Arboricultural
Impact Assessment
& Method Statement

For planning purposes at

26 Netherhall Gardens
Camden
London
NW3 5TL

Dated
18th May 2015

CROWN Consultants

Tree consultants throughout England and Wales

Contents

1. Introduction

1.1. Instruction

1.1.1. We are instructed by Dome Assets Ltd to assess the likely impact of development proposals and produce a Method Statement detailing how trees shall be protected from proposed construction activity at 26 Netherhall Gardens. This report should be read in conjunction with our report dated 2nd April 2013 which presents the results of our tree survey to British Standard 5837 (2012).

1.2. Scope and Purpose of the Report

1.2.1. This report is designed to accompany a planning application for development proposals at the above site. Its purpose is to assist and inform the planning process. It is produced according to the guidance and recommendations within *BS 5837: 2012 - Trees in Relation to Design, Demolition and Construction.*

1.2.2. The Method Statement should be viewed as a *Heads of Terms* Method Statement which specifies the general principles to be adopted during construction and demolition. However, specific construction activities proposed within Root Protection Areas may need to be agreed in more detail if requested by the local authority at the reserved matters stage.

1.3. References

1.3.1. We have liaised with the project architects in order to agree a workable design that will minimise the impact of the proposal on adjacent trees. We have an adequate understanding of the project to enable us to carry out an accurate assessment of the proposals and to specify workable tree protection measures.

1.4. Drawings

1.4.1. The *Tree Constraints Plan* shows the existing layout. For each tree the stem location is indicated and scaled according to its diameter, the canopy is indicated according to measurements taken along the four cardinal points of the compass. Root protection areas (RPAs) are indicated which are calculated according to the guidelines within BS 5837 (2012).

1.4.2. Where appropriate, the shapes of the RPAs have been amended to reflect actual site conditions or where trees have been heavily pruned. The 'original' RPAs are indicated as a dashed line whereas the amended RPAs are indicated as a solid line.

1.4.3. The *Impact Assessment Plan* indicates the tree constraints with the proposals overlaid. Where applicable, this plan shows where works are proposed in Root Protection Areas and which trees are to be pruned or removed. This plan accompanies the Impact Assessment which is to be found in Section 2.

1.4.4. The *Tree Protection Plan* shows the protection measures that are to be installed during the construction phase. This plan accompanies the Method Statement which is to be found in Section 3.

2. Arboricultural Impact Assessment

2.1. Overview

2.1.1. It is proposed to demolish the existing buildings and construct a new detached residential property as indicated on the plans in Appendix 6. The existing layout is indicated in black, the footprint of the proposed layout is indicated in pale green.

2.1.2. The landscaping of the front garden has been designed around the root system of the lime tree, T6 (the existing ground levels within the retained ground around this tree are to be maintained). The alterations to the rear garden have been designed to minimise the impact on T1 by largely avoiding any incursion into its Root Protection Area. Where excavation is proposed close to the edge of the Root Protection Area, contiguous piling has been proposed to ensure soils beyond the footprint remain undisturbed.

2.1.1. The table below summarises the potential impact on trees due to various activities.

Activity	Trees Potentially Affected
Tree Removal: Retention Category A	None
Tree Removal: Retention Category B	None
Tree Removal: Retention Category C	None
Tree Removal: Retention Category U	None
Tree Pruning	None
RPA: Foundations	T1
RPA: New Surface	None
RPA: Underground Services	None
RPA: Change of Ground Levels	None
RPA: Soil Compaction	All trees throughout the site xxxx (preventable by installing tree protection measures)

2.1.2. Other potentially damaging activities often associated with construction sites include demolition or the careless use of plant machinery, hazardous materials, or fires.

2.1.3. All of the above potential impacts are considered in detail throughout this section. Section 3 specifies the measures proposed to minimise all possible potential risks of damage to the retained trees.

2.2. Tree Removal

2.2.1. All trees within the site are to be retained.

2.3. Impact on Tree Canopies

2.3.1. The canopies of all retained trees are located sufficiently far from proposed building works and sufficiently high over access routes throughout the site that they shall not be impacted upon by any construction activity. Consequently no pruning works are required to facilitate construction activity or access throughout the site. Restrictions are placed on activities throughout the site to ensure that no canopies are accidentally damaged – see Section 3.12.

2.4. Impact on Tree Roots

2.4.1. Rooting Habits:

2.4.1. The Root Protection Areas on the Tree Constraints Plan are drawn as circles. However, for the lime tree, T6, the roots are more likely to be concentrated in the area of soft landscaping surrounding this tree which is enclosed on all sides by a retaining wall. This is because the wall and its foundations shall effectively act as a root barrier. What few roots grow beneath the foundations will find relatively inhospitable rooting conditions so are unlikely to proliferate.

2.4.2. The results of a trial excavation within the rear garden are presented in our report dated 28th May 2013. These are summarised below:

Summary of Conclusions

At a distance of 12m from T1, any proposed development would have no impact on the health or vigour of this tree.

At a distance of 9.5m from T1. any proposed development would have negligible impact on the health or vigour of this tree.

At a distance of 7.5m from T1, any proposed development would have some impact on the health and vigour of this tree. The extent of the impact would depend on the length and depth of the foundations. A deep excavation extending from the existing building half way to the rear boundary is not considered likely to result in the death of any foliage, rather the vigour is likely to be reduced for one or two growing seasons whilst the tree establishes a balanced root:shoot ratio.

Excavation closer than 7.5m could have a significant impact on T2 and should be kept to a minimum.

2.4.3. The location of the trial trenches is also marked on the accompanying Tree Constraints Plan.

2.4.4. Foundations:

2.4.5. The impact Assessment plan shows where excavation is proposed for foundations / basement within the rear garden. The vast majority of excavation for the basement shall be in excess of 12.5m from T1 and shall have no detrimental impact. A small area is shaded yellow on the accompanying impact assessment Plan. This indicates where excavation is proposed into the embankment where roots may be growing. However, this area equates to less than 1% of the Root Protection Area of this tree.

2.4.6. Research has shown that healthy trees of most species are able to withstand the loss of some roots (to a maximum of about 20% of the rooting area) with no long term detrimental impact (Helliwell, D.R. and Fordham, S.F. (1992) Tree Roots and Tree Growth. Reading Agricultural Consultants, Didcot, UK.). An impact on less than 1% or 2% of the root system at distances in excess of 8.5m should therefore be tolerated by this tree without a long term detrimental impact.

2.4.7. In order to ensure that foundations do not impact on more than the footprint of the building / basement, is it proposed to utilise contiguous piling. Using this method piles are driven deep into the ground along the edge of the proposed footprint of the basement and associated light-well / access. Excavation may then occur within the footprint of the basement without affecting soils, or roots beyond it.

2.4.8. **New Surfaces:**

2.4.9. No new surfaces are proposed within the rooting areas of any trees.

2.4.10. **Underground Services:**

2.4.11. There is ample opportunity for service and drainage provision without the need to pass through the Root Protection Areas of any retained trees. The exact position of services should be agreed and installation engineers should be made aware of the need to keep trenches outside of RPAs.

2.4.12. Due to the potentially major impact of excavating trenches within Root Protection Areas, the locations of all underground services should be approved by the local authority after consultation with an appointed arborist to assess the potential impact on trees.

2.4.13. **Soil Compaction:**

2.4.14. Tree protection measures specified are specified in Section 3. These include measures to minimise soil compaction. They should be maintained throughout the project to ensure minimal impact on tree roots due to construction activity.

2.5. Demolition Activities

2.5.1. The tree protection measures specified within Section 3 should be installed prior to the commencement of all demolition activities (including soil stripping) to prevent any detrimental impact on tree health.

2.6. Hazardous Materials

2.6.1. All hazardous materials (including cement and petrochemical products) will need to be controlled according to COSHH regulations in order to ensure there is no detrimental impact on tree health. Provision shall need to be made to ensure that cement and cement run-off are contained outside of all Root Protection Areas.

2.7. Cabins and Site Facilities

2.7.1. There is limited room for the siting of cabins and storage of materials / spoil during the construction phase so the logistics of the development shall need to be well organised to ensure that there is adequate space outside of the Tree Protection Zones for construction activity.

2.8. Boundary Treatments

2.8.1. I am not aware of any changes which are proposed to the existing boundary features that could impact on trees.

2.9. Impact of Retained Trees on the Development

2.9.1. The dimensions between the property and the extent of the tree canopies are recorded on the Proposed Layout Plan. The closest canopy is that of T6, at a distance of 3m from the front of the property. However, the proposed footprint follows the same footprint as the existing building so there shall be no increase in proximity to tree canopies here.

2.9.2. The rear corner of the building shall be slightly closer to the canopy of T1 than the existing building is. However, there shall still be a distance of at least 3.3m from the outer edge of the canopy to the building corner. Since no windows shall face directly onto the canopy of this tree, the juxtaposition between tree canopies and buildings is considered to be good and the proposal shall not lead to any increase in pressure to remove or overly-prune any of the retained trees.

2.10. Summary

2.10.1. The proposal seeks to retain all of the vegetation surveyed.

2.10.2. No pruning works are required to facilitate the proposal.

2.10.3. No new hard surfacing is proposed in RPAs.

2.10.4. The raised planting area around T6 is to be retained undisturbed to avoid any damage to its root system.

2.10.5. Excavation within the rear garden shall be almost entirely outside of the rooting zone of T1 as identified during our trial excavation. Less than 1% of the Root Protection Area shall be affected by the installation of foundations. Contiguous piling is proposed to ensure no disturbance of soils beyond the building footprint.

2.10.6. Adequate space has been allowed between the proposal and all trees such that no future pressure to overly prune or remove trees shall occur as a consequence of the proposal.

3. Method Statement

Section A: Introduction and Overview

3.1. Definition of Terms

3.1.1. Some terms used within the Arboricultural Method Statement have very specific meanings. These are defined below:

3.1.2. **Root Protection Area (RPA).** This is a theoretical area of ground around a tree where the roots are likely to proliferate. Ground disturbance in this area should be minimised in order to avoid significant impact on tree health. RPAs are indicated on all plans accompanying this report as a pink line.

3.1.3. **Construction Exclusion Zone (CEZ).** These zones are created to protect roots and canopies form inadvertent damage by construction activity – see Section 3.7. -*Construction Exclusion Zones*. They are usually fenced off by protective barriers throughout the entire construction phase. No works are permitted in these zones other than minor landscaping works which do not require a change in ground level. Where practicable the entire *Root Protection Area* and the area beneath the tree canopy shall be treated as a *Construction Exclusion Zone*. These zones are hatched purple on the Tree Protection Plan.

3.1.4. **Restricted Activity Zone (RAZ).** It is not always possible to create a *Construction Exclusion Zone* over the entire RPA. This is because access may be required or some works may be proposed within the RPA. In such circumstances a *Restricted Activity Zone* is created where limitations are placed on construction activity. Ground protection measures may be specified or the Restricted Activity Zone may be fenced off throughout part of the construction phase. See the legend on the Tree Protection Plan to identify these zones.

3.2. Tree Protection Barriers - Overview

3.2.1. The Tree Protection Plan indicates the location of all proposed tree protection barriers according to the following legend and overview:

Symbol on Tree Protection Plan	Barrier type See Section 5	Location
	In-Ground System or Back-Stay System	Around the Construction Exclusion Zones, close to where construction activity is proposed. As indicated on the Tree Protection Plan.
	Back-Stay System	N/A
	Barrier Mesh System	N/A

3.2.2. The barriers shall be installed prior to the commencement of any construction activity including soil stripping and delivery of materials. A detailed specification of the barriers can be found in Section 5.

3.3. Planning Status

3.3.1. Tree protection measures specified within this report should be agreed with the local authority so that they may be conditioned upon planning consent.

3.3.2. The site manager must be familiar with all aspects of this Method Statement and should liaise with the author of this report for clarification, or regarding any unforeseen issues where trees may be impacted upon.

3.3.3. A copy of this Method Statement shall be available on-site at all times. All personnel working on the site shall be made aware of any sections appertaining to their work. This includes short term contractors and persons responsible for deliveries and installation of services.

3.4. Overview of Protection Measures

3.4.1. Below is a list of potential arboricultural impacts and a summary of the proposed protection measures:

Reference	Comments	Potential Impact	Protection measures
T6	Existing retaining wall to be replaced	Root severance.	New retaining wall to be located in the same place as the existing wall. Demolition to be undertaken without disturbing soils beyond the retaining wall and in the presence of an appointed arborist. Exposed roots to be covered New wall to be installed without damaging existing roots,
T1	Basement/foundations to be installed in RPA.	Excessive root severance if excavation extends significantly into the Root Protection Area.	Contiguous piling to be installed adjacent the proposed footprint using narrow diameter piles. Tree officer or an appointed arborist invited to oversee.
All other retained trees	No works proposed in Root Protection Areas.	Compaction and contamination from general construction activity.	Protective fencing installed as specified in Section 5 and *Construction Exclusion Zone* created where appropriate. No works permitted in Exclusion Zone.

3.4.2. The above measures are described in more detail throughout the remainder of this section.

3.5. Timing of Operations

3.5.1. Activity within the site shall be phased according to the following chronology:

Order	Phase	Activity
1st.	Pre-Construction Phase	Detailed design submission for approval (see Section 3.6 below). Discharge of any planning conditions relating to trees.
2nd.		Install the tree protection barriers (see Tree Protection Plan and Section 5 -*Tree Protection Barriers*.
Protection measures confirmed acceptable by the local authority		
3rd.	Construction Phase	Demolish existing structures and remove existing surfaces where applicable.
4th.		Install new buildings, hard surfaces and services taking into account restricted activities as specified in Sections 3.7 onwards
5th.	Post-Construction Phase	Remove protective barriers (fencing and ground protection measures as applicable).
6th.		Undertake restricted landscaping operations within Root Protection Areas, including boundary treatments, pedestrian surfaces, decking and any proposed tree planting.

3.6. Confirming Detailed Proposals

3.6.1. This Method Statement is a *Heads of Terms* method statement. This means that it specifies the general principles to be adopted during proposed development works. Often additional input is required from engineers to confirm the exact locations of services or technical specifications which are beyond the scope of an arborist. This is usually provided at the reserved matters stage (for an outline planning applications) or via planning conditions. The table below highlights where such confirmation is required.

Nature of Activity	Areas Potentially Affected	To be Confirmed
Services	Construction Exclusion Zones and Restricted Activity Zones	Exact location of all underground services and trenches. Location of any proposed soak-aways. Method of installation where services pass through Root Protection Areas.
Boundary Treatments	Plot boundaries	Nature of new boundary features. Method of installation of walls and fences over Root Protection Areas where applicable.
Landscaping	Construction Exclusion Zones	Any specific landscaping proposals requiring approved by the local authority but not considered within this report.

3.6.2. The limitations specified within this report need to be considered in detail by building and/or demolition contractors. Any conflicts should be raised at an early stage so that issues may be resolved and agreed with the local authority. This may require the production of a revised Method Statement.

Section B: Restrictions on Activities – Specific Zones

3.7. Construction Exclusion Zones

3.7.1. Within Construction Exclusion Zones (shaded purple on the Tree Protection Plan) the following restrictions shall apply:

- Tree Protection Barriers shall be erected and maintained throughout the entire project as indicated on the Tree Protection Plan and specified in Section 5 -*Tree Protection Barriers*.
- No construction activity whatsoever shall occur.
- No vehicles or plant machinery shall be driven or parked.
- No tree works, other than those specified in this report shall be undertaken.
- No alterations of ground levels or conditions.
- No chemicals or cement washings permitted.
- No excavation whatsoever shall occur.
- No temporary structures.
- No fires shall be permitted.
- All hazardous materials (including non-essential cement products) shall be forbidden.

3.8. Restricted Activity Zone A

3.8.1. In this zone, contiguous piling or sheet piling is proposed over (or close to) the Root Protection Area of T1. The following restrictions shall apply:

- The piles shall be located along the edge of the footprint of the proposed basement / building.
- The pile driver shall operate from outside the Restricted Activity Zone and Construction Exclusion Zone.
- The ground between the piles and the tree (T1) shall remain completely undisturbed.
- Any variation from this shall first be approved by the local authority.

3.9. Restricted Zone B

3.9.1. Around T6, the following restrictions shall apply:

- Existing wall to be carefully demolished outwards away from T8. Soils beyond this wall to remain undisturbed.
- This shall be done in the presence of an appointed arborist.
- If roots in excess of 25mm diameter are encountered close to the edge of the excavation, they shall be retained wherever possible and protected with damp sacking during times that they are unearthed. Any roots that need to be severed shall be pruned with secateurs.
- Existing foundations to be reused or strengthened by excavating outside / beneath them.
- The existing foundations shall not be removed if the appointed arborist deems that this would overly impact on the soils beyond the retaining wall.
- New wall to be installed and any back-filling shall use fertile top-soil.
- No fires shall be permitted.
- All hazardous materials (including non-essential cement products) shall be forbidden.
- All machinery in excess of 2m tall shall be carefully marshalled through this zone.

Section C: Restrictions on Activities – Throughout the Site

3.10. Installation of New Access Drives

3.10.1. The access drives do not pass through any Root Protection Areas therefore no restrictions on their design or installation are required from an arboricultural perspective.

3.11. Installation of New Hard Surfacing

3.11.1. No hard surfaces are proposed where roots are likely to proliferate so no limitations are placed on their design or installation.

3.12. Canopy Protection

3.12.1. In order to protect tree canopies the following restrictions shall apply throughout the site:

- No machinery in excess of 2m shall pass beneath the canopy of any tree without being carefully marshalled in order to ensure that no branches are damaged.
- If materials require installation or delivery beneath tree canopies, this shall be done without the use of overhead cranes.
- If materials are to be installed or delivered close to tree canopies (but not beneath them) and a crane is required, they shall be carefully marshalled in order to ensure that branches are not accidentally damaged.

3.13. Site Hoarding

3.13.1. If site hoarding shall be installed over the Root Protection Area of any tree, the following restrictions shall apply:

- Ground levels shall be maintained as existing.
- Post holes shall not exceed 300mm x 300mm.
- No post hole shall be excavated within 1.5m of any tree stem.
- Post holes shall be excavated using hand tools or by a post-hole auger attached to plant machinery sited outside the Root Protection Area(s).
- Roots in excess of 25mm shall be retained wherever possible.
- Roots in excess of 10mm shall be pruned with sharp secateurs.
- Pruning shall be minimal and only undertaken where absolutely necessary to facilitate the site hoarding. It shall be undertaken by a reputable tree surgeon working to BS 3998 (2010).
- Cement products shall be mixed away from Root Protection Areas (see Section 3.22 - *Hazardous Materials*).

3.13.2. Site hoarding may be installed in place of the specified tree protection measures subject to the approval of the local authority with regard to its location and specification.

3.14. Fence Posts or Decking Posts

3.14.1. If permanent fencing or decking is to be installed within Root Protection Areas, the following restrictions shall apply:

- All post holes shall be excavated by hand and kept as narrow as possible (maximum diameter 300mm).

- Exploratory post holes shall be dug before committing to post / panel positions. If any roots in excess of 25mm are encountered they are to remain intact and the post hole shall be relocated slightly. The fencing system must permit such flexibility (i.e. where fixed panel widths are used, all post holes must be excavated before committing to the final location).
- Any roots in excess of 10mm which are severed shall be neatly pruned back with secateurs. This will encourage healing and reduce the likelihood of infection.

3.14.2. Walls shall be avoided over Root Protection Areas unless their foundations may be spanned over roots using a beam system.

3.14.3. Hedges may be planted within Root Protection Areas using hand tools to minimise excavation.

3.15. Demolition and Initial Ground Works

3.15.1. No demolition, removal of surfaces, or soil stripping shall commence until the protective fencing and ground protection measures are installed to the satisfaction of the local authority.

3.16. Underground Services

3.16.1. No underground services (including soak-aways) shall be located in any part of the *Construction Exclusion Zones* or *Restricted Activity Zones* unless done so in a manner detailed in a specific Method Statement and approved by the local authority.

3.17. Lighting, Bollards, CCTV and associated Cables

3.17.1. If any of the above are to be installed close to tree canopies or within Root Protection Areas of retained trees; installation methods shall be detailed in a specific Method Statement and approved by the local authority. Consideration should be given to the following:

- Pruning of branches to enable sufficient clearance for light and views. Branches should be removed to the *branch collar* as per British Standard 3998 (2010).
- Post holes must be excavated by hand or using an appropriate sized auger. No other form of mechanical excavation may be used.
- Cables should be routed in a direction directly away from the tree. It will not be acceptable to excavate a trench across any Root Protection Areas.

3.18. Use of Heavy Plant

3.18.1. All machinery operatives are to be made aware of any *Construction Exclusion Zones* and *Restricted Activity Zones* that apply to this site (see the Tree Protection Plan and Section 3.7 onwards).

3.18.2. All machinery operatives are to respect these zones and ensure that no damage occurs to trees due to the careless use of machinery.

3.18.3. Plant machinery shall be limited to a maximum weight of 2 tonnes in all Restricted Zones.

3.18.4. Mechanical excavators should have tracks rather than wheels to help spread their load. They should be carefully marshalled when working close to tree canopies.

3.19. Scaffolding

3.19.1. If scaffolding is required in areas containing ground protection measures, the protective boards shall need to remain in-situ and be strengthened and stabilised to bear the weight of scaffold poles.

3.19.2. Prior to the installation of any scaffolding within 0.5m of any tree branches, the appointed arborist shall be consulted to specify any pruning works that may be required.

3.20. Siting of Cabins and Storage of Materials

3.20.1. Cabins and heavy building materials may be located or stored anywhere outside of *Construction Exclusion Zones* and *Restricted Activity Zones*.

3.20.2. Any proposal to install cabins or materials within these zones shall be agreed in writing with the local authority prior to installation.

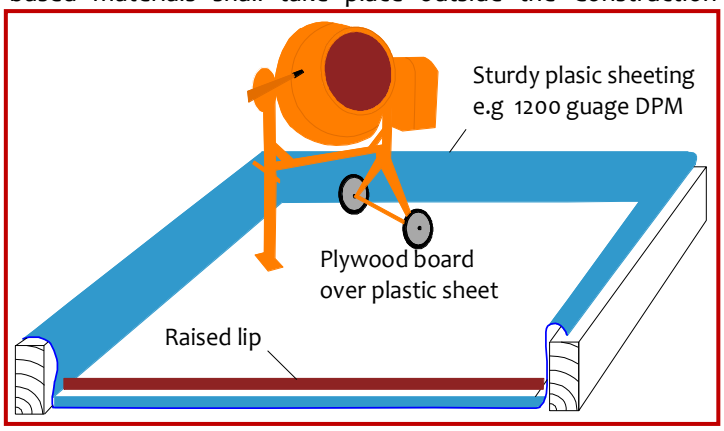
3.20.3. It may be acceptable to locate site cabins such that they act as a tree protection barrier and replace the specified protective fencing. Where this is being considered, written approval must be sought from the local authority.

3.21. Pedestrian Paving

3.21.1. If it is proposed to install new pedestrian surfaces over Root Protection Areas, excavation shall be limited to the removal of existing turf/vegetation plus an additional 50mm. Excavation shall be undertaken using hand tools only. Porous materials are preferred but not essential if the new surface covers less than 10% of the Root Protection Area. Paving with a thickness of 50mm bedded on mortar, or sand, bearing directly onto the ground, with a finished surface level with existing ground levels will be acceptable. No retaining kerbs shall be used.

3.22. Hazardous Materials

3.22.1. Any mixing of cement based materials shall take place outside the Construction Exclusion Zones and Restricted Activity Zones. Where cement is to be mixed at considerable distances from trees and water run-off cannot enter Root Protection Areas, then no further special measures are required. Otherwise, provision shall be made to ensure that the mixing area is contained so that no water run-off enters the Root Protection Area of any trees (see diagram for example). Mixers and barrows shall be cleaned within this area.



3.22.2. All other chemicals hazardous to tree health, including petrol and diesel, shall be stored in suitable containers as specified by current COSHH Regulations, and kept away from Root Protection Areas.

Section D: Post-Construction Phase

3.23. Removal of Tree Protection Barriers

3.23.1. This will be done after all major construction work is complete. Vehicular access will not be permitted within the Construction Exclusion Zones.

3.23.2. The local authority tree officer shall be made aware that the fencing is to be removed.

3.24. Ground Remediation

3.24.1. After all construction activity is completed a site meeting shall take place and the soil conditions assessed. The appointed arborist shall attend and the local authority tree officer shall be invited.

3.24.2. Where compaction is deemed to have occurred over the Root Protection Area of T1 or T6, suitable remediation measures shall be agreed and implemented (e.g. terraventing).

3.25. Landscaping

3.25.1. No machinery used within landscaping operations shall operate within the Root Protection Areas of retained trees.

3.25.2. Ground levels shall not be altered within Root Protection Areas without consultation and approval from the local authority.

3.26. Tree Planting

3.26.1. Trees planted in poor soils or compacted soils are unlikely to become established, so prior consideration should be given to rooting conditions. Where compaction or contamination is believed to have occurred expert horticultural or arboricultural advice should be sought.

3.26.2. Any new tree planting shall be carried out after completion of all construction activity in the vicinity.

4. Site Inspection

4.1. Inspection Schedule

4.1.1. In order to ensure that the trees are adequately protected it shall be necessary to periodically monitor the works. This will be done by the local authority tree officer or an appointed arborist (see Section 4.2 below) who will provide the tree officer with a copy of inspection details.

4.1.2. The following inspection schedule is suggested though the local authority may specify additional supervision where deemed necessary.

Inspection	Attendees	Comments
Pre- Start To occur prior to any works taking place on the site.	N/A.	Site manager to study this Method Statement & contact the appointed arborist to agree all protection measures.
Pre-Construction Meeting After tree works completed & tree protection barriers / ground protection measures installed. Prior to any other activity, inc. demolition & soil stripping.	Site manager, appointed arborist and/or local authority tree officer. *	Tree protection fencing locations & specification checked. Additional ground protection measures checked. Further protection measures / restrictions agreed.
Intermediate Reporting Throughout the entire project. At least once per month.	N/A.	Site manager to liaise with the appointed arborist regarding any issues which may affect trees. General site photos indicating tree protection measures to be provided monthly.
Wall demolition and installation of piles in Restricted Zones A, and B.	Site manager, appointed arborist and/or local authority tree officer.	At least one week's notice shall be given prior to commencing works.
Post-Construction Meeting Post major construction activity but prior to removal of fencing & landscaping operations.	Site manager, appointed arborist and/or local authority tree officer.	Retained trees inspected. Further landscaping operations and restrictions to be agreed.

* Where agreed with the L.A. it may be acceptable to supply photographs of the fencing to avoid the necessity for a site visit.

4.2. The Appointed Arborist

4.2.1. The appointed arborist must be acceptable to the local authority. He / she must have a good understanding of the project requirements and be suitably qualified to understand the hazards associated with development near to trees.

4.2.2. The appointed arborist should work closely with the site manager and shall have the authority to insist upon work stoppage until resolution of any major issues arising which could be detrimental to the health of protected or important trees.

4.2.3. The appointed arborist must keep the local authority updated at each of the stages within the inspection schedule and will advise on any unexpected issues arising throughout the project which could impact on trees.

5. Tree Protection Barriers

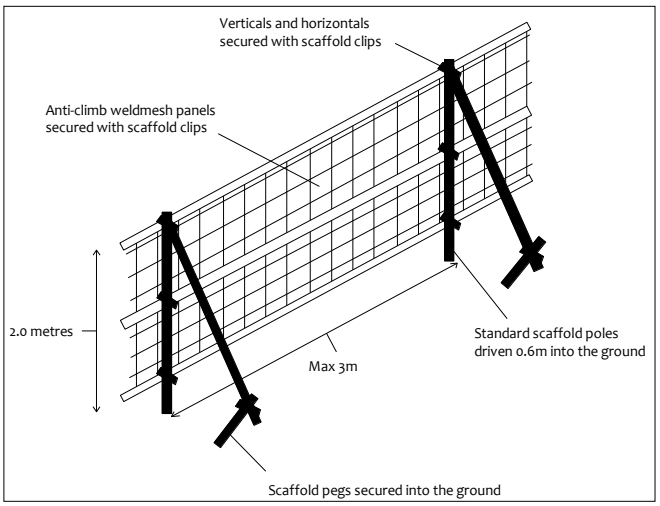
Detailed Specification

5.1.1. The purpose of tree protection barriers is to keep construction activity away from *Restricted Activity Zones* or *Construction Exclusion Zones*. They should be appropriate to the nature and proximity of activity within the site. The barriers should be erected prior to the commencement of all activity including demolition, soil stripping and delivery of materials and demolition (except where existing structures require demolition to enable the barriers to be installed). Barrier systems are specified below and should be installed according to the legend on the Tree Protection Plan.

5.2. The In-Ground System

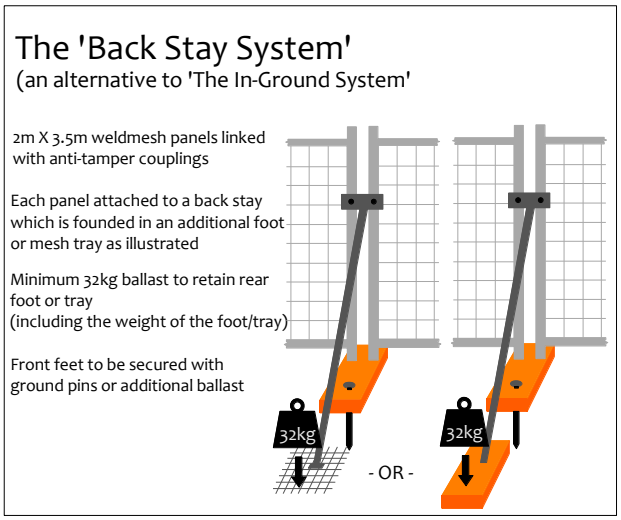
5.2.1. This system may be installed where indicated by a solid purple line on the Tree Protection Plan. It should be robust enough to withstand occasional knocks by plant machinery and, once installed, shall remain in place throughout the entire construction phase.

5.2.2. Vertical scaffold poles are driven into the ground, onto which are affixed horizontal scaffold poles and diagonal bracing struts. Weldmesh panels (or similar – e.g. Heras type fencing panels, or 18mm+ plywood boards) are secured to this scaffold framework using sturdy clips e.g. standard scaffold clips. The system is illustrated in the diagram to the right and is based on BS 5837 guidelines.



5.3. The Back-Stay System

5.3.1. This system may be installed where indicated by a solid or dashed purple line on the Tree Protection Plan. It is more practical over existing hard surfaces or where the fencing needs to be moved to enable permitted activities within a *Restricted Activity Zone*. This system should be able to withstand occasional knocks by machinery and should not be relocated except with the consent of the site manager and the approval of the local authority.



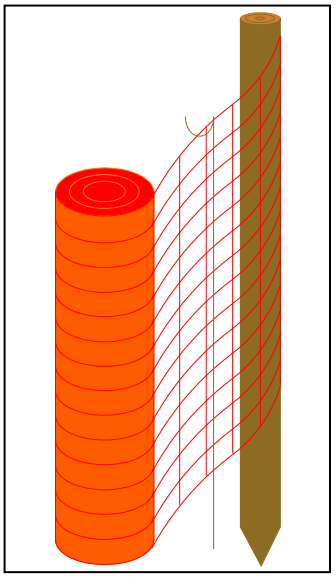
5.3.2. Within this system, weldmesh fencing panels (minimum height 2m) are affixed into rubber or concrete feet and clipped together with anti-tamper couplers. Where topography permits, two couplers should be used, spaced at least 1m apart. Alternate panels should be

attached to a diagonal back stay connected to an additional foot or baseplate secured with ground pins or additional ballast. Where ground pins are not used, the total weight of the foot/plate plus ballast should total not less than 32kg.

5.3.3. Alternatively, timber struts may be used to affix the panels to existing walls using brackets and screws where the fence panels are sufficiently close for this to be effective.

5.3.4. Where it is not possible to install diagonal struts (such as very close to a hedge) then the front feet shall be secured using ground pins or ballast.

5.4. The Barrier-Mesh System



5.4.1. Where indicated by a thick red line (solid or dashed) on the Tree Protection Plan, it shall be acceptable to install a less robust system than those specified above. This is because of the nature of construction activity or its distance from tree protection areas. The purpose of such a system shall be to demarcate the protection zone. It is not intended that such fencing will withstand knocks by construction machinery.

5.4.2. In this system, high visibility plastic safety fencing, 1m high, minimum grade 140g/m2, is secured onto alternate wooden posts and fencing pins. Wooden posts to be located at 5m intervals, minimum dimensions 75mm.

6. Signature

This report represents a true and factual account of the potential impact of development along with proposed protection measures at

26 Netherhall Gardens
Camden
London
NW3 5TL

Signed

.....

Ivan Button N.C.H. (Arb), FDSc (Arb), BSc (Hons), P.G.C.E., M. Arbor. A.

on behalf of

Crown Consultants Ltd

Dated

18th May 2015

CROWN Consultants
Tree consultants throughout England and Wales

Appendix 1: BS 5837: 2012 – Guidance Notes

This Standard prescribes the principles to be applied to achieve a satisfactory juxtaposition of trees and structures. It sets out to assist those concerned with trees in relation to design, demolition and construction to form balanced judgements.

It acknowledges the positive contribution trees may offer to a site, as well as the negative aspects of retaining inappropriate trees. It addresses the negative impacts that construction activity may have upon trees and offers mitigation strategies to minimise these impacts.

The Standard suggests a three stage approach to ensure best practice is followed when developing close to trees:

A1.1 Stage 1: Survey of Existing Trees

This identifies the existing trees on and adjacent to the site. Data is recorded for each tree and is presented in a Tree Data Schedule. Each tree is allocated a ***Retention Category*** according to its size, amenity value, condition and safe useful life expectancy. The categories are allocated independently of development proposals. Our interpretation of the Retention Categories is explained below:

A1.1.1 Retention Categories

A Category: Trees of high quality and amenity value. Usually, mature trees with a significant life expectancy which would enhance any development. Retention of these trees is strongly encouraged.

B Category: Trees of moderate quality and amenity value. Usually these are maturing trees or younger trees with exceptional form. Retention of these trees is desirable though the removal of occasional specimens may be acceptable.

C Category: Trees of low quality or small specimens with a relatively low amenity value. These trees are not considered to be a material planning constraint and their removal will generally be seen as acceptable in order to facilitate development.

U Category: Trees of such low quality that their removal is recommended regardless of development proposals.

A1.1.2 Occasionally trees are borderline and do not fall neatly into one of the categories A, B or C. In such cases we apply a superscript (**+/-**) such that:

C^{+} Indicates borderline C/B, though Category C is deemed to be most appropriate.

B^{-} Indicates borderline C/B, though Category B is deemed to be most appropriate.

A1.1.3 The British Standard suggests that each of the A, B and C categories may be further subdivided (A1, A2, A3, B1, B2, B3 etc) such that subcategory 1 denotes mainly arboricultural values, subcategory 2 denotes mainly landscape values and subcategory 3 denotes mainly cultural values (including conservation). Multiple subcategories may be used.

Our experience suggests that these subdivisions lack clarity and can be confusing. Within this report subcategories are **not** denoted. Where appropriate, the use of phrases such as '*Part of a formal group*', or '*Has a high ecological value*', or '*Offers good screening to the site*' are incorporated into the observation section of the Tree Data Schedule. We believe this conveys all relevant landscape and cultural information without any confusion.

A1.1.4 **Tree Constraints Plan (TCP).** This indicates the position, crown spread, Retention Category and Root Protection Area of each tree. It is used to inform where development may proceed without causing damage to trees.

A1.1.5 **Root Protection Area (RPA).** This is the area around each tree likely to contain the majority of roots. It should ideally remain undisturbed to avoid a detrimental impact on tree health. For single stemmed trees It is calculated according to the formula "radius of RPA" = "12 x stem diameter". For multiple-stemmed trees a more complex formula is used which may occasionally produce an RPA which seems inappropriately large relative to the trees canopy. This shape can then be modified to take into account site factors which influence rooting activity, e.g. foundations, soil type or impermeable surfaces. Where development works are proposed within the RPA they should be undertaken in a sympathetic manner to minimise root disturbance.

A1.1.5 **Shade Constraints.** The previous Standard (BS 5837 2005) suggested that shade constraints should be indicated on the TCP. This are denoted as a circle-segment drawn northwest to due east with a radius equal to the height of the tree. These do not represent the actual shade pattern which varies through the seasons. Rather, they indicate the area most shaded by the tree throughout the course of the year. Ideally habitable room windows should be located outside of these shade constraints. Where we consider it appropriate, we will include shade constraints information on our Impact Assessment Plan or Proposed Layout Plan.

A1.2 Stage 2: Arboricultural Impact Assessment

After the initial survey and the production of the Tree Constraints Plan, arborists and designers are encouraged to work together to establish a design proposal with minimal impact on the high quality trees. An assessment should be made of all possible impacts including the impact that the trees may have upon the proposal. The arborist may recommend mitigation strategies to minimise these impacts and help achieve a more harmonious juxtaposition between buildings and trees.

A1.3 Stage 3: Arboricultural Method Statement

This type of report specifies the measures necessary to protect trees against damage from construction activity. The Method Statement should be written in a manner that it may be conditioned and enforced by the local authority upon granting of planning permission. The site manager should be familiar with all aspects of the Method Statement and should ensure that all persons working on the site are aware of those aspects which appertain to their work. This includes service installation engineers and operators of plant machinery.

Appendix 2: Explanation of Tree Data & Glossary

This section explains the terms used in the **Tree Data Schedule** (see Section 3 and Appendix 6).

A4.1 General Observations

A4.1.1	**Numbering System:**	Each item of vegetation has its own unique number prefixed by a letter such that T1=Tree 1, G2=Group 2, H3=Hedge 3 and W4=Woodland 4, S5=Shrub 5.
A4.1.2	**Age Categories:**	
	Young	Usually less than 10 years old.
	Semi-Mature	Significant future growth to be expected, both in height and crown spread (typically below 30% of life expectancy).
	Early-Mature	Full height almost attained. Significant growth may be expected in terms of crown spread (typically 30-60% of life expectancy).
	Mature	Full height attained. Crown spread will increase but growth increments will be slight (typically 60% or more of life expectancy).
	Veteran	A level of maturity whereby significant management may be required in order to keep the tree in a safe condition.
	Over Mature	As for veteran except management is not considered worthwhile.
A4.1.3	**Species:**	Common names and Latin names are given.
A4.1.4	**Height:**	Measured from ground level to the top of the crown.
A4.1.5	**Stem Diameter:**	Taken at 1.5m above ground level where possible. On multi-stemmed trees this measurement may be taken at ground level, though usually an indication of the number of stems and average diameter is given, e.g. 3 x 30cm.
A4.1.6	**Crown Height:**	Measured from ground level to the height at which the main crown begins. Where the crown is unbalanced it is measured on the side deemed to be most relevant. This is usually the side facing the area of anticipated development.
A4.1.7	**Tree Diagram:**	This scaled drawing is computer generated based on measurements taken for stem diameter, crown height and spread, and overall height. It is designed to help the reader rapidly assess the data. It is not an accurate representation of the form of the tree.
A4.1.8	**Crown Spread:**	Measured N, E, S & W, taken from the centre of the stem and usually rounded up to the nearest metre.
A4.1.9	**Observations:**	If a tree's position is considered to be relevant it will be commented upon (e.g. overhanging a children's play area). Tree form and pruning history are also recorded along with an account of any significant defects. Defects and descriptive terms are dealt with in more detail at the end of this section.
A4.1.10	**Recommendations:**	Usually based on any defects observed and intended to ensure that the tree is in an acceptable condition.
A4.1.11	**Priority Scale:**	Depending upon the threat posed by the tree, and the likelihood of failure, recommendations should be carried out according to the following priority scale:
	Urgent	To be carried out as soon as possible.
	Very High	To be carried out within 1 month.
	High	To be carried out within 3 months.
	Moderate	To be carried out within 1 year.
	Low	To be carried out within 3 years.
A4.1.12	**Inspection Frequency:**	An interval of 6 months, 1 year, 1.5 years or 3 years is allocated before the next inspection is due. Wherever practical, consideration should be given to seasonal changes so that deciduous trees are not always surveyed in winter when they have no leaves, or in summer when leaves may obscure branches within the upper crown.
A4.1.13	**Vigour:**	An indication of growth rate and the tree's ability to cope with stresses:
	High	Having above average vigour.
	Moderate	Having average vigour.
	Low	Having below average vigour.
	Very Low	Tree is struggling to survive and may be dying.
A4.1.14	**Physiological Condition:**	
	Good	Healthy and with no symptoms of significant disease.
	Fair	Disease present or vigour is impaired.
	Poor	Significant disease present or vigour is extremely low.
	Very Poor	Tree is dying.
A4.1.15	**Structural Condition:**	
	Good	Having no significant structural defects.
	Fair	Some defects observed though no high priority works are required.
	Poor	Significant defects found. Tree requires monitoring or remedial works.
	Very Poor	Major defects which will usually require significant remedial works or tree removal.
A4.1.16	**Amenity Value:**	
	Very High	Exceptional specimen, observable by a large number of people.
	High	Attractive specimen, observable by a significant number of people.
	Moderate	One of the above factors is not applicable.
	Low	Unattractive specimen or largely hidden from view.
A4.1.17	**Life Expectancy:**	The estimated number of years before the tree may require removal. Classified as (<10), (10 – 20), (20 – 40), or (40+).
A4.1.18	**Retention Category:**	These are explained in detail in Appendix 1.

A4.2 Evaluation of Defects

A4.2.1 Cavities, wounds, deadwood etc are all evaluated as follows:

Major	Such that structural integrity is, or will become, compromised and the tree is, or will inevitably become, hazardous.
Significant	A defect that may over time become a major defect, though not necessarily so. This will depend on the vigour of the tree and its ability to deal with decay etc.
Minor	A defect that is not likely to compromise the tree's structural integrity.

General Glossary

Adaptive growth	**In tree biomechanics, the process whereby wood formation is influenced both in quantity and quality by the action of gravitational forces and mechanical stresses on the cambial zone.**
Aerobic	**Conditions in which oxygen is freely available, or to biomechanical processes that depend on the presence of oxygen.**
Anaerobic	**A condition marked by the absence of oxygen; Generally such areas are unsuitable for normal life and growth of plant tissues. These sites tend to be populated by bacteria capable of surviving low oxygen conditions often associated with Slime Flux.**
Arboriculture	**The culture and management of trees as groups and individuals primarily for amenity and other non-forestry purposes.**
Arborist	**A person possessing the technical competence through experience and related training to provide management of trees or other woody plants in a landscape setting. Generally involved with the development or management of trees for visual amenity or land management rather than the growth of trees for product or profit.**
Barrier zone	**A layer within an annual increment of wood which contains abnormal xylem cells, laid down by the cambium in response to wounding or other trauma.**
Body language	**In trees, the outward display of growth responses and or deformation in response to mechanical stress.**
Bole	**Or Trunk, the main stem of a tree below its first major branch.**
Bracket	**A type of fruiting body produced by various fungal species, plate like to hoof like in shape and often a one sided attachment to the wood or bark.**
Branch bark ridge	**A ridged area located at the union of a branch to a trunk or stem.**
Branch Collar	**Trunk tissue that forms around the base of a branch between the main stem and the branch, or between a main branch and a lateral branch. As a branch decreases in vigour or begins to die, the collar usually becomes more pronounced and completely encircles the branch.**
Brown Rot	**Form of decay where cellulose is degraded, while lignin is only modified.**
Buttress Root	**Roots that emerge from the base of the tree stem, normally large and well developed that rapidly reduce in diameter to create the Root Plate this offers structural support for the tree. Buttress roots divide rapidly forming the connection between the stem and the transport roots.**
Cabling Bracing	**Installing cables within the crown of a tree to prevent collapse.**
Callus	**Undifferentiated cells often formed at the edges of recent injuries. This tissue quickly becomes differentiated, forming cells of the type characteristic of that position on the tree (e.g. forming wood, bark, roots, etc.) see wound response tissue.**
Cambium	**A thin layer of actively growing and dividing cells, located between the xylem (sapwood) and bark of a plant; the part responsible for radial growth of a tree stem or branch.**
Canopy	**The topmost layer of twigs and foliage in a woodland, tree or group of trees.**
Canker	**A localised area of dead bark and cambium on a stem or branch, caused by fungal or bacterial organisms, characterised by woundwood development on the periphery. This may be annual or perennial.**
Cavity	**An open and exposed area of wood, where the bark is missing and internal wood has been decayed and dissolved.**
Chlorotic	**Also Chlorosis. A condition of the plant marked by yellowing of normally green foliage, often indicating nutrient deficiency or plant dysfunction.**
Clinometer	**Devices that measures vertical angles, and provides direct height measurements of objects by triangulation.**
Co-dominant stems/trunk	**Are forked branches or trunks of nearly the same size in diameter and lacking a normal branch union.**
Compacted soils	**Soils in which the air-space (oxygen space) has been reduced or eliminated, reducing water infiltration and percolation, reducing root presence and inhibiting new root development.**
Compartmentalisation	**The physiological process that creates the chemical and mechanical boundaries that act to limit the spread of disease and decay organisms.**
Compression Failure	**Localized buckling of fibres and other longitudinal elements produced by compression of wood along the grain; compression failures sometimes develop in standing trees.**
Compression Strength	**The ability of a material or structure to resist failure when subjected to compressive loading; measurable in trees using special drilling devices**
Compression Wood	**Abnormal wood formed on the lower side of branches and curved stems, with physical properties different from normal wood.**
Conservation Area	**In Great Britain, designated areas of architectural or historical interest, in which there are special procedures for planning applications. Additionally tree works cannot generally be undertaken without prior notification (Currently 6 weeks) to the relevant local planning authority. See also Tree Preservation Orders.**
Core Sample	**A sample of wood extracted from a trunk or branch, using an increment borer tool. The resulting core can be analysed for characteristics of growth, wood strength, structure, decay, and for species identification.**
Crotch	**The union of two or more branches; the auxiliary zone between branches.**
Crown	**The upper canopy of a tree, including upper trunk, scaffold branches, secondary branches, stems and leaves.**
Crown lifting / raising	**Crown Lift The removal of the lowest branches, usually to a given height. It allows more residual light and greater clearance underneath for vehicles etc.**
Crown reduction	**The reduction of a tree's height or spread while preserving its natural shape.**
Crown thinning	**The removal of some of the density of a tree's crown, usually 5-25% allowing more light through its canopy and reducing wind resistance.**
Deadwood (noun)	**Deadwood is often present within the crown or on the stems of trees. It may be an indication of ill health, however, it may also indicate natural growth processes. If a target is present beneath the tree, deadwood may fall and cause injury or damage and should be removed, otherwise deadwood can remain intact for conservation purposes (insects, fungi, birds etc.).**
Deadwood (verb)	**The removal of dead branches from a tree's canopy, usually of a specified size (in diameter).**
Decay	**Progressive deterioration of organic tissues, usually caused by fungal or bacterial organisms, resulting in loss of cell structure, strength, and function. In wood, the loss of structural strength.**
Decay Detection	**The assessment of decay within a tree has been traditionally difficult, but recent advances have made it possible to achieve accurate representations of the internal section of a tree in both 2D and 3D, removing doubt over the condition of the tree and allowing accurate management decisions.**
Defect	**In relation to tree hazards, any feature of a tree which detracts from the uniform distribution of mechanical stress, or which makes the tree mechanically unsuited to its environment.**
Defoliation	**The losing of plants foliage.**
Dieback	**Progressive death of buds, twigs and branch tissues, on individual limbs resulting in Deadwood, or throughout the canopy,**

	extreme cases can result in Stag Heading.
Dripline	A projected line on the ground that corresponds to the spread of branches in the canopy; the farthest spread of branches.
Epicormic shoots	Fast growing, weakly attached shoots/branches that often grow as a response to stress factors upon a tree or branch removal.
Failure	In connection with tree hazards, a partial or total fracture within the wood tissue or loss of cohesion between roots and soil. (In total failure affected parts will snap or tear away completely, Partial failure there is a crack or deformation, which results in an altered distribution of mechanical stress.
Feeder Roots	Fine fibrous Water and nutrient absorbing roots located in the outer root system.
Flush-Cut	In trees and shrubs, a pruning cut close to the parent stem, which removes the branch bark ridge.
Foliage	The live leaves or needles of the tree; the plant part primarily responsible for photosynthesis.
Formative pruning	The trimming of a tree to remove weaknesses and irregularities which may lead to problems. The formative pruning operation is aimed at reducing the potential for future weaknesses or problems within the tree's crown.
Gall	An abnormal, disorganized growth of plant tissues, caused by parasitic or infectious organisms such as insects, fungi, bacteria, or viruses.
Girdling	In woody plants, any form of damage that destroys the bark and / or the Cambium all the way around the stem, branch or root, normally resulting in death of the damaged section.
Girdling Root	In woody plants, a root that grows across the buttress, or across other roots, eventually causing constriction of the radial growth.
Growth Increment	The incremental growth added as new annual ring develops each season over existing wood. This is seen as (growth) rings in cross-sections of wood.
Hazard beam	An upwardly curved branch in which strong internal stresses may occur without the compensatory formation of extra wood (longitudinal splitting may occur in some cases).
Heartwood	Inner non functioning tissues that provide structural support to trunk.
Heave	In relation to shrinkable clay soils, expansion due to rewetting of a volume of soil previously subjected to the removal or water by plant / trees following felling or root severance. Also in relation to root growth, the lifting of pavements and other structures by radial expansion. Also in relation to tree stability, the lifting of one side of a wind rocked root plate.
Herbicide	A chemical compound that causes the death of a plant.
Included Bark	Bark that becomes embedded in a crotch between branch and trunk or between co-dominant stems, usually found in narrow or tight crotches, and causes a weak structure.
Increment Borer	A tool that cuts and extracts a narrow cylinder of wood from a tree for analysis of the wood tissue and growth increments.
Leader	The primary terminal shoot or trunk of a tree.
Limb	A large lateral branch growing from the main trunk or from another larger branch.
Lion Tailing	Often the result of poor pruning practices; the main leader or branches are largely devoid of side branches, growth is restricted to the end of branches and is likely to suffer damage through end loading.
Lopping	In trees, a general term that related to the removal of branches from a tree.
Monitoring	Due to the relative life span of trees in relation to our own, long-term monitoring provides a valuable insight to the health of trees, identifying decline and or stabilisation and or improvement.
Mulch	A material laid over the root system of a tree to help conserve moisture within the soil. Additionally it may help control the development of weeds close to the tree.
Mycelium	A mass of growing filaments (hyphae) formed by fungi.
Mycorrhizae	The symbiotic relationship between roots and certain beneficial fungi. Mycorrhizae are the combined root / fungal growth.
Occluding tissue	The general tern of wood, cambium and bark that develop around the site of a wound on a woody plant
Pathogen	A microorganism that causes diseases within another organism.
Phloem	The principle conductive tissue that the products of Photosynthesis are transported around the plant
Photosynthesis	The process were light energy is used to create energy (Carbohydrate) for use within the plant.
Pollard	A term for a pollarded tree.
Pollard head	The swollen section of branch / stem that forms behind the pollarding cut.
Pollarding	The complete or partial removal of the crown of a young tree so as to encourage the development of numerous branches either for amenity or historically as fodder, repeated management is required cyclically to maintain the feature
Prune or Pruning	Selective removal of woody plant parts of any size, using saws, Loppers, Secateurs, or other pruning tools.
Reaction Wood	Wood with distinctive anatomical characteristics, formed in parts of leaning or crooked stems and in branches to provide additional strength / support. In hardwoods, tension wood usually forms. In conifers, compression wood is usually found.
Reaction Zone	A zone normally darker than surrounding wood that denoted the boundary often a defensive one between functional sapwood and dysfunctional or decaying wood.
Re-grading	The raising or lowering of a soil profile from its original grade.
Remedial pruning	The removal of old stubs, deadwood, epicormic growth, rubbing or crossing branches and other unwanted items from the tree's crown.
Resistograph	Invasive decay detection technique whereby the resistance offered by the timber to a spinning probe is measured and plotted.
Rib	In tree body language, a long narrow, axial protuberance which often over lays a crack.
Ring Barking	Artificial Girdling of the stem, to result in the death of a tree. May be used in habitat creation were the retention of dead standing trees is required.
Rod Bracing / Bolting	Traditionally, this has relied upon the Installation of steel rods or bolts through the stems or limbs, to reduce twisting or splitting of the wood. The installation of such features does require legal interpretation.
Root Barriers	Both Buildings and services can benefit from the installation of root barriers to protect a soil volume from the ingress of roots.
Root Collar	The basal area of the tree; transition zone from trunk to root. Also sometimes called trunk flare.
Root Plate	The primary support area for the tree; an area of the root system close to the base that structurally anchors the tree to the soil.
Root Rot	Either a general term for decay within the wood of the lower stem / buttress roots, or a disease in which the fine roots are killed.
Root System	The portion of the tree containing the root organs, including buttress roots, transport roots, and fine absorbing roots; all underground parts of the tree.
Root Zone	The area and volume of soil around the tree in which roots are expected. May extend to three or more times the branch spread of the tree, or several times the height of the tree.
Sail Area	That area or the tree subjected to wind load.

Sapwood	**Xylem wood tissue, usually light in colour, representing the outer growth rings of the wood. Usually living, reactive wood tissue, in a healthy tree. See heartwood**
Scaffold limbs / scaffold Branches	**The branches that from the main network framework of the crown of a tree.**
Senescent	**A decline in growth and vigour due to age or stress factors.**
Shrub	**A woody plat that branches at or close to the ground level and so does not have a single stem.**
Slime Flux	**Relating to a toxic condition from the spreading of bacteria or their products from a source of infection; characterized by malodorous gases, or salt deposits upon the bark. If these products enter the sap stream, localised vessel necrosis can result, usually associated with anaerobic conditions.**
Soft Rot	**A kind of wood decay, were a fungi degrades cellulose within the cell wall, without causing overall degradation.**
Soil Compaction	**The compression of soil, causing a reduction of pore space and an increase in the density of the soil. Air is squeezed out and nutrients become locked. Tree roots cannot grow in compacted soil.**
Sonic Decay Detection	**Non invasive method whereby sound waves are passed through the tree and the speed is measured. Slow speeds indicate decay and a tomography picture representing the inner stem is produced.**
Stag Heading	**In a tree, a state of dieback were dead branches protrude beyond the current living crown.**
Stress	**In plant physiology, conditions were one or more physiological functions Are not working within normal parameters.**
Stump Grinding	**The removal of a tree stump using a specialist grinding machine.**
Subsidence	**In relation to vegetation, the removal of water by plant growth resulting in localised shrinkage in the soil volume.**
Sucker	**Same as sprout.**
Suppressed	**Trees which are dominated by surrounding vegetation and whose crown development is restricted from above.**
Systemic	**Affecting the whole plant or organism. A systemic compound is carried throughout the entire plant to all parts through the vascular system.**
Target	**Any person or object within reach of a falling tree or part of a tree that may be injured or damaged.**
Target Pruning	**The pruning of a branch were the wound affects only branch material, often result in a target shaped wound.**
Tension Wood	**Reaction wood typically formed on the upper side of limbs or curved stems; characterized by lack of cell wall lignifications (higher ratios of cellulose to lignin).**
Tight Union / Tight Crotch	**Also, narrow crotch. A crotch with a narrow angle between branches, often having included bark.**
Tomography	**The comparison of sound or stress waves through the tree allows the creation of a 2D or 3D representation of the internal structure of a stem or branch section and highlights areas of damage. Virtually non-injurious.**
Topography	**The configuration of surface features, including the vertical and horizontal relationships of the ground and other features.**
Topping	**Cutting large limbs back severely, without regard to form or habit of the tree. Cuts are usually made between lateral branch nodes. This practice is extremely injurious to trees, and promotes decay and structural weakness within the crown.**
Tree	**A woody plant that typically has a single stem, at maturity has a height of a least 4 metres and a stem diameter at breast height of at least 75mm.**
Tree Preservation Order	**In Great Britain, an order made by the local planning authority, were consent must be gained before undertaking all but exempt works to a tree.**
Trunk Flare	**The basal area of the trunk that flares or widens, and merges with the main roots. See root collar**
Veteran Tree	**Veteran trees are often found in large parks or estates and commonly affected by extensive decay or have been subject to extensive works. These trees are retained for historical importance and often pose greater risk than normal, which is generally justified. They need careful management and often propping or bracing to support them, some require fencing to limit access.**
Vigour	**Active, healthy growth of plants: ability to respond to stress factors.**
Visual Tree Assessment (VTA)	**An assessment of the mechanical condition of trees based upon their 'body language'. Trees are dynamic and respond to faults / decay / environmental factors in various ways, these responses can be indicative of structural integrity.**
Wetwood	**An infection caused by bacteria living inside the plant tissues. The bacteria ferment the plant fluids, resulting in death of nearby cells, and often causing exudations of fluid from the bark, often referred to as a Slime Flux.**
White Rot	**A kind if wood decay were a fungi attacks the lignin within the wood matrix**
Wind loading	**Forces placed upon tree canopy, branches, trunk and roots of a tree under windy conditions.**
Wind Throw	**The failure of a tree due to wind loading.**
Witches Broom	**A deformed or unusual growth of twigs from adventitious buds, caused by insects, disease, or dieback of twigs and buds.**
Wood	**Secondary Xylem; the main structural support and water conducting tissue of trees and shrubs.**
Wound Response Tissue	**Also Occluding Tissue, Wound Wood or Callus. Differentiated wood tissue that grows around the margins of a wound or injury.**
Wound Wood	**Wood with atypical features, formed in the vicinity of a wound and a term to describe the occluding tissues around a wound**
Xylem	**Plant tissues with special function of translocation of water and dissolved nutrients.**

Appendix 3: Survey Methodology

A2.1 Ground level visual surveys are carried out using the *Visual Tree Assessment* technique described by Mattheck and Broeler (1994) and endorsed by the Arboricultural Association (LANTRA Professional Tree Inspection course, 2007).

A2.2 Structural condition is assessed by inspecting the stem and scaffold branches from all angles looking for weak branch junctions or symptoms of decay. Particular attention is paid to the stem-base. Cavities are explored using a metal probe in order to assess the extent of any decay. If this is not possible further inspection is recommended in the form of a climbed inspection or using specialist decay detection equipment.

A2.3 The physiological condition is assessed by inspecting the stem, branches and foliage for symptoms of disease. The overall vigour of the tree is also taken into account.

A2.4 Where significant defects are observed, recommendations are made according to a scale of priority in order to reduce the likelihood of structural failure. The position of the tree and its potential targets are taken into account.

A2.5 Measurements are obtained using a diameter tape, clinometer, distometer and loggers tape. Where this is not practical measurements are estimated.

A2.6 Some trees are surveyed as groups, though this is usually avoided close to areas likely to be developed.

A2.7 Finally, a *Retention Category* is allocated as described in Appendix 1.1.1.

Appendix 4: Author's Qualifications

Qualifications & Experience of Ivan Button N.C.H. (Arb), FDSc (Arb), BSc (Hons), P.G.C.E., M. Arbor. A.

Construction

Between 1983 and 1995 Ivan worked primarily within the construction industry and received training in a broad range of practical building skills and general construction principles. During this time he obtained a BSc (Hons) at Leeds University followed by a P.G.C.E at The University of Wales.

Arboriculture

He obtained a NCH (Arboriculture) at the University of Lincoln and became a member of the Arboricultural Association. He then worked for an Arboricultural Consultancy for one year before establishing a tree surgery and landscaping business in 1998. In 2005 Ivan commenced full time employment with a leading Arboricultural Association approved consultancy and soon adopted a senior role responsible for five consultants.

He obtained a FDSc in arboriculture at the University of Lancashire, which he passed with distinction and is now a Director and Principal Consultant of Crown Consultants Ltd. He is accredited as a LANTRA *Professional Tree Inspector*. A qualification produced in association with the Arboricultural Association and generally recognised as appropriate for all levels of tree inspection.

He is a member of the Consulting Arborist Society and is listed within their areas of professional expertise for QTRA and as an expert witness.

Ivan is a professional member of the Arboricultural Association and the International Society of Arboriculture.

He is a licensed Quantified Tree Risk Assessment user.

Ivan has undertaken professional expert witness training and has been registered as a Sweet and Maxwell Checked Expert Witness since 2008.

Throughout 2009 acted as the principal Tree Officer for Barnsley Metropolitan Borough Council.

Ivan has produced several hundred Arboricultural Reports for the purposes of Development, Safety, Management, Mortgage, Subsidence, Mitigation and Litigation.

Appendix 5: Further Information

Building Near Trees – General

National Joint Utilities Group publication # 10 (1995), *Guidelines for the Planning, Installation and Maintenance of Utility Services in Proximity to Trees. Downloadable at www.njug.demon.co.uk/pdf/NJUG%20Publication10.pdf*

NHBC Standards Chapter 4.2., *Trees and Buildings.*

Horticulture LINK project 212. (*University of Cambridge,* 2004), *Controlling Water Use of Trees to Alleviate Subsidence Risk.*

Tree Planting and aftercare

See www.trees.org.uk/leaflets.php# for downloadable leaflets on selecting a garden tree, planting, aftercare and veteran tree management.

British Standards

BS 5837: 2012. Trees in Relation to Design, Demolition and Construction – Recommendations.
Bs 3998: 2010. Recommendations for Tree Work.
BS 3936: 1992. Nursery Stock. Part 1: Specification for Trees and Shrubs.
BS 3936: 1992. Nursery Stock. Part 10: Specification for Groundcover Plants.
BS 4043: 1989. Transplanting Root-balled Trees.
BS 8004: 1986. Foundations.
BS 8103: 1995. Structural design of Low-Rise Buildings.
BS 8206: 1992. Lighting for Buildings.
BS 8545:2014. Trees: From nursery to independence in the landscape – Recommendations
BS 3882: 2007. Topsoil.
BS 4428: 1989. General Landscaping Operations (excluding hard surfaces).

Permission to do Works to Protected Trees / Tree Law

Forestry Commission (Edinburgh, 2003), *Tree Felling – Getting Permission*. Country Services Division - Forestry Commission. Downloadable at www.forestry.gov.uk/website/pdf.nsf/pdf/wgsfell.pdf/$FILE/wgsfell.pdf

Transport and the Regions (Department of the Environment, 2000), *Tree Preservation Orders, A Guide to the Law and Good Practice*. Downloadable at www.communities.gov.uk/publications/planningandbuilding/tposguide

C. Mynors, *The Law of Trees, Forests and Hedgerows* (Sweet and Maxwell, London, 2002)

Communities and Local Government website with numerous downloadable documents, from: http://www.communities.gov.uk/planningandbuilding/planning/treeshighhedges/

Lighting Levels

P.J. Littlefair, *B.R.E. 209: Site layout planning for daylight and sunlight A guide to good practice.* B.R.E. Bookshop, London.

British Standards Institution. Code of practice for day lighting. *British Standard* BS 8206: Part 2 (1992).

Chartered Institution of Building Services Engineers. *Applications manual: Window Design* (London, 1987).

NBA Tectonics. A study of passive solar housing estate layout. *ETSU Report* S-1126. Harwell, Energy Technology Support Unit (1988).

I.P. Duncan; D. Hawkes, Passive solar design in non-domestic buildings. *ETSU Report* S-1110. Harwell, Energy Technology.

P. J. Littlefair, Measuring Daylight, *BRE Information Paper 23/93 f3.50.* (Advises on measuring daylight under the real sky or an artificial sky, allowing for the changing nature of sky light).

High Hedges

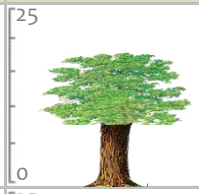
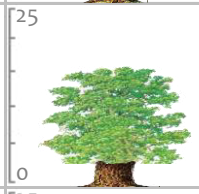
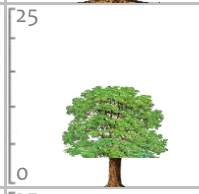
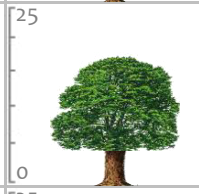
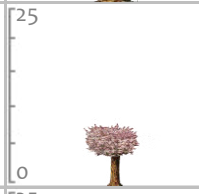
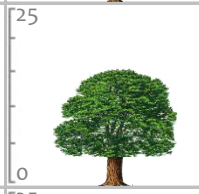
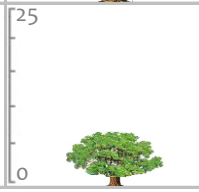
Communities and Local Government website with numerous downloadable documents, from: http://www.communities.gov.uk/planningandbuilding/planning/treeshighhedges/

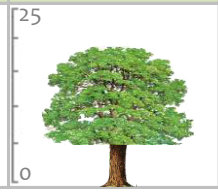
Tree Specific Websites

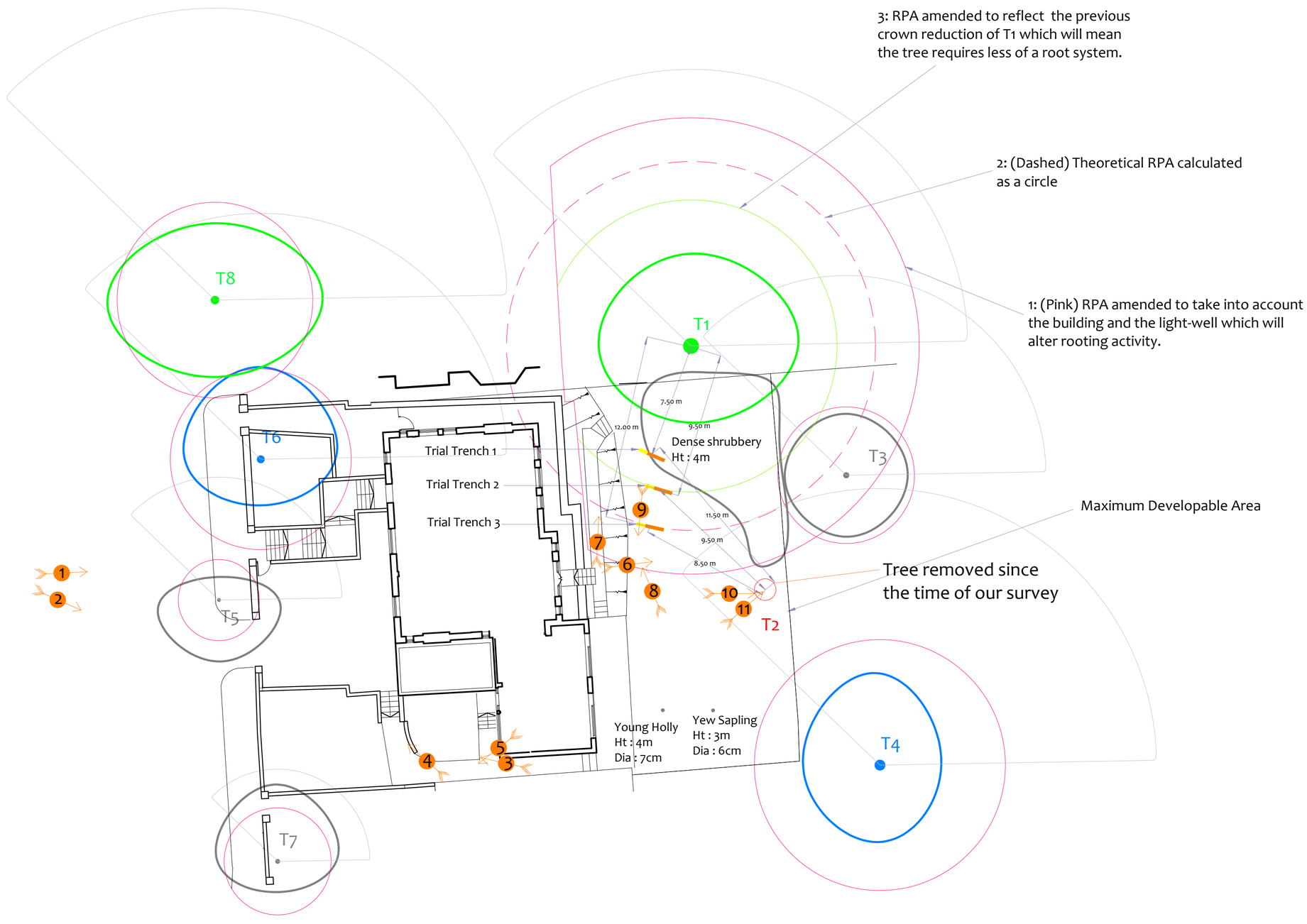
www.crowntrees.co.uk	Crown Consultants site containing useful information
www.trees.org.uk	Arboricultural Association
www.rfs.co.uk	Royal Forestry Society of England, Wales and N. Ireland
www.treehelp.Info	The Tree Advice Trust
www.woodland-trust.org.uk	The Woodland Trust
www.treecouncil.org.uk	The Tree Council

Appendix 6: Tree Data Schedule and Site Plan(s)

The Tree Data Schedule and all plans accompanying this report follow this page. They are also provided as separate documents for ease of printing and referring between when viewing on a screen.

Reference (G = Group, H = Hedge)	Age & Species	Height (m)	Crown Ht (m)	Diameter (cm)	Crown Spread (m) W N E S	Scaled Tree Diagram (m)	Notes	Recommendations (independent of proposals) Priority	Inspect Freq (yrs)	Vigour / Physiological Condition / Structural Condition	Amenity Value / Life Expectancy (yrs) / Retention Category
T1	Mature **Oak** Quercus robur.	18	9	Est 100	W 6, N 6, E 7, S 5		Position: Situated on third party land. Form: Twin-stemmed at 3m with a balanced crown. History: Reduced. **Defects: No defects observed.** Other: Ivy prevented detailed inspection.	Remove ivy and inspect stem for defects.	Moderate / 1.5	Moderate / Good / Good	High / 40+ / A
T2	Mature **Oak** Quercus robur.	16	3	140	W 8.5, N 7, E 3, S 6		Position: Situated within the rear garden. Form: Single stemmed and vertical with a well-formed crown. History: No evidence of significant pruning. **Defects: Major advanced decay to stem (ground level to 1m, 40% of stem diameter).** Other: Decay is extensive, **hazardous** tree.	Remove.	High / N/A	Moderate / Good / **Very Poor**	High / <10 / **U**
T3	Semi-Mature **Sycamore** Acer pseudoplatanus.	13	4	37	W 4, N 4, E 4, S 4		Position: Situated within the rear garden. Distance to property is 17.6m. Form: Twin-stemmed at 2.5m with a balanced crown. History: No evidence of significant pruning. **Defects: No significant defects.**	No action required.	n/a / 3	High / Good / Good	Low / 40+ / C
T4	Mature **Lime** Tilia sp.	18	5	68	W 5, N 6, E 4, S 5		Form: Single stemmed and vertical with a slightly unbalanced crown. History: No evidence of significant pruning. **Defects: No defects observed.** Other: Ivy prevented detailed inspection.	Remove ivy and inspect stem for defects.	Moderate / 1.5	Moderate / Fair / Fair	Moderate / 40+ / B
T5	Semi-Mature **Cherry** Prunus sp.	8	4	22	W 4, N 1.5, E 4, S 4		Position: Street tree. Form: Single stemmed and vertical with a well-formed crown. History: No evidence of significant pruning. **Defects: No significant defects.** Other: Bark wound at base.	No action required.	n/a / 3	High / Good / Good	Moderate / 40+ / C +
T6	Early-Mature **Lime** Tilia sp.	16	4	49	W 5, N 6, E 5, S 3		Position: Situated within the front garden. Form: Twin-stemmed at ground level with a balanced crown. History: No evidence of significant pruning. **Defects: No defects observed.** Other: Ivy prevented detailed inspection.	Remove ivy and inspect stem for defects.	Moderate / 1.5	High / Good / Fair	High / 40+ / B
T7	Semi-Mature **Sycamore** Acer pseudoplatanus.	6	1	29	W 4, N 5, E 4, S 2		Position: Situated on third party land. Form: Multi-stemmed at 2m with a slightly unbalanced crown. History: No evidence of significant pruning. **Defects: No significant defects.**	No action required.	n/a / 3	High / Good / Fair	Low / 40+ / C

Reference (G = Group, H = Hedge)	Age & Species	Height (m)	Crown Ht (m)	Diameter (cm)	Crown Spread (m) N / W / E / S	Scaled Tree Diagram (m)	Notes	Recommendations (independent of proposals)		Vigour / Physiological Condition / Structural Condition	Amenity Value / Life Expectancy (yrs) / Retention Category
								Priority	Inspect Freq (yrs)		
T8	Early-Mature **Silver Maple** Acer saccharinum.	19	6	53	N 5 / W 7 / E 7 / S 5		Position: Street tree. Form: Single stemmed and vertical with a well-formed crown. History: No evidence of significant pruning. **Defects: No significant defects.**	No action required. n/a	3	High Good Good	High 40+ **A**



Tree Constraints Plan

(Existing Layout)

Tree Ref.	Species	Height (m)	Root Protection Area		
			Radius (m)	m²	Square (m)
T1	Oak	18	12.0	452	21.3
T2	Oak	16	16.8	887	29.8
T3	Sycamore	13	4.4	62	7.9
T4	Lime	18	8.2	209	14.5
T5	Cherry	8	2.6	22	4.7
T6	Lime	16	5.9	109	10.4
T7	Sycamore	6	3.5	38	6.2
T8	Silver Maple	19	6.4	127	11.3

MN = Measured North:

Canopy spreads are sometimes measured to an approximate N defined by site features. Often more accurate, especially where rows of trees are not aligned N-S or E-W.

Drawing No:	CCL 08927 / TCP Rev: 2
Title:	Tree Constraints Plan (Existing Layout)
Site:	26 Netherhall Gardens Camden, NW3 5TL
Scale:	1:200
Paper Size:	A2

0 5 10m

CROWN
Arboricultural Consultants
01422 316660

Tree Retention Categories
Stems & canopies shown

Category A tree	Trees of high quality with an estimated life expectancy of 40+ years. Usually large trees with significant presence or smaller trees with excellent form. Retention of these trees is highly desirable.
Category B tree	Trees of moderate quality with a life expectancy of 20+ years. Usually maturing trees, or younger trees with good form. Retention of these trees is desirable though less than Category A trees
Category C tree	Unremarkable trees of low quality and merit. Individual specimens are not considered to be a material planning consideration.
Category U tree	Trees unsuitable for retention due to their very poor condition.

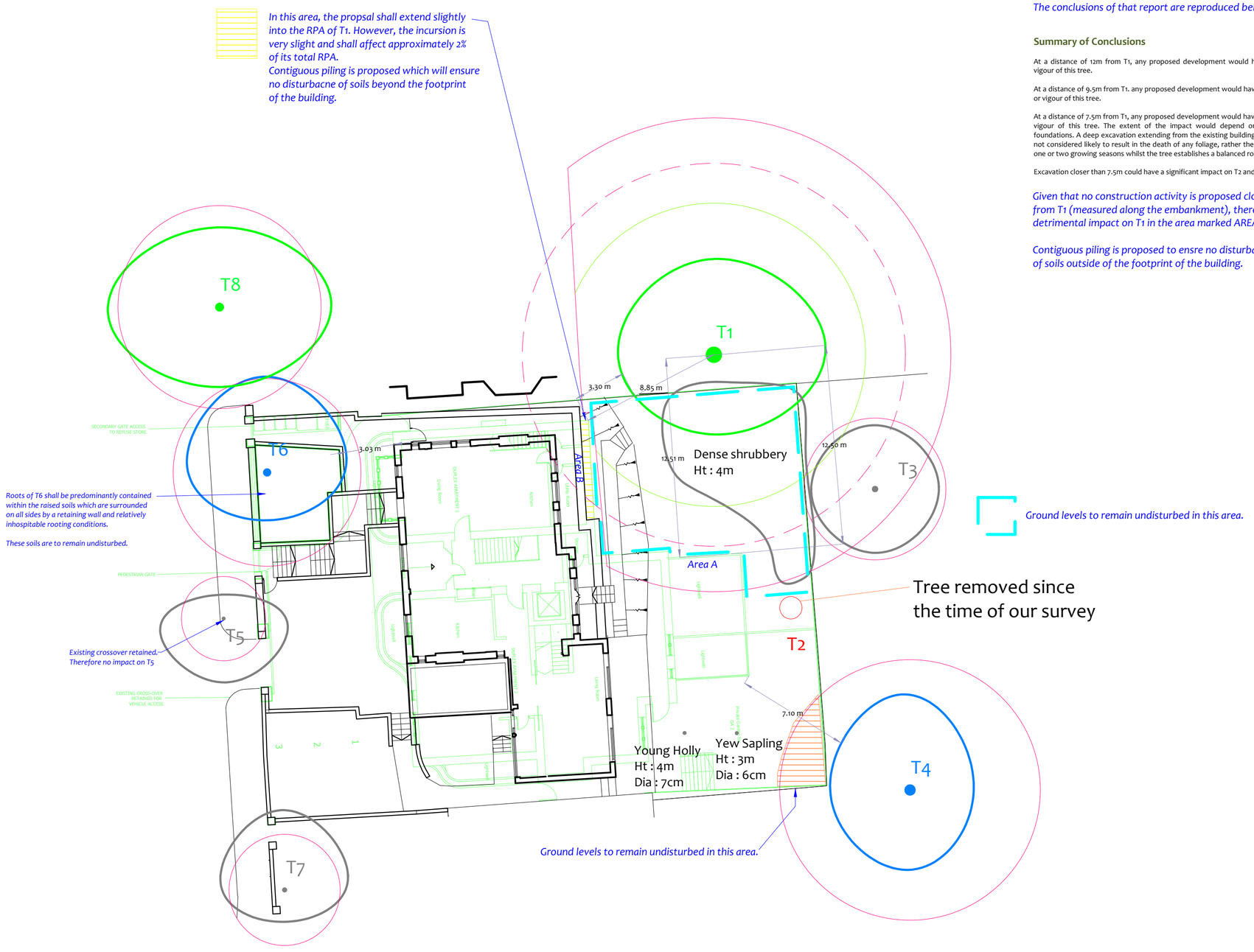
Tree Constraints Plan

BS 5837 Root Protection Area (radius = 12xstem diameter)

Root Protection Area needing amendment due to site conditions, e.g. presence of exising road or building.

Root Protection Area having been amended to account for for site conditions

T1 = Tree No 1 G2 = Group No 2 H3 = Hedge No 3



The results of a Trial Pit Investigation into the rooting habit of T1 are presented in our arboricultural report dated 28th May 2013.

The conclusions of that report are reproduced below:

Summary of Conclusions

At a distance of 12m from T1, any proposed development would have no impact on the health or vigour of this tree.

At a distance of 9.5m from T1. any proposed development would have negligible impact on the health or vigour of this tree.

At a distance of 7.5m from T1, any proposed development would have some impact on the health and vigour of this tree. The extent of the impact would depend on the length and depth of the foundations. A deep excavation extending from the existing building half way to the rear boundary is not considered likely to result in the death of any foliage, rather the vigour is likely to be reduced for one or two growing seasons whilst the tree establishes a balanced root:shoot ratio.

Excavation closer than 7.5m could have a significant impact on T2 and should be kept to a minimum.

Given that no construction activity is proposed closer than 12m from T1 (measured along the embankment), there shall be no detrimental impact on T1 in the area marked AREA A.

Contiguous piling is proposed to ensre no disturbance of soils outside of the footprint of the building.

N

Impact Assessment Plan

(Existing Layout with Proposals Overlaid)

Drawing No:	CCL 08927 / IAP Rev: 1
Title:	Impact Assessment Plan (Existing Layout with Proposals Overlaid)
Site:	26 Netherhall Gardens Camden, NW3 5TL
Scale: 1:200	Paper Size: A2

0 5 10m

CROWN
Arboricultural Consultants
01422 316660

Tree Retention Categories
Stems & canopies shown

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Impact Assessment Plan

BS 5837 Root Protection Area (radius = 12xstem diameter)

Root Protection Area needing amendment due to site conditions, e.g. presence of exising road or building.

Root Protection Area having been amended to account for for site conditions

T1 = Tree No 1 G2 = Group No 2 H3 = Hedge No 3

BS 5837 Shade Pattern

Photo 1

Tree to be removed to facilitate the proposal

Tree to be removed due to its low quality

Proposed pruning

MN = Measured North:

Canopy spreads are sometimes measured to an approximate N defined by site features. Often more accurate, especially where rows of trees are not aligned N-S or E-W.

Tree Ref.	Species	Height (m)	Root Protection Area		
			Radius (m)	m²	Square (m)
T1	Oak	18	12.0	452	21.3
T2	Oak	16	16.8	887	29.8
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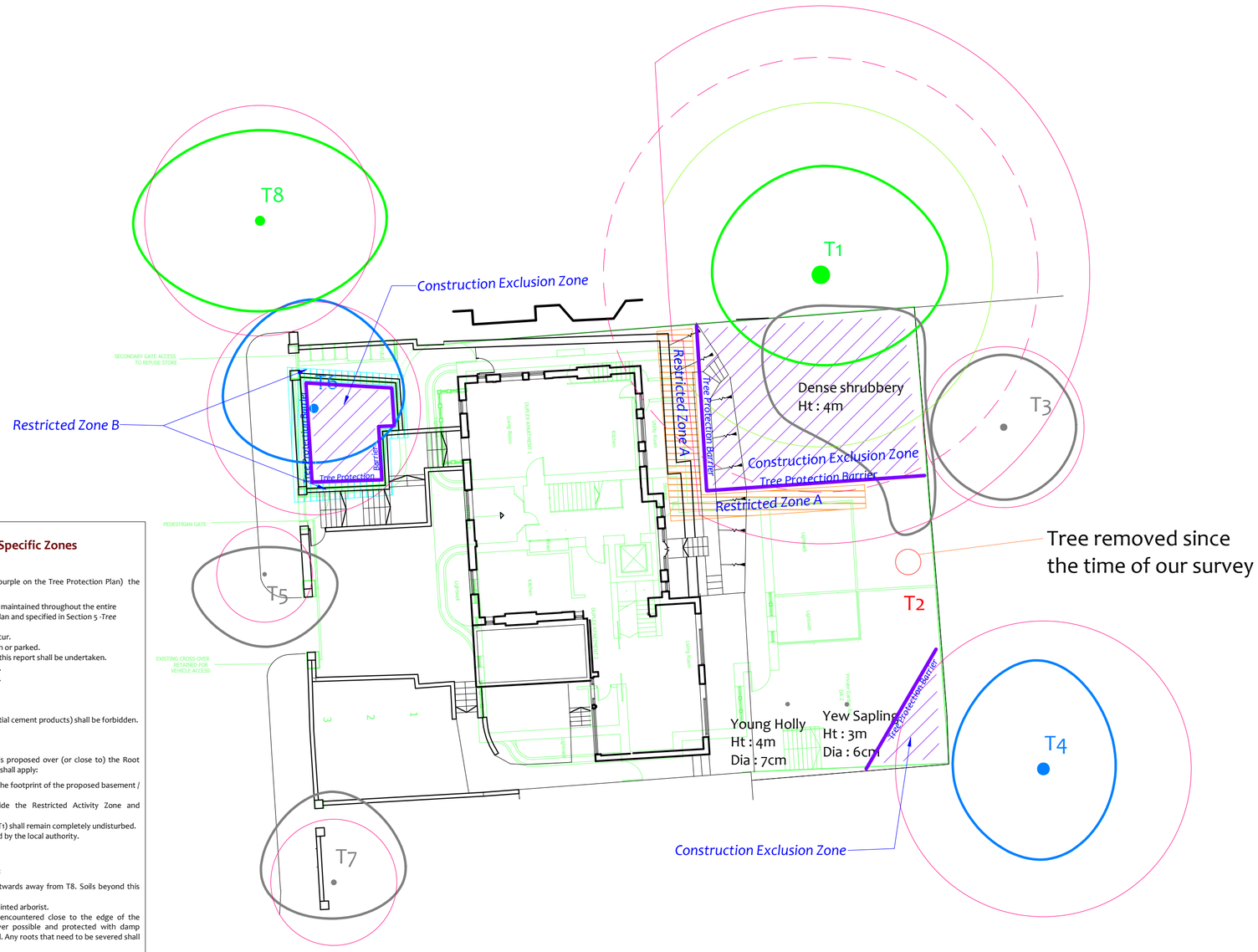

Section B: Restrictions on Activities – Specific Zones

3.7. Construction Exclusion Zones

3.7.1. Within Construction Exclusion Zones (shaded purple on the Tree Protection Plan) the following restrictions shall apply:

- Tree Protection Barriers shall be erected and maintained throughout the entire project as indicated on the Tree Protection Plan and specified in Section 5 -*Tree Protection Barriers*.
- No construction activity whatsoever shall occur.
- No vehicles or plant machinery shall be driven or parked.
- No tree works, other than those specified in this report shall be undertaken.
- No alterations of ground levels or conditions.
- No chemicals or cement washings permitted.
- No excavation whatsoever shall occur.
- No temporary structures.
- No fires shall be permitted.
- All hazardous materials (including non-essential cement products) shall be forbidden.

3.8. Restricted Activity Zone A

3.8.1. In this zone, contiguous piling or sheet piling is proposed over (or close to) the Root Protection Area of T1. The following restrictions shall apply:

- The piles shall be located along the edge of the footprint of the proposed basement / building.
- The pile driver shall operate from outside the Restricted Activity Zone and Construction Exclusion Zone.
- The ground between the piles and the tree (T1) shall remain completely undisturbed.
- Any variation from this shall first be approved by the local authority.

3.9. Restricted Zone B

3.9.1. Around T6, the following restrictions shall apply:

- Existing wall to be carefully demolished outwards away from T8. Soils beyond this wall to remain undisturbed.
- This shall be done in the presence of an appointed arborist.
- If roots in excess of 25mm diameter are encountered close to the edge of the excavation, they shall be retained wherever possible and protected with damp sacking during times that they are unearthed. Any roots that need to be severed shall be pruned with secateurs.
- Existing foundations to be reused or strengthened by excavating outside / beneath them.
- The existing foundations shall not be removed if the appointed arborist deems that this would overly impact on the soils beyond the retaining wall.
- New wall to be installed and any back-filling shall use fertile top-soil.
- No fires shall be permitted.
- All hazardous materials (including non-essential cement products) shall be forbidden.
- All machinery in excess of 2m tall shall be carefully marshalled through this zone.

Drawing No:	CCL 08927 / TPP Rev: 1
Title:	Tree Protection Plan
Site:	26 Netherhall Gardens Camden, NW3 5TL

0 5 10m

Scale: 1:200 Paper Size: A2

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Arboricultural Consultants
01422 316660

Tree Retention Categories
Stems & canopies shown

Category A tree	Trees of high quality with an estimated life expectancy of 40+ years. Usually large trees with significant presence or smaller trees with excellent form. Retention of these trees is highly desirable.
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Category U tree	Trees unsuitable for retention due to their very poor condition.

Tree Protection Plan

BS 5837 Root Protection Area (radius = 12xstem diameter)

Root Protection Area needing amendment due to site conditions, e.g. presence of exising road or building.

Root Protection Area having been amended to account for for site conditions

T1 = Tree No 1 G2 = Group No 2 H3 = Hedge No 3

BS 5837 Shade Pattern

X Tree to be removed to facilitate the proposal

X Tree to be removed due to its low quality

Proposed pruning

N

Tree Protection Plan

Tree Protection Barriers:

Fixed protective barrier: The 'In-Ground System' or the 'Backstay System'. To remain in place for all construction activity		Construction Exclusion Zone Stem protected to a height of 2.5m with thick cloth & wire Tree Protection Boxing 1.2 x 1.2 x 2.4m high 25mm plywood
Moveable protective barrier: The 'Backstay System'. To remain in place except when approved works are being undertaken in the Restricted Zone		Orange Barrier Mesh Fencing, Ht 1m, on steel fencing pins and wooden posts To remain in place throughout all construction activity

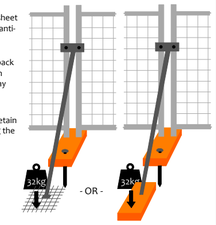
The 'Back Stay System'

2m X 3.5m weldmesh (or sheet metal) panels linked with anti-tamper couplings

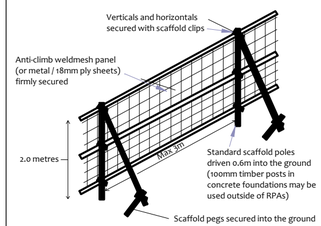
Each panel attached to a back stay which is founded in an additional foot or mesh tray as illustrated

Minimum 32kg ballast to retain rear foot or tray (including the weight of the foot/tray)

Alternate front feet to be secured with ground pins or additional ballast



The 'In-Ground' System



Construction Exclusion Zone

Within this area the following restrictions shall apply:

No excavation or land regrading whatsoever.
No storage of materials, rubble, soil or spoil.
No fires within the exclusion zone or within 10m of any tree canopy.
No site cabins or other temporary structures.
No discharge of polluted water, cement or chemicals of any kind.
No use of any machinery, or passage or parking of vehicles.
No tree works without council consent.

Restricted Activity Zones

Restrictions are detailed within the accompanying Method Statement

Restricted Zone A	Restricted Zone B

Dedicated Mixing and Cleaning Area