

Tree Survey, Arboricultural Impact Assessment, and Tree Protection Plan

**For Proposed Studio,
Ingleby, St Eunan's Road, Aboyne**

Wednesday 27th December 2023



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PART 1 - EXECUTIVE SUMMARY

1.1 Proposal

The proposal is to construct a studio in the rear garden at Ingleby, St Eunan's Road, Aboyne. A tree survey is required, written in accordance with British Standard Institute publication BS 5837:2012 'Trees in relation to design, demolition and construction - Recommendations'.

1.2 Tree Survey

A tree survey was carried out by the surveyor on 14th December 2023. The trees were recorded as T1-25. All trees surveyed were assigned to the category A, B, C or U classification.

1.3 Arboricultural Impact Assessment

Ingleby is in a Conservation Area and all trees over 75mm DBH are protected. It is proposed to retain all trees at the site which includes the relocation of one tree T24 which is a young tree of less than 75mm DBH which is located within the development footprint. This is a Category C tree and BS5837 states that there is no restriction on Category C trees. There will be no alteration to the existing tree cover.

The proposed development impacts the RPAs of 5 trees T6, 7, 8, 9, 10. The directly impacted area is approximately 2.5% of the RPA for T6; 20% for T7; 20% for T8; 4% for T9; and 4% for T10. Arboricultural methodology must be followed in the area where the RPAs are located. Where excavation is required within RPAs non-mechanical excavation is proposed and cutting roots greater than 2.5cm diameter is to be avoided. Screw pile foundations are recommended with hand-dug pile, pad, or post locations down to a depth of 60cm and, if necessary, location adjusted to avoid cutting roots greater than 2.5cm diameter. A no dig surface methodology such as a 3D cellular confinement system is proposed to avoid negative impacts in other areas. Where this raises the level of the ground in any RPA a permeable surface material is recommended to allow air and water to percolate. As most of the rooting area for the tree is beyond the development footprint, it is considered that the long-term health and longevity of the tree will not be detrimentally affected.

It is not anticipated that the RPAs of other retained trees will be directly impacted by the work. However, in the event work is required which may encroach into any RPA, work must be non-mechanical excavation using hand tools or use a no dig surface method where excavation is not required. Arboricultural methodology must be adopted for any works in the RPAs of retained trees in case tree roots are discovered. It is anticipated that the impact of the proposed development can be satisfactorily mitigated against to ensure that there is no detrimental long-term impact to RPAs at the site. The RPAs of all trees on the site which are in the vicinity of, but out-with, the proposed development footprint can be safely protected from compaction or other disturbance by protective fencing and/or ground protection.

Tree-work management recommendations are proposed to remove hanging deadwood from T7 where it overhangs the garden. It is also recommended T1 is reduced/removed as it is causing damage to the boundary wall. N.B. Both trees are located out with the boundary of the site.

1.4 Tree Protection

Tree protection specifications for tree protection barriers are provided, together with general advice on tree retention, working in RPAs, and an arboricultural method statement for tree works.

1.5 Conclusion

It is anticipated that the impact of the proposed development can be satisfactorily mitigated against to ensure that there is no detrimental long-term impact to retained trees at the site and that there will be no alteration in the existing tree cover.

PART 2 - GENERAL INFORMATION

2.1 Brief From Client

A tree survey is required written in accordance with British Standard Institute publication BS 5837:2012 'Trees in relation to design, demolition and construction - Recommendations'.

2.2 Proposed Works

The proposal is to construct a studio in the rear garden at Ingleby, St Eunan's Road, Aboyne.

2.3 Documents Referred To

The British Standard Institute publication BS 5837:2012 'Trees in relation to design, demolition and construction - Recommendations' is referred to throughout this report. This is a nationally recognised standard typically used by LPAs to assess planning applications.

2.4 Documents Received

Location Plan and Proposed Site Plan

2.5 Limitations

2.5.1 This report was prepared for use by our client in accordance with the terms of the contract and for planning purposes only. Information provided by third parties used in the preparation of this report is assumed to be correct.

2.5.2 All trees have been inspected from ground level only using established visual assessment methodology. This is primarily a survey to assess the general health, condition, value, and life expectancy of existing trees as part of the planning and design process. This report is not a detailed document on tree safety.

2.5.3 Trees are dynamic living organisms, whose health and condition can be subject to rapid change, depending on a number, of external and internal factors. The conclusions and recommendations contained in this report relate to the trees at the time of inspection. The findings and recommendations are valid for twelve months and it is strongly recommended that trees are inspected at regular intervals and after extreme weather events for reasons of safety.

2.5.4 Whilst every effort has been made to detect defects within the trees inspected, no guarantee is given as to the absolute safety or otherwise of any individual tree. Extreme climatic conditions can cause damage to apparently healthy trees.

2.5.5 The findings and recommendations contained within this report are based on the current site conditions. The construction of roads, buildings, service wayleaves, removal of shelter, and alterations to established soil moisture conditions can all have a detrimental impact on the health and stability of retained trees. Accordingly, a re-inspection of retained trees is recommended on completion of any development operations.

2.5.6 This report has been prepared for the use of the client and their appointed agents. A 10 figure GPS was used to position features, this has limitations of 2-4m accuracy, therefore site photos and field measurements were utilised to reduce the error. Adjacent private property was not entered, all measurements were from within the site boundary or areas of open public access. Any third party referring to this report or relying on information contained within it does so at their own risk.

2.6 Personnel

Emma has worked in the environmental sector for nineteen years, including thirteen years predominantly focused on woodland management, during which time she has gained a wealth of experience and expertise. Emma has been qualified in arboriculture for seventeen years, has carried out tree surveys for eleven years, and holds the Lanta Professional Tree Survey and Inspection Award. During the last nine years she has worked as an ecological and arboricultural consultant for Tay Ecology with lead responsibility for development projects. She graduated with a BSc from University of Edinburgh, has a Postgraduate Diploma in Environmental Management and is a member of the Arboricultural Association, Chartered Institute for Ecology and Environmental Management, and the Institute of Environmental Management and Assessment.

PART 3 – TREE SURVEY

3.1 METHODOLOGY

3.1.1 Trees on and adjacent to the proposed development site where these trees may be impacted by the proposed work have been recorded. Trees are numbered T1-25. All trees surveyed were assigned to the category A, B, C or U classification.

3.1.2 Data was collected in accordance with the requirements of British Standard 5837:2012. All observations were from ground level, with the aid of binoculars, without detailed or invasive investigations. Measurements were taken using a tape measure, clinometer, and laser measure. Where this was not possible or reasonably practical, measurements have been estimated by eye.

3.1.3 The trees were surveyed and assessed impartially and irrespective of the proposed development. Management recommendations should be implemented regardless of any proposed development for reasons of sound arboricultural management or safety.

3.1.4 BS 5837:2012 requires retention of better quality (category A and B trees) where possible. Planning permission overrides a Tree Preservation Order and Conservation Area. Furthermore, trees are a material consideration in the UK planning system irrespective of their legal status. It is therefore not considered necessary to highlight or give additional merit to trees that have legal protection.

3.1.5 All category A, high & B moderate quality and value trees will, where possible, be retained on development sites, and should influence and inform the design, site layout, and in some cases the specific construction methods to be used. The root protection areas of these trees will generally form a construction exclusion zone, although under certain circumstances it may be possible to build within these areas providing that appropriate, specifications have been agreed between the local planning authority, the consulting arboriculturist and the developer/client.

3.1.6 As regards category C trees; under normal circumstances these would not normally be required to be retained in a development context, unless in a location that they do not represent a significant constraint on the proposal. See relevant note at foot of Cascade diagram BS 5837:2012.

3.1.7 All category U trees should be removed for reasons of sound arboricultural practice or health & safety, irrespective of any development proposals.

3.1.8 Trees may be recorded as group or woodland where:

- i) The canopies touch.
- ii) The trees have more group value than individual merit.
- iii) They are part of a formal landscape feature like an avenue.
- iv) It is impractical to record them individually.

3.1.9 Where trees within groups or woodlands etc. are recorded together, it may be necessary to record individual trees where it is necessary to distinguish them from others, this may be required initially, e.g., if a tree is in category U, or at a subsequent stage as the design process evolves.

3.2 ANALYSIS

3.2.1 Site Description

The proposed site is located in the rear garden of Ingleby, St Eunan's Road Aboyne. The site is garden ground with semi-mature to mature trees around the perimeter of the site which are primarily located in the neighbouring properties. There are two young planted broadleaved trees in the garden.

3.2.2 Species

A range of broadleaved and coniferous species around the site. The scientific names for the species recorded only in common names are as follows:

Common Name	Scientific Name	Number
Silver birch	<i>Betula pendula</i>	4
Atlas cedar	<i>Cedrus atlantica</i>	1
Leyland cypress	× <i>Cuprocyparis leylandii</i>	2
Beech	<i>Fagus sylvatica</i>	5
Norway spruce	<i>Picea abies</i>	3
Sitka spruce	<i>Picea sitchensis</i>	1
Scots pine	<i>Pinus sylvestris</i>	6
Cherry sp.	<i>Prunus spp.</i>	2
Willow sp.	<i>Salix spp.</i>	1

3.2.3 Categories

The trees recorded are 40% Category B, 60% Category C trees. The distribution of categories of individual trees is as follows:

BS 5837 Category	Number of Trees	% Trees
A	0	0
B	10	40
C	15	60
U	0	0
Total	25	100

3.2.4 Life stage

44% mature, 48% semi-mature, 8% young trees recorded.

The life stages recorded for individual trees are summarised as follows:

Life Stage	Number of trees	% of Trees
Young	2	8
Semi-mature	12	48
Mature	11	44
Over-mature	0	0
Dead	0	0

3.3 Tree Survey Schedule

Ref.	Species	Hgt. (m)	DBH (mm)	Branch spread (m)				Clr (m)	Life stage	General observations/vigour	Condition	ERC	Cat.	RPA (m)	Recommendations / Timescale
				N	E	S	W								
1*	Sitka spruce	30	1000	6	6	6	6	4S	M	East Large mature tree / Good – damage is being caused to the adjoining wall due to size of tee	Good	20+	B2	12.0	Reduce or remove / 12 months.
2*	Scots pine	20	600	4	4	4	4	8N	M	East boundary / Good	Good	20+	B2	7.2	No work required.
3*	Wild cherry	6	150;150	1	4	1	1	2E	M	East boundary, Co-dominant stems, leaning east / Moderate	Fair	10+	C2	2.55	No work required.
4*	L.cypress	7	160	2	2	2	2	n/a	SM	North boundary / Moderate	Fair	10+	C2	1.92	No work required.
5*	L.cypress	5	80	1	1	1	1	n/a	SM	North boundary / Moderate	Fair	10+	C2	0.96	No work required.
6*	Beech	12	300	3	3	3	3	2S	M	North boundary / Moderate	Fair	20+	B2	3.6	No work required.
7*	Scots pine	20	590	5	5	5	5	4S	M	North boundary / Good	Good	20+	B2	7.08	Remove hanging branches/12months.
8	S.birch	14	260	2	2	2	2	2S	M	North boundary / Moderate	Fair	10+	C2	3.12	No work required.
9*	Beech	8	240	3	3	3	3	2S	SM	North boundary / Moderate	Fair	10+	C2	2.88	No work required.
10*	Atlas cedar	12	250	3	3	3	3	1S	SM	North boundary / Good	Good	10+	C2	3.0	No work required.
11*	Beech	6	100	1	1	1	1	n/a	SM	North boundary / Moderate	Fair	10+	C2	1.2	No work required.
12*	S.birch	12	180	2	2	2	2	n/a	SM	North boundary / Moderate	Fair	20+	B2	2.16	No work required.
13*	S.birch	12	230	2	2	2	2	2S	M	North boundary / Good	Good	20+	B2	2.76	No work required.
14	N.spruce	12	180	2	2	2	2	n/a	SM	North boundary / Moderate	Fair	10+	C2	2.16	No work required.
15	Beech	6	100	1	1	1	1	n/a	SM	North boundary / Moderate	Fair	10+	C2	1.2	No work required.
16	N.spruce	8	120	1	1	1	1	n/a	SM	West boundary / Moderate	Fair	10+	C2	1.44	No work required.
17	Scots pine	18	410	4	4	4	4	4E	M	West boundary / Good	Good	20+	B2	4.92	No work required.
18*	Beech	7	150	2	2	2	2	n/a	SM	West boundary / Moderate	Fair	10+	C2	1.8	No work required.
19*	Scots pine	20	590	4	4	4	4	4E	M	West boundary / Good	Good	20+	B2	7.08	No work required.
20*	Scots pine	20	400	3	3	3	3	4E	M	West boundary / Good	Good	20+	B2	4.8	No work required.
21	N.spruce	6	150	2	2	2	2	n/a	SM	West boundary / Moderate	Fair	10+	C2	1.8	No work required.
22	S.birch	12	220	2	2	2	2	3E	M	West boundary / Good	Good	10+	C2	2.64	No work required.
23	Scots pine	20	590	4	4	4	4	4E	SM	West boundary / Good	Good	20+	B2	7.08	No work required.
24	Prunus sp.	4	30;20	1	1	1	1	n/a	Y	Young planted / Good	Good	10+	C2	0.43	No work required.
25	Salix sp.	5	30;30	1	1	1	1	n/a	Y	Young planted / Good	Good	10+	C2	0.51	No work required.

* Estimated measurements where tree located within in grounds of neighbouring property.

KEY

Ref: Reference number assigned to that item with a code to help identification such as T = tree

Hgt: Height of the tree in metres rounded up to the nearest half metre.

DBH: 'Diameter at Breast Height' – the stem diameter measured in millimetres at 1.5m above ground level, to the nearest 10mm. Where the ground around the base of the tree is not level this is taken 1.5m above the upper side of the slope.

Crown Spread: The crown spread is given to four cardinal points, rounded up to the nearest half metre.

Clr: 'Crown clearance' is the height of the lowest branch above ground level, with the general direction it is growing to a cardinal point.

Life Stage: Recorded with codes as follows, and relative to the species of the tree: Y – Young; SM – Semi-mature; M – Mature; OM - Over-mature; D – Dead.

General observations: includes notes on structural defects, physiological problems, special features, decay, and management recommendations. Please note that management recommendations do not constitute a specification for any required works.

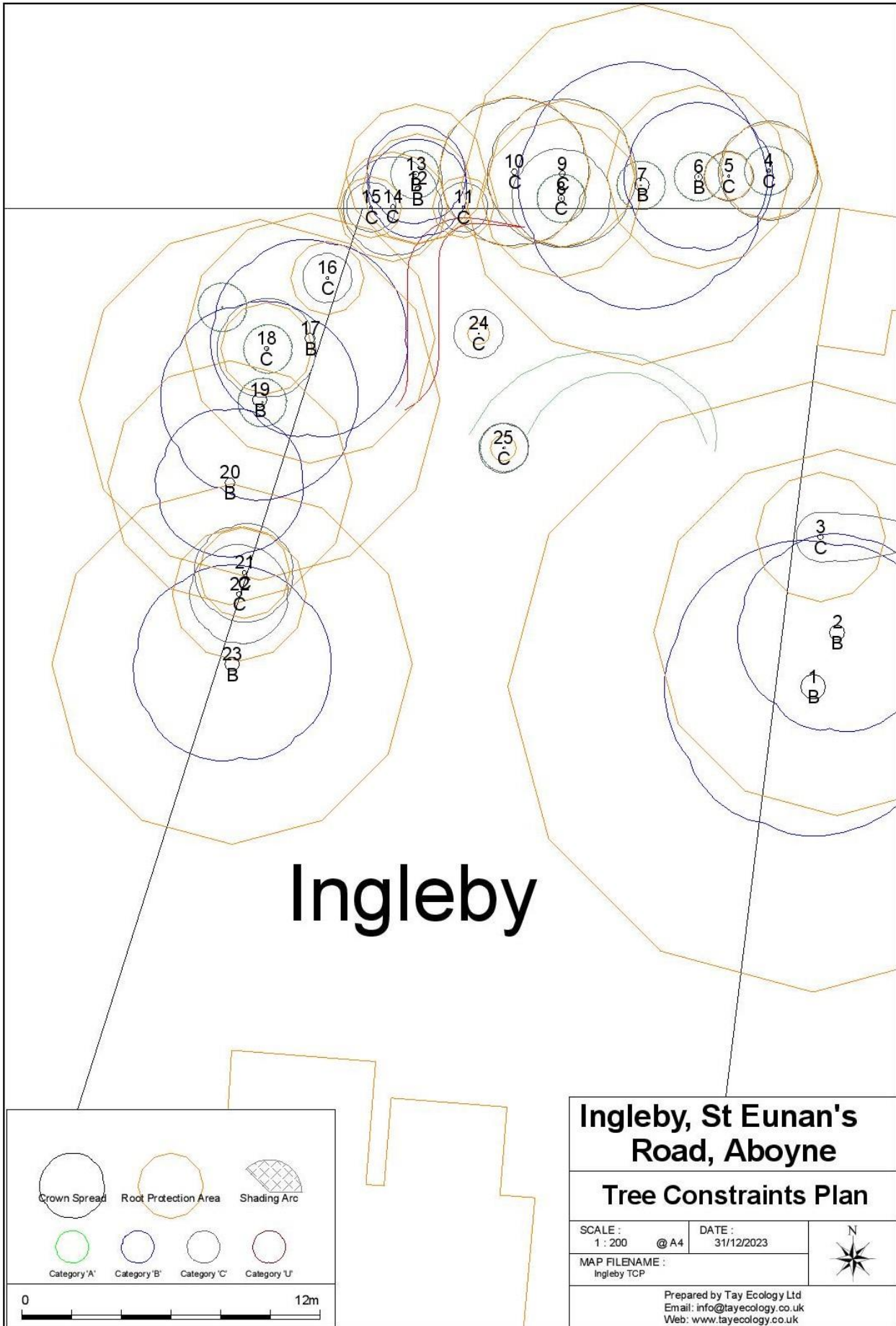
Condition: Good = Healthy tree with no major defects, considerable life expectancy, with good shape or form; Fair = Healthy tree with easily remedied defects, shorter life expectancy, with reasonable shape or form; Poor = Tree with significant structural defects and/or decay, low vigour, under stress, limited life expectancy and with inferior shape and form; Dead = Dead, dying, and dangerous trees, very, low vigour, severely limited life expectancy, serious structural defects and/or decay.

ERC: 'Estimated remaining contribution', recorded in a range of years is the amount of time the tree can realistically be retained for.
<10 - Unsuitable for retention; 10-20 - Can be retained in the short term; 20-40 - Will continue to offer benefits for the foreseeable future; 40+ - Good longevity potential

Cat.: 'Category grading', a full explanation of the categories is given in an excerpt from BS 5837:2012 in the cascade chart, appendix 2.

RPA: 'Root protection area', appears on the survey plan and is calculated by multiplying the stem diameter using one of three methods specified in BS 5837:2012 depending on the number of stems the tree has. This should be considered an indication only as various factors may influence the size and shape of the RPA, such as past and present site conditions, and ground constraints such as roads, underground services, soil type, drainage, and topography.

3.4 Tree Constraints Plan - see below and Tree Constraints Plan as separate pdf 1



3.5 Site Photographs

Scots pine T7



Scots pine T7



North boundary trees



West boundary trees



Sitka spruce T1 and Scots pine T2



Hanging branch Scots pine T7



PART 4 – ARBORICULTURAL IMPACT ASSESSMENT

4.1 TREE LOSS AND RETENTION

Ingleby is in a Conservation Area and all trees over 75mm DBH are protected. It is proposed to retain all trees at the site which includes the relocation of one tree T24 which is a young tree of less than 75mm DBH which is located within the development footprint. This is a Category C tree and BS5837 states that there is no restriction on Category C trees. There will be no alteration to the existing tree cover.

4.2 INCURSION INTO ROOT PROTECTION AREAS

The proposed development impacts the RPAs of 5 trees T6, 7, 8, 9, 10. The directly impacted area is approximately 2.5% of the RPA for T6; 20% for T7; 20% for T8; 4% for T9; and 4% for T10. Arboricultural methodology must be followed in the area where the RPAs are located.

Where excavation is required within RPAs non-mechanical excavation is proposed and cutting roots greater than 2.5cm diameter is to be avoided. Screw pile foundations are recommended with hand-dug pile, pad, or post locations down to a depth of 60cm and, if necessary, locations adjusted to avoid cutting roots greater than 2.5cm diameter. A no dig surface methodology such as a 3D cellular confinement system is proposed to avoid negative impacts in other areas. Where this raises the level of the ground in any RPA a permeable surface material is recommended to allow air and water to percolate. As most of the rooting area for each tree is beyond the development footprint, it is considered that the long-term health and longevity of the trees will not be detrimentally affected.

It is not anticipated that the RPAs of other retained trees will be directly impacted by the work. However, in the event work is required which may encroach into any RPA, work must be non-mechanical excavation using hand tools or use a no dig surface method where excavation is not required. Arboricultural methodology must be adopted for any works in the RPAs of retained trees in case tree roots are discovered. It is anticipated that the impact of the proposed development can be satisfactorily mitigated against to ensure that there is no detrimental long-term impact to RPAs at the site. The RPAs of all trees on the site which are in the vicinity of, but out-with, the proposed development footprint can be safely protected from compaction or other disturbance by protective fencing and/or ground protection.

4.2.2 Protective Fencing

BS 5837 requires the installation of protective fencing to protect trees to be retained during construction operations. The fence creates a physical barrier between the construction area and the Construction Exclusion Zone (CEZ). The line that a protective fence takes is based upon the calculation of Root Protection Areas but also requires the physical constraints of the site to be taken into consideration. The provisional Tree Protection Plan gives an indicative positioning for the placement of protective fencing and construction exclusion zones. A specification for protective fencing is given in Appendix 3.

4.2.3 Changes in Ground Level and Surfaces

Changes in ground levels and surfaces within the RPAs of trees to be retained can be detrimental to tree health and stability. Excavations which result in root severance and soil compaction can have serious implications for the long-term future health and stability of the tree. Increasing levels and changing surfaces within root protection areas can be equally damaging as this may result in anaerobic conditions at rooting level resulting in tree root disease and death. Therefore, it is essential that trees to be retained must have their RPAs protected from any changes in in levels. Permeable surfacing materials are recommended to be used in the construction of any surfacing that encroaches on RPAs to allow for percolation of water and gas diffusion.

Where excavation is required within RPAs non-mechanical excavation is proposed and cutting roots greater than 2.5cm diameter is to be avoided. Screw-pile foundations are recommended with hand-dug pile, pad, or post locations down to a depth of 60cm and, if necessary, locations adjusted to avoid cutting roots greater than 2.5cm diameter.

A no dig surface methodology such as a 3D cellular confinement system is proposed to avoid negative impacts to RPAs in other areas. This would raise the level of the ground in the identified area. A no dig surface can cover approximately 20% of any RPA. Where the ground level is raised in any RPAs a permeable surface material is recommended to allow air and water to percolate.

4.2.4 Installation of Services

Traditionally the installation of underground services is carried out by the digging of open trenches and installation of the service(s) prior to backfilling. It is widely recognised that this methodology is detrimental to the health of trees where the digging of trenches involves the severance of tree roots. Overhead services can also come into conflict with tree canopies resulting in unnecessary pruning or tree removal. To minimise any impact on trees all services should, wherever possible, be located out-with the root protection areas and crown spreads (for overhead cables) of retained trees. Where services must be installed in root protection areas excavation must be non-mechanical and roots greater than 2.5cm diameter retained.

4.2.5 During Construction

Where construction vehicles are required to enter any RPA, a preference will be given to the use of small construction vehicles and ground protection will be used. Ground protection requirements will depend on the intensity of work around any individual tree in such areas. Where materials storage is required, this will be outside of any RPAs of trees to be retained.

4.3 ABOVE GROUND CONSTRAINTS

4.3.1 Canopies and Shading

The canopies of retained trees can be protected with barriers where any work takes place or where any machinery to be used on site which may impact the canopies.

4.3.2 Future Tree Inspections

Due to the time lapse between the initial survey and start of any development work a further inspection of the trees should form part of the formal risk assessment process carried out prior to commencement. This initial assessment of the trees was carried out on the basis that a follow-up inspection would be undertaken within one year and the advice given on tree condition reviewed on an annual basis or after extreme weather events.

4.4 TREE-WORK RECOMMENDATIONS

Tree-work management recommendations are proposed to remove hanging deadwood from T7 where it overhangs the garden. It is also recommended T1 is reduced/removed as it is causing damage to the boundary wall. N.B. Both trees are located out with the boundary of the site.

4.5 CONCLUSIONS

Ingleby is in a Conservation Area and all trees over 75mm DBH are protected. It is proposed to retain all trees at the site which includes the relocation of one tree T24 which is a young tree of less than 75mm DBH which is located within the development footprint. This is a Category C tree and BS5837 states that there is no restriction on Category C trees. There will be no alteration to the existing tree cover.

The proposed development impacts the RPAs of 5 trees T6, 7, 8, 9, 10. The directly impacted area is approximately 2.5% of the RPA for T6; 20% for T7; 20% for T8; 4% for T9; and 4% for T10. Arboricultural methodology must be followed in the area where the RPAs are located. Where excavation is required within RPAs non-mechanical excavation is proposed and cutting roots greater than 2.5cm diameter is to be avoided. Screw pile foundations are recommended with hand-dug pile, pad, or post locations down to a depth of 60cm and, if necessary, location adjusted to avoid cutting roots greater than 2.5cm diameter. A no dig surface methodology such as a 3D cellular confinement system is proposed to avoid negative impacts in other areas. Where this raises the level of the ground in any RPA a permeable surface material is recommended to allow air and water to percolate. As most of the rooting area for the tree is beyond the development footprint, it is considered that the long-term health and longevity of the tree will not be detrimentally affected.

It is not anticipated that the RPAs of other retained trees will be directly impacted by the work. However, in the event work is required which may encroach into any RPA, work must be non-mechanical excavation using hand tools or use a no dig surface method where excavation is not required. Arboricultural methodology must be adopted for any works in the RPAs of retained trees in case tree roots are discovered. It is anticipated that the impact of the proposed development can be satisfactorily mitigated against to ensure that there is no detrimental long-term impact to RPAs at the site. The RPAs of all trees on the site which are in the vicinity of, but out-with, the proposed development footprint can be safely protected from compaction or other disturbance by protective fencing and/or ground protection.

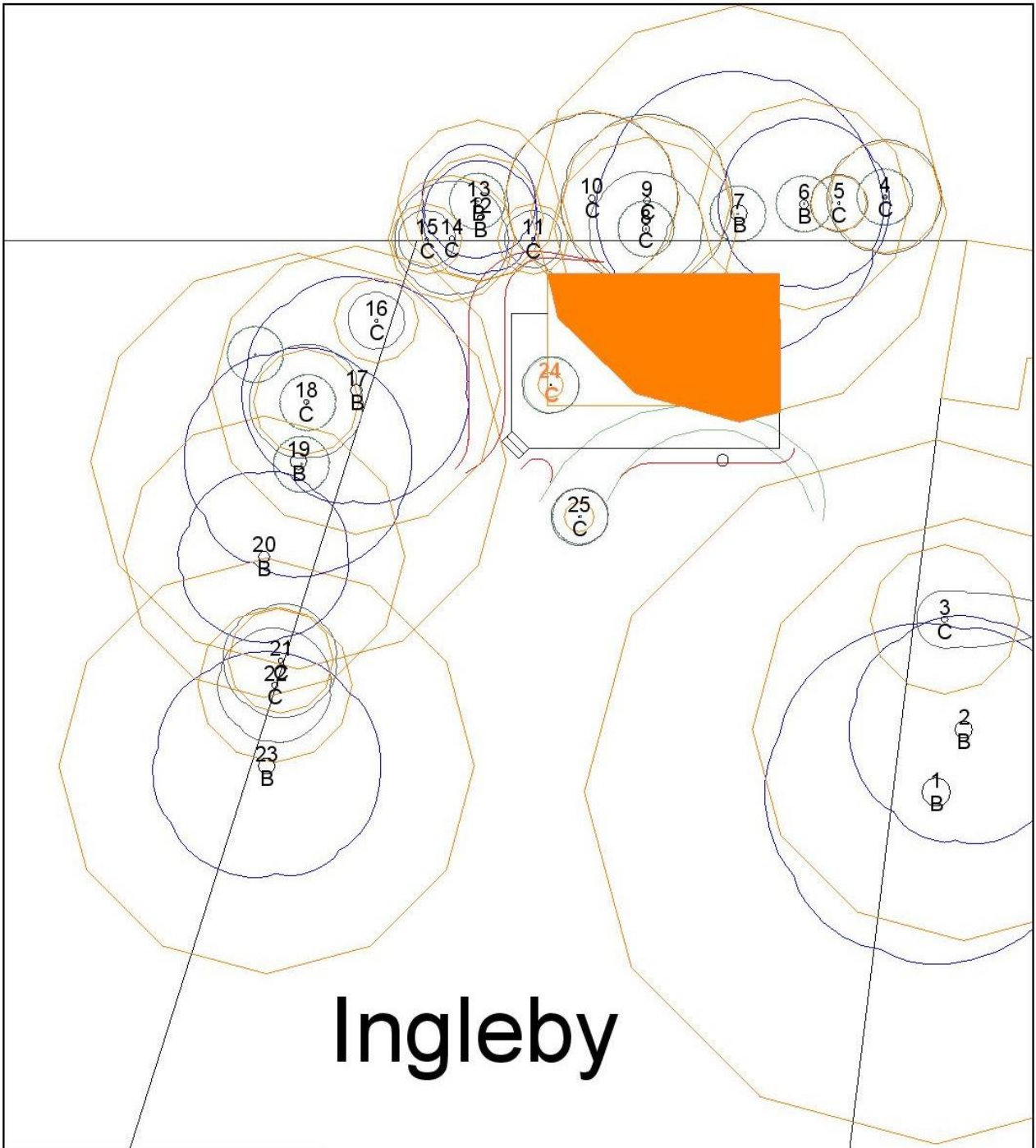
Tree-work management recommendations are proposed to remove hanging deadwood from T7 where it overhangs the garden. It is also recommended T1 is reduced/removed as it is causing damage to the boundary wall. N.B. Both trees are located out with the boundary of the site.

Tree protection specifications for tree protection barriers are provided, together with general advice on tree retention, working in RPAs, and an arboricultural method statement for tree works.

It is anticipated that the impact of the proposed development can be satisfactorily mitigated against to ensure that there is no detrimental long-term impact to retained trees at the site and that there will be no alteration in the existing tree cover.

4.6 ARBORICULTURAL IMPACT ASSESSMENT - see below and Arboricultural Impact Plan as separate pdf 2








An arboricultural impact assessment plan has been produced for the site. The trees were recorded as T1-25. One tree is proposed to be relocated, T24. Five trees have directly impacted RPAs, marked in solid orange, these are T6, 7, 8, 9, 10.



Ingleby

Key


- Impacted RPAs
- Trees to Relocate
- Trees to Remove

			
Crown Spread	Root Protection Area	Shading Arc	
			
Category 'A'	Category 'B'	Category 'C'	Category 'U'



Ingleby, St Eunan's Road, Aboyne

Arboricultural Impact Plan

SCALE : 1 : 200	@ A4	DATE : 31/12/2023
MAP FILENAME : Ingleby AIP		

Prepared by Tay Ecology Ltd
 Email: info@tayecology.co.uk
 Web: www.tayecology.co.uk

PART 5 – TREE PROTECTION PLAN

5.1 GENERAL

5.1.1 The client and agent shall ensure that:

- the site manager and all other personnel are provided with this document.
- all planning conditions relating to underground works, services, trees and landscaping are cleared before development commences.
- all requirements of this Tree Protection Plan are adhered to.
- the site manager is updated of any approved changes or variations to this document.

5.1.2 The client and site manager shall ensure that:

- a copy of this document with the tree protection plan is easily accessible for site personnel to refer to before and during the time construction activity is taking place.
- all personnel working on the site are made aware of the tree protection plan and arboricultural method statements covering any activities they will undertake. This duty includes delegating the task of briefing personnel in the absence of the site manager.
- The tree protection measures are left in place until the construction phase of development is completed, except with the written consent of the LPA.
- site personnel are updated of any approved changes to approved tree protection measures.

5.1.3 Procedures for incidents

If any breach of the approved tree protection measures occurs:

- The LPA Tree officer or other Planning Officer and Tay Ecology are informed.
- The site manager must be informed immediately.
- Swift action must be taken to halt the breach and prevent any further breach.
- Damage mitigation measures appropriate to the scale of incident, deployed where required.

5.1.4 Prohibited Activities

The following must not be carried out under any circumstances:

- Cutting down, uprooting, damaging or otherwise destroying any retained tree.
- Lighting a fire within 10 metres of the canopy of any retained tree.
- Equipment, signage, fencing, tree protection barriers, materials, components, vehicles, or structures shall not be attached to or supported by a retained tree.
- Mixing cement, chemical toilets and other use or storage of anything that would be harmful to trees shall not take place within, or close to a Root Protection Area (RPA). The distance away from the RPA must be sufficient, and site slope must be such that contamination of soil in the RPA would not occur if there were spillage, seepage, or displacement.
- No plant or vehicle with a hydraulic arm such as a mini digger shall be operated within striking distance of the stem and branches or the RPA of any retained tree unless otherwise specified.

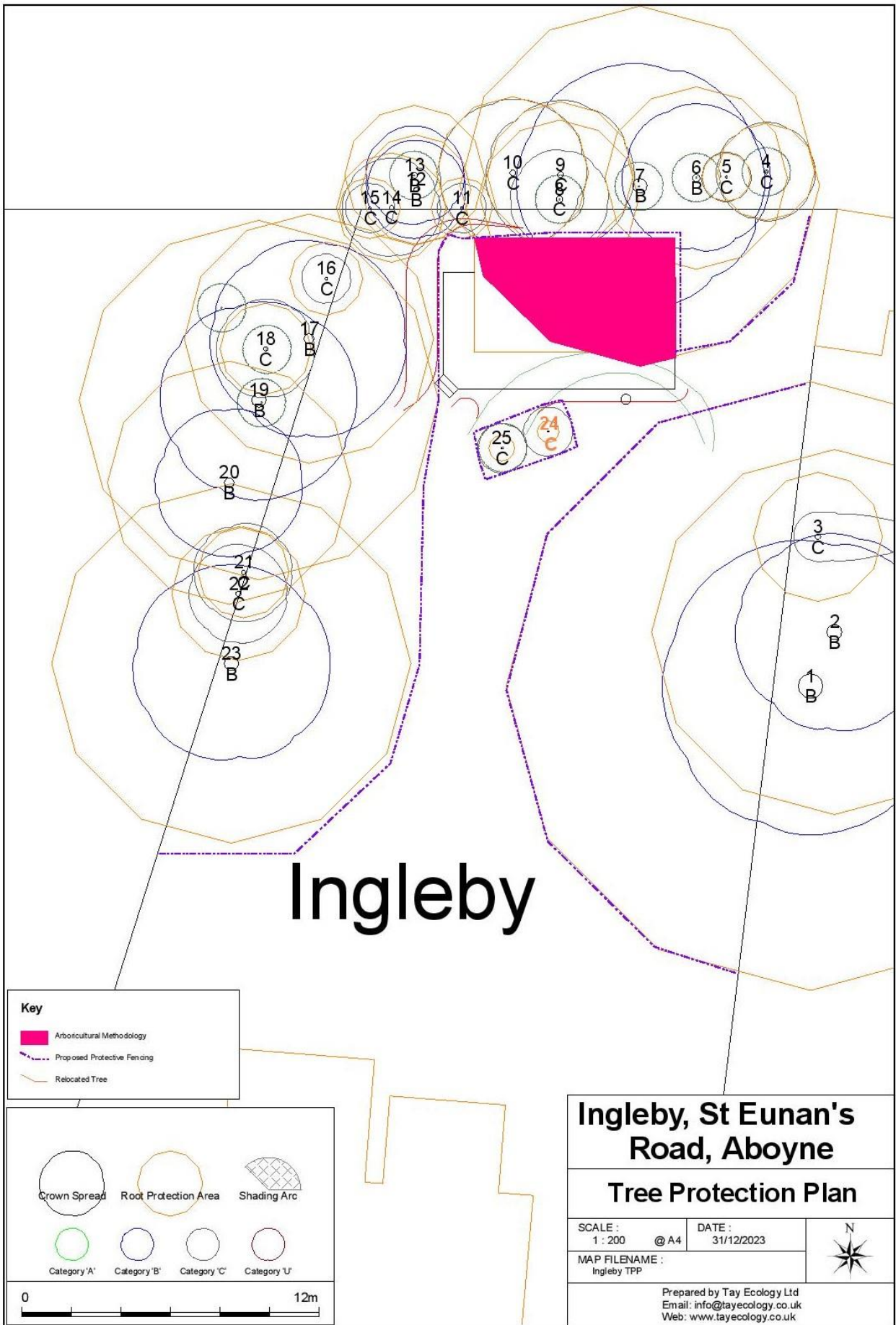
5.1.5 No alterations or variations shall be made to the approved tree protection measures without written approval from the LPA.

5.1.6 Timing and order of operations

The development must be carried out in the following order unless otherwise agreed in writing with the LPA. Each step must be completed before moving onto the next:

- i. Tree relocation.
- ii. Mark out RPAs of retained trees.
- iii. Installation of tree protection barriers and temporary ground protection.
- iv. Construction.
- v. Removal of the remaining ground protection and barriers.

5.2 TREE PROTECTION PLAN - see below and Tree Protection Plan separate pdf 3



5.3 PROTECTIVE BARRIERS AND GROUND PROTECTION

5.3.1 Protective barriers, ideally at the limit of the RPA, or in positions to be agreed within the RPA once further detailed proposals are available, are required to enclose a sufficient RPA to ensure that trees to be retained survive the development process. The aim of any barrier is to exclude any construction activity which may damage tree health. Appropriate distances to be measured from the base of trees are as in the Tree Survey Schedule RPA.

5.3.2 Any barriers shall be installed and removed in accordance with the timing of operations above and laid out in accordance with the appended Tree Protection Plan. The appended notice, Appendix 5 Tree Protection Notice, should be used to create all weather notices that must be added to the tree protection barriers or suitable intervals. In the event of any panel or support becoming damaged, this must be immediately reinforced by adding panels with the designs below as appropriate.

5.3.3 Tree protection barriers

The default specification is a vertical and horizontal scaffold framework, braced to resist impacts, Appendix 3. The vertical tubes are spaced at a maximum interval of 3m and these are driven securely into the ground. Welded mesh panels are securely attached to the frame. During installation it is important to consider the position of below ground services and structural roots, which must not be damaged. Where these constraints prevent the use of this specification, an alternative specification is given.

5.3.4 Alternative tree protection barrier design

2 metres high welded mesh panels standing in rubber or concrete feet joined using a minimum of two anti-tamper couplers installed so they can only be removed from inside the protected area. The fence couplers should be spaced at least 1m apart, but uniformly across the whole barrier. These panels must be supported within the protected area with struts attached to a base plate secured by ground pins, Appendix 3.

5.3.5 Protective barriers should be adapted to fit the site requirements and may include improvised structures around specific trees.

5.3.6 The supervising tree consultant should confirm that the tree protection barriers have been installed as agreed before any significant site work starts.

5.4 ARBORICULTURAL METHOD STATEMENT FOR WORK WITHIN RPAS

5.4.1 Where it has been agreed during the design stage, and shown on the tree protection plan, that vehicular or pedestrian access for the construction operation may take place within the RPAs, the possible effects of construction should be addressed by a combination of barriers and ground protection. The position of the barrier may be shown within the RPAs at the edge of the agreed working zone but the soil structure beyond the barrier to the edge of the RPAs should be protected with ground protection. Where intermittent work within the RPA occurs on existing hard surfaces no additional root protection is required.

5.4.2 BS 5837:2012 allows for the use of ground protection in conjunction with protective fencing. Where temporary access for small scale machinery is needed within the RPAs ground protection should be used. Ground protection should be of sufficient strength and rigidity to prevent soil disturbance and compaction. A geotextile membrane should be used to prevent contamination of soil below by toxic substances.

5.4.3 For pedestrian movements within the RPAs the installation of ground protection in the form of a single thickness of scaffold boards on top of a compressible layer laid onto a geotextile or

supported by scaffold is acceptable. For wheeled or tracked movements within the RPAs the ground protection should be designed by an engineer to accommodate the likely loading and may involve the use of proprietary systems or reinforced concrete slabs.

5.4.4 The supervising tree consultant should confirm that the ground protection has been installed as agreed before any significant site work starts.

5.4.5 Where excavation is required within RPAs non-mechanical excavation is proposed and cutting roots greater than 2.5cm diameter is to be avoided. Screw pile foundations are recommended with hand-dug pile, pad, or post locations down to a depth of 60cm and, if necessary, location adjusted to avoid cutting roots greater than 2.5cm diameter. The diameter and the distribution of the supports will be minimised to reduce the risks of disturbance during the installation. The bases of such structures will allow for air and water input beneath through ventilation and irrigation provision.

5.4.5.1 Any tree roots found up to 25mm diameter can be pruned back with sharp secateurs leaving a wound of the smallest diameter possible. If any roots over 25mm are found, these must be retained undamaged, and further advice sought from the supervising tree consultant. Cut exposed roots to be removed cleanly 10-20cm behind the final face of the excavation. Protect roots temporarily exposed, but to be retained, from drying out by covering with damp hessian sacks or boards. Use an inert granular material mixed with top-soil or sharp sand around retained roots greater than 25mm width before light compaction.

5.4.6 Where any surfacing encroaches into the RPAs and no excavation is required, a no-dig surface is preferentially recommended where 20% or less of the RPA will be impacted. The design of such a construction needs to be sensitive to the requirements of tree roots, substantial enough to withstand the proposed structure and practicable in terms of ease of fabrication. The no-dig method involves construction of a surface with no excavation or soil stripping. All construction takes place above ground level. Appendix 6 Example of no-dig surface installation method.

5.4.6.1 BS 5837 recommends that three-dimensional cellular confinement systems are an appropriate sub-base for installing surfacing in RPAs. Most products are made from heavy-duty plastic that is pulled apart to open into cells. These are then filled with washed stone, after the product is spread over the ground and pinned in place. This forms a base layer that acts as a floating raft, spreading the load across the whole construction width. The base layer can be topped with a variety of finishes.

5.4.6.2 Tay Ecology is not qualified to recommend any specific construction method in terms of durability or structural integrity and any proposed construction should be approved by a structural engineer prior to implementation, however, with regards to trees, the following comments are made:

- Severance of roots and soil compaction should be avoided.
- Air and water must be able to diffuse into the soil beneath the engineered surface. Toxic substances which could leach into the ground must be avoided, as should substances which affect the pH value of the soil, for example limestone.

5.4.6.3 Existing ground vegetation may be killed using a suitable herbicide. Care must be taken to select a herbicide which does not damage the tree roots within the treated area. Once the vegetation has died, the dead organic matter should be removed. This helps prevent the future build-up of anaerobic conditions or settlement due to decomposition.

5.4.7 For any landscaping in RPAs avoid soil compaction around existing trees. Any cultivation within RPAs should be undertaken by hand, but no heavy mechanical cultivation should occur. Decompaction measures if required include forking, spiking, soil augering and tilted radial trenching.

5.4.8 To prevent pollution in RPAs make provision for emergency spillage clean-up; mix cement and wash vehicles as far away from RPAs as possible; use bunding and impermeable membranes to prevent liquid contaminants reaching RPAs; use impermeable membranes to prevent leachates from poured concrete contaminating RPAs; keep pollution control measures in place until there is no significant risk of RPA contamination.

5.4.9 Summary of arboricultural supervision

Mark out the RPAs of retained trees.

Ensure that the tree protection barriers are installed and fixed to the ground in the correct position and as specified.

Oversee any excavation required within RPAs.

Ensure that any cellular containment system is installed as per the manufacturers

Recommendations.

Undertake regular site visits to ensure that the works are in accordance with the Tree Protection Plan and Arboricultural Method Statement.

PART 6 – REFERENCES

BSI Standards Publication, 2012 “*British Standard 5837:2012 Trees in relation to design, demolition and construction – Recommendations*”

BSI Standards Publication, 2010 “*British Standard 3998:2010 Tree work – Recommendations*”

Rose, B., 2020 “*The Use of Cellular Confinement Systems near Trees: A Guide to Good Practice*”
Arboricultural Association Guidance Note 12

PART 7 – APPENDICES

Appendix 1 – Terms and Definitions p.20

Appendix 2 – Tree Category Codes p.21

Appendix 3 – Protective Fencing Specifications p.22-23

Appendix 4 – Installing Services in RPAs p.24-31

Appendix 5 – Example of No Dig Surface Method p.32-37

Appendix 6 – Tree Protection Notice p.38

APPENDIX 1 TERMS AND DEFINITIONS

1.0 Arboricultural Method Statement

Guidelines for specified working operations near trees to avoid any harmful impact as defined within BS 5837:2012, may cover works from tree work to operating cranes, installing foundations or services and guidelines for engineering performance to function as a tree protection measure.

1.1 Ground Protection

In this context the term refers to a method for preventing the ground from being disturbed, usually within the Root Protection Areas of retained trees. Other uses include protection areas to be planted. The way ground protection should be designed to perform is typically described within an Arboricultural Method Statement.

1.2 Root Protection Area (RPA)

A minimum recommended area for tree protection in 'BS 5837:2012 Trees in Relation to Construction'. In these areas works should be avoided where possible. Where work in these areas cannot be avoided, it should be carried out in accordance with a Tree Protection Plan and / or Arboricultural Method Statement.

1.3 Tree Constraints Plan

As defined within BS 5837:2012. This plan shows above and below ground constraints that may impact on a planning proposal such as the tree branch spread and Root Protection Area.

1.4 Tree Preservation Order (TPO)

A type of land charge which specifies certain trees for protection under the Town and Country Planning Act (1990) that makes it necessary to make an application to the LPA to work on them (with notable exceptions) and a criminal offence to otherwise damage or destroy them.

1.5 Conservation Area

Normal TPO procedures apply, if a tree is not covered by a TPO, written notice to the LPA detailing any proposed work must be given at least 6 weeks before work starts. Notice of work is not required where the tree has a diameter of less than 75mm, measured 1.5m above the ground, or 100mm diameter if thinning to enable the growth of other trees.

APPENDIX 2 TREE CATEGORY CODES

Cascade chart for tree quality assessment from BS 5837:2012

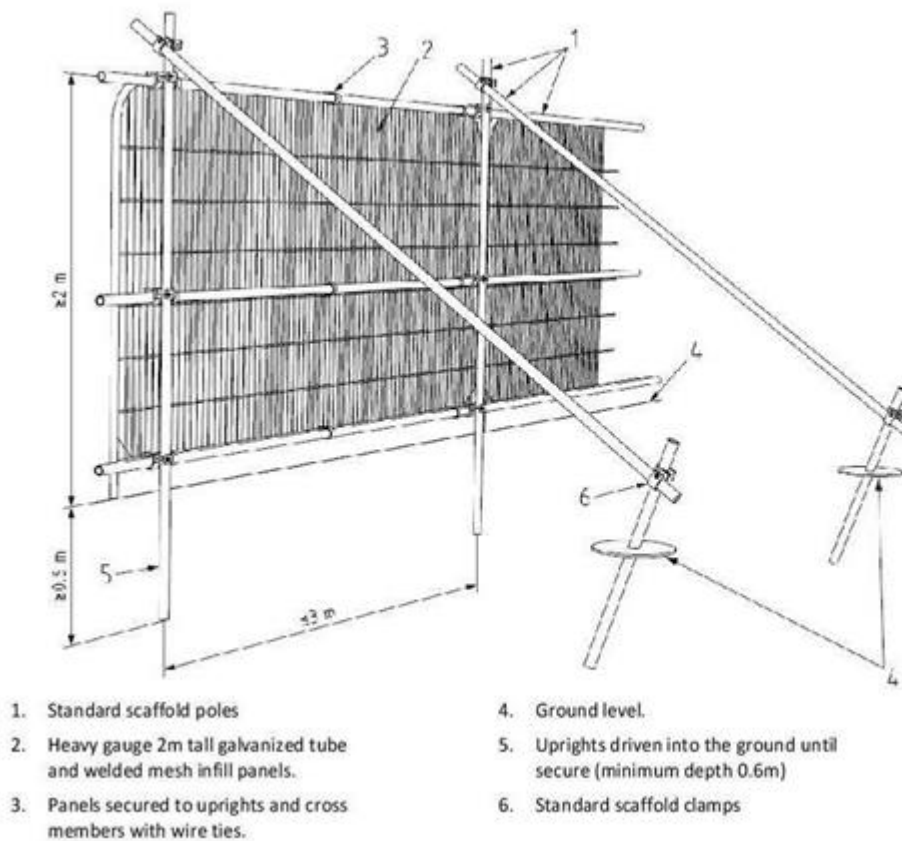
Category and definition	Criteria (including subcategories where appropriate)			Identification on plan
Trees unsuitable for retention				
Category U Those in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years.	<p>Trees that have a serious, irremediable, structural defect, such that their early loss is expected due to collapse, including those that will become unviable after removal of other category U trees (eg. Where, for whatever reason, including the loss of companion shelter cannot be mitigated by pruning)</p> <p>Trees that are dead or are showing signs of significant, immediate and irreversible overall decline.</p> <p>Trees infected with pathogens of significance to tree health and/or safety of other trees nearby, or very low-quality trees suppressing adjacent trees of better quality. <i>NOTE Category U trees can have existing or potential conservation value which it might be desirable to preserve.</i></p>			Dark red
Trees to be considered for retention				
	1 Mainly arboricultural qualities	2 Mainly landscape qualities	3 Mainly cultural values, including conservation	
Category A Trees of high quality with an estimated remaining life expectancy of at least 40 years.	Trees that are particularly good examples of their species, especially if rare or unusual; or those that are essential components of groups or formal or semi-formal arboricultural features (eg. The dominant and/or principal trees within in an avenue).	Trees groups or woodlands of particular visual importance as arboricultural and/or landscape features.	Trees, groups or woodlands of significant conservation, historical, commemorative or other value (eg. Veteran trees or wood-pasture).	Light green
Category B Trees of moderate quality with an estimated remaining life expectancy of at least 20 years.	Trees that might be included in category A but are downgraded because of impaired condition (eg. Presence of significant though remediable defects, including unsympathetic past management and storm damage), such that they are unlikely to be suitable for retention for beyond 40 years; or trees lacking the special quality necessary to merit the category A designation.	Trees present in numbers, usually growing as groups or woodlands, such that they attract a higher collective rating than they might as individuals; or trees occurring as collectives but situated so as to make little visual contribution to the wider locality.	Trees with material conservation or other cultural value.	Mid blue
Category C Trees of low quality with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter of below 150mm.	Unremarkable trees of very limited merit or such impaired condition that they do not qualify in higher categories.	Trees present in groups or woodlands, but without this conferring on them significantly greater collective landscape value; and/or trees offering low or only temporary/transient landscape benefits.	Trees with no material conservation or other cultural value.	Grey
<i>NOTE: Whilst 'C' category trees will usually not be retained where they would impose a significant constraint on development, young trees with a stem diameter of less than 150 mm should be considered for relocation.</i>				

APPENDIX 3 PROTECTIVE FENCING SPECIFICATION

5.2.3 The default specification is a vertical and horizontal scaffold framework, braced to resist impacts, as per figure 1 below. The vertical tubes are spaced at a maximum interval of 3m and these are driven securely into the ground. Welded mesh panels are securely attached to the frame. During installation it is important to consider the position of below ground services and structural roots, which must not be damaged. Where these constraints prevent the use of this specification, an alternative specification is given below.

Figure 1 is taken from BS5837:2012 ‘Trees in Relation to Design, Demolition & Construction – Recommendations’ and illustrates the systems to be employed for ensuring an adequate Construction Exclusion Zone about retained trees. Refer to BS5837:2012 for further details.

Figure 1 – default tree protection barrier specification



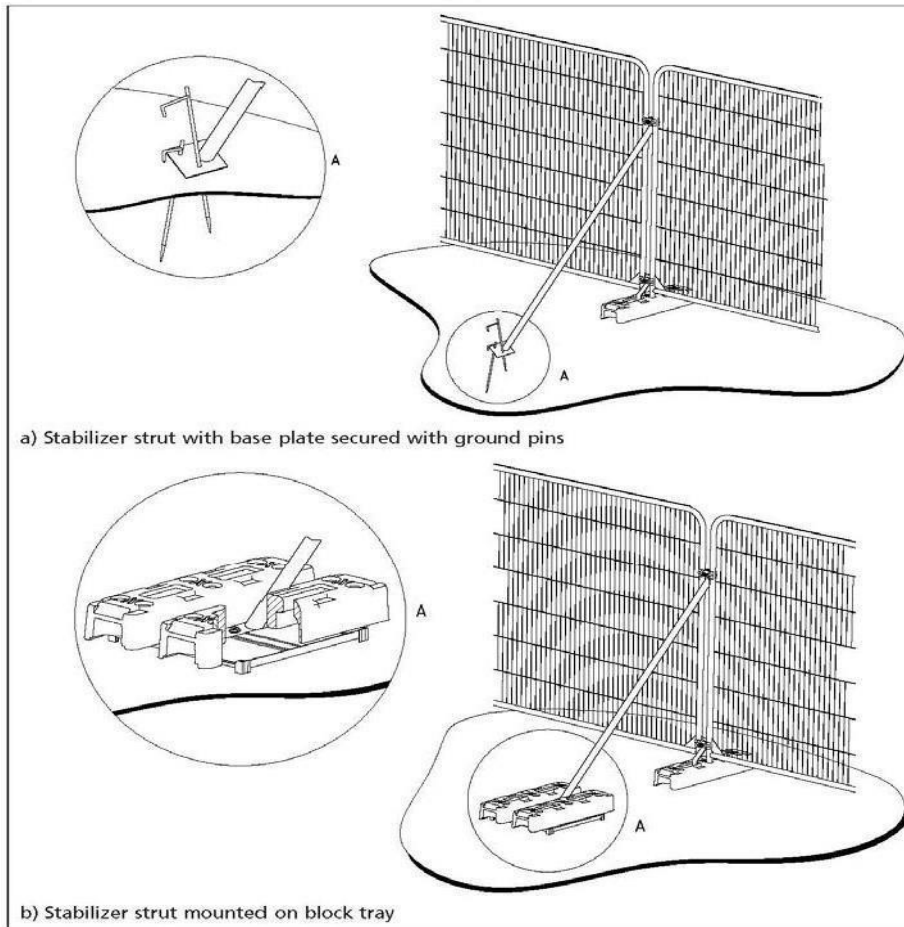
5.2.4 Alternative tree protection barrier design

2 metres high welded mesh panels standing in rubber or concrete feet joined using a minimum of two anti-tamper couplers installed so they can only be removed from inside the protected area. The fence couplers should be spaced least 1m apart, but uniformly across the whole barrier. These panels must be supported within the protected area with struts attached to a base plate secured by ground pins as per figure 2a.

Where the fencing is installed above retained hard surfacing and/or it is otherwise not feasible to use ground pins (e.g., due to underlying services or structural roots), the struts can be mounted on a block tray as per figure 2b.

Figure 2 is taken from BS5837:2012 Trees in Relation to Design, Demolition & Construction – Recommendations and illustrates the systems to be employed for ensuring an adequate Construction Exclusion Zone about retained trees. Refer to BS5837:2012 for further details.

Figure 2 – above ground stabilising systems



APPENDIX 4A INSTALLING SERVICES IN RPAs

Site guidance note 11:
Installing services in root protection areas

barrell
TREE CONSULTANCY



Site Guidance Note 11: Installing services in root protection areas

This document is only a summary of its subject matter. You should not rely on this general guidance in isolation, and you should always seek detailed advice from an appropriate expert in relation to specific circumstances before any action is taken or refrained from. The content of these pages is protected by copyright © Barrell Treecare Ltd 2018. You may download and republish (in its full format) and print copies of the guidance – but you must not adapt any guidance.

SGN 11: Summary guidance for site operatives

Administration

1. **Unauthorised damage to protected trees is a criminal offence and could lead to enforcement action.**
2. **Work under the normal site risk assessment procedures and comply with the wider site safety rules.**
3. **Brief operatives entering root protection areas (RPAs) by the supervising arboriculturist before work starts.**

Other relevant SGNs

4. **Monitor works in RPAs by the supervising arboriculturist (See SGN 1 Monitoring tree protection).**
5. **Design access to avoid soil compaction (See SGN 3 Ground protection).**
6. **Minimise excavation into original undisturbed soil (See SGN 7 Excavation in root protection areas).**

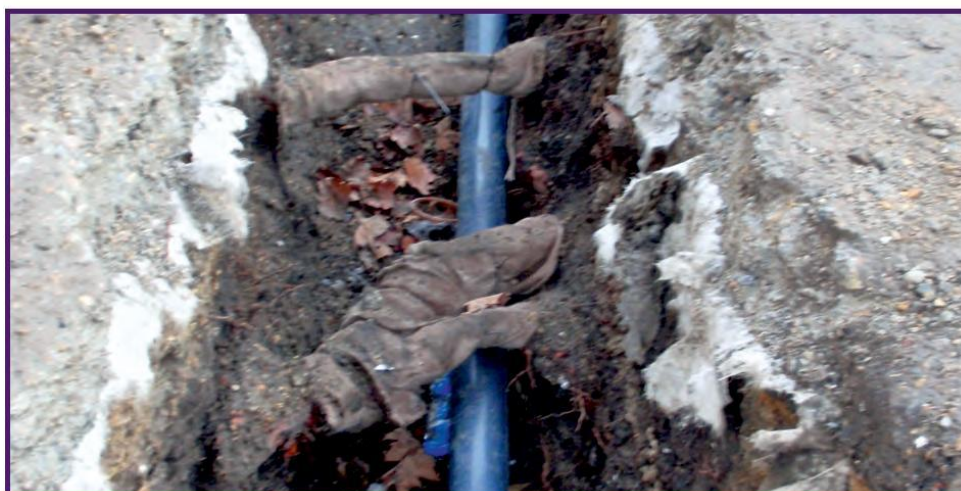
Important reminders

7. **Trenchless installation will be preferred. The fall-back approaches of hand-dug broken trench and then hand-dug continuous trench, will be acceptable if agreed by the supervising arboriculturist.**
8. **For trenchless installation, the starting and finishing pits will be outside RPAs.**

SGN 11: Explanatory notes and examples

Purpose

SGN 11 describes the practical requirements for installing new services within RPAs, based on the recommendations in BS5837 (7) and the guidance in NJUG (4.1).



General principles and clarifications

Excavation to upgrade existing services or install new services in RPAs may damage retained trees. Where possible, all services will be outside RPAs and installation in RPAs will only be chosen as a last resort. If installation within RPAs is being considered, as advised in 4.1.3 of the NJUG guidance, the decision will be made in consultation with the supervising arboriculturist before any work is carried out. If service installation is agreed within RPAs, the NJUG protocol as set out in 4.1.3 of its guidance will be used to decide the most appropriate method. In summary, this sets out that “Acceptable techniques in

order of preference are; a) trenchless, ... b) Broken trench – hand-dug ... c) Continuous trench – hand-dug”. If trenchless methods are to be used, the starting and finishing pits dug at each end of the service run will be outside RPAs. Where a hand-digging option is agreed, any roots discovered during the excavations will be dealt with as described in SGN 7 (Excavation in root protection areas). Backfilled material around excavated services will not be heavily compacted, observing the specific advice provided in 4.1.5 of the NJUG guidance.

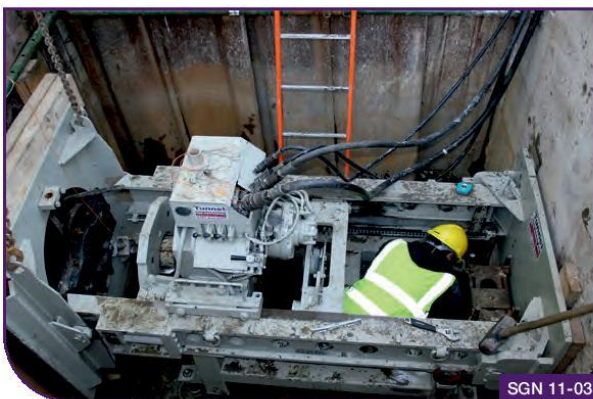
SGN 11: Explanatory notes and examples



Conventional installation of services digging a trench with a machine is **not permitted** in RPAS.



Trenching with machines to install services close to trees can make them unsafe and cause their premature death.



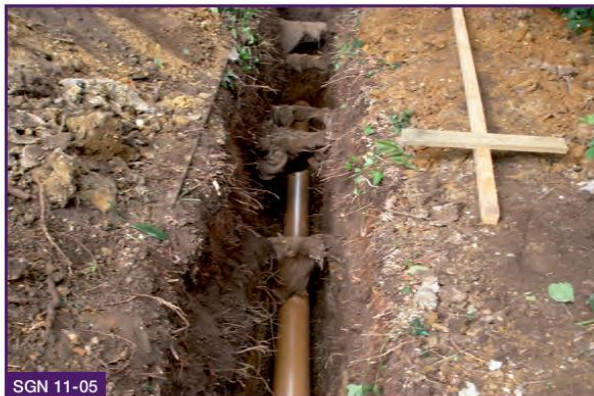
Thrust boring is the preferred option for installing service routes through the RPAs of retained trees.

SGN 11: Explanatory notes and examples

The start and finish pits for thrust boring are substantial and must be outside of RPAs.



Alternatives to thrust boring are to hand-dig broken or continuous trenches, so that roots can be retained (with the service ducting threaded beneath). Note the ground protection boards with soil piled on top on the left.



Ducting services that have to be threaded through existing roots is good practice because it reduces the need to excavate in the future. Note the hessian protection over roots while they are temporarily exposed to prevent sunscorch and drying.



SGN 11: Explanatory notes and examples

Technical reference

Due to copyright restrictions, the relevant British Standard clauses are summarised, not quoted, as follows:

1. **BS 5837 (2012) Trees in relation to design, demolition and construction – Recommendations:**

Clause 7 (Demolition and construction in proximity to existing trees) recommends:

- 7.1.3 *The installation of underground utility apparatus using trenchless technology will be acceptable where entry and retrieval pits can be formed outside the RPA. Even if the utility installation does not require planning permission, the work should still be undertaken in accordance with the guidance in NJUG Volume 4, issue 2.*
- 7.7.1 *Care should be taken when routing underground apparatus because the mechanical trenching can sever roots and change the local soil hydrology, both of which can adversely affect tree health. Wherever possible, underground services should be routed outside RPAs. If services are installed within RPAs, it is preferable to use common ducts, with inspection chambers sited outside the RPA.*
- 7.7.2 *Underground services within the RPAs should be shown on a plan prepared in conjunction with the project arboriculturist. Trenchless insertion methods should be the preferred option, with entry and retrieval pits outside RPAs, but if roots can be retained and protected, excavation using hand-held tools might be acceptable for shallow service runs.*

2. **National Joint Utilities Group (“NJUG”) Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees – Issue 2** (www.njug.org.uk/wp-content/uploads/2016/09/V4-Trees-Issue-2-16-11-2007.pdf): Section 4.1 (How to avoid damage to trees – Below ground) advises:

“4.1.3 Realignment: Whenever possible apparatus should always be diverted or re-aligned outside the Prohibited or Precautionary Zones. Under no circumstances can machinery be used to excavate open trenches within the Prohibited Zone.

Where works are required for the laying or maintenance of any apparatus within the Prohibited or Precautionary Zones there are various techniques available to minimise damage. Acceptable techniques in order of preference are;

- a) *Trenchless: Wherever possible trenchless techniques should be used. The launch and reception pits should be located outside the Prohibited or Precautionary Zones. In order to avoid damage to roots by percussive boring techniques it is recommended that the depth of run should be below 600mm. Techniques involving external lubrication of the equipment with materials other than water (e.g. oil, bentonite, etc.) must not be used when working within the Prohibited Zone. Lubricating materials other than water may be used within the Precautionary Zone following consultation and by agreement.*

SGN 11: Explanatory notes and examples

b) Broken Trench – Hand-dug: This technique combines hand dug trench sections with trenchless techniques if excavation is unavoidable. Excavation should be limited to where there is clear access around and below the roots. The trench is excavated by hand with precautions taken as for continuous trenching as in (c) below. Open sections of the trench should only be long enough to allow access for linking to the next section. The length of sections will be determined by local conditions, especially soil texture and cohesiveness, as well as the practical needs for access. In all cases the open sections should be kept as short as possible and outside of the Prohibited Zone.

c) Continuous Trench – Hand-dug: The use of this method must be considered only as a last resort if works are to be undertaken by agreement within the Prohibited Zone. The objective being to retain as many undamaged roots as possible.”

APPENDIX 4B AIR SPADE

The use of a compressed air-powered tool, or AirSpade, facilitates excavation, soil management, and tree healthcare within RPAs. Air-spading is a form of non-mechanical excavation which efficiently removes or loosens soil without damaging a tree's root system.

AirSpade is a purpose-built excavation tool which penetrates soil with compressed air that expands rapidly to fracture the soil. Air-spading can cause some temporary loss of beneficial mycorrhizal fungi; in order to help repopulate these important organisms, adding a broad-spectrum mix of mycorrhizal fungi spores to exposed tree roots after any Air Spade work is recommended.

Example AirSpade from AVArboriculture



APPENDIX 5 EXAMPLES OF 3D CELLULAR CONFINEMENT SYSTEMS

Tree Root Protection Using Cellweb TRP®

Fact Sheet 2: Water and Oxygen Transfer Through the Cellweb TRP® System



Water and Oxygen Transfer Through the System

Water and oxygen are the lifeblood of trees without which they will wither and die. It is important to design developments in and around the root protection area (RPA) of existing trees to maximise the availability of water and oxygen to the roots. This can be achieved in a number of ways using the Cellweb TRP® tree root protection system.

The main causes of reduced water and oxygen availability for tree roots are:

- Compaction of the soil around the roots
- Covering the ground surface with impermeable cover which prevents water infiltration.

Both of these effects can be reduced or prevented by using Cellweb TRP® tree root protection within an appropriately designed road or car park surface.

Compaction of Soil

The use of Cellweb TRP® tree root protection system for building roads, car parks and other vehicular pathways includes a sub-base infill material of 20mm to 40mm or 4mm to 20mm clean angular stone which does not need to be compacted. This immediately provides a layer of material that will absorb compaction energy applied to the top of materials placed over it. Cellweb TRP® also spreads the wheel loads from traffic which reduces compaction, thus maintaining the soil bulk density at levels that are suitable for tree root growth.

The effectiveness of the Cellweb TRP® no-dig construction in reducing soil compaction has been demonstrated in trials carried out by the Environmental Protection Group Limited (See Fact Sheet 1).

Water and Oxygen Availability

The Cellweb TRP® tree root protection system is constructed using 20mm to 40mm or 4mm to 20mm gravel infill and has perforated cell walls. The pore spaces between the aggregate particles are greater than 0.1mm in diameter and are therefore defined as macropores (Roberts 2006). This open structure is far more permeable than typical soils and allows the free movement of water and oxygen within it so that supplies to trees are maintained as shown in Figure 1. The use of continuous permeable surfacing and intermittent gaps in impermeable surfacing are recognised ways of providing water and air infiltration pathways through a pavement surface into the tree root zone (Ferguson 2005).

The Cellweb TRP® system incorporates the Treetex® geotextile at the base. This is a very robust geotextile that is resistant to puncturing. Crucially for tree root protection it does not have a water breakthrough head that other geotextiles may have. Therefore it will always be free draining and will not limit oxygen availability to the roots.

Breakthrough Head

All geotextiles are by their nature permeable, however in order to develop optimum water-flow performance, some types of geotextiles (eg, thermally bonded types) require a minimum depth of water to develop over them.

Therefore a layer of up to 50mm of water can build-up over some geotextiles after rainfall. Treetex® needle punched geotextiles however remains free draining at all times as it has "zero breakthrough head" which means it does not require a build up of water to permeate.

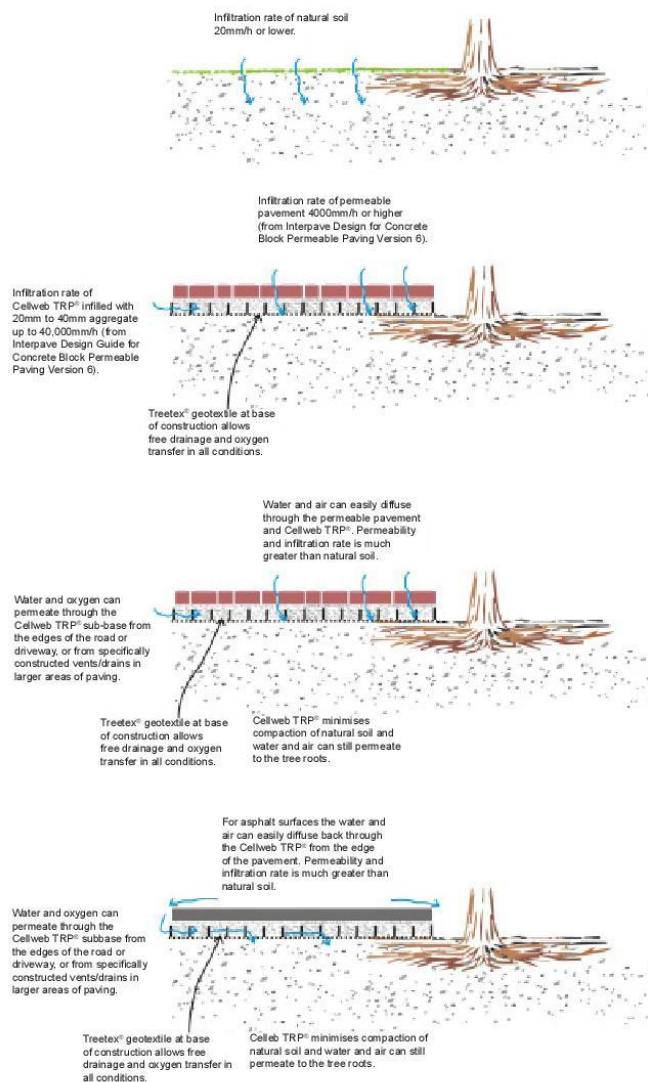


Figure 1 Water and oxygen availability in Cellweb TRP® tree root protection pavements



Tree Root Protection Using Cellweb TRP®

Fact Sheet 2: Water and Oxygen Transfer Through the Cellweb TRP® System



If the Cellweb TRP® sub-base layer is covered by a layer of permeable block paving the rate of oxygen transfer through the system is estimated to be around 1×10^{-4} g/s/m² using simple diffusion theory. For a natural sandy soil the rate of transfer to the same depth is around 7×10^{-5} g/s/m². Therefore even on the most aerated of natural soils the Cellweb TRP® tree root protection system does not restrict oxygen supply to tree roots.

Water ingress will also be maintained at the levels similar to a natural sites as water simply passes through the pavement. Permeable block paving and porous asphalt have infiltration rates that are very large (typically > 2500mm/h) in comparison with most rainfall events. The infiltration rate is also far higher than natural soils (infiltration rate for sand is quoted as >20mm/h by Hillel 1998). Thus the pavement allows rainfall to soak into the soil as it would naturally (there will be some reduction as some water soaks into the blocks and gravel as the rainfall passes through).

TABLE 1 - CHARACTERISTICS OF ROOT SYSTEMS OF MATURE EUROPEAN BROADLEAVED AND CONIFEROUS TREE SPECIES GROWING ON WELL AERATED, SANDY SOILS

Species	Tolerance to Oxygen Deficiency	Species	Tolerance to Oxygen Deficiency
Ash	Medium-high	Japanese Larch	Medium
Aspen	High	Lime	Low
Birch	Low	Norway Maple	Medium
Beech	Low	Norway Spruce	Very low
Common Alder	High	Red Oak	Medium-high
Corsican Pine	--	Scots Pine	Medium
Douglas Fir	Medium-low	Sessile Oak	High
English Oak	High	Silver Fir	High
European Larch	Medium	Sycamore	Low
Hornbeam	Medium	White pine	Very low

From Roberts et al (2006)

If the Cellweb TRP® is covered by impermeable asphalt or similar materials the aeration of the sub-base can be promoted from the side of a paved area. This is achieved using gravel filled conduits to connect the sub-base to the surface, allowing oxygen into the layer from where it can freely travel to the root area. Open areas that are normally provided immediately around the tree will also be beneficial in allowing oxygen into the Cellweb TRP® layer. Oxygen can flow horizontally through the Cellweb TRP® because of the perforated walls.

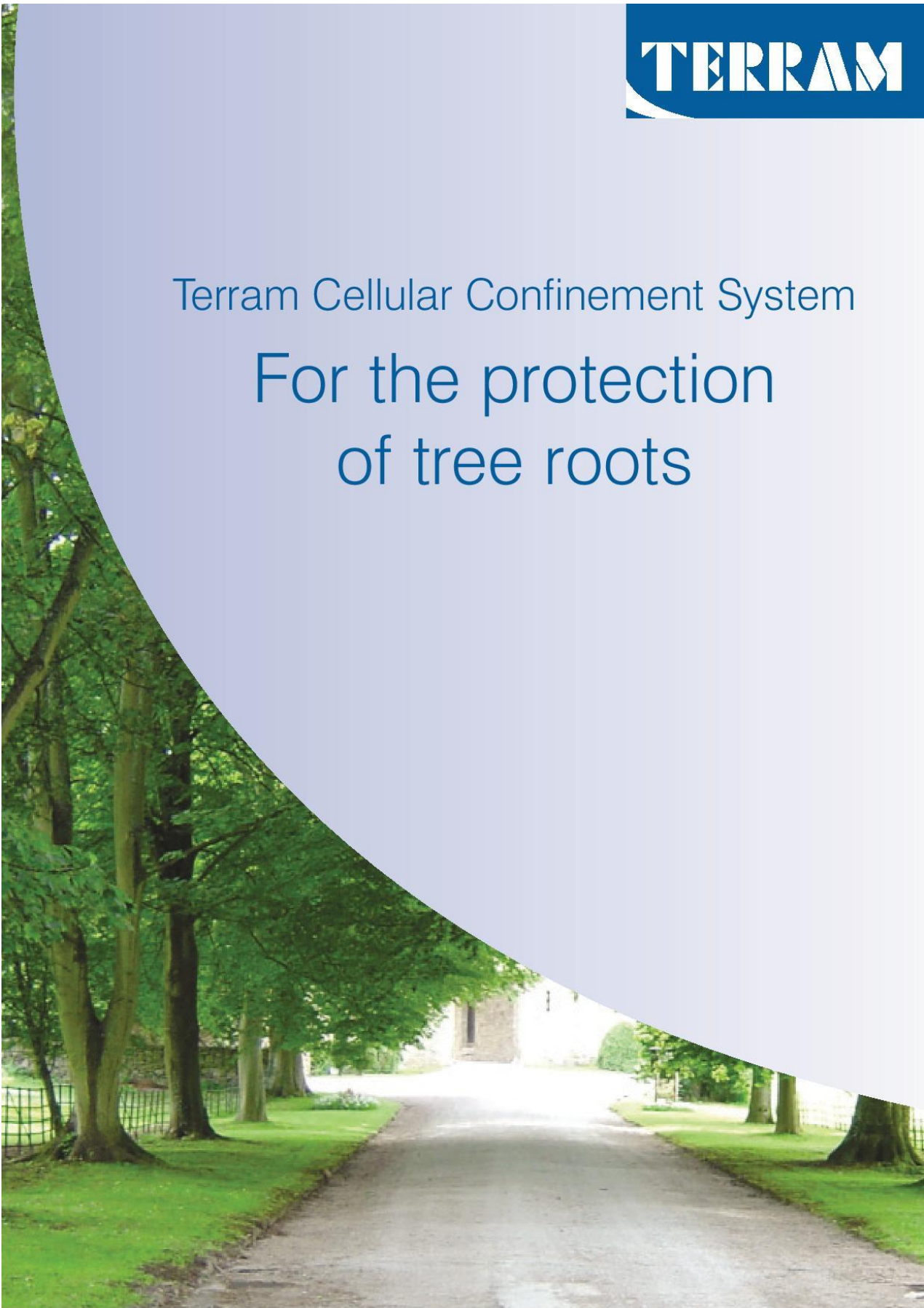
Notwithstanding the above, some trees are more tolerant than others to a deficit of oxygen (Table 1). The use of permeable surfaces over the Cellweb TRP® is advisable where pavements are to be constructed over trees with a low tolerance to oxygen deficit.

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A photograph of a paved road lined with mature trees, viewed from a low angle looking down the road. The image is partially obscured by a light blue curved overlay that contains the text.

Terram Cellular Confinement System
For the protection
of tree roots

Cellular Confinement Systems

The perfect no-dig ground reinforcement system.
Provides above-ground load bearing for paths and driveways
whilst preventing soil compaction and protecting tree roots.

Damage to tree roots during driveway construction

The conventional method for constructing paths, drives and roads involves excavating soil to enable the installation of a sub-base that will adequately support traffic loads. Unfortunately this method of construction can badly damage trees since a by-product of the excavation is root severance. Most people don't realise that trees are very sensitive to disturbances in the soil around them. The reason for this is that, contrary to popular belief, trees do not have massive roots that go down deep into the soil but rather have lots of relatively small roots (frequently only a few centimetres in diameter) which spread out from the tree very close to the soil surface for quite large distances (often equal to the height of the tree).



If you imagine a tree system as a wine glass standing on a dinner plate you will have a roughly accurate idea of the above and below ground proportions of a tree (Figure 1). It may come as a surprise to learn that about 80-90% of all tree's roots are in the upper metre of soil (Figure 2). These roots serve two purposes: anchorage and absorption of moisture. If even relatively small roots are severed, for example by digging a trench, the tree can begin to suffer symptoms of drought stress as it is no longer able to obtain all its water needs. In addition the tree may become unstable as cutting the roots is a bit like cutting the guy ropes on a tent.

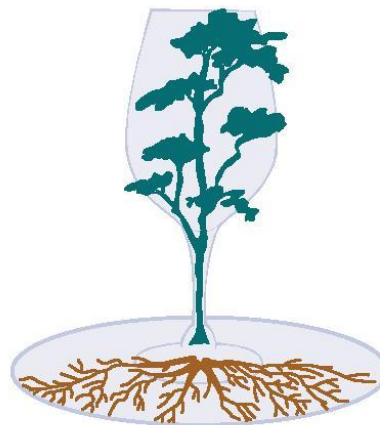


Figure 1

It is not only root severance that may harm trees but also compaction of the soil. If the root zone of a tree is not protected during development then the soil may become compacted by vehicles or heavy machinery moving repeatedly over the ground (Figure 3). The effect of compaction is to close up pores in the soil which contain air and water. The tree's roots then begin to suffer from both a lack of oxygen and a lack of moisture, and, as the soil becomes denser, roots find it hard to penetrate the soil. All this can lead to a dieback of the root system and frequently dieback of the tree. Raising of soil levels has a similar damaging effect as it deprives roots of oxygen and creates a build up of harmful carbon dioxide around the roots.

So, How Do Tree Roots Grow?

People often wrongly assume that tree roots are thick and grow down into the soil for many metres (Figure A). In reality tree roots:

- Are usually only large near to the trunk and get thinner the deeper and further from the tree they go. At a distance of just 3-4 metres from the trunk most roots are no bigger than a few centimetres in diameter.
- Spread outwards from the trunk, more or less parallel with the soil surface, rather than growing downwards (Figure B).
- Can spread horizontally in any direction for a distance equivalent to at least the tree's height.
- Are usually relatively shallow; 80-90% of a tree's roots are in the upper metre of soil. Few roots reach depths of more than about 2-3 metres and at this depth they are only a few millimetres in diameter.

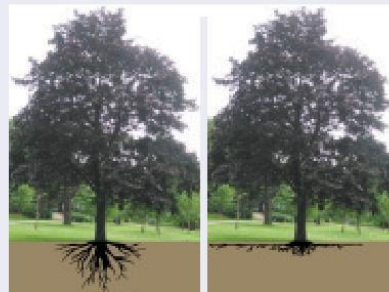


Figure A: Incorrect

Figure B: Correct

Figure 2

British standard for trees in relation to construction and APN1

In recognition of the fact that trees are sensitive to disturbance the British Standards Institution has published recommendations on how to protect trees during development. In line with the earlier British Standard (BS 5837: 1991) the most recent guide, published in September 2005 (see further reading), recommends that there should be a 'root protection area' in which development should not be permitted.

In most cases this area has a radius equal to twelve times the trunk diameter and forms an exclusion zone around the tree protected by means of robust fencing. This guidance had the effect of prohibiting the installation of roads, driveways and parking areas near to trees. But In 1996 the Arboricultural Advisory and Information Service published Arboricultural Practice Note 1 Driveways Close to Trees (APN1) which suggested that driveways could be installed within the root protection area provided roots and the soil were not damaged.

The conditions set out for a suitable system were as follows:

- Roots must not be severed
- Soil should not be compacted
- Free movement of oxygen and carbon dioxide into and out of the soil should be maintained
- Water infiltration into the soil should not be impeded

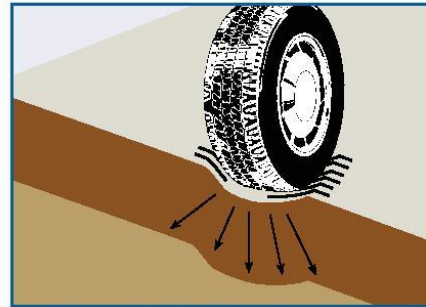
Thus, APN1 advised that driveways could be installed within the root protection zone provided that an above-ground, no-dig construction was used. This advice was incorporated into the recent British Standard which recommended that the most effective means of achieving this was through the use of a three-dimensional cellular confinement system.

Terram Geocell ground protection

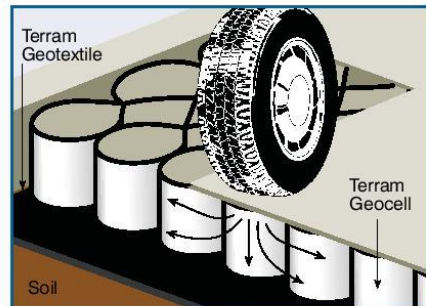
Terram Geocell is an ideal solution for providing ground reinforcement within tree protection areas. It confines fill material within its strong yet flexible cell structure in order to provide a stable base for traffic and an even load distribution (Figures 3 and 4). A big advantage of Terram Geocell over other products is that the geotextile material is permeable and allows lateral movement of air and water.

Terram Geocell is suitable for permanent woodland trails, paths, driveways, roads and parking areas.

It may also be used as temporary ground reinforcement where access to a site is limited by the presence of trees. Once operations on site are completed the temporary surface can easily be removed and the ground left undamaged.



No ground reinforcement: Unreinforced soil becomes compacted and rutted by vehicle loads



Geocell ground reinforcement: Forces are spread laterally reducing loads on the underlying soil

Figure 3. The Geocell distributes loads evenly in order to prevent rutting

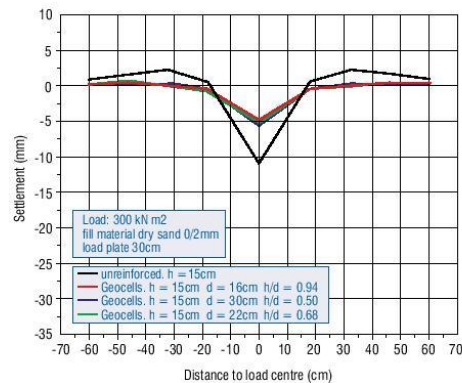


Figure 4. Static loading tests of up to 300kN/m² revealed only minimal deflection (<5mm) of the surface of filled Geocell



Figure 5

Getting the design right

Every application will be slightly different so it is important to have the input of an engineer and arboriculturist together in order to design the right solution for an installation near to trees. The arboriculturist will be able to advise on tree protection issues and the engineer will be able to specify details such as cell depth, fill type (Figure 5) and load bearing capacity.

For example, the design of a pedestrian footpath may be less rigorous than that of an access road that may have to withstand the load of a heavy crane or a lorry.

But there are some principles that should be considered in every application (see Figure 6):

- The ground must be protected at all stages during installation - there is no point in installing a ground protection system when soil or roots have already been damaged by other site activities
- Terram Geotextile should be used underneath the Geocell to prevent fill materials penetrating the soil
- The fill material should be granular and should permit water and air flow
- Any edgings should be carefully designed to avoid excavation and root severance
- A permeable and gas-porous wearing course should be installed above the Geocell
- In most cases the driveway or parking area should not exceed 20% of the root protection area.

If correctly designed and installed the Geocell cellular confinement system should allow paths, drives and parking areas to be located within a tree's protection zone, thus enabling development that might not otherwise be permitted by local authorities.

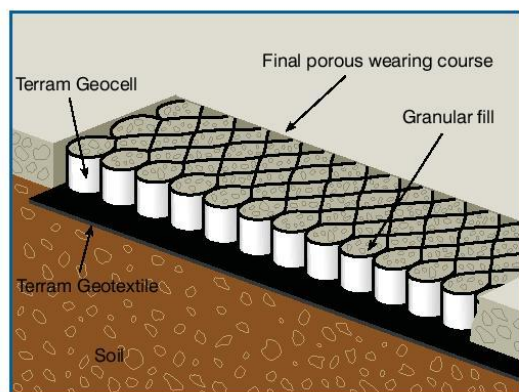


Figure 6. Components of an above-ground load-bearing platform suitable for vehicles

Example installation

Driveway construction

- 1 Remove grass and other vegetation and the upper organic layer of soil by hand digging. Arisings should be wheel-barrowed out of the tree protection area. Machinery (even low ground pressure tracked vehicles) should not be used due to the danger of soil compaction
- 2 Small depressions may be filled with sharp sand
- 3 Lay out Terram Geotextile over the driveway area
- 4 Lay out Terram GeoCell and carefully peg in place
- 5 Fill the cells working from the area furthest from the tree first. Further filling should be carried out using the filled Geocell as a platform
- 6 Install a permeable wearing course, e.g. porous tarmac, block pavements on a sharp sand base (a further layer of Terram above the filled Geocell will be needed in this case to prevent the sand mixing with the granular fill below).

Conclusion

BS5837 Trees in Relation to Construction and APN 1 allow the careful development of paths, drives and roads within the root protection area of trees provided an above-ground, no-dig construction is used.

The use of Terram Geocell as a ground reinforcement platform is therefore an ideal solution that can facilitate such development near to trees which might not otherwise be permitted due to fears of damage to soil structure and tree roots.

Further reading

BS 5837: 2005 *Trees in Relation to Construction - Recommendations*. British Standards Institution

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Products Available	Panel size	Depth	Cell Diameter
Erocell 22/20	5.0m x 10.1m	200mm	220mm
Erocell 25/15	7.0m x 10.0m	150mm	250mm
Erocell 25/10	7.0m x 10.0m	100mm	250mm

The cell depth and diameter is dependent upon specific site conditions

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The instructions contained here are a general guide only and therefore cannot cover all aspects involved or all possible uses of Terram Cellular System. If you are not experienced in carrying out projects of the type Terram Cellular System is designed for, you should seek advice from someone appropriately qualified. Any recommendations or suggestions (including design guidance) given by or on behalf of Terram on the use of its products for particular applications are given in good faith and (unless otherwise agreed) free of charge, but it remains your responsibility to ensure the use is appropriate and the product correctly installed. Terram, its agents and employees, accept no responsibility for guidance or advice given. Terram guarantees that this product is in accordance with its specification and if not Terram will at its option supply replacement product or reimburse the price paid for it. This states Terram's entire liability, all other liability and responsibility is excluded. THIS DOES NOT AFFECT THE STATUTORY RIGHTS OF A CONSUMER.

TREE PROTECTION BARRIER – ACCESS PROHIBITED

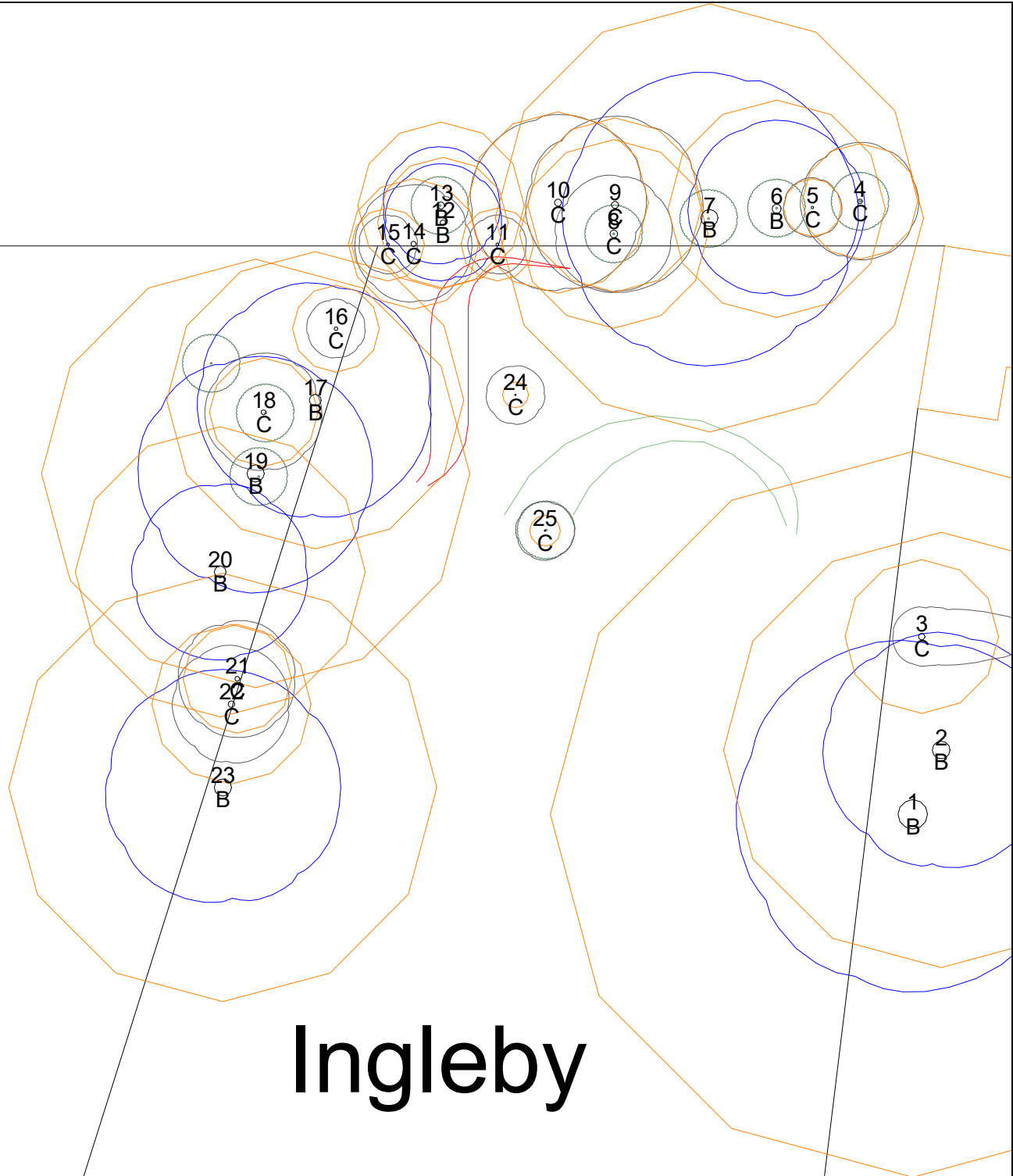
DO NOT TAMPER WITH THIS BARRIER OR REMOVE IT



This area contains trees which must be retained as part of the planning permission. Additional legal protection may also apply e.g. a Tree Preservation Order. Removing or damaging trees in this area may be a breach of planning permission. Damage to protected trees may lead to a criminal conviction and / or a fine.

Only the site manager may permit for the removal or moving of tree protection measures. This should always be in accordance with the planning permission.

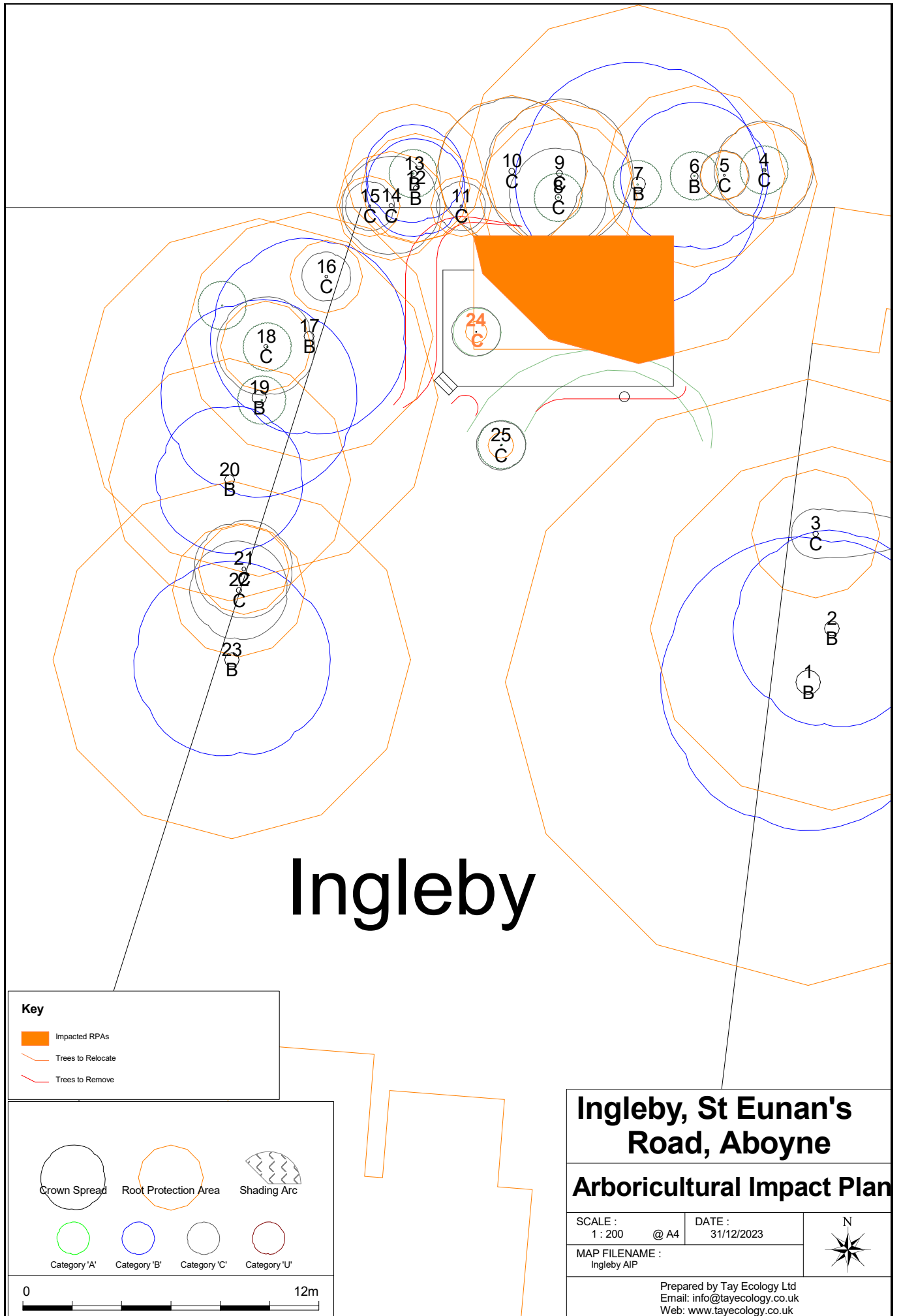
Ingleby



Crown Spread	Root Protection Area	Shading Arc
Category 'A'	Category 'B'	Category 'C'
Category 'U'		

0 12m

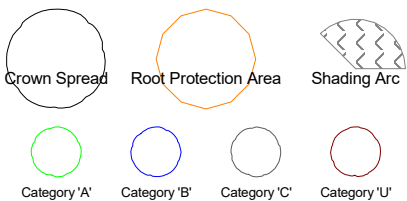
Ingleby, St Eunan's Road, Aboyne		
Tree Constraints Plan		
SCALE : 1 : 200 @ A4	DATE : 31/12/2023	
MAP FILENAME : Ingleby TCP		
Prepared by Tay Ecology Ltd Email: info@tayecology.co.uk Web: www.tayecology.co.uk		



Ingleby

Key

-  Impacted RPAs
-  Trees to Relocate
-  Trees to Remove



Ingleby, St Eunan's Road, Aboyne

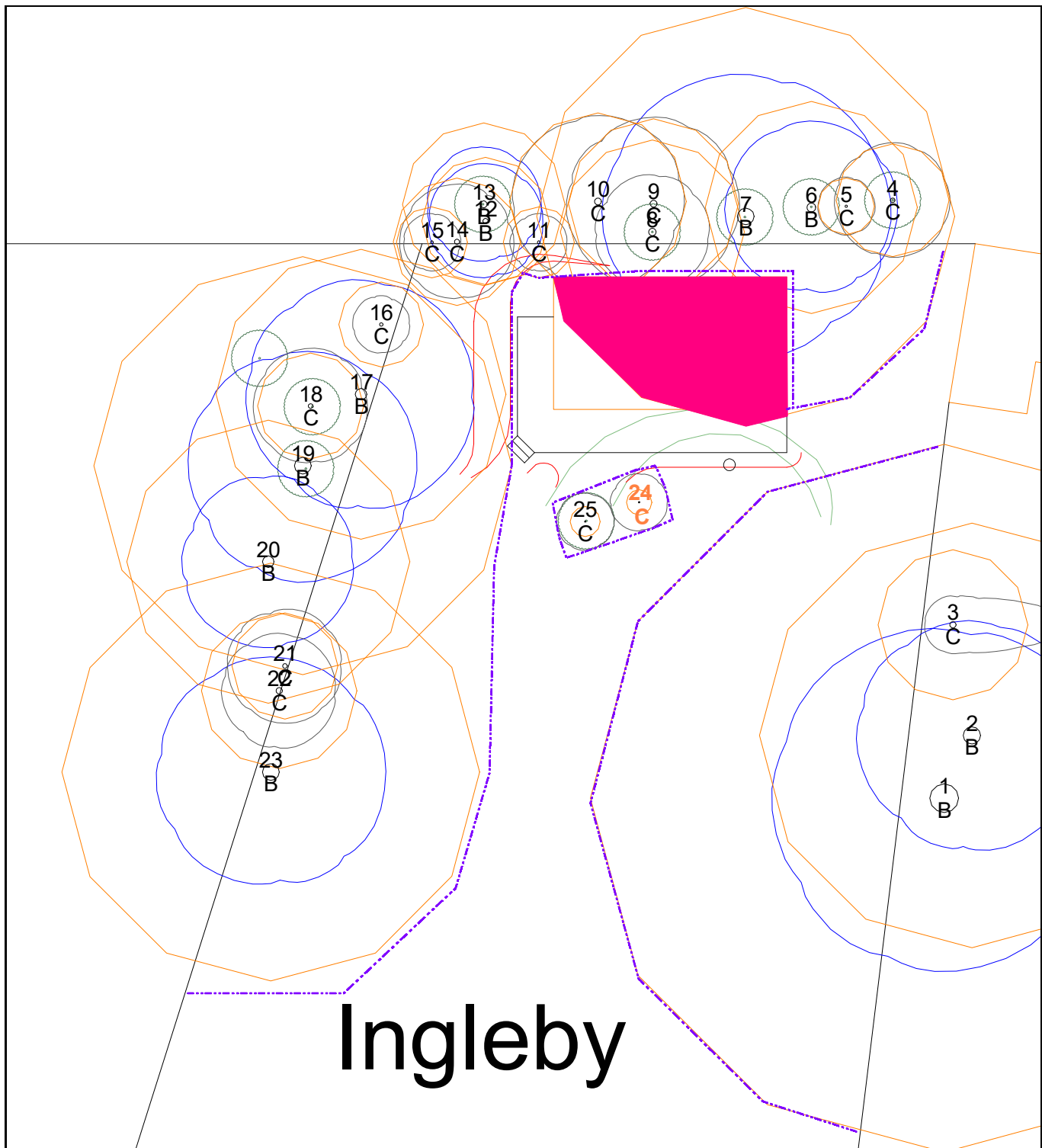
Arboricultural Impact Plan

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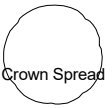






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Ingleby

Key

- Arboricultural Methodology
- Proposed Protective Fencing
- Relocated Tree

 Crown Spread	 Root Protection Area	 Shading Arc
 Category 'A'	 Category 'B'	 Category 'C'
 Category 'U'		

0

 12m

Ingleby, St Eunan's Road, Aboyne		
Tree Protection Plan		
SCALE : 1 : 200	@ A4	DATE : 31/12/2023
MAP FILENAME : Ingleby TPP		
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