Arboricultural Survey & Report

Client: Richie O'Farrell

Site: Lynnbrook, Whitechurch Rd, Rathfarnham, Dublin 16

Prepared by:

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SUMMARY

Dermot Casey Tree Care was requested by Richie O Farrell to undertake a pre-development Arboricultural survey and report to support the proposed planning application at Lynnbrook, Whitechurch Rd., Rathfarnham, Dublin 16.

The trees within the footprint of the site and within proximity to the proposed development were assessed independently.

The information contained within this report is in accordance with British Standard *BS 5837: 2012 Trees in relation to Design, Demolition and Construction – Recommendations* and provides information on the protection of the trees during the development phase.

The report should be read in conjunction with the drawings provided indicating the tree locations and their protection zones.

The report will provide guidance in regard to the constraints the trees may place on the development and arboricutural factors to be considered during the construction works of the proposed development

The report contains an Arboricultural Impact Assessment and an Arboricultural Method Statement that details the protection needed for trees to be retained during the development phase.

21 individual trees and 3 groups of trees were assessed as part of this report in accordance with BS 5837.

Contents

1.0 INTRODUCTION

1.1 SCOPE OF THE REPORT

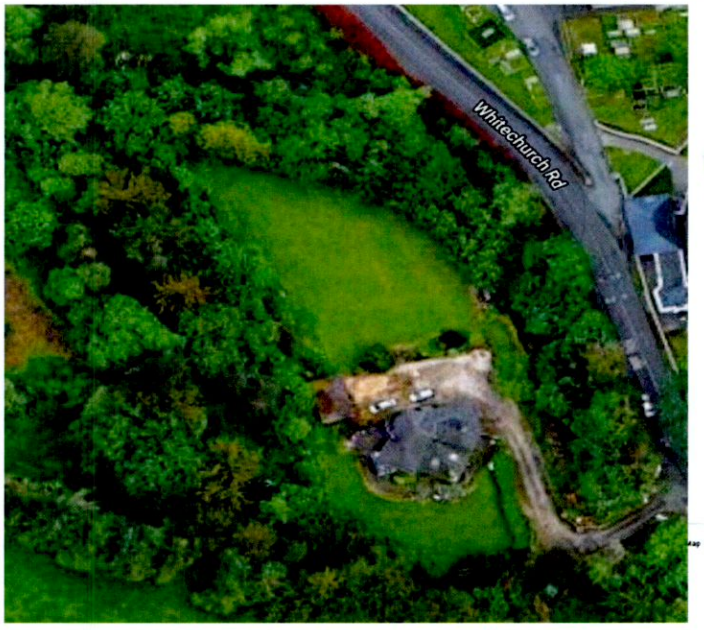
The report's purpose is to provide the appropriate information needed for the proposed development in relation to the trees located within or adjacent to the development site. It also gives re-assurance that the health and consideration of the trees is an integral part of the proposed development.

The report will provide an Arboricultural Impact Assessment (AIA) based on BS 5837 in order to evaluate the direct and indirect effects the proposed development will have on the trees, both within the footprint of the proposed layout and within the exclusion zone required for construction plant machinery and works. These protection considerations must be in accordance with Section 7 of BS 5837 (*Demolition and construction in proximity to existing trees*). This report should be read in conjunction with the Tree Survey Data and the attached Tree Constraints Plan Drawing.

As part of this report an Arboricultural Method Statement (AMS) and Tree Protection Plan (TPP) in accordance with BS 5837 will also be provided. The AMS and TPP will outline the methodologies and specifications needed for the implementation of any tree protection measures with important consideration been given to the root protection area. Any disturbance of the root protection area, whether below ground or above ground, during the development phase is likely to have a negative impact on the trees with the potential to making them unsafe structures and therefore unsuitable for retention post development.

1.2 SITE DESCRIPTION AND TREE ASSESSMENT

The proposed residential development site is situated to the north of the existing dwelling at Lynnbrook, Whitechurch Rd., Rathfarnham, Dublin 16. The site is for the most part on level ground with a sloping aspect along the western boundary. A stream runs from a south to north to a north/west direction forming the boundary of the site. The trees that are the subject of this report are



located along the eastern, northern and western boundaries. All of the trees are located within the footprint of the site.

FIG 1 – Subject Site

The entire site requires consideration from an arboricultural perspective due to the presence of trees, within a landscape setting. The tree survey and objective individual assessment resulted in a range of retention categories, B – moderate, C – low and U – un-retainable as outlined in BS 5837.

As part of this report 22 trees and 2 groups of trees were assessed.

1.3 PLANNING CONTEXT

At the time of writing, it is presumed that none of the trees on site are subject to a tree preservation order (TPO) or similar retention orders. A TPO can apply to a tree, trees, group of trees or woodland and can be implemented by the planning authority if it deems them to be desirable and appropriate in the interest of amenity or the environment. TPOs can be made under Part XIII of the Planning and Development Act 2000.

The Forestry Act 2014 contains the main provisions for the felling of trees. Where a felling license is not required is a tree in an urban area (Part 2 of Schedule 5 and Schedule 6 of the Local Government Act 2001 before the enactment of the Local Government Reform Act 2014) and a tree within 30 meters of a building, excluding any building built after the trees were planted.

Before any recommended works are undertaken the trees should be inspected for any signs or activity of protected species within the trees. Under the Wildlife (Amendment) Act 2000 it is an offence to destroy or disturb nesting birds. Also, under the Wildlife Act and the EU Habitats Directive it is an offence to recklessly kill, injure or capture bats, to disturb them or destroy, obstruct or damage any bat roosts found. As some of the trees within the report have large cavities it may be prudent to conduct a bat survey prior to any works.

2.0 METHODOLOGY AND LIMITATIONS

The inspection of these trees was carried out on Wednesday 13th July 2022. The inspection was conducted from ground level only using visual tree assessment techniques (VTA) which only gives a snap-shot of what is visible not obscured or accessible on the day of the survey. The survey does not include any climbing inspections, internal investigations of the tree or inspections below ground level.

Only relevant factors that are apparent at the time of the survey are included in this report. Trees are living organisms whose health and condition can change rapidly so as such any recommendations made within this report are valid for a period of 12 months only. It is suggested that further monitoring be required if potential hazards are to be avoided.

Climbing plants such as ivy can obscure decays or structural defects present at the time of the survey. Where the ivy is so dense a thorough examination is not possible and it is recommended that it be severed at ground level and the tree re-inspected once the ivy has died back.

The fruiting bodies of some important wood decay fungi can only be seen at certain times of the year and may not be present at the time of this survey.

The tree survey was conducted in accordance with BS 5837:2012. All trees over 150mm in diameter at breast height were given a unique reference number using metal tags and had their positions plotted on the survey drawings. All individual trees and groups of trees were assessed in relation to their – species, age class, tree height, crown spread, stem diameter at 1.5m above ground, minimum ground clearance, condition and management recommendations. The measurements for tree height, ground clearance and crown spread were taken to an accuracy of 0.5 m. The conditions of the trees both physiologically and structurally were assessed from being – good to fair to poor with additional information shown within the comments.

When categorizing a tree, as recommended in BS 5837:2012 – 4.5.5, the classification should begin by considering whether the tree falls within the scope of category U. If the tree does not fall into this category, it should be considered according to the criteria for inclusion in category A. Subsequently if trees do not meet the criteria, they should be considered in light of the criteria for inclusion in category B. If this criteria is not met, trees are placed in the low category C.
Definitions of the different categories as shown in the Cascade chart in 4.5 of BS 5837 are given below

- Category U – those in such a condition that they cannot realistically be retained as living trees in the context of the current land use for longer than 10 years
- Category A – trees of high quality with an estimated remaining life expectancy of at least 40 years
- Category B – trees of moderate quality with an estimated remaining life expectancy of at least 20 years
- Category C – trees of low quality with an estimated remaining life expectancy 0f between 10 and 20 years

The above categories can be further subdivided regarding the nature of their values or qualities–

- Sub-category 1 - Arboricultural qualities : the trees influence as a good example of its species, it's health and structure
- Sub-category 2 - Landscape qualities : the trees importance within and as landscape features
- Sub-category 3 - Cultural qualities : trees of an age that have a significant conservation and historical value

2.1 ROOT PROTECTION AREA (RPA)

The Root Protection Area (RPA) first appeared in the 2005 version of BS: 5837 and then within the updated version BS: 5837 - 2012. The BS describes the RPA as –

> *"layout design tool indicating the minimum area around a tree deemed to contain sufficient roots and rooting volume to maintain the trees viability and where the protection of the roots and soil structure is treated as priority"*

The Root Protection Area (RPA) is the area around an individual tree to be protected from disturbance during construction works. The RPA is shown as a radius in metres measured from the centre of the tree's stem. Protection of the roots and soil structure in the RPA should be treated as a priority.

For single stem trees the root protection area is calculated as a circle with a radius 12 times the stems diameter. A separate calculation should be used for trees with more than one stem. The calculated RPA for each tree should be capped at 707 m2 or a circle with a radius of 15m. These calculations are based on the formulas set out in Section 4.6 and Annex D of BS 5837.

The RPA is generally regarded as a compromise between carrying out development and retaining a tree. Trees with a large stem diameter at 1.5 m can produce an RPA that if protected would not allow for developments to progress.

The RPA for each tree is plotted on the Tree Survey Drawings.

3.0 ARBORICULTURAL IMPACT ASSESSMENT

3.1 PROTECTION OF RETAINED TREES

Before any on-site works begin the protection measures outlined in detail in the Arboricultural Method Statement (AMS) should be adhered to. In general, this protection usually consists of a combination of barriers and ground protection. In general, but not exclusive to, the protection of all trees on-site must be able to accommodate all building works, ingress and egress routes outside the designated RPAs. Appropriate planning should be in place to accommodate the ingress and egress of plant machinery on-site so no trees selected for retention are impacted.

The majority of tree roots grow in the upper metre of soil and they may spread outwards in any direction. Any disturbance of the ground within the root spread of a tree can damage its roots and may severely injure the tree. Damage to roots will interrupt the supply of water and nutrients necessary to keep the tree alive and may cause decline in vigour, dieback or even death of the tree. Damage to roots can also de-stabilize the tree and pose an unacceptable threat to the safety of people.

Details of protection measures as recommended in Section 6.2 *Barriers and Ground Protection* of BS 5837 should be adhered to.

3.2 DEVELOPMENT DESIGN LAYOUT CONFLICT WITH TREES

The image in Fig 2 highlights the proposed design layout and the location of the trees within the footprint of the site. The trees of concern are those that may be in direct conflict with the proposed development and are located along the eastern, T030 – T038, and western, T045 – T053, boundaries.

The proposed design, outlined in Fig's 2 below, and their subsequent construction works are within the RPA of trees recommended for retention. Any works within the RPA's of trees will have negative effects on those trees with the potential to limit their survival into the future, refer to section 3.1 on the impacts of working within the RPA of trees.

FIG 2 – Design layout

3.3 CONSTRUCTION AND ACCESS REQUIRMENTS AND CONSTRAINTS

During the construction phase of any development there will be a necessity for the use of plant machinery around the site. The constant movement of vehicles on the ground around the trees can cause compaction of the soil. Compaction will reduce soil pore space which can inhibit the tree's ability to access water and nutrients and can restrict root growth. Soil contamination from fuel and lubricants can also contaminate the roots as they access water and nutrients and subsequently have a negative effect on the tree.

The removal of any trees as a result of the development should be mitigated with the planting of as many trees where the space allows

Above ground constraints are indicated by the crown spread of trees to be retained. Where the canopy is deemed to be in direct conflict with the design and construction works it is recommended to prune the canopy.

Below ground constraints will include a layout design of the root protection area (RPA) which shows the minimum rooting area around the tree needed for its health and viability. The RPA is the area where the roots and the soil take priority and in accordance with BS 5837 no construction works can take place within it.

3.4 CELLULAR CONFINEMENT SYSTEMS

In order to ensure the health and vigour of trees, their roots need to be retained undamaged. To achieve this there must be no excavation, no soil stripping and no grading of the ground within the RPA of the trees recommended for retention.

Cellular confinement systems can be used for ground protection where tree roots are at risk from soil compaction and where it is unacceptable to dig into the ground to lay a conventional sub-base. Standard engineering practice is to remove the upper layer of soil and lay a compacted sub-base and a final surface that is level with the surrounding ground. Surfaces constructed in this way can sever tree roots at a shallow depth and future root growth can be inhibited by soil compaction.

3.4 NEW PLANTING

To mitigate the potential loss of any existing trees as part of the development it would be considered appropriate to replant as many trees as those lost if the space provides. This new planting schedule should be considered from the outset of the design and planning application phase. Any advice required for a new planting regime should be given by a landscape architect or otherwise competent person.

3.5 DEVELOPMENT OF RETAINED TREES

On-going management of retained trees, including a regular review and inspection system should be put in place. As trees are dynamic living organisms and their condition can change rapidly this report will only remain valid for a period of 12 months. If the landscape of the site is to be altered in the future a further assessment should be made on the impacts that proposed development would have on these trees. A continuous monitoring approach to the health of the retained trees should be initiated to determine their health over the coming years.

4.0 ARBORICULTURAL METHOD STATEMENT

4.1 TREE PROTECTION AREA AND SEQUENCE OF OPERATION

Prior to any construction works commencing on the proposed development site, including any ground works, demolition, delivery of materials or the use of vehicular machinery, a sequence of operations will be implemented. All operations will follow this sequence in a systematic way in order to ensure that all trees selected for removal are done so before the construction phase.

4.2 TREE WORKS

Trees that were identified for removal either as a result of the proposed development or as result of the survey conducted for this report will be shown in the Tree Constraints Plan (TCT) and identified with a red outline. Any trees to be removed will be done so according to best practice as recommended in BS 3998:2010 Tree Work Recommendations. All tree work operations recommended as part of this survey should be undertaken by suitably qualified tree surgeons with the appropriate insurance.

If tree works are to be undertaken within the bird nesting season, March – September, the trees in question will be assessed for the presence of any nests by a competent person before any works commence. If bird nests are present works will cease and an ecologist consulted before works can commence.

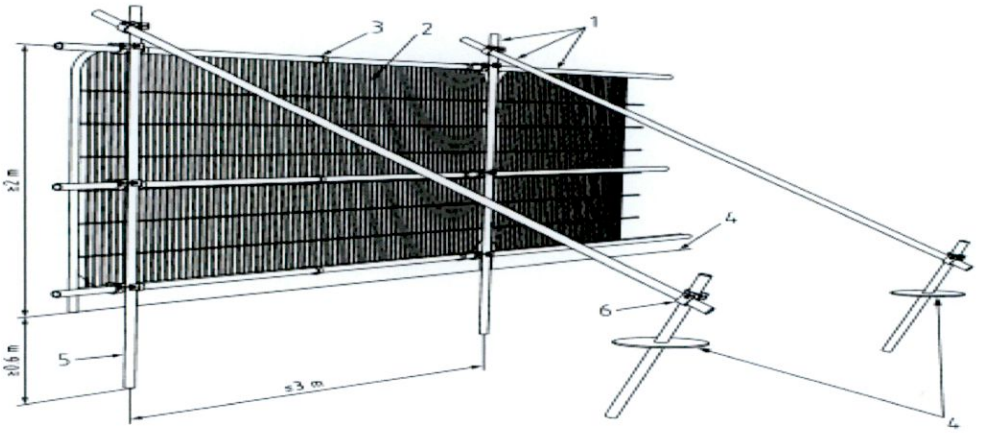
4.3 INSTALLATION OF PROTECTIVE BARRIERS

All protective barriers will be installed prior to the commencement of any works on the improvement scheme. The location of all tree protection barriers will be visible on the Tree Protection Plan (TPP). The installation of the protective barriers will be done as outlined in Section 6.2 Barriers and Ground Protection of BS 5837.

The tree protection barriers will remain in place for the duration of the construction works and should only be removed once the on-site arborist has signed off on its removal.

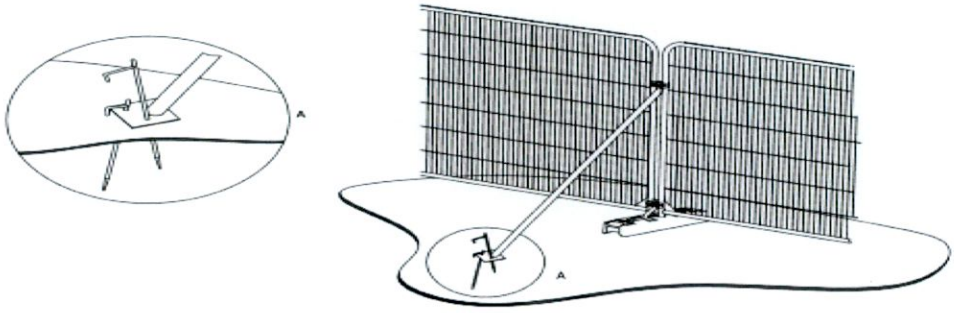
The appropriate tree protection signage should be attached to the protective fencing, either a visual representation of tree protection or for example – T.P.A. Tree Protection Area Restricted Access Keep Out – should be used.

Below are illustrations as recommended in BS 5837. These illustrations provide a visual representation of possible options for the construction of the protective fencing –

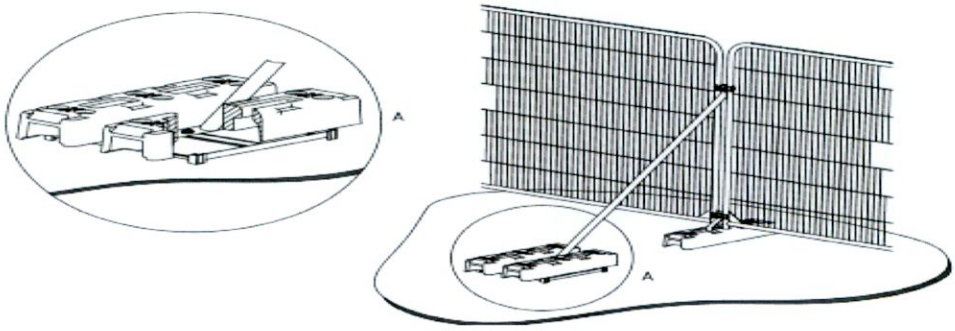


Key

1 Standard scaffold poles
2 Heavy gauge 2 m tall galvanized tube and welded mesh infill panels
3 Panels secured to uprights and cross-members with wire ties
4 Ground level
5 Uprights driven into the ground until secure (minimum depth 0.6 m)
6 Standard scaffold clamps



a) Stabilizer strut with base plate secured with ground pins



4.4 GROUND PROTECTION

The conflict between the trees recommended for retention and the proposed design layout are highlighted in section 3.2 above. The use of cellular confinement systems can mitigate any damage inflicted on the roots as it can be laid directly on top of existing surfaces. Section 4.7 below outlines the functions of Geocells.

In all cases the objective should be to avoid compaction of the soil so that the tree root functions remain unimpaired.

4.5 INSTALLATION OF UNDERGROUND SERVICES

Where possible the location, direction and installation of new underground services should be designed so as not to enter the RPAs of retained trees. Where it is not feasible to re-route the services, the excavations should be done with hand tools in conjunction with an air-spade. The methodology for trenchless installation can be found in NJUG Vol.4: Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees located in Appendix 3.

4.6 INSTALLATION OF CELLULAR CONFINEMENT SYSTEM

There is a risk that the preparatory works required to level the ground could cause direct root damage which would leave affected trees vulnerable to soil-borne pathogens and could lead to the accelerated decline of the tree. If the cellular confinement system is to be used for the proposed development than only permeable surfacing should be used for these sections.

By using the cellular confinement system there should be no damage inflicted on the roots as it can be laid directly on top of existing surfaces.

The edge restraint will be installed first followed by the base geotextile membrane. The geotextile must cover the entire area to be surfaced and if several sheets are required, they should overlap by at least 30cm. Where the ground is either uneven or sloping surface the infill of the angular stone will be used on top of the geotextile to create a level surface as outlined in the Appendix 4. During this part of the installation machinery should be restricted from entering the RPA in order to limit the risk of compaction to the soil. The geo-cell mat will then be stretched out and staked in place and if the on-site conditions require that adjacent sections of the geo-cell be joined together rather than butted against each other than zip ties or staples can be used. The recommended depth for geo-cell designed to support pedestrians is 100mm. The infill of angular stone should not be overly compacted as this will result in compaction of the soil beneath the geo-cells.

The installation will require an excavator, preferably a wheeled excavator as there will be less movement and risk of compaction, and a dumper. The excavator should be fitted with an un-toothed spreading bucket and the dumper with a swivel tip which would prove easier for installing the stone. The machinery will stay outside the RPA where possible for the levelling of the surface and where necessary a temporary surface will be installed for the installation of the geo-cells and infill.

There is a detailed account of the installation process for Geocells outlined in Appendix 4 below. There is a requirement that only porous materials can be used for the finished surface and these are also outlined in Appendix 4.

This guidance is based on the most recent publication "The use of cellular confinement systems near trees" – A guide to good practice, published in 2020.

4.8 DURING CONSTRUCTION WORKS

The tree protection barriers will be maintained at all times for the duration of the construction works. Any interference with or damage to the tree protection barriers should be recorded and the on-site arborist informed.

The location of the tree protection barriers will be visible on the Tree Protection Plan (TPP) and a copy should be retained on-site for reference at all times.

No machinery will enter the RPA exclusion zones for the duration of the on-site works. No excavations will take place within the RPAs as outlined on the TPP. The ground levels within the RPAs will not be altered at any stage of the construction works

All diesel, petrol, concrete and other materials hazardous to the health of the trees will be kept within the confines of the designated storage area for the duration of the construction works

No trees will be used to support cables, wires or signage.

All on-site personnel will be briefed on the RPAs of the retained trees and their measures and requirements during their initial site induction.

4.9 REMOVAL OF TREE PROTECTION BARRIERS

The tree protection barriers will be assessed and signed off by the on-site arborist prior to their removal. During the removal of the barriers care will be taken to avoid any unnecessary damage to the trees. If machinery is being used, they should remain on the hard surfaces and outside the RPAs during the dismantling operations.

4.10 CONCLUSION

All trees proposed for retention should be reassessed during and after completion of the construction phase. The trees may require remedial work to improve form and reduce risk. Trees that are structurally un-sound should be assessed and removed to remove the hazard. Trees should also be assessed if the ground levels in the vicinity of them or if other trees and structures nearby have been removed.

5.0 RESULTS

The tree survey was conducted on Wednesday 13th July 2022. The survey was from ground level only. The survey assessed 21 individual trees, 3 groups of trees. The majority of the trees assessed were deemed to be trees of medium or low quality and are classified as category B and C trees.

The information in Table 1 below gives a breakdown of the species and their categorisations recorded on site.

SPECIES	CATEGORY A	CATEGORY B	CATEGORY C	CATEGORY U
ALDER		2	1	
APPLE/ELDER			1	
ASH			3	2
HOLLY				1
HORSE CHESTNUT			2	
LAWSON CYPRESS			1	
LEYLANDII			1	
MACROCARPA		3	1	
MIXED SPECIES			1	
PEAR		1		
SCOTS PINE		2		
SITKA SPRUCE		1		
SYCAMORE		1		

TABLE 1

The trees along the eastern boundary with the stream include a group of 19 large canopy mature Lawson Cypress, T030, 3 mature Italian Alder, T031, T032 and T035, a large mature Spruce, T033, a group of small canopy Horse Chestnut trees, T034 and a small canopy Holly, T036.

The group of Lawson Cypress trees create a dense shelter belt along the stream and serves the purpose of screening the site from the road. The recommendations within the tree data propose that if the trees are to be retained, they should be maintained at their current height and the extended branches to the west to be pruned to create a more compact hedge-like structure. There is evidence that the trees have had a crown reduction in the past and allowing them to continue to grow can increase the potential for wind induced damage. There are also large branch fractures within the canopy of the trees, Fig 3, especially to the west where the branches are heavily weighted. Removal of the fractured branches will create gaps within the canopy, it is therefore recommended to prune these branches as much as possible and create the dense hedge-like structure

FIG 3 – Large branch fractures

FIG 4 – Trees along eastern boundary

Trees T031 and T032 are both large mature Italian Alders. Their lower canopies have been suppressed by the dense canopies of the Lawson Cypress. If the recommendation, suggested within the tree data, to remove the the Cypress trees was considered it would benefit these two large trees and allow them to

grow a canopy more typical of their species. In-planting of similar riparian species would also create a more open canopy along the stream whilst still maintaining the screening from the road.

T033 is a large canopy Spruce tree more suited to a forestry setting than close to a proposed residential area and is recommended for removal within the tree data.

The group of Horse Chestnut trees, T034, are all small canopy trees, having been overgrown and suppressed by the large canopies of the Spruce and L. Cypress. There is extensive leaf damage within the canopies of the 3 living trees as shown in Fig 5. The cause of the damage is the Horse Chestnut Leaf Miner and when infestations build up, all of the leaves of the infected tree can become brown and shrivelled as the larvae eat all of the inner leaf material. Over years of sustained infestation, the tree can become weakened and susceptible to secondary infection from a different bacteria and fungi. It is recommended to remove the small canopy trees and replant with species more suited to the site where the space allows.

FIG 5 – Leaf damage from Horse Chestnut Leaf Miner

The Italian Alder tree, T035, has four distinct stems growing from a large bowel. There is extensive decay throughout the base of three of the stems, the stem to the south is already dead and the central stem and stem to the north are showing signs of dysfunction. There is a large decay column, Fig 6, along both these stems and there is evidence of the perinnial brackets of the wood decay fungi *Inonotus radiatus* colonizing the cavity. The stem to the east over the stream has a healthy canopy and there is

no evidence of decay along the main stem. it is reconmmended to remove the three dysfunctional stems and retain and reassess the stem to the east.

FIG 6 – Large decay column colonized by *Inonotus radiatus*

Trees T039 are a group of 9 Leylandii 'Castlewellan Gold'. The group of trees have formed a very dense canopy along the northern boundary of the site. There have been a number of trees to the east of T039 removed in the past and this has left the remaining trees with little canopy cover as shown in Fig 7. Leylandii trees do not have the capacity to re-shoot or create epicormic growth when their canopies have been removed.

FIG 7 – Leylandii with bare canopy – H.Chestnut to right under ESB lines

The image in Fig 8 shows trees T041 and T042 in the background and the dense area of Ash, Blackthorn and Apple, T040, in the foreground. The two Ash trees have evidence of dieback within their canopies. T040 is a large area of self-seeded trees, dominated by young Ash.

FIG 8 – T040 – T042

The largest trees within the footprint of the site are located along the western boundary. All the trees are growing from an inclined bank rising to approx. 1 – 1.5m above ground level. The roots of the trees will be spread along the bank but also extending east into the proposed site. The largest root area has a radius of 13m from the centre of its stem. The canopies of the three large Monterey Cypress trees are extending almost 7m out over the site.

The extended, heavily weighted, lateral branches of Monterey Cypress trees have the potential to fracture under strong wind conditions. The risk of wind induced branch failure to the proposed development formed the recommendations to prune all extended branches by approx. 30%. As these trees have the capacity to respond well to pruning, it will not have any long-term negative effects on the tree. However, the trees would have to be maintained on an on-going basis after initial pruning. All the trees have been heavily pruned in the past to the west due to the presence of ESB wires.

It is also recommended to crown thin these trees, as the present dense branching structure does not allow the wind to pass freely through the canopy. The crown thinning should only involve the removal of all small diameter branches from the main stem and large branches. The crown thinning should not leave any remaining large branches heavily weighted or create a 'lion-tailing' effect. Pruning cuts to thin the crown of a large tree typically range in size from **one to four inches** in diameter. For purposes of reducing damage from wind, cuts smaller than about one inch in diameter appears to be less effective.

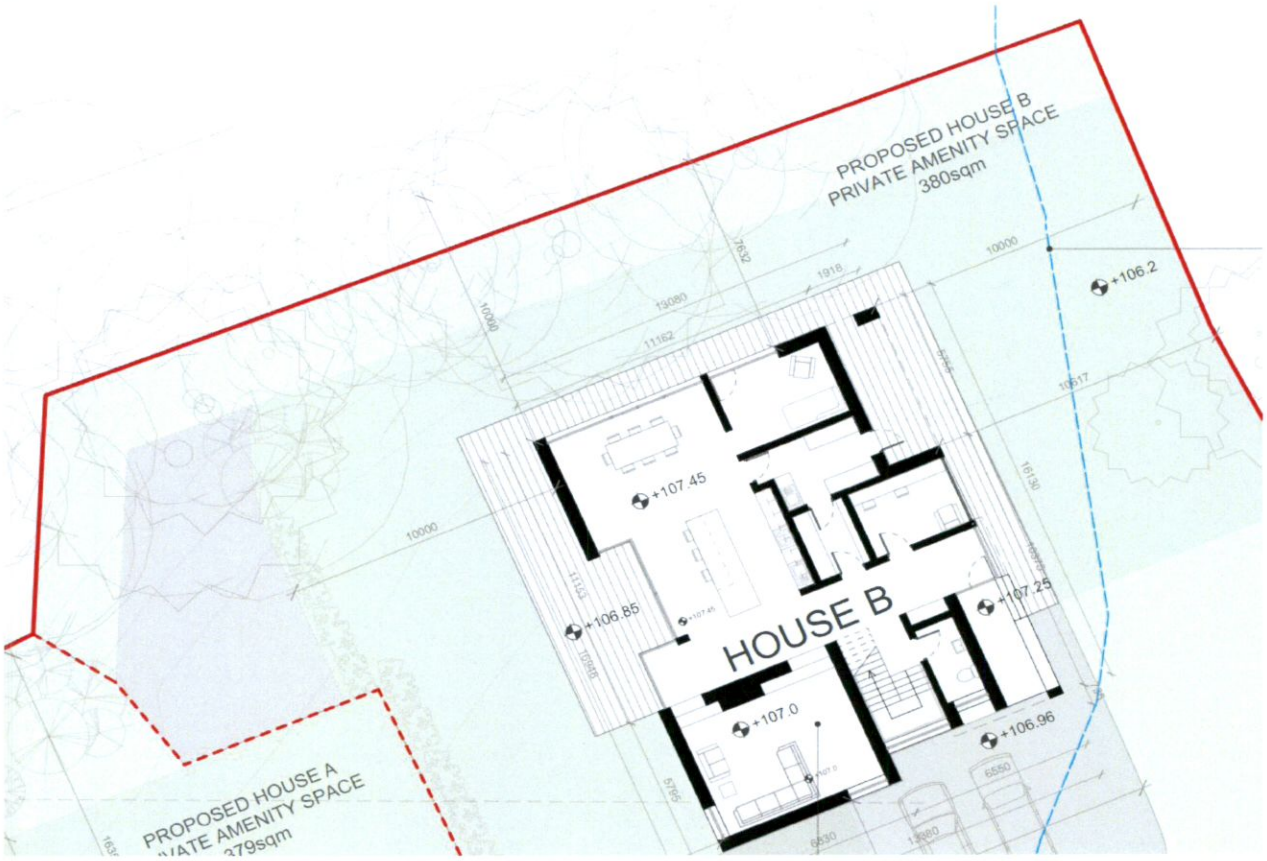


FIG 9 – Proximity of proposed House B to trees along the western boundary

FIG 10 – T045 – T053 along western boundary – extended branches of Monterey Cypress trees evident.

Tree T053 is a large canopy Ash tree. Its large lateral branches extend over the site to the east by almost 8m. Its rooting system will extend almost 10m into the site from the centre of its stem. The tree has a sparse canopy typical of its species and has been heavily pruned to the west due to the presence of ESB wires. There is a large basal cavity below the union of the two stems on the west side of the main stem. There is evidence that the cavity has been infected by the white rot decay fungi *Cerioporous squamosus*. This decay fungi is generally saprotrophic, feeds on already dead sections of the tree, but has the ability to colonise dysfunctional areas of wood. Although it is infrequently associated with the failure of trees and large stems itself, it does have the potential to seriously weaken a tree and leave it susceptible to infection from a secondary pathogen, such as honey fungus. Due to the size of the decay column, the presence of the decay fungi and the disproportionate weight and lean of the tree toward the proposed development site it is recommended to remove the tree.

FIG 11 – Decay column on T052 colonised by *Cerioporus squamosus*

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APPENDIX 1

SURVEY KEY

Tree No.....	refers to numbered metal tag on each tree
Species	refers to common and botanical name
Age.....	referred to in generalised categories including -
Young.....	a tree planted within the last 10 years
Semi Mature...	a tree that has grown less than 1/3 its expected height
Early Mature...	a tree between 50% & 80% its expected height
Mature.....	a tree that has reached its expected height but still has potential to grow
Over Mature...	a tree at the end of its time and the crown is starting to break up and decrease in size
Ht.....	tree height in meters
Spread(S).....	tree canopy from north, east, south and west in meters
DBH.....	tree diameter at breast height in cm
RPA.....	root protection area as a radius from trees stem centre that is to be protected from disturbance during construction works. For a single stem the root protection area is calculated as an area that is 12 times the stem diameter. The RPA is plotted on the tree constraints plan in meters
Condition.....	condition of the tree both physical and structural
G – Good.....	a specimen of generally good form and health
F – Fair.....	a specimen with defects but can be managed and retained
P – Poor.....	a specimen through defect, decay or reduced vigour has a limited life
D – Dead.....	a dead tree
Comments.....	Additional description/commentary on each individual tree

Recommendations Management recommendations are noted, including remedial pruning works and re-inspections where necessary

ERC..... estimated remaining contribution in years - < 10, 10 – 20, 20 – 40, >40

Retention categories (RC)

The retention category is to identify the quality and value of an existing tree and make decisions whether trees should be retained or removed in accordance with BS 5837 section 4.5

Category U – trees with no expected value in the immediate future and recommended for removal based on arboricultural best practice

Category A – trees of high quality with a minimum 40 years life expectancy

Category B – trees of moderate quality with a minimum 20 years life expectancy

Category C – trees of low quality with a minimum 10 years life expectancy

Sub-category 1 - Arboricultural qualities : the trees influence as a good example of its species, it's health and structure

Sub-category 2 - Landscape qualities : the trees importance within and as landscape features

Sub-category 3 - Cultural qualities : trees of an age that have a significant conservation and historical value

APPENDIX 2

TREE SURVEY DATA

ARBORICULTURAL SURVEY

TREE NO	SPECIES	AGE	HT	SPREAD	DBH	RPA	CONDITION PHYSIO / STRUCTURAL	COMMENTS	RECOMMENDATIONS	ERC	RC
TREE DATA FOR LYNBROOK, RATHFARNHAM											
030	*Chamaecyparis lawsoniana* Lawson Cypress	M	10	N 14.2 S 14.2 E 4 W 4.5	54 43	6.9	GOOD / FAIR	Linear treeline of 19 trees planted along the stream. Mixture of stem diameters, largest stem taken for RPA – large branch failures throughout the trees – extended heavily weighted branches to the east over stream and west over the proposed site – multiple leaders with evidence of the trees have been reduced in the past – large re growths from previous pruning cuts will be weakly attached and can be prone to failure in high winds – good shelter belt	Retain the trees at their current Height and side trim the western side to create a more compact hedge Or Remove and replant with a line of riparian species such as Alder and Birch	20-40	C 1,2
031	*Alnus cordata* Italian Alder	M	15	N 3 S 3 E 4 W 4	83	10	GOOD / GOOD	Large single stem tree to approx 10m – Suppression of a lower canopy by the dense growth of the Cypress trees – would benefit from the removal of the cypress trees good ext growth in the higher canopy Canopy merging with T032	No works required	>40	B 1,2
032	*Alnus cordata* Italian Alder	M	15	N 3 S 3 E 4 W 1	51	6.1	GOOD / GOOD	Large single stem tree to approx 10m – Suppression of a lower canopy by the dense growth of the Cypress trees – would benefit from the removal of the cypress trees good ext growth in the higher canopy Canopy merging with T033	No works required	>40	B 1,2
033	*Picea sitchensis* Sitka Spruce	M	16	N 3 S 3 E 2 W 3	51	6.1	GOOD / GOOD	Large tree more commonly found in a forestry setting – good form, structure and ext growth typical of its species – the tree will continue to increase in height as it matures and it should be considered whether this species is suitable for retention post development	Unsuitable for retention post development	>40	B 1,2

ARBORICULTURAL SURVEY

TREE NO	SPECIES	AGE	HT	SPREAD	DBH	RPA	CONDITION PHYSIO / STRUCTURAL	COMMENTS	RECOMMENDATIONS	ERC	RC
TREE DATA FOR LYNBROOK, RATHFARNHAM											
034	*Aesculus hippocastanum* Horse Chestnut	E/M	5	N 2 S 2 E 0 W 4	24.5	2.9	FAIR / FAIR	Cluster of four trees growing close to each Other – largest of the trees dead – all trees Have evidence of extensive infection on Their leaves from the Horse Chestnut Leaf Miner – small canopy trees	Remove and replant with a line of riparian species such as Alder and Birch	10-20	C 1
035	*Alnus cordata* Italian Alder	M	10	N 4 S 4 E 4 W 2	54 45 x 2	8.3	FAIR / POOR	4 distinct stems from base – stem to the south is dead – stem to north and central stem with large decay cavities and evidence of white rot wood decay fungi *Inonotus radiatus* – dense undergrowth obscuring base of tree – stem to east over stream healthy with good ext growth	Remove stems to south, north And central stem – reassess stem To east over stream	10-20	C 1
036	*Ilex aqufolium* Holly	E/M	3	N 1 S 1 E 0 W 2	13 x 3	2.2	FAIR / FAIR	2 small diameter stems with small sparse Canopies – damage at basal stem	Remove	<10	U
037	*Aesculus hippocastanum* Horse Chestnut	E/M	5	N 3 S 1 E 2 W 2	28	3.4	FAIR / FAIR	Canopy beneath ESB wires – continuously 'topped' in the past leaving multiple re-growths forming dense canopy – 2 individual trees growing 1m apart – unsuitable for retention post development	Remove	10-20	C 1
038	*Acer pseudoplatanus* Sycamore	M	10	N 3 S 4 E 3 W 4	57	6.8	GOOD / GOOD	Growing on edge of stream – twin stem from 1.8m with bark inclusion at union – dense ivy Throughout obscuring visibility – large Canopy merging with Sycamore across Stream – good form, vigour & ext growth	No works required	>40	B 1,2

ARBORICULTURAL SURVEY

TREE NO	SPECIES	AGE	HT	SPREAD	DBH	RPA	CONDITION PHYSIO / STRUCTURAL	COMMENTS	RECOMMENDATIONS	ERC	RC
TREE DATA FOR LYNBROOK, RATHFARNHAM											
039	*x Cupressocyparis Leylandii* 'Castlewellan Gold' Leylandii 'Castlewellan Gold'	M	8	N 5 S 5 E 3 W 5	35	4.2	FAIR / GOOD	Cluster of 9 trees on northern boundary close to stream – trees felled to the south & east in the past leaving retained trees with poor growth to east – very dense cluster with dense undergrowth of Elder	Remove and replant with a line of riparian species such as Alder and Birch	10-20	C 1
040	Area of mixed species Ash, Blackthorn, Apple	E/M	8	N 4 S 4 E 4 W 4	N/A	N/A	FAIR / GOOD	Dense area of vegetation in north/west of Site consisting of Ash, Blackthorn and Apple Tree uprooted in the past and resting on Small canopy Apple tree	Remove	10-20	C 1
041	*Fraxinus excelsior* Ash	M	10	N 3 S 4 E 4 W 0	35 29	4.5	FAIR / GOOD	Twin stem co-dominant from 1m – growing On edge of stream – canopy merging with T042 – very dense ivy obscuring visibility – Evidence of Ash dieback within the canopy Dense Elder @ base	Monitor for increased signs of Dieback	10-20	C 1
042	*Fraxinus excelsior* Ash	M	12	N 4 S 0 E 2 W 2	35	4.2	FAIR / GOOD	Single stem with extensive lean over stream To north – canopy weighted to north – Evidence of Ash dieback within the canopy Dense undergrowth of Blackthorn	Monitor for increased signs of Dieback	10-20	C 1
043	*Pyrus communis* Common Pear	M	7	N 0 S 4 E 4 W 0	25 21	3.3	GOOD / GOOD	Twin stem from 1m with good union – Canopy obscured by dense canopies of Blackthorn – good ext growth visible – older Specimen tree	No works required	>40	B 1,2

044	*Cupressus Macrocarpa* Monterey Cypress	M	8	N 2 S 2 E 2 W 2	N/A	N/A	FAIR / POOR	Single extended stem growing from up-rooted base – main stem lying on ground unsuitable for retention	Remove	10-20	C 1

ARBORICULTURAL SURVEY

TREE NO	SPECIES	AGE	HT	SPREAD	DBH	RPA	CONDITION PHYSIO / STRUCTURAL	COMMENTS	RECOMMENDATIONS	ERC	RC
TREE DATA FOR LYNBROOK, RATHFARNHAM											
045	*Cupressus Macrocarpa* Monterey Cypress	E/M	17	N 7 S 4 E 6 W 2	87.5	10.5	GOOD / GOOD	Very large canopy tree – dense branching Structure throughout – extended & weighted Branches to east over site – slight lean to North – growing from sloping bank – good Form, structure and ext growth – heavily Pruned to west in past due to ESB wires – Minor deadwood & broken branches	Prune weighted extended Branches to east by 30% Crown thin smaller diameter Branches only & deadwood	>40	B 1,2
046	*Cupressus Macrocarpa* Monterey Cypress	M	17	N 4 S 4 E 7 W 3	87 51	10.9	GOOD / GOOD	3 stems from merging from base – stem to East heavily weighted & leaning too east over Site – Very large canopy tree – dense branching structure throughout – growing from sloping bank – good form, structure & ext growth – heavily pruned to west in past due to ESB wires – Minor deadwood & broken branches	Crown reduce stem to east by 30% Crown thin smaller diameter Branches only & deadwood	>40	B 1,2
047	*Fraxinus excelsior* Ash	E/M	3	N 2 S 1 E 2 W 1	23	2.8	POOR / POOR	Heavily pruned to west due to ESB wires – Evidence of Ash Dieback – small canopy tree	Remove	<10	U
048	*Pinus sylvestris* Scots Pine	M	16	N 2 S 2 E 2 W 2	47	4.9	GOOD / GOOD	Tall slender tree – no lower canopy – small Canopy at its extent – no signs of defects – Good ext growth visible	No works required	>40	B 1,2
049	*Pinus sylvestris* Scots Pine	M	16.5	N 2 S 2 E 2 W 2	48	4.9	GOOD / GOOD	Tall slender tree – no lower canopy – small Canopy at its extent – no signs of defects – Good ext growth visible	No works required	>40	B 1,2

ARBORICULTURAL SURVEY

TREE NO	SPECIES	AGE	HT	SPREAD	DBH	RPA	CONDITION PHYSIO / STRUCTURAL	COMMENTS	RECOMMENDATIONS	ERC	RC
TREE DATA FOR LYNBROOK, RATHFARNHAM											
050	*Fraxinus excelsior* Ash	E/M	4	N 3 S 0 E 2 W 0	18 15	2.4	POOR / POOR	Extensive dieback & deadwood throughout – Small sparse canopy – tree in a state of Advanced decline	Remove	<10	U
051	*Cupressus Macrocarpa* Monterey Cypress	M	18	N 5 S 5 E 7 W 2	108	13	GOOD / GOOD	Very large canopy tree – dense branching Structure throughout – extended & weighted Branches to east over site – growing from sloping bank – good form, structure and ext growth – heavily pruned to west in past due to ESB wires – Minor deadwood & broken branches	Crown reduce stem to east by 30% Crown thin smaller diameter Branches only & deadwood	>40	B 1,2
052	*Fraxinus excelsior* Ash	M	16.5	N 3 S 7 E 8 W 2	73 67	9.9	FAIR / FAIR	Heavily weighted leaning canopy to east over Site – open canopy typical of its species – Large basal cavity at base to west with the Wood decay fungi *Cerioporus squamosus* Evident colonizing the area	Remove	20-40	C 1,2
053	*Malus spp* *Sambucus nigra* Apple & Elder	M	4	N 3 S 3 E 3 W 3	22	2.6	GOOD / GOOD	Cluster of 3 small diameter trees – 2 elder & 1 mature Apple – Apple tree overgrown by Elder & Ash to west – dense ivy & bindweed	Remove Elder Reassess Apple	20-40	C 1,2

APPENDIX 3

The National Joint Utilities Group

NJUG Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees

Volume 4

NJUG GUIDELINES FOR THE PLANNING, INSTALLATION AND MAINTENANCE OF UTILITY APPARATUS IN PROXIMITY TO TREES

4. HOW TO AVOID DAMAGE TO TREES This section gives general guidance on methods of work to minimise damage to trees. The local authority (or for privately owned trees, the owner or their agent), should be consulted at an early stage prior to the commencement of any works. This will reduce the potential for future conflict between trees and apparatus.

4.1 Below Ground Wherever trees are present, precautions should be taken to minimise damage to their root systems. As the shape of the root system is unpredictable, there should be control and supervision of any works, particularly if this involves excavating through the surface 600mm, where the majority of roots develop.

4.1.1 Fine Roots Fine roots are vulnerable to desiccation once they are exposed to the air. Larger roots have a bark layer which provides some protection against desiccation and temperature change. The greatest risk to these roots occurs when there are rapid fluctuations in air temperature around them e.g. frost and extremes of heat. It is therefore important to protect exposed roots where a trench is to be left open overnight where there is a risk of frost. In winter, before leaving the site at the end of the day, the exposed roots should be wrapped with dry sacking. This sacking must be removed before the trench is backfilled.

4.1.2 Precautions The precautions referred to in this section are applicable to any excavations or other works occurring within the Prohibited or Precautionary Zones as illustrated in Figure 1 – 'Tree Protection Zone'.

4.1.3 Realignment Whenever possible apparatus should always be diverted or re-aligned outside the Prohibited or Precautionary Zones. Under no circumstances can machinery be used to excavate open trenches within the Prohibited Zone.

The appropriate method of working within the Precautionary Zone should be determined in consultation with the local authority (or for privately owned trees the owner or their agent) and may depend on the following circumstances;

• the scope of the works (e.g. one-off repair or part of an extensive operation)

• degree of urgency (e.g. for restoration of supplies)

• knowledge of location of other apparatus

• soil conditions

• age, condition, quality and life expectancy of the tree

Where works are required for the laying or maintenance of any apparatus within the Prohibited or Precautionary Zones there are various techniques available to minimise damage.

Acceptable techniques in order of preference are;

a) Trenchless

Wherever possible trenchless techniques should be used. The launch and reception pits should be located outside the Prohibited or Precautionary Zones. In order to avoid damage to roots by percussive boring techniques it is recommended that the depth of run should be below 600mm. Techniques involving external lubrication of the equipment with materials other than water (e.g. oil, bentonite, etc.) must not be used when working within the Prohibited Zone. Lubricating materials other than water may be used within the Precautionary Zone following consultation and by agreement.

b) Broken Trench - Hand-dug

This technique combines hand dug trench sections with trenchless techniques if excavation is unavoidable. Excavation should be limited to where there is clear access around and below the roots. The trench is excavated by hand with precautions taken as for continuous trenching as in (c) below. Open sections of the trench should only be long enough to allow access for linking to the next section. The length of sections will be determined by local conditions, especially soil texture and cohesiveness, as well as the practical needs for access. In all cases the open sections should be kept as short as possible and outside of the Prohibited Zone.

c) Continuous Trench - Hand-dug

The use of this method must be considered only as a last resort if works are to be undertaken by agreement within the Prohibited Zone. The objective being to retain as many undamaged roots as possible. Hand digging within the Prohibited or Precautionary zones must be undertaken with great care requiring closer supervision than normal operations. After careful removal of the hard surface material digging must proceed with hand tools. Clumps of roots less than 25mm in diameter (including fibrous roots) should be retained in situ without damage. Throughout the excavation works great care should be taken to protect the bark around the roots. All roots greater than 25mm diameter should be preserved and worked around. These roots must not be

severed without first consulting the owner of the tree or the local authority tree officer / arboriculturist. If after consultation severance is unavoidable, roots must be cut back using a sharp tool to leave the smallest wound.

4.1.5 Backfilling

- Any reinstatement of street works in the United Kingdom must comply with the relevant national legislation (see: Volume 6 – 'Legislation and Bibliography'). In England this relates to the requirements of the code of practice – 'Specification for the Reinstatement of Openings in Highways' approved under the New Roads and Street Works Act 1991. Without prejudice to the requirements relating to the specification of materials and the standards of workmanship, backfilling should be carefully carried out to avoid direct damage to roots and excessive compaction of the soil around them.
- The backfill should, where possible, include the placement of an inert granular material mixed with top soil or sharp sand (not builder's sand) around the roots. This should allow the soil to be compacted for resurfacing without damage to the roots securing a local aerated zone enabling the root to survive in the longer term.
- Backfilling outside the constructed highway limits should be carried out using the excavated soil. This should not be compacted but lightly "tamped" and usually left slightly proud of the surrounding surface to allow natural settlement. Other materials should not be incorporated into the backfill.

4.1.6 Additional Precautions near Trees

- Movement of heavy mechanical plant (excavators etc.) must not be undertaken within the Prohibited Zone and should be avoided within the Precautionary Zone, except on existing hard surfaces, in order to prevent unnecessary compaction of the soil. This is particularly important on soils with a high proportion of clay. Spoil or material must not be stored within the Prohibited Zone and should be avoided within the Precautionary Zone.
- Where it is absolutely necessary to use mechanical plant within the Precautionary Zone care should be taken to avoid impact damage to the trunk and branches. A tree must not be used as an end-stop for paving slabs or other materials nor for security chaining of mechanical plant. If the trunk or branches of a tree are damaged in any way advice should be sought from the local authority tree officer / arboriculturist.

See TABLE 1 – 'Prevention of Damage to Trees Below Ground' below for summary details regarding causes and types of damage to trees and the implications of the damage and the necessary precautions to be taken to avoid damage.

TABLE 1 - Prevention of Damage to Trees Below Ground

Causes of Damage	Type of Damage	Implications to Tree	Precautions
Trenching, mechanical digging etc.	Root severance	• The tree may fall over • Death of the root beyond the point of damage • Potential risk of infection of the tree The larger the root the greater the impact on the tree.	Hand excavate only within the Precautionary Zone. Work carefully around roots. Do not cut roots over 25mm in diameter without referring to the local authority tree officer. For roots less than 25mm in diameter use a sharp tool and make a clean cut leaving as small a wound as possible.
Trenching, mechanical digging, top soil surface removal etc.	Root bark damage	• The tree may fall over • If the damage circles the root it will cause the death of the root beyond that point • Potential risk of infection of the tree The larger the root the greater the impact on the tree.	Do not use mechanical machinery to strip the top soil within the Precautionary Zone. Hand excavate only within the Precautionary Zone. Work carefully around roots. Do not cut roots over 25mm in diameter without referring to the local authority tree officer. For roots less than 25mm use a sharp tool and make a clean cut leaving as small a wound as possible.
Vehicle movement and plant use. Material storage within the precautionary area.	Soil compaction & water saturation	Restricts or prevents passage of gaseous diffusion through soil, the roots are asphyxiated and killed affecting the whole tree.	Prevent all vehicle movement, plant use or material storage within the Precautionary Zone.
Top-soil scouring, excavation or banking up.	Alterations in soil level causing compaction or exposure of roots.	Lowering levels strips out the mass of roots over a wide area. Raising soil levels asphyxiates roots and has the same effect as soil compaction.	Avoid altering or disturbing soil levels within the Precautionary Zone.
Use of herbicides.	Poisoning of the tree via root absorption	• Death of the whole tree • Death of individual branches Damage to leaves and shoots.	The selection and application of herbicides must be undertaken by a competent person in accordance with COSHH regulations.
Spillage of oils or other materials.	Contamination of soil	Toxic and asphyxiation effects of chemicals, oils, building materials (cement, plaster, additives etc.) on the root system can kill the tree.	Never store oils, chemicals or building materials within the Precautionary Zone or within the branch spread of a tree, which ever is the greater.
Placement or replacement of underground apparatus.	Various	Death of all or part of the tree.	Effective planning and liaison with local authority tree officer, taking into consideration the position of trees, and their future growth potential and management

APPENDIX 4

CELLULAR CONFINEMENT SYSTEMS

A cellular confinement system is a series of geo-cells arranged in a honeycomb-like formation that is combined with an underlying geotextile to spread loads in such a way as to avoid compaction of underlying soils. To create a stable base for hard surfacing near trees it is recommended that a cellular confinement system made of High Density Polyethylene (HDPE) should be used for the expansion of the greenway. The plastics are bonded together to form a three-dimensional matrix that can be filled be angular stone. Only 20mm and 40mm, or its equivalent, angular stone with a 'no fines' content should be used because even when it is compacted it will be free draining and will allow gaseous diffusion into and out of the soil. Angular stone infill also increases friction between stones and enhances load spreading. For a cellular confinement system to function effectively it is crucial that all of the cells are expanded and filled to capacity. Geo-cells made out of flexible geotextiles are not suitable for use near trees as they have a tendency to deform as they are filled which can impact on their load-spreading ability. The underlying geotextile material used should be needle punched non-woven as it provides adequate tensile resistance and allows water reach the soil.

The cellular confinement system chosen for use on the greenway link development should conform to ISO 13426 – 1 : 2019 Geotextiles and geotextile related products – strength of internal structural junctions – Part 1 : Geo-cells

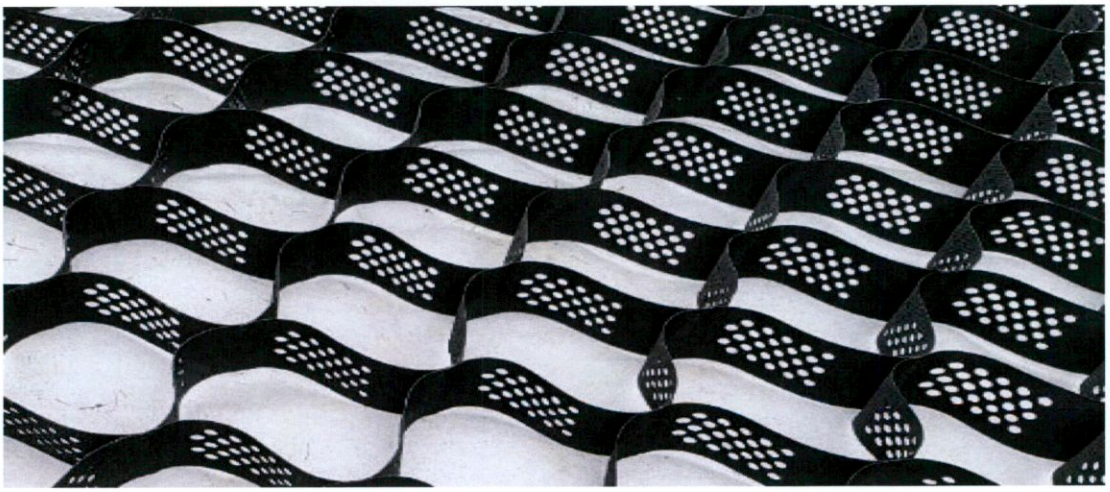

FIG. 1 – Expanded geo-cell sheet prior to been filled with angular stone

Geo-cell mats need to be laid on level surfaces and so sloping or uneven ground will need to have edge restraint installed first, followed by the base geotextile and then

add infill to the lower areas to raise the level up to the highest point. The infill used would preferably be the same angular stone used for filling the geo-cells. See Fig 2

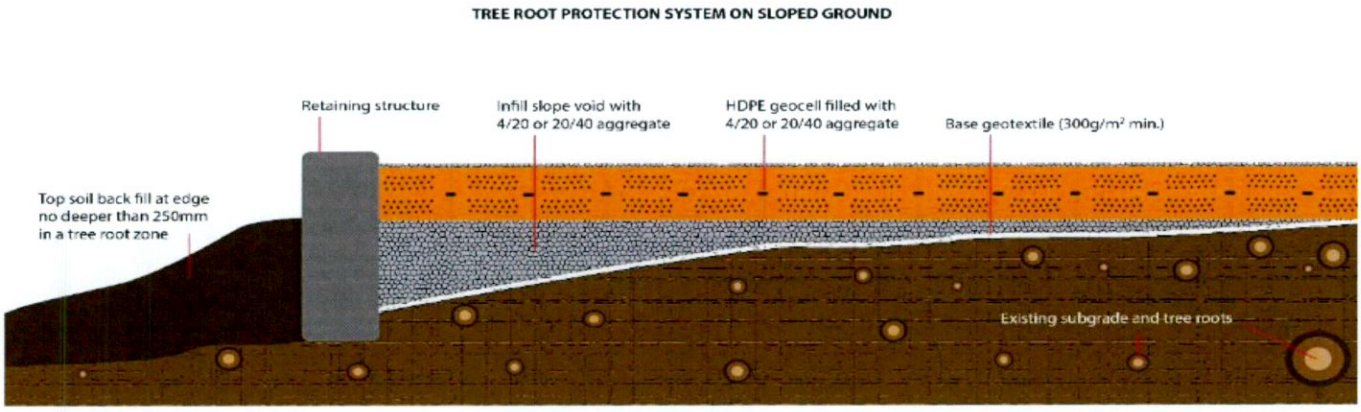

FIG. 2 – Example of how cellular confinement system should be installed on sloping or uneven ground

PROTECTING THE SYSTEM DURING CONSTRUCTION

In order to protect soils and the RPA of trees the cellular confinement system to be used in the greenway link development should be fenced off and treated as an exclusion zone during construction. As a final surface course is not laid down until the end of construction works the cellular confinement system will be exposed and may be vulnerable to wear and tear. If the geo-cell surface needs to be used as an access road during construction it should be taken into consideration the type of traffic that the surface will be subject to. The surface will experience heavier traffic than its intended final use, vehicles of particular concern could include dumpers, excavators or HGV's. Mud from the tyres of the machinery used in the installation process has the potential to be deposited on the unprotected infill which could impair its long-term permeability. Installing a temporary surface or over-filling the geo-cells with 50-75mm of material could be a suitable solution for temporary protection – see Fig. 3 below.

FIG 3 – Top separation geotextile to stop mud from entering infill

EDGE SUPPORTS

Edge supports are required to retain the wearing course of the cellular confinement system. A block paving finish can move and the joints can spread leading to movement and potential migration of the bedding material beneath. Porous asphalt finish can crack at the edge if it is not properly retained. The standard method of kerb stones set in concrete haunchings that are dug into the ground is not suitable near trees because the necessary excavations are likely to result in damaged roots. Table 1 below outlines a list of suitable edge support systems.

Peg & board edging	Treated timber 'peg and board' edging is seen as the simplest option being easy and quick to install. Pegs are inserted into the ground every metre to prevent the boards from bowing. They could split with the use of heavy plant machinery during construction so the use of thicker boards would be more appropriate. Thicker boards would last longer and have the added benefit of providing a more attractive finish.
Standard kerbs	Where levels are suitable standard kerbstones can be set on top of the geo-cells. The edge cells can be filled with concrete and the haunchings are placed above the cellular confinement system. Care should be taken that only those cells deemed necessary should be filled as the concrete will negate the permeable nature of the geo-cells
Metal or plastic strips	There are a range of edging products that are designed to retain block paving and provide a clean edge. These are typically L-shaped edging strips that are secured by being pinned into the ground below. Care should be taken that no roots are damaged during the pinning

SUITABLE SURFACE FINISHES

Any impermeable surface would be inappropriate to be placed over cellular confinement systems because it seals the surface preventing the ingress of water and gaseous exchange between the soil and the atmosphere. If the cellular confinement system is to be used for the proposed development, than only permeable surfacing should be used.

As highlighted in Section 4.7 the most recent guidance only offers four surfacing options for cellular confinement systems – Porous Asphalt, Loose Gravel, Resin-

bound Gravel and Permeable Block Paving. As suggested in Section 4.7 it may be possible and worth considering the use of 'Grassrings' in order to create the desired surface finish. The information in Appendix 5 outlines the use of 'Grassrings'.

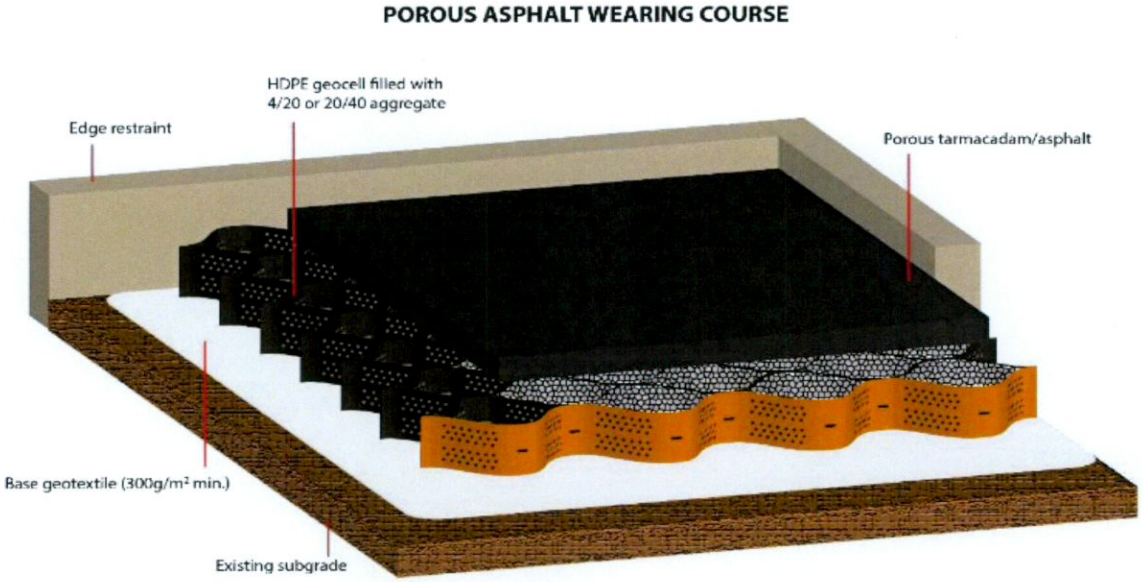

FIG. 4 – Surface finish with geo-cell sub-base

Only the basic approach to using the cellular confinement system over RPA's are outlined in this report. In order to guarantee that the surface will be suitably durable the final specifications will be produced by a civil engineer.