



REPORT TITLE

BS:5837 ARBORICULTURAL IMPACT ASSESSMENT

PROJECT TITLE

**Mixed Use Large-scale Residential Development at
Kilbride, Arklow, Co. Wicklow**

On behalf of the
Certain Assets of Dawnhill and Windhill Limited

April 2025

SUMMARY

Green Tree Arboricultural Consultants were requested by McGill Planning Limited, Chartered Town Planners, 9 Pembroke Street Upper, Dublin 2 to undertake an Arboricultural Impact Assessment to assess the existing tree population within the footprint of the site at Kilbride, Arklow.

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 trees that are within the zone of influence of the proposed design layout.

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

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.

70 individual trees, 1 group of riparian trees and 11 hedgerows were assessed as part of this report in accordance with BS 5837.

1.0 INTRODUCTION

SCOPE OF THE REPORT

- 1.1 The purpose of this report is to provide arboricultural guidance relevant to the design and construction phases of the proposed development at Kilbride, Arklow, Co. Wicklow, in support of the associated planning application.
- 1.2 The proposed development is to be a mixed use, large scale Residential Development, which will include the construction of 666 no. residential units with a mix of semidetached, detached, and terraced houses along with duplex apartments and apartments. These will comprise of 1, 2, 3 and 4 bed houses. The proposal will also deliver 3 no. retail units, 3 no. community/ medical units, 1 no. creche unit and new pedestrian/ cyclist link connecting into Arklow Town Centre are also proposed. The development will also provide for landscaping, public open spaces and all associated site development works to enable the development including boundary treatments, attenuation storage area and other service provision including ESB substation
- 1.3 This Arboricultural Impact Assessment (AIA), will evaluate the direct and indirect effects the proposed construction works might have on the trees and the impact the trees will have on the construction works in accordance with BS 5837.
- 1.4 Where possible the design layout will be placed outside the RPA of retained trees. Where this is not possible alternative methods will be recommended that allow the works progress whilst retaining the trees.
- 1.5 This report should be read in conjunction with the accompanying Arboricultural Report and Tree Protection Plan.
- 1.6 As part of this report an Arboricultural Method Statement (AMS) accordance with BS: 5837 will also be provided. The AMS 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.
- 1.7 The Tree Protection Plan will provide the relevant protection measures required to protect the trees during the construction phase.

SITE DESCRIPTION

- 1.8 The proposed development is situated north of the centre of Arklow town. The site is currently in active agricultural use, primarily designated for tillage. Other than the former private residence with dwelling house, out-building and agricultural shed adjacent to the northern boundary with Kilbride Road, there are no structures or developments on the land and it has been well-maintained for its current agricultural purpose.
- 1.9 The proposed new boardwalk will transect the Arklow marsh and cross the Avoca River as highlighted in Fig 1 below.

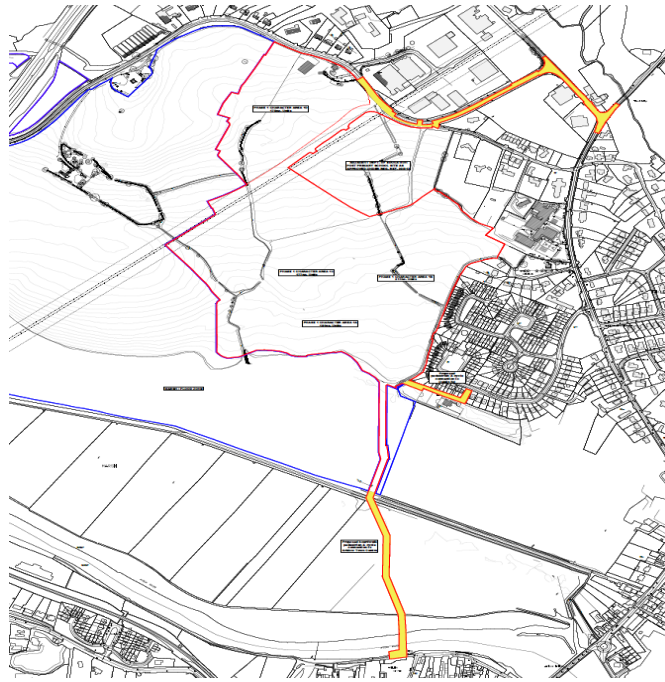


Fig 1 – Site layout in red – transecting marsh and river in yellow

2.0 STATUTORY LEGISLATION

2.1 The legislation in regard to the felling of trees is set out in the Forestry Act 2014 along with the Forestry Regulations 2017. Trees can be felled without the need to submit a tree felling license application under Section 19 of the Forestry Act 2014 where it is –

- A tree in an urban area (an urban area is an area that comprised a city, town or borough as specified in Part 2 of Schedule 5 & Schedule 6 of the Local Government Act 2001)
- A tree within 30 m of a building – excluding any building built after the trees were planted
- Trees outside a forest – the removal of which is specified in a grant of planning permission

2.2 The Wicklow County Council Tree Management Policy (2022) provides guidance in relation to the protection and management of trees within the county. Under section 3.1.4 of the policy, it states that:

“The protection of trees in general is considered as part of the planning process. Where feasible it the policy of Wicklow County Council to retain trees on site and where tree removal is necessary to facilitate development steps should be taken to augment tree cover locally with trees of similar stature.”

2.3 The Wicklow County Development Plan (2022-2028) provides guidance in relation to the protection of trees under the section Woodlands, Trees and Hedgerows within chapter 17.4 Natural Heritage & Biodiversity Objectives. The following objectives state:

- CPO 17.20 Development that requires the felling of mature trees of environmental and/or amenity value, even though they may not have a TPO in place, will be discouraged.
- CPO 17.21 To strongly discourage the felling of mature trees to facilitate development and encourage tree surgery rather than felling if such is essential to enable development to proceed.
- CPO 17.22 To require and ensure the preservation and enhancement of native and semi-natural woodlands, groups of trees and individual trees, as part of the development management process, and require the planting of native broad-leaved species, and species of local provenance in all new developments.
- CPO 17.23 To require the retention, wherever possible, of hedgerows and other distinctive boundary treatment in the County. Where removal of a hedgerow, stone wall or other distinctive boundary treatment is unavoidable, provision of the same type of boundary will be required of similar length and set back within the site in advance of the commencement of construction works on the site (unless otherwise agreed by the Planning Authority).

2.4 Under Protocol 3 – Planned removal of trees, of the Wicklow County Council Tree Management Policy (2022) it states that:

“Trees may be removed in limited circumstances as part of planned redevelopment. This may be done when existing trees are unsuitable for the site” & “The removal of trees that are unsuitable for the space in which they were planted will be permitted when recommended by an arborists report. Circumstances may include trees that are interfering with utilities and where pruning has compromised their continued growth in reasonable condition, trees planted too close to buildings and walls, trees which dangerously restrict sightlines on public roads or trees of species that have roots that are unsuitable for the urban environment in which they have been planted”

3.0 ARBORICULTURAL IMPACT ASSESSMENT

ARBORICULTURAL PRINCIPLES

- 3.1 This document should be read in conjunction with the associated Arboricultural Report and Tree Protection Plan.
- 3.2 A total of 70 trees, 11 hedgerows and 1 group of riparian trees were assessed as part of the accompanying BS:5837 Arboricultural Report
- 3.3 The proposed design layout must take into account, that the protection of all retained trees on-site must be able to accommodate all building works, ingress and egress roots outside the designated RPAs. Appropriate planning should also be in place to accommodate the ingress and egress of plant machinery on-site so no trees selected for retention are impacted.
- 3.4 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.
- 3.5 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.
- 3.6 When soil is compacted a combination of high soil bulk density and elevated soil strength can directly limit root growth. The large pores in well-structured soil are important for gas exchange, the process of respiration and diffusion and these are lost when soils are compacted to high bulk densities.
- 3.7 Soil compaction also reduces the rate of water infiltration and the availability of water to the roots, it impairs root growth and the root systems ability to support a healthy crown. The compaction of soil within tree root areas (RPA) can ultimately lead to crown dieback and a decline in tree health.
- 3.8 To avoid damage to tree roots existing ground levels should be retained within the RPA. Intrusion into soil within the RPA is generally not acceptable and topsoil within it should be retained in situ.

TREE SPECIES & CATEGORISATION

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

INDIVIDUAL TREE QUALITY ASSESSMENT SUMMARY				
SPECIES	CATEGORY			
	A	B	C	U
ALDER		1	1	
APPLE			1	
ASH			4	10
BEECH			2	
BIRCH			2	
CHERRY PLUM			1	
HAWTHORN			1	
LAWSON CYPRESS			1	
LIME			1	
NORWAY MAPLE			3	
OAK		7	9	4
SYCAMORE		2	5	8
WILLOW			6	
DEAD TREE				1
HEDGEROWS	1	1	9	
GROUP		1		

Table 1 – Species and their categorisation

3.10 The majority of the trees assessed were deemed to be trees of medium or low quality and are classified as category B or C trees. The majority of the trees are part of the older hedgerows that run throughout the site.

TREES TO BE REMOVED					
Tree Category	A	B	C	U	TOTAL
Trees to be removed due to direct conflict with the proposed design layout.		361, 406, 412, 437, 438,	362, 363, 364, 366, 367, 368, 376, 377, 378, 401, 402, 403, 407, 408, 414, 439, 441, 442, 443, 450, 451, 452, 454, 455, 456, 457, 459, 460, 462		34
Trees to be removed based on their poor physiological & structural condition				365, 369, 370, 375, 379, 380, 381, 382, 383, 384, 399, 405, 409, 411, 413, 415, 416, 440, 447, 448	20
Hedgerows & Groups of trees to be removed due to direct conflict with the proposed design layout	H1 (part)	H3 G01 (part)	H2, H4, H5, H7, H8 (part), H9, H13, H15 (part)		11

3.11 There are 5 category B trees, two Sycamore and three Oaks, 1 category B group of riparian trees (GO1) and 29 category C are proposed for removal due to being in direct conflict with the proposed design layout.

3.12 There are 20 category U trees recommended for removal based on their physiological and structural condition. Of the 20 trees ten are Ash with seven heavily infected with Ash Dieback. The trees T379 through to T384 and the trees T447 and T448 have all been severely ‘topped’ or had half their canopies removed due to the presence of overhead ESB wires.

3.13 There are 7 hedgerows to be removed and sections of the hedgerows H1, H8, H15 and G01.

3.14 All trees identified to be removed are highlighted in red in the tree protection plan.

TREES TO BE RETAINED					
Tree Category	A	B	C	U	TOTAL
Trees to be retained		400, 418, 445, 453, 458,	397, 398, 404, 410, 417, 444, 446, 449, 461, 463		15
Hedgerows & Groups of Trees to be retained	H1 (part)	G01 (part)	H14, H15 (part)		4

- 3.15 Of the 15 individual trees to be retained on site there are five category B and ten category C trees. Four of the five category B trees are important mature Oak trees and there are six category C Oak trees retained. Only six Oak trees are to be removed from the site due to conflict with the proposed design layout.

CONSTRUCTION AND PROTECTION OF RETAINED TREES

- 3.16 The Root Protection Areas (RPAs) of several trees proposed for retention within the site will be encroached upon under the current design layout. It is recommended that efforts be made to retain these trees and to monitor their condition continuously throughout and following the construction phase, rather than pre-emptively recommending their removal where only minor RPA incursions are anticipated
- 3.17 During the construction phase of the development there will be a necessity for the use of plant machinery around the site. Ingress and egress routes for all vehicles on the site have the potential to have a negative effect on the tree's health and its structural integrity.
- 3.18 The use of lifting machinery can impact on the trees canopy and can cause structural damage to the tree's branches and stem.
- 3.19 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.
- 3.20 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.
- 3.21 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.
- 3.22 During the construction phase of the development, tree protection fencing will be used to protect areas of existing soft ground within the RPA's of retained trees. The tree protective fencing will be visible on the tree protection plan, which will be produced after the pre-planning consultation.
- 3.23 Where there is proposed surface level changes within the RPA of retained trees, then a no-dig method (cellular confinement systems) must be implemented.

- 3.24 Limited manual excavation within the RPA may be acceptable subject to justification and consultation with the on-site arborist. Such excavations should be undertaken carefully using hand-held tools and preferably by using an air-spade – the use of compressed air to expose the tree's root system. It should be noted that it is not realistic to plan for large excavations using hand-held tools due to the demands that manual excavation places on the development project and limitations arising from health and safety considerations.
- 3.25 If roots are exposed, they should be wrapped or covered immediately to prevent desiccation and to protect them from rapid temperature changes. Any coverings or wrappings will be removed before backfilling commences, which should happen as soon as possible.
- 3.26 Details of protection measures as recommended in Section 6.2 *Barriers and Ground Protection* of BS 5837 should be adhered to.
- 3.27 The on-site arborist should be responsible for checking and approving the position of all tree protection measures at the first site visit prior to the commencement of works.
- 3.28 Category B trees, as outlined in detail in Table 1, are trees of high quality and arboricultural or landscape value and are highlighted as such and their protection is taken as paramount.

CONSTRUCTION OF NEW HARD SURFACES IN RPA'S

- 3.29 The construction of new hard surfaces is proposed within the RPA of a number of trees within the site.
- 3.30 The proposed construction of road 21 will impact on a section of the RPA of T410. It is recommended to retain the tree and evaluate it during and on completion of the development.
- 3.31 The proposed construction of road 03 will impact on 23% of the RPA of T453. It is recommended to retain the tree and evaluate it during and on completion of the development.
- 3.32 There is a proposed new pathway to be constructed within the public open space between roads 25 and 26. There is the potential the proposed path would be constructed within the RPA of either T444, T445 or T446. A no-dig approach, which involves the use of cellular confinement systems, should be considered within the RPA of these trees. The secondary hedgerow layer beneath these trees will be removed.
- 3.33 There is a proposed new pathway to be constructed within the bio retention planting area at the north of the site. There is the potential the proposed path would be constructed within the RPA of the trees T458, T461 and T463. A no-dig approach should also be considered within the RPA of these trees for the path.
- 3.34 Cellular confinement systems are typically used for ground protection where tree root damage would be caused by digging into the ground to lay a conventional sub-base for new a new hard surface. They will also protect the long-term viability of the trees by eliminating the risk of soil compaction within the RPA.
- 3.35 Standard tarmac surfacing 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 footpath, then only permeable surfacing should be used.

- 3.36 The Arboricultural Method Statement gives a brief description of the installation of a typical no-dig surface. This follows the recommendations set out in Section 7.4 of British Standard 5837:2012 and, The use of cellular confinement systems near trees: A guide to good practice published by the Arboricultural Association. A more comprehensive guide can be found in Appendix 1.

CONSTRUCTION OF NEW SOFT SURFACES IN RPA's

- 3.37 There are new soft surface back gardens to constructed within the RPA's of the trees T397, T398, T400, T404. The RPA of the trees T397 and T398 will be affected to the south west. The RPA of the trees T400 and T404 will be affected to the south by south-west. A no-dig approach should be considered within the remaining RPA of these trees.
- 3.38 Based on the design layout provided the trees T417, T418 and T449 are outside any proposed construction works. Tree protection fencing will be placed at the extent of the RPA of these trees for the duration of the construction phase.

REMEDIAL TREE WORK

- 3.39 Where pruning works are required to facilitate works, they will be carried in accordance with best practice as set out in BS3998:2010 Tree Work. Any recommended remedial tree works or facilitatory tree works will be approved by the local tree officer and project engineer.

NEW PLANTING

- 3.40 Where established trees exist within a proposed development site, the presumption should always be that as many trees as possible will be retained. However, where there is conflict between the trees and the design layout of the new development and there is no option but to remove the trees, compensation for their loss must be considered.

In the UK under the statutory framework for biodiversity net gain, planning permission is granted subject to the condition that the biodiversity gain objective is met. This objective is for development to deliver at least a 10% increase in biodiversity value relative to the pre-development biodiversity value of the onsite habitat.

Although not part of legislation within Ireland the requirement to meet these biodiversity gain objectives is becoming a common occurrence.

The Bristol Tree Forum (BTF) in the UK is a community-based organization dedicated to the protection, planting and promotion of trees in Bristol City. The Forum reviews and responds to planning applications in Bristol, that might impact trees, ensuring that the value of trees is considered in the development process.

The BTF have proposed a "Bristol Tree Replacement Strategy" in response to the new Biodiversity Net Gain legislation brought into law in February 2024 in the UK.

Table 3 below is taken from the Statutory Biodiversity Metric User Guide and is used to calculate the 'area equivalent' of individual trees:

“The biodiversity metric uses set values to represent the area of trees depending on their diameter at breast height. This value is a representation of canopy biomass, and is based on the root protection area formula, derived from [BS 5837:2012](#).”

Size class	Diameter at breast height (cm)	Biodiversity metric area equivalent (ha)
Small	greater than 7.5cm and less than or equal to 30cm	0.0041
Medium	greater than 30cm and less than or equal to 60cm	0.0163
Large	greater than 60cm and less than or equal to 90cm	0.0366
Very large	greater than 90cm	0.0765

Table 3 – Tree size classes & their area equivalents

In order to create a viable replacement strategy for individual trees the BTF took the information from the table above and calculated their own strategy for replacing individual trees. The spreadsheet setting out the basis of their calculations can be downloaded here – [RPA Table Statutory BNG 13 table Comparison](#).

The table below is the result of their calculations and sets out their tree replacement strategy for replacing individual trees.

Statutory BNG			BTRS Obligation
Category	DBH (cm)	Area (ha)	Replacement Trees Required
Small	greater than 7.5cm and less than or equal to 30cm	0.0041	2
Medium	greater than 30cm and less than or equal to 60cm	0.0163	5
Large	greater than 60cm and less than or equal to 90cm	0.0366	10
V. Large	greater than 90cm	0.0765	21

Table 4 – tree replacement strategy for different size class trees

To offset the potential loss of existing trees associated with the development a 10% biodiversity net gain through new planting is considered an appropriate and effective mitigation measure.

Based on the biodiversity net gain metric developed by the Bristol Tree Forum (refer to Table 4), a total of 183 replacement trees are required to compensate for the removal of 33 individual trees

The proposed landscape plan includes the planting of 1,278 new trees, significantly exceeding the minimum requirement for a 10% biodiversity net gain as determined by the adopted metric.

Number of Individual Trees to be Removed	Number of Replacement Trees Required based on Table 4 metric	Proposed Number of Trees To be Planted as part of the Proposed development
33	183	1278

Table 5 – the amount of trees proposed by the landscape plan and the number of trees required to meet 10% Biodiversity Net Gain target.

CONCLUSION

- 3.41 The majority of the retained trees assessed on this site have the potential to remain as part of the landscape for many years. As trees are dynamic living organisms and their condition can change rapidly this report will only remain valid for a period of 12 months. A continuous monitoring approach of these trees should be initiated post construction work to determine their health over the coming years.

ARBORICULTURAL METHOD STATEMENT

INTRODUCTION

- 4.1 The purpose of this Arboricultural Method Statement is to ensure the safe retention of those trees recommended for retention on and adjacent to the site in accordance with BS: 5837. The method statement will outline in detail the specific tree protection measures required and how sensitive construction operations are to be conducted in proximity to the trees and there RPA's.
- 4.2 The method statement will also address general site activities to ensure no trees are unnecessarily damaged.
- 4.3 The method statement should be read in conjunction with the tree protection plan (TPP) attached to this report and copies of both will be permanently available on site for the duration of the construction phase.
- 4.4 This is a site-specific method statement with the sole purpose of protecting those trees within and adjacent to the footprint of this site and is not relevant to or to be used for any other site or situation.
- 4.5 No changes may take place to the content or application of the Method Statement without the prior written approval of the Project Arboriculturist

SEQUENCE OF EVENTS

- 4.6 Order of operation
- Preliminary tree works
 - Site briefing for site personnel
 - Preliminary ground investigation using air-spade
 - Accurate installation of tree protective fencing as indicated on the tree protection plan
 - Construction of cellular confinement systems
 - Removal of tree protection fencing
- 4.7 Tree protection fencing may be re-adjusted where required during any demolition and construction phase once agreed between the site contractor and project arboriculturist.

RESTRICTIONS WITHIN THE RPA

- 4.8 The following will be adhered to within the RPA of those trees to be retained
- No ground levels within the RPAs will be altered at any stage of the construction works
 - 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 storage of 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.

PROTECTION OF THE TREE CANOPIES

- 4.9 All construction works and in particular the use of machinery, must be carefully co-ordinated to avoid damage to retained trees. Long reach machinery with jibs, booms or counterweights will require particular care.
- 4.10 Where trees are at risk of impact damage from plant that cannot be controlled with fencing or a careful working methodology, a banksman will be present. The banksman must be in place for all operations in proximity to retained trees to ensure there is no damage to above ground parts of the trees including the trunks and branches.
- 4.11 There should be enough space on-site that no damage will occur to the canopies of retained trees. However, if it happens that the canopies are restricting construction works, access facilitation pruning can be carried out. This pruning operation will be carried out in accordance with BS 3998:2010 Tree Work Recommendations and by a reputable Contractor. It is not permitted for site construction personnel to carry out tree pruning works.

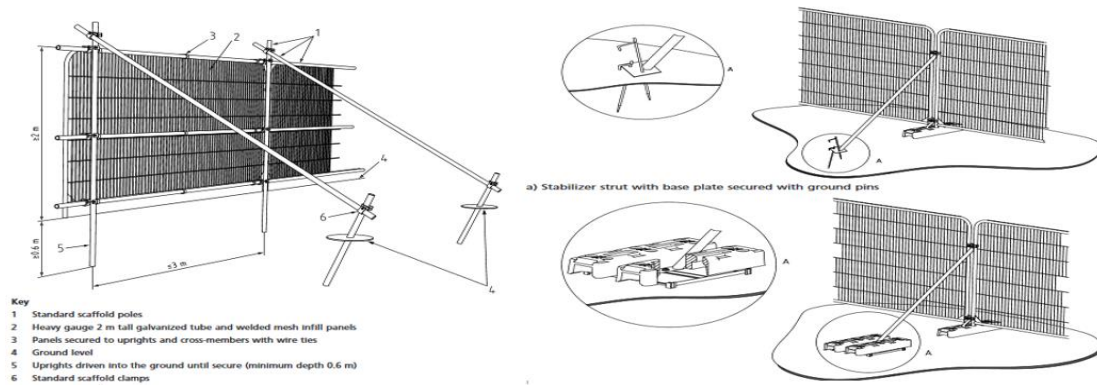
TREE REMOVAL AND REMEDIAL WORKS

- 4.12 Those trees that were identified for removal either as a result of the proposed construction works or as result of the survey conducted for this report will be shown in the Tree Protection Plan (TPP) and identified with a red outline.
- 4.13 A list of the trees to be removed can be found in section 3.10 of the A.I.A.
- 4.14 Any trees to be removed will be done so according to best practice as recommended in BS 3998:2010 Tree Work Recommendations.
- 4.15 All tree work operations recommended as part of this survey should be undertaken by suitably qualified tree surgeons with the appropriate insurance.
- 4.16 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.
- 4.17 All tree work operations will be carefully carried out to avoid damage to the trees retained. No trees to be retained shall be used for anchorage or winching purposes.

INSTALLATION OF TREE PROTECTION FENCING

- 4.18 The location of all tree protection barriers will be made 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.
- 4.19 A copy should be retained on-site for reference at all times.

- 4.20 In accordance with BS 5837:2012 all trees to be retained will be protected from construction operations with robust fencing. It is recommended to use 2m high Heras fencing panels on rubber feet that will be joined together using a minimum of two anti-tamper couplers. The couplers will be installed so that they can only be removed from inside the fence. The distance between the couplers should be at least 1m apart and should be uniform throughout the fencing. Below are illustrations as recommended in BS 5837. These illustrations provide a visual representation of possible options for the construction of the protective fencing:



- 4.21 The soft landscaping areas behind the protection fencing will be regarded as sacrosanct and will form the Construction Exclusion Zone (CEZ). The RPA of T410 will be reduced by 20% in a south-easterly direction. This area will be protected at all times. The protective fencing will not be removed or altered without the prior approval of the project arboriculturist.
- 4.22 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.
- 4.23 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.



- 4.24 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.

INSTALLATION OF GROUND PROTECTION

- 4.25 The proposed new paths will enter the RPA of a number of trees including the category B trees T445 and T458. In order to protect the root systems of these trees ground protection measures will be put in place.
- 4.26 The ground protection measures will include the use of cellular confinement systems. These ground protection measures will intersect the protective fencing for the construction of the new path.
- 4.27 Where construction working space or temporary construction access is justified within the RPA this should be facilitated by moving the protection fencing under supervision from the on-site arborist.
- 4.28 Where the moving of the tree protection fencing would expose any soft surfaces to construction damage, new temporary ground protection should be installed as part of the implementation of physical tree protection measures prior to work starting within an exclusion zone.
- 4.29 Where necessary, the locations of any temporary ground protection required as part of the construction works will be highlighted by the project engineers. Once any locations have been identified, the method statement and tree protection plan will be updated to include the design for the temporary ground protection.

INSTALLATION OF UNDERGROUND SERVICES

- 4.30 Where possible the location, direction and installation of any new underground services should be designed so as not to enter the RPAs of retained trees. Where this is not an option 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 should in Proximity to Trees.

CONSTRUCTION OF NEW SURFACES WITHIN THE RPA

- 4.31 Where any new hard surfaces are to be constructed within the RPA of retained trees the recommendations made in BS:5837 – “existing ground levels should be retained within the RPA. Intrusion into soil within the RPA is generally not acceptable, and topsoil within it should be retained in situ”, would normally be adhered to. However, where there will be intrusion into the RPA of some retained trees, it is preferable to retain the trees and evaluate them on an on-going basis.

LOCATION OF SITE COMPOUND, STORING AND MIXING OF MATERIALS

- 4.32 The location of the site compound will be outside the RPA of retained trees. The area will be fenced off as an exclusion area from the start of works
- 4.33 The storage and mixing of materials will take place within a designated area of the compound at least 5m away from the RPA of retained trees. Re-fuelling will also take place in an isolated area at least 5m from the RPA of retained trees. No run-off will be allowed enter the RPA of retained trees.
- 4.34 No signs, cables or other items will be attached to any part of a tree to be retained.
- 4.35 No fires will be lit within the RPA or within 5m of trees to be retained.

REMOVAL OF TREE PROTECTION BARRIERS

- 4.36 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.

CONCLUSION

- 4.37 Successfully preventing ground compaction and damage to the rooting system of the retained trees during the construction phase needs to be adhered to from the outset. If any part of the arboricultural method statement is deemed unfeasible or needs to be altered in some way the on-site arborist should be consulted before any works re-commence.
- 4.38 In order to achieve the construction of the proposed design layout it is necessary to fell 33 individual trees, a number of trees within the riparian group, 7 hedgerows and sections of another three hedgerows. A further 20 trees are unsuitable for retention based on their poor physiological or structural condition.
- 4.39 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.

APPENDIX 1

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 by 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 cycleway 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

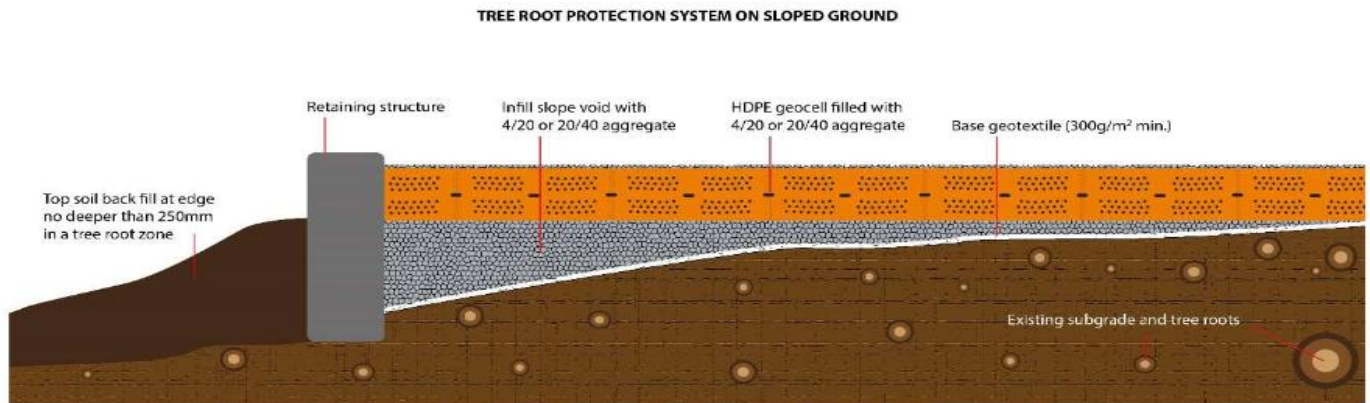


FIG. 2 – Example of how cellular confinement system should be installed on sloping or uneven ground

PROTECTING THE SYSTEM DURING CONSTRUCTION

In order to protect soils and the RPA of trees the cellular confinement system to be used in the cycleway 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 cycleway, 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.

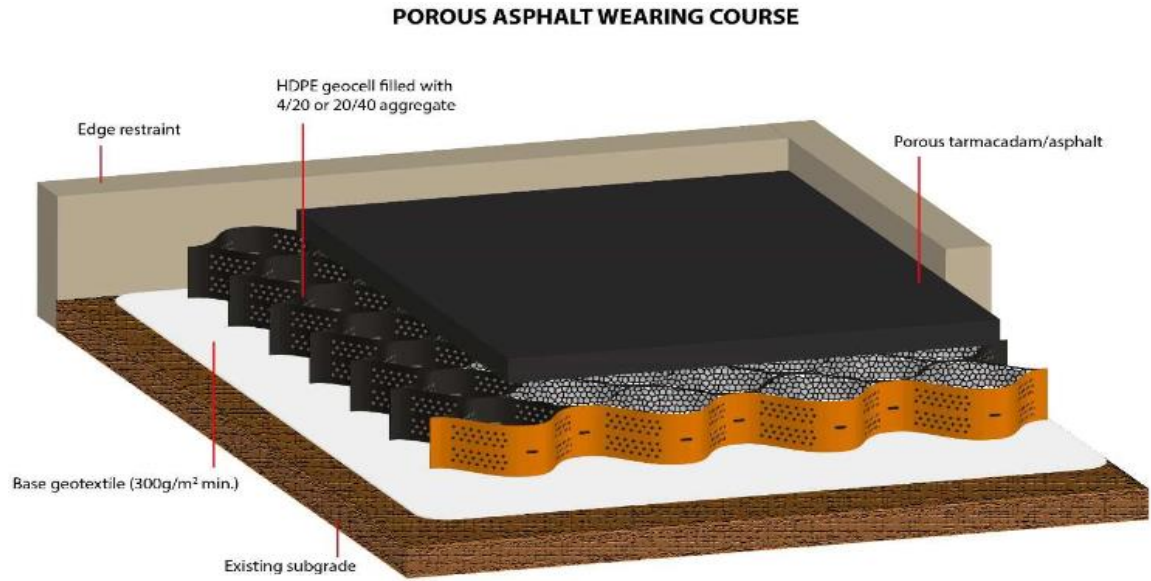


FIG. 4 – Surface finish with geo-cell sub-base

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.