

FORMER
PLAYING FIELDS
STAKES ROAD
PURBROOK

ARBORICULTURAL
IMPACT
ASSESSMENT
&
METHOD
STATEMENT

ACD
ENVIRONMENTAL

Ecology
Archaeology
Arboriculture
Landscape Architecture



PERSIMMON

Together, we make a home

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1.0 Executive Summary

- 1.1. ACD was initially instructed, to carry out a tree survey, and present constraints details in accordance with BS5837:2012 *Trees in relation to design, demolition and construction*. This was to identify the quality and value of existing trees on site, allowing decisions to be made as to the retention or removal of trees during development. Subsequently, the subject layout has been produced and is in line with recommendations of the British Standard. Adequate protection can be provided to ensure all retained trees are protected throughout development.
- 1.2. A number of residential dwellings are proposed for this field site, the layout of which can be seen on the appended tree protection plan.
- 1.3. Trees to be removed are limited to low quality trees of little individual value. The protected lime trees are to be retained and there will be no impact on the off-site trees that are subject to a tree preservation order.
- 1.4. The relationship between the buildings and retained trees is sustainable and is not likely to result in any unreasonable 'pressure to prune' requests from future occupants.
- 1.5. The arboricultural method statement and tree protection plan include details of all tree protection measures required.
- 1.6. The fencing and any ground protection required must be erected after tree removals and surgery but before any demolition or construction contractor enter the site, and before any soil stripping takes place.
- 1.7. There will be no changes in levels, service routing, machine activity, storage of materials or site hut positioning within areas to be protected, and the protective fencing shall remain in position for the duration of the construction process.

2.0 Introduction

- 2.1. Persimmon instructed ACD Environmental in February 2016 to prepare the following impact assessment.
- 2.2. Following the recommendations of the British Standard¹, this report includes the necessary information to support a planning application. It demonstrates that the impact, both direct and indirect, of the proposed development within the site, has been assessed and where appropriate, mitigation and tree protection proposed.
- 2.3. The implementation of the protection methods recommended within this report are critical for ensuring the retained trees are successfully protected through the construction process and must be implemented prior to any work on site.
- 2.4. This assessment is based upon the supplied layout drawing, ref: 471 A-02-014-SL, rev A and site survey, ref: 11PP001, by Siteline, dated January 2015.
- 2.5. The controlling authority is Havant Borough Council, who can be contacted at: Civic Centre Road, Havant, Hampshire PO9 2AX, Tel: (023) 9247 4174.
- 2.6. This assessment considers the impact of the development on the constraints posed by the retained trees (both beneath ground: the root protection area (RPA), and above ground: the canopy).
- 2.7. Direct impact from development comes in six main forms: 1) Surface installation within RPAs, 2) Root loss from excavation for foundations, drainage and other utilities within RPAs, 3) Soil stripping, removal and level changes within RPAs, 4) Excessive access facilitation pruning to retained trees, 5) Soil compaction from storage and vehicle movements within RPAs, 6) Soil contamination.
- 2.8. Indirect impact can come from changes to the site hydrology, future pressure to prune or fell, failure of trees exposed by removal of neighbouring trees, and other environmental changes which can take several years to manifest.

¹ BS5837:2012 *Trees in relation to design, demolition and construction- Recommendations*, London: British Standards Institute

2.9. The RPA for each tree represents a minimum area in m² that should be left undisturbed around each retained tree. This is initially represented by a circle but is often adjusted to account for constraints to root growth within the site (primarily highways and buildings). It is therefore important to ensure the protection of trees both above and below ground. Recommendations are provided in the British Standard as to the protection of existing trees before, during and after development. This is achieved by ensuring the tree protection plan and arboricultural method statement are implemented before any commencement on site.

3.0 Arboricultural Impact Assessment

3.1. Overview of proposed development

3.1.1. A number of residential dwellings are proposed on this field site, the layout of which can be seen on the appended plan.

3.2. Tree Preservation Orders

3.2.1. The two lime trees (T26 & T27) are protected under TPO 2018, and the off-site wellingtonia (T19) and hemlock (T6) are included within TPO 1447.

3.3. Previous planning applications and consents

3.3.1. There are no relevant past applications or extant planning consents for this site.

3.4. Trees proposed for removal & surgery

3.4.1. The trees proposed for removal can be seen on the appended plan and include 12 in total. One of these is from within the category B group G1. However, it is of lesser individual value and its removal will not result in significant detriment to the character of the area. All other trees are category C (low quality) or U (unsuitable for retention).

3.4.2. A section of the frontage hedge (G2) is to be removed to facilitate the formation of the new site access and drive to plot 26.

3.4.3. In relation to the conception and design of development proposals, BS5837:2012 section 5.1.1 states: The constraints imposed by trees, both above and below ground should inform the site layout design, although it is recognised that the competing needs of development mean that trees are only one factor requiring consideration. Certain trees are of such importance and sensitivity as to be major constraints on development or to justify its substantial modification. However, care should be taken to avoid misplaced tree retention; attempts to retain too many or unsuitable trees on a site can result in excessive pressure on the trees during demolition or construction work, or post-completion demands for their removal.

3.4.4. It is therefore deemed acceptable to remove the trees listed and, as part of the detailed landscape design for the scheme, include suitable and sustainable replacements as and where appropriate. This will more than mitigate any loss that may be felt from tree removals, by providing robust long-term tree cover in keeping with the proposal and surrounding properties.

3.4.5. Following the preliminary recommendations made at the time of the survey and works necessary to facilitate construction of the proposed development, tree works are recommended and listed in the method statement. This work includes:

- 1) Cutting back of some crowns over site
- 2) Crown lifting to allow construction

3.5. Demolition, site clearance & archaeology

3.5.1. To ensure damage does not occur to trees highlighted for retention, tree protection fencing must be erected before ANY plant/vehicles entering site whatsoever. This should be subject to a pre-commencement site meeting between the developer, their project arboriculturist and a representative from the Local Authority.

3.5.2. No special demolition procedures need be observed on this site, other than respecting the tree protection fencing.

3.6. Construction within RPAs

3.6.1. The construction of all houses is proposed outside the RPAs of retained trees.

3.6.2. The construction of the garages for plot 17 encroaches slightly into the RPA of the adjacent wellingtonia (T19). This encroachment is considered marginal (<4% of the advised 547m² RPA) and will not be to the detriment of the tree. Therefore, special construction measures or adjustment of the plans are NOT required.

3.7. Access and working room within RPAs

3.7.1. To build the garage for plot 17, space is required for scaffold erection and working room within the RPA of T19. Following the recommendations of 6.2.3 of the British Standard, ground protection can be employed to retain the underlying soil structure and avoid detriment to roots. However, given the operational issues with implementing ground protection, an alternative solution is proposed, in that the protection area is extended contiguous to the RPA². This can be seen on the appended TPP. We are comfortable with this approach and that it will not be deleterious to the health of the tree. Nonetheless, should the council wish to see the installation of ground protection, this can be enforced by a suitably worded planning condition.

3.8. Permanent hard surfaces within RPAs

3.8.1. In section 7.4 of the British Standard, permanent hard surfacing within the RPAs of retained trees is addressed, and recommendations made.

3.8.2. In the case of T23, the parking bays for plot 18 pass through its notional circular RPA. The British Standard advises that a no-dig approach can be adopted limiting the impact on RPAs. However, as with the ground protection for plot 17/T19 an alternative solution is proposed, in that the protection areas is extended

² Section 5.3a). *BS5837:2012 Trees in relation to design, demolition and construction- Recommendations*, London: British Standards Institute.

contiguous to the RPA³. We are comfortable with this approach and that it will not be deleterious to the health of the tree. Nonetheless, should the council wish to see the installation of a no-dig surface, this can be enforced by a suitably worded planning condition.

3.8.3. The vehicular surface to the front of plot 25 passes within the RPA of the frontage hedge. However, the encroachment is small and the hedge young and vigorous. Therefore, as it is not likely to result in significant detriment to the hedge a no-dig surface is not proposed.

3.9. Protection fencing

3.9.1. Figure 2 of the British Standard recommends a standard fencing design for tree protection. This is a weld mesh panel design, mounted upon a well-braced scaffold framework. This is perfectly adequate for this site and all the retained trees can be suitably protected by its erection before any works start on site whatsoever.

3.10. Shade and future pressure to prune

3.10.1. ACD have worked with the design team from the start of this project and we feel that the resulting proposed layout is both sustainable and results in juxtapositions between trees and buildings which will not bring future requests for excessive pruning and/or tree removal.

3.11. Services

3.11.1. Full details of the service and utility provisions for the site remain to be finalised. However, there is adequate space for utility trenches to access the site whilst avoiding RPAs and exclusion zones.

³ Section 5.3a). *BS5837:2012 Trees in relation to design, demolition and construction- Recommendations*, London: British Standards Institute.

4.0 Arboricultural Method Statement

TO BE READ IN CONJUNCTION WITH THE APPENDED TREE PROTECTION PLAN REF: PERSC19831-03

4.1. Phasing of operations & site supervision

4.1.1. The tree protection and other arboricultural works must be carried out in the following order:

Phase	Operation	Present	Notes
1	Tree removals & surgery	Tree contractor	See Tree Protection Plan for trees to be removed
2	Protection barriers erected	Fencing contractor	See Tree Protection Plan for position and type of barriers
3	Pre-start meeting	ACD, site manager, groundwork, foreman, demolition foreman	To 'sign-off' protection prior to any plant activity, demolition & groundworks on site
4	Removal of protection barriers and landscape work	ACD, landscape contractor, site manager	See method statement

4.1.2. Supervision is required should any unplanned access and/or work be required in the construction exclusion zone.

4.1.3. Supervision will require the arboriculturist to be present throughout the task, to ensure all the arboricultural objectives are met. If the task is to take a long period of time, provided the arboriculturist is satisfied, and after an initial 'tool-box talk', the supervision may be reduced to telephone contact between the site foreman/contractor and arboriculturist.

4.2. Construction exclusions zone

4.2.1. Barriers and/or ground protection must be used to protect all retained trees before any machinery or materials are brought onto the site, and before any demolition, development or stripping of soil commences.

4.2.2. Where all activity can be excluded from the RPA, vertical barriers must be erected to create the construction exclusion zone (CEZ). The default position of which is shown on the appended Tree Protection Plan.

4.2.3. Where, due to site constraints, construction activity cannot be fully or permanently excluded from all, or part of a tree's RPA, appropriate ground protection can be installed.

4.2.4. It is the responsibility of everyone engaged in the construction process to respect the tree protection measures and observe the necessary precautions within and adjacent to them.

4.2.5. Inside the exclusion zone, the following shall apply:

- No mechanical excavation whatsoever.
- No excavation by any other means without arboricultural site supervision.
- No hand digging without a written method statement having first been approved by the project arboriculturist.
- No lowering of levels for any purpose (except removal of grass sward using hand tools).
- No storage of plant or materials.
- No storage or handling of any chemical including cement washings.
- No vehicular access.
- No fire lighting.

4.2.6. In addition to the above, further precautions are necessary adjacent to trees:

- No substances injurious to tree health, including fuels, oil, bitumen, cement (including cement washings), builders sand, concrete mixing and other chemicals shall be stored or used within or directly adjacent to the protection area of retained trees.
- No fire shall be lit such that flames come within 5m of tree foliage.

4.3. Tree protection barriers

4.3.1. The construction exclusion zone will be protected as per the appended tree protection plan that shows the default alignment of the tree protection barriers, to be installed prior to any of the following taking place:

- Archaeology
- Demolition
- Plant and material delivery
- Soil stripping
- Utility installation
- Construction works
- Landscaping

4.3.2. Stages for installation of barriers:

- 1) Hand clearance of any vegetation to allow clear working access.
- 2) Setting out of node points
- 3) Barriers erected
- 4) Site meeting with project arboriculturist to 'sign-off' tree protection fencing.
- 5) Site accessible to demolition/construction traffic

4.3.3. Once erected, all barriers will be regarded as sacrosanct, and will not be removed or altered without prior recommendation by the project arboriculturist and approval of the local planning authority.

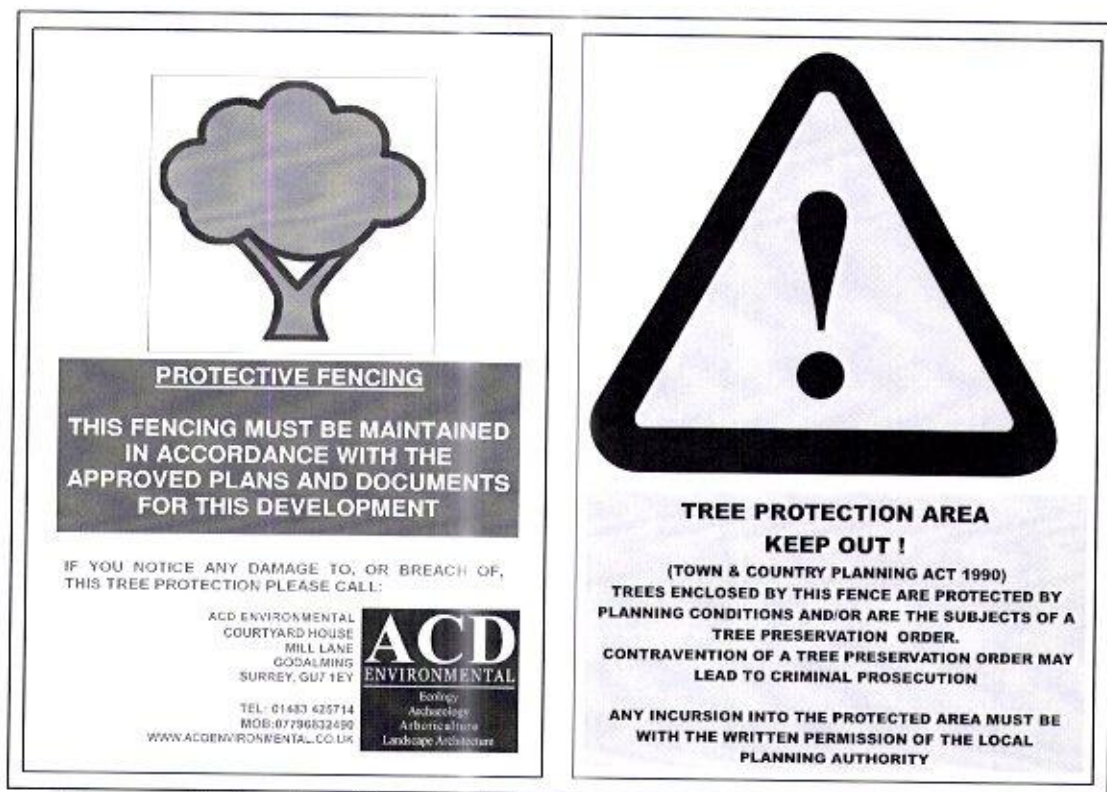
4.3.4. The default barrier construction is suitable for areas of high intensity development, and shall comprise of interlocking weld-mesh panels, well braced to

resist impacts by attachment to a scaffold framework that is set firmly into the ground. A detailed specification can be found on the TPP.

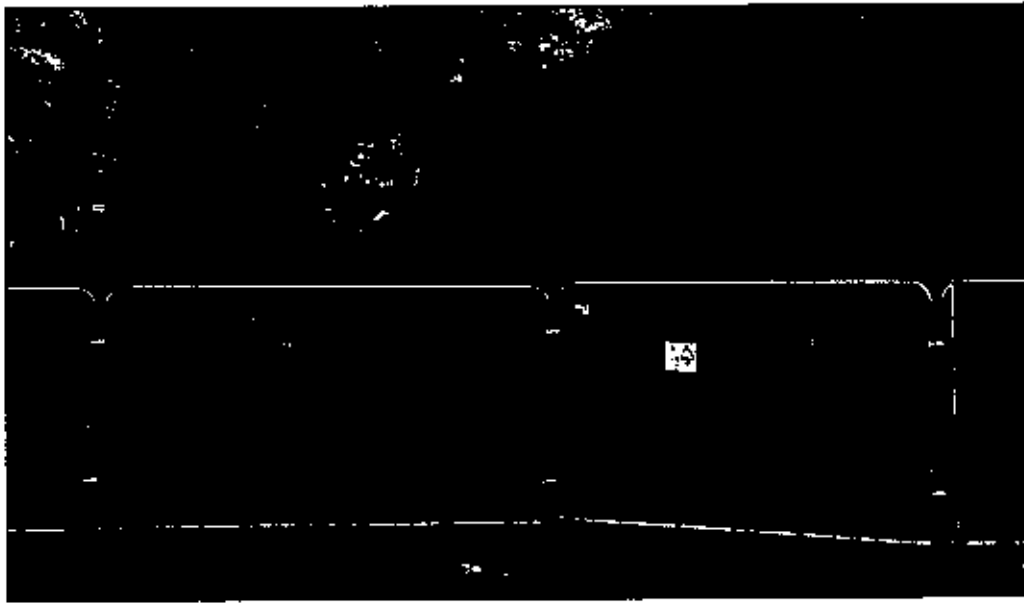
4.3.5. The images below are alternative barrier designs that have been successfully used on site and that ACD are happy to support if a variation from the default style is required. If such a variation is necessary, the approval of the project arboriculturist will be obtained prior to any implementation on site.

4.3.6. Once barriers and/or ground protection have protected the exclusion zone, construction work can commence.

4.3.7. All weather notices should be erected on the barriers (for example see figure below).



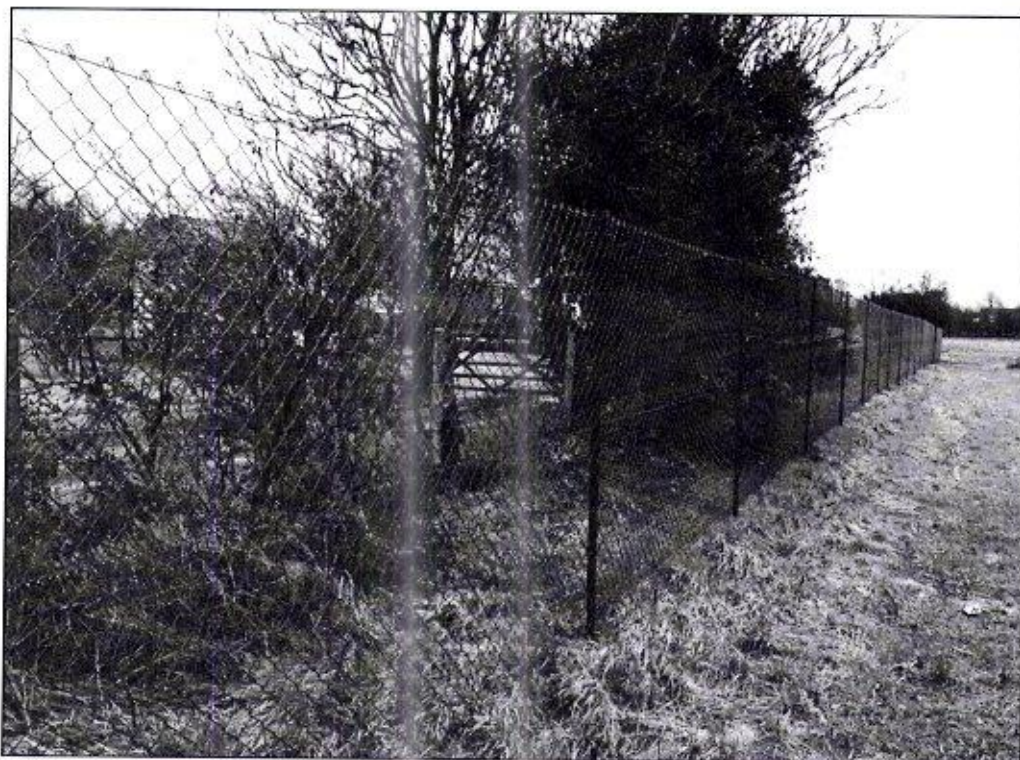
Tree protection sign (download from <http://www.acdenvironmental.co.uk>)



Weld-mesh panels on scaffold uprights



Weld-mesh panels on wooden posts



Chain-link on angle-iron uprights

4.4. Ground protection

4.4.1. If required, ground protection is to be installed as follows. It must be capable of supporting the expected loads and avoiding rutting, compaction and damage to the soil: as advised in section 6.2.3 of the British Standard.

4.4.2. Stages for ground protection installation:

- 1) No plant machinery to be used in the area of ground protection for whatever reason
- 2) Dismantle primary TPF and re-erect in secondary location as shown on TPP (if required) OR erect fencing to protect any newly exposed CEZ not to be covered by ground protection.
- 3) Any shrubs, saplings or trees to be removed, are to be cut, or ground out to just below ground level rather than grubbed or winched out, which can damage roots of retained trees.
- 4) Lay woven geotextile over existing ground surface by hand
- 5) Cover the area with compressible layer, woodchip for example, using hand tools only
- 6) Cover compressible layer with side butting scaffold boards or plywood boards
- 7) Confirm surface is acceptable for use with project arboriculturist
- 8) Area ready for construction access

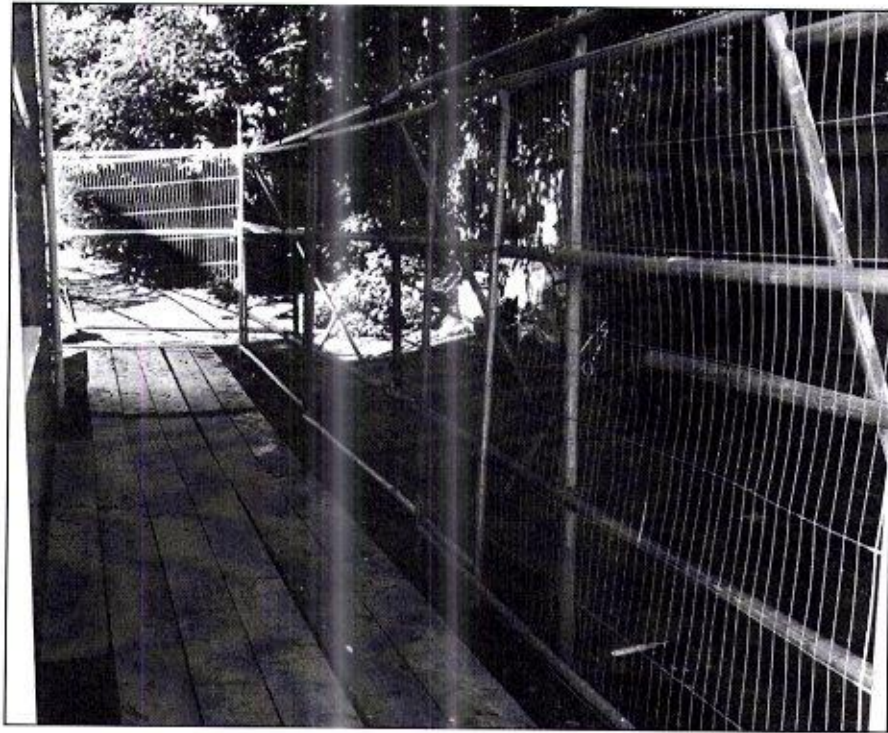
4.4.3. Any scaffolding required within the area will be erected with the uprights placed on spreader boards.

4.4.4. The boarding will be left in place until the construction works are finished.

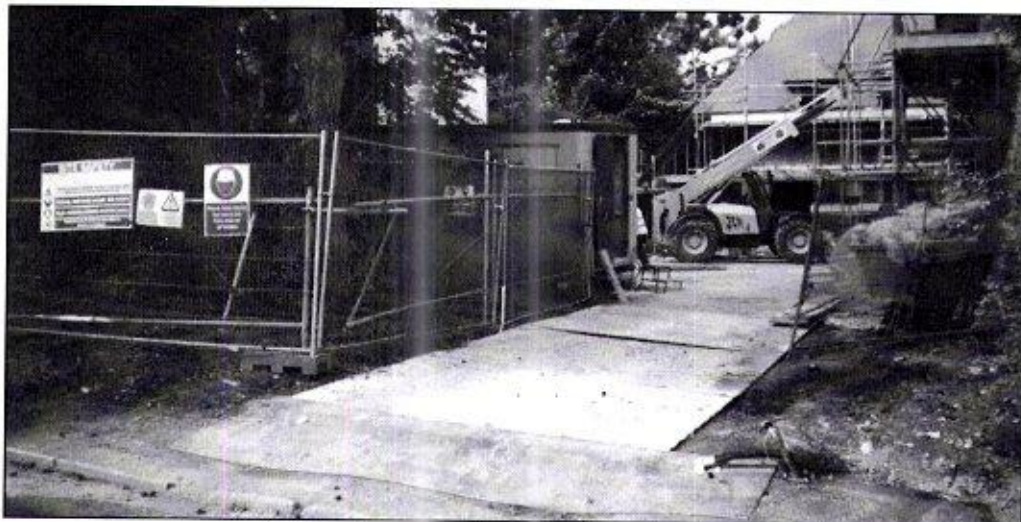
4.4.5. A single thickness of boarding laid on the soil surface will provide sufficient protection for pedestrian loads. However, for wheeled or tracked construction traffic movements within the RPA, ground protection will involve the use of temporary cellular confinement systems, reinforced concrete slabs or track-board systems details of which are to be specified by the project engineer and approved for use by the project arboriculturist and local authority before construction commences.

4.4.6. Track-boards can be sourced from Trakmats Europe Ltd, 0845 6435388, www.trakmatseurope.com, or groundguards.com

4.4.7. There is to be no-excavation within ground protection area whatsoever. This includes installation of services and associated utilities.



Scaffold board pedestrian ground protection



Vehicular ground protection trackway

4.5. Site storage, parking, welfare facilities, etc.

4.5.1. The site will require provision for; site storage, contractor parking, welfare facilities, temporary services/drainage, material drop off points, etc.

4.5.2. It is acceptable to place site cabins and walkways within the CEZ provided they are installed sensitively:

- Cabins must be placed on sleepers (or similar) to spread the load, avoiding point loading and associated soil compaction.
- The delivery of cabins should ensure that any unloading via 'hi-ab' crane can be carried out without impact on the crowns of retained trees.
- Walkways, if required, should be installed as per the ground protection specification.
- Any utilities for site compounds must be run above ground. For example, WC foul pipes/drainage and temporary electrical connections.

4.5.3. It is imperative that if cabins and walkways are installed, that fencing is erected to limit access to the protected areas. If amendments are made, the project arboriculturist should sign off the proposals prior to their implementation.

4.5.4. Contractor parking and storage areas should be sited outside the CEZ.

4.6. Tree surgery and removal

4.6.1. The following surgery works are to be carried out:

- 1) G2 hedge: Remove sections as shown and cut back over site as required/to formalise and tidy.
- 2) T23 lime: Crown lift over plot 18 parking to give 34m clearance.
- 3) T13 sycamore: reduce crown spread over site to retain at least 6.5m radius.
- 4) T10 hawthorn: reduce crown spread over site to retain at least 5m radius.
- 5) G1 sycamore: reduce crown spread over site to retain at least 4.5m radius only to 1No. tree within group as shown on plan.
- 6) Crown lift trees on north boundary to give 2.5m clearance over gardens where required.

4.6.2. All trees to be removed are indicated on the TPP.

4.6.3. If any further surgery work is proposed, details will be submitted to, and approved by, the council, before being carried out.

4.6.4. All work will be carried out in accordance with BS3998⁴ industry best practice and in line with any works already agreed with the council.

4.6.5. The tree surgeon shall ideally be chosen from The Arboricultural Association's Approved Contractor list. All work shall be undertaken at the appropriate time and with the consent and approval of the site agent.

4.6.6. The statutory protection^{5 6} will be adhered to. If further advice is required, particularly if bats are discovered during tree work, it will be obtained from Natural England or other competent persons and recommendations adhered to.

⁴ BS3998:2010- *Recommendations for Tree Work*. London: British Standards Institute

⁵ *Wildlife and Countryside Act*. (1981) London: HMSO.

⁶ *Countryside and Rights of Way Act*. (2000) London: HMSO.

4.6.7. The stumps of any trees removed from within the Construction Exclusion Zone or the RPAs of retained trees will be either cut flush to ground level and left in situ or ground out using a stump grinder. They will not be winched out.

4.6.8. All operations shall be carefully carried out to avoid damage to the trees being treated or neighbouring trees. No trees to be retained shall be used for anchorage or winching purposes.

4.7. Soft landscaping

4.7.1. All landscaping and associated ground preparation within exclusion zones will be carried out sensitively to ensure root damage is minimised as much as is practicable.

4.7.2. At no time is any heavy plant to be used within any protected area.

4.7.3. Removal of existing vegetation (including turf) will be carried out with hand tools only.

4.7.4. Should the soil be compacted or have a poor structure that may hinder the development of any new planting, soil decompaction techniques may be used upon consultation with the project arboriculturist.

4.7.5. Tree protection barriers may be removed to allow access and then replaced as required/per approved documents (in liaison with the arboricultural clerk of works)

4.7.6. Levels (high spots) will not be reduced or excavated in any way. Use good quality top-soil to level any low-lying areas and hollows, and provide a fine tilth to lay turf on. This imported soil must not result in a level increase of more than 100mm in any area.

4.7.7. Import materials by hand in wheelbarrow or using a digger sited outside the sensitive area.

4.7.8. Any excavation for planting pits must be dug using hand tools only.

4.7.9. No works will be carried out within any protected areas if the soil moisture is of a level likely to allow compaction to occur.

4.8. Installation of underground services

4.8.1. Mechanical trenching for the installation of underground apparatus and drainage severs any roots present and can change the local soil hydrology in a way that adversely affects the health of the tree. For this reason, particular care should be taken in the routing and methods of installation of all underground apparatus. Wherever possible, apparatus should be routed outside RPAs. Where this is not possible, it is preferable to keep apparatus together in common ducts. Inspection chambers should be sited outside the RPA.

4.8.2. Where underground apparatus is to pass within the RPA, detailed plans showing the proposed routeing should be drawn up in conjunction with the project arboriculturist. In such cases, trenchless insertion methods should be used: Microtunnelling, Surface-launched directional drilling, Pipe ramming or Impact moling (see BS5837:2012 Table 3), with entry and retrieval pits being sited outside the RPA. Provided that roots can be retained and protected, excavation using hand-held tools might be acceptable for shallow service runs. If this is the case, the following methodology must be followed:

4.8.3. Stages for installing services by hand within tree protection areas:

No plant machinery to be used in the area for whatever reason

- 1) Contact project arboriculturist to hold pre-start site meeting and 'toolbox' talk before starting work.
- 2) Remove just enough tree protection fencing to allow access to area and facilitate trenching.
- 3) Remove any surface vegetation or existing hard surfaces using hand tools.
- 4) Using an air-pick excavate the trench, keeping to minimum dimensions required.

- 5) Roots occurring in clumps of 25 mm diameter and over are encountered they will be retained, and kept damp by covering with hessian (re-wetted as required). If required, these should be severed only following consultation with an arboriculturist; as such roots might be essential to the tree's health and stability.
- 6) Feed in services.
- 7) Back fill trench with 200-300mm depth of excavated soil, or a mixture of excavated and imported top-soil to BS3882 (BSI, 2007), firming down with heels.
- 8) Repeat step 7 until trench is filled.
- 9) Re-erect tree protection fencing as per approved plan.

4.8.4. The method of excavation above, for trenching within RPAs, is using air excavation. This tool utilises compressed air to remove soil from around tree roots causing minimal damage and can be run off a typical site compressor. ACD can provide details of contractors supplying air excavation services if required.

4.8.5. Alternatively, trenchless technology, such as thrust boring can be used in some instances and is particularly effective as it can pass directly under the tree, at a depth which is likely to avoid almost all impact on roots of the subject tree. As no access/thrust pits will be located within the RPAs of the subject trees, the need for arboricultural supervision is limited.

4.8.6. Reference can be made to NJUG Vol 4⁷ for guidance, but any approach must be approved by the project arboriculturist and brought to the attention of the local authority tree officer.

⁷ National Joint Utilities Group. (2010). *Volume 4: NJUG Guidelines For The Planning, Installation And Maintenance Of Utility Apparatus In Proximity To Trees (Issue 2) – Operatives Handbook*. NJUG.

4.9. Installation of boundary fencing within protected areas

4.9.1. Stages for installing wooden fence posts:

No plant machinery to be used in the area for whatever reason

- 1) Contact project arboriculturist to hold pre-start site meeting and 'toolbox' talk before starting work.
- 2) Remove TPF to allow access to area.
- 3) Dig postholes using hand tools, avoiding damage to the protective bark covering larger roots. Roots smaller than 25mm diameter may be pruned back using either secateurs or a hand saw, leaving a clean cut.
- 4) Damage or severance of roots above 25mm diameter must be avoided. If roots of this size are discovered, the hole should be relocated. If there are a large number of such roots it may be necessary to relocate the hole by half a fence panels length and adjust the fence panels accordingly.
- 5) Line hole with non-porous lining, for example durable polythene bag.
- 6) Insert post and fill post-hole with concrete to just below ground level.
- 7) Trim polythene to ground level and fill with clean topsoil.

Mark Welby Tech Cert (ArborA), Dip Arb (RFS), FArborA
Director & principal arboriculturist
10 February 2016



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Appendix: Tree Protection Plan

PERSC19831-03

4. For corporations, CFCs could consist of plans, investments and storage of offshore income production assets.
5. Trusting income CFCs—CFCs that merely give either the taxpayer or a trust the income of the trust. 2000s are "taxable savings" CFCs. The underlying funds have the same storage or investment characteristics and are creating no real value.
6. Trusting or borrowing funds—CFCs that are set up to increase income tax compared to what would pay for the U.S. Government bonds and interest (CFCs creating leverage to the trust).

Black and French describe both removal and taxable savings, and allow donors and taxpayers to make the following:

The impact of any of the above can thus prove to achieve some of the

Endre Jónsson, a member of the Icelandic parliament, says the bill is a "symbolic

Information is available at www.fda.gov/cder/rdmt/rdmt.htm. The FDA is developing a new regulatory approach for drugs that are "highly innovative, first-in-class, and have the potential to address unmet medical needs." The new approach is called "Breakthrough Therapy." The FDA is currently reviewing several drugs that are being developed under this approach. The FDA is also developing a new regulatory approach for drugs that are "highly innovative, first-in-class, and have the potential to address unmet medical needs." The new approach is called "Breakthrough Therapy." The FDA is currently reviewing several drugs that are being developed under this approach.

Full-text available for research purposes only

☐ I already have a name suggestion.



1. *Chlorophyll* is the green pigment in plants that captures light energy.
 2. *Photosynthesis* is the process by which plants use light energy to produce glucose and oxygen.
 3. *Glucose* is a simple sugar that provides energy for plants.
 4. *Oxygen* is a gas that is released by plants during photosynthesis.
 5. *Light energy* is the energy from the sun that drives the process of photosynthesis.
 6. *Carbon dioxide* is a gas that is taken up by plants during photosynthesis.
 7. *Water* is a liquid that is taken up by plants during photosynthesis.
 8. *Stomata* are small openings on the surface of leaves that allow carbon dioxide to enter and oxygen to exit.
 9. *Chloroplasts* are organelles in plant cells where photosynthesis takes place.
 10. *Thylakoids* are membrane-bound structures within chloroplasts where the light-dependent reactions of photosynthesis occur.
 11. *Stroma* is the fluid-filled space within the chloroplast where the Calvin cycle takes place.
 12. *Electron transport chain* is a series of reactions in the thylakoid membrane that transfer electrons and pump protons.
 13. *Proton gradient* is the difference in proton concentration across the thylakoid membrane that drives ATP synthesis.
 14. *ATP synthase* is an enzyme that uses the proton gradient to synthesize ATP.
 15. *Calvin cycle* is a series of reactions in the stroma that use ATP and NADPH to fix carbon dioxide into glucose.
 16. *Carbon fixation* is the first step of the Calvin cycle where carbon dioxide is combined with a five-carbon sugar.
 17. *Three-carbon sugar* is the product of carbon fixation, which can be used for glucose or other organic molecules.
 18. *Regulation of photosynthesis* involves various factors such as light intensity, temperature, and the availability of carbon dioxide and water.
 19. *Limiting factor* is a factor that restricts the rate of photosynthesis, such as light or carbon dioxide.
 20. *Photorespiration* is a wasteful process that occurs when the enzyme RuBisCO reacts oxygen instead of carbon dioxide.
 21. *C₃ pathway* is the most common pathway for photosynthesis, where the first stable product is a three-carbon compound.
 22. *C₄ pathway* is an alternative pathway for photosynthesis, where the first stable product is a four-carbon compound.
 23. *Kranz anatomy* is a specialized leaf structure found in C₄ plants that facilitates the C₄ cycle.
 24. *Bundle sheath cells* are cells surrounding the vascular bundles in C₄ plants that play a role in carbon fixation.
 25. *Epidermal cells* are the outermost cells of the leaf that protect the internal tissues.
 26. *Mesophyll cells* are the cells in the middle of the leaf where most photosynthesis occurs.
 27. *Guard cells* are cells that surround the stomata and control their opening and closing.
 28. *Transpiration* is the process by which water is lost from the leaf through the stomata.
 29. *Water potential* is a measure of the potential energy of water, which determines the direction of water movement.
 30. *Root pressure* is the pressure exerted by water in the roots that can push it up the xylem.
 31. *Xylem* is the tissue in the vascular system that transports water and minerals from the roots to the leaves.
 32. *Phloem* is the tissue in the vascular system that transports organic nutrients from the leaves to other parts of the plant.
 33. *Vascular bundle* is a cluster of xylem and phloem tissues that transport water and nutrients.
 34. *Plasmodesma* is a channel between adjacent plant cells that allows for the exchange of water and small molecules.
 35. *Cell wall* is the rigid outer layer of a plant cell that provides structural support.
 36. *Central vacuole* is a large, fluid-filled organelle in plant cells that maintains turgor pressure.
 37. *Turgor pressure* is the pressure exerted by water inside the cell against the cell wall.
 38. *Plasmolysis* is the process by which a plant cell loses water and shrinks.
 39. *Guttation* is the process by which water is exuded from the leaves through specialized structures called hydathodes.
 40. *Hydathodes* are specialized structures at the tips of leaves that allow for the exudation of water.
 41. *Stomatal conductance* is a measure of the rate at which water vapor and gases pass through the stomata.
 42. *Transpiration rate* is the rate at which water is lost from the leaf through the stomata.
 43. *Relative humidity* is the ratio of the current water vapor pressure to the saturation vapor pressure at a given temperature.
 44. *Wind speed* is the speed at which air is moving, which affects the rate of transpiration.
 45. *Temperature* is a measure of the average kinetic energy of the particles in a substance, which affects the rate of transpiration.
 46. *Light intensity* is the amount of light energy falling on a surface, which affects the rate of photosynthesis and transpiration.
 47. *Carbon dioxide concentration* is the amount of carbon dioxide in the air, which affects the rate of photosynthesis.
 48. *Water potential gradient* is the difference in water potential between two points, which determines the direction of water movement.
 49. *Root hair cells* are specialized cells in the roots that increase the surface area for water and mineral absorption.
 50. *Endodermis* is the innermost layer of cells in the root cortex that surrounds the vascular cylinder.
 51. *Pericycle* is the layer of cells just inside the endodermis that gives rise to the vascular tissues.
 52. *Xylem vessels* are large, open tubes in the xylem that transport water and minerals.
 53. *Xylem tracheids* are smaller, tapered cells in the xylem that transport water and minerals.
 54. *Phloem sieve tubes* are specialized cells in the phloem that transport organic nutrients.
 55. *Companion cells* are cells that are closely associated with phloem sieve tubes and help in the transport of nutrients.
 56. *Phloem parenchyma* are cells in the phloem that store and transport nutrients.
 57. *Phloem fibers* are thick-walled cells in the phloem that provide structural support.
 58. *Angiosperms* are flowering plants that have seeds enclosed in a fruit.
 59. *Gymnosperms* are non-flowering plants that have seeds that are not enclosed in a fruit.
 60. *Monocots* are a group of angiosperms that have one cotyledon and scattered vascular bundles.
 61. *Eudicots* are a group of angiosperms that have two cotyledons and vascular bundles arranged in a ring.
 62. *Gymnosperms* are a group of non-flowering plants that have seeds that are not enclosed in a fruit.
 63. *Conifers* are a group of gymnosperms that have needle-like leaves and produce cones.
 64. *Cycads* are a group of gymnosperms that have large, woody trunks and produce cones.
 65. *Ginkgo* is a living fossil gymnosperm that has a unique fan-shaped leaf shape.
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 119.

[illegible]

Abstract The authors have been unable to locate any other studies that have examined the effect of a 100% alcohol solution on the survival of *Salmonella* spp. on a surface. The authors have been unable to locate any other studies that have examined the effect of a 100% alcohol solution on the survival of *Salmonella* spp. on a surface.

For greater accuracy, construct table $\tau_{\text{table}} = \{\tau_{\text{table}}[i][j]\}$ using all possible values of i and j . Initial table entry should be negative, as engineering approximation $\tau_{\text{table}}[0][0]$ will give false idea of τ corresponding to $\tau_{\text{table}}[0][0]$.

Diagram illustrating the removal of a side from a square. A square is shown with a dashed line indicating the side to be removed, labeled "SIDE TO BE REMOVED".

[illegible]

☐ **IF YOU REQUEST IT**
☐ **YOU CAN PROTECT YOUR COMPANY FROM FUTURE RISK**

NOTES ON CONTRIBUTORS

1. No treatment in the first 48 hours
 2. No treatment in the first 72 hours
 3. No treatment in the first 96 hours
 4. No treatment in the first 120 hours

- the resulting theory is appropriate for the needs of the business and the world
- the resulting plan is realistic
- the resulting strategy is a balanced, holistic, and/or emerging
- the resulting plan is

1. In addition to having to present evidence that the defendant's possession of the stolen property was not innocent, the state must also prove that the defendant knew the property was stolen at the time of the offense.

* The first three items are taken from the original scale by Levenson et al. (1980).

Source	Parameter	Value	Notes
1	Water resources of country	0.000000	Not taken into account. No water in the country.
2	Population density of region	0.000000	Not taken into account. No population in the region.
3	Climate	0.000000	Not taken into account. No climate in the region.
4	Topography	0.000000	Not taken into account. No topography in the region.
5	Vegetation	0.000000	Not taken into account. No vegetation in the region.
6	Soil	0.000000	Not taken into account. No soil in the region.
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10	Topography	0.000000	Not taken into account. No topography in the region.
11	Vegetation	0.000000	Not taken into account. No vegetation in the region.
12	Soil	0.000000	Not taken into account. No soil in the region.

The original of this drawing was prepared in color. A reproduction copy should not be used.

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Address: Former Playing Fields
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Client: Persimmon Homes

Siting: Tree Protected or Flat
date: February 2018

Scale: 1:25000

Project: P88267/001/23

Images: NW, SW, SE, E, S, W, N



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