Western Forestry Co-op
Your Local Forestry Co-op

Forestry Report

1.0 BACKGROUND

This report examines the effects of the proposed Castlebanny Wind Farm project across the existing forest area and the potential impact associated with forestry clearfelling for this development. It will describe the existing forest environment and the impact of the proposed wind farm in relation to the ongoing operation of the forest. Environmental impacts associated with forestry clearfelling and replanting e.g. ecology, water quality, landscape, soils etc. is addressed in the relevant technical sections of the EIAR.

1.1 STATEMENT OF AUTHORITY

This report has been prepared by the following staff of Western Forestry Co-op:

Marina Conway is the author of the report and holds a Bachelor and Master's degree in Agricultural Science in Forestry, a postgraduate certificate in Water Pollution Control and is professional Member of the Society of Irish Foresters. Marina has 24 years specialised experience as a professional manager in the field of forestry and environmental development. Her key skills are in forest management from afforestation to harvesting, reforestation, appropriate assessments and biodiversity. Marina has experience in project management, implementation, environment & climate change policy, capacity building, data analysis, auditing and government policy.

Joseph McManus holds a BSc in Forestry and is professional Member of the Society of Irish Foresters. Joseph has 6 years specialised experience in harvesting, forest inventory, field work, site assessment and mapping for harvest operations and health and safety. Joe assisted with the field work and the mapping.

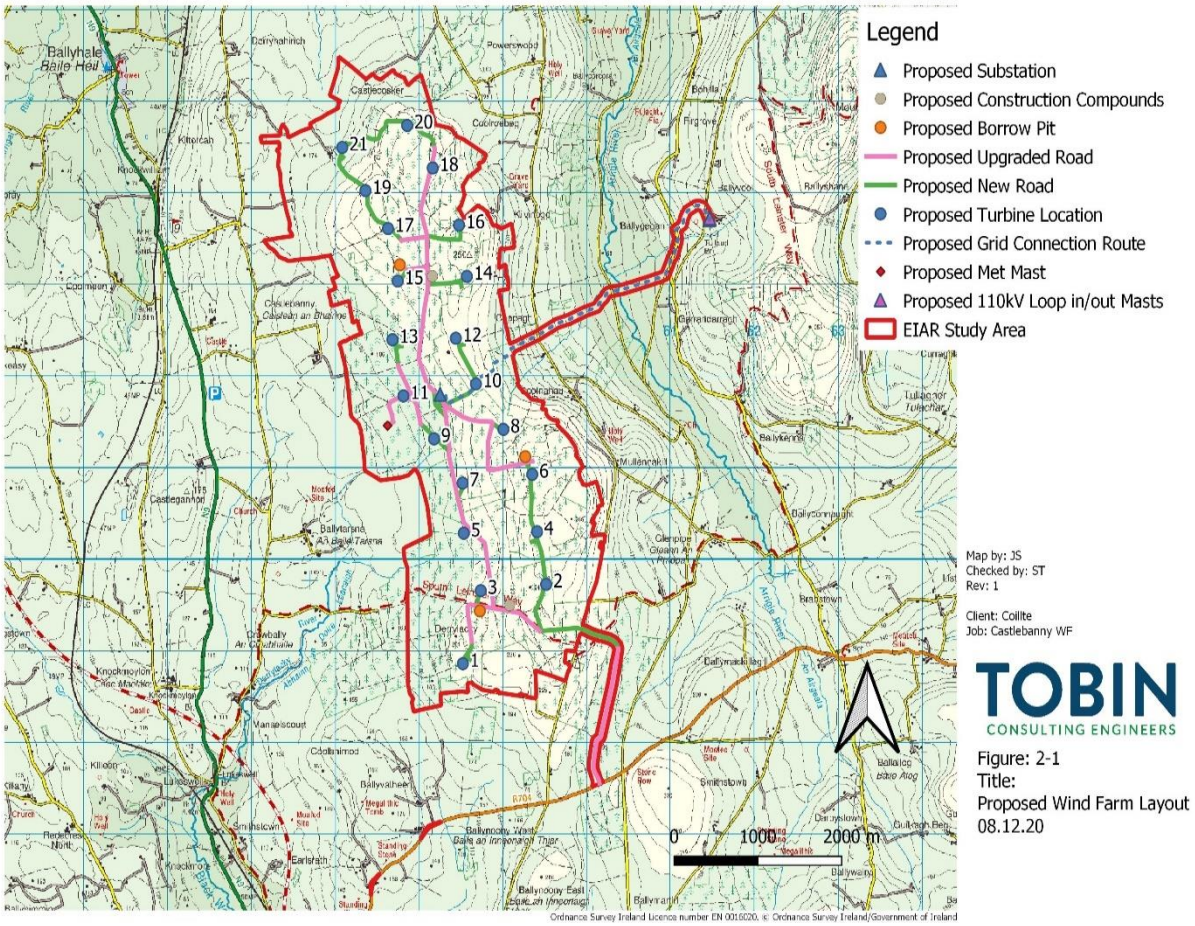
Kevin Dunne holds a BSc in Forestry and is professional Member of the Society of Irish Foresters. Kevin has 2 years specialised experience in forest inventory, field work and mapping for harvest operations specialising in forest roads, thinning and clearfelling. Kevin assisted with the field work and forest measurement data.

1.2 INTRODUCTION

The proposed Castlebanny Wind Farm project includes 21 no. turbines, and all associated infrastructure which is described in detail in Chapter 2 (Description of the Proposed Development) of this EIAR: Description of the Proposed Development. The site of the proposed wind farm measures c. 1,434 ha and is predominantly covered in actively managed coniferous forestry plantations. Approximately 1200 ha are in Coillte's ownership whilst the remaining area comprise third-party owned areas of agricultural grassland, arable crops and commercial forest. There is an extensive network of existing access roads across the site to facilitate the

ongoing forestry operations. Figure 1 shows the proposed wind farm layout with associated grid connection.

Figure 1 - Site Study Area and Turbine Layout (Extracted from main EIAR)



The site is characterised by locally steep topography between 145m and 265m above ordnance datum (AOD) and is bounded to the east by the Arrigle River, to the south-west by the Derrylacky River and the north-west by the Little Arrigle River

As part of the proposed development there will be a requirement to clearfell some of this forestry in the areas immediately around the footprint of the wind farm infrastructure. As a commercial crop, this forestry is scheduled to be felled in the future regardless of the proposed wind farm being constructed or not, and within two years of felling the area would be replanted.

Felling is the process of cutting down trees. Clearfelling involves most or all of the trees in an area being cut down at the same time. The felling operations will be done both by manual (chainsaw felling) and mechanical means. For mechanical harvesting this includes a harvesting machine (Plate 1) which mechanically cuts, delimbs and processes the tree into different timber assortment sizes (pulp, stakewood, palletwood, sawlog) and an 8 wheel mounted forwarder

machine (Plate 2) that collects the different timber assortments and stacks them at the road for removal by the timber lorries to the sawmill.

Plate 1 - Timber Harvester

Plate 2 - Timber Forwarder

Clearfelling for this proposed development will be in small compartments or coupes within the forest areas. Felling has the potential to impact adversely upon the environment if done in an uncontrolled manner; however, by the adoption of sound planning procedures, operating

techniques and control measures as outlined in Section 1.6, this will considerably reduce any potential adverse environmental effects.

Subject to receipt of consent for the proposed Castlebanny Wind Farm project, the developer will apply to the Forest Service for a Felling Licence for clearfelling works, in line with the requirements of the Forestry Act, 2014. A felling licence granted by the Minister for Agriculture, Food and the Marine provides authority under the Forestry Act 2014 to fell or otherwise remove a tree or trees and to thin a forest for silvicultural reasons. The proposed development must have obtained planning consent before an application can be made for a felling license from the Forest Service, as per their policy on tree felling for wind farms. As part of this process, an area of at least an equivalent size to that which will be permanently felled must be replanted. This replanting land can be located anywhere within the state, provided an afforestation license is granted for the land.

The regulatory authority in Ireland, the Forest Service, has developed the Code of Best Forest Practice (Forest Service 2000b) which details forestry operations and the manner in which they should be carried out to ensure the implementation of sustainable forest management in our forest ecosystems and a suite of environmental guidelines which prescribe best practice in relation to Forestry and Water Quality and Forest Harvesting and the Environment (Forest Service 2000a, 2000b, 2000c), Felling and Reforestation Policy and Standards for Felling and Reforestation.

Coillte is certified to two forest management certification schemes, namely FSC (Forest Stewardship Council) certification of responsible forest management, and PEFC (Programme for the Endorsement of Forest Certification) certification of sustainable forest management. Both FSC and PEFC forest management certification schemes are independent schemes which audit and inspect forest managers to ensure their work meets strict forest management standards against social, economic and environmental criteria. For more information see https://www.coillte.ie/our-forests/public-goods/certification/.

1.3 METHODOLOGY

The methodology used to produce this report included a review of relevant legislation and guidance documents, a desk study, site walkthrough and field inspection of the proposed development footprint, evaluation of potential effects and an identification of measures to avoid and mitigate effects. Permanent felling requirements, which assume the worst case scenario and may be less than estimated, while ensuring constructability, should be the minimal possible area and have been determined based on turbine manufacturers requirements and any environmental or other mitigations proposed. The requirements include the felling required for the wind farm to assess impacts in terms of runoff and nutrient mobilisation and present mitigation measures against all impacts.

1.3.1 Relevant Legislation and Guidance Documentation

The following documents have been referenced in the preparation of this report:

- Felling and Reforestation Policy, Forest Service, Department of Agriculture, Food and the Marine, Dublin. May 2017
- Standards for Felling and Reforestation, Forest Service, Department of Agriculture, Food and the Marine, Dublin. October 2019

- Forestry Act 2014 and the Forestry Regulations 2017 (SI No 191 of 2017) and SI 31 of 2020 - Forestry (Amdmt) Regs 2020 re reg 19AA procedures (pdf 99Kb)

- Forest Service. 2000a. Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin.

- Forest Service. 2000b. Code of Best Forest Practice – Ireland. Irish National Forest Standard. Forest Service, Department of the Marine and Natural Resources, Dublin.

- Forest Service. 2000c. Forest Harvesting and the Environment Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin.

1.3.2 Desk Study

A desk study was undertaken in order to collate and review background information in advance of the site survey. The desk study was carried out initially in December 2019 and again in June 2020. It involved the following:

- Examination of the IFORIS (Integrated Forestry Information System) INET online mapping system, Department of Agriculture, Food and the Marine. To include assessment of the site against the following environmental GIS mapping layers:
    - EPA Hydrology
    - High status objectives waterbodies
    - OPW Flood Hazard areas
    - Fisheries Sensitive Areas
    - Landscape Sensitivity
    - Sites, Monuments and Records
    - NPWS Natura Sites
    - ESB Buffers
    - County Development Plan
    - Fresh Water Pearl Mussel
    - Acid Sensitive Areas
- Examination of the EPA Appropriate Assessment mapping
- Coillte Castlebanny Forest Sub-compartment data

1.3.3 Field Work

Initial site walkover was undertaken during December 2019 by Marina Conway and a detailed site assessment during June 2020 by a project team of Marina Conway, Joseph McManus and Kevin Dunne. The purpose of the field work was to identify the forest type and the impact of the proposed felling on the forest environment. All of the proposed infrastructure locations that occurred within forest areas were visited. During the visit 0.01ha measurement plots were taken in order to calculate the standing volume and estimate a yield class for the plots as an assessment of volume to be removed and associated carbon loss as a result of permanent forest removal. The baseline/existing conditions of the forest areas to be felled were assessed for:

- Area of impacted forest (felling area hectares)
- Age of forest
- Species planted
- Standing Volume

1.3.4 Evaluation of Potential Impacts

The significant effect of the proposed windfarm and the associated felling and forest impacts that will be identified and monitored include:

- Soil disturbance and compaction
- Carbon loss
- Water quality (sediment & nutrient)

A Site Hazard & Risk Assessment was undertaken to identify hazard and risk factors that have the potential to identify and protect social and environmental features and considerations, these are recorded in the harvest plan in section 1.6.1, potential hazards include:

- ESB/Gas lines
- Water Mains
- Steep banks
- Roadside harvesting
- Deep drains
- Erosion Risk
- Public Access/Rights of Way

1.4 EXISTING ENVIRONMENT (BASELINE DESCRIPTION)

The existing environment is discussed in terms of felling area, tree species, forest age, condition, estimated standing volume (m^3) and Yield Class (where appropriate, i.e. in younger trees it is not possible to take measurements in trees <7cm diameter at breast height), aquatic zones or relevant watercourses (any other watercourse that has the potential to act as a pathway for the movement of significant amounts of sediment and/or nutrients from the site to an aquatic zone, they are often artificial, and include existing drains and channels and other potential pathways that contain flowing water during and immediately after rainfall).

1.4.1 Description of Forestry plots

1.4.1.1 Area, age & species

The total forest area comprises approximately 1,200 ha of commercial forest owned by Coillte and approximately 100 ha of third party commercial forests planted since 1996. As part of the windfarm development, areas of forest will be felled to facilitate both infrastructure and construction felling, as set out in Table 1 Total Area to be felled for Windfarm Development. As per the Felling and Reforestation Policy, Forest Service, Department of Agriculture, Food and the Marine, the Infrastructure felling relates to trees that are permanently removed from the site in order to make way for infrastructure associated with the wind farm (Table 2) and the construction felling relates to areas that require temporary forest removal to facilitate windfarm construction such as borrow pits and a temporary construction compound where the land will be replanted once construction is completed (Table 3). Bat felling buffers were taken into account in the calculation of the areas required for permanent tree removal around the turbines (see chapter 6 of this EIAR – Biodiversity, Flora & Fauna).

The total area of forestry to be felled is 82.88 ha, as shown in Table 1 and outlined on maps in Figures 2 and 3.

Table 1 - Total Area (ha) to be felled for Windfarm Development

Windfarm Infrastructure & Construction Felling	**Area (ha)**
Turbine Felling Area Incl Met Mast	45.32
Substation	2.68
Temp Construction Compound (2)	4.31
New Road	12.51
Borrow Pits	5.94
Upgraded Road	10.52
Passing Bays	0.42
Corner Widening	0.2
Grid connection Route	0.98
Total Felling Area	**82.8**

Table 2 - Area (ha) to be permanently felled for Windfarm Infrastructure

Windfarm Infrastructure	**Area (ha)**
Turbine Felling Area Including Met Mast	45.32
Substation	2.68
Temporary Construction Compound (2)	2.37
New Road	12.51
Upgraded Road	10.52
Passing Bays	0.42
Corner Widening	0.2
Grid connection Route	0.98
Total Felling Area	**75.00**

Table 3 - Area (ha) to be temporarily felled for Windfarm Construction

Windfarm Construction	**Area (ha)**
Borrow Pits (3)	5.94
Temporary Construction Compound (1)	1.94
Total Felling Area	**7.88**

Figure 2 – Forest areas to be felled for Turbines 1, 2, 3, 4 and 5 borrow pit, passing bay, temporary construction compound, corner widenings and new roads.

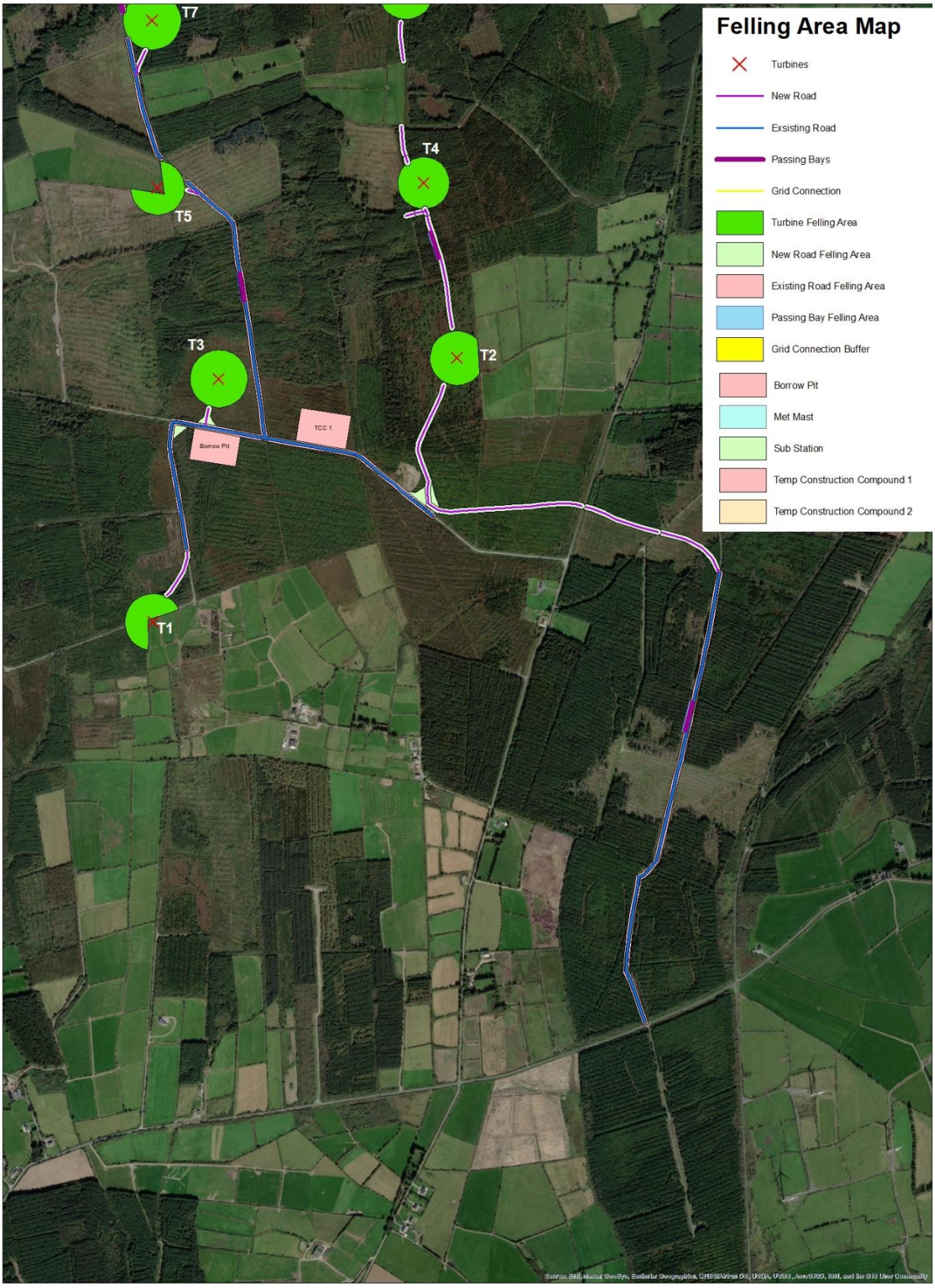
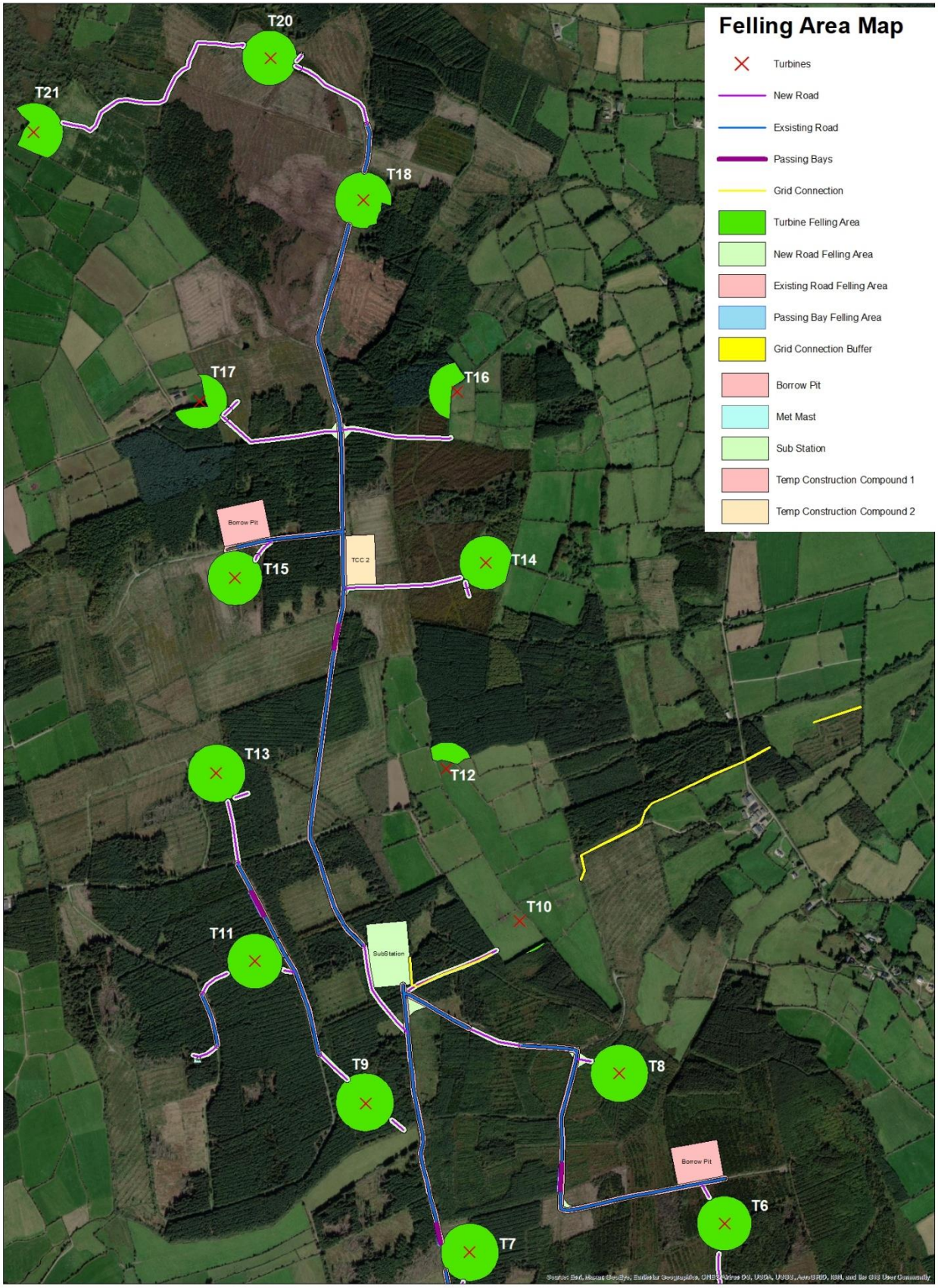


Figure 3 - Forest areas to be felled for Turbines 6 – 18 and 20 – 21, borrow pit, mast, substation, passing bay, temporary construction compound, corner widenings and new roads.



The Coillte owned and privately owned forests in the proposed study area are managed as commercial forestry. The main tree species present is Sitka spruce (Plate 1) which is managed on a commercial forestry basis which includes multiple rotations of establishment, thinning harvest (selective removal of trees in 3-5 year periods), final harvest by clearfell and replanting for the forest cycle to start again (Plate 2 and 3). The rotation length of the different plots will vary depending on productivity, soil type and exposure. There was evidence of windblow (Plate 4) during the site visits and significant areas of the commercial forest were damaged during Storm Darwin in 2014 as mapped on IFORIS INET Mapping system. Other species of trees that were present included Lodgepole pine mainly planted in mixture with Sitka spruce (Plate 5). There are trial plots of Eucalyptus where Sitka spruce and Birch is regenerating freely. There are also some small broadleaf plots of Sycamore, Birch, Alder and Willow, mostly regenerating freely in different areas throughout the forest. Of the different forest areas that were field surveyed for this study, the age of the forest ranged from newly planted (4 month) trees to a closed canopy 38 year old stand of Sitka spruce where windblow is occurring. The forest areas were at various stages of newly planted, pre-thicket forest, thicket[1] stage, closed canopy, thinned areas and clearfelled. The forest species and age in the infrastructural felling areas are shown in Table 4.

Table 4 – Forest Tree Species, Age and Area - Infrastructural felling areas

Infrastructure Type*	Tree Species	Planting Year	Area (ha)
T1 & R	SS Bi (90:10)	2014	2.74
T2 & R & PB	SS LP (90:10)	2002	3.23
T2 New Road	SS/Willow (Regen)	2011	1.15
T2 TCC	EUC	2014	2.37
T3 CW	Syc/ Willow/Bi/Alder	2003	0.046
T3 BP	Euc/SS/Bi	2003	1.98
T3 & R	Euc/SS/Bi	2008	2.81
T4 & R	SS/LP 50:50	1994	3.6
T5 & R	SS/Bi	2017	2.24
T6 BP	SS/LP 50:50	2007	1.98
T6 & R	SS/Bi	2007	2.45
T7 & PB	SS	1996	2.72
T8 & R	SS/LP 50:50	2003	2.84
T8 CW (2)	SS/LP 50:50	2003	0.1
T9	SS	1996	2.65
T10 & R	SS	1992	0.78
T10 Sub	SS	1992	2.68
T10 CW	Bi/Willow	2013	0.046
T11 & R	SS	1997	2.87
T12	NF	1997	0.49
T13 & R & PB	SS	1990	3.22
T14 TCC	SS	2020	1.94
T14 R & PB	Euc/SS Regen/Oak	2014	0.56
T14	SS/JL 50:50	1997	2.35
T15 & R	Clearfelled	NA	2.89

[1] Densely planted trees

T15 BP	SS	1985	1.98
T16 & R	SS	2020	2.53
T17 & R	SS	1995	3.65
T18 & R & PB	SS Windblow	1982	3.09
T20 & R	LP/BI	2012	3.82
T21	SS/Syc/Bio	2013	2.25
T21 Road	SS	2012	1.66
MM & R	SS	1988	0.45
Proposed Entrance Road	SS	1995	1.21
Grid Connection	SS	1992	0.98
Road Upgrade	SS (>90%)	Various	10.52

^ T – Turbine; PB – Passing Bay; Sub – Substation; TCC – Temporary Construction Compound; MM – Met Mast; CW – Corner Widening; BP – Borrow Pits; R - Roads

* SS (Sitka spruce *Picea sitchensis*); LP (Lodgepole pine, *Pinus contorta*); Euc (*Eucalyptus*); Bi (Birch, *Betula*); Willow (*Salix)*; Alder (*Alnus glutinosa*), Oak (*Quercus*); Syc (Sycamore, *Acer pseudoplatanus*)

Plate 3 – Semi mature Sitka spruce at T10, Substation

Plate 4 – T14 TCC Recently clearfelled forest replanted during 2020 with Sitka spruce

Plate 5 – Clearfelled forest area not replanted

Plate 6 – T18 Windblow Sitka spruce stand

Plate 7 – T2 Sitka spruce and Lodgepole pine intimate mixture

1.4.1.2 Standing Volume and Carbon

The standing volume in a forest refers to the volume in cubic metres of the standing trees present at the time of forest measurements. In order to calculate the standing volume, it is necessary to take sample measurement plots, these are laid out as 0.01ha plots. In these plots tree stocking, DBH (diameter at breast height) and Top Height of the largest DBH tree is recorded. Forest measurement plots were only taken in areas where the trees were >7cm diameter at breast height as per standard forest practice. Where it was not possible to take measurements, a general yield class was taken from the forest sub-compartment data supplied by Coillte. A yield class is an estimate of the average volume production of a crop in m^3 per hectare per annum that it is estimated an even aged stand can achieve, it is an estimate of the productivity potential of the forest crop. Using the Forestry Commission Forest Yield the volume per hectare was calculated. In most cases the rotation that maximises return (net present value) will be less than the rotation of Maximum Mean Annual Increment (MMAI). For this reason and for supply and market reasons it has been customary in Ireland to use rotations of MMAI minus 20% for Sitka spruce. Based on this the total volume to be removed for the windfarm development is 11,721 m3. Table 5 outlines the different Yield class, area and standing volume for the different forest areas that are to be cleared for the proposed windfarm development.

Table 5 - Standing Volume in Forest Areas to be cleared for Windfarm Infrastructure

Infrastructure	Tree Species	Area (Ha)	Vol per Ha (m3)	YC	Total Vol (m3)
T1 & R	SS Bi (90:10)	2.74	30	18	82
T2 & R & PB	SS LP (90:10)	1.15	45	18	52
T2 New Road	SS/Willow (Regen)	3.23	59	12	191
T2 TCC	EUC	2.37	20	18	47
T3 CW	Syc/ Willow/Bi/Alder	0.046	81	6	4
T3 BP	Euc/SS/Bi	1.98	81	18	160
T3 & R	Euc/SS/Bi	2.81	60	18	169
T4 & R	SS/LP 50:50	3.6	58	6	209
T5 & R	SS/Bi	2.24	16.8	20	38
T6 BP	SS/LP 50:50	1.98	65	18	129
T6 & R	SS/Bi	2.45	293	24	718
T7 & PB	SS	2.72	213	18	579
T8 & R	SS/LP 50:50	2.84	95	20	270
T8 CW (2)	SS/LP 50:50	0.1	95	20	10
T9	SS	2.65	241	20	639
T10 & R	SS	0.78	271	18	211
T10 Sub	SS	2.68	306	20	820
T10 CW	Bi/Willow	0.46	4.2	6	0.2
T11 & R	SS	2.87	231	20	663
T12	NF	0.49	137	14	67
T13 & R & PB	SS	3.22	173	12	557
T14 TCC	SS	1.94	0	18	0
T14 R & PB	Euc/SS Regen/Oak	0.56	60	6	34
T14	SS/JL 50:50	2.35	133	10	313

T15 & R	Clearfelled	2.89	0	N/A	0
T15 BP	SS	1.98	361	18	715
T16 & R	SS	2.53	0	18	0
T17 & R	SS	3.65	252	20	920
T18 & R & PB	SS (Windblow)	3.09	345	16	1066
T20 & R	LP/BI	3.82	34	12	130
T21	SS/Syc/Bio	2.25	35	18	79
T21 Road	SS	1.66	40	18	66
MM & R	SS	0.45	349	20	158
Proposed Entrance Road	SS	1.21	280	22	339
Grid Connection	SS	0.98	306	20	300
Road Upgrade	SS	10.52	189	18	1988
Subtotal		**82.88**			**11721**

Forest Carbon

The ability of forests to store and sequester atmospheric carbon is well known and established. Indeed, forests represent the largest global terrestrial store of carbon, containing approximately 39% of global soil carbon and 77% of global vegetation carbon (Bolin et al. 2000). Trees absorb carbon dioxide from the atmosphere for growth, convert it to wood and release oxygen back to the atmosphere. Harvesting the trees before they die naturally (and return their carbon to the atmosphere) locks the carbon into the wood and harvested wood products. Replanting the trees then begins the cycle of carbon storage immediately.

The Carbon cycle in forests is characterised by a number of carbon pools. Pools are locations of carbon in the forest, such as the above- and below-ground biomass, forest floor and soil. The above ground biomass consists of stemwood, branchwood, bark and foliage and is the carbon pool that is referred to here.

Carbon sequestration in woodland biomass is restricted to the long-term average carbon stock that is projected to accumulate on the site in the woody biomass. Carbon values are based on those used in the UK Woodland Carbon Code (https://www.woodlandcarboncode.org.uk/), a voluntary standard for woodland creation projects and the amount of carbon dioxide they can sequester based on different types of tree species, yield class, stocking and forest management. The Woodland Carbon Code calculator has been chosen due to the choice of species and management and the similar assumptions and conditions that exist in forest management data in the UK and Ireland, and due to the absence of similar data in Ireland currently. The total forest carbon that would be removed due to the proposed windfarm development is 15,128.65 tCO^2e, Table 6 - Total Carbon (tCO^2e) in the Above Ground Woody Biomass. Much of this carbon will be locked up in the harvested wood products that are produced from the timber such as construction timber used in housing, fencing material, decking, pallet wood, fibreboards, plywood, veneers, laminates etc. Furthermore, an equivalent area of land is being replanted to account for the permanently felled areas of 75 ha and temporary felled areas of 7.88ha which will be replanted in situ and so the forest carbon cycle starts again. Therefore, any loss of forest carbon due to this proposed windfarm development is only a temporary loss of carbon, which would occur at different stages through normal commercial forest management of harvesting and replanting.

Table 6 – Total Carbon (tCO^2e) in the Above Ground Woody Biomass

Infrastructure	Tree Species	Carbon (tCO^2e/ha/yr)	Total Carbon (tCO^2e)
T1 & R	SS Bi (90:10)	4.21	69.21
T2 & R & PB	SS LP (90:10)	12.23	126.58
T2 New Road	SS/Willow (Regen)	12.79	743.61
T2 TCC	SS/Willow (Regen)	6.92	98.40
T3 CW	Syc/ Willow/Bi/Alder	4.31	0.91
T3 BP	Euc/SS/Bi	20.61	693.73
T3 & R	Euc/SS/Bi	9.74	328.43
T4 & R	SS/LP 50:50	2.25	210.60
T5 & R	SS/Bi	2.55	17.14
T6 BP	SS/LP 50:50	16.26	418.53
T6 & R	SS/Bi	24.9	793.07
T7 & PB	SS	11.27	735.71
T8 & R	SS/LP 50:50	22.05	1064.57
T8 CW (2)	SS/LP 50:50	22.05	22.49
T9	SS	16.33	1038.59
T10 & R	SS	11.27	246.14
T10 Sub	SS	16.33	1225.40
T10 CW	Bi/Willow	4.31	0.91
T11 & R	SS	16.03	1058.14
T12	NF	3.51	39.56
T13 & R & PB	SS	5.79	559.31
T14 TCC	SS	2.02	3.92
T14 R & PB	Euc/SS Regen/Oak	4.31	14.48
T14	SS/JL 50:50	3.62	110.59
T15 & R	Clearfelled	0	0.00
T15 BP	SS	12.7	880.11
T16 & R	SS	2.02	5.11
T17 & R	SS	9.22	841.33
T18 & R & PB	SS (Windblow)	12.99	1619.07
T20 & R	LP/BI	4.72	144.24
T21	SS/Syc/Bio	4.21	75.78
T21 Road	SS	4.21	55.91
MM & R	SS	15.58	225.85
Proposed Entrance Road	SS	17.47	528.47
Grid Connection	SS	14.63	356.39
Road Upgrade	SS	7.38	776.38
Subtotal			**15128.65**

1.5 POTENTIAL EFFECTS

This section addresses the potential impacts on the surrounding environment due to the felling and removal of the trees for the proposed wind farm. The potential impacts include soil disturbance and compaction, carbon loss, water quality (sediment & nutrient) and biodiversity from the proposed infrastructure works.

1.5.1 Do Nothing Scenario

In the do-Nothing scenario, if the proposed wind farm development for which this EIAR has been prepared does not proceed, the existing practice of commercially managed forest would continue, i.e. it would be harvested in line with sustainable forest management practices on a continuous basis and replanted in line with the requirements of the felling license as per the Forestry Act 2014, on a continuous basis. Felling would normally take place when the crop reaches its MMAI (Maximum Mean Annual Increment) minus 20%. Due to the exposed nature of the site and incidences of windblow some areas may be felled before MMAI. It should be noted that any of the potential impacts in *Section 1.5.2.1 Potential Effects Felling and Removal of Trees for the Construction Phase* due to clearfelling and subsequent replanting would also occur in the do-nothing scenario under the normal felling cycle.

1.5.2 Construction Phase

1.5.2.1 Felling and Removal of Trees

A number of potential effects can arise from forest harvesting. Harvesting will be done by clearfelling. Clearfelling involves most or all of the trees in an area being cut down at the same time. The felling operations will be done by manual and mechanical means as outlined in Section 1.2.

The associated felling and forest impacts that will be identified and monitored include:

- Soil disturbance and compaction
- Carbon loss
- Water quality (sediment & nutrient)
- Biodiversity impact
- Landscape impact

The potential impacts of the proposed felling and onsite replanting activities are assessed in Appendix 2-5 to this EIAR for an assessment of off-site Replacement lands.

1.5.2.1.1 Soil Disturbance and Compaction

The movement of harvesting machinery over the soil can contribute to soil disturbance and compaction. Potential adverse impacts include:

- Felling and extraction machines unsuited to the site and material, leading to crop, soil and machine damage
- Excessive haulage distances to roads, leading to site soil damage
- Damage to the soil such as rutting and compaction by extraction machines due to overloading
- Inadequate brash mats, leading to soil damage and sedimentation

- Machine damage to drains
- Site and environmental damage due to poor timing and failure to curtail operations in adverse weather conditions
- Sediment entering aquatic zones
- Brash and debris in aquatic zones
- Rutting and compaction through the overuse of tracks

The main sources of sediment in forest activities due to harvesting are:

- Disruption of the soil surface by harvesting machinery, removal of tree cover causing the soil to be exposed to erosion and eventually the transportation of the finer particles by overland flow.
- Weathering of parent material resulting in particle movement by overland flow.
- The transportation of loose or decaying organic particles.

Due to the fact there are many ages classes that are to be felled i.e. commercial and non-commercial timber, it is envisaged that any commercial timber will be removed from the site for haulage to a timber sawmill. A proportion of construction traffic for the windfarm development will be associated with the haulage of the timber from these felling activities. Based on the volume of timber to be harvested as detailed in Table 5 - Standing Volume in Forest Areas to be cleared for Windfarm Infrastructure, this will involve approximately 350 articulated timber truck movements. Any timber that is not of merchantable quality, i.e. less than 7cm diameter relates to the tops of trees and branches known as lop and top and will be left on site where the trees are felled. This protects the soil and provides deadwood for habitat Where full tree removal is required for infrastructure such as turbine hardstands, substation, met mast, roads etc. smaller trees can be removed by excavator and/or tree shears depending on size. In the bat felling buffer areas, any timber that is not of merchantable value i.e. lop and top will be left on site so as to minimize disturbance.

1.5.2.1.2 Carbon Loss

There will initially be a decrease in the carbon sequestration potential of the forest due to the clearfelling of 82.88 ha for infrastructure and construction felling associated with the footprint of the proposed development. As referred to in section 1.4.1, infrastructure felling relates to trees that are permanently removed from the site in order to make way for infrastructure associated with the wind farm (Table 2) and construction felling relates to areas that require temporary forest removal to facilitate windfarm construction such as borrow pits and temporary construction compounds. The total carbon that would be removed due to the felling of this 82.88ha is 15,128.65 tCO^2e. Some 75 ha will involve permanent forest removal for infrastructure felling and an equivalent area of bare land will be afforested as replacement land (See Appendix 2-5 to this EIAR for further information and an assessment of off-site Replacement lands) in lieu of this within 2 years of clearfelling as required under the Forestry Act 2014. The remaining 7.88ha that will be temporarily felled will be replanted in the same location as soon as proposed development is completed. Therefore, although there will be a temporary loss of carbon, the overall impact on carbon stock will be neutral.

1.5.2.1.3 Water Quality Impact

Harvesting and associated activities such as extraction have the potential to cause temporary and local damage to soils and adversely impact on water quality, through increased erosion rates, sedimentation and nutrient losses. However, adherence to best practices will minimise this risk. All water and hydrological impacts are assessed in detail in Chapter 9. The main sources of sediment from harvest operations are described in Section 1.5.2.1. The key factors associated with sediment release and potential water quality impact during harvest operations are:

- Soil type, sensitivity and slope – the soil conditions at Castlebanny are varied from well drained acid brown earths to poorly drained surface water gleys (See Chapter 8 Land, Soils and Geology). As outlined in *Forestry and Water Guidelines* correct buffer zone management will help reduce the risk of sedimentation
- The felling and extraction system and harvesting machinery to be used including number and type of machine passes
- Operation details such as extraction routes, landing bays for harvested material, location of machine maintenance, refuelling and repair areas and storage areas for fuel, motor oils, lubricants and chemicals.
- Availability of brash material (lop and top) for placing under machines to protect the soil. This is more of a concern in forest thinning operations where brash availability is low then in clearfell operations as proposed here and would be a low risk.
- Environmental receptors such as water features, including aquatic zones, relevant watercourses, hotspots, water abstraction points and crossing points.

With regard to the source of nutrients, during clearfelling there is a higher potential for nutrient loss as there are no living tree roots left to take up the nutrients. Any organic matter (particularly recently dead material such as brash or roots) that is left on site to rot will release phosphorus and nitrogen. Decaying brash resulting from the clearfell can generate nutrients which could potentially lead to nutrient enrichment of any small first order streams. The breakdown of brash, roots and other organic matter takes a number of years. Potentially a clearfell site continues to release phosphorus to the aquatic zone for at least three years after clearfelling. The rate of decomposition is influenced by temperature, moisture and humidity. Consequently, phosphorus loss tends to be greatest during the warmer months and may be particularly problematic during a flood event following a prolonged hot and dry period (Cummins & Farrell 1999 & 2003; Rodgers et al 2010)

In addition to sediment and nutrient release, accidental spillage or leakage of chemicals potentially used on site (herbicides and pesticides during reforestation operations and urea sprayed on freshly felled tree stumps to prevent the spread of disease as is a condition of all felling licenses in Ireland), fuel and machine oils (hydraulic, engine, gearbox, lubricant or cutting oils) are detrimental to aquatic flora and fauna and impair water quality; however adherence to best practices will minimise this risk; mitigation measures are outlined under Section 1.6

It should be noted that potential impacts on water quality as outlined above as a result of clearfelling will also be relevant in the do-nothing scenario in the course of normal forest harvesting at Castlebanny.

1.5.2.1.4 Biodiversity Impact

Wildlife habitats can be affected during harvesting, especially the removal of the forest canopy. Mature conifer stands are important wildlife habitats for a variety of birds and other fauna.

In Chapter 6 of the EIAR, Biodiversity, the potential impacts section assesses in detail the potential impacts on habitats from the tree felling associated with the wind farm development.

It should be noted that any potential impacts on biodiversity as a result of clearfelling will also be relevant in the do-nothing scenario in the course of normal forest harvesting that would occur at Castlebanny.

1.5.2.1.5 Landscape Impact

The visual effect of the premature harvesting of trees is assessed in Chapter 13 of the EIAR, Landscape and Visual Impact Assessment.

Brash left onsite after clearfelling can be unsightly, particularly if the forest flanks a scenic route.. The majority of the areas to be clearfelled for the proposed development occur within commercially managed forestry.

It should be noted that any potential impacts on the landscape as a result of clearfelling will also be relevant in the do-nothing scenario in the course of normal forest harvesting that would occur at Castlebanny.

1.6 MITIGATION MEASURES

1.6.1 Construction Phase

Comprehensive planning (as outlined in Section 1.6.1.1 Harvest plan) combined with best practice operating techniques will ensure the protection and enhancement of the environment at Castlebanny Wind Farm Development. Felling operations associated with this project will adhere to the *Felling and Reforestation Policy (Forest Service), Standards for Felling and Reforestation (Forest Service), Code of Best Forest Practice (Forest Service 2000b), Forest Harvesting and the Environment (Forest Service 2000c) and Forest and Water Quality Guidelines (Forest Service 2000a).*

Notwithstanding the hydrological distance from the proposed development site to any Natura site or fisheries sensitive area, the potential sediment and nutrient loss risks will be managed through the application of the mitigation measures outlined hereunder and in the mitigation measures of the EIAR outlined in Chapter 5 Population and Human Health, Chapter 6 Biodiversity: Flora & Fauna, Chapter 7 Biodiversity: Ornithology, Chapters 8 Land, Soils and Geology, Chapter 9 Hydrology and Hydrogeology, Chapter 13 Landscape and Visual Impact and Chapter 14 Air Quality & Climate

The Harvest Plan (Section 1.6.1.1) and associated Harvest Plan Maps, outline the measures to be implemented with regard to forest harvesting at the proposed development site for Castlebanny Windfarm development.

All forestry operations are to be undertaken in accordance with current best practice guidelines as listed in the Harvest Plan, which details practical measures to protect the existing environment.

Further information on mitigation measures for onsite activity are provided in the various EIAR chapters, as well as the CEMP (Appendix 2-7 to this EIAR).

1.6.1.1 Harvest Plan

A harvest plan outlines strict environmental guidance to minimise environmental and social disturbance. This harvest plan is specific to forest harvesting operations and is the standard plan used by the felling license authority of the Department of Agriculture, Food and the Marine. It encompasses all possible felling methods, social and environmental considerations and measures to protect same, only those of relevance to the tree felling at Castlebanny Windfarm have been selected.

Harvest Plan for Felling at Castlebanny Windfarm, Co Kilkenny

Proposed Felling & Reforestation Methods	
Thinning	☒ N/A ☐ Harvester ☐ Chainsaw ☐ Forwarder ☐ Tractor/Quad ☐ Skyline ☐ Other (specify):
Clearfelling	☐ N/A ☒ Harvester ☒ Chainsaw ☒ Forwarder ☐ Tractor/Quad ☐ Skyline ☒ Other (specify): Excavator and Tree Shears
Reforestation	☐ N/A ☒ Windrowing ☒ Pit planting ☒ Mounding ☐ Scrap mounding ☐ Scarification ☐ Other (specify):
Site access (i.e. via forest road)	☒ Present ☐ Planned ☐ Not required ☐ Other (e.g. temporary roading/forest track):

Social & Environmental Features & Considerations		
Social	**Habitat & Biodiversity**	**Soil & Water**
☒ Recreational usage	☐ Designated area (SAC, SPA, etc)	☒ Aquatic zone(s) on/adjoining site
☒ Adjoining dwelling(s)	☒ Broadleaves/diverse conifers	☒ Relevant watercourse(s)
☐ Right(s)-of-way present	☒ Hedgerows	☐ Water-related 'hotspots'
☐ Utilities (power lines/water main)	☐ Old/veteran trees	☐ Water abstraction point
☐ Sensitive landscape	☐ Large scale deadwood	☒ Peaty or peaty/gley
☐ Important viewpoint(s)	☒ Badger sett, rookery, etc.	☐ Steep slope(s)
☐ Archaeological site(s) & feature(s)	☐ Protected fauna	☒ Water setback(s) present & intact
☐ Cultural feature(s)	☐ Protected flora	☐ Supply of brash limited
☒ Anti-social (dumping, fire etc)	☐ Wetland habitat	☐ Other:
☐ Other (specify):	☐ Other (specify):	☐ Other:

Proposed Measures to Protect Social & Environmental Features & Considerations	
☒ Consult with local residents	☐ Establish excl. zones around arch. sites/features
☒ Erect safety signage	☒ Temporary bridging points (TBPs) required
☒ Onsite briefing of all operators, pre-commencement	☒ Install water setback at refor.
☒ Carefully selected refuelling/repair/storage depot	☒ Install dwelling setback at refor.
☐ Measures to protect right(s)-of-way	☒ Install public road setback at refor.
☐ Measures to protect service features	☐ Install archaeological setback at refor.
☒ Measures to protect habitats & biodiversity features	☒ Install biodiversity setback at refor.
☐ Limit operations to dry weather	☒ Install landscape setback at refor.
☒ Daily visual monitoring of ground conditions	☐ Inclusion of Refor. Objective 'CCF'
☒ Daily visual monitoring of water	☐ Inclusion of Refor. Objective 'BIO'

Proposed Measures to Protect Social & Environmental Features & Considerations (Cont..)	
☒ Water sampling	☐ Forest edge planting
☒ Install silt traps/barriers	☐ Environmental setback planting
☐ Drain blocking/slow-water dams	☐ Other (specify)
☒ Utilise brash mats along extraction routes	☐ Other (specify)
☒ Exclude machinery in areas adjoining aquatic zones, water abstraction points & water-related 'hotspots'	☐ Other (specify)

Ancillary Information (include relevant information to expand on above & to detail important aspects such as the sequencing of operations, the width of environmental setbacks & contingency planning. Ensure accurate cross-referencing and consistency with maps)

The following guidelines will be adhered to for all harvest operations:

Interim Standards for Felling and Reforestation Forest Service, Department of Agriculture, Food and the Marine, Dublin. October 2019

Forestry and Water Quality Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Forestry and the Landscape Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Forestry and Archaeology Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Forest Biodiversity Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Forest Harvesting and Environment Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Forest Protection Guidelines, Forestry and Water Quality Guidelines. Forest Service, Department of the Marine and Natural Resources, Dublin, 2000

Felling and Reforestation Policy, Forest Service, Department of Agriculture, Food and the Marine, Dublin. May 2017

Harvesting

Harvesting will be done by clearfelling. Clearfelling involves most or all of the trees in an area being cut down at the same time. The felling operations will be done by mechanical means which includes a harvesting machine which mechanically cuts, delimbs and processes the tree into different timber assortment sizes (namely pulp, stakewood, palletwood, sawlog) and a 8 wheel mounted forwarder to collects the different timber assortments and stacks them at the roadside for removal by the timber lorries to the sawmill.

Low ground pressure harvester and forwarder is to be used for all clearfelling operations. In areas where it is not feasible to cut the trees by harvester due to the trees being too small (i.e. <7cm DBH) an excavator with tree shears will be sufficient to cut and windrow the trees and for stump removal (for example Turbines 1, 2, 3). In the bat felling buffer areas, the brash will be left to decompose. For the footprint of the proposed infrastructure there will be full tree removal to facilitate the windfarm development infrastructure.

Clearfelling operations should be carried out during suitable weather conditions where feasible. Where felling is to be carried out adjoining any buffer zones or set back areas, the timber should be felled away from these zones. Any timber stacking for removal should also be outside these buffer zones and setback areas.

The machine maintenance and refuelling area is to be located on a dry elevated site with a minimum distance of 50 metre from any aquatic zones. Any material that is to be used for any maintenance operations will be removed from site when the work is completed. Harvest operations will be planned to minimise surface water flow rates and flow volume during heavy rains to prevent sediment and silt from entering environmental sensitive areas.

Brash will be used along harvesting and extraction routes for soil protection. The forwarder will be loaded to the manufacturer's maximum specification and no more to avoid overloading and unnecessary soil compaction.

Where it is necessary to cross existing forest drains this will be done by determining a suitable crossing point. The crossing point will be made by laying logs in the drain length ways so as not to restrict the flow of water (temporary bridging point). Brash (branches) will be placed across the logs. The crossing point will be maintained during its use and removed when works are completed. The crossing point will be monitored for any possible water flow restriction and material deposited in the drain. If any material is deposited in the drain it is to be removed immediately. Drain crossings are to be installed during operations and to be removed when felling is complete. Where existing drains flow into water course these will have silt traps and silt fences installed before the end of the drain. Any branches or debris that accidently enters any watercourses will be removed immediately.

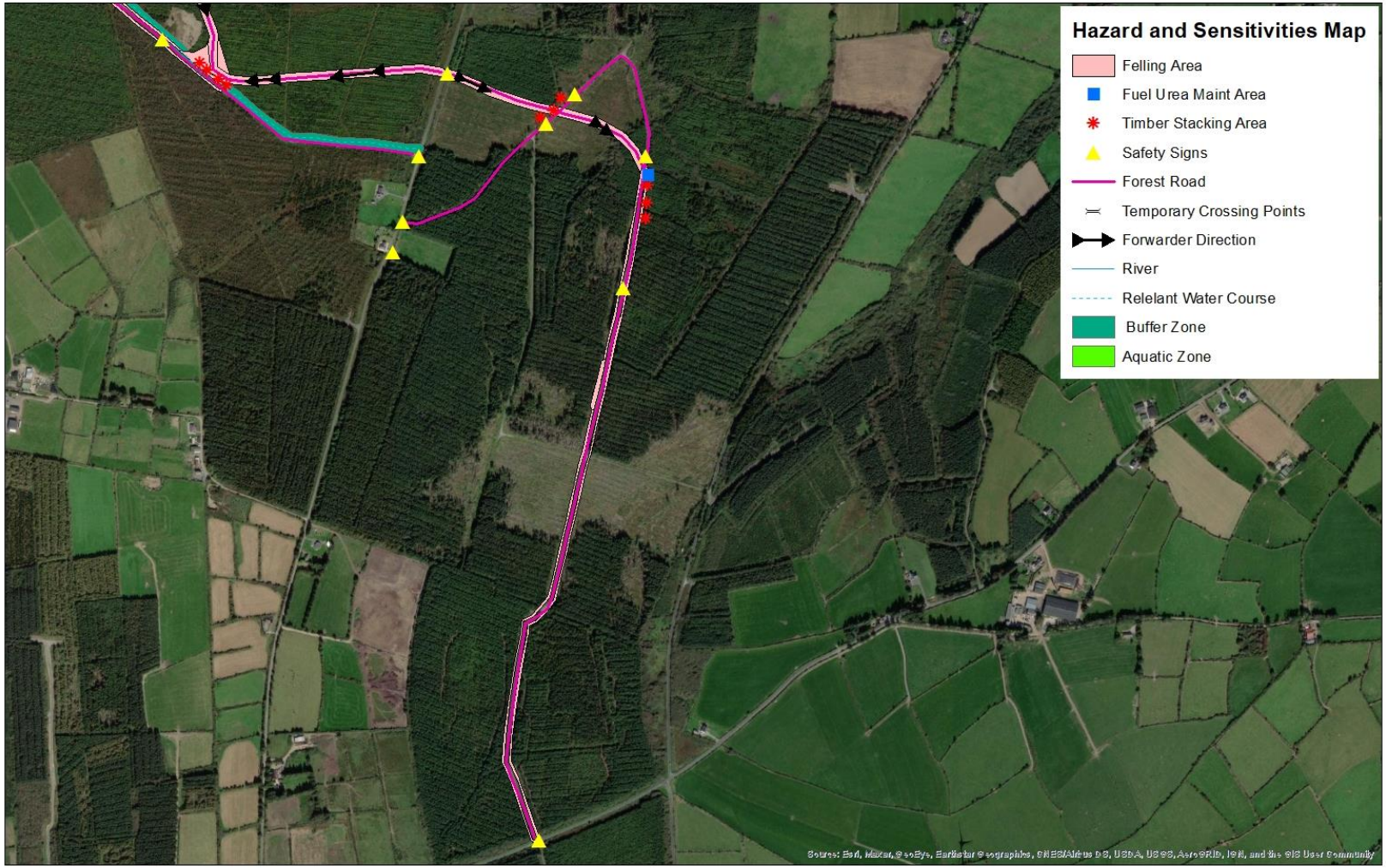
The extraction directions are marked with black arrows on the Harvest Plan Map. Excessive use of extraction routes is to be avoided. Silt traps will be installed within the drains along roadside drains and

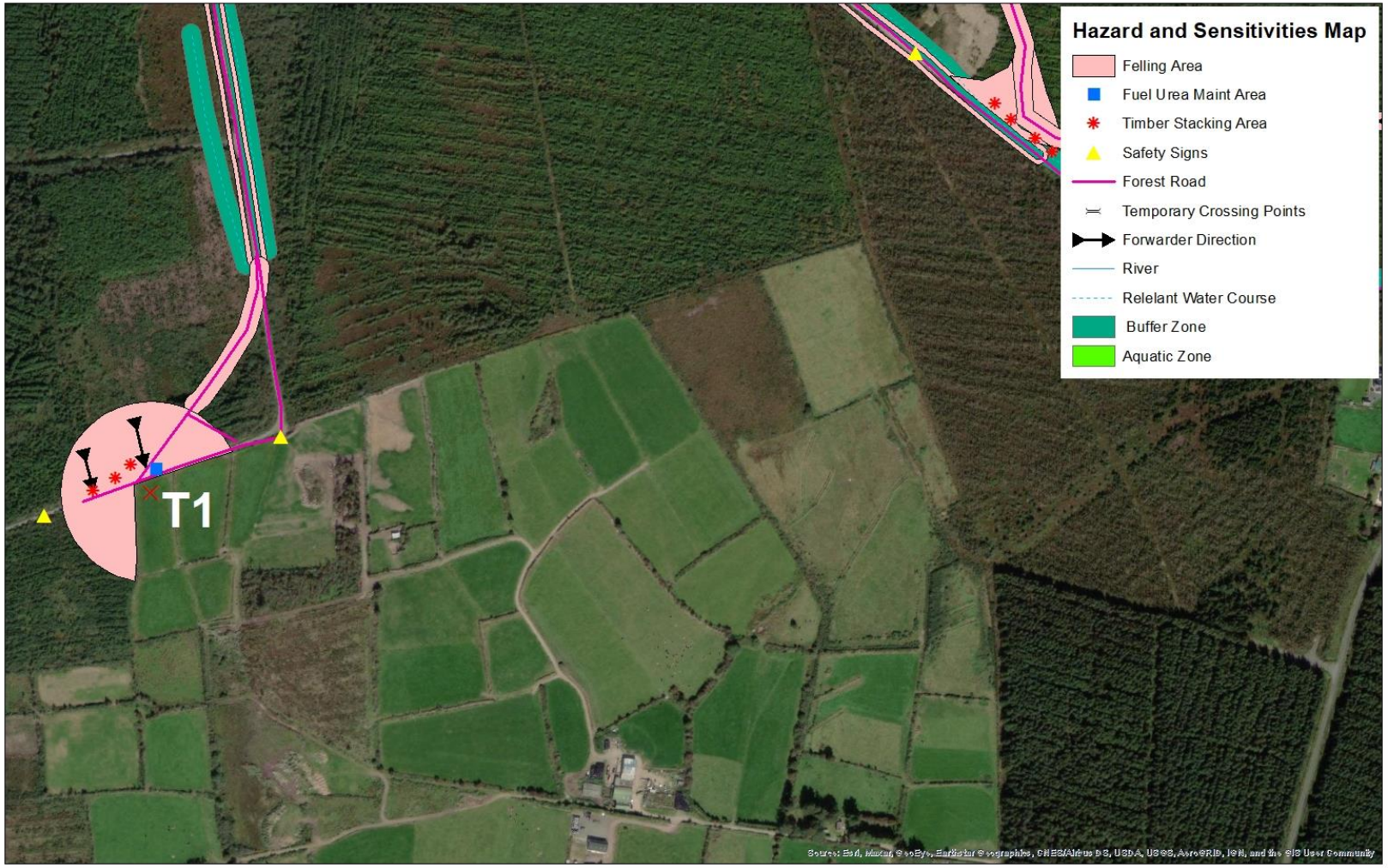
along extraction routes as required to intercept any sediment and needles. Existing silts trap will be checked regularly to ensure that they are working properly.

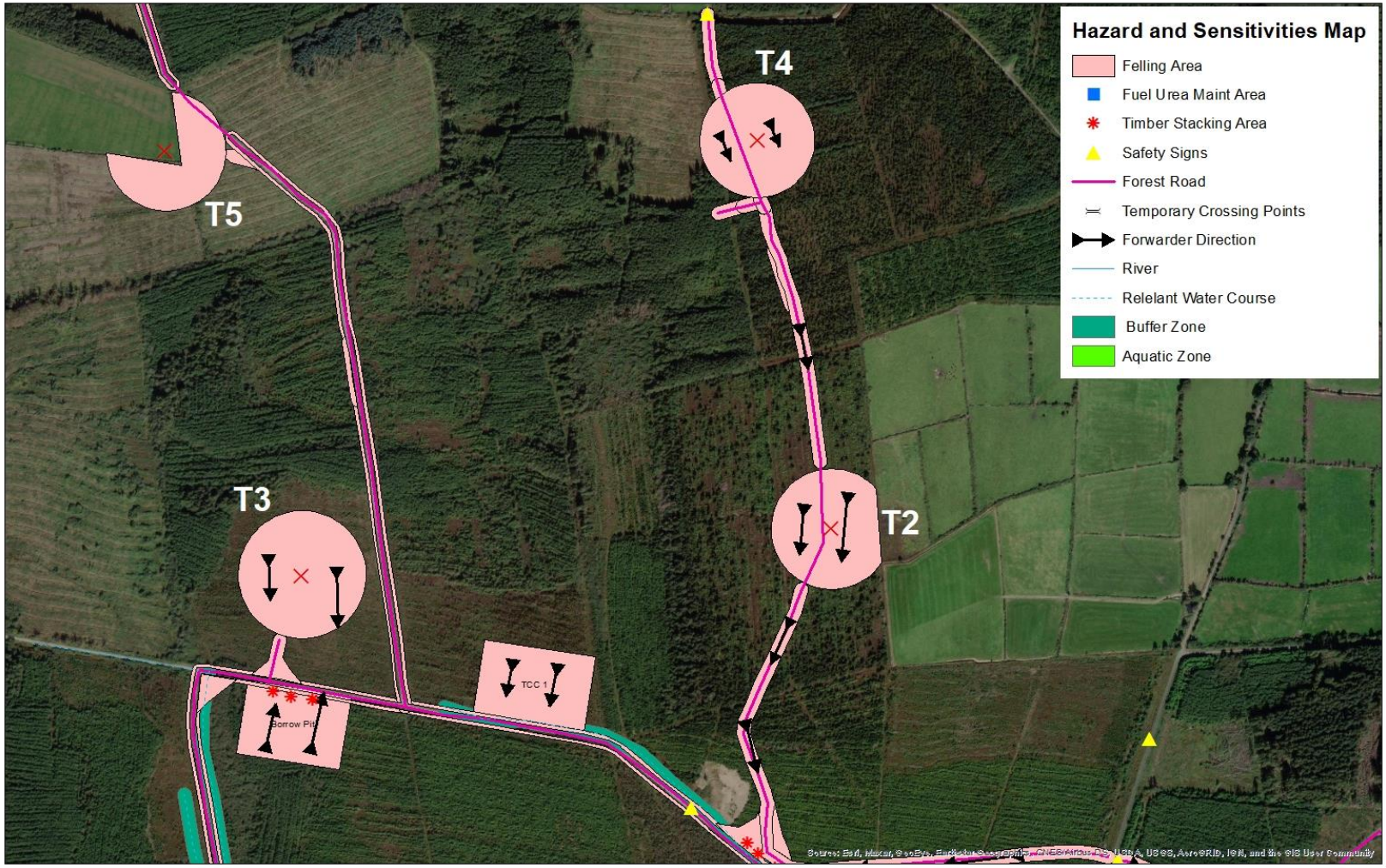
Onsite supervision and checks are necessary to ensure that felling and extraction operations are carried out appropriately and that water protection measures are adequate and remain effective throughout, and also to trigger contingency measures, if necessary (e.g. to cease operations if rainfall creates a risk of sediment mobilisation and runoff).

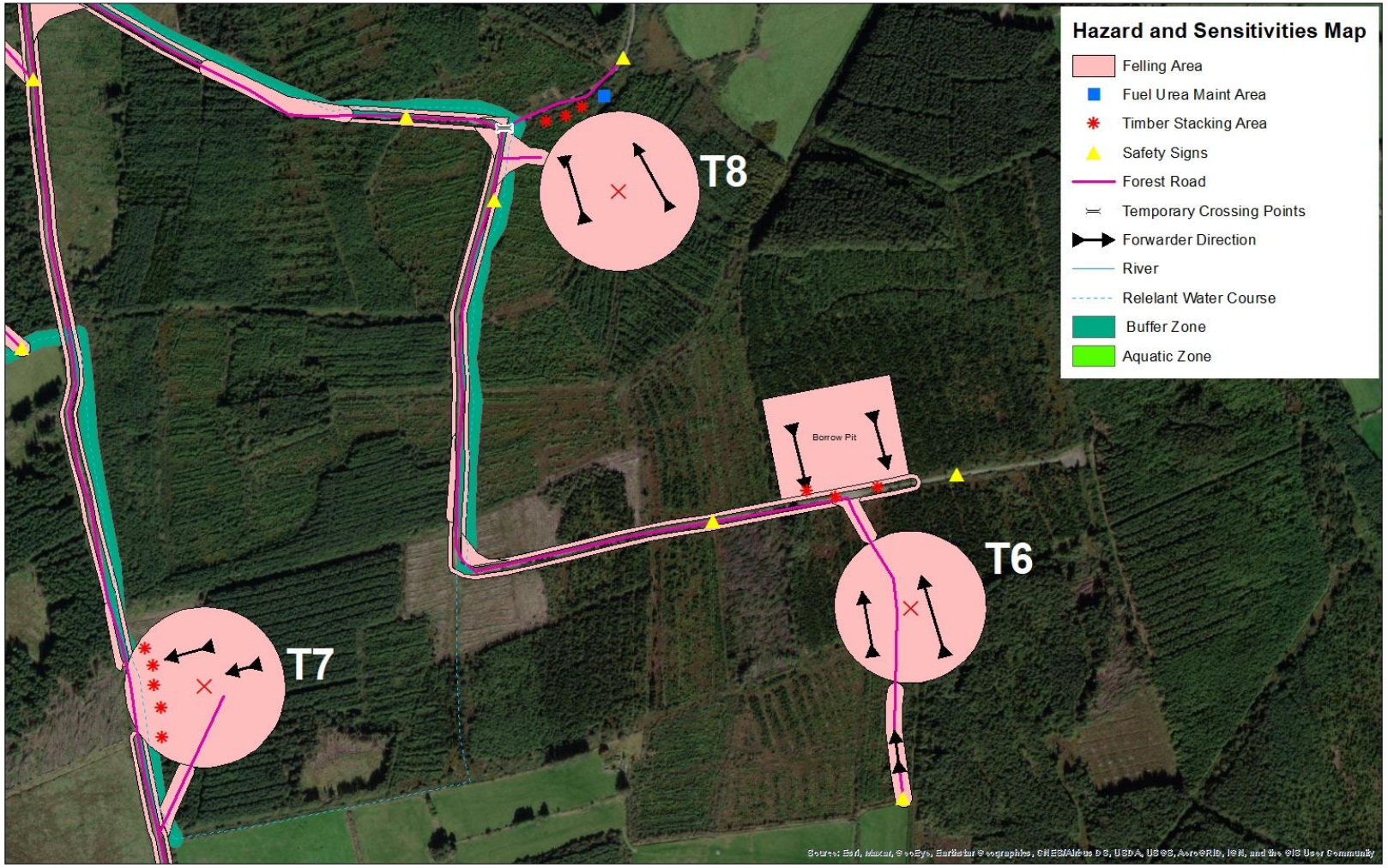
All sub-contractors should be briefed prior to operations starting and a copy of the Harvest Plan and harvest plan maps made available to them.

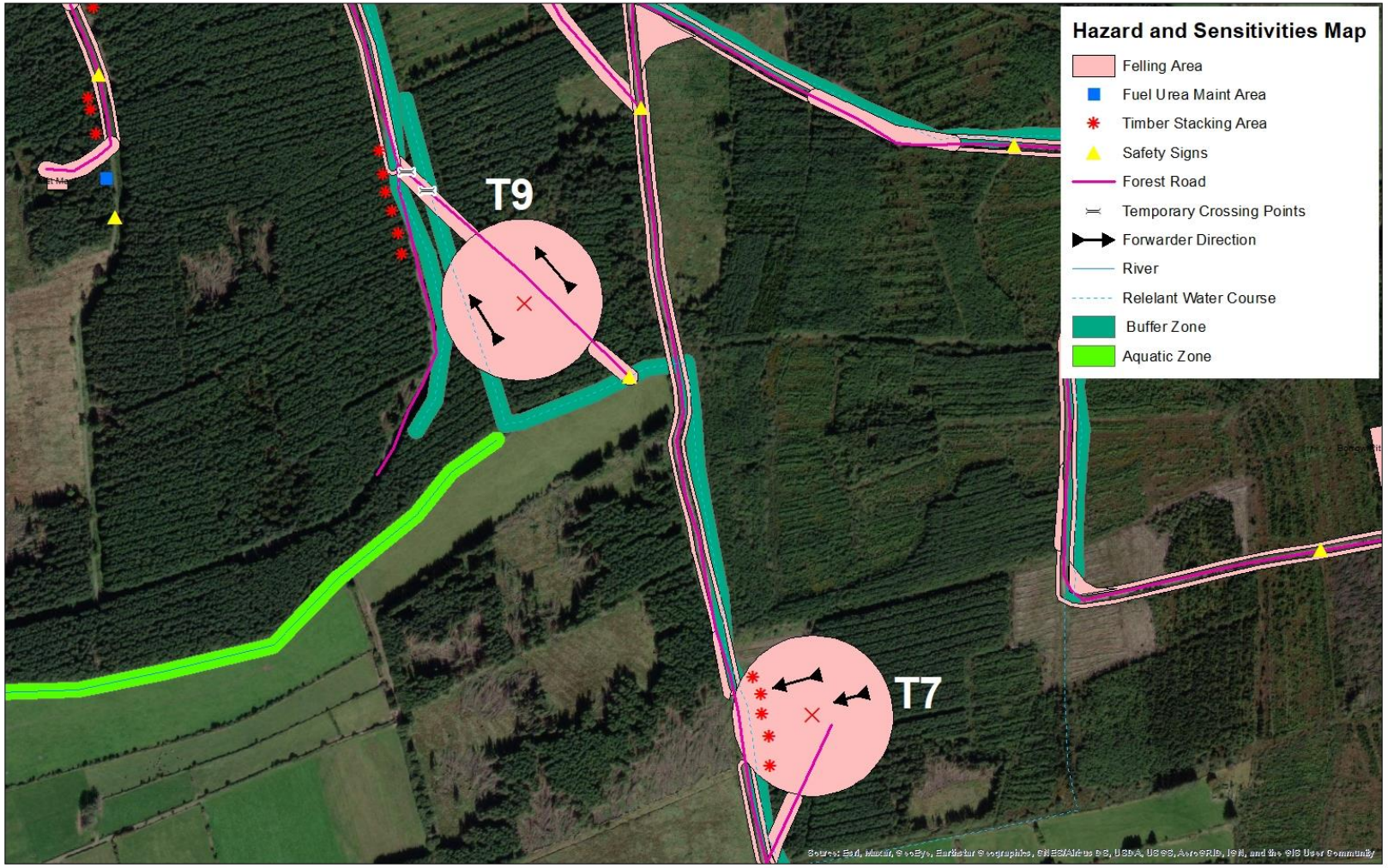
Figure 4(a–i)- - Harvest Plan Maps for Turbines 1-20, Substation, New Roads, Existing road widening, Corner Widening, Met Mast, Borrow Pits, Temp Construction Compounds, Passing Bays, Grid Connection



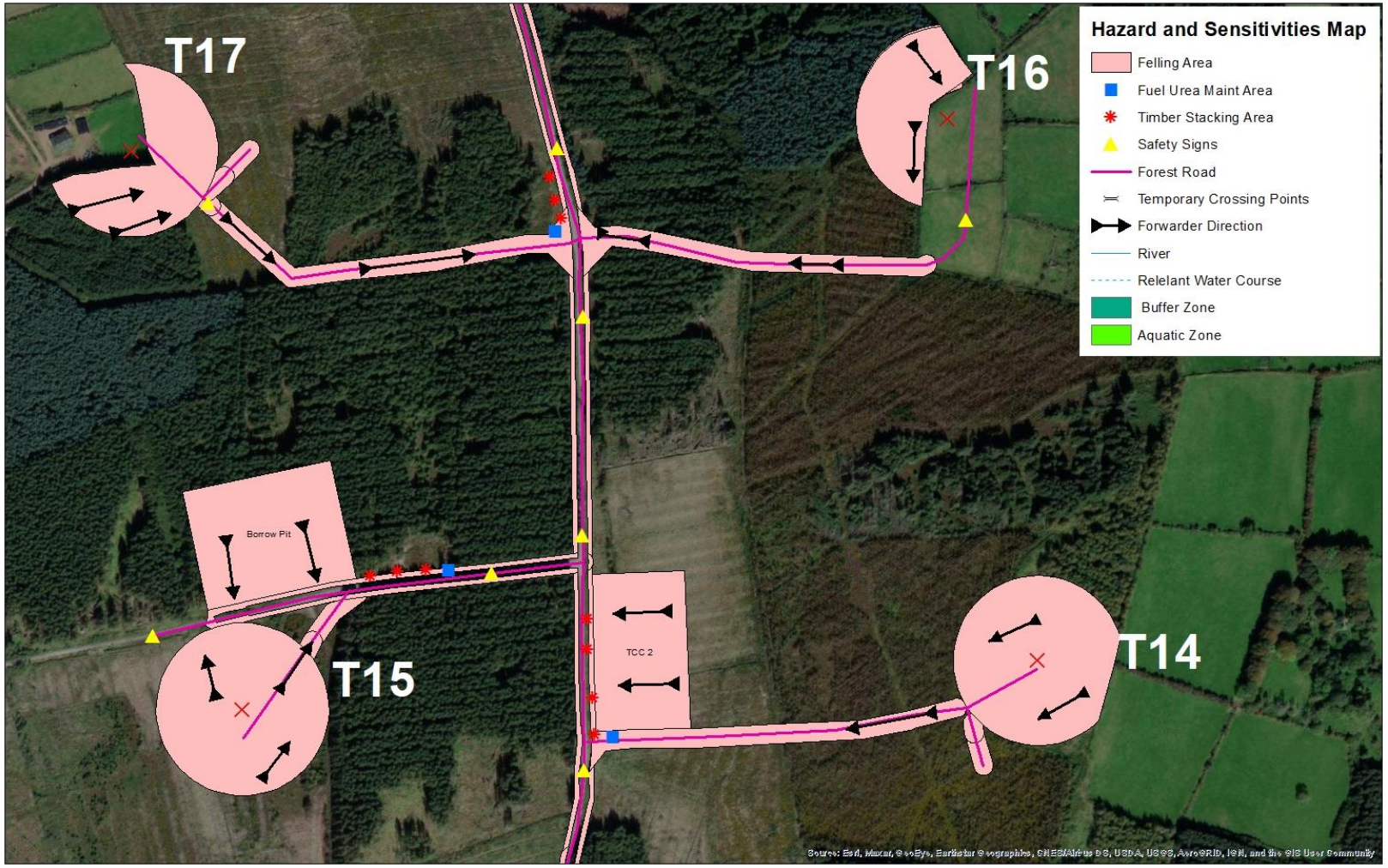

Hazard and Sensitivities Map
Felling Area
Fuel Urea Maint Area
Timber Stacking Area
Safety Signs
Forest Road
Temporary Crossing Points
Forwarder Direction
River
Relelant Water Course
Buffer Zone
Aquatic Zone
T1

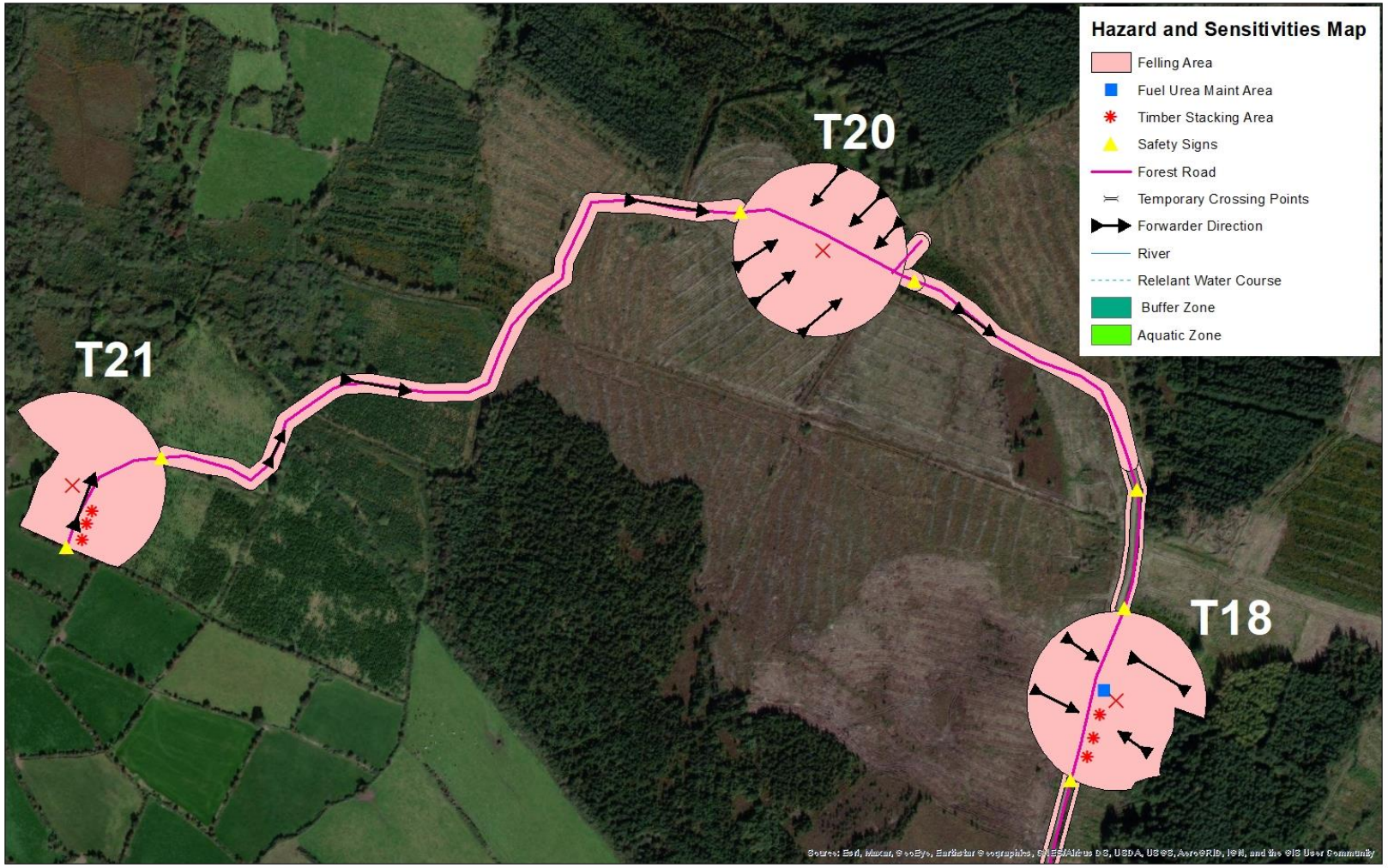

Hazard and Sensitivities Map
Felling Area
Fuel Urea Maint Area
Timber Stacking Area
Safety Signs
Forest Road
Temporary Crossing Points
Forwarder Direction
River
Relelant Water Course
Buffer Zone
Aquatic Zone
T5
T4
T3
T2
TCC 1
Borrow Pit

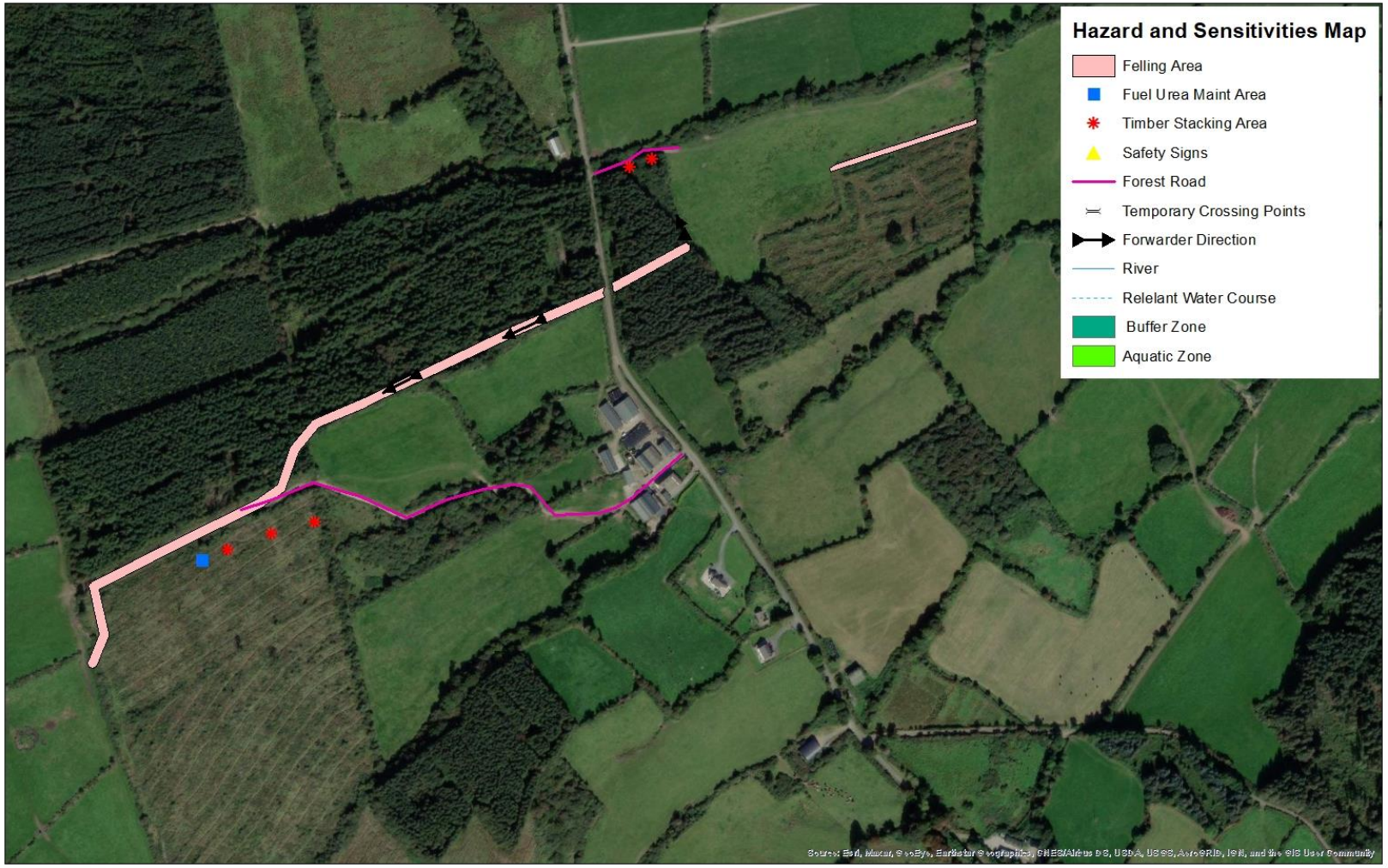

Hazard and Sensitivities Map
Felling Area
Fuel Urea Maint Area
Timber Stacking Area
Safety Signs
Forest Road
Temporary Crossing Points
Forwarder Direction
River
Relelant Water Course
Buffer Zone
Aquatic Zone
T8
T7
T6
Borrow Pit


Hazard and Sensitivities Map
Felling Area
Fuel Urea Maint Area
Timber Stacking Area
Safety Signs
Forest Road
Temporary Crossing Points
Forwarder Direction
River
Relelant Water Course
Buffer Zone
Aquatic Zone
T9
T7


Hazard and Sensitivities Map
Felling Area
Fuel Urea Maint Area
Timber Stacking Area
Safety Signs
Forest Road
Temporary Crossing Points
Forwarder Direction
River
Relelant Water Course
Buffer Zone
Aquatic Zone
T13
T12
T10
T11
SubStation


T17
T16
T15
T14
Borrow Pit
TCC 2
Hazard and Sensitivities Map
Felling Area
Fuel Urea Maint Area
Timber Stacking Area
Safety Signs
Forest Road
Temporary Crossing Points
Forwarder Direction
River
Relelant Water Course
Buffer Zone
Aquatic Zone


Hazard and Sensitivities Map
Felling Area
Fuel Urea Maint Area
Timber Stacking Area
Safety Signs
Forest Road
Temporary Crossing Points
Forwarder Direction
River
Relelant Water Course
Buffer Zone
Aquatic Zone
T20
T21
T18


Hazard and Sensitivities Map
Felling Area
Fuel Urea Maint Area
Timber Stacking Area
Safety Signs
Forest Road
Temporary Crossing Points
Forwarder Direction
River
Relelant Water Course
Buffer Zone
Aquatic Zone

1.6.1.1.1 Harvesting Site Specifications

All staff must wear high visibility jacket and hard hat at all times. Chainsaw contractors must wear all required PPE equipment during operations set out in the Health & Safety Authority's (HSA) *Code of Practice for Managing Safety & Health in Forestry Operations*. All personnel on site must have appropriate Health and Safety training.

Agreed Truck Types: Artic ☑ Rigid ☐ Rigid and Trailer ☐

EMERGENCY CONTACT NUMBERS

Agencies	Telephone	Location
Coillte Forest Representative	TBC	Kilkenny
Garda Síochána	999; (051) 898 122	Mullinavat, Co Kilkenny
NPWS Wildlife Ranger Regional Office	076 1002667	NPWS South Eastern Region
Forest Service Inspector Robert Windle	053-9165506 087-1460011	Johnstown Castle Estate Wexford
Fire Station New Ross	999 or 112 (051) 421 777	New Ross, Co Wexford

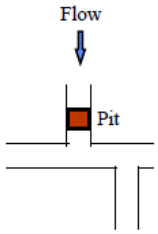
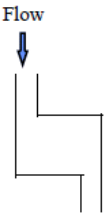
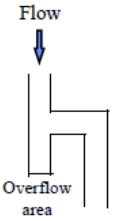
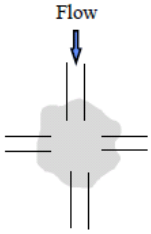
It is essential that all forest workers and machine operators involved in any forest operation are made aware of and understand the Forest Service Environment Guidelines, all relevant environmental issues relating to the site and the working practices which minimise environmental disturbance. All operators will have contact telephone numbers onsite for all relevant agencies (Owners, Local Authorities, Regional Fisheries Board, NPWS, Garda Síochána, etc.) in case of accidental damage to aquatic zones, archaeological sites, important wildlife habitats and other environmental features. Furthermore all Coillte forest workers and machine operators will have completed the Coillte Environmental Risk Assessment Training as well as all appropriate training and certification as required for harvesting operations.

Further information in relation to site safety and operations can be found in the Construction & Environmental Management Plan which forms which forms Appendix 2-7 to Chapter 2 (Description of the Proposed Development) of this EIAR.

1.6.1.1.2 Silt and Sediment Control Measures

Best forest practice aims at minimising sediment mobilisation by reducing soil disturbance through planning, timing of operations and using appropriate machinery. Mobilised sediment transportation is minimised by the use of naturally occurring vegetated overland flow areas and the use of sediment traps. The following mitigation measures with regard to forest clearfelling will be followed:

- Prior to commencement of operations sediment or silt traps will be installed at intervals, as close as possible to the source of the sediment. Where required, correctly planned, installed and maintained sediment traps/drains for each individual felling site will help to ensure that water quality is protected. Typical sediment trap designs are illustrated below (source *Forestry Schemes Manual, 2011)*:

No. 1 (Pit)	No. 2 (Staggered Type)	No. 3 (Run Off Type)	No 4 (Swamp Type)
			
The end of the mound drain is slightly deepened for c. 0.3 metres before it enters the collector drain.	Forces water to slow down within the trap - more efficient than if the water ran straight through the trap. Minimum 1 metre long.	Caters for runoff events that exceed the design capacity. Useful on slopes. Overflows floods onto vegetation. Do not plant within 4 metres of the lower side in order to conserve dense vegetation.	Many drains may enter a natural depression to create a mini "swamp". Dimensions of the "swamp" depend on the needs of the site. May be c. 20 sq. metres. Do not plant within 4 metres of the "swamp".

Sediment traps will require monitoring and maintenance throughout the operations. Sediment traps are to be constructed and maintained in line with the requirements of the *Forestry Schemes Manual (2011), the Forest Road Manual and Forest Drainage Engineering – A Design Manual.* Sediment or silt trap mitigation measures are also included in Chapter 9 Hydrology & Hydrogeology.

- Silt traps and silt fences, such as geotextile membrane and straw bales, should be placed in the forest drainage network to minimise silt loss. Silt traps should be staggered along the length of the drain, and not only at the lower reaches towards its outflow. These should be inspected and cleaned regularly. A series of stepped silt traps/fences to trap any silt/debris will be installed. Their purpose will be to slow water flow and allow settlement of solids to occur. These will be regularly inspected and cleared out to ensure they are functioning properly. Traps should not be constructed immediately adjacent to natural water courses.
- Silt trap design can vary, from depressions added to the drain bed, to log sections laid lengthways into the drain or the use of geotextile barriers.
- Apply silt fences where necessary, to block pathway for silt in areas where overland flow is possible.
- Brash from the clearfell should be utilised as roading material to reduce impact on ground thereby minimising ground disturbance.
- Existing forest drainage shall be reinstated where damaged to allow use to be made of vegetated ground areas to reduce the flow of silt overland.
- A 15m buffer zone should remain between the silt trap and the watercourse with natural vegetation left intact so as to assist in silt interception.
- Within the buffer zone, forest harvesting, machine refuelling, forwarder movement and other forest operations are prohibited in order to protect water quality. Furthermore, drainage channels leading from the site must taper out before entering the buffer zone. This ensures that discharged water gently fans out over the buffer zone before entering the aquatic zone, with sediment filtered out from the flow by ground vegetation within the zone.

During a study of a harvesting site by Rodgers et al 2002 in Co Mayo, sediment concentrations, yields and release patterns upstream and downstream were compared before and after harvesting. These showed that harvesting did not significantly increase the sediment concentrations in the receiving water, confirming that if the Forests and Water Quality Guidelines are followed and care is taken on site, the aquatic zone need not be adversely affected by sediment releases from sites without a buffer strip.

1.6.1.1.3 Temporary Water Crossings

Temporary water crossings include forest drains, roadside drains, relevant watercourses[2] and aquatic watercourses. The following measures should be adhered to as per the *Interim Standards for Felling and Reforestation:*

Forest Drains:

- Minimise the crossing of drains during felling and extraction and restrict machine activity to brashed extraction racks and forwarding routes as shown in Figure 4 Harvest Plan Maps
- Where a drain crossing is needed, based on the size of the forest drain one of the following methods will be selected that prevents the breakdown and erosion of drain sides, namely:
    - For larger drains , deploy a heavy-duty plastic culvert lengthways into the channel and cover with brash material. The culvert must be of a diameter approximating the depth of the drain, to avoid any unnecessary undulation along the extraction route.
    - Where required, a solution for smaller drains is to temporarily lay log sections lengthways into the channel and overlay with brash. Again, select logs that approximate the depth of the channel to be crossed.

Aquatic Zones and Larger Relevant Watercourses:

- Minimise the crossing of aquatic zones and larger relevant watercourses during felling and extraction by choosing alternative routes which avoid the watercourses/aquatic zones where possible.
- Direct crossing over the stream bed is not permitted.
- If you must cross an aquatic zone or larger relevant watercourse install a temporary crossing point. When installing and removing the temporary crossing, ensure that no work is carried out within the aquatic zone, and that the stream bed and bankside remain undisturbed.
- Avoid crossing points in hollows where surface water gravitates towards, or in areas of the site more prone to sediment release, as indicated by terrain classification.
- Ensure the feature is crossed at a right angle to the flow of water.
- Where needed, any necessary crossing shall be via an appropriate structure that spans proud of the flow of water and prevents the breakdown and erosion of the banks.
- Typical solutions include the laying down of a bridge comprising logs overlaid with geotextile and brash to intercept soil falling off wheels.
- Alternatively, utilise prefabricated concrete drop-in bridging

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[2] **Relevant watercourse:** Any other watercourse that has the potential to act as a pathway for the movement of significant amounts of sediment and/or nutrients from the site to an aquatic zone. Relevant watercourses are existing drains and channels that may contain flowing water during and immediately after rainfall.
Note, not every watercourse is a 'relevant watercourse'. For example, a well-vegetated agricultural drain or ditch draining a small area of moderately sloping ground may not be a relevant watercourse, as there will be little or no potential for it to carry significant amounts of sediment/nutrients

1.6.1.1.4 Brash Management

The objective of brash management is to contribute to the retention of the nutrients on site, thus preventing nutrients entering watercourses and to provide for access of machinery, specifically harvesters and forwarders, minimising damage to the soil.

The decay of brash takes place for some time after harvesting is completed and this process releases nutrients to the environment. These nutrients can be taken up by the soil or plants either within the forest or in a buffer zone/strip. Nutrients, which are not immobilised, can be washed away by overland flow, usually during the first significant rainfall event after their release.

Retention of the nutrients on site is achieved by the control of water, ensuring that the sediment and nutrients it contains are retained on site and as far away from the watercourse as possible. The following points will be implemented for this site:

- Where the brash is not required to form brash mats, it should be allowed to decay evenly distributed over the harvesting site. This allows for a more even distribution of the nutrient release on the site. If windrowing[3] is required, it should not be carried out until the needles have been shed
- Where the brash is required to form brash mats, it is laid out at harvesting stage as a mat to prevent soil disturbance by machine movement. Brash which has not been pushed into the soil may be moved within the site to facilitate the creation of mats in more demanding locations
- Extraction routes, and hence brash mats, should be aligned to the contour where possible. This assists in reducing the rate of water flow towards the receiving waters and consequently assists in onsite sediment entrapment
- Brash mats must be minimum 20m away from the watercourses, and
- The removal of brash mats in normal clearfell and replanting is not recommended as it is likely to be a source of sedimentation and ineffective in reducing nutrient loss.

1.6.1.1.5 Ancillary structures

The following ancillary structures will be required on site:

- Sediment traps in drains where considerable sediment flow is expected
- Brash mats to reinforce short sections of soft ground subject to high traffic usage
- Log steps on steep routes to prevent the flow of sediment-laden surface water along machine paths, especially where wheel ruts form.

Furthermore, prevent the accumulation of brash, logs and debris in drains and aquatic zones. The installation of heavy-duty plastic culverts with a protective brash cover is preferable for drain crossings. If logs are used for this purpose, they should be examined regularly and removed, if necessary, to avoid blockages and localised flooding. Remove temporary bridges and crossings as harvesting progresses.

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[3] Windrowing is the stacking of leftover vegetation, brash and other organic. matter into long narrow rows. The purpose of windrowing is to clear enough space for the replanting of new trees.

1.6.1.1.6 Site restoration

After felling has been completed, the felled areas will be checked to replace any damaged culverts, clear and repair drains, clean sediment traps, correctly dispose of hazardous materials such as machine oils or lubricants and remove log bridges and other temporary structures as necessary. Clearfelling, if possible, should be carried out early in the season, to facilitate reforestation and to allow the site to 'green over' quickly.

1.6.1.1.7 Wildlife habitats and biodiversity

Assess harvest operations with due regard to the breeding and nesting seasons of important species, and associated features such as badger setts and red squirrel dreys, as discussed in Chapter 6 Biodiversity: Ornithology.

1.6.1.1.8 Method of harvesting and the harvesting equipment

Load sizes recommended by machinery manufacturers will not be exceeded. Overloading will damage extraction machinery and will increase the risk and severity of soil compaction and rutting. Good management practices such as the use of brash mats and harvesting only in dry weather should be used to minimise soil surface disturbance and stream bank erosion. As some of the soils at the site are poorly drained soils, 8 wheeled harvesters should be used which will distribute the weight and reduce the loading and compaction and damage to the soil.

1.6.1.1.9 Storage and Handling of Chemicals, Fuels and Oils

Prepare and securely store all chemicals, fuel and machine oils under shelter on a dry, elevated site at least 50m from the nearest aquatic zone. Cleaning of equipment should not take place within 50m of an aquatic zone. All wash waters must be disposed of carefully. Spent oil must be collected and retained for correct off-site disposal. Biodegradable oil should be used as a substitute for mineral oil, where possible. Refer to the CEMP (Appendix 2-7) and Chapter 9 Hydrology and Hydrogeology for more information.

1.6.1.1.10 Landscape

Coupe sizes should reflect the scale of the landscape. Landscape issues favour asymmetric and irregularly shaped coupes which follow landform, with edges diagonal to the contour, rising in hollows and descending on spurs. Skylines need to be treated on a large scale, with the forest either left standing or cleared fully to reveal the shape of the underlying landform. Narrow belts of perimeter trees on the skyline tend to accentuate the negative visual impact of harvesting operations and generally, should not be retained. The coupe sizes for this proposed development are generally small in nature averaging 2-3 hectares.

1.6.1.1.11 Monitoring Requirements

Regular inspections during the course of harvesting operations will be undertaken to allow for immediate corrective action to be taken in the event of deviations from the plan or unforeseen problems. An assessment should involve an evaluation of the location and condition of roads, landings and machine routes, particularly in relation to drainage, compaction and rutting. Sites should be visited in the aftermath of an extended period of heavy rainfall to ensure that, if merited, operations are suspended. An assessment should be undertaken to determine whether protected areas are undamaged, and that fuel, lubricants and other hazardous compounds are stored correctly and removed from the site on the completion of operations.

1.6.2 Operational Phase

1.6.2.1 Onsite Replanting

Under the Forestry Act 2014, permanent forest removal is permitted under certain scenarios. Supporting renewable energy in the form of windfarm installation is an acceptable scenario as outlined in Table 7, Forest Service Felling and Reforestation Policy May 2017.

Table 7 – Requirements for each category of felling associated with wind farm development, regarding reforestation, alternative afforestation, and the refunding of grant and premiums.

Category of tree felling		Reforestation of felled area required?	Alternative afforestation required? (See Note 1)	Refunding of grant & premiums required? (See Note 2)
Infrastructure felling		No	Yes	Yes
Construction felling		Yes	No	No
Turbulence felling	≤20 ha	Yes	No	No
	>20 ha	Yes	Yes, 10% turbulence fell area – see Section 5.3.2.4	No

Note 1 If 'YES', the alternative site must be of an area equivalent in size. Section 5.7 sets out the procedures required. If the forest area proposed for permanent removal is still in receipt of premiums and / or is still in contract under the Afforestation Grant & Premium Scheme, the alternative site may be eligible under the Afforestation Grant & Premium Scheme.

Note 2 If 'YES', the refunding of any afforestation grants and premiums already paid out by the Forest Service is required if the forest area proposed for permanent removal is still in receipt of premiums and / or is still in contract under the Afforestation Grant & Premium Scheme. Also, if 'YES' or 'NO', if premiums are still being paid, premium payments on the area will cease.

As outlined in Section 1.4.1.1, it is estimated a total of 75 ha will be required to be replanted under the Infrastructural felling. Construction felling areas (7.88 ha) as outlined in section 1.4.1.1 will be temporarily felled and replanted at the same location once construction works are completed. There areas will be replanted with the same tree species that were felled, namely Sitka spruce, Lodgepole pine, Eucalyptus and Birch.

As part of the application for a Felling License for permanent forest removal, details of the replacement lands must be included. The offsite replacement lands are outlined in Appendix 2-5 to the main EIAR. A Technical Approval for an afforestation license for these replacement lands must be granted by the licensing authority, the Department of Agriculture, Food and the Marine (DAFM), which will have assessed the silvicultural and environmental suitability for planting.

1.7 RESIDUAL EFFECTS

The premature and semi-mature felling of the different forest areas for the construction of the infrastructure (temporary and permanent) will result in a slight effect to the forest structure within the proposed development site as opposed to the do nothing scenario.

The residual impacts of the proposed felling and onsite replanting activities are assessed through the EIAR chapters for the relevant topic.

1.8 CONCLUSION

There is an extensive network of existing access roads across the site to facilitate the ongoing forestry operations and will subsequently facilitate the windfarm development. The area of forest to be permanently removed for infrastructural felling is estimated at 75 ha distributed throughout much of the study area. This loss of forest area and carbon stored is temporary as an equivalent area of 75 ha of bare land will be planted as replacement land elsewhere. A further 7.88 ha will be felled to facilitate the wind farm construction phase and replanted once construction operations have ceased. It is expected that clearfelling works would be carried out over a period of up to 18months period and during dry weather conditions.

It is concluded that, with the implementation of the Harvest Management Plan and associated mitigation measures, forestry operations associated with the proposed Castlebanny Wind Farm development will not give rise to significant impacts on the surrounding environment..

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