

Steve Ambler & Sons Tree Specialists Limited

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East Street. Rhayader.			
Date	28 th February, 2022	To	Mr. Steve Gealy (Powys County Borough Council)
Subject	Resistograph & Fractometer Decay Detection Testing on a Single Pedunculate oak (<i>Quercus robur</i>)	cc	



Source: Google Images April 2021

INTRODUCTION

I am instructed by Mr. Steve Gealy (Powys County Council) to undertake decay detection testing on a single mature Pedunculate oak (*Quercus robur*) on East Street, Rhayader. This testing follows an earlier visual tree assessment (VTA), Mattheck¹, which was conducted on the 17th of February in the presence of Mr. Gealy.

It is recognised this is an important local tree and one which is highly visible within the immediate street scene providing some maturity to the landscape. For this reason and given that the tree has a high-very high target occupancy, it was deemed prudent to ascertain the extent of decay initially identified.

Using the decay detection equipment - ³ IML-PD 500 Resistograph Drill, it is possible to map out the extent of decay and help determine the extent of internal decay in standing trees. The structural integrity and quality of the remaining wood to the outside of decay (residual wall) will be tested and assessed using a ⁵Fractometer 1 unit. These will be set against the Failure Criteria designed by¹

The purpose of the former investigation was to assess the general health and condition of the subject tree and identify any obvious defects or concerns that may pose unacceptable risk to third parties. Some concerns were noted and hence this more advanced level of testing, being the intention of my clients to offset any unreasonable risk. Recommendations are sought where appropriate, and the findings are offered by way of a written report.

Important Note - The Terms and Conditions of Steve Ambler & Sons Tree Specialists Ltd apply, which are situated at the rear of this Report.

¹ Mattheck. C., Bethge. K. and Weber. K – The Body Language of Trees (Encyclopaedia of Visual Tree Assessment)

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⁵ The **Fractometer 1**, is a hand portable field-testing device for measuring wood quality. This is possible through the application of force to an extracted wooden core, taken from the specimen under investigation. The breaking moment and braking angle is measured. The results are compared with those taken from known healthy trees of the same species.

THE SITE

This isolated, mature oak tree is located on a raised narrow bank between the Fire Station and Number 1 East Street, Rhayader, a residential property. This mature tree is seemingly a remnant of an old field boundary.

The tree has a high to very-high target occupancy, being located just off the main road and within falling distance of the house, a fire station, car park, 'A' road, and possibly the museum & gallery opposite.

Altitude: 215-m above sea level.

What3Words: ///newlywed.value.rating

FINDINGS

Base line data

Reference Number;

Species; Pedunculate oak (*Quercus robur*)

Location: To the west of N.o 1 East Street

Estimated Height; 15-m

Crown Spread (Est); 10-m North, 8-m South, 7-m East & 7-m West

Trunk: 1530-mm diameter measured at the base, just above the buttresses.

Age; Mature

Vigour; Low

Target Occupancy; High to Very High

Remarks:

(Refer to photograph in Appendices)

This tree has a very limited rooting area that has been significantly compromised on this narrow bank with some form of building or construction development occurring to all sides.

Immediately to the west lies the Fire Station and its Car Park, an access lane and house to the east with a highway and path to the south. The rooting area (hedge bank) immediately to the north has been historically excavated to the level of the access road, to accommodate the construction of sheds. The development activities will almost certainly have resulted in historic root severance, including some structural roots to compromise an already very much reduced rooting environment.

The tree has undergone several unsympathetic and excessive pruning interventions, resulting in a large decaying basal wound noted to the east, where a stem would have been removed. It is estimated that some 15 years ago this tree was excessively reduced with large decaying pruning wounds noted, supporting weakly attached regrowth, now forming a substantial part of the crown.

These unsympathetic interventions have reduced the tree's ability to cope with the decay progression and along with the limited rooting potential, result in a tree with low vitality. The historic development and root loss along with the large pruning wounds also provide access points for the entry of pathogens, as identified below.

The annual fungal fruiting bodies of *Ganoderma resinaceum* are noted in several locations around the base of the stem. *G. resinaceum* is a fungal decay pathogen that causes selective delignification decay and can lead to ductile fracture of the stem or roots, potentially resulting in whole tree failure when in an advanced stage. Advanced stages of decay will also result in the degradation of cellulose. *G. resinaceum* has the ability to develop and progress through previously sound sapwood.

A basic resonance test using a sounding hammer was undertaken during the first site visit on the 17th Feb 2022, which detected basal decay in the lower stem and buttresses. A relatively small diameter basal cavity occurs to the south and its depth was probed to > 450-mm using a metal rod.

Note. Professor Claus Mattheck recommends that decay in relation to *Ganoderma resinaceum* should involve detailed decay detection investigations using a combined Increment Borer, Fractometer and a Resistograph Drill, in order to complete the VTA process.

An IML PD-500 Resistograph Drill was utilised to map the decay, with 14 drill measurements being taken to all cardinal points and at varying heights and angles - (Refer to summary results below and measurement graphs in the Appendices). Drilling could not occur to the north .

Sound Wall Thickness: Failure criteria and the t/R ratio was developed by Claus Mattheck as a key factor when determining if a tree with a hollow and/or decayed stem is safe to be retained. It states that if the residual wall (t) of sound wood is greater than 0.3-0.35 of the radius (R) of the stem, the tree maybe safe to be retained, providing it is of adequate wood quality (the Fractometer is a tool that is used to assess this). Multiple factors are considered when assessing tree safety and the t/R should be considered as a guide only, not as a singular ruling principle.

Calculation: Subject tree basal stem diameter = 1530-mm / 2 = 765-mm stem radius x 0.35 = 267.75

Therefore, the minimum sound wall thickness required to satisfy failure criteria is 267-mm (26.7cm)

AGL: above ground level

IML PD-500 Resistograph Drill Measurements 1 - 14. Summary Results.

(Where measurements do not achieve the minimum sound wall thickness, they have been highlighted in red text, whereas marginal measurements given in orange).

1. South at base (west side of cavity) = FAIL
2. South-east at base = FAIL
3. South-west buttress = PASS
4. South-west at 20-cm AGL = PASS
5. East buttress = FAIL
6. East at 20-cm AGL = FAIL
7. North-east at 20-cm AGL = FAIL
8. North-east at 20-cm AGL = PASS (decay occurs at 35-cm depth)

9. North-west at base = FAIL
10. North-west at 20-cm AGL = MARGINAL PASS
11. South-west at 1-m AGL = PASS
12. North-east at 1m AGL = PASS (decay occurs at 34-cm depth)
13. South-east at 1m = FAIL
14. North-east at 1-m AGL = FAIL

Fractometer Wood Quality Testing.

The Fractometer testing aims to assess in greater detail the quality of the remaining wood within the stem. Four increment bore samples were taken at four cardinal points, to a depth of approximately 27-30-cm (which is in excess of the minimum required sound wall thickness). Due to the space required to turn the large handle of the increment borer, these core samples were taken a little higher than would be ideal when assessing the decay associated with a basal decay pathogen, and therefore it's reasonable to concur that had lower samples been able to be taken, then the results would have indicated further wood degradation. Typically, the core samples were taken at 400-500-mm above ground level.

The results are summarised below, and photographs of the core samples and field notes can be found in the Appendices.

When reading the field notes in the Appendices, the results in the red zone are deemed critical, whereas trees that may be retained with heavy pruning, lie in the yellow zone. The wood readings in the green zone are deemed to be healthy wood samples.

North-East = FAIL

North-West = FAIL

South-West = PASS

South-East = FAIL

The Fractometer results suggest that the decay caused by *G. resinaceum* is in the late stages, with advanced lignin decay and where cellulose degradation is underway.

Summary.

The lower stem and buttress decay is extensive mostly recorded in the basal stem measurements taken to the south, south-east, east, north-west, and within the east buttress measurements. The results from the north-west buttress measurement were marginal. The only sound wood seems to be restricted at the base to the south-west only, being the only side that passed the Fractometer testing. There are signs of fibre buckling (early failure) at the base of the stem where it meets the point of extensive decay this is caused as the weight of the tree and wind forces are transferred to this section. The tree's ability to respond to this loading through the formation of reactionary wood has been compromised due to the unsympathetic pruning, limited rooting potential and historic root severance.

RECOMMENDATIONS.

- ✓ Climb and dismantle to ground level. **PRIORITY 1 (ASAP - within 1 month of the report).**
- ✓ Traffic Management (3 -way) will be required by a Specialist Traffic Management Company (East Street, A44).
- ✓ Liaise with the Fire Service to ensure the works and the required working area does not interrupt their activities. Liaise with those using the access road to the east of the tree for the same reasons.
- ✓ Given the local amenity value of this tree, consider replacement planting within a more suitable site where a tree can grow unrestricted, to reach its full potential, into maturity.
- ✓ Powys are advised to check the **Tree Preservation Order** status of this tree, as some residents thought it may be subject to protection. If the tree is subject to a Tree Preservation Order, then you are advised to give a '5-day written notice' of your intent to fell the tree under the exemption of 'dead, dying or dangerous' , and provide this report as evidence.
- ✓ YOU ARE STRONGLY RECOMMENDED TO undertake the works as recommended within the time period given.
- ✓ Tree felling and surgery works should only be undertaken by trained, competent and appropriately certificated personal with adequate experience and public, third party and employers liability insurance to £5,000,000. Always ask for proof from the contractors prior to engagement and seek references where necessary.
- ✓ ANY LANDOWNER OR LAND MANAGER SHOULD BE AWARE THAT - Trees must receive regular tree inspections by persons with adequate specialist arboricultural qualifications. A landowner has a duty of care imposed by statute and common law to do so and keep records of such (see legal constraints below). For further advice contact www.trees.org.uk

NOTE - There is a duty within law imposed on all landowners' and managers requiring an active programme of tree condition inspections and recording to include all remedial works, to satisfy a Landowner' s Duty of Care towards offsetting foreseeable risk that trees within their ownership may pose. In addition, this is likely to be a requirement of the client' s insurance. It is strongly recommended that all trees within influencing distance of third - party properties, highways or public space should be inspected to offset any foreseeable risk to third parties or property. Further advice and guidance can be sought from Steve Ambler & Sons Tree Specialists Ltd.

APPENDICES

PHOTOGRAPHS

RESISTOGRAPH MEASUREMENTS

FRACTOMETER (FIELD TEST NOTES)

TARGET RATING EXPLAINED

TERMS AND CONDITIONS FOR ARBORICULTURAL CONSULTANCY WORK

PHOTOGRAPHS.

Photograph 1. Large basal wound to the east of the tree. An access driveway and house is within close proximity. The north bank has been excavated historically, with associated root severance, and with sheds now restricting access to that section of the stem.



Photograph 2. Small diameter but deep basal decay cavity to the south. An operator undertaking an increment core sample is seen in the background. The IML PD-500 Resi Drill can be seen in the foreground (black arrow).



Photograph 3. Tree located on a narrow bank that is a remnant field boundary and now surrounded by development. This tree has a very limited rooting potential which has also been compromised, in addition to root severance.



Photograph 4. Increment core sample – South-West.



Photograph 5. Increment core sample – North-West.

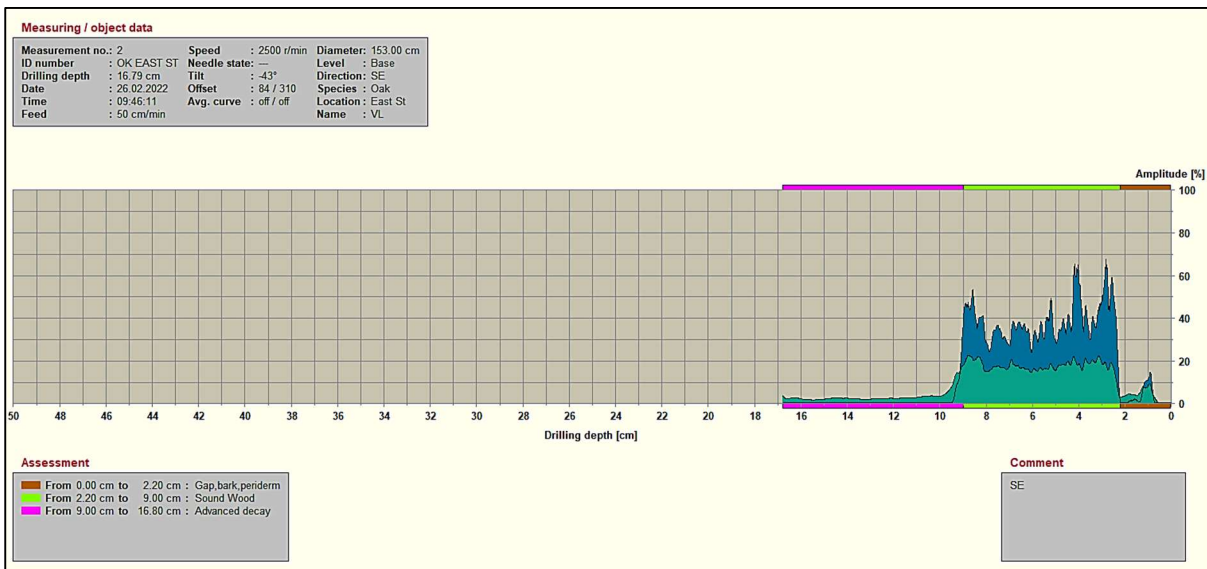
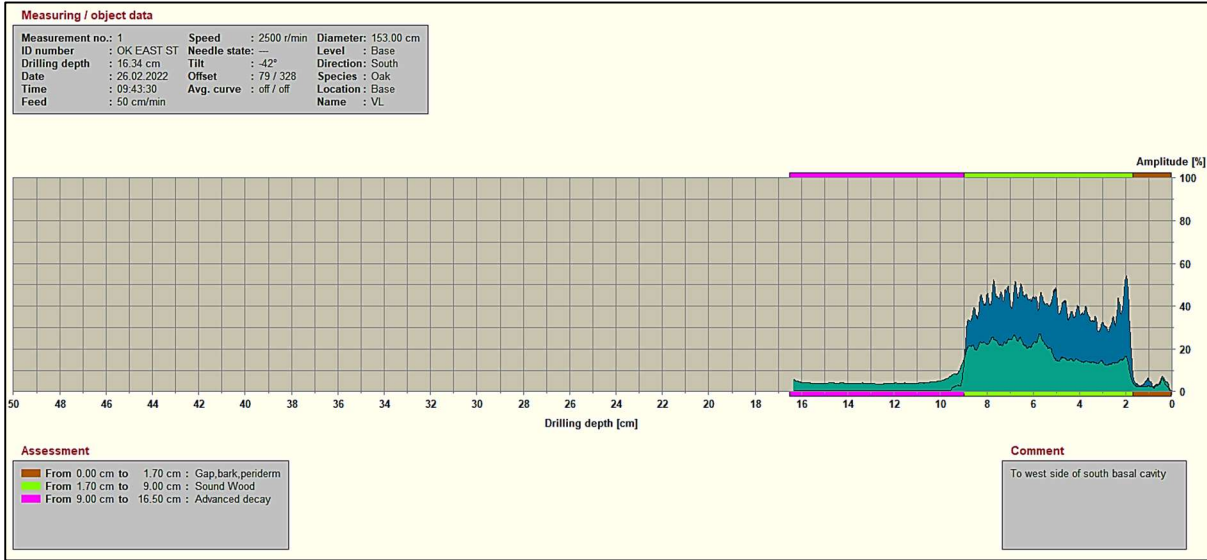


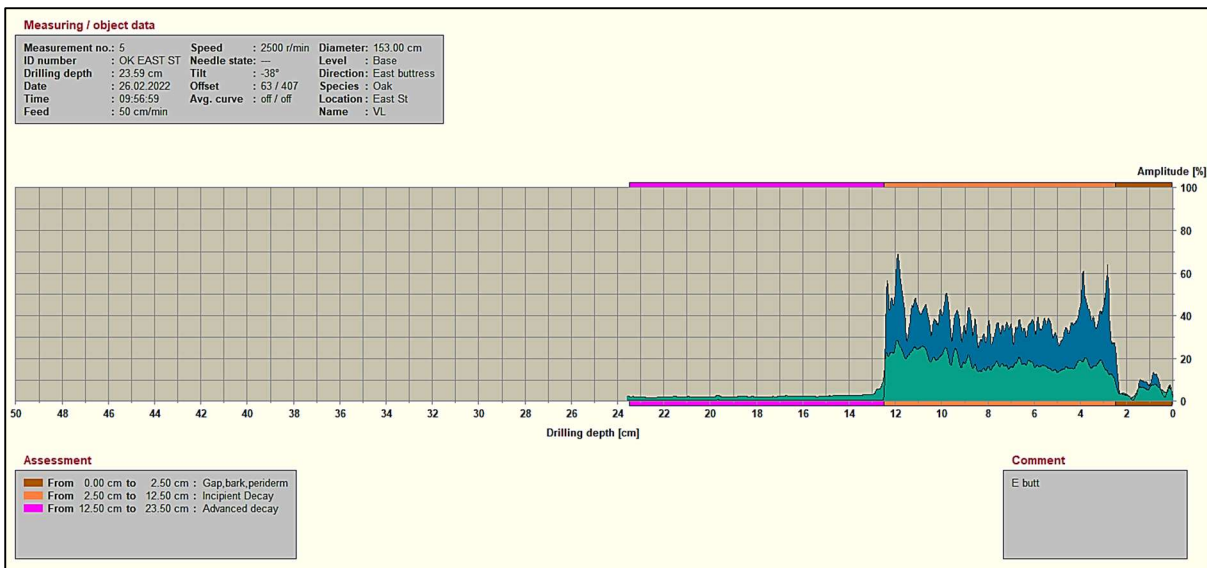
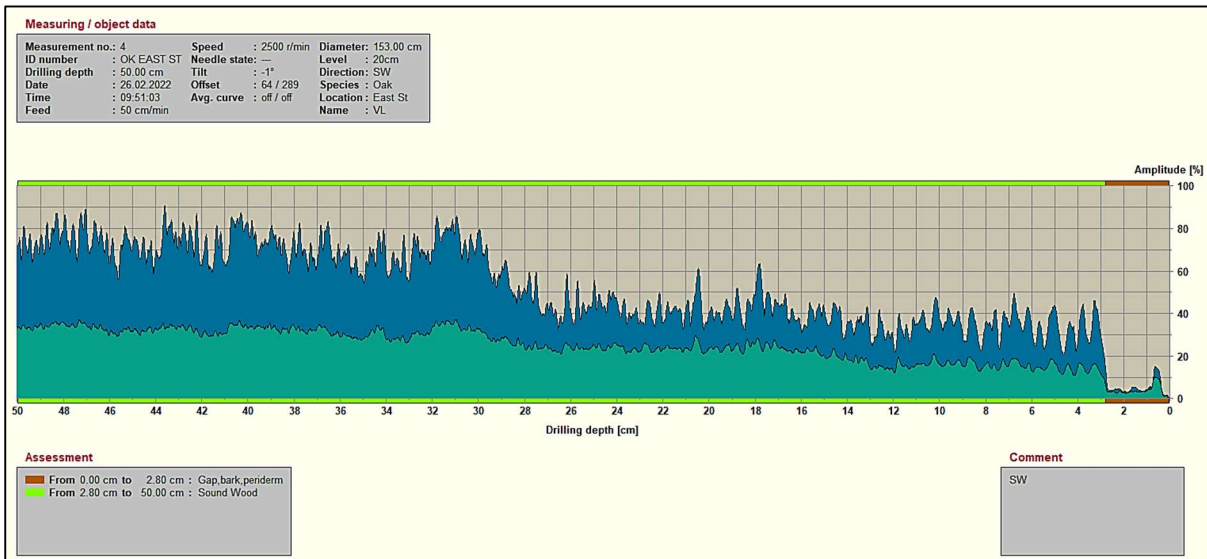
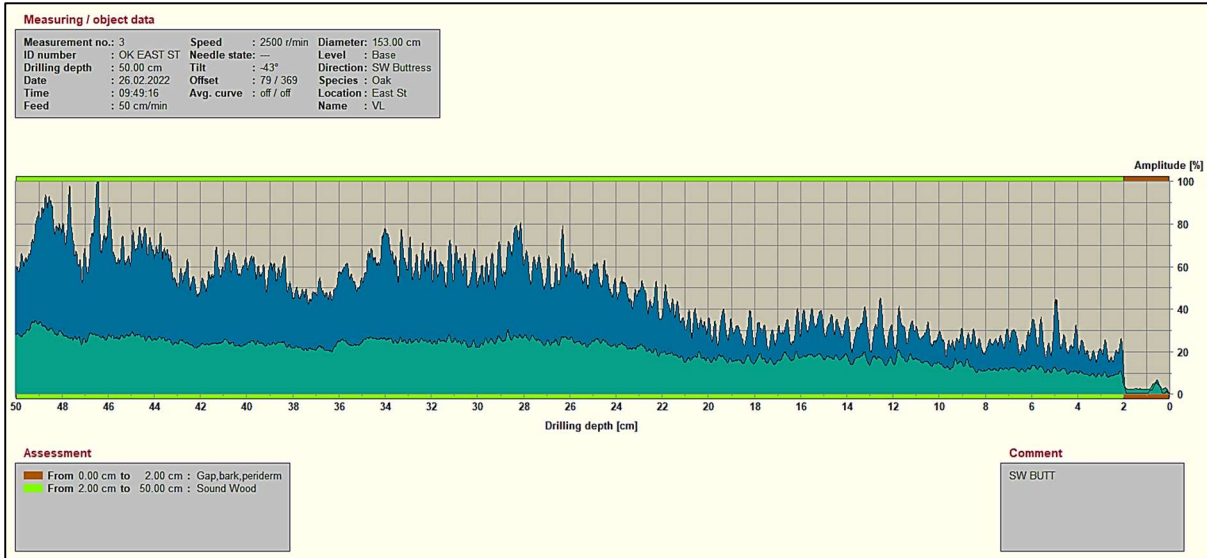
Photograph 6. Increment core sample –North-East.

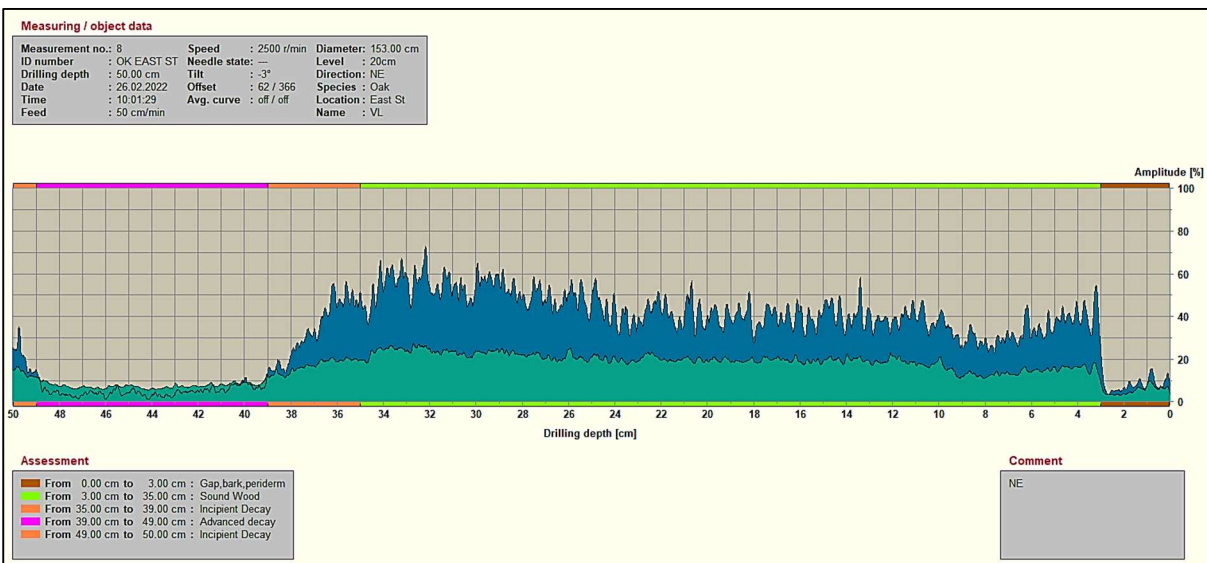
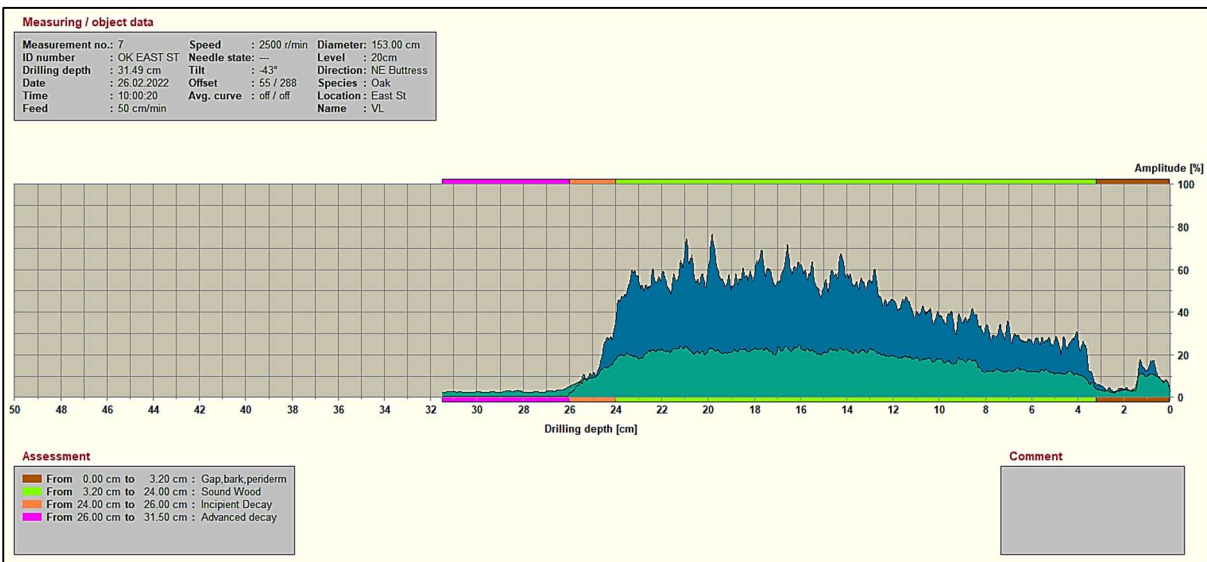
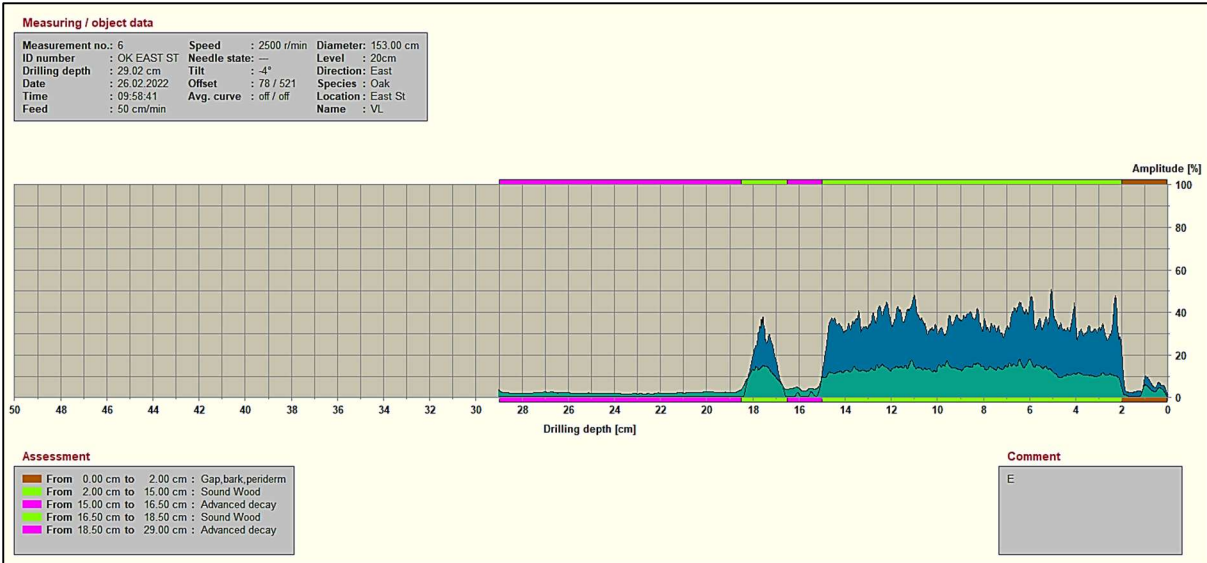


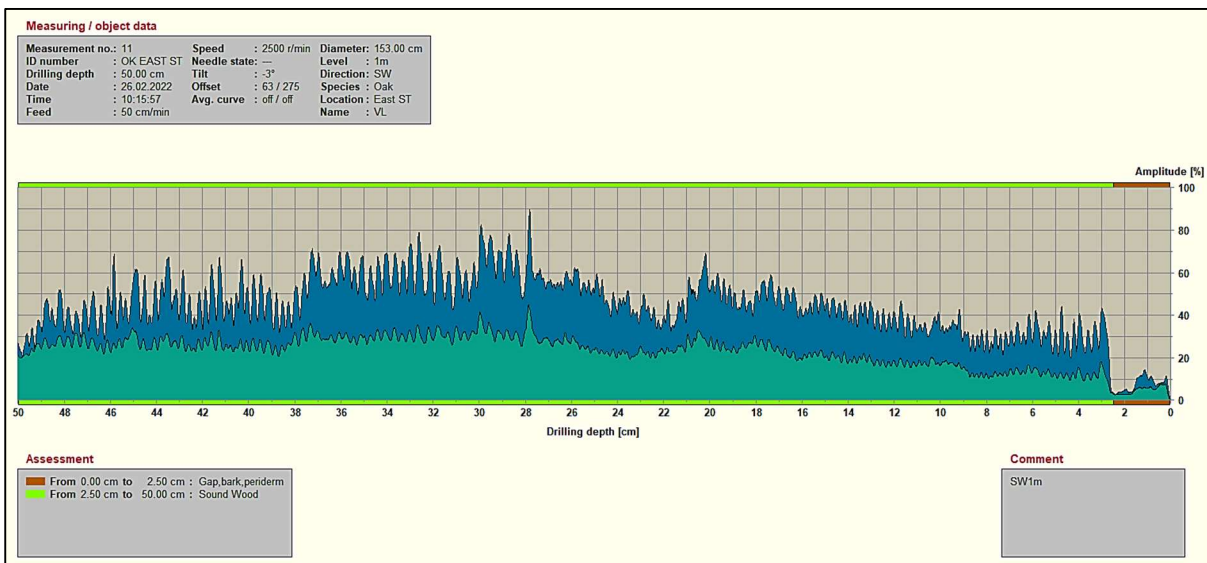
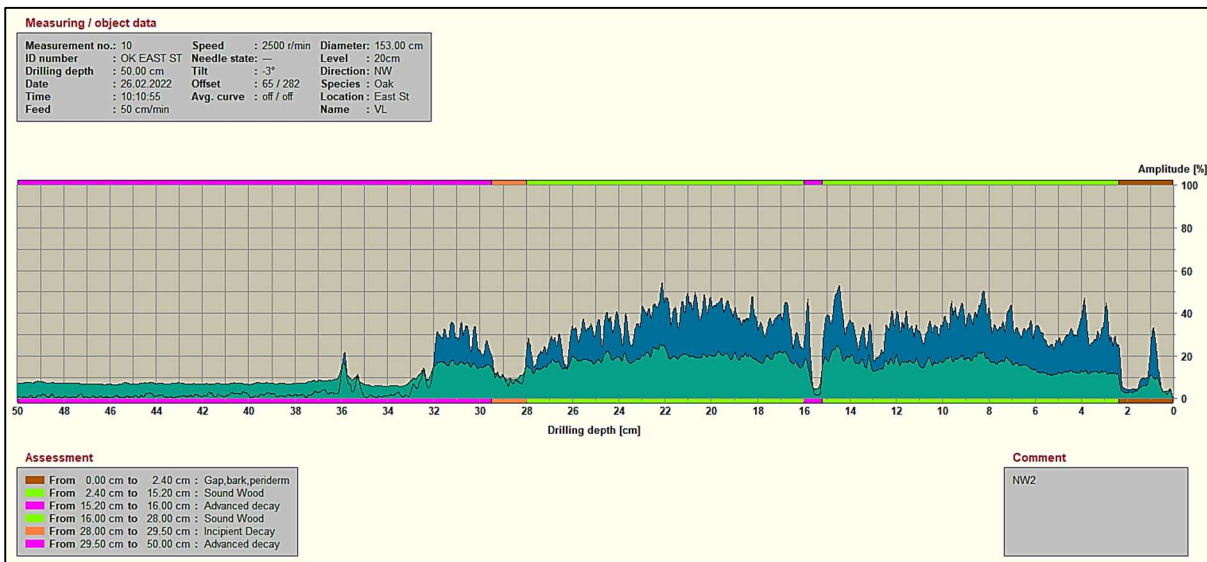
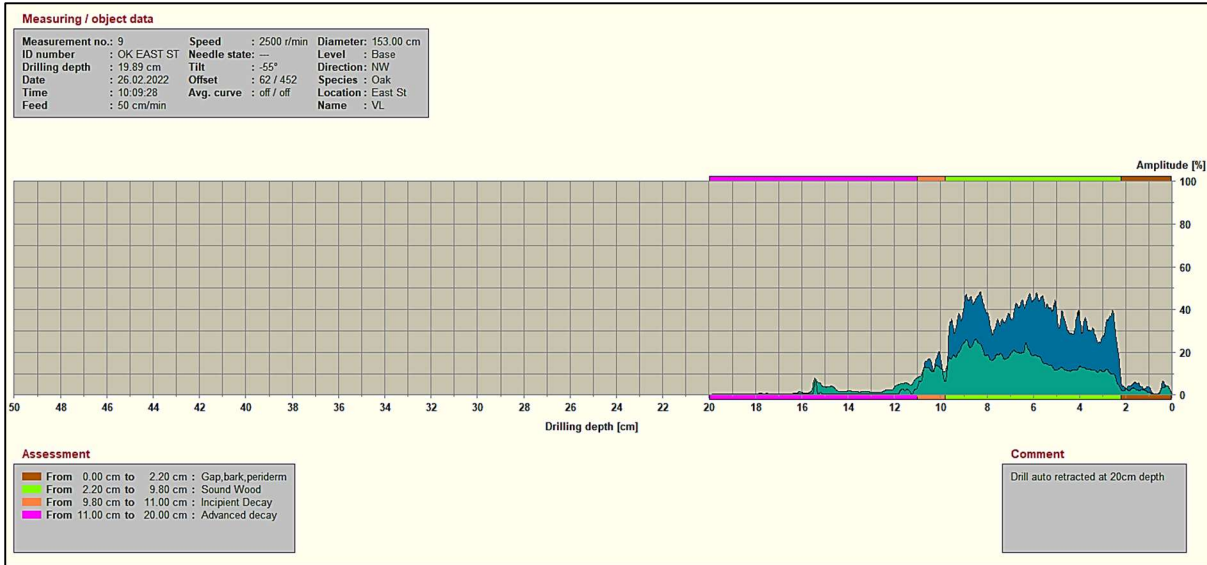
NOTE. The photograph of the core sample taken to the South-East was not of suitable quality to include within this report.

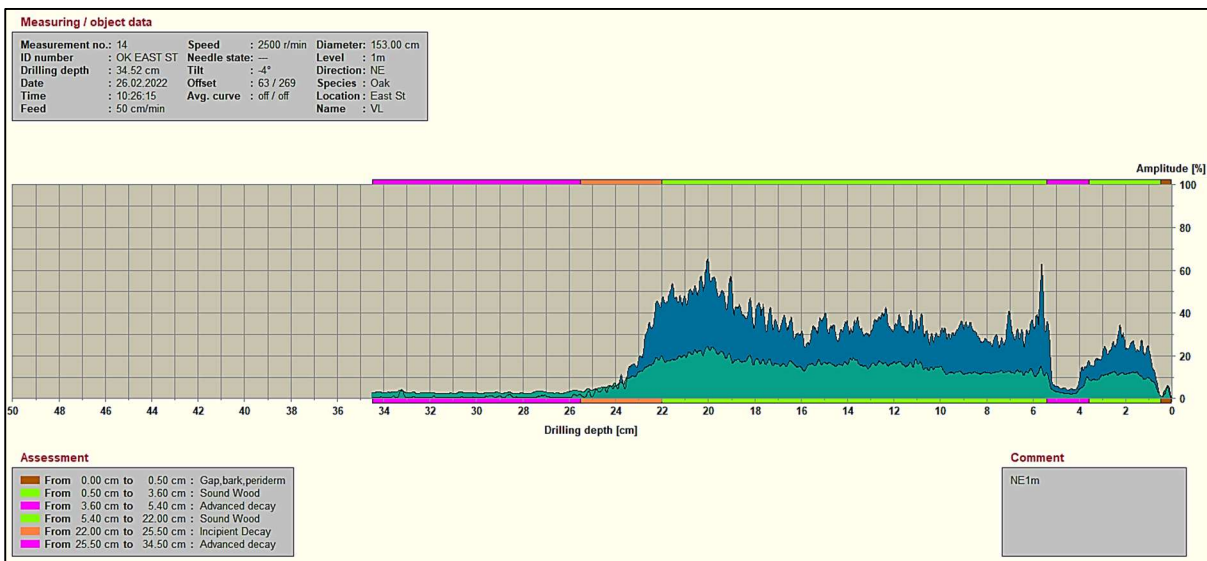
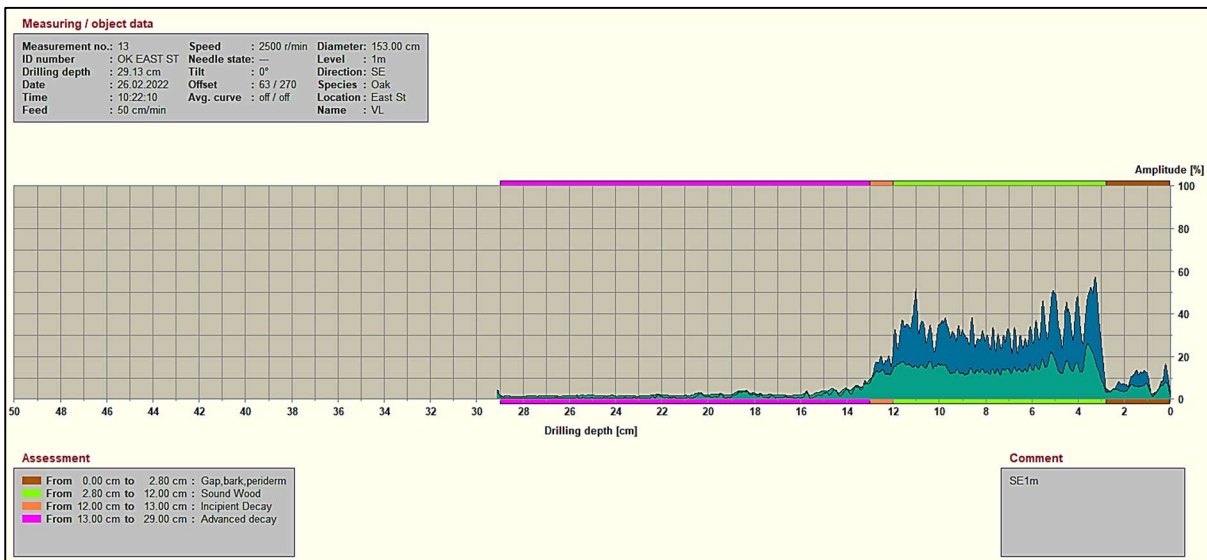
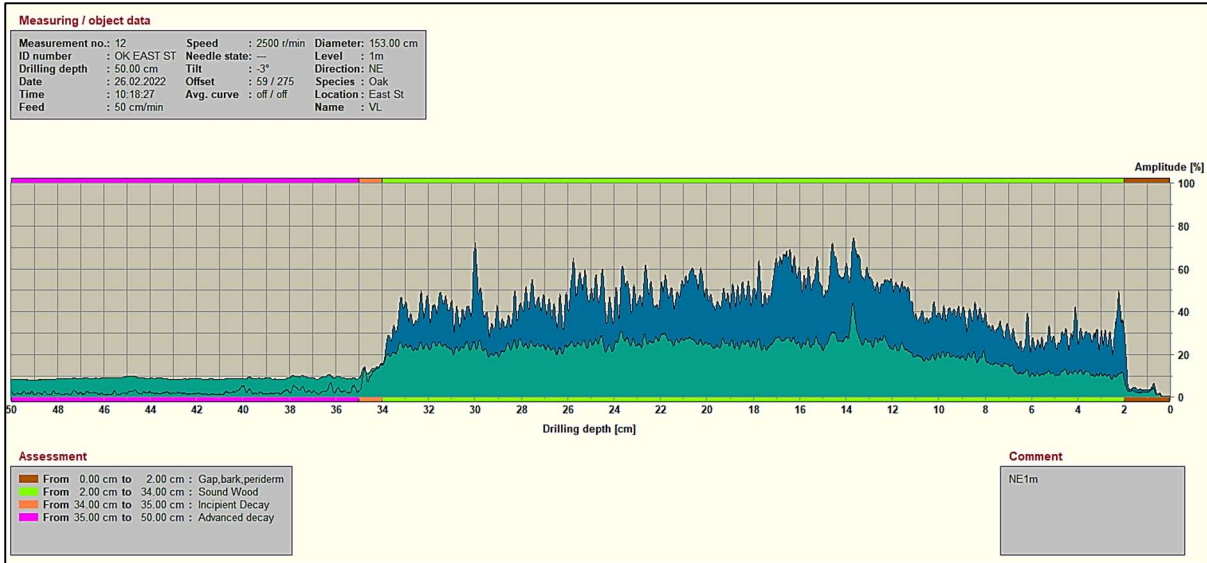
RESISTOGRAPH MEASUREMENTS











FRACTOMETER RESULTS (FIELD TEST NOTES).

MIN SOUND
WALL = 267mm

INCREMENTAL CORE SAMPLE

Length of core	Distance inwards in mm. working from outside (bark) inwards	Bending moment in degrees	Breaking moment in Fractometer values	Colour range or Quality
265mm	40 -mm	20°	54 #	RED
	80 -mm	20°	43 #	RED
	120 -mm	18°	47 #	RED
	160 -mm	16°	31 #	RED
	200 -mm	17°	44 #	RED
Sample taken from...	240mm	20°	40 #	RED
Sample taken from...	NORTH WEST @ 400mm AGL			
Visual description of findings				

Length of core	Distance inwards in mm. working from outside (bark) inwards	Bending moment in degrees	Breaking moment in Fractometer values	Colour range or Quality
290mm	40 -mm	15°	41 #	RED
	80 -mm	16°	84 #	YELLOW
	120 -mm	17°	91 #	GREEN
	160 -mm	16°	96 #	GREEN
	200 -mm	16°	83 #	YELLOW
Sample taken from...	240mm	15°	92 #	GREEN
Sample taken from...	SOUTH WEST @ 400mm AGL			
Visual description of findings				

INCREMENTAL CORE SAMPLE

Length of core	Distance inwards in mm. working from outside (bark) inwards	Bending moment in degrees	Breaking moment in Fractometer values	Colour range or Quality
80mm	40 -mm	15 °	44 #	RED
	80 -mm	13 °	73 #	YELLOW
	-mm	°	#	
	-mm	°	#	
	-mm	°	#	
Sample taken from...				
Sample taken from... SOUTH EAST @ 500mm AGL				
Visual description of findings - SOFT / DECAY > 80mm DEPTH				

Length of core	Distance inwards in mm. working from outside (bark) inwards	Bending moment in degrees	Breaking moment in Fractometer values	Colour range or Quality
240mm	40 -mm SAP WOOD	10 °	48 #	RED
	80 -mm	16 °	48 #	RED
	120 -mm	16 °	77 #	YELLOW
	160 -mm	16 °	— #	
	200 -mm	13 °	79 #	YELLOW
Sample taken from... 240-mm 20° 46 RED				
Sample taken from... NORTH EAST @ 500mm AGL				
Visual description of findings SOFT / DECAY > 240mm.				

TARGET RATING EXPLAINED

Target rating is used to consider how likely a mobile or stationary target will be present at any one moment in time, within proximity to the tree under investigation. It is often approximated after a short period on site and often with little knowledge of the site. Unless otherwise stated, no information on visitor or vehicle numbers have been provided by the client and this assessment is based on a small 'snap-shot in time', the client should consider this assessment and where it is not considered accurate, should make the Author aware immediately and certainly within 7 days of issue of the Report.

Low Target Occupancy (occasional use)

Infrequently used footpaths, isolated car parks, desire lines (permissive and non-permissive paths) through woodlands, open spaces without particular features or attractions, (such as picnic benches), and difficult to access areas due to undergrowth, perhaps the occasional jogger, dog walker or cyclist could be expected during day light and reasonable weather conditions.

Medium Target Occupancy (Intermittent use)

Target does not present for any length of time i.e. low use car parks, footpaths in countryside, parkland open during normal working hours and access roadways. No stationary targets and could normally be expected during day light and reasonable weather conditions.

High Target Occupancy (Frequent use)

Target does not present for 24 hours but a frequently used site such as - day use car parks, B-Class and minor roads, footpaths in towns and cities, offices operating normal working hours, excluding weekends, access roadways to a facility. Target maybe stationary for short periods of time.

Very High Target Occupancy (Constant use)

Where persons are present at all times such as a hospital building and car park, A-class roads, railways, dual carriageways, motorways and residential properties where vehicles or persons are expected during any time day or night.

Priority Coding is provided to relay the urgency in which any recommended work is required based on the hazard presented by the tree and the considered target occupancy. Whilst it highlights the most urgent works to help offset risk, it may also be helpful for budgeting purposes.

Priority 1	Top priority; to be undertaken as soon as it is practicable for reasons of offsetting foreseeable risk, injury or damage and where the likelihood of it occurring is considered high. Action should be taken diligently
Priority 2	Medium priority; attention strongly advised at your earliest convenience to deal with a problem that whilst is not as serious as priority one, carries significant concern and liability. In any event, works should be completed within 3 months.
Priority 3	Low Priority; the work is advised but of a lower priority than above which should be carried out before a period of 12 months' lapses.
Priority 4	Minor Problems representing no immediate hazard at the time of inspection although potential for harm or hazard to develop as the tree grows or faults developing that may become significant at a later date if left to develop. Works without any immediate urgency, possibly to rectify a minor fault or to abate a nuisance present or developing.

TERMS AND CONDITIONS FOR ARBORICULTURAL CONSULTANCY WORK

The Parties:

“**The Consultant Arboriculturalist**” will be Mr. S J Ambler, of Steve Ambler Arboricultural Consultancy and Sons Tree Specialists or otherwise the person duly authorised and appointed by Mr. S J Ambler, who is to investigate and report on the arboricultural matter forming the subject of any investigation. “**The Client**” is the party commissioning and funding the investigation and report.

1. The Report is for sole use of the named Client and his/her professional advisors and other persons with a legitimate interest in the management of the trees under investigation. No responsibility is accepted to any persons other than the Client in respect of its contents and conclusions. Neither the Report nor any part of it may be published, broadcast or otherwise distributed to the general public in any form without the express written consent of the Consultant.
2. The Client shall pay the Consultant his/her fee for preparing the Report, based upon an hourly rate to be determined from time to time (the relevant rate available on request), unless a fixed price quotation has been offered and accepted prior to engagement. In addition, all reasonable out of pocket expenses incurred will be payable, as will any VAT due on the fee and expenses. The total sum due must be paid within 15 days of the date of invoice, unless otherwise agreed in writing by the Consultant. The right to charge interest on overdue accounts is reserved, both before and after any judgement that might be made until full payment is made; (a part of a month to be taken as a full month in calculating interest). The interest rate to be 2% above that current under section 69 of the County Court Act 1984 (or as superseded by subsequent relevant legislation).
3. The Consultant retains full title on any report until the fee is paid in full: No liability whatsoever is accepted on the contents of any report where the due fee remains unpaid in part or in full.
4. The Consultant will carry out the inspection and investigations as specified in the Clients Instructions and/or as set out in the Consultant’s preliminary proposals. Unless otherwise specified, inspections will comprise Visual Tree Assessments made working from ground level only. The Consultant will not be expected or required to carry out any further investigations or inspections unless such investigations/ inspections are agreed between the Consultant and Client.
5. The Inspection will be limited to those areas or trees included in the Clients instructions that are practically accessible for inspection. The Client must ensure that free and lawful access is available; the Consultant is under no obligation to inspect areas that are unexposed, inaccessible or potentially hazardous.
6. Unless stated in writing, the inspection shall not include any underground parts of a tree, nor will it consider any possible effects of root action upon shrinkable soils. Unless the Report is specified to include a Subsidence Risk Assessment, or an investigation of roots in relation to drainage systems, no liability is accepted for any loss or expense incurred consequent upon such effects.
7. The Report will be prepared with the care and diligence to be reasonably expected of a professional Consultant Arboriculturalist, with due account taken of any and all limitations specified in the instructions. No responsibility is accepted to comment on subjects or circumstances other than those specified in the Client’s instructions, nor for matters beyond the professional competence of a Consultant Arboriculturalist.
8. The Consultant shall provide his opinion on Arboricultural matters as agreed with the Client. It may be recommended that other specialists (e.g. Structural Engineer, Soil Scientist, Drain Engineer) be required to carry out further investigations. The Consultant accepts no liability in respect of matters on which the Client is recommended to obtain such other specialist advice, nor if the Client acts without obtaining, or in contradiction of, such advice.
9. Trees and their environments change over time; No liability is accepted for events arising as a result of circumstances not apparent at, or developing subsequent to the inspection, unless such circumstances are specifically brought to the attention of the Consultant by the Client or his/her agents. Unless otherwise stated, and in the absence of altered circumstances, a Report on the health and safety of a tree or trees should not be relied upon after a period of 12 months without a further inspection being carried out. Subsidence Risk Assessments remain valid for a period of 5 years, under similar contradiction of, such advice.
10. Any claim by the Client based on an alleged defect in the scope, nature or quality of a Report shall be notified to the Consultant within 14 days of the date of the supply of that Report. Should any problem allegedly arise relating to a tree (or other matter) the subject of a submitted Report, any claim must be notified to the Consultant within 14 days of the alleged problem becoming apparent.
11. Any dispute arising out of or in connection with the contract between the Client and Consultant shall be referred to the arbitration of a single Arbitrator appointed by agreement between the parties, or in default of agreement, nominated by the Arboricultural Association upon the application of either party.
12. The Consultant shall not be liable to the Client for any consequential loss arising in any way from the negligence of the Consultant or his employees or agents or otherwise.

13. The Consultant shall not be liable to the Client or be deemed to be in breach of the contract by reason of any delay in performing, or any failure to perform, any of the Consultant' s obligations in relation to the services he renders, if the delay or failure was due to any cause beyond the Consultant' s control.
14. Each provision of these conditions limiting or excluding liability operates in itself and survives independently of the others.
15. The Laws of England shall govern the contract between the Client and the Consultant.
16. Only reports bound and signed by Mr. S J Ambler, of Steve Ambler Arboricultural Consultancy and Sons Tree Specialists are valid. Any electronic or digital versions transmitted by whatever means are not valid and cannot be relied upon.