Arboricultural Impact Assessment & Tree Protection Measures		**Prepared by:**	**Hal Appleyard** Dip. Arb(RFS), F. Arbor.A MICFor, RC Arbor A
Project:	**7 The Grove, Epsom**	**Produced for:**	**Mr & Mrs Orr**
Date: 13th July 2023	**Ref:** ha/aiamsan1/7tg/2023		
Planning Ref:			

1.0 Introduction and Scope

1.1 I have been instructed to carry out a tree survey at 7 The Grove Epsom and to provide advice in respect of the trees and any impacts, which may be realised from proposed construction of a new driveway and to provide advise upon methods of effective tree protection.

1.2 The trees have been assessed in July 2023 and in accordance with BS5837 trees in relation to design, demolition and construction – recommendations (the BS).

2.0 Site and Trees

2.1 The construction area comprises an existing front garden of lawn, shrubs and small ornamental trees. The garden is broadly flat with no significant inclines in any direction. The site is within a conservation area, which affords protection to trees over 75mm diameter at 1.5m above ground level.

2.2 The main trees associated with the project are those which grow in neighbouring grounds and which are included within a tree preservation order (Ref: 58/G2 including Limes and Yew trees).

2.3 The tree details are provided in **Appendix 1** and their positions are shown upon the tree protection plan at **Appendix 2**.

2.4 Although none of the trees is directly impacted by the proposed new driveway construction, roots from the neighbouring trees are likely to have breached the boundary and precautions during construction to avoid the possibility of root damage are prudent.

Fig. 1. Front garden area to be used for a new driveway. Note the existing drop kerb

Fig. 2 proposed driveway with neighbouring Holly and Lime trees arrowed.

3.0 Proposal and Impacts of Construction upon trees

3.1 The proposal includes the construction of a new, gravel driveway. In order to avoid undue harm or loss of roots from neighbouring, protected trees, the driveway will need to be installed using well-established tree techniques, which serve to protect trees during and following construction.

3.2 Initially, it will be prudent to manually dig out the line of the driveway edge nearest the trees to the east of the site (See Appendix 2). This will reveal any roots which are to be protected. These can be retained and protected using permeable geotextile membrane and a load-spreading material e.g. Cellweb 100.

3.3 The BS at para. 5.3 recommends that applicants should provide justification for conducting construction works within BS root protection areas (RPAs) of trees to be retained. Where this is proposed, the reasonable protection and preservation of the trees is dependent upon a range of factors. To this end, I have identified six arboricultural impact criteria to be considered positively in order for a tree(s) to be reasonably retained and protected, where construction is proposed within an RPA.

1) The linear separation distance between construction and the tree's trunk and canopy spread is sustainable for the future.
2) The tree's maturity, condition and known species tolerance to root loss or disturbance (biological tolerance).
3) The extent of RPA used by the proposed construction
4) The nature and intensity of the proposed construction and its associated implementation
5) The level of existing constraints to tree growth and development
6) The scope of opportunities for tree root and tree growth mitigation* measures

Each of the above impact criteria carries an escalating score ranging from 0-4, where 0 represents the potential for significant impacts and 4 identifies a low to negligible impact.

Impact Criteria Scores	
0-10	Tree unsuitable for retention
11-20	Tree suitable for retention; protection and preservation methods available
>20	Tree unaffected by the proposals

Table 1

Impact Criteria	Distance from Tree	Biological Tolerance	Extent of RPA	Construction Type	Existing Constraints	Mitigation	Total
	Score						
G1	1	3	4	4	3	1	16
T2	1	3	4	4	4	1	17
T3	4	4	4	4	2	2	20
T4	2	4	4	4	4	4	22
T5	4	2	4	4	4	4	22

*mitigation means soil/rooting area environment improvement works e.g. applications of mulch, bio stimulants or soil aeration.

NOTES on Impact Criteria:

1 – Distance from tree - Within the canopy merits up to 2 points; up to 2m beyond the canopy merits 3 points; more than 2m separation from the canopy merits 4 points.
2 – Biological Tolerance - Veteran/very mature tree or tree with low vitality merits 0-2 points; mature tree with normal vitality merits 3; maturing tree with normal vitality merits 4 points.
3 – Extent of RPA - Use of more than 20% of the RPA merits 0-2 points; than 10-20% merits 3 points; less than 10% merits 4 points – **Note to be considered in the context of criterion 2 above.**
4 – Construction Type - High intensity construction and excavations through expected rooting profile merits 0-2 points; moderate intensity work or excavations no deeper than 50% of the rooting profile merits 3 points and low invasive or no-dig work, retaining 100% of the rooting profile merits 4 points
5 – Existing Constraints - Lateral root and canopy spread restricted in more than one compass direction merits 0-2 points; lateral growth of roots or canopy in one direction merits 3 points; no constraints to roots or canopy merits 4 points
6 – Up to 50% of the existing RPA available for mitigation but no compensatory root growth area merits 0-2 points; more than 50% of the RPA available for mitigation and compensatory root growth areas merits 3 points; 100% of RPA available for mitigation and compensatory root growth area merits 4 points.

The extent of proposed works within the BS root protection areas and the justification for same, is set out in Table 2 below:

Table 2 Construction Activities within RPAs of trees

Tree Ident.*	Maturity	Vitality	% of RPA*	Tolerance** Acceptability	Justification/Recommendation
G1	Mature	Normal	<3%	High	1. Negligible RPA encroachment
T2	Mature	Normal	6%	High	2. Low-invasive/no-dig construction

* % of BS RPA used for construction
** Tolerance to construction activities is described as High (no adverse effects); Medium (potential for temporary stress, mitigation recommended) and Low (Potentially unsustainable adverse impacts, tree replacement to be considered)

Table 3 **Proposed/Recommended Tree Works**

Tree Works (Spec.)	Tree Nos	Visual Landscape Impact of Works*	Space Available for Replacement Planting(Y/N)	Comments
No tree works proposed				

Table 4 Summary of Impact of Proposed Construction on Trees*

Tree Ident.*	Landscape Contribution	Implications /Impact	Mitigation measures	***Tolerance[1,2]	Impact Assessment**
G1-T5	Medium/High	Construction of low-invasive driveway surface over RPAs	1. Erect tree protection and install load-spreading material 2. Retain all roots of 25mm diameter and over	High	**Neutral**

* Main trees selected for comment included above. Refer to previous notes on other trees.
** Negative – adverse impact upon trees and landscape; Neutral – no material impact (negative or positive); Positive – improvement (potential) to tree quality and landscape
*** Tolerance to proposed work within extent of RPA, in association with proposed tree protection – High - No adverse impacts; Medium - Temporary reduction in vitality only; Low - Susceptible to longer-term reduction in vitality and likely to require follow-up management.

3.0 Summary and Conclusions

3.1 Subject to the implementation of the tree and root protection measures from the outset of construction, there will be a **neutral impact** upon the trees of importance to the local landscape.

4.0 Tree Protection Measures to be adopted on site

4.1 In order to afford protection from general construction processes associated with the building of the new driveway, it will be necessary to first erect robust tree protection fences/barriers (normally wire mesh panels) in the position indicated on the Tree Protection Plan at **Appendix 2** (TPP1_TG_7). A recommended example of the type BS grade tree protection is included at **Appendix 3**.

4.2 In order to afford protection to off-site trees and their root systems, a manual dig exercise is to be carried out along the line of the driveway edge nearest the trees. The purposes of this is to i) identify any roots to be protected and ii) to protect the roots before the driveway area is exposed and installed. The methods of manual digging near trees are described within **Appendix 5** but for clarity I have set out the procedure below, which is to be overseen by the appointed arboricultural consultant:

i) Clearly mark out the area for hand dig (using biodegradable marker paint) (see TPP)
ii) Use hand tools (forks and spades) to remove the spoil and deposit beyond RPA.
iii) Identify roots to be retained by brushing or the use of compressed air
iv) Unless after professional assessment permits pruning, roots in excess of 25mm Ø are to be retained in-situ by manually clearing around (with compressed air for example), wrapping with non-woven geotextile (e.g.Terram), covering with a void former e.g. split, rigid polythene piping.
v) Unless after professional assessment permits pruning, retention of roots 50mm Ø or more will be by the use of void-formers (see **Appendix 5**).
vi) Roots <25mm Ø will be pruned using sharp pruning tools ensuring that no splits or tears occur and that the pruning wound is made as small as possible. Roots will be pruned back to a side shoot where possible or to a suitable position.

NOTE: THE APPOINTED ARBORICULTURAL SUPERVISOR IS TO BE CONSULTED BEFORE ANY WORK, EITHER SCHEDULED OR UNSCHEDULED, IS CONSIDERED WITHIN THE EXCLUSION ZONE OR ROOT PROTECTION AREAS OF ANY RETAINED TREE. FAILURE TO DO SO MAY LEAD TO ENFORCEMENT ACTION BY THE LPA.

4.3 A proposed method for construction of a new driveway to include a load-spread material is provided at **Appendix 5**.

4.4 In order to ensure that the tree protection measures are implemented effectively, a site monitoring exercise will be undertaken to confirm:

i) The efficacy and accuracy of the fencing and ground protection
ii) The root inspection and treatment exercise
iii) Effective maintenance of tree and ground protection

An example of a site record (tree protection) is provided at **Appendix 4**. In this case, the form will be used as confirmation that all practical precautions have been undertaken in accordance with this method statement.

4.5 A copy of this method statement is to be retained on site for the duration of the build process together with a scaled, colour copy of the Tree Protection Plan.

4.6 Key times for site supervision include:

1. Erection of tree protection barriers
2. Manual dig exercise
3. Construction of new driveway

4.7 Effective site monitoring will be undertaken from the outset of the project and at agreed intervals thereafter. The frequency of monitoring may well decrease following the proper installation of all tree protection measures. Below is a recommended programme of arboricultural supervision. (This programme may alter dependent upon site circumstances or by agreement.)

4.8 The process for recording the tree protection measures will involve:

i) Site Agent to contact Arboricultural Supervisor with a minimum of 5 days' notice of any site work commencement.
ii) Arboricultural Supervisor to monitor site to agree tree protection fencing
iii) When all tree protection is installed in accordance with the tree protection plan, the Arboricultural Supervisor is to arrange with LPA tree officer and relevant contractors **the pre-commencement site meeting** in order to agree the tree protection and subsequent works within RPAs of retained trees and importantly the lines of communication between the on-site contractors, the Arboricultural Supervisor and the LPA tree officer and incident reporting,
iv)Arboricultural Supervisor to record all site visits and distribute reports to LPA tree officer and contractors for their records
v)Subsequent to completion, Arboricultural Supervisor to sign-off and complete.
vi) Any incidents resulting in potential tree damage are to be reported in line with the 'Incident Reporting Flow Chart in **Appendix 4**.

Table 5 Preliminary site supervision schedule

Stage	Action	Arboricultural Supervisor (AS) (Required – Y/N)	Notes
1	Pre-commencement meeting*	Y	Site Agent(SA) and LPA tree officer, contractor to attend
2	Installation of tree protection and ground protection	Y	PRIOR to ground/demolition works
3	Initial manual dig exercise and any root treatment	Y	SA to advise AS prior to commencement
4	Ground works and installation of low-invasive driveway	Y	AS to monitor tree protection at agreed and suitable intervals
5	Remove tree protection	N	No tree protection to be removed without prior agreement with the AS
6	Tree planting/landscaping	Y	Brief landscape company & sign off

4.9 The frequency of tree protection monitoring depends upon the nature of the project. In this case, it will be appropriate for the SA to organise with the AS monitoring visits to be twice in the initial 28 days from commencement and thereafter once every 28 days for two months.

Table 6 Contact List (to be completed **PRIOR** to commencement)

Interested Party	Name	Company/LPA	Contact Number(s)	Comment/ Responsibilities
Planning Consultant(s)	TBA			Planning submissions & Conditions
Site Agent	TBA			Day to day site management; co-ordination of timings; **contact with project Arboriculturist**
Main Contractor	TBA			Legal and administrative running of the project; finance; appointment of and liaison with all project consultants
Arb. Supervisor	TBA			Tree protection and management; dissemination of tree-related information
LPA Tree Officer	J Young	Epsom & Ewell Borough Council		Tree protection and enforcement
Site Engineers	TBA			Technical advice and design
Architects	TBA			Design

TBA – to be advised

***Pre-commencement means i) before any works including tree felling or pruning and ii) before any ground works or demolition commences and upon completion of the initial installation of the tree protection, including ground protection.**

5.0 General site care (trees)

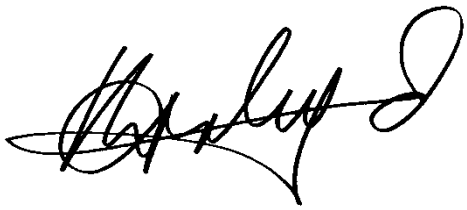
5.1 No fires will be lit on site.

5.2 No access will be permitted to within the fenced or otherwise protected areas (unless for site accommodation or Authorised agreement) at any stage during construction.

5.3 No materials, equipment or debris will be stored within the fenced areas unless agreed with the arboricultural supervisor.

5.4 Areas for mixing are to be located beyond RPAs of trees and contained to prevent leaching into the soil.

5.5 A copy of this report and the Tree Protection Plan is to remain on site at all times.



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References:
1. Matheny. N, Clark. J. R, 1998. 'Trees and development; A technical guide to the preservation of trees during land development'. ISA
2. Costello, L.R, Jones. K. S, 2003. 'Reducing infrastructure damage by roots: A compendium of strategies.' ISA Western Chapter.
3. Roberts. J, Jackson. N, Smith. M, 2006. 'Tree roots in the built environment.' TSO DCLG
4. Lindsey, P. Bassuk, N. 1991 'Specifying soil volumes to meet the water needs of mature urban street trees and trees in containers'. Journal of Arboriculture vol. 17 No 6.
5. Harris et al, 1999 'Arboriculture, Integrated Management of Trees, Shrubs and Vines' Third Edition Prentice Hall
6. Watson, G.W., Costello, L., Scharenbroch, B. & Gilman, E. 2008 The landscape below ground III The international society of arboriculture
('Tree root system response to woody root severing and fine root desiccation' – 'The root severing location producing the greatest decay or discolouration varied among species. Defect development as a result of severing roots of any size root at any distance is not likely to result in a threat to the health or the stability of the tree.')
7. Dobson, M 1995 Tree Root Systems AAIS 130/95/ARB

Appendices
1 – Tree survey data
2 – Tree protection plan
3 – Tree protection barriers
4 – Site monitoring record (example)
5 – Manual digging near trees & Low Invasive construction methods

APPENDIX 1

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No.	Species	Height	Trunk Dia.	Radial Crown Spread	Crown Clear-ance	Height to 1st Branch	Life Stage	Physi-ology	Struct. Condition	Landscape Value	Est. Years	Cate-gory	Comments	RPA Radius	RPA m2
G1	Common Holly *(Ilex aquifolium)*	10m	Avg 300 (e)	N4m E3m S3m W3m	2m	2m N	Mature	Normal	Good	Medium	20+	B (2)	Off-site trees.	3.6m	40.7m²
T2	Common lime *(Tilia x europaea)*	20m	4 stems @ 550	5m	2m	2m N	Mature	Normal	Good	High	40+	B (12)	Off site tree with multi stems; dense canopy; reduced in past; possible TPO.	13.2m	547.4m²
T3	Common Yew *(Taxus baccata)*	11m	250 (e)	N3m E4m S4m W3m	1m	1m W	Mature	Normal	Good	Medium	40+	B (2)	TPO: Off site tree; one a small boundary collection of trees; pruned back in past;	3.0m	28.3m²
T4	Willow-leafed pear *(Pyrus salicifolia)*	5m	110	2m	2m	2m N	Early Mature	Normal	Good	Low	20+	C (1)	Garden ornamental.	1.3m	5.5m²
T5	Flowering cherry *(Prunus sp.)*	2m	100	1m	1m	1m N	Semi-Mature	Fair	Fair	Low	10+	C (1)	Subordinate tree in landscape.	1.2m	4.5m²

Note: Trunk Diameter (e) = Estimated

Refer also to 'Notes to the Schedules'

Notes to the tree survey schedule

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Notes:

1. No refers to the tree identification number e.g. T1, T2 etc. numbers preceded by 'G' refer to Groups and 'H' refer to Hedges
2. Species refers to the tree name as an English and botanical. (Sometimes the botanical name will not be included)
3. Height describes the approximate height of the tree in meters from ground level.
4. Trunk Diameter is the diameter of the stem/trunk measured in millimetres at 1.5m from ground level. The diameter may be estimated (e), where access is restricted. An average (a) may be taken for tree groups. A full inspection is always recommended.
5. Radial Crown Spread refers to the crown's radius in meters from the stem centre. This dimension is estimated.
6. Crown Clearance is the height in meters of crown clearance above ground level together with the height and direction of the lowest branch
7. Height to first branch is the height in metres from ground level to the first main branch
8. Life stage is the tree's maturity **Y**oung; **S**emi **M**ature, **E**arly **M**ature, **M**ature, **O**ver **M**ature, **V**eteran
6. Physiology describes the tree's general vitality as **Good** (normal), **Fair** (sub normal), **Poor** (weak), **Dead**.
8. Structural Condition - **Good** (no or only minor defects), **Fair** (remediable defects), **Poor** - Major defects present or suspected.
9. Landscape Value (Contribution) - **High** (prominent landscape feature), **Medium** (visible in landscape), **Low** (secluded/among other trees).
10. Estimated Years – Estimated remaining useful years: **10yrs+**, **20yrs+**, **40yrs+**
11. Category - refers to the British Standard 5837:2012 Table 1 Category and refers to the tree/group quality and value; **'A'** - **High**, **'B'** - **Moderate**, **'C'** - **Low**, **'U'** - **Remove or very poor quality**. The sub-category in brackets refers to the retention criteria values where **1** is **Arboricultural**, **2** is **Landscape** and **3** is **Cultural** including **Conservation/ecological, historic and commemorative**.
12. Comments include observations regarding tree condition, setting and function/properties and characteristics
13. RPA radius refers to the radial distance measured in metres from the trunk centre. It is a function of the tree's diameter (s). RPA means root protection area
14. RPA m^2 means the area of the BS standard root protection area derived from the RPA radius.

NB: Column headings may alter and some of the above notes are not applicable to the schedule in question.

Table 1 **Cascade chart for tree quality assessment**

Category and definition	Criteria (including subcategories where appropriate)			Identification on plan
Trees unsuitable for retention (see Note)				
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 (e.g. where, for whatever reason, 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 the 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; see **4.5.7**.*			See Table 2
	1 Mainly arboricultural qualities	**2 Mainly landscape qualities**	**3 Mainly cultural values, including conservation**	
Trees to be considered for retention				
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 (e.g. the dominant and/or principal trees within 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 (e.g. veteran trees or wood-pasture)	See Table 2
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 (e.g. 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	See Table 2
Category C **Trees of low quality** with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150 mm	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	See Table 2

APPENDIX 2

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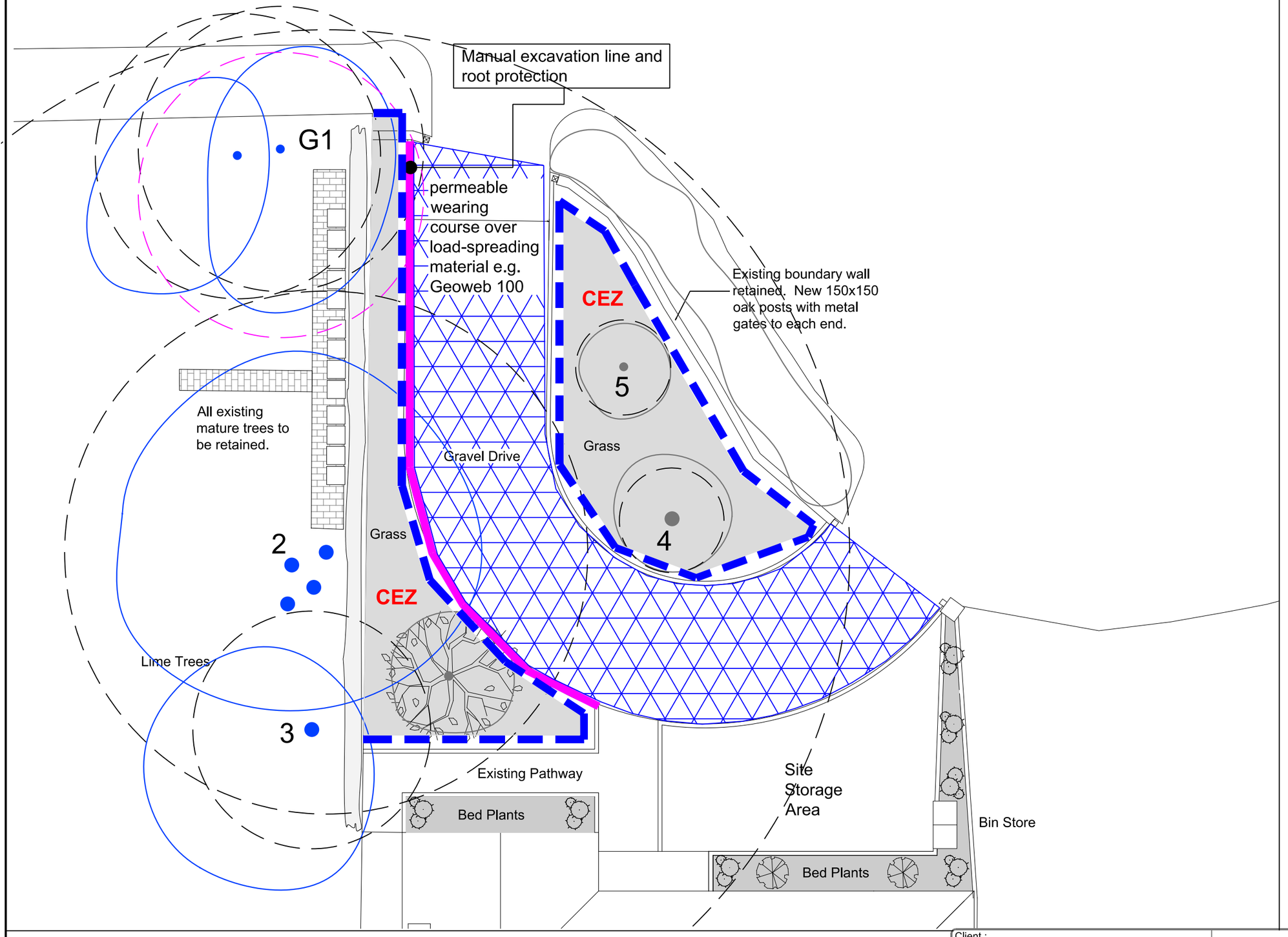

0 1 m 5 m 10 m

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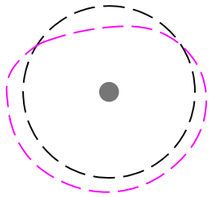
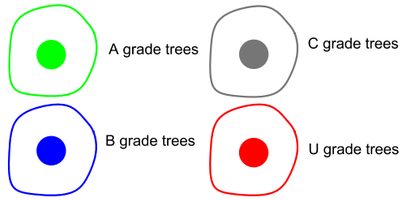


Indicative

BS Root Protection Area, (RPA) shown uniform (above left) but site features such as roadways, retaining walls and foundations, may modify root patterns and therefore the RPA shape.



CEZ — Position of tree protection barriers; denotes Construction Exclusion Zone for the duration of the project.

Recommended area for low-invasive & permeable hard standing construction methods.

Area identified for low-invasive edging detail

Tree Management Methods to be adopted on site.

1. Undertake pre-commencement site meeting to agree tree protection methods and timings.
2. Install all tree protection barriers (see Appendix 3).
3. Undertake manual ground works root protection measures.
4. Install low-nvasive driveway including the load-spreading material
5. Construct new gates
6. Remove tree protection and carry out landscaping/planting

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Project : 7 The Grove, Epsom KT17 4DQ		**Consultants in the Management of Trees and Woodlands**	Urban & rural tree management
Title : Tree Protection Plan		Tree Tops | Redwood Mount | Reigate | Surrey | RH2 9NB	
Scale : 1: 100 A3	Dwg No : TPP1_TG_7 / Rev : -	TEL: 01737 244819 | 07770 820105	
Date : Jul. 2023		E: info@acstrees.co.uk	
		www.acstrees.co.uk	

Do not scale from this drawing. Any discrepancies are to be reported to ACS (Trees) Consulting.
This drawing is to be used when printed to scale & in colour.

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Tree Protection Barriers

Specifications (specifically identified by outline box and shading)

2.4m Hoarding

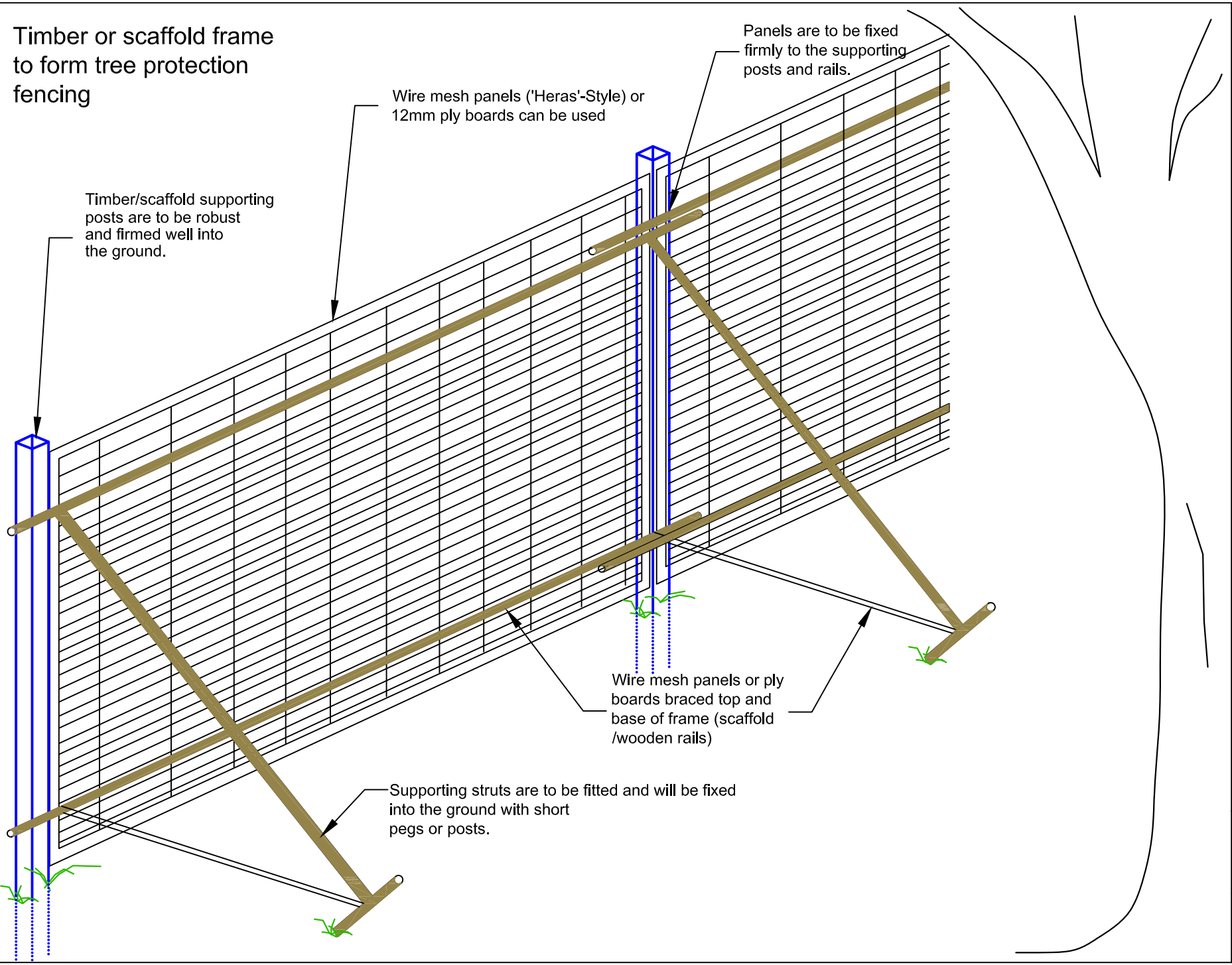
3.0m 100 X 100mm square wooden posts
3 X 38 X 87mm wooden rails affixed to posts
2.4m X 1200 outside grade ply panels (12mm) affixed to rails.
50 X 100mm angled supporting struts affixed internally (quantity as required).

(Supporting posts fixed into position using concrete. All post holes to be hand excavated. Post holes to be no larger than 300 X 300mm.)

'Heras' (Style) Fencing

'Heras' fencing describes the 2.4m galvanised steel mesh panelled fencing normally supplied with block bases and block trays. Block bases are to be used in conjunction with angled scaffold struts only. The use of blocks only is not effective. For extra barrier vertical stability, scaffold poles set at a 45^0 angle upon the 'tree-side' of the barrier and fixed to the ground at the end of each panel. Up-right supporting posts will be braced at the top and the base for added support.

Timber or scaffold frame to form tree protection fencing



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Title:

Example of Tree Protection Fencing

Note:

Steel scaffold or timber can be used to support boards or wire mesh panels

Date: Jan. 07

Ref:

Note: Sketch Plan Only - Not to Scale

Tree Protection Fencing

Scaffold Framework supporting ‘Heras’ type panels with signs attached.

Wooden Framework with ‘Heras’ type panels attached.

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Arboricultural Site Supervision

ACS CONSULTING

Site:	Project Site Address/Name
Inspected By:	Arboricultural Supervisor (AS)
Client:	Client
Site Agent:	Site Agent's Name (SA)
Date of Inspection:	24/02/2017
Time of Inspection:	8:15:00

Tree Protective Fencing

Tree protection in correct location

Comments/Action

Ground protection - temporary concrete and existing paving

Agreed Construction Exclusion Zone

No debris within construction exclusion zone

Comments/Action

Amendments to Documentation Required

No amendments required

Comments/Action

Remedial Works

Robust hoarding and temporary concrete ground protection

Tree protection Hoarding and ground protection over sharp sand.

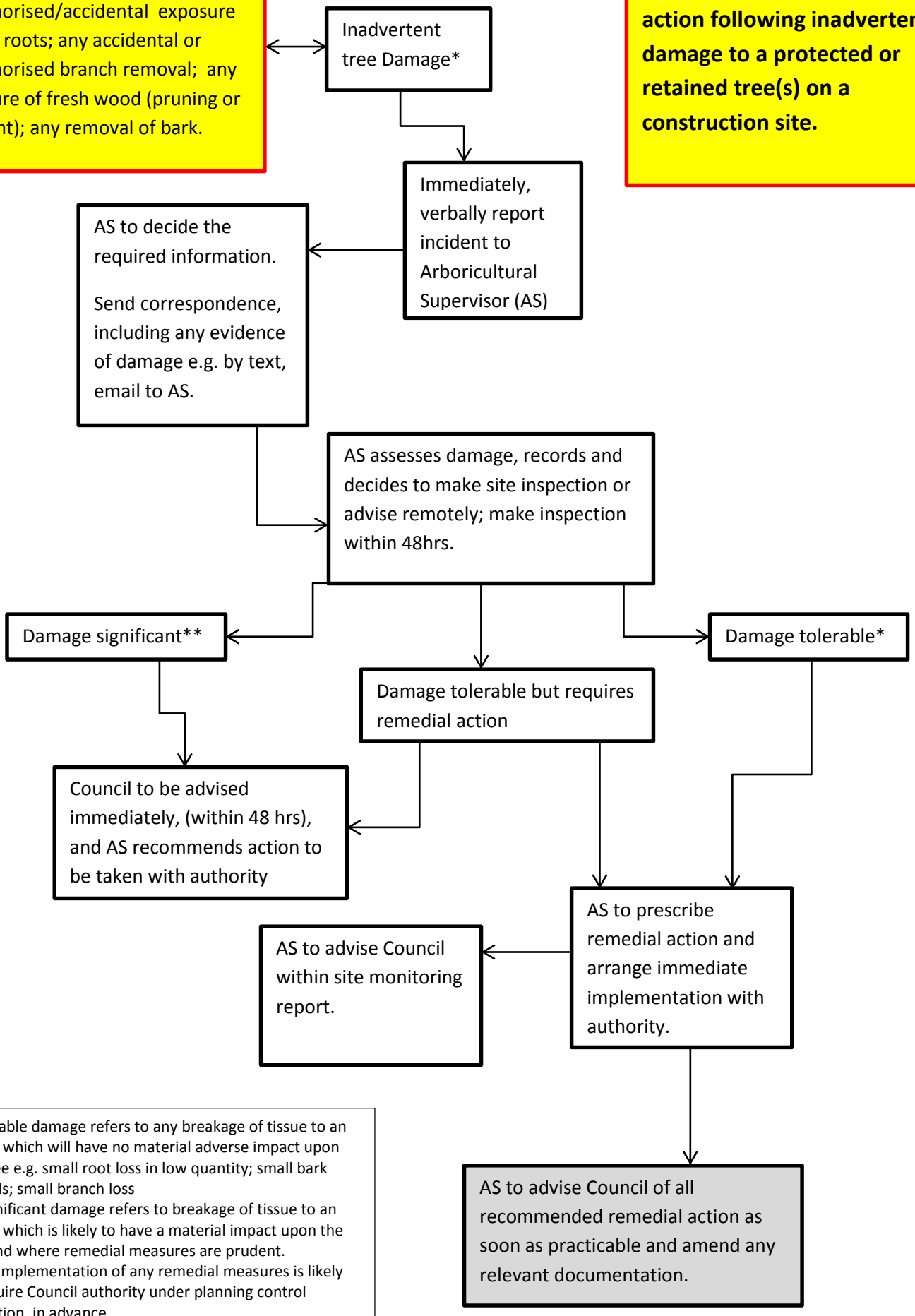
General Comments

1. Tree protection in position and effective
2. Position of site huts used as tree protection for T7 and T10
3. Temporary concrete used for ground protection for T10
4. Hoarding style tree and ground protection effective and in position

Next Inspection April 2017

*Tree Damage is defined as: any unauthorised/accidental exposure of tree roots; any accidental or unauthorised branch removal; any exposure of fresh wood (pruning or accident); any removal of bark.

Procedure for reporting and action following inadvertent damage to a protected or retained tree(s) on a construction site.



*Tolerable damage refers to any breakage of tissue to an extent which will have no material adverse impact upon the tree e.g. small root loss in low quantity; small bark wounds; small branch loss

** Significant damage refers to breakage of tissue to an extent which is likely to have a material impact upon the tree and where remedial measures are prudent.

Note: Implementation of any remedial measures is likely to require Council authority under planning control legislation, in advance.

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APPENDIX 5

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Manual Digging in the Vicinity of Trees - Method Statement

1.0 Introduction

1.1 Within and adjacent to areas of construction, trees valued as important landscape assets may exist. It is possible such trees are protected by legislation in the form of a Tree Preservation Order, conservation area or by planning conditions. In either case, disregard of the tree's well being by causing damage to the roots, trunk or branches may be an offence. Consent from the Local Planning Authority may be required to undertake works that may have an impact on the tree prior to commencement.

1.2 Whilst the trunk and branches of a tree can be seen and therefore more easily avoided, tree roots are concealed beneath the ground. Their hidden nature can lead to inadvertent damage from construction processes. Dependant upon the extent of any root damage, the whole tree can be adversely affected. It is for this reason that it is necessary to ensure adequate precautions are adopted when considering construction in the vicinity of trees.

1.3 Hand digging rather than excavation by mechanical means has proved to be an effective way of limiting the effects of construction on nearby trees. It is often considered impractical, time consuming and costly to excavate by hand when machinery exists specifically for the purpose of digging. However, avoidance of unsustainable damage being caused to important trees through hand digging may far out weigh subsequent costs associated with legal penalties and loss of amenity.

1.4 Below are detailed the basic principles to acknowledge in respect of tree roots and the practical steps that can be taken to effectively avoid causing unsustainable damage to trees.

1.5 It is assumed that all operations are commenced only AFTER having undertaken and recorded appropriate risk assessments in line with current and relevant Health & Safety legislation, common industry practice and guidance.

2.0 Tree/Root Damage – How it can occur

2.1 The majority of tree roots exist in the upper **600mm to 1000mm** of soil. Excavations of the soil in the vicinity of trees, to this depth, can be harmful to tree roots and consequently the tree.

2.2.1 Tree root systems comprise two main root types, those that **anchor** the tree in the ground and those that **supply** the tree with water and elements. Roots that support the tree are woody and those that are involved with the **conduction** of water and nutrients are non-woody or fibrous. Both types of roots can be damaged directly by severing or crushing.

Fibrous roots can die from asphyxiation by **soil compaction** and/or soil contamination. Trees differ in their tolerance of root loss or disturbance, according to their species and condition or both.

2.2.2 Normally, the greater the diameter of the damaged root, the greater the adverse impact upon the tree.

Fig. 1 Damage to roots can both kill and destabilise a tree. Planning work and care can avoid root damage

3.0 Hand Digging in the Vicinity of Trees – The Process

3.1 First it is necessary to consider all available options to construct beyond the likely range of influence on the tree's condition – always beyond 1m from the tree's trunk an by referring to an area (distance) calculated using the formulae at para 4.6.1 of BS 5837:2012 'Trees in relation to design, demolition and construction - Recommendations'. The simple calculation is 12 x the trunk diameter at 1.5m above ground level. The NJUG Volume 4 Issue 2 method is 4 x the trunk circumference/girth. The resulting area is called the Root Protection Area or Precautionary Zone. **When it is established that no options are available other than to construct within this zone, hand digging will be needed.** When considering hand digging, an appointed specialist supervisor/consultant will be able to advise during construction and must be on site at the commencement of works.

3.2 Before beginning to dig, mark out the tree's precautionary area with ground marker paint, clearly on the ground. This will identify the area within which hand digging must take

place. **For safety and before beginning to dig, ensure there are no underground services or objects that may cause injury if damaged**. Any existing protection fencing is to be located to the nearest position of construction and fixed in place, between the tree and area of construction. It will be clearly visible to operators thereafter where hand digging will need to be undertaken. The use of mechanical digging equipment to remove the top surface layer (50-100mm) is to be avoided and hand tools are required for this exercise too.

3.3 When hand digging, using typical hand tools, carefully work around roots, retaining as many as possible. Using a brush or compressed air will expose roots cleanly before deciding whether it will be necessary to prune. Care must be taken not to damage roots including the roots' bark.

Fig. 2 Roots exposed, retained and protected during manual digging exercise

3.4 Retain all roots with a diameter greater than 25mm. Where such roots must be removed, after consulting a trained arboriculturalist (e.g. Local Authority Tree Officer or the appointed Arboricultural Consultant), these roots must be pruned with sharp cutting tools such as a handsaw, secateurs or pruners. The cut must leave the smallest wound possible and the root must be left as long as practicably possible. Roots in excess of 50mm diameter are to be retained and protected by surrounding the root with uncompacted sharp sand, void-formers or other compressible materials.

3.5 Where roots do not exist, e.g. beyond the depth of the rooting area, mechanical excavation should not be considered without specialist supervision.

3.6 All spoil is to be deposited beyond the precautionary zone. Soil build-up can cause roots to die.

3.7 As soon as practicable, exposed roots are to be covered with loose backfill material such as soil/sand mix or a hessian-type material to offer immediate protection from drying winds and desiccation. When excavating for the introduction of posts, pads or piles, the sides of the pits should be lined with a geotextile material to prevent the potential for lime scorching of small diameter roots.

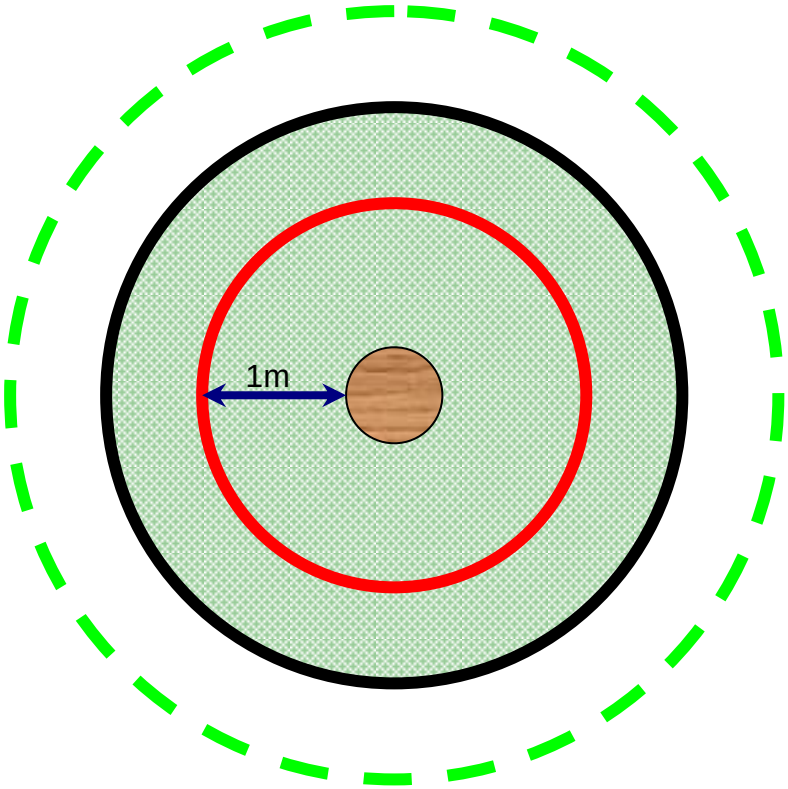
3.8 Where it is impossible to avoid completing the construction in one day for example, any exposed roots or their cut ends are to be covered with sacking material over night to prevent drying out and to add protection. This is particularly important in winter months, where frost can cause further damage to roots.

3.9 Upon completion of the hand digging, where appropriate protection fences are to be re-located and fixed in their original position.

Attached is an extract from the National Joint Utilities Group publication V4 2007, 'Guidelines for the planning installation and maintenance of utility services in proximity to trees'.

Before considering hand digging and determining precautionary zones or root protection areas, specialist arboricultural advice should be sought.

Fig. 3 Trees can be destabilised by poor planning and root damage



TREE PROTECTION ZONE

Key to Diagram

Trunk of Tree

Spread of canopy or branches

PROHIBITED ZONE – 1m from trunk. Excavations of any kind must not be undertaken within this zone unless full consultation with Local Authority Tree Officer is undertaken. Materials, plant and spoil must not be stored within this zone.

PRECAUTIONARY ZONE – 4 x trunk circumference. Where excavations must be undertaken within this zone the use of mechanical excavation plant should be prohibited. Precautions should be undertaken to protect any exposed roots. Materials, plant and spoil should not be stored within this zone. Consult with Local Authority Tree Officer if in any doubt.

PERMITTED ZONE – outside of precautionary zone. Excavation works may be undertaken within this zone however caution must be applied and the use of mechanical plant limited. Any exposed roots should be protected.

DAMAGE TO TREES

Tree roots keep a tree healthy and upright. Most roots are found in the top 600mm of soil and often grow out further than the tree's height. The majority of these roots are very fine; even close to a tree few will be thicker than a pencil. Most street tree roots grow under the footway but may also extend under the carriageway. If roots are damaged the tree may suffer irreversible harm and eventually die.

PROTECTING ROOTS - DO'S and DON'TS

There are three designated zones around a tree each of which has its own criteria for working practices.

THE PROHIBITED ZONE

Don't excavate within this zone.

Don't use any form of mechanical plant within this zone

Don't store materials, plant or equipment within this zone.

Don't move plant or vehicles within this zone.

Don't lean materials against, or chain plant to, the trunk.

Do contact the local authority tree officer or owner of the tree if excavation within this zone is unavoidable.

Do protect any exposed roots uncovered within this zone with dry sacking.

Do backfill with a suitable inert granular and top soil material mix as soon as possible on completion of works.

Do notify the local authority tree officer or the tree's owner of any damage.

THE PRECAUTIONARY ZONE

Don't excavate with machinery. Where excavation is unavoidable within this zone excavate only by hand or use trenchless techniques.

Don't cut roots over 25mm in diameter, unless advice has been sought from the local authority tree officer.

Don't repeatedly move / use heavy mechanical plant except on hard standing.

Don't store spoil or building material, including chemicals and fuels, within this zone.

Do prune roots which have to be removed using a sharp tool (e.g. secateurs or handsaw). Make a clean cut and leave as small a wound as possible.

Do backfill the trench with an inert granular material and top soil mix. Compact the backfill with care around the retained roots. On non highway sites backfill only with excavated soil.

Do protect any exposed roots with dry sacking ensuring this is removed before backfilling.

Do notify the local authority tree officer or the tree's owner of any damage.

THE PERMITTED ZONE

Don't cut roots over 25mm in diameter, unless advice has been sought from the local authority tree officer.

Do use caution if it is absolutely necessary to operate mechanical plant within this zone.

Do prune roots which have to be removed using a sharp tool (e.g. secateurs or handsaw). Make a clean cut and leave as small a wound as possible.

Do protect any exposed roots with dry sacking ensuring this is removed before backfilling.

Do notify the local authority tree officer or the tree's owner of any damage.

Low-invasive, Permeable Surface (LIS)

Construction Methodology

The following design criteria for low-invasive surfaces (LIS) will need to be considered when installing new hard, permeable surfacing within the BS Root Protection Areas (RPAs) of retained trees:

- Maintain oxygen diffusion through new surface to rooting area (3-12% by volume, **Ref 1**)
- Maintain sufficient passage of water to the rooting area (12-40% by volume, **Ref 2)**
- Maintain existing ground levels to avoid unsustainable root damage (severance and/or asphyxiation)
- Avoid compaction by maintaining a soil structure sufficient to sustain root growth (soil bulk density below 1.6g/cc, **Ref 1**)

The above criteria will provide the conditions for continued tree growth and preservation.

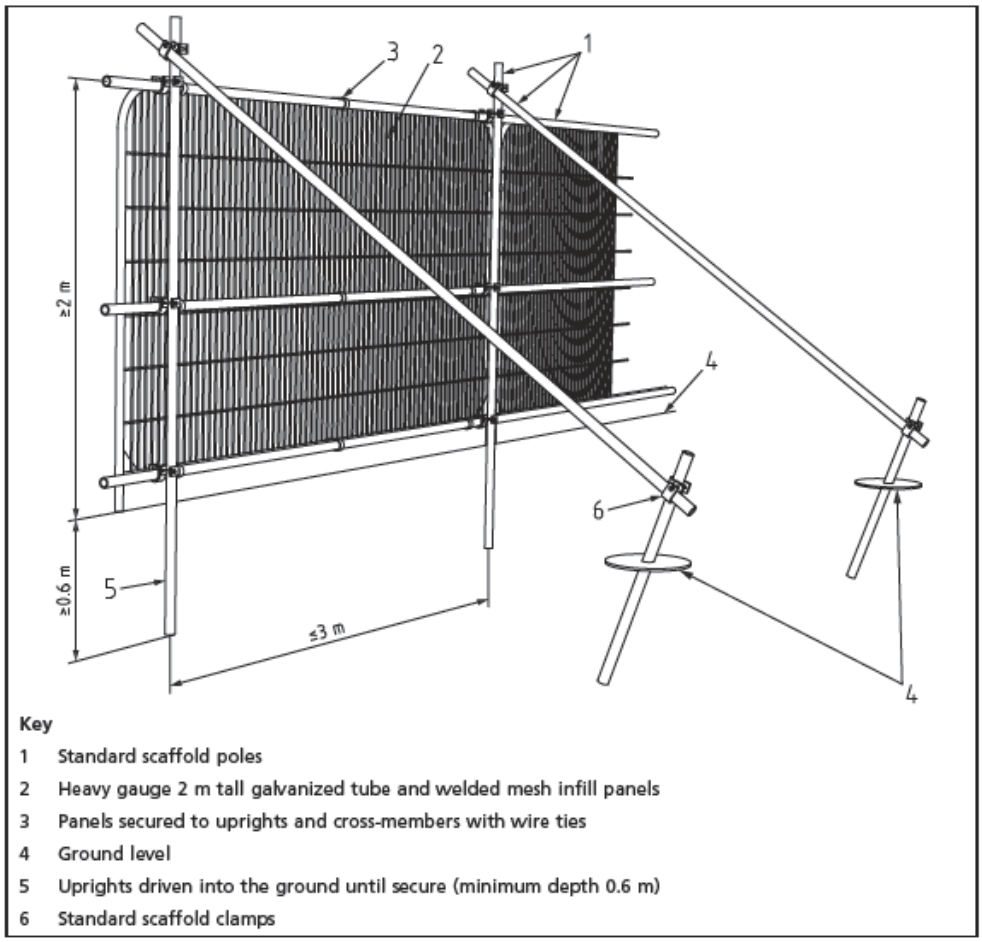
Site analysis of the soil type and its Californian Bearing Ratio (CBR) should be established prior to determining the specific depth of products to be adopted for the LIS. For example, footpaths normally require a depth of 100mm and, 150mm to 200mm depths are used for residential driveways, while greater depths may be required for the passage of heavier traffic such as for construction access and delivery vehicles.

1. The use of a three dimensional cellular confinement system within an LIS is an acceptable approach, which aims to fulfil the above design criteria. This system maintains the passage of oxygen and water to root systems; avoids root loss through severance or asphyxiation and minimises the potential for soil compaction. It is achieved by using Geotextile membranes and the introduction of the three dimensional Cellular Confinement System product. The material is laid onto a geotextile membrane covering the soil, whose existing levels within the Root Protection Area (RPA) of retained trees, is to be maintained so far as practicable.

2. Retained trees must first be protected during all stages of the development including demolition, by the erection of fencing as shown in the diagram below and with reference to specifications and the Tree Protection Plan (TPP). Installing the LIS may require the re-positioning of the tree protection fencing to a secondary location in line with TPP and associated method statement. This follows the

recommendations provided within British Standard 5837:2012 'Trees in relation to design, demolition and construction – Recommendations'.

Figure 2 **Default specification for protective barrier**



Key

1 Standard scaffold poles
2 Heavy gauge 2 m 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 0.6 m)
6 Standard scaffold clamps

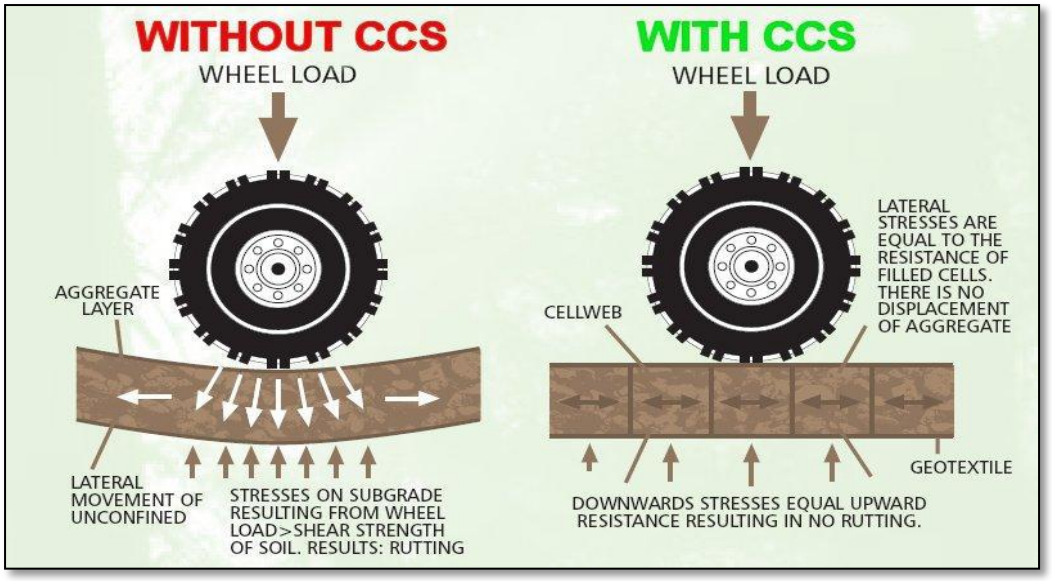
3. Where ground levels are to be raised more than 150mm (**Ref 3**) within the RPA this should be achieved by the use of a granular material, which does not inhibit vertical gaseous diffusion. For example: no-fines gravel (MOT Type 3), washed aggregate, structural soil (min. 20% sand content) or cobbles.

4. The LIS should be installed between May and October, when the ground is driest and least prone to compaction. The approved wearing course is to be laid over the cellular confinement system. Where the LIS is to cover in excess of 20% of the RPA of a previously uncovered RPA, justification is to be provided.

5. The effect of the CSS produces **a composite mattress**, with high flexural stiffness and load support

capabilities. This will prevent soil rutting and mechanical root damage by confining the porous infill materials within the CCS.

Fig. 1 Illustration of stress distribution using a cellular confinement system over roots.



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6. The use of a non-woven Geotextile beneath the cellular mattress acts as a separation/filtration layer. The CCS should be filled with **no-fines** stone in the 20-40mm range. This operation will be carried out avoiding the use of heavy machinery within the RPA of retained trees. Once filled, the perforated cellular wall structure provides mechanical interlock for infill materials, increasing the shear strength while allowing lateral drainage and gaseous exchange.

7. The system will be used as a permanent base for a wearing course and/or will provide a temporary site access for root protection. The minimum depth for CCS material is 75mm but depths up to 400mm may be suitable; the material required is dependant on the load bearing capacity of the final surface. A structural engineer should design all engineering solutions to surfaces.

8. A pre-commencement site meeting with the appointed ground work contractor, site manager, arboricultural consultant and appointed engineer should be designed to agree the stages and specification for the installation of the LIS. A qualified arboricultural consultant will supervise any works within the RPAs of retained trees.

Stages for Installation of the LIS (with CCS)

Stage 1 **Erection of Tree Protection Fencing** (see Tree Protection Plan).

Stage 2 **Remove existing vegetation** by using a specific herbicide (as advised by a specialist) or manual removal with hand tools only. Agreed removal of shrubs, saplings or trees, within the RPAs of retained trees are to be cut to or just below ground level rather than grubbed or ground out, which can damage roots of retained trees.

Stage 3 **Remove existing hard surfaces** (paving, tarmac etc.) Machinery operating on existing surfaces or outside the RPAs and tree canopies could, be used to carefully remove existing wearing surfaces under specialist arboricultural supervision. The sub base of existing surfaces or foundations should be left in situ where possible to avoid unnecessary root disturbance and provide a base for a new LIS.

Stage 4 **Install the non-woven Geotextile** directly over soil grade level (levelled where necessary, by the infill of no-fines gravel, washed aggregate or structural soil (min. 20% sand content) and fix in place.

Stage 5 **Lay the CCS over the Geotextile**, which is secured open under tension during the infill process with steel staples or wooden pegs.

Stage 6 **Install kerbs and edgings** directly on top of existing soil grade level. For light structures, a treated peg and board may be acceptable. For more substantial structures, railway sleepers, haunched concrete with road pins, drilled kerbstones or gabians may be appropriate.

Stage 7 **Fill the CCS** ensuring any machinery works only on already filled areas. Typical infill consists of no fines angular granular material 20-40mm, **which will remain uncompacted**.

Stage 8 **Install wearing course surface.**

Permanent permeable surfacing types

Small Block Paving

- Lay a second layer of Geotextile separation fabric over the infill CCS.
- Lay a sharp sand-bedding layer to recommended depth.
- Place block paviors as per manufacturer's instructions.

Washed Gravel

- Place second layer of Geotextile separation fabric over the infill CCS.
- Place pea shingle/ gravel aggregate to required depth.

Example of cellular confinement system without final wearing course.

References: 1 – Tree Roots in the Built Environment 2006, Roberts Jackson Smith HSO
2 - Tree Root Growth Requirements, Dr Kim. D. Coder, University of Georgia. July 2000
3 – Arboriculture, Tree Management of Shade Trees and Vines 2004, Harris, Clarke, Matheny