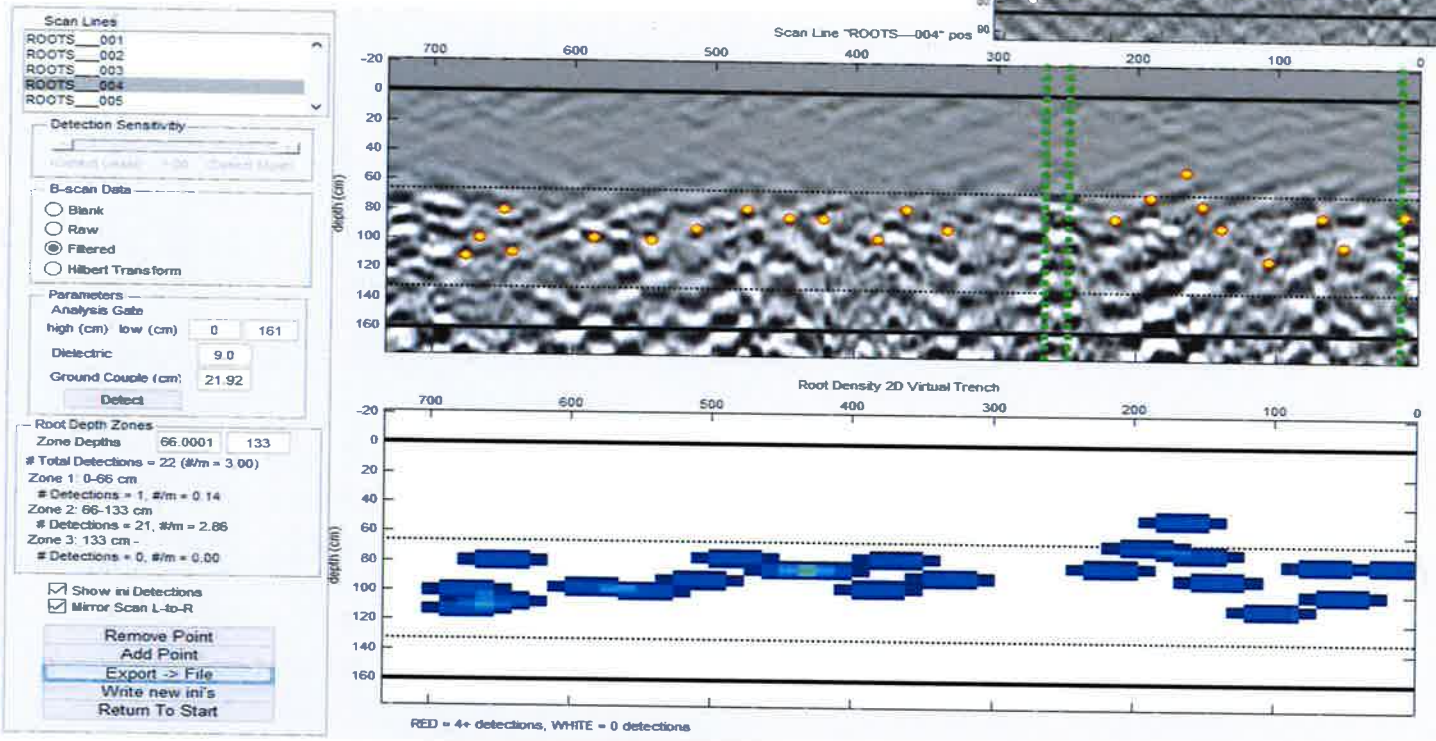
Below: Scan-Line 4
Radargram showing below ground spatial depth (2m) profile. Majority of roots have exploit a 50cm band width. There is one root indicator for roots over 20mm diameter in the top 70cm soil depth. There are some indications of excavations towards end of line. Root density: 3.00 ARDM.



Inset: Scan-Line 4(9)
Radargram showing distribution of roots about 10mm diameter in the top 100cm soil depth.



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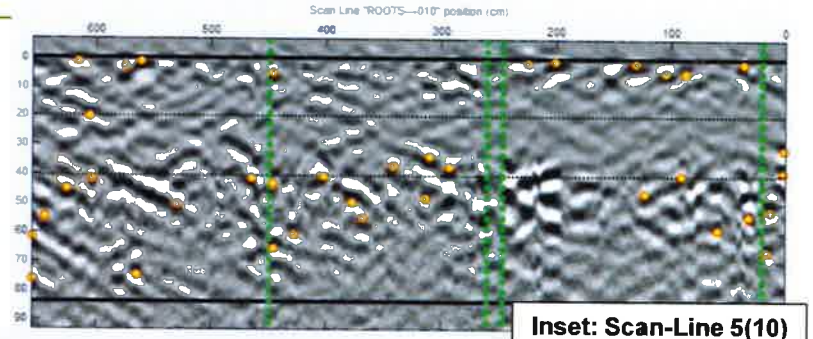
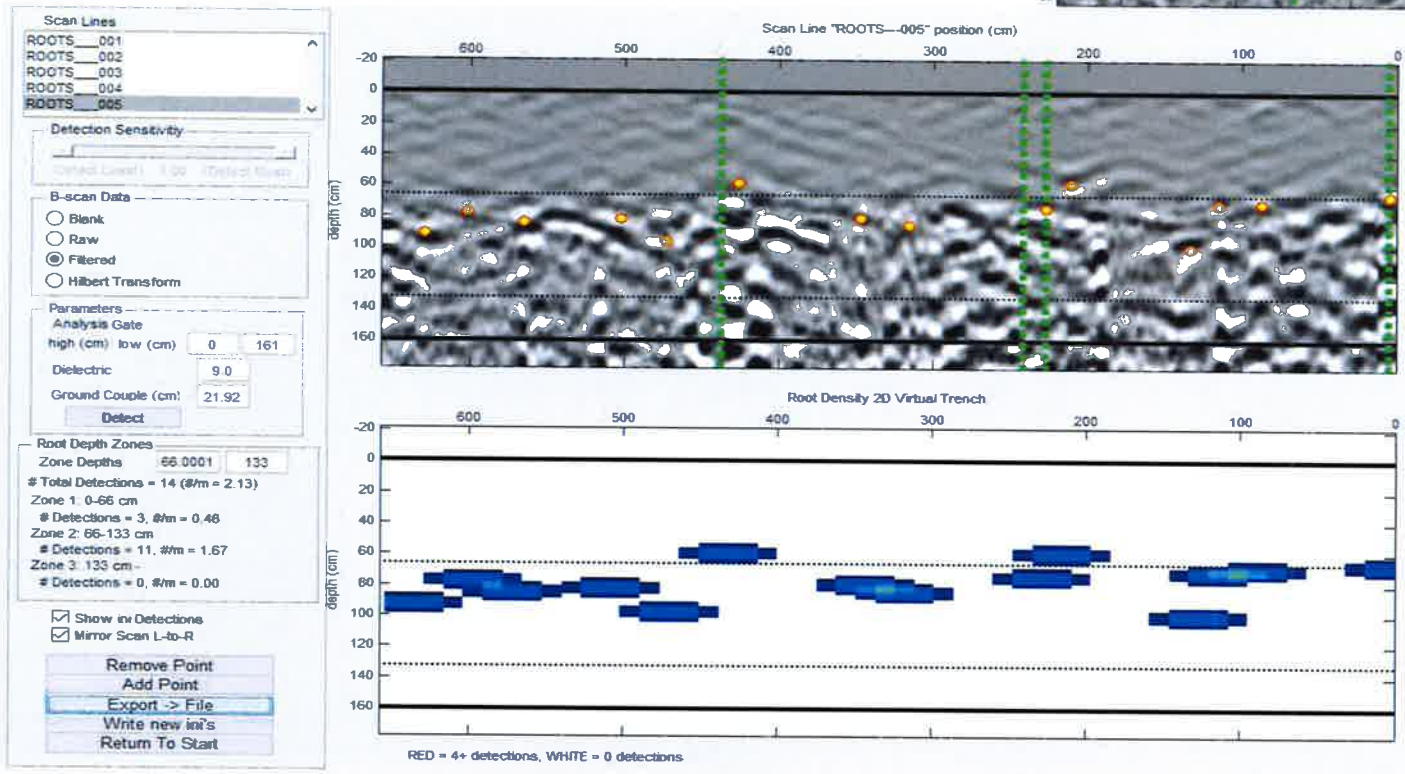
Below: Scan-Line 5
Radargram showing below ground spatial depth (2m) profile. Roots have exploit a 40cm band width. There are no indicators for roots over 20mm diameter in the top 60cm soil depth. There are indicators of excavations and large non-root reflections. Root density: 2.13 ARDM.



Inset: Scan-Line 5(10)
Radargram showing distribution of roots about 10mm diameter in the top 100cm soil depth.



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Appendix 3 – Plans (Various)

PRICE&MYERS

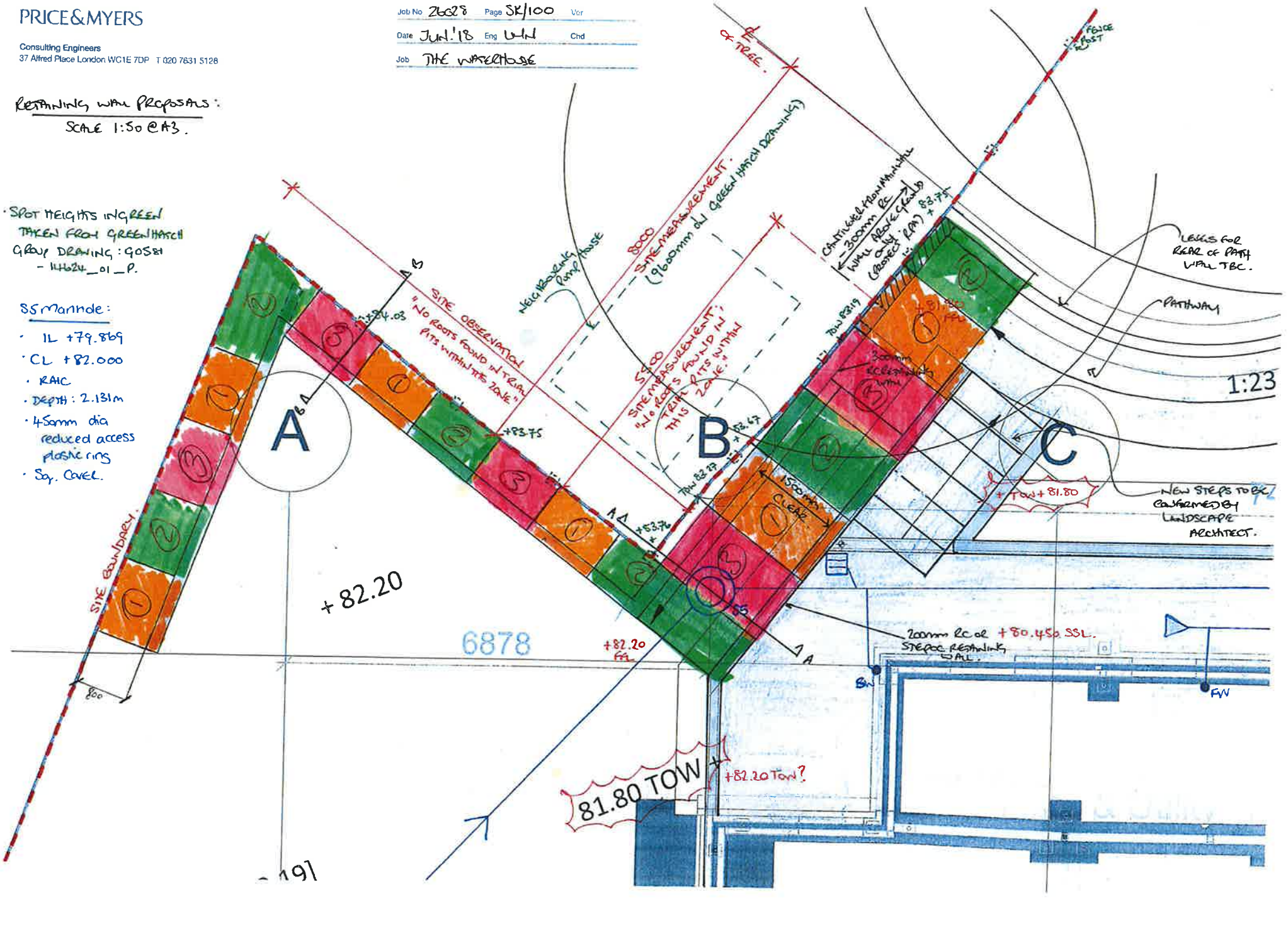
Consulting Engineers
37 Alfred Place London WC1E 7DP T 020 7631 5128

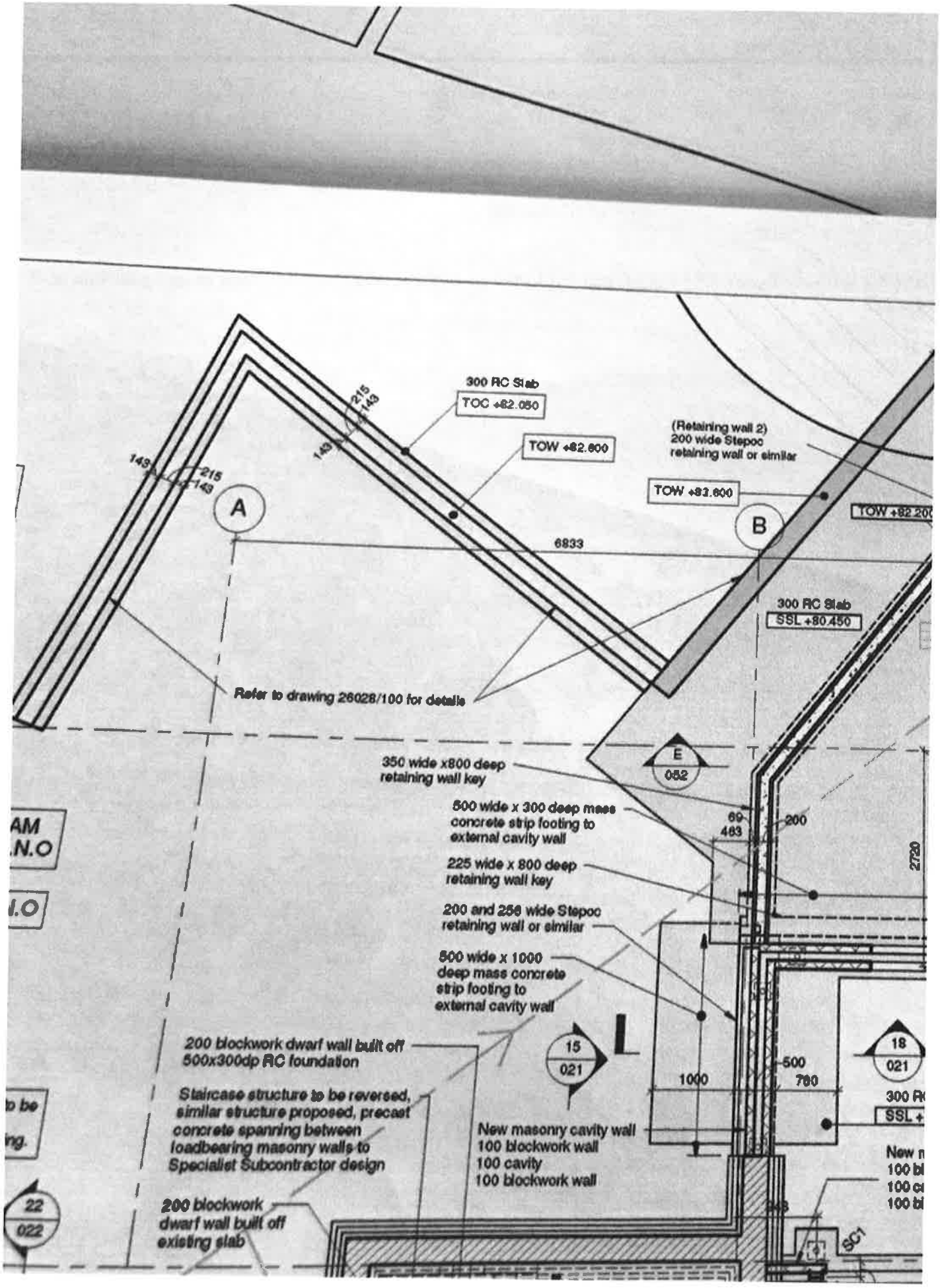
Job No 26628 Page SK/100 Ver
Date JUN'18 Eng LHN Chd
Job THE WATERHOUSE

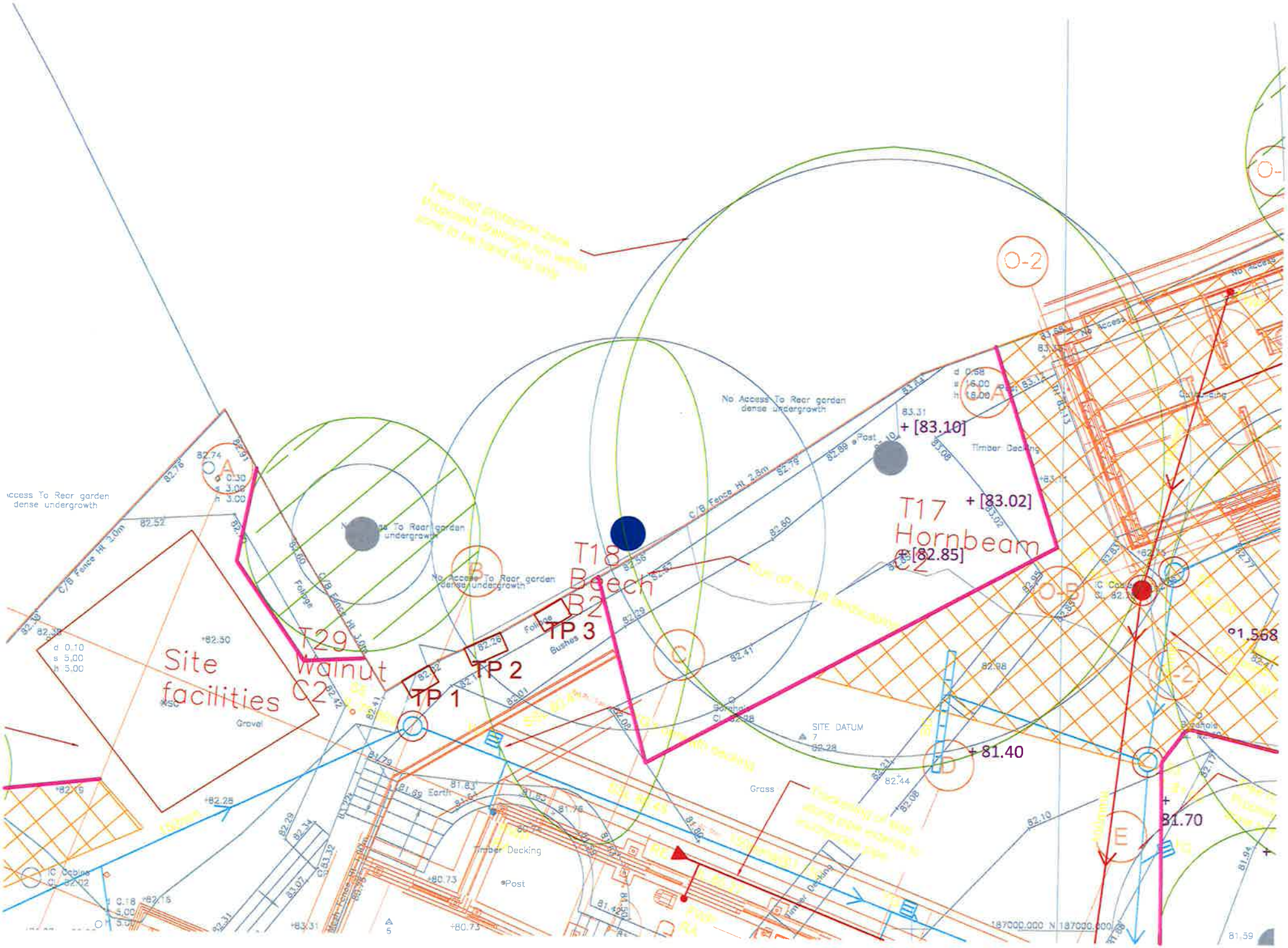
RETAINING WALL PROPOSALS:
SCALE 1:50 @A3.

- SPOT HEIGHTS IN GREEN TAKEN FROM GREEN HATCH GROUP DRAWING: 605811-LL1624_01_P.

SS Manhole:
- IL +79.869
- CL +82.000
- RAIC
- DEPTH: 2.131m
- 450mm dia reduced access plastic ring
- Sq. Cover.




300 RC Slab
TOC +82.050
TOW +82.600
(Retaining wall 2)
200 wide Stepoc
retaining wall or similar
TOW +82.600
TOW +82.200
A
B
6833
300 RC Slab
SSL +80.450
Refer to drawing 26028/100 for details
350 wide x800 deep
retaining wall key
E
052
500 wide x 300 deep mass
concrete strip footing to
external cavity wall
225 wide x 800 deep
retaining wall key
200 and 256 wide Stepoc
retaining wall or similar
500 wide x 1000
deep mass concrete
strip footing to
external cavity wall
200 blockwork dwarf wall built off
500x300dp RC foundation
15
021
L
18
021
Staircase structure to be reversed,
similar structure proposed, precast
concrete spanning between
loadbearing masonry walls to
Specialist Subcontractor design
New masonry cavity wall
100 blockwork wall
100 cavity
100 blockwork wall
200 blockwork
dwarf wall built off
existing slab
22
022
SC1
1000
500
700
2720
200
69
483


T29
Walnut
C2
T18
Beech
B2
T17
Hornbeam
C2
TP 1
TP 2
TP 3
Site facilities
Gravel
Grass
Timber Decking
Post
Bushes
Foliage
C/B Fence Ht 2.0m
No Access To Rear garden dense undergrowth
SITE DATUM
+ [83.10]
+ [83.02]
+ [82.85]
+ 81.40
+ 81.70
+81.568
187000.000 N
187000.000

Appendix 4 – An Introduction to Ground-Penetrating Radar (GPR)

An Introduction to Ground-Penetrating Radar (GPR)

Ground-Penetrating Radar (GPR) is an established technique that has been used worldwide for over 30 years to locate objects underground, including pipes, barrels, drums, and other engineering and environmental targets. When an electromagnetic wave emitted from a small surface transmit antenna encounters a boundary between objects with different electromagnetic properties, it will reflect, refract, and/or diffract from the boundary in a predictable manner.

Use of GPR instrumentation for internal trunk decay detection and subsurface structural root mapping is an innovative and recent application to the arboricultural industry. It has been developed and patented by TreeRadar™, Inc.

The electromagnetic differences between tree roots and the surrounding soil matrix provide the necessary contrast and reflection properties that are detected by GPR. In addition, an air-filled trunk (hollow) or partially air-filled incipient decay zone are excellent reflectors for detection by GPR systems.

GPR measurement as a method of mapping tree roots has several advantages over other methods:

(1) It is capable of scanning root systems of large trees under field conditions in a short time,

(2) It is completely non-invasive and does not disturb the soils or damage the trees examined and causes no harm to the environment.

(3) Being non-invasive, it allows repeated measurements that reveal long-term root system development,

(4) It allows observation of root distribution beneath hard surfaces (concrete, asphalt, bricks), roads and buildings,

(5) Its accuracy is sufficient to resolve structural roots with diameters from less than 1 cm (0.4 in) to 3 cm (1.2 in) or more

(6) It can characterize roots at both the individual tree and stand levels, facilitating correlations with tree-and stand-level measurements of physiological processes (e.g., sap flow) in complex ecological studies.

Appendix 5 – Report Caveats

General - Trees

Unless otherwise stated tree observations have been undertaken from ground level and using non-invasive techniques only. Comments contained within the report on the condition and risk associated with any tree relate to the condition of the tree at the date and time of survey. Please note that the condition of trees is subject to change. This change may occur, but is not limited to biological and non-biological factors as well as mechanical/ physical changes to conditions in the proximity of the tree. Trees should be inspected at intervals relative to identified site risks and in accordance with relevant HSE and Central Government guidance. Landscape Planning can provide further information on this matter if required.

Unless otherwise specified, no checks have been carried out in respect of statutory controls that may apply, e.g. Tree Preservation Orders, Conservation Areas or planning conditions. In addition, prior to undertaking any tree works, it is necessary to ensure due diligence is followed in respect of protected species and habitats.

Where tree surgery works have been identified these works are based on the assumption that planning is approved, no tree works should be undertaken prior to determination of this application without up to date confirmation of the Tree Preservation Order / Conservation Area Status of the vegetation. All works should be undertaken in accordance with the appropriate Duty of Care. This should include, for example, site specific risk assessments and due diligence inspections for the presence of protected species.

Any comment relating to 3rd party trees has been made without full access to the tree(s). Should these trees have any impact on the proposed development we would advise you to instruct us to contact the 3rd party and undertake further inspection work.

Not a Design Statement or Method Statement

This report has been prepared in respect of development impacts on trees. The report provides details and makes in principle recommendations relating to tree protection, which may have implications for design, construction, materials and methods to be employed in the development. Any such recommendations should be approved by the relevant designer / competent person.

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