BOB WIDD ASSOCIATES

ARBORICULTURAL IMPACT ASSESSMENT SURVEY

TO BS5837:2012

PROPOSED PARTIAL RE-DEVELOPMENT OF

15 DULOE ROAD

EATON SOCON

St. NEOTS

CAMBRIDGESHIRE PE19 8FQ

JUNE 2025

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ARBORICULTURL SURVEY to BS5837:2012



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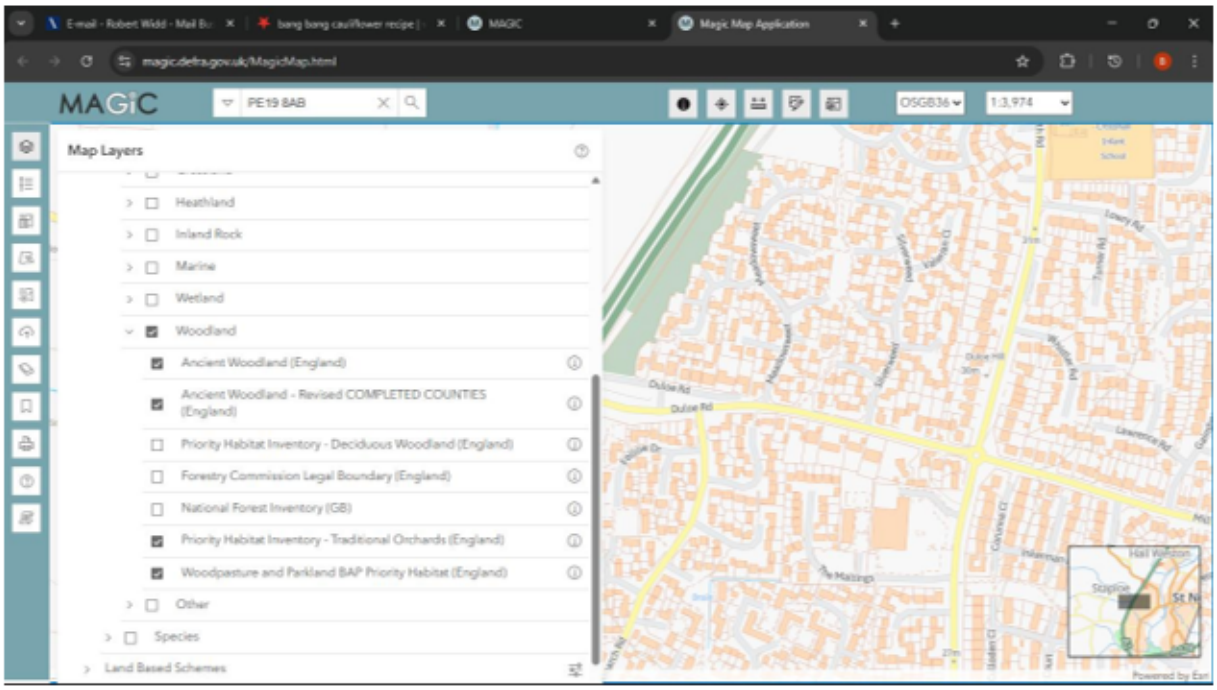
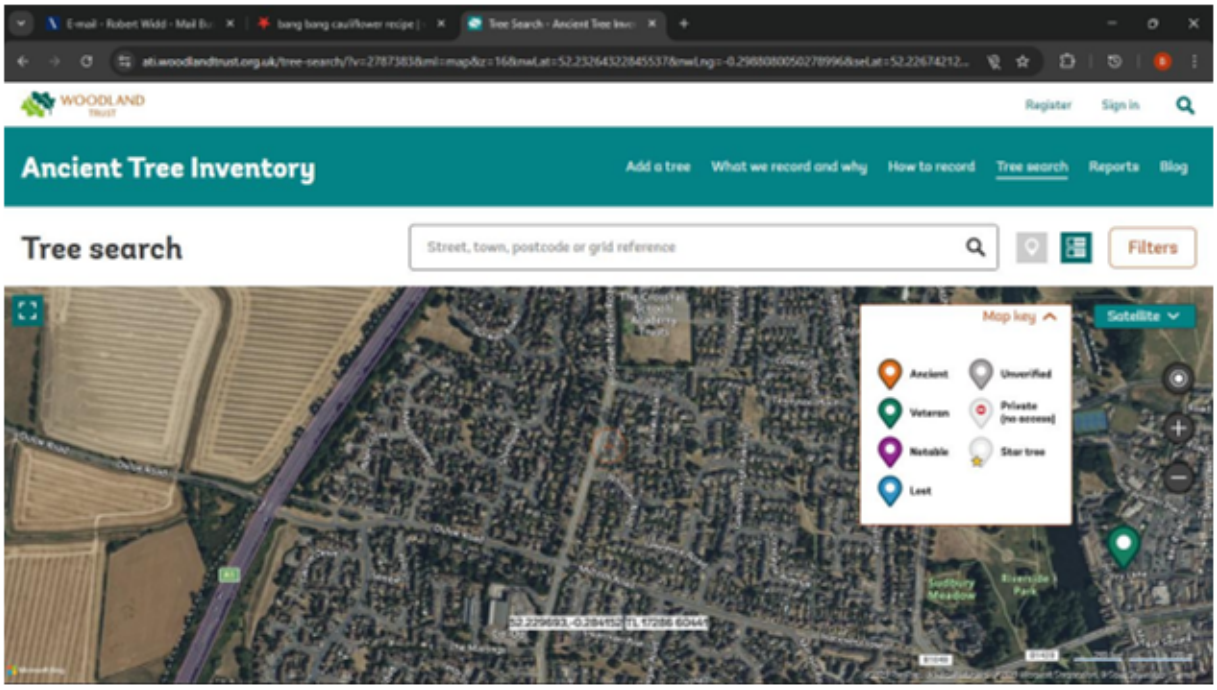
Executive Summary

- Bob Widd Associates Limited has been commissioned by Mr S Orr to produce an Arboricultural Report, Tree Protection Plan and Arboricultural Impact Assessment [AIA] to accompany the application for the proposed re-development of the property at 15 Duloe Road, Eaton Socon, Cambridgeshire PE19 8FQ
- An online search of the Huntingdonshire District Council website shows that the site does not fall within a Conservation Area and there are no trees on site that have been served with a Tree Preservation Order.
- An online search of the Woodland Trust Ancient Tree Inventory shows no Ancient, Notable or Veteran trees registered within influencing distance of the site.
- A search of the DEFRA MAGIC map shows there to be no ancient woodlands, traditional orchards, wood pasture or parklands within influencing distance of the site– see map below.
- The report highlights the procedures required to protect the retained trees during the construction phase, and it is the responsibility of developer to ensure that the correct protection measures are always put in place and adhered to in accordance with **BS5837:2012 Trees in relation to design, demolition and construction –Recommendations.**
- The report is a snapshot of the trees and their current categorization within the framework of BS5837:2012 Trees in relation to design, demolition and construction recommendations, on the day of the survey. **It is not a health and safety conditional report**, however, where trees are of poor form or are dangerous, these have been mentioned in the Tree Schedule [Appendix D]
- A total of two individual trees and one group of trees were surveyed. Of these there are no A grade trees/groups, three x B grade trees/groups, no x C grade trees/groups and no x U grade trees/groups, as per the classifications of BS5837:2012.



No Ancient Woodlands, Wood Pasture or Traditional Orchards within 1km of the proposed development site



No Ancient, Veteran or Notable trees within 1km of the proposed development site

1. Introduction

1.1 Terms of Reference

Bob Widd Associates Limited [BWA] has been commissioned by Steven Orr to undertake an Arboricultural Survey and produce a report to BS5837:2012 with an Arboricultural Impact Assessment [AIA] and Tree Protection Plan [TPP] for planning application purposes. This report provides the information of the tree stock on site at the time of inspection which is shown in the table in Appendix D. The Tree Protection Plan shows the trees to be retained along with the location of the protective measures to be put in place to prevent damage occurring to the retained trees.

The area surveyed is the front garden to the north of the existing dwelling. It is centred on grid reference 52^{0}13'43.53" N: 0^{0}17'16.12" W and shown in Diag 1 below. No additional trees outside the development site were inspected.



Diag 1: Location of surveyed site shown in yellow

1.2 Scope of Work and Tree Assessment Methodology

The Scope of Work was to:

1. Assess the current condition of the trees on site for categorisation under *BS5837:2012 Trees in relation to design, demolition and construction – Recommendations*, and *NJUG 4 - Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees*
2. Determine whether the trees warrant removal on the grounds of Health and Safety
3. Determine whether any trees require removal for the provision of the proposed development works.
4. Plot the position of the trees and measure their diameters at 1.5m above ground level.
5. Calculate the Root Protection Area (RPA) around each tree as per Section 4.6 of *BS5837: 2012.*
6. Produce an AIA and TPP.

The tree survey was carried out by a qualified Arboriculturist, to assess the quality and value of the principal trees and hedges to comply with the above Scope of Works.

The survey process categorises the trees/hedges onsite and will select those appropriate for retention; review the options for incorporating these trees within the developed landscape; and provide a finalised plan for tree protection during construction. The survey provides comment on the general quality of the trees but does not constitute a full or thorough assessment of the health and safety of trees on or adjacent to the site.

The full Tree Survey Schedule and categorisation of the trees in their existing context is in Appendix D. The Root Protection Area (RPA) calculations are provided in Appendix E.

The position of all the trees on the site was previously plotted on a topographical plan, and these are numbered in accordance with the data found in the Tree Schedule [Appendix D] along with the Protection Plan [Appendix A].

We have used the topographical plan to overlay the Root Protection Areas for each retained tree/hedge. [Appendix A: Tree Protection Plan].

The diameters of the trees were measured using an industry recognised girthing tape, at a height of 1.5m from the ground. This data can be found in column 4 of Table 2 in Appendix D. Where access to measure the diameter was not possible a visual estimate was carried out.

Heights were recorded, where possible, using a Hagar hypsometer. Where it was not possible then a visual estimate of the height was made.

1.3 LIMITATIONS OF SURVEY

1. The survey only encompassed the trees/hedges likely to be affected by the proposed development.
2. The report is not, nor should be taken to be, a full or thorough assessment of the health and safety of the trees on or adjacent to the site.
3. No soil analysis was performed on site.
4. No root, shoot or folia samples were taken for analysis from site.
5. Where decayed trees were found, these were not tested with scientific instruments to determine the extent of decay, nor were they climbed, but inspected from ground level.
6. Where access to the base of a tree was not possible an estimate of the diameter is given and noted in the comments.
7. Where the top of the tree could not be seen, a visual estimate was made and noted in the comments.

8. No investigation to locate underground utilities was undertaken. Where trees are growing close to inspection chambers this is noted in the comments.
9. Overhead utilities are noted where appropriate in the comments.

2. Tree Summary

2.1 Overview

The proposed development site is located within the front garden of 15 Duloe Road and runs in a west to east direction. The ground has a gentle slope from the northwest down to the southeast.

The site does not fall within a Conservation Area, nor does it have any trees that are currently served with a Tree Preservation Order.

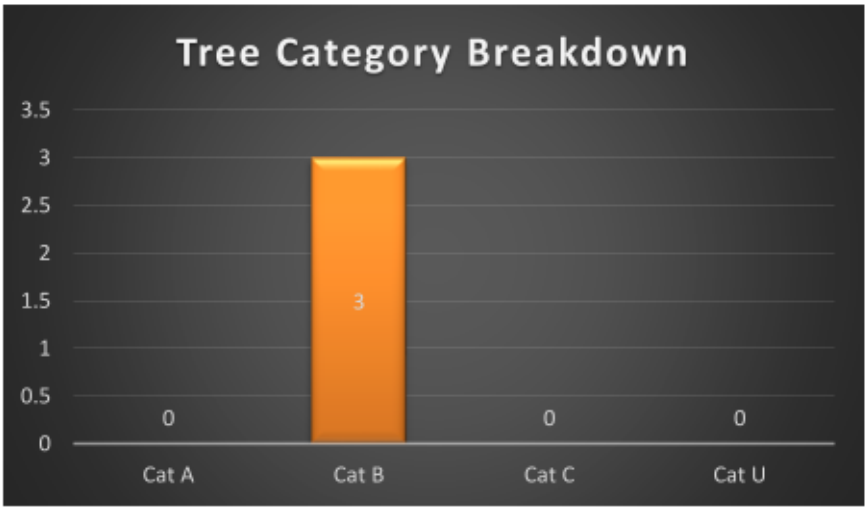
The existing tree stock consists of two large mature Horse chestnut trees along the northern boundary and an avenue of eight Laburnum trees located on either side of the entrance driveway to the west.

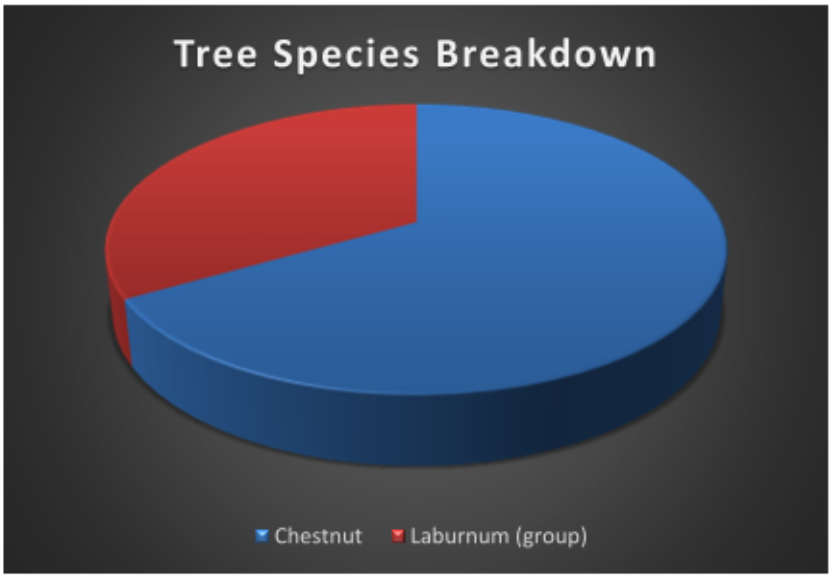
The remaining garden consists of a mixture of mature and semi mature shrubs of various species.

The purpose of the survey was to identify the current tree stock on site and only the trees within influencing distance of the proposed development have been surveyed, and of these two individual trees and one group the following table provides a summary of their quality and value, as assessed in accordance with BS 5837:2012 (Appendix B– Cascade chart for tree quality assessment)

Summary of BS 5837:2012 tree categories assigned to the surveyed trees.

Tree Category	Description	Total Number Surveyed
Category A	Trees or groups of high quality and value	0
Category B	Trees or groups of moderate quality and value	3
Category C	Trees or groups of low quality and value	0
Category U	Trees or groups for removal	0





3. Tree Constraints

3.1 Proposed Development

The two main constraints that trees impose upon construction works are the size and spread of both.

1. the above ground canopy, and
2. the subterranean root system,

All care should be taken at the design stage to remove any risks that may compromise these.

The default position is to avoid any construction or demolition works within the Root Protection Area where possible. If construction works are unavoidable within the Root Protection Area certain guidelines and recommendations must be adhered to throughout the construction process.

Section 7.4.2.3 of BS5837:2012 gives guidance on the maximum unsurfaced area of the RPA that could be covered in hard surfacing. The recommendation is that an area not exceeding 20% of the unsurfaced ground should be covered.

There is no requirement to remove any trees on site, and there are no trees whose RPA is compromised by the proposed development works.

It can therefore be seen that the new proposal does not encroach beyond the 20% as recommended in the British Standards BS5837:2012.

This therefore should not be used as a reason for refusing Planning Permission by the Local Authority.

All retained trees which are close to the construction works (or the access route) are to be afforded full fence protection in accordance with British Standard 5837:2012, Trees in relation to demolition, design and construction recommendations. The position of the

Tree Protection Fence (TPF) would usually be along the outer edge of the RPA, thus protecting the land and roots under the canopy of the tree.

However, in this particular case, a large proportion of the RPA's of the trees on site are already protected by hard standing in the form of a paved driveway. Due to this, the TFP is to be located along the edge of the drive, so as to protect the soft landscaped areas of the front lawn and shrubbery.

The foundations for the two areas of development have already been excavated and the concrete poured, the consent for which was granted by Huntingdonshire District Council in Application **16/02053/HHFUL**. The proposed project consists of building upon these foundations.

Building materials will be delivered and 'off loaded' at the front gate and manually transported to site using wheelbarrows. This therefore means there will be no plant on site and the only machinery present will be a cement mixer.

As such, there is minimal risk to the trees and we recommend that the Tree Protection Fence be constructed of a 1.2m high chestnut paling or plastic barrier type along the area shown in red on the Tree Protection Plan. To add a higher level of protection to the trunks of the Laburnums along the driveway, we recommend using heras fencing in plastic footings, as shown in blue on the Tree Protection Plan. The area protected behind the fence will be designated a No Work Zone [NWZ], and there will be no unauthorised access into this area for building contractors.

Storage of the building materials transported from the front gate will be located on the hard standing near to the existing property. There will be no fires within 20m of any tree and the washings from the cement mixer will be removed from site in an appropriate manner and not allowed to be disposed of within the NWZ. On completion of the construction works, the TPF is to be dismantled and removed from site.

4. Recommendations

4.1 The Final Design

The final design for the scheme should be undertaken in accordance with the following guidance: See Appendix H for further information.

4.1.1 Risk to trees from general construction activities

Trees can be easily damaged by construction processes, with both the tree roots and the main structure of a tree susceptible to a range of impacts. Root damage can affect the anchorage and stability of the tree, as well as preventing or inhibiting the absorption of water and nutrients. Damage to the trunk and branches leaves the tree more exposed to disease and decay.

Activities that can cause damage to tree roots include:

- Trenches.
- Alterations in soil level.
- Non-porous surfaces.
- Compaction of soil.
- Changes in soil hydrology.
- Root exposure.
- Soil pollution (i.e., oil spill, incorrect application of herbicide and/or other chemicals).
- Fire.

Activities that can cause damage to tree trunks and branches include:

- Pressure from materials stored against trunks.
- Physical impact from plant and equipment.
- Incorrect pruning.

- Exposure of bark or leaves to chemicals; and,
- Damage to bark from mowers and strimmer's.

Any works associated with the scheme that could affect the existing trees as described above must be discussed and approved by a qualified Arboriculturist prior to commencement.

4.1.2 Risk to trees from removal of existing structures/fencing

Trees can also be damaged during any proposed demolition process of existing buildings and the removal of hard surfacing and other structures. It is important that the Tree Protection Fence is erected prior to these works commencing and stay in place around the hedges/trees during these works.

4.1.3 Root Protection Areas (RPA)

Subterranean works in proximity of trees is likely to cause some root damage since in the order of 80% of the roots of any tree will occur within the upper 600mm of the soil. Roots will spread out for a considerable distance from a tree and may be encountered at a distance beyond the canopy spread of a tree. Where construction activities are proposed within the rooting zone of trees, the potential for significant damage exists.

Section 4.6 of BS 5837:2012 prescribes a methodology for the calculation of a Root Protection Area (RPA). This is further explained in Appendix E.

The RPA represents the minimum area that should be retained undisturbed around a tree or trees for the avoidance of an unacceptable degree of root disturbance. The required RPA of a tree is calculated and typically plotted as a circle (or where appropriate as a square of equivalent area) to determine constraints or the location of protective fencing.

In certain circumstances the actual shape of this area may then be adjusted to take account of local topography or any existing site features that may serve as restrictions to 'normal' root development.

The final design for the scheme should avoid excavation within the RPA of all retained trees. Any deviation in the RPA from the original circular plot should consider the morphology and disposition of the roots when influenced by past or existing site conditions and the tolerance of the tree to root disturbance. The Root Protection Area calculations and the trees to which this offset can be applied are stated within Appendix E. For each instance where avoidance of the RPA is not possible, details of an appropriate works methodology and protection measures necessary must be addressed within the Arboricultural Method Statement

Areas of proposed landscape planting are to be protected during construction where possible, to avoid compaction of the soil with appropriate barriers or ground protection as stated in, '*BS5837:2012 Trees in Relation to Design, Demolition and Construction - Recommendations*'. The proposed areas for protection are detailed in the Tree Protection Plan in Appendix A.

4.1.4 Tree Orders (TPO) and Conservation Areas (CA)

The primary measures which provide statutory protections to trees are Tree Preservation Orders (TPOs) and Conservation Areas (CA). Where present, these measures determine that, either notification to the Local Planning Authority (CA designations) or consent from the LPA (TPO designations) is required, for any works that may affect trees or tree groups.

A search of the Huntingdonshire District Council's website showed there to be no Tree Preservation Orders served at 15 Duloe Road, and the site does not fall within a Conservation Area.

4.1.5 Trees and Wildlife

The Wildlife and Countryside Act 1981 (as amended), The Countryside and Rights of Way Act 2000 and the Conservation of Habitats and Species Regulations 2010 provide statutory protection for birds, bats, dormice, reptiles and other species that could be affected by tree works. Careful consideration should be given to the design of the scheme, and the timing of any associated tree works to avoid impacting protected species.

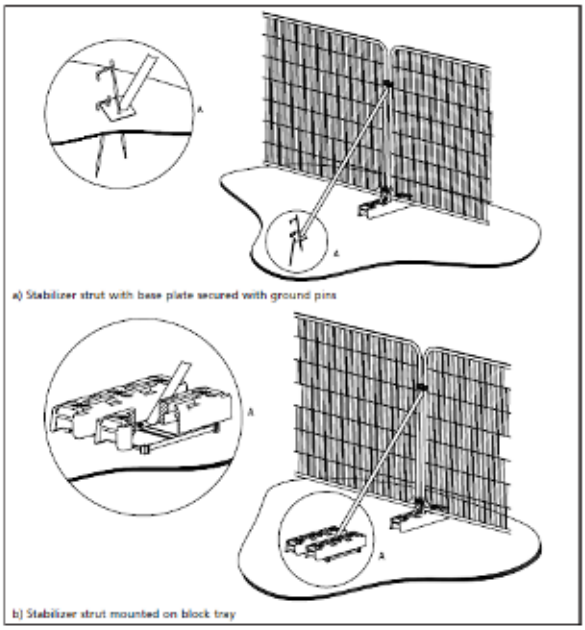


Figure 1 – BS5837 design for heavy duty protective fencing



Figure 2 – Tree Protection Area warning sign – a different design is shown in Appendix A

5. Impact Assessment

5.1 Development site

The proposed development requires no trees to be removed to allow the development to proceed.

Protective fencing is to be erected as per the Tree Protection Plan [Appendix A]. This should be of a design recommended within the British Standards BS5837:2012 and erected on site prior to the commencement of any construction works. Figure 1 shows a design specified within the British Standards that is recommended for erection on site. Where the ground is too hard to insert steel pins to support the braces as per option a, then the design in option b is to be used.

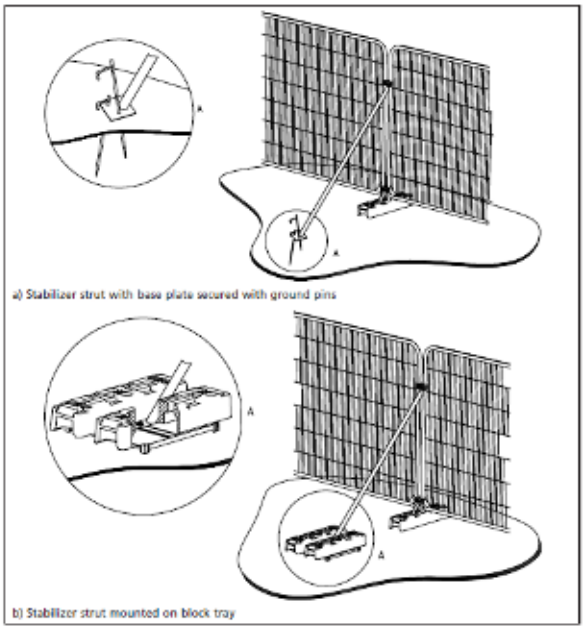


Figure 1 – BS5837 design for heavy duty protective fencing

It is paramount that the fence is constructed in a robust manor and weatherproof warning signs are placed on the fence panels indicating what the fence is for and that no unauthorised access is allowed beyond the fence. See Figure 2



Figure 2 – Tree Protection Area warning sign – an alternative design is shown in Appendix A

5.2. Impact of Development upon Existing Tree Stock

The development of the site will have a neutral impact upon the current tree stock as no trees are to be removed or pruned.

Table 4 indicates the likely arboricultural impact on the development prior, during and post all the development stages.

Table 4 Summary Table of development impacts and mitigation for development site at 16 Duloe Road, Eaton Socon

Timing	Proposed activity or conflict	Characteristic of impact without mitigation	Nature, Magnitude, Extent and Probability of impact without mitigation	Proposed mitigation and/or compensation	Nature, Magnitude, Extent and Probability of impact with mitigation
Pre-development	No removal of trees or bushes required	No impact	no impact at Site level – Certain	No mitigation required	Neutral impact at site level within public view- Highly likely
Development stage	General site works in proximity to trees being retained.	Damage to trees possibly leading to decline and death	Major negative impact at Local level – Highly Likely	Erection of protective fence as specified in BS5837:2012. Works to be undertaken outside of RPA	Neutral at local level – Likely
Post-development	Creation of new buildings under tree canopies.	Encroachment/shading of roof from existing trees	Negligible impact at Local level –Likely	Facilitation pruning as required in future years. Additional management of trees on site when required.	Neutral impact at Local level – Likely

6. Conclusion

This AIA report covers the trees affected by the proposals to develop part of the existing building at 15 Duloe Road, Eaton Socon, Cambridgeshire.

To accommodate these proposals, it will not be necessary to remove any trees.

At no time should the trees' health or integrity be compromised, so all workings must be in line with current guidelines and legislation as laid out in BS5837:2012, BS3998:2010 and NJUG 4.

We recommend using heras type fencing along the driveway for the Tree Protection Fence so as to give added protection to the Laburnum trees. The section of Tree Protection Fence between the grass lawn and the drive can be constructed of a temporary chestnut paling or plastic barrier type of fence.

The area behind the fence(s) will become a No Work Zone and no unauthorised access will be allowed to construction workers.

There will be no fires on site and the washings from the cement mixer will be removed in an approved manner.

According to the Huntingdonshire District council web site number 15 Duloe Road is not within a Conservation Area nor are there any trees on site served with a TPO.

Appendices

Appendix A. Tree Protection Plan

Appendix B. Key to Tree Survey Schedule and 5837 Cascade Table

Appendix C. Key to Common and Scientific Names

Appendix D. Tree Survey Schedule

Appendix E. Root Protection Areas

Appendix F. Utility Guidelines

Appendix G. Temporary Protective Fencing

Appendix H. Prevention of Damage to Roots

Appendix I. Glossary

Appendix J. References

Appendix A - Tree Protection Plan (Refer to attached PDF Plans for scaling)

Appendix B. Key to Tree Survey Schedule

Key to Tree Survey Schedule		
Tree Number	Unique reference or Tree Tag Number, identifying each tree and/or tree group on the accompanying plan. In line with the advice of BS5837:2012, where trees are growing in a cohesive group these will be prefixed with W for a Woodland or G for a Tree Group. The data for these groups will be based on a mean of the dimensions, unless individual trees have been singled out for measurement within the group. HD denotes a domestic hedge and HR denotes a rural hedge. These may be assessed under the Hedgerow Regulations 1997.Where trees have not been included on the original topographical drawing they have been inserted in an indicative position.	
Species	Tree species giving the common and full botanic name.	
Height	Approximate height of tree in meters. Where possible, heights were measured with an industry recognised instrument and where access was not possible an estimate given	
Stem Diameter	Diameter of the tree, measured at 1.5m above ground level if the tree has a single trunk. These figures are used to calculate the Root Protection Area of the tree, by multiplying by a factor of 12 for single stemmed trees, or separate mathematical formulae for multi-stemmed trees [Section 5.4], [Annex 6, BS5837:2012]. (See Appendix E for further explanation)	
Crown Spread	Distance from the centre of the trunk to the four cardinal points, north, east, south, and west, measured in meters.	
Height of 1st Branch	Height of the lowest branch above ground level, measured at the union point in meters. A zero figure indicates branches are at ground level.	
Age	Estimated life expectancy assessed in accordance with figures provided in Arboricultural Association Leaflet No. 4 Tree Management.	
	Y	Young: recently planted or self-set tree under 10 years old.
	EM	Early Mature within first third of normal life expectancy.
	SM	Semi Mature: within second third of normal life expectancy
	M	Mature: within final third of normal life expectancy.
	OM	Over Mature: senescent trees nearing end of their anticipated life expectancy
	V	Veteran: exhibiting features of biological, cultural or aesthetic value characteristic of individuals surviving beyond typical age range
	D	Dead
Comments	General notes and comments about the tree and any recommended works required to mitigate or reduce any risks created by the tree.	
Physiological condition	Assessment of the health and vigour of the tree divided as such	
	Good	Generally, in healthy condition with full canopy
	Average	Generally in good health but lacking vitality and vigour
	Poor	Poor or sparse leaf coverage
	Dead	No growth at all
Structural condition	Assessment of integral structure and form of the tree. Visual assessment includes the presence of included bark, weak forking, fungal brackets, decay pockets, storm damage, hanging branches, sever leaning to one side, root plate movement and any other notable feature.	
ULE (yrs.)	Useful Life Expectancy. Gives an indication of the life expectancy of the tree, in years, based on the current survey.	
Impact of Removal	Gives a preliminary indication as to the impact the removal of the tree would have on **i.**the local landscape and **ii.**the local environment	
	H	High Impact
	Mm	Medium Impact
	L	Low Impact
Category Grading In accordance with Table 1 (BS 5837:2012	Tree categorisation as defined by Table 1 – Cascade chart for tree quality assessment of British Standard 5837:2012	
	A	High quality trees with high retention priority.
	B	Moderate quality trees with medium retention priority.
	C	Low quality trees with low retention priority.
	U	Trees for removal
RPA Radius	Calculated distance of the Root Protection Area radius from the centre of the tree, measured in meters. [Table D.1 (Annex D of BS5837.2012) states the distances to be used so as to avoid impractical measurements, to several decimal points, being used to plot out RPA distances while on site]	
RPA Area (m^2)	Area of the Root Protection Area in square meters	

Table 6: Cascade Chart for Tree Quality Assessment

TREES FOR REMOVAL

Category and definition	Criteria	Identification on plan
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.	• Tree that has 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 U category trees (i.e.,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;	RGB Code 127-000-000 DARK RED

TREES TO BE CONSIDERED FOR RETENTION

Category and definition	1. Mainly arboricultural values	2. Mainly landscape values	3. Mainly cultural values, including conservation	
Category A **Those of high quality and value:** 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 essential components of groups, or of formal or semi-formal arboricultural features (e.g., the dominant and/or principal trees 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 (e.g., veteran trees or wood-pasture)	RGB Code 000-255-000 LIGHT GREEN
Category B **Those trees of moderate quality and value:** with an estimated remaining life expectancy of at least 20 years	Trees that might be included in the 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 as groups or woodlands, such that they attract a higher collective rating then they might as individuals, or trees occurring as collectives but situated so as to make little visual contribution to the wider locality	Trees with clear identifiable conservation or other cultural value	RGB Code 000-000-255 MID BLUE
Category C **Those trees of low quality and value:** with an estimated remaining life expectancy of at least 10 years or young trees with a stem diameter 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 landscape value, and/or trees offering low or only temporary /transient landscaping benefits.	Trees with no material conservation or other cultural value	6 RGB Code 091-091-091 GREY

Appendix C. Key to Common and Scientific Names

Table 7

Tree Family Group	Common Name	*Scientific Name*
Sapindaceae	Horse chestnut	*Aesculus hippocastanum*
Fabaceaea	Laburnum	*Laburnum anagyroides*

Client: Mr S Orr
Site: 15 Duloe Road, Eaton Socon, St Neots, Cambridgeshire
Project: Proposed partial re-development of property

Appendix D. Tree Survey Schedule

1	2	3	4	5				6	6a	7	8	9	10	11	12		13	14	15
Tree Number	Species	Approx. Height	Diameter as per Table D1 of BS5837	Crown Spread in metres				Height of 1st Branch	Direction	Age	Physiological Condition	Structural Condition	Comments	ULE	Impact of removal expressed as Low, Medium or High.		BS5837 Category	RPA Radius-Table D1	RPA Area-Table D1
	Common Name	m	*mm*	N	E	W	S	m						Years	Visual	Ecological		m	m^2
1	Horse chestnut	24	*1410*	7.0	7.0	8.0	8.0	2	NW	M	G	A	Pollarded at 2.2m producing four scaffold stem, which sub-divide into a network of scaffold limbs. Minor evidence of Pseduonomus infection on the trunk and Leaf Minor (Camaria odhereia) in the canopy. Epicormic growth on branches and on one stem may indicate early levels of stress. No major deadwood in the canopy noted. Canopy requires crown raising over the external grass verge to 3m high.	20	H	M	B	16.92	900

Client: Mr S Orr
Site: 15 Duloe Road, Eaton Socon, St Neots, Cambridgeshire
Project: Proposed partial re-development of property

2	Horse chestnut	4	*820*	5.0	6.0	6.0	5.0	1.8	W	M	G	A	Minor evidence of Pseduonomus infe3ction and Camaria odhereia infestation on the leaves. Two major limbs historically removed and occluding over, but we recommend that a diagnostic investigation be undertaken to establish the level of structural compromise that has occurred within the trunk.	15	H	M	C2	9.84	304
G3	Laburnum x8	6	*200*	2.0	2.0	2.0	1.5	1.8	E	SM	G	A	Planted as an avenue on either side of the entrance drive. DBH is the average of the eight trees	20	L	L	C2	2.40	18

Appendix E. Root Protection Areas

ROOT PROTECTION AREAS

Tree roots can be damaged very easily and once this has occurred then, depending on the age, species and extent of damage the tree may suffer severe die back in the area normally supplied by that root and as a result may die altogether. This is unacceptable and as such trees that are to be retained on construction sites must be protected as far as reasonably possible from suffering such damage.

Most tree roots tree roots will be found within the top 600mm of soil, as this is where the moisture, light, air and heat are concentrated. Any damage to this soil structure may kill the roots. Damage can occur from chemical leakage, soil compaction, soil stripping, and dehydration due to soil level changes.

For these reasons it is essential that the soil around a tree to be retained must be protected. This area is known as the **ROOT PROTECTION AREA** and is calculated using the criteria supplied in BS5837: 2012, section 4.6.

The RPA should be an area equivalent to a circle with a radius 12 times the stem diameter for single stem trees and for trees with more than one stem one of two calculations should be used.

a) for trees with two to five stems, the combined stem diameter should be calculated as follows:

$$\sqrt{(\text{stem diameter 1})^2 + (\text{stem diameter 2})^2 \ldots + (\text{stem diameter 5})^2}$$

b) for trees with more than five stems, the combined stem diameter should be calculated as follows:

$$\sqrt{(\text{mean stem diameter})^2 \times \text{number of stems}}$$

The calculated RPA should be capped at 707m^2, e.g., which is equivalent to a circle with a radius of 15m or a square with approximately 26m sides.

The figures found in column 14 of Appendix D indicate the distance, from the centre of the tree to the outer limits of the RPA. It is clear to see that the older and larger a tree is then the larger the RPA area is. [Table D.1 BS5837:2012 indicates the rounded-up dimensions to be used when calculating RPA distances. (This prevents the over-use of figures to several decimal points being used as per BS5837:2005)]

As per section 4.6.2 of BS5837 alterations to the shape of the RPA may have to be accounted for in situations where the morphology and disposition of the roots is affected by physical barriers and constraints, (for example trees planted in raised beds with a retaining wall around them, ditches and roads). There are no trees on site, within the proposed development area, whose root structure will be adversely affected by topographical features.

ADJUSTMENTS TO RPA

It should be emphasised that the RPA distances in the Tree Survey Schedule (Appendix D), relates to distances from the centre of the tree to the protective fencing. Other considerations, particularly the need to provide adequate space around the tree, including allowances for future growth and working space will usually indicate that the fence should be further away.

With appropriate precautions, temporary site works can occur within the protected area, e.g., for access or scaffolding, however, this can only occur AFTER a method statement has been submitted and approved by the local LPA.

All positioning of protective fence lines should, as a default, be outside the RPA designated distances and erected around each retained tree for the duration of the construction works.

If works within the RPA are proposed, the project Arboriculturist should be able to demonstrate that the tree(s) can remain viable, and that the area lost to encroachment can be compensated for elsewhere).

Table 8: Root Protection Areas – Calculated in Accordance with Table D1 of BS5837:2012

Tree	Species	Height	Trunk Diameter (mm)	RPA Radius (m)	RPA Area (m^2)
1	Horse chestnut	24	*1410*	16.92	900
2	Horse chestnut	4	*820*	9.84	304
G3	Laburnum x8	6	*200*	2.40	18

Appendix F. Utility Guidelines

NJUG 4 GUIDELINES

In 1995, the National Joint Utility Group (NJUG) published Guidelines for the **Planning, Installation and Maintenance of Utility Services in Proximity to Trees,** and produced it as publication number 10. The most recent version of the document is NJUG 4, dated 2007.

It is a comprehensive document and provides recommendations based on information obtained from several Arboricultural bodies coupled with information from the Utility Industry.

The guidelines are applicable to all services (underground and overhead) and to trees in any location (public, private, rural or urban). They are to be considered when new services are to be constructed adjacent to existing trees and when new trees are to be planted next to existing services.

DAMAGE TO UNDERGROUND SERVICES

The delivery of services involves a wide range of different systems and materials. The methods used have evolved over time in response to new requirements and new materials and therefore it cannot be assumed that any service will have either a modern or consistent structure. In general, the services fall into three categories: pipes, cables and ducts.

Electricity customers are supplied via overhead wires or underground cables, the latter usually being laid in ducts. These duct runs were previously constructed of short lengths of clay pipes,

but are now being replaced with longer lengths of modern plastic ducting, which are colour coded for the different utilities.

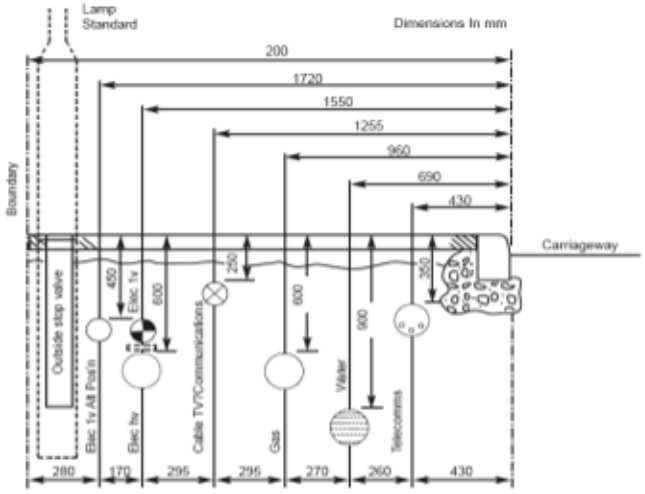


Figure 2: Layout of Utilities under a 2-meter-widepath – Taken from NJUG4

Recommendations for the positioning of the services are contained in NJUG Publication 4 'Recommended Positioning of Utilities Mains and Plant for New Works'.

The recommended arrangements for a 2m wide footpath are shown in Figure 2.

Although new services beneath footpaths should follow these positions, older services are more variable. The current recommendations are based on an Institution of Civil Engineers' Report 1946, which was widely adopted, so that services laid since that date should generally be similar.

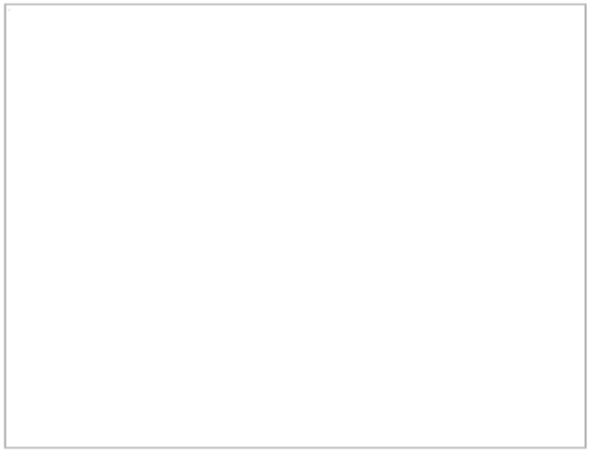
Underground services, especially if they are within the top 600mm, may be affected by root activity and there may be a risk of damage to the joints and the ducting by distortion because of soil movement due to root growth. The most common forms of damage are:

- Direct damage caused by the increase in diameter of the roots bringing it in to contact with the service. Ducting mad of short pipes will be more vulnerable to distortion and cracking.
- Root incursion into pre-damaged ducting. Roots will not penetrate intact services but if there is a breach of the integrity of the ducting then roots may exploit this and grow within the pipe work, thus causing a multitude of problems such as blocked drains, overheated electricity cables and distorted fibre optic cables.
- Indirect damage caused by shrinkable clay soils and peats. When the soil shrinks due to dehydration the resultant movement of the soil can distort the ducting.
- Wind movement of the tree may cause the roots to move within the top layers of soil and distort the soil profile. The result of a wind-blown tree with its roots ripped out of the ground may cause the service ducting to be lifted completely out of the ground if it is entangled in the root plate.

Appendix G. Temporary Protective Fencing

Recognised fencing methods for protecting the RPA depend on the likelihood of heavy machinery being on site. Once the fence is erected the location of it must be maintained and as such if heavy plant is likely to be on site, then a robust construction should be undertaken. Figure 3 shows the approved default fencing specification for most construction sites.

Fencing should be fit for purpose and rigid enough to withstand damage. Where the fencing is to be erected on retained hard surfacing, or it is otherwise unfeasible to use ground pins, the stabilizer struts should be mounted on a block tray as per Figures 4b. We recommend the use of a fence as shown in the design (Figure 4b), for erecting around the trees shown on the Tree Protection Plan. A notice should be fastened to every second panel with words similar to '**TREE PROTECTION AREA–KEEP OUT!",** as per the example below.



G.1. Extract from BS 5837:2012: Default Design for Protective Fencing



Figure 3: Default Design for Protective Fencing

G.2. Extract from BS 5837:2012: Alternative Design for Protective Fencing

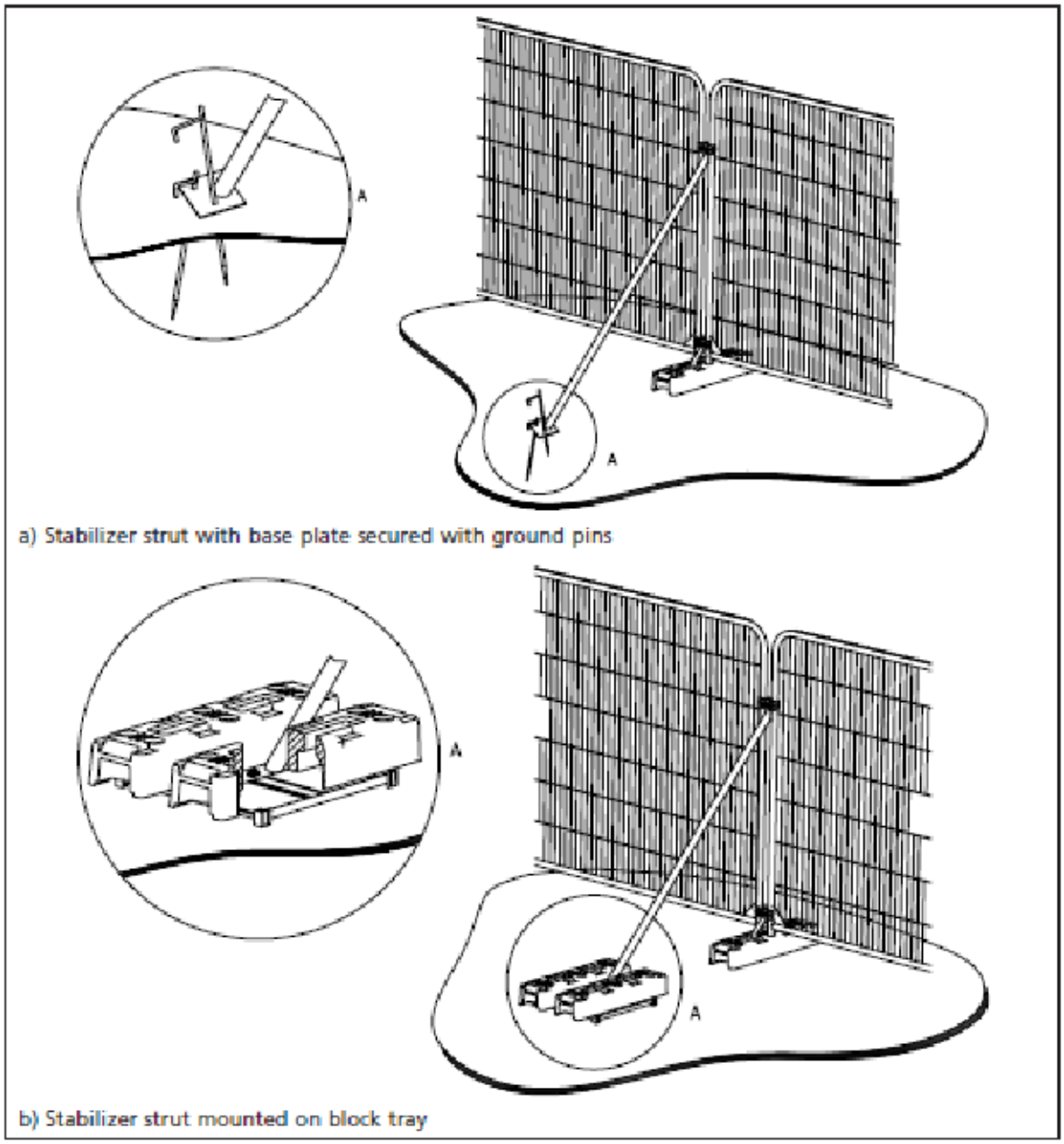


Figure 4a & 4b: Alternative Design for Protective Fencing

G.3. Extract from BS 5837:2012: Ground Protection during Demolition and Construction

Where the set-back of the tree protection barrier would expose unmade ground to construction damage, new temporary ground protection should be installed as part of the implementation of physical tree protection measures prior to work starting on site.

New temporary ground protection should be capable of supporting any traffic entering or using the site without being distorted or causing compaction of underlying soil.

NOTE the ground protection might comprise one of the following:

a) for pedestrian movements only, a single thickness of scaffold boards placed either on top of a driven scaffold frame, to form a suspended walkway, or onto of a compression resistant layer (e.g., 100 mm depth of woodchip), laid onto a geotextile membrane.

b) for pedestrian-operated plant up to a gross weight of 2t, proprietary, inter-linked ground protection boards placed on top of a compression-resistant layer (e.g., 150 mm depth of woodchip), laid onto a geotextile membrane.

c) for wheeled or tracked construction traffic exceeding 2t gross weight, an alternative system (e.g., proprietary systems or pre-cast reinforced concrete slabs) to an engineering specification designed in conjunction with arboricultural advice, to accommodate the likely loading to which it will be subjected.

The locations of and design for temporary ground protection should be shown on the tree protection plan and detailed within the arboricultural method statement.

In all cases, the objective should be to avoid compaction of the soil, which can arise from the single passage of a heavy vehicle, especially in wet conditions, so that tree root functions remain unimpaired.

Appendix H. Prevention of Damage to Roots

HOW ROOTS ARE DAMAGED.

Tree roots are **not** a mirror image of the foliage above ground level nor is there generally speaking a long 'taproot' anchoring the tree down. The majority of roots are found within the top 600mm of the surface soil and extend radially in any direction for distances up to 1.5 times the trees height. It is clear to see that any excavation work within this rooting area could possibly damage the tree roots.

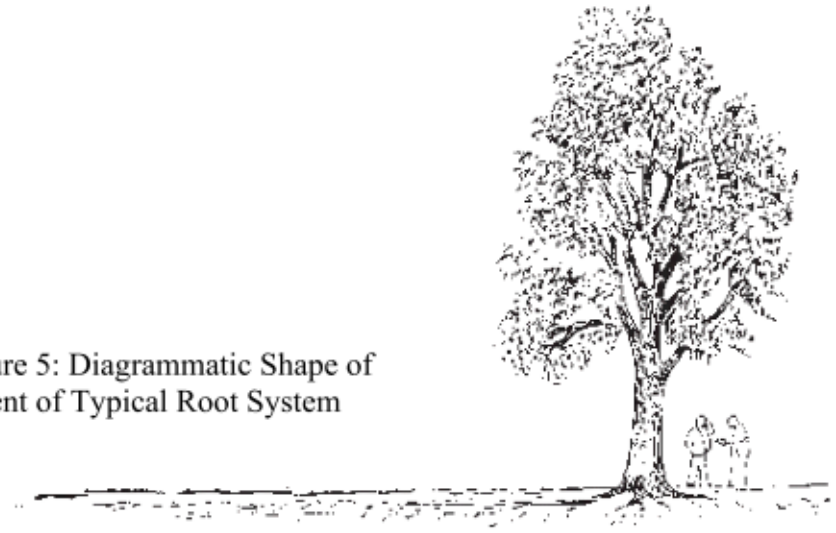


Figure 5: Diagrammatic Shape of Extent of Typical Root System

The base of the trunk typically flares out in buttresses, with these extending into the main lateral structural roots. These rapidly subdivide into the mass of roots, which serve to anchor the tree into the ground, and to conduct water and nutrients. Even at a short distance (3m) from a mature tree, most roots will be less than 10mm in diameter and these may well extend to well beyond the extent of the canopy. A mass of finer roots, less than 1mm diameter, develop from this system and it is these finer roots that absorb the nutrients and moisture from the soil. If these finer roots suffer major extensive damage, then the side of the tree that

they service may well suffer and eventually die. It is imperative therefore that damage to any of the root system is kept to the bare minimum.

Root systems can be damaged by: -

- The severance of a root, for example by trenching, which will destroy all parts of the root beyond that point.
- Damage to the bark of the root. The bark protects the root from decay and is also essential for future root growth. It can be easily damaged as it is loosely attached.
- Soil compaction caused by the movement of heavy plant over the root area or the storage of materials on site. This can restrict the gaseous diffusion through the soil and asphyxiate the roots. The roots must have oxygen to survive.
- Alteration of the soil levels, either lowering the soil by stripping off the top layer or increasing the depth of the soil by storing more on top of the existing levels.
- Incorrect application of herbicide.
- Spillage of other dangerous chemicals

If the roots are damaged, new roots must develop as quickly as possible to sustain the tree. This may be done by increased growth in other areas of the root system or by the development of new roots from the damaged area, and in either case may take several years to fully recover. It is therefore essential that the growing medium around a damaged root must be of a suitable condition to sustain the required elements of moisture retention, uncontaminated with chemicals, free draining and of an open crumb texture to allow oxygen to penetrate.

Young, vigorous trees will recover quicker and more successfully than old mature trees, and as such the protection of the root system of a mature tree is more critical than that of a young specimen.

Symptoms of damaged roots may not be evident for some time, even years in some species. If the root system recovers rapidly then there may be no noticeable ill effects. Such symptoms may range from branch dieback to deterioration of the whole tree and ultimately the death of the tree.

HOW TO AVOID DAMAGE TO ROOTS/TREES

This section gives general guidance on methods of protecting roots damage to trees.

Wherever trees exist, precautions should be taken to minimise damage to the root system. As the shape of the root system is unpredictable, there should be careful control and supervision of any excavation, particularly if this involves digging through the surface 600mm where the majority of roots are.

The precautions advocated here are applicable to any excavation occurring within a distance from the tree equal to 4 times the circumference of the trunk. The circumference is measured at 1.5m high.

This area around the tree is known as the PRECAUTIONARY AREA and is measured radially from the centre of the trunk. If works must take place within this area, then certain precautions must be maintained.

If possible, services should be located outside this area, but where this is not possible then there are various techniques to minimise the damage. The appropriate method of laying will depend on the circumstances, such as:

1. The scope of the works

2. Degree of urgency
3. Knowledge of other services in the area
4. Soil conditions
5. Amenity value of the trees
6. Cost

Acceptable techniques, in order of preference are: -

1. Trenchless
2. Broken Trench
3. Continuous Trench

EXCAVATION OF OPEN TRENCHES BY MACHINES IS TOTALLY UNACCEPTABLE IN THE PRECAUTIONARY AREA.

Trenchless (Mole)

Wherever possible, trenchless techniques should be used. The pit excavations for starting and receiving the machinery should be located outside the precautionary area.

To avoid damage to the roots by the mole, it is recommended that the run should be below 600mm deep. Lubrication of the mole should be with water wherever possible, as oils and other lubricants may contaminate the soil layer.

Broken Trench

This is a combination of hand dug techniques and moling. If excavation is unavoidable, it should be limited to practical access and installation around/below the roots. The trench is

hand dug taking into account the required precautions (see below). Open sections of the trench should be only long enough to allow access for linking up to the next section.

Continuous Trench

The object of this method is to retain as many roots as possible, bearing in mind the need for working space, access to the service in question and room to install the new service. Hand digging needs to be undertaken with great care and for this reason is likely to require closer supervision than normal operations and an understanding by all the staff as to the risks involved.

After removal of the hard surface material, digging should proceed with hand tools. All roots greater than 25mm ∅ should be retained and worked around. Where clumps of other roots are found, including fibrous roots, these should also be retained. Roots with a diameter in excess of 25mm ∅ must not be severed without the advice of the LA Arboriculturist, who should respond within 24hrs. If severance is unavoidable then this must be carried out with a sharp blade, leaving as small a wound as possible.

Backfilling

Any reinstatement works must comply with the New Roads and Street Works Act 1991 and carefully carried out to avoid direct damage to the roots and excessive compaction of the soil.

The material use for back filling should, where possible, include the placement of an inert granular material mixed with topsoil or sharp sand, (not builders' sand), around the retained roots. This will allow the soil to be compacted for surfacing without losing the localised aeration zone.

ADDITIONAL PRECAUTIONS REQUIRED WITHIN THE PRECAUTIONARY AREA (PA)

1. Repeated movement of heavy machinery and plant should be avoided within the PA, except on existing hard surfaces. This is more important on soils with a high clay content.
2. Material or spoil should not be stored or stockpiled with the PA.
3. Care should be taken to avoid damage to the trunk and the branches of the tree from the machinery.
4. If damage does occur to the tree, then the advice of an Arboriculturist must be sought as to the possible retention of the tree and the works required. Any works undertaken must be done in accordance with BS3998: 2010. 'Recommendations for Tree Works'

Appendix I. Glossary

Term / Abbreviation	Description
Adventitious Bud	Adventitious buds develop from places other than a shoot at the tip of a stem, along a branch, often formed as a result of stress e.g., after the stem is wounded or pruned
AGL (Above Ground Level)	Terminology (prefixed by a measurement) stated within the Tree Survey Schedule to reference the location/height of a particular tree feature or tree part
Co-dominant stem	A stem that has grown in direct competition to the main stem and which has formed a substantial size influencing the appearance of the tree
Crown Lift	The removal of the lowest branches, usually to a specified height. It can be used to allow more residual light and greater clearance underneath the canopy for vehicles etc.
Dieback	Where branches are beginning to show signs of death usually at the tips of the crow
Epicormic growth	Small branches that grow in uncharacteristic clusters around the base of a tree, usually as a result of bad pruning or other stress factor
Etiolated	Tall, thin tree which has extended vertically without substantial lateral development. Usually as a result of competition for light from other species
'Hung up' branch	A branch which has become detached from the tree but is prevented from falling to the ground by the presence of other branches within the crown.
Included bark	Where the bark on two adjoining branches or stems is growing tight together, forming a joint with limited physical strength.
Ms	A multi-stemmed tree
Pollarding	A method of tree management in which the main trunk of the tree is cut at a particular height, and the resulting branches are then cropped on a regular basis.
Occluded Wound	The overgrowth of a wound with (callus) tissue produced subsequently
RPA (Root Protection Area)	The theoretical rooting area of a tree defined by BS5837:2005 Trees in Relation to Construction – Recommendations
Ss	A self-set tree i.e., not intentionally planted
Stag Headed	Describes the silhouette of a large tree whose crown has died back so that the ends of the dead branches protrude like spikes or antlers from the reduced live foliated crown.
Topping	Topping is a form of pruning that removes terminal growth leaving a 'stub' cut end. Topping causes serious health problems to a tree

Appendix J. References

British Standard BS 5837:2012 Trees in Relation to Design, Demolition and Construction – Recommendations; April 2012; ISBN 978 0 580 69917 7

British Standard BS 3998:2010 Recommendations for Tree Work; Third (present) edition, December 2010; ISBN 978 0 580 53777 6

The National Joint Utilities Group, Issue 1 – 8th October 2007, Volume 4 - Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees

Arboricultural Association, 1991, Leaflet 4 –

The Hedgerow Regulations 1997 – A Guide to the Law and Good Practice. ISBN 1 85112 0378