Figure 2-1: Plan Drawing of Wind Farm with Road Construction Type

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Existing Forestry Roads
Visitor Carpark
Temporary Construction Compound 1
Substation Location
Site Boundary
Repository Area 2
T01
T02
T03
T04
T05
T06
T07
T08
T09
T10
Proposed Turbine Location
Proposed Walkway
Temporary Construction Compound 2
New Proposed Access Track
Proposed Met Mast
Proposed Boardwalk
Borrow Pit
Existing Access Track
Repository Area 1
Site Boundary

Road Type Legend:

Type A - Upgrade of Existing Excavated Access Tracks

Type B - Upgrade of Existing Floated Access Tracks

Type C - New Excavate & Replace Access Road

Type D - New Floated Access Road

0m 120m 240m 360m 480m 600m 720m 840m 960m 1080m 1200m

Scale 1:24000

Scale 1:24000

Scale (@ A3) 1:24000

Date - 03.07.20

FIGURE 2-1 : PLAN DRAWING OF WIND FARM WITH ROAD CONSTRUCTION TYPE

Drawn - POR

Checked - IH

Rev - E

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Friday 3 July 2020

3 UPGRADE OF EXISTING ACCESS TRACKS – TYPE A AND B

Up to 11.1km of existing access tracks requiring upgrade are present across the Croagh wind farm site and based on Coillte records have been in operation for a significant number of years. The existing access tracks were constructed using both excavate and replace and floated construction techniques. Based on the site walkover carried out by FT the existing access tracks were typically noted as been in relatively good condition. Upgrading works will involve both widening and resurfacing of the existing access track. The proposed locations for upgrading of the existing access tracks on site are shown in Figure 2-1 and details are shown in Figures 3-1 and 3-2.

Two different types of existing access tracks are present on site which were constructed using both excavate and replace and floated construction techniques (Appendix A – Photos 1 and 2). Upgrading for each is proposed as per details for type A and B respectively.

3.1 Upgrading Existing Access Tracks Construction Methodology

This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage considerations, which are discussed in detail in Section 4.7 of the EIAR.

(1) For upgrading of existing excavated access tracks (Type A – Figure 3-1) the following guidelines apply:

- (a) Excavation will be required on one or both sides of the existing access track to a competent stratum.
- (b) Granular fill to be placed and compacted in layers in accordance with the designer's specification.
- (c) The surface of the existing access track should be overlaid with up to 500mm of selected granular fill.
- (d) Access roads to be finished with a layer of capping across the full width of the road.
- (e) A layer of geogrid/geotextile may be required at the surface of the existing access road in areas where the existing track shows signs of excessive rutting, etc.
- (f) For excavations in peat and spoil, side slopes shall be not greater than 1 (v):3 (h). Where areas of weaker peat are encountered then slacker slopes will be required to ensure stability.

(2) For upgrading of existing floated access tracks (Type B – Figure 3-2) the following guidelines apply:

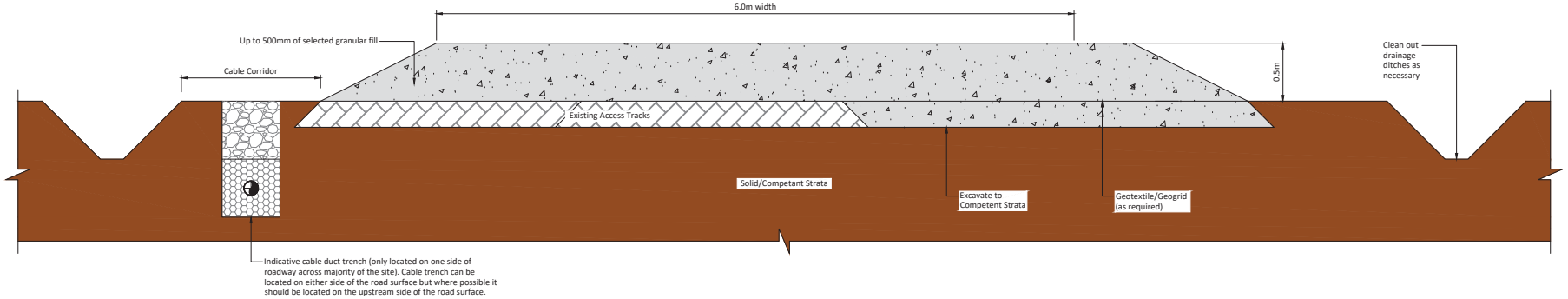
- (a) The make-up of the existing floating access roads on site is generally locally tree brash/trunks laid directly onto the peat surface and/or geotextile overlain by up to 500mm of coarse granular fill/till type (fine granular/cohesive) site won material. It should be noted that there are localised variations in the make-up of the existing floated access tracks on site, frequently no tree brash/trunks were used in the make-up and the presence of a geogrid was also noted in localised sections of the existing track.
- (b) The surface of the existing access track should be levelled prior the placement of any geogrid/geotextile, where necessary (to prevent damaging the geogrid/geotextile).
- (c) Where coarse granular fill has been used in the existing floated access road make-up, a layer of geogrid should be placed on top of the existing floated access track.
- (d) Where fine granular/cohesive type material has been used in the existing floated access road make-up (as is the case on some of the existing access roads in the southeast of the site), a layer of geotextile is likely to be required as a separator layer with a layer of geogrid.
- (e) The geogrid will be overlaid with up to 500mm of selected granular fill. Granular fill to be placed and compacted in layers.

(3) The finished road width will have a running width of 5m, with wider sections on bends and corners.

(4) On side long sloping ground any road widening works required will be done on the upslope side of the existing access road, where possible.

(5) At transitions between new floating and existing excavated roads a length of road of about 10 to 20m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the road surface transitions smoothly from floating to excavated road.

(6) A final surface layer shall be placed over the existing access track, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.



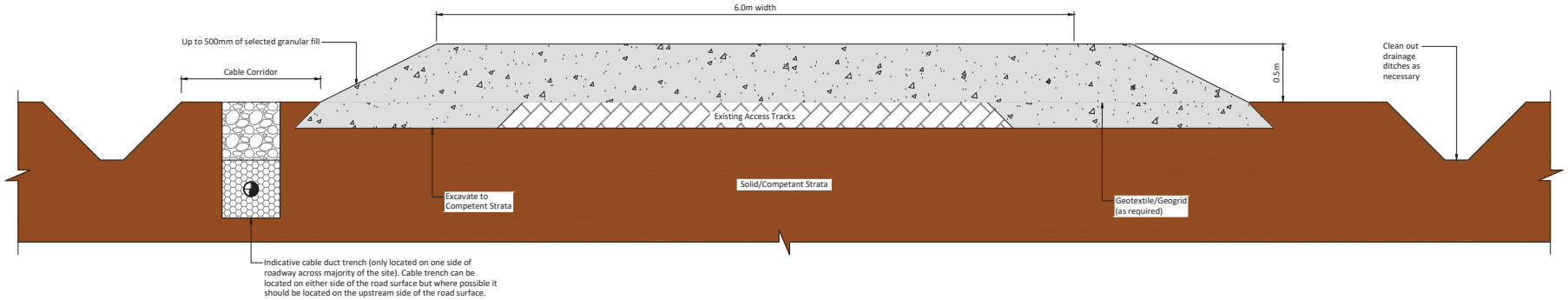


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FIGURE 3-1 : TYPE A - UPGRADE OF EXISTING EXCAVATED ACCESS TRACKS

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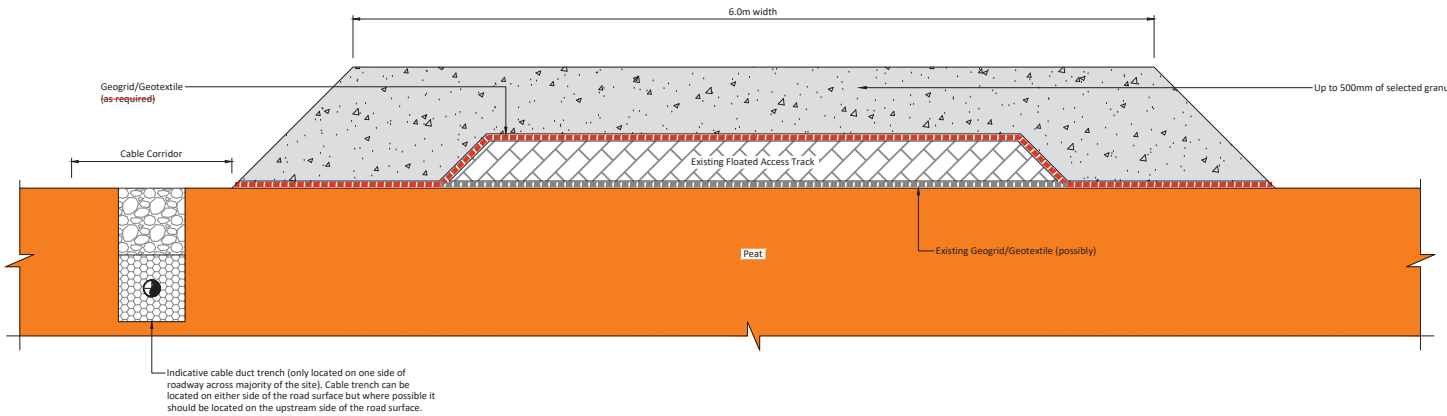
Thursday 16 April 2020



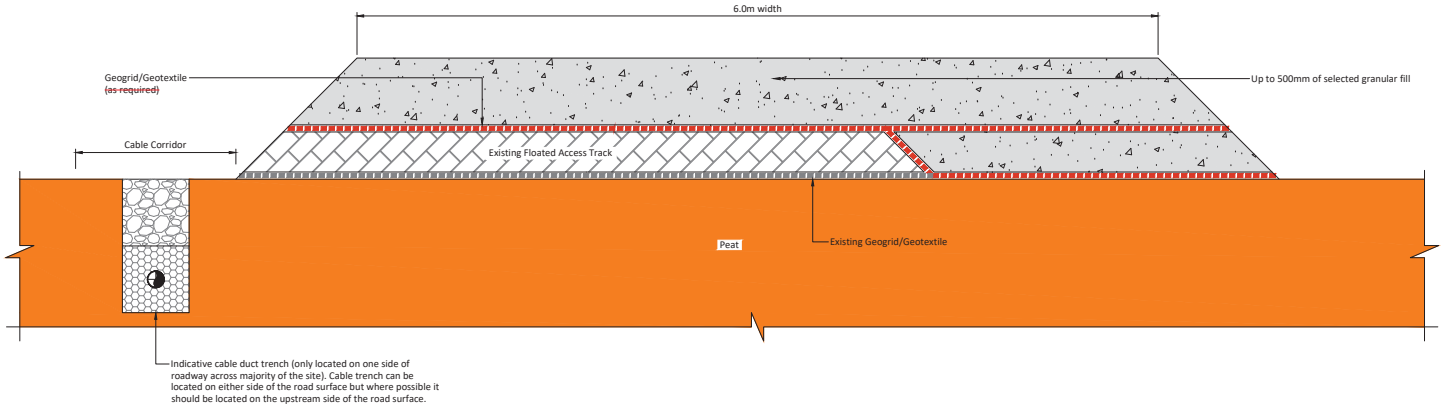


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FIGURE 3-2 : TYPE B - UPGRADE OF EXISTING FLOATED ACCESS TRACKS

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4 CONSTRUCTION OF NEW EXCAVATED ROADS THROUGH PEAT – TYPE C

The excavation of peat and spoil and founding of access roads on competent stratum (below the peat) for new access roads will be carried out at various locations on the site. The proposed locations for new excavated access roads on site are shown in Figure 2-1 and details are shown in Figure 4-1.

Excavate and replace type access roads are the conventional method for construction of access roads on peatland sites and the preferred construction technique provided sufficient placement/reinstatement capacity is available on site for the excavated peat.

4.1 Excavated Road Construction Methodology

This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage considerations, which are discussed in Section 4.7 of the EIAR.

(1) Prior to commencing road construction movement monitoring posts will be installed in areas where the peat depth is greater than 2m.

(2) Interceptor drains will be installed upslope of the access road alignment to divert any surface water away from the construction area.

(3) Excavation will take place to a competent stratum beneath the peat.

(4) Road construction will be carried out in sections of approximately 50m lengths i.e. no more than 50m of access road should be excavated without replacement with stone fill.

(5) Excavation of materials with respect to control of peat stability.

  (a) Acrotelm (top about 0.3 to 0.4m of peat) is generally required for landscaping and shall be stripped and temporarily stockpiled for re-use as required. Acrotelm stripping shall be undertaken prior to main excavations.

  (b) Where possible, the acrotelm shall be placed with the vegetation part of the sod facing the right way up to encourage growth of plants and vegetation.

  (c) All catotelm peat (peat below about 0.3 to 0.4m depth) shall be transported immediately on excavation to the borrow pit or peat repositories.

(6) Side slopes in peat shall be not greater than 1 (v): 2 or 3 (h). This slope inclination will be reviewed during construction, as appropriate. Where areas of weaker peat are encountered then slacker slopes will be required. Battering of the side slopes of the excavations will be carried out as the excavation progresses.

(7) The excavated access road will be constructed of up to 1000mm of selected granular fill.

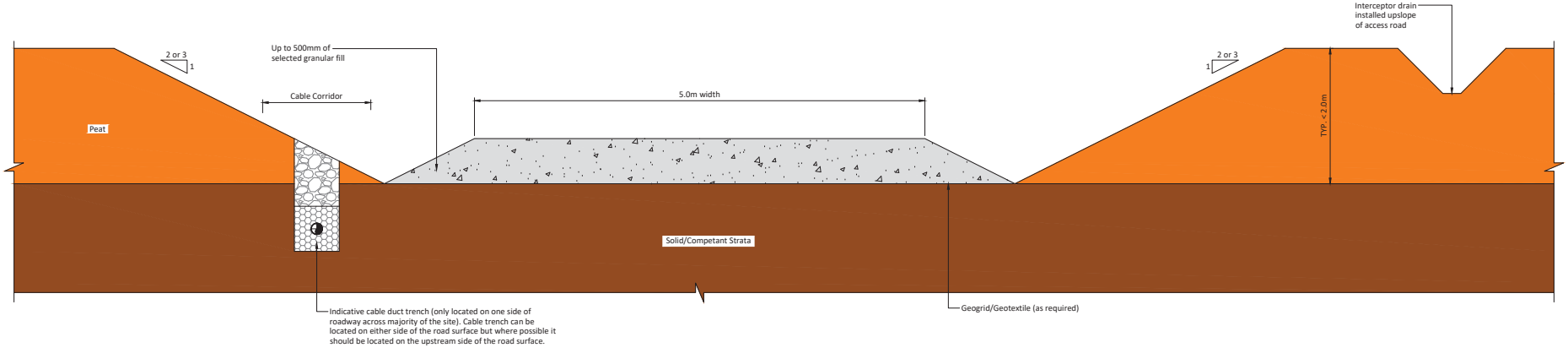
(8) Access roads to be finished with a layer of capping across the full width of the road.

(9) A layer of geogrid/geotextile may be required at the surface of the competent stratum.

(10) At transitions between floating and excavated roads a length of road of about 10 to 20m shall have all peat excavated and replaced with suitable fill. The surface of this fill shall be graded so that the road surface transitions smoothly from floating to excavated road.

(11) Where steeper slopes are encountered along with relatively deep peat (i.e. typically greater than 1m) and where it is proposed to construct the access road perpendicular to the slope contours it is best practice to start construction at the bottom of the slope and work towards the top, where possible. This method avoids any unnecessary loading to the adjacent peat and greatly reduces any risk of peat instability.

(12) A final surface layer shall be placed over the excavated road and graded to accommodate wind turbine construction and delivery traffic.



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Date - 15.04.20

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FIGURE 4-1 : TYPE C - NEW EXCAVATE AND REPLACE ACCESS ROAD

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Thursday 16 April 2020

5 CONSTRUCTION OF NEW FLOATING ROADS OVER PEAT – TYPE D

It will be necessary to construct floating roads over peat at various locations across the site. The use of new floated access tracks will be limited on site to areas of typically flatter terrain. The proposed locations for the new floating access roads on site are shown in Figure 2-1 and details are shown in Figure 5-1.

A confirmatory stability analysis to confirm the conditions predicted in this EIAR will be carried out where it is proposed to install floating access roads over the peat prior to any construction work commencing on site.

Floating roads minimise impact on the peat, particularly peat hydrology. Also, as there is no excavation required no peat arisings are generated. However, where the underlying peat has insufficient bearing capacity or due to topographic restrictions an excavate and replace type access road may be more suitable (see Section 6), although this is not anticipated at the location of the floated roads.

5.1 Floating Road Construction Methodology

This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage considerations, which are discussed in Section 4.7 of the EIAR.

Note: Details of geogrid arrangement will be provided by the specialist geogrid provider/designer.

(1) Prior to commencing floating road construction movement monitoring posts will be installed in areas where the peat depth is greater than 3m.

(2) Base geogrid to be laid directly onto the existing peat surface along the line of the road in accordance with geogrid provider's requirements.

(3) The typical make-up of the new floated access road is a minimum of 1000mm of selected granular fill with 2 no. layers of geogrid with possibly the inclusion of a basal layer of tree trunks/brash (See Figure 5-1).

(4) Granular fill to be placed in layers and compacted in accordance with the TII Specification for Road Works.

(5) During construction of the floated access roads it may be necessary to include pressure berms either side of the access road in some of the deeper/weaker peat areas. The inclusion of a 2 to 5m wide pressure berm (typically 0.5m in height) either side of the access road at such locations will reduce the likelihood of potential bearing failures beneath the access road.

(6) The finished running width of the road will be 5m, with wider sections on bends and corners.

(7) Stone delivered to the floating road construction shall be end-tipped onto the constructed floating road. Direct tipping of stone onto the peat shall not be carried out.

(8) To avoid excessive impact loading on the peat due to concentrated end-tipping all stone delivered to the floating road shall be tipped over at least a 10m length of constructed floating road.

(9) Where it is not possible to end-tip over a 10m length of constructed floating road due to the presence of weak deep peat then dumpers delivering stone to the floating road shall carry a reduced stone load (not greater than half full) until such time as end-tipping can be carried out over a 10m length of constructed floating road.

(10) Following end-tipping a suitable bulldozer shall be employed to spread and place the tipped stone over the base geogrid along the line of the road.

(11) A final surface capping layer shall be placed over the full width of the floating road, as per design requirements, to provide a road profile and graded to accommodate wind turbine construction and delivery traffic.

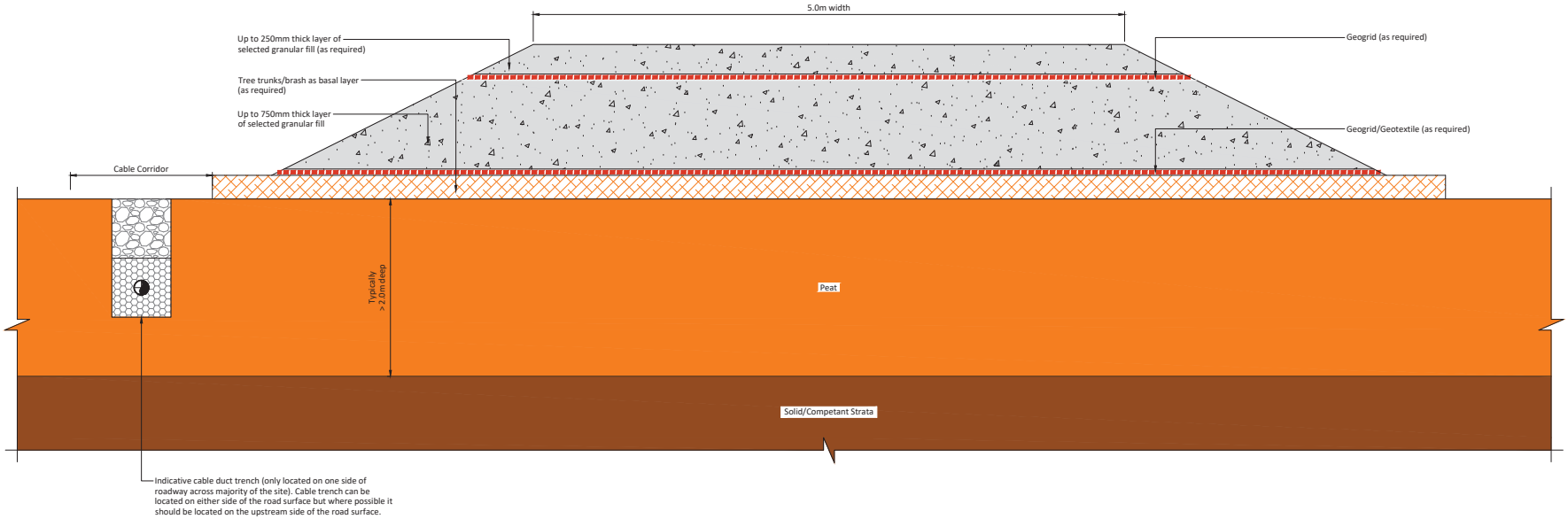

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FIGURE 5-1 : TYPE D - NEW FLOATED ACCESS ROAD

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Checked - IH

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6 GENERAL CONSTRUCTION GUIDELINES FOR ACCESS ROADS

The following general construction guidelines are given for the access roads on site.

(1) Where an open ditch is present alongside an existing/proposed floating access track, the ditch will need to be filled prior to upgrading/constructing the access track. The ditch shall be filled with suitable drainage stone. As applicable, a perforated pipe shall be laid into a ditch prior to filling so as to maintain water flow within the ditch.

(2) Where existing drainage crosses the road then it will be necessary to ensure that this drainage is not affected by settlement of the upgraded access road. Cross drains comprising flexible perforated pipes within a permeable stone fill surround will be used to maintain the existing drainage.

(3) No excavations (e.g. drainage, peat cuttings) shall be carried out within a minimum 5m distance of a completed floated access road edge, or at a distance determined following site inspection by the Contractor. The presence of excavations can destabilise the road. Temporary excavations should be excavated in short lengths and backfilled as soon as practicable.

(4) No stockpiling of materials shall take place on or adjacent to floated access roads so as to avoid bearing failure of the underlying peat.

(5) End-tipping of stone onto the road during the construction/upgrading of the access road should be carefully monitored to ensure that excessive impact loading, which may adversely affect the underlying peat, is limited.

(6) Due to the nature of floating road construction it will be necessary to monitor the settlement/movement of the road. Survey points will be located along the road at 10m intervals in areas of deep peat (greater than 3m). These survey points shall be surveyed on a weekly basis, and more frequently when construction activities are ongoing in the area.

(7) The construction and upgrading of access roads in areas of deep peat (greater than 3m) shall be inspected on a routine basis during the works, particularly before/following trafficking by heavy vehicular loads.

(8) In the event of excessive vertical displacement of the road during/following construction then remedial measures will be required to ensure the stability of the road. These would include:

(a) Introduction of pressure berms either side of the road (that is 2 to 5m wide by 0.5m deep stone layer).
(b) Where peat is relatively shallow then excavate peat and replace with suitable fill.
(c) Slowing the rate of construction.

(9) Settlement of a floated access road is expected and will likely be in the order of several 100mm in the deeper peat areas; as such it will be necessary to re-level the road at convenient intervals during the works. The magnitude and extent of settlement is likely to be greater in areas of deeper peat with the rate of settlement reducing over time. Prior to completion of the works measures shall be taken to re-level the road, as necessary.

7 EXCAVATION AND PLACEMENT OF ARISINGS

7.1 Excavation and Placement/Reinstatement Methodology

This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage considerations, which are discussed in Section 4.7 of the EIAR.

(1) All excavated peat and spoil shall be transported immediately on excavation to one of the 2 no. repository areas or borrow pit on site (see Figure 2-1).

(2) Further details on the construction and reinstatement of the borrow pit is given in Section 7.4.

(3) Further details on the placement of excavated material in the repository areas is given in Section 7.5.

(4) Some of the peat in particular the acrotelm (upper layer of the peat) excavated during construction will be used for landscaping purposes.

7.2 Summary of Excavated Peat and Spoil Volumes on Site

A summary of the excavated peat and spoil volumes calculated for the Croagh wind farm site are given in Table 7-1.

Table 7-1: Summary of Excavated Peat and Spoil Volumes on Site

Infrastructure Element (1)	Typical Dimensions	Peat Volume (m^3)	Spoil (non-peat) Volume (m^3) (2)	Comment
10 no. Turbines and Hardstands	23m diameter excavation footprint for turbine foundation with 55 x 35m hardstand area	65,925	48,635	Hardstanding area and foundation footprint
Access Roads	5m running surface with 6m wide development footprint	103,500	93,550	Excludes proposed floating sections of access road where no excavation of peat will take place (see Figure 2-1)
Substation	Hardstanding area of 65 x 40m	2,810	17,095	-
Meteorological Mast	Foundation footprint within 14 x 21m hardstanding area	425		-
Temporary Construction Compounds	Hardstanding areas of 60 x 40m	7,490		Hardstanding areas
Borrow Pit	1 no. borrow pit	14,820	34,580	-
Repository Areas	2 no. repository areas	15,000	3,000	Beneath footprint of perimeter buttresses
	Total =	**209,970m^3**	**196,860m^3**	**Total = 406,830m^3 (peat and spoil volume) (3)**

Note (1) The location of the infrastructure elements on site are shown on Figure 2-1.
Note (2) The excavated spoil volumes have been determined based on a cut-fill assessment carried out for the site, see section 13 of this report for further details.
Note (3) It should be noted that the excavated rock volume is not included in the total volume quoted above in Table 7-1, see the cut-fill assessment in Section 13 of this report for further details.

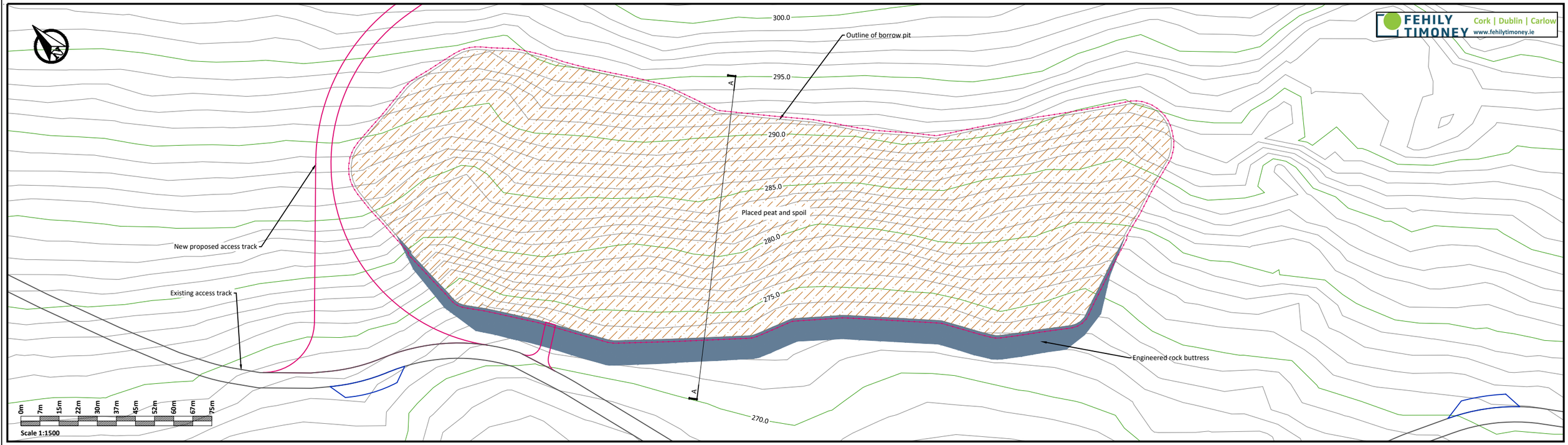
7.3 Summary of Peat and Spoil Placement/Reinstatement Areas on Site

A summary of the potential peat and spoil placement/reinstatement areas at the Croagh wind farm site are given in Table 7-2.

Table 7-2: Summary of Peat and Spoil Placement/Reinstatement Areas on Site

Location (1)	Peat and Spoil Volume (m^3)	Comment
Borrow Pit	298,000	See Figure 7-1 for further details
Repository Area 1	82,000	See Figure 7-2 for further details
Repository Area 2	18,000	See Figure 7-3 for further details
Landscaping (2)	10,000	Approximately 1,000m^3 of peat will be required for landscaping purposes at each of the 10 no. turbine locations
Total =	**408,000m^3**	

Note (1) The location of the proposed borrow pit and repository areas at the site are shown on Figure 2-1.
Note (2) Some of the acrotelm (upper layer of the peat) excavated during construction will be used for landscaping purposes.



Plan

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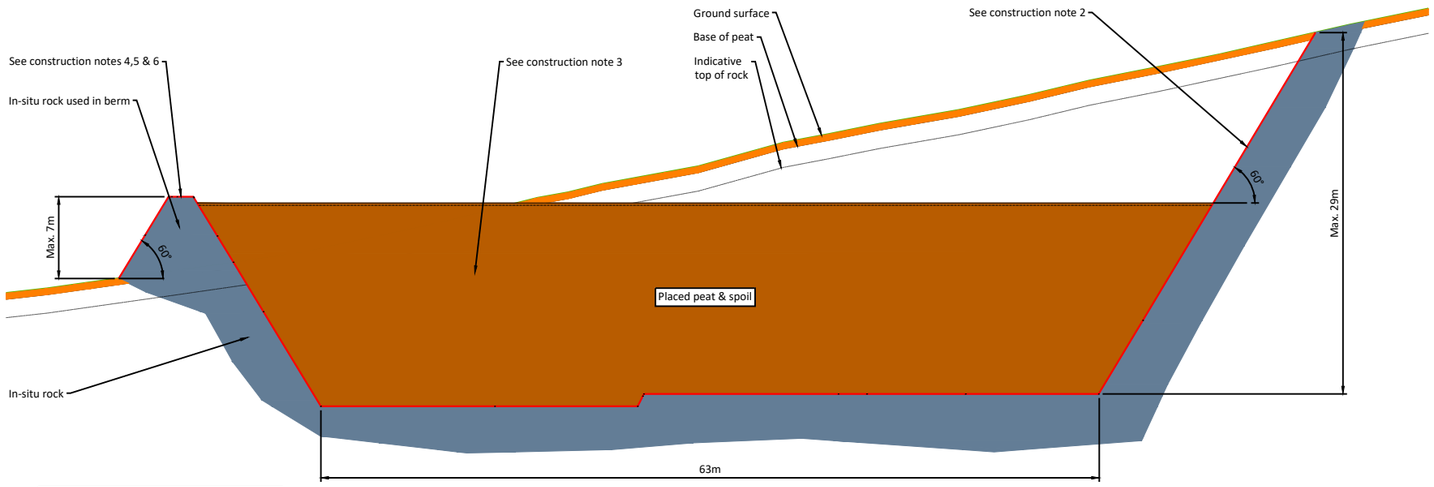

Section Scales:

1:1 Horizontal
1:1 Vertical

(No exaggeration on vertical scale i.e. true scale)

0m 3m 5m 8m 10m 13m 15m 18m 20m 23m 25m

Scale 1:500

Section

Scale 1:500

Construction Notes Borrow Pit:

(1) It is proposed to construct the borrow pit so that the base of the borrow pit is below the level of the adjacent section of access road.

(2) Slopes within the excavated rock formed around the perimeter of the borrow pit will be formed at stable inclinations to suit local in-situ rock conditions.

(3) Infilling of the peat & spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. Leaving in place upstands/segments of intact rock which will help to retain the placed peat & spoil and will allow the borrow pit to be developed and infilled in cells.

(4) A rock buttress is required at the downslope edge of the borrow pit to safely retain the infilled peat and spoil. The height of the rock buttresses constructed should be greater than the height of the infilled peat & spoil to prevent any surface peat & spoil run-off. A buttress up to 7m (approx.) in height is likely to be required.

(5) The rock buttress will be founded on competent strata. The founding stratum for the rock buttress should be inspected and approved by the project geotechnical engineer.

(6) In order to prevent water retention occurring behind the buttresses, the buttresses will be constructed of coarse boulder fill with a high permeability.

(7) The surface of the placed peat & spoil will be shaped to allow efficient run-off of surface water from the placed arising's.

(8) Control of groundwater within the borrow pit will be required.

(9) Further guidelines on the construction of the borrow pit are included within Section 7.4 of the Peat & Spoil Management Plan.

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Date - 26.06.20

FIGURE 7-1 : BORROW PIT - PLAN & CROSS SECTION DETAILS

Drawn - POR

Checked - IH

Rev - C

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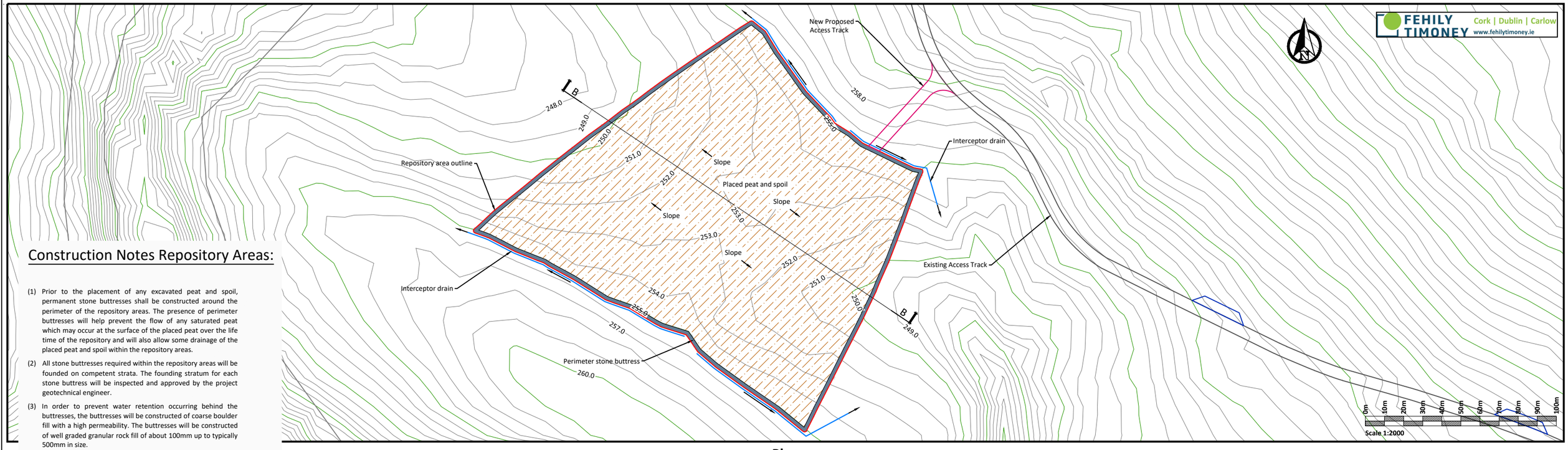
Friday 26 June 2020



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Construction Notes Repository Areas:

(1) Prior to the placement of any excavated peat and spoil, permanent stone buttresses shall be constructed around the perimeter of the repository areas. The presence of perimeter buttresses will help prevent the flow of any saturated peat which may occur at the surface of the placed peat over the life time of the repository and will also allow some drainage of the placed peat and spoil within the repository areas.

(2) All stone buttresses required within the repository areas will be founded on competent strata. The founding stratum for each stone buttress will be inspected and approved by the project geotechnical engineer.

(3) In order to prevent water retention occurring behind the buttresses, the buttresses will be constructed of coarse boulder fill with a high permeability. The buttresses will be constructed of well graded granular rock fill of about 100mm up to typically 500mm in size.

(4) The height of the stone buttresses constructed will be greater than the height of the stored peat and spoil to prevent any surface run-off.

(5) The side slopes of the stone buttresses will be constructed at typically 45 degrees. The stone buttresses will be widened to allow construction traffic access for tipping purposes during the placement of the excavated peat and spoil.

(6) An interceptor drain will also be installed upslope of the repository areas.

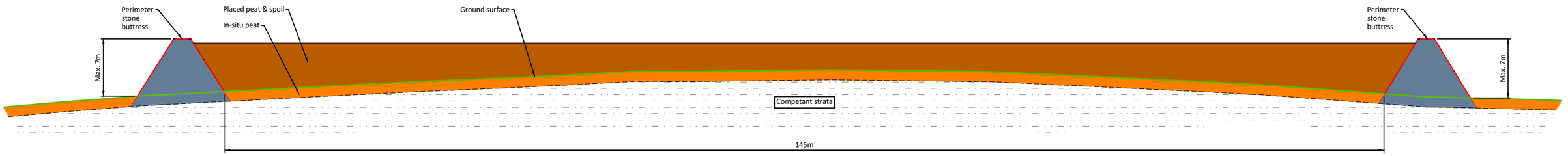
(7) A silting pond will be required at the lower side of the repository areas.

(8) The placement of the excavated spoil will commence at the downslope edge of the repository area against the stone buttress and placement will then continue upslope.

(9) It is important that the surface of the stored spoil be shaped to allow efficient run-off of water from the stored spoil.

(10) Supervision by the project geotechnical engineer or appropriately competent person is recommended for the construction of the repository area.

(11) Further guidelines on the construction of the repository area are included within Section 7.5 of the Peat & Spoil Management Plan.



Section B - B

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Date - 26.06.20

FIGURE 7-2 : REPOSITORY AREA 1 - PLAN & CROSS SECTION DETAILS

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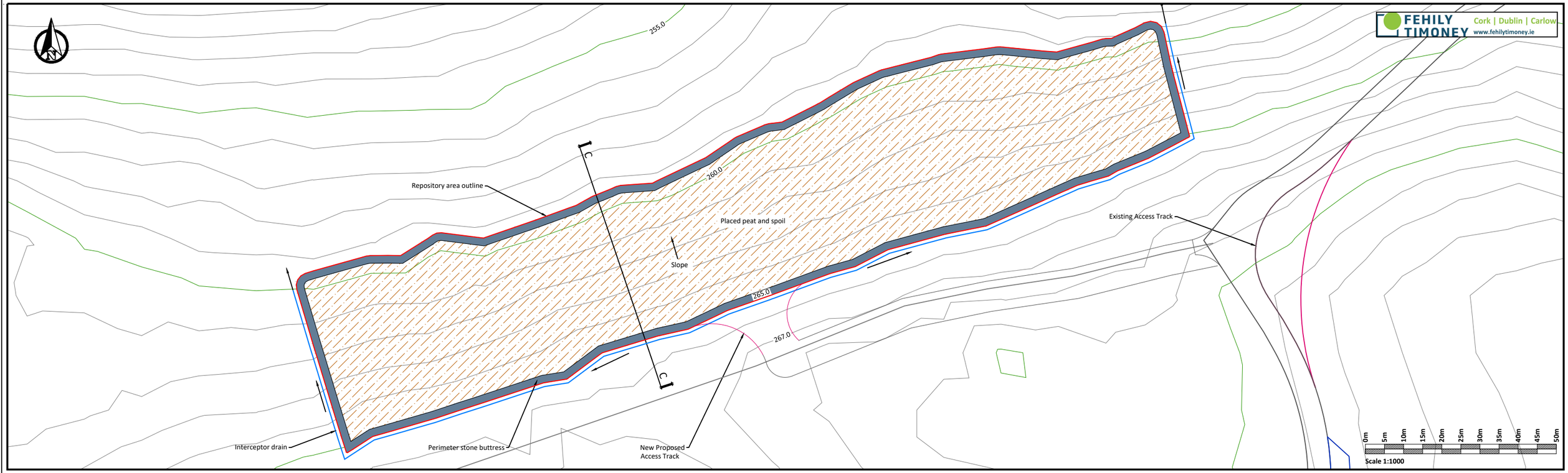

Plan

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Construction Notes Repository Areas:

(1) Prior to the placement of any excavated peat and spoil, permanent stone buttresses shall be constructed around the perimeter of the repository areas. The presence of perimeter buttresses will help prevent the flow of any saturated peat which may occur at the surface of the placed peat over the life time of the repository and will also allow some drainage of the placed peat and spoil within the repository areas.

(2) All stone buttresses required within the repository areas will be founded on competent strata. The founding stratum for each stone buttress will be inspected and approved by the project geotechnical engineer.

(3) In order to prevent water retention occurring behind the buttresses, the buttresses will be constructed of coarse boulder fill with a high permeability. The buttresses will be constructed of well graded granular rock fill of about 100mm up to typically 500mm in size.

(4) The height of the stone buttresses constructed will be greater than the height of the stored peat and spoil to prevent any surface run-off.

(5) The side slopes of the stone buttresses will be constructed at typically 45 degrees. The stone buttresses will be widened to allow construction traffic access for tipping purposes during the placement of the excavated peat and spoil.

(6) An interceptor drain will also be installed upslope of the repository areas.

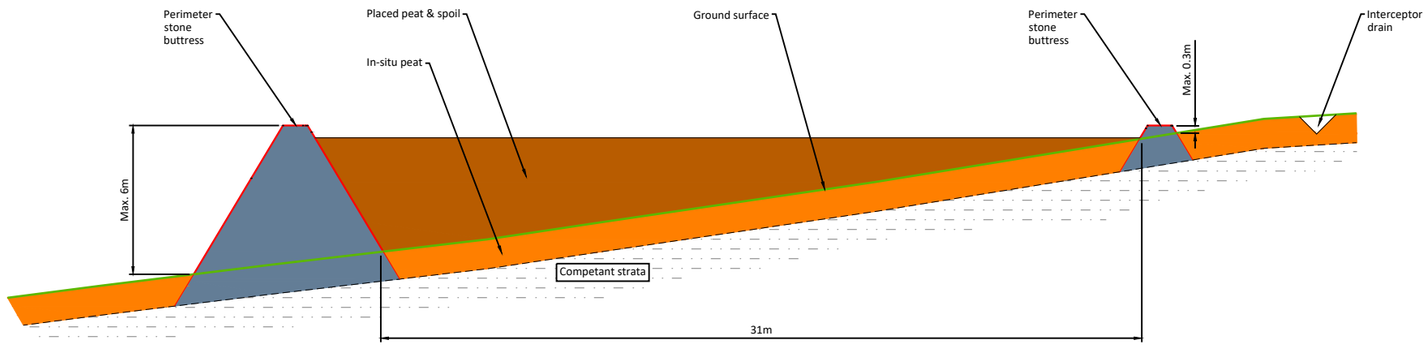
(7) A silting pond will be required at the lower side of the repository areas.

(8) The placement of the excavated spoil will commence at the downslope edge of the repository area against the stone buttress and placement will then continue upslope.

(9) It is important that the surface of the stored spoil be shaped to allow efficient run-off of water from the stored spoil.

(10) Supervision by the project geotechnical engineer or appropriately competent person is recommended for the construction of the repository area.

(11) Further guidelines on the construction of the repository area are included within Section 7.5 of the Peat & Spoil Management Plan.



Section C - C

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Date - 26.06.20

FIGURE 7-3 : REPOSITORY AREA 2 - PLAN & CROSS SECTION DETAILS

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7.4 Guidelines for the Construction and Reinstatement of Borrow Pit

A location has been identified as a borrow pit and is shown on Figure 2-1. Peat depths recorded within the footprint of the borrow pit range from 0.5 to 1.7m.

Upon removal of the rock from the borrow pit, it is proposed to reinstate the borrow pit using excavated peat & spoil within cells located inside the borrow pit. The excavated rock from the borrow pit will be used in the construction of the infrastructure elements (turbine bases, roads, etc.) at the wind farm. It is proposed to construct cells within the borrow pit for the placement of the excavated peat and spoil. This is to allow for the safe placement and grading of the peat and spoil using dumper trucks and excavators.

It should be noted that there are significant excavations works required in order to develop this borrow pit at the site. Excavation works will be undertaken and supervised by an experienced contractor and suitably qualified personnel. The text below provides some design and construction guidelines for the borrow pit.

Figure 7-1 shows the construction details for the borrow pit.

The borrow pit shall be constructed as follows:

(1) The rock within the borrow pit footprint will be removed by a combination of breaking and blasting, depending on its excavatability, which will be determined from confirmatory ground investigation carried out at the borrow pit.

(2) It is proposed to construct the borrow pit so that the base of the borrow pit is below the level of the adjacent section of access road. Localised deepening of the borrow pit floor may be required depending on extraction operations.

(3) Depending on the condition of the rock present in the borrow pit it may be possible to excavate the rock from the borrow pit whilst leaving in place upstands/segments of intact rock which will help to retain the placed peat and spoil. The upstands/segments of intact rock will essentially act as engineered rock buttresses within the borrow pit.

(4) Slopes within the excavated rock formed around the perimeter of the borrow pit will be formed at stable inclinations to suit local in-situ rock conditions. Exposed sections of the rock slopes will be left with irregular faces and declivities to promote re-vegetation and provide a naturalistic appearance.

(5) The stability of the rock faces within the borrow pit will be inspected by competent personnel upon excavation to ensure stability during construction works and in the long term. This inspection will allow unfavourable rock conditions to be identified and suitable mitigation measures to be applied such as removal of loose rock, in line with best practice guidelines.

(6) Infilling of the peat and spoil will commence at the back edge of the borrow pit and progress towards the borrow pit entrance/rock buttress. Leaving in place upstands/segments of intact rock which will help to retain the placed peat spoil and will allow the borrow pit to be developed and infilled in cells.

(7) A rock buttress is required at the downslope edge of the borrow pit to safely retain the infilled peat and spoil. The height of the rock buttresses constructed will be greater than the height of the infilled peat and spoil to prevent any surface peat and spoil run-off. A buttress up to 7m (approx.) in height will be required.

(8) The rock buttress will be founded on mineral soil or bedrock i.e. competent strata. The founding stratum for the rock buttress should be inspected and approved by the Project Geotechnical Engineer.

(9) In order to prevent water retention occurring behind the buttresses, the buttresses will be constructed of coarse boulder fill with a high permeability. The buttress will be constructed of well graded granular rock fill of about 100mm up to typically 500mm in size. Alternatively, drains will be placed through the buttresses to allow excess water to drain.

(10) The rock buttress will be wide enough to allow construction traffic access for tipping and grading during the placement of the excavated peat and spoil. The side slopes of the rock buttress will be constructed at between 45 to 60 degrees.

(11) The use of temporary access ramps and long reach excavators during the placement of the excavated peat and spoil will be required.

(12) The surface of the placed peat and spoil will be shaped to allow efficient run-off of surface water from the placed arising's.

(13) A layer of geogrid to strengthen the surface of the placed peat and spoil within the borrow pit may be required.

(14) An interceptor drain will also be installed upslope of the borrow pit. This drain will divert any surface water away from the borrow pit and hence prevent run-off from ponding and lodging in the reinstated area.

(15) Control of groundwater within the borrow pit may be required and measures will be determined as part of the confirmatory ground investigation programme. A temporary pump and suitable outfall locations are likely to be required during construction. Refer to EIAR Chapter 4 and 9 for drainage details.

(16) A settlement pond will be required at the lower side/outfall location of the borrow pit.

(17) Supervision by a geotechnical engineer or appropriately competent person is required for the development of the borrow pit.

(18) All the above-mentioned general guidelines and requirements will be confirmed by the Contractor prior to construction.

7.5 Guidelines for the Construction of the Repository Areas

Two locations have been identified as repository areas and are shown on Figure 2-1. The peat depth within the footprint of the repository areas is generally less than 1.5m.

Both repository areas have a perimeter buttress which will contain and ensure the placed peat and spoil remains stable in the long-term. Prior to the placement of any excavated peat and spoil, the permanent stone buttresses shall be constructed around the perimeter of the repository areas. Construction details for each of the repository areas are shown on Figures 7-2 and 7-3.

The presence of perimeter buttresses will help prevent the flow of any saturated peat which may occur at the surface of the placed peat over the lifetime of the repository and will also allow some drainage of the placed peat and spoil within the repository areas.

The repository areas, in particular the stone buttresses, should be constructed as follows:

(1) All stone buttresses required within the repository areas will be founded on mineral soil or bedrock i.e. competent strata. The founding stratum for each stone buttress will be inspected and approved by a geotechnical engineer or competent person.

(2) In order to prevent water retention occurring behind the buttresses, the buttresses will be constructed of coarse boulder fill with a high permeability. The buttresses will be constructed of well graded granular rock fill of about 100mm up to typically 500mm in size. Alternatively, drains will be placed through the buttresses to allow excess water to drain.

(3) The height of the stone buttresses constructed will be greater than the height of the stored peat and spoil to prevent any surface run-off. The height of the stone buttresses will be a minimum of 0.5m above the height of the placed peat and spoil to prevent any potential for saturated peat to flow out of the repository area.

(4) The side slopes of the stone buttresses shall be constructed at 45 degrees. The stone buttresses will be widened to allow construction traffic access for tipping purposes during the placement of the excavated peat and spoil.

(5) An interceptor drain will also be installed upslope of the repository areas. The drain will divert any surface water away from the repository area and hence prevent water from ponding in the area.

(6) A settlement pond will be required at the lower side of the repository areas.

(7) A granular layer of material will be required at the base of the stored spoil immediately upslope of the stone buttresses to act as a drainage layer. This drainage layer will aid in preventing a build-up of pore water pressure behind the stone buttress.

(8) The placement of the excavated spoil will commence at the downslope edge of the repository area against the stone buttress and placement will then continue upslope.

(9) It is important that the surface of the stored spoil be shaped to allow efficient run-off of water from the stored spoil.

(10) Supervision by a geotechnical engineer or appropriately competent person is required for the construction of the repository area.

8 EXCAVATIONS IN PEAT AND SPOIL

The works require that most of the turbine bases are to be founded on competent founding strata which will require excavation through peat and spoil. Some turbine bases may require a piled solution following confirmatory ground investigations by the Contractor.

Similarly, crane hardstandings, temporary construction compounds and substation platforms and the met mast foundations are to be founded on competent mineral soil and/or rock which will also require excavation through peat and spoil.

Excavations for the borrow pit and perimeter buttresses for the repository areas will also require the removal of peat and spoil overlying the rock.

8.1 Methodology

This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are covered in Chapter 4 and 9 of the EIAR.

(1) With respect to placement of arisings from excavation the guidelines given in Section 7 are to be followed.

(2) All excavations within peat are to be adequately supported or peat slopes are to be battered to a safe slope inclination of 1 (v): 3 (h).

(3) Excavations shall be kept reasonably free from water at all times. Water should be prevented from being impounded within excavations by either using drainage channels cut into the excavation face or by pumping.

(4) Where water is channelled or pumped from an excavation then this water is to be fed into an appropriately located outfall following suitable treatment, as noted in Section 4 and 9 of the EIAR.

9 EXCAVATIONS FOR UNDERGROUND CABLES

It is proposed to construct a 38kV substation within the site and to connect from here to the existing Garvagh substation, located approximately 730m east of the site. Connection will be via underground cabling located within existing forestry roads. The cabling route measures approximately 6.1km in total.

The proposed grid connection construction methodology, including proposals for water crossings on the underground cabling routes is described in Chapter 4 of the EIAR.

The cable trench route will encounter peat. It is proposed to excavate the trenches for the underground cable at a uniform depth in peat or non-peat overburden material. The trenches will be approximately 900mm wide and 1220mm deep.

9.1 Methodology

This methodology includes procedures that are to be included in the construction to minimise any adverse impact on peat stability. The methodology is not intended to cover all aspects of construction such as drainage and environmental considerations, which are discussed in Chapter 4 and 9 of the EIAR.

(1) With respect to placement of arisings from excavations the guidelines given in Section 7 are to be followed.

(2) It is proposed to excavate the trenches for the underground cable at a uniform depth in peat or other overburden material.

(3) All excavations within peat for the cable trench are to be adequately supported or peat slopes are to be battered to a safe slope inclination typically of 1 (v): 3 (h). Where areas of weaker peat are encountered then slacker slopes will be required.

(4) Similarly, all excavations within non-peat overburden for the cable trench are to be adequately supported or battered to a safe slope inclination typically of 1 (v): 1.5 or 2 (h).

(5) Excavations shall be kept reasonably free from water at all times.

(6) Any material excavated from the cable trench which is deemed suitable for reinstatement of the trench will be used for this purpose i.e. stockpiled locally to the works and reused for backfilling.

(7) Any material not deemed suitable for the reinstatement of the cable trench will be transported to the borrow pit or peat repository.

10 GENERAL RECOMMENDATIONS FOR GOOD CONSTRUCTION PRACTICE ON SITE

To minimise the risk of construction activity causing potential peat instability the Construction Method Statements (CMS's) for the project will also take into account, but not be limited, to the general recommendations below together with the specific recommendations above.

(1) Avoidance of uncontrolled concentrated water discharge onto peat slopes identified as being unsuitable for such discharge. All water discharged from excavations during work shall be piped over areas specifically assessed as being unsuitable and hence directed into suitable drainage lines. See Chapter 4 and 9 of the EIAR.

(2) Avoidance of unstable excavations. All excavation shall be suitably supported to prevent collapse and development of tension cracks.

(3) Avoidance of placing fill and excavations in the vicinity of steeper peat slopes, that is at the crest or toe of the slope.

(4) Installation and regular monitoring of geotechnical instrumentation, as appropriate, during construction in areas of possible poor ground, such as deeper peat deposits (see Section 11).

(5) Site reporting procedures to ensure that working practices are suitable for the encountered ground conditions. Ground conditions to be confirmed by suitably experienced geotechnical engineer.

(6) Regular briefing of all site staff (e.g. toolbox talks) to provide feedback on construction and ground performance and to promote reporting of any observed change in ground conditions.

(7) Routine inspection of wind farm site by Contractor and Project Geotechnical Engineer to include an assessment of ground stability conditions (e.g. cracking, excessive floating road settlement, disrupted surface, closed-up drains) and drainage conditions (e.g. blocked drains, absence of water in previously flowing drains, springs, etc.).

11 INSTRUMENTATION

11.1 Movement Monitoring Posts

To monitor possible peat movements, it is proposed to install sighting posts upslope and downslope of the access roads at staggered intervals at locations where the peat depth is greater than 2m for excavated access roads and 3m for floated access roads. Additional monitoring locations will be required at infrastructure locations with deeper peat deposits. Details of sighting posts are given below.

(1) A line of sighting posts shall comprise:

(a) A line of wooden stakes (typically 1 to 1.5m long) placed vertically into the peat to form a straight line.

(b) The sighting line shall comprise 6 nos. posts at 5m centres that is a line some 25m long.

(c) A string line shall be attached to the first and last posts and all intervening posts shall be adjusted so they are just touching the string line.

(2) Lines of sighting posts shall be placed across the existing slope about 5m away from the area to be worked. The posts shall be located along the road at 10m intervals in areas of deep peat (greater than 2m). Where there are relatively steeper slopes or softer ground a sighting line shall be placed down the slope, or at any location where monitoring would be deemed useful.

(3) Each line of sighting posts shall be uniquely referenced with each post in the line given a reference. The post reference shall be marked on each post (e.g. reference 1-1, 1-2, 1-3, 1-4, 1-5, and 1-6 for posts in line 1).

(4) The sighting lines shall be monitored at the beginning of each working day, and during the day where considered appropriate (e.g. when working activity is concentrated at a specific location).

(5) Monitoring of the posts shall comprise sighting along the line and recording any relative movement of posts from the string line.

(6) Where increased movements are recorded the frequency of monitoring shall be increased.

(7) A monitoring record shall be kept of the date, time and relative movement of each post, if any. This record shall be updated and stored as a spreadsheet.

12 CONTINGENCY MEASURES

12.1 Excessive Movement

Where there is excessive movement or continuing peat movement recorded at a monitoring location or identified at any location within the site but no apparent signs of distress to the peat (e.g. cracking, surface rippling) then the following shall be carried out.

(1) All activities (if any) shall cease within the affected area.

(2) Increased monitoring at the location shall be carried out. The area will be monitored, as appropriate, until such time as movements have ceased.

(3) Re-commencement of activities shall only start following a cessation of movement and agreement with all parties (Resident Engineer, Contractor and Client).

12.2 Onset of Peat Slide

In the unlikely event where there is the onset or actual detachment of peat (e.g. cracking, surface rippling) then the following shall be carried out.

(1) On alert of a peat slide incident, all activities (if any) in the area should cease and all available resources will be diverted to assist in the required mitigation procedures.

(2) Action will be taken to prevent a peat slide reaching any watercourse. This will take the form of the construction of check barrages on land. Due to the terrain and the inability to predict locations it may not be possible to implement any on-land prevention measures, in this case a watercourse check barrage will be implemented.

(3) For localised peat slides that do not represent a risk to a watercourse and have essentially come to rest the area will be stabilised initially by rock infill, if required. The failed area and surrounding area will then be assessed by the engineering staff and stabilisation procedures implemented. The area will be monitored, as appropriate, until such time as movements have ceased.

12.3 Check Barrage

Whilst it is not anticipated from the analysis undertaken that a peat slide will occur on site, as a contingency a check barrage procedure is included below.

The check barrage procedure deals with preventing a peat slide from moving downstream within a watercourse.

The most effective method of preventing excessive peat slide debris from travelling downstream in a watercourse is the use of a check barrage. A check barrage comprises the placement of rock fill across a watercourse. The check barrage is a highly permeable construction that will allow the passage of water but will prevent peat debris from passing through. Rock fill should comprise well-graded coarse rock pieces from about 300mm up to typically 1000mm.

The rock fill for the check barrage could be sourced from the borrow pit on site, preferably the closest borrow pit, or where rock level is close to/at the ground surface.

The size of the barrage will vary depending on the scale of the peat debris to be contained and the geometry of the watercourse at the barrage location. In general, due to the low speed of a peat slide there is generally little impact force and most of the lateral load is due to fluid pressure on the upslope face of the barrage.

Typically, the check barrage should fill the entire channel width of the watercourse up to a height of 3 to 4m with a crest width of typically 2m and side slopes of about 45 degrees depending on the geometry of the barrage location.

The check barrage procedure is as follows:

(1) Access to the check barrage location shall be along the existing access roads on the wind farm site and/or along public roads, where possible. When it is necessary to form the barrage then rock fill will be placed across the watercourse to effectively block the passage of peat debris.

(2) Operatives employed to carry out the construction of the check barrage would need to be inducted by means of a briefing by on-site supervisors as to the proposed location of the check barrage.

(3) The check barrage provides containment for peat debris in the unlikely event of a major peat slide. Further remedial measures, should they be required, will be assessed by the Contractor and the Project Geotechnical Engineer and carried out as soon as physically possible when the location and extent of the failure is established.

(4) Where a barrage was constructed as a precaution and no peat debris reached the watercourse then the barrage should be removed as soon as any measures to prevent further peat sliding is agreed with all parties.

13 CUT AND FILL EARTHWORKS ASSESSMENT

FT carried out an assessment for the site which quantifies the total volume of cut and fill earthworks required for the construction of the wind farm. The cut and fill assessment is graphically presented in Figure 13-1.

The outputs from the cut and fill earthworks assessment includes the following:

- Plan drawings of the entire site showing an outline of cut & fill earthworks at all infrastructure elements (Figure 13-1)
- Cut and fill earthwork volumes (see Table 13-1 of this report)

A summary of the basis for the cut and fill earthworks assessment are included in Appendix B of this report.

A summary of the cut and fill earthwork volumes is given in Table 13-1.

13.1 Commentary on Earthwork Volumes

This section of the report should be read in conjunction with Sections 7.2 and 7.3 of the report which summarise the peat and spoil volumes for site and the placement/reinstatement areas on site.

In summary:

1) The total net earthwork volume (cut minus fill) which includes peat, non-peat superficial deposits and rock for the scheme is estimated at 762,585m^3 (Cut). Fill requirements for the scheme are relatively minor, see Table 13-1.

2) The total net earthwork volume (cut minus fill) excluding peat (i.e. non-peat overburden and rock) for the scheme is estimated at 552,650m^3 (Cut).

3) The estimated quantity of available rock within the borrow pit is 372,600m^3, based on the information gathered from site investigations.

4) The total volume of non-peat superficial deposits only requiring placement/reinstatement on site is estimated at 196,860m^3. This material will be excavated and placed/reinstated to one of the 2 no. repository areas or the borrow pit.

5) No bulking or contingency factors have been applied to the excavation volumes presented in Table 13-1.

Table 13-1: Summary of Cut and Fill Earthwork Volumes

Infrastructure Element	Description	Total Earthwork Volume [1] - Peat & non-peat overburden (spoil) & rock			Earthwork Volume [2] - Estimated non-peat material only (non-peat overburden and rock)			Earthwork Volume [3] - Estimated rock volume only	Comment
		Cut (m^3)	Fill (m^3)	Net Volume (m^3) = Cut - Fill	Cut (m^3) [2]	Fill (m^3)	Net Volume (m^3) = Cut - Fill	Cut (m^3)	
10 no. Turbines and Hardstands	23.2m diameter excavation footprint for turbine foundation with 55 x 35m hardstand area	114,580	20	114,560 (Cut)	48,655	20	48,635 (Cut)	-	Hardstanding area and turbine foundation footprint
Access Roads	5m running surface with 6m wide development footprint	197,050	16,810	180,240 (Cut)	93,550	16,810	76,740 (Cut)	-	Excludes proposed and existing floating sections of access road where no excavation of peat will take place (see Figure 2-1).
Various Infrastructure Locations	Includes substation, 2 no. temporary construction compounds and met mast	28,395	610	27,785 (Cut)	17,705	610	17,095 (Cut)	-	-
Borrow Pit	Borrow pit footprint of 24,700m^2	422,000	-	422,000 (Cut)	407,180	-	407,180 (Cut)	372,600 (Cut)	Potential rock volume from the borrow pit is 372,600m^3.
Repository Areas	Repository Area 1 and 2	18,000	-	18,000 (Cut)	3,000	-	3,000 (Cut)	-	
	Total =	**-**	-	**762,585 m^3 (Cut)**	**-**	-	**552,650 m^3 (Cut)**	**372,600 m^3 (Cut)**	

Notes

Note (1) The total earthwork volumes includes peat, non-peat superficial deposits and rock from the borrow pit.
Note (2) The earthwork volumes quoted for the non-peat material were calculated based on the total earthwork volume (peat and non-peat material) minus the peat volumes calculated and presented in Table 7-1 within Section 7.2 of this report.
Note (3) The in-situ rock volume from the borrow pit was estimated based on the available ground investigation to define rockhead level.
Note (4) It should be noted that the earthwork volumes given in Table 13-1 are subject to confirmatory design.
Note (5) No bulking or contingency factors have been applied to the earthwork excavation volumes presented above.

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Existing Forestry Roads
Visitor Carpark
Temporary Construction Compound 1
Substation Location
Site Boundary
Repository Area 2
T01
T02
T03
T04
T05
T06
T07
T08
T09
T10
Proposed Turbine Location
Proposed Walkway
Temporary Construction Compound 2
New Proposed Access Track
Proposed Met Mast
Proposed Boardwalk
Borrow Pit
Existing Access Track
Repository Area 1
Site Boundary

Cut / Fill Legend:

Areas of Cut

Areas of Fill

0m 120m 240m 360m 480m 600m 720m 840m 960m 1080m 1200m

Scale 1:24000

Scale 1:24000

Scale (@ A3)
1:24000

Date - 03.07.20

FIGURE - 13-1 : PLAN DRAWING OF CUT FILL EARTHWORKS FOR SITE

Drawn - POR
Checked - IH
Rev - F

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Friday 3 July 2020

Appendix A

Photos from Site Walkover

Photo 1 Example of an existing excavated access track on site

Photo 2 Example of an existing floating access track on site

Appendix B

Basis for Cut and Fill Earthworks Assessment

Basis for Cut and Fill Earthwork Assessment

Main Infrastructure Locations

Appendix B provides a summary of the main assumptions for the cut and fill earthworks assessment.

Table B1 provides a summary of the dig depths adopted for the cut and fill assessment for the main infrastructure elements at Croagh wind farm.

The assumed excavation footprint for the turbine foundation is the turbine base diameter of 19m plus 2m working room all around the base i.e. 23m.

Table B1: Summary of the dig depths at the main infrastructure locations

Turbine	Easting	Northing	Average Peat Depth for Turbines (m)	Dig depth for Turbine Foundation (m) (1)	Average Peat Depth for Crane Hardstands (m)	Max Dig depth for Associated Crane Hardstand (m) (2)
T1	583322	823639	2.0	3.0	2.1	2.4
T2	583831	824112	2.4	3.4	2.4	2.7
T3	583648	823314	2.2	3.2	1.2	1.5
T4	584223	823820	0.8	3.0	0.8	1.1
T5	584259	823347	0.8	3.0	1.1	1.4
T6	584841	823616	2.0	3.0	3.3	3.6
T7	584968	823032	2.4	3.4	3.0	3.3
T8	585523	822935	3.5	4.5	4.7	5.0
T9	586144	822595	3.2	4.2	3.9	4.2
T10	584676	822493	0.9	3.0	1.6	1.9
Infrastructure Element	**Easting**	**Northing**	**Average Peat Depth (m)**	**Max Dig depth for Infrastructure Element (m) (3) & (4)**		
Substation	584584	823867	1.2	1.5		
Temporary Construction Compound 1	584170	823980	1.2	1.5		
Temporary Construction Compound 2	585150	823232	1.6	1.9		
Met Mast	548059	823136	1.2	2.2		
Borrow Pit	585697	822449	0.5	Varies		

Notes

(1) Based on ground investigation information, founding depths for the turbines were assumed to be the average peat depth + 1m to a competent stratum. A minimum dig depth of 3m is assumed for each turbine foundation. For the

purpose of this assessment it is assumed that all turbine foundations will be gravity type founded bases i.e. no piled foundations. If piled foundations are required, then the calculated excavation volumes will be reduced.

(2) Founding depths for the crane hardstands were assessed to be the average peat depth + 0.3m to a competent stratum.

(3) For the temporary construction compounds and substation, the founding depth was assessed to be the average peat depth +0.3m to a competent stratum.

(4) For the met mast the founding depth was assumed to be the average peat depth +1.0m to a competent stratum.

(5) Note the maximum dig depths stated in Table B1 form the basis of this assessment and are subject to confirmation at detailed design stage following a ground investigation.

(6) It is not anticipated that the proposed amenity trails will generate any spoil.

Access Roads

The following basis for the cut and fill assessment is given in relation to the access roads.

- Typical gradient requirements from turbine suppliers were assumed for the cut and fill assessment i.e. maximum gradients of 10 to 12%. A maximum gradient of 12% has been used for straight sections of access road on site.
- For the purpose of the assessment, the average width of the existing access tracks has been taken as 4m.
- There are 4 types of access tracks/roads proposed/present on site, which include:
    - Existing excavated and replace type access tracks - some excavation works as a result of localised widening will be required. It has been assumed that widening will typically take place on both sides of the road as per Figure 3.1. In areas of side long ground/steeper terrain (greater than 5% gradient), widening of existing tracks will take place on the upslope side of the road as per Figure 3.1. Estimated dig depth to competent strata for both cases is 0.3m below the base of the peat.

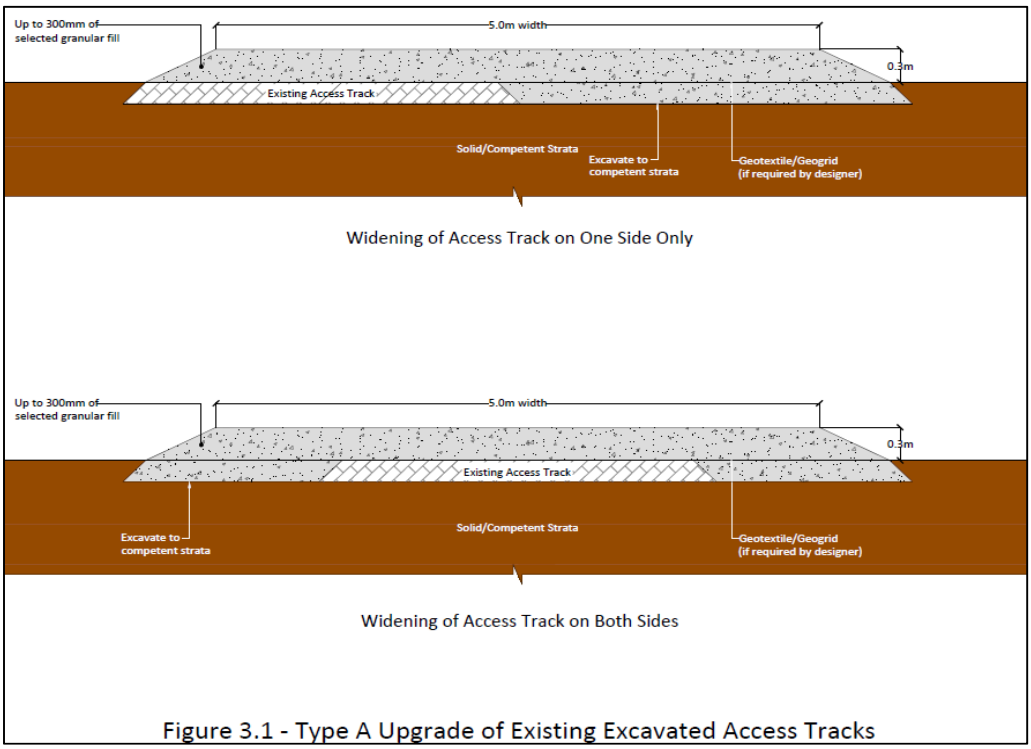

Figure 3.1 - Type A Upgrade of Existing Excavated Access Tracks

    - Existing floating type access tracks – minimal/no excavation will be required
    - New proposed floating access roads - no excavation will be required

- New proposed excavate and replace type access roads – excavation work will be required. Estimated dig depth to competent strata was 0.3m below the base of the peat

Borrow Pit

The cut and fill assessment for the borrow pit is based on the cross-section drawing (Figures 7-1) included in this report. The borrow pit was sized to allow for the reinstatement of some of the excavated peat and spoil volume generated on site and to accommodate the estimated site-won stone fill requirements.

General Assumptions

No spoil is anticipated from the proposed amenity facilities (walkways/trails).

A 1(v): 2(h) configuration for all excavation faces was used in the cut and fill earthworks assessment, except for excavations in rock at the borrow pit where a configuration of 1(v): 0.7(h) i.e. 60 degrees was used. These configurations are considered reasonable based on the ground conditions encountered on the site, and in line with best practice guidelines.

APPENDIX 4-3

FORESTRY REPLACEMENT LANDS ASSESSMENT

Planning and Environmental Consultants

Assessment of Forestry Replacement Lands

Proposed Croagh Wind Farm, Co. Leitrim & Co. Sligo

DOCUMENT DETAILS

Client:	**Coillte**
Project Title:	**Proposed Croagh Wind Farm, Co. Leitrim & Co. Sligo**
Project Number:	**180511**
Document Title:	**Assessment of Forestry Replacement Lands**
Document File Name:	**AFRL – 2020.07.06 - F**

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Planning and Environmental Consultants

Rev	Status	Date	Author(s)	Approved By
01	Draft	11/12/2019	KM	MW
02	Draft	01/07/2020	KM, EM	MW
03	Final	06/07/2020	EM	MW

Table of Contents

1. INTRODUCTION

This forestry replacement assessment report has been prepared by MKO on behalf of Coillte who intend to apply to both Leitrim County Council and Sligo County Council (the local authorities) for planning permission to construct a wind energy development 'Croagh Wind Farm', which straddles the border between Co. Leitrim and Co. Sligo comprising up to 10 no. wind turbines and associated infrastructure near Drumkeeran, Co. Leitrim.

Construction of the proposed wind farm will require felling of 55.1 hectares of forestry. In line with the Forest Service's published policy on granting felling licenses for wind farm developments, areas permanently cleared of forestry for turbine bases, access roads, and any other wind farm-related uses will have to be replaced by the planting of forestry at an alternative location. The Forest Service policy requires replanting on a hectare for hectare basis.

A total of 55.1 hectares of new forestry will therefore be replaced as a condition of any felling licence that might issue in respect of the proposed wind farm development. Replanting is a requirement of the Forest Service and is primarily a matter for the statutory licensing processes under the Forestry Act 2014 that are under the control of the Minister for Agriculture, Food and the Marine and the Forest Service.

The replacement of forestry can occur anywhere in the State subject to licence. Bare replacement lands are therefore required to be obtained by the applicant and ringfenced for the replacement of forestry felled as part of the construction of wind energy developments. These lands are subject to an application for Technical Approval by the Forest Service. Should technical approval be granted, the lands can be left bare until a felling licence for the wind farm to which they are linked has been acquired. Bare replacement lands can also be planted ahead of a felling licence being acquired for the wind farm as long as they are held specifically for the purpose of replacing forestry felled as part of the wind farm development.

Three potential forestry replacement areas have been identified and are located at Stranamart, Co. Cavan, Brackloon, Co. Roscommon and Ballard, Co. Wicklow. The total replanting area granted Forest Service Technical Approval for afforestation at these three sites is 59.33 hectares, which is more than sufficient to accommodate the wind farm replanting requirement. If these replacement lands become unavailable, other similarly approved replant lands will be identified for replanting should the proposed wind farm be developed.

1.1 Report Structure

This report provides a description of the proposed replacement lands and an assessment of the potential impacts, including cumulative impacts, associated with afforestation at this location. The main sections of this report are presented as follows:

- Section 2: Project Background and Description
- Section 3: Planning Policy and Planning History
- Section 4: Impact Assessment Methodology
- Section 5: Biodiversity
- Section 6: Land, Soils and Geology
- Section 7: Hydrology and Hydrogeology
- Section 8: Landscape
- Section 9: Cultural Heritage
- Section 10: Air, Climate and Noise
- Section 11: Population and Human Health
- Section 12: Material Assets

In this report, these replacement lands are assessed cumulatively with any existing, permitted or proposed developments located in the immediate vicinity of the replacement lands. The replacement lands are assessed cumulatively with the proposed Croagh wind farm development in Chapters 5 to 14 of the Environmental Impact Assessment Report (EIAR).

2. PROJECT BACKGROUND AND DESCRIPTION

2.1 Background

2.1.1 Afforestation Approval

Replanting or off-site afforestation is a requirement of the Forestry Act 2014 and its consent is regulated by the Forestry Regulations 2017 (SI No 191 of 2017). Under the Forestry Regulations 2017, all applications for licences for afforestation require the prior written approval of the Minister for Agriculture, Food and the Marine. Before the Minister can grant approval, he must first determine if the project is likely to have a significant environmental effect. The lands assessed in this document have been granted Technical Approval by the Forest Service for afforestation.

The application for approval for afforestation is known as Pre-Planting Approval – Form 1 and is subject to the following procedures as outlined in S.I. No. 191/2017 - Forestry Regulations 2017:

- The application is referred to the relevant Forest Service Inspector for assessment and recommendations;
- If there are any environmental considerations identified, the application is referred to the relevant external body, e.g. National Parks and Wildlife Services, National Monuments Service, Regional Fisheries Boards, Local Authorities, etc., for consideration;
- If the proposed development is greater than 25 hectares the application is referred to the relevant Local Authority;
- If the site is greater than 2.5 hectares the application is advertised on the Department's website;
- If the site is greater than 50 hectares an Environmental Impact Assessment and planning permission are required (Part 3, Article 5 (2)(c) of S.I. 191/2017)

The Pre-Planting Approval – Form 1 requires a wide range of details in relation to the proposed area to be forested. Notwithstanding the size of the proposed application, the environmental considerations which must be answered/considered for the Forest Service approval are listed in Table 2.1 below. The Pre-Planting Approval – Form 1 notes that, if present, all items listed may require the Department to consult with prescribed bodies, while those in bold type may require the Department to undertake public consultation.

Table 2-1 Environmental Considerations in Afforestation Applications for Approval – Form 1

Environmental Considerations	
1	Water Quality
1.1	Is the area designated potentially acid sensitive by this Department (DAFM)?
1.2	Is the area >5 ha and sensitive for fisheries?
1.3	Is the area non-sensitive for fisheries and >40 ha?

1.4	Is the area >10 ha and within a catchment area of a Local Authority designated water scheme?
2	Designated Habitats
2.1	**Is the area within a NHA, pNHA, SAC, SPA or National Park?**
2.2	If the area is within an NHA, is a completed notifiable Action Form/ Action Requiring Consent Form (consent from National Parks and Wildlife Service) included?
2.3	If the area within a Hen Harrier SPA, will operations occur between the 1st of April and the 15th August inclusive?
2.4	Is the area within a NPWS referral zone for NHA, pNHA, SAC or SPA?
2.5	Is the area within 3 km upstream of a NHA, pNHA, SAC, SPA or National Park?
2.6	Is the area within a Fresh Water Pearl Mussel 6 km zone? If yes, the Forestry and Fresh Water Pearl Mussel Requirements Forms A and B should be included with the Application
2.7	Is the area within a Freshwater Pearl Mussel Catchment?
2.8	Does the area contain a current REPS plan habitat?
3	Archaeology
3.1	**Does the area contain an archaeological site or feature with intensive public usage?**
3.2	Does the area contain or adjoin a listed archaeological site or monument?
4	Landscape
4.1	**Is the area within a prime scenic area in the County Development Plan?**
4.2	Are there any other High Amenity Landscape considerations?
5	Size for Notification to Local Authority
5.1	Is the area greater than 25 ha?
6	Other Environmental Considerations
6.1	Specify

2.1.2 Proposed Replanting Lands

Three potential areas have been identified, and any replanting associated with the Croagh Wind Farm will take place at these lands or similarly Technically Approved lands. The potential sites have been assessed as part of the Afforestation Approval – Form 1 process described above and have obtained Technical Approval for Afforestation from the Forest Service. The list of Technically Approved lands

assessed in this report is presented in Table 2.2. Site location maps and further details on each site are provided in Sections 2.1.2 to 2.1.4 below.

Table 2-2 Proposed Replanting Locations

Location No.	Property Name	Location	Proposed Replanting Area (Hectares)
1	Stranamart	Co. Cavan	12.57ha
2	Brackloon	Co. Roscommon	7.2ha
3	Ballard	Co. Wicklow	39.56ha
Total Area Available			**59.33ha**

2.1.2.1 Forestry Replacement Area 1: Stranamart, Co. Cavan

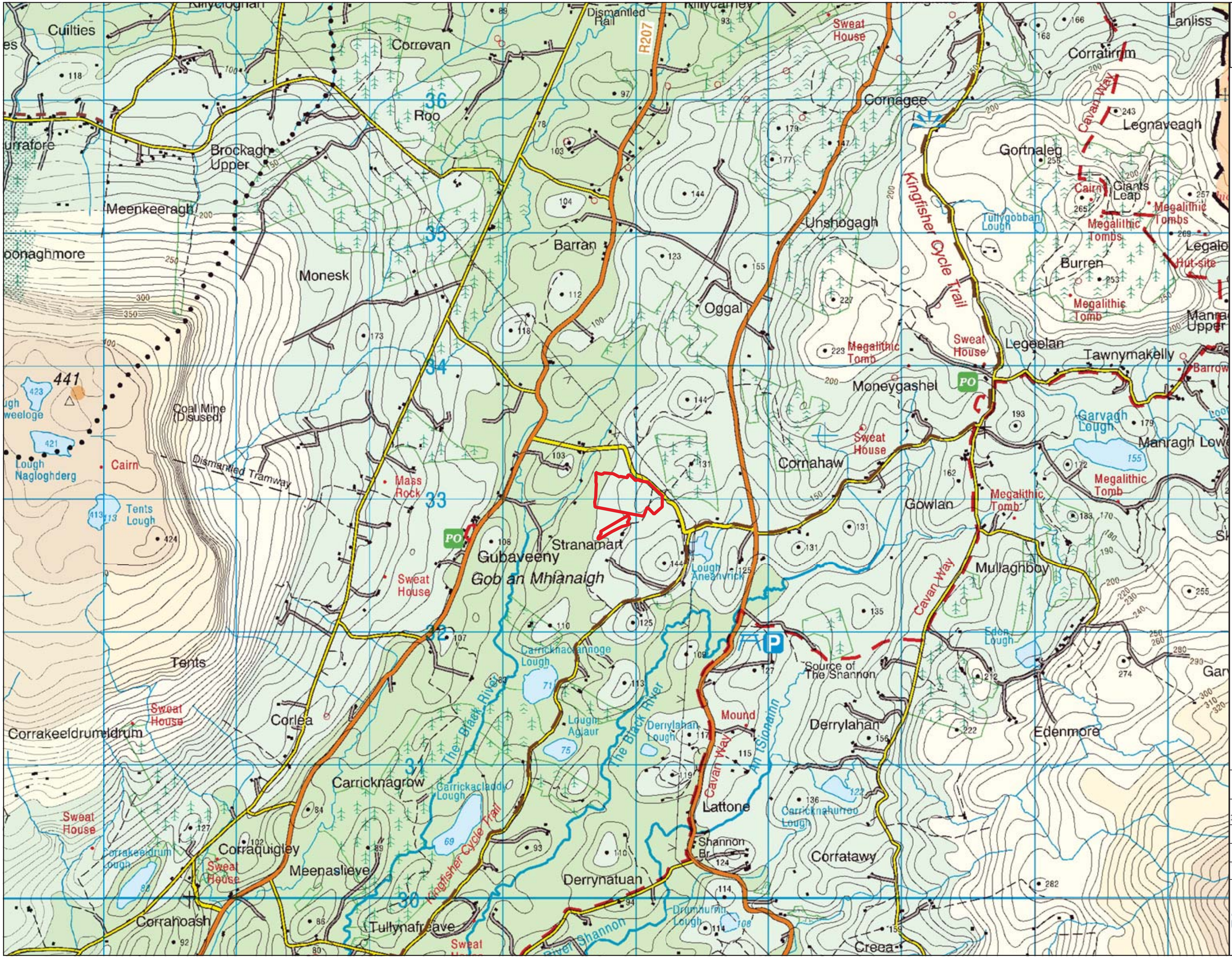
This replacement area is located in the townland of Stranamart, Co. Cavan, approximately 6.3km southwest of the town of Blacklion. This area has already been planted. Prior to afforestation, this replacement area comprised several small fields located within a rural setting The site location and aerial view are presented in Figure 2.1 and 2.2. The site is accessed via an existing track directly off a local road which connects to both the R207 and R206.The Technical Approval area for afforestation at Stranamart measures 12.57 hectares in total. The current land use is commercial forestry. The Cuilcagh - Anierin Uplands SAC/pNHA is located to the east and the Bolebrack Mountain SAC is 2.2km to the west.

2.1.2.2 Forestry Replacement Area 2: Brackloon, Roscommon

This replanting area is in the townland of Brackloon, Shankill, Co. Roscommon. The replanting site is located approximately 3.7km east of the village of Ballinagare and 8km west of the town of Elphin. The site location and aerial view are presented in Figure 2.3 and 2.4. The site will be accessed off local unnamed road which bounds the site to the east. The Technical Approval area for afforestation Brackloon measures 7.2 hectares in total. The current land use is pastoral farming. Existing Coillte forestry can be found immediately to the north and west and further to south and east.

2.1.2.3 Forestry Replacement Area 3: Ballard, Co. Wicklow

This replanting area is in the townland of Ballard in Co. Wicklow, approximately 1.3km west of the village of Ballinaclash and approximately 4km southwest of the Rathdrum town. Avondale Forest is located 3.5km to the east. The site location and aerial view are presented in Figure 2.5 and 2.6. The site is accessed via a track directly off a local unnamed road which runs along the southern boundary. The Technical Approval area for afforestation measures 39.56 hectares in total. Existing Coillte forestry can be found immediately to the south, and to the west and east.



Map Legend

Stranamart Forestry Replacement Site Location

Drawing Title: Site Location: Stranamart

Project Title: 180511 - Croagh Wind Farm EIAR

Drawn By	Checked By
Daire O'Shaughnessy	Eoin McCarthy
Project No.	**Drawing No.**
180511	Fig 2.1
Scale	**Date**
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MKO
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+353 (0) 91 735611
email:info@mkoireland.ie
Website: www.mkoireland.ie

Map Legend

Stranamart Forestry Replacement Site Location

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Drawing Title

Site Location: Stranamart

Project Title	180511 - Croagh Wind Farm EIAR
Drawn By: Daire O'Shaughnessy	Checked By: Eoin McCarthy
Project No.: 180511	Drawing No.: Fig 2.2
Scale: 1:5,000	Date: 15.06.20

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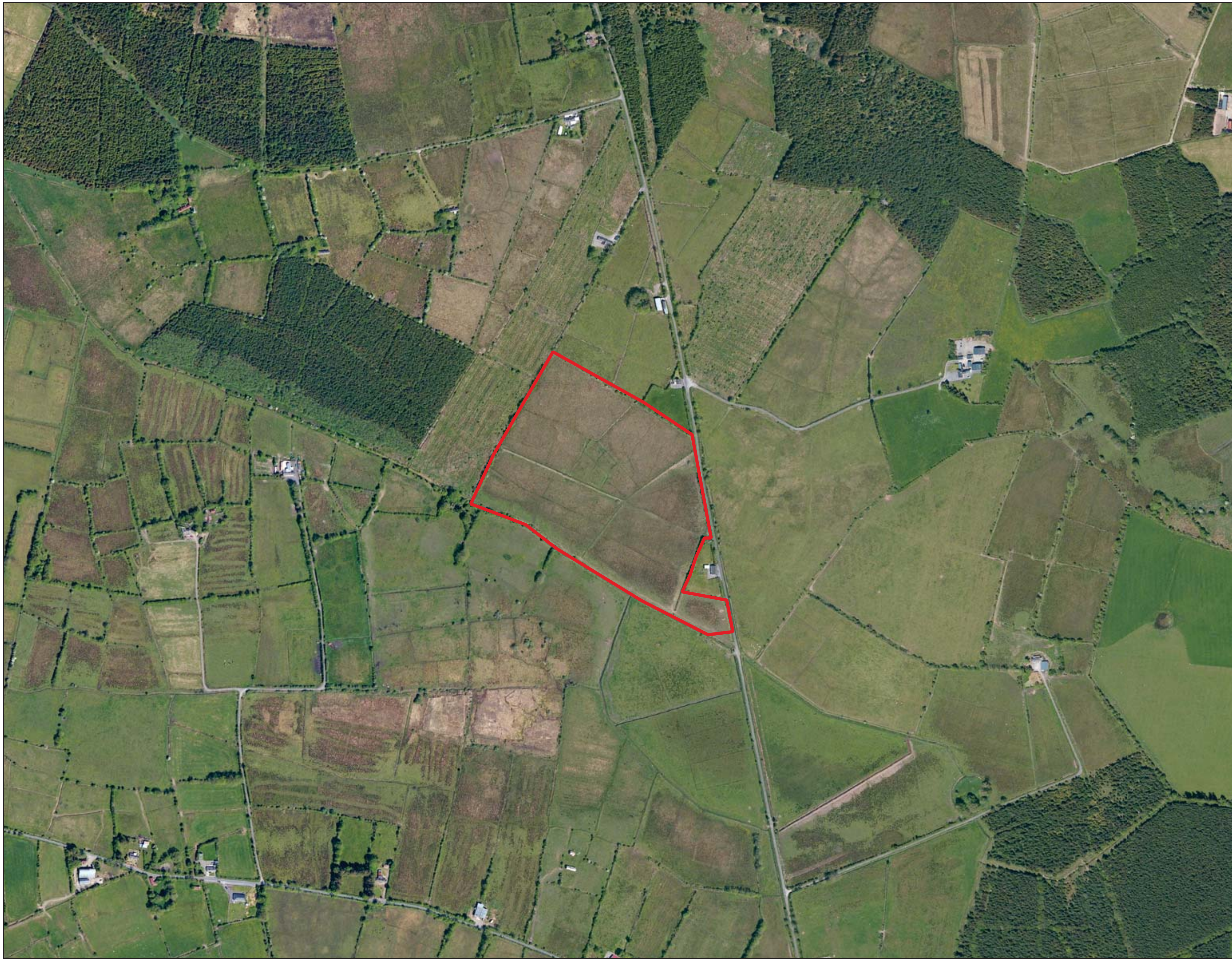

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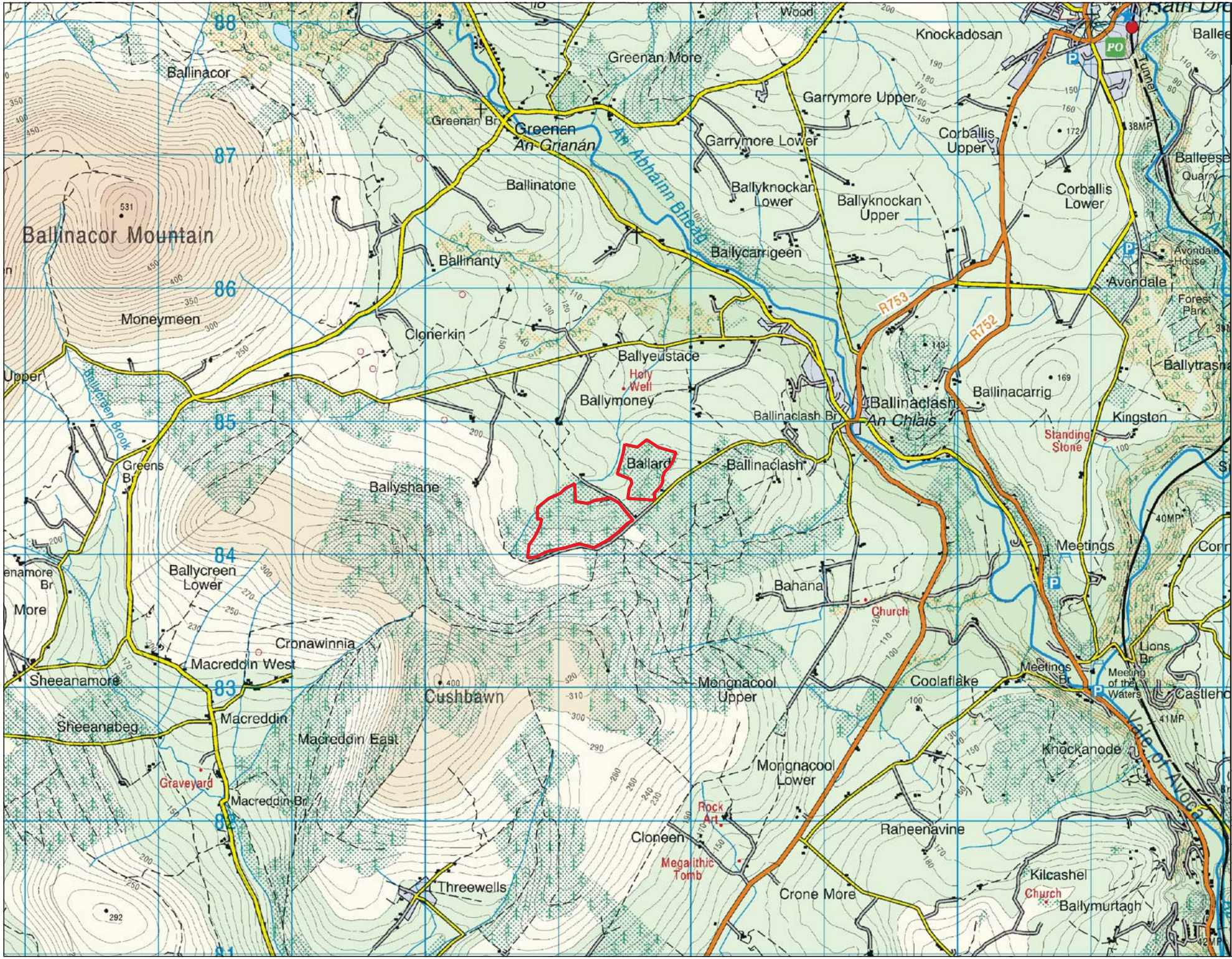

Map Legen1

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Site Location: mallar1

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Map Legend

Ballard Site Boundary

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Drawing Title

Site Boundary: Ballard

Project Title	180511 - Croagh Wind Farm EIAR
Drawn By: Daire O'Shaughnessy	Checked By: Eoin McCarthy
Project No.: 180511	Drawing No.: Fig 2.5
Scale: 1:5,000	Date: 15.06.20

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2.2 Proposed Afforestation Techniques

2.2.1 Forest Service Best Practice

Afforestation and subsequent harvesting will conform to current best practice Forest Service policies, strategic guidance documents as well as Coillte produced guidance documents, including the specific guidelines listed below, to ensure that newly planted trees remain viable and afforestation provides minimal potential impacts to the receiving environment.

- 'Land Types for Afforestation' [2016]
- 'Environmental Requirements for Afforestation' [2016]
- 'Forest Operations & Water Protection Guidelines' (2009)
- 'Methodology for Clear Felling Harvesting Operations' (2009)
- 'Forestry and Water Quality Guidelines' (2000)
- 'Forestry and the Landscape Guidelines' (2000)
- 'Forestry and Archaeology Guidelines' (2000)
- 'Forestry Biodiversity Guidelines' (2000)
- 'Forestry Protection Guidelines' (2002)
- 'Forestry Harvesting and Environmental Guidelines' (2000)

Planting will be carried out in accordance with the 'Forestry Schemes Manual' (Forest Service, 2011), which provides guidance in relation to ground cultivation, stocking and spacing, plant handling, planting dates, fertiliser application, fencing, fire, and weed control. Certain specific silvicultural and environmental conditions are also set out in the Forest Service Technical Approvals for each site, which will be adhered.

2.2.1.1 Planting

Planting will be by hand. The main forms of planting, as described in the Forestry Schemes Manual, are set out as follows.

Slit Planting

A spade is used to make a vertical slit in the ground. The trees roots are carefully positioned in the slit to ensure that roots are equally spaced in the vertical slit created. The slit is closed and firmed up ensuring the tree is vertical and upright. It is important to ensure that roots are not bent over which can lead to poor development, e.g. J root. This form of planting can be suitable for ribbons, mounds and ripped ground.

Angle Notch

A spade is used to cut a T or L-shaped slit in the ground. The spade is used to lift the slit and the trees roots placed underneath to ensure good root distribution without causing damage. The slit is closed and firmed up to ensure that stem is left vertical and upright.

Pit Planting

A spade is used to dig a hole and the trees roots placed in the centre. Soil is placed around the tree and firmed in, ensuring that it is upright and straight. This form of planting can be used in sensitive sites where no ground preparation has taken place. It may also be appropriate for steep slopes where other types of preparation may lead to sediment run off. The Technical Approvals for the proposed replanting lands include the species approved for afforestation.

2.2.1.2 Drainage

Drainage and sediment control at each site will conform to Forest Service best practice as detailed in the Forestry and Water Quality Guidelines and the Forests & Water Achieving Objectives under Ireland's River Basin Management Plan 2018-2021 . Appropriate drainage designs will include collector drains, interceptor drains and cut-off drains. A description of each drain type, as per the Forestry Schemes Manual, is set out below. Figure 2.7 presents a schematic diagram of each drain type.

Collector Drains

Collector drains collect water from mound drains, plough furrows, mole drains, etc., and discharge via sediment traps and/or an interceptor drain. Collector drains are excavated to a depth not greater than 10-15 cm below the depth of mound drains. Where collector drains must be extended into erodible material, 'mini' silt traps are placed appropriately by deepening the drains in places.

Interceptor Drains

Interceptor drains are constructed along the edges of aquatic buffer zones, i.e. areas where forest operations are curtailed, and which are managed for environmental protection and enhancement. Interceptor drains collect the discharge from the drainage sub-catchment and allow it to overflow into the buffer zone. In most cases, slope will allow for drainage channels to taper out or be connected to an interceptor drain rather than enter a buffer zone. However, on flat sites, or those with low slopes, it will be necessary to connect drains into the aquatic zone. This may be done only where it will not result in sediment or any pollutants entering the aquatic zone.

Cut off Drains

Cut off drains are constructed immediately up slope of a site and are designed to direct water away from the site.

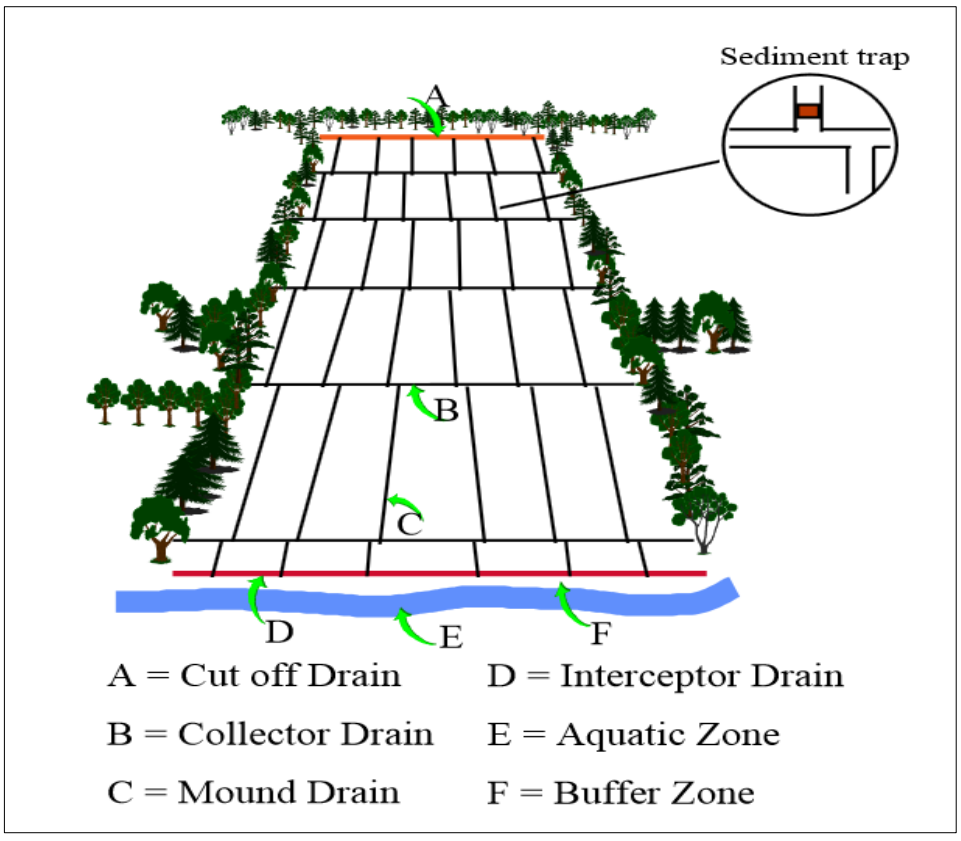


Figure 2-1 Standard Forestry Drainage (Forestry Schemes Manual, Forest Service, 2011)

3. PLANNING POLICY AND PLANNING HISTORY

This section contains relevant National and Local policies regarding forestry. This includes reference to several National forestry policy documents, the National Climate Change Strategy, as well as County Development Plans for Cavan, Roscommon and Wicklow.
This section of the report also addresses the planning history within and in the vicinity of the proposed replanting lands.

3.1 Planning Policy

3.1.1 National Policy

National Policy includes Forest Policy as well as policy on climate change. Forestry policy in Ireland is overseen by the Forest Policy Section of the Department of Agriculture, Food and the Marine (DAFM). At a European and International level, the Forest Policy Section is responsible for the transposition of EU Directives and Regulations into Irish Law as well as representing the Forest Service at a European Level. On a National Level, the policy Section deals with issues relating to climate change, carbon sequestration, wood energy, forestry and the environment, legislative framework and liaison with stakeholders which includes other Government agencies.

National Policy is aimed towards increasing Ireland's forest cover in a sustainable manner. As part of the Department's policy to ensure compatibility between forestry development and the protection of the environment, the Forest Service is implementing Sustainable Forest Management (SFM) with a view to ensuring that all timber produced in Ireland is derived from sustainably managed forests. This work is in accordance with Ireland's commitment to the six pan-European criteria for SFM adopted at the Third Ministerial Conference on the Protection of Forests in Europe, Lisbon, 1998. The implementation of SFM within Ireland is supported by the Irish National Forest Standard, the Code of Best Forest Practice and a suite of environmental guidelines (relating to water quality, landscape, archaeology, biodiversity and harvesting) as well as the work of the Forestry Inspectorate and the ongoing review of Irish forest legislation. These environmental guidelines are referred to in Section 3.1.1.4 below.

3.1.1.1 Forests, Products and People: Ireland's Forest Policy – A Renewed Vision

The Forests, Products and People document, published in 2014 by the Department of Agriculture, Food and the Marine, sets out the strategic goals and recommendations of the Forest Policy Review Group. The Strategic goal is to:

"*Develop an internationally competitive and sustainable forest sector that provides a full range of economic, environmental and social benefits to society and which accords with the Forest Europe definition of sustainable development.*"

The report notes the increasing economic, environmental and social role of forestry in Ireland, stating that forestry accounts for 10.8% of the land area of the country, which is low in comparison with other European countries. The strong forest growth rates found in Ireland when compared to other European countries is also noted. The role of forestry in rural development and diversification as well as rural employment is also recognised.

The document notes also the contribution of forests to mitigation of climate change through carbon sequestration which is referred to in the National Climate Change Strategy (see Section 3.1 below) and

notes that Irish forests will sequester approximately 4.8 million tonnes of C02 in 2020. This document's afforestation policy therefore supports Ireland's efforts to reach the greenhouse gas emission reduction targets as well as reducing dependence on fossil fuels.

The role of the forest resource in contributing to the renewable energy policy goals such as achieving a percentage of power generation by co-firing with biomass, as well as biomass in power generation is also noted. The report notes that the contribution of forestry to achieving renewable energy targets is dependent on the scale and accessibility of the resource, and that a continuation of afforestation in order to maintain a sustainable level supply of small roundwood would result in confidence for investment in Combined Heat and Power and other wood energy mechanisms.

Some recommended relevant policies and actions include:

- Expansion of the Forest Resource: To increase the forest area in accordance with sustainable forest management (SFM) principles, in order to support a long term sustainable roundwood supply of 7 to 8 million cubic metres per annum. This policy aims to increase afforestation to 15,000 hectares.
- Management of the Resource: To ensure that the sustainable management of the forest resource in accordance with best practice thereby ensuring its capacity to provide the full range of timber and other benefits.
- Environment and Public Goods: To ensure that afforestation, management of existing forests and development of the forest sector are undertaken in a manner that enhances their contribution to the environment and the capacity to provide public goods and services.

3.1.1.2 Forestry Programme 2014-2020

The Forestry Programme was submitted by the Department of Agriculture, Food and the Marine in accordance with EU Guidelines on State aid for agriculture and forestry in rural areas 2014-2020 and represents Ireland's proposals for 100% State aid funding for a new forestry programme 2014-2020. These measures are consistent with the document 'Forests, products and people; Ireland's forest policy – a renewed vision' as referred to in Section 3.1.1 above.

This document contains several responses to the actions and policies identified in the above document, and these include an Afforestation scheme - this is the main response to the policy entitled '*Expansion of the forest resource'*.

An identification of needs was carried out by the Department of Agriculture, Food and the Marine (DAFM) in relation to forestry, and these needs are as follows:

- *Increase, on a permanent basis, Ireland's forest cover to capture carbon, produce wood and help mitigation;*
- *Increase and sustain the production of forest-based biomass to meet renewable energy targets;*
- *Support forest holders to actively manage their plantations;*
- *Optimise the environmental and social benefits of new and existing forests.*

Several measures are proposed to meet these needs, and the most relevant of these refers to the first measure, which is aimed at increasing Ireland's forest cover (at approximately 10.7% which is well below the EU average of 38%. The aim is to increase forest cover to 18% by the mid-century. The second need, that to increase forest-based biomass in order to meet the stated targets for renewable energy by 2020.

3.1.1.3 Project Ireland 2040- National Planning Framework

Agricultural diversification and alternative landuses are necessary in order to maintain and create jobs in rural Ireland where low quality land presents challenges for sustainable development and economic growth. Afforestation is recognised as an alternative landuse which creates rural employment and drives the national economy. The direct and indirect contribution of the forestry sector to the economy has been calculated at €2.3 billion annually. Afforestation play an important role reaching national CO_2 target emissions "*through carbon sequestration in forests and the provision of renewable fuels and raw materials. Irish forestry is a major carbon sink and afforestation is the most significant mitigation option that is available to Ireland's land use sector".* In order to facilitate this further, the annual target for afforestation by 2020 is 8,290 hectares, an increase in over 2,000 hectares over the past three years.

Table 3-1 Project Ireland 2040 NPF Objectives which relate to forestry

National Policy Objective 23	Facilitate the development of the rural economy through supporting a sustainable and economically efficient agricultural and food sector, together with forestry, fishing and aquaculture, energy and extractive industries, the bio-economy and diversification into alternative on-farm and off-farm activities, while at the same time noting the importance of maintaining and protecting the natural landscape and built heritage which are vital to rural tourism.

3.1.1.4 National Climate Change Strategy 2007-2020

The National Climate Change Strategy notes that forest residues and thinnings are recognised as a major biomass resource alongside dedicated energy crops and farm wastes. It also notes that the Department of Agriculture run several schemes to encourage afforestation (Afforestation Grant Scheme) and early harvesting (Forest Roading Scheme), as well as schemes aimed at encouraging the growth of biomass crops such as miscanthus and willow. Such schemes are complimented by the RETROFIT 3 scheme, which aims to create a demand for the biomass by encouraging the bioenergy industry.

3.1.2 Local Policy

3.1.2.1 Cavan County Development Plan 2014-2020

The Cavan County Development Plan (CDP) sets out the counties plans and objectives regarding strategic landuse and is reviewed every six years. The current adopted plan illustrates the county's vision for continuous, sustainable development for the period 2014 to 2020.

The CDP recognises the National Spatial Strategy (NSS) classification of Cavan as located within the 'Border Region', one of the Eight Regions established for the Republic of Ireland. The 'Border Region' comprises Donegal, Louth, Sligo, Monaghan, Leitrim and Cavan. The NSS further divides the Border Region into three subcategories with Cavan falling under the classification of 'Rural Areas with strong Potential for Diversification'. These areas have the potential for rural diversification based around a possible mix of activities including forestry. The Cavan CDP considers enterprises such as forestry a means to provide employment and maintain populations in rural areas.

The CDP supports the diversification and sustainable development of appropriate lands to forestry subject to appropriate location selection in order to prevent potential impacts on the environment, landscape, visual amenity etc., all of which can be minimised through careful planning. The CDP is careful to point out that new access points for, and additional traffic generated by, afforestation developments should be avoided in order to prevent potential impacts on National Roads with over 60kmh speed limits.

Policies and objectives related to forestry and rural enterprise can be found in Table 3.2.

Table 3-2 Policies and Objectives of the Cavan CDP which relate to forestry

EDP5	Encourages the sustainable development of rural enterprises within the County.
EDP11	To encourage the development of a well-managed sustainable forestry sector, which is planted, managed and harvested in accordance with the 'Forest Service Guidelines for Landscape, Forest Harvesting and Environmental, Archaeology, Biodiversity and Water Quality.'
EDP12	To encourage forestry and forestry related development, as a means of diversifying from traditional farming activity.
EDP13	To promote forestry development of appropriate scale and character whilst ensuring that the development does not have a negative visual impact on the countryside or cause pollution or degradation to wildlife habitats, natural waters or areas of ecological importance.
EDP14	To encourage the provision of public access to forests for walking routes, recreational areas and other similar facilities.
EDP15	To retain existing right of way through forest lands.
ED013	To promote the growth of rural enterprises whilst ensuring the protection of the environment and our natural assets. Individual projects shall be accessed on a case by case basis in line with best practice and in compliance with all sections of this plan.
ED014	To promote the diversification of the rural economy and the growth of rural indigenous industry, such as farming, forestry and tourism, while safeguarding the environment and the role of the rural area as an asset.
EDO27	To promote and support the Forest Service in the preparation and adoption of the 'Indicative Forestry Strategy for County Cavan,' in order to plan sustainable forestry development.
EDO28	To investigate, with Coillte, the potential to provide forest and countryside walks on lands in state ownership in County Cavan and in the promotion of a high level of environmental quality/protection.
EDO29	To promote the planting of native deciduous trees and mixed forestry.
EDO30	To resist forestry proposals which would unduly impact on protected views, sensitive upland areas, lands of wildlife interest and in the upper reaches of salmonid rivers which would affect biodiversity.
EDO31	That existing Rights of Way and established walking routes are identified prior to any new planting and are maintained as Rights of Way/Walking Route.
EDO32	To ensure forestry and forestry type development adheres to the 'Forestry and Water Quality Guidelines,' issued by the Forest Service, DAFF.

3.1.2.2 Roscommon County Development Plan 2014-2020

The Roscommon CDP states that the council acts as a consultee rather than an assessor in relation to forestry development and adhere to the 'Code of Best Forestry Practice – Ireland (2000)'. The council recognise the benefits of forestry as a method of: boosting the rural economy, encouraging population growth and agricultural diversity, and assisting in Irelands goal of reaching CO_2 target emissions. It is also recognised as a recreational use and therefore the council encourages forestry development. However, any such afforestation proposals must be appropriate in scale and nature with the surrounding environment to the location, comply with the following:

- *"landscapes of scenic value are not unduly eroded.*
- *areas with environmental and archaeological protections are safeguarded.*
- *access from forestry development onto public roads for the purposes of thinning and felling do not compromise traffic safety"*

Roscommon County Council (RCC) requests a mixture of broadleaf and conifer species to be planted where possible in order to support flora and fauna species and to encourage rich biodiversity in the forestry landscape. A planting free zone of 30m along public roads should be observed. Reference should be made to the document Code of Best Forestry Practice – Ireland (2000), published by the Forest Service, Department of the Marine and Natural Resources.

Policies and objectives in the Roscommon CDP which relate to forestry can be found in Table 3-3 below.

Table 3-3 Policies and objectives in Roscommon CDP which relate to forestry

Policy 188	RCC shall facilitate forestation in suitable locations in co-operation with the Forest Service and Coillte Teoranta and in accordance with sustainable Forest Management guidelines including; • Forestry and Landscape Guidelines in order to enhance the overall landscape, involving shape, scale, diversity, visual force and unity • Forestry and Water Quality Guidelines including recommendations in relation to sensitive water catchments, cultivation, drainage, fertilizing and storage, the use of chemicals, herbicides and fuels, road making, bridges and culverts and harvesting Forestry and Archaeology Guidelines designed to ensure that Ireland's rich heritage of archaeological sites and artifacts are not damaged by forest operations • Forest Biodiversity Guidelines to recognize the importance of the maintenance and enhancement of forest biodiversity and implement the objectives in a forestry context of the National Biodiversity Plan such as structural diversity, retained habitats and open spaces, the retention of deadwood, the control of troublesome species and the use of conservation of native species • Forest Harvesting and Environmental Guidelines to ensure that all forest harvesting operations, including felling, extraction, road and site restoration, are environmentally sustainable
Policy 189	Facilitate forestation in appropriate locations, in co-operation with Coillte Teoranta and the Forest Service and in line with National policy and the Roscommon LCA (S 3.6 of the LCA Report 2007), while ensuring the no pollution or injury is caused to natural waters, wildlife habitats or conservation areas
Policy 190	Discourage forestry development in proposed/candidate/adopted SAC's, NHA'S and SPA's, in designated Sensitive Rural Landscapes and in water quality

	sensitive areas
Policy 191	Promote appropriate forestry related industries and rural tourism.
Policy 192	Prevent excessive forestation that would negatively impact on rural communities i.e. forestry development should be appropriate to the surrounding area in terms of nature and scale and should not allow that residential development becomes isolated when plantations mature
Policy 193	Promote mixed species forestry and selective rather than clear felling
Policy 194	The Council will co-operate with Coillte Teoranta, the Forest Service and private landowners in promoting greater public access and recreational use of Forests in the County
Policy 195	Have regard to the Bio-energy Action Plan for Ireland 2007, to the Department of Agriculture and Food Best Practice Manuals and to the LCA when considering significant planting of bio energy crops
Policy 196	RCC shall support the development of the bio energy industry over the Plan period.

3.1.2.3 Wicklow County Development Plan 2016-2022

The Wicklow County Development Plan (CDP) outlines the economic, social, cultural, and environmental aims and objectives of the council to ensure proper planning and sustainable development until 2022 and beyond. Please see Table 3.4 for details.

3.1.2.3.1 *Wicklow Indicative Forestry Strategy 2002*

County Wicklow has a long history of forest management establishing Irelands first forestry training centre in Avondale in 1905. Since then, a strong tradition of forest management has sustained throughout the county. Wicklow County Council developed the 'Wicklow Indicative Forestry Strategy' in 2002 to assist planners in the assessment of afforestation proposals. The Strategy also establishes Areas Preferred to Afforestation and Areas Sensitive to Afforestation.

Table 3-4 Forestry Objectives and Policies of Wicklow County Council.

Strategic Objective	To promote state and private afforestation, to a scale and in a manner, which maximises its contribution to the County's economic and social wellbeing on a sustainable basis and which is compatible with the protection of the environment.
FTY1	To facilitate afforestation in appropriate locations, in accordance with the 'Wicklow Indicative Forestry Strategy' (Wicklow County Council, 2002), and in co-operation with forestry operators and the Forest Service. The Wicklow Indicative Forestry Strategy was produced by the Council in 2002, in consultation with the Forest Service. The strategy is intended to be a tool of assistance to planners in dealing with proposals for forestry applications. The strategy includes a list of areas that are preferred for afforestation and a list of areas where afforestation would be inappropriate by virtue of landscape, soil type, settlement or environmental grounds. The strategy also includes a series of objectives which are intended to guide planning decisions. The Council will have particular regard

	to developments that are 13 Farm shops refer to premises primarily for the sale of produce originating from the farm holding or the local area. Chapter 5 | Economic Development Wicklow County Development Plan 2016-2022 located in the areas included in 'Table 3: Areas Sensitive to Afforestation', and as per the Strategy, should be consulted on all forestry grant applications in these areas
FTY2	To promote afforestation in co-operation with relevant agencies, including the Forest Service (Department of Agriculture, Food and the Marine) and forestry operators and to ensure that afforestation is undertaken in a manner that is consistent with the principle of 'sustainable forest management'. The Council will only permit development that complies with the following: › The development is compatible with the protection of the environment, and does not cause pollution or degradation of wildlife habitats, natural waters or areas of ecological importance; › the development does not have a negative visual impact on the scenic quality of the countryside, and is of an appropriate nature and scale to the surrounding area; › the development is not detrimental to archaeological or other historic/heritage features; and, › the Council will permit forestry development where it is considered that the roads infrastructure (in terms of design, width, surfacing etc.), which is to serve the development, can accommodate the proposed development. No development will be permitted that will result in damage to roads infrastructure or undue nuisance to other road users. The Council may apply a special financial levy to certain developments for works that are required to be undertaken to the road network.
FTY3	To promote the use of forests for appropriate recreation purposes and to facilitate the development of appropriate recreation facilities at suitable locations. The recreational use of forests will only be permitted where it can be demonstrated that the recreational use is compatible with the other forest objectives, functions and values of the forest, such as timber production, sensitive habitats and important archaeology. Developments will only be permitted that are acceptable in terms of other planning considerations, including the provision of acceptable infrastructure such as roads, car parking, water and sewerage infrastructure.
FTY4	To promote County Wicklow as a 'centre of excellence' in the forestry research and management field. The Council will facilitate the development of forestry research / interpretative centres, at appropriate locations.
FTY5	To promote the use of native hardwood species using seed of native provenance where possible in afforestation schemes. The use of native species or a broadleaf / conifer mixture and age class diversity can enhance the visual impact and biodiversity of forests.
FTY6	To encourage the development of farm forestry as a means of promoting rural diversity and strengthening the rural economy.
FTY7	To encourage the development of forestry for timber biomass which can be used as a renewable energy source.

3.1.3 Forest Service Guidelines

The Environmental Requirements for Afforestation, released in December 2016, incorporate more recent developments in relation to environmental regulation, research and changes in forest practices, and consolidate into one single coherent document those measures and safeguards relating to afforestation which were previously contained within the following Forest Service Environmental 'Guidelines': Forestry & Water Quality Guidelines, Forestry & Archaeology Guidelines, Forestry & the Landscape Guidelines and Forest Biodiversity Guidelines. The use of the word 'requirements' in the title was selected over 'guidelines', in order to underline the mandatory nature of the measures therein.

The overall aim of the Environmental Requirements for Afforestation is to ensure that the establishment of forests is carried out in a way that is compatible with the protection and enhancement of the environment, regarding water quality, biodiversity, archaeology, landscape and other environmental receptors. In relation to water, the focus is on reducing and eliminating sources of pollution and preventing the creation of pathways to receiving waters. The Requirements provide an enhanced 'baseline' level of protection regarding afforestation and water, with the water setback representing an important feature. They will also support the Plan for Forestry & Freshwater Pearl Mussel in Ireland, by providing an enhanced baseline level of protection regarding afforestation and water.

The Environmental Requirements for Afforestation are set out in three stages that reflect the project development process, i.e. pre-application design, site works, and ongoing site management. While some overlap exists, these three stages reflect the typical sequence of activities undertaken by an Applicant and her / his Registered Forester, and the corresponding sequence of mandatory environmental measures that apply, throughout afforestation up until the end of the premium period (or 15 years, for non-grant aided forests).

3.1.4 Planning History

A planning history search was carried out for the proposed replanting lands and the lands in their immediate vicinity. This entailed reference to the Planning Application search facility and maps on the website of each relevant Planning Authority, i.e. Cavan County Council, Roscommon County Council and Wicklow County Council. The planning history searches found that planning applications in the vicinity of the proposed replanting lands comprise one-off houses or agricultural buildings. No projects or plans of similar scale and type within proximity to the replanting site were identified that would be incompatible with the proposed replanting or give rise to significant cumulative impacts.

4. IMPACT ASSESSMENT METHODOLOGY

The impacts associated with afforestation at the potential replanting land are assessed in Sections 5 to 12 of this document under the following key environmental headings:

- Biodiversity
- Land, Soils and Geology
- Hydrology and Hydrogeology
- Landscape
- Cultural Heritage
- Air, Climate and Noise
- Population & Human Health
- Material Assets

Each site is addressed separately under the key environmental headings, and described in terms of Baseline Environment, Impact Assessment, Proposed Mitigation Measures and Residual Impacts. The findings of the assessment are presented in Sections 5 to 12 of this report.

Impacts are described in terms of quality, significance, duration and type, where possible. The classification of impacts in this report uses the standard best-practice terms provided in the Environmental Protection Agency document, "Draft Guidelines on the Information to be Contained in Environmental Impact Assessment Reports' in August 2017 (an update for the 'Guidelines on the Information to be contained in Environmental Impact Statements' (2002). Table 1.1 (page 1-6) of this EIAR presents a copy of the EPA glossary of terms.

Appropriate mitigation measures are presented where relevant to reduce, remedy or eliminate potential impacts. Residual impacts are also presented following any impact for which mitigation measures are prescribed.

5. BIODIVERSITY

This section of the report includes accurate descriptions of the baseline ecological environment of the forestry replacement lands, which is based on an appropriate level of survey work that was carried out in accordance with the most appropriate guidelines and methodologies. The assessment then completes a thorough assessment of the impacts of the proposed afforestation on biodiversity. Where likely ecologically significant effects are identified, measures are prescribed to avoid or minimise or compensate for such effects associated with afforestation, at the following locations:

5.1 Establishing the Zone of Influence

As described in the CIEEM, 2018 *Guidelines for Ecological Impact Assessment in The UK and Ireland*, *'the 'zone of influence' for a project is the area over which ecological features may be affected by biophysical changes as a result of the proposed project and associated activities'*. The zone of influence will vary with different ecological features, depending on their sensitivities to an environmental change. This may extend beyond the project site, for example where there are ecological or hydrological links beyond the site boundaries.

The assessment of the site began with a desk study of available published data on sites designated for nature conservation, other ecologically sensitive sites, habitats and species of interest near the proposed development. A review of OSI mapping, online environmental web-mappers and ortho-photography was also undertaken. The baseline information obtained from the desk study was the first stage in defining a zone of influence of the proposed development.

The zone of likely influence for the proposed development varied depending on the ecological receptors identified on site. In the assessment, effects on habitats and species within the site were considered and also the potential for the proposed development to affect habitats and species outside the site.

5.2 Methodology

5.3 Field Surveys

Ecological site visits were undertaken to the subject sites between 2016 and 2019. Habitats were identified in accordance with the Heritage Council's *'Guide to Habitats in Ireland'* (Fossitt, 2000). Plant nomenclature for vascular plants follows '*New Flora of the British Isles*' (Stace, 2010), while mosses and liverworts nomenclature follows '*Mosses and Liverworts of Britain and Ireland - a field guide'* (British Bryological Society, 2010).

The multi-disciplinary walkover surveys was designed to detect the presence, or likely presence, of a range of protected habitats and species. Incidental sighting/observations of birds and additional fauna were noted during the site visits. Surveys were undertaken in accordance best practice guidance (TII, 2008: *Ecological Surveying Techniques for Protected Flora and Fauna during the Planning of National Road Schemes*). During the multi-disciplinary ecological walkover surveys the potential for the study area to support protected mammals listed in the Wildlife Acts, 1976–2019, such as pine marten, red squirrel, Irish hare, pygmy shrew, Irish stoat etc. was assessed.

During the multi-disciplinary walkover surveys, a search for non-native invasive species was undertaken. The survey focused on the identification of invasive species listed under the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations 2011 (As Amended) (S.I. 477 of 2015).

Features within the sites were visually assessed for potential as bat roosting habitat using a protocol set out in the Bat Conservation Trust (BCT) Bat Surveys for Professional Ecologists: good practice Guidelines (3rd edn.) (Collins, J (ed.), 2016). Table 4.1 of the BCT Guidelines identifies a grading protocol for assessing structures, trees and commuting/foraging habitat for bats. The protocol is divided into four Suitability Categories: High, Moderate, Low and Negligible.

Seasonal factors that affect distribution patterns and habits of species were taken into account when conducting the surveys. The potential of the sites to support certain populations (in particular those of conservation importance that may not have been recorded during the field survey due to their seasonal absence or nocturnal/cryptic habits) was assessed. All habitats were readily identifiable and it is considered that a comprehensive and accurate assessment of the habitats was achieved.

5.3.1 Desk Study

The following sections detail the results of the searches of published material that were consulted as part of the desk study. These included the Site Synopses of relevant designated sites as compiled by the National Parks and Wildlife Service (NPWS) of the Department of Culture Heritage, and the Gaeltacht (CHG) bird and plant distribution atlases and other research publications.

5.3.1.1 Designated Sites

5.3.1.1.1 *European Sites*

The Habitats Directive (together with the Birds Directive) forms the cornerstone of Europe's nature conservation policy. It is built around two pillars: the Natura 2000 network of protected sites and the strict system of species protection. In total, the Habitats Directive protects over 1,000 animal and plant species and over 200 'habitat types' (e.g. special types of forests, meadows, wetlands, etc.), which are of European importance.

With the introduction of the EU Habitats Directive (92/43/EEC) and Birds Directive (79/409/EEC) which were transposed into Irish law as S.I. No. 94/1997 *European Communities (Birds and Natural Habitats) Regulations* 1997, the European Union formally recognised the significance of protecting rare and endangered species of flora and fauna, and also, more importantly, their habitats. The 1997 Regulations and their amendments were subsequently revised and consolidated in S.I. No. 477/2011- *European Communities (Birds and Natural Habitats) Regulations* 2011. This legislation requires the establishment and conservation of a network of sites of particular conservation value that are to be termed 'European Sites'. This includes Special Areas of Conservation and Special Protection Areas, as described below.

Special Areas of Conservation

Articles 3 – 9 of the EU Habitats Directive (92/43/EEC) provide the EU legislative framework of protecting rare and endangered species of flora and fauna, and habitats. Annex I of the Directive lists habitat types whose conservation requires the designation of Special Areas of Conservation (SAC). Priority habitats, such as Turloughs, which are in danger of disappearing within the EU territory are also listed in Annex I. Annex II of the Directive lists animal and plant species (e.g. Marsh Fritillary, Atlantic Salmon, and Killarney Fern) whose conservation also requires the designation of SAC. Annex IV lists animal and plant species in need of strict protection such as Lesser Horseshoe Bat and Otter, and Annex V lists animal and plant species whose taking in the wild and exploitation may be subject to management measures. In Ireland, species listed under Annex V include Irish Hare, Common Frog and Pine Marten.

Species can be listed in more than one Annex, as is the case with Otter and Lesser Horseshoe Bat which are listed on both Annex II and Annex IV.

Special Protection Areas

Council Directive 79/409/EEC of 2 April 1976 on the conservation of wild birds (Birds Directive) has been substantially amended several times. In the interests of clarity and rationality the said Directive was codified in 2009 and is now cited as Directive 2009/147/EC. The Directive instructs Member States to take measures to maintain populations of all bird species naturally occurring in the wild state in the EU (Article 2). Such measures may include the maintenance and/or re-establishment of habitats in order to sustain these bird populations (Article 3).

A subset of bird species have been identified in the Directive and are listed in Annex I as requiring special conservation measures in relation to their habitats. These species have been listed on account of inter alia: their risk of extinction; vulnerability to specific changes in their habitat; and/or due to their relatively small population size or restricted distribution. Special Protection Areas (SPAs) are to be identified and classified for these Annex I listed species and for regularly occurring migratory species, paying particular attention to the protection of wetlands (Article 4).

5.3.1.1.2 *Nationally Designated Sites*

Natural Heritage Areas (NHAs) and Proposed Natural Heritage Areas (pNHAs) are heritage sites that were designated for the protection of flora, fauna, habitats and geological sites under the Wildlife (Amendment) Act 2000. These sites do not form part of the Natura 2000 network.

5.3.2 Methodology for Assessment of Impacts and Effects

5.3.2.1 Identification of Target Receptors and Key Ecological Receptors

The methodology for assessment followed a precautionary screening approach with regard to the identification of Key Ecological Receptors (KERs). Following a comprehensive desk study, site visits were undertaken, "Target receptors" likely to occur in the zone of influence of the development were identified. The target receptors included habitats and species that were protected under the following legislation:

- Annexes of the EU Habitats Directive
- Qualifying Interests (QI) of Special Areas of Conservation (SAC) within the likely zone of impact.
- Species protected under the Wildlife Acts 1976-2019
- Species protected under the Flora Protection Order 2015

5.3.2.2 Determining Importance of Ecological Receptors

The importance of the ecological features identified within the study area was determined with reference to a defined geographical context. This was undertaken following a methodology that is set out in Chapter 3 of the '*Guidelines for Assessment of Ecological Impacts of National Roads Schemes*' (NRA, 2009). These guidelines set out the context for the determination of value on a geographic basis with a hierarchy assigned in relation to the importance of any particular receptor. The guidelines provide a basis for determination of whether any particular receptor is of importance on the following scales:

- International
- National
- County
- Local Importance (Higher Value)
- Local Importance (Lower Value)

The Guidelines clearly set out the criteria by which each geographic level of importance can be assigned. Locally Important (lower value) receptors contain habitats and species that are widespread and of low ecological significance and of any importance only in the local area. Internationally Important sites are either designated for conservation as part of the Natura 2000 Network (SAC or SPA) or provide the best examples of habitats or internationally important populations of protected flora and fauna. Specific criteria for assigning each of the other levels of importance are set out in the guidelines and have been followed in this assessment. Where appropriate, the geographic frame of reference set out above was adapted to suit local circumstances. In addition, and where appropriate, the conservation status of habitats and species is considered when determining the significance of ecological receptors.

Any ecological receptors that are determined to be of National or International, County or Local importance (Higher Value) following the criteria set out in NRA (2009) are considered to be Key Ecological Receptors (KERs) for the purposes of ecological impact assessment if there is a pathway for effects thereon. Any receptors that are determined to be of Local Importance (Lower Value) are not considered to be Key Ecological Receptors.

5.3.2.3 Characterisation of Impacts and Effects

The proposed development will result in a number of impacts. The ecological effects of these impacts are characterised as per the CIEEM '*Guidelines for Ecological Impact Assessment in the UK and Ireland*' (2018). These guidelines are the industry standard for the completion of Ecological Impact Assessment in the UK and Ireland. This chapter has also been prepared in accordance with the corresponding EPA guidance (EPA 2017). The headings under which the impacts are characterised follow those listed in the guidance document and are applied where relevant. A summary of the impact characteristics considered in the assessment is provided below:

- **Positive or Negative.** Assessment of whether the proposed development results in a positive or negative effect on the ecological receptor.
- **Extent.** Description of the spatial area over which the effect has the potential to occur.
- **Magnitude** Refers to size, amount, intensity and volume. It should be quantified if possible and expressed in absolute or relative terms e.g. the amount of habitat lost, percentage change to habitat area, percentage decline in a species population.
- **Duration** is defined in relation to ecological characteristics (such as the lifecycle of a species) as well as human timeframes. For example, five years, which might seem short-term in the human context or that of other long-lived species, would span at least five generations of some invertebrate species.
- **Frequency and Timing.** This relates to the number of times that an impact occurs and its frequency. A small-scale impact can have a significant effect if it is repeated on numerous occasions over a long period.
- **Reversibility.** This is a consideration of whether an effect is reversible within a 'reasonable' timescale. What is considered to be a reasonable timescale can vary between receptors and is justified where appropriate in the impact assessment section of this report.

5.3.2.4 Determining the Significance of Effects

The ecological significance of the effects of the proposed development are determined following the precautionary principle and in accordance with the methodology set out in Section 5 of CIEEM (2018).

For the purpose of Ecological Impact Assessment (EcIA), 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives for 'important ecological features' or for biodiversity in general. Conservation objectives may be specific (e.g. for a designated site) or broad (e.g. national/local nature conservation policy) or more wide-ranging (enhancement of biodiversity). Effects can be considered significant at a wide range of scales from international to local (CIEEM, 2018).

When determining significance, consideration is given to whether:

- Any processes or key characteristics of key ecological receptors will be removed or changed
- There will be an effect on the nature, extent, structure and function of important ecological features
- There is an effect on the average population size and viability of ecologically important species.
- There is an effect on the conservation status of important ecological habitats and species.

The EPA draft *Guidelines on information to be included in Environmental Impact Assessment Reports* (EPA, 2017) and the *Guidelines for assessment of Ecological Impacts of National Road Schemes*, (NRA, 2009) were also considered when determining significance and the assessment is in accordance with those guidelines.

The terminology used in the determination of significance follows the suggested language set out in the Draft EPA Guidelines (2017) as shown in

Table 5.1.

Table 5.1 Criteria for determining significance of effect, based on (EPA, 2017) guidelines

Effect Magnitude	Definition
No change	No discernible change in the ecology of the affected feature.
Imperceptible effect	An effect capable of measurement but without noticeable consequences.
Not Significant	An effect which causes noticeable changes in the character of the environment but without significant consequences.
Slight effect	An effect which causes noticeable changes in the character of the environment without affecting its sensitivities.
Moderate effect	An effect that alters the character of the environment that is consistent with existing and emerging trends.
Significant effect	An effect which, by its character, its magnitude, duration or intensity alters a sensitive aspect of the environment.
Very Significant	An effect which, by its character, magnitude, duration or intensity significantly alters most of a sensitive aspect of the environment.
Profound effect	An effect which obliterates sensitive characteristics.

As per TII (NRA, 2009) and CIEEM (2018) best practice guidelines, the following key elements should also be examined when determining the significance of effects:

- The likely effects on 'integrity' should be used as a measure to determine whether an impact on a site is likely to be significant (NRA, 2009).
- A 'significant effect' is an effect that either supports or undermines biodiversity conservation objectives (CIEEM, 2018).

Integrity

In the context of EcIA, 'integrity' refers to the coherence of the ecological structure and function, across the entirety of a site, that enables it to sustain all of the ecological resources for which it has been valued (NRA, 2009). Impacts resulting in adverse changes to the nature, extent, structure and function of component habitats and effects on the average population size and viability of component species, would affect the integrity of a site, if it changes the condition of the ecosystem to unfavourable.

Conservation status

An impact on the conservation status of a habitat or species is considered to be significant if it will result in a change in conservation status. According to CIEEM (2018) guidelines the definition for conservation status in relation to habitats and species are as follows:

- Habitats – conservation status is determined by the sum of the influences acting on the habitat that may affect its extent, structure and functions as well as its distribution and its typical species within a given geographical area
- Species – conservation status is determined by the sum of influences acting on the species concerned that may affect its abundance and distribution within a given geographical area.

As defined in the EU Habitats Directive 92/43/EEC, the conservation of a habitat is favourable when:

- Its natural range, and areas it covers within that range, are stable or increasing
- The specific structure and functions which are necessary for its long-term maintenance exist and are likely to continue to exist for the foreseeable future
- The conservation status of its typical species is favourable.

The conservation of a species is favourable when:

- Population dynamics data on the species concerned indicate that it is maintaining itself on a long-term basis as a viable component of its natural habitats
- The natural range of the species is neither being reduced nor is likely to be reduced for the foreseeable future
- There is and will probably continue to be, a sufficiently large habitat to maintain its population on a long-term basis.

According to the NRA/CIEEM methodology, if it is determined that the integrity and/or conservation status of an ecological feature will be impacted on, then the level of significance of that impact is related to the geographical scale at which the impact will occur (i.e. local, county, national, international).

5.3.2.5 Incorporation of Mitigation

Sections 5.4, 5.5 and 5.6 of this document assesses the potential effects of the proposed development to ensure that all effects on Key Ecological Receptors (KERs) are adequately addressed. Where significant effects on Key Ecological Receptors are predicted, mitigation is incorporated into the assessment to address such impacts. The implemented mitigation measures avoid or reduce or offset potential significant residual effects, post mitigation.

5.3.2.6 Limitations

The information provided in this assessment accurately and comprehensively describes the baseline ecological environment following dedicated ecological surveys; provides an accurate prediction of the likely ecological effects of the proposed development; prescribes best practice and mitigation as necessary; and, describes the residual ecological impacts.

The specialist studies, analysis and reporting have been undertaken in accordance with the appropriate guidelines.

The habitats and species on the site were readily identifiable and comprehensive assessments were made during the field visits. No significant limitations in the scope, scale or context of the assessment have been identified.

5.4 Forestry replacement lands - Site 1: Stranamart, Co. Cavan

The proposed forestry replacement lands at Stranamart, Co. Cavan have been assessed as part of the Afforestation Approval – Form 1 process described above and has obtained Technical Approval for Afforestation from the Forest Service. The site location is presented in Figure 2.1.

5.4.1 Desk Study

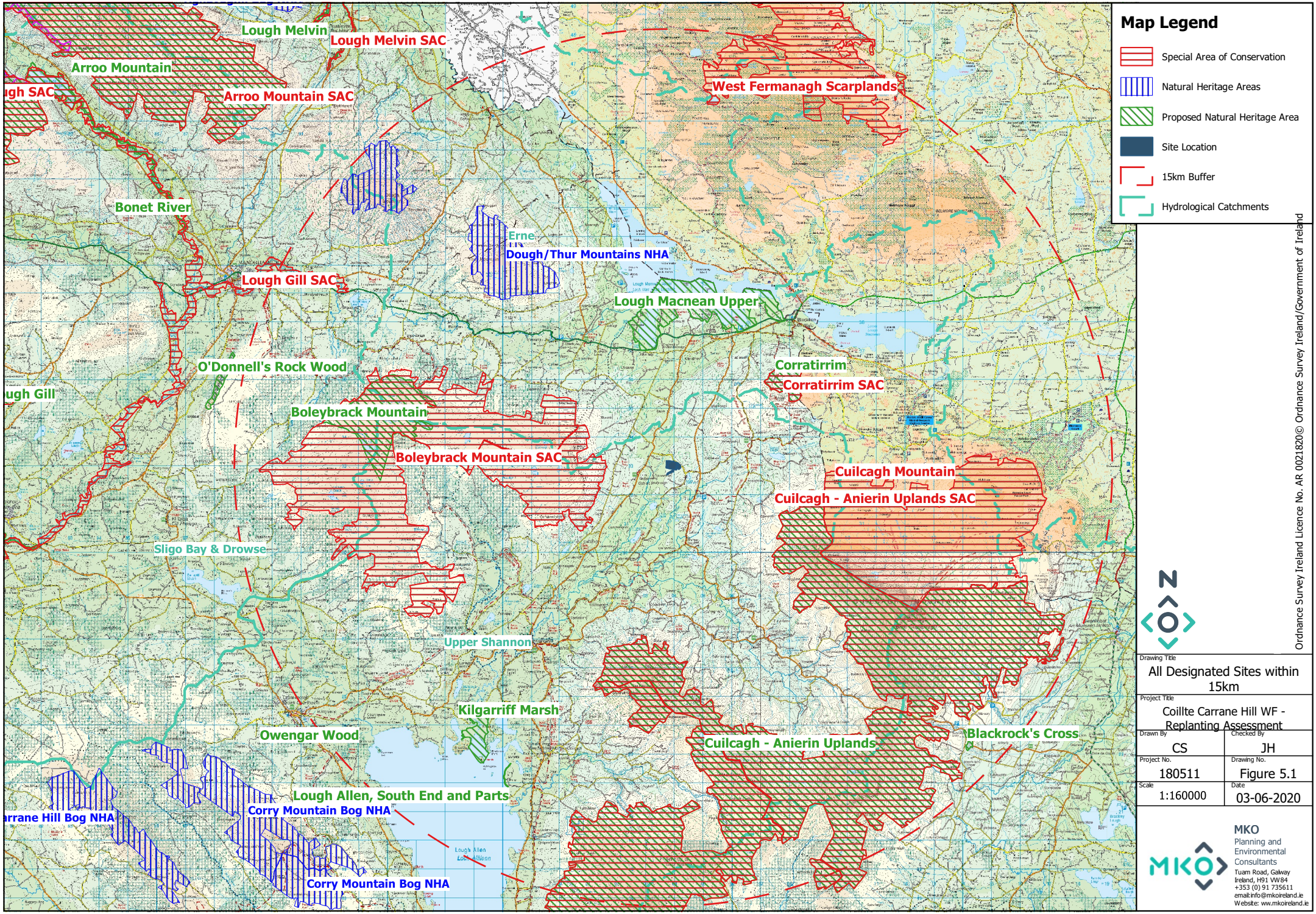
The following sections detail the results of the searches of published material that were consulted as part of the desk study for the Stranamart site.

5.4.1.1 Identification of the Designated Sites Likely Zone of Influence of the Project

Using the Geographic Information System (GIS) software QGIS Version 3.4 designated sites within a within a 15-kilometre radius of the proposed afforestation site were identified. Sites outside 15km were considered but no potential for impact was identified. The European designated sites are listed below in Table 5.2. Special Areas of Conservation (SACs) and Special Protection Areas for birds (SPAs) are designated under the EU Habitats Directive and EU Birds Directive, respectively, and are collectively known as 'European Sites'. The potential for significant effects on the integrity of European Sites is fully assessed in the AA Screening Report that accompanies this report, see Appendix 2. As per EPA draft Guidance 2017, *"a biodiversity section of an EIAR, should not repeat the detailed assessment of potential effects on European sites"* contained in a Screening for Appropriate Assessment but should *"incorporate their key findings as available and appropriate"*. Section 5.4.1.1 of this report provides a summary of the key assessment findings with regard to European Designated Sites. All designated sites are displayed in Figure 3.1 of the accompanying AASR and Figure 5.1 of this document. EU designated sites are listed in Table 5.2.

Natural Heritage Areas (NHAs) are designated under Section 18 the Wildlife (Amendment) Act 2000 and their management and protection is provided for by this legislation and planning policy. The potential for effects on these designated sites is fully considered in this assessment.

Proposed Natural Heritage Areas (pNHAs) were designated on a non-statutory basis in 1995 but have not since been statutorily proposed or designated. However, the potential for effects on these designated sites is fully considered in this EcIA. Nationally designated sites are listed in Table 5.3. All designated sites are displayed in Figure 5.1.



Drawing Title: All Designated Sites within 15km

Project Title: Coillte Carrane Hill WF - Replanting Assessment

Drawn By	Checked By
CS	JH
Project No.	Drawing No.
180511	Figure 5.1
Scale	Date
1:160000	03-06-2020

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Table 5.2 Identification of EU designated sites within the Likely Zone of Impact

European Sites and distance from proposed development	Likely Zone of Impact Determination
Special Area of Conservation (SAC)	
Boleybrack Mountain SAC (002032) **Distance:** 2.0km	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this SAC and therefore no potential for indirect effects on the SAC exists as a result of the proposed small scale works. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Cuilcagh - Anierin Uplands SAC (000584) **Distance:** 3.8km	There will be no direct effects as the project footprint is located entirely outside the designated site. Cuilcagh - Anierin Uplands SAC is located approximately 3.8km south-east of the proposed afforestation site and are buffered by a variety of habitats. Although the sites are located within the same hydrological catchment, no hydrological connectivity exists between the proposed development and the European designated site. Impacts on all of the listed QI habitats and species can be ruled out due to the distance from the proposed small scale afforestation and the absence of a complete source-pathway-receptor chain for impact. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Corratirrim SAC (000979) **Distance:** 4.1km	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no connectivity between this European site designated for terrestrial habitats and the proposed afforestation works in a separate hydrological sub-catchment. No pathway for indirect effects was identified. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Cuilcagh Mountain SAC [UK0016603] **Distance:** 5.0km	There will be no direct effects as the project footprint is located entirely outside the designated site. Cuilcagh Mountain SAC is located approximately 5km east of the proposed afforestation site and is buffered by a variety of habitats. Although the sites are located within the same hydrological catchment, no hydrological connectivity exists between the proposed development and the European designated site. Impacts on all of the listed QI habitats and species can be ruled out due to the distance from the proposed small scale works area and the absence of a complete source-pathway-receptor chain for impact. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**

European Sites and distance from proposed development	Likely Zone of Impact Determination
Special Area of Conservation (SAC)	
Lough Gill SAC (001976) **Distance:** 12.5km	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the site and the European Designated Site. The SAC is located in a separate surface water catchment to the proposed small-scale afforestation site. Therefore, no pathway for indirect effects was identified. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
West Fermanagh Scarplands SAC [UK0030300] **Distance:** 12.5km	There will be no direct effects as the project footprint is located entirely outside the designated site. This European site is located in a separate hydrological catchment to the proposed small scale afforestation works. No pathway for indirect effects was identified. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Special Protection Area (SPA)	
There are no SPA's within 15km of these forestry replacement lands.	

Table 5.3 Identification of Nationally Designated sites within the Likely Zone of Impact

Designated Sites and distance from proposed development	Features of Interest	Likely Zone of Impact Determination
Natural Heritage Area (NHA)		
Dough/Thur Mountains NHA (002384) **Distance:** 7.1km	› Peatlands [4]	There will be no direct effects as the project footprint is located entirely outside the designated site. No hydrological connectivity exists between the proposed development and the designated site. This site is located in a separate hydrological catchment to the proposed afforestation works. No pathway for indirect effects was identified. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Proposed Natural Heritage Area (pNHA)		
Cuilcagh - Anierin Uplands (000584)	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated

Designated Sites and distance from proposed development	Features of Interest	Likely Zone of Impact Determination
Distance: 3.8km		site. Cuilcagh Mountain pNHA is located approximately 5km east of the proposed afforestation site and is buffered by a variety of habitats. Although the sites are located within the same hydrological catchment, no hydrological connectivity exists between the proposed development and the European designated site. Impacts on all of the listed QI habitats and species can be ruled out due to the distance from the proposed small scale afforestation area and the absence of a complete source-pathway-receptor chain for impact. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Lough Macnean Upper (000986) **Distance:** 3.9km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. No hydrological connectivity exists between the proposed development and the designated site. This site is located in a separate hydrological catchment to the proposed afforestation works. No pathway for indirect effects was identified. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Corratirrim (000979) **Distance:** 4.1km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. No hydrological connectivity exists between the proposed development and the designated site. This site is located in a separate hydrological sub-catchment to the proposed afforestation works. No pathway for indirect effects was identified. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Boleybrack Mountain (002032) **Distance:** 8.2km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. Boleybrack Mountain pNHA is located approximately 8.2km west of the proposed afforestation site and is buffered by a variety of habitats. Although the sites are located within the same hydrological catchment, no hydrological

Designated Sites and distance from proposed development	Features of Interest	Likely Zone of Impact Determination
		connectivity exists between the proposed development and the Natural Heritage designated site. Impacts on all of the site can be ruled out due to the distance from the proposed small scale afforestation area and the absence of a complete source-pathway-receptor chain for impact. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Kilgarriff Marsh (000426) **Distance:** 10.2km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site has potential surface water connectivity in excess of 15.9km downstream with Kilgarriff Marsh pNHA via a drainage ditch that flows along the eastern boundary of the site, which discharges to the Black (Cavan) River >530m downstream. This river provides connectivity downstream with this Natural Heritage Area. Given the nature and small scale of the proposed planting and the distance of the pNHA downstream, no pathway for indirect effects on this coastal Nationally designated pNHA was identified. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Lough Allen, South End and Parts (000427) **Distance:** 11.4km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site has potential surface water connectivity in excess of 18km downstream with Lough Allen, South End and Parts pNHA via a drainage ditch that flows along the eastern boundary of the site, which discharges to the Black (Cavan) River >530m downstream. This river provides connectivity downstream with Lough Allen and this Natural heritage area. Given the nature and small scale of the proposed afforestation and the distance of the pNHA downstream, no pathway for indirect effects on this coastal nationally designated pNHA was identified. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Blackrock's Cross (000976) **Distance:** 13.4km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site.

Designated Sites and distance from proposed development	Features of Interest	Likely Zone of Impact Determination
		No hydrological connectivity exists between the proposed development and the designated site. This site is located in a separate hydrological catchment to the proposed afforestation works. No pathway for indirect effects was identified. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Owengar Wood (001419) **Distance:** 14.8km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. No hydrological connectivity exists between the proposed afforestation site and the nationally designated site, located in a separate hydrological sub-catchment to the proposed afforestation works. No pathway for indirect effects was identified. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**

5.4.1.2 New Flora Atlas

A search was made in the New Atlas of the British & Irish Flora (Preston et al, 2002) to investigate whether any rare or unusual plant species listed under Annex II of the EU Habitats Directive, Ireland Red List no 10 Vascular Plants (Wyse et.al 2016) or the Flora (Protection) Order, 2015 had been recorded in the relevant 10km square in which the study site is situated (H03).

Small-white orchid *(Pseudorchis albida)* and globe-flower *(Trollius europaeus)* protected under the Flora (Protection) Order, 1999 (as amended 2015) and listed on the Irish Red List (Vulnerable) has been previously recorded within the hectad.

Small-white orchid *(Pseudorchis albida)* is also listed on the Irish Red List (Vulnerable). Chaffweed (*Anagallis minima),* frog orchid (*Coeloglossum viride),* six-stamened waterwort (*Elatine hexandra),* dwarf Spurge(*Euphorbia exigua*), field gentian(*Gentianella campestris*), globe-flower(*Trollius europaeus)*and green field-speedwell(*Veronica agrestis*) listed on the Irish Red List (Near threatened) have also been previously recorded within the hectad.

5.4.1.3 Biodiversity Ireland Database

A search of the National Biodiversity Data Centre (NBDC) database was conducted with a focus on records of protected fauna recorded from hectad H03. The results of the database search (excluding birds) are provided below in Table 5.4 and the results for bird species recorded within the hectad are provided in Table 5.5. Table 5.6 includes records of non-native invasive species listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2015).

Table 5.4 NBDC records for species of conservation interest within 10km Grid Square H03 [excluding birds]

Common Name	Scientific Name	Designation
Brown long-eared bat	*Plecotus auritus*	HD Annex IV, WA
Common frog	*Rana temporaria*	HD Annex V, WA
Daubenton's bat	*Myotis daubentonii*	HD Annex IV, WA
Eurasian badger	*Meles meles*	WA
Eurasian red squirrel	*Sciurus vulgaris*	WA
European otter	*Lutra lutra*	HD Annex II & IV, WA
Freshwater white-clawed crayfish	*Austropotamobius pallipes*	HD Annex II & V, WA
Killarney Fern	*Trichomanes speciosum*	HD Annex II & IV
Lesser noctule	*Nyctalus leisleri*	HD Annex IV, WA
Natterer's Bat	*Myotis nattereri*	HD Annex IV, WA
Marsh Fritillary	*Euphydryas aurinia*	HD Annex II
Pine marten	*Martes martes*	HD Annex V, WA
Pipistrelle	*Pipistrellus pipistrellus sensu*	HD Annex IV, WA

	lato	
Soprano Pipistrelle	*Pipistrellus pygmaeus*	HD Annex IV, WA
West European hedgehog	*Erinaceus europaeus*	WA

WA = Wildlife Acts (1976-2019), HD Annex II, III, IV and V = EU Habitats Directive.

Table 5.5 NBDC records for bird species of conservation interest within 10km Grid Square H03

Common Name	Scientific Name	Designation
Black-headed gull	*Larus ridibundus*	BoCCI Red List, WA
Common kingfisher	*Alcedo atthis*	BD Annex I, WA
Common pochard	*Aythya ferina*	BoCCI Red List, WA
Corn crake	*Crex crex*	BD Annex I, BoCCI Red List, WA
Eurasian curlew	*Numenius arquata*	BoCCI Red List, WA
Eurasian Wigeon	*Anas penelope*	BoCCI Red List, WA
Eurasian woodcock	*Scolopax rusticola*	BoCCI Red List, WA
European golden plover	*Pluvialis apricaria*	BD Annex I, BoCCI Red List, WA
Grey wagtail	*Motacilla cinerea*	BoCCI Red List, WA
Hen harrier	*Circus cyaneus*	BD Annex I, WA
Meadow pipit	*Anthus pratensis*	BoCCI Red List, WA
Red grouse	*Lagopus lagopus*	BoCCI Red List, WA
Whooper swan	*Cygnus cygnus*	BD Annex I, WA
Yellowhammer	*Emberiza citrinella*	BoCCI Red List, WA

WA = Wildlife Acts (1976-2019), BoCCI Red List = Birds of Conservation Concern Red List; BD Annex I = EU Birds Directive Annex I.

Table 5.6 NBDC records for invasive species in hectad H03

Common Name	Scientific Name
Brown Rat	*Rattus norvegicus*
Canadian Waterweed	*Elodea Canadensis*
Eastern Grey Squirrel	*Sciurus carolinensis*
Fallow Deer	*Dama dama*
Indian Balsam	*Impatiens glandulifera*

Japanese Knotweed	*Fallopia japonica*
Nuttall's Waterweed	*Elodea nuttallii*
Rhododendron	*Rhododendron ponticum*
Roach	*Rutilus rutilus*
Salmonberry	*Rubus spectabilis*

5.4.1.4 Water Quality

The proposed afforestation site is located within the Shannon Upper Catchment. A drainage ditch flows along the eastern boundary of the site has potential surface water connectivity with the Black (Cavan) River >530m downstream. There are no other watercourses within or adjacent to these forestry replacement lands. The Water Framework Directive (WFD) ground waterbody risk score for the site, within the 'Glenarde Dowra' region has been assessed as 'Good'.

5.4.1.5 Freshwater Pearl Mussel Sensitive Areas

The site is not located within a freshwater pearl mussel (*Margaritifera margaritifera)* sensitive area. The site has no connectivity to any freshwater pearl mussel sensitive areas.

5.4.1.6 Conclusions of the Desktop Study

The afforestation site is not located within any site designated for nature conservation. The mammal species recorded within the relevant hectad have widespread range and distributions and are likely to be recorded frequently throughout Ireland. A number of rare and protected flora and fauna have been recorded from the hectad in which the proposed development is located.

5.4.2 Habitats Present

The site at Stanamart consists of ringfenced planted forestry classified as ***conifer plantation (WD4)***. A ***drainage ditch (FW4)*** exists along the eastern boundary of the site.

5.4.3 Significance of Habitats

The Ecological evaluation within this section follows a methodology that is set out in Chapter 3 of the 'Guidelines for Assessment of Ecological Impacts of National Roads Schemes' (NRA, 2009).

The conifer plantation and drainage ditches that are present within the site, given their highly modified nature, are of Local Importance (*Lower Value*) as they contain areas which are of some local importance for wildlife. However, these habitats are common in the wider landscape and are not of ecological impact assessment

5.4.3.1 Do Nothing' Impact

The site has received Technical Approval from the Forest Service as described above and was afforested per the provisions of the approval.

5.4.3.2 Loss of Floral Habitat

The replacement lands at Stranamart have been afforested, no further floral loss is anticipated. No significant effects are anticipated.

5.4.3.3 Loss of Faunal Habitat

No further faunal loss is anticipated at the planted site. It is likely that the ring-fenced conifer plantation will limit faunal access on-site however deer and some faunal species are likely to forage and habituate the site.

5.4.3.4 Impacts During Operational Phase (i.e. Harvesting/ Planting)

Afforestation and subsequent harvesting will conform to current best practice Forest Service regulations, policies and strategic guidance documents as well as Coillte produced guidance documents, including the specific guidelines listed below, to ensure that newly planted trees remain viable and afforestation results in minimal potential impacts to the receiving environment.

- 'Land Types for Afforestation' [2016]
- 'Environmental Requirements for Afforestation' [2016]
- 'Forest Operations & Water Protection Guidelines' (2009)
- 'Methodology for Clear Felling Harvesting Operations' (2009)
- 'Forestry and Water Quality Guidelines' (2000)
- 'Forestry and the Landscape Guidelines' (2000)
- 'Forestry and Archeology Guidelines' (2000)
- 'Forestry Biodiversity Guidelines' (2000)
- 'Forestry Protection Guidelines' (2002)
- 'Forestry Harvesting and Environmental Guidelines' (2000)

Following afforestation, subsequent forestry related activities will be subject to a separate consent process (i.e. from the Forest Service). All such activities will be undertaken in accordance with the above guidance documents. No potential for significant effect has been identified.

5.4.3.5 Impact on Designated Sites

The site was subject to Article 6(3) Appropriate Assessment Screening as part of the technical approval process and an Appropriate Assessment Screening Report has also been prepared, see Appendix 1 of this report.

Potential indirect impacts on European Designated sites (SACs and SPAs) are fully assessed within a separate Appropriate Assessment Screening Report (AASR), see Appendix 2. The AASR concludes that:

> *It is concluded beyond reasonable scientific doubt, in view of best scientific knowledge, on the basis of objective information and in light of the conservation objectives of the relevant European sites, that the replacement land, individually or in combination with other plans and projects, will not have a significant effect on any European Site.*
>
> *The replacement lands have Technical Approval from the Forest Service and will be undertaken accordingly. This approval is conditional to all associated works being undertaken in accordance with Forest Service requirements. The impacts associated with this afforestation have been classified overall as a neutral impact. As such, when considered in combination with the other land uses in the area, and considering that the forestry guidelines are designed to minimise and prevent impacts to habitats that are outside the site, cumulative impacts on sensitive ecological receptors are not anticipated.*

The impact on nationally designated sites was assessed as per Table 5.2 above and there was no Natural Heritage Areas (NHA) or proposed Natural Heritage Areas (pNHAs) identified within the Zone of Likely Impact. All forestry activities will be undertaken in accordance with industry guidance and best practice. No potential for significant effect was identified based on the nature and scale of the works and separation in distance from the designated site.

5.4.3.6 Cumulative Impacts

The proposed afforestation has Technical Approval from the Forest Service and will be undertaken accordingly. This approval is conditional to all associated works being undertaken in accordance with Forest Service requirements. The impacts associated with this afforestation have been classified overall as a neutral impact. As such, when considered in combination with the other land uses in the area, and considering that the forestry guidelines are designed to minimise and prevent impacts to habitats that are outside the site, cumulative impacts on sensitive ecological receptors are not anticipated.

5.5 Forestry replacement lands - Site 2: Brackloon, Co. Roscommon

The proposed forestry replacement land at Brackloon, Co. Roscommon has been assessed as part of the Afforestation Approval – Form 1 process described above and has obtained Technical Approval for Afforestation from the Forest Service. The site location is presented in Figure 2.3.

5.5.1 Desk Study

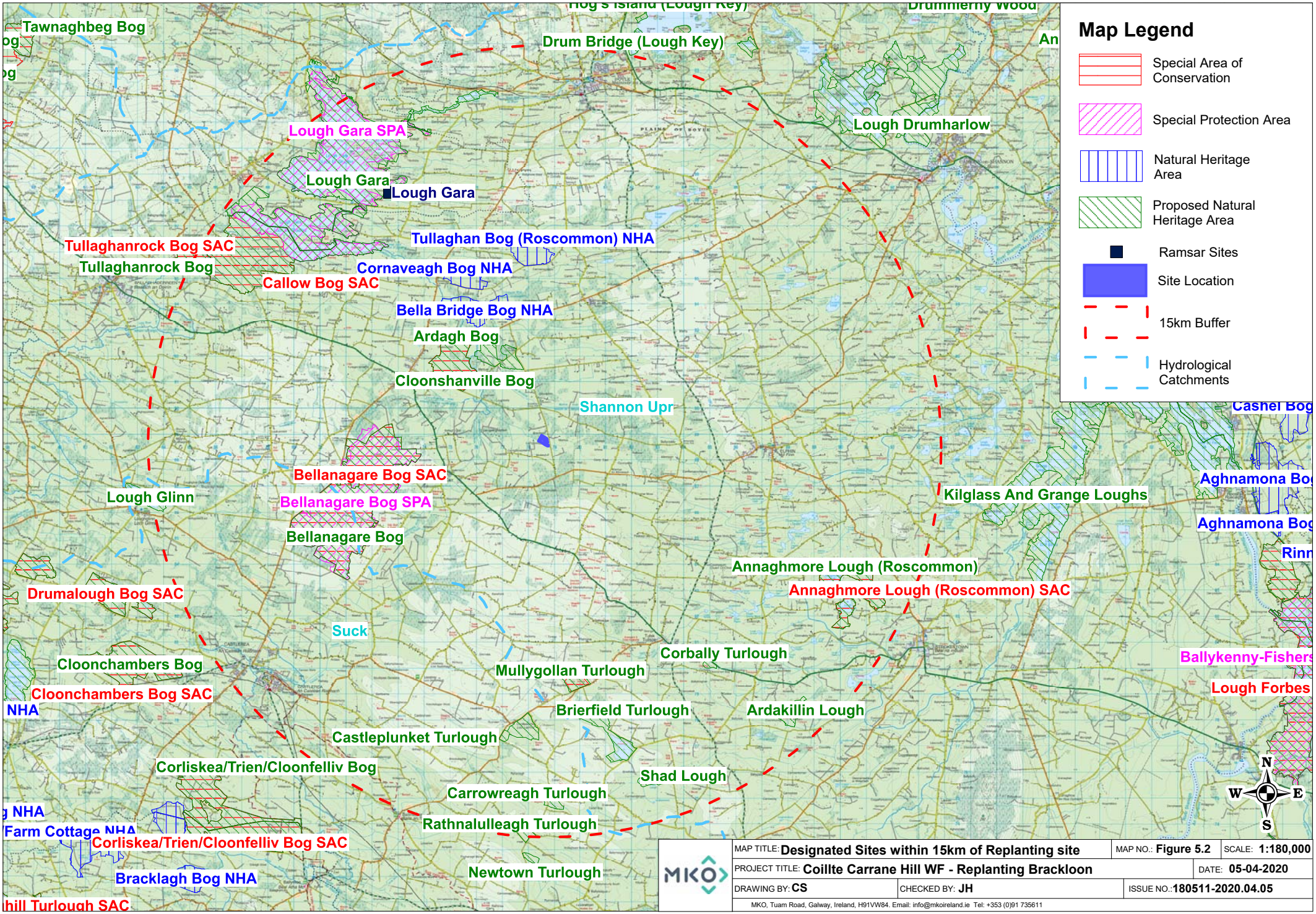
The following sections detail the results of the searches of published material that were consulted as part of the desk study for the Brackloon site.

5.5.1.1 Identification of the Designated Sites Likely Zone of Influence of the Project

Using the Geographic Information System (GIS) software QGIS Version 3.4 designated sites within a within a 15-kilometre radius of the proposed afforestation site were identified. Sites outside 15km were considered but no potential for impact was identified. The European designated sites are listed below in Table 5.7. Special Areas of Conservation (SACs) and Special Protection Areas for birds (SPAs) are designated under the EU Habitats Directive and EU Birds Directive, respectively, and are collectively known as 'European Sites'. The potential for significant effects on the integrity of European Sites is fully assessed in the AA Screening Report that accompanies this application, see Appendix 2. As per EPA draft Guidance 2017, *"a biodiversity section of an EIAR, should not repeat the detailed assessment of potential effects on European sites"* contained in a Screening for Appropriate Assessment but should *"incorporate their key findings as available and appropriate"*. Section 5.5.1.1 of this document provides a summary of the key assessment findings with regard to European Designated Sites. All designated sites are displayed in Figure 3.1 of the accompanying AASR and Figure 5.2 of this report.

Natural Heritage Areas (NHAs) are designated under Section 18 the Wildlife (Amendment) Act 2000 and their management and protection is provided for by this legislation and planning policy. The potential for effects on these designated sites is fully considered in this assessment.

Proposed Natural Heritage Areas (pNHAs) were designated on a non-statutory basis in 1995 but have not since been statutorily proposed or designated. However, the potential for effects on these designated sites is fully considered in this EcIA. Nationally designated sites are listed in Table 5.8.



MAP TITLE: **Designated Sites within 15km of Replanting site**		MAP NO.: **Figure 5.2**	SCALE: **1:180,000**
PROJECT TITLE: **Coillte Carrane Hill WF - Replanting Brackloon**			DATE: **05-04-2020**
DRAWING BY: **CS**	CHECKED BY: **JH**		ISSUE NO.: **180511-2020.04.05**

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Table 5.7 Identification of Designated sites within the Likely Zone of Impact

European Sites and distance from proposed development	Likely Zone of Impact Determination
Special Areas of Conservation (SAC)	
Cloonshanville Bog SAC (000614) **Distance:** 3.3km (4.1km hydrological distance)	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site has surface water connectivity >4.1km downstream with Cloonshanville Bog SAC via a stream, running adjacent along the southern boundary of the site. However, given distance downstream of the terrestrial nature of the habitats for which the SAC has been designated, as well as the nature and small scale of the proposed planting, as permitted in the technical approval document, there is no potential for indirect effects on the SAC. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Bellanagare Bog SAC (000592) **Distance:** 3.3km	There will be no direct effects as the project footprint is located entirely outside the designated site. No hydrological connectivity has been identified between the proposed afforestation site designated for terrestrial habitats and this European site. Due to the lack of connectivity between the small-scale forestry replacement lands and the European Site, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Mullygollan Turlough SAC [000612] **Distance:** 3.4km	There will be no direct effects as the project footprint is located entirely outside the designated site. Mullygollan Turlough SAC is located approximately 3.4km south-east of the proposed afforestation site and is buffered by agricultural, forestry, bog and scrub habitats. No hydrological connectivity exists between the proposed development and the designated site. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Callow Bog SAC (000595) **Distance:** 3.6km	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this European site designated for terrestrial habitats, located in a separate hydrological sub-catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists.

European Sites and distance from proposed development	Likely Zone of Impact Determination
Special Areas of Conservation (SAC)	
	No pathway for effect was identified and the site is not within the Likely Zone of Impact.
Annaghmore Lough (Roscommon) SAC [001626] **Distance:** 4.6km	There will be no direct effects as the project footprint is located entirely outside the designated site. This SAC is located in a separate hydrological catchment to the proposed small-scale afforestation works and there is no connectivity between the afforestation site and the SAC. Impacts on the listed Qualifying Interests can be ruled out due to the distance from the proposed works area and the absence of a complete source-pathway-receptor chain for impact. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Tullaghanrock Bog SAC (002354) **Distance:** 4.6km	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this European site designated for terrestrial habitats, located in a separate hydrological sub-catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Special Protection Area (SPA)	
Bellanagare Bog SPA [004105] **Distance:** 4.6km	There will be no direct effects as the project footprint is located entirely outside the designated site. Bellanagare Bog SPA is located approximately 4.6km south-west of the proposed afforestation site and is buffered by agricultural, forestry and peatland habitats. No significant supporting habitat for SCI species within the site and that given the absence of habitat and distance from the SPA no potential for indirect effects as a result of disturbance exist. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Lough Gara SPA [004048] **Distance:** 9.4km (12.9km hydrological distance)	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site has surface water connectivity >12.9km downstream with Lough Gara SPA via a stream, running adjacent along the southern boundary of the site. However, given

European Sites and distance from proposed development	Likely Zone of Impact Determination
Special Areas of Conservation (SAC)	
	the distance downstream of the wetland species and nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the SPA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**

Table 5.8 Identification of nationally Designated sites within the Likely Zone of Impact

Designated Sites and distance from proposed development	Features of Interest	Likely Zone of Impact Determination
Natural Heritage Area (NHA)		
Bella Bridge Bog NHA (000591) **Distance:** 4.6km	› Peatlands [4]	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site has surface water connectivity >7.6km downstream with Bella Bridge Bog NHA via a stream, running adjacent along the southern boundary of the site. However, given distance downstream and nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the NHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Cornaveagh Bog NHA (000603) **Distance:** 6.1km	› Peatlands [4]	There will be no direct effects as the project footprint is located entirely outside the designated site. Cornaveagh Bog NHA is located approximately 6.1km north-west of the proposed afforestation site and is buffered by agricultural, forestry andpeatland habitats. Although the sites are located within the same hydrological catchment, no hydrological connectivity exists between the proposed development. This designated site is designated for terrestrial habitats. No pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Tullaghan Bog (Roscommon) NHA (001652) **Distance:** 6.6km	› Peatlands [4]	There will be no direct effects as the project footprint is located entirely outside the designated site. Tullaghan Bog (Roscommon) NHA is located approximately 6.6km north of the proposed afforestation

Designated Sites and distance from proposed development	Features of Interest	Likely Zone of Impact Determination
		site and is buffered by agricultural, forestry and peatland habitats. Although the sites are located within the same hydrological catchment, no hydrological connectivity exists between the proposed development. This designated site is designated for terrestrial habitats. No pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Proposed Natural Heritage Area (pNHA)		
Ardagh Bog [001222] **Distance:** 2.7km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site has surface water connectivity >5.4km downstream with Ardagh Bog pNHA via a stream, running adjacent along the southern boundary of the site. However, given distance downstream and nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Cloonshanville Bog [000614] **Distance:** 3.3km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site has surface water connectivity >4.1km downstream with Cloonshanville Bog pNHA via a stream, running adjacent along the southern boundary of the site. However, given distance downstream of the site, nature and small scale of the forestry replacement lands as permitted in the technical approval document there is no potential for indirect effects on the pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Bellanagare Bog [000592] **Distance:** 4.6km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. Bellanagare Bog pNHA is located approximately 4.6km south-west of the proposed afforestation site and is buffered by agricultural, forestry and peatland habitats. Although the sites are located within the same hydrological catchment, no hydrological connectivity exists between the proposed development. This designated site is designated for terrestrial habitats. No pathway for indirect effect between

Designated Sites and distance from proposed development	Features of Interest	Likely Zone of Impact Determination
		the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Mullygollan Turlough [000612] **Distance:** 8.8km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this nationally designated site, located in a separate hydrological catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Lough Gara [000587] **Distance:** 9.4km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site has surface water connectivity >12.9km downstream with Lough Gara pNHA via a stream, running adjacent along the southern boundary of the site. However, given the distance downstream and nature and small scale of the forestry replacement lands as permitted in the technical approval document there is no potential for indirect effects on the pNHA. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Brierfield Turlough [000594] **Distance:** 10.1km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this natural heritage area, located in a separate hydrological catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Corbally Turlough [001627] **Distance:** 10.2km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this nationally designated site, located in a separate hydrological catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists.

Designated Sites and distance from proposed development	Features of Interest	Likely Zone of Impact Determination
		No pathway for effect was identified and the site is not within the Likely Zone of Impact.
Castleplunket Turlough [0000598] **Distance:** 10.2km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this nationally designated site, located in a separate hydrological catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Annaghmore Lough (Roscommon) [001626] **Distance:** 11.4km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this nationally designated site, located in a separate hydrological catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Ardakillin Lough [001617] **Distance:** 13.0km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this nationally designated site, located in a separate hydrological catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Carrowreagh Turlough [001624] **Distance:** 13.1km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this nationally designated site, located in a separate hydrological catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**

Designated Sites and distance from proposed development	Features of Interest	Likely Zone of Impact Determination
Shad Lough [001648] **Distance:** 13.1km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this natural heritage area, located in a separate hydrological catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Lough Glinn [001644] **Distance:** 14.1km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this natural heritage area located in a separate hydrological sub-catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Tullaghanrock Bog [002013] **Distance:** 14.4	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this proposed natural heritage area located in a separate hydrological sub-catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Rathnalulleagh Turlough [000613] **Distance:** 14.5km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this natural heritage area located in a separate hydrological catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Drum Bridge (Lough Key)	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site.

Designated Sites and distance from proposed development	Features of Interest	Likely Zone of Impact Determination
[001631] **Distance:** 15.0km		There is no hydrological connectivity between the proposed afforestation site and this natural heritage area located in a separate hydrological sub-catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**

5.5.1.2 New Flora Atlas

A search was made in the New Atlas of the British & Irish Flora (Preston et al, 2002) to investigate whether any rare or unusual plant species listed under Annex I of the EU Habitats Directive had been recorded in the relevant 10km squares in which the study site is situated (M78), during the 1987-1999 atlas survey. Smooth brome *(Bromus racemosus)* – Red Listed Species – (Near Threatened); was the only rare species that have been previously recorded within hectad N78. No species were recorded within the 10km hectad designated under the Flora Protection Order.

5.5.1.3 National Biodiversity Data Centre Notable Records

A search of the National Biodiversity Data Centre (NBDC) website was conducted with a focus on records of protected fauna recorded from hectad M78. The results of the database search (excluding birds) are provided below in

Table 5.9 and the results for bird species recorded within the hectad are provided in

Table 5.10. Table 5.11 includes records of non-native invasive species listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2015).

Table 5.9 Notable species that occur within 10km Grid Square M78 [excluding birds]

Common Name	Latin name	Designation
Common Frog	*Rana temporaria*	WA, HD Annex V
Eurasian Badger	*Meles meles*	WA
Eurasian Red Squirrel	*Sciurus vulgaris*	WA
European Otter	*Lutra lutra*	HD Annex II and IV, WA
Freshwater White-clawed Crayfish	*Austropotamobius pallipes*	HD Annex II and V
Lesser Noctule	*Nyctalus leisleri*	HD Annex IV, WA
Marsh Fritillary	*Euphydryas aurinia*	HD Annex II
Natterer's Bat	*Myotis nattereri*	HD Annex IV, WA
Pipistrelle	*Pipistrellus pipistrellus sensu lato*	HD Annex IV, WA

Soprano Pipistrelle	*Pipistrellus pygmaeus*	HD Annex IV, WA
West European Hedgehog	*Erinaceus europaeus*	WA

WA = Wildlife Acts (1976-2019), HD Annex II, III, IV and V = EU Habitats Directive.

Table 5.10 Notable bird species that occur within 10km Grid Square M78

Common Name	Latin name	Designation
Barn Owl	*Tyto alba*	BoCCI Red List, WA
Black-headed Gull	*Larus ridibundus*	BoCCI Red List, WA
Common Kingfisher	*Alcedo atthis*	BD Annex I, WA
Corn Crake	*Crex crex*	BD Annex I, BoCCI Red List, WA
Eurasian Curlew	*Numenius arquata*	BoCCI Red List, WA
Eurasian Woodcock	*Scolopax rusticola*	BoCCI Red List, WA
European Golden Plover	*Pluvialis apricaria*	BD Annex I, BoCCI Red List, WA
Grey Wagtail	*Motacilla cinerea*	BoCCI Red List, WA
Hen Harrier	*Circus cyaneus*	BD Annex I, WA
Lapwing	*Vanellus vanellus*	BoCCI Red List, WA
Meadow Pipit	*Anthus pratensis*	BoCCI Red List, WA
Red Grouse	*Lagopus lagopus*	BoCCI Red List, WA
Whinchat	*Saxicola rubetra*	BoCCI Red List, WA
Whooper Swan	*Cygnus cygnus*	BD Annex I, WA
Yellowhammer	*Emberiza citrinella*	BoCCI Red List, WA

WA = Wildlife Acts (1976-2019), BoCCI Red List = Birds of Conservation Concern Red List; BD Annex I = EU Birds Directive Annex I.

Table 5.11 NBDC records for invasive species in hectad M78

Common Name	Scientific Name
American Mink	*Mustela vison*
Japanese Knotweed	*Fallopia japonica*

5.5.1.4 Water Quality

The proposed afforestation site is located within the Upper Shannon Catchment and the Breedoge Sub catchment. A stream, runs adjacent along the southern boundary of the site, flowing in a north westerly direction and discharging to the Owennaforeesha River, approximately 2.3km downstream of the site.

There are two EPA water quality monitoring stations downstream of the site along Owennaforeesha River; one approximately 2.8km down-stream of the site at the 100 m u/s Breedoge confl station on the

Owennaforeesha River (Station code: RS26O040200). This monitoring station was most recently surveyed in 2011 and had a Q value of 3, indicating that water quality is poor.

The second water quality monitoring station located approximately 3km downstream of the afforestation site on the Owennaforeesha River at the Breedoge - Br 2 km E.S.E. of Frenchpark station (Station code: RS26B090100). This monitoring station was most recently surveyed in 2005 and had a Q value of 3, indicating that water quality was poor.

The Water Framework Directive (WFD) river waterbody risk score for the Owennaforeesha River has been assessed as 'At Risk' for the section of the watercourse flowing along the southern site boundary. The WFD River Waterbody status for the period 2013 - 2018 classifies the stream to the south of the site and the downstream Owennaforeesha River waterbody status as 'Poor'.

5.5.1.5 Freshwater Pearl Mussel Sensitive Areas

The site is not located within a Pearl Mussel (*Margaritifera margaritifera*) sensitive area. The site has no connectivity to any freshwater pearl mussel sensitive areas.

5.5.1.6 Conclusions of the Desktop Study

The afforestation site is not located within any site designated for nature conservation. The proposed afforestation site has surface water connectivity >4.1km downstream with Cloonshanville Bog SAC and approximately >12.9km downstream with Lough Gara SPA [004048]. However, given distance downstream, nature and small scale of the forestry replacement lands, as permitted in the technical approval document, there is no potential for indirect effects on the designated sites. The mammal species recorded within the relevant hectad have widespread range and distributions and are likely to be recorded frequently throughout Ireland. A number of rare and protected flora and fauna have been recorded from the hectad in which the proposed development is located. The field surveys will identify if any of the identified habitats, flora or fauna or additional ecological receptors occur within the study area.

5.5.2 Habitats Present

The site is largely dominated by an ***improved agricultural grassland/wet grassland (GA1/GS4)*** mosaic with field boundaries demarcated by ***hedgerows(WL1)*** (Plate 5.1). This grassland habitat is extensively dominated by rushes (*Juncus* spp.). Other species recorded include cock's-foot (*Dactylus glomerata*), perennial ryegrass (*Lolium perenne*), spear thistle *(Circium vulgare),* flag iris (*Iris pseudacorus),* ivy (Hedera helix) and bramble (*Rubus fructicosus* agg.). The ***hedgerows (WL1)*** are dominated by willow *(Salix* spp.), hawthorn (Crataegus monogyna) and bramble.

A stream categorised as ***eroding/upland river (FW1)***, Plate 5.2, runs adjacent along the southern boundary of the site, flowing in a north westerly direction and discharging to the Owennaforeesha River, approximately 2.3km downstream of the site.

Plate 5.1 Improved agricultural grassland/wet grassland (GA1/GS4) mosaic with field boundaries demarcated by hedgerows (WL1)

Plate 5.2 Stream categorised as eroding/upland river (FW1) adjacent along the southern boundary of the site

5.5.2.1 Invasive Species

No invasive species listed on the Third Schedule of the European Communities (Birds and Natural Habitats) Regulations, 2011 were recorded within the site boundary during the site visit.

5.5.2.2 Significance of Habitats

Ecological evaluation within this section follows a methodology that is set out in Chapter 3 of the 'Guidelines for Assessment of Ecological Impacts of National Roads Schemes' (NRA, 2009).

No habitats which correspond to those that are listed in the EU Habitats Directive were identified during the site visit. The grassland habitats that are present within the site, given their highly modified nature, are of *Local Importance (Lower Value)* as they contain areas which are of some local importance for wildlife. Hedgerows and eroding/upland river habitats were assigned a significance of *Local Importance (Higher Value)* as these habitats have a higher level of biodiversity within the context of the local environment, and in the case of the hedgerows and watercourses provide cover and commuting corridor links between habitats of higher ecological value.

5.5.3 Fauna in the Existing Environment

Birds

Records of birds seen and heard on the forestry replacement site were taken. Common passerines were recorded incidentally within the site. No birds listed on Annex I of the EU Birds Directive were recorded during the field survey. The site provided habitat for a range of common and widespread species but not of significance for rare or protected bird species. Given the lack of significant habitat for rare or protected bird species, there is no requirement for further bird surveys at the site.

Terrestrial Mammals

No evidence of badger was recorded during the site visit and no other protected mammal species or evidence of such species were recorded within the site boundaries.

No species listed under Annex II of the Habitats Directive were recorded during the site visit.

Otter

A comprehensive search for otter was undertaken along a 10m riparian buffer of the stream adjacent to the southern site boundary (NRA, 2008 and Reid, et al 2013). No otter resting or breeding sites and no evidence of otter was recorded within the development site, however, the watercourse along the site boundary is likely to be utilised by commuting and foraging otter.

Bats

There are no structures within the site which may provide suitable roosting habitat for bats. A large open landscape structure dominates the site and though linear features may be used by foraging and commuting bats, overall, the site is considered to have low suitability for bat species.

5.5.3.1 Significance of Fauna

No evidence of Annex listed species, or other species of conservation concern were recorded within the site boundaries.

Bird species recorded within the site boundaries are common generally and assigned a value of **Local Importance (Lower Value):** The forestry replacement site provides some limited foraging, commuting

and nesting habitats for these and other common bird species in general. Similar habitat is widespread in the locality.

5.5.4 Impact Assessment

5.5.4.1 Do Nothing' Impact

Were the site to remain unplanted the management on site would likely remain as it is presently i.e. wet agricultural grassland grazed by livestock. However, given that the site has received Technical Approval from the Forest Service as described above it will be afforested per the provisions of the approval at a later date.

5.5.4.2 Impacts During the Site Preparation and Planting Phase

5.5.4.2.1 *Loss of Floral Habitat*

Long-Term Neutral Impact

The development will result in the loss of wet agricultural grassland habitat assigned local importance (lower value). This habitat type is common in a local, national and international context and their loss will constitute a neutral impact.

The loss of these habitats is not considered significant.

All hedgerows of *Local Importance (Higher Value)* within the site will be retained.

Mitigation

Despite the fact that the loss of habitats on the forestry replacement site is not a significant ecological effect, all works will be carried out in accordance with the relevant Forest Service requirements, including 'Forestry Biodiversity Guidelines' (2000)'. All hedgerows will be retained and appropriate set-back applied as per the Forest Service document 'Environmental Requirements for Afforestation (2016)'. The Technical Approval document specifies the area that should contain suitable broadleaf and conifer species. This management would allow for the retention of some of the Local Value (Higher Importance) habitats.

Residual Impact

The replacement of grassland habitat with coniferous and broadleaf forestry is considered to be a Long-Term Neutral Impact. No significant effects are anticipated.

5.5.4.2.2 *Loss of Faunal Habitat*

Long Term Neutral Impact

The proposed planting site is not of high value or importance as a faunal habitat, being dominated mostly by wet agricultural grassland and limited cover or shelter for faunal species in bramble and hedgerow habitats. It is likely that the proposed planting of forestry will result in some loss of foraging for small mammals, along with local bird species. Grassland habitat is widespread in the local area and this loss is considered to be negligible.

The proposed development site does not provide significant foraging or roosting habitat for protected bird species given the highly managed/modified nature of habitats on site, dominated by wet agricultural grassland. Given the lack of significant bird assemblages recorded within or adjacent to the

site, significant impacts as a result of disturbance or displacement are not anticipated on bird species at any geographic scale.

Hedgerows provide bat commuting and foraging habitat, there will be no loss of hedgerow or trees as part of the proposal and therefore no impacts on bat commuting and foraging habitat.

The afforestation, in particular that of broadleaf species will result in the creation of cover and nesting habitat for a range of bird species, resulting in an overall Long-Term Neutral Impact.

Mitigation / Best Practice

- All works will be carried out in accordance with the relevant Forest Service requirements, including 'Forestry Biodiversity Guidelines' (2000)'.
- All hedgerows and existing treelines will be retained and appropriate set-back applied as per the Forest Service document '*Environmental Requirements for Afforestation (2016)*'.
- Vegetation clearance will be carried out in line with the Wildlife Acts

Residual Impact.

- No significant effects on faunal habitat as a result of the proposed afforestation is anticipated.

5.5.4.2.3 *Water Pollution*

Short-Term Slight Negative Impact

Following a precautionary approach, in the absence of best practice and design, there is potential for water pollution to occur through discharge to the adjacent stream and therefore potential localised water pollution effects in the form of release of suspended solids, siltation and erosion as a result of the proposed afforestation.

Mitigation/Best Practice

Best practice methods related to water incorporated into the forestry management and mitigation measures have been derived from:

- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Forest Service (Draft): Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures; and,
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.
- Forest Service (2016) Environmental Requirements for Afforestation. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.
- Forest Service (2016) Land Types for Afforestation. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.

Measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods which will be applied at the forestry replacement lands. These include:

- Machine combinations will be chosen which are most suitable for ground conditions at the time of excavation and felling, and which will minimise surrounding soils disturbance;
- Where possible, existing drains will not be disturbed during drainage works;

- Drains and sediment traps will be installed during ground preparation and felling. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and should avoid being placed at right angles to the contour;
- Drains and silt traps will be maintained throughout all planting works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimised and controlled;
- Apply a 5 metre wide (minimum) uncultivated and unplanted water setback along relevant watercourses (as defined in Circular 12/2017) located within or adjoining the site. This setback is to remain undisturbed during establishment and throughout the forest rotation. Apply and maintain as per details set out in Tables 5 and 6 of the Environmental Requirements for Afforestation (DAFM, 2016).
- Adhere to all water protection measures relating to cultivation, herbicide application, the location of onsite storage depots and the disposal of waste, set out in the Environmental Requirements for Afforestation (DAFM, 2016).
- There will be no woody weed removal within 20 m of a drainage ditch.

Buffer Zones

There is a requirement in the Forest Service Code of Practice and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zones at planting stage. Minimum buffer zone widths recommended in the Forest Service (2000) guidance document "Forestry and Water Quality Guidelines" are shown in Table 5.12.

Table 5.12 Minimum Buffer Zone Widths (Forest Service, 2000)

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0 – 15%)	10 m	15 m
Steep	(15 – 30%)	15 m	20 m
Very steep	(>30%)	20 m	25 m

Residual Impact.

- No significant impacts on water quality as a result of the proposed afforestation are anticipated.

5.5.4.3 Impacts During Operational Phase (i.e. Harvesting/ Afforestation)

There will be no significant indirect or direct impacts on the biodiversity, ground water or designated sites once the site has been afforested.

Residual Impact

No residual impacts are anticipated associated with the proposed afforestation site during the planted phase.

5.5.4.4 Impact on Designated Sites

Potential indirect impacts on European Designated sites (SACs and SPAs) are fully assessed within a separate Appropriate Assessment Screening Report (AASR), see Appendix 2. The AASR concludes that:

> *It is concluded beyond reasonable scientific doubt, in view of best scientific knowledge, on the basis of objective information and in light of the conservation objectives of the relevant European sites, that the proposed replanting replacement land, individually or in combination with other plans and projects, will not have a significant effect on any European Site.*
>
> *The proposed afforestation has Technical Approval from the Forest Service and will be undertaken accordingly. This approval is conditional to all associated works being undertaken in accordance with Forest Service requirements. The impacts associated with this afforestation have been classified overall as a neutral impact. As such, when considered in combination with the other land uses in the area, and considering that the forestry guidelines are designed to minimise and prevent impacts to habitats that are outside the site, cumulative impacts on sensitive ecological receptors are not anticipated.*

The impact on nationally designated sites was assessed as per Table 5.8 above and there was no Natural Heritage Areas (NHA) or proposed Natural Heritage Areas (pNHAs) identified within the Zone of Likely Impact. All forestry activities will be undertaken in accordance with industry guidance and best practice. No potential for significant effect was identified based on the nature and scale of the works and separation in distance from the designated site.

5.5.4.5 Cumulative Impacts

The proposed afforestation has Technical Approval from the Forest Service and will be undertaken accordingly. This approval is conditional to all associated works being undertaken in accordance with Forest Service requirements. The impacts associated with this afforestation have been classified overall as a neutral impact. As such, when considered in-combination with the other land uses in the area, and considering that the forestry guidelines are designed to minimise and prevent impacts to habitats that are outside the site, cumulative impacts on sensitive ecological receptors are not anticipated.

5.6 Forestry replacement lands - Site 3: Ballard, Co. Wicklow

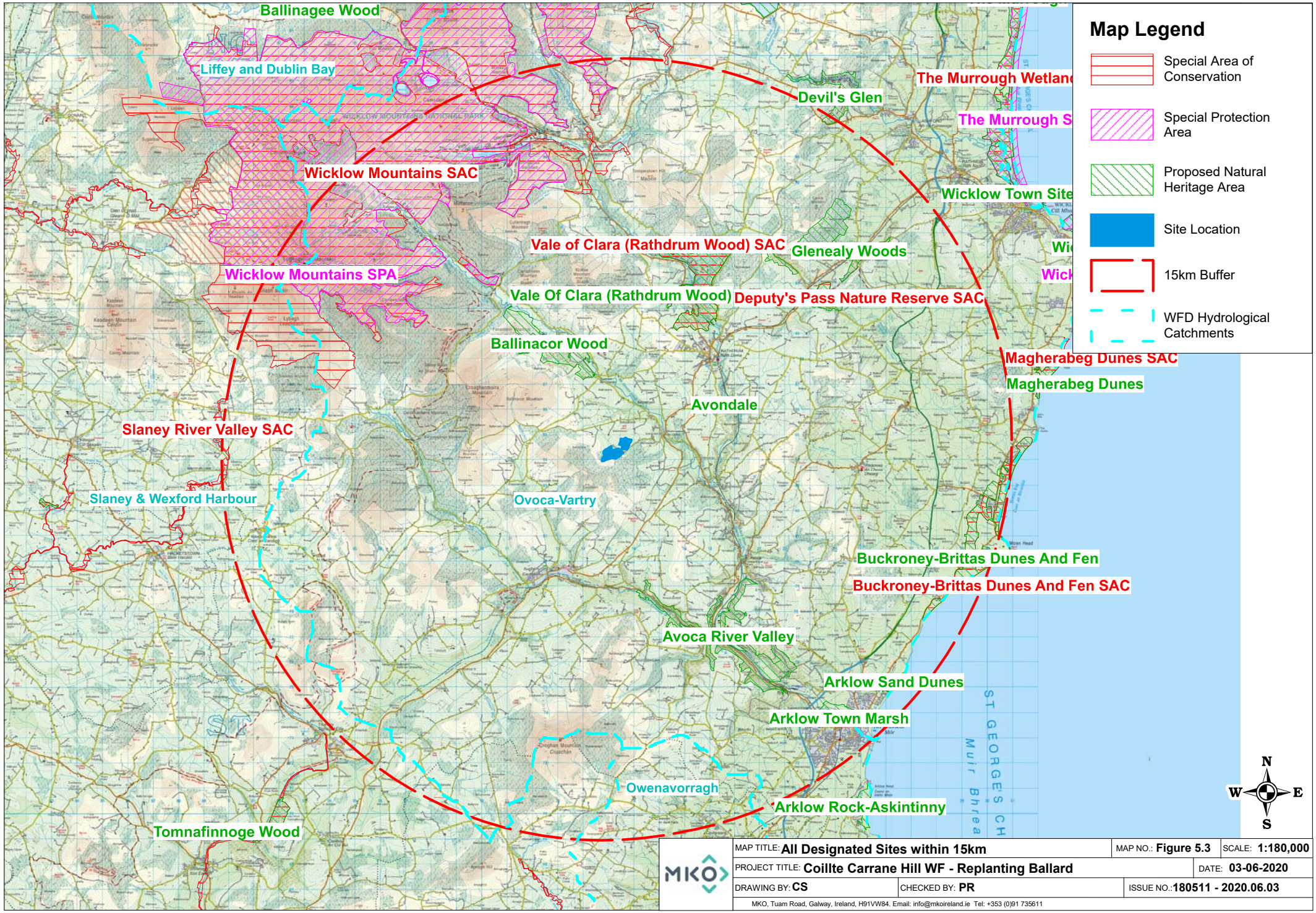
The proposed forestry replacement land at Ballard, Co. Wicklow has been assessed as part of the Afforestation Approval – Form 1 process described above and has obtained Technical Approval for Afforestation from the Forest Service. The site location is presented in Figure 2.5.

5.6.1 Desk Study

The following sections detail the results of the searches of published material that were consulted as part of the desk study for the Ballard site.

5.6.1.1 Identification of the Designated Sites Likely Zone of Influence of the Project

Using the Geographic Information System (GIS) software QGIS Version 3.4 designated sites within a within a 15-kilometre radius of the proposed afforestation site were identified. Sites outside 15km were considered but no potential for impact was identified. The European designated sites are listed below in Table 5.13. Special Areas of Conservation (SACs) and Special Protection Areas for birds (SPAs) are



MAP TITLE: **All Designated Sites within 15km**		MAP NO.: **Figure 5.3**	SCALE: **1:180,000**
PROJECT TITLE: **Coillte Carrane Hill WF - Replanting Ballard**			DATE: **03-06-2020**
DRAWING BY: **CS**	CHECKED BY: **PR**		ISSUE NO.: **180511 - 2020.06.03**

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designated under the EU Habitats Directive and EU Birds Directive, respectively, and are collectively known as 'European Sites'. The potential for significant effects on the integrity of European Sites is fully assessed in the AA Screening Report that accompanies this application, see Appendix 3. As per EPA draft Guidance 2017, *"a biodiversity section of an EIAR, should not repeat the detailed assessment of potential effects on European sites"* contained in a Screening for Appropriate Assessment but should *"incorporate their key findings as available and appropriate"*. Section 5.6.1.1 of this document provides a summary of the key assessment findings with regard to European Designated Sites. All designated sites are displayed in Figure 3.1of the accompanying AASR and Figure 5.3 of this report.

Natural Heritage Areas (NHAs) are designated under Section 18 the Wildlife (Amendment) Act 2000 and their management and protection is provided for by this legislation and planning policy. The potential for effects on these designated sites is fully considered in this assessment.

Proposed Natural Heritage Areas (pNHAs) were designated on a non-statutory basis in 1995 but have not since been statutorily proposed or designated. However, the potential for effects on these designated sites is fully considered in this EcIA. Nationally designated sites are listed in Table 5.14.

Table 5.13 Identification of Designated sites within the Likely zone of Impact

European Sites and distance from proposed development	Likely Zone of Impact Determination
Vale of Clara (Rathdrum Wood) SAC (000733) **Distance:** 4.7km	There will be no direct effects as the project footprint is located entirely outside the designated site. This European site is designated for terrestrial habitats and is located in a separate hydrological sub-catchment to the proposed afforestation works. No pathway for indirect effect between the proposal and the designated site exists. No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.
Wicklow Mountains SAC (002122) **Distance:** 7.8km	There will be no direct effects as the project footprint is located entirely outside the designated site. Wicklow Mountains SAC is located approximately 7.8km north-west of the proposed afforestation site and are buffered by agricultural, forestry, peatland and scrub habitats. Although the sites are located within the same hydrological catchment, no hydrological connectivity exists between the proposed development and the designated site. No pathway for effect was identified and the site is not within the Likely Zone of Impact.
Deputy's Pass Nature Reserve SAC (000717) **Distance:** 9.0km	There will be no direct effects as the project footprint is located entirely outside the designated site. This European site is designated for terrestrial habitats. There is no connectivity between the forestry replacement lands and the SAC. Therefore, no pathways for indirect effects were identified. No pathway for effect was identified and the site is not within the Likely Zone of Impact.
Buckroney-Brittas Dunes and Fen	There will be no direct effects as the project footprint is located entirely

European Sites and distance from proposed development	Likely Zone of Impact Determination
SAC (000729) **Distance:** 13.4km	outside the designated site. This European site is located in a separate hydrological sub-catchment to the proposed afforestation works. Given the nature and small scale of the forestry replacement lands and the distance between the works and the SAC, no pathways for indirect effects via surface water were identified. No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.
Slaney River Valley SAC (000781) **Distance:** 14.7km	There will be no direct effects as the project footprint is located entirely outside the designated site. This European site is located in a separate hydrological catchment to the proposed afforestation works. Given the nature and small scale of the forestry replacement lands and the distance between the works and the SAC, no pathways for indirect effects via surface water were identified or any significant impacts on any QI's. No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.
Special Protection Areas (SPAs)	
Wicklow Mountains SPA (004040) **Distance:** 7.8km	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site is located outside of the core foraging range of Merlin (5km core range) and Peregrine (2km core range) (SHN 2016). The site does not support significant suitable habitat for the SCI species for which the SPA is designated. Therefore, potential for indirect effects as a result of disturbance can be ruled out. No pathway for effect was identified and the site is not within the Likely Zone of Impact.

Table 5.14 Identification of nationally designated sites within the Likely Zone of Impact

Designated Sites and distance from proposed development	Features of Interest	Likely Zone of Impact Determination
Natural Heritage Area (NHA)		
There are no NHA's within 15km of the proposed afforestation site		
Proposed Natural Heritage Area (pNHA)		
Ballinacor Wood [001749] **Distance:** 2.7 km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. Ballinacor Wood pNHA is located approximately 2.7km

Designated Sites and distance from proposed development	Features of Interest	Likely Zone of Impact Determination
		north-west of the proposed afforestation site and are buffered by predominantly agricultural and forestry, habitats. Although the sites are located within the same hydrological catchment, no hydrological connectivity exists between the proposed development and the designated site. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Avondale [002093] Distance: 3.9km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. Avondale pNHA is located approximately 3.9km east of the proposed afforestation site and are buffered by predominantly agricultural and forestry habitats. Although the sites are located within the same hydrological catchment, no hydrological connectivity exists between the proposed development and the designated site. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Vale of Clara (Rathdrum Wood) [000733] **Distance:** 4.7 km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this natural heritage site, located in a separate hydrological sub-catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Avoca River Valley **Distance**: 4.9km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site has surface water connectivity in excess of 11.8km downstream with Avoca River Valley pNHA via Ballyeustace stream which discharges into the Avonbeg River. However, given distance downstream and nature and small scale of the forestry replacement lands as permitted in the technical approval document there is no potential for indirect effects on this pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Glenealy Woods **Distance:** 8.8km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed

Designated Sites and distance from proposed development	Features of Interest	Likely Zone of Impact Determination
		afforestation site and this natural heritage area, located in a separate hydrological sub-catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Arklow Town Marsh **Distance:** 12.6km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. The proposed afforestation site has surface water connectivity in excess of 20.3km downstream with Arklow Town Marsh pNHA via Ballyeustace stream which discharges into the Avonbeg River which joins the Avoca River further downstream. However, given distance downstream and nature and small scale of the forestry replacement lands as permitted in the technical approval document there is no potential for indirect effects on this pNHA. **No pathway for significant effect was identified and the site is not within the Likely Zone of Impact.**
Buckroney-Brittas Dunes And Fen (000729) **Distance:** 13.4km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this natural heritage site, located in a separate hydrological sub-catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Arklow Sand Dunes **Distance:** 13.8km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this coastal natural heritage site, located in a separate hydrological sub-catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**
Devil's Glen **Distance:** 14.7km	› N/A	There will be no direct effects as the project footprint is located entirely outside the designated site. There is no hydrological connectivity between the proposed afforestation site and this natural heritage area, located in a

Designated Sites and distance from proposed development	Features of Interest	Likely Zone of Impact Determination
		separate hydrological sub-catchment. Therefore, no pathway for indirect effect between the proposal and the designated site exists. **No pathway for effect was identified and the site is not within the Likely Zone of Impact.**

5.6.1.2 New Flora Atlas

A search was made in the New Atlas of the British & Irish Flora (Preston et al, 2002) to investigate whether any rare or unusual plant species listed under Annex II of the EU Habitats Directive, Ireland Red List no 10 Vascular Plants (Wyse et.al 2016) or the Flora (Protection) Order, 2015 had been recorded in the relevant 10km square in which the study site is situated (T18), during the 1987-1999 atlas survey. Lanceolate spleenwort *(Asplenium obovatum),* sword-leaved helleborine*(Cephalanthera longifolia)* and heath cudweed*(Gnaphalium sylvaticum)*protected under the Flora (Protection) Order, 1999 (as amended 2015) have been previously recorded within the hectad. Oak fern (*Gymnocarpium dryopteris)* and shepherd's-needle *(Scandix pecten-veneris)* protected as Red Listed (Regionally Extinct) species have been previously recorded within the hectad T18 in which the proposed afforestation site lies. Green-Winged Orchid *(Orchis morio),* lanceolate spleenwort *(Asplenium obovatum)* and sword-leaved helleborine (*Cephalanthera longifolia)* protected as Red List (Vulnerable) were also recorded within hectad T18. Common moonwort *(Botrychium lunaria),* dwarf spurge *(Euphorbia exigua),* large flowered hemp nettle *(Galeopsis speciosa),* corn marigold *(Chrysanthemum segetum),* bog orchid *(Hammarbya paludosa),* greater broomrape*(Orobanche rapum-genistae)* and common wintergreen*(Pyrola minor)* protected as Red listed (Near threatened) species have also been previously recorded within the hectad T18 in which the proposed afforestation site lies.

5.6.1.3 National Biodiversity Data Centre Notable Records

A search of the National Biodiversity Data Centre (NBDC) website was conducted with a focus on records of protected fauna recorded from hectad T18. The results of the database search (excluding birds) are provided below in Table 5.15 and the results for bird species recorded within the hectad are provided in

Table 5.16. Table 5.17 includes records of non-native invasive species listed under the Third Schedule of the European Communities Regulations 2011 (S.I. 477 of 2015).

Table 5.15 Notable species that occur within 10km Grid Square T18 [excluding birds]

Common Name	Scientific Name	Designation
Brown long-eared bat	*Plecotus auritus*	HD Annex IV, WA
Common frog	*Rana temporaria*	HD Annex V, WA
Daubenton's bat	*Myotis daubentonii*	HD Annex IV, WA
Eurasian badger	*Meles meles*	WA
Eurasian red squirrel	*Sciurus vulgaris*	WA
European otter	*Lutra lutra*	HD Annex II & IV, WA
Irish Hare	*Lepus timidus subsp. Hibernicus*	WA
Irish Stoat	*Mustela erminea subsp. Hibernica*	WA
Lesser noctule	*Nyctalus leisleri*	HD Annex IV, WA
Marsh fritillary	*Euphydryas aurinia*	HD Annex II

Pine marten	*Martes martes*	HD Annex V, WA
Pipistrelle	*Pipistrellus pipistrellus sensu lato*	HD Annex IV, WA
Soprano pipistrelle	*Pipistrellus pygmaeus*	HD Annex IV, WA
West European Hedgehog	*Erinaceus europaeus*	WA
Whiskered bat	*Myotic mystacinus*	HD Annex IV, WA

WA = Wildlife Acts (1976-2019), HD Annex II, III, IV and V = EU Habitats Directive.

Table 5.16 Notable bird species that occur within 10km Grid Square T18

Common Name	Scientific Name	Designation
Barn owl	*Tyto alba*	BoCCI Red List, WA
Black-headed gull	*Larus ridibundus*	BoCCI Red List, WA
Common kingfisher	*Alcedo atthis*	BD Annex I, WA
Corn crake	*Crex crex*	BD Annex I, BoCCI Red List, WA
Eurasian curlew	*Numenius arquata*	BoCCI Red List, WA
Eurasian woodcock	*Scolopax rusticola*	BoCCI Red List, WA
Grey partridge	*Perdix perdix*	BoCCI Red List, WA
Grey wagtail	*Motacilla cinerea*	BoCCI Red List, WA
Hen harrier	*Circus cyaneus*	BD Annex I, WA
Herring gull	*Larus argentatus*	BoCCI Red List, WA
Meadow pipit	*Anthus pratensis*	BoCCI Red List, WA
Merlin	*Falco columbarius*	BD Annex I, WA
Northern lapwing	*Vanellus vanellus*	BoCCI Red List, WA
Peregrine falcon	*Falco peregrinus*	BD Annex I, WA
Red grouse	*Lagopus lagopus*	BoCCI Red List, WA
Yellowhammer	*Emberiza citronella*	BoCCI Red List, WA

BoCCI Red List = Birds of Conservation Concern Red List; BD Annex I = EU Birds Directive Annex I, WA = Wildlife Acts (1976-2019).

Table 5.17 NBDC records for invasive species in hectad T18

Common Name	Scientific Name
American Mink	*Mustela vison*
Brown rat	*Rattus norvegicus*
Chinese Muntjac	*Muntiacus reevesi*
Eastern Grey Squirrel	*Sciurus carolinensis*
Fallow deer	*Dama dama*
Greylag goose	*Anser anser*
Himalayan knotweed	*Persicaria wallichii*
Rhododendron	*Rhododendron ponticum*
Salmonberry	*Rubus spectabilis*
Sitka deer	*Cervus Nippon*
Three-cornered garlic	*Allium triquetrum*

5.6.1.4 Water Quality

The proposed afforestation site is located within the Avoca-Vartry Catchment. The Ballyeustace stream, a tributary of the Avonbeg River flows along the site to the north-west draining in a north easterly direction.

There is no EPA water quality monitoring station downstream from the Ballyeustace stream to provide a River Water Quality assessment score. There is a monitoring station downstream of the site along Avonbeg River approximately 3.7km downstream of the site. The latest Q value from this monitoring station Avonbeg - Ballinaclash Bridge River Station from 1990 was '5' – 'High' Q ValueStatus. The Water Framework Directive (WFD) river waterbody status for the Ballyeustace stream has been assessed as 'Good'. The Ground waterbody WFD Status 2013-2018 for the area in which the forestry replacement lands, and wider surrounding area, is 'Good'.

5.6.1.5 Freshwater Pearl Mussel Sensitive Areas

The site is not located within a freshwater pearl mussel (*Margaritifera margaritifera*) sensitive area. The site has no connectivity to any freshwater pearl mussel sensitive areas.

5.6.1.6 Conclusions of the Desktop Study

The afforestation site is not located within any site designated for nature conservation. The site has downstream connectivity with Avoca River Valley pNHA >11.8km downstream and Arklow Town Marsh pNHA approximately 20.3km downstream. However, given distance downstream, nature and small scale of the works (afforestation only) as permitted in the technical approval document there is no potential for indirect effects on the natural heritage area.

The mammal species recorded within the relevant hectad have widespread range and distributions and are likely to be recorded frequently throughout Ireland. A number of rare and protected flora and fauna have been recorded from the hectad in which the proposed development is located.

5.6.2 Habitats Present

The proposed afforestation site was visited on the 29th October 2018. The dominant habitats at the site were ***Scrub (WS2).*** In the western block, the scrub formed a habitat mosaic with ***Dry-humid acid grassland (GS3).*** Pockets of ***Dense bracken (HD1***) occurs throughout the site, mostly adjoining disused tracks which are classified as ***Recolonising bare ground (ED3).*** The site boundaries are a combination of ***Hedgerow (WL1)*** habitat and ***Treeline (WL2).*** Both the eastern and western extent of the Ballard site each features a small area of ***Immature woodland (WS2),*** consisting of birch (*Betula* sp.). The western extent of the Ballard site features a small area of ***Mixed broadleaved conifer woodland (WD2), Conifer plantation (WD4)*** and ***Wet grassland (GS4).***

The only evidence of drainage at the Ballard site existed as shallow drills created during a previous planting operation. These were widely spaced and sloped towards the Ballyeustace Stream classified as ***Depositing/lowland river (FW2***). The stream flows along the north–western and northern boundary of the western compartment and along the northern boundary of the eastern compartment. The sides of this stream are well vegetated by willows (*Salix sp.)* and birch (*Betula* sp.). The shallow drains were dry at the time of the survey and had floral cover of terrestrial plants.

Plate 5.3 Typical character of the replacement lands at Ballard (Photo: Malachy Walsh & Partners).

5.6.2.1 Significance of Habitats

Ecological evaluation within this section follows a methodology that is set out in Chapter 3 of the 'Guidelines for Assessment of Ecological Impacts of National Roads Schemes' (NRA, 2009).

No habitats which correspond to those that are listed in the EU Habitats Directive were identified during the site visit. Treelines, hedgerows, woodland habitats and the lowland/depositing river habitats were assigned a significance of Local Importance (Higher Value) as these habitats have a higher level of biodiversity within the context of the local environment, and provide cover and commuting corridor links between habitats of higher ecological value.

The grassland habitats, scrub and bare ground within the site is of Local Importance (Lower Value) as it contains areas which are of some local importance for wildlife.

5.6.3 Fauna in the Existing Environment

Non-volant mammals

A comprehensive search of the site for mammals was undertaken. Evidence of badger (a subsidiary sett) and sitka deer was seen while onsite as well as droppings were identified within the development boundary.

Bats

There are no structures within the site which may provide suitable roosting habitat for bats. Treelines, hedgerows, woodland habitat and the stream habitat within and around the site are likely to be utilised by commuting and foraging bat species.

Birds

Bird species recorded within the site included jay *(Garrulus glandarius)*, snipe (*Gallinago gallinago*), buzzard (*Buteo buteo),* kestrel (*Falco tinnunculus*) and stonechat *(Saxicola torquata).* The site provided habitat for a range of common and widespread species but not of significance for rare or protected bird species. Given the lack of significant habitat for rare or protected bird species, there is no requirement for further bird surveys at the site.

5.6.3.1 Significance of Fauna

No evidence of Annex listed species were recorded within the site boundaries. Evidence of badger was observed from a single subsidiary sett entrance identified within the site boundary.

The watercourse along the site boundaries is likely to be utilised by commuting and foraging otter. Otter is listed on Annex II and IV of the EU Habitats Directive and is protected under the Irish Wildlife Act. No suitable habitat for other species of conservation concern was identified within the proposed afforestation site.

No Annex I listed bird species and no bird species associated with any SPA were recorded during the site visit. Bird species recorded within the site were common species. The forestry replacement site provides some foraging and nesting habitats for these and other common bird species in general.

5.6.4 Impact Assessment

5.6.4.1 Do Nothing' Impact

Were the site to remain unplanted the management on site would likely remain as it is presently i.e. Scrub habitat mosaic with Dry-humid acid grassland, wet grassland with some dense bracken accumulations, woodland habitats with the river running along the site boundary. However, given that the site has received Technical Approval from the Forest Service as described above it will be afforested per the provisions of the approval at a later date.

5.6.4.2 Impacts During the Site Preparation and Planting Phase

5.6.4.2.1 *Loss of Floral Habitat*

Long-Term Neutral Impact

The proposed afforestation will result in the loss of wet agricultural grassland, dense bracken habitats, scrub, bare ground and some dry-humid acid grassland assigned Local importance (lower value). These habitats are common in the wider landscape and the loss of these habitats is not considered to be significant.

The treelines, hedgerows and woodland habitats within the site will be retained.

The impacted habitats are not considered to be of ecological sensitivity and their loss will constitute a neutral impact when compared with the coniferous forestry to be planted. The loss of these habitats is not considered significant.

Mitigation

Despite the fact that the loss of habitats on the forestry replacement site is not a significant ecological effect, all works will be carried out in accordance with the relevant Forest Service requirements, including 'Forestry Biodiversity Guidelines' (2000)'. All hedgerows and existing treelines will be retained and appropriate set-back applied as per the Forest Service document 'Environmental Requirements for Afforestation (2016)'. The Technical Approval document specifies the area that should contain a suitable broadleaf and conifer species. This management would allow for the retention of the Local Value (Higher Importance) habitats.

Residual Impact

The replacement of these grassland habitats, scrub and bracken with forestry is considered to be a Long Term Neutral Impact. No significant effects are anticipated.

5.6.4.2.2 *Loss of Faunal Habitat*

Long Term Neutral Impact

The proposed planting site is not of high value or importance as a faunal habitat, being dominated mostly by wet agricultural grassland, dense bracken habitats, scrub, bare ground and some dry-humid acid grassland assigned Local importance (lower value). It is likely that the proposed planting of forestry will result in some loss of foraging habitat for deer. These habitats are common in the wider landscape and the loss of these habitats is not considered to be significant.

Evidence of badger was observed from a single subsidiary sett entrance identified within the site boundary. A pre-planting commencement site visit should be conducted by a qualified ecologist to determine if the sett is occupied. If it established that the sett is active a badger sett closure licence should be applied for from NPWS, to temporarily close the sett during planting in order to avoid any potential impact on badger. Following the completion of the afforestation/planting, the sett will be reopened. Loss would therefore be short-term in nature. All affected badger setts should be clearly marked, and the extent of bounds prohibited for vehicles clearly marked by fencing and signage. As per the NRA (2006) '*guidelines for the treatment of badgers prior to the construction of national road schemes*', 'light work, such as digging by hand or scrub clearance should not take place within 10m of sett entrances,' however this work should not be undertaken during the breeding season (December to June inclusive).

The proposed development site does not provide significant foraging or roosting habitat for protected bird species given the highly managed/modified nature of habitats on site, dominated by agricultural

wet grassland. Given the lack of significant bird assemblages recorded within or adjacent to the site, significant impacts as a result of disturbance or displacement are not anticipated on bird species at any geographic scale.

Treelines, hedgerow and woodland habitat provide bat commuting and foraging habitat and there will be no loss of hedgerow or trees as part of the proposal and therefore no impacts on bat commuting and foraging habitat.

The afforestation, in particular that of broadleaf species will result in the creation of cover and nesting habitat for a range of bird species, resulting in an overall Long-Term Neutral Impact.

Mitigation / Best Practice

- Afforestation will be preceded by an ecological survey to identify if badger occupy the site by an appropriately qualified and experienced ecologist. If badger are found to occupy the site, consultation with the National Parks and Wildlife Service (NPWS) will be required,
- Any works undertaken within 50 metres of any identified badger sett will be undertaken under licence from the National Parks and Wildlife Service (NPWS). All such works will follow best practice measures described in the NRA (2006) '*guidelines for the treatment of badgers prior to the construction of national road schemes*',
- Where works are undertaken within 30 metres of a badger sett, site preparation works will be supervised by an appropriately qualified ecologist as per NRA (2006) guidelines.
- All works will be carried out in accordance with the relevant Forest Service requirements, including '*Forestry Biodiversity Guidelines*' (2000)'.
- All hedgerows, existing treelines and mixed broadleaf woodland will be retained and appropriate set-back applied as per the Forest Service document '*Environmental Requirements for Afforestation (2016)*'.
- Vegetation clearance will be carried out in line with the Wildlife Act.

Residual Impact.

- No significant effects on faunal habitat as a result of the proposed afforestation is anticipated.

5.6.4.2.3 *Water Pollution*

Short-Term Slight Negative Impact

Following a precautionary approach, in the absence of best practice and design, there is potential for water pollution to occur through discharge to the Ballyeustace stream along the site's northern and north-western boundaries and therefore potential localised water pollution effects in the form of release of suspended solids, siltation and erosion as a result of the proposed afforestation.

Mitigation

Best Practice

Best practice methods related to water incorporated into the forestry management and mitigation measures have been derived from:

- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & Water Protection Guidelines;

- Forest Service (Draft): Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures; and,
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.
- Forest Service (2016) Environmental Requirements for Afforestation. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.
- Forest Service (2016) Land Types for Afforestation. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.

Measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods which will be applied at the forestry replacement lands. These include:

- Machine combinations will be chosen which are most suitable for ground conditions at the time of excavation and felling, and which will minimise surrounding soils disturbance;
- Where possible, existing drains will not be disturbed during drainage works;
- Drains and sediment traps will be installed during ground preparation and felling. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and should avoid being placed at right angles to the contour;
- Drains and silt traps will be maintained throughout all planting works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimised and controlled;
- Apply a 5 metre wide (minimum) uncultivated and unplanted water setback along relevant watercourses (as defined in Circular 12/2017) located within or adjoining the site. This setback is to remain undisturbed during establishment and throughout the forest rotation. Apply and maintain as per details set out in Tables 5 and 6 of the Environmental Requirements for Afforestation (DAFM, 2016).
- Adhere to all water protection measures relating to cultivation, herbicide application, the location of onsite storage depots and the disposal of waste, set out in the Environmental Requirements for Afforestation (DAFM, 2016).
- There will be no woody weed removal within 20 m of a drainage ditch.

Buffer Zones

There is a requirement in the Forest Service Code of Practice and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zones at planting stage. Minimum buffer zone widths recommended in the Forest Service (2000) guidance document "Forestry and Water Quality Guidelines" are shown in Table 5.18.

Table 5.18 Minimum Buffer Zone Widths (Forest Service, 2000)

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0 – 15%)	10 m	15 m
Steep	(15 – 30%)	15 m	20 m
Very steep	(>30%)	20 m	25 m

Residual Impact

No impacts on water quality are anticipated as a result of any element of the proposed afforestation.

5.6.4.3 Impacts During Operational Phase (i.e. Harvesting/ Afforestation)

There will be no significant indirect or direct impacts on the biodiversity, surface or ground water. In addition, no potential for impact on designated sites was identified once the site has been afforested.

Residual Impact

No residual impacts are anticipated associated with the proposed afforestation while planted.

5.6.4.4 Impact on Designated Sites

Potential indirect impacts on European Designated sites (SACs and SPAs) are fully assessed within a separate Appropriate Assessment Screening Report (AASR), see Appendix 3. The AASR report concludes that:

> *It is concluded beyond reasonable scientific doubt, in view of best scientific knowledge, on the basis of objective information and in light of the conservation objectives of the relevant European sites, that the proposed forestry replacement land, individually or in combination with other plans and projects, will not have a significant effect on any European Site.*
>
> *The proposed afforestation has Technical Approval from the Forest Service and will be undertaken accordingly. This approval is conditional to all associated works being undertaken in accordance with Forest Service requirements. The impacts associated with this afforestation have been classified overall as a neutral impact. As such, when considered in-combination with the other land uses in the area, and considering that the forestry guidelines are designed to minimise and prevent impacts to habitats that are outside the site, cumulative impacts on sensitive ecological receptors are not anticipated.*

The impact on nationally designated sites was assessed as per Table 5.15 above and there was no Natural Heritage Areas (NHA) or proposed Natural Heritage Areas (pNHAs) identified within the Zone of Likely Impact. All forestry activities will be undertaken in accordance with industry guidance and best practice. No potential for significant effect was identified based on the nature and scale of the works and separation in distance from the designated site.

5.6.4.5 Cumulative Impacts

The proposed afforestation has Technical Approval from the Forest Service and will be undertaken accordingly. This approval is conditional to all associated works being undertaken in accordance with Forest Service requirements. The impacts associated with this afforestation have been classified overall as a neutral impact. As such, when considered in-combination with the other land uses in the area, and considering that the forestry guidelines are designed to minimise and prevent impacts to habitats that are outside the site, cumulative impacts on sensitive ecological receptors are not anticipated.

6. SOILS AND GEOLOGY

6.1 Introduction

This section of the report provides baseline information on the environmental setting of the approved forestry replacement sites in terms of soils and geology and assesses the potential impacts that the activity may have on these. Where required, appropriate mitigation measures to limit any identified significant impacts to soils and geology are recommended.

6.2 Desk Study

This desk study involved collecting all relevant geological data for each site and its surrounding area. This included consultation of the following:

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - National Draft Bedrock Aquifer map;
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Geological Survey of Ireland (GSI, 2003);
- Geological Survey of Ireland – 1:25,000 Field Mapping Sheets; and,
- General Soil Map of Ireland 2nd edition (www.epa.ie).

6.2.1 Impact Assessment Methodology

Using information from the desk study, an estimation of the importance of the soil and geological environment within the study area is assessed using the criteria set out in Table 6.1 (NRA, 2005).

Table 6-1 Estimation of Importance of Soil and Geology Criteria (NRA, 2005)

Importance	Criteria	Typical Example
Very High	Attribute has a high quality, significance or value on a regional or national scale. Degree or extent of soil contamination is significant on a national or regional scale. Volume of peat and/or soft organic soil underlying route is significant on a national or regional scale.	Geological feature rare on a regional or national scale (NHA). Large existing quarry or pit. Proven economically extractable mineral resource
High	Attribute has a high quality, significance or value on a local scale. Degree or extent of soil contamination is significant on a local scale. Volume of peat and/or soft organic soil underlying site is significant on a local scale.	Contaminated soil on site with previous heavy industrial usage. Large recent landfill site for mixed wastes Geological feature of high value on a local scale (County Geological Site). Well drained and/or highly fertility soils. Moderately sized existing quarry or pit Marginally economic extractable mineral resource.

Medium	Attribute has a medium quality, significance or value on a local scale. Degree or extent of soil contamination is moderate on a local scale. Volume of peat and/or soft organic soil underlying site is moderate on a local scale.	Contaminated soil on site with previous light industrial usage. Small recent landfill site for mixed Wastes. Moderately drained and/or moderate fertility soils. Small existing quarry or pit. Sub-economic extractable mineral Resource.
Low	Attribute has a low quality, significance or value on a local scale. Degree or extent of soil contamination is minor on a local scale. Volume of peat and/or soft organic soil underlying site is small on a local scale.	Large historical and/or recent site for construction and demolition wastes. Small historical and/or recent landfill site for construction and demolition wastes. Poorly drained and/or low fertility soils. Uneconomically extractable mineral Resource.

The statutory criteria (EPA, 2017, EPA, 2002 and EPA, 2003) for the assessment of impacts require that likely impacts are described with respect to their extent, magnitude, complexity, probability, duration, frequency, reversibility and transfrontier nature (if applicable). The descriptors used in this environmental impact assessment are those set out in EPA (2017) Glossary of Impacts as shown in Section 1 of the EIAR which accompanied the application. In addition, the two impact characteristics proximity and probability are described for each impact and these are defined in Table 6.2.

In order to provide an understanding of this descriptive system in terms of the geological/hydrological environment, elements of this system of description of impacts are related to examples of potential impacts on the hydrology and morphology of the existing environment, as listed in Table 6.3.

Table 6-2 Additional Impact Characteristics

Impact Characteristic	Degree/ Nature	Description
Proximity	Direct	An impact which occurs within the area of the proposed project, as a direct result of the proposed project.
	Indirect	An impact which is caused by the interaction of effects, or by off-site developments.
Probability	Low	A low likelihood of occurrence of the impact.
	Medium	A medium likelihood of occurrence of the impact.
	High	A high likelihood of occurrence of the impact.

Table 6-3 Impact descriptors related to the receiving environment

Impact Characteristics		Potential Hydrological Impacts
Quality	Significance	
Negative only	Profound	Widespread permanent impact on: - The extent or morphology of a SAC. - Regionally important aquifers. - Extents of floodplains. Mitigation measures are unlikely to remove such impacts.
Positive or Negative	Significant	Local or widespread time dependent impacts on: -The extent or morphology of a SAC / ecologically important area. -A regionally important hydrogeological feature (or widespread effects to minor hydrogeological features). -Extent of floodplains. Widespread permanent impacts on the extent or morphology of an NHA/ecologically important area, Mitigation measures (to design) will reduce but not completely remove the impact – residual impacts will occur.
Positive or Negative	Moderate	Local time dependent impacts on: - The extent or morphology of a SAC / NHA / ecologically important area. - A minor hydrogeological feature. - Extent of floodplains. Mitigation measures can mitigate the impact OR residual impacts occur, but these are consistent with existing or emerging trends
Positive, Negative or Neutral	Slight	Local perceptible time dependent impacts not requiring mitigation.
Neutral	Imperceptible	No impacts, or impacts which are beneath levels of perception, within normal bounds of variation, or within the bounds of measurement or forecasting error.

6.3 Proposed Replanting Lands

6.3.1 Replanting Area 1: Stranamart, Co. Cavan

6.3.1.1 Geology and Subsoils

Information on the main geological formations and subsoils underlying replanting area 1 Stranamart, Co. Cavan.

Table 6-4 Information on geology and subsoil under site in Stranamart, Co. Cavan.

Site	Geological Formation	Subsoil Type
Stranamart	› Pale orthoquartzitic sandstone	› Shales and sandstones till (Namurian) › Cutover peat

Much of the site at Stranamart is underlain with Pale orthoquartzitic sandstone, described as ah omogenous, thick bedded, medium-grained, orthoquartzitic, brown coloured sandstone with minor amounts of shale. The subsoil comprises Shales and sandstones till (Namurian) with pockets of cutover peat to the east and south. The immediate area surrounding the site is underlain with similar subsoils to the site; however, further to the east and west, vast areas of blanket peat can be found.

6.3.1.2 Geological Resource Importance

The bedrock at the site is classified as having a "moderate potential" for construction purposes. There is no record of mining in the area.

The peat deposits at the site are classified as "low" importance. Is not designated in this area, is poorly drained and extensive in the surrounding landscape. Refer to Table 6.1 for criteria.

6.3.1.3 Geological Heritage and Designated Sites

There are no recorded Geological Heritage sites, historical landslides, mineral deposit sites or mining sites (current or historic) within the proposed development area.

6.3.1.4 Potential Impacts

6.3.1.4.1 *Likely and Significant Impacts and Associated Mitigation Measures*

The likely impacts of the proposed development and mitigation measures that will be put in place to eliminate or reduce them are described below.

Construction of Drains and Planting of Trees

There will be some minor disturbance of soils, associated with the construction of drains through the site. Planting of trees will be carried out by hand using the slit planting method, so soil disturbance from this will be insignificant. There are no likely impacts of this afforestation on the underlying geology.

Site Roads & Tracks Construction

Forestry felling would typically occur within 0.5km of access points (roads & tracks) to the main forest body. Due to the small size of this site, additional access tracks or roads will not be required. This site is located adjacent to an existing road network which will not require upgrading or alteration.

6.3.1.5 Mitigation Measures

Planting of trees will be carried out by hand. Any drains will be generally shallow and will be constructed in accordance with the forestry service best practice guidelines described in detail in Section 2. Soils will remain in situ at the site and will not be removed offsite.

6.3.2 Operational Phase

There will be no significant indirect or direct impacts on soils and geology once the site has been afforested.

6.3.2.1.1 *Residual Impact*

There will be no impacts on soils and geology associated with the proposed afforestation.

6.3.2.1.2 *Significance of the Effects*

Based on the above, there will be no significant effects on soils and geology at this site.

6.3.3 Replanting Area 2: Brackloon, Co. Roscommon

6.3.3.1 Geology and Subsoils

Information on the main geological formations and subsoils underlying replanting area 2, Brackloon, Co. Roscommon.

Table 6-5 Information on geology and subsoil under site in Brackloon Co. Roscommon.

Site	Geological Formation	Subsoil Type
› Brackloon	› Dark fine-grained limestone & shale	› Till derived from mixed Devonian and Carboniferous rock › Cutover peat

The site at Brackloon is underlain with dark fine-grained limestone & shale with a sandstone till (Devonian/ Carboniferous) subsoil covering most of the site. A strip of cutover peat subsoil can be found along the southern boundary. To the east and further south, the same subsoils can be found, while to the north, west and immediate south, basin peat can be found.

6.3.3.2 Geological Resource Importance

The limestone & shale bedrock at the site is classified as “Medium” importance. The bedrock is used on a “sub-economic” local scale for construction purposes. The bedrock at the site has not been used in the past for this purpose.

6.3.3.3 Geological Heritage and Designated Sites

There are no recorded Geological Heritage sites, mineral deposit sites or mining sites (current or historic) within the proposed development area.

6.3.3.4 Potential Impacts

6.3.3.4.1 *'Do-Nothing' Scenario*

The lands have been Technically Approved and will be afforested should the Croagh Wind Farm proceed or not. If the land was not replanted, the current landuse would continue at the site.

6.3.3.4.2 *Likely and Significant Impacts and Associated Mitigation Measures*

The likely impacts of the proposed development and mitigation measures that will be put in place to eliminate or reduce them are described below.

Construction of Drains and Planting of Trees

There will be some minor disturbance of soils, associated with the construction of drains through the site. Planting of trees will be carried out by hand using the slit planting method, so soil disturbance from this will be insignificant. There are no likely impacts of this afforestation on the underlying geology.

Site Roads & Tracks Construction

Forestry felling would typically occur within 0.5km of access points (roads & tracks) to the main forest body. Due to the small size of this site, additional access tracks or roads will not be required. This site is located adjacent to an existing road network which will not require upgrading or alteration.

6.3.3.4.3 *Mitigation Measures*

Planting of trees will be carried out by hand. Any drains will be generally shallow and will be constructed in accordance with the forestry service best practice guidelines described in detail in Section 2. Soils will remain in situ at the site and will not be removed offsite.

6.3.4 Operational Phase

There will be no significant indirect or direct impacts on soils and geology once the site has been afforested.

6.3.5 Residual Impact

There will be no impacts on soils and geology associated with the proposed afforestation.

6.3.5.1.1 *Significance of the Effects*

Based on the above, there will be no significant effects on soils and geology at this site.

6.3.6 Replanting Area 3: Ballard, Co. Wicklow

6.3.6.1 Geology and Subsoils

Information on the main geological formations and subsoils underlying replanting area 3, Ballard, Co. Wicklow.

Table 6-6 Information on geology and subsoil under site in Ballard, Co. Wicklow.

Site	Geological Formation	Subsoil Type
› Ballard	› Dark grey semi-pelitic, psammitic schist	› Sandstone and shale till

The site at Ballard is underlain with dark grey semi-pelitic, psammitic schist, with the subsoil being composed of sandstone and shale till. The surrounding area comprises the same with a small pocket of sandstone and shale sands and gravels to the north of the site.

6.3.6.2 Geological Resource Importance

The schist bedrock at the site is classified as "Medium" importance. The bedrock is used on a "sub-economic" local scale for construction purposes. The bedrock at the site has not been used in the past for this purpose.

6.3.6.3 Geological Heritage and Designated Sites

There are no recorded Geological Heritage sites, mineral deposit sites or mining sites (current or historic) within the proposed development area.

6.3.6.4 Potential Impacts

6.3.6.4.1 *'Do-Nothing' Scenario*

The lands have been Technically Approved and will be afforested should the Croagh Wind Farm proceed or not. If the land was not replanted, the current land use would continue at the site.

6.3.6.4.2 *Likely and Significant Impacts and Associated Mitigation Measures*

The likely impacts of the proposed development and mitigation measures that will be put in place to eliminate or reduce them are described below.

Construction of Drains and Planting of Trees

There will be some minor disturbance of soils, associated with the construction of drains through the site. Planting of trees will be carried out by hand using the slit planting method, so soil disturbance from this will be insignificant. There are no likely impacts of this afforestation on the underlying geology.

Site Roads & Tracks Construction

Forestry felling would typically occur within 0.5km of access points (roads & tracks) to the main forest body ('Forest Roads Scheme'. Forest Service, 2012). Due to the small size of this site, additional access

tracks or roads will not be required. This site is located adjacent an existing road network with existing entrances, which will not require alteration.

6.3.6.4.3 *Mitigation Measures*

Planting of trees will be carried out by hand. Any drains will be generally shallow and will be constructed in accordance with the forestry service best practice guidelines described in detail in Section 2. Soils will remain in situ at the site and will not be removed offsite.

6.3.7 Operational Phase

There will be no significant indirect or direct impacts on soils and geology once the site has been afforested.

6.3.7.1.1 *Residual Impact*

There will be no impacts on soils and geology associated with the proposed afforestation.

6.3.7.1.2 *Significance of the Effects*

Based on the above, there will be no significant effects on soils and geology at this site.

7. HYDROLOGY AND HYDROGEOLOGY

7.1 Introduction

7.1.1 Background and Objectives

The objective of the hydrology and hydrogeology assessment is to:

- Produce a baseline study of the existing water environment (surface and groundwater) in the area of the site locations;
- Identify likely positive and negative impacts of the proposed development on surface and groundwater during all phases of the development; and,
- Identify mitigation measures to avoid, remediate or reduce significant negative impacts.

This section of the report provides baseline information on the environmental setting of the approved afforestation sites in terms of hydrology and hydrogeology and discusses the potential impacts that the activity may have on it. Where required, appropriate mitigation measures to limit any identified significant impacts to site hydrology and hydrogeology are recommended.

7.1.2 Methodology

7.1.2.1 Desk Study

A desk study of the site and the surrounding areas involved collecting the relevant geological, hydrological, hydrogeological and meteorological data for the area. This included consultation with the following:

- Environmental Protection Agency database (www.epa.ie);
- Geological Survey of Ireland - National Draft Bedrock Aquifer map;
- Geological Survey of Ireland - Groundwater Database (www.gsi.ie);
- Met Eireann Meteorological Databases (www.met.ie);
- National Parks & Wildlife Services Public Map Viewer (www.npws.ie);
- Water Framework Directive "Catchments" Map Viewer (www.catchments.ie);
- Bedrock Geology 1:100,000 Scale Map Series, Geological Survey of Ireland (GSI, 2003);
- OPW Indicative Flood Maps (www.floodmaps.ie);
- Environmental Protection Agency – "Hydrotool" Map Viewer (www.epa.ie);
- CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.cfram.ie); and,
- Department of Environment, Community and Local Government on-line mapping viewer (www.myplan.ie).

7.1.2.2 Impact Assessment Methodology

Please refer to Chapter 1 of the EIAR for details on the impact assessment methodology (EPA, 2017, 2002 & 2003). In addition to the above methodology, the sensitivity of the water environment receptors was assessed on completion of the desk study. Levels of sensitivity which are defined in Table 7.1 are then used to assess the potential effect that the proposed development may have on them.

Table 7-1 Receptor Sensitivity Criteria (Adapted from www.sepa.org.uk)

Sensitivity of Receptor	
Not sensitive	Receptor is of low environmental importance (e.g. surface water quality classified by EPA as A3 waters or seriously polluted), fish sporadically present or restricted). Heavily engineered or artificially modified and may dry up during summer months. Environmental equilibrium is stable and is resilient to changes which are considerably greater than natural fluctuations, without detriment to its present character. No abstractions for public or private water supplies. GSI groundwater vulnerability "Low" – "Medium" classification and "Poor" aquifer importance
Sensitive	Receptor is of medium environmental importance or of regional value. Surface water quality classified by EPA as A2. Salmonid species may be present and may be locally important for fisheries. Abstractions for private water supplies. Environmental equilibrium copes well with all-natural fluctuations but cannot absorb some changes greater than this without altering part of its present character. GSI groundwater vulnerability "High" classification and "Locally" important aquifer.
Very sensitive	Receptor is of high environmental importance or of national or international value i.e. NHA or SAC. Surface water quality classified by EPA as A1 and salmonid spawning grounds present. Abstractions for public drinking water supply. GSI groundwater vulnerability "Extreme" classification and "Regionally" important aquifer

7.2 Proposed Drainage

The proposed replanting land will be drained in accordance with the Forestry Guidelines. Forestry plantations are generally drained by a network of mound drains which typically run perpendicular to the topographic contours of the site and feed into collector drains, which discharge to interceptor drains down-gradient of the plantation.

Mound drains are generally spaced approximately every 15m. Interceptor drains are generally located up-gradient (cut-off drains) and down-gradient of forestry plantations. A schematic of a typical standard forestry drainage network and one which is representative of the proposed site drainage network is shown in Figure 2.7 of this report.

7.3 Replanting Area 1: Stranamart, Co. Cavan.

7.3.1 Baseline Environment and Local Hydrology

Ground level elevations at the replanting site range from 93m OD (meters above Ordnance Datum) in the northwest to 120m OD in the northeast.

There are no watercourses within or adjacent to the Stranamart site.

7.3.1.1 Regional Hydrology

The site is located within the Shannon [Upper]_SC_010 subcatchment., which in turn is located in the Upper Shannon Catchment IE_26A. The status of the replanting site and the subcatchment overall is 'Good' condition. The River Waterbodies Risk of the subcatchment area is 'Not at Risk'.

7.3.1.2 Water Balance

While the process of afforestation may result in a slight alteration in the water runoff of the site, the small size of the site (0.13km^2) when compared with the Upper Shannon 26A catchment (604.47 km^2) means that any potential impacts this may have would be insignificant. The afforestation will lead to an imperceptible reduction in the runoff volumes in the longer term as the trees mature.

7.3.1.3 Flood Risk Identification

OPW's indicative river and coastal flood map (www.floodmaps.ie), CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.cfram.ie), Department of Environment, Community and Local Government on-line planning mapping (www.myplan.ie) were consulted to identify those areas as being at risk of flooding.

No records or risks associated with flooding were identified in the published data sets.

7.3.1.4 Surface Water Hydrochemistry

The underlying sandstone bedrock (in part) and the sandstone derived till subsoil and peat would have slightly acidic groundwater characteristics which would have some effect on surface water chemistry, specifically during dry periods when baseflow is likely to be more prevalent.

7.3.1.5 Hydrogeology

The underlying bedrock at the site is mapped as Pale orthoquartzitic sandstone with a Shales and sandstones till (Namurian) subsoil and areas of cutover peat (refer to Section 6 – Soils & Geology). The GSI has classified the bedrock formation here as a Locally Important Aquifer - Bedrock which is Generally Moderately Productive (Lm).

7.3.1.6 Groundwater Vulnerability

The vulnerability rating of the aquifer for the majority of the site is categorised as ''High' (H) with areas of 'Extreme' (E) and 'Rock at or near Surface or Karst' (X) to the south.

7.3.1.7 Surface Water Body Status

The EU Water Framework Directive aims to protect, enhance and restore all waters with aim to achieve at least good status by 2021.

Under the first cycle of the Water Framework Directive Local surface water Body status reports were available for download from www.wfdireland.ie. Local surface water body (1st and 2nd cycle) information is available for viewing from www.catchments.ie.

There are no watercourses within or adjacent to the study site.

7.3.1.8 Groundwater Body Status

Under the first cycle of the Water Framework Directive Local Groundwater Body status reports were available for download from www.wfdireland.ie. and information related to the 1st and 2nd cycles of the WFD is available at www.catchments.ie.

The site is located in the Glenade Dowra IEGBNI_SH_G_264 Ground Water Body (GWB) which has a status of 'Good' in the 2013-2018 assessment cycle and 'Not at Risk'.

7.3.1.9 Designated Sites and Habitats

Designated sites include National Heritage Areas (NHAs), Proposed National Heritage Areas (pNHAs) Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). The proposed site is not located within any designated conservation-site. Designated sites in proximity to the proposed development site are described Section 5 Biodiversity.

7.3.1.10 Water Resources

There are no borehole wells within or adjacent to the site. The nearest borehole G-19-2965 is 1.53km south of the site however, there is no information on the GSI website regarding it function, or year of construction.

7.3.1.11 Receptor Sensitivity

As afforestation is a near-surface construction activity, impacts on groundwater are largely negligible and surface water is generally the main sensitive receptor assessed during impact assessments. The primary risk to groundwater at the site is from nutrients associated with fertilisers.

As there are no surface water bodies within or near the site, there is no risk to waterbody pollution by surface run off in the area.

7.3.2 Proposed Drainage Management

Runoff control and drainage management are key elements in terms of mitigation against impacts on surface water bodies. Two distinct methods will be employed to manage drainage water within the proposed development. The first method involves 'keeping clean water clean' by avoiding disturbance to natural drainage features. The second method involves collecting any drainage waters from planted areas within the site that might carry silt or sediment, and nutrients, using cut off drains to control direct discharge into streams.

As there are no surface water bodies within or near the site, there is no risk to waterbody pollution by surface run off in the area, therefore drainage management is not required.

7.3.3 Potential Impacts

The potential impacts of the proposed development and mitigation measures that will be put in place to eliminate or reduce them are set out below.

7.3.3.1 'Do-Nothing' Scenario

The lands have been Technically Approved and will be afforested should the Croagh Wind Farm proceed or not. If the land was not replanted, the current land use would continue at the site.

7.3.3.2 Planting Phase

7.3.3.2.1 *Excavation of Forestry Drains and Planting*

Pathways: Drainage and surface water discharge routes.

Receptors: Surface waters and associated dependent ecosystems.

Potential Impacts: Indirect, negative, slight, short term low probability impact.

Shallow forestry drains will be constructed using an excavator throughout the site to a similar drainage pattern as Figure 2.7 and will discharge into the adjacent watercourse.

Potential impacts during drain construction occur mainly from:

- Exposure of soil and subsoils due to excavation, vehicle tracking, and skidding resulting in a source of suspended sediment which can become entrained in surface water runoff and enter drains; and,
- Nutrient release.

7.3.3.2.2 *Harvesting Operations*

Pathways: Drainage and surface water discharge routes.

Receptors: Surface waters and associated dependant ecosystems.

Potential Impacts: Indirect, negative, moderate, short term, medium probability impact.

Potential impacts during tree felling occur mainly from:

- Exposure of soil and subsoils due to vehicle tracking, and skidding or forwarding extraction methods resulting in a source of suspended sediment which can become entrained in surface water runoff;
- Release of sediment attached to timber in stacking areas; and,
- Nutrient release.

7.3.3.2.3 *Site Access*

Forestry felling would typically occur within 0.5km of access points (roads & tracks) to the main forest body. Due to the small size of this site, additional access tracks or roads will not be required. This site is located adjacent an existing road network with which will not require upgrading or alteration.

7.3.3.2.4 *Proposed Mitigation Measures*

Best practice methods related to water incorporated into the forestry management and mitigation measures have been derived from:

- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Forest Service (Draft): Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures; and,
- Forest Service (2000): Forestry and Water Quality Guidelines. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.
- Forest Service (2016) Environmental Requirements for Afforestation. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.
- Forest Service (2016) Land Types for Afforestation. Forest Service, DAF, Johnstown Castle Estate, Co. Wexford.

Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods which are set out as follows:

- Machine combinations will be chosen which are most suitable for ground conditions at the time of excavation and felling, and which will minimise surrounding soils disturbance;
- Where possible, existing drains will not be disturbed during drainage works;
- Drains and sediment traps will be installed during ground preparation and felling. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and should avoid being placed at right angles to the contour; and,
- Drains and silt traps will be maintained throughout all planting works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimised and controlled.

Buffer Zones

There is a requirement in the Forest Service Code of Practice, Environmental Requirements for Afforestation document and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zones at planting stage. Minimum buffer zone widths recommended in the Forest Service (2000) guidance document "Forestry and Water Quality Guidelines" are shown in Table 7.2.

Table 7-2 Minimum Buffer Zone Widths (Forest Service, 2000)

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0 – 15%)	10 m	15 m
Steep	(15 – 30%)	15 m	20 m
Very steep	(>30%)	20 m	25 m

There are no surface waterbodies within or adjacent to the site. The closest is a watercourse IE_SH_26S020300 which is 113m west of the site, Therefore, the above buffer zones are not required.

7.3.3.2.5 *Residual Impact*

Indirect, imperceptible, short term, low probability impact.

7.3.3.3 Potential Release of Hydrocarbons during drainage works

Pathway: Groundwater flow paths and site drainage network.

Receptor: Groundwater and surface water.

Potential Impact: Indirect, negative, not significant, temporary, low probability impact to surface water quality.

Indirect, negative, not significant, temporary, medium probability impact to local groundwater quality.

The replanting will be carried out by hand, but it may be necessary to employ one excavator to create shallow drainage channels prior to planting. There is the potential for minor leaks from the excavator.

7.3.3.3.1 *Proposed Mitigation Measures*

Mitigation measures proposed to avoid release of hydrocarbons at the site are as follows:

- Maintenance will not be carried out on site.
- Fuels will not be stored on site.
- The plant used will be regularly inspected for leaks and fitness for purpose;

7.3.3.3.2 *Residual Impact*

Indirect, not significant, imperceptible, short term, low probability impact.

7.3.3.4 Potential Hydrological Impacts on Designated Sites

The proposed afforestation site is located within the Upper Shannon catchment. There will however be no direct discharges from the site and the hydrological regime locally will not be altered by the afforestation due to its small scale.

Pathway: Surface water flow paths.

Receptor: Down-gradient water quality & designated sites.

Potential Impact: Indirect, negative, imperceptible, short term, low probability impact.

7.3.3.4.1 *Impact Assessment & Proposed Mitigation Measures*

The proposed mitigation measures which will include buffer zones and drainage control measures (*i.e.* cut off drains, tapered drains before buffer zones) will ensure that the quality of runoff from proposed development areas will be very high. The proposed development site is located in Shannon Upper catchment. There could potentially be an "*imperceptible, short term, low probability impact*" on local streams and rivers but this would be very localised and over a very short time period (*i.e.* hours).

7.3.3.4.2 *Residual Impact*

No residual impacts.

7.3.4 Operational Phase

There will be no significant direct or indirect effects on groundwater and surface water during the operational phase.

7.3.4.1.1 *Residual Impact*

No residual impacts.

7.4 Replanting Area 2: Brackloon, Co. Roscommon

7.4.1 Baseline Environment and Local Hydrology

Ground level elevations at the replanting site range between 74–79m OD.

There are no rivers or streams located within the site; however, drainage channels run through the site and a large drain flows in a northwest direction along the southern boundary and discharges into the Owennaforeesha Stream. The latter confluences with Carricknabraher Stream to form the Breedoge

River which discharges into the Lough Gara SPA/pNHA 9.5km northwest of the site. The drain is under OPW control and maintenance and part of an Arterial Drainage Scheme.

7.4.1.1 Water Balance

While the process of afforestation may result in a slight alteration in the water runoff of the site, the small size of the site (0.0.72 km^2) when compared with the Upper Shannon catchment (674.13km^2) means that any potential impacts this may have would be insignificant. The afforestation will lead to an imperceptible reduction in the runoff volumes in the longer term as the trees mature.

7.4.1.2 Regional Hydrology

The site is located within the Upper Shannon Catchment IE_26B and forms part of the Breedoge subcatchment_SC_010. The subcatchment here has an overall status of 'Poor' condition due to urban pressures as approximately half of the surrounding dwellings are not connected to the wastewater treatment works resulting in discharges to surface water drains. Sediment impacts from peat and forestry on the Breedoge_010 subcatchment are part of the ongoing WFD 2018 – 2021 river basin management plan.

7.4.1.3 Flood Risk Identification

OPW's indicative river and coastal flood map (www.floodmaps.ie), CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.cfram.ie), Department of Environment, Community and Local Government on-line planning mapping (www.myplan.ie) were consulted to identify those areas as being at risk of flooding.

No records or risks associated with flooding were identified in the published data sets. The nearest flood event was recorded in 2005 at Kinclare, Co. Roscommon, approximately 2.17km east of the replanting site.

7.4.1.4 Surface Water Hydrochemistry

Slightly high pH values of surface waters would be typical of poorly drained mineral soil found on site. In addition, the underlying limestone and shale bedrock would have slightly alkaline groundwater characteristics which would have some effect on surface water chemistry, specifically during dry periods when baseflow is likely to be more prevalent.

7.4.1.5 Hydrogeology

The underlying bedrock at the site is mapped as being dark fine-grained limestone and shale (refer to Section 6 – Soils & Geology). The GSI has classified the bedrock formation here as 'Rkc' Regionally Important Aquifer – Karstified.

7.4.1.6 Groundwater Vulnerability

The vulnerability rating of the aquifer within the site is 'Low'. The surrounding area is also categorised as 'Low' with the exception of a small area approximately 300 to the southwest of where the vulnerability ranges from 'Moderate' to 'Extreme'.

7.4.1.7 Surface Water Body Status

The EU Water Framework Directive aims to protect, enhance and restore all waters with aim to achieve at least good status by 2021.

Under the first cycle of the Water Framework Directive Local surface water Body status reports were available for download from www.wfdireland.ie. Local surface water body (1st and 2nd cycle) information is available for viewing from www.catchments.ie.

As stated above, a drain runs along the southern boundary of the site and flows into the Breedoge River which has a status of 'Poor' since 2010 as some surrounding dwellings are not connected to the wastewater treatment works resulting in discharges to surface water drains. The Breedoge_010 subcatchment is 'At Risk'. Sediment impacts from peat and forestry on the Breedoge_010 subcatchment are part of the ongoing WFD 2018 – 2021 river basin management plan.

7.4.1.8 Groundwater Body Status

Under the first cycle of the Water Framework Directive Local Groundwater Body status reports were available for download from www.wfdireland.ie. And information related to the 1st and 2nd cycles of the WFD is available at www.catchments.ie.

The proposed afforestation site lies on the Carrick on Shannon Groundwater Body IE_SH_G_048 (GWB) as classified during the 2013-2018 assessment cycle. This GWB has an overall status of 'Good' but a projection of 'At Risk' due to potential groundwater contribution of phosphate from agriculture.

7.4.1.9 Designated Sites and Habitats

Designated sites include National Heritage Areas (NHAs), Proposed National Heritage Areas (pNHAs) Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). The proposed forestry development site is not located within any designated conservation-site. Designated sites in proximity to the proposed development site are described Section 5 Biodiversity.

7.4.1.10 Water Resources

There are no borehole wells within or adjacent to the site. The nearest well (GSI name: 1727NWW047) is located 0.54km southwest of the proposed replanting area and was constructed in 1899 for agricultural purposes.

7.4.1.11 Receptor Sensitivity

As afforestation is a near-surface construction activity, impacts on groundwater are largely negligible and surface water is generally the main sensitive receptor assessed during impact assessments. The primary risk to groundwater at the site is from nutrients associated with fertilisers.

Based on criteria set out in Table 7.1 groundwater at the site can be classed as Sensitive to pollution because the bedrock is classified 'Rkc' Regionally Important Aquifer – Karstified.

Surface water mitigation and controls are outlined below to ensure protection of all downstream receiving waters. Mitigation measures will ensure that surface runoff from the afforested areas of the site will be of a high quality and will therefore not impact on the quality of downstream surface water bodies.

7.4.2 Proposed Site Drainage

The site will be drained in accordance with the Forestry Guidelines. Forestry plantations are generally drained by a network of mound drains which typically run perpendicular to the topographic contours of the site and feed into collector drains, which discharge to interceptor drains down-gradient of the plantation.

Mound drains are generally spaced approximately every 15m. As illustrated in Figure 2.7, Interceptor drains are generally located up-gradient (cut-off drains) and down-gradient of forestry plantations. A schematic of a typical standard forestry drainage network and one which is representative of the proposed site drainage network is shown above as Figure 2.7.

7.4.3 Proposed Drainage Management

Runoff control and drainage management are key elements in terms of mitigation against impacts on surface water bodies. Two distinct methods will be employed to manage drainage water within the proposed development. The first method involves 'keeping clean water clean' by avoiding disturbance to natural drainage features. The second method involves collecting any drainage waters from planted areas within the site that might carry silt or sediment, and nutrients, using cut off drains to control direct discharge into streams.

7.4.4 Potential Impacts

The potential impacts of the proposed development and mitigation measures that will be put in place to eliminate or reduce them are set out below.

7.4.4.1 'Do-Nothing' Scenario

The lands have been Technically Approved and will be afforested should the Croagh Wind Farm proceed or not. If the land was not replanted, the current land use would continue at the site.

7.4.4.1.1 *Excavation of Forestry Drains and Planting*

Pathways: Drainage and surface water discharge routes.
Receptors: Surface waters and associated dependent ecosystems.
Potential Impacts: Indirect, negative, slight, short term, medium probability impact.

Shallow forestry drains will be constructed using an excavator throughout the site to a similar drainage pattern as Figure 2.7. There are no surface water courses on or adjacent the site and so the drains will ultimately discharge to the existing offsite field drain networks.

Potential impacts during drain construction occur mainly from:

- Exposure of soil and subsoils due to excavation, vehicle tracking, and skidding resulting in a source of suspended sediment which can become entrained in surface water runoff and enter drains; and,

Nutrient release.

7.4.4.1.2 *Harvesting Operations*

Pathways: Drainage and surface water discharge routes.

Receptors: Surface waters and associated dependant ecosystems.

Potential Impacts: Indirect, negative, moderate, short term, medium probability impact.

Potential impacts during tree felling occur mainly from:

- Exposure of soil and subsoils due to vehicle tracking, and skidding or forwarding extraction methods resulting in a source of suspended sediment which can become entrained in surface water runoff;
- Release of sediment attached to timber in stacking areas; and,
- Nutrient release.

7.4.4.1.3 *Site Access*

Forestry felling would typically occur within 0.5km of access points (roads & tracks) to the main forest body. Due to the small size of this site, additional access tracks or roads will not be required. This site is located adjacent an existing road network with which will not require upgrading or alteration.

7.4.4.2 Proposed Mitigation Measures

Best practice methods related to water incorporated into the forestry management and mitigation measures have been derived from:

- Forest Service (2016) Environmental Requirements for Afforestation
- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Forest Service (Draft): Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures

Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods which are set out as follows:

- Machine combinations will be chosen which are most suitable for ground conditions at the time of excavation and felling, and which will minimise surrounding soils disturbance;
- Where possible, existing drains will not be disturbed during drainage works;
- Drains and sediment traps will be installed during ground preparation and felling. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and should avoid being placed at right angles to the contour; and,
- Drains and silt traps will be maintained throughout all planting works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimised and controlled.

Buffer Zones

There is a requirement in the Forest Service Code of Practice and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zones at planting stage. Minimum buffer zone widths recommended in the Forest Service (2000) guidance document *"Forestry and Water Quality Guidelines"* are shown in Table 7.3.

Table 7-3 Minimum Buffer Zone Widths (Forest Service, 2000)

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0 – 15%)	10 m	15 m
Steep	(15 – 30%)	15 m	20 m
Very steep	(>30%)	20 m	25 m

7.4.4.2.2 *Residual Impact*

Indirect, slight, short term, low probability impact.

7.4.4.3 Potential Release of Hydrocarbons during drainage works

Pathway: Groundwater flow paths and site drainage network.

Receptor: Groundwater and surface water.

Potential Impact: Indirect, negative, slight, temporary, medium probability impact to surface water quality.

Indirect, negative, slight, temporary, medium probability impact to local groundwater quality.

The replanting will be carried out by hand, but it may be necessary to employ one excavator to create shallow drainage channels prior to planting. There is the potential for minor leaks from the excavator.

7.4.4.3.1 *Proposed Mitigation Measures*

Mitigation measures proposed to avoid release of hydrocarbons at the site are as follows:

- Maintenance will not be carried out on site.
- Fuels will not be stored on site.
- The plant used will be regularly inspected for leaks and fitness for purpose

7.4.4.3.2 *Residual Impact*

Indirect, negative, imperceptible, short term, low probability impact.

7.4.4.4 Potential Hydrological Impacts on Designated Sites

The proposed afforestation site is located within the upper Shannon 26B catchment. There will however be no direct discharges from the site and the hydrological regime locally will not be altered by the afforestation due to its small scale.

Pathway: Surface water flow paths.

Receptor: Down-gradient water quality & designated sites.

Potential Impact: Indirect, negative, imperceptible, short term, low probability impact.

7.4.4.4.1 *Impact Assessment & Proposed Mitigation Measures*

The proposed mitigation measures which will include buffer zones and drainage control measures (*i.e.* cut off drains, tapered drains before buffer zones) will ensure that the quality of runoff from proposed development areas will be very high. The proposed development site is located in the Upper Shannon catchment. There could potentially be an "*imperceptible, short term, low probability impact*" on local streams and rivers but this would be very localised and over a very short time period (*i.e.* hours).

7.4.4.4.2 *Residual Impact*

No residual impacts.

7.4.5 Operational Phase

There will be no significant indirect or direct impacts on hydrology and hydrogeology once the site has been afforested.

7.4.5.1.1 *Residual Impact*

No residual impacts.

7.5 Replanting Site 3: Ballard, Co. Wicklow.

7.5.1 Baseline Environment and Local Hydrology

Ground level elevations at the replanting site range from 158m to 219m OD.

There are no drains, rivers or streams located within the site; however, the Ballyeustace Stream flows in a northeast direction approximately 50m north of the northern boundary.

7.5.1.1 Water Balance

While the process of afforestation may result in a slight alteration in the water runoff of the site, the small size of the site (0.396 km^2) when compared with the Avoca-Vartry catchment (1234.19 km^2) means that any potential impacts this may have would be insignificant. The afforestation will lead to an imperceptible reduction in the runoff volumes in the longer term as the trees mature.

7.5.1.2 Regional Hydrology

The site is located in the Avoca-Vartry Catchment IE_10 and forms part of the Avonbeg_SC_010 subcatchment. The subcatchment here has an overall status of 'At Risk' condition due to acidification.

7.5.1.3 Flood Risk Identification

OPW's indicative river and coastal flood map (www.floodmaps.ie), CFRAM Preliminary Flood Risk Assessment (PFRA) maps (www.cfram.ie), Department of Environment, Community and Local Government on-line planning mapping (www.myplan.ie) were consulted to identify those areas as being at risk of flooding.

No records or risks associated with flooding were identified in the published data sets.

7.5.1.4 Surface Water Hydrochemistry

Slightly high pH values of surface waters would be typical of poorly drained mineral soil found on site. In addition, the sandstone and till derived subsoils would have slightly acidic groundwater characteristics which would have some effect on surface water chemistry, specifically during dry periods when baseflow is likely to be more prevalent. As stated above, the WFD status for the Avonbeg_010 is 'Poor' due to acidification.

7.5.1.5 Hydrogeology

The underlying bedrock at the site is mapped as dark grey semi-pelitic, psammitic schist (refer to Section 6 – Soils & Geology). The GSI has classified the bedrock formation here as a Locally Important Aquifer - Bedrock which is Moderately Productive only in Local Zones.

7.5.1.6 Groundwater Vulnerability

The vulnerability rating of the aquifer within the site is categorised as 'High' due to the presence of bedrock relatively close to the surface. To the south and west of the site and in pockets to the north, the groundwater vulnerability is categorised as 'Extreme' (E) and 'Rock near surface or karst' (X) which is likely to be as a result of the presence of bedrock at or within 1 to 3 metres of the surface.

7.5.1.7 Surface Water Body Status

The EU Water Framework Directive aims to protect, enhance and restore all waters with aim to achieve at least good status by 2021.

Under the first cycle of the Water Framework Directive Local surface water Body status reports were available for download from www.wfdireland.ie. Local surface water body (1st and 2nd cycle) information is available for viewing from www.catchments.ie.

The Ballyeustace Stream IE_EA_10A040800 flows in a northeast direction, 50m north of the replanting site's northern boundary before it confluences with the Avonbeg River IE_EA_10A040800 and is deemed to be of 'Good' status but 'at risk' in the 2010-2015 assessment cycle of the Water Framework Directive.

7.5.1.8 Groundwater Body Status

Under the first cycle of the Water Framework Directive Local Groundwater Body status reports were available for download from www.wfdireland.ie. and information related to the 1st and 2nd cycles of the WFD is available at www.catchments.ie.

The proposed afforestation site lies on the Wicklow IE_EA_G_076 (GWB) and was classified during the 2013-2018 assessment cycle as having a 'Good' overall ground water status with a projection status of in 'Review'.

7.5.1.9 Designated Sites and Habitats

Designated sites include National Heritage Areas (NHAs), Proposed National Heritage Areas (pNHAs) Special Areas of Conservation (SACs) and Special Protection Areas (SPAs). The proposed forestry development site is not located within any designated conservation-site. Designated sites in proximity to the proposed development site are described Section 5 Biodiversity.

7.5.1.10 Water Resources

There are no borehole wells within the site. The nearest borehole wells (GSI name- 2917NEW038; and 2917NEW054) can be found at a minimum distance of 0.1km east of the site and were constructed in 1969/1970 for domestic use. The exact location of these wells cannot be determined from the online database.

7.5.1.11 Receptor Sensitivity

As afforestation is a near-surface construction activity, impacts on groundwater are largely negligible and surface water is generally the main sensitive receptor assessed during impact assessments. The primary risk to groundwater at the site is from nutrients associated with fertilisers.

Based on criteria set out in Table 7.1 groundwater at the site can be classed as sensitive to pollution because the dark grey semi-pelitic psammitic schist bedrock is classified as a locally important Aquifer.

Surface water mitigation and controls are outlined below to ensure protection of all downstream receiving waters. Mitigation measures will ensure that surface runoff from the afforested areas of the site will be of a high quality and will therefore not impact on the quality of downstream surface water bodies.

7.5.1.12 Proposed Site Drainage

The site will be drained in accordance with the Forestry Guidelines. Forestry plantations are generally drained by a network of mound drains which typically run perpendicular to the topographic contours of the site and feed into collector drains, which discharge to interceptor drains down-gradient of the plantation.

Mound drains are generally spaced approximately every 15m. As illustrated in Figure 2.7, Interceptor drains are generally located up-gradient (cut-off drains) and down-gradient of forestry plantations. A schematic of a typical standard forestry drainage network and one which is representative of the proposed site drainage network is shown above as Figure 2.7.

7.5.1.13 Proposed Drainage Management

Runoff control and drainage management are key elements in terms of mitigation against impacts on surface water bodies. Two distinct methods will be employed to manage drainage water within the proposed development. The first method involves 'keeping clean water clean' by avoiding disturbance to natural drainage features. The second method involves collecting any drainage waters from planted areas within the site that might carry silt or sediment, and nutrients, using cut off drains to control direct discharge into streams.

7.5.2 Potential Impacts

The potential impacts of the proposed development and mitigation measures that will be put in place to eliminate or reduce them are set out below.

7.5.2.1 'Do-Nothing' Scenario

The lands have been Technically Approved and will be afforested should the Croagh Wind Farm proceed or not If the land was not replanted, the current land use would continue at the site.

7.5.2.1.1 *Excavation of Forestry Drains and Planting*

Pathways: Drainage and surface water discharge routes.

Receptors: Surface waters and associated dependent ecosystems.

Potential Impacts: Indirect, negative, slight, short term, medium probability impact.

Shallow forestry drains will be constructed using an excavator throughout the site to a similar drainage pattern as Figure 2.7. There are no surface water courses on or adjacent the site and so the drains will ultimately discharge to the existing offsite field drain networks.

Potential impacts during drain construction occur mainly from:

- Exposure of soil and subsoils due to excavation, vehicle tracking, and skidding resulting in a source of suspended sediment which can become entrained in surface water runoff and enter drains; and,
- Nutrient release.

7.5.2.1.2 *Harvesting Operations*

Pathways: Drainage and surface water discharge routes.

Receptors: Surface waters and associated dependant ecosystems.

Potential Impacts: Indirect, negative, moderate, short term, medium probability impact.

Potential impacts during tree felling occur mainly from:

- Exposure of soil and subsoils due to vehicle tracking, and skidding or forwarding extraction methods resulting in a source of suspended sediment which can become entrained in surface water runoff;
- Release of sediment attached to timber in stacking areas; and,
- Nutrient release.

7.5.2.1.3 *Site Access*

Forestry felling would typically occur within 0.5km of access points (roads & tracks) to the main forest body. Due to the small size of this site, additional access tracks or roads will not be required. This site is located adjacent an existing road network with which will not require upgrading or alteration.

7.5.2.2 Proposed Mitigation Measures

Best practice methods related to water incorporated into the forestry management and mitigation measures have been derived from:

- Forest Service (2016) Environmental Requirements for Afforestation
- Forestry Commission (2004): Forests and Water Guidelines, Fourth Edition. Publ. Forestry Commission, Edinburgh;
- Coillte (2009): Forest Operations & Water Protection Guidelines;
- Forest Service (Draft): Forestry and Freshwater Pearl Mussel Requirements – Site Assessment and Mitigation Measures

Mitigation measures which will reduce the risk of entrainment of suspended solids and nutrient release in surface watercourses comprise best practice methods which are set out as follows:

- Machine combinations will be chosen which are most suitable for ground conditions at the time of excavation and felling, and which will minimise surrounding soils disturbance;
- Where possible, existing drains will not be disturbed during drainage works;
- Drains and sediment traps will be installed during ground preparation and felling. Collector drains will be excavated at an acute angle to the contour (~0.3%-3% gradient), to minimise flow velocities. Main drains to take the discharge from collector drains will include water drops and rock armour, as required, where there are steep gradients, and should avoid being placed at right angles to the contour; and,
- Drains and silt traps will be maintained throughout all planting works, ensuring that they are clear of sediment build-up and are not severely eroded. Correct drain alignment, spacing and depth will ensure that erosion and sediment build-up are minimised and controlled.

Buffer Zones

There is a requirement in the Forest Service Code of Practice and in the FSC Certification Standard for the installation of buffer zones adjacent to aquatic zones at planting stage. Minimum buffer zone widths recommended in the Forest Service (2000) guidance document "Forestry and Water Quality Guidelines" are shown in Table 7.4.

Table 7-4 Minimum Buffer Zone Widths (Forest Service, 2000)

Average slope leading to the aquatic zone		Buffer zone width on either side of the aquatic zone	Buffer zone width for highly erodible soils
Moderate	(0 – 15%)	10 m	15 m
Steep	(15 – 30%)	15 m	20 m
Very steep	(>30%)	20 m	25 m

7.5.2.2.2 *Residual Impact*

Indirect, slight, short term, low probability impact.

7.5.2.3 Potential Release of Hydrocarbons during drainage works

Pathway: Groundwater flow paths and site drainage network.

Receptor: Groundwater and surface water.

Potential Impact: Indirect, negative, slight, temporary, medium probability impact to surface water quality.

Indirect, negative, slight, temporary, medium probability impact to local groundwater quality.

The replanting will be carried out by hand, but it may be necessary to employ one excavator to create shallow drainage channels prior to planting. There is the potential for minor leaks from the excavator.

7.5.2.3.1 *Proposed Mitigation Measures*

Mitigation measures proposed to avoid release of hydrocarbons at the site are as follows:

- Maintenance will not be carried out on site.
- Fuels will not be stored on site.

- The plant used will be regularly inspected for leaks and fitness for purpose;

7.5.2.3.2 *Residual Impact*

Indirect, negative, imperceptible, short term, low probability impact.

7.5.2.4 Potential Hydrological Impacts on Designated Sites

The proposed afforestation site is located within the Mal Bay catchment. There will however be no direct discharges from the site and the hydrological regime locally will not be altered by the afforestation due to its small scale.

Pathway: Surface water flow paths.

Receptor: Down-gradient water quality & designated sites.

Potential Impact: Indirect, negative, imperceptible, short term, low probability impact.

7.5.2.4.1 *Impact Assessment & Proposed Mitigation Measures*

The proposed mitigation measures which will include buffer zones and drainage control measures (*i.e.* cut off drains, tapered drains before buffer zones) will ensure that the quality of runoff from proposed development areas will be very high. The proposed development site is located in Avoca-Vartry catchment. There could potentially be an "*imperceptible, short term, low probability impact*" on local streams and rivers but this would be very localised and over a very short time period (*i.e.* hours).

7.5.2.4.2 *Residual Impact*

No residual impacts.

7.5.3 Operational Phase

There will be no significant indirect or direct impacts on hydrology and hydrogeology once the site has been afforested.

7.5.3.1.1 *Residual Impact*

No residual impact.

8. LANDSCAPE AND VISUAL

8.1 Introduction

This section of the report addresses the landscape and visual impacts of the proposed replanting areas at Stranamart, Co. Cavan, Brackloon, Co. Roscommon and Ballard, Co. Wicklow.
It includes a description of the relevant County Council landscape policy for each site and describes the sites' landscape values and sensitivity. The landscape of each area is described in terms of its character, which includes a description of landform and landcover. An impact assessment of the proposed replanting is then undertaken. Documents consulted include:

- 'Landscape and Landscape Assessment: Consultation Draft of Guidelines for Planning Authorities' (Department of the Environment and Local Government 2000)
- 'Guidelines for Landscape and Visual Impact Assessment' (The Landscape Institute/Institute of Environmental Management & Assessment, 2013)
- 'Environmental Requirements for Afforestation (Forest Service, 2016)
- Forestry and the Landscape Guidelines' (Forest Service, 2000)

In order to carry out this assessment, a desk study was undertaken which identified relevant policies and guidelines, both at national and local level. This includes policies on forestry, landscape and landscape character, designated landscapes, and scenic routes. Maps and aerial images of the replanting site were also studied.

8.2 Landscape Policy Context

This section of the report refers to policies of the relevant County Council Development Plans as well as to the Forest Service Landscape Guidelines.

8.2.1 Cavan County Development Plan 2014-2020

8.2.1.1 Forestry Policy and Objectives

Section 3: 'Economic Development' of the Cavan County Development Plan deals with policies and objectives relating to forestry. This section outlines the vision for sustainable economic activity within the county and emphasises the benefit of forestry as a manner of diversifying agriculture and enterprise and boosting population levels in rural areas and acknowledges its benefit in the protection of the environment. The policies are listed in Chapter 3.

8.2.1.2 Landscape Policy and Objectives

This section of the report refers to the Cavan County Development Plan 2014 – 2020 and the Landscape Character Assessment of County Cavan, as well as to the Environmental Requirements for Afforestation document. Cavan County Council has not prepared a Landscape Character Assessment. The Border Region Planning Guidelines (BRPG) 2010-2022 which, along with the National Spatial Strategy, shapes the Cavan CDP, supports the preparation and implementation of a Regional Character Assessment and Strategy by Local Authorities and supports the enhancement of landscape in the region.

8.2.1.3 Landscape Character Assessment of County Cavan

The replanting site is located within the Cavan Rural Area Type classed as a 'Structurally Weak Area'. There are five Landscape Character Areas with the proposed replanting are located within the 'No. 1

Cuilcagh-Anierin Uplands of West Cavan'. The Cavan High Value Landscape Area 'Uplands Areas in West Cavan' is located to the north and south of the replanting site. Cavan County Council endeavour to maintain the scenic and recreation value of these areas by restricting adverse uses and negative visual impacts.

8.2.1.4 Heritage Landscapes

The Cavan Heritage Plan is currently under review. The CDP has identified various sites of heritage value within the county. The aim of the CDP is to restrict incompatible development in order to protect the amenity, scientific and historical value of these areas. The nearest heritage landscape is the Cuilcagh Mountain Geological Heritage Site to the east of the site which comprises the Marble Arch Caves Global Geopark. It incorporates the Marble Arch Caves. While no landscape assessment has been undertaken for the area, the CDP follows the guidelines set out in the Planning and Development Act 2000 (as amended), the Heritage Act 1995 and the Wildlife Amendment Act 2000 which mandates the council to conserve the county's Geological Heritage.

8.2.1.5 Scenic Routes

There are three Scenic Routes (SR) in the county and are included in Appendix 4 Map 10 of the Cavan CDP. The Dowra to Blacklion Scenic Route (Kingfisher Cycle Trail) runs northeast to southwest approximately 400m east of the site, along the R206. There are no Scenic Views within the surrounding landscape.

The aims and objectives of the CDP in relation to scenic routes and views are as follows:

- **NHEO30** *"To regulate development that would seriously obstruct and detract from views of high scenic value from designated Scenic Routes. Development will be restricted where it is likely to cause irreconcilable damage to the exceptional scenic value.*
- ***NHEO31*** *"To maintain and protect the natural landscapes visual character which is recognised to be of an exceptional high amenity value. These upland landscapes of west Cavan are open and exposed, unenclosed and vulnerable to insensitive development. These scenic routes are considered to be part of the County's amenity resources."*

8.2.2 Forestry and the Landscape Guidelines

There are four 'Forest Parks and Other Parks' within the county. Appendix 20 of the CDP outlines the Draft Indicative Forest Strategy (IFS) for the county. The aim of the IFS is to "*provide high-level, national guidance in relation to the suitability of land for afforestation".* The Strategy is a GIS based system which identifies areas most suitable for planting primarily on the basis of environmental considerations and soil-productivity. Guidance within the Strategy also details the economic and amenity value of forestry as an alternative farm income and boost to tourism. It also recognises the benefit of afforestation in climate change mitigation.

According to the IFS forestry suitability map, the replanting site is located within a Category 2 area: "Suitable for certain types of forest development". Please see Table 8.1 below for details.

Table 8-1 Description of Policy Categories, Environmental Designations and the Process associated with each Policy Category

Policy Category	Description	Environmental Designations	Application Process
Category 2 "Suitable for certain types of forest development"	Areas where at least one environmental designation (such as a fisheries sensitive areas) exist. For more details on the consultation system associated with specific environmental designations see Appendix 1.	› Acid sensitive areas. › Areas sensitive for fisheries. › Catchment areas of local authority water schemes. › REPs areas. › Archaeological sites or monuments › Areas of moderate landscape sensitivity.	Process as for "Suitable for a range of forest types" and, in addition: consultation with relevant authority (such as Regional Fisheries Boards, National Parks and Wildlife Service, Local Authority).

The replanting site has been granted Technical Approval for afforestation. The Technical Approval document includes as a condition that all guidelines (which includes the Forest Service landscape guidelines) will apply to afforestation at the site.

8.3 Baseline Environment

8.3.1 Landscape Character

The topography, vegetation and anthropological features on the land surface in an area combine to set limits on the amount of the landscape that can be seen at any one time. These physical restrictions form individual areas or units, known as physical units, whose character can be defined by aspect, slope, scale and size. A physical unit is generally delineated by topographical boundaries and is defined by landform and landcover.

The replanting site is located on elevated but relatively flat land within an elevation range of 90–120 m OD. The replanting site is immediately adjacent to areas of existing conifer plantation to the south and northeast. The physical unit of the replanting site is defined by the R207 to the west and R206 to the east. The 'Cuilcagh - Anierin Uplands LCA' are further to the east and the Bolebrack Mountains SAC are further to the west.

The proposed replanting area which has been given technical approval is 12.57ha. This represents a roughly one third of the existing forestry immediately adjacent to the site (c. 30ha). In the wider landscape, there are larger tracts of forestry, measuring over 300 ha.

The replanting area is located c. 40m southwest of the nearest residential dwelling which is located across the R206 and screened from the site by existing high growing boundary vegetation along the R206. The replanting site comprises several small fields whose boundaries will be retained on the site where possible. A second house is located just under 300m east of the site and is screened from the site by mature tree-lined boundaries within its own curtilage and existing forestry.

8.3.2 Landscape Sensitivity

The sensitivity of a landscape to development and therefore to change varies according to its character and to the importance that is attached to any combination of landscape values. The sensitivity of a landscape is derived from consideration of designations such as Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Natural Heritage Areas (NHAs) and National Parks, from information such as tourist maps, guidebooks and brochures, and from the evaluation of indicators such as uniqueness, popularity, distinctiveness, and quality of the elements of the area.

A desktop assessment of landscape sensitivity in the vicinity of the replanting site was carried out. The methodology for this assessment was based on that set out in the Department of the Environment and Local Government (DoEHLG) guidance document *'Landscape and Landscape Assessment – Consultation Draft of Guidelines for Planning Authorities'* (2000). This document recommends an assessment of landscape sensitivity based on an evaluation of individual features, such as the quality, integrity, etc. The results of the assessment are presented in Table 8.2.

Table 8-2 Stranamart Landscape Sensitivity

Feature	Description
Quality	The quality of the landscape in this area can be described as modified due to agriculture and forestry plantations.
Integrity	The current development site has been modified by the interaction of man with the environment.
Distinctiveness	There are no distinctive features on the site.
Popularity	A sense of popularity is created where landscape features are widely recognised or appreciated. There are no popular features on the replanting site.
Rarity	The site is not located within a designated ecological area. The closest Natura 2000 site, i.e. Special Area of Conservation (SAC) or Special Protection Area (SPA), is the Boleybrack Mountain SAC is over 3km west of the site.
Cultural Meaning	A sense of cultural meaning arises where a site or features within a site are deemed to explain, represent or inspire cultural values. There are no archaeological monuments close to the site and none within the site.
Sense of Public Ownership & Social Importance	A sense of public ownership arises due to ease of accessibility, visibility or a widely shared meaning. The site is owned by the applicant and has no special social importance.

The replanting site is therefore considered to be of a low sensitivity.

8.3.2.1 Landscape Context and Site Visibility

Views of coniferous forestry are a feature of the immediate and wider area with views of the Cuilcagh-Anierin Uplands and Bolebrack Mountains in the distance. Views from the site are dominated by existing conifer plantation, the Bolebrack Mountains and the Cuilcagh-Anierin Uplands.

8.3.3 Potential Impacts

8.3.3.1 'Do-Nothing' Scenario

In the 'Do Nothing' scenario, the subject site would be afforested in any case, as per Technical Approval that has been issued for the site. If the land was not replanted, the current land use would continue at the site.

8.3.4 Site Preparation and Planting Phase

8.3.4.1 Impacts on Landscape Character –Temporary Imperceptible Neutral Impact

The planting of forestry will entail site works in terms of woody weed clearance and construction of forestry drains and will use the angle notch planting method described in Section 2.2.1.1 above. These activities will have a temporary imperceptible neutral impact on the landscape character, which is that of a rural working landscape with a mixture of agricultural and forestry land uses. A neutral impact is a change which does not affect the quality of the environment (EPA, 2017). The site clearance and replanting activities will assimilate well into the receiving environment, and are therefore classed as an imperceptible impact, i.e. an impact capable of measurement but without noticeable consequences.

8.3.4.2 Impacts on Visual Amenity - Long Term Imperceptible Neutral Impact

The proposed replanting is to be carried out in an area where there are already existing conifer plantations among agricultural fields, and therefore the proposed replanting is not introducing a new land use but conforming to an established one. The predicted residual visual impact of the proposed replanting is Long Term, Imperceptible Neutral Impact.

8.3.5 Operational Phase

8.3.5.1 Impacts on Landscape Character – Long Term Imperceptible Neutral Impact

The proposed replanting is to be carried out in an area where there are already existing conifer plantations among agricultural fields, and therefore the proposed replanting is not introducing a new land use but conforming to an established one and contributing to the patchwork of forestry plantations with open land. The predicted residual visual impact of the proposed replanting is Long Term, Imperceptible Neutral Impact.

8.3.5.2 Impacts on Visual Amenity - Long Term Imperceptible Neutral Impact

The proposed replanting is to be carried out in an area where there are already existing conifer plantations among agricultural fields, and therefore the proposed replanting is not introducing a new land use but conforming to an established one and contributing to the patchwork of forestry plantations with open land. Felling will be carried out in accordance with the Environmental Requirements for Afforestation. The predicted residual visual impact of the proposed replanting is Long Term, Imperceptible Neutral Impact.

8.3.6 Proposed Mitigation Measures

The forestry drains are to be mound drains where deemed necessary along contours, or at most at a 30% acute angle to the contours, as outlined in the Conditions in the Technical Approval Document. Mitigation measures for the construction of the drainage and planting methods have been included as indicated in the Technical Document, and as a mitigation measure the planting method will be pit planting and mound drains constructed.

8.3.7 Residual Impacts

Following mitigation, the Residual Impact on Landscape Character will be Long Term Imperceptible Neutral Impact while the Residual Impact on Visual Amenity will be Long Term Imperceptible Neutral Impact.

8.3.8 Cumulative Impacts

Cumulative impacts are described as additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments or actions that occurred in the past, present or are likely to occur in the foreseeable future. The cumulative impact assessment is based on the planning history search carried out as described in Section 3.1.4 and the existing landuses. The cumulative impact arising from the proposed replanting in conjunction with other developments and the existing forestry plantations in the immediate vicinity and future development is assessed as Long Term, Imperceptible Neutral Impact. The cumulative impact of the replanting site is assessed as Long Term Imperceptible Neutral Impact in conjunction with the existing and future forestry developments in the vicinity.

8.3.9 Roscommon County Development Plan 2014-2020

8.3.9.1 Forestry Policy and Objectives

Section 9: 'Development Management Guidelines and Standards' of the Roscommon County Development Plan deals with policies and objectives relating to forestry. The planning authority acts as a consultee rather than an assessor in relation to forestry. Policies in the Roscommon CDP relating to forestry can be found in Chapter 3 Table 3.2.

8.3.9.2 Landscape Policy and Objectives

This section of the report refers to the Roscommon County Development Plan (CDP) 2014-2020 and the Landscape Character Assessment of the county, as well as to the Environmental Requirements for Afforestation document.

8.3.10 Landscape Character Assessment of Co. Roscommon

Section 11 of the Roscommon CDP comprises the Landscape Character Assessment of the county. The aim of the assessment is to provide technical background for the local planning authority to formulate a set of Landscape Objectives and Policy Recommendations for the county. The objectives and policies aim to strike a balance between boosting rural economic diversity, job creation and tackling climate change with landscape suitability and environmental sensitivity. Particular emphasis is laid on the following development types when assessing landscape sensitivity:

- Housing (including housing in existing settlements as well as single rural dwellings relating to the guidance set out in the Sustainable Rural Housing Guidelines for Planning Authorities);
- Quarries;
- Wind farms;
- Afforestation; and
- Rural buildings and alternative enterprise proposals (an increase of farm buildings is anticipated as a result of the recent EU Nitrates Directive).

The main sensitivities and areas of concern when assessing the above developments are:

- The conservation and enhancement of the landscape diversity, character and quality of the County; Protection of sensitive areas from development that would detract from or be injurious to the amenity of the area;
- Provision for development and change that would benefit the economy of the county including the rural economy while protecting and enhancing the landscape;
- Identification of suitable 'working' landscapes where there is potential to accommodate development.
- The landscape objectives and policy recommendations focus on the following five specific development types:
- Heritage Landscapes

8.3.10.1 Scenic Routes

There are a total of 9 existing and proposed Scenic Routes and a total 25 existing and proposed Scenic Views within the county and can be found in Appendix 1 of the Landscape Character Assessment of the CDP. The need to preserve scenic routes and views are highlighted throughout the CDP and are taken into consideration, along with sites of special value and immediate and long-distance views, when processing all types of development within the county.

8.3.11 Forestry and the Landscape Guidelines

As of 2011, almost 21,000ha (8.7%) of forestry has been planted within the county, with 13,000 if this on private land and 8,000ha in public ownership. The grant-driven Forest Environment Protection Scheme (FEPS) maintains public interest in this type of agricultural diversification. The Landscape Assessment of the CDP follows the national guidelines produced by the Department of Agriculture and outlined in Chapter 3 Table 3.2 to ensure that sustainable Forest Management is implemented throughout the county.

8.4 Baseline Environment

8.4.1 Landscape Character

The topography, vegetation and anthropological features on the land surface in an area combine to set limits on the amount of the landscape that can be seen at any one time. These physical restrictions form individual areas or units, known as physical units, whose character can be defined by aspect, slope, scale and size. A physical unit is generally delineated by topographical boundaries and is defined by landform and landcover.

The landscape character of Roscommon varies from greatly in form and cover and therefore it is recommended that proposed afforestation sites consider the surrounding landscape and the suitably for that particular type of development in the area. There are 4 distinct landscape character types:

- Rolling moorland, represented in County Roscommon by the Landscape Character Type of Hills and Uplands and Bogland.
- Rolling fertile farmland, represented by Wet Farmland, Dry Farmland, River Corridors.
- Drumlins represented by Drumlin Lakelands.
- Mountain and farmland complex, including Bog and Farmland Complex.

The site is located in LCA No. 20: Breedoge Bogland Basin which comprises varying landcover; wet and dry grassland complexes with low hedgerows of hawthorn and willow in the east, raised bog and reclaimed raised bog in the centre with birch and willow woodland and drier grassland in the northwest. The physical unit of the replanting site is defined by the drainage channel to its southern boundary, a local unnamed road to its east and areas of forestry to the west and north.

Forces of change in this LCA are listed as:

- "*afforestation of bogland,*
- *encroachment of rural housing into bogland fringes and overlooking Lough Gara*
- *increased marginalisation of farmland particularly to the east."*

The LPA recommends an alternative for rural enterprise in the LCA where bogland dominates.

8.4.2 Landcover on the site

The proposed replanting area which has been given technical approval is 7.2 ha. This represents a relatively small area of cover considering the existing 500ha+ of forestry plantation located within the immediate and surrounding environs.

The proposed replanting adjacent to the curtilage of the nearest residential dwelling. Field boundaries are not always prominent; however, the boundaries of the replanting site follow the existing field patterns. Although the internal field boundaries of the site are not always obvious, they will be retained on the site where possible.

8.4.3 Landscape Sensitivity

The sensitivity of a landscape to development and therefore to change varies according to its character and to the importance that is attached to any combination of landscape values. The sensitivity of a landscape is derived from consideration of designations such as Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Natural Heritage Areas (NHAs) and National Parks, from information such as tourist maps, guidebooks and brochures, and from the evaluation of indicators such as uniqueness, popularity, distinctiveness, and quality of the elements of the area.

A desktop assessment of landscape sensitivity in the vicinity of the replanting site was carried out. The methodology for this assessment was based on that set out in the Department of the Environment and Local Government (DoEHLG) guidance document *'Landscape and Landscape Assessment – Consultation Draft of Guidelines for Planning Authorities'* (2000). This document recommends an assessment of landscape sensitivity based on an evaluation of individual features, such as the quality, integrity, etc. The results of the assessment are presented in Table 8.4.

Table 8-3 Brackloon Site: Landscape Sensitivity

Feature	Description
Quality	The quality of the landscape in this area can be described as modified due to agriculture and forestry plantations.
Integrity	The current development site has been modified by the interaction of man with the environment.
Distinctiveness	There are no distinctive features on the site.
Popularity	A sense of popularity is created where landscape features are widely recognised or appreciated. There are no popular features on the replanting site.
Rarity	There are no Natura 2000 sites within the vicinity of the site
Cultural Meaning	A sense of cultural meaning arises where a site or features within a site are deemed to explain, represent or inspire cultural values. There are no archaeological monuments close to the site and none within the site.
Sense of Public Ownership & Social Importance	A sense of public ownership arises due to ease of accessibility, visibility or a widely shared meaning. The site is owned by the applicant and has no special social importance.

The replanting site is therefore considered to be of Low landscape sensitivity.

8.4.3.1 Landscape Context and Site Visibility

Views towards the site would be westward from the local unnamed road that runs adjacent to the eastern boundary. Views from the west and north are partially blocked from existing forestry. Views of the site will be indiscernible due to the existing blocks of forestry.

8.4.4 Potential Impacts

8.4.4.1 'Do-Nothing' Scenario

In the 'Do Nothing' scenario, the subject site would be afforested in any case, as per Technical Approval that has been issued for the site. If the land was not replanted, the current land use would continue at the site.

8.4.4.2 Site Preparation and Planting Phase

8.4.4.2.1 *Impacts on Landscape Character –Temporary Imperceptible Neutral Impact*

The planting of forestry will entail site works in terms of woody weed clearance and construction of forestry drains using methods described in Section 2.2.1.1 above. These activities will have a temporary imperceptible neutral impact on the landscape character, which is that of a rural working landscape with a mixture of agricultural and forestry land uses. A neutral impact is a change which does not affect the quality of the environment (EPA, 2017). The site clearance and replanting activities will assimilate well into the receiving environment, and are therefore classed as an imperceptible impact, i.e. an impact capable of measurement but without noticeable consequences.

8.4.4.2.2 *Impacts on Visual Amenity - Long Term Imperceptible Neutral Impact*

The proposed replanting is to be carried out in an area where there are already existing conifer plantations among agricultural fields, and therefore the proposed replanting is not introducing a new land use but conforming to an established one. The predicted residual visual impact of the proposed replanting is Long Term, Imperceptible Neutral Impact.

8.4.5 Operational Phase

8.4.5.1 Impacts on Landscape Character – Long Term Imperceptible Neutral Impact

The proposed replanting is to be carried out in an area where there are already existing conifer plantations among agricultural fields, and therefore the proposed replanting is not introducing a new land use but conforming to an established one and contributing to the patchwork of forestry plantations with open land. The predicted residual visual impact of the proposed replanting is Long Term, Imperceptible Neutral Impact.

8.4.5.2 Impacts on Visual Amenity - Long Term Imperceptible Neutral Impact

The proposed replanting is to be carried out in an area where there are already existing conifer plantations among agricultural fields, and therefore the proposed replanting is not introducing a new land use but conforming to an established one and contributing to the patchwork of forestry plantations

with open land. Felling will be carried out in accordance with the Environmental Requirements for Afforestation. The predicted residual visual impact of the proposed replanting is Long Term, Imperceptible Neutral Impact.

8.4.6 Proposed Mitigation Measures

Mitigation measures for the construction of the drainage and planting methods have been included in the Technical Approval document. The planting method will be as per Section 2 above and mound drains will be constructed. The proposed replanting will be carried out in line with the recommendations of the Forestry and the Landscape Guidelines.

8.4.7 Residual Impacts

Following mitigation, the Residual Impact on Landscape Character will be Long Term Imperceptible Neutral Impact while the Residual Impact on Visual Amenity will be Long Term Imperceptible Neutral Impact.

8.4.8 Cumulative Impacts

Cumulative impacts are described as additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments or actions that occurred in the past, present or are likely to occur in the foreseeable future. The cumulative impact assessment is based on the planning history search carried out as described in Section 3.1.4 and the existing landuses. The cumulative impact arising from the proposed replanting in conjunction with the existing forestry plantations in the immediate vicinity and future development is assessed as Long Term, Imperceptible Neutral Impact. The cumulative impact of the replanting site is assessed as Long Term Imperceptible Neutral Impact in conjunction with the existing and future forestry developments in the vicinity.

8.5 Wicklow County Development Plan 2016-2022

8.5.1.1 Forestry Policy and Objectives

Wicklow County Council developed the 'Wicklow Indicative Forestry Strategy' in 2002 to assist planners in the assessment of afforestation proposals. The Strategy also establishes Areas Preferred to Afforestation and Areas Sensitive to Afforestation. Policies relating to forestry can be found in Chapter 3 and Table 3.3.

8.5.1.2 Landscape Policy and Objectives

This section of the report refers to the Wicklow County Development Plan 2016-2022, and the Landscape Character Assessment of County Wicklow as well as to the Environmental Requirements for Afforestation document. Section 10 of the Wicklow CDP discusses Natural Heritage and Landscape.

Wicklow is described as the 'Garden County' due to its attractive scenic quality and varying topography of rolling hills, forests, lakes, mountains and beaches. Enhancement and conservation of the natural environment while adapting to and tackling climate change is paramount for the local authority. The Natural Heritage Strategy is listed below:

- To conserve and enhance biodiversity in recognition of the many ecosystem services provided to society;
- to promote an integrated approach to landscape planning and management in order to protect the County's unique landscape character;
- to conserve and enhance the County's geological heritage;

- to avoid negative impacts upon the natural environment and promote appropriate enhancement of the natural environment as an integral part of any development; and to support the actions in the County Wicklow Heritage Plan which seek to enhance the understanding, appreciation and protection of Wicklow's biodiversity including the County Wicklow Biodiversity Action Plan.

The Strategy is based on policy and guidelines established in the EU Directives on Habitats, Birds, Water Framework and groundwater as well as the nation Planning and Development Act 2000 (as amended).

Table 8-4: Wicklow's Landscape Objectives

Objective	
NH49	All development proposals shall have regard to the County landscape classification hierarchy in particular the key landscape features and characteristics identified in the Wicklow Landscape Assessment (set in Volume 3 of this plan) and the 'Key Development Considerations' set out for each landscape area set out in Section 5 of the Wicklow Landscape Assessment
NH50	Any application for permission in the AONB which may have the potential to significantly adversely impact the landscape area shall be accompanied by a Landscape / Visual Impact Assessment, which shall include, inter alia, an evaluation of visibility and prominence of the proposed development in its immediate environs and in the wider landscape, a series of photos or photomontages of the site / development from clearly identified vantage points, an evaluation of impacts on any listed views / prospects and an assessment of vegetation / land cover type in the area (with particular regard to commercial forestry plantations which may be felled thus altering character / visibility). The Assessment shall demonstrate that landscape impacts have been anticipated and avoided to a level consistent with the sensitivity of the landscape and the nature of the designation.
NH51	To resist development that would significantly or unnecessarily alter the natural landscape and topography, including land infilling / reclamation projects or projects involving significant landscape remodelling, unless it can be demonstrated that the development would enhance the landscape and / or not give rise to adverse impacts

8.5.2 Landscape Character Assessment of County Wicklow

Wicklow contains many different landscape types and 15 distinctive landscape categories which fall within 6 hierarchies have been identified for the county. The replanting site is located within LCA 1(a) 'Mountain Uplands' which falls within the Mountain and Laksehsore AONB., It is described as "Upland areas, the Wicklow Mountains National Park and the Poulaphouca Reservoir" and holds a category 'High' landscape sensitivity. This LCA is described as "*mountainous with U-shaped valleys, lakes and glacial topography"* with land generally above 300m+. The replanting site ranges in elevation from 158m to 219m OD.

All proposals within this area must consider impacts upon the visual amenity, listed views and prospects of the uplands AONB, the various heritage assets within the area and the National Park. Proposals must also maintain the favourable conservation status of existing natural habitats including Natura Sites and Annex I-Habitats and Annex II-Animal and Plant species within this LCA.

8.5.2.1 Heritage Landscapes

Heritage Landscapes are those areas within the County where sensitive environmental resources – scenic, ecological and historic, are located. The site is not located within or near a Heritage Landscape.

8.5.2.2 Scenic Routes

Proposed developments within the Mountain Uplands must "*ensure developments on steep slopes (i.e. 10%) will not be conspicuous or have a disproportionate or dominating visual impact on the surrounding environment as seen from relevant scenic routes and settlements.*" The replanting site is not located near a scenic route.

8.5.3 Forestry and the Landscape Guidelines

Wicklow County Council released an Indicative Forestry Strategy in 2002 to assist planners in the assessment of afforestation proposals. The Strategy also establishes Areas Preferred to Afforestation and Areas Sensitive to Afforestation. Policies and objectives can be found in Table 3.4.

8.6 Baseline Environment

8.6.1 Landscape Character

The topography, vegetation and anthropological features on the land surface in an area combine to set limits on the amount of the landscape that can be seen at any one time. These physical restrictions form individual areas or units, known as physical units, whose character can be defined by aspect, slope, scale and size. A physical unit is generally delineated by topographical boundaries and is defined by landform and landcover.

The replanting site comprises two land parcels with the western parcel totalling 39.56ha with an elevation range of 158m to 219m OD. The physical unit of the replanting site is defined by large areas of forestry to the south and west and the Ballyeustace Stream to the north. Agricultural fields can be found to the east. As the replanting site occupies 39.56ha, it represents a relatively small area compared with the existing 615ha+ of forestry within the immediate environs.

The proposed replanting area is located adjacent to the curtilage of the nearest dwelling. Field boundaries are not always prominent; however, the boundaries of the replanting site follow the existing field patterns. Although the internal field boundaries of the site are not always obvious, they will be retained on the site where possible.

8.6.2 Landscape Sensitivity

The sensitivity of a landscape to development and therefore to change varies according to its character and to the importance that is attached to any combination of landscape values. The sensitivity of a landscape is derived from consideration of designations such as Special Protection Areas (SPAs), Special Areas of Conservation (SACs), Natural Heritage Areas (NHAs) and National Parks, from information such as tourist maps, guidebooks and brochures, and from the evaluation of indicators such as uniqueness, popularity, distinctiveness, and quality of the elements of the area.

A desktop assessment of landscape sensitivity in the vicinity of the replanting site was carried out. The methodology for this assessment was based on that set out in the Department of the Environment and Local Government (DoEHLG) guidance document *'Landscape and Landscape Assessment – Consultation Draft of Guidelines for Planning Authorities'* (2000). This document recommends an

assessment of landscape sensitivity based on an evaluation of individual features, such as the quality, integrity, etc. The results of the assessment are presented in Table 8.5.

Table 8-5 Ballard Site: Landscape Sensitivity

Feature	Description
Quality	The quality of the landscape in this area can be described as modified due to agriculture and forestry plantations.
Integrity	The current development site has been modified by the interaction of man with the environment.
Distinctiveness	There are no distinctive features on the site.
Popularity	A sense of popularity is created where landscape features are widely recognised or appreciated. There are no popular features on the replanting site.
Rarity	There are no Natura 2000 sites within the vicinity of the site
Cultural Meaning	A sense of cultural meaning arises where a site or features within a site are deemed to explain, represent or inspire cultural values. National Monuments Service Record No WI034-006 Enclosure is located within the northern parcel of the replanting site. A 50m buffer zone has been placed around this recorded monument. It is not visible at ground level. It is only included in the 6" Historical Map (1829-41). It is not included in the 25" (1897-1913) or the Cassini (1940s).
Sense of Public Ownership & Social Importance	A sense of public ownership arises due to ease of accessibility, visibility or a widely shared meaning. The site is privately owned and has no special social importance.

The replanting site is therefore considered to be of Medium landscape sensitivity.

8.6.2.1 Landscape Context and Site Visibility

Views towards the site would be downwards from the Wicklow Mountains to the north upwards from the east. Views from the west and south are impeded by large tracts of forestry plantation. As the additional replanting matures, it will be indistinguishable from the surrounding forestry.

8.6.3 Potential Impacts

8.6.3.1 'Do-Nothing' Scenario

In the 'Do Nothing' scenario, the subject site would be afforested in any case, as per Technical Approval that has been issued for the site. If the land was not replanted, the current land use would continue at the site.

8.6.4 Site Preparation and Planting Phase

8.6.4.1 Impacts on Landscape Character –Temporary Imperceptible Neutral Impact

The planting of forestry will entail site works in terms of woody weed clearance and construction of forestry drains and will use methods described in Section 2.2.1.1 above. These activities will have a temporary neutral impact on the landscape character, which is that of a rural working landscape with a mixture of agricultural and forestry land uses. A neutral impact is a change which does not affect the quality of the environment (EPA, 2017). The site clearance and replanting activities will assimilate well into the receiving environment, and are therefore classed as an imperceptible impact, i.e. an impact capable of measurement but without noticeable consequences.

8.6.4.2 Impacts on Visual Amenity - Long Term Imperceptible Neutral Impact

The proposed replanting is to be carried out in an area where there are already existing conifer plantations among agricultural fields, and therefore the proposed replanting is not introducing a new land use but conforming to an established one. The predicted residual visual impact of the proposed replanting is Long Term, Imperceptible Neutral Impact.

8.6.5 Operational Phase

8.6.5.1 Impacts on Landscape Character – Long Term Imperceptible Neutral Impact

The proposed replanting is to be carried out in an area where there are already existing conifer plantations among agricultural fields, and therefore the proposed replanting is not introducing a new land use but conforming to an established one and contributing to the patchwork of forestry plantations with open land. The predicted residual visual impact of the proposed replanting is Long Term, Imperceptible Neutral Impact.

8.6.5.2 Impacts on Visual Amenity - Long Term Imperceptible Neutral Impact

The proposed replanting is to be carried out in an area where there are already existing conifer plantations among agricultural fields, and therefore the proposed replanting is not introducing a new land use but conforming to an established one and contributing to the patchwork of forestry plantations with open land. Felling will be carried out in accordance with the Environmental Requirements for Afforestation. The predicted residual visual impact of the proposed replanting is Long Term, Imperceptible Neutral Impact.

8.6.6 Proposed Mitigation Measures

The forestry drains are to be mound drains where deemed necessary along contours, or at most at a 30% acute angle to the contours, as outlined in the Conditions in the Technical Approval Document. Mitigation measures for the construction of the drainage and planting methods have been included as indicated in the Technical Document, and as a mitigation measure the planting method will be pit planting and mound drains constructed.

The 100m buffer zone (zone of notification) around recorded monument WI034-006 will be maintained and no ground disturbance will occur in this area. Elsewhere, there will be some minor disturbance of soils associated with the construction of drains through the site. Planting of trees will be carried out by hand using the slit planting method, so soil disturbance from this will be insignificant.

8.6.7 Residual Impacts

Following mitigation, the Residual Impact on Landscape Character will be Long Term Imperceptible Neutral Impact while the Residual Impact on Visual Amenity will be Long Term Imperceptible Neutral Impact.

8.6.8 Cumulative Impacts

Cumulative impacts are described as additional changes to the landscape or visual amenity caused by the proposed development in conjunction with other developments or actions that occurred in the past, present or are likely to occur in the foreseeable future. The cumulative impact assessment is based on

the planning history search carried out as described in Section 3.1.4 and the existing landuses. The cumulative impact arising from the proposed replanting in conjunction with the existing forestry plantations in the immediate vicinity and future development is assessed as Long Term, Imperceptible Neutral Impact. The cumulative impact of the replanting site is assessed as Long Term Imperceptible Neutral Impact in conjunction with the existing and future forestry developments in the vicinity.

9. CULTURAL HERITAGE

9.1 Introduction

This section presents the results of an archaeological and cultural heritage impact assessment for the proposed afforestation of the proposed replanting areas.

The purpose of this section is to assess the potential impacts of the afforestation on the surrounding archaeological, architectural and cultural heritage landscape. An assessment of potential impacts is presented, and a number of mitigation measures are recommended where appropriate.

9.2 Methodology

A desk-based study of the proposed replanting areas was undertaken in order to assess the archaeological, architectural and cultural heritage potential of the area and to identify constraints or features of archaeological/cultural heritage significance within or adjacent to the sites. Each of the proposed sites have been Technically Approved for afforestation which will be completed in accordance with the *'Forestry and Archaeology Guidelines' (2000) (the Guidelines).* The guidelines provide specific mitigation measures to be employed for afforestation which will minimise potential impacts on this resource.

9.2.1 Statutory Context

9.2.1.1 Current Legislation

Archaeological monuments are safeguarded through national and international policy, which is designed to secure the protection of the cultural heritage resource. This is undertaken in accordance with the provisions of the European Convention on the Protection of the Archaeological Heritage (Valletta Convention). This was ratified by Ireland in 1997. Both the National Monuments Acts 1930 to 2004 and relevant provisions of the Cultural Institutions Act 1997 are the primary means of ensuring protection of archaeological monuments, the latter of which includes all man-made structures of whatever form or date. There are a number of provisions under the National Monuments Acts which ensure protection of the archaeological resource:

- It is recorded in the Record of Monuments and Places (RMP).
- It is registered in the Register of Historic Monuments (RHM).
- It is a national monument subject to a preservation order (or temporary preservation order).
- It is a national monument in the ownership or guardianship of the Minister for Culture, Heritage and the Gaeltacht or a Local Authority.

The Record of Monuments and Places (RMP) was established under Section 12 (1) of the National Monuments (Amendment) Act 1994 and consists of a list of known archaeological monuments and accompanying maps. The Record of Monuments and Places affords some protection to the monuments entered therein. Section 12 (3) of the 1994 Amendment Act states that any person proposing to carry out work at or in relation to a recorded monument must give notice in writing to the Minister (Environment, Heritage and Local Government) and shall not commence the work for a period of two months after having given the notice. All proposed works, therefore, within or around any archaeological monument are subject to statutory protection and legislation (National Monuments Acts 1930-2004).

Under the Heritage Act (1995) architectural heritage is defined to include *'all structures, buildings, traditional and designed, and groups of buildings including street-scapes and urban vistas, which are of*

historical, archaeological, artistic, engineering, scientific, social or technical interest, together with their setting, attendant grounds, fixtures, fittings and contents...'. A heritage building is also defined to include *'any building, or part thereof, which is of significance because of its intrinsic architectural or artistic quality or its setting or because of its association with the commercial, cultural, economic, industrial, military, political, social or religious history of the place where it is situated or of the country or generally'*.

9.2.1.2 Granada Convention

The Council of Europe, in Article 2 of the 1985 Convention for the Protection of the Architectural Heritage of Europe (Granada Convention), states that *'for the purpose of precise identification of the monuments, groups of structures and sites to be protected, each member State will undertake to maintain inventories of that architectural heritage'*. The Granada Convention emphasizes the importance of inventories in underpinning conservation policies.

The National Inventory of Architectural Heritage (NIAH) was established in 1990 to fulfill Ireland's obligations under the Granada Convention, through the establishment and maintenance of a central record, documenting and evaluating the architectural heritage of Ireland. Article 1 of the Granada Convention establishes the parameters of this work by defining *'architectural heritage'* under three broad categories of Monument, Groups of Buildings, and Sites:

- **Monument**: all buildings and structures of conspicuous historical, archaeological, artistic, scientific, social or technical interest, including their fixtures and fittings;
- **Group of buildings**: homogeneous groups of urban or rural buildings conspicuous for their historical, archaeological, artistic, scientific, social or technical interest, which are sufficiently coherent to form topographically definable units;
- **Sites**: the combined works of man and nature, being areas, which are partially built upon and sufficiently distinctive and homogenous to be topographically definable, and are of conspicuous historical, archaeological, artistic, scientific, social or technical interest.

The Council of Europe's definition of architectural heritage allows for the inclusion of structures, groups of structures and sites which are of significance in their own right, or which are of significance in their local context and environment. The NIAH believes it is important to consider the architectural heritage as encompassing a wide variety of structures and sites as diverse as post boxes, grand country houses, mill complexes and vernacular farmhouses.

9.2.2 Desktop Assessment

A primary cartographic source and base-line data for the archaeological assessment was the consultation of the Sites and Monuments Record (SMR) and Record of Monuments and Places (RMP) through the electronic database of recorded monuments which may be accessed at www.archaeology.ie. All known recorded archaeological monuments are indicated on 6-inch Ordnance Survey (OS) maps and are listed in this record.

The following sources were consulted for this assessment report:

- Electronic database of recorded monuments (www.archaeology.ie)
- Aerial photographs (copyright of Ordnance Survey Ireland (OSI.ie)

9.2.2.1 Recorded Monuments and Places

The Sites and Monuments Record (SMR) and Record of Monuments and Places (RMP) is a record of all known recorded archaeological monuments. The SMR/RMP is not a complete record of all monuments as newly discovered sites may not appear in the list or accompanying maps. In conjunction

with the consultation of the SMR and RMP, the electronic database of recorded monuments which may be accessed at www.archaeology.ie was consulted.

9.2.2.2 Aerial Photograph Analysis

Aerial photographs of the sites were examined, and no previously unrecorded archaeological features could be seen. Sources included Bing, Google Maps and Ordnance Survey of Ireland.

9.2.3 Archaeology

Archaeological heritage is a non-renewable resource. The overall objective of this assessment of impacts of the proposed development is to ensure that where a potential impact has been identified, that it can be mitigated against to ensure that the archaeological heritage will be available for future generations. The potential impacts on the recorded archaeological heritage are assessed here.

Potential impact is assessed based on the impact classification terminology outlined in Table 5.1 of this Report, with the significance of impacts being defined as either imperceptible, slight, moderate, significant or profound, or if no impact is predicted to occur, 'No Impact'.

9.2.4 Potential Impacts

Potential afforestation impacts include direct destruction of recorded and unrecorded sites and indirect impacts on archaeological potential of nearby sites.

9.3 Replanting Area 1: Stranamart, Co. Cavan

9.3.1 Existing Environment

9.3.1.1 Recorded Monuments within the Study Area

The Electronic database of recorded monuments (www.archaeology.ie) was used to compile a list of known sites which occur in the vicinity of the site. There are no recorded archaeological features on or in the vicinity of the study site.

The nearest Recorded Monuments and Place (RMP) is a cairn- unclassified CV02429, located approximately 760m north of the site in the townland of Stranamart. Currently the information for this record has not been uploaded to the national monuments database. Aerial photography indicates there are little surface remains of this asset. Intervisibility between this low-lying asset and the site are not possible due to the screening effect of intervening vegetation from field boundaries and along roads.

9.3.1.2 Record of Protected Structures

There are no Protected Structures (RPS) located within or adjacent to the replanting area. The nearest RPS, St Felim's Roman Catholic Church - Reg. No. 40400401 is located 2.5km east of the site. Intervisibility between the chapel and the site are not possible due to the screening effect of intervening vegetation from field boundaries and along roads, and large tracts of forestry

9.3.1.3 Potential Impacts

9.3.1.4 'Do-Nothing' Scenario

The lands have been Technically Approved and will be afforested should the Croagh Wind Farm proceed or not. If the land was not replanted, the current land use would continue at the site.

9.3.1.5 Potential Direct Impacts on the Archaeological Heritage

Direct Impact refers to a 'physical impact' on a monument. The afforestation will require some minor earthmoving activities such as drainage and the provision of access tracks. Harvesting will require tree felling. There are no recorded monuments on the site and therefore there will be no direct impacts.

9.3.1.6 Potential Indirect Impacts on the Archaeological Heritage

Potential indirect impacts may arise where a monument or area of archaeological potential is situated in relatively proximity to a proposed development but is not directly (physically) affected by the development. In such cases the impact on the setting of the monument or views to and from it are assessed.

There are no recorded monuments in the vicinity of the site with the nearest RMP and RPS located approximately 760m north and 2.5km east of the site, respectively. Intervisibility between these assets and the proposed replanting areas are heavily impeded by intervening vegetation of field boundaries along roads and existing tracts of forestry. Furthermore, the small area to be replanted will be indistinguishable from the existing forestry in the immediate and surrounding environs. Therefore, indirect impacts are considered to be imperceptible.

9.3.1.7 Cumulative Impacts

As stated above, the small area to be replanted will be indistinguishable from the existing forestry in the immediate and surrounding environs. Therefore, cumulative impacts on heritage assets are considered to be imperceptible. Additionally, there are no proposed developments of a similar scale or nature located in the vicinity of the site that would give rise to cumulative impacts in conjunction with the proposed replanting on features of cultural heritage significance. The cumulative impact of the replanting site is assessed as Long Term Imperceptible Neutral Impact in conjunction with the existing and future forestry developments in the vicinity.

9.3.2 Operational Phase

There will be no significant indirect or direct impacts on cultural heritage once the site has been afforested.

9.3.2.1.1 *Residual Impact*

No residual impacts.

9.4 Replanting Area 2: Brackloon, Co. Roscommon

9.4.1 Existing Environment

9.4.1.1 Recorded Monuments within the Study Area

There are no recorded archaeological features on or in the vicinity of the study site. The Electronic database of recorded monuments (www.archaeology.ie) was used to compile a list of known sites which occur in the vicinity of the site.

The nearest recorded features are a ringfort, located approximately 1km to the north-east of the site.

9.4.2 Potential Impacts

9.4.2.1 'Do-Nothing' Scenario

The lands have been Technically Approved and will be afforested should the Croagh Wind Farm proceed or not. If the land was not replanted, the current land use would continue at the site.

9.4.2.2 Potential Direct Impacts on the Archaeological Heritage

Direct Impact refers to a 'physical impact' on a monument. The afforestation will require some minor earthmoving activities such as drainage and the provision of access tracks. Harvesting will require tree felling.

There are no recorded monuments on the site and therefore there will be no direct impacts.

9.4.2.3 Potential Indirect Impacts on the Archaeological Heritage

Potential indirect impacts may arise where a monument or area of archaeological potential is situated in relatively proximity to a proposed development but is not directly (physically) affected by the development. In such cases the impact on the setting of the monument or views to and from it are assessed.

The nearest RMP comprises a group of 4 records: two possible Bullaun Stones ROO15-054002 & ROO15-054003, an enclosure R0015-054001 and a redundant record R00150-54004. The RMPs are located 400m to the southeast of the replanting site. A 50m Zone of Notification remains around the RMP cluster.

Enclosure R0015-054001

The enclosure comprises a natural hillock (44m north-south, 33m east-west, H 1.8–2.5m) with an earthen bank (W 3m, internal H 0.2m, external H 1.3m-1.4m) and scarp and fosse; the latter recut by a drain. Mature trees are growing on the hillock.

Bullaun Stones ROO15-054002

Both 'possible' bullaun stones have not been found to date. Therefore, there are no indirect impacts on these assets.

Penitential Station ROO15-054003

The Penitential Station is described within the RMP as a "*on an oval hillock ... [...] ...slab resting on some small stones and surrounded by a drystone wall. A broken slab surrounded by and partly overlain by a collapsed drystone wall...mature deciduous trees grow at the edge of the hill and one at the summit has a small shrine with a statue. Two possible bullaun stones ROO15-054002 (Gannon 1972) could not be found. Stations were performed here on Garland Sunday (MacNeill 1962, 631-2)*". The western boundary of the RMP features on both the 6" OS historical Map (1829-1841) and the 25" historical Map (1897-1913) as the Mullenduff townland, Kilcolgah parish and Frenchpark Barony boundary.

Redundant record R00150-54004

This RMP is known as St. Patricks Bed and was initially thought to have been a megalithic tomb. It has since been determined to be a natural hillock. Thus, the record is redundant.

The 25" map shows that a private lane was constructed along its southern boundary and a drain was inserted into the fosse of an earthen bank which was constructed around the base of the hillock; both compromising the setting of the heritage asset. The site is no longer used for penitential ceremonies, is not accessible to the public and is currently used for grazing cattle. The 'possible' bullaun stones have never been located and record R00150-54004 is redundant. Intervisibility between these RMPs and the replanting site is possible; however, the proposed replanting area is considered small in comparison with existing forestry plantation in the area. Therefore, the replanted site will be indistinguishable from the surrounding forestry. Hence, indirect impacts on this RMP cluster is considered to be imperceptible.

9.4.2.4 Cumulative Impacts

There will be no cumulative impact associated with the afforestation of the site as there are no features close to the site. A planning history search of applications in the vicinity of the proposed replanting lands has also been carried out, as described in Section 3.1.4 of this report. There are no developments of a similar scale and nature located in the vicinity of the site that would give rise to cumulative impacts in conjunction with the proposed replanting on features of cultural heritage significance. The cumulative impact of the replanting site is assessed as Long Term Imperceptible Neutral Impact in conjunction with the existing and future forestry developments in the vicinity.

9.4.3 Operational Phase

There will be no significant indirect or direct impacts on cultural heritage once the site has been afforested.

9.4.3.1.1 *Residual Impact*

No residual impacts.

9.5 Replanting Area 3: Ballard, Co. Wicklow

9.5.1 Existing Environment

9.5.1.1 Recorded Monuments within the Study Area

There are no recorded archaeological features on or in the vicinity of the study site. The Electronic database of recorded monuments (www.archaeology.ie) was used to compile a list of known sites which occur in the vicinity of the site.

The nearest recorded features are a ringfort, located approximately 1km to the north-east of the site.

9.5.2 Potential Impacts

9.5.2.1 'Do-Nothing' Scenario

The lands have been Technically Approved and will be afforested should the Croagh Wind Farm proceed or not. If the land was not replanted, the current land use would continue at the site.

9.5.2.2 Potential Direct Impacts on the Archaeological Heritage

Direct Impact refers to a 'physical impact' on a monument. The afforestation will require some minor earthmoving activities such as drainage and the provision of access tracks. Harvesting will require tree felling.

There is one RMP Enclosure WI034-006 located within the eastern parcel of the replanting site. It is described within the RMP as "situated on a gentle NW-facing slope. Circular enclosure (dims. C. 40m x 35m) marked only on the 1838 OS 6" map. Not visible at ground level". A 100m zone of notification (buffer) is placed around this RMP.

The zone of notification will be maintained during the planting phase. Planting of trees outside of this zone will be carried out by hand using the methods described in Section 2.2.1.1 above. Drains will be constructed in accordance with the Forestry Service Best Practice Guidelines described in detail in Section 2.

9.5.2.3 Potential Indirect Impacts on the Archaeological Heritage

Potential indirect impacts may arise where a monument or area of archaeological potential is situated in relative proximity to a proposed development but is not directly (physically) affected by the development. In such cases the impact on the setting of the monument or views to and from it are assessed.

There are a further three RMPs (WI035-001, WI035-003 and WI035-002) recorded as enclosures and mounds located within 500m of the replanting site. However, all RMPs are located within existing forestry land with one (WI035-002) bisected by a local road. All are not visible at surface level or recorded as in 'poor condition'. The setting and intervisibility of all RMPs have been heavily compromised by existing forestry and roads. Therefore, impacts on all RMPs are considered not significant.

9.5.2.4 Cumulative Impacts

There will be no cumulative impact associated with the afforestation of the site as there are no features close to the site. A planning history search of applications in the vicinity of the proposed replanting lands has also been carried out, as described in Section 3.1.4 of this report. There are no developments of a similar scale and nature located in the vicinity of the site that would give rise to cumulative impacts in conjunction with the proposed replanting on features of cultural heritage significance. The cumulative impact of the replanting site is assessed as Long Term Imperceptible Neutral Impact in conjunction with the existing and future forestry developments in the vicinity.

9.5.3 Operational Phase

There will be no significant indirect or direct impacts on cultural heritage once the site has been afforested.

9.5.3.1.1 *Residual Impact*

No residual impacts.

10. AIR, CLIMATE AND NOISE

10.1 AIR

10.1.1 Background

The primary land-uses within and in the vicinity of the 3 no. site locations comprises agriculture and forestry. Due to the non-industrial nature of afforestation and the general character of the surrounding environment, air quality sampling was deemed to be unnecessary for this study. It is expected that air quality in the existing environment is good, since there are no major sources of air pollution (e.g. heavy industry) in the vicinity of the sites.

The growth of forestry has no direct atmospheric emissions. Some minor indirect emissions associated with site preparation, planting and harvesting include vehicular and dust emissions.

10.1.2 Air Quality Standards

In 1996, the Air Quality Framework Directive (96/62/EC) was published. This Directive was transposed into Irish law by the Environmental Protection Agency Act 1992 (Ambient Air Quality Assessment and Management) Regulations 1999. The Directive was followed by four Daughter Directives, which set out limit values for specific pollutants:

- The first Daughter Directive (1999/30/EC) deals with sulphur dioxide, oxides of nitrogen, particulate matter and lead.
- The second Daughter Directive (2000/69/EC) addresses carbon monoxide and benzene. The first two Daughter Directives were transposed into Irish law by the Air Quality Standards Regulations 2002 (SI No. 271 of 2002).
- A third Daughter Directive, Council Directive (2002/3/EC) relating to ozone was published in 2002 and was transposed into Irish law by the Ozone in Ambient Air Regulations 2004 (SI No. 53 of 2004).
- The fourth Daughter Directive, published in 2007, deals with polyaromatic hydrocarbons (PAHs), arsenic, nickel, cadmium and mercury in ambient air.

The Air Quality Framework Directive and the first three Daughter Directives have been replaced by the Clean Air for Europe (CAFE) Directive (Directive 2008/50/EC on ambient air quality), which encompasses the following elements:

- The merging of most of the existing legislation into a single Directive (except for the Fourth Daughter Directive) with no change to existing air quality objectives.
- New air quality objectives for PM2.5 (fine particles) including the limit value and exposure concentration reduction target.
- The possibility to discount natural sources of pollution when assessing compliance against limit values.
- The possibility for time extensions of three years (for particulate matter PM10) or up to five years (nitrogen dioxide, benzene) for complying with limit values, based on conditions and the assessment by the European Commission.

Table 10.1 below sets out the limit values of the CAFE Directive, as derived from the Air Quality Framework Daughter Directives. Limit values are presented in micrograms per cubic metre ($\mu g/m^3$) and parts per billion (ppb). The notation PM_{10} is used to describe particulate matter or particles of ten micrometres or less in aerodynamic diameter. $PM_{2.5}$ represents particles measuring less than 2.5 micrometres in aerodynamic diameter.

Table 10-1 Limit values of Directive 2008/50/EC, 1999/30/EC and 2000/69/EC (Source: EPA)

Pollutant	Limit Value Objective	Averaging Period	Limit Value (µg/m^3)	Limit Value (ppb)	Basis of Application of Limit Value	Attainment Date
Sulphur dioxide (SO_2)	Protection of Human Health	1 hour	350	132	Not to be exceeded more than 24 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO_2)	Protection of human health	24 hours	125	47	Not to be exceeded more than 3 times in a calendar year	1st Jan 2005
Sulphur dioxide (SO_2)	Protection of vegetation	Calendar year	20	7.5	Annual mean	19th Jul 2001
Sulphur dioxide (SO_2)	Protection of vegetation	1st Oct to 31st Mar	20	7.5	Winter mean	19th Jul 2001
Nitrogen dioxide (NO_2)	Protection of human health	1 hour	200	105	Not to be exceeded more than 18 times in a calendar year	1st Jan 2010
Nitrogen dioxide (NO_2)	Protection of human health	Calendar year	40	21	Annual mean	1st Jan 2010
Nitrogen monoxide (NO) and nitrogen dioxide (NO_2)	Protection of ecosystems	Calendar year	30	16	Annual mean	19th Jul 2001
Particulate matter 10 (PM_{10})	Protection of human health	24 hours	50	-	Not to be exceeded more than 35 times in a calendar year	1st Jan 2005
Particulate matter 2.5 ($PM_{2.5}$)	Protection of human health	Calendar year	40	-	Annual mean	1st Jan 2005
Particulate matter 2.5 ($PM_{2.5}$) Stage 1	Protection of human health	Calendar year	25	-	Annual mean	1st Jan 2015

Particulate matter 2.5 ($PM_{2.5}$) Stage 2	Protection of human health	Calendar year	20	-	Annual mean	1st Jan 2020
Lead (Pb)	Protection of human health	Calendar year	0.5	-	Annual mean	1st Jan 2005
Carbon Monoxide (CO)	Protection of human health	8 hours	10,000	8,620	-	1st Jan 2005
Benzene (C_6H_6)	Protection of human health	Calendar Year	5	1.5	-	1st Jan 2010

The Ozone Directive 2002/3/EC is different from Directive 2008/50/EC in that it sets target values and long-term objectives for ozone rather than limit values. Table 10.2 presents the limit and target values for ozone.

Table 10-2 Target values for Ozone Defined in Directive 2008/50/EC

Objective	Parameter	Target Value for 2010	Target Value for 2020
Protection of human health	Maximum daily 8 hour mean	120 mg/m^3 not to be exceeded more than 25 days per calendar year averaged over 3 years	120 mg/m^3
Protection of vegetation	AOT_{40} calculated from 1-hour values from May to July	18,000 $mg/m^3.h$ averaged over 5 years	6,000 $mg/m^3.h$
Information Threshold	1-hour average	180 mg/m^3	-
Alert Threshold	1-hour average	240 mg/m^3	-

AOT_{40} is a measure of the overall exposure of plants to ozone. It is the sum of the excess hourly concentrations greater than 80 $\mu g/m^3$ and is expressed as $\mu g/m^3$ hours.

10.1.2.1 Air Quality Zones

The Environmental Protection Agency (EPA) has designated four Air Quality Zones for Ireland:

- Zone A: Dublin City and environs
- Zone B: Cork City and environs
- Zone C: 16 urban areas with population greater than 15,000
- Zone D: Remainder of the country.

These zones were defined to meet the criteria for air quality monitoring, assessment and management described in the Framework Directive and Daughter Directives. The 3 sites for afforestation lie within Zone D, which represents rural areas located away from large population centres.

10.2 Replanting Area 1: Stranamart, Co. Cavan

10.2.1 Potential Impacts on Air Quality

10.2.1.1 'Do-Nothing' Impact

The lands have been Technically Approved and will be afforested should the Croagh Wind Farm proceed or not. If these lands are not afforested, the landuse at the site will continue and potential for the reduction in $C0_2$ emissions will be lost.

10.2.1.2 Planting Phase

10.2.1.2.1 *Short-term Imperceptible Negative Impact*

Some minor emissions associated with the use of an excavator for site drainage works are expected. This potential impact will not be significant and will be restricted to the duration of the drainage works.

10.2.1.3 Mitigation

All construction machinery will be maintained in good operational order while on-site, minimising any emissions that are likely to arise.

10.2.1.4 Operational Phase

10.2.1.4.1 *Long Term Slight Positive Impact*

The growth of trees will result in the fixation of atmospheric carbon, and the production of oxygen.

10.2.1.5 Residual Effects

On balance there will be positive effects on air associated with the proposed afforestation.

10.2.2 Potential Impacts from Dust

10.2.2.1 Planting Phase

10.2.2.1.1 *Short-term Imperceptible Negative Impact*

Potential dust emission sources include the working of an excavator. This potential impact will not be significant and will be restricted to the duration of the drainage works.

10.2.2.2 Mitigation

Areas of excavation will be kept to a minimum, and all works will be carried out in accordance with the Forestry Service Best Practice Guidelines described in detail in Section 2.

10.2.2.3 Operational Phase

There will be no significant indirect or direct impacts from dust the site has been afforested.

10.2.2.4 Residual Effects

On balance there will be positive impacts on air associated with the proposed afforestation.

10.3 Replanting Area 2: Brackloon, Co. Roscommon

10.3.1 Potential Impacts on Air Quality

10.3.1.1 'Do-Nothing' Impact

The lands have been Technically Approved and will be afforested should the Croagh Wind Farm proceed or not. If these lands are not afforested, the landuse at the site will continue and potential for the reduction in C02 emissions will be lost.

10.3.1.2 Planting Phase

10.3.1.3 Short-term Imperceptible Negative Impact

Some minor emissions associated with the use of an excavator for site drainage works are expected. This potential impact will not be significant and will be restricted to the duration of the drainage works.

10.3.1.4 Mitigation

All construction machinery will be maintained in good operational order while on-site, minimising any emissions that are likely to arise.

10.3.1.5 Operational Phase

10.3.1.5.1 *Long Term Slight Positive Impact*

The growth of trees will result in the fixation of atmospheric carbon, and the production of oxygen.

10.3.1.6 Residual Effects

On balance there will be positive effects on air associated with the proposed afforestation.

10.3.2 Potential Impacts from Dust

10.3.2.1 Replanting Phase

10.3.2.1.1 *Short-term Imperceptible Negative Impact*

Potential dust emission sources include the working of an excavator. This potential impact will not be significant and will be restricted to the duration of the drainage works.

10.3.2.2 Mitigation

Areas of excavation will be kept to a minimum, and all works will be carried out in accordance with the Forestry Service Best Practice Guidelines described in detail in Section 2.

10.3.2.3 Operational Phase

There will be no significant indirect or direct impacts from dust the site has been afforested.

10.3.2.4 Residual Effects

On balance there will be positive impacts on air associated with the proposed afforestation.

10.4 Replanting Area 3: Ballard, Co. Wicklow

10.4.1 Potential Impacts on Air Quality

10.4.1.1 'Do-Nothing' Impact

The lands have been Technically Approved and will be afforested should the Croagh Wind Farm proceed or not. If these lands are not afforested, the landuse at the site will continue and potential for the reduction in C02 emissions will be lost.

10.4.1.2 Planting Phase

10.4.1.2.1 *Short-term Imperceptible Negative Impact*

Some minor emissions associated with the use of an excavator for site drainage works are expected. This potential impact will not be significant and will be restricted to the duration of the drainage works.

10.4.1.3 Mitigation

All construction machinery will be maintained in good operational order while on-site, minimising any emissions that are likely to arise.

10.4.1.4 Operational Phase

10.4.1.4.1 *Long Term Slight Positive Impact*

The growth of trees will result in the fixation of atmospheric carbon, and the production of oxygen.

10.4.1.5 Residual Effects

On balance there will be positive effects on air associated with the proposed afforestation.

10.4.2 Potential Impacts from Dust

10.4.2.1 Planting Phase

10.4.2.1.1 *Short-term Imperceptible Negative Impact*

Potential dust emission sources include the working of an excavator. This potential impact will not be significant and will be restricted to the duration of the drainage works.

10.4.2.2 Mitigation

Areas of excavation will be kept to a minimum, and all works will be carried out in accordance with the Forestry Service Best Practice Guidelines described in detail in Section 2.

10.4.2.3 Operational Phase

There will be no significant indirect or direct impacts from dust the site has been afforested.

10.4.2.4 Residual Effects

On balance there will be positive impacts on air associated with the proposed afforestation.

10.5 Climate

10.5.1 Climate Change and Greenhouse Gases

Although climate change is thought to be a natural process, the rate at which the climate is changing has been accelerated rapidly by human activities. Climate change is one of the most challenging global issues facing us today and is primarily the result of increased levels of greenhouse gases in the atmosphere. These greenhouse gases come primarily from the combustion of fossil fuels in energy use. Changing climate patterns are thought to increase the frequency of extreme weather conditions such as storms, floods and droughts. In addition, warmer weather trends can place pressure on animals and plants that cannot adapt to a rapidly changing environment. Moving away from our reliance on coal, oil and other fossil fuel-driven power plants is essential to reduce emissions of greenhouse gases and combat climate change.

10.5.2 International Policy

10.5.2.1 United Nations Framework Convention on Climate Change

In 1992, countries joined an international treaty, the United Nations Framework Convention on Climate Change (UNFCCC), as a framework for international efforts to combat the challenge posed by climate change. The UNFCCC seeks to limit average global temperature increases and the resulting climate change. In addition, the UNFCCC seeks to cope with impacts that are already inevitable. It recognises that the climate system is a shared resource whose stability can be affected by industrial and other emissions of carbon dioxide and other greenhouse gases. The framework set no binding limits on greenhouse gas emissions for individual countries and contains no enforcement mechanisms. Instead, the framework outlines how specific international treaties (called "protocols" or "Agreements") may be negotiated to set binding limits on greenhouse gases.

Ireland is a Party to the Kyoto Protocol, which is a protocol to the UNFCCC. The Kyoto Protocol is an international agreement that sets limitations and reduction targets for greenhouse gases for developed countries. It came into effect in 2005, as a result of which, emission reduction targets agreed by developed countries, including Ireland, are now binding. Further details on Ireland's obligations under the Kyoto Protocol are presented below.

10.5.2.2 Kyoto Protocol Targets

Under the Kyoto Protocol, the EU agreed to achieve a significant reduction in total greenhouse gas emissions of 8% below 1990 levels in the period 2008 to 2012. Ireland's contribution to the EU commitment for the period 2008 – 2012 was to limit its greenhouse gas emissions to no more than 13% above 1990 levels.

10.5.2.3 Doha Amendment to the Kyoto Protocol

In Doha, Qatar, on 8th December 2012, the "Doha Amendment to the Kyoto Protocol" was adopted. The amendment includes:

- New commitments for Annex I Parties to the Kyoto Protocol who agreed to take on commitments in a second commitment period from 1 January 2013 to 31 December 2020;
- A revised list of greenhouse gases (GHG) to be reported on by Parties in the second commitment period; and
- Amendments to several articles of the Kyoto Protocol which specifically referenced issues pertaining to the first commitment period and which needed to be updated for the second commitment period.

During the first commitment period, 37 industrialised countries and the European Community committed to reduce GHG emissions to an average of 5% below 1990 levels. During the second commitment period, Parties committed to reduce GHG emissions by at least 18% below 1990 levels in the eight-year period from 2013 to 2020. The composition of Parties in the second commitment period is different from the first; however, Ireland and the EU signed up to both the first and second commitment periods.

Under the protocol, countries must meet their targets primarily through national measures, although market-based mechanisms (such as international emissions trading) can also be utilised.

10.5.2.4 COP21 Paris Agreement

COP21 was the 21st session of the Conference of the Parties (COP) to the UNFCCC. Every year since 1995, the COP has gathered the 196 Parties (195 countries and the European Union) that have ratified the Convention in a different country, to evaluate its implementation and negotiate new commitments. COP21 was organised by the United Nations in Paris and held from 30thNovember to 12th December 2015.

COP21 closed on 12th December 2015 with the adoption of the first international climate agreement (concluded by 195 countries and applicable to all). The 12-page text, made up of a preamble and 29 articles, provides for a limitation of the global average temperature rise to well below 2°C above pre-industrial levels and to limit the increase to 1.5°C. It is flexible and takes into account the needs and capacities of each country. It is balanced as regards adaptation and mitigation, and durable, with a periodical ratcheting-up of ambitions. Ireland formally ratified the agreement on the 27th October 2016, and it entered into force on the 4th November 2016.

10.5.2.5 COP25 Climate Change Conference

The 25th United Nations Climate Change conference COP25 was held in Madrid and ran from December 2nd to December 13th, 2019. While largely regarded as an unsuccessful conference, the European Union launched its most ambitious plan, 'The European Green New Deal' which aims to lower CO_2 emissions to zero by 2050. The deal includes proposals to reduce emissions from the transport, agriculture and energy sectors and will affect the technology chemicals, textiles, cement and steel industries. Measures such as fines and pay-outs by member states who rely on coal power will be in place to encourage the switch to renewable clean energies such as wind. The Commission will present draft laws for the new deal to the EU in January of 2020 and if accepted will likely be implemented in 2021. Decisions regarding the global carbon market were postponed until the next Climate Conference (COP26) which will be held in Glasgow in November 2020.

10.6 Replanting Area 1: Stranamart, Co. Cavan.

County Cavan has a temperate oceanic climate, resulting in mild winters and cool summers. The Met Éireann weather station at Finner Camp, Co. Donegal is the nearest weather and climate monitoring station to the site, located approximately 33.8 km northwest of the site. This station was installed in 2010 and replaced an existing weather station which had taken measurements since April 1996. There is no long-term meteorological data available from this station. The nearest station with 30-year data is recorded Clones over the 30-year period from 1978-2007 and is shown in Table 10.3 while mean monthly data collected at the Finner met station for the years 2017- 2020 to date can be found in Table 10.4.

The wettest month on average monitored at the Clones station from the period 1978-2007 was October with an average monthly rainfall of 102.7mm. The wettest month monitored at Finner from 2017 to April 2020 was also October with an average rainfall of 136.8mm. The warmest month detected at the Clones monitoring site was July with an average daily temperature of 15.3°C. The warmest month detected at Finner was also July with an average daily temperature of 15.1°C.

Table 10-3 Data from Met Éireann Weather Station, Clones, Co. Monaghan 1979 to 2007

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
TEMPERATURE (degrees Celsius)													
mean daily max	7.2	7.8	9.7	12.1	15.1	17.4	19.2	18.8	16.6	13.1	9.8	7.6	12.9
mean daily min	1.6	1.6	3.0	4.2	6.5	9.5	11.4	11.1	9.2	6.6	3.9	2.3	5.9
mean temperature	4.4	4.7	6.4	8.1	10.8	13.4	15.3	15.0	12.9	9.9	6.8	5.0	9.4
absolute max.	14.8	16.3	16.9	21.5	25.9	29.3	30.5	28.3	25.3	20.1	16.9	14.8	30.5
min. maximum	-3.8	-0.4	2.3	0.0	0.0	10.1	10.7	11.3	10.7	6.2	1.6	-5.7	-5.7
max. minimum	12.0	11.3	11.0	12.1	13.4	16.9	18.7	18.0	17.1	15.4	12.7	12.6	18.7
absolute min.	-12.4	-7.3	-6.8	-3.8	-3.7	1.6	4.6	3.5	0.2	-4.5	-5.4	-11.0	-12.4
RELATIVE HUMIDITY (%)													
mean at 0900UTC	89.9	88.7	86.6	81.8	77.4	78.8	81.7	84.6	87.3	89.3	90.8	90.9	85.7
mean at 1500UTC	83.3	77.3	72.9	67.5	66.5	68.7	69.6	71.2	72.8	77.3	82.5	85.9	74.6
SUNSHINE (Hours)													
mean daily duration	1.5	2.2	3.0	4.6	5.6	4.6	4.4	4.2	3.6	2.8	1.8	1.2	3.3
greatest daily duration	7.5	9.8	11.0	13.1	15.5	16.0	15.2	14.4	12.0	9.6	8.5	6.9	16.0
mean num. of days with no sun	12.1	8.3	6.0	3.8	2.2	2.6	2.2	2.8	4.0	6.9	10.3	13.2	74.3
RAINFALL (mm)													

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mean monthly total	87.6	71.0	84.0	61.6	63.4	70.9	70.8	88.7	76.2	102.7	85.1	98.4	960.4
greatest daily total	30.0	26.9	34.0	23.5	37.7	38.1	50.3	74.6	27.1	43.8	33.1	31.9	74.6
mean num. of days with >= 0.2mm	20	17	20	16	16	17	18	18	18	20	19	19	218
mean num. of days with >= 1.0mm	15	12	15	12	12	12	13	13	13	15	14	15	161
mean num. of days with >= 5.0mm	6	5	6	4	4	5	4	5	5	7	6	7	64
WIND (knots)													
mean monthly speed	9.2	9.4	9.4	7.9	7.2	6.7	6.3	6.3	7.0	7.8	8.2	8.7	7.8
max. gust	70	81	69	61	53	50	53	49	57	62	60	72	61.4
max. mean 10-minute speed	46	51	41	34	35	31	30	29	37	37	35	44	37.5
mean num. of days with gales	0.6	0.4	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.4	2.2
WEATHER (Mean No. of Days With:)													
snow or sleet	4.9	4.7	3.8	1.1	0.3	0.0	0.0	0.0	0.0	0.0	0.6	2.6	18.0
snow lying at 0900UTC	2.8	1.1	0.8	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	1.2	6.2
Hail	0.8	1.6	2.8	2.3	1.3	0.1	0.1	0.0	0.1	0.6	0.4	0.8	10.8
Thunder	0.1	0.1	0.1	0.1	0.8	1.0	0.5	0.8	0.1	0.1	0.0	0.1	3.8
Fog	3.7	3.6	2.1	2.2	1.5	1.3	1.6	2.9	4.0	3.5	4.0	4.4	34.8

Table 10-4 Monthly values from Met Eireann Weather Station, Finner Camp, Co. Donegal from Jan 2017 to April 2020

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
TOTAL RAINFALL (millimetres)													
2020 (to date)	91.0	263.2	101.3	9.0									464.5
2019	91.6	72.2	194.2	43.6	73.9	94.6	95.7	188.1	106.8	136.4	81.9	143.6	1322.6
2018	219.7	77.5	52.7	84.0	51.5	47.7	84.0	150.9	79.8	85.5	88.9	123.9	1146.1
2017	54.4	63.4	140.6	25.7	69.9	63.0	105.1	163.7	147.8	141.3	125.9	121.4	1222.
Mean	**130.4**	**95.4**	**103.8**	**75.9**	**77.2**	**72.3**	**91.0**	**105.7**	**102.4**	**136.8**	**128.6**	**130.6**	**1249.9**
MEAN TEMPERATURE (degrees Celsius)													
2020	7.0	5.7	6.2	9.4									6.6
2019	6.1	8.3	7.4	9.4	10.6	12.6	15.7	15.4	13.5	9.5	6.2	6.5	10.1
2018													
2017	6.6	6.5	8.1	9.2	12.4	13.7	14.4	14.3	12.4	11.6	7.4	6.4	10.3
Mean	**5.1**	**5.3**	**6.8**	**8.3**	**10.9**	**13.3**	**15.1**	**14.8**	**13.1**	**10.3**	**7.6**	**5.5**	**9.7**
Global Solar Radiation in Joules/cm2 for FINNER													
2020	6723	11790	25833	8565									52911
2019	5327	11581	23137	36446	52142	51699	51680	38828	29753	17508	7864	5396	331361
2018	5771	14374	24839	38305	55249	62758	51170	38331	24744	16581	8337	4349	344808

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2017	6465	10381	26417	33449	57451	44685	48853	42815	25654	12833	7448	4553	321004
Mean	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
POTENTIAL EVAPORTRANSPIRATION (millimetres)													
2020	20.6	24.4	36.6	14.2									95.8
2019	15.4	26.9	37.4	57.9	74.3	78.6	82.7	65.5	46.3	28.2	13.0	14.7	540.9
2018	16.5	21.0	33.5	52.7	84.5	99.1	84.4	59.7	44.6	32.8	18.2	15.0	562.0
2017	19.5	24.4	41.5	53.5	88.9	76.3	80.5	67.3	45.2	30.8	20.4	14.5	562.8
Mean	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
EVAPORATION (millimetres)													
2020	25.8	36.8	54.6	20.8									138.0
2019	19.9	35.0	56.6	84.5	108.3	115.4	118.5	94.2	66.4	38.7	17.4	18.2	773.1
2018	22.8	29.5	49.8	79.2	120.7	139.2	117.3	87.2	63.1	43.9	22.5	18.5	793.7
2017	25.1	32.8	59.4	79.1	126.2	111.0	114.6	97.5	63.7	41.6	25.4	18.3	794.7
Mean	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
DEGREE DAYS BELOW 15.5 DEGREE CELSIUS													

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2020	264	286	287	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2019	292	202	252	188	158	102	36	34	71	187	278	279	2079
2018	316	320	334	213	114	57	42	55	107	164	230	235	2188
2017	275	251	230	190	114	68	57	53	97	124	243	281	1985

10.6.1 Potential Impacts

10.6.1.1 Planting Phase

10.6.1.1.1 *Short Term Imperceptible Negative Impact*

The use of machinery during the drainage works will result in the emission of greenhouse gases. Operations such as the transport of materials are typical examples of machinery use. This impact is considered to be imperceptible only, given the insignificant quantity of greenhouse gases that will be emitted. Planting will be carried out by hand.

10.6.1.2 Proposed Mitigation Measures

Planting of trees will be carried out by hand using the methods described in Section 2.3.2 above. Any drains will be constructed in accordance with the Forestry Service Best Practice Guidelines described in detail in Section 2.

10.6.2 Operational Phase

10.6.2.1 Long Term Slight Positive Impact

The growth of forestry allows for the fixation of atmospheric carbon as it grows.

10.6.3 Residual Impacts

On balance there will be positive impacts on air and climate associated with the proposed afforestation

10.6.4 Replanting Area 2: Brackloon, Co. Roscommon.

County Roscommon has a temperate oceanic climate, resulting in mild winters and cool summers. The Met Éireann weather station at the Bord na Móna site at Mount Dillon is the nearest weather and climate monitoring station to the site, located approximately 25.4 km southeast of the site. This met station was established in 2003; hence, historical data at this station is not available. The nearest met station to the site which portrays historical data is Claremorris. Meteorological data recorded at Claremorris over the 30-year period from 1971–2000 is shown in Table 10.5 overleaf while data from 2017-2020 to date from the Mount Dillon weather station can be found in Table 10.6.

The wettest month recorded at Claremorris across the 1971–2000 timeframe was December with an average rainfall of 129.6mm and the warmest month recorded was July with an average temperature of 15°C. At Mount Dillon, the wettest month recorded during the 2017-2020 timeframe was October with an average rainfall of 111.8mm. The warmest month was July with an average temperature of 15.3°C. and April is usually the driest.

10.6.5 Potential Impacts

10.6.5.1 Planting Phase

10.6.5.1.1 *Short Term Imperceptible Negative Impact*

The use of machinery during the drainage works will result in the emission of greenhouse gases. Operations such as the transport of materials are typical examples of machinery use. This impact is

considered to be imperceptible only, given the insignificant quantity of greenhouse gases that will be emitted. Planting will be carried out by hand.

10.6.6 Proposed Mitigation Measures

Planting of trees will be carried out by hand using the methods described in Section 2.3.2 above. Any drains will be constructed in accordance with the Forestry Service Best Practice Guidelines described in detail in Section 2.

10.6.6.1 Operational Phase

10.6.6.1.1 *Long Term Slight Positive Impact*

The growth of forestry allows for the fixation of atmospheric carbon as it grows.

10.6.7 Residual Impacts

10.6.8 On balance there will be positive impacts on air and climate associated with the proposed afforestation.

Table 10-5 Data from Met Éireann Weather Station, Claremorris, Co. Mayo 1971-2000

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
TEMPERATURE (degrees Celsius)													
mean daily max	7.5	8.1	9.8	12.1	14.9	17.0	18.9	18.7	16.4	13.1	9.9	8.1	12.9
mean daily min	1.7	1.8	2.9	3.9	6.1	8.8	11.0	10.6	8.6	6.4	3.5	2.5	5.7
mean temperature	4.6	4.9	6.3	8.0	10.5	12.9	15.0	14.7	12.5	9.8	6.7	5.3	9.3
absolute max.	13.3	13.6	16.2	22.3	25.4	29.8	30.5	28.0	25.1	19.9	15.9	14.3	30.5
min. maximum	-2.9	0.1	0.0	5.0	6.1	11.2	11.7	12.2	10.5	6.8	1.3	-1.5	-2.9
max. minimum	11.3	10.9	10.4	11.3	14.2	15.3	17.0	16.7	16.7	15.6	12.5	12.1	17.0
absolute min.	-11.7	-9.1	-8.0	-5.5	-3.1	0.7	0.6	2.6	-1.2	-4.3	-5.3	-12.9	-12.9
mean num. of days with air frost	8.7	7.3	5.2	3.3	0.8	0.0	0.0	0.0	0.1	1.2	5.3	7.6	39.5
mean num. of days with ground frost	**15**	**14**	**12**	**10**	**5**	**0**	**0**	**0**	**2**	**5**	**12**	**14**	**89**
mean 5cm soil	3.2	3.1	4.5	7.3	10.9	14.1	15.5	14.6	12.0	8.9	5.3	4.2	8.6
mean 10cm soil	3.5	3.4	4.7	7.0	10.3	13.5	15.0	14.3	12.0	9.3	5.8	4.5	8.6
mean 20cm soil	4.2	4.2	5.5	7.7	10.7	13.8	15.3	15.0	13.0	10.3	6.9	5.3	9.3
RELATIVE HUMIDITY (%)													
mean at 0900UTC	90.7	90.3	88.7	82.5	79.3	80.4	83.6	86.2	88.1	91.6	91.2	91.0	87.0

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mean at 1500UTC	85.6	79.8	75.7	67.9	68.0	71.1	73.2	73.4	74.7	80.2	84.4	88.1	76.8
SUNSHINE (Hours)													
mean daily duration	1.3	1.9	2.6	4.3	5.0	4.4	3.7	3.8	3.2	2.4	1.7	0.9	2.9
greatest daily duration	7.9	9.3	10.8	13.4	15.1	15.8	14.8	13.7	11.4	9.3	8.6	6.7	15.8
mean num. of days with no sun	9.5	7.3	5.7	2.8	2.0	2.2	2.2	2.1	3.4	5.0	8.1	10.8	61.1
RAINFALL (mm)													
mean monthly total	127.9	102.1	101.6	63.7	68.1	64.5	70.1	95.7	94.3	128.2	127.7	129.6	1173.6
greatest daily total	31.5	107.0	26.8	34.0	51.3	38.0	42.2	49.7	41.0	46.7	54.9	41.2	107.0
mean num. of days with >= 0.2mm	21	18	21	16	16	15	17	18	18	21	21	22	224
mean num. of days with >= 1.0mm	18	15	17	12	12	11	12	13	14	17	18	17	176
mean num. of days with >= 5.0mm	9	7	7	4	4	4	4	6	5	8	8	9	75
WIND (knots)													
mean monthly speed	10.2	10.3	10.2	8.7	8.1	7.7	7.2	6.8	7.7	8.7	8.9	9.7	8.7
max. gust	96	85	74	74	62	51	66	78	58	70	67	81	96
max. mean 10-minute speed	59	48	45	41	41	34	39	32	37	46	40	52	59
mean num. of days with gales	1.4	0.9	0.7	0.1	0.1	0.0	0.0	0.0	0.1	0.3	0.4	0.8	4.8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
WEATHER (Mean No. of Days With:)													
snow or sleet	5.7	4.4	3.8	1.6	0.2	0.0	0.0	0.0	0.0	0.1	1.2	3.1	20.0
snow lying at 0900UTC	2.3	0.7	0.7	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.2	0.7	4.6
Hail	4.4	3.2	5.4	3.2	1.6	0.4	0.1	0.0	0.7	0.8	2.6	2.7	25.2
Thunder	0.3	0.1	0.2	0.2	0.4	0.7	0.7	0.2	0.2	0.2	0.3	0.5	4.0
Fog	3.4	2.3	1.6	1.8	1.2	1.4	2.0	3.2	3.3	3.2	2.6	3.4	29.5

Table 10-6 Monthly data collected at Mount Dillon 20167 2020 to date

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
TOTAL RAINFALL (millimetres)													
2020	100.7	225.3	80.6	7.2									413.8
2019	51.7	56.8	158.2	80.1	43.9	113.7	63.5	200.8	130.8	85.6	99.6	96.3	1181.0
2018	176.6	62.5	62.9	69.5	61.4	82.2	42.2	105.1	50.5	42.3	97.5	111.9	964.6
2017	31.9	84.5	103.3	15.9	63.8	72.9	94.0	102.8	104.9	107.9	85.3	128.4	995.6
Mean	**105.0**	**77.7**	**88.2**	**66.6**	**70.5**	**74.2**	**73.1**	**88.3**	**79.4**	**111.8**	**102.4**	**109.8**	**1047.1**
MEAN TEMPERATURE (degrees Celsius)													
2020	5.7	5.4	6.0	9.1									6.0
2019	5.7	7.0	7.0	8.8	10.6	12.8	16.1	15.4	12.6	8.6	5.5	5.5	9.7
2018	4.7	3.4	4.3	8.4	12.1	15.5	15.8	14.6	11.4	9.2	6.8	7.3	9.5
2017	5.6	5.8	7.8	8.8	11.8	14.0	14.5	14.0	11.9	10.7	6.4	5.3	9.7
Mean	**4.7**	**5.0**	**6.5**	**8.3**	**10.9**	**13.5**	**15.3**	**14.8**	**12.7**	**9.6**	**6.9**	**5.0**	**9.4**
MEAN 10CM SOIL TEMPERATURE AT 0900 UTC													
2020	5.5	5.4	6.2	n/a									5.7
2019	6.9	6.4	7.5	9.0	11.7	13.5	15.9	15.6	13.6	9.8	6.6	5.6	10.2

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2018	4.7	4.3	5.2	8.6	12.4	16.3	17.0	16.1	12.9	10.4	7.4	7.0	10.2
2017	5.8	6.1	7.5	9.8	13.0	15.1	16.0	15.7	13.5	11.6	8.0	5.7	10.7
Mean	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
GLOBAL SOLAR RADIATION IN JOULES/cm^2													
2020	6697	12510	27776	9787									56770
2019	6099	12282	23256	32863	50018	49058	49347	38822	29860	18311	8347	5789	324052
2018	7199	15035	23757	33533	52484	59724	47260	37188	26158	17054	8108	4223	331723
2017	7101	10458	26263	32305	57915	49056	45609	38797	27791	13020	8445	n/a	316760
Mean	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
POTENTIAL EVAPORTRANSPIRATION (millimetres)													
2020	9.9	16.7	32.4	14.0									73.0
2019	10.7	18.8	32.3	49.6	74.4	78.2	85.6	64.3	41.9	23.1	9.2	7.2	495.3
2018	9.5	15.8	29.9	48.9	79.8	98.0	84.1	61.3	39.4	24.5	12.1	9.3	512.6
2017	9.6	15.5	35.5	48.4	84.6	79.2	74.8	60.9	40.6	21.3	9.9	n/a	480.3
Mean	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
EVAPORATION (millimetres)	0.1	0.1	0.1	0.1	0.8	1.0	0.5	0.8	0.1	0.1	0.0	0.1	3.8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2020	13.4	24.1	47.7	19.9									105.1
2019	14.2	25.3	46.8	71.0	103.9	109.1	115.6	88.3	58.8	32.2	12.6	9.2	687.0
2018	12.6	22.4	44.2	70.0	111.2	132.3	112.5	83.7	54.7	33.4	16.0	11.9	704.9
2017	12.8	22.1	50.9	68.5	119.0	111.6	102.9	84.2	56.9	29.5	13.4	n/a	671.8
Mean	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
DEGREE DAYS BELOW 15.5 DEGREE CELSIUS													
2020	303	292	295	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2019	305	237	263	210	163	108	42	48	105	214	299	309	2301
2018	334	339	346	216	135	65	51	69	134	199	260	256	2403
2017	308	271	240	202	140	71	64	73	117	151	274	316	2227

10.6.9 Replanting Area 3: Ballard, Co. Wicklow

County Wicklow has a temperate oceanic climate, resulting in mild winters and cool summers. The Met Éireann weather station at Teagasc, Oakpark, Co. Carlow is the nearest weather and climate monitoring station to the site, located approximately 42 km west of the site. Meteorological data was manually recorded at this station and no data prior to 2016 is available. Data collected at Casement aerodrome in Co. Dublin from 1981–2010, the nearest met station with historical data can be found in Table 10.7 while data collected at Oakpark from 2017 –2020 to date can be found in Table 10.8.

The wettest month recorded at Casement Aerodrome during the period 1981–2010 was October with an average rainfall of 128.2mm. The wettest month recorded at Oakpark in the period 2017–2020 was also October with an average rainfall of 92.6mm. The warmest month recorded was July with an average temperature of 15˚C at Casement Aerodrome and 15.6˚C at Oakpark.

10.6.10 Potential Impacts

10.6.10.1 Planting Phase

10.6.10.1.1 *Short Term Imperceptible Negative Impact*

The use of machinery during the drainage works will result in the emission of greenhouse gases. Operations such as the transport of materials are typical examples of machinery use. This impact is considered to be imperceptible only, given the insignificant quantity of greenhouse gases that will be emitted. Planting will be carried out by hand.

10.6.10.2 Proposed Mitigation Measures

Planting of trees will be carried out by hand using the methods described in Section 2.3.2 above. Any drains will be constructed in accordance with the Forestry Service Best Practice Guidelines described in detail in Section 2.

10.6.10.3 Operational Phase

10.6.10.3.1 *Long Term Slight Positive Impact*

The growth of forestry allows for the fixation of atmospheric carbon as it grows.

10.6.10.4 Residual Impacts

10.6.11 On balance there will be positive impacts on air and climate associated with the proposed afforestation

Table 10-7 Data from Met Éireann Weather Station, Casement Aerodrome, Co. Dublin 1981-2010

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
TEMPERATURE (degrees Celsius)													
mean daily max	8.0	8.2	10.2	12.4	15.2	17.9	19.8	19.5	17.1	13.6	10.2	8.3	13.4
mean daily min	2.1	2.0	3.3	4.1	6.6	9.4	11.5	11.3	9.5	7.0	4.2	2.4	6.1
mean temperature	5.1	5.1	6.8	8.2	10.9	13.6	15.7	15.4	13.3	10.3	7.2	5.4	9.7
absolute max.	15.2	15.9	17.3	22.7	24.9	27.6	31.0	29.5	25.4	21.3	17.7	14.8	31.0
min. maximum	-3.0	-0.7	2.3	4.5	7.1	10.2	10.6	11.7	10.8	5.2	-3.1	-4.7	-4.7
max. minimum	11.3	13.0	11.5	12.6	13.8	17.2	18.1	18.3	17.8	16.4	13.8	12.7	18.3
absolute min.	-12.4	-8.0	-9.0	-5.5	-2.4	0.4	4.6	2.2	0.2	-4.1	-9.1	-15.7	-15.7
mean num. of days with air frost	7.5	7.7	4.6	3.4	0.8	0.0	0.0	0.0	0.0	1.3	4.3	7.6	37.2
mean num. of days with ground frost	14.0	14.0	11.0	11.0	4.0	0.0	0.0	0.0	1.0	4.0	9.0	14.0	82.0
mean 5cm soil	3.7	3.6	5.3	8.4	12.6	15.7	17.1	16.0	12.8	9.2	6.0	4.2	9.6
mean 10cm soil	3.9	3.8	5.2	7.6	11.4	14.6	16.2	15.3	12.6	9.2	6.2	4.4	9.2
mean 20cm soil	4.6	4.5	5.9	8.1	11.5	14.5	16.3	15.8	13.4	10.1	7.1	5.1	9.7
RELATIVE HUMIDITY (%)													
mean at 0900UTC	87.2	86.7	84.5	80.1	77.4	77.7	79.7	82.2	84.5	86.3	88.9	88.4	83.6

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
mean at 1500UTC	82.2	76.7	71.8	67.7	67.3	67.9	68.9	69.0	71.8	76.6	81.6	84.1	73.8
SUNSHINE (Hours)													
mean daily duration	1.7	2.5	3.3	5.1	6.0	5.3	4.9	4.8	4.1	3.3	2.2	1.5	3.7
greatest daily duration	8.1	9.2	10.9	13.2	15.4	16.0	15.5	14.4	12.3	10.1	8.5	6.9	16.0
mean no. of days with no sun	8.9	5.8	4.4	2.5	1.8	2.1	1.6	1.1	2.4	4.5	7.0	9.9	52.0
RAINFALL (mm)													
mean monthly total	63.8	48.5	50.7	51.9	59.1	62.5	54.2	72.3	60.3	81.6	73.7	75.7	754.2
greatest daily total	30.0	32.2	31.1	38.7	29.8	97.5	33.7	89.3	51.1	50.1	82.0	46.8	97.5
mean num. of days with >= 0.2mm	17	14	16	14	15	14	15	16	14	16	16	16	183
mean num. of days with >= 1.0mm	12	10	11	10	11	10	10	11	10	12	11	12	130
mean num. of days with >= 5.0mm	4	3	3	3	3	3	3	4	4	4	4	5	43
WIND (knots)													
mean monthly speed	13.6	12.9	12.4	9.8	9.1	8.6	8.8	9.0	9.6	11.1	11.6	12.3	10.7
max. gust	80	78	71	59	63	51	58	55	59	65	66	82	82
max. mean 10-minute speed	57	54	47	43	43	36	39	36	38	44	46	57	57
mean num. of days with gales	4.5	3.2	2.1	0.6	0.4	0.1	0.1	0.2	0.3	1.2	1.9	3.5	18.1

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
WEATHER (Mean No. of Days With:)													
snow or sleet	4.1	3.9	2.5	1.1	0.1	0.0	0.0	0.0	0.0	0.0	0.5	2.3	14.6
snow lying at 0900UTC	1.8	1.0	0.2	0.1	0.0	0.0	0.0	0.0	0.0	0.0	0.1	1.0	4.1
Hail	1.0	1.5	2.7	2.4	1.5	0.2	0.2	0.1	0.2	0.2	0.7	0.6	11.3
Thunder	0.1	0.1	0.3	0.4	1.1	1.0	1.0	1.2	0.6	0.4	0.1	0.1	6.3
Fog	1.8	1.9	1.6	1.6	1.5	1.2	1.1	2.0	2.8	2.0	2.1	2.4	22.1

Table 10-8 Met data collected at Oakpark Co. Carlow 2017–2020

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
TOTAL RAINFALL (millimetres)													
2020	61.4	172.8	51.8	11.9									297.9
2019	30.9	36.8	122.9	72.5	14.1	55.0	42.6	86.4	116.7	102.3	117.2	68.0	865.4
2018	108.1	38.7	98.1	73.0	24.3	5.2	42.5	39.8	53.7	58.3	160.5	119.3	821.5
2017	36.3	57.8	66.6	15.8	81.8	91.0	52.7	62.3	92.5	62.9	52.8	84.2	756.7
Mean	**80.4**	**57.3**	**63.4**	**55.9**	**59.8**	**60.8**	**58.7**	**71.9**	**69.6**	**92.9**	**85.9**	**83.6**	**840.2**
MEAN TEMPERATURE (degrees Celsius)													
2020	5.9	6.0	6.6	9.3									6.4
2019	5.9	7.5	7.4	8.9	11.0	13.0	16.7	16.2	13.7	9.4	6.3	5.9	10.2
2018	5.4	3.6	4.8	9.0	12.5	16.4	17.8	16.0	12.8	10.0	8.1	8.4	10.4
2017	6.0	6.5	8.3	9.0	12.4	15.0	15.7	15.0	13.0	11.5	6.7	5.6	10.4
Mean	**5.1**	**5.6**	**6.9**	**8.4**	**11.0**	**13.7**	**15.6**	**15.3**	**13.2**	**10.1**	**7.2**	**5.5**	**9.8**
MEAN 10CM SOIL TEMPERATURE AT 0900 UTC													
2020	4.7	4.4	5.1	8.3									5.0
2019	5.3	5.5	6.3	8.8	12.8	14.8	17.7	16.1	13.8	8.8	5.7	4.6	10.0

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2018	4.0	2.5	4.1	8.8	13.4	18.6	19.4	16.3	12.7	9.4	6.8	6.9	10.3
2017	4.9	5.1	7.0	9.7	13.8	16.4	16.7	15.3	12.8	10.9	6.4	4.5	10.3
Mean	**3.7**	**3.7**	**5.4**	**8.1**	**12.0**	**15.5**	**16.9**	**15.9**	**13.0**	**9.3**	**6.0**	**4.2**	**9.5**
GLOBAL SOLAR RADIATION IN JOULES/cm^2													
2020	8431	15487	31358	10558									65834
2019	7642	14822	29254	35333	52217	52607	53970	44104	32306	19242	8423	6290	356210
2018	8391	15960	23667	38598	56893	65358	57086	40751	32665	19493	7581	4932	371375
2017	7224	11187	27159	34762	55979	52967	52622	39969	30597	14765	10430	6224	343885
Mean	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
POTENTIAL EVAPORTRANSPIRATION (millimetres)													
2020	12.1	23.2	40.7	14.9									90.9
2019	12.6	20.6	37.5	52.0	76.6	82.3	94.1	77.3	51.3	25.9	11.2	11.1	552.5
2018	13.5	17.0	29.8	52.3	84.7	110.7	107.9	74.5	50.7	27.4	13.4	11.6	593.5
2017	11.5	17.9	35.4	50.0	80.7	86.5	87.7	68.2	45.8	25.9	10.3	9.4	529.3
Mean	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
EVAPORATION (millimetres)	0.1	0.1	0.1	0.1	0.8	1.0	0.5	0.8	0.1	0.1	0.0	0.1	3.8

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec	Year
2020	15.9	33.6	59.5	21.4									130.4
2019	16.5	28.8	55.5	74.6	107.4	115.4	127.0	106.0	70.1	35.8	15.3	14.1	766.5
2018	17.5	24.3	43.7	77.3	119.3	148.6	142.2	100.2	70.0	37.6	17.9	14.8	813.4
2017	15.3	25.4	51.7	71.0	114.0	121.5	120.1	93.3	64.2	35.5	13.9	11.9	737.8
Mean	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**	**n/a**
DEGREE DAYS BELOW 15.5 DEGREE CELSIUS													
2020	298	274	276	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A
2019	299	225	252	206	148	97	30	38	78	190	277	N/A	N/A
2018	312	334	333	199	117	47	26	46	101	175	222	221	2134
2017	293	253	223	194	116	54	44	52	92	129	N/A	307	N/

10.7 Noise

10.7.1 Replanting Area 1: Stranamart, Co. Cavan

The nearest sensitive location to the afforestation site is the residential dwellings located 40m north of the replanting site across the R206. A second residential dwelling is located just under 300m east of the site. Both dwellings are screened from the site by mature boundary vegetation.

In general, the existing noise climate is typical of a rural agricultural location. There are existing forestry plantations located in the vicinity of the site, along with a small number of agricultural yards.

10.7.2 Likely and Significant Impacts and Associated Mitigation Measures

10.7.2.1 Do-Nothing' Scenario

The land has been Technically Approved and will be afforested should the proposed Croagh Wind Farm proceed or not. If the land was not replanted, the current land use would continue at the site.

10.7.3 Planting Phase

10.7.3.1 Negative Imperceptible Short-term Impact

There will potentially be an increase in noise levels in the vicinity of the proposed development site during the planting phase, as a result of the use of an excavator for drainage works. These impacts will be short-term in duration and are not considered potentially significant. The noise levels will be similar to the existing agricultural machinery in use in the vicinity of the lands which is a working rural environment. Noise at any given noise sensitive location will be variable throughout the works, depending on the distance from the excavator to the receiving properties.

10.7.3.2 Mitigation

Best practice measures for noise control will be adhered to onsite during the planting phase of the afforestation in order to mitigate the potentially imperceptible short-term negative impact associated with this phase of the development. The measures include:

- Noise will be controlled by prescribing that all work will be restricted to the specified working hours. Any work carried out outside of these hours shall be restricted to activities that will not generate noise of a level that may cause a nuisance.
- The excavator used on the site shall be well maintained and will comply with E.U. and Irish legislation in relation to noise emissions. The timing of on- and off-site movements of plant near occupied properties will be controlled.

10.7.4 Operational Phase

10.7.4.1 Negative Slight Short-term Impact

There will be an intermittent increase in noise levels in the vicinity of the proposed development site during the operational phase, as a result of the use of machinery for timber harvesting works. These impacts will be short-term in duration. Noise at any given noise sensitive location will be variable

throughout the harvesting works, depending on the distance from the machinery to the receiving properties.

10.7.4.2 Mitigation

Best practice measures for noise control will be adhered to onsite during the timber harvesting at the proposed afforestation site in order to mitigate the slight short-term negative impact associated with this phase of the development. The measures include:

- Harvesting noise will be controlled by prescribing that all construction work will be restricted to the specified working hours. Any work carried out outside of these hours shall be restricted to activities that will not generate noise of a level that may cause a nuisance.
- The machinery used on the site shall be well maintained and will comply with E.U. and Irish legislation in relation to noise emissions. The timing of on- and off-site movements of plant near occupied properties will be controlled.

10.7.4.3 Residual Impacts

Potential residual impacts will be imperceptible and temporary in nature and not dissimilar to the existing noise sources of a working rural environment.

10.8 Replanting Area 2: Brackloon, Co. Roscommon

The eastern side of the replanting site at Brackloon extends around three sites of the curtilage of the nearest sensitive location to the afforestation site. The nearest dwelling to the western, northern and southern sides is located approx. 250m to the southwest of the replanting site. In general, the existing noise climate is typical of a rural agricultural location. There are existing forestry plantations located in the vicinity of the site, along with a small number of agricultural yards.

10.8.1 Likely and Significant Impacts and Associated Mitigation Measures

10.8.1.1 'Do-Nothing' Scenario

The land has been Technically Approved and will be afforested should the proposed Croagh Wind Farm proceed or not If the land was not replanted, the current land use would continue at the site.

10.8.1.2 Planting Phase

10.8.1.3 Negative Imperceptible Short-term Impact

There will potentially be an increase in noise levels in the vicinity of the proposed development site during the planting phase, as a result of the use of an excavator for drainage works. These impacts will be short-term in duration and are not considered potentially significant. The noise levels will be similar to the existing agricultural machinery in use in the vicinity of the lands which is a working rural environment. Noise at any given noise sensitive location will be variable throughout the works, depending on the distance from the excavator to the receiving properties.

Mitigation

Best practice measures for noise control will be adhered to onsite during the planting phase of the afforestation in order to mitigate the potentially imperceptible short-term negative impact associated with this phase of the development. The measures include:

- Noise will be controlled by prescribing that all work will be restricted to the specified working hours. Any work carried out outside of these hours shall be restricted to activities that will not generate noise of a level that may cause a nuisance.
- The excavator used on the site shall be well maintained and will comply with E.U. and Irish legislation in relation to noise emissions. The timing of on- and off-site movements of plant near occupied properties will be controlled.

10.8.2 Operational Phase

10.8.2.1 Negative Slight Short-term Impact

There will be an intermittent increase in noise levels in the vicinity of the proposed development site during the operational phase, as a result of the use of machinery for timber harvesting works. These impacts will be short-term in duration. Noise at any given noise sensitive location will be variable throughout the harvesting works, depending on the distance from the machinery to the receiving properties.

Mitigation

Best practice measures for noise control will be adhered to onsite during the timber harvesting at the proposed afforestation site in order to mitigate the slight short-term negative impact associated with this phase of the development. The measures include:

- Harvesting noise will be controlled by prescribing that all construction work will be restricted to the specified working hours. Any work carried out outside of these hours shall be restricted to activities that will not generate noise of a level that may cause a nuisance.
- The machinery used on the site shall be well maintained and will comply with E.U. and Irish legislation in relation to noise emissions. The timing of on- and off-site movements of plant near occupied properties will be controlled.

Residual Impacts

Potential residual impacts will be imperceptible and temporary in nature and not dissimilar to the existing noise sources of a working rural environment.

10.9 Replanting Area 3: Ballard, Co. Wicklow

There are two residential dwellings located adjacent to the replanting site with a further two more dwellings located within 100m.In general, the existing noise climate is typical of a rural agricultural location. There are existing forestry plantations located in the vicinity of the site, along with a small number of agricultural yards.

10.9.1 Likely and Significant Impacts and Associated Mitigation Measures

10.9.1.1 'Do-Nothing' Scenario

The land has been Technically Approved and will be afforested should the proposed Croagh Wind Farm proceed or not. If the land was not replanted, the current land use would continue at the site.

10.9.2 Planting Phase

10.9.2.1 Negative Imperceptible Short-term Impact

There will potentially be an increase in noise levels in the vicinity of the proposed development site during the planting phase, as a result of the use of an excavator for drainage works. These impacts will be short-term in duration and are not considered potentially significant. The noise levels will be similar to the existing agricultural machinery in use in the vicinity of the lands which is a working rural environment. Noise at any given noise sensitive location will be variable throughout the works, depending on the distance from the excavator to the receiving properties.

Mitigation

Best practice measures for noise control will be adhered to onsite during the planting phase of the afforestation in order to mitigate the potentially imperceptible short-term negative impact associated with this phase of the development. The measures include:

- Noise will be controlled by prescribing that all work will be restricted to the specified working hours. Any work carried out outside of these hours shall be restricted to activities that will not generate noise of a level that may cause a nuisance.
- The excavator used on the site shall be well maintained and will comply with E.U. and Irish legislation in relation to noise emissions. The timing of on- and off-site movements of plant near occupied properties will be controlled.

10.9.3 Operational Phase

10.9.3.1 Negative Slight Short-term Impact

There will be an intermittent increase in noise levels in the vicinity of the proposed development site during the operational phase, as a result of the use of machinery for timber harvesting works. These impacts will be short-term in duration. Noise at any given noise sensitive location will be variable throughout the harvesting works, depending on the distance from the machinery to the receiving properties.

Mitigation

Best practice measures for noise control will be adhered to onsite during the timber harvesting at the proposed afforestation site in order to mitigate the slight short-term negative impact associated with this phase of the development. The measures include:

- Harvesting noise will be controlled by prescribing that all construction work will be restricted to the specified working hours. Any work carried out outside of these hours shall be restricted to activities that will not generate noise of a level that may cause a nuisance.

- The machinery used on the site shall be well maintained and will comply with E.U. and Irish legislation in relation to noise emissions. The timing of on- and off-site movements of plant near occupied properties will be controlled.

Residual Impacts

Potential residual impacts will be imperceptible and temporary in nature and not dissimilar to the existing noise sources of a working rural environment.