Appendix A10.8: Arboricultural Assessment

1.1 Introduction

1.1.1 This Appendix presents the likely impacts of the proposed scheme with respect to arboriculture, including the impact on trees, groups of trees and woodland. The assessment should be read in conjunction with Chapter 4 (The Proposed Scheme), with reference to the glossary of arboricultural terms included in Annex A of this Appendix. This assessment should also be read in conjunction with Figure 10.9 to Figure 10.12 of this EIAR.

1.1.2 Owing to the size of the survey area and the large number of trees within it, a proportional and focused assessment of the existing tree population was conducted. The assessment used a combination of a baseline dataset illustrating tree cover (based on Lidar and aerial imagery via the National Tree Map (NTM), provided by BlueSky International Ltd (2024)), and targeted site survey work to address limitations which could arise from sole reliance on using the dataset in this way.

1.1.3 All tree locations have been located using Global Positioning System (GPS) and Lidar data, obtained from the NTM data. The tree stem location is based on the centre of an indicative circular canopy spread, so is approximate and subject to variation.

1.1.4 Land access was available for the majority of the proposed scheme footprint during the ground truthing surveys. Where land was inaccessible and not visible from surrounding accessible vantage points total reliance on the NTM data was required. Such areas were isolated and small in size and the approach taken on this project is consistent with other large scale infrastructure projects where total land access is not fully available.

1.1.5 The assessment of arboricultural impacts has been based on GIS data analysis using a range of assumptions and filters. As such, the assessment represents the likely potential impacts whilst adopting a precautionary approach. Some trees identified for removal may have the potential to be retained subject to further site-based assessment in relation to the detailed design. For example, trees which have a theoretical root protection area (RPA) affected by the proposed scheme located on a ditch feature that safely separates their root systems from construction activities may be suitable for retention.

1.1.6 This assessment does not take into consideration windthrow risk. The impact on trees is considered in relation to the individual tree's root protection area and any impact the proposed scheme may have on it, in line with the guidance given is BS5837:2012.

1.1.7 The Draft Compulsory Purchase Order (CPO) boundary (including Scottish Ministers Land and land managed by Forestry Land Scotland) includes two areas of woodland at the Muir of Thorn which are to be used to deliver mitigation measures in the form of tree planting and native woodland restoration. These works will be the subject of detailed management plans and the arboricultural impact of those is not considered in this assessment.

Study Area

1.1.8 NTM data was purchased for a wide area, extending well beyond the footprint of the proposed scheme. This represents a very large dataset which is useful to give context to the surrounding area and to support other assessments such as reported in Chapter 16 (Population – Land Use) and Chapter 12 (Biodiversity). The specific NTM data analysis can be undertaken on any

specific area of trees within the larger project area but to reduce data analysis effort for the purposes of this assessment, the study area was restricted to 30m (metres) on either side of the CPO boundary which includes, but is not limited to haul routes, access points, laydown areas and temporary drainage.

1.1.9 An overview of the proposed scheme including its routing and construction methodologies is included in Chapter 4 (The Proposed Scheme).

1.1.10 A minimum buffer of 30m has been applied to the Draft CPO boundary to allow for the capture of any potential veteran trees which can have an uncapped root protection area (RPA) as per the British Standards Institution (BSI) British Standard (BS) 5837:2012 Trees in relation to design, demolition and construction – Recommendations (BSI 2012), and using the UK Government and the Ancient Tree Forum recommendations of a stem diameter multiplier of 15 as opposed to the standard 12. For a veteran to have an RPA of 30m, it would have a diameter at breast height of 2m. Identifying a tree any larger than this is considered unlikely, therefore resulting in the 30m cap.

1.1.11 The compensatory woodland areas to the south of the main scheme, at the Muir of Thorn, have not been included in this assessment. Collectively these areas have an area of 51.2ha.

Relevant Guidelines, Policy and Legislation

1.1.12 The following legislation was considered:

- Town and Country Planning (Scotland) Act 1997, as amended by the Planning etc. (Scotland) Act 2006 - Provides for the making of Tree Preservation Orders (TPOs) by the Planning Authority where it is considered desirable to preserve trees on amenity grounds. This prevents the cutting down, topping, lopping or wilful destruction of trees without the specific consent of the Planning Authority. Such TPOs do not apply to the cutting of trees which are dead or dying or have become dangerous, or to the cutting of trees in compliance with statutory obligations to prevent or abate nuisance; and
- Forestry and Land Management (Scotland) Act 2018 - Contains the main provisions for the felling of trees. Under this act it is an offence for any person to uproot or cut down any tree unless the owner has obtained permission in the form of a felling licence from the Scottish Forestry, unless a relevant exemption exists.

1.1.13 The following policy was considered:

- National Planning Framework 4 - Sets out the Scottish Government's spatial principles, regional priorities, national developments and national planning policy. Policy 6 Forestry, woodland and trees intends to 'protect and expand forests, woodland and trees.'
- Scotland's Forestry Strategy – Presents a 50 year vision and 10-year framework 'to action, expand, protect and enhance Scotland's forests and woodlands'.
- The Scottish Government's Policy on Control of Woodland Removal – Provides policy direction on planning decisions which require removal of woodland, with a presumption against granting permission for schemes that require woodland loss.
- Perth and Kinross Council (PKC) Forest & Woodland Strategy 2014-2024 - This document defines PKC strategy for sustainable management of woodland trees within the Council

Boundaries. It includes specific guidance for how trees should be considered during development.

1.1.14 The following technical guidance was considered:

- BS5837:2012 Trees in relation to design, demolition and construction – Recommendations – Details the steps that should be taken to ensure that trees are appropriately and successfully retained when a development takes place (BSI 2012);
- National Joint Utilities Group (NJUG), Vol 4 Issue 2 – Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees – Technical guidance to guide the installation of underground services and allow them to co-exist with trees (NJUG 2007);
- BS3998:2010 Tree Work – Recommendations – Gives general recommendations for tree work. It gives guidance on management options for established trees (including soil care and tree felling) and overgrown hedges (BSI 2010);
- Ancient and other veteran trees: Further guidance on good management – Guidance for veteran tree classification and assessment (Ancient Tree Forum 2013);
- Tree Root Systems – Technical advice paper which considers the various factor influencing tree root growth (Arboricultural Advisory and Information Service 2015);
- The Influence of Soils and Species on Tree Root Depth, Information Note, Peter Crow – Technical advice paper which considers factor influencing tree root depth which is of relevance to buried utilities (Forestry Commission 2005);
- The Root Atlas, Central European forest trees and shrubs, Stocker – European study of tree species rooting depth and spread (Lore Kutschera, Erwin Lichtenegger 2002); and
- The Landscape Below Ground, Proceedings of an International Workshop on Tree Root Development in Urban Soils, International Society of Arboriculture P54-61- A Selection of technical papers which discuss tree root development and environmental influences on tree development (Watson and Neely 1995).

1.2 Approach and Methods

Introduction

1.2.1 Data for the appraisal was collected via a two-stage process. Initially data was gathered from GIS datasets and other publicly available sources and subject to detailed GIS analysis. The analysed data was then subjected to ground truthing surveys by qualified arboriculturalists to check for accuracy and provide information which cannot be wholly gathered from desk-based work (in particular the identification of 'significant trees').

Desk-Based Assessment

1.2.2 Using NTM data as a baseline dataset, a desk-based GIS analysis was conducted. Several filters were applied to the data to categorise the existing tree stock within the study area. The NTM dataset contains a range of metadata that allowed this approach. For each individual tree record the NTM records:

- Location as co-ordinates;

- Maximum tree height;
- Canopy area as both an indicative circular canopy and as an actual canopy outline; and
- Approximate stem location based on maximum height.

1.2.3 Using the Jacobs Project Mapper GIS database, Track Record, each NTM record was created as a unique item with an individual reference number. Tree height and tree canopy sizes were banded in size ranges commonly applied to tree inventory databases (Table A10.1-1 and Table A10.1-2). Each band was assigned a colour and a score. The combination of both score for height and canopy size was combined to give a total weighting score, which was also assigned appropriate colour scores (Table A10.1-3).

1.2.4 To keep the combined weighting score consistent with the preceding scoring bands, once added together, the combined score was divided by two to give an average and maintain a five tier banding structure using the same colour symbology.

Table A10.8-1: Tree Height Banding

Height Range	Weighting
<5m	1
5-10m	2
10-15m	3
15-20m	4
>20m	5

Table A10.8-2: Tree Canopy Size Banding

	Range (m2)		
Radius (m)	Bottom	Top	Weighting
1 to 3	0	28.2743	1
3 to 6	28.2744	113.097	2
6 to 9	113.098	254.47	3
9 to 12	254.48	452.39	4
12+	452.4	upwards	5

Table A10.8-3: Combined Weighting Banding

Combined Score	Colour
1	
2	
3	
4	
5	

1.2.5 This produced a series of maps of trees based on height (Figure 10.9), canopy size (Figure 10.10) and a combined weighting of both (Figure 10.11). This gives an indication of the location of the 'important' trees in the study area based on the assumption that taller and larger canopied trees will be the most valuable trees in terms amenity / biodiversity / carbon absorption and storm water interception (collectively referred to as ecosystem services, of which there are numerous) and also that taller, larger canopied trees, in general, are older trees (with some species related exceptions). On all the 'heat' mapping plans, trees in the 'darkest' colours are likely to be trees of greatest importance in the study area.

1.2.6 There is a risk that when using this methodology, a very tall tree with a small canopy or a short tree with very large canopy is underrepresented. While such trees would be very unusual, a review of the data indicated that no records fell into either category after scoring was completed.

Root Protection Area Mapping

1.2.7 The RPA of any given tree is the area of ground around that tree which should not be disturbed by excavation, compaction, changes in level or other construction / demolition operations. The extent of the RPA is calculated in accordance with BS5837:2012 Trees in relation to design, demolition and construction – Recommendation (BSI 2012), and is an important metric for understanding the impact a proposal will have on tree removal and retention and how to protect those trees retained.

1.2.8 It is well known that there is a strong relationship between tree height and stem diameter. While this can be influenced by many factors including climate and soils, for the purpose of the desk-based assessment, a ratio of 0.65 was selected. Using this, all trees in the dataset for the study area were assigned an approximate / indicative RPA as calculated as per BS5837:2012 Trees in relation to design, demolition and construction – Recommendation (which is 12 x stem diameter measured at 1.5m from ground level). The majority of available studies on the relationship between tree height and stem diameter have been carried out in the United States of America on forestry trees. Therefore, the RPA generated in this way is likely to underestimate the stem diameter of an open grown tree in Scotland, as open grown trees generally grow larger and more expansive due to lack of competition. To allow for this, a second RPA was applied to the NTM indicative circular tree canopies. This was applied as a 2m buffer on the outside of the canopy. The two RPAs applied to the individual trees represent what would be reasonably expected to be a maximum and minimum RPA of the trees, with a few notable exceptions.

1.2.9 It is a common misconception that tree roots are confined to the canopy drip line of the tree. Numerous studies, as well as BS5837:2012 Trees in relation to design, demolition and construction – Recommendation guidance, make it clear that this is not always the case. Tree root morphology is complicated, and few trees grow perfectly circular root systems. An RPA provides a notional circular buffer around a given stem based on the stem diameter taken at 1.5m. However, this is not necessarily representative of a tree root system, for example, the roots may extend beyond the RPA boundary on one side and remain inside it on the other. The actual root network extent is dependent on many factors including species, age, soil conditions, topography and exposure etc. which have not been considered in the assessment.

1.2.10 Veteran trees have an RPA calculated as 15 x stem diameter at breast height. All veterans in the study area are identified by field work, and the RPA subsequently plotted using field data and used in the assessment. A category trees, which might be larger than 'average trees' have also been identified and the RPAs plotted and used for the assessment as per BS5837:2012 guidance.

1.2.11 Trees have a finite reserve of energy, produced (and excess stored) each year, throughout the spring / summer seasons, which is utilised for biological processes such as growth and defence against pests or diseases.

1.2.12 Any scheme in proximity to trees has the potential to cause harm to those trees unless control measures are identified and acted upon. As such, it is essential to consider the relationship between the proposed scheme and the retained trees to identify what precautions are necessary and proportionate. The proposed scheme has the potential to impact upon the above ground (canopy, stems and branches) and below ground (rooting environment) parts of the trees.

1.2.13 Whilst some clear and obvious physical damage can occur to trees during the construction phase, such as to stems and branches, other impacts are not always so immediately evident, such as damage to the soil structure by compaction and / or changes in ground levels causing root damage, altering the water table and affecting moisture availability.

1.2.14 This assessment recognises that activities during the construction phase pose a real and significant threat and assesses the likely impacts of the proposals on the tree stock and, where appropriate, recommends mitigation measures.

Identifying trees of Significance

1.2.15 Using the weighting system, 'significant' trees are identified through colour coding.

1.2.16 A significant tree is considered to be:

- An ancient, veteran or notable tree, assessed as per Ancient Tree Inventory (Woodland Trust 2021) (that is a tree of great age for the species, of great girth for the species and exhibiting veteran tree features.);
- Large mature tree (or cohesive groups of trees, and woodland) which would be considered A category under BS5837:2012 Trees in relation to design, demolition and construction – Recommendation (BSI 2012) (Appendix B contains BS5837:2012 categorisation description);
- A tree notable for its ecological / cultural or historical significance, these are likely (but not exclusively) to be found in historic planned landscapes;
- Ecologically important trees; and
- Trees covered by TPOs.

1.2.17 A TPO check was conducted on Perth and Kinross Council online TPO portal on the 14 August 2024. This identified no TPOs were identified in the study area. Part of the study area is covered by the Birnam Conservation Area.

1.2.18 The PKC online search also indicated some trees to the west of the proposed scheme are located within the Historic Environment Scotland, Garden and Designed Landscape (GDL), Murthly Castle (reference GDL00292). Some trees to the south of the scheme, west of Inver are located within Historic Environment Scotland, GDL, The Hermitage (reference GDL00363). While the GDL designation does not infer any specific statutory protection of trees within it, the designation should carry weight when considering any proposals which may require trees to be removed.

1.2.19 The Woodland Trust maintains the Ancient Tree Inventory (ATI) which is an online resource which records notable veteran and ancient trees across the United Kingdom and Ireland. This inventory was checked on the 14 August 2024.

1.2.20 The check indicated that the study area contains one 'notable' tree.

1.2.21 The 'notable' tree is an atlas cedar (*Cedrus atlantica*) located on the northside of the A9 at Inver. This tree was recorded as a veteran (T3 on Figures 10.11, 10.12) in the ground truthing survey.

1.2.22 The ATI database is a definitive record and a lack of records on the database does not necessarily mean there are no more veteran or ancient trees are within the study area.

1.2.23 A desk-based only tree survey based purely on size metrics has a number of inherent risks One of the greatest risks is missing veteran trees, as the application of the above filters could potentially miss veteran or other 'significant' trees which often have very large stems but can have small canopies due to crown retrenchment and senescence caused by great age. There is also a more general risk across the study area that for whatever reason a tree has a large stem diameter but is low in height.

1.2.24 Tree bat roost features are commonly found on older trees and importantly veteran trees. Bat tree roost data gathered during ecological surveys (see Chapter 12 (Biodiversity) was overlaid upon the arboricultural survey area data to identify overlapping features which could indicate veteran or other 'significant' trees.

Ground Truthing Survey

1.2.25 Ground truthing walkover surveys were carried out by qualified Jacobs arboriculturalists between 16 August 2024 and 27 August 2024. The purpose of this survey was to check the whole study area for 'significant' trees which may have been missed due to the limitations of the desk-based survey.

1.2.26 The arboriculturalists based their assessment of potential veteran (ancient and notable) trees on the guidance provided by the Ancient Tree Forum and the Woodland Trust, specifically the document Practical Guidance, Ancient Tree Guide 4: What are ancient, veteran, and other trees of special interest, November 2008, Woodland Trust (Woodland Trust 2008) and the species-specific guidance on the Ancient Tree Inventory website (Woodland Trust 2023).

1.2.27 Field surveys were conducted using mobile data collection apps generated using ESRI Field Maps. Data was geo-located using the smart devices internal GPS and cross-referenced against the NTM which was displayed as a reference layer in the data-driven map. Using this information, individual 'significant' trees were surveyed as well as a small sample of NTM trees

to check the accuracy of the data contained in that data base. The information was then analysed and visualised in ArcGIS Pro. Survey data was handled in accordance with Jacobs Geospatial Information Management Plan standards. The ground truthing element found that the desk-based analysis and the underlying NTM data was reliable.

1.3 Baseline Conditions

1.3.1 No TPOs were identified in the study area. Birnam Conservation Area covers some trees around the Birnam settlement within the study area.

1.3.2 Within the vicinity of Birnam village the study area is peri-urban with the majority of the trees located in gardens, within formal green spaces and surrounding properties. Most trees recorded are of native or naturalised species typical for the setting. Sycamore (*Acer pseudoplatanus*), ash (*Fraxinus excelsior*), pedunculate oak (*Quercus robur*), rowan (*Sorbus aucuparia*) and beech (*Fagus sylvatica*) are all in abundance, with other ornamental species present. Significant outlying individuals generally comprise of species imported historically as specimen trees by individuals such as David Douglas and other seed collectors/botanists known for their contribution to trees within Perthshire. A large amount of the survey area is covered by commercially planted woodland, typically comprising of a monoculture of predominantly spruce (*Picea sp.)* with some minor broadleaf and mixed species elements present.

1.3.3 Perthshire is renowned for large, mature trees, of which a number were found during the survey. Age class diversity is present across the site but typically confined within respective woodland/grouping types. Most trees situated within tree groups or woodlands are early-mature or mature. Within some of these stands natural regeneration is occurring which is generally young or semi-mature in age. However, many trees found directly adjacent to the A9 and the various road junctions are consistent with self-set natural regeneration and are predominantly semi-mature or early-mature.

1.3.4 The study area contained numerous ash trees of all age classes. The majority of these trees were noted to be suffering from Ash Die Back (ADB).

1.3.5 ADB also known as Chalara or Chalara dieback of ash, is a disease of ash trees caused by a fungus called *Hymenoscyphus fraxineus*. ADB causes leaf loss, crown dieback and bark lesions in affected trees. Once a tree is infected the disease is usually fatal, either directly or indirectly by weakening the tree to the point where it succumbs more readily to attacks by other pests or pathogens, especially Armillaria fungi, or honey fungus.

1.3.6 It has caused widespread damage to ash populations in continental Europe, where experience indicates that it can kill young ash trees quite quickly, while older trees can resist it for some time, until prolonged exposure or another pest or pathogen attacking them in their weakened state, eventually causes them to succumb.

1.3.7 Evidence from other parts of Europe and the United Kingdom suggest that infected trees rapidly lose structural integrity and are more prone to branch shedding and total collapse. Furthermore, ash, as a species is known for its inability to retain even small deadwood, which it sheds regularly as it appears in the crown.

1.3.8 The Tree Council has produced a document giving guidance on how to deal with ADB to tree owners and managers, 'Ash dieback: an Action Plan Toolkit (Summer 2019)' (The Tree Council 2019). This document gives guidance on assessing the danger posed by the trees infected by ADB and recommends the adoption of the Suffolk County Council Ash Health Assessment System, which categorises ash trees with the symptoms in four categories:

- Ash Health Class (AHC) 1 – 100 – 75% Canopy healthy (Vitality Class 0);
- Ash Health Class (AHC) 2 – 75% -50% Canopy healthy (Vitality Class 1);
- Ash Health Class (AHC) 3 – 50% - 25% Canopy healthy (Vitality Class 2); and
- Ash Health Class (AHC) 4 – 25% - 0% Canopy healthy (Vitality Class 3).

1.3.9 The above system was used when assessing ash trees during the ground truthing survey, and in general almost all the trees were at least AHC2.

1.3.10 Some of the large individual trees recorded within this survey, as well as groups and woodlands are located within areas of farmland which is subjected to a range of agricultural practices. Regular ploughing and associated sub-soiling are common practice in many areas, and this often occurs close to the stems of large established trees, well within the theoretical RPA calculated by BS5837:2012. Some sub-soilers operate at depth of up to 60cm below the surface, and regular ploughs in the region of 12 to 35cm deep. There is little research done on the impact of such practices on tree root profile, but in many cases the trees affected appear to suffer few adverse impacts. It can be assumed that regular ploughing and sub soiling leads to a deeper rooting profile, and that the rhizosphere is much better adapted to the effects of trafficking from heavy vehicles and equipment. Field trees are generally also significantly crown lifted to allow large farm machinery to pass below them. This has been taken into consideration when assessing the requirement for tree removals and protection for such trees.

1.3.11 Water courses are also a significant feature of the survey area. Such features create an effective root barrier to any trees growing alongside them, and it would not be expected to encounter tree roots on the opposite side of a watercourse to which the tree is growing.

1.3.12 Some of the trees are located alongside surfaced roads. Tree roots need uncompacted soils to grow within and survive, an important element being access to oxygen. Forestry Commission research has found that tree roots do not occur in significant quantities at substantial depths (e.g. more than 2m) in the soil profile (Forestry Commission 2005). There are cases where isolated roots have been found at depths much greater than this, in deep and loose soils (Gilman 1990). However typically between 90 and 99% of a tree's total root length occurs in the upper 1m of soil. All the roads in the study area appears to be of substantial construction and it is considered unlikely they will contain significant rooting from roadside trees, due to the harsh rooting environment they represent.

1.3.13 Table A10.8-4 and Figure A10.8-1 show the number of the trees by weighting in both the study area and the Planning Application Boundary.

Table A10.8-4: Total Trees Within Study Area/Draft CPO Boundary

Combined Score	Draft CPO Boundary Total Trees	Study Area Total Trees
1	274	425
2	1685	2824
3	4950	7838
4	6476	9357
5	228	320
Total	13613	20764

1.3.14

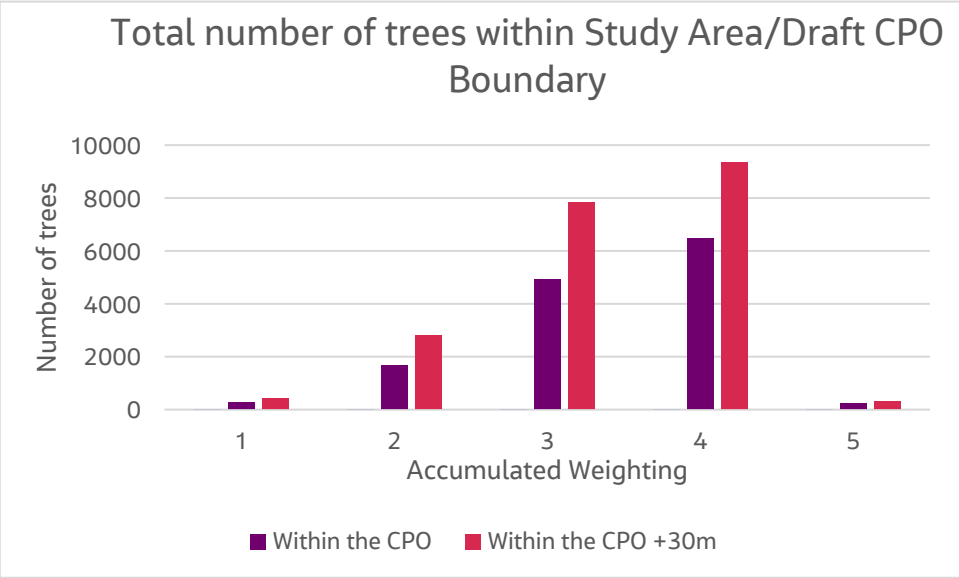

Figure A10.8-1: Total Trees Within Study Area / Draft CPO Boundary

1.3.15 Figures are included in Volume 4 of the EIAR. Figure 10.9 presents trees graded by canopy size, Figure 10.10 presents trees graded by height, and Figure 10.11 presents trees by accumulated weighting.

1.3.16 Generally, the higher scoring trees can be considered the most important due to the numerous benefits they deliver, increasing with size. In general, the loss of trees with a score of 2 or less is of less significance than the higher scoring trees. Trees with lower scores are less important in terms of ecosystem and amenity benefits but in most cases represent younger trees which are an essential cohort of any tree population as they provide the replacement trees as the upper age classes of the population age and die. Younger trees can more easily be replaced than older trees, as can 'smaller' trees than 'bigger' trees in so far as it takes less time to replace a 10-year-old tree than a hundred year old tree.

1.3.17 However, on balance in assessing the impact of larger schemes it is generally better to consider canopy area loss rather than individual tree loss, as the importance of the collective often far outweighs the importance of the individual.

Significant trees

1.3.18 The ground truthing survey identified 34 trees within the Draft CPO boundary, and 45 within the study area that were considered A Category trees as per the BS5837:2012 guidance (See Annex B).

1.3.19 The survey also identified (or confirmed ATI entries) five veteran/ancient trees within the Draft CPO boundary and five within the study area. The breakdown of these trees by accumulated weighting is presented in Table A10.8-5. This breakdown helps to confirm the assumption made in section 1.4.15 '*In general the loss of trees with a score of 2 or less is of less significance than the higher scoring trees*' as only one of the significant trees identified was in weighting bands 1 & 2.

Table A10.8-5: Significant Trees by Accumulated Weighting

Accumulated Weighting	Total Number of Trees					
	Within the draft CPO	Within the Draft CPO +30m	Of which - within Draft CPO are		Of which - within Draft CPO + 30m are	
			Category A trees	Veteran trees	Category A trees	Veteran trees
1	274	425	0	0	0	0
2	1,685	2,824	0	1	0	1
3	4,950	7,838	5	1	8	1
4	6,476	9,357	18	2	26	2
5	228	320	11	1	11	1
Totals	13,613	20,764	34	5	45	5

1.3.20 The features detailed in Table A10.8-6 were highlighted as ancient or veteran, during the site survey.

Table A10.8-6: Ancient & Veteran Trees

Survey Reference	Species	Girth (cm)	Discussion
T1	European beech (Fagus sylvatica)	300	This tree is directly adjacent to a shared use access track within the northern portion of the survey area. It is typical of phoenix regeneration with a bole height around 4m. A remnant crown outline is present, with live residual growth in the canopy. Epicormic growth is abundant on the tree stem, likely as a result of the significant decay, tears, historic storm damage and hollowing found throughout the tree. It was noted that this tree has moderate bat roosting potential.

Survey Reference	Species	Girth (cm)	Discussion
			This tree is listed as BT111. This tree is not listed on the ATI.
T2	Pedunculate oak (Quercus robur)	440	This tree is directly adjacent to a shared use access track within the northern portion of the survey area. The tree is a natural pollard with mostly full live growth throughout a nearly full crown outline. Tears, scars and stubs are all found throughout the canopy with extensive hollowing within the lower stem and basal area. Simultaneous white and brown rot was noted at the time of surveying, indicative of the extensive hollowing. A slight western lean is visible, with many buttress roots exposed at the base. The canopy is conflicting with surrounding trees, likely indicative of storm damage. This tree is listed as BT113. This tree is not listed on the ATI.
T3	Atlantic cedar	700 (Estimated)	This cedar is an extremely large and expansive individual. With a maiden form and mostly full, live crown outline, dysfunction can be found in the form of tears, scars and stubs. Furthermore, water pockets, rot, bark necrosis and deadwood are all present. Multiple fungal fruiting bodies were found on the basal bole, with fern growing from historic branch collars. Storm damage is evident, with some sparse pockets in the upper canopy. Visibility is restricted into the upper canopy, with a dense lower canopy encapsulating the stem. This tree is listed on the ATI as notable – Ref 197488 This tree is tagged 1698.
T4	Pedunculate oak (Quercus robur)	400	This tree is an oak with a unique form. Likely a result of historic storm damage, this tree has lost one of its co-dominant stems. With a maiden form and partially live, crown outline this tree is still reasonably vigorous considering the extensive hollowing and loss of a stem. Decay is evident, with a brown rot noted within the heartwood of the remaining stem. Multiple areas of deadwood, both within the canopy and fallen

Survey Reference	Species	Girth (cm)	Discussion
			were noted, with the fallen stem remaining at ground level nearby. This tree is not listed on the ATI.
T5	European beech (Fagus sylvatica)	314	This tree is a natural pollard with a bole height around 7m. A residual live canopy and remnant crown outline is present from 2m, with epicormic growth in abundance on the stem. Bark flaking and issues were noted at the time of surveying, from the base to 2m, likely due to animal damage. Extensive hollowing from the basal area to the canopy is present, with holes, water pockets and simultaneous rot observed. Both attached and fallen deadwood were found alongside Meripilus sp. fruiting bodies in the basal area. This tree is rich in habitat value, with wood dust found, indicative of boring insects utilising the stem. This tree is not listed on the ATI.

Canopy Area

1.3.21 Canopy area is an important metric and one used by Governments to set targets for both tree planting and to limit deforestation. The Forestry Commission, Tree cover outside woodland in Great Britain, National Forestry Inventory, calculated that 19.4% of the total land area of Scotland has tree cover (tree cover and canopy cover being interchangeable terms here) (Forestry Commission, 2017). This compares with an average 33.5% at European Union (EU) level and 30% globally.

1.3.22 The same report calculated canopy cover of Scotland's woodlands represented 18.3% of land area and 'tree cover outside woodland' represented 1.1%.

1.3.23 Within East Scotland (the area the report defines Dunkeld as being located within) woodland covered 104.2ha (of land area) or 16.2% and 'tree cover outside woodland', 2.3% giving a total canopy area of 18.4%. Therefore, the proposed scheme is in a region of Scotland with an average canopy cover below that of the national level (19.4%). However, such a difference should be considered alongside the physical constraints the regions topography and climate present to widespread tree growth.

1.3.24 Canopy area was calculated for the study area by merging all overlapping canopies of trees to give a combined canopy area of 134.8ha (See Table A10.8-7) This equates to a canopy cover of 52% of land area within the study area. 52% is higher than both the Region results in the FC Statistical report and the national average.

Table A10.8-7 Canopy Areas

Land Area within Draft CPO Boundary (ha)	Canopy Area Within Draft CPO Boundary (ha)	Canopy Cover of Draft CPO Boundary (as % of Land Area)	Land Area Within the Study Area (ha)	Canopy Area Within the Study Area (ha)	Canopy Cover of the Study Area (as % of Land Area)
157.0	81.4	52%	259.8	134.8	52%

1.4 Potential Impacts and Effects

1.4.1 Due to the scale of the proposed scheme and the current stage of design maturity, certain assumptions have been made to assess the impact on trees within the study area. It should be noted that there are many variables which will need to be considered when deciding on the actual removals required. Therefore, the figures presented in this section represent a precautionary approach (where all at risk trees assumed to require removal), and with further design work could be reduced.

1.4.2 The 51.2ha of woodland and open ground to the south of the scheme (at the Muir of Thorn), secured for mitigation, has not been included in this assessment. While tree felling will take place at these sites, it will form part of a phased restructuring plan to restore native woodland and will be the subject of detailed management plans. As this woodland management is not required to construct the proposed scheme, it has not been included in this assessment.

1.4.3 Assumptions for the assessment of removals:

- The 2m indicative maximum RPA was used for the initial assessment. The initial assessment was reassessed through an iterative process of specialist review, which used a combination of site survey target notes, the maximum and minimum RPAs and imagery;
- Trees located within the Draft CPO boundary, outside of retained vegetation areas will require removal to facilitate construction activities. When a tree is located outside of the Draft CPO boundary but with more than 20% of the RPA located within the Draft CPO boundary, it will require assessment by an arboriculturalist to determine if it can be retained. Previous iterations of BS5837:2012 Trees in relation to design, demolition and construction – Recommendation (BSI 2012) accepted that in the region of 20% of a tree's RPA could be removed with minimal adverse impact on the trees health. However, the arboriculturalist will need to assess severity of root damage, health of the tree, and potential working practices to determine if a tree can be safely retained or requires removal. These trees have been recorded as 'at-risk' in the assessment;
- Areas of the Draft CPO are specifically dedicated for ecological mitigation, including tree planting and habitat creation. Within these areas existing trees would be retained and protected. Any trees within these areas are assessed as retained, though trees along the boundaries are assessed using the same 'at risk' methodology outline above;
- Areas of trees within the Draft CPO have been identified as being important for retention for landscape and ecological purposes. Trees within these areas are shown as retained, but trees on the boundaries are assessed using the 'at risk' methodology:

- Where roadside trees are to be retained alongside undisturbed 'blacktop' (the bitumen sealed running surface of the road) then there will be no impact on surrounding trees for the reasons previously discussed; and
- Watercourses form important tree protection barriers from construction activity. Where possible, removals have been adjusted to take account of physical root barriers which mean the Construction Phase will have minimal impact on trees.

1.4.4 Based on these assumptions, a GIS desk-based assessment (with iterative refinements) was made on the removals required to construct the proposed scheme. The numbers of trees, by weight banding are presented in Table A10.8-8 and indicated on the Tree Removal and Retention Plans (Figure 10.12). These have been produced at this stage for illustrative purposes to visually demonstrate a precautionary scenario of potential tree removals required. These are not definitive vegetation removal plans and will require further refinement as the proposed scheme design is developed.

1.4.5 Out of a total of 20,764 trees within the study area, 7,795 will be required to be removed (37% of all the trees). A further 463 trees are at-risk in the study area (2% of all trees). In a precautionary scenario, where all at-risk trees will be required to be removed, 8,258 trees will need to be felled, representing 39% of the total trees within the study area.

Table A10.8-8 Tree Loss by Accumulated Weighting

Accumulated Weighting	Trees at-risk	Trees Removed	Trees Retained	Grand Total
1	11	222	192	425
2	78	1,247	1,499	2,824
3	175	2,978	4,685	7,838
4	196	3,251	5,910	9,357
5	3	97	220	320
Grand Total	463	7,795	12,506	20,764

1.4.6 While Table A10.8-8 presents the impacts as numbers of trees, a more useful metric for considering tree loss on a project of this scale is canopy cover. Table A10.8-9 shows canopy loss within the study area (as some removals may fall outside of the Draft CPO boundary). Based on the below removal calculations, 51.47ha of canopy cover would be lost in the study area, with a further 3.48ha at-risk. In a precautionary scenario, if all the at-risk trees are removed, 54.95ha of canopy would be lost. The resulting canopy cover in the study area would be 21% (reduced from its current 52%). If all the at-risk trees could be retained, the resulting canopy cover of the study area would be 32%.

Table A10.8-9 Canopy Loss

	Canopy Area Lost Within Study Area	Remaining Canopy Area Within Study Area	Canopy Area 'At Risk' in Study Area
Area in Ha	51.47	79.87	3.48

1.4.7 The precautionary scenario for canopy cover removal (i.e., all the at-risk trees are removed) would leave the canopy cover of the study area (21%) higher than the canopy area of the region (18.4%) the country (19.4%) and Great Britian (16.7%) as reported in the 2017 Tree cover outside woodland in Great Britian Statistics Report.

Impact on significant trees

1.4.8 The assessment indicates that proposed scheme would require the removal of 24 A category trees within the study area, with a further one 'at risk'. In addition, five trees identified as veteran/ancient require removal.

1.4.9 The removals of significant trees are present in Table A10.8-8. While the assessment indicates five veteran trees require removal, in some cases there may be an option to retain the tree or part of it, with further design work and arboricultural interventions. This is summarised in Table A10.8-10.

Table A10.8-10 Impacts on Significant Trees in the Study Area

Accumulated Weighting	Removed		At Risk	
	Category A Trees	Veteran/Ancient	Category A Trees	Veteran/Ancient
1	0	0	0	0
2	0	1	0	0
3	3	1	0	0
4	12	2	1	0
5	10	1	0	0
Total	25	5	1	0

1.4.10 The impact on significant trees is summarised in Table A10.8-11.

Table A10.8-11 Impact on Veteran/Ancient Trees

Survey Reference	Species	Discussion
T1	European beech (Fagus sylvatica)	Assessment indicates tree requires removal due to significant encroachment into its RPA. There may be an option to retain the tree with further design iterations and mitigation measure such as canopy reductions.

Survey Reference	Species	Discussion
T2	Pedunculate oak (Quercus robur)	Assessment indicates tree requires removal due to significant encroachment into its RPA. There may be an option to retain the tree with further design iterations and mitigation measure such as canopy reductions.
T3	Atlantic cedar	Assessment indicates tree requires removal due to its location being within the footprint of a new structure and significant encroachment into its RPA. There may be an option to retain the tree with further design iterations and mitigation measure such as canopy reductions.
T4	Pedunculate oak (Quercus robur)	Assessment indicates tree requires removal due to significant encroachment into its RPA. There may be an option to retain the tree with further design iterations and mitigation measure such as canopy reductions.
T5	European beech (Fagus sylvatica)	Assessment indicates tree requires removal due to significant encroachment into its RPA. There may be an option to retain the tree with further design iterations and mitigation measure such as canopy reductions.

Operational Phase

1.4.11 Once construction is complete, there should be no direct further requirements for the removal of trees during the operation of the proposed scheme. However there remains a possibility that 'at risk' trees which have been retained with root damage succumb to either wind damage or physiological decline and require removal (or blow over).

1.4.12 An indirect need to fell additional trees may be created by the prevalence of infected ash trees within the study area. As the current tree stock declines further due to the effects of the disease, felling of dead and dangerous trees may be required to ensure the safety of personnel accessing elements of the new infrastructure. This felling will be the responsibility of the landowner upon which the trees are located and is necessary as part of their duty of care to persons on their land and neighbours.

1.4.13 Windthrow can be an issue in commercial crops following tree felling operations. The effects of windthrow can be unpredictable especially in relation to infrastructure projects which may locally impact on the movement and effects of wind in an unforeseen way. There is a residual risk that following completion of the scheme, some windthrow is experienced in surrounding commercial crops. However, windthrow in commercial crops would likely only trigger harvesting of a stand earlier than initially planned, along with associated restocking. As commercial sites are restocked, the overall impact on tree cover is relatively short lived as the new crop rapidly regrows.

1.5 Mitigation

Construction Phase

1.5.1 The early desk-based GIS analysis of the existing tree stock, including the generation of indicative RPAs and subsequent site surveys to identify significant trees has fed into iterations of the development of the proposed scheme and its various elements in an effort to design out impacts on trees, where possible. Figure 10.12 included in Volume 4 of this EIAR presents a Tree Removal and Retention Plan.

1.5.2 The main element of any Arboricultural Method Statement (AMS) is the protection of unmade (that is not protected by a loadbearing surface) RPAs by suitable buffers protected by suitably robust tree protection fencing or other barriers. On linear infrastructure schemes such barriers can often be formed by soil berms. Such schemes often require the pruning of retained trees, and such pruning schedules and specifications will be produced by a qualified arboriculturalist, in line with BS 3998:2010. Trees Work – Recommendations (BSI 2010), and carried out by qualified arboricultural contractors. In this way, any tree pruning will not have a detrimental impact on the trees.

1.5.3 Annex C of this appendix contains a generic AMS which sets out the general principles of the methodology that will be adopted on the proposed scheme, where appropriate. The generic AMS specifies generic tree protection measures to protect retained trees on-site.

1.5.4 The following mitigation measures will be implemented during the detailed design stage:

- A Project Arboriculturalist will be appointed to provide relevant additional input to be addressed at appropriate points;
- The generic AMS (Annex C) will be reviewed and updated into a site-specific AMS to provide appointed contractors with details on how specific operations need to be performed to protect trees including use of exclusion zones and ground protection; and
- A Tree Protection Plan will be produced providing schematic details of how protective fencing will be installed and any other pre-planned targeted tree protection measures.

1.5.5 In addition, at future design stages, potential design amendments and detailed arboricultural interventions will be considered to lessen the impact on the 'at risk' veteran tree and those veteran trees identified for removal, that have the potential to be retained in some form within the final scheme design.

1.5.6 The following mitigation measures will be implemented during construction:

- The site-specific AMS and Tree Protection Plan will be implemented as soon as works begin on-site;
- The Project Arboriculturalist will advise and resolve any unforeseen tree related issues which might occur and to provide general tree related advice; and
- On-site monitoring will be undertaken at agreed intervals before and during construction (this will be achieved through a combined effort between Transport Scotland and the appointed contractor) to ensure protection measures and the site-specific AMS are being implemented correctly.

Operational Phase

1.5.7 There are no anticipated direct impacts on the retained trees along the route of the proposed scheme during the Operational Phase, and therefore, no specific mitigation is identified.

1.6 Residual Effects

Construction Phase

1.6.1 Potential tree removals required to construct the proposed scheme are discussed in Section 1.4 and shown on Figure 10.12. Out of a total of 20,764 trees within the study area, 7,795 will be required to be removed (37% of all the trees). A further 463 trees are at-risk in the study area (2% of all trees). In a precautionary scenario, where all at-risk trees will be required to be removed, 8,258 trees will need to be felled, representing 39% of the total trees within the study area. The proposed scheme has a comprehensive compensatory planting scheme which will replace the canopy cover lost. As a large area of the Draft CPO will be occupied by new structures and tree planting space will be limited, much of the tree loss within the footprint of the new road is considered permanent.

Operational Phase

1.6.2 Significant changes in land use including the construction of structures and hard surfacing can have unforeseen impacts on the localised effects of wind. Combined with tree clearance of existing wind firm trees and wind firm edges of commercial blocks, there remains there a residual risk of windthrow in retained stands of trees. Windthrow in commercial stands usually leads to a quicker instigation of the felling and restocking cycle. This may lead to the loss of mature trees, but forestry regulations require the restocking of felled stands so any loss to windthrow is not likely to be permanent.

Conclusion

1.6.3 The proposed scheme will require the removal of 51.47ha of canopy area with a further 3.48ha at-risk of removal. In a precautionary scenario, if all the at-risk trees have to be removed,

54.95ha of canopy will be lost. The resulting canopy cover in the study area will be 21% (from its current 52%). If all of the at-risk trees could be retained, the resulting canopy cover of the study area would be 32%.

1.6.4 The precautionary scenario for canopy cover removal (i.e., all of the at-risk trees are removed) would still leave the canopy cover of the study area (21%) higher than the canopy area of the region (18.4%) the country (19.4%) and Great Britian (16.7%) as reported in the 2017 Tree cover outside woodland in Great Britian Statistics Report.

1.6.5 Out of a total of 20,764 trees within the study area, 7,795 will be required to be removed (37% of all the trees). A further 463 trees are at-risk in the study area (2% of all trees). In a precautionary scenario, where all at-risk trees will be required to be removed, 8,258 trees will need to be felled, representing 39% of the total trees within the study area.

1.6.6 The assessment indicates that proposed scheme would require the removal of 25 A category trees within the study area, with a further one 'at risk'. In addition, five trees identified as veteran/ancient require removal. Further iterations of the design process may allow for the retention of a number of the veteran trees identified for removal, though arboricultural interventions such as canopy pruning, may be required.

1.6.7 It is expected to be able to retain the at-risk 'features' with the implementation of mitigation measures during construction.

1.6.8 The implementation of a site-specific AMS and associated Tree Protection Plans will minimise any impact on retained trees and significantly reduce the number of at-risk trees which require removal.

1.6.9 Due to construction of the new road structure, some of the canopy loss is considered permanent within the Draft CPO boundary. However, the proposed scheme has a comprehensive mitigation proposal which includes planting of 51.18ha (plan area) of new woodland as shown on Figure 10.6.

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Annex A: Comprehensive Glossary of Arboricultural Terms

Ancient tree: An ancient tree is exceptionally valuable attributed with great age/size/cultural heritage/biodiversity value as a result of significant wood decay and the habitat created from the ageing process. All ancient trees are veteran trees with very few trees of any species reaching the ancient life-stage.

Bark: A term usually applied to all the tissues of a woody plant lying outside the vascular cambium.

Buttress zone: The region at the base of a tree where the major lateral roots join the stem, with buttress-like formations on the upper side of their junction.

Canker: A lesion formed by the death of bark and cambium often due to fungal or bacterial infection.

Condition: An indication of the physiological vitality of the tree. Where the term 'condition' is used in a report, it should not be taken as an indication of the stability of the tree.

Construction exclusion zone: Area based on the Root Protection Area (in square metres) to be protected during development, by the use of barriers and/or ground protection.

Crown/Canopy: The main foliage bearing section of the tree.

Crown lifting: A term used to describe the removal of limbs and small branches to a specified height above ground level.

Deadwood: Branch or stem wood bearing no live tissues. Retention of deadwood provides valuable habitat for a wide range of species and seldom represents a threat to the health of the tree. Removal of deadwood can result in the ingress of decay to otherwise sound tissues and climbing operations to access deadwood can cause significant damage to a tree. Removal of deadwood is generally recommended only where it represents an unacceptable level of hazard.

Dieback: The death of parts of a woody plant, starting at shoot-tips or root-tips.

Diameter at Breast Height (DBH): Stem diameter measured at a height of 1.5 metres (UK) or the nearest measurable point. Where measurement at a height of 1.5 metres is not possible, another height may be specified.

Habit: The overall growth characteristics, shape of the tree and branch structure.

Hazard beam: An upwardly curved part of a tree in which strong internal stresses may occur without being reduced by adaptive growth; prone to longitudinal splitting.

Minor deadwood: Dead wood of a diameter less than 25mm and or unlikely to cause significant harm or damage upon impact with a target beneath the tree.

Notable: Notable trees are usually mature trees which may stand out in the local environment because they are large in comparison with other trees around them.

Pollarding: The removal of the tree canopy, back to the stem or primary branches. Pollarding may involve the removal of the entire canopy in one operation or may be phased over several years. The period of safe retention of trees having been pollarded varies with species and individuals. It is usually necessary to re-pollard on a regular basis, annually in the case of some species.

Primary branch: A major branch, generally having a basal diameter greater than 0.25 x stem diameter.

Pruning: The removal or cutting back of twigs or branches, sometimes applied to twigs or small branches only, but often used to describe most activities involving the cutting of trees or shrubs.

Root protection area (RPA): An area of ground surrounding a tree that contains sufficient rooting volume to ensure the tree's survival, calculated with reference to Table 2 of BS5837 (2005).

Snag/stub: In woody plants, a portion of a cut or broken stem, branch or root which extends beyond any growing-point or dormant bud; a snag usually tends to die back to the nearest growing point.

Stem(s): The main supporting structure(s), from ground level up to the first major division into branches.

Topping: In arboriculture it is the removal of the crown of a tree, or of a major proportion of it.

Tree Preservation Order (TPO): Is an order made by the local authority and placed upon individual trees, groups of trees or areas of trees. The local authority must usually grant permission prior to any works undertaken to affected trees.

Veteran tree: A term for an old specimen that is of interest biologically, culturally or aesthetically because of its age, size or condition and which has usually lived longer than the typical upper age range for the species concerned.

Annex B: BS5837:2012 Table 1 Cascade Chart for Tree Quality Assessment

1.7.1 Extract from BS5837:2012 Trees in relation to design, demolition, and construction – Recommendations

Figure A10.8-2 BS5837:2012 Table 1 Cascade Chart for Tree Quality Assessment

Table 1 **Cascade chart for tree quality assessment**

Category and definition	Criteria (including subcategories where appropriate)			Identification on plan
Trees unsuitable for retention (see Note)				
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	• Trees that have a serious, irremediable, structural defect, such that their early loss is expected due to collapse, including those that will become unviable after removal of other category U trees (e.g. where, for whatever reason, the loss of companion shelter cannot be mitigated by pruning) • Trees that are dead or are showing signs of significant, immediate, and irreversible overall decline • Trees infected with pathogens of significance to the health and/or safety of other trees nearby, or very low quality trees suppressing adjacent trees of better quality *NOTE Category U trees can have existing or potential conservation value which it might be desirable to preserve; see **4.5.7**.*			See Table 2
	1 Mainly arboricultural qualities	**2 Mainly landscape qualities**	**3 Mainly cultural values, including conservation**	
Trees to be considered for retention				
Category A **Trees of high quality** with an estimated remaining life expectancy of at least 40 years	Trees that are particularly good examples of their species, especially if rare or unusual; or those that are essential components of groups or formal or semi-formal arboricultural features (e.g. the dominant and/or principal trees within an avenue)	Trees, groups or woodlands of particular visual importance as arboricultural and/or landscape features	Trees, groups or woodlands of significant conservation, historical, commemorative or other value (e.g. veteran trees or wood-pasture)	See Table 2
Category B **Trees of moderate quality** with an estimated remaining life expectancy of at least 20 years	Trees that might be included in category A, but are downgraded because of impaired condition (e.g. presence of significant though remediable defects, including unsympathetic past management and storm damage), such that they are unlikely to be suitable for retention for beyond 40 years; or trees lacking the special quality necessary to merit the category A designation	Trees present in numbers, usually growing as groups or woodlands, such that they attract a higher collective rating than they might as individuals; or trees occurring as collectives but situated so as to make little visual contribution to the wider locality	Trees with material conservation or other cultural value	See Table 2
Category C **Trees of low quality** with an estimated remaining life expectancy of at least 10 years, or young trees with a stem diameter below 150 mm	Unremarkable trees of very limited merit or such impaired condition that they do not qualify in higher categories	Trees present in groups or woodlands, but without this conferring on them significantly greater collective landscape value; and/or trees offering low or only temporary/transient landscape benefits	Trees with no material conservation or other cultural value	See Table 2

Annex C: Generic Arboricultural Method Statement

Introduction

1.7.2 Jacobs has prepared a Generic Arboricultural Method Statement (AMS) for the project. The AMS specifies generic tree protection measures to protect retained trees onsite. Once full construction detail and phasing is fixed, this document will be reviewed and updated to make the details it contains specific, a Tree Protection Plan produced, and both will be implemented as soon as works begin on site.

1.7.3 The services of a competent arboriculturist (the Project Arboriculturalist) will be retained throughout the planning and design stage for the relevant additional input to be addressed at the appropriate point. This Project Arboriculturalist will also be retained during the construction phase to advise and resolve any unforeseen tree related issue which might occur and to provide general tree related advice.

1.7.4 Additional visits are recommended post construction to identify any physiological and/or structural defect that may have been caused by the works. This timing of these visits will be agreed with the Project Arboriculturalist.

Arboricultural Action Required - Next Steps

1.7.5 Table A10.8-12 lists the standard elements, as referenced in BS 5837:2012 (BSI, 2012), recommended to satisfy planning concerns for this scheme and to ensure appropriate tree protection is considered and applied throughout the duration of the works.

Table A10.8-12 Follow up Arboricultural input relating to this project

Recommended arboricultural input	Purpose	Timing
Site specific Arboricultural Method Statement (AMS)	Work information package designed to provide contractors with details on how specific operations need to be performed to protect trees including use of ground protection.	Following detail design, subject to consent.
Tree Protection Plan	Provide schematic details of how protective fencing shall be installed and any other pre-planned targeted tree protection.	Following final design agreement in conjunction with the site-specific AMS
On site monitoring	To ensure protection measures and the method statement are being implemented correctly.	At agreed intervals before and during the construction phase of the project.

1.7.6 Impacts to the trees, as outlined within the body of the report, could alter with any changes to the current design proposals. Tree impacts will therefore be reviewed as the design process progresses with all relevant parties informed of the changes, where appropriate.

Arboricultural Method Statement

Introduction

1.7.7 The most important and effective process, in terms of preventing damage to trees on a construction site, is the timely erection of tree protection fencing. This must be erected as the first operation on site, for example, before access track construction, before Contractor's site cabins, and before trenching for service runs.

1.7.8 However, it is noted that the fencing provides an unnecessary and potentially dangerous restriction to essential tree works and therefore tree works can be carried out before fencing is erected.

1.7.9 To protect retained trees and hedges correctly throughout the construction process, tree protection measures will be removed in the exact opposite order and methodology they were installed so that one of the last actions onsite is the removal of the tree protection measures.

General

1.7.10 This Arboricultural Method Statement is generic, and once the final development plans are finalised, it will be reviewed so that it is tailored specifically to the scheme. An AMS will always be supported by a detailed Tree Protection Plan, which will indicate the alignment of Tree Protection Fencing, Construction Exclusion Zones and other specific site methodologies.

<u>Phasing</u>

1.7.11 Detailed below is an indicative phasing programme which must be followed by the contractor throughout the life of the proposed scheme to ensure that trees are protected in accordance with the Arboricultural Method Statement.

Phase 1 – enabling works

- Install Tree Protection Fencing as required;
- Install ground protection measures as required; and
- Carry out approved tree removal and pruning

Phase 2 – development / construction

- Establish site compound - location for cabins, car park and the storage of materials;
- Carry out initial ground works and services installations; and
- Undertake main development construction.

Phase 3 – post-development

- Carry out soft landscaping (e.g. proposed replanting, grass reinstatement etc.);

- Remove protective fencing as required;
- Remove ground protection as required; and
- Carry out ground decompaction and reinstatement.

Pre-Commencement

1.7.12 A Pre-Commencement Site Meeting will be held with contractors who are responsible for operating machinery on site. The meeting will firstly highlight the potential for damage occurring to tree crowns, but thereafter ensure that extra care is applied when manoeuvring any machinery within close proximity of retained trees to prevent any contact with the tree and consequent damage to crown, stem or roots.

1.7.13 For clarity, prior to any construction or development work proceeding, the alignment of the protective fencing and the RPAs of any individual trees to be retained which are not able to be protected by fencing will be marked out using the distances provided by the Project Arboriculturalist. Marking out will be completed or approved by a person with arboricultural expertise as individual trees will have root zones that may be affected by local conditions and allowances will need to be made to accommodate this.

Access facilitation pruning

1.7.14 It is expected necessary to operate a wide or tall load, plant bearing booms, jibs and counterweights or other such equipment, as part of construction works and/or traffic on the construction access road. Such equipment would have potential to cause injurious contact with crown material i.e. low branches and limbs, of retained trees within, or without, the RPA fencing. It is best advised that appropriate, but limited tree pruning, be carried out beforehand to remove any obvious problem branches. This is classed as 'Facilitation Pruning' within BS 5837:2012.

1.7.15 The Facilitation Pruning Works specification shall be prepared by an arboriculturalist and submitted to the local planning authority for approval before construction, demolition or fencing operations commence on site.

1.7.16 All tree works will be carried out in accordance with BS 3998:2010 'Tree Works-Recommendations'.

1.7.17 The Facilitation Pruning will be carried out on site by a suitably qualified and experienced arborist before construction or demolition operations commence on site. The Facilitation Pruning can run concurrent with operations to erect tree protection fencing as long as this can be co-ordinated such that neither presents a hazard to the other.

1.7.18 Trees on site which are not to be retained can be removed as part of the Facilitation Pruning (or earlier if the appropriate planning consent is confirmed). To avoid mistakes, the individual trees to be removed will be identified and marked by a person with arboricultural expertise.

1.7.19 Any access facilitation pruning will not have a significant adverse impact on the tree's physiology or amenity value. In some cases, a suitable working space may be provided by temporarily tying back tree branches.

1.7.20 Pruning will generally occur after the leaves have 'flushed' and hardened, so late spring through summer. There are some exceptions, however, as some species such as Birch, Walnut and Maples, will 'bleed' sap and risk losing valuable sugars in the process if pruned in early spring, therefore the pruning of these trees will be carried out when this risk is low i.e. summer or mid-winter.

1.7.21 Hornbeam trees have two growth phases each year. One during the spring and the other in summer. The best time to prune them therefore is in September after the summer flush and before the leaves change colour and drop. This is also outside of the bird nesting season which usually runs from March to August. Alternatively prune in mid winter.

1.7.22 Species belonging to the genus Prunus such as Cherry partially rely on the production of a resin or gum to aid in the defence against wound related pathogens, therefore pruning will occur in the summer. In general, pruning will avoid periods where the exposed wood will be left open to severe conditions such as drought, frost, and periods of fungal sporulation (autumn).

1.7.23 Any tree works undertaken must take account of all protected species of flora and fauna and comply with all appropriate legislation. All tree work operations are covered by these provisions and advice from an ecologist will be obtained before undertaking any works that might constitute an offence.

1.7.24 It is recommended that any trees that require removal or significant canopy works, will be checked in advance of works by an ecologist to ensure there is no possibility of any disturbance to nesting birds or roosting bats.

Tree Protection Fencing and the Construction Exclusion Zone

1.7.25 The development design prepared for the site indicates that a number of trees within the RLB are being retained. In addition, there are numerous trees within influencing distance of the construction activity. The majority of these trees need to be protected from all construction operations by a protective barrier which creates a sacrosanct Construction Exclusion Zone (CEZ).

1.7.26 The alignment of the protective barrier is based on the calculated extent of the RPA which has been generated as a maximum and minimum based on spatial measurements taken from the NTM and in accordance with BS 5837:2012. The detailed alignment of tree protection fencing will be decided by the project arboriculturalist and indicated on a tree protection plan.

1.7.27 In principle, protective fencing will be erected before any construction operations start on site and will be removed only on completion of all construction works on site. In a phased project there may be a need to alter or remove/reposition fencing as the project progresses. The planning of these works will be carried out in consultation with the Project Arboriculturalist and no tree will be left unprotected during construction works.

1.7.28 Site hoarding is an acceptable alternative. It may be appropriate on some sites to use temporary site offices as components of the protection barriers, on the understanding that they will remain in situ for the duration of the construction works and their removal will be planned to ensure the Contractor's co-ordinated withdrawal from site away from the trees rather than towards them.

1.7.29 BS 5837:2012 clause 6.2.2.3 specifies an alternative protective barrier where site circumstances and associated risk of damage incursion into the RPA do not necessitate the default level of protection. In this project it is proposed that in areas remote from significant construction activity alternative fencing will provide the tree protection fencing. In places this will consist of agricultural stockproof fencing. Elsewhere the corridor the CEZ will be delineated with high viability orange site netting firmly attached to wooden post. This fencing will be erected before construction activities commence and will be inspected regularly and repaired as necessary.

1.7.30 All weather notices will be placed on fencing to indicate that operations are not permitted within the high visibility fenced area, for example "CONSTRUCTION EXCLUSION ZONE – NO ACCESS" or similar.

1.7.31 Once set up fences will not be removed or altered without prior consultation with the project arboriculturalist.

1.7.32 The presence of long grass and other vegetation in the 'Construction Exclusion Zone' is a welcome indicator that the protected area has been left undisturbed. However, on occasion, and certainly towards the end of the project, it is acceptable to cut the vegetation by hand held strimmer or scythe taking care not to work within 300mm of the tree trunk (to avoid damaging the bark). Vegetation within 300mm of the trunk can be cut with non-mechanised shears.

Temporary Ground Protection

1.7.33 Where unmade ground within the RPA of trees but outside the protective barrier is exposed to construction damage and/or soil compaction, temporary ground protection will be installed immediately following the erection of tree protection fencing and prior to starting work on site.

1.7.34 The ground protection will be capable of supporting any traffic entering or using the site without being distorted or causing compaction of underlying soil.

1.7.35 BS 5837:2012 suggests temporary ground protection might comprise of one of the following:

- For pedestrian movements only, a single thickness of scaffold boards placed either on top of a driven scaffold frame, so as to form a suspended walkway, or on top of a compression-resistant frame, so as to form a suspended walkway, or on top of a compression-resistant layer (e.g. 100 mm depth of woodchip), laid onto a geotextile membrane;
- For pedestrian-operated plant up to a gross weight of 2 t, proprietary (EuroMat or similar), interlinked ground protection boards placed on top of a compression-resistant layer (e.g. 150 mm depth of woodchip) laid onto a geotextile membrane;
- For wheeled or tracked construction traffic exceeding 2 t gross weight, an alternative system (e.g. proprietary systems or pre-cast reinforced concrete slabs) to an engineering specification designed in conjunction with arboricultural advice, to accommodate the likely loading to which it will be subjected. It may be that a cellular confinement system, such as Presto Geoweb or similar, laid on geotextile membrane and over filled with angular clean stone is more appropriate.

1.7.36 Existing hard surfaces offer good ground protection, and as far as possible will remain in situ as temporary ground protection during site works. Upon completion of works the surface can be carefully lifted if not required or used as a sub-base as appropriate.

1.7.37 Following completion of construction/demolition works, the ground protection will be removed and the ground reinstated without soil disturbance.

Demolition

1.7.38 Where demolition of a structure be required close to retained trees it shall employ a 'top down, pull back' procedure in small, controlled sections using a small arm demolition vehicle, removing all demolition debris in small amounts as soon as it has fallen to the ground. This is to ensure that the canopy, as much as is reasonably practical, is not damaged by machinery or falling masonry and building debris, and that the demolition debris is not stored over the RPA.

Installation of power supply and services

1.7.39 Any underground power supplies and services routed through the RPA will be installed in accordance with BS 5837:2012 clause 7.7.2 and NJUG Guidelines for the Planning, Installation and Maintenance of Utility Apparatus in Proximity to Trees. The preference is for all excavations to be completed by hand within an RPA. If this is not possible, then the smallest toothless bucket will be utilised removing small amounts of soil at each pass. If a root is encountered, then it will be exposed by hand and a suitable course of action agreed with eth project arboriculturalist.

1.7.40 When roots between 10-25mm in diameter be encountered, these would be retained undamaged wherever possible and protected from desiccation/frost by damp hessian sacking or a similar protective material until the excavation is back filled. Roots below 10mm in diameter may be trimmed back neatly in line with the edge of the excavation trench using secateurs.

Construction within RPA

1.7.41 The delivery, storage, mixing and discharge of concrete and all other cement-based materials shall be carried out so that there is no run-off and spillage near the RPAs of retained trees. No substances that are potentially injurious to plant tissue (including diesel, bitumen, concrete, mortar and other phyto-toxic materials) shall be stored, discharged, prepared or used, where direct contact, infiltration or run-off might reasonably be considered liable to harmfully affect existing root growth or other parts of retained trees.

1.7.42 Where chemicals are stored, it is now standard practice to have emergency spillage kits available to minimise the impacts of any accidental spillages to the local environment. All cement mixing, vehicle washing or any other activity where toxic chemicals are used shall have the provision to contain any accidental spillage. This can be achieved using suitable soil bunding or using a supporting timber framework sealed with heavy duty plastic sheeting.

Fence construction within RPAs

1.7.43 Where fence posts need to be installed within RPAs, excavations will be minimal and carried out using handheld tools. Fence posts will be erected at least 1 m from trees and using metal post support spikes or if using concrete mix, post holes will be lined with an impermeable membrane to prevent contact between tree roots and potentially damaging chemicals in the concrete.

1.7.44 The proposed fence alignment will allow for a minimum distance of 500 mm between the tree stems and the fence, providing sufficient room for the future increase of the stem diameter and minimising the risk of potential conflicts between the fence structure and the tree stem.

Root Pruning

1.7.45 The specific need for root pruning has not been identified in any areas of the scheme though a number of retained trees have minor incursions into their theoretical RPA which means root severance may be required. In most cases, will tree roots be uncovered during excavation works then they are most likely to belong to trees removed during the site clearance. Will it be clear that an uncovered root is associated with a retained tree then the following steps will be taken.

1.7.46 Minor roots (less than 25mm in diameter) will be cleanly severed with a sharp pruning saw, leaving as small a final cut wound as possible. Roots larger than 25mm diameter will be carefully exposed by hand. Once exposed the Environmental Clerk of Works or the Project Arboriculturalist will be contacted for advice on how to proceed. If it is considered the removal of the root will not have a destabilising, or detrimental impact on the parent tree, then it can be cleanly severed with a sharp pruning saw. A photographic record of any root pruning will be taken, along with its location marked clearly on a site plan.

1.7.47 If it is considered an unacceptable risk to sever the root, then it will be reburied or wrapped in damp hessian to prevent desiccation, whilst the project team work through options for dealing with the situation. In certain cases, this may require the removal of the parent tree.

Changes of level within RPAs

1.7.48 Generally, the levels within the RPA or protected area will not be changed. Typically, between 90 and 99% of a tree's total root length occurs in the upper 1 m of soil. Obviously, any excavation into this will remove part of the root system and potentially affect the vigour or stability of the tree. Conversely, any additional material built up above ground level will compact the soil beneath it, potentially compacting all the air pores in the 600 mm depth of soil that most roots are in, effectively suffocating the roots and thus affecting the vigour or stability of the tree.

1.7.49 On occasion, additional soil may be gently spread by hand within the RPA/protected area, for example, to marry levels in small areas between raised levels of no-dig construction and the existing levels. The maximum depth of this would be to 150 mm, reducing to nil. However, it is not generally acceptable, in large areas of the RPA/protected area to raise the level as a blanket. Any areas which will need to be raised are to be agreed with the project arboriculturalist prior to construction. Specifically, there will be no mechanical equipment within the RPA/protected area to spread, compact, or level out soil levels as this would compact the soil.

Permanent Surfacing (No-dig construction) in RPA

1.7.50 Should permanent surfacing be required within the RPA of a retained tree, the following methodology will be adopted.

1.7.51 After scraping off the above soil vegetation layer, a geotextile will be laid out on top of the existing ground, and subsequently a three-dimensional Cellular Confinement System (CCS) will be pegged out and infilled as manufacturer's recommendations. Infill materials will be no-fines aggregate (granular) which will interlock and be free draining and allow gaseous exchange. When infilled, this structure will act as the sub-base. Over fill (for example by 25 mm) in accordance with manufacturer's recommendations and proposed use. A separation geotextile will be laid on top of this construction before any final wearing course is installed (unless machine laid bounded surface), or overfill by 40-60mm to provide the wearing course.

1.7.52 The wearing course will be a permeable surface allowing gaseous exchange and the infiltration of water into the root zone.

1.7.53 Where existing hard surfaces were retained as temporary ground protection, new permanent hard surfacing will be built using the existing sub base and therefore avoiding any excavations and changes in level. This is to be carried out only on completion of surrounding construction work.

1.7.54 Roots smaller than 25mm diameter may be pruned back, making a clean cut with a suitable sharp tool except where they occur in clumps. Roots occurring in clumps or of 25mm diameter and over will be severed only following consultation with an arboriculturalist, as such roots might be essential to the tree's health and stability.

1.7.55 Kerbs and edgings that require excavations will not be used. Where kerbing is required for light structures, above-ground peg and board edging might be acceptable. Where the use of standard kerbs is unavoidable in areas used by vehicular traffic, foundations will not be continuous where this would require cutting or severing of roots larger than 25mm diameter. Instead, the kerbs will be "bridged" over the roots, leaving space that allows for future increase of the root diameter.

Excavations for soft landscaping

1.7.56 Where soft landscaping is proposed within the RPA of retained trees, excavations will be kept to the minimum required to provide adequate conditions for the establishment of new shrubs and trees. Excavations will be carried out carefully and by hand, avoiding the severance of any roots larger than 25mm diameter.

Removal of Existing Hard Standing

1.7.57 Where soft landscaping is proposed within the RPA in existing hard surfaces, the wearing course and its sub-base will be carefully lifted using handheld tools. Will any roots be exposed in the process, they will be immediately wrapped or covered to prevent desiccation and to protect them from rapid temperature changes. Any wrapping will be removed prior to backfilling, which will take place as soon as possible.

1.7.58 Prior to backfilling, retained roots will be surrounded with topsoil or uncompacted sharp sand (other than builders' sand), or other loose inert granular fill, before soil or other suitable material is replaced.

Soil Improvements and Mulching

1.7.59 To compensate for root damage and stress caused by construction activities it is recommended that the RPA of significant retained trees onsite will be mulched where possible. The materials that may be used for mulching include coarsely divided plant matter, such as wood chip, pulverized bark, or leaf mould, any of which may be combined with well-rotted animal manure. The mulched area will extend over as much of the root system as can be allowed by other site-usage requirements. The depth of an organic mulch will not be so much as to inhibit aeration of the root system or to cause overheating of uncomposted material (normally no more than 80 mm to 100 mm). The mulch will be periodically replenished as it decomposes, so that it does not become depleted.

Arboricultural Site Supervision

1.7.60 Tree Protection of trees on development sites is an iterative process which does not end with the finalisation of Arboricultural reports.

1.7.61 As such will appoint an Arboricultural Clerk of Works (ACoW), also known as the Project Arboriculturalist (PA). Their role is to adapt and update the AMS and TPP as the scheme is delivered to provide pragmatic and deliverable tree protection on site. As such the AMS and TPP will be seen as live documents, which are subjected to continual revision.

1.7.62 The ACoW will arrange to make regular visits to the site to attend pre commencement meetings, at key stages of the development (such as checking the erection of tree protection fencing) and to resolve any issue arriving onsite.

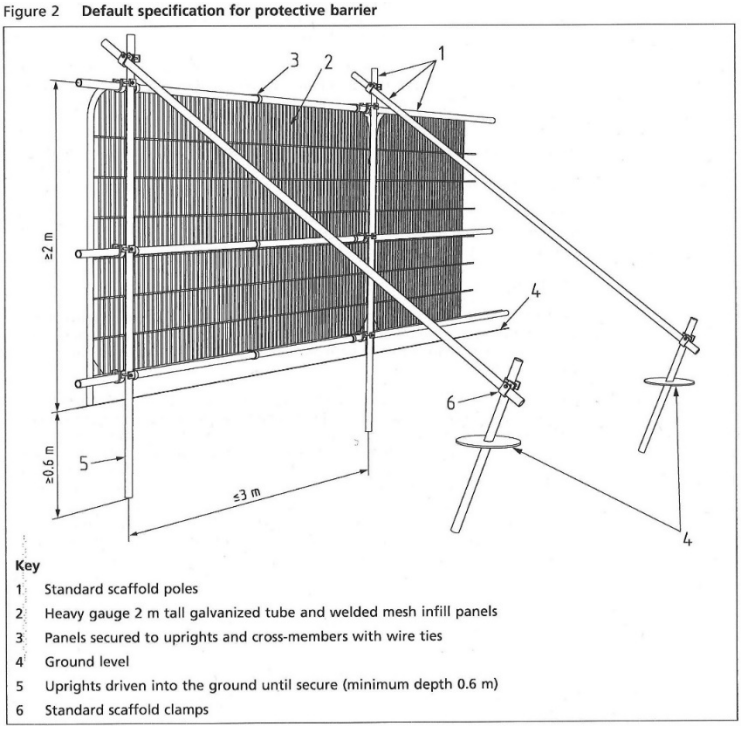
1.7.63 Records of any visits will be kept in the site diary and as brief site report documents. If requested, details of site visits will be made available to the Local Planning Authority.

1.7.64 Will non-compliance be observed during site visits, the ACoW will have the ability to halt work until the issues can be rectified, and the relevant persons informed.

Suggested Tree Protection Specification

Default Tree Protection Specifications (taken from pages 20-21 of BS5837:2012)

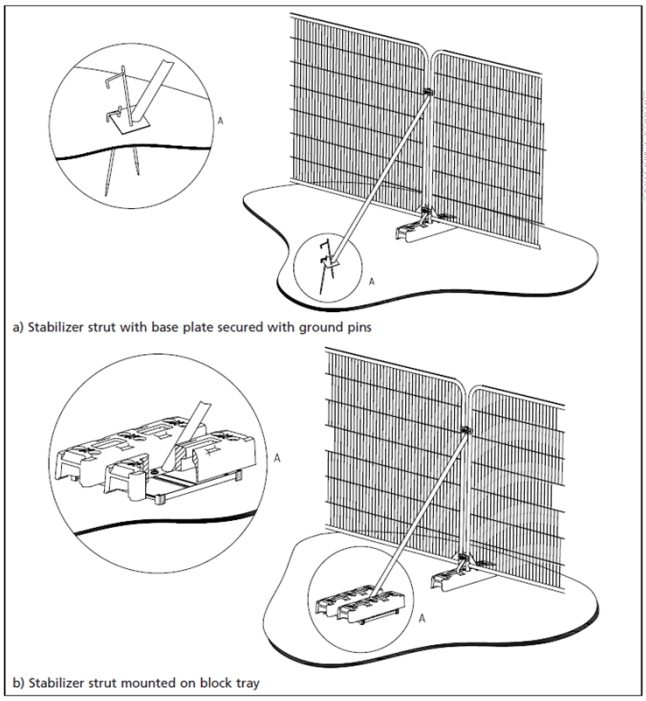
Figure 2 **Default specification for protective barrier**



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

Figure 3 **Examples of above-ground stabilizing systems**



Suggested Tree Protection Signage

1.7.65