16 Forestry

Contents

This page is intentionally blank.

16 Forestry

16.1 Executive Summary

16.1.1 The Proposed Development is situated within an extensive area of commercial forestry known as the Cumberhead Forestry Complex, which was originally planted between 1974 and 1989. Felling and replanting has been taking place under a Forestry Commission Scotland/Scottish Forestry (FCS/SF) approved Forest Plan since 2006, steadily restructuring the age and species profile of the forest.

16.1.2 This chapter details the design approach adopted to optimise the fit between the Proposed Development and the existing Baseline Forest Plan, before analysing the differences between the Baseline Forest Plan and Wind Farm Forest Plan in order to assess the potential impacts.

16.1.3 The Proposed Development will have an infrastructure and associated tree free area of 98.64 ha, requiring 59.38 ha of woodland to be felled. Of this 98.64 ha area, 61.96 ha was due to be replanted predominantly with Sitka spruce under the Baseline Forest Plan. As the Proposed Development precludes this replanting, 61.96 ha (3.0 % of the total forest area) will be subject to compensatory planting, to be delivered through the Compensatory Planting Plan on third-party land via option agreement with the landowner. A number of search areas for borrow pits have been identified within forestry areas and these areas have been included within the compensatory planting calculation.

16.1.4 The Proposed Development results in an additional 37.31 ha of harvesting in Phase 2 of the Forest Plan between (2021 to 2025), which represents a 7.7 % change from the Baseline Phase 2 felling area but only a 1.8 % change over the entire forest area. The relatively minor changes required to accommodate the Proposed Development are reflected in the timber production forecasts. The Wind Farm Forest Plan results in a slight decrease in timber production of 3,171 T or 2.0 % in Phase 2 between (2021 to 2025), and a 1.5 % decrease in total production over the 20-year Forest Plan period compared to the Baseline.

16.1.5 Timber harvesting to facilitate construction will occur ahead of the main construction phase, with all timber extracted via the existing forest road access to Station Road at Douglas West. As the Proposed Development has been designed to fit closely with the Baseline Forest Plan, there is little generation of forestry residues, however a Forest Residue Management Plan (Section 16.8) has been produced detailing how the small volumes generated will be utilised.

16.1.6 Overall, the Proposed Development is considered to have a good fit with the Baseline Forest Plan and a correspondingly modest effect on the social, economic and environmental benefits delivered by the Cumberhead Forest Complex, with the Wind Farm Forest Plan having an overall minor beneficial effect.

16.2 Introduction

16.2.1 The Proposed Development encompasses approximately 970ha of existing woodland, extending over two ownerships. The majority of the woodland forms part of the Cumberhead Forest Complex, extending to 2,014.62ha which is held in a single private ownership, of which, approximately 931 ha forms part of the Proposed Development. Eighteen turbines are located within the Cumberhead Forest Complex, primarily located in areas of young, recently felled and replanted woodland or woodland due to be felled over the next five years. The remaining three turbines are located on the neighbouring Cumberhead Farm, where one turbine is located in open ground and two turbines are partially located within a young commercial woodland, extending to 39.49 ha planted on the farm in 2017. For the purposes of this report, the total area of forestry has been reported as a single area, with figures broken down by ownership within the summary tables.

16.2.2 Cumberhead Forest was originally planted between 1974 and 1989 predominantly with Sitka spruce, with smaller proportions of other conifers including Lodgepole pine, Japanese larch and

Scots pine. Integral open ground is found throughout the forest, primarily associated with rides, riparian corridors and hill tops. The site is a productive commercial woodland with yield classes varying from 4 to 20, with the majority of the crop recording yield classes of 12 to 20. As such Cumberhead can be considered a good commercial forest property.

16.2.3 Cumberhead Forest has been extensively restructured over the past thirty years under successive Forest Plans, with greater species diversity having been introduced since 2006 when harvesting commenced, including areas of diverse conifers, native broadleaved trees associated with riparian corridors and designed open ground to improve landscape design.

16.2.4 Cumberhead Farm planted 39.49ha of new commercial woodland in 2017 designed to tie in with the replanting design of the adjoining Cumberhead Forest. As may be expected from a young woodland, no felling or replanting plans are yet in place.

16.2.5 This chapter describes the forestry related aspects of the Proposed Development, which consists of 21 turbines, which are to be located within areas of established commercial forestry within Cumberhead Forest and Cumberhead Farm. This assessment will compare the baseline position in relation to felling and replanting operations against changes arising as a result of the Proposed Development. The main forest is currently undergoing restructuring through an approved Forest Plan (the Baseline Forest Plan), detailing the sequential felling and replanting of conifer crops, gradually increasing the age class structure, species diversity and improving landscape design, with tree crops currently having planting years between 1974 and 2020.

16.2.6 Wherever possible, turbines have been located as sympathetically as possible reflecting the current forest structure, felling phases and replanting design identified within the Baseline Forest Plan, and keyholing of turbines into the forest to minimise the area impacted by the Proposed Development.

16.2.7 Replanting will take place up to the keyhole areas with bat protection buffer zones of 75 m radius around turbine bases to minimise woodland removal. The infrastructure associated with the Proposed Development, as described in the EIA Report (refer to Chapter 3 Proposed Development), including access tracks, turbines and crane pads, substation/energy storage and site compounds will require some limited removal of trees. Borrow pits and the temporary laydown and construction compound areas will be re-instated following the construction period and replanted (although following pre-application consultation with SF, these areas will be accounted for in the compensatory planting calculations).

16.3 Legislation, Policy and Guidelines

16.3.1 Relevant legislation and guidance documents have been reviewed and taken into account as part of this forestry assessment. Chapter 5 Planning Policy sets out the planning policy framework that is relevant to the EIA. The policies set out below include those from the South Lanarkshire Local Development Plan 2015. This section also considers the relevant aspects of Scottish Planning Policy (SPP), Planning Advice Notes and other relevant guidance. Of relevance to the forestry assessment presented within this chapter, regard has been had to the following policies:

- Forestry and Land Management (Scotland) Act, 2018;
- Climate Change Action Plan (Scotland), 2018;
- Scotland's Forestry Strategy (SFS), 2019;
- Scottish Land Use Strategy (SLUS), 2016;
- Scottish Planning Policy (SPP), 2014;
- National Planning Framework for Scotland 3 (NPF3), 2014;
- Control of Woodland Removal Policy (CoWRP), 2009;
- Guidance to FCS staff on implementing the Scottish Government's Policy on Control of Woodland Removal, 2019;

- Supplementary guidance to support the FC Forests and Peatland Habitat Guidance Note, 2000;
- Management of Forestry Waste, 2017;
- Use of Trees Cleared to Facilitate Development on Afforested Land – Joint Position Statement and Guidance, 2014;
- Clydeplan Strategic Development Plan and Local Development Plan, 2017; and
- Glasgow and Clyde Valley Forestry and Woodland Strategy, 2011.

16.3.2 These documents and their relevance to this chapter are described in more detail below.

National Policies

16.3.3 The Forestry and Land Management (Scotland) Act 2018 marked a new era for forestry in Scotland. Both the Act and the Strategy have the principles of sustainable forest management at their core, including adherence to the principle of 'the right tree, in the right place, for the right purpose,' and recognising the opportunities to better integrate forestry with other land uses and businesses.

16.3.4 The Scottish Government's 2018 Climate Change Plan outlines the crucial contribution of forestry to mitigating climate change through sequestering carbon dioxide from the atmosphere and storing carbon in sustainably managed forests and wood products. The Plan sets targets for increasing forest cover and woodland creation, and for increasing the use of timber in construction.

16.3.5 The SFS (FCS, 2019) is the Scottish Ministers' framework for taking forestry through the first half of this century and beyond. The strategy sets out the Ministers' 50-year vision for a Scottish forestry sector that is:

"In 2070, Scotland will have more forests and woodlands, sustainably managed and better integrated with other land uses. These will provide a more resilient, adaptable resource, with greater natural capital value, that supports a strong economy, a thriving environment, and healthy and flourishing communities".

16.3.6 This vision is built on the key strategic themes of Wood and Wood Fibre Supply and Demand, Climate Change Mitigation, Market Value and Efficiency, Adaptation and Resilience, Integrated Land Use, Skills and Workforce, Natural Assets, Environmental Quality and Biodiversity, Sustainable Thriving Rural Communities, Landscape and the Historic Environment, Health and Well-Being, and Urban Forestry.

16.3.7 The SFS sets out the following objectives:

- Ensuring Forest and Woodlands are Sustainably Managed
- Expanding the area of forests and woodlands, recognising wider land-use objectives
- Improving efficiency and productivity, and developing markets
- Increasing the adaptability and resilience of forests and woodlands
- Enhancing the environmental benefits provided by forests and woodlands
- Engaging more people, communities and businesses in the creation, management and use of forests and woodlands

16.3.8 Scotland's Forestry Strategy Implementation and Plan 2020-22 details for the delivery, actions, monitoring and reporting on SFS, with the following specific action relating to forestry and renewables:

- Implement the Control of Woodland Removal Policy.

16.3.9 The SLUS is a strategic framework for achieving the 'best' use from Scotland's land resource. The strategy aims to achieve a more integrated approach to land use, maintaining the future capacity of the land resource and is based on the three pillars of sustainability; economy, environment and

communities. Attaining multiple benefits from land is a key theme, and the focus on forestry is the identification of areas best for tree planting in an integrated land use system. Regional Forestry and Woodland strategies developed by local authorities are identified as the delivery mechanism to promote good practice and multi benefit land use.

16.3.10 Trees and woodlands are addressed in the SPP, which recommends local authorities prepare woodland strategies to support the development of forestry and woodlands in their area (Paragraph 201). The opportunities for woodland creation are highlighted in Paragraph 217, along with the need for the Control of Woodland Removal Policy to be taken into consideration in relation to development (Paragraph 218), stating woodland removal should only be permitted where it would achieve significant and clearly defined additional public benefits. Where woodland is removed in association with development, developers will generally be expected to provide compensatory planting.

16.3.11 NFP3 details the national woodland expansion target of 100,000 ha over the ten years between 2012 and 2022, with a subsequent review of woodland expansion targets in the 2020s to ensure national objectives on emissions and land use are achieved.

16.3.12 In general, there is a strong presumption against woodland removal, and replanting of harvested forests is a normal condition of gaining felling approval. The ability of woodlands to sequester carbon, and hence their role in possible mitigation of climate change, is an important factor in shaping regulatory mechanisms.

16.3.13 The control of forestry felling is usually administered under the Forestry and Land Management (Scotland) Act, (2018). Woodland removal, defined as *"the permanent removal of woodland for the purposes of conversion to another land use"* falls within the scope of Forestry (Environmental Impact Assessment) (Scotland) Regulations 2017, except in cases when woodland removal is associated with development. In the case of wind farm development, potential significant environmental effects of woodland removal are assessed by the Scottish Ministers for consent applications over 50 MW as is proposed here.

16.3.14 The Scottish Government's policy document on Control of Woodland Removal provides the broad framework under which accompanying implementation guidance has been produced to give details and background on the latest guidance, policy and to discuss the principles, criteria and process for managing the policy's implementation in respect of forestry removal on development sites.

16.3.15 Principal aims of the Control of Woodland Removal Policy are to provide a strategic framework for appropriate woodland removal and to support climate change mitigation and adaptation.

16.3.16 The Control of Woodland Removal Policy is built on the following principles:

- strong presumption in favour of protecting Scotland's woodland resource;
- woodland removal should be allowed only where significant and clearly defined additional public benefit can be demonstrated. A proposal for compensatory planting may add additional public benefit;
- approval for woodland removal should be conditional on the undertaking of actions to ensure full delivery of the defined additional public benefits;
- planning conditions and agreements are used to mitigate the environmental impacts arising from development and SF will also encourage their application to development-related woodland removal; and
- where felling is permitted but woodland removal is not supported, conditions conducive to woodland regeneration should be maintained through adherence to good forestry practices as defined in the UK Forestry Standard.

16.3.17 The Control of Woodland Removal Policy identifies the following criteria for areas where woodland removal may occur without a requirement for compensatory planting:

- enhancing priority habitats and their connectivity;
- enhancing populations of priority species;
- enhancing nationally important landscapes, historic environment and geological Sites of Special Scientific Interest (SSSIs);
- improving conservation of water resources;
- improving conservation of soil resources; and
- public safety.

16.3.18 The requirements raised in the policy may be addressed by implementing changes to forest design, adapting design and/or undertaking compensatory planting.

16.3.19 In relation to the Proposed Development, the Control of Woodland Removal Policy (FCS, 2009) has been taken into account with woodland removal being restricted to areas essential for operational requirements as described in Chapter 3: Proposed Development, of the EIA Report as well as "keyholing" of turbines to reduce the need for felling. Where woodland removal is required, this has been identified and compensatory planting of an area equivalent to the public benefit loss of the woodland being removed has been allowed for. Due to the limitation of suitable open ground within Cumberhead Forest Complex, areas for compensatory planting are being explored out-with the site boundary, as detailed in the Compensatory Planting Plan in section 16.8.

16.3.20 In 2013 SEPA produced guidance on the Management of Forestry Waste in response to renewable energy developments on afforested land and more recently The Use of Trees Cleared to Facilitate Development on Afforested Land – Joint Position Statement and Guidance was produced by SEPA, SNH and FCS to complement this advice (Scottish Environment Protection Agency, Scottish Natural Heritage, FCS, 2014). The guidance notes do not apply to conventional forestry activities as no land use change is involved, there being exclusions under the EU Waste Framework Directive applicable to forestry (European Commission, 2008). Where trees are being removed for conversion to a non-forestry land use, the guidance note advises the following considerations:

16.3.21 Professional forester input to quantify the likely volumes, markets and economic uses of trees to be exported from the site:

- Developer commitment to employ a professional forester (preferably the same one used to provide advice on the EIA Report) to implement and maximise the removal of timber and forest residue on site.
- Quantify the likely volumes of material for which no economic off-site use can be found.
- Identify if there are valid uses on site for material for which no economic off-site use can be found, using professional ecological consultant input where ecological uses are proposed, and using professional water quality expertise when material is to be retained on site. Boundaries of areas proposed for such uses should be set out on plans, and information on depth and size of material to be used for such uses provided, within the EIA Report.

16.3.22 In relation to the Proposed Development these issues have been addressed in Section 16.8.1 (Forest Residue Management Plan) and Section 16.8.28 (Compensatory Planting Plan) of this chapter and in Chapter 3: Proposed Development of this EIA Report.

Regional Policy

16.3.23 The Proposed Development falls within South Lanarkshire Council (SLC) which is covered by the South Lanarkshire Local Development Plan and supported by the Clydeplan Forest and Woodland Strategy (Glasgow and the Clyde Valley Strategic Development Planning Authority, 2015).

16.3.24 Clydeplan Forest and Woodland Strategy (the Strategy) aims to support and integrate national policies with all eight Local Authorities covered by the Strategy (including SLC), guiding forestry and

woodland expansion in the region, providing a policy and spatial framework to maximise the contribution of woodland and forestry to the people, environment and economy of the region.

16.3.25 The Strategy is in line with national policy, emphasising a presumption against woodland removal. The facilitation of other forms of renewable energy development has been identified where it does not result in a net reduction of woodland cover.

16.3.26 Regional priorities for woodland expansion and management are detailed by spatial landscape zones, with the Proposed Development falling within the Plateau Moorlands zone. South Lanarkshire's Plateau Moorland zone is characterised by gently sloping moorland with a mixture of peatland, grassland and coniferous forests. The Strategy identifies the surrounding land as either preferred or sensitive to woodland expansion.

16.3.27 One of the key issues identified within this zone is the restructuring of commercial forests to retain commercial productivity while improving their landscape and ecological value, as well as having potential for a significant increase in new woodland cover including:

- productive commercial woodlands with suitable access;
- mixed and energy woodlands close to communities or associated with mineral working to provide screening and forming part of site restoration when extraction is complete; and
- native woodland expansion to contribute to habitat networks along river valleys.

16.3.28 The Proposed Development is close to the border with East Ayrshire which is covered by the Ayrshire and Arran Forestry and Woodland Strategy (East Ayrshire Council, 2014). The neighbouring landscape zone within this Strategy is the Muirkirk Upland Zone, much of which is open moorland covered by the Muirkirk and North Lowther Uplands Special Protection Area (SPA) and is identified as being "sensitive" to woodland expansion (new woodlands) or compensatory planting.

16.4 Consultation

16.4.1 Table 16.1 Summarises the responses from the Scoping process and additional post-scoping comments received relevant to forestry and how these have been addressed in the EIA Report.

16.4.2 In addition to the formal Scoping process, pre-application consultation was undertaken with FCS, with a site meeting to review and discuss the Wind Farm Forest Plan proposals.

Table 16.1 - Summary of Forestry related Consultation Responses

Consultee	Scoping Response	Consultee Response
SF	Having reviewed the proposal and participated in pre-scoping site consultation, Scottish Forestry were pleased to see the approach proposed in the scoping report, offering confidence that deforestation mitigation measures required as a result of the development are being acknowledged and will be addressed as part of the complete proposal. Scottish Forestry were pleased to see the following areas were being acknowledged and would wish to see them reflected in the EIA Forestry Chapter and conditioned as part of any development approval; That an amendment to the current Forest design plan will be sought from Scottish Forestry to	This forestry chapter has been prepared by a suitably qualified professional and supported by all necessary data and maps. Pre-application consultation and site meetings were conducted with FCS to agree proposals before use in this report. Detailed Baseline and Forest Plans are provided with an assessment of changes relating to the timing and scale of changes between the two plans including felling

	remove the development's footprint from the Forest Plan. That the keyhole method of siting wind turbines within the forest environ is utilised as a point of best practice, ensuring that the development can be achieved whilst still complying with the UK Forestry Standard. A suitable Compensatory Planting Plan will be provided subject to agreement by Scottish Forestry that addresses the amount of deforestation required to accommodate the windfarms infrastructure. That the area identified land for compensatory planting is able to support woodland creation with the same productive potential as that being removed. The compensatory planting plan needs to be compliant with the UK Forestry Standard in terms of species, design, ground preparation, protection and maintenance.	programmes, timber production, haulage, species composition and age structure. Cumulative impacts of wind farm developments are detailed in this chapter (Section 16.10). Mitigation measures relating to replanting and compensatory planting are detailed in the report (Section 16.8). A commitment to deliver all forestry operations to UKFS and UKWAS standards is included in the forestry chapter along with a compensatory planting plan (refer to Figure 16.6).
SEPA	Require a map and table detailing forest removal.	Woodland removal is detailed on Figure 16.5.
SEPA	Require the inclusion of a comprehensive breakdown on all aspects of the 'forestry works' planned at the site, including proposals for the use of 'forestry by-products'.	A forest residue management plan is provided in this chapter (section 16.8).

16.5 Assessment Methodology and Significance Criteria

16.5.1 This chapter follows the assessment methodology set out in the Guidance on Implementing the Scottish Government's Policy on Control of Woodland Removal – Annex 1 Environmental Statement (FCS 2015). This report also draws on the principals set out in *The Forestry (Environmental Impact Assessment) (Scotland) Regulation 2017* in assessing the overall significance of environmental effects (Scottish Government, 2017).

16.5.2 A number of parameters were taken into account in considering the felling requirements for the Proposed Development, including creating the following tree free areas:

- 20 m wide corridors within which necessary access tracks would be located and around the substation, control room and energy storage facility;
- 75 m radius centred around each turbine to establish bat protection buffer zones (as set by Bat Conservation Trust Good Practice Guidelines (BCT, 2016)) to be maintained as tree free for the life of the turbines; and
- 10 m tree free buffer zone around crane pads, temporary construction compounds and borrow pits;

16.5.3 Permanent infrastructure areas and their associated buffers will be cleared and maintained as tree free while temporary infrastructure areas will be cleared, restored and replanted following construction.

16.5.4 Restored areas will be replanted but will be not be included in the replanting figures and will instead be included in the requirements for compensatory planting calculations due to concerns raised by SF over the suitability of restored sites for woodland post-restoration.

16.5.5 Forestry considerations associated with the eastern access route are detailed in Appendix 3.3.

Desk Study

16.5.6 Cumberhead Forest benefits from an existing Baseline Forest Plan (refer to Figure 16.1) and good base data relating to current tree species, planting years, Yield Class, Wind Hazard Class and LiDAR tree crop height data, combining to provide reliable information to support silvicultural decision making. This plan was reviewed, with data updated reflecting changes to species composition, ages and yield classes arising from the ongoing programme of harvesting and replanting as well as in response to observed growth rates within the forest. This review fed into a series of field surveys to verify and update the baseline forestry data.

Site Visit

16.5.7 Ground truthing of specific aspects of the forest was undertaken February to July 2020 to support the desk study and to provide quantitative validation for specific aspects of the Proposed Development, particularly those identified in pre-application consultation and site meetings with SF. Field survey validation was primarily in relation to tree canopy top heights and felling phasing in relation to the access road line between turbines 10 and 11, to inform the appropriateness of specific management proposals.

Assessment of Potential Effect Significance

Forest Plans

16.5.8 In 1919 the Forestry Commission was established and tasked with encouraging large-scale forest expansion, to provide a strategic timber reserve for the United Kingdom. Afforestation often took place in the uplands with a limited number of tree species capable of successful establishment. As these forests have matured and policy has changed, a move towards creating more diverse, multi-purpose woodlands has developed.

16.5.9 Restructuring of even age, single species dominated forests to achieve a more diverse age and species structure is required through the UKFS and certification systems such as the UK Woodland Assurance Standard (UKWAS, 2018). Forest restructuring is approved through the forest planning process, usually in the form of a Forest Plan, which is assessed and authorised by SF as the Competent Authority.

16.5.10 Forest Plans can relate to individual forests or groups of woodlands and represent a strategic document describing forest operations such as harvesting, replanting and road building over a 20-year period, broken down into four, 5-year phases. Forest Plans bring together and attempt to balance management objectives, silvicultural prescriptions and other considerations relevant to the forest area such as landscape, access, biodiversity and the historic and water environments. Forest Plans describe how the management strategy will deliver these objectives, through the structures detailed within the UKFS and UKWAS requirements. Silvicultural prescriptions are underpinned by site specific conditions such as location, species, age structure of the woodlands and the risk of windblow damage to commercial conifer crops.

16.5.11 A Baseline Forest Plan is in place at Cumberhead Forest, which is due for renewal in 2026 and provides the basis upon which to compare and assess any impacts arising from the Proposed Development. The Cumberhead Farm Woodland was planted in 2017 as a UKFS compliant commercial farm woodland. As a young woodland there are no formal plans in place for felling or replanting and as such any additional felling associated with the Proposed Development has been detailed as "Outwith Plan Period" for reporting purposes. Similarly, for replanting and compensatory planting, there are no baseline plans, so as a UKFS compliant woodland, it has been assumed that any replanting would have been on a like-for-like basis.

16.5.12 As part of the EIA consultation process, proposed felling and restocking plans have been drafted in consultation with SF. Prior consultation and a site meeting were conducted with SF with the site meeting being held on 30 June 2020 to discuss and agree the principles of the felling and replanting plans for the Proposed Development. Revised plans were discussed and shared with SF in November 2020 along with agreeing the approach to the assessment of the Cumberhead Farm Woodland.

16.5.13 The Felling and Replanting Plans from the Baseline Forest Plan (including the Cumberhead Farm Woodland) are presented in Figures 16.1 and 16.2 along with the Felling and Replanting Plans for the Wind Farm Forest Plan which are detailed in Figures 16.3 and 16.4.

16.5.14 An assessment of potential significant effects on forestry can be achieved by comparing key comparable statistics for the Baseline Forest Plan and Wind Farm Forest Plan to quantify:

- areas felled across the felling phases;
- timber volumes to be felled over the course of the Forest Plan phases;
- changes to species composition; and
- requirements for compensatory planting.

Design Methodology

16.5.15 Initial proposals were scoped with FCS in 2019 and a site meeting was held in June 2020 to consider the potential impact of the proposed turbines. Following feedback from SF and other consultees a number of design iterations were undertaken in order to balance the impacts on forestry as well as ecology, landscape, peat environments and other considerations (refer to Chapter 2 Site Selection and Design).

16.5.16 In locating turbines for the Proposed Development, a range of factors were considered and balanced including detailed consultee feedback, tree height and crop age structure, felling and replanting plans in the Baseline Forest Plan as well as landscape and topography at individual turbine locations. This process involved looking at opportunities for:

- Locating turbines in areas where the potential for woodland removal is minimised based on the Baseline Forest Plan restructuring design e.g. areas of open ground.
- Locating near to existing forest roads and rides to reduce crop loss to infrastructure.
- Locating turbines where there would be least impact on the current forestry felling phases (in young crops or in compartments due to be felled).
- Reducing keyhole requirements to the absolute minimum area required to accommodate turbines and associated bat protection zones.

16.5.17 The following section explores how the various elements of this design approach fed into the iterative Wind Farm design process, leading to the final design.

Cumberhead Forest Plan

16.5.18 Cumberhead is a large commercial forest complex with a wide range of crop ages, from young, recently felled and replanted crops, through to mid rotation crops as well as mature crops ready for harvesting. This complexity is added to by the presence of Nutberry Hill Wind Farm located near the centre of the property, plus the consented Cumberhead Wind Farm either side of this and the proposed Douglas West Extension Wind Farm to east.

16.5.19 Age diversity at Cumberhead offers a number of opportunities when considered in the context of planning a wind farm development:

- Existing Baseline Forest Plan; detailed forest management proposals balancing forest management objectives with key economic, social and environmental considerations and subject to full public consultation.
- Good existing crop data and knowledge of the property by both the Forest Managers and SF staff.
- Age class diversity across the site offers greater potential for siting turbines in young crops where there will be limited requirement for felling to wind-firm edges or for wind resource or felling areas outside the existing harvesting coupes and phases.
- A greater number of wind-firm boundaries have been created through past harvesting and replanting operations with a greater understanding of site susceptibility to windblow.

16.5.20 Cumberhead Forest has been managed since planting as a commercial forest, with a strong focus on commercial production and has operated under an approved Forest Plan since 2006. One of the benefits of having a Baseline Forest Plan is as a benchmark for "normal" management against which the Proposed Development can be assessed.

16.5.21 Key issues for wind farm developments in relation to forestry often revolve around what felling and replanting would be acceptable under “normal” forestry operations against which an assessment of the wind farm forestry proposals can be assessed. In this instance the presence of a Baseline Forest Plan provides the baseline against which to compare the Proposed Development, while providing a vital tool for helping to prioritise turbine locations where there is greatest synergy with routine forest management.

Keyholing

16.5.22 The design concept has been to avoid woodland loss wherever possible and where this is not possible, to have the smallest possible keyhole and associated felling within afforested areas. The size of the keyhole is dependent on a number of factors relating to the crop, turbine selection and other factors such as the presence of protected species.

16.5.23 This design approach considered location, altitude, topography, soils, exposure, tree height, age and species which all influence the scale of keyholes and associated felling. Young crops require no additional felling to wind-firm boundaries, as there is very low risk of inducing windblow by "cookie cutting" the turbine keyhole into the existing crops. Mature crops may require more extensive felling to wind-firm boundaries before replanting the felled area back to the desired keyhole. Both approaches result in the same keyhole area, but the latter requires more initial felling.

16.5.24 Turbine selection also plays a significant role in the size of the keyhole area. In basic terms, the taller the hub height, the greater the potential to reduce keyhole sizes as the rotor blades will be higher above the forest canopy. This is also the preferred approach for wind resource, as the higher the turbines, the greater the wind resource and less interference from the forestry below. Limiting factors in this situation have been:

- Rotor blade length – this is the largest single component to be transported to site.
- Landscape – the need to ensure the selected turbines are appropriate to the scale and setting of the area and comparable in appearance to neighbouring wind farms.

16.5.25 Turbines with a tip height of 200 m have been selected for the Proposed Development in order to maximise potential for woodland retention and wind resource, while balancing other key considerations. The selected turbines would permit retained tree heights of 20 m adjacent to turbines minimising woodland removal.

16.5.26 A further important design consideration in keyhole size is the presence of bats, which are European Protected Species and require tree free stand-off zones between tree canopies and the swept edge of the turbine blades, as detailed in EIA Report (refer to Chapter 7: Ecology and Nature Conservation). In this design approach, a bat protection buffer zone has been the limiting factor in how close the tree edge can be to the base of turbines. For the turbines and rotor blades proposed, the bat protection buffer zone radius used for this assessment is 75 m.

Wind Resource and Turbine Warranties

16.5.27 Wind resource engineers and turbine manufacturers were engaged to determine the potential for an upper height limit for tree canopy retention directly adjacent to turbines. Initial feedback indicated (subject to turbine selection) a canopy height of 20 m. This figure was a compromise balancing retaining forestry to an economic height against crop loss for bat protection buffer zones, as the taller the crops, the larger the tree free buffer zone required and associated woodland removal around each turbine.

16.5.28 Windblow risk was assessed using a combination of past experience at Cumberhead Forest along with standard silvicultural Critical Height and Terminal Height figures for the Wind Hazard Classes (WHC) at each turbine location. The majority of the site is classified as WHC 5 with smaller areas of WHC 4 and 6. Critical Height is the height at which the onset of windblow can be expected and the Terminal Height is the height at which significant windblow can be expected (defined as 40% or more of the stand area). Table 16.2 details the age at which the yield classes of crop found within the Proposed Development area will reach Critical and Terminal Heights for WHC 5.

Table 16.2 - Summary table for the ages at which yield class 6 to 20, unthinned Sitka spruce crops will reach Critical and Terminal Heights for Wind Hazard Class 5 sites.

Yield Class (YC)	Critical Height (16m)	Terminal Height (19.5m)
6	60 years	70 years
8	50 years	65 years
10	42 years	54 years
12	36 years	46 years
14	34 years	41 years
16	30 years	37 years
18	24 years	34 years
20	20 years	31 years

16.5.29 The table above broadly supports field observations at Cumberhead Forest which indicate unthinned crops of Sitka spruce between 18 m and 23 m in height will start to suffer significant windblow.

16.5.30 Yield classes across this section of the forest are moderate ranging from 4-20, with a weighted average yield class of 13 (rounded up to 14). The turbines will be located in coupes that will either be felled in-phase and replanted to key holes, or keyholed into young crops ranging in age from 1 to 13 years at point of construction.

16.5.31 For crops felled in-phased and replanted back to a keyhole, there is no risk that the replanted crops will achieve a canopy top height in excess of 20 m within 25 years of replanting, as can be seen from

table 16.2 above. This is also true of the existing young crops, where the oldest and most productive crops were planted in 2009 and are recorded as yield class 16.

16.5.32 Combining observational and theoretical evidence to assess tree canopy retention heights shows a good degree of overlap:

- wind resource engineer and turbine warranty feedback: Canopy heights of 18 m to 24 m subject to bat protection buffer zone;
- Critical Height and Terminal Height figures for WHC 5 sites: Canopy heights of 16 m to 19.5 m; and
- field observations of windblow: Target harvesting height of 18 m to 23 m.

16.5.33 The reasonably flexible approach to tree heights adjacent to turbines adopted by the wind resource engineers, turbine manufactures in combination with the turbine and rotor blade selection introduces substantial flexibility for siting turbines in order to minimise woodland loss.

Topography and Landscape

16.5.34 A full landscape and visual assessment of the Proposed Development is provided in Chapter 6: Landscape and Visual and a landscape analysis is included as part of the Baseline Forest Plan. Forestry and landscape are considered here within the context of the Proposed Development and the existing Baseline Forest Plan which has been assessed against current forestry best practice under the UKFS and supporting documentation including the *UKFS Guidelines - Forests and Landscape* (Forestry Commission, 2017) and Forestry Commission Guidance Notes such as *Design Techniques for Forest Design Planning* (Forestry Commission, 2014).

16.5.35 It is important to note that the majority of the felling detailed in the Wind Farm Forest Plan will be approved by SF through the routine Forest Plan approval process, with only the felling required for the immediate infrastructure footprint and associated tree free buffer zones being applied for as part of the Proposed Development. As such, forestry harvesting coupe design, scale and acceptability for the majority of felling will fall under the assessment of SF as the Competent Authority.

16.5.36 The design approach was to adhere to the principles for the Baseline Forest Plan in relation to coupe design, scale and, as far as possible, existing felling phases and crop separation considerations.

Timber Harvesting Volume Calculation Methodology

16.5.37 Timber volumes are derived from Forestry Commission Yield Models using the age of the tree crops and estimated Yield Class (YC) based on LiDAR data and field verification.

16.5.38 The default yield model used was Sitka spruce, 2 m initial planting spacing, no thinning, as this reflects the dominant species and planting regime within the forest.

16.5.39 Net volumes have been used for the purposes of this assessment. These have been calculated by deducting 10% of the gross volume to account for drainage ditches, rides and small open spaces within the crop.

16.5.40 A standard conversion factor of 1.2 has been used to convert the net volume into tonnage and this was used to determine forecast timber volumes.

Summary of Design Methodology

16.5.41 Turbine locations were assessed against the Baseline Forest Plan and forecast crop heights in 2021 with compartments assessed to highlight the level of fit with the Baseline Forest Plan. This assessment formed the basis of a more detailed pre-application consultation and site visit with FCS to explore appropriate approaches to design and mitigation to limit forestry impacts.

16.5.42 The result of this process should be a Wind Farm Forest Plan design with an acceptable fit with the Baseline Forest Plan and associated felling and replanting designs, resulting in the smallest possible impact on the overall forest when considered in the context of felling areas, harvesting volumes or

replanting design. The key test of the success of this approach should be a Wind Farm Forest Plan that is capable of being supported by SF following the pre-application site visit and subsequent submission.

Requirements for Mitigation

16.5.43 Where woodland removal is an unavoidable consequence of land use change, compensatory planting will need to be delivered in accordance with the Implementation Guidelines for the Control of Woodland Removal Policy (Scottish Government, 2019), with the details for delivery set out in a compensatory planting plan.

16.5.44 Where felling and replanting are not being carried out as part of routine forestry operations, there is the scope for the production of non-forestry residues. In such cases a forest residues management plan will need to be produced.

Assessment of Residual Effect Significance

16.5.45 Comparable forest statistics will be produced for the Baseline Forest Plan and the Wind Farm Forest Plan in order to assess the scale, magnitude and speed of changes proposed between the two Forest Plans as well as their delivery against UKFS and UKWAS standards.

Limitations to Assessment

16.5.46 The precise scale of borrow pits is not yet known, however it is anticipated that these will be relatively small in extent and will not extend to the full borrow pit search areas shown. A worst-case approach has been taken in relation to the calculation compensatory planting, assuming all areas will be required.

16.6 Baseline Forest Plan

16.6.1 Forest Plans are a critical tool in strategic forest management, designed to balance the objectives of the owner with site specific considerations such as landscape, biodiversity, protection of soils and water, archaeology and public access, i.e. balancing the social, economic and environmental aspects of the forest.

16.6.2 The Baseline Forest Plan at Cumberhead runs from 2016 to 2035, with detailed approvals for felling and replanting covering the first ten-year period (leading up to 2025) and indicative felling phases for the second ten-year period (2026 to 2035).

16.6.3 Key site factors assessed in the Cumberhead Baseline Forest Plan are summarised below.

Social

16.6.4 Community engagement and Scoping was carried out as part of the Forest Planning process. Through this process the key actions identified by local residents were:

- Improved access (installation of gates) on the tracks leading into Cumberhead from South Cumberhead Farm and Stockhill Farm; and
- Opening up of a historic footpath running through the eastern corner of the property through the eastern-most section of Hagshaw Hill.

16.6.5 An archaeological survey was commissioned as part of the Baseline Forest Plan, which revealed no Scheduled Ancient Monuments within Cumberhead Forest but identified 21 archaeological or potential archaeological features (none of which are located within the Proposed Development Area). Most features related to past agricultural use such as sheepfolds, enclosures and dykes as well as some disused mines and associated infrastructure.

16.6.6 All identified archaeological features have been mapped and recorded for forest management purposes, to ensure they will be marked on site prior to felling and protected from harvesting

operations, with 20 m unplanted buffers around major features and 10 m open ground buffers around minor features.

16.6.7 This large area of mid to late rotation forest has been planted on land that can be characterised as extensive plateau moorland, dominated by large, gently sloping areas of forest that rise sharply onto the slopes of the hills to the south. Wedder Hill (465 m), Hagshaw Hill (470 m), Common Hill (488 m), Burnt Rig (441 m) and Arkney Hill (375 m) form a ridge to the south, which act as a topographic screen from potential viewpoints to the south-west through to the south-east.

16.6.8 To the west and northwest, Cumberhead Forests extends over the Law (419 m), Black Hill (360 m) and Tod Law (380 m), screening views into the Hagshaw Hill landscape unit. From the north, views into the forest are extremely distant with intervening topography, obscuring all but the upper margins of the forest from Lesmahagow, located 5.5 km to the north, on the far side of the former opencast workings.

16.6.9 Views from the east and northeast have the greatest number of potential vantage points and visual receptors, most of which are relatively distant, at oblique angles, with only the upper margins of the forest visible. Coalburn is located 1.5 km north-east of Cumberhead Forest but sits relatively low in the landscape with the lower village sitting in the valley and the upper village partially screened by the former opencast workings and intervening woodlands. Where the forest is visible from the top of Coalburn Road and Bellfield Road, only the eastern-most section of the forest is visible, with considerable foreshortening of lower and mid-slope woodlands as a result of the gentle gradient. More distant views from the northeast are taken from the main north-south transport corridor along the B7078 and the M74 corridor ranging from 3.5 km to 5.5 km distant.

16.6.10 Views from the village of Douglas, just over 2.5 km to the east, are extremely limited as the forest is over the brow of the hill, with the village sitting down on the lower slopes of the Douglas Water valley, topographically screened by the escarpment running from Douglas West to Curly Brae upon which Long Plantation is located.

16.6.11 Views from the minor public road to the north and north-east are the most prominent in relation to the Todlaw Hill area of Cumberhead Forest, however distance and intervening topography mean the majority of the forest is screened from external views and as such the sensitivity of the Todlaw Hill section of Cumberhead Forest in terms of coupe scale and design is considered to be low.

16.6.12 A landscape character assessment was carried out for the Baseline Forest Plan which was supported by viewpoint images, which recorded most areas as having low or moderate landscape sensitivity. The greatest landscape design considerations in relation to the Todlaw Hill landscape unit are considered to be the north-eastern most margins of the forest. In designing felling coupes, consideration was given to their scale and fit within the landscape, ensuring coupes are proportional to the relatively large scale of the forest unit and relatively low sensitivity of the landscape setting.

16.6.13 The resulting coupe size and design had relatively large coupe sizes to reflect the scale of the landscape and the need to fell to existing wind-firm boundaries given the risk of windblow, while replanting design was used to improve future forest design. Coupe size varied from 10 ha to in excess of 100 ha over the four felling phases, with the first ten-year period detailing 798 ha of felling, with average coupe sizes between 50 ha to 70 ha.

Economic

16.6.14 One of the key management objectives identified in the Baseline Forest Plan is to maximise the financial return from growing timber through the sound practice of silviculture in balance with other site considerations. Cumberhead Forest is owned by a pension fund, with a requirement for steady, predictable annual income. This regular and reliable production of timber also helps to supply and support considerable regional rural economic benefits associated with both in-forest and downstream industries.

16.6.15 This objective was delivered through the Baseline Forest Plan by developing felling coupes that allowed for regular harvesting on an economic scale and replanting plans that maximised future timber production from the most suitable ground (the right tree in the right place). Replanting plans were designed to be both UKFS and UKWAS compliant while retaining the optimum area for

commercial forestry using improved site preparation, drainage and improved planting stock to enhance productivity of second rotation crops. These proposals were balanced with other site-specific considerations, with areas of less suitable ground removed from production to deliver other benefits such as creation of riparian corridors as natural buffer zones and habitat networks as well as including designed open ground associated with hill tops, access routes and archaeological features.

Environmental

16.6.16 As part of the Baseline Forest Plan and UKWAS certification an ecological audit was commissioned to identify significant features and inform recommendations for future management. Recognising the importance of the Muirkirk and Lowther Uplands SPA/Muirkirk Uplands SSSI and a geological SSSI on the northern boundary, NatureScot (formerly SNH) was consulted as part of this process.

16.6.17 As well as statutory designations, a number of additional datasets were assessed including the Ancient Woodland Inventory and deep peat deposits database to check for the presence of these features. This was supported by desk-top and site surveys which recorded past and present use of the area associated with Nutberry Hill by black grouse (*Tetrao tetrix*) and notable populations of cloudberry (*Rubus Chamaemorous*) as well as small areas of semi-natural woodlands.

16.6.18 The Baseline Forest Plan was designed to reflect the natural characteristics of the site, with generous use of designed open ground in the upper reaches of the riparian corridors, narrowing where the watercourses become incised, using native broadleaves to emphasis this design, especially in the lower sections of the property.

16.6.19 Where the forest borders the SSSI/SPA, greater areas of open ground and lower density stocking of Sitka spruce and native broadleaves were included to create a mosaic of open ground and scattered sheltered woodland to be kept as natural reserves to provide valuable shelter and a food source for black grouse.

16.6.20 Reflecting the records of high elevation deep peat associated with Priesthill Heights and to improve the linkage between the SSSI/SPA and open ground habitats of Nutberry Hill, replanting was designed to be held back in these areas. This design was supported by creating long term retentions and natural reserves in crops on the lower elevations of Nutberry Hill in the west and to the north of the Birkenhead Burn.

16.6.21 Areas of very low yield class crops to the west of Standingstone Hill were identified for reversion to open ground habitats and low-density native woodlands, while also helping to redesign the long, linear crop boundaries at high elevations in this section of the forest.

16.6.22 High elevation planting boundaries, where crop growth has been limited by poor soils and exposure were designed to bring the treeline down the hill while creating a more natural feature in the landscape. Similarly, poor, waterlogged soils at lower elevations in compartments associated with the Pockmuir Burn flood plain were designed to create areas of open ground in the centre of the forest.

16.6.23 In 2011/12 the six turbine, Nutberry Wind Farm was consented and built on The Law in the centre of the property. This development was accommodated within the forest through an amendment to the Forest Plan, which saw these compartments felled to wind-firm boundaries before being replanted back to 100 m keyholes around the six turbines with delayed restocking by five years.

Baseline Forest Plan

16.6.24 The Baseline Forest Plan can be used as a benchmark against which to assess the changes associated with the Wind Farm Forest Plan. By using comparable forest statistics relating to the composition of the forest (felling and replanting plans) it is possible to accurately quantify and assess the potential impact of the Proposed Development.

16.6.25 For the purpose of this report, summary statistics for the area of forest being felled within each of the felling phases has been used, along with timber production forecasts, haulage requirements, replanting areas, species and proportions and benchmarked against both UKFS and UKWAS

requirements. Statistics will be replicated for both the Baseline Felling and Replanting Plans and the Wind Farm Felling and Replanting Plans.

16.7 Potential Effects – Wind Farm Forest Plan

16.7.1 As set out above in Section 16.6, the premise for designing the Proposed Development in relation to forestry reflected both the Landowner's management objectives and Scottish Government Policy in terms of minimising impact on the Baseline Forest Plan. In doing so, the resulting Proposed Development maintains the social, economic and environmental aspects set out in the Baseline Forest Plan, while including sustainable energy production into the forest planning process.

16.7.2 A discussion and assessment of the impacts of the Wind Farm Forest Plan in relation to the social, economic and environmental aspects of the forest detailed in the Baseline Forest Plan follows.

Social

16.7.3 Access considerations identified in the Baseline Forest Plan Scoping are being delivered; The access gates leading to South Cumberhead and Stockhill Farm have been installed and the opening up of the historic footpath following harvesting in the far eastern section of the forest is planned when this area becomes due for felling and replanting over the next five years.

16.7.4 There are no identified archaeological features within the areas proposed for forestry operations as part of the Proposed Development. A single archaeological feature, Canmore ID 45559, is recorded within the forest boundary of the Proposed Development. This relates to a former standing stone (after which the hill is named) but was removed before 1858. This feature is located on the summit of Standingstone Hill, where no harvesting is planned as part of the Proposed Development.

16.7.5 Any known or newly discovered archaeological features will continue to be marked on site prior to felling and protected from operations, with 20 m unplanted buffers around major features and 10 m open ground buffers around minor features.

16.7.6 Further discussion of archaeological aspect in relation to the Proposed Development is covered in Chapter 10, Cultural Heritage, which sets out full details of the consideration and potential impact of the Proposed Development on archaeology and Cultural Heritage.

16.7.7 The approach to coupe design reflecting the relative landscape sensitivity, landscape character assessment and topography in the Baseline Forest Plan has been adopted in the Wind Farm Forest Plan. Phasing of coupes has been based on LiDAR yield class data and supported with ground truthing of tree heights. Coupe structures in the western Todlaw Hill section of the forest reflect the scale and setting of the landscape to create interlocking coupes of varying sizes. Draft coupe design and phasing for the Wind Farm Forest Plan were consulted upon and agreed with SF before use in this report and remain the same as the Baseline Felling Plan.

16.7.8 Twenty-one turbines are proposed in the western most section of Cumberhead Forest, known as Todlaw Hill. This is the oldest section of the forest planted over a four-year period between 1976 and 1979 and represents approximately 46 % of the total forest. A phased programme of harvesting and replanting commenced in this section of the forest in 2007, restructuring the forest in 14 coupes, 10 of which are phased for felling between 2016 and 2030 (represented by the phase 1 and 2 areas on Figures 16.1). The context of the Proposed Development in the landscape in relation to existing, consented and proposed wind farm developments is considered in full in Chapter 6: Landscape and Visuals of the EIA Report.

16.7.9 General Forestry Practice Guideline 15, of the UKFS (Forestry Commission, 2017) states *"In forests characterised by a lack of diversity due to extensive areas of even-aged trees, retain stands adjoining felled areas until the restocking of the first coupe has reached a minimum height of 2m; for planning purposes this is likely to be between 5 and 15 years depending on establishment success and growth rates"*.

16.7.10 UKFS recognises that this is not always possible and as such this is a guideline and not a requirement, however, the aim should be to minimise separation issues between coupes. In order to assess potential separation issues, the objective of the guidelines needs to be considered in the context of

the forest property. The objective of the guideline is to encourage age class diversity into even aged plantations while minimising visual impacts of harvesting operations.

16.7.11 Cumberhead was part of the first cohort of forest properties in Scotland to be managed under a Forest Plan when these were first widely introduced under the Scottish Forestry Grant Scheme. The Forest Plan has seen the property restructure from 13 original planting years when harvesting started in 2006, to 27 planting years at time of writing, with further age diversity forecast to be introduced steadily over the next 20 years of the Forest Plan. By the time restructuring of all first rotations crops is complete the age range will be in excess of 40 years, with no single coupe accounting for more than 5% of the forest area. Cumberhead will be in a state of near continuous sustainable timber production.

16.7.12 Restructuring has already occurred over approximately half of the Proposed Development area. Under the Baseline Forest Plan most of the remaining area will be felled in Phase 2 (2021-2025) with a small area planned for felling in Phase 3 (2026-2030). Construction felling is planned to commence in 2021 allowing most of the felling to occur in phase. Where turbines are proposed in areas containing mature conifer crops, replanting following felling will need to be to infrastructure keyholes. Where turbines are located within young, replanted crops, infrastructure can be directly keyholed into these crops.

16.7.13 Under the Wind Farm Forest Plan felling areas, age structure and species diversity do not change significantly, with the tree free buffers around the base of the turbines being sufficiently small to be screened by the proximity of adjacent trees, therefore, having a **negligible** effect on the forestry landscape.

16.7.14 The coupe and replanting designs in the Baseline Forest Plan reflect site specific considerations, using existing wind-firm boundaries for the felling coupes with interlocking designs of varying sizes, appropriate to the scale of the landscape and the low to moderate landscape sensitivity of the forest. This approach is carried through to the Wind Farm Forest Plan coupe design and was a key feature of the pre-application consultation with Forestry Commission.

16.7.15 The Todlaw section of Cumberhead Forest associated with the Proposed Development is topographically well screened from the main potential visual receptors. Viewpoints from the north and east are obscured by undulating topography containing shelterbelts and woodlands associated with Chapelhill and Tod Law screening direct views into the core of this area of the forest. The extensive and undeveloped Muirkirk SSSI/SPA lies to the north and west, with limited visual receptors.

16.7.16 Under the Wind Farm Felling Plan the core of the coupe design, scale, structure and phasing remain the same, with little observable difference from key viewpoints. The single Phase 3 coupe in the centre of the Proposed Development area requires an amendment to facilitate the insertion of turbine 10 and an access track between turbines 10 and 11 (refer to Figure 16.3). Crop productivity in this Phase 3 felling coupe is generally very poor, with crop heights at the point of construction estimated at between 8 m and 15 m and low stocking levels from historic browsing damage. Reflecting the height, age, low stocking and wind hazard class (5) and critical height for unthinned crops (16 m), keyholing is considered possible without undue risk of inducing catastrophic windblow by keyholing. The crop height, stability along with the scale and design are all considered appropriate to the setting and are not visible from key external or internal viewpoints and allows the retention of the wider coupe.

16.7.17 In considering the felling coupe for these turbines, key considerations were to:

- minimise the area required for the turbines;
- maximise fit with Baseline Forest Plan;
- use of existing wind-firm boundaries; and
- appropriate scale and fit within the landscape.

16.7.18 This approach resulted in a coupe design mirroring the Baseline design and in-line with the average coupe size across the forest, suitably reflecting the scale of the landscape setting, with interlocking coupes addressing separation with adjacent coupes.

16.7.19 The Baseline replanting design breaks up geometric patterns from first rotation crops, with generous use of native broadleaf woodlands along the riparian corridors and introducing feathered edges adjacent to the Muirkirk SSSI/SPA. This design creates a more natural visual linkage and long-term landscape framework between low ground and open hill above the forest, especially when combined with greater species diversity on the lower ground and long riparian corridors.

Summary of Potential Social Effects

16.7.20 The Wind Farm Forest Plan has followed the design principles set out in the Baseline Forest Plan. Key access and archaeological considerations and deliverables remain unchanged from the Baseline Forest Plan. The scale, design and timing of harvesting coupes in the western-most Todlaw section of the forest, has relatively low landscape sensitivity, and remains unchanged, beyond the access track through the phase 3 coupe. The keyhole areas associated with each turbine will be sufficiently small so as to screen any additional open ground by the proximity of adjacent trees as they grow, as well as having mature trees crops retained downslope providing further visual screening. The appropriate scale and design of the proposed windfarm felling coupes and the retention of the Baseline Replanting Plan (minus the smallest possible keyhole) combine to create a **negligible** effect on the forestry landscape compared to the Baseline Forest Plan. Overall, there can be considered to be a **negligible** effect on the social benefits delivered by Cumberhead Forest as a result of the Proposed Development.

Economic

16.7.21 This objective continues to be delivered through the Wind Farm Forest Plan by retaining the balanced approach to harvesting set out in the Baseline Forest Plan allowing for regular harvesting on an economic scale and replanting plans maximising production from the most suitable ground. Inclusion of 3.0 % of additional open ground across the forest to accommodate the Proposed Development does not significantly adversely impact the forest's ability to deliver sustainable, economic production of timber or the support this provides to the rural economy in terms of in-forest and downstream industry employment. These potential impacts are further mitigated through the local delivery of compensatory planting, ensuring no net loss of woodland related benefits. The economic benefits of the Proposed Development also contribute to delivering this objective, with the benefits in this case, shared between the local community, the developer, the local farmer, and the pensioners within the large national pension scheme (the majority landowner).

Summary of Potential Economic Effects

16.7.22 As a result of diversification of the forestry asset to include renewable energy generation and the increased revenue generation, there is considered to be a **beneficial** effect on the economic benefits delivered by Cumberhead Forest as a result of the Proposed Development.

Environmental

16.7.23 As the Wind Farm Forest Plan differs very little in scope, scale and timing from the Baseline Forest Plan, the original environmental considerations will continue to be managed and delivered under the Proposed Development. The good existing internal road infrastructure results in a limited impact from new roading on woodland areas. Areas felled to accommodate the Proposed Development will be replanted back to the bat protection buffer zones around each turbine. Any loss of woodland cover is mitigated through the delivery of a local compensatory planting programme of equivalent area.

16.7.24 Closely following the Baseline Forest Plan in relation to the areas, timing and volumes of timber to be harvested means standard forestry harvesting practice and guidelines can be used, generating little additional timber traffic and non-forestry residues.

Summary of Potential Environmental Effects

16.7.25 The minimal reduction in overall planted area of 61.96 ha which is being converted from commercial forestry to open ground, is being mitigated through the delivery of compensatory planting. When combined with the significant renewable energy generation and carbon reduction benefits arising from the Proposed Development, overall, there is considered to be a **beneficial** effect on the environmental benefits delivered by Cumberhead Forest as a result of the Proposed Development.

Summary of Differences between the Baseline and Wind Farm Forest Plans

Felling Plans

16.7.26 In order to assess the potential impacts of the Proposed Development in a forestry context, it is necessary to consider the Baseline and Wind Farm Forest Plans using comparable statistics.

16.7.27 Table 16.3 provides a comparison between the Baseline and Wind Farm Felling Plans.

Table 16.3 - Comparison of Cumberhead Forest Baseline and Wind Farm Felling Plans

Felling Phase	Baseline Forest Plan (ha)	Wind Farm Forest Plan (ha)	Variance (ha)	Change (%)
Phase 1 (2016 to 2020)	359.39	359.39	0.0	0%
Phase 2 (2021 to 2025)	437.84	471.41	33.57	7.7%
Phase 3 (2026 to 2030)	177.48	174.28	-3.20	-1.8%
Phase 4 (2031 to 2035)	134.35	134.32	-0.03	-<0.1%
Outwith Plan Period	905.56	875.22	-30.34	-3.4 %
Total	**2014.62**	**2014.62**	**0**	**0**

16.7.28 Phase 1 (2016 to 2020) felling will be complete before any wind farm felling takes place.

16.7.29 In Phase 2 (2021 to 2025) an additional 33.57 ha of felling is required to accommodate the felling for the Proposed Development. This 7.7 % increase across the five-year felling phase is not considered significant, especially when considered in the context of the Forest extending to 2,014.62 ha.

16.7.30 Changes to the areas recorded in Phases 3 and 4 are relatively minor, with the phase 2 felling relating to the insertion of turbine 10 and the access road to turbine 11, with the 0.03ha change in Phase 4 corresponding to minor widening of corners along the road line.

16.7.31 The treatment of borrow pits in relation to felling, replanting and compensatory planting is addressed in Section 16.8.

16.7.32 The majority of additional felling, 33.57 ha, is associated with extremely young, replanted crops, represented as Outwith Plan Period or Phase 1 Felling in the Baseline Felling Plan. In these areas turbines and associated infrastructure can be keyholed into the young, wind-firm crops without the risk of windblow or the requirement for any additional management felling.

16.7.33 In summary, the core of the felling phases remains unchanged from the Baseline Felling Plan, with an additional 33.57 ha of felling, or some 1.7 % of the total forest area represented by very young

crops with minimal impact on the wider coupes. The Proposed Development is therefore not considered to be a significant change from the Baseline Felling Plan.

16.7.34 As the Cumberhead Farm Woodland is a young, recently planted woodland, no felling and replanting plans are in place, so it has been assumed that any future harvesting would see the whole area harvested as a single coupe and as a UKFS compliant woodland, replanting would be on a directly like-for-like basis. Working on these assumptions would see 3.74 ha of Sitka spruce crop lost to accommodate turbines 20 and 21 plus their associated access infrastructure. Taken across the combined Cumberhead Forest and Cumberhead Farm woodland area of 2054.11ha, there would be an additional 37.31ha of felling or 1.8% of the combined forest area.

Timber Harvesting and Production

16.7.35 Table 16.4 shows timber production associated with the Baseline and Wind Farm Felling Plans.

Table 16.4 - Comparison of Cumberhead Forest Baseline and Wind Farm Felling Plan Timber Harvesting Tonnage

Felling Phase	Baseline Felling Tonnage (T)	Wind Farm Felling Tonnage (T)	Variance (T)	Change (%)
Phase 1 (2016 to 2020)	N/A	N/A	N/A	N/A
Phase 2 (2021 to 2025)	160,504	157,333	-3,171	-2.0 %
Phase 3 (2026 to 2030)	61,451	60,463	-988	-1.6 %
Phase 4 (2031 to 2035)	58,599	58,590	-9	0 %
Total	280,554	276,386	-4168	-1.5%

16.7.36 The decrease in felling tonnage in Phase 2 associated the Proposed Development results from felling taking place in the first year of Phase 2 (2021), as opposed to the Baseline Felling where timber would be felled sequentially over the 5 years of the phase. Therefore, despite the increase in felled area from 437.84 ha to 471.41 ha between the Baseline and Wind Farm Felling Plans, the additional years of loss of growth associated with the mature crops is larger than the extra volume gained from harvesting a larger area, as much of the additional area is comprised of young crops. The relatively small difference between the increase in area being felled and the difference in tonnage of timber reflects that the majority of the felling under the Wind Farm Forest Plan is either being felled as per the Baseline Felling Plan or close to the original phasing.

16.7.37 The majority of harvesting associated with the Proposed Development can be considered routine in relation to coupe area and crop size and as such, will be harvested using conventional forestry practices and associated guidelines. All timber harvested from site as part of the Proposed Development will be transported to conventional timber markets via the existing forestry access road to Station Road at Douglas West. There will be no requirement for felling to waste or mulching.

Timber Haulage

16.7.38 Chapter 12: Traffic and Transport details the considerations associated with the Proposed Development in more detail. Changes to felling programmes associated with the Proposed Development have potential implications for traffic and transport in relation to timber haulage. The number of timber lorry round trips has been assessed for both the Baseline and Wind Farm Forest Plans on the basis of 25 tonnes of timber per loaded lorry. Table 16.5 provides a comparison of

timber haulage over the 20-year Forest Plan period for both the Baseline and Wind Farm Forest Plans.

Table 16.5 - Comparison of Baseline and Wind Farm Forest Plan Timber Haulage (lorry loads)

Felling Phase	Baseline Felling No. of Timber Lorries	Wind Farm Felling No. of Timber Lorries	Variance (T)	Change (%)
Phase 1 (2016 to 2020)	N/A	N/A	0	0.0 %
Phase 2 (2021 to 2025)	6,420	6,293	-73	-1.1 %
Phase 3 (2026 to 2030)	2,458	2,419	-39	-1.6 %
Phase 4 (2031 to 2035)	2,344	2,343	-1	0 %
Total	**11,222**	**11,055**	**-167**	**-1.5%**

16.7.39 Over the 20-year operational period of the Forest Plan, timber haulage decreases by 1.5 % (or 167 fewer loaded lorry movements) as a result of the Proposed Development, which can be considered a **negligible** effect. The table above does not include brash recovery from harvesting sites, which is detailed in section 16.8.

16.7.40 Coupes to be felled to accommodate the Proposed Development will be harvested in 2021 ahead of the main construction operations, with all timber being transported to conventional timber markets via the existing forestry access road.

Replanting Plans

16.7.41 Forestry is a long-term industry and the long-term forest structure based on the Baseline and Wind Farm Replanting Plans for Cumberhead Forest requires 58.22 ha of additional open ground, or 3.0% of the total forest area, to accommodate the Proposed Development. The majority of change is in areas of conifer crop (52.65 ha) with the remainder being a combination of young broadleaf woodland and areas planned to be established with broadleaves after the current crop of Sitka spruce is felled. On this basis, it can be considered that there is a **negligible** long-term impact on the forest environment arising from the Proposed Development.

Table 16.6 - Comparison of Baseline and Wind Farm Long Term Replanting Plans

Species	Baseline Forest Plan (ha)	Wind Farm Forest Plan (ha)	Variance (ha)	Change (%)
Cumberhead Forest				
Sitka spruce	1128.17	1,087.94	-40.22	-3.6 %
Sitka spruce/Larch	76.34	73.61	-2.73	-3.6 %
Sitka spruce/Lodgepole pine	43.26	43.26	0.00	0.0 %
Norway spruce	48.39	46.99	-1.40	-2.9%
Scots pine	0.35	0.35	0.00	0.0 %

Species	Baseline Forest Plan (ha)	Wind Farm Forest Plan (ha)	Variance (ha)	Change (%)
Native Broadleaves	52.96	50.82	-2.14	-4.0%
Native Broadleaves/Open ground	94.85	91.43	-3.42	3.6 %
Mixed Conifer/Open Ground	34.70	32.22	-2.48	-7.1 %
Open ground	437.59	495.81	58.22	13.3%
Long-Term Retentions	72.83	69.77	-3.05	-4.2 %
Natural Reserves	18.10	15.32	-2.77	-15.3 %
SSSI	7.09	7.09	0.00	0.0 %
Total	**2,014.62**	**2,014.62**	**0.00**	
Cumberhead Farm Woodland				
Sitka spruce	29.48	25.74	-3.74	-12.7 %
Norway spruce	4.00	4.00	0.00	0 %
Native Broadleaves	2.00	2.00	0.00	0 %
Open ground	4.01	7.75	3.74	93.3 %
Total	**39.49**	**39.49**	**0.00**	

16.7.42 This modest change in replanting across the total Cumberhead Forest area reflects the close alignment between the Baseline and Wind Farm Forest Plans due to the design approach adopted. It should be noted that the figures above do not include ground to be re-instated and replanted after construction (borrow pits, construction compounds etc), as it has been agreed with SF that these areas will be included in the compensatory planting requirement calculation in this report.

16.7.43 As the Cumberhead Farm Woodland is a young, recently planted woodland, no felling and replanting plans are in place, so it has been assumed that as a UKFS compliant woodland, replanting would be on a directly like-for-like basis, which would see 3.74 ha of Sitka spruce crop lost to accommodate turbines 20 and 21 plus their associated access infrastructure. The combined woodland removal requirement based on the Baseline Replanting Plans for the combined area of Cumberhead Forest and Cumberhead Farm Woodland is 61.96 ha.

16.7.44 Guidelines under the UKFS recommend owners diversify forest composition so that no more than 75 % of the forest management unit is allocated to a single species and a minimum of the following are incorporated:

- 10 % open space;
- 10 % of other species or ground managed for environmental objectives; and
- 5 % native broadleaved trees or shrubs.

16.7.45 Table 16.7 demonstrates how both the Baseline Forest Plan and the Wind Farm Forest Plan deliver against these guidelines.

Table 16.7 - Baseline and Wind Farm Forest Plan Compliance with UKFS Species Diversity Guidelines.

Species	Baseline Area (ha)	Baseline Percentage	Wind Farm Forest Plan (ha)	Wind Farm Forest Plan Percentage	Change (%)
Cumberhead Forest					
Sitka spruce dominated crops	1,247.77	61.9 %	1,204.82	59.8 %	-2.1 %
Diverse Conifer	48.74	2.4 %	47.64	2.3 %	-0.1 %
Native Broadleaves	147.81	7.3 %	142.25	7.1 %	-0.3 %
Open Ground	437.59	21.7 %	495.81	24.6 %	2.9 %
Long-Term Retentions	72.83	3.6 %	69.77	3.5 %	-0.2%
Natural Reserves/SSSI	59.88	3.0 %	54.63	2.7 %	-0.3 %
Total	**2,014.62**	**100 %**	**2,014.61**	**100 %**	
Cumberhead Farm Woodland					
Sitka spruce	29.48	74.6 %	25.74	62.9 %	-12.7 %
Diverse Conifer	4.00	10.1 %	4.00	10.1 %	0.0 %
Native Broadleaves	2.00	5.1 %	2.00	5.1 %	0.0 %
Open Ground	4.01	10.2 %	7.68	21.9 %	11.7 %
Total	**39.49**	**100 %**	**39.49**	**100 %**	

16.7.46 Both the Cumberhead Forest Baseline and Wind Farm Forest Plans have less than 75 % of the forest management unit allocated to a single species. The Baseline Forest Plan has 21.7 % open ground, with the Wind Farm Forest Plan having a corresponding additional 2.9 % (representing the Proposed Development infrastructure).

16.7.47 Site suitability limits species choice for a greater diversity of conifer species with the best ground identified for replanting with Norway spruce. The requirement for 10 % other species or ground managed for environmental objectives is delivered through a combination of Norway spruce, Long-Term Retentions, Natural Reserves (primarily established adjacent to the SSSI and SPA) and additional native broadleaf planting over and above the 5 % minimum area, taking both Plans to 11.3 % and 10.6 % respectively. Both the Baseline and Wind Farm Forest Plans can demonstrate compliance with the requirements of UKFS in relation to diversity.

16.7.48 As all areas will continue to be managed as part of a UKWAS certified commercial forest, current UKFS and industry best practice will continue to be followed for the replanting of all felled areas. Replanting methodology will vary depending on whether commercial conifers or native broadleaves are being replanted, however both methods will follow UKFS and UKWAS guidelines and best practice.

16.7.49 Commercial conifer replanting methodology:

- Site preparation by machine mounding and drainage;
- Manual planting at a minimum density of 2,700 stems per hectare; and
- Ongoing establishment maintenance such as the replacement of failed trees, weed control and pest protection as necessary to ensure satisfactory establishment.

16.7.50 Native broadleaved replanting methodology:

- Site preparation by machine mounding and drainage where necessary;
- Manual planting at a minimum density of 1,700 stems per hectare using native, local provenance tree species most appropriate to the site;
- Trees and shrubs protected in 1.2 m or 0.6 m staked tubes according to species; and
- Ongoing establishment maintenance such as the replacement of failed trees, weed control and pest protection as necessary to ensure satisfactory establishment.

16.7.51 Replanted areas will form part of the existing and on-going crop establishment work at Cumberhead Forest which has seen the successful establishment of both conifer and broadleaf replanting programmes. Crop establishment will include protection against browsing damage from wild animals (deer, hare, rabbit, weevil) and domestic stock, as well as drainage and weed maintenance to ensure crop establishment. Replanted areas will be protected and insured against fire in common with the rest of the property.

Construction

16.7.52 Harvesting of timber crops will continue as detailed in the Forest Plan, with felling to accommodate the Proposed Development due to start in 2021 ahead of the main phase of construction. All timber will be harvested following standard forest practices:

- Harvesting coupes will be identified and agreed with SF and approved for felling through the formal Forest Plan approval mechanism.
- Coupes will be marketed before harvesting using conventional wheeled machinery, with no requirement for specialist equipment.
- All felled material will be cut into product specific lengths, forwarded to the forest road for uplift and haulage to conventional local timber markets. There will be no requirement to fell to waste or mulching of crops.
- Timber will be hauled via the existing forest road network to the public road via Douglas West.
- Subject to site suitability, brash will be recovered from parts of the site and sold into biomass markets.

16.7.53 From a forestry perspective, the scale and timing of forestry operations is relatively unchanged from the Baseline Forest Plan, with the majority of forestry operations directly associated with the Proposed Development occurring ahead of the main construction phase.

Operation

16.7.54 There will be no operational effects on forestry resources or operations as a result of the Proposed Development.

Decommissioning

16.7.55 There are no effects on forestry resources or operations associated with the decommissioning of the Proposed Development.

16.8 Mitigation

Forest Residue Management Plan

16.8.1 Consideration has been given to the production of non-forestry residues in line with the *Management of Forestry Waste WST-G-027 version 3* (SEPA, 2017) and the accompanying *Use of Trees Cleared to Facilitate Development on Afforested Land – Joint Position Statement and Guidance* (SNH, SEPA, FCS 2014).

16.8.2 These policies require consideration of unmerchantable timber, residual brash and stumps produced by tree harvesting to facilitate developments where standard forestry replanting is not being undertaken.

16.8.3 In the context of the Proposed Development, this relates to previously afforested areas associated with:

- 75 m radii tree free bat protection buffers around turbines (brash);
- 20 m radii hard standing areas around turbine bases and substation (brash and stumps);
- 20 m wide tree free road corridors (brash);
- 6 m wide road construction corridor (within the 20m tree free road corridor) (brash and stumps);
- Temporary construction compounds and control buildings (brash and stumps); and
- Borrow pits (brash and stumps).

16.8.4 The following Forest Residue Management Plan (FRMP) has been produced to address the areas of forest where trees will be harvested and not replanted in order to accommodate the Proposed Development, detailing the amount and management of unmerchantable trees, brash and stumps generated.

Ground Conditions

16.8.5 A high proportion of the turbines and associated infrastructure are located in elevated and exposed locations on gley, peaty-gley or peat dominated soils. Wet, infertile, peat dominated ground result in tree crops with poor, checked growth. Such soils are at risk of being damaged as part of forestry operations, regardless of being associated with routine forestry or renewables developments.

16.8.6 The passage of forestry machinery used for felling, processing and extraction of timber can result in rutting, compaction and soil erosion unless appropriate ground protection measures are employed as detailed under the Section 16.8.25 in this FRMP. Further details of ground conditions across the Proposed Development site, including details of peat distribution and condition, are provided in Chapter 11: Hydrology, Hydrogeology and Geology.

Access

16.8.7 The existing forestry access via Douglas West onto the A70 will be used for all forestry purposes and will therefore be entirely separate from the Proposed Development construction access, with harvesting planned to take place in late 2021, a year ahead of the main construction phase of the Proposed Development.

Timber Markets

16.8.8 At the time of writing timber markets are buoyant, with strong demand and Cumberhead Forest is well located to take advantage of major sawlog, wood panel and pulp mills located in the region. As well as traditional timber markets (saw log, pallet wood, pulp and chip wood) the emerging biomass market has grown steadily in recent years, with the FCS *Woodfuel Demand and Usage in Scotland Report* (Forestry Commission, 2013) predicting continued growth. The closest facility is the

Dalquhandy CHP plant located approximately 1 km from Cumberhead Forest, which is owned and operated by 3R Energy.

Materials Generated

16.8.9 For the purpose of quantifying the various materials generated, the Proposed Development footprint and associated tree free buffers can be broken down as follows:

- Mature crops being felled and not replanted (37.66 ha) – Merchantable material to be sold into conventional markets, brash and an element of stump removal to be sold into biomass markets;
- Young crops being felled and not replanted (21.72 ha) – Young crops to be whole tree harvested and sold into biomass markets;
- Existing open ground (39.26 ha)

Feature	Area (ha)	FRMP Considerations
Mature crops being felled and not replanted	37.66	Merchantable, Brash and an element of Stump removal
Young Crops being felled and not replanted	21.72	Young crop brash
Existing Open Ground	39.26	
Total Infrastructure and Buffer Footprint	**98.64**	

Merchantable Timber

16.8.10 Of the mature crops to be harvested to accommodate the Proposed Development, 37.66 ha constitutes crops which will be felled and not be replanted. This mature conifer crop carries merchantable timber, defined as having a diameter greater than 7 cm, over bark, as detailed in SEPA's *Guidance Note on the Use of Trees Cleared to Facilitate Development on Afforested Land* (SEPA, 2014).

16.8.11 These areas will be conventionally harvested, as part of a routine planned phased felling programme, using standard forestry timber harvesting and forwarding machinery, with merchantable material stacked by product at roadside ready for onward haulage to market. A critical part of the harvesting approach at Cumberhead will be the use of brash mats to support harvesting and extraction machinery and to protect underlying soils from rutting, compaction and erosion.

16.8.12 Based on an average production of 460 cubic metres (m^3) or 383 tonnes per hectare over the 37.66 ha of ground to be felled and not replanted, 17,324 m^3 of merchantable timber, weighing approximately 14,436 T and requiring 577 loaded lorry movements will be generated.

Brash Generation

16.8.13 Unlike timber volumes and tonnages, there is an absence of published research data regarding volumes and tonnages of brash and stumps produced per hectare of commercial conifer crop. For the purposes of this report an industry rule has been used based on evidence from harvesting managers who have been at the forefront of forest residue recovery. It has been assumed that the tonnage of brash and stumps produced is equal to the tonnage of standing merchantable timber, with equal amounts of brash and stumps. Therefore, a tree crop of 402 T of standing timber per hectare should produce 201 T of brash and 201 T of stumps per hectare.

16.8.14 Brash will be generated from the infrastructure footprint and associated tree free buffer areas, where mature crops and felled and not replanted and from young trees.

16.8.15 On this basis, calculating brash generation is achieved by multiplying the area of merchantable crops being felled and not replanted (37.66 ha) by half the average timber production per hectare (460 m^3 or 383T per hectare):

Brash Production = 37.66 ha x 230 m^3/ha = 8,662 m^3 (7,218 T)

16.8.16 Brash generated for trees younger than 15 years of age are not old enough to be measured using conventional forest yield models. Trees less than 5 years old (2.09 ha) are assumed to have no measurable volume. Trees aged 5-9 (6.96 ha) have an assumed volume of 30 m^3/ha and trees aged 10-14 (8.09 ha) have an assumed volume of 55 m^3/ha.

Young Tree Brash Production:

Trees aged 5-9: 6.96 ha x 30 m^3/ha = 209 m^3 (174 T)

Trees aged 10-14: 8.09 ha x 55 m^3/ha = 445 m^3 (371 T)

Total: 654 m^3 (545 T)

Stump Generation

16.8.17 Stump removal will only be carried out where required for the physical infrastructure footprint. This relates to:

- 20 m radii hard standing areas around turbine bases and crane pads;
- 6 m wide road construction corridor (within the 20m tree free road corridor); and
- temporary construction compounds and substation/control building.

16.8.18 Reflecting the smaller area associated with the infrastructure footprint where stump removal is required, stump generation is calculated in much the same way as for brash using the revised area of 15.34 ha:

Stump Production = 15.34 ha x 230 m^3/ha = 3,528 m^3 (2,940 T)

16.8.19 A summary of forecast brash and stumps production is provided in Table 16.8.

Table 16.8 - Summary of Brash and Stump Production from the Proposed Development

Feature	Area (ha)	Volume (m^3)	Tonnage (T)
Brash from mature crops felled and not replanted	37.66	8,662 m^3	7,218 T
Brash from young crops felled and not replanted	15.05	654 m^3	545 T
Stumps from areas cleared for infrastructure footprint	15.34	3,528m^3	2,940 T
Total		**12,844 m^3**	**10,703 T**

16.8.20 A total of 12,844 m^3 or 10,703 T of brash and stump forest residues are estimated to be generated from the Proposed Development.

Destination of Forestry Material

16.8.21 The following section details the use and destination of the various forestry materials resulting from felling associated with the Proposed Development.

Merchantable Timber

16.8.22 Merchantable materials will be sold into existing markets, which for sawlogs are likely to include BSW at Dalbeattie, James Jones & Son at Lockerbie and Forest Garden at Lockerbie. Small

roundwood markets are likely to include Egger at Barony (Cumnock), UPM Caledonian at Irvine and Iggesund at Workington.

Brash and Stumps

16.8.23 As trees are felled the branches and tips of the trees are removed to leave clean tree trunks, which are cut into product specification lengths, forming the merchantable material. The remaining branches and "lop and top" form the brash, which are collected up to form brash lanes/brash mats to protect the soil by helping support the weight of harvester and forwarder movements across the site. This results in brash lanes across the harvesting site approximately every 10-15 m, with the intervening areas being relatively free from brash.

16.8.24 The use of brash mats is particularly important on wet, peaty soils characteristic of those found over much of Cumberhead and following industry best practice, the use of brash mats is considered essential as part of routine harvesting. As the brash mats break down and drop needles the brash mats will be renewed using fresh material generated from harvesting. As brash mats degrade in service, they become embedded in the soft, wet ground. It is proposed brash mats are left in-situ within keyhole areas and areas where there is no infrastructure post-harvesting, as the ground disturbance associated with digging out brash material from the ground is considered to be greater than leaving it in place. It is estimated that some 7,890 m^3 of brash will, however, be removed from the area of ground associated with the infrastructure footprint and tree free buffers.

16.8.25 Due to the risk of soil erosion associated with stump removal on peaty soils on elevated sites, tree stumps in areas to be harvested and maintained as tree free will remain in-situ and allowed to degrade naturally along with the brash as per standard forestry practice for areas reverting to open ground habitats in forests. Only areas required for the physical construction footprint of the Proposed Development will have stumps removed. On this basis, it is estimated 3,528 m^3 of stumps will be generated.

16.8.26 The combined brash and stump production associated with the Proposed Development is therefore forecast to be 12,844 m^3. Brash recovery for use in the biomass market is now a routine part of forestry operations with operators such as Jenkinson's, 3R Energy, Land Energy and Estover Energy all competing in this market. The intention would be to sell the brash and stumps generated from the Proposed Development into this market along with material from the surrounding coupe ground being felled under Forest Plan approval, most likely into the Dalquhandy CHP which would be possible without using public roads.

Conclusions

16.8.27 This FRMP demonstrates that all forestry materials generated as a result of felling to construct the Proposed Development can be sold into existing timber markets. On this basis there will be no requirement for mulching or spreading of crops across the site.

Compensatory Planting

16.8.28 In accordance with best practice, and as agreed with SF in pre-application consultation, approval is only being sought for felling directly associated with the infrastructure footprint and tree free areas under this submission.

16.8.29 The infrastructure and tree free footprint is 98.64 ha, of which 59.38 ha is currently comprised of Sitka spruce dominated commercial forestry, with the remaining 39.26 ha represented by existing open ground (tracks, rides, riparian corridors etc.).

16.8.30 In the Baseline Replanting Plan the areas of current mature crop, once felled, are to be replanted predominantly with commercial Sitka spruce forestry while introducing native woodland and designed open space along the margins. Under the Baseline Plan, some areas within the Development area, which are currently open ground, were to be replanted with native broadleaves and some areas of commercial conifers were to become open ground, with the result being a net reduction in open ground from the current area of 39.26 ha to 36.68 ha following replanting.

16.8.31 Under the Baseline Replanting Plan 36.68 ha of the infrastructure and associated tree free footprint of 98.64 ha is detailed as open ground. Under the Wind Farm Forest Plan the balance of this area, 61.96 ha is required as additional open ground to accommodate turbines, bat protection buffer zones, infrastructure and associated tree free areas.

16.8.32 All other changes associated with felling phases and replanting plans will be subject to a Forest Plan amendment through SF in the event the Proposed Development is consented.

16.8.33 Using the most up to date (February 2019) *Scottish Governments' Policy on Control of Woodland Removal: implementation guidance*, compensatory planting areas have been calculated on the basis of a "hectare for hectare" replacement of woodland areas lost to development. The Baseline Forest Plan, in the absence of the Proposed Development has been taken into account, which would have restructured the woodland to conform with current best practice forest planning principles. No further reductions to compensatory planting requirements have been applied to account for the Proposed Development access tracks, as it is considered these would not have been required to serve the forest.

16.8.34 Table 16.9 summarises the considerations in arriving at the level of compensatory planting for addressing the Scottish Government's *Control of Woodland Removal Policy* in relation to the Proposed Development.

Table 16.9 - Compensatory Planting Calculation associated with the Proposed Development

Feature	Area (ha)
Infrastructure and associated tree free area footprint	98.64 ha
Less Designed Open Ground within Baseline Forest Plan	-36.68 ha
Area to be accounted for under the Control of Woodland Removal Policy	**61.96 ha**

16.8.35 An area of 61.96 ha has been identified as requiring compensatory planting under the *Control of Woodland Removal Policy*. As agreed with Forestry Commission in pre-application consultation, this area does not include areas of ground due to be restored and replanted post-construction.

Compensatory Planting Plan

16.8.36 It is proposed that the required area of compensatory planting, in line with the *Control of Woodland Removal*, will be delivered via a Planning Condition. Due to the lack of appropriate open ground within the Forest, it is not possible to deliver compensatory planting on site, however, suitable areas have been identified for the delivery of the Compensatory Planting Obligation.

16.8.37 Compensatory planting will therefore be delivered offsite, but within the locality. This ground will be subject to full consultation and associated EIA determination by SF under the *Forestry (Environmental Impact Assessment) (Scotland) Regulations 2017*.

16.8.38 Ground for compensatory planting will be secured via a lease over the identified ground to the Applicant, with the Applicant meeting all costs for planting, protection and establishment plus associated professional costs for monitoring and management.

16.8.39 Compensatory planting will be delivered in the first planting season following commencement of the Proposed Development with forestry reports submitted to SF in years 1, 5 and 10, detailing full stocking assessment, establishment and management recommendations.

16.8.40 All areas will be protected within a deer fence with rabbit netting with incursions shot out to ensure tree protection. Ground will be mounded where machine access is possible, with manual screef ground preparation on steeper ground where machine access is not possible. Mounding density should achieve 2,700 trees per hectare for commercial conifers, 1,700 trees per hectare for native woodland areas and 1,250 for W4 (wet woodland) areas, into which commercial conifers and native, local provenance trees appropriate to site will be planted.

16.8.41 Target stocking density will be to achieve no less than 2,500 stems per hectare for commercial conifers, 1,600 stems per hectare for native woodland areas and 1,200 stems per hectare for W4 areas at establishment, with trees capable of onward growth without significant additional management input.

16.8.42 Delivery of the planting, establishment and maintenance will be overseen by Bidwells on behalf of the Applicant, conducting regular inspections and producing annual silvicultural management recommendations to be delivered by the Applicant in order to ensure the delivery of successful and timely tree establishment. Maintenance will include protection against browsing damage from wild animals (deer, hare, rabbit, weevil) and domestic stock, as well as drainage and weed maintenance (as required) to ensure crop establishment. All compensatory planting areas will be protected and insured against fire by the Applicant.

16.8.43 Establishment will be defined as the point when the average tree height is 2.0 m or more with average stocking densities of 2,500 stems per hectare for conifers, 1,600 stems per hectare for native woodland areas and 1,200 stems per hectare for W4 areas. At this point SF will be invited to inspect the compensatory planting, before seeking agreement that the compensatory planting commitment has been delivered. It is anticipated establishment will take 5 to 10 years to achieve and the Applicant will retain the lease for this period, or such additional time as may be required to deliver establishment of the compensatory planting. After the area is agreed as being established the woodland will revert to the landowner.

16.9 Residual Effects

16.9.1 The Wind Farm Forest Plan would see minor changes to the Baseline Forest Plan in order to accommodate the turbines, infrastructure, bat protection buffer zones and open ground associated with the Proposed Development, as summarised below:

- 33.57 ha increase in Phase 2 Felling (2021-2025), a 7.7 % increase against the Baseline Forest Plan for the same period but only 1.6 % increase over the total forest area. Young crops outside the infrastructure footprint and associated tree free areas will remain untouched, while mature crops felled outside of the infrastructure footprint and associated tree free areas will be replanted back to the keyhole as per the Baseline Forest Plan.
- There will be a minor reduction of 3,171 T of Phase 2 Felling (2021-2025), a decrease of 2.0 % against Baseline Plans for the same period and an overall reduction of 4,168 T or 0.6 % over the twenty-year Forest Plan period.
- 73 fewer loaded timber lorry movements in Phase 2 (2021-2025), a 1.1 % decrease against Baseline during the same period and an overall reduction of 167 loaded lorry movements or -1.5 % over the twenty-year Forest Plan period.
- Reduction in conifer area over the twenty-year Forest Plan Period of 56.39 ha against Baseline, representing a reduction of 4.0 % in conifer area or 2.7 % of the total forest area. The reduction in productive conifer area will be off-set by compensatory planting.
- Increase in open ground over the twenty-year Forest Plan Period of 61.96 ha representing an increase of 14.0 % in open ground against Baseline, or 3.0 % across the total forest area. The reduction in productive area will be off-set by compensatory planting.

16.10 Cumulative Assessment

16.10.1 Table 16.10 provides a summary of the forestry related cumulative impacts on Cumberhead Forest based on existing and proposed developments in the area, followed by a brief assessment.

Table 16.10 – Summary of Cumulative Forestry Impacts

Wind Farm	Turbines	Output (MW)	Woodland Removal Area (ha)	Proportion of Forest (%)	Woodland Loss (ha/MW)
Nutberry Wind Farm	6	15	27.30	1.4 %	1.82
Consented Cumberhead Wind Farm	14	50	48.68	2.4 %	0.97
Proposed Douglas West Extension Wind Farm	13	78	33.08	1.6 %	0.42
Proposed Development	**21**	**126**	**61.96**	**3.0 %**	**0.49**

16.10.2 In order to assess cumulative forestry impacts on Cumberhead Forest, woodland removal has been used as the principle indicator. As can be seen in the table above, the Proposed Development seeks to install 21 turbines with a generating capacity of around 6 MW into Cumberhead Forest, with an associated impact of 0.49 ha of woodland removal per megawatt, with the exception of the proposed Douglas West Extension Wind Farm, this is the lowest impact of any of the operational or consented wind farm developments within Cumberhead Forest.

16.10.3 The Proposed Development has adopted a similar approach to the other wind farms in relation to minimising woodland removal, taking advantage of advances in accepted approaches to turbine tip heights and enhanced generating capacity of the turbines. The use of up to 200 m tip heights and higher hub heights results in greater clearance between the swept edge of the rotor and tree canopy, significantly reducing the need for woodland removal. When combined with around 6 MW generators this significantly improves the ratio of woodland removal per megawatt and as such reduces the impact of the Proposed Development on Cumberhead Forest.

16.10.4 This proposal would see a total of 54 turbines, generating 269 MW of renewable energy located across Cumberhead Forest at a loss of 171.02 ha of Sitka spruce dominated woodland within the forest, representing 8.4 % of the total forest area.

16.10.5 It is important to note, the consented Cumberhead Wind Farm, the Proposed Douglas West Extension Wind Farm and the Proposed Development all will deliver compensatory planting to mitigate the loss of productive conifers and as such the actual loss of woodland related benefit is limited to the areas previously removed for Nutberry Wind Farm (which predated this policy).

16.10.6 The cumulative loss of 8.4 % of Cumberhead Forest is considered **minor** in the context of the property, especially when the losses come from generally lower yield class crops in the higher altitude locations, reducing the impact on loss of production. The Wind Farm Forest Plan demonstrates that Cumberhead Forest will remain a largescale, productive commercial forest, capable of longer-term sustainable production of good quality commercial timber. The positive renewable energy and carbon reduction benefits that would accrue from the wind farms within the forest are also noteworthy in this regard.

16.11 Summary

16.11.1 Following best practice detailed in the *Scottish Government's Policy on Control of Woodland Removal: implementation guidance* (February 2019), this chapter has focused on Cumberhead Forest and the Cumberhead Farm Woodland as a single forestry management unit. Cumberhead Forest will continue to be managed as a commercial forest under UKFS and UKWAS in the event the Proposed Development is consented with felling and replanting authorised under the Forestry and Land Management (Scotland) Act, 2018, overseen by SF as the Competent Authority.

16.11.2 The following is a summary of the areas of felling and replanting required to construct and operate the Proposed Development and for which permission is being sought from the Energy Consents Unit:

- Felling approval for 59.38 ha of commercial forest to accommodate construction of the Proposed Development as detailed in the Wind Farm Felling Plan and detailed in Figure 16.5;
- Delivery of the arising Compensatory Planting Obligation extending to 61.96 ha as detailed in the Compensatory Planting Plan (Section 16.8.36) and shown on Figure 16.6; and
- On consent of the Proposed Development, a Forest Plan Amendment will be sought through the standard FS process to implement the Wind Farm Forest Plan.

Table 16.11 – Summary Table

Description of Effect	Significance of Potential Effect		Mitigation Measure	Significance of Residual Effect	
	Significance	Beneficial/ Adverse		Significance	Beneficial/ Adverse
During Construction & Decommissioning					
Social Benefits of the Wind Farm Forest Plan	Negligible	Adverse	Implementation of Wind Farm Forest Plan – public access, archaeological and landscape considerations are materially changed from the baseline	Neutral	
Economic Benefits of the Wind Farm Forest Plan	Minor	Beneficial	Implementation of Wind Farm Forest Plan and Compensatory Planting to address reduced production – the loss of 61.96 ha of commercial woodland does not affect the economic viability of the forest or the wider industry and is being mitigated through compensatory planting.	Minor	Beneficial
Environmental Benefits of the Wind Farm Forest Plan	Minor	Beneficial	Implementation of Wind Farm Forest Plan and Compensatory Planting to address woodland loss – minimal loss of woodland cover (61.96 ha) which is mitigated through compensatory planting and the generation of 126 MW of renewable energy.	Minor	Beneficial
During Operation					
None					
Cumulative Effects					
Potential cumulative reduction of 8.4% of Cumberhead Forest area	Minor	Adverse	Delivery of Compensatory Planting and Implementation of Wind Farm Forest Plan	Neutral	

16.12 References

Bat Conservation Trust (2014). *Bats and onshore wind turbines: Interim guidance. Natural England Technical Information Note TIN05, third edition*. Natural England.

East Ayrshire Council (2014). *Ayrshire and Arran Forestry and Woodland Strategy*. East Ayrshire Council.

Forestry Commission (2017). *The UK Forestry Standard: The Government's Approach to Sustainable Forestry*. Forestry Commission.

Forestry Commission (2017). *Forests and Historic Environment Guidelines*. Forestry Commission.

Forestry Commission (2017). *The UK Forestry Standard*. Forestry Commission.

Forestry Commission (2017). *Forests and Water Guidelines*. Forestry Commission.

Forestry Commission (2017). *Forests and Landscape Guidelines*. Forestry Commission.

FCS (2009). *Scottish Government Control of Woodland Removal Policy*. FCS.

FCS (2013). *Woodfuel Demand and Usage in Scotland Report 2013*. FCS.

Forestry Commission (2014). *Design techniques for Forest Design Planning*. Forestry Commission.

FCS (2014). *Supplementary guidance to support the FC Forests and Peatland Habitats Guideline Note* (2000). FCS.

FCS (2015). *Guidance to FCS staff on implementing the Scottish Government's Policy on Control of Woodland Removal*. FCS.

Glasgow and the Clyde Valley Strategic Development Planning Authority (2015). *Clydeplan Forest and Woodland Strategy*. Glasgow and the Clyde Valley Strategic Development Planning Authority.

Scottish Environmental Protection Agency (2013). *Management of Forestry Waste WST-G-027 version 3*. Scottish Environmental Protection Agency. December 2017.

Scottish Environment Protection Agency, Scottish Natural Heritage, FCS (2014). *Use of Trees Cleared to Facilitate Development on Afforested Land – Joint Position Statement and Guidance* (Draft). Scottish Environmental Protection Agency, Scottish Natural Heritage, FCS.

Scottish Government (2019). *Scotland's Forestry Strategy*. The Scottish Government.

Scottish Government (2011). *Scottish Land Use Strategy*. The Scottish Government.

Scottish Government (2017). T*own & Country Planning (Environmental Impact Assessment) (Scotland) Regulation 2017*. The Scottish Government.

Scottish Government (2014). *The National Planning Framework for Scotland 3*. The Scottish Government.

Scottish Government (2014). *Scottish Planning Policy*. The Scottish Government.

This page is intentionally blank.