Tree Survey, Arboricultural Impact Assessment, Tree Protection and Proposed Planting Plan

For Proposed Access Track
Strathgroy Farmhouse, Killiecrankie

Wednesday 11th October 2023

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PART 1 - EXECUTIVE SUMMARY

1.1 Proposal

The proposal is to construct an access track to Strathgroy Farmhouse. 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 30th August 2023. The trees were recorded as T001-034. 34 trees were surveyed in total across the site. All trees surveyed were assigned to the category A, B, C or U classification.

1.3 Arboricultural Impact Assessment

It is proposed to retain twenty-six trees, T1-26, which are Category A, B and C broadleaved trees include retaining the veteran ash for their high ecological and landscape value. Annual monitoring of tree health is recommended due to the age of the trees and the presence of fungal decay.

It is proposed to fell eight Category C trees broadleaved trees T27-34. BS5837 states that there is no restriction on felling Category C trees where they pose a constraint on development. The loss of the Category C trees can be compensated for by replacement and new planting of native broadleaved species.

At this site it is recommended that sessile and pedunculate oak trees are planted between the veteran ash to provide a future treeline which is of comparable and high ecological and landscape significance. All planting must be agreed with the landowner and tenant farmer and trees must be suitably and robustly protected from grazing animals.

There is also capacity in the lower reaches of the track for planting a wider range of species including alder, silver birch, hazel, holly, bird cherry, wild cherry, rowan and willow.

The proposed development impacts the RPAs of twenty-two trees. These trees are T1-8, T10-19, T23-26. For trees T1-8 the impacted RPA is up to 20% of the RPA area; and for trees T10-19, and T23-26 this is up to 30% of the RPA area. As most of the rooting area is beyond the site of work, it is considered that the long-term health and longevity of these trees will not be detrimentally affected by the works providing that arboricultural methodology is followed.

Where excavation is required to take place within RPAs BS5837 requires this to be non-mechanical excavation and cutting roots greater than 2.5cm diameter is to be avoided. Where supports are required using hand-dug or screw pile foundations or hand-dug pile, pad, or post locations down to a depth of 60cm is recommended. Where excavation is not required a no dig surface methodology such as using 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. It is not anticipated that the RPAs of other retained trees will be directly impacted by the work. However, arboricultural methodology must be adopted for any works in the RPAs of retained trees in case tree roots are discovered. 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 ground marking. Ground protection requirements will depend on the intensity of work around any individual tree in this area.

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.

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 an access track to Strathgroy Farmhouse.

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
Existing and Proposed Site Plans

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. 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 and ground level tree operations 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 full member of CIEEM, a member of the Arboricultural Association and 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 T001-T034. 34 trees were surveyed. 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 access track os located to the west of Strathgroy Farmhouse and utilises the line of a pre-existing access track. It is bordered by a line of mature to over-mature/veteran ash trees to the east. The site grid reference is NN 89281 64829 at an altitude of 130-190m above sea level.

3.2.2 Species

Ash dominates at the site with 30% with smaller numbers of silver birch, hawthorn, rowan, hazel, alder, willow and sycamore surveyed. The scientific names for the species recorded only in common names are as follows:

Common Name	***Scientific Name***	**Number**	**% Trees**
Sycamore	*Acer pseudoplatanus*	5	16
Alder	*Alnus glutinosa*	2	6
Silver birch	*Betula pendula*	7	21
Hazel	*Corylus avellana*	1	3
Hawthorn	*Crataegus monogyna*	4	12
Ash	*Fraxinus excelsior*	10	30
Willow	*Salix spp.*	2	6
Rowan	*Sorbus acuparia*	2	6

3.2.3 Categories

The trees recorded are 24% Category A, 47% Category B, 29% Category C trees. The distribution of categories of individual trees is as follows:

BS 5837 Category	Number of Trees	% Trees
A	8	24
B	16	47
C	10	29
U	0	0

3.2.4 Life stage

52% mature, 24% semi-mature, 24% over mature trees recorded.
The life stages recorded for individual trees are summarised as follows:

Life Stage	Number of trees	% of Trees
Semi-mature	8	24
Mature	18	52
Over mature	8	24

3.3 Tree Survey Schedule – see page 7-8 below

Where tree-work recommendations are made these are highlighted in yellow.

3.4 Tree Constraints Plan - see page 10 below and TCP Strathgroy

A tree constraints plan has been produced for the site. The trees were recorded as T001-T025. The morphology of tree roots is influenced by past and present site conditions and tree management, e.g., soil type, drainage, and local topography. The RPAs of trees may be exaggerated.

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								
001	Ash	16	1450	12	12	12	12	5N	OM	Veteran ash, shaggy bracket *Inonotus hispidus* SW side of tree on main stem, high landscape and ecological value / Moderate	Good	40+	A1	17.40	Monitor tree condition/12months.
002	Ash	16	1350	8	8	8	8	3E	OM	Veteran ash, high landscape and ecological value / Good	Good	40+	A1	16.20	Monitor tree condition/12months.
003	Ash	16	1180	6	6	6	6	2W	OM	Veteran ash, high landscape and ecological value, lost limb to east, declining canopy / Moderate	Fair	40+	A1	14.16	Monitor tree condition/12months.
004	Ash	16	950	5	5	5	5	2W	OM	High landscape and ecological value Moderate	Fair	40+	A1	11.40	Monitor tree condition/12months.
005	Ash	16	1550	8	8	8	8	1.5S	OM	Veteran ash / main stem 1m Dryads saddle *Cerioporus squamosus*, high landscape and ecological value / Moderate	Fair	40+	A1	18.60	Monitor tree condition/12months.
006	Ash	16	1550	9	9	9	9	2W	OM	Veteran ash, high landscape and ecological value / Good	Good	40+	A1	18.60	Monitor tree condition/12months.
007	Ash	16	1120	10	10	10	10	2W	OM	Veteran ash, high landscape and ecological value / Good	Good	40+	A1	13.44	Monitor tree condition/12months.
008	Ash	16	900	6	6	8	6	2E	OM	Vertical hollow cavity with dryads saddle *Cerioporus squamosus*, high landscape and ecological value / Low	Poor	40+	A1	10.80	Monitor tree condition/12months.
009	Hawthorn	3	150	4	4	4	4	n/a	SM	Good	Good	10+	C2	1.80	No work required.
010	Silver birch	18	500	4	4	4	4	4W	M	Good	Good	20+	B2	6.00	No work required.
011	Rowan	12	100-200x20	4	4	4	4	n/a	M	Multi-stemmed / Good	Good	20+	B2	8.05	No work required.
012	Rowan	12	500	4	4	4	4	2W	M	Good	Good	20+	B2	6.00	No work required.
013	Ash	12	300	3	3	3	3	n/a	M	Ash dieback category 2 / Moderate	Fair	20+	B2	3.60	No work required.
014	Ash	6	100;100	1	1	1	1	n/a	SM	Co-dominant stems / Moderate	Fair	10+	C2	1.70	No work required.
015	Silver birch	14	300;300	4	4	4	4	2W	M	Good	Good	20+	B2	5.09	No work required.
016	Rowan	12	250;250	4	4	4	4	n/a	M	Good	Good	20+	B2	4.24	No work required.
017	Hazel	6	50 x 8	2	2	2	2	n/a	SM	Good	Good	10+	C2	1.70	No work required.
018	Sycamore	18	600;400	7	7	7	7	3E	M	Good	Good	20+	B2	8.65	No work required.
019	Silver birch	12	350;300	4	4	4	4	3E	M	Good	Good	20+	B2	5.53	No work required.
020	Silver birch	12	310	3	3	3	3	2W	M	Good	Good	20+	B2	3.72	No work required.
021	Silver birch	14	480	4	4	4	4	3E	M	Good	Good	20+	B2	5.76	No work required.
022	Silver birch	14	360;180	4	4	4	4	3W	M	Good	Good	20+	B2	4.83	No work required.
023	Hawthorn	6	150 x 6	3	3	3	3	n/a	M	Good	Good	20+	B2	4.41	No work required.

024	Silver birch	12	300; 300; 300	4	4	4	4	2W	M	Good	Good	20+	B2	6.24	No work required.
025	Hawthorn	6	200;200	3	3	3	3	n/a	M	Good	Good	20+	B2	3.39	No work required.
026	Hawthorn	8	300	3	3	3	3	n/a	M	Good	Good	20+	B2	3.60	No work required.
027	Alder	6	150	2	2	2	2	n/a	SM	Good	Good	10+	C2	1.80	No work required.
028	Alder	6	150	2	2	2	2	n/a	SM	Good	Good	10+	C2	1.80	No work required.
029	Willow	6	150	2	2	2	2	n/a	SM	Good	Good	10+	C2	1.80	No work required.
030	Willow	6	200	2	2	2	2	n/a	SM	Good	Good	10+	C2	2.40	No work required.
031	Sycamore	12	300	3	3	3	3	n/a	M	Good	Good	10+	C2	3.60	No work required.
032	Sycamore	12	250	3	3	3	3	n/a	M	Good	Good	10+	C2	3.0	No work required.
033	Sycamore	12	250	3	3	3	3	n/a	M	Good	Good	10+	C2	3.0	No work required.
034	Sycamore	12	300	3	3	3	3	n/a	M	Good	Good	10+	C2	3.60	No work required.

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.

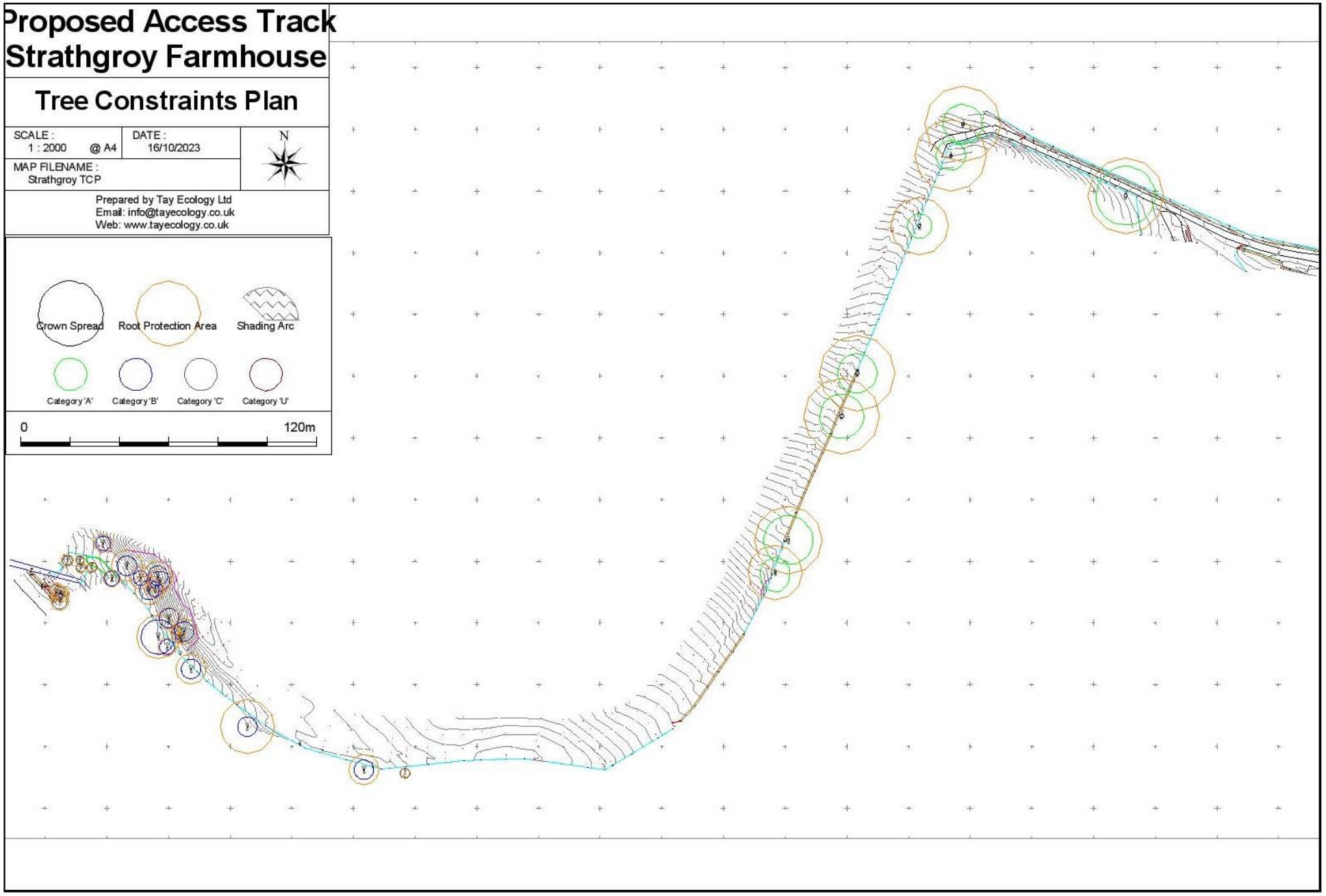
General observations: includes notes on structural defects, physiological problems, special features, decay, and management recommendations. Please note that management recommendations do not constitute a specification for any required works.

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.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Email: info@tayecology.co.uk
Web: www.tayecology.co.uk
Crown Spread
Root Protection Area
Shading Arc
Category 'A'
Category 'B'
Category 'C'
Category 'U'
0
120m

3.5 Photographs

Tree 1 Ash

Trees 1 Ash Inonotus hispidius

Trees 2-4 ash

Tree 3 Ash Hollow cavity top main stem

Looking south down line of access track

Looking north up line of access track

Tree 5 Ash Ceriporus squamosus

Trees 8 Ash vertical hollow cavity

Looking west down line of access track

Looking east up line of access track

West along lower section of track

Birch trees in lower section

PART 4 – ARBORICULTURAL IMPACT ASSESSMENT

4.1 TREE LOSS AND RETENTION

It is proposed to retain twenty-six trees, T1-26, which are Category A, B and C broadleaved trees include retaining the veteran ash for their high ecological and landscape value.

It is proposed to fell eight Category C trees broadleaved trees T27-34.

BS5837 states that there is no restriction on felling Category C trees where they pose a constraint on development. The loss of the Category C trees can be compensated for by replacement and new planting of native broadleaved species.

At this site it is recommended that sessile and pedunculate oak trees are planted between the veteran ash to provide a future treeline which is of comparable and high ecological and landscape significance.

4.2 INCURSION INTO ROOT PROTECTION AREAS

The proposed development impacts the RPAs of twenty-two trees. These trees are T1-8, T10-19, T23-26. For trees T1-8 the impacted RPA is up to 20% of the RPA area; and for trees T10-19, and T23-26 this is up to 30% of the RPA area.

As most of the rooting area is beyond the site of work, it is considered that the long-term health and longevity of these trees will not be detrimentally affected by the works providing that arboricultural methodology is followed.

Where excavation is required to take place within RPAs BS5837 requires this to be non-mechanical excavation and cutting roots greater than 2.5cm diameter is to be avoided. Where excavation is not required a no dig surface methodology such as using 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.

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. Arboricultural methodology must be adopted for any works in the RPAs of retained trees in case tree roots are discovered.

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 ground marking. Ground protection requirements will depend on the intensity of work around any individual tree in this area. RPAs are indicated on the plans as being centred around each stem, note that the actual protection area is often skewed because localised features (such as local topography etc.) make rooting conditions unfavourable on one or more sides of the tree.

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.

In the event excavation is required within RPAs non-mechanical excavation is proposed. Where supports are required within RPAs using hand-dug or screw pile foundations or hand-dug pile, pad, or post locations down to a depth of 60cm and, if necessary, adjust locations to avoid cutting roots greater than 2.5cm diameter is recommended. No excavation must take place into existing soil levels except where, authorised for supports, this specifically applies to ground beams sitting above supports. Provision created for ventilation and watering beneath substantial structures.

Where excavation is not required 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. BS5837 (2012) states that a no dig surface can cover approximately 20% of any RPA, Rose (2020) indicates that larger areas of RPAs can be covered by this methodology on a case-by-case basis. 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 COMPENSATORY PLANTING

The loss of the trees can be compensated for by replacement and new planting of native species. A minimum 3 trees should be planted for every tree felled. Planting should take place in the first planting season after completion of the access track.

At this site it is recommended that sessile oak *Quercus petraea* and pedunculate oak *Quercus robur* trees are planted between the veteran ash to provide a future treeline which is of comparable and high ecological and landscape significance. All planting must be agreed with the landowner and tenant farmer and trees must be suitably and robustly protected from grazing animals.

There is also capacity in the lower reaches of the track for planting a wider range of species including alder *Alnus glutinosa*, silver birch *Betula pendula*, hazel *Corylus avellana*, holly *Ilex aquifolium*, bird cherry *Prunus padus*, wild cherry *Prunus avium*, rowan *Sorbus acuparia* and willow *Salix spp.*.

4.5 TREE-WORK RECOMMENDATIONS

Tree-work management recommendations have been made for the ash trees T1-8. It is recommended that these trees are retained for their high ecological and landscape value. However, annual monitoring of tree health is recommended due to the age of the trees and the presence of fungal decay.

The findings and recommendations are valid for twelve months although it is strongly recommended that trees are inspected at regular intervals and after extreme weather events for reasons of safety.

4.6 CONCLUSIONS

It is proposed to retain twenty-six trees, T1-26, which are Category A, B and C broadleaved trees include retaining the veteran ash for their high ecological and landscape value. Annual monitoring of tree health is recommended due to the age of the trees and the presence of fungal decay.

It is proposed to fell eight Category C trees broadleaved trees T27-34. BS5837 states that there is no restriction on felling Category C trees where they pose a constraint on development. The loss of the Category C trees can be compensated for by replacement and new planting of native broadleaved species.

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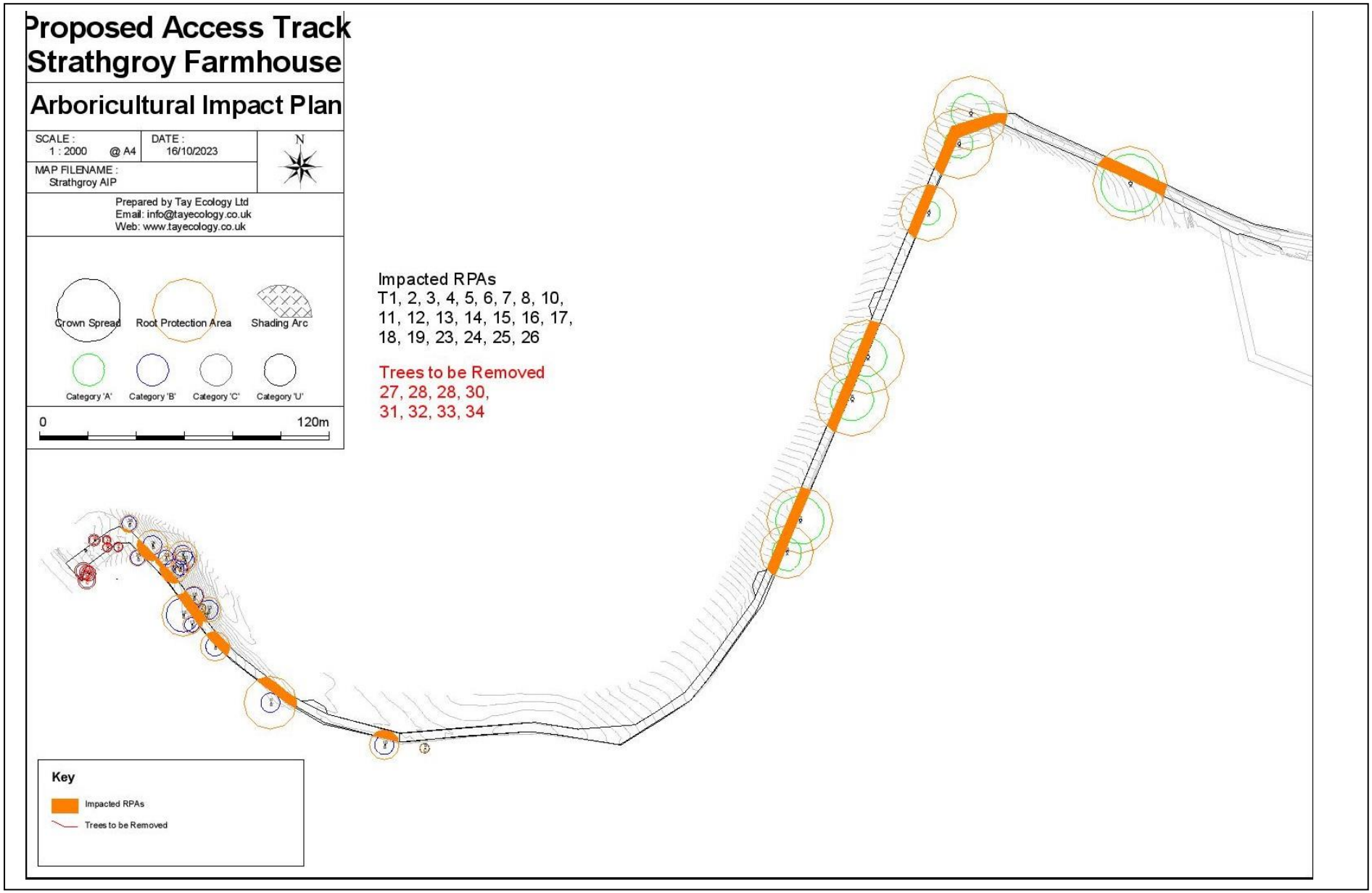
The proposed development impacts the RPAs of twenty-two trees. These trees are T1-8, T10-19, T23-26. For trees T1-8 the impacted RPA is up to 20% of the RPA area; and for trees T10-19, and T23-26 this is up to 30% of the RPA area. As most of the rooting area is beyond the site of work, it is considered that the long-term health and longevity of these trees will not be detrimentally affected by the works providing that arboricultural methodology is followed.

4.7 ARBORICULTURAL IMPACT ASSESSMENT PLAN see below and Strathgroy Track AIP. An arboricultural impact assessment plan has been produced for the site. It is proposed to fell eight Category C trees. Twenty-two trees have impacted RPA, marked in orange on the plan.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Crown Spread
Root Protection Area
Shading Arc
Category 'A'
Category 'B'
Category 'C'
Category 'U'
0
120m
Impacted RPAs
T1, 2, 3, 4, 5, 6, 7, 8, 10,
11, 12, 13, 14, 15, 16, 17,
18, 19, 23, 24, 25, 26
Trees to be Removed
27, 28, 28, 30,
31, 32, 33, 34
Key
Impacted RPAs
Trees to be Removed

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 felling
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 Strathgroy TPP

Proposed Access Track
Strathgroy Farmhouse

Tree Protection Plan

SCALE : 1 : 2000 @ A4
DATE : 16/10/2023
MAP FILENAME : Strathgroy TPP

N

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

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

0 120m

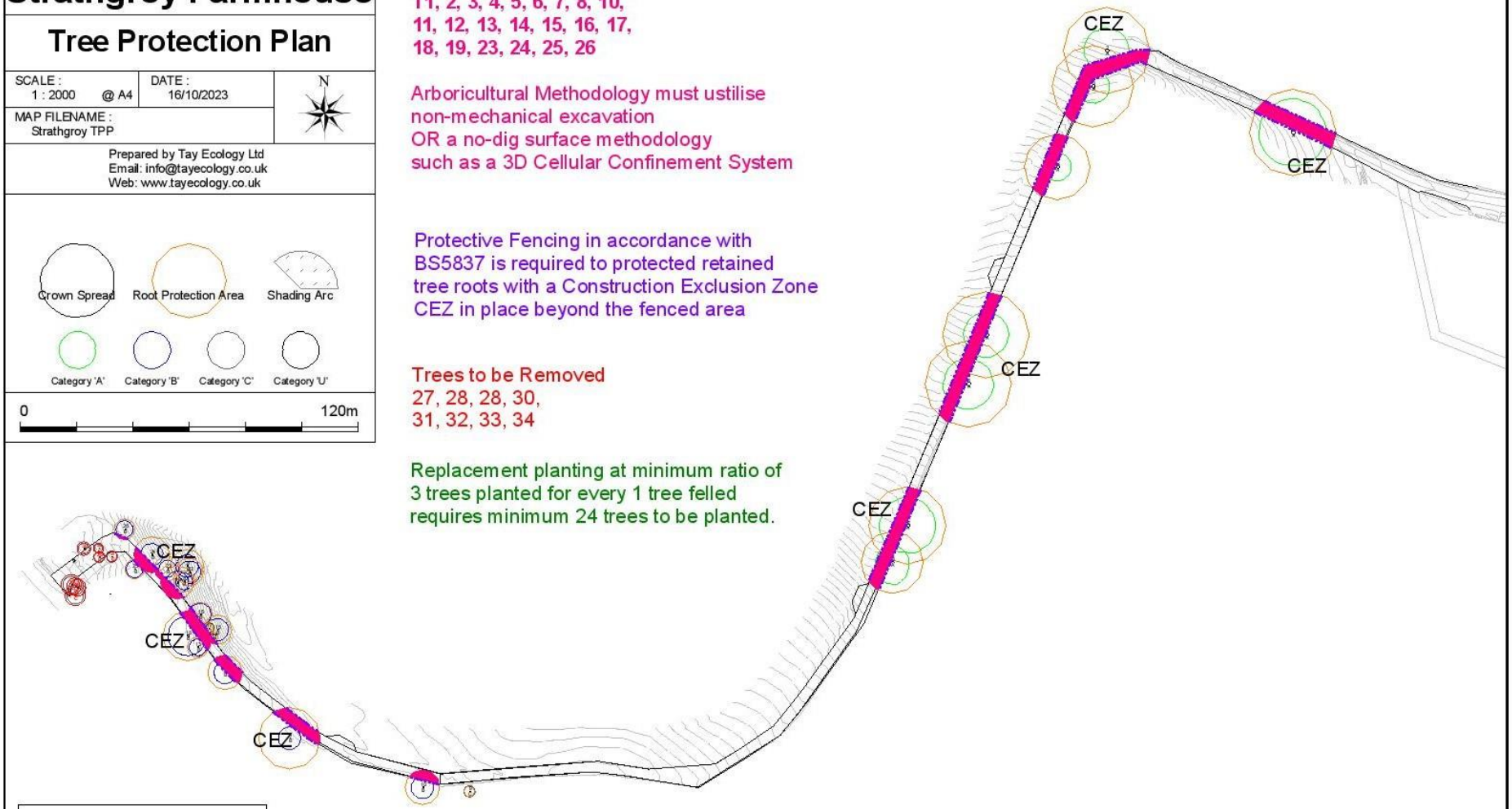
Arboricultural Methodology
T1, 2, 3, 4, 5, 6, 7, 8, 10,
11, 12, 13, 14, 15, 16, 17,
18, 19, 23, 24, 25, 26

Arboricultural Methodology must ustilise
non-mechanical excavation
OR a no-dig surface methodology
such as a 3D Cellular Confinement System

Protective Fencing in accordance with
BS5837 is required to protected retained
tree roots with a Construction Exclusion Zone
CEZ in place beyond the fenced area

Trees to be Removed
27, 28, 28, 30,
31, 32, 33, 34

Replacement planting at minimum ratio of
3 trees planted for every 1 tree felled
requires minimum 24 trees to be planted.



Key
Arboricultural Methodology
Protective Fencing
Trees to be Removed

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 6 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 at 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, 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 CONSTRUCTION IN RPAS

5.4.1.1 Where excavation in RPAs is required do not mechanically excavate. 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.

5.4.1.2 Where excavation is not required a no dig surface methodology should be in place. Where supports are required within RPAs for the garage using hand-dug or screw pile foundations or hand-dug pile, pad, or post locations down to a depth of 60cm and, if necessary, adjust locations to avoid cutting roots greater than 2.5cm diameter is recommended. No excavation must take place into existing soil levels except where, authorised for supports, this specifically applies to ground

beams sitting above supports. Provision created for ventilation and watering beneath substantial structures.

Where excavation is not required 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. BS5837 (2012) states that a no dig surface can cover approximately 20% of any RPA, Rose (2020) indicates that larger areas of RPAs can be covered by this methodology where necessary. Where the ground level is raised in any RPAs a permeable surface material is recommended to allow air and water to percolate.

5.4.1.3 Ground protection boards
Ground protection boards utilised within RPAs to hold excavated soil during any hand-digging.

5.4.1.4 The supervising tree consultant to oversee any work within the RPAs.

5.4.2 GROUND PROTECTION

5.4.2.1 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.

5.4.2.2 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. Where access to the site occurs within RPA areas on existing hard surfaces no additional root protection is required.

5.4.2.3 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.

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

5.4.3 SURFACING

5.4.3.1 Where any new surfacing encroaches into any RPA and no excavation is required, a no-dig surface is preferentially recommended where up to approximately 20% (or more) 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 5 Example of no-dig surface installation method.

5.4.3.2 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.

5.4.4.3 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.

5.4.4.4 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.

5.4.4 DRAINAGE AND SERVICE WORK WITHIN RPAS

5.4.4.1 Where any drainage and/or service work is required within RPAs do not mechanically excavate. The use of a compressed air-powered tool, or AirSpade is recommended to clear soil from around roots, using a machine to dig a trench is not permitted with the RPAs of trees.

5.4.4.2 Hand-dug broken or continuous trench method
This enables roots to be retained with services fed beneath retained roots. The use of a compressed air-powered tool, or AirSpade is recommended at this site. 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. Employ common ducts with inspection chambers out with RPAs.

5.4.4.3 Ground protection boards
Ground protection boards utilised within RPAs to hold excavated soil during hand-digging of trenches.

5.4.4.4 The supervising tree consultant to oversee any work within the RPAs.

Further information is in Appendix 4 Installing Services in RPAs.

5.4.5 LANDSCAPING

5.4.5.1 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.

5.4.6 POLLUTION PREVENTION

5.4.6.1 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.

5.4.7 SUMMARY OF ARBORICULTURAL SUPERVISION

1. Tree felling
2. Mark out the RPAs of retained trees.
3. Ensure that the tree protection barriers are installed and fixed to the ground in the correct position and as specified.
4. Oversee any excavation required within any RPAs.
5. Undertake a site visit to ensure that the works are in accordance with the Tree Protection Plan and Arboricultural Method Statement.

PART 6 - COMPENSATORY AND NEW PLANTING

The loss of the trees can be compensated for by replacement and new planting of native species. A minimum 3 trees should be planted for every tree felled.

6.1 PLANTING SCHEDULE

a. Plant in first planting season (Oct-Mar) following completion of dwellings and infrastructure.
b. Excavate planting pits 50cm x 50cm x 30cm.
c. Plant trees of 1.5m-3m height.
d. Plant shrubs 0.2-0.5m height.
e. Use stakes and ties to support trees.
f. Plant trees 1-10m apart.
g. Plant small groups of same species with small clearings between.
h. Any plants which become damaged or die within 5 years will be replaced.

6.2 AREA 1 PLANTING

At this site it is recommended that sessile oak *Quercus petraea* and pedunculate oak *Quercus robur* trees are planted between the veteran ash to provide a future treeline which is of comparable and high ecological and landscape significance.

6.3 AREA 2 PLANTING

There is also capacity in the lower reaches of the track for planting a wider range of species including alder *Alnus glutinosa,* silver birch *Betula pendula,* hazel *Corylus avellana,* holly *Ilex aquifolium*, bird cherry *Prunus padus,* wild cherry *Prunus avium,* rowan *Sorbus acuparia* and willow *Salix spp.*.

All planting must be agreed with the landowner and tenant farmer and trees must be suitably and robustly protected from grazing animals.

Proposed Access Track Strathgroy Farmhouse

Proposed Planting Plan

SCALE : 1 : 2000 @ A4

DATE : 16/10/2023

MAP FILENAME : Strathgroy PPP

Prepared by Tay Ecology Ltd
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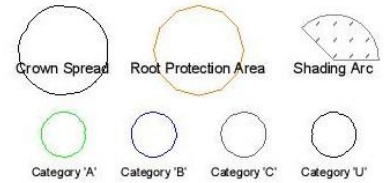


0 120m

Planting Schedule
a. Plant in first planting season (Oct-Mar) following completion of conversion
b. Excavate planting pits 50 x 50x 30cm
c. Plant trees of 1.5m-3m height
d. Plant shrubs 0.2m-0.5m height
e. Use stakes and ties to support trees
f. Plant trees 1-10m apart
g. Plant small groups of same species with small clearings between
h. Any plants which become damaged or die within 5 years will be replaced.

At this site it is recommended that sessile oak Quercus petraea and pedunculate oak Quercus robur trees are planted between the veteran ash to provide a future treeline which is of comparable and high ecological and landscape significance.

There is also capacity in the lower reaches of the track for planting a wider range of species including alder Alnus glutinosa, silver birch Betula pendula, hazel Corylus avellana, holly Ilex aquifolium, bird cherry Prunus padus, wild cherry Prunus avium, rowan Sorbus acuparia and willow Salix spp..

All planting must be agreed with the landowner and tenant farmer and trees must be suitably and robustly protected from grazing animals.

PART 7 – 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"*

The National Joint Utilities Group, 2007 *"NJUG Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees"* [Online]. Available at http://streetworks.org.uk/wp-content/uploads/V4-Trees-Issue-2-16-11-2007.pdf (accessed 11th October 2023)

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

PART 8 – APPENDICES

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

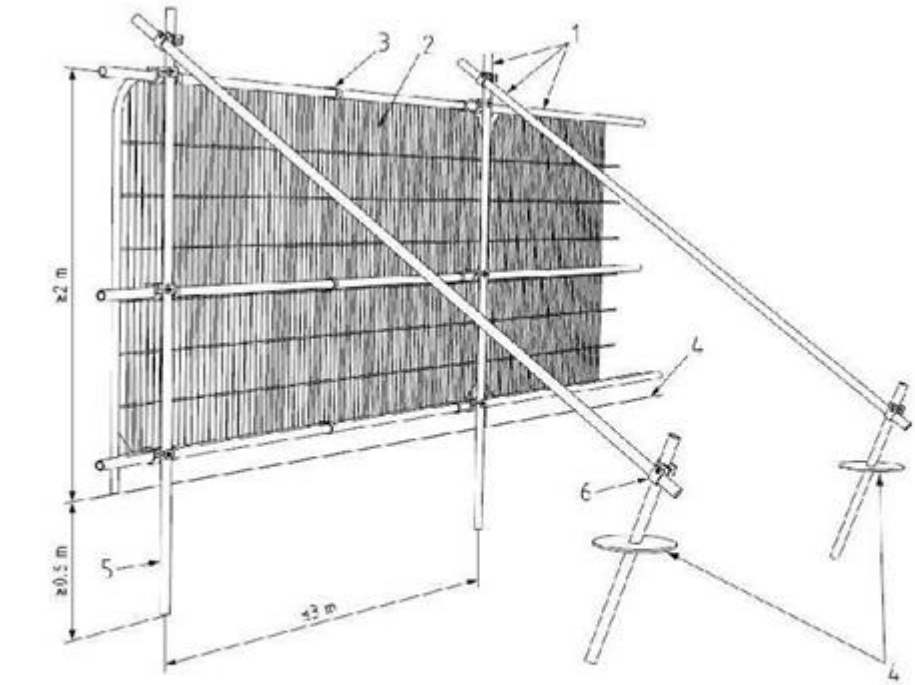
Category and definition	Criteria (including subcategories where appropriate)			Identification on plan
Trees unsuitable for retention				
Category U Those in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years.	Trees 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) Trees that are dead or are showing signs of significant, immediate and irreversible overall decline. 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. *NOTE Category U trees can have existing or potential conservation value which it might be desirable to preserve.*			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 deflects, 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
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.				

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



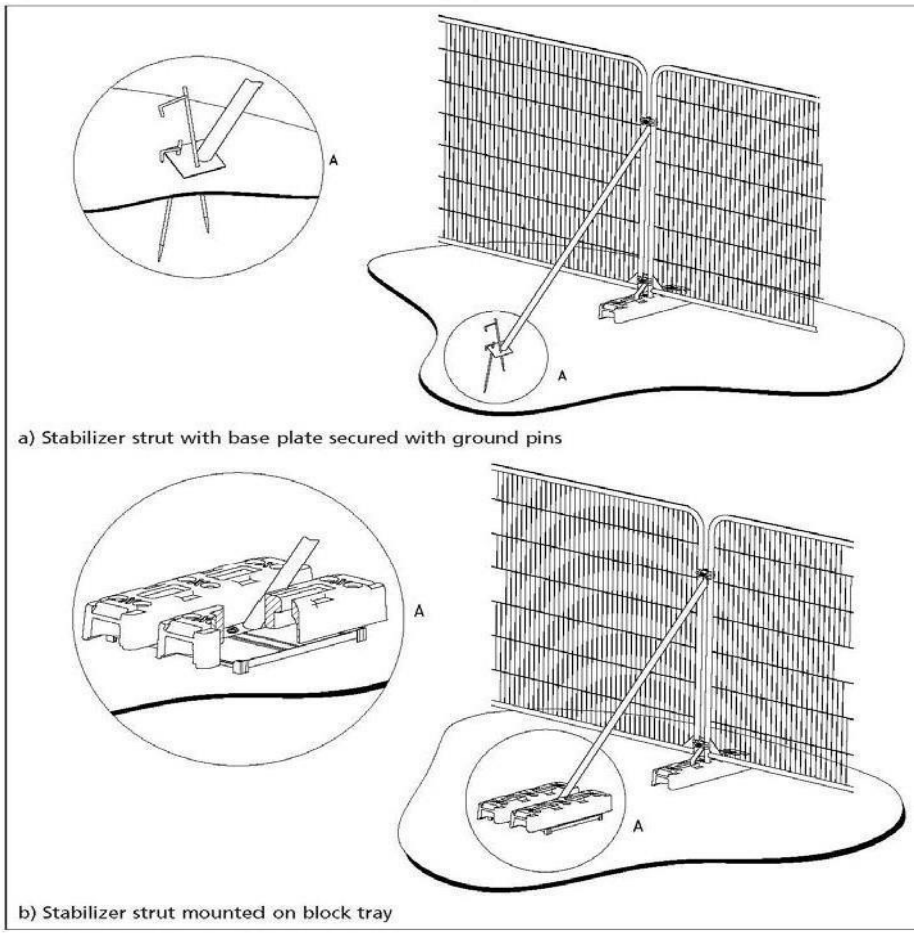
1. Standard scaffold poles
2. Heavy gauge 2m tall galvanized tube and welded mesh infill panels.
3. Panels secured to uprights and cross members with wire ties.
4. Ground level.
5. Uprights driven into the ground until secure (minimum depth 0.6m)
6. Standard scaffold clamps

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 at 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

barrell TREE CONSULTANCY

Site Guidance Note 11: Installing services in root protection areas

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 BS 5837 (7) and the guidance in NJUG (4.1).

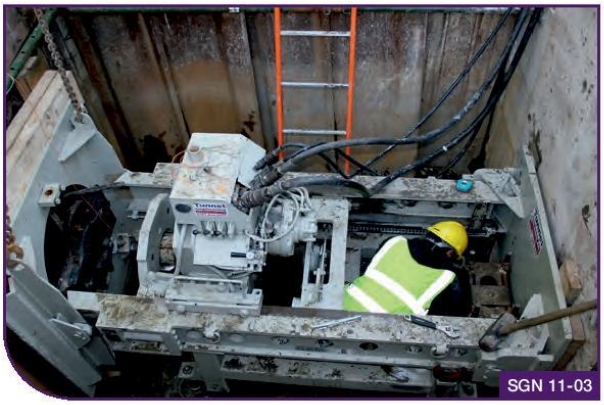
General principles and clarifications

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.


SGN 11-04

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.


SGN 11-05

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 11-06

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 routeing 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.

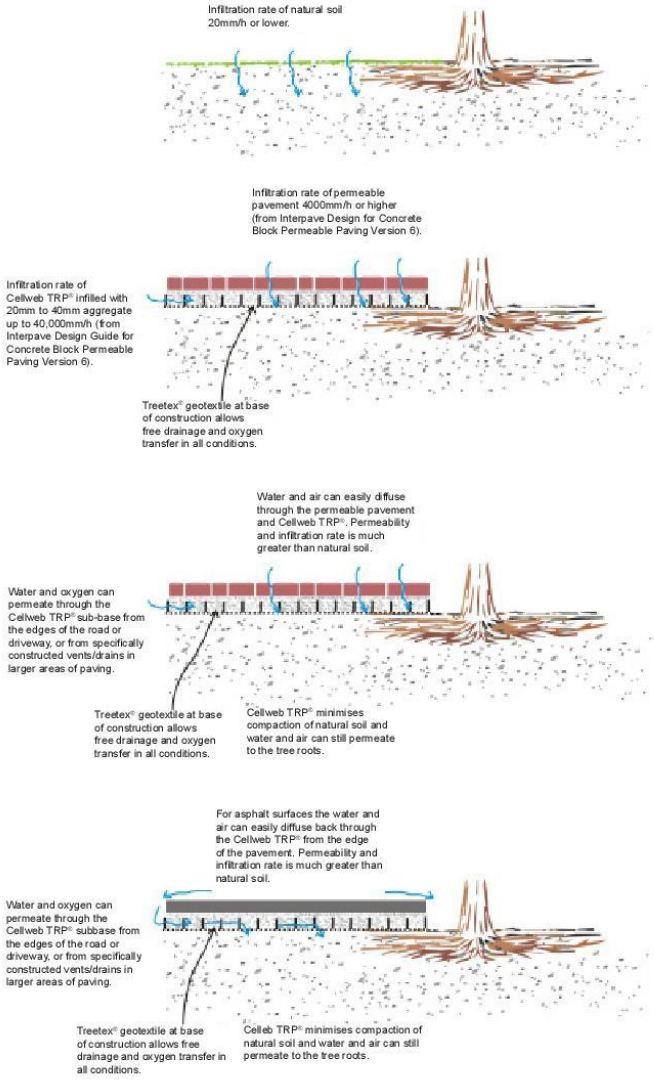


Figure 1 Water and oxygen availability in Cellweb TRP® tree root protection pavements

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.

DR: 58/V3/24.03.15 (Page 1 of 2)

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 x 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 x 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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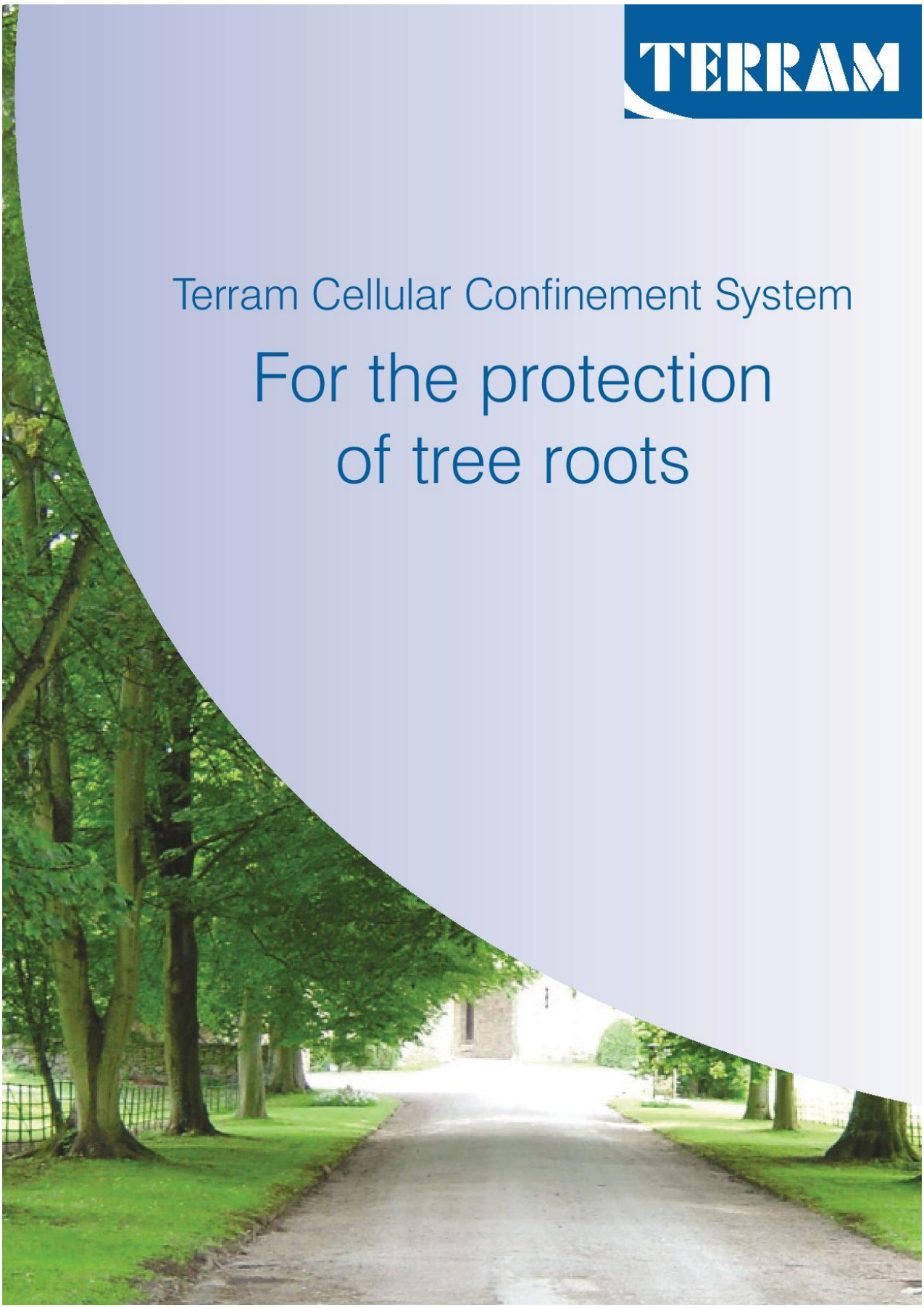
TERRAM

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.

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.

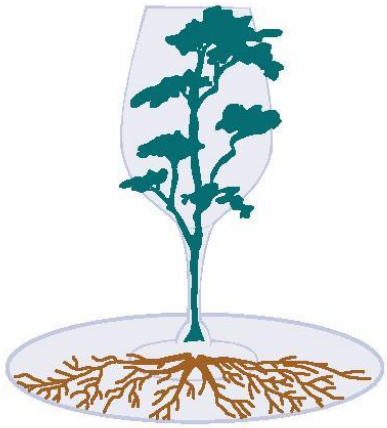


Figure 1

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.

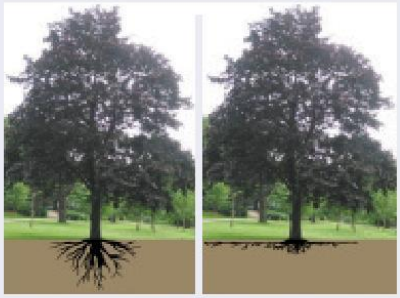


Figure A: Incorrect *Figure B: Correct*

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**

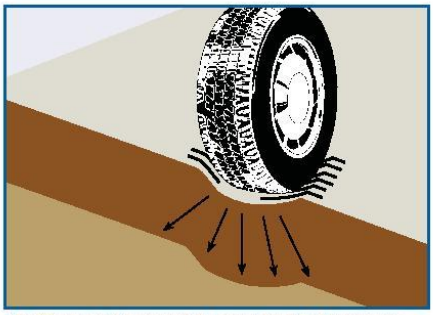
Thus, APN1 advised that driveways could be installed within the root protection zone provided that an above-ground, no-dig construction was used. This advice was incorporated into the recent British Standard which recommended that the most effective means of achieving this was through the use of a three-dimensional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

Terram Geocell ground protection

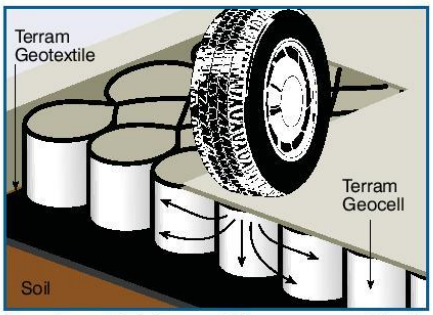
Terram Geocell is an ideal solution for providing ground reinforcement within tree protection areas. It confines fill material within its strong yet flexible cell structure in order to provide a stable base for traffic and an even load distribution (Figures 3 and 4). A big advantage of Terram Geocell 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

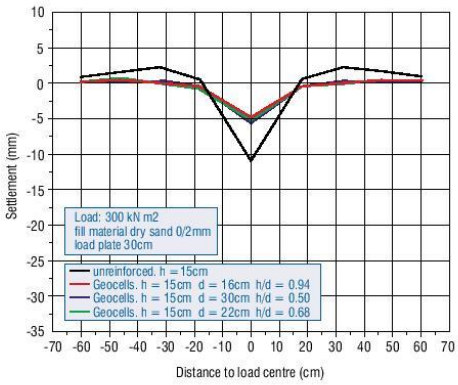


Figure 4. Static loading tests of up to 300kN/m2 revealed only minimal deflection (<5mm) of the surface of filled Geocell

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.

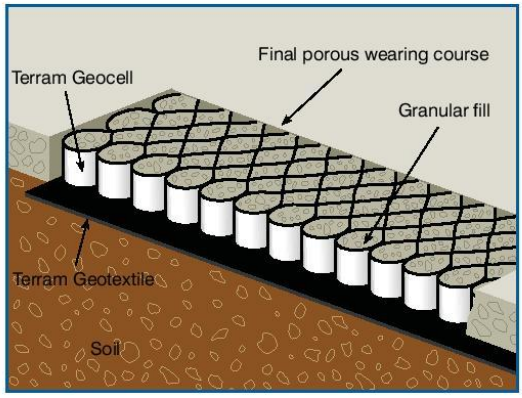


Figure 6. Components of an above-ground load-bearing platform suitable for vehicles

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 paviours 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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Recommendations for use are a guide and purchasers must determine the suitability of the product for their intended use. Terram Ltd assumes no liability for claims beyond the replacement value of our product.

APPENDIX 6 TREE PROTECTION NOTICE

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.

APPENDIX 7 PLANTING SCHEDULE

Tree planting will commence in the first planting season (October to March) following completion of dwellings and associated infrastructure.

In the event any planted tree is observed to be dying, being severely damaged or becoming seriously diseased within 5 years of being planted, it will be replaced by a tree of similar species and size to the original planted.

TREE MANAGEMENT SCHEME

a) When to plant trees

Plant bare root trees during the dormant season which usually runs from October to March, planting before the spring growth commences (Woodland Trust, 2023).

b) What to do when the trees arrive

Store trees upright in an unheated garage or shed protected from frost and wind.
Trees should be planted as soon as practical after delivery, however, delay planting if the ground is frozen or waterlogged.
If trees are to be stored for a longer period heel-in the trees. Dig a trench, ideally in well-drained soil in a shaded location, place tree roots into the trench keeping trees tied up as a bundle as packed. Cover the roots with soil, cut any ties holding the trees together, loosen and shake the roosts to ensure the soil covers them. Use straw or garden compost mulching over the trees to prevent frost damage.
If frozen ground delays planting, unpack the trees and check that the roots are moist. If the roots appear dry, dip them in a bucket of cold water for a few minutes and then return to the polythene bag and tie the top of the bag. Store trees in a cold but frost-free place.
Do not stand the trees in water for any extended length of time (Woodland Trust, 2023).

c) Prepare the site prior to planting

Mark out where each tree will be placed using stones or canes.
Create wavy lines with varied spacing to balance more densely planted areas with open spaces for a natural look and feel. Plant small groups of the same species together to reduce competition between species. Recommended average planting distance is 2 metres with spacing of between 1-4m to create a natural habitat (Woodland Trust, 2023).

d) Planting trees

To prevent the holes becoming filled with rainwater and becoming waterlogged dig shortly before planting.
The hole must accommodate the roots comfortably with additional space. The soil at the base of the hole should be loosened with a spade or fork. Excessively long roost can be pruned. If the roots are very dry cut the tips off and place the roots in water for up to two hours before planting. Use the loose soil to fill the hole, compost can be added to very heavy or sandy soils. Plant trees at the same depth as they had been before being lifted, this depth is indicated by a soil mark and is typically not more than 5 cm above the highest roots. When filling in the hole make sure that the soil gets around the roots and tread in well after planting.

e) Pit Planting Method

Pit planting ensures trees have better contact with the soil. It is suitable for all ground types, though can be difficult if the soil is stony.
1. Use a spade to dig a turf out of the ground, turn it over and chop into smaller pieces.
2. Hold a small piece of turf above a hole in the ground. Hold a sapling in the hole to check the hole is large enough for the roots.

3. Dig a hole slightly wider and deeper than the roots of the tree. Loosen the soil around the edges. Place the cut turf at the base of the pit to provide the tree with extra nutrients.
4. Put the tree in the hole and check the depth. Look for the collar – the mark on the tree where it originally started to grow above the ground. This should be level with the top of the soil. If your tree is planted too deep, the stem may rot; too shallow and the roots above the ground will die.
5. Hold the tree upright and gently push back the soil, pressing it down onto the roots. Do not compact the soil as this will stop water and air circulation, but make sure your tree is secure.
6. Push the cane into the ground next to the tree, making sure it's stable.
7. If using tree guards or spirals to protect your saplings, this is the stage to add these. Press the protection firmly into the soil.

f) Staking trees
All newly planted trees should be tied to canes or stakes.
Ensure that the stake is far enough from the tree to avoid damaging the roots and use good quality tree ties to prevent the tree from rubbing against the stake.

g) Tree guards
Protect trees from browsing mammals such as rabbits, voles, and deer by using tree guards or spirals. Wire mesh rabbit fencing can be tied in a loose cylinder around the tree.

CARING FOR NEWLY PLANTED TREES
HOW TO CARE FOR NEWLY PLANTED TREES YEARS 0 - 3
Ensure everyone involved in maintenance of the space knows where the trees have been planted to avoid accidental damage.

a) Weeding
Maintaining an approximate 1 metre diameter around the tree clear of weeds and grass for the first 2-3 years will reduce competition for moisture and nutrients.
Weeds can be suppressed with mulch, such as leaf mould, straw, or bark chips. Apply to a depth of approximately 10cm to prevent it being dispersed and top up annually (Woodland Trust, 2023).

b) Watering
Trees will adapt to local conditions and regular watering is not necessary as this encourages roots to grow up towards the soil surface rather than down towards groundwater. However, in the event of a particularly long dry spell where watering would be beneficial, saturate the ground to ensure water soaks deep into the soil (Woodland Trust, 2023).

c) Grass cutting
Regular grass cutting is not recommended as it enhances grass growth increasing competition for moisture. If undertaking occasional mowing or strimming care must be taken to avoid damaging the trees and guards (Woodland Trust, 2023).

d) Check tree stakes
Strong winds can blow trees over so make sure guards, canes or stakes are upright and pushed firmly into the soil. Pull up any grass growing inside the guard and carefully replace it (Woodland Trust, 2023).

e) Pests
Pests can cause damage inside the tube so check tree stems and guards. Keeping tree guards firmly pressed into the soil and a weed-free area around trees will help (Woodland Trust, 2023).

HOW TO CARE FOR NEWLY PLANTED TREES YEARS 3 - 10

f) Remove tree guards

Remove and/or upgrade guards (subject to browsing pressures). (Woodland Trust, 2023).

g) Pruning

Pruning is not essential, but it encourages trees to grow upwards rather than outwards once established creating a diverse canopy structure.

Use a pruning saw to cut close to the tree trunk. The cut should be square to the branch and preserve the bulge at its base, which is the branch collar. Avoid damaging any tree bark and do not cut the branch in line with the main stem.

Most native trees are best pruned when dormant in winter (Woodland Trust, 2023).

h) Disease

Trees may be affected by common diseases or experience frost damage however, most young trees will survive (Woodland Trust, 2023).

HOW TO CARE FOR NEWLY PLANTED TREES YEAR 10+

For longer term tree management further advice should be sought. Coppicing which involves cutting a tree at its base to encourage new growth has the benefit of promoting a mixed age structure within the wood and increasing biodiversity. Hazel is a commonly coppiced tree (The Small Woods Association, 2023).

The Royal Forestry Society, the Small Woods Association and the Small Woodland Owner's Group all offer information on longer term tree management.

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