Arboricultural Assessment & Method Statement

The Hall School, 23 Crossfield Road, London

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11 November 2016

15204-AA-MW

Site location and approximate boundaries

Image 1: Provided courtesy of Google. The yellow line indicates the approximate site boundary and is illustrative only.

Report purpose

This is a BS 5837 compliant arboricultural assessment report providing sufficient information for the Local Planning Authority ("LPA") to consider the effect of the proposed development on local character from a tree perspective. It includes an analysis of how trees will be affected and an arboricultural method statement describing how retained trees will be protected and managed during the development activity. It is fully in line with the BS 5837 advice relating to the planning application stage of the process highlighted in Table B1 reproduced below:

Table B. 1 Delivery of tree-related information into the planning system

Stage of process	Minimum detail	Additional information
Pre-application	Tree survey	Tree retention/removal plan (draft)
Planning application	Tree survey (in the absence of pre-application discussions)	Existing and proposed finished levels
	Tree retention/removal plan (finalized)	Tree protection plan
	Retained trees and RPAs shown on proposed layout	Arboricultural method statement - heads of terms
	Strategic hard and soft landscape design, including species and location of new tree planting	Details for all special engineering within the RPA and other relevant construction details
	Arboricultural impact assessment	
Reserved matters/ planning conditions	Alignment of utility apparatus (including drainage), where outside the RPA or where installed using trenchless method	Arboricultural site monitoring schedule
	Dimensioned tree protection plan	Tree and landscape management plan
	Arboricultural method statement – detailed	Post-construction remedial works
	Schedule of works to retained trees, e.g. access facilitation pruning	Landscape maintenance schedule
	Detailed hard and soft landscape design	

Validation statement

For LPA validation purposes, this report includes:

- a **BS 5837 compliant tree survey**, including a tree protection plan showing the location of the existing trees, their categorisation, the location of the new basement, staircase and cycle store, and the tree protection measures;
- an **arboricultural assessment** in Section 1, which describes how the development proposal will affect local character from a tree perspective;
- an **arboricultural method statement** in Section 2 describing the tree protection and management measures, and how they should be implemented; and
- two **appendices** in Section 3 setting out the background administrative information and a schedule of tree information.

The tree protection plan

More specifically, the tree protection plan is based on the provided information and it should only be used for dealing with the tree issues. It shows:

- the existing trees numbered, with high/moderate categories (A & B) highlighted in green triangles and low/unsuitable categories (C & U) highlighted in blue rectangles;
- the circular interpretation of root protection areas ("RPA") of category A, B and C trees (grey circles);
- the location of the construction exclusion zone ("CEZ"), which is the area of restricted access, to be protected by temporary barriers (fencing and/or ground protection); and
- the location of precautionary areas outside the CEZ where limited, but careful access is permitted.

Summary

1. The development proposal

The development proposal is to refurbish part of the existing school and replace the centenary building and hall with new teaching facilities at The Hall School, 23 Crossfield Road, London.

2. Background administrative information

Our instructions, how we prepared this report and other relevant background information is explained in Appendix 1. All the trees that could be affected were inspected and that information is listed in Appendix 2.

3. Table 1: Summary of category A, B and C trees to be removed, pruned or protected using special precautions

	British Standard 5837 Category		
	A (High quality)	B (Moderate quality)	C (Low quality)
Remove	-	-	-
Prune	1	-	-
Protect using special precautions	1	-	3

4. Table 2: Extra precautions in addition to primary protection using barriers (fencing and ground protection)

Activities requiring extra precautions	Tree number(s)
Pollution control near retained trees	All trees
Vehicle restrictions near retained trees	All trees
Excavation in RPAs	1 and 3
Removal of existing surfacing and/or structures in RPAs	1 and 3
Installation of new structures in RPAs	1 and 3
Installation of new services and/or upgrading of existing services in RPAs	All trees
Upgrading existing soft landscaping or replacing existing surfacing and/or structures with new soft landscaping	All trees

Note: The detailed analysis explaining how these trees will be protected is provided in Section 2 of this report. The approximate locations of the protective measures are shown on the tree protection plan. It is likely that some details of the tree protection will need to be refined in response to a planning condition, once consent is issued.

5. Overall assessment of how the development proposal will affect local character from a tree perspective

No trees will be lost because of this proposal. The construction activity may affect trees if appropriate protective measures are not taken. However, if adequate precautions to protect the retained trees are specified and implemented through the arboricultural method statement included in this report, the development proposal will have no significant impact on the contribution of trees to local character.

Section 1
Arboricultural assessment

This arboricultural assessment has taken account of all the recommendations set out in 5.4 of BS 5837 (reproduced courtesy of BSI below).

5.4 Arboricultural impact assessment

5.4.1 The project arboriculturist should use the information detailed in **5.2** and **5.3** to prepare an arboricultural impact assessment that evaluates the direct and indirect effects of the proposed design and where necessary recommends mitigation.

5.4.2 The assessment should take account of the effects of any tree loss required to implement the design, and any potentially damaging activities proposed in the vicinity of retained trees. Such activities might include the removal of existing structures and hard surfacing, the installation of new hard surfacing, the installation of services, and the location and dimensions of all proposed excavations or changes in ground level, including any that might arise from the implementation of the recommended mitigation measures. In addition to the impact of the permanent works, account should be taken of the buildability of the scheme in terms of access, adequate working space and provision for the storage of materials, including topsoil.

NOTE Scaled cross-sections and other drawings might be required to demonstrate the feasibility of the proposals (see Annex B).

5.4.3 As well as an evaluation of the extent of the impact on existing trees, the arboricultural impact assessment should include:

a) the tree survey (see **4.4**);

b) trees selected for retention, clearly identified (e.g. by number) and marked on a plan with a continuous outline;

c) trees to be removed, also clearly identified (e.g. by number) and marked on a plan with a dashed outline or similar;

d) trees to be pruned, including any access facilitation pruning, also clearly identified and labelled or listed as appropriate;

e) areas designated for structural landscaping that need to be protected from construction operations in order to prevent the soil structure being damaged;

f) evaluation of impact of proposed tree losses;

g) evaluation of tree constraints (see **5.2**) and draft tree protection plan (see **5.5**);

h) issues to be addressed by an arboricultural method statement (see **6.1**), where necessary in conjunction with input from other specialists.

Section 1: Arboricultural assessment

6. Relevant background information that has influenced this assessment – strategic and policy considerations

The Climate Change Act (2008) sets out a statutory strategic need to adapt to climate change at a national and local level, which is reiterated through the emphasis on sustainability in the National Planning Policy Framework. It is now widely accepted that trees offer significant climate adaptation benefits to the built environment where people live and work. These benefits include, amongst others, the buffering of temperature extremes and the buffering of rainwater runoff, which can significantly reduce the adverse impacts of climate change.

Additionally, there is an increasing body of research providing reliable evidence that trees impart other significant health-related benefits to the people that live and work near them. These benefits include, amongst others, the potential to improve psychological wellbeing by reducing stress and anxiety through the relaxing nature of their presence. It seems that access to greenspace and trees makes people happier and encourages them to take more exercise, which has a direct and positive impact on physical health and wellbeing. On a subtler level, the ecological enhancement that can be achieved through appropriate tree management makes a positive contribution to environmental sustainability.

These concepts are explored and set into a built-environment context in the recent Trees and Design Action Group's publications *Trees in the Townscape: A Guide for Decision Makers* and *Trees in Hard Landscapes: A Guide for Delivery*. Furthermore, specific advice on planting new trees is provided in British Standard 8545 (2014) *Trees: from nursery to independence in the landscape – Recommendations*. We have given significant weight to the guidance set out in these documents, which is reflected in the analyses in this report.

In line with these references, we agree with and support the general principle that more and bigger trees will deliver more benefits from their presence. Although this must be applied with balance and intelligence, it nonetheless remains an important guiding principle in the planning process and it has been an influential consideration in our analysis on this site.

7. Impact from the basement proposals close to T1

7.1 Rooting requirements of T1: From the provided layout, one London Plane tree (T1 in Image 2) is close enough to be affected by the proposed basement development. Based on its measured stem diameter of 105cm it requires an RPA radius of 12.6m or an area of soil 499m². Whilst it is very difficult to establish exactly where tree roots grow, in many cases in London, we have found them growing vigorously at depth below hard surfaces or structures. Plane trees especially, have capacity to root deeply and often it is possible to find tree roots exploiting suitable areas of soil 2-3m below ground level. In that context, I would expect this tree to be rooting deeply in the surrounding area underneath the playground surface and up to the existing building walls.

Image 2: The London plane (T1) viewed from the northern end of the playground

7.2 Root investigations close to the existing foundations: Whilst it is likely that most of the roots from this tree are growing beneath the playground surface, it is feasible for roots to be growing beneath the existing foundations. In this respect, further investigations have been undertaken to establish the extent of rooting with a tree radar. This report concludes the following:

The TreeRadar unit picks up roots with a diameter greater than 20cm in diameter. The roots are fairly evenly distributed in the vertical and horizontal profile. There are no remarkable features in the rooting morphology within the astroturf area.

There are no roots in the footpaths to the east and south of the building. The tree does not root under the building, but does root up to the basement wall. It is probable that major roots were severed in 1989 when the building was constructed, and that the compensatory crown pruning at that time prevented tree failure.

N.B I have included an extract of this conclusion in Appendix 3 for ease of reference but if the full report details are required, this can be provided on request.

7.3 **Site meeting with Tree Officer:** To progress the scheme and keep the LPA informed of the design process, it was agreed that a meeting on 11 August 2016 would be held with members from the design team and the Tree Officer (Nick Bell). During this meeting, we reviewed the recent results from the tree radar investigations and reviewed the design drawings. The main points which were agreed during our meeting are listed below:

- No roots were found on the southern side of the tree from the tree radar investigations where the existing underground sports hall is located; so provided the building on this side is demolished in a way that minimises harm to the tree, this would be acceptable to the LPA.
- Part of the existing building to be demolished on the western side of the tree is close to the edge of its RPA. This was considered acceptable provided care is taken to remove the foundations, and the piles do not encroach into the RPA.
- Overall it was agreed that it should be practically possible to protect the tree through the construction process and we agreed to look at the timings of the necessary operations to ensure the tree will be well cared for at all times.
- The tree has been regularly managed in the past and it was agreed that some form of containment pruning is feasible to the overall crown to maintain acceptable levels of risk for the future and also to aid working space during the construction period.
- As part of the pruning works, it was also agreed that the large low limb on the eastern side of the crown can be pruned back beyond its existing pollard points to provide space for the new proposal. Image 3 below shows the approximate agreed location (yellow dotted line halfway along the limb) for the branch to be pruned back. It was agreed that the loss of the larger secondary and tertiary regrowth at the end of this branch is not likely to be detrimental to the appearance or crown shape, and the overall balance of the crown is unlikely to be significantly affected (See Image 4). Also, because the tree is showing good signs of vigour, it is likely to be able to respond well to this type of wounding by creating good wound wood and replacement stems at the point of pruning. On this basis, the work was considered acceptable.
- The principal of installing a staircase around the base and trunk of the tree is acceptable, provided that some form of engineering method is adopted to minimise harm. During our discussions, we agreed to look at an engineering design that incorporates some form of concrete base supported above the existing ground level on mini piles. These piles will only be installed after careful root investigations have been undertaken and will be manoeuvred to take account of roots at the time of construction. From an engineering point of view it was confirmed by Elliott Wood that this was achievable. In terms of the position of the staircase, it was agreed that this will be designed so that no parts of the structure will physically touch the tree and that adequate allowance will be made for the future incremental growth (Image 8).

Section 1: Arboricultural assessment

Image 3: The yellow dotted line indicates the approximate line agreed for pruning to accommodate the new building and staircase.

Image 4: Computer 3D model showing that the lowest branch can be cut back to provide space for the classrooms without adversely affecting the shape or health of the tree

7.4 Impact from pruning to accommodate the proposal: The proposed classrooms are close to the canopy of the tree so the crown will need to be contained on this side in the future. However, this tree has been regularly reduced in the past to leave multi-stemmed regrowth that currently extends 1-2m beyond the old pruning points (Image 5). If this regrowth is left unmanaged there is the potential for parts to fail as they increase in size, causing harm or damage to the property or children and teaching staff below. It is for this reason that approval was given in the past for the regrowth to be reduced back to contain the crown. Further pruning work was considered acceptable in principle by Mr Bell during our site meeting. On this basis, I believe that the crown can be regularly managed in the future and I do not believe the location of the tree or its canopy will adversely affect the normal use of the property.

Image 5: The old reduction points are indicated by the yellow fill and this part of the crown will be retained. The red fill indicates the regrowth that will be reduced back to the old pruning points.

7.5 Impact from the proposed basement works: Based on the evidence in the tree radar report, I believe it is unlikely that roots from this tree have found their way beneath the existing gymnasium foundations (Images 6 and 7), and are probably being contained within the area of soil occupying the playground courtyard. On this basis, the tree is unlikely to be significantly affected by the proposed replacement basement works, but as a precaution, the engineers have produced a contiguous piled wall construction to minimise impact from the works close to the tree. For further clarification, these section drawings along with the construction sequence can be found in Appendix 4 and the tree protection plan BT1.

Some hand digging techniques will be required to investigate whether any roots are present close to the eastern building where the basement staircase is proposed. If roots are encountered, then it may be possible for careful root pruning to be done but this will need specialist advice and should only be done under a supervision agreement to minimise any adverse effects on the tree's health or amenity value. In this context, at its worst, the basement encroachment may result in the loss of some minor roots but it is unlikely to have a detrimental effect on the tree's long term health or stability.

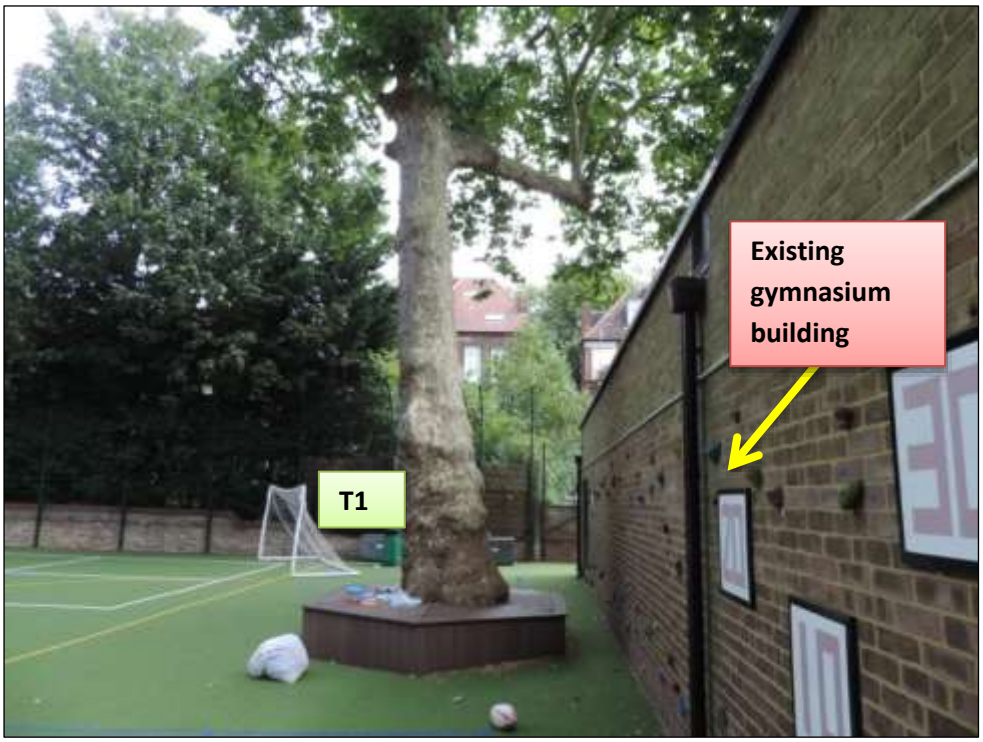


Image 6: The tree and existing building are close to T1.

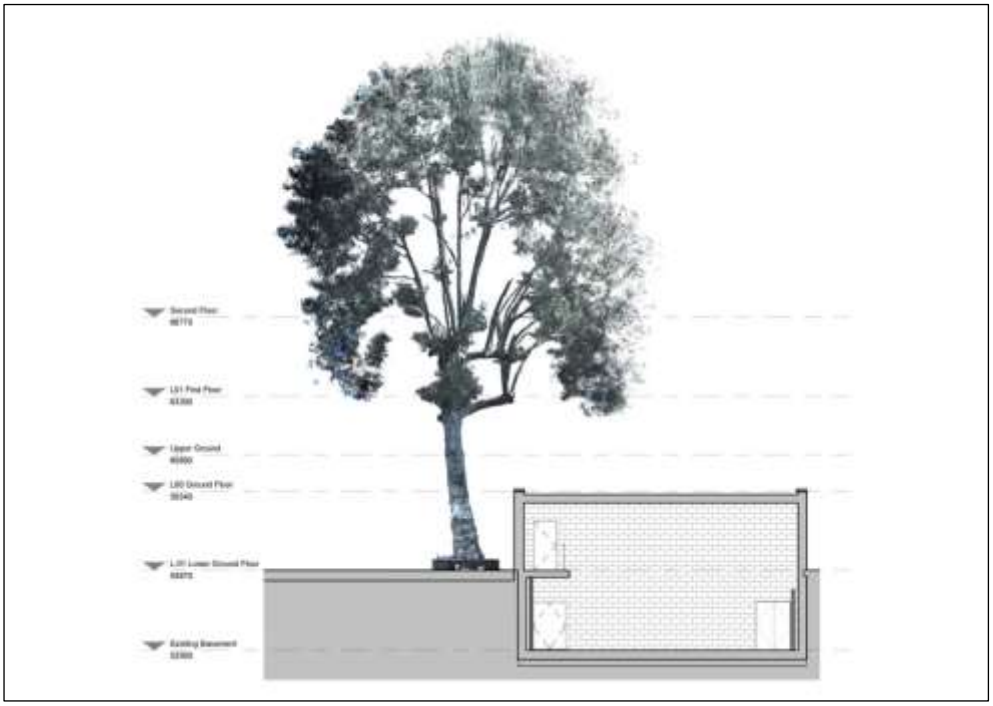


Image 7: Section showing the existing basement in relation to T1

7.6 Impact from the installation of the stairs close to T1: Based on discussions with the structural engineers, it has been agreed that the staircase will be constructed around the tree in a manner that minimises harm to tree roots. On this basis, it is proposed that the staircase framework will be supported by a concrete base which is installed with screw piles strategically located to avoid the main structural roots (Image 8). These will be installed after the timber seat has been taken down and the surrounding soil carefully removed by hand or with an airspade to reveal the main buttress root area without harm to the tree.

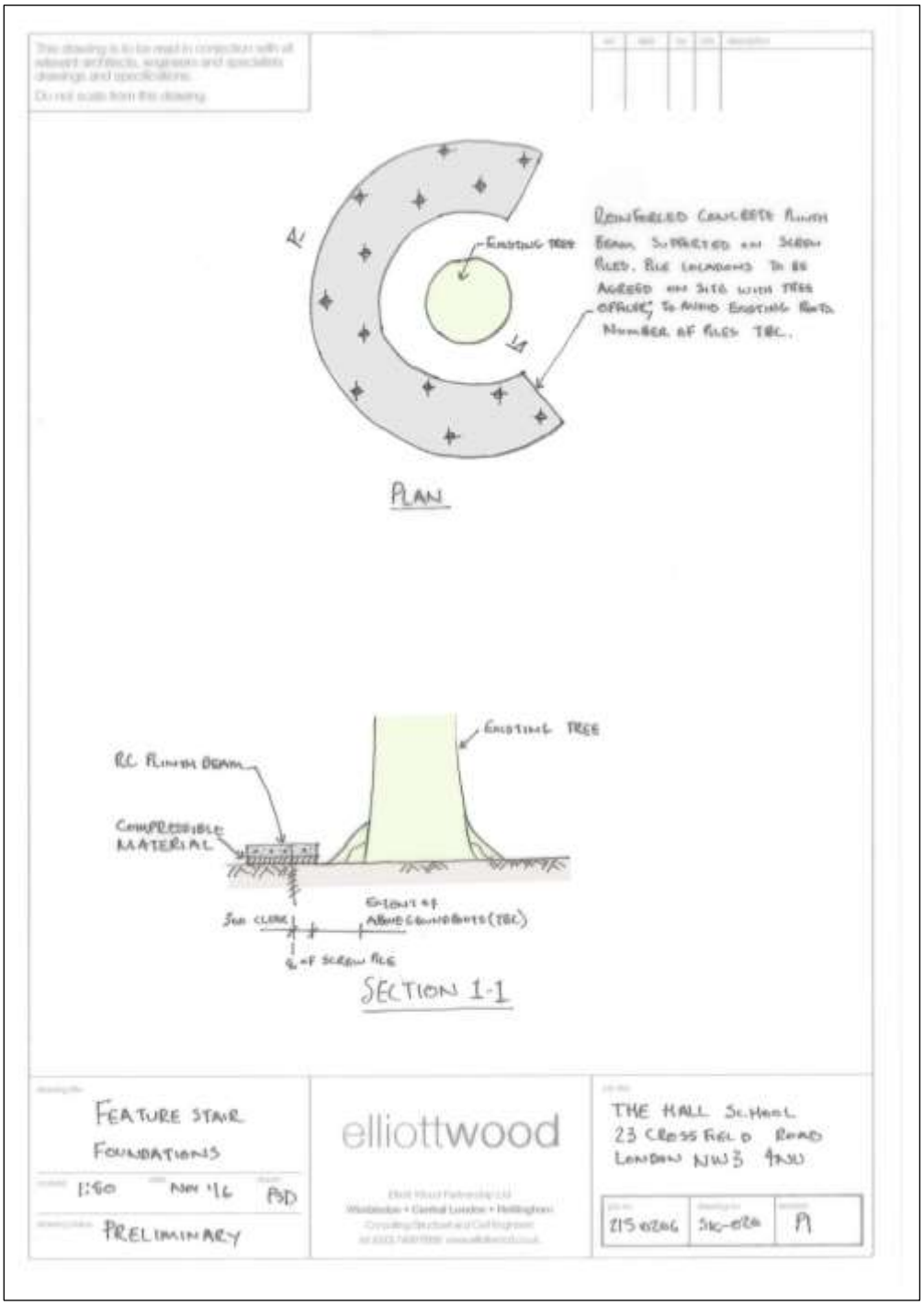


Image 8: Sketch provided by Elliotwood showing the proposed concrete base location and installation method

7.7 **Installation of the new cycle store:** These works will be close to one low category tree (3) and there is potential for harm to tree roots if special care is not taken. However, these works only encroach into a small part of its RPA so if the guidance in section 2 of this report is followed, there is unlikely to be a significant impact on its health or stability.

7.8 **General impact on other trees from the construction works (2 and G4):** All of these trees are outside the areas proposed for this development and they are unlikely to be directly affected from the works. However, as a precaution to minimise harm from construction traffic, these trees can be protected by the use of fencing or use of existing surfacing for ground protection. This tree protection is explained in the arboricultural method statement in Section 2 of this report. If the precautions set out in this arboricultural method statement are implemented as described, these trees can be successfully retained without any adverse impact on them or on visual amenity.

8. Summary of the impact on local character

No trees will be lost because of this proposal. The construction activity may affect trees if appropriate protective measures are not taken. However, if adequate precautions to protect the retained trees are specified and implemented through the arboricultural method statement included in this report, the development proposal will have no significant impact on the contribution of trees to local character.

Section 2
Arboricultural method statement

This arboricultural method statement has taken account of all the recommendations set out in 6.1 of BS 5837 (reproduced courtesy of BSI below).

6.1 Arboricultural method statement

6.1.1 A precautionary approach towards tree protection should be adopted and any operations, including access, proposed within the RPA (or crown spread where this is greater) should be described within an arboricultural method statement, in order to demonstrate that the operations can be undertaken with minimal risk of adverse impact on trees to be retained.

6.1.2 The arboricultural method statement should be appropriate to the proposals and might typically address some or all of the following, incorporating relevant information from other specialists as required:

a) removal of existing structures and hard surfacing;

b) installation of temporary ground protection (see **6.2.3**);

c) excavations and the requirements for specialized trenchless techniques (see **7.7.2**);

d) installation of new hard surfacing – materials, design constraints and implications for levels;

e) specialist foundations – installation techniques and effect on finished floor levels and overall height;

f) retaining structures to facilitate changes in ground levels;

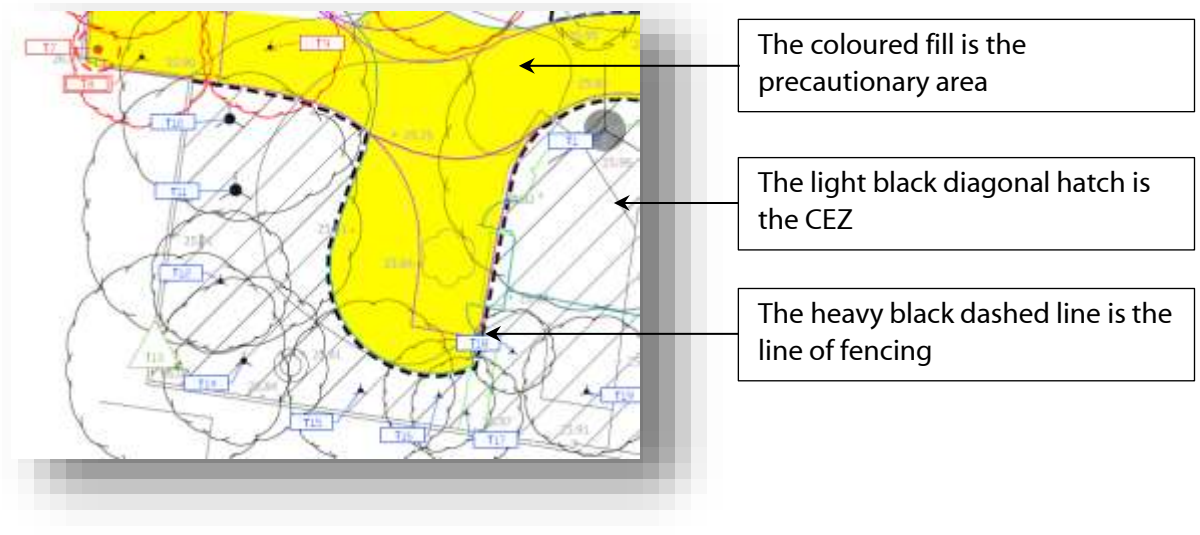
g) preparatory works for new landscaping ;

h) auditable/audited system of arboricultural site monitoring, including a schedule of specific site events requiring input or supervision.

Section 2: Arboricultural method statement

9. Identification of areas to be protected

The tree protection plan (typical annotation illustrated below) shows all the areas where protective measures are necessary. The construction exclusion zone ("CEZ") boundary is shown on the plan as the heavy dashed black line, with the lighter diagonal hatching behind. If necessary, further precautionary areas outside the CEZ are shown on the plan as a coloured fill, where a high level of care is required.



10. Construction method statement (heads of terms summary)

A construction method statement is a description of how operations that may affect trees will be carried out to minimise any adverse impact on them. The details of how the site will be managed are construction and contractual matters that can only be finalised once the post-consent detailed planning begins. For that reason, at this stage in the planning process, it is only possible to list a heads of terms summary of the issues that will require more detailed consideration once consent is issued. The issues that may require further clarification on this site include:

1. The order of work on site, including demolition, site clearance and building work.
2. Erection and maintenance of security hoarding near trees.
3. Who will be responsible for protecting the trees on site.
4. Detailed proposals for inspecting and supervising the tree protection, and how problems will be reported and solved.
5. What size vehicles will be used under canopies and will large machinery be lifted over trees.
6. The parking arrangements for workers and visitors.
7. A schedule of emergency contact numbers.
8. Areas for loading and unloading of materials and storage of materials and plant.
9. Where site facilities will be located and when will they be installed.
10. How machinery and equipment (such as excavators, cranes and their loads, concrete pumps and piling rigs) will enter, move on, work on and leave the site.
11. Wheel washing facilities near trees.
12. Measures to control the emission of dust and dirt during construction near trees.
13. Recycling and storage of waste near trees.
14. Details of earthworks, grading and mounding and removal of spoil, including any planned lowering or raising of ground levels.
15. Details of upgrading/removing/replacing existing surfacing and areas where this will happen, including detailed and precise cross-sections where no-dig surfacing is to be installed.
16. How and when any temporary surfacing will be laid and removed.
17. Precise services locations, including the method of excavation when near trees.
18. Proposed locations of site facilities/crane location/material storage/loading bays etc.

19. How post-construction damage through compaction to soil near existing trees and new trees will be ameliorated.

Note: It is not our role as arboricultural consultants to detail the timing and implementation of these measures, although we can input into the process and will need to confirm that the final proposals will not adversely affect retained trees.

11. Arboricultural supervision

An arboricultural consultant should be appointed by the developer to advise on the tree management for the site and to attend:

- a pre-commencement meeting before any work starts;
- regular supervision visits to oversee the agreed tree protection; and
- further supervision visits as necessary to oversee any unexpected works that could affect trees.

More specifically, the form and purpose of the supervision should be as follows:

- **Pre-commencement meeting:** A pre-commencement meeting should be held on site before any of the site clearance and construction work begins. This would normally be attended by the site manager, the arboricultural consultant and a local planning authority ("LPA") representative. In the event that a LPA representative declines to be present, the arboricultural consultant should inform the LPA in writing of the details of the meeting. All tree protection measures detailed in this document should be fully discussed so that all aspects of their implementation and sequencing are understood by all the parties. This should include agreeing the form and location of the most appropriate combination of fencing and/or ground protection to be used as barriers for the CEZ. Any agreed clarifications or modifications to the consented details will be recorded and circulated to all parties in writing. This meeting is where the details of the programme of tree protection should be agreed and finalised, which should then form the basis of any supervision arrangements between the arboricultural consultant and the developer.

- **General site management:** It is the developer's responsibility to ensure that the details of this arboricultural method statement and any agreed amendments are known and understood by all site personnel. Copies of the agreed documents should be available on site and the site manager should brief all personnel who could have an impact on trees on the specific tree protection requirements. This should be a part of the site induction procedures and written into appropriate site management documents.

- **Ongoing supervision of operations that could affect trees:** Once the site is active, the arboricultural consultant should visit at an interval agreed at the pre-commencement site meeting. This would normally be every two to four weeks for general supervision, but could be at a longer interval if agreed between the parties. The supervision arrangement should be sufficiently flexible to allow the supervision of all sensitive works as they occur. The arboricultural consultant's initial role is to liaise with the developer and the LPA to ensure that protective measures are fit for purpose and in place before any works start on site. Once the site is working, that role should switch to monitoring compliance with arboricultural planning conditions and advising on any tree problems that arise or modifications that become necessary.

12. Summary of the tree issues to be project managed by the supervising arboriculturist

In overview, it is anticipated that arboricultural input is likely to be needed for the following operations:

1. Pre-commencement meeting
2. Preliminary tree pruning
3. Installation of CEZ barriers (fencing and/or ground protection)
4. Pollution control near retained trees
5. Load restrictions near retained trees

6. Excavation in RPAs
7. Removal of existing surfacing and structures in RPAs
8. Installation of new surfacing and/or upgrading of existing surfacing in RPAs
9. Installation of new structures in RPAs
10. Installation of new services and/or upgrading of existing services in RPAs
11. Upgrading existing soft landscaping or replacing existing surfacing or structures with new soft landscaping
12. Removal of protective measures
13. Tree planting and general landscaping

13. Table 3: Suggested programme of arboricultural supervision during the development process

Finalising tree management details after consent, but before work starts	
Action	**Arboricultural input**
Review of tree protection and any emerging design issues that may affect trees with the construction team	• Meeting/discussion with relevant members of the developer's team to explain the extent of the tree constraints • Review working space requirements to consider barrier and ground protection adjustments to improve site functionality • Review drainage proposals and identify potential conflicts with RPAs • Review any post-consent layout changes that may affect trees • Review all works within RPAs that may affect trees • Identify any potential conflicts and work towards resolutions • Preparation of working drawings, if necessary
Review consented tree protection proposals for discussion at pre-commencement meeting	If necessary: • prepare revised plans and specifications • liaise with LPA to discuss modifications
Briefing landscape architect on restrictions imposed on new landscape design by RPAs	• Advise landscape architect of the RPA locations, the restrictions to landscaping activity that applies and the details of agreed new tree planting • Review the final landscaping proposals to identify any conflicts between tree protection and landscaping
Pre-commencement site meeting with supervising arboriculturist, site manager and the LPA representative (if appropriate)	• Meeting on site • Agree detail of supervision requirements, i.e. frequency of visits and reporting • Review any updated proposals • Review tree protection, if already installed

Site operations before work starts on site	
Action	**Arboricultural input**
Tree works carried out	• Review the site requirements with the tree work contractor
Installation of tree protection for agreement by the LPA	• If appropriate, preparation of any revised plans and specifications for agreement by the LPA • Photographs showing relevant aspect of installed tree protective measures • Liaise with the contractor installing protection until satisfactorily completed
Demolition	• Liaise with the demolition contractor about tree protection

Operations that could affect trees during construction	
Action	**Arboricultural input**
Excavation within RPAs	• Meeting with contractor for briefing before installation, with further supervision visits as necessary at the discretion of the arboricultural consultant

Section 2: Arboricultural method statement

Operations that could affect trees during construction	
Action	**Arboricultural input**
Removal of existing structures and/or surfacing within RPAs, but outside barriers to be replaced with ground protection or new surfacing	• Meeting with contractor for briefing before work starts, with further supervision visits as necessary at the discretion of the arboricultural consultant
Installation of new structures	• Meeting with contractor for briefing before work starts, with further visits as necessary at the discretion of the arboricultural consultant
Removal of barriers and ground protection	• Meeting with contractor for briefing before work starts, with further visits as necessary at the discretion of the arboricultural consultant • **NOTE:** This should only be authorised once there is no risk of RPA damage from the construction activity
Installation of new services	• Meeting with contractor for briefing before work starts, with further visits as necessary at the discretion of the arboricultural consultant

The precise order and timing of some of these operations may change due to site operating requirements, but all operations that could affect trees should remain under arboricultural supervision.

14. Tree works

In most situations, the tree works need to be carried out before the main construction activity starts. Tree works, based on our assessment of the proposal and the original site inspection, are set out in the work recommendations column of the tree schedule in Appendix 2. The location of each tree by number is shown on the tree protection plan and any to be removed are indicated with a red number and red crown outline. All tree works must be reassessed before any site activity starts as part of the standard risk management process.

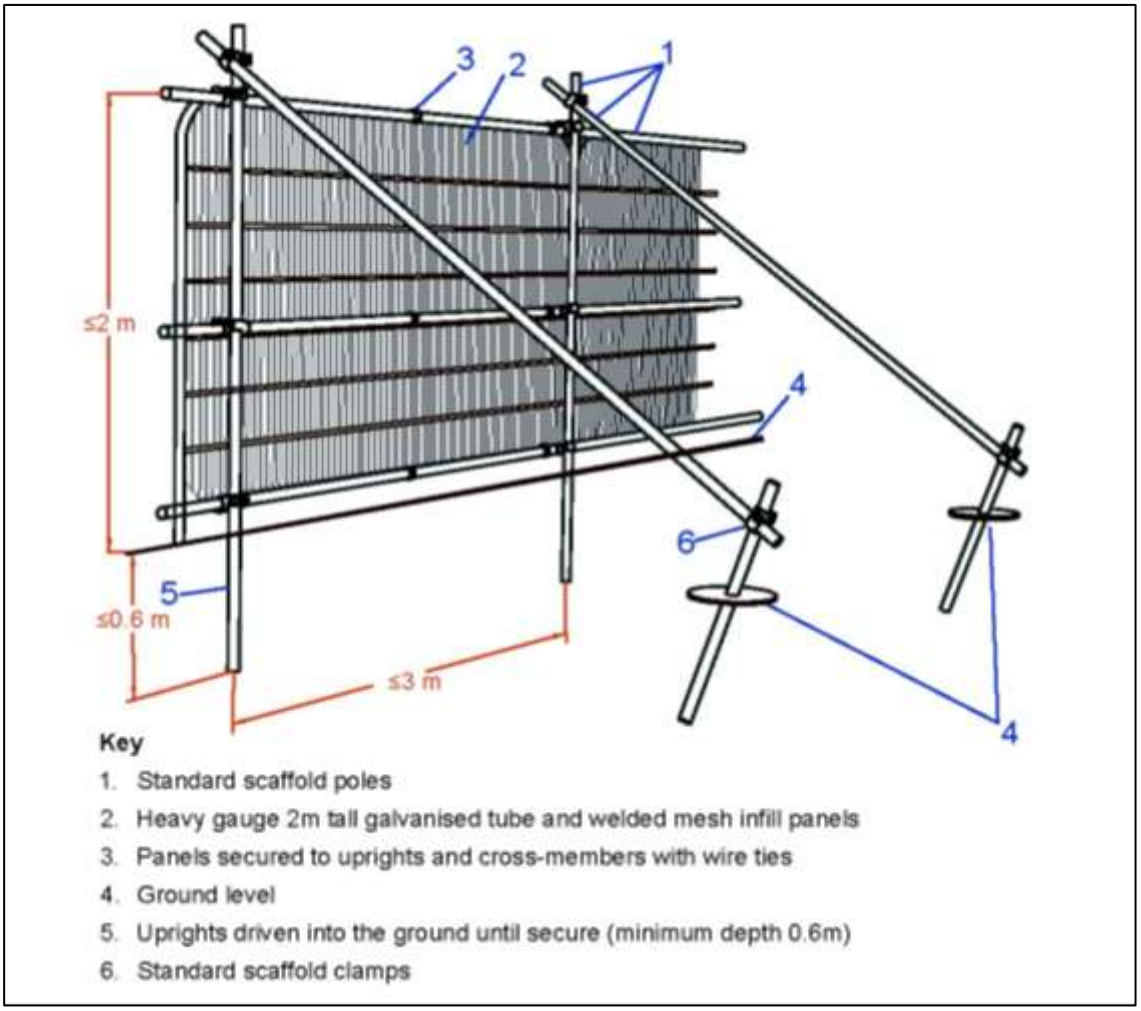
15. Primary tree protection using fencing

The CEZ is the RPA surrounding retained trees that must be protected from any disturbance by the construction activity. In practice, this can be done by any combination of fencing and ground protection, to be finalised and agreed at the pre-commencement meeting. Whether the CEZ is protected by fencing or ground protection, all the protective measures should be installed before the start of any site works that could affect trees. No protective measures should be removed or temporarily dismantled without consulting the supervising arboriculturist. Furthermore, the condition of all the protective measures should be regularly monitored to ensure they remain fit for purpose. The main means of preventing damage to trees and their RPAs in the CEZ are fencing, barriers and ground protection.

Protective fencing should be installed at the locations shown on the tree protection plan by the heavy black dashed line. If agreed with the LPA, fencing can be set back to improve access, provided the exposed ground is protected with ground protection. Various fencing options are illustrated in Fencing images 1–6. The minimum specification for the fencing should be as described in figure 2 of BS 5837 (Fencing image 1) or an equivalent design that effectively restricts access to the RPA it protects.

The precise form of the fencing can vary, provided it is fit for purpose in that it effectively restricts access and damaging activities within the RPA that it encloses. More specifically, behind the fencing, there should be no vehicular access; no fires; no storage of excavated debris, building materials or fuels; no mixing of cement; no service installation or excavation; no raising or lowering of soil levels; and no excessive cultivation for landscape planting. Any variations to these restrictions should be agreed by the supervising arboriculturist.

Section 2: Arboricultural method statement



Fencing image 1: Recommendations taken from figure 2 of BS 5837.

Fencing image 2: Heras fencing wired to scaffold braced posts is a robust and effective interpretation of the BS specification.

Fencing image 3: Close up of bracing detail, essential for increasing the stability of the vertical framework.

Fencing image 4: Board specification on secure wooden posts is a suitable alternative to the standard braced scaffold design.

Where individual trunks or branches are vulnerable to impact damage, a framework of scaffold or wood can be constructed to provide protection (Fencing images 5 and 6).

Fencing image 5: A scaffold-braced framework surrounding the trunk reduces the risk of accidental impact.

Fencing image 6: Board secured to scaffold framework adds another layer of protection for vulnerable trunks and branches

16. Primary tree protection using ground protection

Where it is not practical to protect the CEZ by the use of fencing alone, BS 5837 (6.2.3) allows for the fencing to be set back and the soil protected by ground protection. This allows improved access during construction, with the ground protection preventing damage to the CEZ outside the protection of the fencing. A range of methods can be used, including retaining existing hard surfacing or structures that already protect the soil, installing new materials, or a combination of both. Whatever the choice of method, the end result must be that the underlying soil (rooting environment) remains undisturbed and retains the capacity to support existing and new roots. Ground protection images 1–8 illustrate a range of practical surface coverings that can effectively protect CEZs of retained trees.

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Ground protection image 1: Heavy-duty plywood set onto a compressible woodchip layer and pinned into position is suitable to spread the loading from pedestrian access.

Ground protection image 2: Spreading soil excavated from footings is an effective way of buffering the plywood surface from the wear of light vehicles.

Ground protection image 3: Plywood fixed to a wood frame is another effective method of protecting soil from pedestrian compaction.

Ground protection image 4: A scaffold framework attached to the main scaffold fencing can be used to support either scaffold planks or plywood to create an elevated platform with a gap beneath.

Ground protection image 5: Cellular products are a very effective means of providing ground protection where heavy vehicle use is expected. Here, it is being used to temporarily widen an existing road, to be removed once the construction is finished.

Ground protection image 6: Custom designed sectional tracks can be joined to support very heavy traffic use through sensitive areas.

Ground protection image 7: A combination of retaining existing surfacing and using temporary construction cabin accommodation can be a very effective means of preventing damage to sensitive areas.

Ground protection image 8: Steel plates can be an effective way of temporarily reinforcing weak surfacing over a construction access during the development activity.

On this site, all the precautionary areas annotated with yellow shading on the tree protection plan should be protected with ground protection while vulnerable to damage, in line with the above examples. Where appropriate, any existing hard surfacing can be retained and utilised. Any surfacing to be retained that is disrupted during the course of the construction activity can be replaced, reconditioned or upgraded as necessary. This work should be subject to arboricultural supervision.

17. Extra precautions – pollution control near retained trees

The following guidance should be applied wherever risk assessment identifies a significant risk of chemical pollution.

Spilt chemicals that can soak into RPAs will kill existing roots and may prevent new roots growing, so provision must be made to minimise the risk of contamination to soil within the normal risk management protocols for the site. This would normally include means of containing spillages and procedures for clearing them up if they occur (Pollution image 1). All cement mixing and vehicle washing points must be located outside RPAs, with provision to contain any spillages. Where the contours of the site create a risk of polluted water or toxic liquids running into RPAs, a precautionary measure of bunding or a frame, sealed with heavy-duty plastic sheeting sufficient to prevent contamination (Pollution image 2), must be used to contain accidental spillages.

Pollution image 1: Where fuel or other chemicals are stored on site, it is now standard practice to have emergency spillage kits available to restrict the environmental impact of accidents.

Pollution image 2: Soil bunding or a supporting framework covered in heavy-duty plastic sheeting is essential where there is a risk of spillages contaminating RPAs. This specifically applies to cement mixing areas and vehicle washing facilities.

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18. Extra precautions – excavation in RPAs

The following guidance applies to trees **1 and 3**, which are shown on the tree protection plan.

Precautionary areas are RPAs outside the fencing, i.e. they are areas where construction activity can take place, but it must be carried out with care to avoid damaging the sensitive rooting environment. BS 5837 (7.2) makes provision for excavating in RPAs, explaining that all excavation must be carried out carefully using hand-held tools and preferably by compressed air soil displacement, taking care not to damage the bark and wood of any roots (Excavation images 1–4).

All soil removal must be done with care to minimise the disturbance of roots beyond the immediate area of excavation. Where possible, flexible clumps of smaller fibrous roots should be retained if they can be displaced temporarily or permanently beyond the excavation without damage. If digging by hand, a fork should be used to loosen the soil and help locate any substantial roots. Once roots have been located, the trowel should be used to clear the soil away from them without damaging the bark. Exposed roots to be removed should be cut cleanly with a sharp saw or secateurs 10–20cm behind the final face of the excavation. Roots temporarily exposed must be protected from direct sunlight, drying out and extremes of temperature by appropriate covering such as dampened hessian sacking (Excavation image 4). If necessary, roots less than 2.5cm in diameter can be cut cleanly without consultation with the supervising arboriculturist. Roots greater than 2.5cm in diameter should be retained where possible and only cut after consultation with the supervising arboriculturist.

Excavation image 1: Careful hand-digging using conventional tools is acceptable for exposing roots in RPAs.

Excavation image 2: Air spades are very effective at exposing roots and services with minimal damage.

Excavation image 3: Air spades are particularly useful where roots are very dense.

Excavation image 4: Exposed roots must be protected from light, drying out and extremes of temperature by covering with hessian sacking and boards until they can be covered back with soil.

19. Removal of existing hard surfacing and structures in RPAs

The following guidance will be applied where necessary for all trees shown on the tree protection plan.

For the purposes of this guidance, the following broad definitions apply:

- **Hard surfacing:** Any hard surfacing used as a vehicular road, parking or pedestrian path including tarmac, solid stone, crushed stone, compacted aggregate, concrete and timber decking. This does not include compacted soil with no hard covering.
- **Structures:** Any man-made structure above or below ground including service pipes, walls, gate piers, buildings and foundations. Typically, this would include drainage structures, car-ports, bin stores and concrete slabs that support buildings.

Roots frequently grow adjacent to and beneath existing surfacing and structures, so great care is needed during access and demolition. Damage can occur through physical disturbance of roots and/or the compaction of soil around them from the weight of machinery or repeated pedestrian passage. This is not generally a problem whilst surfacing and structures remain in place because they spread the load on the soil beneath and further protective measures are not normally necessary. However, once that protection is removed and the soil below is newly-exposed, the potential for damage to roots becomes an issue. In summary, there should be no vehicular or repeated pedestrian access unless existing ground protection is retained or new protective measures are installed (Hard surfacing/structure removal image 1). All exposed RPAs must be protected until there is no risk of damage from the development activity.

Hard surfacing/structure removal image 1: Ground protection must be used where repeated foot or vehicle traffic could cause compaction in sensitive RPAs. It can be as simple as plywood for pedestrians, but must be more robust for vehicles.

Hard surfacing/structure removal image 2: Machines with a long reach can be used to lift out heavy surfacing and structures as long as the machine sits outside the RPA and the exposed surface is protected before there is any further access.

Removing existing surfacing and structures is a high-risk activity for any adjacent roots and the following guidance must be observed:

1. Appropriate tools for manually removing debris may include a pneumatic breaker, crow bar, sledgehammer, pick, mattock, shovel, spade, trowel, fork and wheelbarrow (Images 3 and 4 below). Secateurs and a handsaw must also be available to deal with any exposed roots that have to be cut.
2. Machines with a long reach may be used if they can work from outside RPAs or from protected areas within RPAs (Image 2 above), but they must not encroach onto unprotected soil in RPAs.
3. Debris to be removed from RPAs manually must be moved across existing hard surfacing or temporary ground protection in a way that prevents compaction of soil. Alternatively, it can be lifted out by machines, provided this does not disturb RPAs (Image 2 above).
4. Great care must be taken throughout these operations not to damage roots as set out in the above paragraph on excavation and dealing with roots.

5. If appropriate, leaving below ground structures in place should be considered if their removal may cause excessive root disturbance.

Hard surfacing/structure removal image 3: Careful lifting of cemented-in sets round this tree allowed them to be re-laid on a permeable sand base, improving the water input into the soil around the trunk.

Hard surfacing/structure removal image 4: These trees had impermeable surfacing right up to their trunks, which had to be removed by hand before installing new structures.

20. Extra precautions – upgrading of existing surfacing in RPAs

The following guidance will be applied near trees 1 and G4, which are shown on the tree protection plan. It is proposed to retain the existing playground surfacing for the duration of the main building works and upgrade it at the end of the project. It is likely that any new surfacing will be installed either directly on top of the existing, or a thin layer will be skimmed off the current level and the new surfacing installed on top of the existing sub-base. Normally, this will not result in significant excavation that could expose roots and so special precautions are not necessary. However, if roots are found, then they should be retained and worked around rather than cutting them. All these works will be carried out by hand taking care not to damage any existing roots.

21. Extra precautions – installation of new structures in RPAs

The following guidance will be applied to trees **1 and 3**, which are shown on the tree protection plan.

New structures in RPAs are potentially damaging to trees because they may disturb the soil and disrupt the existing exchange of water and gases in and out of it. Mature and over-mature trees are much more prone to suffer because of these changes than young and maturing trees. Adverse impact on trees can be reduced by minimising the extent of these changes in RPAs. This can be done by constructing the main structures above ground level on piled supports and redirecting water to where it is needed. The detailed design and specification of such structures is an engineering issue that should be informed and guided by tree expertise.

Small sheds, carports and bin stores

Light structures do not normally require substantial foundations and can have permeable bases. Ideally, their bases should be of a no-dig, load-spreading construction set directly on to the soil surface. They require a flat base and so an undulating site will need levelling to provide a suitable surface. Excavation of any high points by up to 5cm and filling depressions with permeable fill to provide a flat base will normally be acceptable provided no roots greater than 2.5cm in diameter need to be cut. If large roots are found, the preferred course of action would be to raise the base level of the structure by filling rather than cutting roots. However, if this is not practical and large roots have to be cut, the situation should be discussed with the supervising arboriculturist before a final decision is made. Light covering structures can be fixed onto a frame that can rise directly from the base or be fixed to supports either banged into the ground or set in carefully dug holes (New structure image 1). Provided the supports are well spaced, i.e. greater than 1.5m apart, and

of a relatively narrow diameter, i.e. not in excess of 15cm, it is unlikely they will cause any significant disturbance to RPAs (New structure image 2).

New structure image 1: These carports are formed by wooden posts above a three dimensional cellular no-dig and load-spreading surface of permeable crushed stone.

New structure image 2: This deck supported above the ground on small posts provides a low-impact alternative to conventional stone patio surfacing in RPAs.

New foundations for free-standing walls, gate piers, buildings and bridges

Conventional strip foundations in RPAs for any significant structure may cause excessive root loss and are unlikely to be acceptable. However, BS 5837 (7.5) confirms special engineered foundations can be used in RPAs. Damaging disturbance can be significantly reduced by supporting the above ground part of the structures on small diameter piles and beams or cast floor slabs set above ground level (New structure images 3 and 4). The design should be sufficiently flexible to allow the piles to be relocated if significant roots are encountered in the preferred locations (New structure images 5 and 6). Before the actual installation of the new structure starts, any vulnerable RPA should be protected by temporary ground protection as set out above (New structure image 6). At expected pile or gate pier locations, gaps in the ground protection should be left to allow access to the soil beneath. The preferred pile locations should be carefully excavated to a depth of 60cm to establish if there are any significant roots over 2.5cm in diameter that could be damaged. If significant roots are found, they should be dealt with as set out above or the pile location may have to be moved slightly (New structure image 5).

Once the piles have been installed, the ground protection is usually removed ready for the installation of the slab supporting the structure (New structure images 7 and 8). It is important to note that the lowest points of the new structure, i.e. the underside of the main slab and any pile-capping beam must be above the ground level between the piles and there should not be any further excavation. The supported structure base can be pre-cast and imported to the site ready to fix or can be cast in position using shuttering for the sides and a biodegradable void-former for the base (New structure image 9). BS 5837 (7.5.4) recommends that where impermeable structures cover significant proportions of RPAs, it may be necessary to provide water input through redirecting roof drainage beneath the supporting slab (New structure image 10).

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New structure image 3: Small diameter piles (less than 150mm) are an effective means of supporting structures in RPAs with minimal disturbance.

New structure image 4: It is possible to support very large structures on piles within sensitive RPAs without any significant adverse impact on tree roots.

New structure image 5: Where piles are proposed close to trunks, it is essential to excavate 50–75cm deep to see if there are any significant roots in the way, with provision to move the pile location if roots are found (note the pile was finally installed to avoid this root).

New structure image 6: Ground protection must be used to spread the load of the piling rig once excavation has confirmed that no substantial roots are in the preferred pile location.

New structure image 7: Once the piles have been installed (yellow tops), the ground protection to support the piling rig is removed ready to fix the void-former onto the bare soil, in advance of pouring the building slab.

New structure image 8: Piles can also be used to support bridges across sensitive RPAs, but the temporary ground protection has to be removed before the main structure is either imported in or cast on site.

New structure image 9: Where a slab is cast on site, a biodegradable void-former (red arrow) temporarily supports the weight of the liquid concrete until it sets. The void-former can then be wetted and washed away to leave a void or left to degrade naturally, both of which allow movement of air beneath the slab.

New structure image 10: This reinforced base slab for a double garage has drainage provision (red arrow) beneath the structure to redirect roof runoff to supply roots with water.

Gate piers generally require larger holes and have less flexibility for relocation if large roots are found. Localised loss of roots may be unavoidable, so each situation should be assessed on its own merits by the supervising arboriculturist once the careful excavations have been completed. When installing any of these structures, the ground protection must remain in place until the construction is completed and there is no risk of damage to RPAs.

Walls on existing foundations and retaining walls

A free-standing wall on an existing foundation is unlikely to require any additional excavation and so its construction should have no adverse impact on RPAs if the appropriate ground protection is in place while the new wall is being built. However, replacing existing walls or constructing new walls that retain the soil of RPAs normally requires some limited excavation back into the exposed soil face to provide a working space of at least 10–20cm behind the inside wall face. This should be done carefully and limited to no more than required to construct the new wall. Any roots found should be dealt with as set out above. Once the wall is completed, any voids behind it should be filled with good quality top soil and firmed into place, but not over compacted. Specific difficulties with large roots that are found during the course of the construction should be referred to the supervising arboriculturist.

22. Extra precautions – installation of new services and/or upgrading of existing services in RPAs

The following guidance will be applied to all retained trees where new services are proposed.

Excavation to upgrade existing services or install new services in RPAs may damage retained trees. Where possible, all services should be outside RPAs and installation in RPAs should only be chosen as a last resort. If installation within RPAs is being considered, as advised in 4.1.3 of the NJUG guidance, the decision should be made in consultation with the LPA or the supervising arboriculturist before any work is carried out. If service installation is agreed within RPAs, the NJUG protocol as set out in 4.1.3 of its guidance should be used to decide the most appropriate method. In summary, this sets out that "*Acceptable techniques in order of preference are; a) trenchless, … b) Broken trench – hand-dug … c) Continuous trench – hand-dug*". If trenchless methods are to be used, there is normally a starting pit and a finishing pit that have to be dug at each end of the service run and these must be outside RPAs (Services image 1). Where a hand-digging option is agreed (Services image 2), any roots discovered during the excavations should be dealt with as explained above. Where possible, backfilled material around excavated services must not be heavily compacted, with specific advice provided in 4.1.5 of the NJUG guidance.

Services image 1: If possible, thrust boring is the preferred option for installing service routes through the RPAs of important trees, but there has to be space at the start and finish to dig substantial working pits.

Services image 2: Continuous trenches dug by hand so that important roots can be retained (with the service ducting threaded beneath) is an effective means of minimising damage (note the ground protection boards with soil piled on top on the left).

23. Extra precautions – upgrading existing soft landscaping or replacing existing surfacing or structures with new soft landscaping

This guidance should be applied wherever new landscaping is installed near retained trees.

For the purposes of this guidance, soft landscaping includes the re-profiling of existing soil levels and covering the soil surface with new plants or an organic covering (mulch). It does not include the installation of new structures or compacted surfacing, which are considered as substantial works and covered in the preceding sections of this document.

Soft landscaping activity after construction can be extremely damaging to trees. No significant excavation or cultivation, especially by rotovators, should occur within RPAs. Where new designs require levels to be increased to tie in with new structures or the removal of an existing structure has left a void below the surrounding ground level, good quality and relatively permeable top soil should be used for the fill. It should be firmed into place, but not over compacted, in preparation for turfing or careful shrub planting. Ideally, all areas within 1m of tree trunks should be kept at the original ground level and have a mulched finish rather than grass to reduce the risk of mowing damage (Landscaping images 1 and 2).

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Landscaping image 1: The RPA of this tree was not effectively protected during construction and excessive compaction of the soil meant it died soon after this turf covered up the damage.

Landscaping image 2: This tree had tarmac parking within its RPA that was removed and replaced with an organic mulch near the trunk and limited no-dig surfacing on the outer edges of its RPA.

Section 3
Appendices

Appendix 1: Background administrative information, data collection and any additional relevant information

24. Table 4: Background administrative information

	Background administrative information
Report date & reference	11/11/16 – 15204-AA-MW
Tree protection plan reference	BT1
Our instructing client	The Hall School
Our instructions	Visit the site, assess the relevant trees, prepare a schedule of their details, describe the impact of the proposal on those trees and identify the tree protection issues in an arboricultural method statement confined to the heads of terms
Provided documents	**Plan information:** Topo = (October-06-2016) 16077B/TOPO/OS Layout base1= (October-06-2016) X20-B1-02 Rev B Layout base2= (October-06-2016) X20-B2-02 Rev B Layout LgF= (October-06-2016) X20-LG-02 Rev B Layout GF/Upper= (October-06-2016) X20-00-02 Rev A Layout CycleGF = (November-09-2016) IALN14-0046-Hall School-Front Gardens Layout Plan.dwg Cycle shelter = (November-09-2016) IALN14-0046-Hall School-New Cycle Shelter Section.dwg **Design and Access Statement 2016** IALN14-0046 V2 **Draft basement construction sequence (Elliott Wood)** 2150206 – 0700 P1 **Feature Stair Foundation design (Elliott Wood)** sk-020 P1
Report author and credentials	Mark Wadey is a Chartered Forester (www.charteredforesters.org) and an AA Registered Consultant (www.trees.org.uk), and fully qualified to undertake the assessments in this report. Further details of his credentials can be found at http://www.barrelltreecare.co.uk/career-summaries/Mark%20CS.pdf.
Report limitations	We have not checked if the trees are protected. If any tree works are proposed before a planning consent is given, then the existence of any statutory protection must be checked with the LPA. This report does not consider ecological or archaeological issues, or any other matter beyond the assessment of the trees.
Technical references	In preparing the analysis in this report, detailed consideration was given to the guidance and advice in the following technical references: • Climate Change Act (2008) www.legislation.gov.uk/ukpga/2008/27/contents • Town and Country Planning Act 1990 http://www.legislation.gov.uk/ukpga/1990/8/contents • National Planning Policy Framework ("NPPF"), published by the DCLG www.gov.uk/government/publications/national-planning-policy-framework--2 • BS 5837 (2012) *Trees in relation to design, demolition and construction – Recommendations*, BSI http://shop.bsigroup.com/ • Relevant local plan policy • BS 8545 (2014) *Trees: from nursery to independence in the landscape – Recommendations*, BSI http://shop.bsigroup.com/ • BS 3998 (2010) *Tree work – Recommendations*, BSI http://shop.bsigroup.com/ • *Trees in the Townscape: A Guide for Decision Makers*, published by the Trees & Design Action Group http://www.tdag.org.uk/ • *Trees in Hard Landscapes: A Guide for Delivery*, published by the Trees & Design Action Group http://www.tdag.org.uk/ • National Joint Utilities Group (2007) Volume 4, Issue 2: *Guidelines for*

Appendix 1: Background administrative information, data collection and any additional relevant information

	Background administrative information
	the planning, installation and maintenance of utility apparatus in proximity to trees www.njug.org.uk/publications/

25. Table 5: Data collection

	Data collection
Date of site visit	18 May 2015
People present during site visit	Mark Wadey
Weather & visibility	Clear, still and dry, with good visibility
Limitations to observations	• Our inspection of the trees for the purposes of assessing their condition and work requirements is made on the basis that they will be annually inspected in the future to identify any changes in condition and review the original recommendations. For these reasons, the tree assessment advice only remains valid for one year from the date that the trees were last inspected. • All observations were of a preliminary nature and did not involve any climbing or detailed investigation beyond what was visible from accessible points at ground level. • Observations of trees outside the site boundaries are confined to what was visible from within the site. • All dimensions were estimated unless otherwise indicated.
Tree location and numbering	Each tree was inspected and the numbering scheme is indicated on the tree protection plan. If appropriate, obvious hedges and groups were identified and numbered. If important trees were found on site that were not included on the provided plan, their approximate positions and canopy extents are indicated on the plan.
Recording of tree data	For each tree and any group or hedge found on site, the information collected was recorded on the tree schedule in Appendix 2 and the tree protection plan.
Compliance of data collection with BS 5837	The data collection is fully compliant with the advice in subsection 4.4.2 of BS 5837. When collecting this information, specific consideration was given to any low branches that may influence future use, age class, physiological condition, structural condition and remaining contribution. Where appropriate, crown spreads were also noted where they differed from those shown on the provided land survey.
Calculation of RPAs	Following the recommendations in Table D1 of BS 5837, the diameter of each tree was rounded up to the next 2.5cm increment, with the radius of a nominal circle and the resultant RPA taken directly from that table. This information is listed for each tree in the tree schedule in Appendix 2.

Appendix 2: Tree schedule and explanatory notes

NOTE: Colour annotation is A & B trees with green background; C & U trees with blue background; trees to be removed in red text.

Tree No	Species	Height (m)	Diameter (cm) @ 1.5m	Maturity	Low Branches	Category	Notes	Tree Works	RPA radius (m)	RPA area (m2)
All retained trees & hedges								Carry out safety check and lift over site to 3-4m as necessary.		
T1	London plane	20	105*	Mature	-	A	Pollarded in past	-	12.6	499
T2	Maple sp	10	30	Maturing	-	B	-	-	3.6	41
T3	Purple plum	5	25	Maturing	-	C	-	-	3.0	28
G4	Sycamore, poplar, London plane, cypress	18	70	Mature	-	B	-	-	8.4	222

Appendix 2: Tree schedule and explanatory notes

Explanatory Notes

- **Abbreviations:**

G : Group
RPA : Root protection area

- **Botanical tree names:**

Cypress	: *Cupressus* sp
London plane	: *Platanus* x *hispanica*
Maple	: *Acer* sp
Poplar	: *Populus* sp
Purple plum	: *Prunus cerasifera* 'Nigra'/'Pissardii'
Sycamore	: *Acer pseudoplatanus*

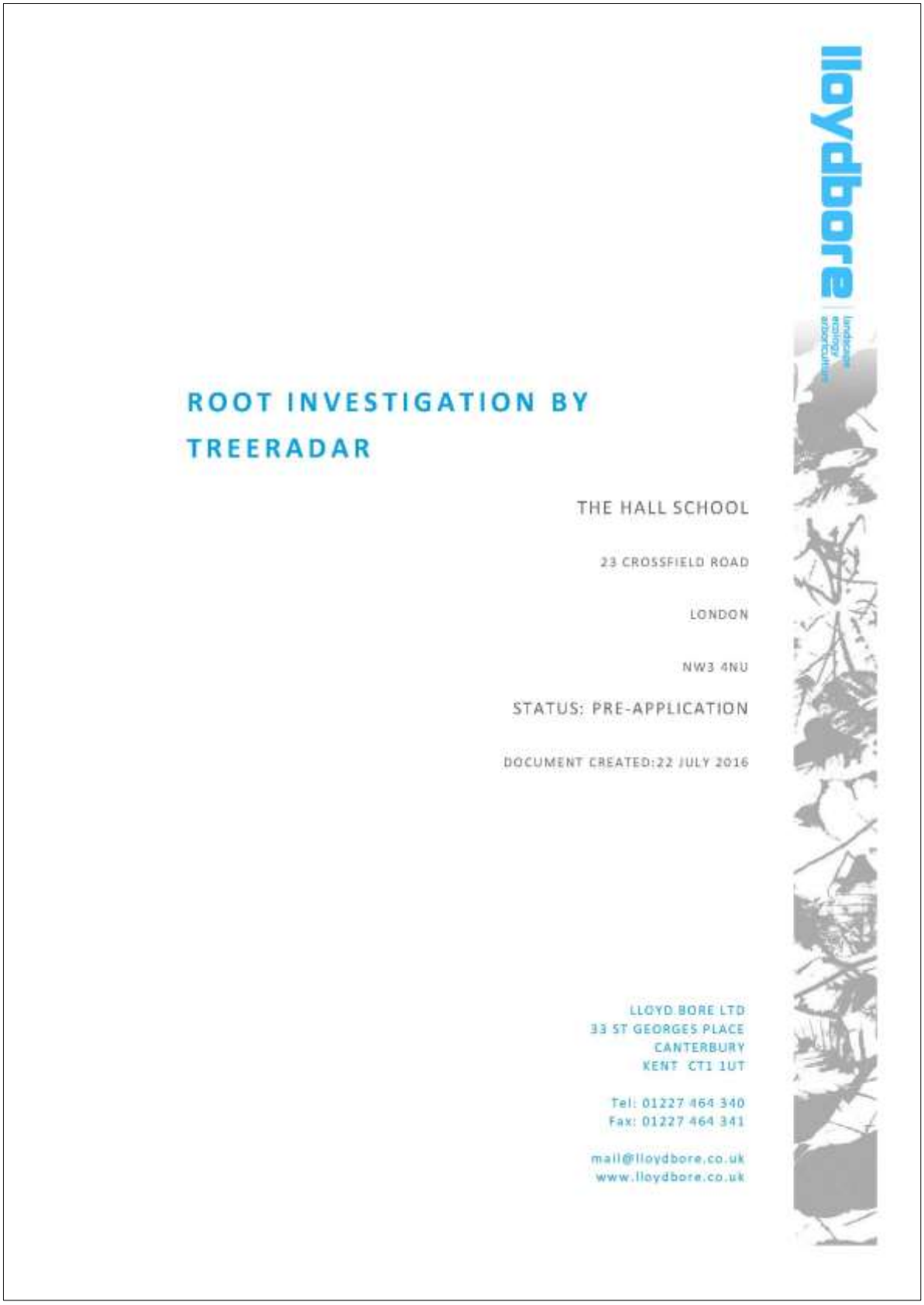
- **BS 5837 (2012) compliance:** All data has been collected based on the recommendations set out in subsection 4.4 of BS 5837.
- **Tree inspections and site limitations:** Each tree was subjected to a quick visual check level of inspection. Where there is restricted access to the base of a tree, its attributes are assessed from the nearest point of access. Climbing inspections are not carried out during this level of inspection and, if heavy ivy is present, tree condition is assessed from what can be seen from the ground. A separate note is recorded if further investigation may be required to clarify its status.
- **Crown spreads:** Crown spread dimensions are not listed in the tree schedule because they are illustrated on the land survey base to all the plans in this document. Where crown spreads of significant trees on site are found to deviate from those shown on the provided land survey, we have noted it in the text of the report and annotated it on our plans.
- **Dimensions:** All dimensions are estimated unless annotated with a '*'.
- **Species:** Species identification is based on visual observations. Where there is some doubt over tree identity, sp is noted after the genus name to indicate that the species cannot be reliably identified at the time of the survey. Where there is more than one species in a group, only the most frequent are noted and not all the species present may be listed.
- **Height:** Height is estimated to provide a broad indication of the size of the tree.
- **Trunk diameter:** Trunk diameter is estimated or measured and recorded in 2.5cm increments as advised in BS 5837 Table D1. It is measured with a diameter tape unless access is restricted, direct measurement is not possible because of ivy on the trunk or the tree is assessed as poor quality. The point of measurement and the adjustments for stem variations are as advised in Figure C1 of BS 5837.
- **Maturity:** In planning context, maturity provides a simplistic indication of a tree's ability to cope with change and its potential for further growth. For the purposes of this report, young indicates a potential to significantly increase in size and a high ability to cope with change, maturing indicates some potential to increase in size and a medium ability to cope with change, and mature indicates little potential to increase in size and limited ability to cope with change.
- **Low branches:** Any low branches that would not be feasible for removal during normal management and should be considered as a design constraint are noted here and explained in the notes.
- **Category:** Our assessment automatically considered tree physiological/structural condition (BS 5837, 4.4.2.5h), and so these are not listed separately in the schedule. Additionally, the category accounts for the remaining contribution (BS 5837, 4.4.2.5i) as greater than 40 years for A trees, greater than 20 years for B trees, at least 10 years for C trees and less than 10 years for U trees, so this

Appendix 2: Tree schedule and explanatory notes

is also not listed separately in the schedule. Category A, B and C trees are automatically listed as sub-category 1 unless otherwise stated.

- **Notes:** Only relevant features relating to physiological or structural condition and low branches that may help clarify the categorisation are recorded. If there are no notes, then the presumption should be that no relevant features were observed.
- **Tree works:** The recommended tree works are based on the quick visual check level of inspection and only intended to address significant hazards identified during that inspection.
- **Future tree safety inspections:** Due to the time that may elapse between the original survey and the start of development, all trees should be re-inspected as part of the standard risk management process before any works start on site. Our assessment of the trees was carried out on the basis that a re-inspection would be carried out within a year of the assessment visit and our advice on tree condition must be reviewed annually from the date of that visit.

Appendix 3: Extracts from Lloydbore Tree root radar report



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ROOT INVESTIGATION BY TREERADAR

THE HALL SCHOOL

23 CROSSFIELD ROAD

LONDON

NW3 4NU

STATUS: PRE-APPLICATION

DOCUMENT CREATED:22 JULY 2016

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Appendix 3: Extracts from Lloydbore Tree root radar report

CONTENTS

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Checked/Approved by	xxxxx

lloydbore landscape ecology arboriculture

Appendix 3: Extracts from Lloydbore Tree root radar report

1. INTRODUCTION

1.1. **Brief:** This report is investigates the rooting of a mature London plane tree in the sports ground at The Hall School, 23 Crossfield Road, London NW3 4NU. Of particular interest is the presence of roots up to, and potentially under, the sports building which has a basement.

1.2. **Tree and site description**: The tree is a mature London plane in good health. It is 25m high, with a crown spread of 5- 6m radius. The trunk has a diameter of 1100mm measured at 1.5m high, equating to a root protection area with a radius of 13.2m. The tree has been pollarded in the distant past at a height of 12m and crown reduced in the 1989. It is regularly maintained every 4 - 5 years by cyclical reductions. There were no visible defects from ground level, and the tree has a good vitality. The tree is growing in a small hexagonal raised plinth, with an all weather sports pitch to the north. 1.6m from the trunk to the south is a sports building with basement, constructed in the 1989 (source - Estate Manager). Photo 1 shows the tree in its immediate surroundings.

1.3. **Scope of this report:** This report identifies locations of roots with a diameter greater than 20mm along scan lines. The scanning conditions were excellent due to the smooth surface of the astroturf, the basement floor and uncluttered internal wall.

1.4. Summary: The tree is rooting extensively in the all weather sports pitch in a typical rooting pattern. There are roots between the plinth and the building, as indicated by the vertical scan of the wall basement and the scan line 0001 of 0003t. There are no roots under the basement floor.

2. BACKGROUND AND METHODOLOGY

2.1. A TreeRadar investigation was carried out on 11 July 2016 on areas within the root protection area. The location of the scan lines are found at appendix on drawing reference 3711 TR and the results are found for each group of trees in the report at section 4.

2.2. All scan lines where in the root protection areas of the tree. The individual scan lines where measured from the tree and a 'marker' (the tree trunk and marks on the sports pitch) was noted to assist plotting parallel lines. The lines are 1m apart. Photographs were taken and the lines plotted on a plan and described in survey tables. Each area (as appropriate) has a unique file number (e.g. 005) and each scan within that file has a unique reference number (e.g. 0002). The lines are shown on a digital plan.

2.3. The scan lines are grouped as follows:

- File 0004 - scan lines parallel to the building, commencing 0.5m from the plinth and then every 1m apart until 14m from the tree (scan lines 001 - 013). Each scan line is 17.5m long.

- File 004 - scan lines perpendicular to the building, 1m from the plinth to the west and 1m apart. (Scan lines 014 - 018). Each scan line is 5.5m long.

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Appendix 3: Extracts from Lloydbore Tree root radar report

- File 004 - scan lines perpendicular to the building, 1m from the plinth to the east and 1m apart. (Scan lines 019 - 025). Each scan line is 5.5m long.

- File 0001.003t - scan between the plinth and the building using a 900MHz antennae. Scan line is 3.5m long.

- File 005 - scan line -001. The centre of the path between the building and the eastern boundary.

- File 005 - scan line - 002. The centre of the path between the building and the southern boundary.

- File 006 - scan lines 001 - 004. Along the floor of the basement, 1m from the wall nearest the tree and then 1m apart.

- File 002 - scan lines on the wall nearest the tree, 2m either side of the trunk. Scan lines 001 - 006 taken at 2.2m from the basement floor down to 1m from the floor. These were taken using a 900MNZ antenna.

2.4. The TreeRadar unit is a scanning cart with a 400MHz antenna which sends a beam every 1cm down to a depth prescribed by the operator (usually between 2 - 3m, which is the maximum depth). The reflection is recorded in a field computer and then analysed by the latest software, TBA. Water and metal reflect, therefore the machine records live roots which contain moisture, and cannot detected dead dried out roots. For each scan line a 'virtual trench' is produced which shows all roots with a diameter greater than 20mm. The machine cannot determine root diameter, other than it being greater than 20mm, due to the lack of correlation between the amounts of live root tissue in a root compared to the thickness of a roots. For example a large root may only have a live central core.

2.5. For each group of roots, the scan are organised into a 'top down ' root morphology plan which is to scale. For concentric circular scans snap shots of 3D morphology have been produced. The software 'joins the dots' of root hits to produce this, but the reality of the root growth between the root hits may be slightly different.

2.6. The 900MHz antennae were used as it is lighter and can be hand held to carry out scans on walls and trunks. This picks up every root with a diameter 10mm and above. The machine was set to 600mm penetration from the internal wall. The overall basement wall appears to be 300mm thick (note - this is a lay persons observation only and cannot be relied upon).

3. RESULTS

3.1. Full details are at appendix 3. The summary of the results is found below:

File 0004 - scan lines 001 -025

Comments

Typical rooting pattern normal density between depths of below the astroturf fill down to c.600 - 800mm with a deeper, more scattered band of roots from c.1200mm to 2200mm deep.

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Appendix 3: Extracts from Lloydbore Tree root radar report

File 0001.003t - between the plinth and the building

Comments

Roots found to a depth of 500mm. Note this scan shows roots with a diameter of 10mm and above.

File 005 - scan line -001 - in the centre of the path to the east of the building

Comments

No roots, except one root nearest the tree

File 005 - scan line - 002 - in the centre of the path to the south of the building

Comments

No roots

File 006 - scan lines 001 - 004 in the basement floor

Comments

No roots

File 002 - scan lines 001 - 006 in the wall.

Comments

Some roots.

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Appendix 3: Extracts from Lloydbore Tree root radar report

4. CONCLUSION

The TreeRadar unit picks up roots with a diameter greater than 20cm in diameter. The roots are fairly evenly distributed in the vertical and horizontal profile. There are no remarkable features in the rooting morphology within the astroturf area.

There are no roots in the footpaths to the east and south of the building. The tree does not root under the building, but does root up to the basement wall. It is probable that major roots were severed in 1989 when the building was constructed, and that the compensatory crown pruning at that time prevented tree failure.

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Appendix 4: Basement Construction Sequence from ElliotWood

Draft sequence elliottwood

Hall School

Basement Draft Construction Sequence

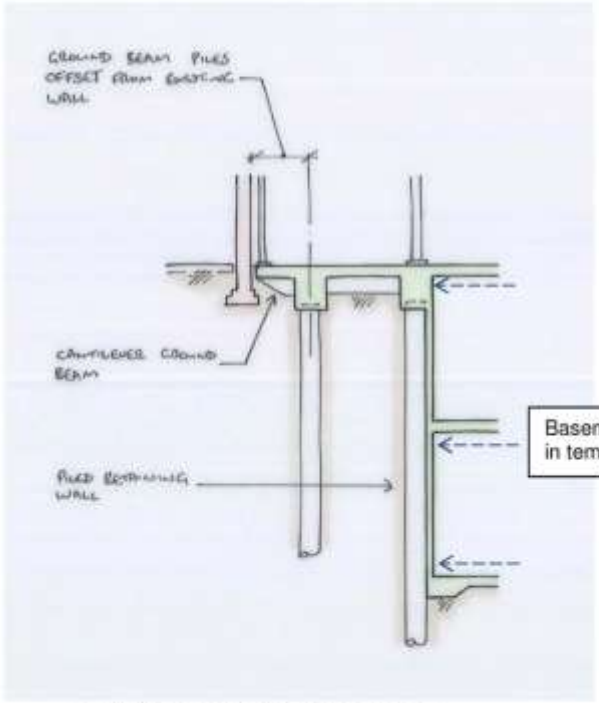


Fig.1: Contiguous piled wall construction

Sequence

1) Install piles
2) Install capping beam
3) Prop at high level
4) Dig down to mid-level
5) Prop at mid-level
6) Dig down to low level
7) Prop at low level
8) Dig down to formation level
9) Install all basement slabs and liner walls from lowest level up, removing propping after concrete has cured.

Appendix 4: Basement Construction Sequence from ElliotWood

Draft sequence elliottwood

Hall School

Basement Draft Construction Sequence

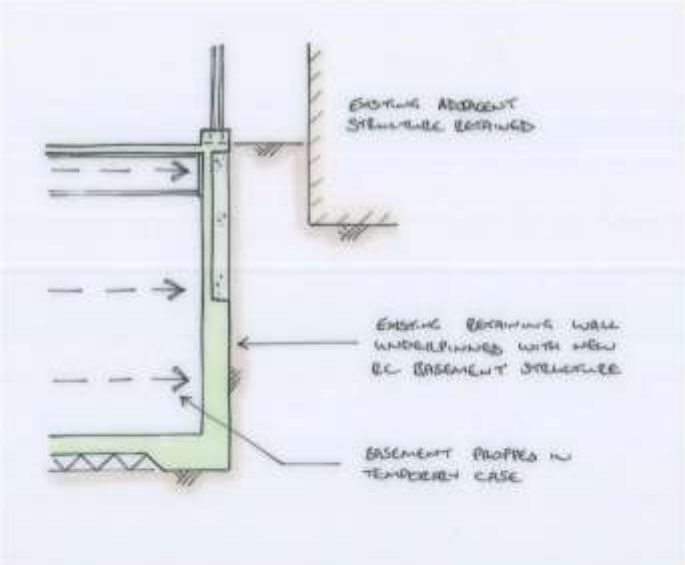
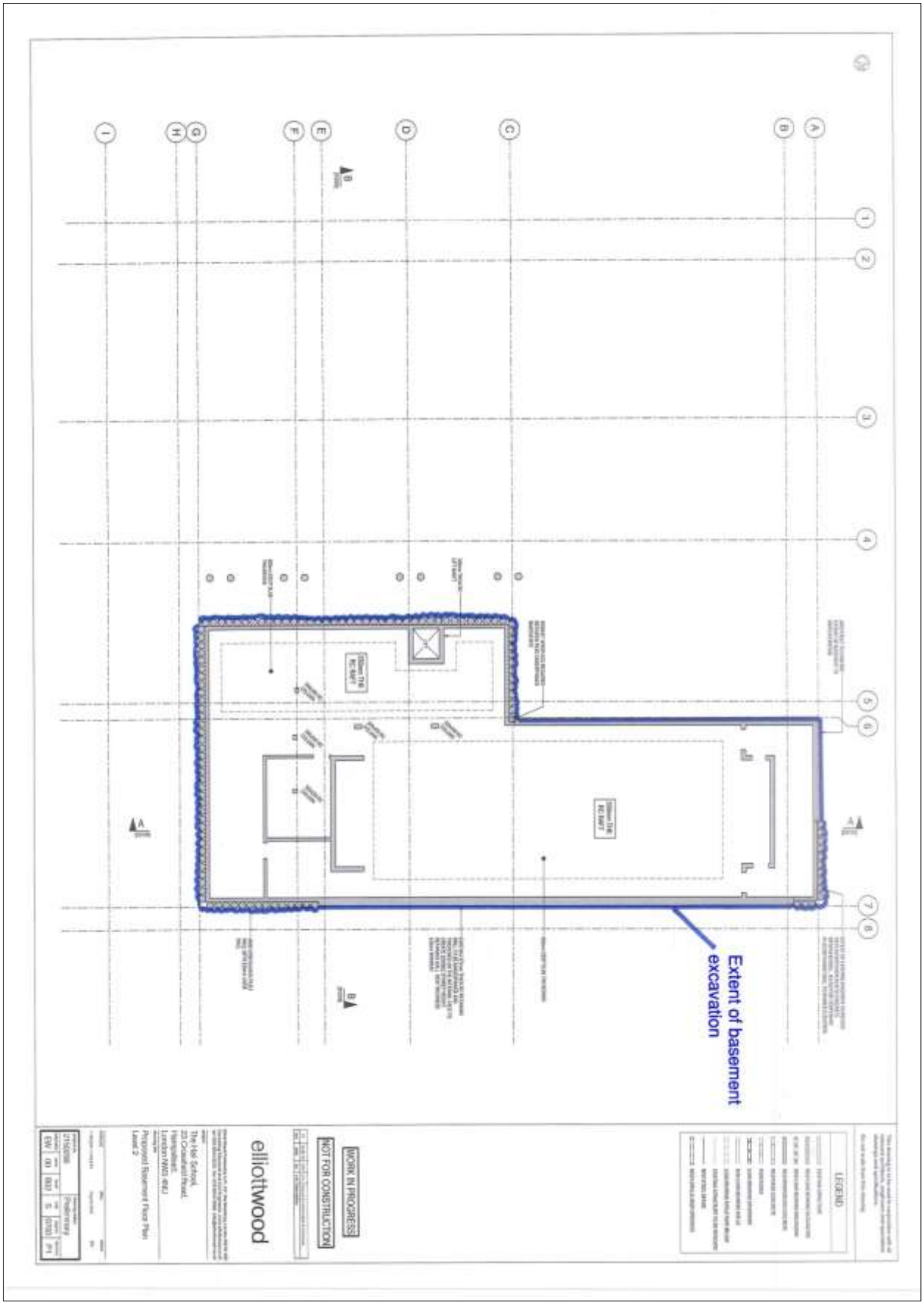


Fig. 2: Proposed underpinning construction

Sequence

1) Install props at high and mid-level
2) Dig down to low level
3) Prop at low-level
4) Dig down to formations level
5) Cast all basement slabs and retaining walls, from lowest level up.

Appendix 4: Basement Construction Sequence from ElliotWood



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