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TREE CONSULTANCY

Arboricultural Impact Appraisal and Method Statement

Havant Retail Park, Portsdown Hill Road, Bedhampton

Prepared by
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Ref: **13042-AIA2-PB**

Validation statement

This report contains the supporting tree information relating to the proposal to redevelop the existing retail park at Portsdown Hill Road, Bedhampton to form a new eighty six unit residential development.

For Local Planning Authority (LPA) validation purposes, this report contains the following:

- A full tree survey compliant to the requirements of ***BS5837: (2012 Trees in relation to design, demolition and construction – Recommendations*** undertaken by a qualified arboriculturist
- A plan with a north point showing tree survey information, including BS 5837 categories
- An assessment of the arboricultural implications of development, detailing trees to be retained and removed, and the proposed protection measures (Section 1)
- An arboricultural method statement describing a feasible means of tree protection, its implementation and the phasing of works (Sections 2 and 3)

Summary

Purpose of this report

This is an arboricultural impact appraisal report describing the trees on and near the development area, what the impact of the development proposal on those trees will be and how any adverse impact will be mitigated. It also includes an arboricultural method statement describing how trees will be protected and managed during the development. Its purpose is to provide sufficient tree information for the LPA to assess the impact of the proposal on local character as part of the process of determining the planning application.

More detailed reasoning relating to the protection of important trees can be reviewed in section 2.4 of this report.

Report contents

It includes:

- a **tree protection plan** showing the location of the trees, their categorisation, the location of the new development, the trees to be lost and the tree protection measures;
- an **arboricultural impact appraisal** in Section 1, which describes the impact of the development on trees;
- an **arboricultural method statement** in Section 2, which describes the tree protection measures, and how they will be implemented; and
- a series of **appendices** in Section 3 providing relevant background information and more detailed guidance to supplement the explanations in Section 2.

Background administrative information

Background information on our specific instructions and how we carried them out is included as Appendix 1. All the trees that could be affected were inspected and their details are listed in Appendix 2.

Summary of the impact on trees and local character

The majority of trees to be lost because of this proposal are low category because of their poor condition or small size. Seven moderate quality trees located centrally within the existing parking area will also be removed but their loss will have no significant impact on the present character of the area. The layout of the proposal scheme has established significant space for new tree planting and a comprehensive new landscape prepared by TGD Landscape Ltd incorporating the establishment of structural tree planting is included as part of the planning submission. The size of these new trees at the time of planting and their future growth will significantly enhance the contribution of this site to local amenity and more than compensate for the relative small loss of existing trees. The proposed changes may affect further 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, then the development proposal will have no significant impact on the contribution of trees to local amenity or character.

Phillip Brophy **HNDArb MArborA CEnv MICFor**

Explanatory notes for the tree protection plan

The tree protection plan (our reference 13042-BT2) is based on the provided information. It should only be used for dealing with the tree issues and all scaled measurements must be checked against the original submission documents. The precise location of all protective measures should be confirmed at the pre-commencement meeting before any construction activity starts. Its base is the existing land survey with the proposed layout superimposed, so the two can be easily compared. It shows:

- the existing trees numbered, with high categories (A & B) highlighted in green triangles and low categories (C & U) highlighted in blue rectangles (note that these colours are used to assist colour blind people in differentiating the categories);
- the trees to be removed indicated by a red dashed crown outline; and
- the location of the construction exclusion zone (CEZ) to be protected by barriers formed by fencing and/or ground protection; and
- the location of precautionary areas outside the fencing where special care will be taken; and
- the location of the new tree planting (taken from TGD Landscape Ltd Landscape Strategy Plan reference 313-101 Rev C.

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Section 1

Arboricultural impact appraisal

This arboricultural impact appraisal describes our assessment of how the proposal will affect trees and any impact this will have on local amenity and character. The impact on trees is summarised at the beginning in 1.1, more detailed explanation of this analysis is set out in 1.2 and the proposed mitigation measures are described in 1.3.

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Section 1: Arboricultural impact appraisal

1.1 SUMMARY OF THE IMPACT ON TREES

Development proposals can impact on trees by causing them to be removed, by adversely affecting their health through disturbance in root protection areas (RPAs) or by severe pruning. However, in many instances, disturbance to trees close to development activity can be reduced to tolerable levels through the use of precautionary measures. Our assessment of the trees that will be affected by this proposal and those that need to be protected by special precautions is summarised in Table 1.

Table 1: Summary of trees that will be affected and protected

	British Standard 5837 category		
	A (High quality)	B (Moderate quality)	C (Low quality)
Trees to be removed	-	1, 3, 5, 20, 21, 22, 31	2, 4, 6, 11, G18(part), 23, G26(part), G28(part), G30(part)
Trees to be protected through special precautions (other than fencing and ground protection)	-	G7, 9, 10	-

Abbreviation: G = group

1.2 DISCUSSION OF THE IMPACT ON VISUAL AMENITY

1.2.1 Trees to be removed for development (1, 2, 3, 4, 5, 6, 11, G18 (part), 20, 21, 22, 23, G26 (part), G28 (part), G30 (part) and 31)

Category A and B tree removals: There are no category A trees within the site and only seven category B trees (1, 3, 5, 20, 21, 22 and 31), will need to be removed as part of the proposed redevelopment. All seven of these trees are part of the internal landscaping that was established for the retail park. As such this intention in conjunction with the relative small size of these trees (no individual is above 8m in height), means that the amenity value provided by these trees is specific to users of the retail park. They have no context with the broader landscape character and their proposed removal will be unnoticeable from wider public vantages.

Category C tree removals: Five individual trees (2, 4, 6, 11 and 23), and parts of four groups (G18, G26, G28 and G30) trees will be removed. None of these trees are of sufficient importance to be worthy of influencing any layout due to either their poor condition or very small size. They are not held to be important in the overall planning context and their loss should not influence the determination of this application.

1.2.2 Trees to be protected through the use of special precautions (G7, 9 and 10)

All the retained trees will be protected from damage by the use of barriers (fencing and ground protection). Additionally, in the precautionary areas shown on the tree protection plan in yellow highlight, special precautions relating to the management of existing and new surfacing and landscaping will be required. All these protective measures are shown on the plan and explained in the arboricultural method statement

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in Sections 2 and 3 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.

1.2.3 Trees advised for removal for management reasons (19 and 24)

In addition to trees to be removed because of the development proposal, two further trees have been advised for removal in the interest of good management. These works are advisory and are not a direct result of this proposal, so they should not be attributed to it. They are not listed in Table 1 for that reason. It is unclear as to the precise ownership of these trees given their locations, and as such legal ownership should be formally confirmed before any works are undertaken.

1.3 PROPOSALS TO MITIGATE ANY IMPACT

1.3.1 Protection of retained trees

The successful retention of trees depends on the quality of the protection and the administrative procedures to ensure those protective measures remain in place whilst there is an unacceptable risk of damage. An effective means of doing this is through an arboricultural method statement that can be specifically referred to in a planning condition. An arboricultural method statement for this site is set out in Sections 2 and 3 of this report. Implementation of this method statement will allow all the retained trees to survive without any adverse impact and allow them to continue to contribute to local amenity and character.

1.3.2 New tree planting

As part of the redevelopment a comprehensive new landscaping scheme has been prepared by TGD Landscape Ltd that includes the establishment of structural tree planting in sustainable locations throughout the new residential layout. The suggested size and location are flexible and open to amendment if necessary. Species selection will be made in coordination with the LPA to ensure that all these new trees have the potential to reach a significant height and maturity without excessive inconvenience and be sustainable into the long term, significantly improving the potential of the site to contribute to local amenity and character. This new planting will more than mitigate the loss of existing trees throughout the site which were primarily planted as landscaping for the internal areas of the retail park rather than to the benefit of the locality and the character of the wider landscape.

1.4 SUMMARY OF THE IMPACT ON VISUAL AMENITY

The majority of trees to be lost because of this proposal are low category because of their poor condition or small size. Seven moderate quality trees located centrally within the existing parking area will also be removed but their loss will have no significant impact on the present character of the area. The layout of the proposal scheme has established significant space for new tree planting and a comprehensive new landscape prepared by TGD Landscape Ltd

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incorporating the establishment of structural tree planting is included as part of the planning submission. The size of these new trees at the time of planting and their future growth will significantly enhance the contribution of this site to local amenity and more than compensate for the relative small loss of existing trees. The proposed changes may affect further 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, then the development proposal will have no significant impact on the contribution of trees to local amenity or character.

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Section 2
Arboricultural method statement

This is an arboricultural method statement describing how trees will be protected and managed during the development of the site. As explained in Table B1 of BS 5837, it is based on the best available information at this stage in the planning process and may need to be updated in the context of a specific planning condition when the full detail is known. Its purpose is to explain how and when the protection measures should be installed, and how they will be maintained for the duration of the development activity.

The following explanations relate specifically to this site and they should be read in conjunction with the attached plan. Please note that this plan is not a 'dimensioned tree protection plan' at this stage because BS 5837 advises in Table B1 that this is not required at the planning application stage. Appendix 3 sets out further guidance to supplement the following explanations.

A copy of this report must be permanently available on site for the duration of the development activity. It can be:

- included in tendering documentation to identify and quantify the tree protection and management requirements;
- used to plan the timing of site operations to minimise the impact on trees; and
- referenced on site for practical guidance on how to protect important trees.

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Section 2: Arboricultural method statement

2.1 ARBORICULTURAL SUPERVISION

2.1.1 General principles

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

1. the pre-commencement meeting before any work starts;
2. regular supervision visits as agreed at the pre-commencement meeting; and
3. as needed to oversee any specific works that could affect trees.

Additionally, the consultant will have a supervisory input into operations that could adversely affect protected trees (see 2.2 below).

2.1.2 Detailed proposals

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

- **Pre-commencement meeting:** A pre-commencement meeting will 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 LPA representative. In the event that a LPA representative declines to be present, the arboricultural consultant will inform the LPA in writing of the details of the meeting. All tree protection measures detailed in this document will be fully discussed so that all aspects of their implementation and sequencing are understood by all the parties. This will 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 will be agreed and finalised, which will 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 will be available on site and the site manager will brief all personnel who could have an impact on trees on the specific tree protection requirements. This will 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 will 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 will be sufficiently flexible to allow the supervision of all sensitive works as they occur. The arboricultural consultant's initial role is to liaise

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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 will switch to monitoring compliance with arboricultural planning conditions and advising on any tree problems that arise or modifications that become necessary.

- **Proof of compliance to help refute liability and facilitate the discharge of planning conditions:** All supervisory visits will be formally confirmed in writing and circulated to all relevant parties, including the LPA. The purpose of these written records is firstly to provide proof of compliance that will allow the developer to robustly demonstrate adherence to best practice in the event of any disputes, and secondly to help the LPA efficiently discharge the relevant planning conditions.

2.2 PROGRAMME AND PHASING OF TREE MANAGEMENT

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

1. Pre-commencement meeting
2. Preliminary tree felling and pruning
3. Installation of CEZ barriers (fencing and/or ground protection)
4. Upgrading existing surfacing
5. Replacing existing surfacing with new soft landscaping
6. Installation of new services or upgrading of existing services
7. Removal of protective measures
8. Tree planting and general landscaping

More specifically, a preliminary programme for the arboricultural input is set out below:

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 CEZ fencing 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
Review the construction method statement to detail how the site activities will account for the protection of trees	• If necessary, advise in its updating
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

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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 tree protection, if already installed • Agree any changes to CEZ barrier combinations of fencing and ground protection
Site operations before demolition/construction 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 within precautionary areas that could affect trees during construction	
Action	**Arboricultural input**
Installation of new services	• Meeting with contractor for briefing before work starts, with further supervision visits as necessary at the discretion of the arboricultural consultant
Removal of surfacing retained as ground protection to be replaced with soft landscaping	• Meeting with contractor for briefing before work starts, with further supervision 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
Operations that could affect trees after construction is completed	
Action	**Arboricultural input**
Removal of barriers and ground protection	• Meeting with contractor for briefing before work starts, with further supervision 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
New tree planting	• Check tree size, species, quality, handling, site preparation and planting comply with the specification
Soft and hard landscaping	• Meeting with contractor for briefing before work starts, with further supervision visits as necessary at the discretion of the arboricultural consultant
Tree planting maintenance	• Liaise with landscape contractor to check maintenance complies with the specification

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

2.3 GENERAL TREE MANAGEMENT AND PROTECTION

2.3.1 General site operation

The day-to-day running of the site will take full account of the tree protection measures set out in this document, a copy of which will be kept on site at all times. All site personnel will be briefed on the tree protection requirements as part of the site induction procedures.

2.3.2 Tree works

The proposed tree works are set out in the work recommendations column of the tree schedule in Appendix 2. These are made on the basis that all trees will be re inspected within a year of the original inspection and the management advice only remains valid for up to a year after that inspection date. The trees to be removed are highlighted with

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red text in the schedule. The location of each tree by number is shown on the plan and those to be removed are indicated with a red number and a red dashed crown outline.

2.3.3 Protection of the CEZ by the use of fencing and ground protection

BS 5837 (3.6) describes the CEZ as the "*area based on the RPA from which access is prohibited for the duration of a project*". In practice, this can be done by any combination of fencing and ground protection, to be finalised and agreed at the pre-commencement meeting.

- **Protective fencing:** On the tree protection plan, the approximate boundary of the CEZ is shown by the heavy black dashed line, with the diagonal black hatching indicating the enclosed CEZ. Further detail on fencing options is included in Appendix 3 (paragraphs 3–6). The precise form of the fencing can vary, provided it is fit for purpose in that it prevents damaging activities within the CEZ that it encloses.
- **Ground protection:** Where it is not practical to protect the CEZ by the use of fencing alone, BS 5837 (6.2.3.1) allows for the fencing to be set back and the soil protected by ground protection. This allows fencing to be set back to improve access, 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. Further detail on ground protection options is included in Appendix 3 (paragraph 6). 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.

Throughout this report, there is a presumption that all RPAs identified for protection on the plan outside the CEZ will be protected from soil degradation at all times during any demolition and construction. This applies to all the shaded precautionary areas shown on the plan at all times during the development while there is a risk of damage to the RPAs of retained trees. All work operations in RPAs will be strictly controlled to comply with BS 5837, as explained in Appendix 3. All barriers, whether fencing or ground protection, must remain intact and fit for purpose for the duration of any development activity that could cause damage. The barriers are intended to prevent any unsupervised activities within the protected CEZ. All construction activities with the potential to disturb RPAs must be subject to arboricultural supervision. Additionally, once the barriers are removed, any landscaping activity must be carefully controlled in RPAs.

2.3.4 Control of activities within precautionary areas

Precautionary areas are shown on the tree protection plan as coloured shading outside the main protective barriers of the CEZ. They indicate where agreed activities can be carried out within RPAs, provided sufficient care is taken to ensure that any impact on retained trees is minimised. This specifically applies to excavation, but also covers all other development operations with the potential to adversely affect trees. **All activities**

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within precautionary areas must be carried out in accordance with the guidance principles set out in Appendix 3 and be supervised by an arboricultural consultant. In particular, this guidance applies to removing surfacing, installation/upgrading of new surfacing, services, and soft landscaping.

2.3.5 Control of activities near RPAs

Any risk to trees from activities outside RPAs, but close enough to have a knock-on impact, will be assessed during the day-to-day running of the site and appropriate precautions put in place to reduce that risk. More specifically, all cement mixing and washing points for equipment and vehicles will be outside RPAs. Where the contours of the site create a risk of polluted water or toxic liquids running into RPAs, a precautionary measure of using heavy-duty plastic sheeting and sandbags with the ability to contain accidental spillages will be put in place to prevent contamination.

2.3.6 New tree planting

Although new trees can be planted at any stage in the development process, it usually happens towards the end, along with the general landscaping. On this site, one hundred and seven new trees, will be planted and maintained according to the guidance in Appendix 3 (paragraphs 25 and 26) at the locations illustrated on the plan. It is proposed that the detail of the species and sizes are agreed with the LPA through a condition to ensure that the final scheme optimises the potential of the space available. Any trees that die or progressively decline within five years will be replaced and maintained until successfully established.

Additionally, all trees that are to be established adjacent or within hard surfaced areas should be planted with a minimum of nine cubic metres ($9m^2$ x 1m depth) per tree of below ground preparation using structured tree soil and a root guidance product will be installed according to the guidance in Appendix 3 (paragraphs 27 and 28). It is possible that such planting pits could be coordinated with the grey water management provision within the site.

2.4 SPECIFIC TREE PROTECTION REQUIREMENTS

The specific tree protection operations, in roughly the order that they will be carried out, are explained in detail in the following subsections. Where appropriate, more detailed guidance is referenced in Appendix 3 to supplement the following explanations.

2.4.1 Installation of CEZ barriers (fencing and/or ground protection)

The CEZ boundary is shown on the tree protection plan as the heavy black dashed line. Its location is approximate because its precise position will need to be finalised on site, depending on the local site conditions. If necessary, BS 5837 allows the fencing location to be moved provided the exposed CEZ is protected by ground protection, but this would need to be formally agreed by all parties at the pre-commencement meeting. Once the tree works have been carried out, the appropriate fencing and ground

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protection will be installed before any construction work starts, following the guidance in Appendix 3 (paragraphs 3–6).

2.4.2 Reconditioning/upgrading of existing hard surfacing

The existing hard surfacing adjacent to trees 9, 10 and group 7 will be retained and utilised as an appropriate form of ground protection throughout the main phase of redevelopment. Where this surfacing will continue to be hard surfacing within the new scheme it will be carefully reconditioned (it is not expected that there will be significant rooting within the existing sub base material). Where the new scheme allows for the complete removal of the existing surfacing, then it will be carefully broken up and replaced with new soft landscaping. These works will be subject to arboricultural supervision and will be undertaken in accordance with the guidance set out in Appendix 3.

2.4.3 Installation of new services or upgrading of existing services

It is often difficult to clearly establish the detail of services until the construction is in progress. Where possible, it is proposed to use the existing services into the site and keep all new services outside RPAs. However, where existing services within RPAs require upgrading or new services have to be installed in RPAs, great care must be taken to minimise any disturbance. Trenchless installation should be the preferred option but if that is not feasible, any excavation must be carried out by hand according to the guidelines in Appendix 3 (paragraph 22). If unexpected services do need to be installed within RPAs, written approval must be obtained from the LPA before any works are carried out.

2.4.4 Removal of protective measures

All protective barriers must remain in place until the construction activity is finished and there is no realistic risk of damage to the protected soil surfaces.

2.4.5 Landscaping and reinstatement

The final tidying up and reinstatement can only be carried out when all the protective barriers have been removed, which means great care is needed by all the contractors to observe the tree protection requirements. No machines can be used within RPAs, which specifically includes rotovators, and all new planting and soil level variations must be agreed and supervised by the arboriculturist. All these works will be carried out strictly in accordance with the guidance in Appendix 3 (paragraph 25).

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Section 3

Appendices

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Appendix 1: Administrative information, site visit and data collection

Administrative information

1. Instruction

We are instructed by Linden Homes and Rawlings Developments Ltd to inspect the significant trees that could be affected by the development proposal at Havant Retail Park, Portsdown Hill Road, Bedhampton, and to prepare the following information to accompany the planning submission:

- a schedule of the relevant trees to include basic data and a condition assessment
- an appraisal of the impact of the proposal on trees and any resulting impact that has on local amenity
- an arboricultural method statement dealing with the protection and management of the trees to be retained

2. Documents provided

The tree protection plan is derived from the following provided information:

- Land survey, drawing number 5530 A, received by email on 23 January 2013
- Layout, drawing number PP1169 110-00 P6, received by email on 22 July 2013

3. Limitations of this report

The following limitations apply to this report:

- **Statutory protection:** The existence of tree preservation order or conservation area protection does not automatically mean trees are worthy of being a material constraint in a planning context. Trees can be formally protected, but be in poor structural condition or in declining health, which means that they are unsuitable for retention or influencing the future use of the site. Furthermore, a planning consent automatically takes precedent over these forms of protection, which makes them of secondary importance. For these reasons, we do not check statutory protection as a matter of course in the process of preparing this report. However, 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.
- **Ecology and archaeology:** Although trees can be valuable ecological habitat and can grow in archeologically sensitive locations, we have no specialist expertise in these disciplines and this report does not consider those aspects.
- **Tree assessment and management advice:** 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.

4. Technical references

This arboricultural method statement is based on the following primary technical references:

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- British Standards Institution (2012) BS 5837: *Trees in relation to design, demolition and construction – Recommendations*
- National Joint Utilities Group (2007) Volume 4, Issue 2: *Guidelines for the planning, installation and maintenance of utility apparatus in proximity to trees*

5. Qualifications and experience

This report is based on my site observations and the provided information, interpreted in the context of my experience. I have experience and qualifications in arboriculture that can be reviewed at www.barrelltreecare.co.uk/about-us.php.

Site visit and data collection

6. Site visit

I visited the site on 24 January 2013. All my observations were from ground level without detailed investigations and I estimated all dimensions unless otherwise indicated. I did not have access to trees outside the boundaries and have confined observations of them to what was visible from within the property. The weather at the time of inspection was dull and damp, with average visibility.

7. Brief site description

Havant Retail Park is located to the south of Portsdown Hill Road, Bedhampton. It consists of two large commercial units situated along the western and southern boundaries. A large area of car parking is located between these units and the sites northern boundary. Whilst the topography within the site is broadly flat and consistent, the levels of the surrounding land to the north and south are dramatically higher, which gives the site an almost bowl like context. Within the site there are a small number of trees that have been specifically planted as internal landscaping for the car park area. These trees are relatively small and are set within tree pits and surrounded by hard surfacing. Some limited boundary planting is visible on the northern boundary but this is broadly of poor quality and provides little amenity to the locality. A linear belt of young trees has been established on and immediately beyond the western boundary in order to provide low level screening between the rear of the commercial units and the adjacent A3(M) carriageway slip road.

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Appendix 1: Administrative information, site visit and data collection

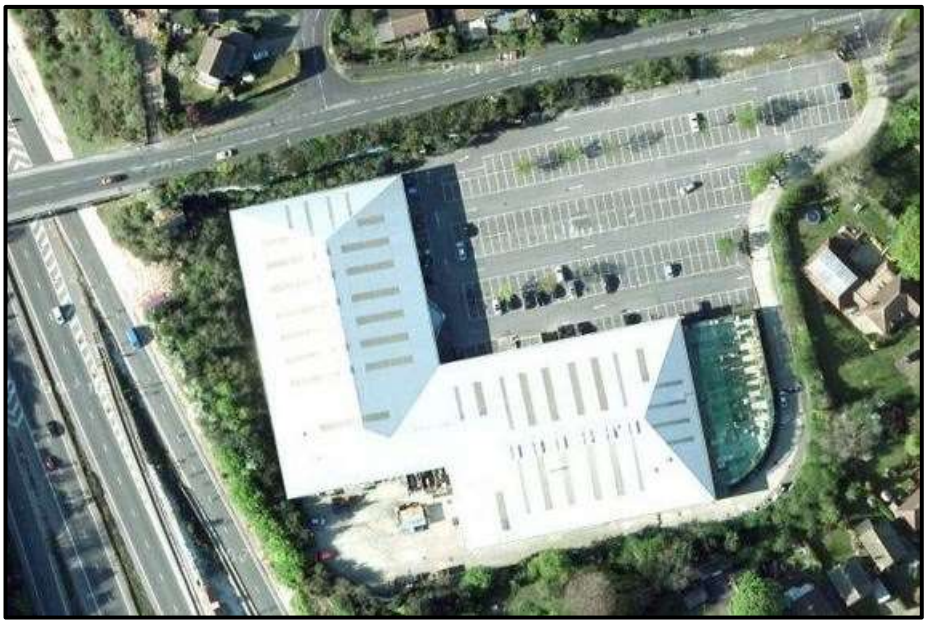

Image 1: Aerial view of Havant Retail Park, Portsdown Hill Road, Bedhampton

8. Collection of basic data and compliance with BS 5837

Each tree was inspected and the numbering scheme is indicated on the tree protection plan. Obvious groups were identified where appropriate. For each individual tree and group, information was collected on species, height, diameter, maturity and potential for contribution to amenity in a development context. As advocated in BS 5837, each tree was then allocated to one of four categories (A, B, C or U), which reflected its suitability as a material constraint on development. Each category A, B and C tree was automatically assigned BS sub-category 1 unless otherwise stated. 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. This data with explanatory notes is set out in the tree schedule included as Appendix 2 and the supporting plan information. Each tree inspection was of a preliminary nature and did not involve any climbing or detailed investigation beyond what was visible from accessible points at ground level. BS 5837 (4.4.2) sets out recommendations for the collection of data and this report is fully compliant with that advice in the context of the BS 5837 Foreword, which states: "*Any user claiming compliance with this British Standard is expected to be able to justify any course of action that deviates from its recommendations.*" In that context, we will justify any deviation in this report from the strict BS 5837 recommendations on request.

9. 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.

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Appendix 1: Administrative information, site visit and data collection

10. Plan updates

During the site visit, one small individual tree (13) and parts of two other groups (G15 and G18) were noted not to be shown on the site survey. Their approximate locations have been illustrated on the tree protection plan, but these positions have not been accurately surveyed. It is unlikely that this has affected the report conclusions, but if their locations are considered important, they should be accurately surveyed.

11. The use of the tree information in layout design

Following the inspection of the trees, the information listed in Appendix 2 was used to provide constraints guidance to the architect based on the locations of all the category A and B trees. All the category C and U trees were discounted because they were not considered worthy of being a material constraint. This guidance identified the estimated developable footprint of the site and was considered by the architect to arrive at the submitted design. For conciseness, and because it is not a BS recommendation, this detailed constraints advice has not been included in this report.

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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								Carry out safety check and lift to 3-4m over site as necessary		
T1	Norway maple	6	27.5	Maturing	-	B	Formal planting within car park, some minor raising of metal planting grill	Fell	3.3	34
T2	Norway maple	4	17.5	Maturing	-	C	Formal planting within car park, historic damage to main stem	Fell	2.1	14
T3	Norway maple	6	22.5	Maturing	-	B	Formal planting within car park	Fell	2.7	23
T4	Norway maple	5	12.5	Maturing	-	C	Damage to base and lower stem - slight lean	Fell	1.5	7
T5	Norway maple	7	27.5	Maturing	-	B	Formal planting within car park, slight impact damage to lower limb	Fell	3.3	34
T6	Norway maple	5	15	Maturing	-	C	Poor structural form	Fell	1.8	10
G7	Norway maple	7	23	Maturing	-	B	Combined canopy elements, located within grass verge, established but replaceable due to relative small size	-	2.8	24
T8	Norway maple	6	12.5	Young	-	C	Canopy suppressed by tree 9	-	1.5	7
T9	Norway maple	7	19	Maturing	-	B	-	-	2.3	16
T10	Norway maple	7	20	Maturing	-	B	Located in grass verge	-	2.4	18
T11	Norway maple	6	15	Young	-	C	-	Fell	1.8	10
T12	Norway maple	7	22.5	Maturing	-	B	Would benefit from formative pruning	-	2.7	23
T13	Ash	6	12.5	Young	-	C	Suppressed tree	-	1.5	7

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Appendix 2: Tree schedule and explanatory notes

Tree No	Species	Height (m)	Diameter (cm) @ 1.5m	Maturity	Low Branches	Category	Notes	Tree Works	RPA radius (m)	RPA area (m2)
G14	Ash	9	17.5	Young/maturing	-	C	Poor structural form	-	2.1	14
G15	Sycamore	9	17.5	Young	-	C	Self sown sycamore	-	2.1	14
T16	Field maple	10	70	Over-mature	-	C	Subject to historic reduction pruning, located at top of bank	-	8.4	222
T17	Sycamore	8	50	Over-mature	-	C	Ivy clad, twin stemmed tree, unable to inspect closely due to restricted access	-	6.0	113
G18	Sycamore, hazel, ash, holly	12	20	Young	-	C	-	Fell selected individuals	2.4	18
T19	Ash	10	30	Maturing	-	U	Self sown tree located in precarious position on cliff	Fell	3.6	41
T20	Norway maple	8	27.5	Maturing	-	B	-	Fell	3.3	34
T21	Norway maple	8	30	Maturing	-	B	-	Fell	3.6	41
T22	Norway maple	8	17.5	Maturing	-	B	Formal planting within car park, minor damage to lower limb	Fell	2.1	14
T23	Norway maple	7	26	Maturing	-	C	Significant wounds at base of tree and at top of trunk	Fell	3.1	31
T24	Sycamore	10	40	Maturing	-	U	Multi stemmed tree growing from cliff face, unable to closely inspect due to restricted access	Fell	4.8	72
G25	Ash, pine, holly	9	25	Young/maturing	-	C	Scrub tree poor quality ivy clad tree - no access due to cliff based location	-	3.0	28
G26	Elder, hawthorn, willow	5	25	Maturing/mature	-	C	Poor quality trees - several collapsed elder within group	Fell selected individuals	3.0	28

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Appendix 2: Tree schedule and explanatory notes

Tree No	Species	Height (m)	Diameter (cm) @ 1.5m	Maturity	Low Branches	Category	Notes	Tree Works	RPA radius (m)	RPA area (m2)
T27	Sycamore	11	30	Maturing	-	C	Self sown tree, poor form, suppressed by adjacent cypress tree	-	3.6	41
G28	Field maple	6	10	Young/maturing	-	C	Roadside planting (adjacent to motorway slip road)	Fell selected individuals	1.2	5
T29	Holly	6	12.5	Young	-	C	Small but established tree	-	1.5	7
G30	Pine	8	15	Young	-	C	Young but established tree with potential for future growth but could be replaced without adverse impact on existing amenity	Fell selected individuals	1.8	10
T31	Norway maple	6	22.5	Maturing	-	B	Small tree	Fell	2.7	23

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Appendix 2: Tree schedule and explanatory notes

Explanatory notes for schedule

- **Abbreviations:**

G	: Group
RPA	: Root protection area

- **Botanical tree names:**

Ash	: *Fraxinus excelsior*
Elder	: *Sambucus nigra*
Field maple	: *Acer campestre*
Hawthorn	: *Crataegus monogyna*
Hazel	: *Corylus avellana*
Holly	: *Ilex aquifolium*
Norway maple	: *Acer platanoides*
Pine	: *Pinus* sp
Sycamore	: *Acer pseudoplatanus*
Willow	: *Salix* sp

- **BS 5837 (2012) compliance:** All data has been collected based on the recommendations set out in subsection 4.4 of BS 5837.

- **Future tree safety inspections:** 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.

- **Site limitations:** 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 a walkover tree survey 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 in the botanical names section above 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 an 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 a 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 some ability to cope with change, and mature indicates little potential to increase in size and limited ability to cope with change.

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Appendix 2: Tree schedule and explanatory notes

- **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 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 inspection of all trees was of a preliminary nature and only defects visible from the ground have been identified. Each individual tree may not have been inspected closely because of access difficulties and only defects visible from the inspection point have been noted. In addition to tree removals for development and management reasons, further works are listed to reduce the threats from retained trees. All trees on the site should be checked by the contractor at the time of carrying out the main tree works to deal with any emerging safety issues in the context of the consented development. Additionally, if and where appropriate to facilitate access, all tree canopies should be lifted to 3–4m above the site. Only works in excess of this have been listed for individual trees. The following points should also be noted before carrying out any works:

  1. **Reporting during work operations:** In the context of the preliminary nature of the tree inspection, any defects that may affect tree safety discovered by the contractor when carrying out the work recommendations should be reported to the supervising officer. Modification to the schedule of works may be required because of these reports. The contractor should be specifically instructed on this point.
  2. **Implementation of works:** All tree works should be carried out to BS 3998 *Recommendations for Tree Work* as modified by more recent research. It is advisable to select a contractor from the local authority list and preferably one approved by the Arboricultural Association. Their Register of Contractors is available free from The Malthouse, Stroud Green, Standish, Stonehouse, Gloucestershire GL10 3DL; phone 01242 522152; website www.trees.org.uk.
  3. **Statutory wildlife obligations:** The Wildlife and Countryside Act 1981 as amended by the Countryside and Rights of Way Act 2000 provides statutory protection to birds, bats and other species that inhabit trees. All tree work operations are covered by these provisions and advice from an ecologist must be obtained before undertaking any works that might constitute an offence.
  4. **Future tree 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.

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Appendix 3: Protecting retained trees

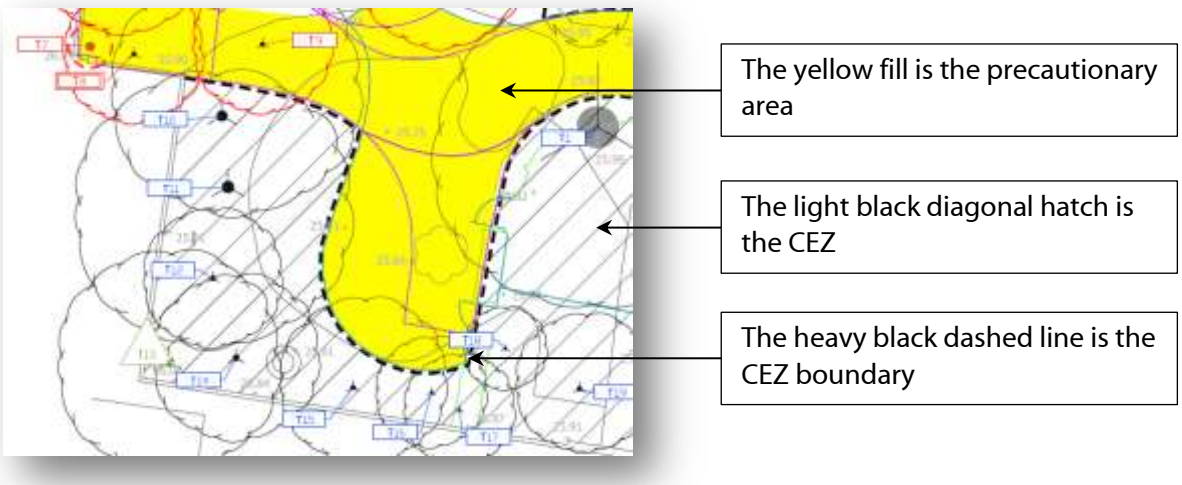
Introduction

1. Purpose and use of this guidance

This general guidance is for construction site management to help protect trees that have been agreed for retention. It must be read in conjunction with the site-specific proposals shown on the tree protection plan and explained in the body text of this report. It supplements and expands upon the principles set out in the British Standards Institution (2012) BS 5837: *Trees in relation to design, demolition and construction – Recommendations* (www.bsigroup.com) and the National Joint Utilities Group (NJUG) (2007) Volume 4, Issue 2: *Guidelines for the planning, installation and maintenance of utility apparatus in proximity to trees* (www.njug.org.uk). More specifically, it describes useful practical precautions that can be taken when working close to retained trees and provides sources of further information. Important terms include:

- **Root protection areas (RPAs):** RPAs are the areas surrounding retained trees where disturbance must be minimised.
- **Construction exclusion zone (CEZ):** This is the RPA where no construction activity should occur and damage is prevented by either installing fencing to restrict access or installing ground protection that allows limited access above the ground, while protecting the rooting environment below.
- **Precautionary area:** This is RPA outside the CEZ where limited works are proposed, but must be carried out with care to minimise any impact on the tree rooting environment.

These areas are illustrated on our plans and annotated as follows:



At the planning stage, this guidance describes practical methods and examples of how trees can be protected to assist the local planning authority (LPA) in deciding whether the proposal is feasible. If the LPA issues consent, this guidance, in conjunction with the report and tree

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protection plan, will act as a written record for reference during the construction process. Once work starts on site, this guidance is designed to help the site personnel implement effective tree protection. All personnel working in RPAs must be familiar with this document and be properly briefed about their responsibilities to protect important trees.

2. Arboricultural supervision

All work within RPAs requires a high level of care. Qualified arboricultural supervision is essential to minimise the risk of misunderstanding and misinterpretation. Site personnel must be properly briefed about protecting retained trees before any work starts. Ongoing work near trees must be inspected regularly by an arboriculturist and, on completion, the work must be signed off to confirm compliance by the contractor. This supervision arrangement will normally include a pre-commencement meeting, regular inspection visits and sufficient flexibility to allow for visits as necessary to deal with emerging tree protection issues.

Primary tree protection

3. Primary tree protection

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 must 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.

4. Protective fencing

Various fencing options are illustrated in figure 1 and photos 2–4 below. The minimum specification for the fencing must be as described in figure 2 of BS 5837 (figure 1 below) or an equivalent design that effectively restricts access to the RPA it protects.

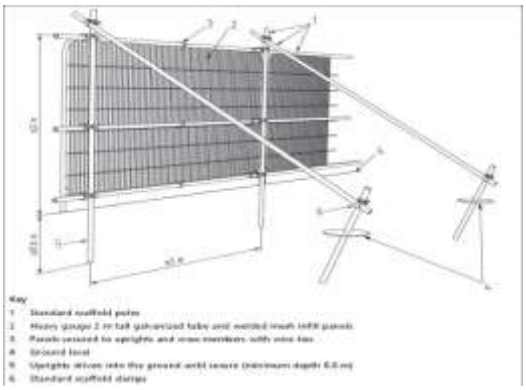

Figure 1: Recommendations taken from figure 2 of BS 5837.

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

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Appendix 3: Protecting retained trees

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

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

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 must 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 must be agreed by the supervising arboriculturist.

5. Trunk protection

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

Photo 5: A scaffold braced framework surrounding the trunk reduces the risk of accidental impact.

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

6. 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.

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Appendix 3: Protecting retained trees

Photos 7–14 illustrate a range of practical solutions that can effectively protect CEZs of retained trees.

Photo 7: Heavy-duty plywood set onto a compressible woodchip layer and pinned into position is suitable to spread the loading from pedestrian access.

Photo 8: Spreading soil excavated from footings is an effective way of buffering the plywood surface from the wear of light vehicles.

Photo 9: Plywood fixed to a wood frame is another effective method of protecting soil from pedestrian compaction.

Photo 10: 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.

Photo 11: 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.

Photo 12: Custom designed sectional tracks can be joined to support very heavy traffic use through sensitive areas.

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Photo 13: A combination of retaining existing surfacing and using temporary construction cabin accommodation can be a very effective means of preventing damage to sensitive areas.

Photo 14: Steel plates can be an effective way of temporarily reinforcing weak surfacing over a construction access during the development activity.

Guidance for working in precautionary areas

7. Excavation and dealing with roots

Precautionary areas are RPAs outside the CEZ, 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 (photo 15, 16 and 17).

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 (photo 18). 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.

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Photo 15: Careful hand-digging using conventional tools is acceptable for exposing roots in RPAs.

Photo 16: Air spades are very effective at exposing roots and services with minimal damage.

Photo 17: Air spades are particularly useful where roots are very dense.

Photo 18: 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.

8. Removing hard surfacing and structures in precautionary areas

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.

9. Access

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.

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In summary, there should be no vehicular or repeated pedestrian access unless existing ground protection is retained or new protective measures are installed (photo 19). All exposed RPAs must be protected until there is no risk of damage from the development activity.

Photo 19: 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.

Photo 20: 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.

10. Removal of material

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 (photos 21 and 22). 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 (photo 20), 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 (photo 20).
4. Great care must be taken throughout these operations not to damage roots as set out in paragraph 7 above.
5. If appropriate, leaving below ground structures in place should be considered if their removal may cause excessive root disturbance.

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Photo 21: 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.

Photo 22: These trees had impermeable surfacing right up to their trunks, which had to be removed by hand before installing new structures.

11. Installation of new surfacing in precautionary areas

BS 5837 (7.4) confirms that new surfacing can be installed within RPAs, but it has to be carried out with care. These operations are potentially damaging to trees because they may require changes to existing ground levels, resulting in localised soil structure degradation and/or disrupt the efficient exchange of water and gases in and out of the soil. Older trees are much more prone to suffer from such changes than young and maturing trees. Adverse impact on trees can be reduced by minimising the extent of these changes in RPAs. Generally, the most suitable surfacing will be relatively permeable to allow water and gas movement, load spreading to avoid localised compaction and require little or no excavation to limit direct damage. The actual specification of the design is an engineering issue that needs to be considered in the context of the bearing capacity of the soil, the intended loading and the frequency of loading. The detail of product and specification are engineering issues and must be provided by appropriate specialists.

12. Cellular confinement systems

BS 5837 (7.4.2.) sets out that no-dig, three dimensional cellular confinement systems can be used as the basis for extending hard surfacing into RPAs. It is our experience (www.barrelltreecare.co.uk/case-studies/SurfacingNearTrees.pdf) that this type of surfacing can be installed in the majority of situations without any significant adverse impact on adjacent trees, provided that proper consideration is given to all the circumstances. Most of our experience is with the CellWeb system supplied by Geosynthetics Ltd (www.geosyn.co.uk) and because of its sustained good performance over time, this is our preferred choice of product. The product is made from heavy-duty plastic that can be pulled apart to open into cells. These are then filled with washed stone, after the product is spread over the ground and pinned in place. This forms a base layer that acts as a floating raft, spreading the load across the whole construction width. The base layer can be topped with a variety of finishes as illustrated in figure 23. Photos 24 and 25 show the product spread over the ground and then filled with stone to produce the base layer.

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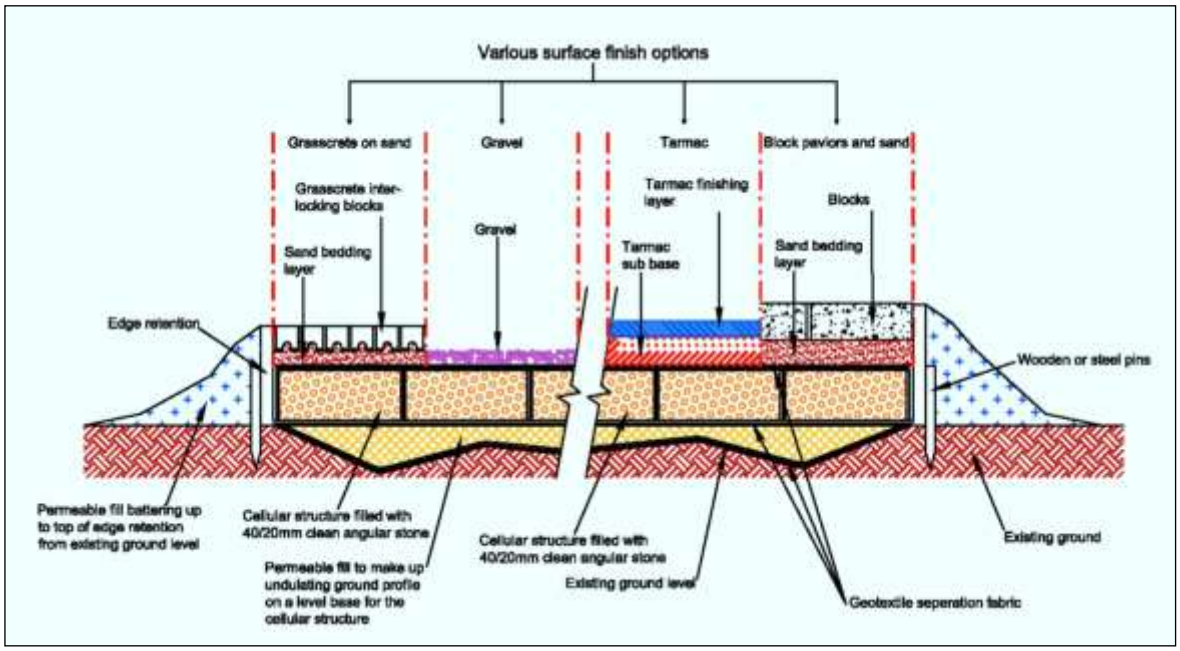

Figure 23: This conceptual cross-section illustrates the structural elements of the system and the multiple surfacing options that can be used with it.

Photo 24: The three-dimensional cells are opened up, spread across the area to be surfaced and pinned in place ready for the stone filling.

Photo 25: The stone-filled cells spreads the load of traffic and the geotextile membrane on the ground prevents migration of the stone into the soil profile.

13. Dealing with undulating surfaces and establishing a tolerable level of excavation

The precise location and depth of roots within the soil is unpredictable and will often only be known when careful digging starts on site. Ideally, all new surfacing in RPAs should be no-dig, i.e. requiring no excavation whatsoever, but this is rarely possible on undulating surfaces. New surfacing normally requires an evenly graded sub-base layer, which can be made up to any high points with granular, permeable fills such as crushed stone or sharp sand. This sub-base must not be compacted as would happen in conventional surface installation. Some limited excavation is usually necessary to achieve this and need not be damaging to trees if carried out carefully and large roots are not cut. Tree roots and grass roots rarely occupy the same soil volume at the top of the soil profile, so the removal of an established turf layer up to 5cm is unlikely to be damaging

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to trees. However, this may not be possible where there is no grass because tree roots may grow right up to the soil surface. In some situations, it may be possible to dig to a greater depth depending on local conditions, but this would need to be assessed by an arboriculturist if excavation deeper than 5cm is anticipated.

On undulating surfaces, finished gradients and levels must be planned with sufficient flexibility to allow on-site adjustment if excavation of any high points reveals large unexpected roots near the surface. If the roots are less than 2.5cm in diameter, it would normally be acceptable to cut them and the gradient formed with the preferred minimal excavation of up to 5cm. However, if roots over 2.5cm in diameter are exposed, cutting them may be too damaging and further excavation may not be possible. If that is the case, the surrounding levels must be adjusted to take account of these high points by filling with suitable material. 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.

14. Sub-base and finishing layers

Once the sub-base has been formed, the load spreading construction is installed on top without compaction. In principle, the load spreading formation will normally be cellular and filled with crushed stone, although the detail may vary with different products. Suitable surface finishes include washed gravel, permeable tarmac or block paviours set on a sand base (figure 23). However, for lightly loaded surfacing of limited widths (<3m) such as pedestrian paths, pre-formed concrete slabs may be appropriate if the sub-base preparation is as set out above.

15. Edge retention

Conventional kerb edge retention set in concrete-filled excavated trenches is likely to result in damage to roots and should be avoided. Edge retention in RPAs must be designed to avoid any significant excavation into existing soil levels (BS 5837, 7.4.3) and there are a number of approaches that are fit for this purpose. For block paviours, the use of pre-formed edging secured by metal pins is effective and can be reinforced by concrete supports as long as there is no excavation into the soil (photo 26). Railway sleepers (photo 27) pinned in place or wooden boards (photo 28) are two options, depending on the expected loading of the surfacing. A permeable soil fill can then be used to batter the grade back down to the existing soil level.

Photo 26: A conventional concrete haunching can be used to retain new surfacing as long as it is not dug into a trench - here is it placed on top of the CellWeb layer.

Photo 27: Although this is only a temporary surface, railway sleepers pinned into the ground can be used to retain the edges of new surfacing.

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Photo 28: Wooden board pinned in place or held in position with backfilled topsoil can provide more informal and rustic surface edging.

Photo 29: In some situations, it may be appropriate to cast a free floating concrete surface directly onto the soil surface provided provision is made to prevent soil contamination while the concrete is being poured, i.e. an impermeable membrane separating the concrete from the soil.

16. Footpaths and surfacing without a load-spreading base layer

In some situations, limited-width floating concrete rafts constructed directly onto the soil surface may be acceptable for both pedestrian (photo 29) and vehicular access (photo 30), but the design must not include any strip-dug supports. If concrete is poured directly, precautions must be taken to ensure that no toxic fluids can contaminate the adjacent soil. Alternatively, elevated paths supported on low impact frames or post supports allow a decking surface to cross sensitive areas (photos 31 and 32). Where paths are installed very close to trunks, provision must be made for distortion from future root growth by selecting flexible components for the supporting frame and surfacing (photo 33).

Photo 30: This temporary access for heavy construction traffic on the outer edge of a RPA is a concrete slab cast above ground level and will be removed when the project is completed.

Photo 31: Board walks supported on posts or a light frame are another way of providing pedestrian access across sensitive RPAs.

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Photo 32: New surfacing can be supported above the ground on posts leaving the soil surface beneath undisturbed.

Photo 33: Where surfacing is needed close to rapidly growing buttress roots, a light metal frame with rubberised surfacing will allow the path to distort without cracking as the roots grow.

17. Installing new surfacing on top of existing surfacing

In some instances, existing surfacing can be retained and used as a base for new surfacing. Normally, this will not result in significant excavation that could expose roots and so special precautions are not necessary. However, if large roots already protrude above the proposed sub-base level, then the precautions and procedures set out above must be observed. If the retained surfacing is impermeable, it may improve conditions for tree roots if it is punctured before the new surfacing is laid, but this is detail that should be agreed with the supervising arboriculturist.

18. Installation of new structures in precautionary areas

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.

19. 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 (photo 34). 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 (photo 35).

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Photo 34: These carports are formed by wooden posts above a three dimensional cellular no-dig and load-spreading surface of permeable crushed stone.

Photo 35: This deck supported above the ground on small posts provides a low-impact alternative to conventional stone patio surfacing in RPAs.

20. 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 (photos 36 and 37). The design should be sufficiently flexible to allow the piles to be relocated if significant roots are encountered in the preferred locations (photos 38 and 39). Before the actual installation of the new structure starts, any vulnerable RPA should be protected by temporary ground protection as set out in paragraph 6 above (one option shown in photo 39). 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 in paragraph 7 above or the pile location may have to be moved slightly (photo 38).

Once the piles have been installed, the ground protection is usually removed ready for the installation of the slab supporting the structure (photos 40 and 41). <u>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.</u> 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 (photo 42). 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 (photo 43).

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Photo 36: Small diameter piles (less than 150mm) are an effective means of supporting structures in RPAs with minimal disturbance.

Photo 37: It is possible to support very large structures on piles within sensitive RPAs without any significant adverse impact on tree roots.

Photo 38: 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).

Photo 39: 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.

Photo 40: 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.

Photo 41: 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.

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Photo 42: 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.

Photo 43: 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.

21. 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 in paragraph 7 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. Services

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 (photo 44). Where a hand-digging option is agreed (photo 45), any roots discovered during the excavations should be dealt with as

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set out in paragraph 7 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.

Photo 44: 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.

Photo 45: 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. Fuel and chemical storage

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 (photo 46).

Photo 46: Where fuel or other chemical are stored on site, it is now standard practice to have emergency spillage kits available to restrict the environmental impact of accidents.

Photo 47: Soil bunding or a supporting framework covered in heavy-duty plastic sheeting is essential where there is a risk of spillages contaminating RPAs.

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24. Cement mixing and vehicle washing points

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 (photo 47), must be used to contain accidental spillages.

Soft landscaping and new tree planting

25. Upgrading existing soft landscaping or replacing existing surfacing or structures with new soft landscaping

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 (photos 48 and 49).

Photo 48: 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.

Photo 49: 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.

26. New tree planting

Where new trees are proposed, the species, location and size will be explained within the text of the report and illustrated on the accompanying plan. Essential considerations on a tree-by-tree basis for the successful establishment and sustainability of new trees include:

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1 **Planting locations:** Illustrative locations are shown on the appropriate plans. The final location for each tree must be agreed with the supervising officer after consideration of the prevailing site conditions in the immediate vicinity.

2 **Site preparation:** All competing weed vegetation within 1m of the stem must be mechanically removed or chemically killed to leave a weed-free planting area.

3 **Tree quality:** New trees must be specifically checked before planting to confirm that they are healthy and free of structural defects.

4 **Planting pits:** All planting must be into good topsoil and the pits excavated to a size of at least 10cm beyond the maximum dimensions of the loose roots or root-ball. The bottoms and sides of pits should be forked and broken up for a distance of at least 10cm beyond the pit boundaries before planting. The larger the tree, the greater this broken-up area needs to be, which can be up to 50cm and more for the larger semi-mature trees.

5 **Drainage:** Planting pits must be free-draining to avoid prolonged waterlogging. This specifically applies to poorly draining soils such as clay, where breaking up the pit bottom and sides is essential for the new tree to survive.

6 **Planting depth:** Planting the roots too deeply can seriously damage and kill trees. They should be planted no deeper than the depth that they were growing in the nursery, i.e. the base of the stem where it meets the roots at the root collar, should be no deeper than the final ground level around the planting pit.

7 **Stabilising by staking and guying:** Most trees taller than 1.5m at planting are likely to need stabilising until new supporting roots have grown. For all trees up to semi-mature size, this should be in the form of short staking so that the tree is held 0.5–0.75m above ground level and no higher. For the larger semi-mature trees, either above ground guying of the stem with cables or securing the root-ball below ground is essential to allow new anchoring roots to develop.

8 **Protection:** Where there is a risk of browsing damage from animals, stems must be protected with individual guards or more substantial fenced protection, if appropriate.

9 **Mulching:** The area surrounding each new tree up to at least 1m from the stem must be covered with a 50mm depth of composted woodchip mulch. Cut grass must not be allowed to grow right up to the stem as it competes for water and nutrients, and predisposes the stem to mowing damage during maintenance.

10 **Watering:** All new trees must be watered in periods of dry and hot weather until they are established to be independent in the landscape. This must be for at least one year for smaller trees and could extend for up to four years for larger trees. All standard and larger trees must have a suitable means of ensuring that water reaches the deeper roots, usually in the form of a perforated pipe installed around the rootball at the time of planting.

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11 **Annual maintenance:** All newly planted trees must be inspected on an annual basis until they are successfully established. All failures must be replaced. Annual maintenance must include keeping the planting area weed-free and topping up the woodchip mulch.

12 **Tree size:** Nurseries can supply most species of tree at a variety of sizes, ranging from small whips less than a metre in height up to large semi-mature specimens up to 12m height and more from some specialist growers. Figure 50 provides a simple guide on the commonest forms and sizes, and photos 51 and 52 indicate the variety of trees available.

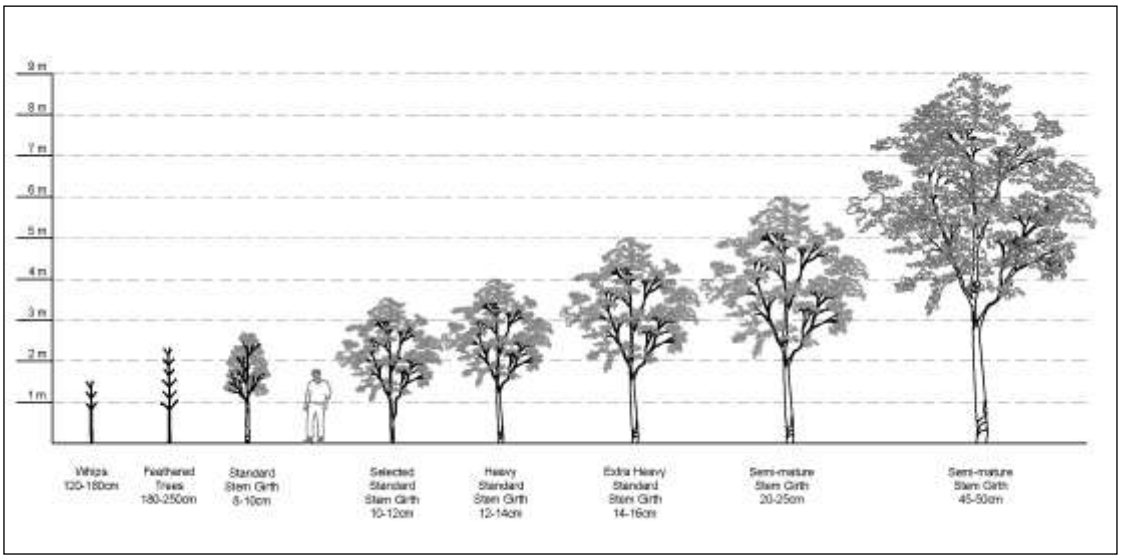

Figure 50: Summary of common conventions used by nurseries to describe tree types and sizes.

13 **Tree form:** Selecting the most appropriate tree for the location so that it does not out-grow the space available is important to avoid future inconvenience to occupiers. Specialist nurseries are able to supply a wide range of different forms (shape, size and proportion) and varieties with different aesthetic characteristics such as leaf shape, branching habit and foliage colour.

Photo 51: Hillier nurseries in Hampshire have a wide range of tree forms and species to provide instant effect in formal landscapes.

Photo 52: Barcham nurseries in Cambridgeshire specialise in supplying large trees for urban planting.

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The larger semi-mature trees over 4–5m in height and the more unusual forms and varieties can be supplied by specialist nurseries (try www.barcham.co.uk, www.hilliertrees.co.uk and www.civictrees.co.uk). Such trees must be planted by experienced landscape contractors for the best results.

27. Structural tree soil

Structural tree soil is a man-made growing medium for trees with a high proportion of angular stone, which provides support for surfacing above while still maintaining voids that roots can grow in. It allows surfacing to be installed close to trees and for roots to establish beneath, making it suitable for growing trees in parking areas (photos 53 and 54). It is generally installed to a depth of about 1m, and filled in layers of about 300mm that can be progressively compacted to provide sufficient bearing for the new surfacing, without compromising future root growth. It is sometimes call tree sand or Amsterdam tree soil, and an internet search on either of these names will identify local suppliers. Three commercial suppliers can be found at www.landtechsoils.co.uk, www.treesand.co.uk and www.woodlandhp.co.uk.

Photo 53: Structural tree soil retains sufficient structure for tree roots to grow, even when compacted.

Photo 54: It allows trees to be successfully established in areas of extensive hard surfacing, with very little, if any, loss of parking space

28. Silva Cells and root deflectors

It is possible to establish trees in fully paved areas using structural supports that protect the soil beneath the surface from being compacted. These are effectively large containers made of concrete or combinations of metal and plastic, which support the surface above and any loads it has to carry. They are filled with soil to provide a viable rooting environment for trees, allowing large trees to provide sustainable amenity in highly urbanised settings. Such systems also have the added advantage that they allow storage of rainwater, significantly reducing the rate of flow of water from paved areas during peak periods. One of the most widely used systems is the DeepRoot Silva Cell (www.deeproot.com) (photos 55–57), but other products are available.

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Photo 55: The individual Silva Cells can be assembled in layers and service ducting threaded through before filling with soil and fitting the reinforced tops.

Photo 56: Drainage from adjacent buildings can be directed into Silva Cells, significantly buffering rainwater runoff from urbanised areas.

New trees planted near surfacing can cause distortion damage from root growth if the appropriate precautions are not taken. Problems of this nature can be significantly reduced by installing root deflectors around the rootballs of new trees at the time of planting (photo 58). New roots growing out from the rootball meet the plastic profiled surface, deflecting them downwards, where they grow outwards at a lower level. Although they do eventually grow back near the surface, the onset of any damage is significantly delayed and it is usually far enough away from the trunk for remedial works to be carried out without seriously affecting the stability of the tree. However, these products are not suitable for all situations, especially on shallow soils, and so their use should always be considered very carefully in the context of individual site conditions. Try www.deeproot.com and www.greenleaftrees.co.uk, or internet search on 'root deflectors' for more information on products.

Photo 57: The finished surfacing is profiled to leave the tree pit open, ready to be filled with good quality topsoil and the new tree.

Photo 58: This excavated tree shows the root deflectors that were installed when it was planted seven years previously. The product has deflected roots downwards and prevented damage to the adjacent surfacing. Note that this is a permeable sandy soil and the roots were able to grow beneath the bottom of the deflectors.

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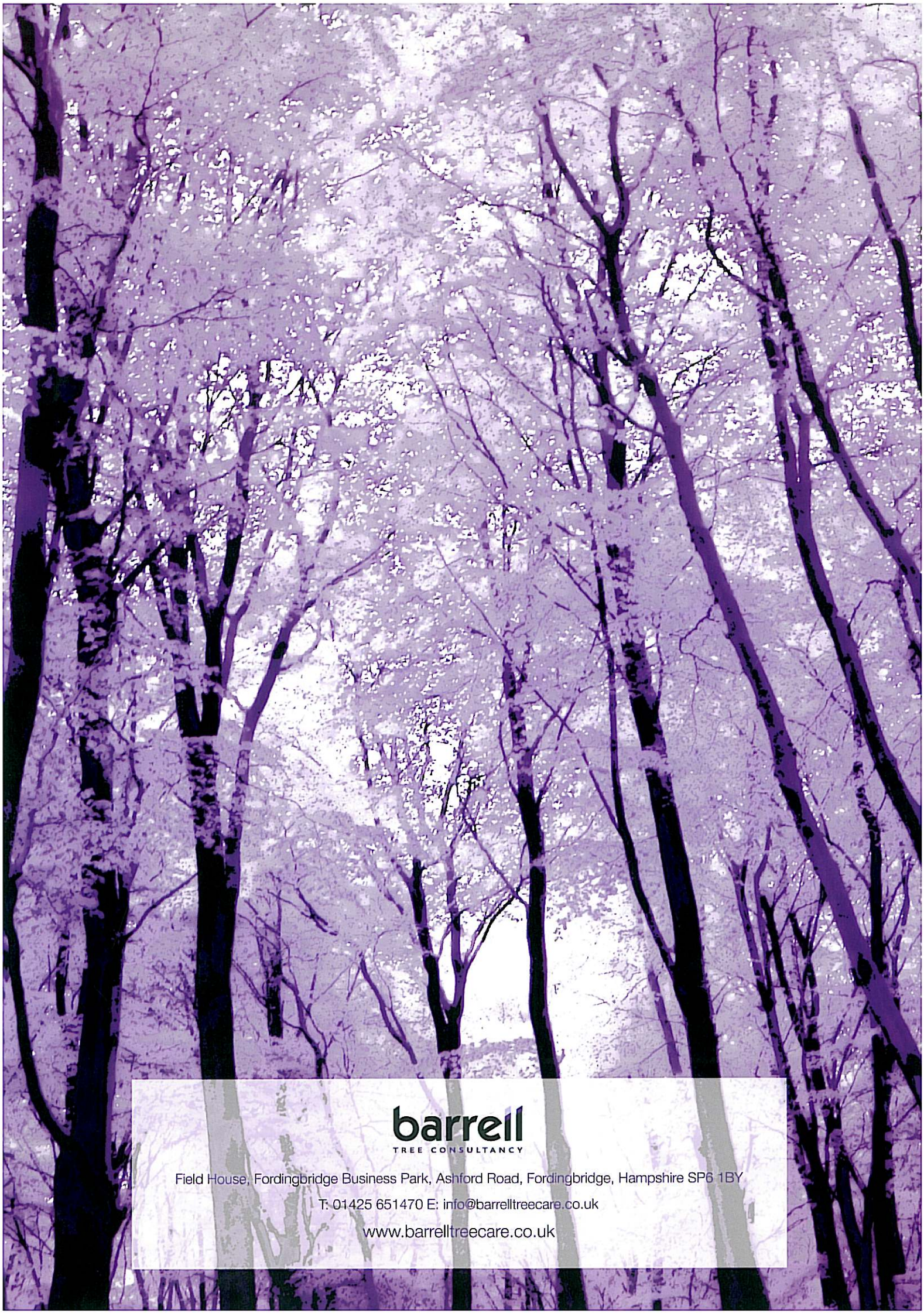

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